Joint Transportation Committee

Auto-Passenger Vessel Sizing and Timing (2009-2030) Draft Report

Washington State Department of Transportation Ferries Division Financing Study II

Prepared For:
Joint Transportation Committee
Washington State Legislature

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EXECUTIVE SUMMARY

The 2007 legislature directed the Joint Transportation Committee (JTC) to make recommendations regarding the most efficient sizing and timing of future Washington State Department of Transportation Ferries Division (Ferries) vessel acquisitions beyond those authorized by the 2007-09 biennium capital budget. New vessels authorized by the 2007-09 biennium capital budget are up to three (3) 144-auto ferries and two (2) 64-auto Island Home class ferries.

This report has been coordinated with Ferries' updating of its 2030 long-term plan, and uses ridership and cost information from that planning effort. A new vessel program consisting of planning, procuring and constructing a new vessel class takes approximately 10 years for each program and is a critical component of Ferries' long-range plan and future financing.[1]

I. FLEET PLANNING MODEL

The consultants analyzed the following:

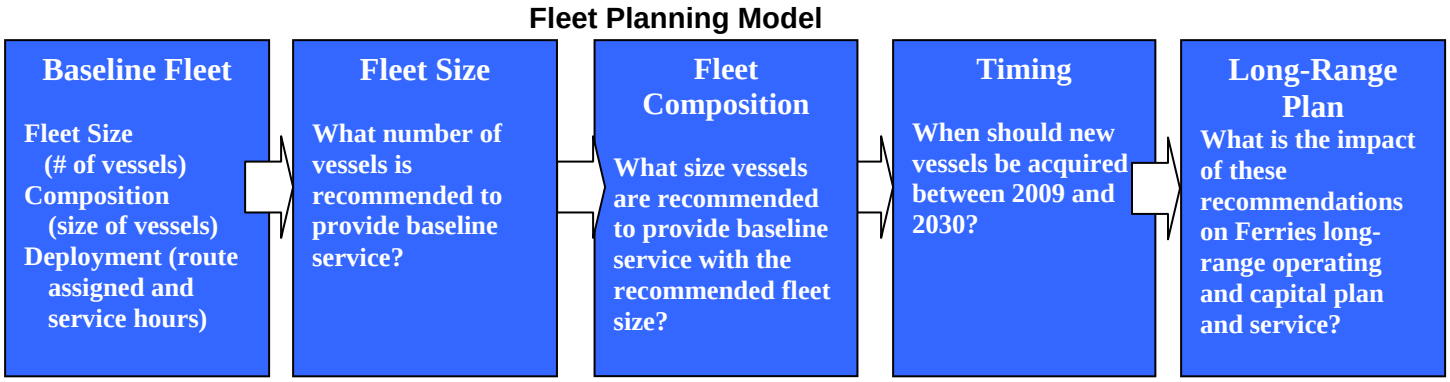
- fleet size - total number of vessels;
- fleet composition - size of recommended vessels; and
- fleet deployment - which vessels are assigned to which route.

The consultants used Ferries' long-range planning fleet[2] as the baseline to compare alternative fleet sizes, compositions, and deployments.

The consultants used the fleet planning model shown below. The first analysis after establishing the baseline service was to examine the number of vessels needed to provide the same level of service as the baseline fleet would provide. The next step was to analyze the size of vessels needed and then the timing of the proposed vessel acquisitions. The final step was to examine the impact of the vessel recommendations on Ferries' long-range operating and capital plan and service.

[1] See the JTC's *Auto-Passenger Vessel Preservation and Replacement Final Report,* January 2008, pp. 40-41 for further discussion.

[2] A 23-vessel fleet was assumed in Ferries' initial long-range planning. The *Revised Draft Long-Range Plan,* January 2009, assumes a 22-vessel fleet for baseline service. The baseline fleet in this report is a 23-vessel fleet.



II. FLEET RECOMENDATIONS

A. 2030 Fleet Size

The baseline fleet is a 23-vessel fleet delivering 114,728 hours of service annually on Ferries' nine routes. The consultants recommend a **21-vessel** fleet to deliver the same 114,728 hours of service on Ferries' nine routes.

The key difference between the two fleet sizes is that Ferries' baseline fleet has two vessels for emergency response that are not assigned an engine room crew ("de-crewed"). The consultants recommend that Ferries not have de-crewed vessels in its fleet. Instead, Ferries should focus on providing emergency response by reducing vessel out-of-service time.

During the 2003-2006 time period, Ferries had a 24-vessel fleet with three de-crewed vessels. The average out-of-service time for the 21 crewed vessels was seven weeks a year. The longest the de-crewed vessels were deployed during this time period was eight weeks in one year.[3]

Ferries could reduce out-of-service time by consolidating Eagle Harbor work with other shipyard work, focusing on reducing time spent on topside painting, designing vessels with aluminum superstructures and other features that reduce required maintenance, and requesting the Coast Guard to allow underwater inspection in lieu of dry docking.[4] If

[3] In 2007, Ferries faced the most extreme emergency condition in its history with steel preservation failures leading to the sudden retirement of four (4) Steel Electric class vessels and increased steel inspection and repairs on other vessels. During 2007, the de-crewed reserve vessels were used for 55 weeks, and service on the Keystone route was shut down during November and December. The consultants note that improved fleet preservation and inspection should prevent the sudden loss of four vessels from occurring.

[4] The United States Coast Guard requires vessels to be drydocked twice in five (5) years. The Coast Guard also allows Underwater Inspection in Lieu of Drydock (UWILD) at the midpoint of the five-year period. There are underwater coatings that are presently certified for five years of service, so this approach is now technically possible. If the Coast Guard allowed UWILD, it would result in half the dry dock out-of-service time and half of the present drydock cost for the vessels for which it is allowed. The application of UWILD is at the discretion of the local United States Coast Guard Officer in Charge of Marine Inspection. Current interpretations are that UWILD is applicable to vessels 15 years old or younger. As currently interpreted, UWILD could be applicable to the three (3) Jumbo Mark II class vessels built in 1997 and 1998 and to Ferries' new vessels as they come on line.

Ferries were able to reduce out-of-service time for the 21 crewed vessels by 2.5 days a year (5 percent), the crewed vessels could provide eight weeks of additional vessel emergency response capacity and eliminate the need for de-crewed vessels.

Under this scenario, Ferries would provide emergency response vessels as follows:

- Reduce out-of-service time by one week (14 percent) on average for each vessel. This might require increased funding for maintenance and preservation to pay for overtime or other charges. However, this may not be necessary if Ferries reduces out-of-service time by the other methods discussed above. Reducing out-of-service time would improve the emergency response capacity of the 21 fully crewed vessels from 25 weeks in Ferries' baseline fleet to 46 weeks. This will allow Ferries to respond more quickly to emergencies, because it takes 12 to 18 hours longer for a de-crewed vessel to respond than a fully crewed vessel.
- As an additional back-up, Ferries could deploy vessels that are in maintenance to respond to emergencies. North Carolina Ferries uses this practice, finding that it takes an average of three days for a vessel in routine maintenance to respond.

Recommendation #1. Ferries should reduce average planned out-of-service time from seven weeks per vessel per year to six weeks. This can be achieved by consolidating Eagle Harbor work with other shipyard work, focusing on reducing time spent on topside painting, designing vessels with aluminum superstructures and other features that reduce required maintenance, and requesting the Coast Guard to allow underwater inspection in lieu of dry docking.

Recommendation #2. The legislature should recognize that in order to reduce out-of-service time and reduce the fleet size, the per-vessel expenditure on maintenance and preservation may increase, and therefore, it will be necessary to provide adequate maintenance and preservation funding for each vessel in the fleet in order to minimize service disruption.

Recommendation #3. Assuming a six-week annual maintenance period, Ferries should plan on a 21-vessel fleet to provide the baseline 2030 service hours. This size fleet will provide adequate maintenance relief and 46 weeks of crewed vessel emergency response capacity. Additional vessel acquisitions could then be used to expand service, not to deliver the baseline service.

Recommendation #4. Ferries should implement a system to use vessels that are in maintenance for emergency response.

B. 2030 Fleet Composition

1. Route Deployment

The consultants reviewed each route to determine the most cost-efficient vessel capacity for that route. The review included a systemwide and route analysis of three key indicators[5]:

1. percentage of auto capacity used;
2. percentage of sailings in which the auto capacity is sold out or fully reserved; and
3. variable cost[6] per auto carried.

Alternative vessel deployments by route were compared based on the projected level of ridership in 2030.[7]

> ***Recommendation #5.*** Ferries should plan on the following active vessel deployments by route for the delivery of the baseline service:

Recommended 2030 Vessel Active Deployment by Route

		Ferries' Baseline Fleet			Recommended Fleet		
Route	# Vessels	Size: Fall, Winter, Spring	Size: Shoulder	Size: Summer	Size: Fall, Winter, Spring	Size: Shoulder	Size: Summer
Bainbridge & Bremerton	4	2 Jumbo		3 Jumbo	2 Jumbo		
		2 Large		1 Large	2 Large		
Clinton	2	1 Large			1 Large		
		1 Medium			1 Medium		
Kingston	2	2 Jumbo			2 Jumbo		
Point Defiance	1	1 Mid-Size			1 Small		
Port Townsend	1 or 2	1 Small	2 Small		1 Small	2 Small	
San Juans & Sidney	4 or 5	2 Large		4 Large (1 Sidney)	1 Large		3 Large
		1 Medium (Sidney except winter)			1 Medium (Sidney except winter)		
					1 Mid-Size		
		1 Mid-Size (Interisland)			1 Small (Interisland)		
Triangle	3	2 Medium			2 Medium		
		1 Mid-Size			1 Medium		1 Mid-Size
Total Deployed		17	18	19	17	18	19

[5] Auto capacity and use was considered rather than passenger use because auto capacity is the prime determinant of vessel size and the primary constraint in the system's ability to carry riders. The ferry system has ample capacity for walk-on passengers.

[6] Fixed costs, such as capital preservation and engine room crews, do not change by route assignments.

[7] Ferries 2030 ridership projection does not include the impact on ridership of pricing and operational strategies to manage demand which could lower ridership.

2. Fleet Composition

After establishing the most cost-efficient assignment of vessels by route, the consultants reviewed sizes for the additional vessels needed to meet the system's maintenance rotation (i.e., moving vessels to a route to replace vessels that are undergoing planned maintenance and preservation work), and emergency reserve needs.

The recommended 21-vessel fleet includes: five jumbo (188-202 auto capacity), six large (144-auto), five medium (124-auto), one mid-size (90-auto), and four small (64-auto) vessels. Of the 21 vessels included in the recommended fleet, 11 vessels (five jumbo, five medium, and one mid-size) are not due for retirement from the fleet until after 2030.

> ***Recommendation #6.*** Ferries should plan for a 21-vessel fleet composed of: five jumbo (188-202 auto), six large (144-auto), five medium (124-auto), one mid size (90-auto), and four small (64-auto) vessels for the delivery of the baseline services.

Recommended 2030 Fleet

Size & Auto Capacity	Ferries Baseline	Recommended
Jumbo (188-202-auto)	5	5
Large (144-auto)	7	6
Medium (124-auto)	5	5
Mid-size (87-90-auto)	3 (2 87-auto and 1 90-auto)	1 (1 90-auto)
Small (34-64-auto)	3 (2 64-auto and 1 34-auto)	4 (4 64-auto)
Total	23	21

3. Fuel Conservation – Recommended Fleet

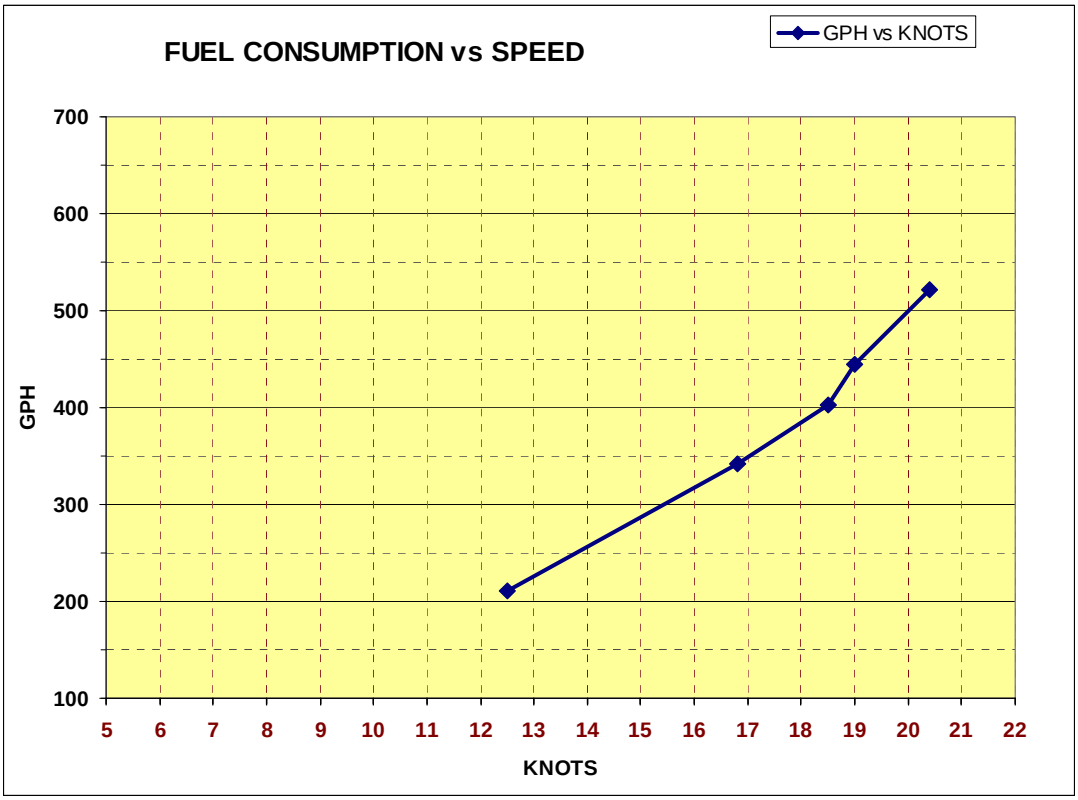
The recommended fleet reduces fuel costs by 1 percent in 2030 from the baseline fleet. Fuel costs in the baseline and recommended fleet projections assume continuation of existing fuel conservation strategies, including those already implemented on the Jumbo Mark II (202-auto) vessels. Additionally, Ferries plans to operate the Super class vessels on two (2) engines starting in the summer of 2009.

The consultants have explored two other fuel conservation strategies for the recommended fleet: (1) slowing vessels, and (2) modifications to Ferries docking procedures.

a. Vessel Speed

As shown in the figure below, relatively minor changes in vessel speed can result in significant fuel savings.

Fuel Consumption vs. Speed



Annual savings from an average reduction of 1.0 knot are $6.0 million per year or 12 percent of fuel costs. Crossing times are increased by a low of 0.5 minutes on the Clinton crossing to a high of 10.0 minutes on the Sidney crossing. Over the 22-year planning period (2009 to 2030), this would be a savings of $132.0 million in 2008 dollars.

The cumulative impact of changes in crossing times could affect the number of sailings on some routes.[8]

> ***Recommendation #7.*** Ferries should analyze the potential for slowing vessel speeds an average of 0.5 to 1.0 knots in order to reduce fuel consumption. This analysis should include a route-by-route review, including the impact on the number of sailings.

b. Docking Procedures

Ferries operates vessel engines at 60 revolutions per minute (RPM) while docked as a means of securing the vessel. Ferries has analyzed the impact on fuel savings if vessel speed at the dock were reduced to 30 RPM. The consultants have identified additional

[8] The consultants, as an example, examined the potential impact on the Bainbridge and Bremerton routes of a reduction in speed. The Bremerton route could accommodate a 1-knot reduction in speed without changing the number of sailings. On the Bainbridge route, it would be difficult to reduce speeds during the peak periods when sailings are more frequent but would be possible the rest of the day.

potential fuel savings of $27.4 million in 2008 dollars in the 2009-2030 time period if Ferries reduced engine speed while docked to 30 RPM.

> ***Recommendation #8.*** Ferries should assess the feasibility of slowing at-dock RPMs from 60 to 30 in order to conserve fuel.

c. Vessel Design

The following design adjustments would improve fuel efficiency:

- aluminum superstructure, reducing weight; and
- longer length-to-beam ratio, reducing drag.

Ferries' baseline vessel acquisition included $8.0 million in 2008 dollars for engineering of the Super class replacement vessels. The consultants agree that this funding is needed and might be used to consider the above design adjustments.

Assuming an aluminum superstructure on the 144-auto vessels would increase the cost of each vessel by approximately $4 million.

> ***Recommendation #9.*** As part of the pre-design process for constructing 144-auto vessels in the 2021-2030 time period (four (4) vessels in the baseline fleet or six (6) in the recommended fleet), Ferries should provide the legislature with a cost-benefit analysis of an aluminum superstructure and other design modifications that might increase fuel efficiency.

C. Vessel Acquisition Timing

The recommended fleet requires building a **total of 10 new vessels** in the 2009-2030 time period instead of the 12 vessels in Ferries' baseline plan. To analyze the best timing for construction of the 10 new vessels in the recommended fleet, the consultants considered:

- the existing vessel retirement schedule;
- the need to restore service to the Keystone route[9];
- the economies of scale of building multiple vessels of a class in one procurement process; and
- the advantages of having a uniform fleet to reduce maintenance repair and staff training costs.

With the baseline fleet, Ferries has assumed that it would design and construct: two (2) 64-auto vessels and three (3) 144-auto vessels in the 2009-2012 time period; and four (4) 144-auto vessels, two (2) 87-auto vessels, and one (1) 34 auto-vessel in the 2020-2030 time period.

[9] Service on the Keystone route has been reduced from two (2) vessels in the shoulder and summer seasons to one (1) vessel since the 2007 retirement of the four (4) Steel Electric class vessels.

In the recommended vessel acquisition plan, Ferries would design and construct four (4) 64-auto vessels as a class in the 2009-2012 time period, and six (6) new 144-auto vessels as a class in the 2020-2030 time period.

Recommendation #10. Ferries should acquire vessels in two waves:

- 2009–2012: Four (4) new 64-auto vessels; and
- 2020–2030: Six (6) new 144-auto vessels.[10]

Summary Recommended Vessel Acquisition Schedule

	Ferries' Baseline Fleet	Recommended Fleet
2009-12	3 144-auto vessels - build	4 64-auto vessels - build
	2 64-auto vessels - build	
2020-30	2 87-auto vessels - design and build	6 144-auto vessels - design and build
	4 144-auto vessels - design and build	
	1 34-auto vessel - design and build	
# New Vessels Acquired	12	10

The consultants' recommended fleet would have 22 vessels between 2011 and 2024 because the *Hiyu* (34-auto) is not due for retirement until 2024. This will provide Ferries with time to reduce planned out-of-service time in order to operate efficiently with a 21-vessel fleet.

Recommended Fleet: Vessel Size Compared to Ferries' Baseline

Size Category	Auto Capacity	Ferries' Baseline Fleet	Recommended Fleet	Change
Jumbo	188-202	5	5	0
Large	144	7	6	-1
Medium	124	5	5	0
Mid-Size	87-90	3	1	-2
Small	34-64	3	4	1
Total		23	21	-2

[10] Ferries' retirement range for the four (4) Super class vessels extends to 2033. It is possible that not all six (6) new 144s would need to be on-line by 2030. For this analysis, the consultants have assumed that all Super class vessels would be retired by 2030, which is the mid-point of the 2025-2033 retirement range for these vessels. The two (2) Evergreen State class vessels that are also being replaced by these new 144-auto vessels are due for retirement in the 2022-2028 time period.

Recommended Fleet: Deployment Compared to Ferries' Baseline

Vessels on Routes at One Time	Ferries' Baseline Fleet	Recommended Fleet	Change
Fall, winter, spring	17	17	0
Shoulder	18	18	0
Summer	19	19	0
Number of New Vessels	12	10	-2
Emergency Reserve Vessel Weeks Available			
Crewed Vessel	25 wks	46 wks	21 wks
De-crewed Vessel	90 wks	0 wks	-90 wks
Total	115 wks	46 wks	-69 wks
Weeks Needed – Based on 2003-06	33 wks	33 wks	0 wks

III. FLEET RECOMMENDATIONS: BUDGET AND SERVICE IMPACTS

A. Operating Budget (Program X) Impact

The recommended fleet would cost $15.4 million less in fixed operating costs in 2008 dollars in the 2009-2030 time period than the baseline fleet would cost. Fixed operating costs are those costs that do not change with the deployment of a vessel to a particular route, primarily engine room crews.

The recommended fleet deployment would cost $91.0 million dollars less in variable operating costs in 2008 dollars in the 2009-2030 time period than the baseline fleet would cost. Variable operating costs are those costs that change with the deployment of a vessel to a particular route, primarily fuel and deck labor.

Fuel costs for the recommended fleet are 1 percent less than for the baseline fleet because Ferries would deploy smaller, more fuel efficient vessels. Additional fuel savings of $159.4 million in 2008 dollars in the 2009-2030 time period could be achieved through the operational modifications described in Section II. B., above.

B. Capital Budget (Program W) Impact

1. Cost Estimates

To assess the financial impact of the vessel size, composition, and timing recommendations, the consultants first reviewed the reasonableness of Ferries' vessel acquisition cost estimates. The consultants agreed with the cost estimates on all the vessels except for the new large 144-auto vessels.

Ferries assumed a cost for each of three or four 144-auto vessels of $115 million in 2008 dollars, including $14 million for the propulsion systems. Based on the consultants' review, it appears that this cost estimate may be low. A more realistic estimate for this size vessel as currently designed is an average of $134.9 million for each of three vessels, or $130.2 million for each of four. The cost for each vessel for the recommended six is $123.7 million.

The consultants concluded that six new 144-auto vessels would cost $141.9 million more than Ferries' estimate. The consultants also provided an additional allowance of $4 million per vessel for aluminum superstructures—raising the total revised cost estimate to $165.9 million more than Ferries' estimate.

> ***Recommendation #11.*** Ferries should review the estimated cost of the 144-auto vessels as it finalizes its long-range plan.

Adjusted for the consultants' revised cost estimate for the new large (144-auto) vessels, the recommended fleet would save $133.0 million in 2008 dollars in the 2009-2030 time period in vessel acquisition costs, and $28.6 million in vessel preservation and improvement costs from Ferries' baseline fleet.

2. Requirement to Build in Washington

The legislature has required Ferries' vessels to be constructed in the State of Washington for policy reasons and on the assumption that vessels built in Washington would be easier for Washington state shipyards to maintain.

The consultants have reviewed comparable sized vessels previously bid by Ferries and bid by North Carolina Ferries. The consultants' assessment is that Ferries could achieve an approximately 20 percent savings in vessel construction, excluding machinery costs, if out-of-state shipyards were permitted to bid on these vessels. This potential savings translates into an additional $166.6 million in 2008 dollars in the 2009-2030 time period if the legislature were to open vessel construction to national competition.

In addition to potential cost savings, allowing national competition would also make Ferries' vessel construction eligible for federal funding.

> ***Recommendation #12.*** The legislature should consider opening vessel construction to national competition by determining the appropriate balance between Ferries' new vessel construction costs, the potential for federal funding, and the policy goals of the State.

Recommended Fleet and Potential Savings 2009-2030

($ 2008 millions)

	$ Saved 21-Vessel Fleet	$ Other Potential Savings	Total
Capital Cost (Program W)			
Vessel Acquisition*	-133.0	-166.6	-299.6
Vessel Preservation & Improvement	-28.6		-28.6
Terminal Preservation & Improvement	TBD		
Sub-total Capital	-161.6	-166.6	-328.2
Operating Cost (Program X)			
Fixed Operating Costs	-15.4		-15.4
Variable Operating Costs	-91.0	-159.4	-250.4
Sub-total Operating	-106.4	-159.4	-265.8
Total	-268.0	-326.0	-594.0

* Savings reflect increased cost estimate for 144-auto vessels and aluminum superstructures in the recommended fleet.

C. Service Impacts

Ferries' current acquisition schedule adds capacity of 20 cars on two routes: Bremerton and Clinton. It also adds 74-auto capacity to the Fauntleroy-Vashon-Southworth Triangle route. The consultants' recommended fleet timing would delay this additional capacity from the 2009-2020 time period to the 2021-2030 time period. Ferries could mitigate this delay by implementing the consultants' recommended deployment on the San Juans–Sidney route. By substituting one medium sized vessel for one of the large vessels on the San Juans-Sidney route, Ferries could increase capacity by 20 cars on either the Bremerton or Clinton route.

The analysis in this report is focused on existing service levels. If there are opportunities in the future to improve service, Ferries could do so by increasing the number of sailings within the service hours, increasing service hours, or adding vessels to the fleet. Adding vessels to the fleet should be the last resort to improve service. It is most cost efficient to add sailings within existing service hours—in which case the marginal cost is only for fuel.[11] The next most cost-efficient way to improve service is to extend service hours with an existing vessel—in which case the marginal cost is for deck labor and fuel. The least cost-efficient way to improve service is to add a vessel, with the attendant costs of acquisition, capital preservation and improvement, fixed engine room, insurance and other operating costs, and fuel and deck labor costs.

> ***Recommendation #13.*** Ferries should consider additional sailings and/or modification to vessel service hours as ways to improve service before considering adding vessels to the fleet to improve service.

SUMMARY OF ANNUAL BUDGET AND SERVICE IMPACTS

	Ferries' Baseline Fleet	Recommended Fleet	Change
Annual Fixed Costs - 2030 Fleet - 2008 $ millions	$ 112.0 M	$108.6 M	$-3.4 M
Annual Variable Costs - 2030 Fleet - 2008 $ millions	$103.0 M	$97.1M	$-5.9 M
Service Hours	114,728 hrs	114,728 hrs	0 hrs
Annual Fixed Costs per Service Hour - 2008 $	$976	$947	$-29
Annual Variable Costs per Service Hour - 2008 $	$898	$846	$-52
Percentage of Auto Capacity Utilized Systemwide 2030 Ridership Level	68%	67%	-1%
Percentage of Sailings in which Auto Capacity is Sold Out or Fully Reserved Systemwide 2030 Ridership Level	36%	37%	1%
Variable Costs per Auto Carried Systemwide 2030 Ridership Level – 2008 $	$6.87	$6.47	$-0.40

[11] In some cases, such as with the Bremerton route, to add sailings within the existing service hours without adding labor costs would require modifications to existing labor agreements to allow 10-hour shifts.

Summary of Recommendations

#	Recommendation
1	Ferries should reduce average planned out-of-service time from seven weeks per vessel per year to six weeks. This can be achieved by consolidating Eagle Harbor work with other shipyard work, focusing on reducing time spent on topside painting, designing vessels with aluminum superstructures and other features that reduce required maintenance, and requesting the Coast Guard to allow underwater inspection in lieu of dry docking.
2	The legislature should recognize that in order to reduce out-of-service time and reduce the fleet size, the per-vessel expenditure on maintenance and preservation may increase, and therefore, it will be necessary to provide adequate maintenance and preservation funding for each vessel in the fleet in order to minimize service disruption.
3	Assuming a six-week annual maintenance period, Ferries should plan on a 21-vessel fleet to provide the baseline 2030 service hours. This size fleet will provide adequate maintenance relief and 46 weeks of crewed vessel emergency response capacity. Additional vessel acquisitions could then be used to expand service, not to deliver the baseline service.
4	Ferries should implement a system to use vessels that are in maintenance for emergency response.
5	Ferries should plan on the following active vessel deployments by route for the delivery of the baseline service in the summer: Bainbridge-Bremerton routes four (4) vessels including two (2) jumbo and two (2) large; Clinton two (2) vessels including one (1) large and one (1) medium; Kingston two (2) jumbo vessels; Point Defiance one (1) small vessel; Port Townsend two (2) small vessels; San Juans and Sidney routes five (5) vessels including three (3) large, one (1) medium, one (1) mid-size, and one (1) small; and the Fauntleroy-Southworth-Vashon Triangle route three (3) vessels including two (2) medium and one (1) mid-size.
6	Ferries should plan for a 21-vessel fleet composed of: five jumbo (188-202 auto), six large (144-auto), five medium (124-auto), one mid size (90-auto), and four small (64-auto) vessels for the delivery of the baseline services.
7	Ferries should analyze the potential for slowing vessel speeds an average of 0.5 to 1.0 knots in order to reduce fuel consumption. This analysis should include a route-by-route review, including the impact on the number of sailings.
8	Ferries should assess the feasibility of slowing at-dock RPMs from 60 to 30 in order to conserve fuel.
9	As part of the pre-design process for constructing 144-auto vessels in the 2021-2030 time period (four (4) vessels in the baseline fleet or six (6) in the recommended fleet), Ferries should provide the legislature with a cost-benefit analysis of an aluminum superstructure and other design modifications that might increase fuel efficiency.
10	Ferries should acquire vessels in two waves: • 2009–2012: Four (4) new 64-auto vessels; and • 2020–2030: Six (6) new 144-auto vessels.
11	Ferries should review the estimated cost of the 144-auto vessels as it finalizes its long-range plan.
12	The legislature should consider opening vessel construction to national competition by determining the appropriate balance between Ferries' new vessel construction costs, the potential for federal funding, and the policy goals of the State.
13	Ferries should consider additional sailings and/or modification to vessel service hours as ways to improve service before considering adding vessels to the fleet to improve service.

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December 24, 2008

To: Joint Transportation Committee Ferry Policy Group

Subj: WSF Response to Draft CRG Vessel Sizing and Timing Report

Ref: Cedar River Group Draft Vessel Sizing and Timing Report dated 5 Nov 2008

WSDOT Ferries Division (WSF) concurs with the majority of findings and recommendations of the Cedar River Group as presented in the Draft Vessel Sizing and Timing Report. The core of the report rests on four integral issues that frame up key decisions that establish the strategic direction for WSF over the next two decades. These issues are:

- Reduction of the annual ferry maintenance time from 7 to 6 weeks
- Number of stand-by vessels maintained
- Timing and number of 64-Auto ferries constructed
- Timing and number of 144-Auto ferries constructed

The following discussion addresses these key issues and provides insight into WSF's recently released Draft Revised Long Range Plan that builds on similar strategies addressed in the consultant's report.

Reduction in Maintenance Time: WSF concurs that there can be cost efficiencies gained if the maintenance time can be reduced for the ferry fleet. WSF recognizes that it is reasonable to establish a target of 6 weeks of maintenance per vessel on average. However, it is usually the unanticipated mandate or repair that drives longer ferry maintenance times. Security system installations (14-weeks for a Jumbo ferry) and extensive ship repairs (e.g. 6 month Yakima structural, one year Elwha main motor) have driven the major out-of-service maintenance and preservation periods the last several years for the fleet. WSF has minimized vessel out of service time by completing renovations and vessel upgrades in a deliberative fashion through a series of smaller segments completed over several years during normal maintenance and preservation periods vs. removing vessels from service for extended periods. However, WSF anticipates that changes to the Clean Air Act rules for diesel engine emissions and the Clean Water Act for vessel discharges may require significant vessel modifications in the coming decade. Such changes will dictate extended out-of-service periods to enable the upgrades to be completed.

Number of Stand-by Vessels: WSF has learned the value of having stand-by vessels which have been essential to maintaining the appropriate level of service for customers. The ferry system will be at high risk for loss of service, especially during the critical summer months, if the system were to reduce the fleet significantly. WSF recommends a 22-vessel fleet instead of the 21-vessel fleet recommended by the consultant. The renovated MV Hyak (144-auto, completed in 2011) would serve as the stand-by vessel. It would have a reduced crew, be fully maintained and provide great flexibility in responding to nearly every route when needed. Maintaining this stand-by capability would require funding the vessel for maintenance and preservation in the biennial budgets unlike what was done in the past for stand by vessels (e.g. MV Nisqually & MV Evergreen State). The vessel would be recalled into active service on short notice as long as it is maintained regularly and properly under the oversight of the Port Engineer and supported by Eagle Harbor.

64-Auto Ferry Construction: WSF understands it is important to construct new 64-Auto ferries as soon as possible to replace the lost service on Pt. Townsend-Keystone route and to replace the 61-year old MV Rhododendron. WSF thus proposes to build three 64-Auto ferries as quickly as possible. This will enable the local shipbuilding sector to develop and refine the necessary skills for new ferry construction and afford the state the benefits of a strong learning curve and its attendant cost savings.

144-Auto Ferry Construction: WSF recommends that construction of the 144-Auto ferries commence as soon as possible after completion of the three 64-Auto ferries. WSF has already invested nearly $50M in the design and the purchase of Owner Furnished Equipment for the 144-Auto ferry. It is also important to capitalize on the newly developed new construction skills the local shipyard industry will gain during the building of the three smaller ferries. Constructing the 144-Auto ferries immediately after completing the 64-Auto vessels will afford the State of Washington the most efficient construction processes at the most affordable costs. Delaying construction of the 144s until the 2020-2030 time frame will result in a decline in that capability and a significant increase in costs due to the loss in shipbuilding efficiency. It is also likely that the current 144-Auto ferry design will not be a viable design, as it currently exists, in the 2020-2030 period due to anticipated changes in air and water emissions regulations plus the expected mandate for further fuel savings through the implementation of currently emerging technologies. Starting construction of the currently designed 144-Auto Ferry as soon as possible will enable a steady, systematic evolution of the design to meet evolving requirements and provide necessary service and capacity improvements.

Making a commitment to a long term, consistent shipbuilding program will encourage local shipyards to make important capital investments. Such investments could allow the shipyards to improve shipbuilding efficiency and production rates and reduce vessel construction costs. This would also enable the shipyards to invest in the workforce through training to develop necessary skills and the establishment of long term collective bargaining agreements.

These four issues are interdependent. The maintenance strategy directly affects, and is affected by the number of stand-by vessels that are maintained in the system. Reducing the number of stand-by vessels directly impacts the scheduling and completion of essential maintenance and preservation of the vessels. With fewer stand-by vessels, the risk of a reduction of service increases due to the unpredictability of equipment failures and other events that result in vessels being removed from service. The fleet size and the condition of the vessels certainly are key in determining the fleet recapitalization strategy.

The attached document provides specific substantive comments to the subject report including addressing the critical concerns noted above.

Sincerely,

David H. Moseley
Assistant Secretary, WSDOT – Ferries Division

Encl: WSF Substantive Comments Dated 23 Dec 2008

Cc:
Paula Hammond, Secretary of Transportation
Jill Satran, Governor's Executive Policy Advisor
Jean Baker, Deputy Chief of Ferries, Administration and Finance
Paul Brodeur, Director of Maintenance, Preservation and Engineering
Steve Rodgers, Director of Operations
Marta Coursey, Director of Communications
Ray Deardorf, Director of Planning
Kathy Scanlan, Cedar River Group
John Boylston, Naval Architect
Janice Baumgardt, Senate Fiscal Analyst
Teresa Berntsen, House Research Analyst

SECTION I.
PURPOSE AND APPROACH

A. Purpose

The 2007 Legislature directed the Joint Transportation Committee (JTC) to make recommendations regarding the most efficient sizing and timing of future Washington State Department of Transportation Ferries Division (Ferries) vessel acquisitions beyond those authorized by the 2007-09 biennium capital budget.

New vessels authorized by the 2007-09 biennium capital budget are up to three (3) 144-auto ferries and two (2) 64-auto Island Home class ferries.[12]

The legislature required the JTC's vessel acquisition recommendations to be based on ridership projections, auto level-of-service standards, and operational and pricing strategies reviewed by the JTC.[13] The vessel acquisition recommendations must also include the impact of those recommendations on the timing and size of terminal capital investments and Ferries' long-range operating and capital finance plans (ESHB 2878 (205) (1) (c) (i)).

Additional legislative directions that affect Ferries' auto-passenger vessel planning are:

- Ferries shall continue to provide service to Sidney, B.C. (ESHB 2878 (224) (3)).
- Legislative approval is required to add or eliminate a route (ESHB 2358 (8) (2)).
- In planning for vessel acquisitions, Ferries must evaluate the long-term vessel operating costs related to fuel efficiency and staffing (SSB 6932 (6) (2) (h)).

B. Ferries' Long-Range Plan

This study has been coordinated with Ferries' updating of its 2030 long-range plan, and uses ridership and cost information from that planning effort. As discussed in the JTC's *Auto-Passenger Vessel Preservation and Replacement Final Report,* January 2008, a new vessel program, consisting of planning, procuring and constructing a new vessel class, takes approximately 10 years for each program and is a critical component of Ferries' long-range plan and future financing (pp. 40-41).

1. Legislative Direction on Ferries' Long-Range Plan

In the 2007 session, the legislature passed ESHB 2358 directing Ferries to adopt adaptive management practices in its operating and capital programs in order to keep costs as low

[12] The 2008 legislature's transportation capital budget funding is for three (3) new auto-passenger vessels up to 100-auto capacity for the Port Townsend-Keystone route. Ferries has decided to build two (2) new 64-auto Island Home class vessels. See *Island Home Report* presented to the JTC's Ferry Policy Group on July 8, 2008, for further information.

[13] The JTC's Ferries Policy Work Group reviewed Ferries' ridership projection, auto level-of-service standard, and operational and pricing strategies during the interims between the 2007 and 2008, and the 2008 and 2009 legislative sessions as directed by ESHB 2878 (205) (1).

as possible, maximize utilization of existing assets, and continuously improve the quality and timeliness of service.

In the 2008 session, the legislature passed SSB 6932 directing Ferries to base its long-range vessel and terminal capital plan on its life-cycle cost models[14] and to include the following:

- Vessel preservation plan
- Systemwide vessel rebuild and replacement plan, including:
    - Projected retirement dates for all vessels
    - Timelines for vessel replacement
    - Rebuild dates for all vessels
    - Summary of the condition of all vessels
- Vessel deployment plan
- Terminal preservation plan

2. JTC Review of Ferries' Long-Range Capital Plan

The Legislature has directed the JTC to participate in and review Ferries' long-range capital plan (ESHB 2878 Section 205 (1)(a)(vi)). This report will help inform the JTC and legislative transportation committees' review of Ferries' plan.

C. Approach

1. Approach to Fleet Size, Composition and Deployment Recommendations

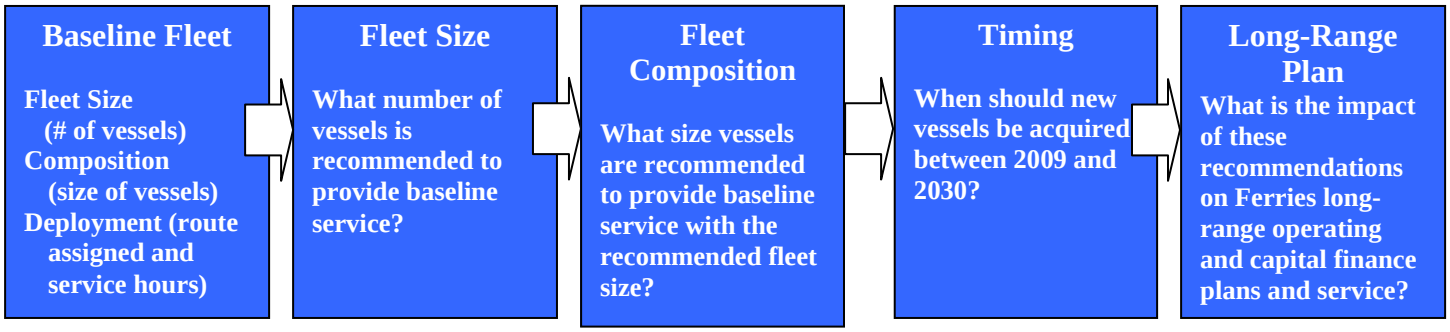
To analyze fleet size (i.e., total number of vessels), fleet composition (i.e., size of recommended vessels), and fleet deployment (i.e., which vessels are assigned to which routes), the consultants established a baseline against which alternative fleet sizes, compositions and deployments could be tested. The baseline fleet conforms to the vessel size, composition, and deployment assumptions used by Ferries in the development of its 2006-2030 ridership forecast and in its initial long-range planning[15].

As shown in the figure below, the consultants used a fleet planning model. The first analysis after establishing the baseline service was to examine the number of vessels needed to provide the same level of service as provided by the baseline fleet. The next step was to analyze the size of vessels needed and then the timing of the proposed vessel acquisitions. The final step was to examine the impact of the recommendations on Ferries' long-range operating and capital finance plan and service.

[14] The JTC Ferries Policy Work Group has reviewed modifications to the terminal life-cycle cost model. See *Joint Transportation Committee Policy Group Ferry System Review Phase II Status Report,* December 15, 2007, for further information on modifications to the terminal life-cycle cost model. The vessel life-cycle cost model is reviewed in *Vessel Preservation and Replacement Study,* January 2008, pp. 37-42.

[15] A 23-vessel fleet was assumed in Ferries' initial long-range planning. The *Revised Draft Long-Range Plan,* January 2009 assumes a 22-vessel fleet for baseline service. The baseline fleet in this report is a 23-vessel fleet.

Figure 1.
Fleet Planning Model



2. Financial Analysis

In order to ensure a reasonable comparison between alternatives, this analysis uses:

- *Constant 2008 dollars.* Ferries' operating and capital costs are affected by inflation. In order to recommend timing of vessel acquisitions, alternatives are compared on a constant dollar basis. Comparing alternatives on a year-of-expenditure basis would distort the alternatives because of the impact of inflation adjustments.
- *Expenditure averages by vessel class.* This analysis uses the average cost per vessel class rather than costs for each individual vessel because vessels within a class have only minor cost differences

SECTION II.
ROUTES, RIDERSHIP AND EXISTING FLEET

A. Auto-Passenger Routes

Ferries provides auto-passenger service on nine (9) routes in Puget Sound and the San Juan Islands. (As shown in Figure 2, in 2006 Ferries provided passenger-only service between Seattle and Vashon. This service is now the responsibility of King County and is not considered in this report.)

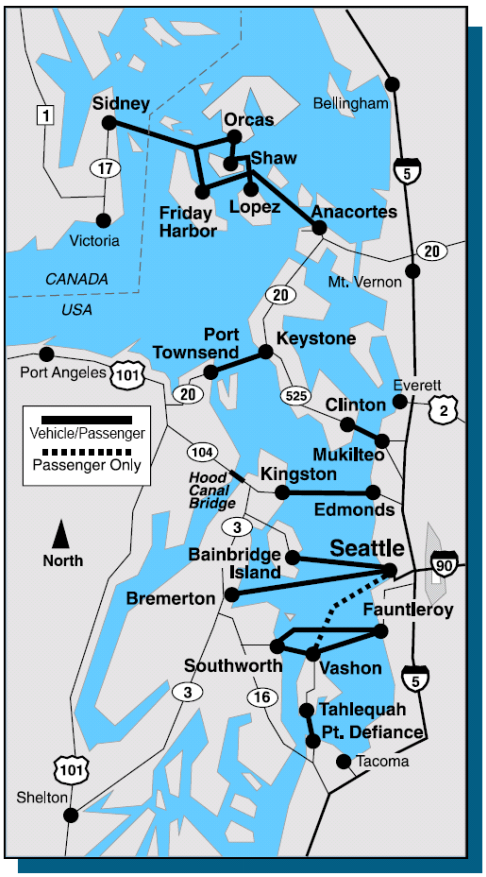
Figure 2.
Ferries Auto-Passenger Routes
Fiscal Year 2006 Ridership

International (Anacortes-Sidney)
1% of ridership

Port Townsend-Keystone
3% of ridership

Bainbridge-Seattle
27% of ridership

Bremerton-Seattle
10% of ridership



San Juan Islands
7% of ridership

Clinton-Mukilteo
17% of ridership

Edmonds-Kingston
19% of ridership

Fauntleroy-Vashon-Southworth
14% of ridership

Point Defiance-Talequah
3% of ridership

B. Ridership Projection – 2006-2030

1. Summary

Ferries projects an increase in systemwide ridership between 2006 and 2030 of 37 percent. Ridership is expected to increase faster for walk-on passengers than for autos, with auto ridership projected to grow 33 percent.[16] Ridership projections do not consider the effect of pricing and operational strategies on ridership growth because those strategies had not been determined when the projection was made.

2. Projected Auto Ridership Growth by Route

This report uses auto ridership[17] as the key measure of capacity. Increases in anticipated auto traffic between 2006 and 2020/2030 vary by route, and between weekdays and weekends. The ridership projections also vary by route segments for the multi-stop routes, which are the San Juans and the Fauntleroy-Vashon-Southworth triangle route.

Table 1.
Projected Auto Ridership Changes 2006-2020-2030

Route	% Change Projected from 2006				% Change	
	2006-2020		2006-2030		2020-2030	
	Weekends	Weekdays	Weekends	Weekdays	Weekends	Weekdays
Bainbridge						
Summer	15%	16%	37%	39%	22%	23%
Rest of Year	16%	16%	39%	39%	23%	23%
Bremerton						
Summer	1%	-4%	19%	14%	18%	18%
Rest of Year	-4%	-4%	15%	15%	19%	19%
Clinton						
Summer	17%	17%	24%	19%	7%	2%
Rest of Year	17%	17%	19%	19%	2%	2%
Kingston						
Summer	21%	39%	22%	38%	1%	-1%
Rest of Year	39%	39%	38%	38%	-1%	-1%
Point Defiance						
Summer	10%	20%	12%	20%	2%	0%
Rest of Year	20%	20%	20%	20%	0%	0%
Port Townsend						
Summer	36%	25%	75%	61%	39%	36%
Rest of Year	25%	25%	61%	61%	36%	36%

[16] Ridership has declined systemwide 10 percent between 1999 and 2006. Systemwide auto and walk-on ridership is expected to grow by 27 percent from 1999 to 2030.

[17] Auto ridership is the number of vehicles that come on board, averaging motorcycles and trucks to the equivalent of passenger cars.

Route	% Change Projected from 2006				% Change	
	2006-2020		2006-2030		2020-2030	
	Weekends	Weekdays	Weekends	Weekdays	Weekends	Weekdays
San Juan Islands						
Anacortes-San Juan						
Summer	17%	17%	33%	33%	16%	16%
Rest of Year	17%	17%	33%	33%	16%	16%
San Juan Interisland						
Summer	35%	35%	58%	59%	23%	24%
Rest of Year	33%	33%	57%	57%	24%	24%
Sidney						
Summer	20%	21%	25%	25%	5%	4%
Rest of Year	22%	22%	27%	27%	5%	5%
Triangle Route: Fauntleroy-Southworth-Vashon						
Fauntleroy-Vashon						
Summer	21%	23%	23%	18%	2%	-5%
Rest of Year	23%	23%	18%	18%	-5%	-5%
Fauntleroy-Southworth						
Summer	43%	64%	41%	63%	-2%	-1%
Rest of Year	64%	64%	63%	63%	-1%	-1%
Southworth-Vashon						
Summer	27%	45%	95%	117%	68%	72%
Rest of Year	44%	44%	118%	118%	74%	74%

C. Existing Fleet

1. 1998-2007 Fleet – Prior to Steel Electric Retirement

From the acquisition of the three (3) Jumbo Mark II class vessels in 1997-98 until the 2007 retirement of the four (4) Steel Electric class vessels, Ferries operated with a 24-vessel fleet. Of the 24 vessels in the fleet, three (3) were inactive, de-crewed vessels used only for emergency response. This fleet configuration was reviewed in the JTC's *Auto-Passenger Vessel Preservation and Replacement Final Report,* January 2008.

2. 2008 Fleet – After Steel Electric Retirement

In 2008 Ferries is operating a fleet of 21 vessels, including one leased from Pierce County to provide service on the Keystone route following the 2007 retirement of four (4) Steel Electric class vessels. Of the 21 vessels, five (5) are jumbo size (188-202 auto capacity); four (4) are large (144 auto capacity); five (5) are medium (124 auto capacity); four (4) are mid-size (87-90 auto capacity); and three (3) are small (34-50 auto capacity).

New vessels authorized by the 2007-09 biennium capital budget will replace the leased vessel from Pierce County with two Island Home vessels, which allows restoration of full shoulder and summer season service to the Keystone route. The 144-auto vessels

authorized by the capital budget will allow for the retirement from the fleet of one small vessel (*Rhododendron*) and one mid-size vessel (*Evergreen State*).[18]

Of the remaining 18 vessels in the 2008 fleet, seven (7) are due for retirement by 2030 including two (2) mid-size vessels, four (4) large vessels and one (1) small vessel. Two (2) jumbo size vessels are due for retirement in 2033 and will be in the planning and engineering process by 2030.

Table 2. 2008 Fleet

Size Category	Auto Capacity	Total	Vessel Class	Retirement
Jumbo	188-202	5	Jumbo Mark I 188 autos (2)/ Jumbo Mark II 202 autos (3)	2 -2033 (JM I))/ 3 - 2058 (JM II)
Large	144	4	Supers	4 - 2028
Medium	124	5	Issaquah	2040
Mid-Size	87-90	4	Evergreen State 87 autos (3) and Issaquah 90 autos (1)	3 - 2022 (ES)/ 1 - 2040 (Issaquah)
Small	34-64	3	Hiyu 34 autos, Rhododendron 48 autos, Leased-50 autos	1 - 2012 Rhod./ 1 - Hiyu 2027
Total		21	3 replaced by 2007-09 capital program	7 due for retirement by 2030 2 engineering by 2030

[18] The up to three (3) new 144-auto vessels authorized by the 2007-09 biennium capital budget, assuming all three are built, will also allow Ferries to place an older large vessel (the *Hyak*) into de-crewed, emergency reserve status.

SECTION III.
FERRIES' BASELINE FLEET

This section reviews Ferries' baseline vessel fleet, which includes three new 144-auto vessels and two Island Home 64-auto vessels consistent with the 2007-09 capital budget. The baseline scenario has the same fleet size, composition, and deployment used by Ferries in its 2006-2030 ridership projection and is the fleet assumed in Ferries' long-range planning.

For the baseline fleet this section reviews:

- *Fixed Costs.* Fixed costs are costs in Ferries capital (Program W) and operating (Program X) budgets that do not change with deployment or service hours. For example, insuring a vessel costs the same whether the vessel is in service 24 hours a day or is not in service at all. Fixed costs also include depreciation of the vessel acquisition cost.
- *Vessel Acquisition Costs.* Vessel acquisition costs are the total costs to design and construct vessels during the planning period in Ferries capital budget, Program W.
- *Vessel Reserve Capacity.* Vessel reserve capacity is needed to fill in on routes when regularly assigned vessels are out-of-service due to scheduled maintenance/preservation, emergency breakdowns, or accidents.
- *Route Vessel Deployment.* Vessel deployment is how the fleet is assigned by route.
- *Service Hours.* Service hours are the number of hours a vessel operates on an assigned route, and does not include hours, for example, spent by a vessel moving from the shipyard to its assigned route.
- *Variable Costs*. Variable costs are vessel costs in Ferries' operating budget that change with service hours and deployment. For example, a vessel in service 24 hours a day requires three deck crew shifts, while a vessel in service for 16 hours a day requires two shifts. There are no variable costs in Ferries capital budget – all capital costs are fixed.
- *Fixed and Variable Costs per Service Hour*. Annual fixed and variable costs are divided by the service hours provided as a measure of cost-efficiency.
- *Terminal Requirements and Costs*. Fleet size and deployment drive terminal requirements. For example, the deployment of a larger vessel on a route may require revisions to the dolphins at the terminal. Larger vessels may also require larger auto holding areas.

This section uses Ferries' 2006-2030 ridership projection and variable cost information to measure three key indicators for the system and for each route based on 2006, 2020 and 2030 ridership levels.[19] These key indicators are as follows:

[19] 2006 ridership is used because that is the base year for Ferries' ridership projection. Sailing information was taken from Ferries' *2006 Route Profile Notebook*, which provides ridership on all sailings during a

- *Percentage of auto capacity utilized.* Auto capacity is the prime determinant of vessel size and the primary constraint in the system's ability to carry riders. The ferry system has ample capacity for walk-on passengers. Ferries has historically analyzed peak demand because its vehicle level-of-service standard was set based on demand during the four-hour PM peak. This report assesses capacity utilization across all time periods. Ferries' long-range plan recommends the implementation of pricing and operational strategies to level out peak period demand, and modifies Ferries' vehicle level-of-service standard to the percentage of total capacity utilized.
- *Percentage of sailings in which auto capacity is sold out or fully reserved.* Analyzing the percentage of sailings in which auto capacity is sold out or fully reserved provides an additional measure of how fully the vessels assigned to a route are utilized.
- *Variable costs per auto carried.* Variable costs are divided by the number of autos projected to be carried, to serve as a measure of cost efficiency. The higher the percentage of capacity used, the lower the variable cost per auto carried. Variable costs are the only costs measured by route because fixed costs do not change with deployment or service hours.

The Ferries' baseline 2030 fleet information, which is summarized below, will be used to compare alternative fleet scenarios. Baseline route information is shown in Table 16.

Table 3. Summary Ferries' Baseline 2030 Fleet

($ 2008 millions)

		Baseline
# of Vessels	*Auto Capacity*	*# of Vessels*
Jumbo	188-202	5
Large	144	7
Medium	124	5
Mid-Size	87-90	3
Small	34-64	3
Total		23
Vessel Deployment		
Vessels on Routes at One Time		
Fall, winter, spring		17
Shoulder		18
Summer		19
# of New Vessels		12
Emergency Reserve Vessel Weeks Available		
Crewed Vessel		25
De-crewed Vessel		90
Total		115 wks

week in May, August and January. The information in the *2006 Route Profile Notebook* was incomplete for the Anacortes based routes, so 2007-08 ridership from Ferries' electronic fare system was used.

	Baseline
Financial	
Acquisition Costs 2009-2030	$1,095.0 M
Annual Fixed Costs - 2030 Fleet - 2008 $ millions	$112.0 M
Annual Variable Costs - 2030 Fleet - 2008 $ millions	$103.0 M
Annual Fixed Costs per Service Hour - 2008 $	$976
Annual Variable Costs per Service Hour - 2008 $	$898
Service Hours and Key Indicators	
Service Hours	114,728 hrs
Percentage of Auto Capacity Utilized Systemwide 2030 Ridership Level	68%
Percentage of Sailings in which Auto Capacity is Sold Out or Fully Reserved Systemwide 2030 Ridership Level	36%
Variable Costs per Auto Carried Systemwide 2030 Ridership Level – 2008 $	$6.87

A. Ferries' Baseline Fleet Size and Composition in 2030

The baseline fleet includes 23 vessels, of which five (5) are jumbo size vessels (188-202 auto capacity); seven (7) are large (144 auto capacity); five (5) are medium (124 auto capacity); three (3) are mid-size (87-90 auto capacity); and three (3) are small (34-64 auto capacity). [20]

Table 4.
Ferries' Baseline 2030 Fleet: Size and Composition

Size Category	Auto Capacity	Total Vessels	Vessel Class and Number in Class
Jumbo	188-202	5	Jumbo Mark I 188 autos (2) and Jumbo Mark II 202 autos (3)
Large	144	7	New 144s (3) and Supers/Super Replacements (4)
Medium	124	5	Issaquah
Mid-Size	87-90	3	Evergreen State 87 autos (2) and Issaquah 90 autos (1)
Small	34-64	3	Hiyu 34 autos (1) and Island Home 64 autos (2)
Total		*23*	

B. Ferries' 2030 Baseline Fleet Acquisition Schedule and Costs

Twelve (12) of the 23 vessels in the baseline fleet would be acquired during the planning period, and two (2) more would be in planning and engineering including:

- *Five authorized in the 2007-09 biennium* – three (3) large (144 autos) and two (2) small (64 autos) vessels.[21]
- *Seven replaced in-kind* – four (4) large to replace the Super Class vessels due for retirement in the 2025-33 time period (144 autos); two (2) mid-size to replace the Evergreen State class vessels due for retirement in the

[20] The baseline fleet assumes that the small *Rhododendron* and the mid-size *Evergreen State* are retired from the system.
[21] As noted in Section I, the legislature authorized up to three (3) new 144-auto ferries. The baseline fleet assumes the acquisition of three (3) new 144-auto ferries.

2022-28 time period (87 autos); and one (1) small to replace the Hiyu, due for retirement in the 2023-27 time period (34 autos).

- *Two vessels in planning and engineering* – replace the Jumbo Mark I class vessels due for retirement in the 2031-37 time period (188 autos). [22]

Ferries has estimated the cost of acquisition for the 2030 baseline fleet to be $1,095.0 million. The estimated costs do not include the machinery previously purchased by Ferries as part of its 144-auto procurement. The four (4) sets of engines that are part of the machinery can be used in either the large 144-auto vessels or the small 64-auto vessels.

Table 5.
Ferries' Baseline 2030 Fleet: Vessels and Acquisition Costs, 2009-11 to 2030-31 Fiscal Years
(2008 $ millions)

Size Category (auto capacity)	# Authorized 2007-09	# to Replace Retiring Vessels	Total # Vessels	Cost 2009-30
Jumbo (188-202)	Planning and engineering			$ 13.0
Large (144)	3	4	7	$785.0
Medium (124)			0	
Mid-Size (87-90)		2	2	$164.0
Small (34-64)	2	1	3	$133.0
Total	5	7	12	$1,095.0

C. Ferries' Baseline Annual Fixed Costs

Fixed costs are those costs in Ferries operating (Program X) and capital (Program W) budgets that do not change with deployment or service hours. Fixed costs also include vessel acquisition depreciation.

Total annual fixed costs in 2008 dollars for the 2030 baseline fleet are $112.0 million.

[22] In the baseline fleet scenario, five (5) of the new vessels are in the fleet before or by 2020—the three new 144-auto vessels and the two Island Home vessels authorized in the 2007-09 biennium. The other seven (7) new vessels are in the fleet before or by 2030. The 2030 fleet has lower costs than the 2020 fleet because the new 144-auto vessels are anticipated to have lower costs than the retiring Super class vessels.

Table 6.
Ferries' Baseline 2030 Fleet: Annual Fixed Costs
(2008 $ in millions)

Cost	Baseline Fleet $
Fixed Operating Budget Costs	57.7
Fixed Capital Budget Costs	32.1
Depreciation Acquisition Costs	22.2
Total	112.0

1. Annual Fixed Costs by Vessel Class

As shown in the table below, annual fixed costs vary by vessel class, ranging from $7.3 million per year for the largest jumbo size vessel to $1.5 million for the smallest vessel.

Table 7.
Ferries' Baseline 2030 Fleet: Annual Fixed Costs by Vessel Class
(2008 $ millions)

Class	$ Annual Fixed Operating Budget Costs*	$ Annual Fixed Capital Budget Costs	$ Annual Depreciat-ion	Total $ Fixed Costs (per Vessel)
Jumbo (188-202)				
Jumbo Mark II (202)	3.3	2.6	1.4	7.3
Jumbo Mark 1 (188)	3.2	2.0	0.2	5.4
Large (144)				
New 144	2.6	1.2	1.8	5.6
Medium (124)				
Issaquah (124)	2.4	1.5	0.3	4.2
Mid-Size (87-90)				
Issaquah (90)	2.4	1.5	0.3	4.2
Evergreen State Replacement (87)	2.4	0.7	0.9	4.0
Small (34-64)				
Island Home (64)	2.6	0.7	0.7	4.0
Hiyu Replacement (34)	0.8	0.2	0.5	1.5

*Assumes all vessels in fleet are fully crewed

2. Total Annual Fixed Costs in Operating Budget

The annual fixed costs in Ferries' operating budget total $57.7 million for the baseline fleet.

Table 8.
Ferries' Baseline 2030 Fleet: Annual Fixed Operating Budget Costs
(2008 $ millions)

	Baseline Fleet $
Engine room labor	34.8
Maintenance - drydock, shipyard repairs, parts	7.7
Engine room non-labor	6.4
Insurance	4.9
Eagle Harbor Repair Facility labor	3.5
Maintenance management and support	0.4
Total	57.7

The largest single fixed operating budget expense is engine room labor totaling $34.8 million or 60 percent of fixed operating budget costs for the baseline fleet. Ferries staffs engine rooms 24 hours a day/7 days a week on all vessels except those that are "de-crewed," which means that the vessel does not have an assigned engine room crew.[23] In the baseline scenario, there are two de-crewed vessels—a small (34 auto) and a large (144 auto) vessel.

Engine room crew sizes vary by vessel class. The Hiyu has one (1) engine room crew; the jumbo size and the four large Super class ferries have four (4) engine room crews; and all others have three (3). Engine room crew sizes are subject to both United States Coast Guard and labor agreement requirements.

Engine room crews for the new Island Home (64 auto) and the new 144-auto vessels are preliminary estimates based on the vessel designs, and may change with final Coast Guard approval. The new 144-auto vessels are assumed to require three-person engine room crews because the engine will be similar to that of the existing medium-size ferry, which operates with three-person crews. The existing Super class 144-auto ferries have four-person engine room crews.

Detailed information on fixed operating budget costs included in the table above can be obtained from previous JTC Ferry Financing Study reports including: (1) *Washington State Ferries Financing Study Final Report,* January 2007, *Appendix E. Operating Budget Review;* (2) *Auto-Passenger Vessel Preservation and Replacement Final Report,* January 2008; (3) *Management and Support Costs Final Report,* July 2008; and (4) *Non-Labor, Non-Fuel Operating Cost Final Report,* July 2008.

3. Annual Fixed Costs in Ferries' Capital Budget

The annual fixed costs in Ferries' capital budget for preservation and improvement of existing vessels total $32.1 million for the baseline fleet.[24]

[23] De-crewed vessels are used for emergency response. See discussion below.
[24] The capital numbers are from Ferries' 2009-11 biennium 16-year capital plan.

Vessel preservation and improvement expenditures are reviewed in two other JTC studies: (1) *Auto-Passenger Vessel Preservation and Replacement Final Report*, January 2008; and (2) *Systemwide Capital Projects Final Report*, July 2008.

4. Vessel Life/Annual Depreciation Costs

Depreciation, which is not included in the capital or operating budgets adopted by the legislature, is an important consideration when analyzing fleet size and configuration. Depreciation provides a way to compare the costs of building new vessels to the costs of keeping older vessels in the system.

Ferries, as discussed in the JTC's *Auto-Passenger Vessel Preservation and Replacement Final Report*, January 2008, has traditionally used a 60-year life as the assumed life of a vessel. The consultants were asked to review that assumption and, based on a review of other ferry systems, agree that 60 years is a reasonable life assumption for a ferry. For example, the Alaska State Ferry system uses 60 years as the anticipated life of a vessel, while the Woods Hole, Martha's Vineyard and Nantucket Steamship Company assumes 61 years as the anticipated vessel life.

In this analysis, the consultants have used a straight-line 60-year depreciation of vessel acquisition costs.

As can be seen in Table 7 above, newer vessels have higher depreciation costs that offset lower fixed costs. If depreciation were not considered, the financial analysis would lead to the conclusion that vessels should be replaced as soon as possible to reduce overall costs. Including depreciation allows for a better comparison of new and old vessels.

D. Ferries' 2030 Baseline Fleet Maintenance and Emergency Response Reserves

Each of the 23 vessels in the baseline scenario is assumed to be available for service 45 weeks a year, spending seven (7) weeks a year on average out-of-service for maintenance and preservation work. See the JTC's *Auto-Passenger Vessel Preservation and Replacement Final Report*, January 2008, for a discussion of vessel out-of-service time (pp. 27-29).

The table below shows that seven (7) of the 23 vessels have time during the year when they are not assigned to a route and are available for maintenance. Total weeks available for maintenance from these seven (7) vessels (227 weeks) provides for the 112 weeks needed to provide maintenance relief for the other 16 vessels and 115 weeks for emergency response. Of the 115 weeks available for emergency response, 25 weeks are available from vessels assigned an engine room crew and 90 are from de-crewed vessels.

A fully crewed vessel can respond to an emergency within six (6) to 12 hours, since the only requirement for the response would be to assemble a deck crew. Emergency response for a de-crewed vessel is 12 to 18 hours longer than for a fully crewed vessel.

Table 9.
Ferries' Baseline 2030 Fleet: Annual Vessel Weeks Available for Emergency Response

Weeks Not Assigned to a Route by Season						
Size	Winter	Fall, Spring	Shoulder	Summer	Weeks for Required Maintenance	Available Weeks
Vessels Assigned Engine Room Crews						
Jumbo (188)	12	18	8		-7	31
Large (144)	12	18	8		-7	31
Medium (124)	12	18	8	14	-7	45
Medium (124)				14	-7	7
Small (64)	12	18			-7	23
Sub-total	*48*	*72*	*24*	*28*	*-35*	*137*
Vessels Not Assigned Engine Room Crews (De-Crewed)						
Large (144)	12	18	8	14	-7	45
Small (34)	12	18	8	14	-7	45
Sub-total	*24*	*36*	*16*	*28*	*-14*	*90*
Total Available Weeks	72	108	40	56	-49	227
Total Weeks Needed for Maintenance of Vessels Assigned to a Route (16 vessels x 7 weeks)						112
Weeks Available for Emergency Response						115
Crewed Vessel Emergency Response Capacity						25
De-crewed Vessel Emergency Response Capacity						90

E. Ferries' Baseline 2030 Fleet Route Deployment

1. Deployment by Season

Under the baseline deployment, 17 vessels are assigned to routes in the fall, winter and spring seasons; 18 are assigned to routes in the shoulder season; and 19 in the summer season. Vessels not assigned to routes are undergoing maintenance/preservation work, providing maintenance relief for other vessels, or are available to respond to emergencies.

Table 10.
Ferries' Baseline 2030 Fleet: Vessel Route Deployment by Season

Route	# Vessels	Size: Fall, Winter, Spring (30 weeks)	Size: Shoulder (8 weeks)	Size: Summer (14 weeks)
Bainbridge	2	2 Jumbo		
Bremerton	2	2 Large		1 Jumbo
				1 Large
Clinton	2	1 Large		
		1 Medium		
Kingston	2	2 Jumbo		
Point Defiance	1	1 Mid-Size		
Port Townsend	1 or 2	1 Small	2 Small	

Route	# Vessels	Size: Fall, Winter, Spring (30 weeks)	Size: Shoulder (8 weeks)	Size: Summer (14 weeks)
San Juans & Sidney	4 or 5	2 Large		4 Large
		1 Medium		
		1 Mid-Size (Interisland)		
Triangle	3	2 Medium		
		1 Mid-Size		
Total Deployed	17 to 19	17	18	19

2. Service Hours

The baseline vessel deployment provides 114,728 service hours per year. Five (5) of the 23 vessels in the baseline scenario are deployed 24 hours a day year-round, and 14 are deployed 16 hours a day at least part of the year. One vessel is deployed eight (8) hours a day for the shoulder and summer season.

Table 11.
Ferries' Baseline 2030 Fleet: Service Hours by Route

Route	Vessels Assigned	Service Hours Per day Winter (12 weeks)	Service Hours Per Day Spring, Fall (18 weeks)	Service Hours Per Day Shoulder (8 weeks)	Service Hours Per Day Summer (14 weeks)	Total Service Hours
Bainbridge	2 Jumbo (202)	24 hrs. & 16 hrs.				14,560
Bremerton	1 Large (144)	24 hrs.				14,560
	1 Large (144)	16 hrs.				
	1 Jumbo (188)				16 hrs.	
Clinton	1 Large (144)	24 hrs.				14,560
	1 Medium (124)	16 hrs.				
Kingston	2 Jumbo (202 & 188)	24 hrs.(202), & 16 hrs.(188)				14,560
Point Defiance	1 Mid-Size (87)	16 hrs.				5,824
Port Townsend	1 Small (64)	16 hrs.				7,056
	1 Small (64)			8 hrs.		
San Juans & Sidney	2 Large (144)	16 hrs. & 11 hrs.	16 hrs. ea.			24,024
	1 Medium (124)	16 hrs.				
	1 Mid-Size (87)	11 hrs.	16 hrs.			
	2 Large (144)				16 hrs ea.	
Triangle	2 Medium (124)	24 hrs. & 16 hrs.				19,584
	1 Mid-Size (90)	16 hrs.				
Total Service Hours						*114,728*

F. Ferries' Baseline 2030 Fleet Variable Costs

Variable costs are those costs in Ferries' operating budget that change with service hours and route deployment. In the baseline scenario, the total annual variable cost is $103.0 million for the baseline fleet.

Table 12.
Ferries' Baseline 2030 Fleet: Annual Variable Costs
(2008 $ in millions)

Cost	Baseline Fleet $
Non-Fuel Costs	49.4
Fuel Costs	53.6
Total	103.0

1. Non-Fuel Costs

Ninety-five percent (95%) of non-fuel variable costs are for deck labor. The size of the deck crew ranges from four (4) to 11 depending on the vessel size. Two (2) additional deck crew are required for vessels on the Sidney international route. Deck crew size is subject to labor union agreements and United States Coast Guard requirements.

Under existing labor agreements, the deck crew are guaranteed a minimum eight-hour call-out, so deck labor is calculated in terms of the number of shifts required to provide eight-, 16- or 24-hour service.

Deck crews for the new Island Home (64 autos) and the new 144-auto ferries are preliminary estimates based on the vessel designs and may change with final Coast Guard approval.

Deck non-labor costs include private auto reimbursement, uniforms, cleaning supplies, and other costs that vary with service hours. The engine room supplies that are variable are items that Ferries has identified as affected by the service hours of a vessel.

Further information on the variable costs in Ferries' operating budget is available from the following JTC reports: (1) *Washington State Ferries Financing Study Final Report*, January 2007, *Appendix E. Operating Budget Review;* (2) *Auto-Passenger Vessel Preservation and Replacement Final Report*, January 2008; (3) *Management and Support Costs Final Report*, July 2008; and (4) *Non-Labor, Non-Fuel Operating Cost Final Report*, July 2008.

Table 13.
Ferries' Baseline 2030 Fleet: Annual Non-Fuel Variable Costs
(2008 $ in millions)

Cost	Baseline Fleet $
Deck labor	47.2
Deck-non labor	1.9
Engine room supplies	0.4
Total	49.4

Non-fuel costs per service hour vary by class of vessel, depending primarily on the size of the deck crew. Costs per service hour range from $535 for the largest vessel in the fleet to $208 for the smallest vessel. The two (2) additional deck crew required for the Sidney route cost $75 per service hour.

Table 14.
Ferries' Baseline 2030 Fleet: Non-Fuel Variable Costs by Vessel Class
(2008 $)

Class	Deck Crew	Deck Labor $ Per Service Hour	Deck Non-Labor $ Per Service Hour	Engine Non-Labor $ Per Service Hour	Total Non-Fuel Variable $ Costs Per Service Hour
Jumbo (188-202)					
Jumbo Mark II (202)	11	510	20	5	535
Jumbo Mark 1 (188)	10	470	18	5	493
Large (144)					
New 144	8	375	16	3	394
Medium (124)					
Issaquah (124)	8	375	16	3	394
Mid-Size (87-90)					
Issaquah (90)	7	338	16	3	357
Evergreen State Replacement (87)	9	417	9	2	428
Small (34-64)					
Island Home (64)	7	338	16	3	357
Hiyu Replacement* (34)	4	198	9	1	208
International Service					
Any Vessel - added crew	2	75			

* Hiyu deck non-labor and engine room non-labor estimated.

2. Fuel Variable Costs

Fuel costs vary by class of vessel, by route and by speed. Total annual fuel cost at the July 2008 cost of $3.21 per gallon in the baseline fleet is $53.6 million or $467 per service hour.

The table below shows the baseline fuel cost per service hour by route and the vessel speed assumed.

Table 15.
Ferries' Baseline 2030 Fleet: Fuel Costs by Route
($ 2008)

Route	# of Vessels by Size	Winter (12 weeks)	Spring, Fall (18 weeks)	Shoulder (8 weeks)	Summer (14 weeks)	$ Total Fuel Costs 2030 Fleet ($ millions)	$ Cost per Service Hour
Bainbridge	2 Jumbo (202)	236 gallons/svc. hr @ 18 kts.				$11.0 M	$758
Bremerton	1 Large (144)	156 gallons/svc. hr. @ 17 kts.				$7.7 M	$530
	1 Large (144)	156 gallons/svc. hr. @ 17 kts.					
	1 Jumbo (188)				213 gallons/svc. hr. @ 17.5 kts		
Clinton	1 Large (New 144)	110 gallons/svc. hr. @ 17 kts.				$4.6 M	$318
	1 Medium (124)	83 gallons/svc. hr. @ 16.5 kts.					
Kingston	1 Jumbo (202)	235 gallons/svc. hr. @ 17.5 kts.				$10.5 M	$718
	1 Jumbo (188)	207 gallons/svc. hr. @ 17 kts.					
Point Defiance	1 Mid-Size (87)	114 gallons/svc. hr.@ 9 kts.				$2.1 M	$366
Port Townsend	1 Small (64)	45 gallons/svc. hr. @ 12 kts.				$1.0 M	$144
	1 Small (64)			45 gallons/svc. hr. @ 12 kts.			
San Juans & Sidney	1 Large (144)	143 gallons/svc. hr. @ 17 kts				$11.4 M	$476
	1 Large (144)	143 gallons/svc. hr. @ 17 kts					
	1 Medium (124) - Sidney	187 gallons/svc. hr. @ 17.5 kts					
	1 Mid-Size (87) - Interisland	100 gallons/svc. hr. @ 9 kts.					
	1 Large (144) - Sidney				209 gallons/svc. hr.@ 17 kts.		
	1 Large (144)				143 gallons/svc. hr. @ 17 kts.		
Triangle	2 Medium (124)	83 gallons/svc. hr. @ 16.5 kts.				$ 5.1 M	$261
	1 Mid-Size (90)	100 gallons/svc. hr. @ 16.5 kts.					
Total 2030 Fleet						*$53.6 M*	*$467*

The table above uses the average crossing speed (knots). Longer routes with longer running times use more fuel per service hour because they are spending relatively less time in dock. For example, if there were a medium-size 124-auto vessel on the Bremerton route, which has a crossing time of 58 minutes at 16.5 knots, it would use 133 gallons of fuel per service hour. The same vessel on the Clinton route, which has a crossing time of 13.7 minutes at 16.5 knots, would use 83 gallons of fuel per service hour.

The three Jumbo Mark II vessels account for approximately one-third of the fuel consumed by all vessels. Ferries has made it a priority to improve fuel consumed per service hour on these vessels and has reduced consumption by 10.5 percent per service hour by running on two (except during landings) rather than three engines.[25] This fuel efficiency is built into the projection of fuel costs.

[25] The Jumbo Mark II vessels have four engines installed but had previously run on three engines.

G. Ferries' Baseline Key Indicators

The key indicators used in this report to compare fleet alternatives are, for the system and by route: (1) the percentage of auto capacity used, (2) the percentage of sailings sold out or fully reserved, and (3) the variable costs per auto carried.

As shown in Table 3 at 2030 levels of ridership on an annual basis, the percentage of auto capacity used with the baseline fleet is 68 percent, the percentage of sailings sold out or fully reserved is 36 percent, and the cost per auto carried in 2008 dollars is $6.87.

The table below shows the key indicators at 2006 (2008 for San Juan routes),[26] 2020 and 2030 projected ridership levels for the lowest ridership winter season and the highest ridership summer season. The table highlights in yellow routes that have relatively low capacity utilization or high costs per auto carried.

Table 16.
Ferries' Baseline 2030 Fleet: Key Indicators

Route	% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable $ 2008 Cost per Auto Carried	
	Summer	Winter	Summer	Winter	Summer	Winter
Systemwide						
2006 Ridership Level	57%	46%	16%	4%	$8.55	$9.76
2020 Ridership Level	70%	57%	44%	18%	$6.93	$7.88
2030 Ridership Level	76%	61%	51%	25%	$6.45	$7.38
Bainbridge						
2006 Ridership Level	74%	60%	23%	8%	$7.59	$9.48
2020 Ridership Level	86%	69%	38%	19%	$6.56	$8.17
2030 Ridership Level	102%	83%	55%	35%	$.562	$6.82
Bremerton						
2006 Ridership Level	51%	42%	8%	4%	$17.59	$20.99
2020 Ridership Level	50%	41%	7%	2%	$18.06	$21.87
2030 Ridership Level	59%	49%	9%	6%	$15.24	$18.26
Clinton						
2006 Ridership Level	68%	59%	11%	6%	$3.93	$4.95
2020 Ridership Level	82%	69%	38%	17%	$3.27	$4.23
2030 Ridership Level	84%	70%	44%	20%	$3.19	$4.16
Kingston						
2006 Ridership Level	81%	60%	21%	3%	$6.21	$8.38
2020 Ridership Level	109%	83%	65%	33%	$5.06	$6.03
2030 Ridership Level	108%	83%	66%	33%	$5.06	$6.08

[26] For San Juan routes, 2008 ridership is used instead of 2006 because Ferries' 2006 information was incomplete for Anacortes-based routes.

Route	% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable $ 2008 Cost per Auto Carried	
	Summer	Winter	Summer	Winter	Summer	Winter
Point Defiance						
2006 Ridership Level	46%	38%	0%	0%	$9.29	$11.24
2020 Ridership Level	54%	46%	4%	2%	$7.92	$9.37
2030 Ridership Level	54%	46%	5%	2%	$7.89	$9.37
Port Townsend						
2006 Ridership Level	88%	63%	26%	7%	$7.09	$10.06
2020 Ridership Level	114%	78%	72%	21%	$6.27	$8.05
2030 Ridership Level	146%	101%	99%	50%	$6.27	$6.31
San Juans & Sidney						
San Juans & Anacortes						
2006 Ridership Level	82%	46%	31%	1%	$12.27	$23.79
2020 Ridership Level	96%	54%	43%	8%	$10.49	$20.33
2030 Ridership Level	109%	61%	49%	11%	$10.04	$17.89
Interisland						
2006 Ridership Level	29%	16%	0%	0%	$78.40	$105.12
2020 Ridership Level	40%	22%	0%	0%	$58.07	$79.04
2030 Ridership Level	47%	26%	0%	0%	$49.37	$66.96
Sidney (2nd number spring, fall & shoulder /no winter service)						
2006 Ridership Level	75%	44%	7%	0%	$35.13	$64.01
2020 Ridership Level	90%	54%	36%	7%	$29.11	$52.47
2030 Ridership Level	93%	56%	39%	7%	$28.10	$50.40
Fauntleroy-Vashon-Southworth						
2006 Ridership Level	33%	30%	3%	2%	$6.12	$6.89
2020 Ridership Level	45%	41%	10%	8%	$4.54	$5.10
2030 Ridership Level	46%	41%	8%	7%	$4.45	$5.05

H. Ferries' Baseline Fleet Impact on Terminal Improvements

Routes where vessel sizes in Ferries' baseline 2030 fleet are changing from those assigned in 2008 are shown in the table below. Although vessel sizes are changing on the Bremerton, Clinton and San Juan Interisland routes, there is unlikely to be any impact on the terminals. These routes either already have larger vessels operating on them and/or the amount of holding capacity needed, particularly with the implementation of operational and pricing strategies, is sufficient to accommodate these changes.

On the Point Defiance route, the increase in the size of the vessel assigned is the largest, with a 81 percent increase in auto capacity. This increase will likely result in increased terminal costs for an expanded holding area with or without the implementation of pricing and operational strategies. It is also likely that the increased vessel size on the route would affect the Point Defiance terminal dolphins which, according to Ferries'

terminal life-cycle cost model, are due for replacement in 2010 (left outer timber dolphin) and 2020 (left outer three (3) pile steel dolphin).[27] As noted in Ferries' *Vashon and Orcas Ferry Terminal Dolphin Replacement Pre-Design* studies, larger and heavier vessels require more robust dolphins. (See *Vashon Ferry Terminal Dolphin Replacement Pre-Design Study*, May 1, 2008, and *Orcas Ferry Terminal Dolphin Replacement Pre-Design Study*, Oct. 4, 2007.)

Table 17.
Ferries' Baseline 2030 Fleet: Impact on Terminals

Route	# Vessels	Baseline 2030 Fleet			Existing			Auto Capacity Change per Sailing	% Change	Likely Impact on Terminals?
		Size: Fall, Winter, Spring	Size: Shoulder	Size: Sumer	Size: Fall, Winter, Spring	Size: Shoulder	Size: Sumer			
Bremerton	2	1 Large		1 Jumbo	1 Large		1 Jumbo			
		1 Large			1 Medium			20	16%	No
Clinton	2	1 Large			1 Medium					
		1 Medium			1 Medium			20	16%	No
Point Defiance	1	1 Mid-Size			1 Small			39	81%	Yes - holding & dolphins
San Juans - Interisland	1	1 Mid-Size			1 Small (with Steel Electric class)			28	47%	No

[27] The Tahlequah dolphins were replaced in 2003 and 2005, and should be adequate for the larger vessel.

SECTION IV.
FLEET SIZE

This section addresses the second part of the fleet planning model: "What number of vessels is recommended to provide baseline service?"

This section reviews Ferries' baseline 23-vessel fleet, an alternative 22-vessel fleet developed by Ferries, and a consultant proposed 21-vessel fleet. All of the fleets provide the same service hours and route auto capacities. Under all alternatives Ferries would have 17 vessels providing service on routes in the winter, spring and fall seasons, 18 in the shoulder season, and 20 in the summer season.

Ferries, as part of its long-range plan, developed a 22-vessel fleet scenario assuming that there would be one less large 144-auto capacity vessel in the fleet.[28] The 22-vessel fleet delivers the same service hours and route auto capacities as the 23-vessel fleet, but has one less de-crewed emergency reserve vessel.

The consultants have developed a 21-vessel fleet alternative that delivers the same service hours and route auto capacities as the 22- and 23-vessel fleet. The 21-vessel fleet includes no de-crewed emergency response vessels.

The consultants recommend that Ferries plan on a 21-vessel fleet to deliver the baseline service. To provide adequate emergency reserve capacity with the 21-vessel fleet, the consultants recommend that Ferries focus on reducing average planned out-of-service time by 2030 from seven (7) weeks per year per vessel to six (6), and that the legislature recognize that additional funding for maintenance and preservation per vessel may be needed to accomplish this reduction.

With a 21-vessel fleet, Ferries would have to acquire 10 rather than 12 vessels in the planning period and would have reduced fixed costs. The two (2) vessels that are being eliminated from the fleet were de-crewed, emergency relief vessels that did not have variable costs because there was no plan to use them for route service.

[28] The consultants modified Ferries' 22-vessel fleet scenario by deploying vessels in such a way as to maintain the same size vessels on each route as provided in the baseline scenario.

Table 18.
Recommended 2030 Fleet Size

	Baseline	Recommended	Change from Baseline
# of Vessels	*# of vessels*	*# of vessels*	*# of vessels*
Total	23	21	-2
# of new vessels (2009-30)	12	10	-2
Vessel Deployment	*# of vessels*	*# of vessels*	*# of vessels*
Vessels on Routes at One Time			
Fall, winter, spring	17	17	0
Shoulder	18	18	0
Summer	19	19	0
Emergency Reserve Vessel Weeks Available	Weeks	Weeks	Weeks
Crewed Vessel	25	46*	21
De-crewed Vessel	90	0	-90
Total	115	46	-69
# of weeks need based on 2003-06	33	33	0
Service Hours	*114,728 hrs.*	*114,728 hrs.*	*0 hrs.*
* Assumes Ferries reduces planned out-of-service time per vessel to an average of 6 weeks per year			

A. Emergency Response Requirement

The 23-, 22- and 21-vessel fleets all provide the same route services. Under each scenario there is sufficient capacity to maintain the fleet with relief vessels.

The key variable in determining the fleet size is how much reserve capacity is needed for emergency response. Ferries does not track the use of its fully crewed vessels for emergency response but does maintain records on the use of its de-crewed emergency response vessels.

As shown in the table below, the consultants examined the use of de-crewed emergency response vessels from 2003 to 2007. During this time period Ferries had 24 vessels in the fleet, three (3) of which were de-crewed emergency response vessels. During this time period, Ferries' average planned out-of-service time was seven (7) weeks per year per vessel. From 2003 through 2006, the highest number of weeks in which the emergency reserve vessels were used was eight (8) weeks in 2006 when the mid-size emergency response vessel was used.

In 2007 Ferries faced the most extreme emergency condition in its history with steel preservation failures leading to the sudden retirement of four (4) Steel Electric class vessels and increased steel inspection and repairs on other vessels.[29] During 2007, the de-crewed reserve vessels were used for 55 weeks, and service on the Keystone route was shut down during November and December. The consultants note that improved fleet

[29] See the JTC's *Auto-Passenger Vessel Preservation and Replacement Final Report*, January 2008, for more information on Ferries' vessel steel maintenance program.

preservation and inspection should prevent the sudden loss of four vessels from occurring.

Table 19.
Weeks in Service of De-Crewed Vessels 2003-07

Size	Small	Small	Mid-Size	Total
Auto Capacity	59	34	87	
Fiscal Year	# Weeks			
2003	0	0	0	0
2004	0	0	1	1
2005	0	0	3	3
2006	0	0	8	8
2007*	17	5	33	55

* Emergency retirement of four (4) Steel Electric class vessels and increased steel inspections on other vessels. In addition, there was no service on the Keystone route in November and December.

B. Emergency Response Capacity – 23-, 22-, 21-Vessel Fleet Sizes

If Ferries continues to have each vessel out-of-service for planned maintenance and preservation an average of seven (7) weeks a year, then, as shown in the table below, under the baseline 23-vessel fleet, Ferries has 115 weeks of emergency response capacity, including 25 weeks of crewed vessel time and 90 weeks of de-crewed vessel time. With a 22-vessel fleet Ferries would have 70 weeks of emergency response time, including 25 weeks of crewed vessel time and 45 weeks of de-crewed vessel time. In a 21-vessel fleet Ferries would have 25 weeks of crewed vessel emergency response time.

Table 20.
Alternative 2030 Fleet Sizes: De-Crewed Vessels – Weeks Available for Emergency Response

Size	Winter	Fall, Spring	Shoulder	Summer	Weeks for Required Maintenance	Available Weeks
23-Vessel Fleet						
Vessels Not Assigned Engine Room Crews ("De-Crewed")						
Large (144)	12	18	8	14	-7	45
Small (34)	12	18	8	14	-7	45
Weeks Available for Emergency Response						115
Crewed Vessel Emergency Response Capacity						25
De-crewed Vessel Emergency Response Capacity						90
22-Vessel Fleet						
Vessels Not Assigned Engine Room Crews ("De-Crewed")						
Small (34)	12	18	8	14	-7	45
Total Weeks Available for Emergency Response						70
Crewed Vessel Emergency Response Capacity						25
De-crewed Vessel Emergency Response Capacity						45

Size	Winter	Fall, Spring	Shoulder	Summer	Weeks for Required Maintenance	Available Weeks
21-Vessel Fleet						
Vessels Not Assigned Engine Room Crews ("De-Crewed")						
Total Weeks Available for Emergency Response						25
Crewed Vessel Emergency Response Capacity						25
De-crewed Vessel Emergency Response Capacity						0

C. Reduce Maintenance and Preservation Out-of-Service Time

Reducing planned out-of-service time for maintenance and preservation is key to reducing the fleet to 21 vessels. A 21-vessel fleet has 25 weeks of crewed emergency response time, the same amount of crewed emergency response time that was available and presumably used in the 2003-2006 time period. A 21-vessel fleet with 7 weeks of planned out-of-service time per vessel does not provide for the de-crewed vessel emergency response time (1 to 8 weeks) used by Ferries in the 2003-2006 time period.

To gain the eight (8) weeks of annual maximum de-crewed vessel time used, Ferries would need to reduce average annual out-of-service time by 2.5 days per vessel or 5 percent.

As discussed below the consultants recommend that Ferries reduce planned out-of-service to six (6) weeks per year or 14 percent. If in a 21-vessel fleet the average maintenance and preservation out-of-service time were reduced to six (6) weeks rather than seven (7) per year, Ferries would have a total of 46 weeks of emergency response capacity from fully crewed vessels which is nearly four times the emergency response use of the de-crewed vessels at the maximum in the 2003-2006 time period.

Table 21.
21-Vessel Fleet: Reduced Out-Service-Time Emergency Response Capacity

	Weeks Not Assigned to A Route by Season					
Size	Winter	Fall, Spring	Shoulder	Summer	Weeks for Required Maintenance	Available Weeks
Vessels Assigned Engine Room Crews						
Jumbo (188)	12	18	8		-6	32
Large (144)	12	18	8		-6	32
Medium (124)	12	18	8	14	-6	46
Medium (124)				14	-6	8
Small (64)	12	18			-6	24
Total	*48*	*72*	*24*	*28*	*-30*	*142*
Total Weeks Needed for Maintenance of Vessels Assigned to a Route (16 vessels x 6 weeks)						96
Weeks Available for Emergency Response						46
Crewed Vessel Emergency Response Capacity						46

1. Ways to Reduce Out-of-Service Time

The JTC's *Auto-Passenger Vessel Preservation and Replacement Final Report*, January 2008, reviewed and made recommendations on potential ways to reduce the average seven (7) weeks per year per vessel planned maintenance and preservation out-of-service time.

As part of the current study, the consultants undertook further analysis of the potential to reduce vessel out-of-service time. Consultants met with Ferries' staff and representatives of various shipyards to determine what options there might be to reduce Ferries' planned out-of-service time, particularly in the summer months. In addition the consultants visited the North Carolina Ferry Division. The consultants found that:

- *By consolidating shipyard and Eagle Harbor work, out-of-service time could be reduced by up to two (2) weeks per year per vessel* – The JTC's *Auto-Passenger Vessel Preservation and Replacement Final Report,* January 2008, found that vessels are at Eagle Harbor for an average of two of the seven weeks of out-of-service time (Table 6. Planned Out-of-service Periods 2008 Fiscal Year [Weeks], p. 28). Union and shipyard agreements allow Eagle Harbor staff to do some work at the shipyards on Ferries' vessels. The consultants' review of the Eagle Harbor work performed and the shipyard labor contracts[30] reveals that all of the Eagle Harbor work could be carried out concurrently with other work while the vessels are at the commercial yard. At no point in Ferries' vessel maintenance lay-up schedule[31] does the time at Eagle Harbor exceed the time at the shipyard; in most cases the time at Eagle Harbor is approximately 30 percent of the time at the commercial shipyard.
- *There is limited dry dock capacity, particularly for Ferries' large vessels* – Todd Pacific Shipyard is the only shipyard that can accommodate the five (5) jumbo size vessels. This has affected Ferries' ability to manage its dry dock schedule. In addition, most Pacific Northwest fleet owners also want to dry dock in the non-summer months. This puts intense pressure on the limited dry dock capacity in the Puget Sound region and leaves Ferries on occasion with no option but to dry dock in the peak summer months. A survey conducted by the consultants with regard to present dry docks reveals that one additional shipyard is acquiring a larger dry dock and another plans to obtain one which should ease some of the dry dock pressure. In advance of any additional available dry docks, Ferries could attempt to contract with one or more shipyards toward blocking out certain periods during the winter when the most vessels are available to fill in for dry docked vessels. Ferries would contract for a specified continuous period, well in advance of the need and then could schedule individual vessels as needs arise within that time period.

[30] The shipyard most generally used and the one assessed by the consultants was Todd Pacific Shipyard in Seattle.

[31] The Vessel Maintenance Lay Up Schedule issued August 24, 2007, and revised on October 22, 2007, was the basis for the analysis of vessel out-of-service time in the JTC's *Auto-Passenger Vessel Preservation and Replacement Final Report,* January 2008.

- *Underwater Inspection in Lieu of Drydocking (UWILD)* – The United States Coast Guard requires vessels to be dry docked twice in five (5) years. The Coast Guard also allows Underwater Inspection in Lieu of Drydock (UWILD) at the midpoint of the five-year period.. There are underwater coatings that are presently certified for five years of service, so this approach is now technically possible. If the Coast Guard allowed UWILD, it would result in half the dry dock out-of-service time and half of the present drydock cost for the vessels for which it is allowed. The application of UWILD is at the discretion of the local United States Coast Guard Officer in Charge of Marine Inspection. Current interpretations are that UWILD is applicable to vessels 15 years old or younger. As currently interpreted, UWILD could be applicable to the three (3) Jumbo Mark II class vessels built in 1997 and 1998 and to Ferries' new vessels as they come on line.
- *Topside painting takes the most out-of-service time* – The longest out-of-service time is associated with painting the topside of a vessel, taking 14 to 16 weeks. There are five ways the consultants have identified to reduce out-of-service time associated with topside painting:
    - *Consolidate topside painting with dry docking.* Given the relatively high labor rate at the only commercial shipyard that can dry dock Ferries' largest vessels, Ferries limits the amount of work done during dry docking. Ferries contracts out to others for additional maintenance work, outside of the drydocking period, adding to out-of-service time.
    - *Paint less frequently*. Ferries' vessel life-cycle cost model calls for topside painting to occur every five (5) years.[32] North Carolina Ferries paints every 7.5 years and Woods Hole, Martha's Vineyard and Nantucket Steamship Company (SSA) every 10 years. Ferries' life-cycle cost model assumes the continued use of alkyd paint which has a shorter life than newer paints. North Carolina is working out of the old paints and substituting new paints, accounting for their less frequent painting. SSA is able to paint only every 10 years because of the aluminum superstructure and use of polyurethane paint.[33]
    - *Utilize a single paint supplier/contractor.* As recommended in the JTC's *Auto-Passenger Vessel Preservation and Replacement Final Report*, January 2008, if all of the fleet painting were bid to one paint supplier for supply of product, supervision of preparation and coating, and monitoring the performance of coatings, with the continued contract based upon paint system performance and out-

[32] 2007-09 life cycle cost model provided to consultants for the JTC *Auto-Passenger Vessel Preservation and Replacement Final Report*, January 2008.

[33] Hull painting has also progressed to where coating manufacturers are now giving 5 year warranties on bottom coating performance. This does not mean that the entire coating system has to be replaced in 5 years, only the top coating has to be refreshed. Usually, modern bottom coating systems can last 15 to 20 years with top coat replacement only. Ferries' life cycle model calls for entire hull painting every 7.5 years.

of-service time for painting, a lesser cost for painting would result, with less out-of-service time.

- *Design and construct to reduce maintenance.* As the topside painting cost per vessel runs between $1.5 and $3.0 million, with a frequency greater than that seen in other ferry fleets, consideration should be given to materials and details in design. All superstructures of future Ferries' vessels should be constructed of aluminum to reduce coating cost, and do away with bleeding (and cosmetic re-painting) and with steel replacement. This will reduce maintenance and repair costs and out-of-service time.[34] The design of sheer strake to main deck joints and related curbings cause corrosion on existing ferries, with expensive, time consuming painting and/or repairs resulting. Other ferry systems, such as North Carolina, have standard vessel specifications for these areas (details) that ensure that no matter who builds the vessel, the vessels get their shell to deck joint and curbing detail in a standard, relatively maintenance-free, way.[35] Materials for ladders and gratings, such as fiberglass, exist where no coating is required for maintenance. The corrosion in the bilges of Ferries' existing vessels[36] shows that it is difficult to inspect, clean and then re-coat these areas. Future designs should lift piping and cable systems well above the shell so easy inspection, preparation and re-coating can take place, even while underway, if necessary. The bilge coating system color should be changed to white, to highlight problem areas.
- *Use an enclosed painting facility*. North Carolina State Ferries, which operates its own shipyard, is contracting for a painting building so that all topside painting can be done inside. This reduces environmental issues, allows for a faster and more predictable painting schedule, and allows painting to be scheduled during the winter and shoulder seasons.

- *Ferries' emphasis on the lowest cost per maintenance and preservation activity results in longer out-of-service time* – The consultants have found that Ferries does an excellent job of minimizing the costs associated with shipyard repairs. However, these cost reductions can also mean that out-of-service time is extended

[34] Aluminum superstructures would cost more than the steel superstructure now planned for the new 144-auto vessels. The consultants estimate the increased cost to be approximately $4.0 million per vessel, which would be offset by reduced maintenance and repair, and, given the lighter weight of aluminum, lower fuel costs.

[35] Where the hull and deck join on the vessels, there is usually an outside curbing against which cars rub if they go too far outboard. Ferries has many different details depending on who built the vessel. Some of the curbs are closed box-like structures, but must have holes through them in places to let deck water spill over the side. Keeping these holes watertight is difficult. When water gets into the box-shaped curb, corrosion starts but cannot be seen immediately. Ferries has patch-fixed some of the corrosion by injecting foam into the box, but this action has only increased the problem.

[36] See the JTC's *Auto-Passenger Vessel Preservation and Replacement Final Report,* January 2008, for more information on bilge corrosion problems in Ferries' existing vessels.

in order to avoid overtime or other rush charges. The consultants believe that Ferries should consider paying more per job if needed to reduce out-of-service time so that the overall size of the fleet can be smaller.

It should be noted that the United States Coast Guard has mandated that Ferries increase steel inspection on vessels as they age. This requirement could have the effect of increasing out-of-service time to some extent.

2. Use of Maintenance Vessels for Emergency Response

North Carolina State Ferries uses a vessel that needs some significant amount of dockside work as its emergency relief vessel. The maintenance project is carried out in such a way that the vessel can be returned to service if need be. This gives them a standby emergency relief vessel without tying up an entire vessel. In North Carolina the vessel can be made available generally with three (3) days.[37] This is an additional way in which Ferries could provide emergency response without having to have a designated de-crewed vessel for that purpose.

3. Service Disruption Risk

In the summer Ferries has 19 of its vessels in service on a route. In a 21-vessel fleet in the best case where no vessels are at the shipyard for service, two (2) vessels would be available for emergency response. However, if one (1) vessel is in the shipyard for maintenance and preservation service, only one (1) vessel would be available to respond to summer emergencies. There is less risk of service disruption in the shoulder season when 18 vessels are in service and even less in the fall, spring and winter seasons when 17 vessels are in service on routes.

4. Crewed Vessels – Emergency Response

The assumption in this report is that all vessels, whether crewed or de-crewed, are fully preserved. However the reality has been that Ferries, given budget constraints, has not been able to fully preserve its de-crewed vessels. In the consultants' judgment, having de-crewed vessels with no preservation funding actually causes the vessel to degrade more quickly that if it were in service and crewed.[38] Alternately, it is difficult to justify full preservation of an emergency response vessel that sees very little service. It also creates problems for Ferries if, in placing a de-crewed under-preserved vessel in emergency service, that vessel then also fails. The consultants believe that it will be more efficient to have a fully operating fleet (with all vessels fully crewed and fully preserved) than to have one or two de-crewed vessels for emergency response.

In addition, a fully crewed vessel can respond 12 to 18 hours faster than a de-crewed vessel.

[37] There are occasions when the vessel is not available due to a missing or broken part, for example.

[38] This can be observed, for example, in the *Evergreen State*, which is in far worse condition than other vessels of her class—the *Tillikum* and the *Klahowya*—that have been in service and maintained.

D. Fleet Size Recommendations

Recommendation #1. Ferries should reduce average planned out-of-service time from seven weeks per vessel per year to six weeks. This can be achieved by consolidating Eagle Harbor work with other shipyard work, focusing on reducing time spent on topside painting, designing vessels with aluminum superstructures and other features that reduce required maintenance, and requesting the Coast Guard to allow underwater inspection in lieu of dry docking.

Recommendation #2. The legislature should recognize that in order to reduce out-of-service time and reduce the fleet size, the per-vessel expenditure on maintenance and preservation may increase, and therefore, it will be necessary to provide adequate maintenance and preservation funding for each vessel in the fleet in order to minimize service disruption.

Recommendation #3. Assuming a six-week annual maintenance period, Ferries should plan on a 21-vessel fleet to provide the baseline 2030 service hours. This size fleet will provide adequate maintenance relief and 46 weeks of crewed vessel emergency response capacity. Additional vessel acquisitions could then be used to expand service, not to deliver the baseline service.

Recommendation #4. Ferries should implement a system to use vessels that are in maintenance for emergency response.

E. Ferries' Response to Section IV

1. Recommendation One: Reduce out-of-service time

- WSDOT Ferries Division concurs that a target of 6 weeks maintenance can be established for vessels. Reducing the average out of service time from 7 weeks to 6 weeks does reduce the need for standby vessel time from the maintenance perspective and thus reduces the apparent need for standby vessels (see discussion regarding recommendation #3). However, out of service time is driven by external forces such as unanticipated regulatory mandates and the time it takes to complete top-side repainting projects. For example, USCG mandated security installations have taken 8-10 weeks for smaller vessels and 14 weeks for the largest ferries which have driven up out of service times from the "normal" requirement for maintenance time. Normal drydocking periods (2-4 weeks) are much shorter and Eagle Harbor (EH) maintenance periods are usually just 1-2 weeks.
- Future regulatory mandates, such as meeting the recently revised Clean Air Act rules, are anticipated. These mandates will require changes to the vessels, most likely resulting in significant out of service time.
- The ferry system relies on a limited workforce in different critical trades within the Puget Sound region. The limited workforce can affect the ability

to complete work within desired time frames. For example, there were too few pipe fitters to install U.S. Coast Guard required remotely operated bilge valves during Elwha's routine drydock in Anacortes. This required a second dockside contract be awarded to a different contractor essentially doubling Elwha's time out of service from 8 to 16 weeks. Similar challenges have been identified with completing security system installations.

- Combining Eagle Harbor time with shipyard work is being done to some extent. However, the ability to do this is driven by the nature of the shipyard work and the contractual requirement for their work to be completed on a "not-to-interfere basis." For example, EH specializes in generator and propulsion motor cleaning. This cannot be done when there is significant shipyard work taking place in the vicinity of the generators and/or propulsion motors due to the risk of contaminating these critical propulsion components. A recent illustration includes steel replacements in the vicinity of the main engineering spaces, which precluded completion of any significant EH maintenance work in those areas. Furthermore, EH staff is prohibited by state law from completing hotwork on vessels at commercial facilities. The cost of EH work is not prohibitive when vessels are docked at Todd Shipyards; however, when at Everett, Anacortes or Bellingham shipyards there is significant travel time for EH crew and sometimes the cost of a hotel for the farthest sites.
- Ferries Division already works closely with the shipyards having drydock capacity to match the system's drydock needs with shipyards' drydock availability. The result is a good match between the system's needs, including maintaining operational schedules and shipyards' ability to effectively blend other work with WSDOT Ferries Division contracts.
- Underwater Inspection in Lieu of Drydocking (UWILD) is applicable only to vessels that are 15 years of age and younger. The program will be pursued for new construction vessels. Ferries Division will investigate costs associated with incorporating for the Jumbo Mark II class to determine the cost benefit of making required changes associated with UWILD to these vessels given their current age (10+ years old).
- Ferries Division already paints the curtain plates (outboard sides of the deckhouse) while the vessels are in drydock due to containment requirements. All other topside painting is done while dockside so that valuable and expensive drydock time is not tied up with this work. Currently, Ferries is using polyurethane paints as a means to improve paint durability. Although the current Life Cycle Cost Model indicates that topside paint will be renewed every 5 years, the reality is that Ferries repaints the vessels every 7-10 years. For instance, the Jumbo Mark IIs recently underwent their first topside paint job in over 10 years. Budget and schedule constraints are the key drivers to the actual completion of vessel painting as compared to the planned schedule as identified in the LCCM. Ferries Division will investigate modifying the LCCM to reflect

painting the vessels every 7 years. Ferries will investigate going to a sole source paint supplier/ contractor. Further investigation of design & construction techniques that will require less paint maintenance will be conducted particularly with the new 144-auto ferry. Design changes were minimized for the new 64-auto ferry to minimize design and construction contract costs.

- Ferries Division plans to updated its Life Cycle Cost Model.

2. Recommendation Three: Plan for a 21 Vessel Fleet

- The consultant indicates that a fully crewed vessel can respond 12 to 18 hours faster than a de-crewed vessel. It should be noted that WSDOT Ferries Division has used the strategy of successfully calling out a partially crewed vessels on a 12 hour stand-by in the past. As a result of this previous success, WSDOT Ferries Division believes that fully crewing the stand by vessel is not necessary.

3. Recommendation Four: Use Maintenance Vessels for Emergency Response

- Ferries Division already practices this recommendation where possible. Ferries pulls vessels early from Eagle Harbor maintenance periods to cover for other vessel problems. Cathlamet's recent quick return to service from an EH maintenance period when the Walla-Walla had thrust bearing problems illustrates this practice.
- The ability to pull vessels out of maintenance for emergency response is dependent on the nature of maintenance. For example, it will be more difficult and will take much more time to restore a vessel to operation that is undergoing controllable pitch propeller maintenance while in drydock than a vessel that is undergoing a routine drydock inspection and painting.
- Maintenance and sparing philosophies may require modification to enable quicker completion of maintenance/preservation contracts. This may include investment in increased sparing levels of major components, to improve readiness during maintenance periods; and a shift in approach from "maintain & repair in place" to "remove & replace".
- The North Carolina ferries cited in the report are significantly smaller (maximum length of 220') and are simpler (single ender hull form/propulsion, only Subchapter K or T) ferries than those built by WSDOT Ferries Division (double ender hull form/propulsion, Subchapter H). There is a significant difference, cost and schedule wise, in how maintenance can be accomplished between the different ferry fleets.
- The consultant cites North Carolina ferries pulling vessels from maintenance to make up lost service when the need arises. North Carolina ferries are pulling vessels from their own maintenance facilities, which comes at significantly less cost than pulling vessels from commercial maintenance facilities under state contract as in the case of the Ferries Division. An example of what it takes to accelerate completion

of a commercial contract: In June 2008, the Ferries Division paid a significant amount of overtime (30% of contract cost) to a drydock contractor to accelerate Yakima's steel repair in order to return the vessel to service as quickly as possible to meet peak season demands.

SECTION V.
FLEET COMPOSITION

This section addresses the third part of the fleet planning model: "What size vessels are recommended to provide baseline service with a 21-vessel fleet?"

This section reviews landside constraints on vessel size. It then reviews vessel size alternatives for each route to establish the most cost-effective vessel configuration to be assigned to routes in the winter, spring and fall season (17 vessels), the shoulder season (18 vessels), and the summer season (19 vessels).

Vessel sizes needed for maintenance relief and emergency response are based on the preferred alternative for vessels assigned to routes.

The recommended fleet composition, summarized in the table below, is based on this analysis and the availability of 11 vessels that are not due for retirement until after 2030.[39]

Table 22.
Summary Recommended vs. Ferries' Baseline 2030 Fleet

		Ferries' Baseline Fleet	Recommended Fleet	Change
# of Vessels	*Auto Capacity*	#	#	
Jumbo	188-202	5	5	0
Large	144	7	6	-1
Medium	124	5	5	0
Mid-Size	87-90	3	1	-2
Small	34-64	3	4	1
Total		23	21	-2
Vessel Deployment		#	#	#
Vessels on Routes at One Time				
Fall, winter, spring		17	17	0
Shoulder		18	18	0
Summer		19	19	0
# of New Vessels		12	10	-2
Emergency Reserve Vessel Weeks Available		Weeks	Weeks	Weeks
Crewed Vessel		25	46	21
De-crewed Vessel		90	0	-90
Total		115 wks	46 wks	-69 wks
Weeks Needed Based on 2003-2006		33	33	0
Financial				
Acquisition Costs 2008-2030 2008 $ millions		$1,095.0M	$796.1M	$-298.9

[39] The 11 vessels not due for retirement until after 2030 are five (5) jumbo size vessels, five (5) medium size vessels, and one (1) mid-size vessel.

	Ferries' Baseline Fleet	Recommended Fleet	Change
Annual Fixed Costs - 2030 Fleet - 2008 $ millions	$ 112.0 M	$108.6 M	$-3.4 M
Annual Variable Costs - 2030 Fleet - 2008 $ millions	$103.0 M	$97.1 M	-5.9 M
Annual Fixed Costs per Service Hour - 2008 $	$976	$947	$-29
Annual Variable Costs per Service Hour - 2008 $	$898	$846	$-52
Service Hours and Key Indicators			
Service Hours	114,728 hrs	114,728 hrs	0 hrs
Percentage of Auto Capacity Utilized Systemwide 2030 Ridership Level	68%	67%	-1%
Percentage of Sailings in which Auto Capacity is Sold Out or Fully Reserved Systemwide 2030 Ridership Level	36%	37%	1%
Variable Costs per Auto Carried Systemwide 2030 Ridership Level – 2008 $	$6.87	$6.47	$-0.40

A. Landside Constraints

1. Constraints on Vessel Size

Highway capacity constrains the size of vessel that can operate on some routes. Of the nine (9) routes in Ferries' system, three (3) can accept a jumbo size vessel; two (2) can accept up to a large size vessel; and two (2) can accept up to a medium size vessel. One (1) route, the Port Townsend-Keystone route, has special navigational conditions as well as land side constraints that limit it to the Island Home class vessel.[40]

Table 23.
Landside Constraints on Vessel Size by Route

Size	Auto Capacity	Terminal that Can Accept this Size Vessel
Jumbo	188-202	Bainbridge, Bremerton, Kingston
Large	144	Clinton, San Juans, Sidney
Medium	124	Point Defiance, Triangle (Vashon-Southworth- Fauntleroy)
Mid-Size	87-90	
Small	34-64	Keystone (64)

2. Constraints on Number of Vessels – Bainbridge

Ferries has determined, based on navigational constraints in Eagle Harbor and highway constraints, that Bainbridge cannot accept an increase beyond the two (2) vessels now assigned to the route.

B. Route Alternatives for Projected Service Hours

Route alternatives are summarized in the table below. None of the alternatives change total service hours on any route but do modify auto capacity. The changes include:

- *Switching the assignment of 24-hour and 16-hour vessels on four routes.* On routes where two different sized vessels are assigned, the baseline plan has in most cases the largest ferry operating a 24-hour schedule, which includes the low

[40] See *Island Home Report* presented to the JTC's Ferry Policy Group on July 8, 2008, for further information.

volume evening sailings. The consultants examined the impact of switching vessel assignments on the Bainbridge, Clinton, Kingston, and Triangle: Fauntleroy-Vashon-Southworth routes.[41]

- *Assigning smaller, more cost-efficient vessels to five routes or route segments.* Smaller vessel assignments were examined for the Bremerton route, Point Defiance route, Anacortes-San Juans route segment, San Juans Interisland route segment, and the Sidney route.
- *Switching with other routes.* Switching San Juan route vessels to another route (Triangle: Fauntleroy-Southworth-Vashon) during the non-summer seasons was examined.

Table 24.
2030 Route Vessel Alternatives Reviewed

Route	# of Vessels	Service Hours Per Day				Alternatives Reviewed
		Winter (12 weeks)	Spring, Fall (18 weeks)	Shoulder (8 weeks)	Summer (14 weeks)	
Bainbridge	2 Jumbo (202)	24 hrs. & 16 hrs.				Switch - 8 hrs. smaller
Bremerton	1 Large (144)	24 hrs.				Smaller vessel
	1 Large (144)	16 hrs.				Smaller vessel/ + 8 hrs. on Bainbridge
	1 Jumbo (188)				16 hrs.	Smaller vessel/+ 8 hrs. on Bainbridge
Clinton	1 Large (144)	24 hrs.				Switch
	1 Medium (124)	16 hrs.				Switch
Kingston	2 Jumbo (202 & 188)	24 hrs. & 16 hrs.				Switch
Point Defiance	1 Mid-Size (87)	16 hrs.				Smaller vessel
Port Townsend	1 Small (64)	16 hrs.				No alternatives
	1 Small (64)			8 hrs.		No alternatives
San Juans & Sidney	2 Large (144)	16 hrs. & 11 hrs.	16 hrs. ea.			Smaller vessel except summer
	1 Medium (124)	16 hrs.				Smaller vessel winter only
	1 Mid-Size (87)	11 hrs.	16 hrs.			Smaller vessel - Interisland Route
	2 Large (144)				16 hrs. ea.	Smaller vessel- Sidney
Triangle	2 Medium (124)	24 hrs. & 16 hrs.				Switch
	1 Mid-Size (90)	16 hrs.				Switch/Switch seasonally with San Juans

[41] Ferries indicates that it rotates vessels between the 24-hour and 16-hour assignments for maintenance purposes. In order to provide a consistent comparison, this analysis does not make any assumptions about the rotation schedule.

C. Bainbridge – Bremerton – Seattle Routes

The Bremerton and Bainbridge routes are considered together because they share the Seattle terminal.

1. Route Characteristics

- *Baseline vessel assignment*
  - *Bremerton* – Two (2) large vessels, except in the summer when the route has one (1) large and one (1) jumbo vessel. One (1) vessel operates 24 hours a day, including the jumbo vessel in the summer, and the other 16 hours a day.
  - *Bainbridge* – Two (2) jumbo vessels, one operating 24 hours a day and the other 16 hours a day.
- *Baseline utilization*
  - *Bremerton* – The Bremerton route has 10 percent of total system ridership, relatively low auto capacity utilization (49 percent winter 2030, 59 percent summer), high costs per auto carried ($18.26 winter 2030, $15.24 in summer), and low percentage of sailings in which the auto space is sold out (6 percent winter 2030, 9 percent summer).
  - *Bainbridge* – The Bainbridge route has 27 percent of total system ridership, relatively high auto capacity utilization (83 percent in winter 2030, 102 percent in summer), low costs per auto carried ($6.82 in winter 2030, $5.62 in summer), and a high percentage of sailings in which the auto space is sold out (35 percent winter 2030, 55 percent summer).[42]
- *Route considerations*
  - *Walk-ons* – In the 2008 survey of ferry customers conducted by the Washington State Transportation Commission, Bremerton and Bainbridge had the highest percentage of walk-on customers in the system at 63 percent and 48 percent respectively. Bremerton also had the highest level of respondents stating that they never drove on the ferry for their primary trip purpose (51 percent), with the next highest the Bainbridge route (35 percent).[43]
  - *Sailings* – Bremerton, with its nearly one-hour crossing time and gaps in the mid-day schedule, has 195 sailings per week. Bainbridge, with shorter crossing times and fewer service gaps, has 315 sailings per week.
  - *Adding vessels* – No additional vessels can be assigned to the Bainbridge route, given navigational and land side constraints.
  - *Late evening sailings* – The late evening sailings have relatively low auto capacity. The last sailings of the day on the Bainbridge route in 2030, for example, are projected to use 27 percent of auto capacity on a summer

[42] A route can have a high percentage of auto capacity used but a smaller percentage of sailings sold out or fully reserved because the analysis does not make any assumptions about how many autos would be diverted from their intended sailing to a different sailing.

[43] Systemwide 36 percent of customers walk on and 64 percent come on to the vessel as a passenger or driver in a vehicle. See *2008 Washington State Ferries Customer Survey*, Joint Transportation Committee Sept. 10, 2008, Northwest Opinion Research presentation, slides 17 and 19.

Saturday night and less than 5 percent on summer Monday-Thursday weekday evenings.

2. Route Alternatives

The alternatives considered for these routes included reducing the size of the vessels assigned to the Bremerton route in order to increase capacity utilization and reduce annual variable costs per auto carried. Reducing the size of vessel assigned to the Bainbridge route for late evening sailings was also considered given: 1) the availability of a smaller 16-hour vessel assigned to the Bremerton route to operate on the Bainbridge route for eight (8) hours per day; and 2) the relatively low capacity utilization on the late Bainbridge sailings.

Four alternatives using smaller vessels were tested for the Bremerton route, ranging from two (2) large vessels year round to two (2) medium vessels year-round. The best alternative that balances costs and service is to operate the Bremerton route with two large vessels year round. The large and medium vessel sizes were also considered for eight (8) service hours on the Bainbridge route.

3. Recommendation

Key indicators and total annual variable costs for each alternative are shown in the table below. The consultants recommend the alternatives highlighted in yellow: two (2) jumbo and one (1) large vessel for Bainbridge and two (2) large vessels for Bremerton. These alternatives are preferred because: 1) results in a $1.8 million per year reduction in variable costs while making a small difference in the percentage of sailings in which the auto capacity is sold out; and, 2) the large vessel provides capacity for 1,500 walk-on passengers, making it a better fit for the Bremerton route than the 1,200 walk-on passengers that can be accommodated in a medium size vessel.

Bainbridge – Bremerton Recommendation. The consultants' recommended fleet configuration for the Bainbridge and Bremerton routes is: two (2) jumbo vessels (both 16 hours a day) and one (1) large (eight [8] hours a day) on the Bainbridge route; and two (2) large vessels (one 24 hours and one 16 hours a day) on the Bremerton route.

Table 25.
Bainbridge – Bremerton – Seattle 2030 Fleet Configuration

2030 Route Fleet Configuration Alternatives (recommended in yellow)	% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable Cost per Auto Carried		Total Annual Variable Costs
	Summer	Winter	Summer	Winter	Summer	Winter	(2008 $)
Bainbridge							
Baseline: 2 Jumbos (24 hr/16)	104%	83%	57%	35%	$5.58	$6.82	$18.8 million
Alt. BA-1: 2 Jumbos (16/16) 1 Large (8)	108%	88%	59%	38%	$5.70	$6.50	$17.7 million
Alt. BA-2: 2 Jumbos (16/16) 1 Medium (8)	111%	90%	60%	38%	$5.73	$ 6.35	$17.5 million
Bremerton							

2030 Route Fleet Configuration Alternatives (recommended in yellow)	% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable Cost per Auto Carried		Total Annual Variable Costs
Baseline: 2 Large/2 Large, 1 Jumbo Summer (24)	59%	49%	9%	6%	$15.24	$18.26	$13.7 million
Alt. Br-1: 2 Large Year Round	70%	49%	23%	6%	$12.82	$18.26	$13.0 million
Alt. Br-2: 1 Large, 1 Medium/2 Large Summer	70%	52%	23%	7%	$12.82	$17.99	$12.9 million
Alt. Br-3: 2 Medium/1 Medium, 1 Large Summer	76%	57%	26%	14%	$12.54	$17.60	$12.6 million
Alt. Br-4: 2 Medium Year-Round	81%	57%	36%	14%	$12.36	$17.60	$12.6 million
Recommended Fleet Configuration Total Annual Variable Cost Reduction							($1.8 million)

D. Clinton – Mukilteo Route

1. Route Characteristics

- *Baseline vessel assignment* – One (1) large (24 hours) and one (1) medium (16 hours)
- *Baseline utilization* – The Clinton-Mukilteo route has 17 percent of total system ridership, relatively high auto capacity utilization (70 percent winter 2030, 84 percent summer), low costs per auto carried ($4.16 winter 2030, $3.19 in summer), and a moderate percentage of sailings in which the auto space is sold out (20 percent winter 2030, 44 percent summer).
- *Route considerations*
  - *Largest vessel* - The largest vessel that can be accepted on this route with the existing terminal is a large 144-auto vessel.
  - *Late evening sailings* – The late evening sailings have relatively low auto capacity utilization. The last sailings of the day from Mukilteo to Clinton in 2030 are projected to use 26 percent of the auto capacity on summer Monday-Thursday weeknights and 21 percent on summer Saturday nights.

2. Route Alternatives

The alternatives considered for this route were to make the large vessel the 16-hour vessel and the small vessel the 24-hour vessel, and to assign two large vessels to the route.

3. Recommendation

The key indicators and total annual variable costs for each alternative are shown in the table below. The consultants recommend the alternative highlighted in yellow (one [1] large and one [1] medium vessel, with the large vessel operating 16 hours a day and the medium vessel 24 hours a day) with a savings of $0.3 million in annual variable costs. This recommendation allows the use of an existing medium size vessel that is not due for retirement during the planning period and, because of the re-configuration of the sailings, reduces the percentage of sailings sold out.

Clinton – Mukilteo Recommendation. The consultants' recommended fleet configuration for the Clinton route is one (1) large vessel (16 hours a day) and one (1) medium vessel (24 hours a day).

Table 26.
Clinton – Mukilteo 2030 Fleet Configuration

2030 Route Fleet Configuration Alternatives (recommended in yellow)	% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable Cost per Auto Carried		Total Annual Variable Costs
	Summer	Winter	Summer	Winter	Summer	Winter	(2008 $)
Clinton							
Baseline: 1 Large (24 hr) 1 Medium (16 hr)	84%	70%	44%	20%	$3.19	$4.16	$10.4 million
Alt. CL-1: 1 Large (16 hr) 1 Medium (24 hr)	85%	71%	42%	18%	$3.11	$4.06	$10.1 million
Alt. CL-2: 2 Large (24 hr/ 16 hr)	79%	66%	32%	12%	$3.35	$ 4.36	$10.9 million
Recommended Fleet Configuration Total Annual Variable Cost Reduction							($0.3 million)

E. Kingston – Edmonds Route

1. Route Characteristics

- *Baseline vessel assignment* – Two (2) jumbo vessels (24 hours and 16 hours)
- *Baseline utilization* – The Kingston-Edmonds route has 19 percent of total system ridership, relatively high auto capacity utilization (83 percent winter 2030, 108 percent summer), low costs per auto carried ($6.08 winter 2030, $5.06 in summer), and a high percentage of sailings in which the auto space is sold out (33 percent winter 2030, 66 percent summer).

2. Route Alternatives

The alternative considered for this route was to make the largest jumbo vessel the 16-hour vessel and the other jumbo vessel the 24-hour vessel.

3. Recommendation

The key indicators and total annual variable costs for the baseline and the alternative are shown in the table below. The consultants recommend the alternative highlighted in yellow (two [2] jumbos with the 202 auto vessel operating 16 hours a day and the 188 auto vessel 24 hours a day). This recommendation results in a savings of $0.4 million per year and, due to the reconfiguration of the sailings, a reduction in the percentage of sailings that are sold out.

Kingston – Edmonds Recommendation. The consultants' recommended fleet configuration for the Kingston-Edmonds route is two (2) jumbo vessels, with the larger jumbo vessel (202 autos) operating 16 hours a day and the smaller vessel (188 autos) operating 24 hours a day.

Table 27.
Kingston – Edmonds 2030 Fleet Configuration

2030 Route Fleet Configuration Alternatives (recommended in yellow)	% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable Cost per Auto Carried		Total Annual Variable Costs
	Summer	Winter	Summer	Winter	Summer	Winter	(2008 $)
Kingston							
Baseline: 1 Jumbo (202) 24 hr/1 Jumbo (188) 16 hr	108%	83%	66%	33%	$5.06	$6.08	$18.0 million
Alt. ED-1: 1Jumbo (202) 16 hr/1 Jumbo (188) 24 hr	110%	84%	66%	32%	$5.01	$5.95	$17.6 million
Recommended Fleet Configuration Total Annual Variable Cost Reduction							($0.4 million)

F. Point Defiance – Tahlequah Route

1. Route Characteristics

- *Baseline vessel assignment* – One (1) mid-size vessel (16 hours a day)
- *Baseline utilization* – The Point Defiance-Tahlequah route has 3 percent of total system ridership and relatively low auto capacity utilization (46 percent winter 2030, 54 percent summer), moderate costs per auto carried ($9.37 winter 2030, $7.89 in summer), and a low percentage of sailings in which the auto space is sold out (5 percent winter 2030, 2 percent summer).

2. Route Alternatives

The alternative considered for this route was to assign a small 64-auto vessel.

3. Recommendation

The key indicators and total annual variable costs for the baseline and the alternative are shown in the table below. The consultants recommend the alternative highlighted in yellow, the assignment of the smaller 64-auto vessel to the route. This recommendation results in a savings of $1.6 million per year in variable costs and brings the route more in line with other routes in terms of capacity utilization and percentage of sailings in which the auto capacity is sold out.

Point Defiance – Tahlequah Recommendation. The consultants' recommended fleet configuration for the Point Defiance-Tahlequah route is one (1) small 64-auto vessel operating 16 hours a day.

Table 28.
Point Defiance – Tahlequah 2030 Fleet Configuration

2030 Route Fleet Configuration Alternatives (recommended in yellow)	% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable Cost per Auto Carried		Total Annual Variable Costs
	Summer	Winter	Summer	Winter	Summer	Winter	(2008 $)
Point Defiance							
Baseline: 1 Mid-Size 16 hr	54%	46%	5%	2%	$7.89	$9.37	$4.6 million
Alt. Pd 1: Small (64 auto) 16 hr	74%	62%	18%	18%	$5.04	$5.99	$3.0 million
Recommended Fleet Configuration Total Annual Variable Cost Reduction							($1.6 million)

G. Port Townsend – Keystone Route

1. Route Characteristics

- *Baseline vessel assignment* – One (1) small vessel 16 service hours a day year round, and a second small vessel 8 hours a day in the shoulder and summer seasons.
- *Baseline utilization* – The Port Townsend-Keystone route has 3 percent of total system ridership, the highest auto capacity utilization in the system (101 percent winter 2030, 146 percent summer), moderate costs per auto carried ($6.31 winter 2030, $6.27 in summer), and the highest percentage of sailings in which the auto space is sold out in the system (50 percent winter 2030, 99 percent summer).

2. Recommendation

The consultants recommend no change to the vessel configuration for this route. The Island Home class vessels have been selected based on the landside constraints and navigation requirements of the route.

Port Townsend – Keystone Recommendation. The consultants' recommended fleet configuration for the Port Townsend-Keystone route is the same as the baseline scenario: two (2) small 64-auto vessels – one operating 16 hours a day year round and one operating 8 hours a day in the shoulder and summer seasons.

Table 29.
Port Townsend – Keystone 2030 Fleet Configuration

2030 Route Fleet Configuration Alternatives (recommended in yellow)	% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable Cost per Auto Carried		Total Annual Variable Costs
	Summer	Winter	Summer	Winter	Summer	Winter	(2008 $)
Port Townsend							
Baseline: 1 small year-round (16 hours) + 1 small (8 hours)	146%	101%	99%	50%	$6.27	$6.31	$3.5 million

H. San Juan Islands – Sidney Routes

The San Juan Islands and Sidney routes are considered together because they share the Anacortes terminal, and on some sailings the Sidney vessel provides service to the San Juan Islands.

1. Route Segments

The San Juan and Sidney routes have 8 percent of the system's total ridership. The routes consist of three route segments which together have 24,024 service hours or 21 percent of all service hours provided by the system.

- *Interisland vessel* – The Interisland vessel runs between San Juan, Orcas, Lopez and Shaw Islands with one stop per day in Anacortes. There is one vessel assigned to this route segment year round.

- *San Juan Island routes* – The San Juan service from Anacortes includes sailings that stop in various combinations at San Juan, Orcas, Lopez and Shaw Islands. There are three (3) vessels assigned to these sailings in the summer, plus a portion of a large vessel assigned to the Sidney route. The rest of the year, three (3) vessels, two (2) large and one (1) medium, are assigned to the Anacortes–San Juans route. The medium vessel also provides service to Sidney in the fall, spring and shoulder seasons.
- *Sidney* –This route provides service from Anacortes to Sidney. In the spring, fall and shoulder seasons, there are two sailings a day (one each way) with 36.5 percent of the total service hours of the assigned vessel attributable to this route, and the rest to the Anacortes-San Juan Islands route. In the summer there are four sailings a day between Anacortes and Sidney (two each way), with 81.5 percent of the total service hours of the assigned vessel attributable to this route and 18.5 percent providing service to the San Juans.

2. Interisland Route Segment

a. Route Characteristics

- *Baseline vessel assignment* – One (1) mid-size vessel providing service 16 hours per day Monday-Friday in the winter and 16 hours per day seven (7) days per week the rest of the year.
- *Baseline utilization* – The Interisland route segment has the lowest auto capacity utilization in the system (26 percent winter 2030, 47 percent summer), high costs per auto carried ($66.96 winter 2030, $49.37 in summer), and the lowest percentage of sailings in which the auto space is sold out (0 percent in either the winter or the summer 2030).

b. Route Considerations

- *Turning around autos* – Service provided between the islands necessitates the ability to turn autos around on the vessel so that they face the unloading direction. If this is not done on the vessel, customers may have to back onto the vessel or back off creating loading and unloading difficulties. To accommodate this requirement, Ferries has assigned a larger vessel to this service than the ridership alone would warrant.
- *Importance of service* – The Interisland service is not heavily used but does allow Ferries to provide more direct service between Anacortes and the San Juan Islands by reducing the need to provide stops between islands.

c. Route Segment Alternatives

Two alternatives were considered for this route.

The first was a small vessel (34-auto) similar to the existing 34-auto vessel in terms of variable costs but specially designed to provide the turn-around capability on board. It should be noted that this vessel will increase the average crossing time for the Interisland service by 41 minutes per round-trip.

The second alternative reviewed was to assign a 64-auto small vessel on the route. This vessel would not have to be re-configured to provide the turn capacity for this route.

d. Recommendation

The consultants recommend the 64-auto option, which would save $1.4 million per year in annual variable costs. The primary advantage of this option is that the 64-auto vessel could be used more widely throughout the fleet whereas the 34-auto vessel does not have a practical use elsewhere.

Interisland Recommendation. The consultants' recommended fleet configuration for the Interisland route segment is a small (64-auto) vessel.

Table 30.
Interisland 2030 Fleet Configuration

2030 Route Fleet Configuration Alternatives (recommended in yellow)	% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable Cost per Auto Carried		Total Annual Variable Costs
	Summer	Winter	Summer	Winter	Summer	Winter	(2008 $)
Interisland							
Baseline: 1 mid-size year round (16 hrs, 5 days a week winter – 16 hrs, 7 days a week rest of year)	47%	26%	0%	0%	$49.37	$66.96	$4.1 million
Alt ii1- 1 small (34 auto) year round same hrs.	119%	66%	57%	0%	$17.72	$20.20	$1.4 million
Alt ii2 - I small (64 auto) year round same hrs.	63%	35%	0%	0%	$32.21	$43.68	$2.7 million
Recommended Fleet Configuration Total Annual Variable Cost Reduction							($1.4 million)

3. San Juan Island – Anacortes Route Segment

a. Route Characteristics

- *Baseline vessel assignment* - Vessel assignments change by season:
  - *Winter* – Three (3) vessels: two (2) large vessels (one operating 16 hours a day and one operating 11 hours a day), plus one (1) medium vessel operating 16 hours a day.
  - *Spring, Fall, Shoulder* – Three (3) vessels: Two (2) large vessels operating 16 hours a day and one (1) medium vessel operating 16 hours a day. The medium vessel is shared with the Sidney route. Based on service hours, 36.5 percent of the costs of the vessel shared with Sidney are attributed to the Sidney route.[44]
  - *Summer* – Four (4) vessels: all large operating 16 hours a day. One (1) of the vessels is shared with the Sidney route. Based on service hours, 81.5 percent of the costs of the vessel shared with Sidney are attributed to the Sidney route.

[44] The ridership information does not distinguish between passengers going to Sidney or Friday Harbor from the morning Anacortes-Sidney sailing.

- *Baseline utilization* – The Anacortes-San Juan route segment has the greatest difference between summer and winter auto capacity utilization in the system (61 percent winter 2030, 109 percent summer), costs per auto carried ($17.89 winter 2030, $10.04 in summer), and the percentage of sailings in which the auto space is sold out (11 percent in winter 2030, 49 percent in summer).

b. Route Considerations

- *Summer peak* – San Juan traffic peaks in the summer more than any other route. In 2006 summer traffic increased 109 percent over winter traffic.[45] Finding the correct balance of vessel capacity between summer and the rest of the year is key for this route segment.
- *Size of vessel* – The largest vessel that can operate in the San Juans is a large 144-auto vessel.
- *Vessel requirements for international service* – There are federal requirements for vessels operating in international waters to meet Safety of Life at Sea (SOLAS) convention requirements. In 2030 one medium size vessel will, without additional investment, meet SOLAS requirements. Additional investments to meet SOLAS requirements are estimated at approximately $5 million.[46]

c. Route Segment Alternatives

Six (6) alternatives were considered for the San Juan routes. The first was, in order to avoid making an additional vessel SOLAS compliant, operating a medium size vessel on the shared Sidney–San Juans route all year.

Two (2) additional alternatives were considered for modifying the winter service only. The first was to assign three (3) medium vessels rather than two (2) large and one (1) medium, and the second to assign two (2) medium and one (1) mid-size (90 auto) vessel to the route in the winter.

Three (3) additional alternatives were considered that would modify service in the spring, fall and shoulder seasons in addition to the winter season. These were the extension of the two (2) winter service options to the spring, fall and shoulder seasons (i.e., two [2] large and one [1] medium vessel and two [2] medium and one [1] mid-size vessel options).

d. Recommendation

The consultants recommended alternative is to deploy one (1) large, one (l) medium, and one (1) mid-size vessel on the route during the fall, winter, spring, and shoulder seasons. In the summer, the consultants recommend deploying three (3) large and one (1) medium (shared with Sidney) vessel on this route segment. This configuration avoids having to build an additional 124-auto medium sized vessel, which would not have as much applicability for the fleet as a 144-auto vessel.

[45] See *2008 Washington State Ferries Customer Survey*, Joint Transportation Committee, Sept. 10, 2008, Northwest Opinion Research presentation, slide 9.

[46] Estimated cost of SOLAS compliance is based on costs incurred in making the Issaquah class *Chelan* SOLAS compliant.

Anacortes – San Juans Recommendations. The consultants' recommended fleet configuration for the Anacortes San Juan Islands route segment is one (1) large, one (1) medium, and one (1) mid-size vessel during the fall, winter, spring, and shoulder seasons, and three (3) large and one (1) medium (shared with Sidney) vessel in the summer.

Table 31.
San Juan Islands 2030 Fleet Configuration

2030 Route Fleet Configuration Alternatives (recommended in yellow)	% Auto Capacity Used			% of Sailings Auto Capacity Sold Out			Variable Cost per Auto Carried (2008 $)			Total Annual Variable Costs (2008 $)
	F,Sp,Sh	W	Sum	F,Sp, Sh	W	Sum	F,Sp, Sh	W	Sum	
Anacortes San Juan										
Summer Service Modification										
Baseline: 4 large summer/rest year 2 large and 1 medium	61%	61%	109%	64%	11%	49%	$16.56	$17.89	$10.04	$14.6 million
Alt. An 1: 3 large, 1 medium in summer (Sidney shared vessel)	61%	61%	114%	64%	11%	57%	$16.56	$17.89	$10.46	$14.6 million
Plus Winter Service Modifications										
Alt. An 2: 1 large (11), 1 medium (16), I mid-size (16)	61%	75%	114%	64%	31%	57%	$16.56	$17.20	$10.46	$14.5 million
Alt. An 2: 3 medium (16,16,11)	61%	68%	114%	64%	23%	57%	$16.56	$17.20	$10.46	$14.5 million
Alt. An 3: 2 medium (16,11) & 1 mid-size (16)	61%	78%	114%	64%	38%	57%	$16.56	$16.92	$10.46	$14.4 million
Plus Fall, Spring, Shoulder Service Modifications										
Alt. An 4: 3 medium (16,16,11)	68%	75%	114%	79%	31%	57%	$16.04	$17.20	$10.46	$14.0 million
Alt. An 5: 1 large (11), 1 medium (16) & 1 mid-size (16)	71%	75%	110%	100%	31%	49%	$16.27	$17.20	$10.09	$14.2 million
Alt. An 6: 2 medium (16,11) & 1 mid-size (16)	75%	75%	114%	107%	31%	57%	$16.04	$17.20	$10.46	$14.0 million
Recommended Fleet Configuration Total Annual Variable Cost Reduction										($0.4 million)

4. Anacortes – Sidney Route

a. Route Characteristics

- *Baseline vessel assignment* – Vessel assignments change by season:
  - *Winter* – No service is offered to Sidney.
  - *Spring, Fall, Shoulder* – One (1) medium size vessel making one (1) sailing each way per day. The medium vessel is shared with the San Juans route. Based on service hours, 36.5 percent of the cost of the vessel is attributed to the Sidney route.
  - *Summer* – One (1) large vessel making two (2) sailings each way per day. Based on service hours, 81.5 percent of the cost of the vessel is attributed to the Sidney route.
- *Baseline utilization* – The Anacortes-Sidney route segment has a large difference between summer and spring/fall/shoulder auto capacity utilization[47] (56 percent spring-fall-shoulder 2030, 93 percent summer), costs per auto carried ($50.40 spring-fall-shoulder 2030, $28.10 in summer), and the percentage of sailings in which the auto space is sold out (7 percent in spring-fall-shoulder 2030, 39 percent in summer).

[47] Ferries applies a quota between Friday Harbor and Anacortes bound autos on the daily sailing from Sidney in the spring, fall and shoulder seasons. However, if there is insufficient traffic to either destination to fill the vessel, then more autos are permitted to go to the other destination. In this analysis the consultants did not have sufficient information to determine how often the quotas were exceeded but instead looked at the total vessel capacity.

b. Route Considerations

- *Vessel requirements for international service* – There are federal requirements for vessels operating in international waters to meet SOLAS convention requirements. In 2030 one medium size vessel will, without additional investment, meet SOLAS requirements. Additional investments to meet SOLAS requirements are estimated at approximately $5 million per vessel.

c. Route Alternatives

The alternative considered was to have the SOLAS compliant medium size vessel operate on the route in the summer rather than investing in a SOLAS compliant large vessel. This will require that the one SOLAS compliant vessel be maintained in the winter, and will leave Ferries without an emergency response SOLAS compliant vessel for this route.

d. Recommendation

Anacortes – Sidney Recommendation. The consultants' recommended fleet configuration for the Anacortes-Sidney route is a medium size, SOLAS compliant vessel during the fall-spring-shoulder and summer seasons. In addition to avoiding the capital expense of making an additional vessel SOLAS compliant, this configuration saves $0.1 million per year in 2008 dollars in variable costs, as shown in the table below.

Table 32.
Sidney Fleet 2030 Configuration

2030 Route Fleet Configuration Alternatives (recommended in yellow)	% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable Cost per Auto Carried (2008 $)		Total Annual Variable Costs (2008 $)
	Summer	Sp, Fall, Sh	Summer	Sp, Fall, Sh	Summer	Sp, Fall, Sh	
Sidney							
Baseline: 1 medium spring, fall, shoulder/1 large summer	93%	56%	39%	7%	$28.10	$50.40	$2.8 million
Alt 1- 1 medium spring, fall, shoulder, summer (1 SOLAS vessel)	108%	56%	61%	7%	$28.56	$50.40	$2.7million
Recommended Fleet Configuration Total Annual Variable Cost Reduction							($0.1 million)

I. Triangle: Fauntleroy – Vashon – Southworth Route

The triangle route includes sailings directly between Fauntleroy and Vashon, and Fauntleroy and Southworth, but the majority of sailings stop at all three points on the route.

a. Route Characteristics

- *Baseline vessel assignment* – Two (2) medium size vessels (24 hours and 16 hours) and one (1) mid-size vessel.
- *Baseline utilization* – The Triangle route has 14 percent of total system ridership and relatively moderate auto capacity utilization (41 percent winter 2030, 46 percent summer), variable costs per auto carried ($5.05 winter, $4.45 summer), and low percentage of sailings in which the auto space is sold out (7 percent winter, 8 percent summer).

b. Route Considerations

- *Segment growth* – As shown in Table 1, the three segments of this route are expected to experience different ridership growth rates between 2006 and 2030. There is relatively modest growth projected for the Vashon and Fauntleroy segment (18 percent most of the year) and high growth projected for the Southworth-Fauntleroy segment (63 percent most of the year).
- *Allocation of auto space on sailings with three stops* – Ferries allocates auto space on the vessels that make all three stops. This analysis is based on the current auto space allocation, which may change over time if the balance of ridership between the segments changes.
- *Number of direct sailings* – Ferries currently makes more direct sailings to Vashon than to Southworth. This may change over time if the balance of ridership between the segments changes.

c. Route Alternatives

The first alternative considered for this route was to make the medium vessels each operate 16 hours a day and the mid-size vessel operate 24 hours a day. A second alternative, to switch the mid-size vessel on this route to the San Juans in the spring, fall, winter and shoulder seasons, is recommended, along with switching the mid-size vessel in the summer to 24 hours a day.

d. Recommendation

The key indicators and total annual variable costs for each alternative are shown in the table below. The consultants recommend the alternative highlighted in yellow, which increases variable costs by $0.1 million per year. This increased cost is more than offset by cost savings in the San Juans.

Table 33.
Triangle: Fauntleroy – Vashon – Southworth 2030 Fleet Configuration

2030 Route Fleet Configuration Alternatives (recommended in yellow)	% auto Capacity Used		% of Sailings auto Capacity Sold Out		Variable Cost per auto Carried		Total Annual Variable Costs
	Summer	Winter	Summer	Winter	Summer	Winter	(2008 $)
Triangle Route							
Baseline: 1 Mid-Size 16 hrs., 1 Medium 24 hrs., 1 Medium 16 hrs.	46%	41%	8%	7%	$4.45	$5.05	$12.5 million
Al. Tr. 1: 3 Medium (2 @ 16 hrs., 1 @ 24 hrs.) all but summer (switch with San Juans)	43%	36%	8%	3%	$4.42	$5.11	$12.6 million
Alt. Tr 1: 1 Mid-Size 24 hrs, 2 Mediums 16 hrs	43%	38%	8%	6%	$4.42	$4.98	$12.3 million
Recommended Fleet Configuration Total Annual Variable Cost Reduction							$0.1 million

J. Recommended Vessel Sizes for Route Deployments, Maintenance, and Emergency Relief

1. Recommendation for Route Deployment

Recommendation #5. Ferries should plan on the following active vessel deployments by route for the delivery of the baseline service:

Table 34.
Summary Recommended Vessel Sizes by Route

Route	# Vessels	Size: Fall, Winter, Spring	Size: Shoulder	Size: Summer
Bainbridge & Bremerton	4	2 Jumbo		
		2 Large		
Clinton	2	1 Large		
		1 Medium		
Kingston	2	2 Jumbo		
Point Defiance	1	1 Small		
Port Townsend	1 or 2	1 Small	2 Small	
San Juans & Sidney	4 or 5	1 Large		3 Large
		1 Medium (Sidney except winter)		
		1 Mid-Size		
		1 Small (Interisland)		
Triangle	3	2 Medium		
		1 Medium		1 Mid-Size
Total Deployed for Service		17	18	19

As shown in the table below, the size of vessels needed for route deployment based on the consultants' recommendation is different from the baseline sizes. The same total number of vessels are deployed but the recommended deployment has been modified by size of vessel, as follows:

- *Jumbo* – One fewer deployed in the summer season
- *Large* – One fewer deployed in the fall, winter, spring and shoulder seasons
- *Medium* – One more deployed all year
- *Mid-size* – Two fewer deployed all year
- *Small* – Two more deployed all year

Table 35.
Comparison of Ferries' Baseline and Recommended Route Vessel Size

		Baseline 2030 Fleet			Recommended 2030 Fleet			
Size Category	Auto Capacity	Fall, Winter, Spring	Shoulder	Summer	Fall, Winter, Spring	Shoulder	Summer	Recommended Deployment
Jumbo	188-202	4	4	5	4	4	4	Bainbridge, Edmonds
Large	144	5	5	6	4	4	6	Bremerton, Clinton, San Juans
Medium	124	4	4	3	5	5	4	Clinton, Triangle, San Juans, Sidney
Mid-Size *	87-90	3	3	3	1	1	1	Triangle summer, San Juans remainder
Small **	34-64	1	2	2	3	4	4	Pt. Defiance, Port Townsend, Interisland
Deployed for Service		**17**	18	19	**17**	18	19	
* 90 auto capacity in recommended fleet								
** All 64 auto capacity in recommended fleet								

2. Maintenance and Crewed Emergency Reserves

Maintenance and crewed emergency reserve vessels are determined by the vessels assigned to the routes and by the non-retiring vessels that will be in the fleet in 2030. The consultants assumed that each vessel will require on average six (6) weeks of planned out-of-service time by 2030 and that Ferries is operating with a 21-vessel fleet that has 46 weeks of crewed emergency response time.

The table below shows that with the recommended route deployment, the 46 weeks of crewed emergency capacity includes 22 weeks from jumbo vessels, 18 weeks from large vessels, and six (6) weeks from small vessels. This assumes that the large vessels provide maintenance relief for medium and mid-size vessels on the Anacortes-San Juans route segment.

Table 36.
Crewed Emergency Response Vessel Sizes – Fleet Deployment

	Vessels Deployed Summer	Non-Retired Vessels Available	Not Deployed Weeks Available	Weeks Short Maint.	Weeks Available for Emergency	Adjust Maintenance Relief	Weeks Available for Emergency	Routes Can Accept
Jumbo	4	5	46		22		22	Bainbridge, Bremerton, Kingston
Large	6		70		40	Large relieve medium & mid size San Juans	18	Above + Clinton, San Juan, Sidney
Medium	4	5	8		-16			Above + Pt. Defiance, Triangle
Mid-Size	1	1		-6	-6			Same as medium
Small	4		24		6		6	Keystone
Total Crewed Emergency Weeks Available							46	

Recommendation #6. Ferries should plan for a 21-vessel fleet composed of: five jumbo (188-202 auto), six large (144-auto), five medium (124- auto), one mid size (90-auto), and four small (64-auto) vessels for the delivery of the baseline services.

The 21-vessel fleet and change from the baseline is shown in the table below.

Table 37.
Recommended Vessel Sizes

Size Category	Auto Capacity	Baseline # Vessels	Recommended # Vessels	Change
Jumbo	188-202	5	5	0
Large	144	7	6	-1
Medium	124	5	5	0
Mid-Size	87-90	3 (2 87-auto and 1-90 auto)	1 (1 90-auto)	-2
Small	34-64	3 (1 34-auto, 2 64-auto)	4 (4 64-auto)	1
Total		23	21	-2

K. Reduction in Annual Variable Costs with Recommended Fleet

Annual variable costs are $5.9 million lower in 2008 dollars with the recommended fleet configuration. The table below summarizes the annual cost reduction by route.

Table 38.
Recommended Fleet Annual Variable Costs
($ 2008 millions)

Route	$ Baseline	$ Recommended	$ Change	Reason
Bainbridge	18.8	17.7	-1.1	Switch smaller vessel to 24 hr
Bremerton	13.7	13.0	-0.7	Smaller vessel summer
Clinton	10.4	10.1	-0.3	Switch smaller vessel to 24 hr
Kingston	18.0	17.6	-0.4	Switch smaller vessel to 24 hr
Point Defiance	4.6	3.0	-1.6	Smaller vessel
Port Townsend	3.5	3.5	0.0	No change
San Juans - Interisland	4.1	2.7	-1.4	Smaller vessel
San Juans - Anacortes	14.6	14.2	-0.4	Smaller vessels
Sidney	2.8	2.7	-0.1	Smaller vessel summer - one SOLAS-compliant vessel
Triangle	12.5	12.6	0.1	Switch with San Juans - 3 medium boats all but summers
Total	103.0	97.1	-5.9	

L. Reduction in Annual Fixed Costs with Recommended Fleet

The smaller size vessels in the recommended fleet also result in a reduction in annual fixed costs. The consultants have allowed for a 5 percent annual increase in the preservation expense per vessel for the smaller fleet to reflect the potentially greater expense associated with reducing out-of-service time. The increased preservation expense per vessel is offset by the lower engine room crew, insurance and other fixed operating costs for the smaller vessels, and the reduction in fleet size.

Table 39.
Recommended Fleet Annual Fixed Costs
(2008 $ millions)

Cost	$ Baseline	$ Recommended	$ Diff.
Fixed Operating Budget Costs	57.7	56.9	-0.8
Fixed Capital Budget Costs*	32.1	32.1	-0.0
Total	89.8	89.0	-0.8
* With increase of 5% per vessel in the smaller recommended fleet.			

M. Reduction in Vessel Acquisition Costs and Depreciation with Recommended Fleet

1. Reduction in Vessel Acquisition Costs

In the 21-vessel fleet scenario, Ferries would acquire 10 new vessels during the planning period – six (6) large 144-auto vessels and four (4) small 64-auto vessels. In addition, Ferries would incur planning and engineering expenses for the replacement of the two (2) Jumbo Mark I ferries due for retirement in the 2031-37 time period.

The recommended fleet is $298.9 million less expensive in 2008 dollars than the baseline fleet.

Table 40.
Recommended Fleet Acquisition Costs
(2008 $ millions)

	Baseline 2030 Fleet		Rec. 2030 Fleet		
Size Category (auto capacity)	Total	2008 $ (millions)	Total	2008 $ (millions)	Diff. 2008 $ (millions)
Jumbo (188-202)		**13.0**		**13.0**	**0.0**
Large (144)	7	785.0	6	608.1	-176.9
Medium (124)	0		0		
Mid-Size (87-90)	2	164.0	0	0.0	-164.0
Small (34-64)	3	133.0	4	175.0	42.0
Total	12	1,095.0	10	796.1	-298.9

2. Reduction in Vessel Depreciation Costs

With fewer and less expensive vessels, depreciation costs are reduced by $2.6 million per year to $19.6 million. Depreciation is not included in the capital or operating budget adopted by the legislature, but has been included as part of fixed costs in this analysis.

N. Change in Key Indicators

The table below shows the change in key indicators for the system as whole and each route between Ferries' baseline fleet and the recommended fleet.

The most significant changes are for the two routes where smaller vessels are deployed in the recommended fleet: Point Defiance and the Interisland route segment.

- *Point Defiance* - at summer 2030 projected ridership levels the percentage of auto capacity used increases by 20 percent from 54 percent to 74 percent, the percentage of sailings in which the auto capacity is sold out or fully reserved increases by 13 percent from 5 percent to 18 percent, and the variable costs per auto carried decrease by $2.85 from $7.89 to $5.04.
- *Interisland* – at summer 2030 projected ridership levels the percentage of auto capacity used increases by 16 percent from 47 percent to 63 percent, the percentage of sailings in which the auto capacity is sold out or fully reserved remains at 0 percent, and the variable costs per auto carried decrease by $17.16 from $49.37 to $32.21.

Table 41. Change in Key Indicators

Route	Baseline 2030 Fleet						Recommended 2030 Fleet						Change					
	% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable $ Cost per Auto Carried 08 $)		% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable $ Cost per Auto Carried (08 $)		% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable $ Cost per Auto Carried (08 $)	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Systemwide																		
2006 Ridership Level	57%	46%	16%	4%	$8.55	$9.76	59%	42%	18%	4%	$7.94	$9.27	2%	-4%	2%	0%	$ (0.61)	$ (0.49)
2020 Ridership Level	71%	57%	44%	18%	$6.93	$7.88	73%	52%	47%	18%	$6.44	$7.48	2%	-5%	3%	0%	$ (0.49)	$ (0.40)
2030 Ridership Level	76%	61%	51%	25%	$6.45	$7.38	78%	56%	54%	24%	$5.99	$7.01	2%	-5%	3%	-1%	$ (0.46)	$ (0.37)
Bainbridge																		
2006 Ridership Level	75%	60%	22%	8%	$7.45	$9.48	79%	63%	24%	10%	$7.20	$9.03	4%	3%	2%	2%	$ (0.25)	$ (0.45)
2020 Ridership Level	87%	69%	40%	19%	$6.44	$8.17	91%	74%	42%	21%	$6.22	$7.79	4%	5%	2%	2%	$ (0.22)	$ (0.38)
2030 Ridership Level	104%	83%	57%	35%	$5.58	$6.82	109%	88%	60%	38%	$5.68	$6.50	5%	5%	3%	3%	$ 0.10	$ (0.32)
Bremerton																		
2006 Ridership Level	51%	42%	8%	4%	$17.59	$20.99	60%	42%	11%	4%	$14.79	$20.99	9%	0%	3%	0%	$ (2.80)	$ -
2020 Ridership Level	50%	41%	7%	2%	$18.06	$21.87	59%	41%	10%	2%	$15.19	$21.87	9%	0%	3%	0%	$ (2.87)	$ -
2030 Ridership Level	59%	49%	9%	6%	$15.24	$18.26	70%	49%	23%	6%	$12.82	$18.26	11%	0%	14%	0%	$ (2.42)	$ -
Clinton																		
2006 Ridership Level	68%	59%	11%	6%	$3.93	$4.95	69%	60%	14%	8%	$3.84	$4.83	1%	1%	3%	2%	$ (0.09)	$ (0.12)
2020 Ridership Level	82%	69%	38%	17%	$3.27	$4.23	83%	70%	39%	17%	$3.19	$4.13	1%	1%	1%	0%	$ (0.08)	$ (0.10)
2030 Ridership Level	84%	70%	44%	20%	$3.19	$4.16	85%	71%	42%	18%	$3.11	$4.06	1%	1%	-2%	-2%	$ (0.08)	$ (0.10)
Kingston																		
2006 Ridership Level	81%	60%	21%	3%	$6.21	$8.38	82%	61%	23%	4%	$6.08	$8.20	1%	1%	2%	1%	$ (0.13)	$ (0.18)
2020 Ridership Level	109%	83%	65%	33%	$5.06	$6.03	110%	84%	68%	33%	$5.01	$5.90	1%	1%	3%	0%	$ (0.05)	$ (0.13)
2030 Ridership Level	108%	83%	66%	33%	$5.06	$6.08	110%	84%	66%	32%	$5.01	$5.95	2%	1%	0%	-1%	$ (0.05)	$ (0.13)
Point Defiance																		
2006 Ridership Level	46%	38%	0%	0%	$9.29	$11.24	63%	52%	10%	13%	$5.95	$7.19	17%	14%	10%	13%	$ (3.34)	$ (4.05)
2020 Ridership Level	54%	46%	4%	2%	$7.92	$9.37	74%	62%	18%	18%	$5.07	$5.99	20%	16%	14%	16%	$ (2.85)	$ (3.38)
2030 Ridership Level	54%	46%	5%	2%	$7.89	$9.37	74%	62%	18%	18%	$5.04	$5.99	20%	16%	13%	16%	$ (2.85)	$ (3.38)
Port Townsend																		
2006 Ridership Level	88%	63%	26%	7%	$7.09	$10.06	88%	63%	26%	7%	$7.09	$10.06	0%	0%	0%	0%	$ -	$ -
2020 Ridership Level	114%	78%	72%	21%	$6.27	$8.05	114%	78%	72%	21%	$6.27	$8.05	0%	0%	0%	0%	$ -	$ -
2030 Ridership Level	146%	101%	99%	50%	$6.27	$6.31	146%	101%	99%	50%	$6.27	$6.31	0%	0%	0%	0%	$ -	$ -
San Juans & Sidney																		

Route	Baseline 2030 Fleet						Recommended 2030 Fleet						Change					
	% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable $ Cost per Auto Carried 08 $)		% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable $ Cost per Auto Carried (08 $)		% Auto Capacity Used		% of Sailings Auto Capacity Sold Out		Variable $ Cost per Auto Carried (08 $)	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
San Juans & Anacortes																		
2006 Ridership Level	82%	46%	31%	1%	$12.27	$23.79	86%	56%	31%	13%	$12.18	$22.88	4%	10%	0%	12%	$ (0.09)	$ (0.91)
2020 Ridership Level	96%	54%	43%	8%	$10.49	$20.33	100%	66%	48%	20%	$10.46	$19.55	4%	12%	5%	12%	$ (0.03)	$ (0.78)
2030 Ridership Level	109%	61%	49%	11%	$10.09	$17.89	114%	75%	57%	31%	$10.46	$17.20	5%	14%	8%	20%	$ 0.37	$ (0.69)
Interisland																		
2006 Ridership Level	29%	16%	0%	0%	$78.40	$105.12	40%	22%	0%	0%	$51.14	$68.58	11%	6%	0%	0%	$ (27.26)	$ (36.54)
2020 Ridership Level	40%	22%	0%	0%	$58.07	$79.04	54%	30%	0%	0%	$37.88	$51.56	14%	8%	0%	0%	$ (20.19)	$ (27.48)
2030 Ridership Level	47%	26%	0%	0%	$49.37	$66.96	63%	35%	0%	0%	$32.21	$43.68	16%	9%	0%	0%	$ (17.16)	$ (23.28)
Sidney (2nd number spring, fall & shoulder /no winter service)																		
2006 Ridership Level	75%	44%	7%	0%	$35.13	$64.01	87%	44%	18%	0%	$32.99	$64.01	12%	0%	11%	0%	$ (2.14)	$ -
2020 Ridership Level	90%	54%	36%	7%	$29.11	$52.47	104%	54%	57%	7%	$28.56	$52.47	14%	0%	21%	0%	$ (0.55)	$ -
2030 Ridership Level	93%	56%	39%	7%	$28.10	$50.40	108%	56%	61%	7%	$28.56	$50.40	15%	0%	22%	0%	$ 0.46	$ -
Fauntleroy-Vashon-Southworth																		
2006 Ridership Level	33%	30%	3%	2%	$6.12	$6.89	31%	26%	3%	0%	$6.07	$6.97	-2%	-4%	0%	-2%	$ (0.05)	$ 0.08
2020 Ridership Level	45%	41%	10%	8%	$4.54	$5.10	42%	35%	8%	3%	$4.50	$5.16	-3%	-6%	-2%	-5%	$ (0.04)	$ 0.06
2030 Ridership Level	46%	41%	8%	7%	$4.45	$5.05	43%	36%	8%	3%	$4.42	$5.11	-3%	-5%	0%	-4%	$ (0.03)	$ 0.06

O. Fuel Conservation

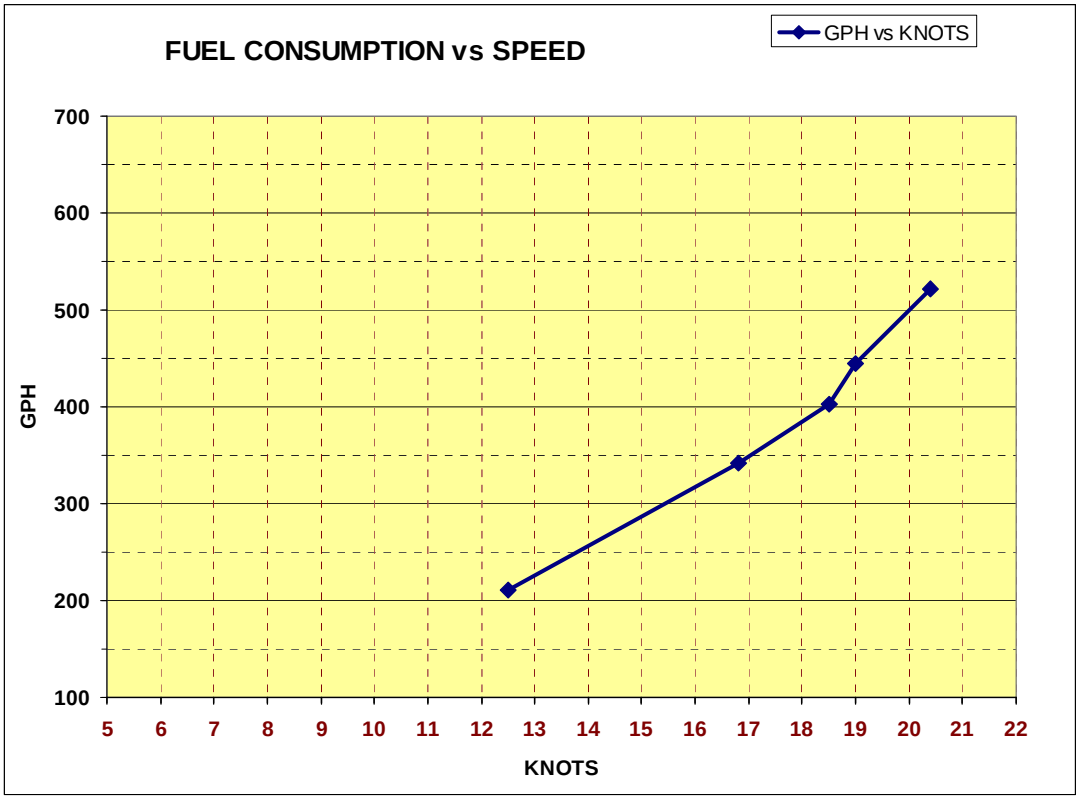
The recommended fleet reduces fuel costs by 6 percent in 2030 from the baseline fleet. Fuel costs in the baseline and recommended fleet projections assume continuation of existing fuel conservation strategies, including those already implemented on the Jumbo Mark II (202-auto) vessels. Additionally, Ferries plans to operate the Super class vessels on (2) two engines.

The consultants have explored two other fuel conservation strategies: (1) slowing vessels, and (2) modifications to Ferries docking procedures.

1. Vessel Speed

As shown in the figure below, relatively minor changes in vessel speed can result in significant fuel savings.

Figure 3.
Fuel Consumption vs. Speed



As shown in the table below, changes in speed result in relatively small increases in crossing time per sailing and significant reductions in fuel consumption.

Annual savings from an average reduction of 0.5 knots are $3.5 million per year or 7 percent of fuel costs. Crossing times are increased by a low of 0.3 minutes on the 13.7-minute Clinton crossing to a high of 6.5 minutes on the 138.5-minute Sidney crossing. Over the 22-year planning period (2009 to 2030), this would be a savings of $77.0 million in 2008 dollars.

Annual savings from an average reduction of 1.0 knot are $6.0 million per year or 12 percent of fuel costs. Crossing times are increased by a low of 0.5 minutes on the Clinton crossing to a high of 10.0 minutes on the Sidney crossing. Over the 22-year planning period (2009 to 2030), this would be a savings of $132.0 million in 2008 dollars.

The cumulative impact of changes in crossing times could affect the number of sailings on some routes. The consultants, as an example, examined the potential impact on the Bainbridge and Bremerton routes of a reduction in speed. The Bremerton route could accommodate a 1 knot reduction in speed without changing the number of sailings. On the Bainbridge route, it would be difficult to reduce speeds during the peak periods when sailings are more frequent but would be possible the rest of the day.

> ***Recommendation #7.*** Ferries should analyze the potential for slowing vessel speeds an average of 0.5 to 1.0 knots in order to reduce fuel consumption. This analysis should include a route-by-route review, including the impact on the number of sailings.

Table 42.
Recommended Fleet Vessel Speed and Fuel Savings

(2008 $ millions)

Route, with fuel use per service hour and speed		.5 kts. Slower				1.0 kts. Slower			
Bainbridge	Annual Fuel $ Cost	Crossing Time Increase Minutes	Fuel $/Service Hr.	Annual $ Cost	Annual $ Diff.	Crossing Time Increase Minutes	Fuel $/Service Hr.	Annual $Cost	Annual $Diff.
Jumbo 236 gallons/svc hr @ 18 kts.	$ 8.8 M	1.3	$222	$8.3 M	$-0.5 M	1.7	$214	$8.0 M	$-0.8 M
Large 160 gallons/svc hr @ 17 kts.	$1.5 M	0.7	$135	$1.3 M	$-0.2 M	1.5	$125	$1.2 M	$-0.3 M
Bremerton									
Large 156 gallons/svc hr @ 17 kts.	$7.3 M	3.7	$135	$6.3 M	$-1.0 M	4.6	$125	$5.8 M	$-1.5 M
Clinton									
Large 110 gallons/svc hr @ 17 kts.	$2.1 M	0.5	$87	$1.6 M	$-0.5 M	1.0	$77	$1.4 M	$-0.7 M
Medium 83 gallons/svc hr @ 16.5 kts.	$2.3 M	0.3	$78	$2.2 M	$-0.1 M	0.5	$73	$2.0 M	$-0.3 M
Kingston									
Jumbo Mark II 235 gallons/svc hr @ 17.5 kts.	$4.4 M	0.4	$213	$4.0 M	$-0.4 M	0.9	$203	$3.8 M	$-0.6 M
Jumbo Mark I 207 gallons/svc hr @17 kts.	$5.8 M	0.4	$193	$5.4 M	$-0.4 M	0.9	$179	$5.0 M	$-0.8 M
Point Defiance									
Small 47 gallons/svc hr @12 kts.	$0.9 M								
Port Townsend									
Small 45 gallons/svc hr @12 kts.	$1.0 M	Information not available							
San Juans - Interisland									
Small 41 gallons/svc hr @12 kts.	$0.7 M								
San Juans - Anacortes									
Large 160 gallons/svc hr @ 17 kts.	$4.5 M	Information not available							
Medium 143 gallons/svc hr @ 17 kts.	$1.6 M	1.5	$132	$1.5 M	$-0.1 M	2.9	$120	$1.3 M	$-0.3 M
Mid-size 143 gallons/svc hr @ 17 kts.	$1.9 M	1.5	$132	$1.8 M	$-0.1 M	2.9	$120	$1.6 M	$-0.3 M
Sidney									
Medium 187 gallons/svc hr @ 17.5 kts.	$1.4 M	6.5	$174	$1.3 M	$-0.1 M	10.0	$164	$1.2 M	$-0.2 M
Triangle									
Medium 83 gallons/svc hr @ 16.5 kts.	$4.5 M	0.3	$81	$4.4 M	$-0.1 M	0.7	$80	$4.3 M	$-0.2 M
Mid-size 83 gallons/svc hr @ 16.5 kts.	$0.6 M	0.3	$81	$0.6 M	$0.0 M	0.7	$80	$0.6 M	0.0
Total	$49.3M			$45.8 M	$-3.5 M			$43.3 M	$-6.0 M
% Change from Recommended Fleet Est.					-7%				-12%

2. Vessel Docking – Between Sailings

Ferries secures vessels to the dock between sailings (not when the vessel is out of service) by running the engines at 60 RPM (revolutions per minute), which pushes the vessel into the dock.[48]

Ferries has analyzed the impact on fuel savings if vessel speed at the dock were reduced to 30 RPM. Ferries anticipates that the new vessels being added to the fleet (small 64-auto and large 144-auto) will not have large fuel savings if speed is reduced to 30 RPM. For example, the new small Island Home class 64-auto vessel will save approximately 20 gallons a day from reducing docking speed to 30 RPM. For the jumbo size vessels that will stay in the fleet through 2030 and the Super class (144-auto) vessels due for retirement starting in 2025, the savings are significant. As shown in the table below, the cost reduction from slower docking of the jumbo and Super class large vessels in the 2009-2030 time period is estimated at $27.4 million in 2008 dollars.

Table 43.
Secure-Boat-Push-Turn Reduction Cost Savings

	Annual Sailings	Time Push Dock/Crossing Hr	60 Turns gal/hr	Full Burn Year (gal)	30 Turns gal/hr	Fuel Burn Year (gal)	Fuel Saved gal /yr	Annual $ Saved ($ 2008 millions)
Savings from 2009-2030 Deployments								
Bainbridge								
Jumbo Mark II	14,506	0.34	132	657,923	119	593,127	64,795	0.2
Edmonds								
Jumbo Mark II	7,696	0.34	132	345,396	119	311,380	34,016	0.1
Jumbo Mark I	10,566	0.34	78	280,210	46	165,252	114,958	0.4
Sub-total				*1,283,529*		*1,069,760*	*213,770*	*0.7*
Savings from 2009-2023-5 Deployment of Large Super Class (144-auto) Vessels								
Bainbridge								
Large Super Class	1,678	0.44	71	52,421	35	25,841	26,580	0.1
Bremerton								
Large Super Class	10,140	0.44	71	316,774	35	156,156	160,618	0.5
San Juan Islands								
Large Super Class	4,988	0.44	71	155,825	35	76,815	79,010	0.3
Sub-total				*472,599*		*232,971*	*239,628*	*0.8*
Savings 2009-2030								27.4

Recommendation #8. Ferries should assess the feasibility of slowing at-dock RPMs from 60 to 30 in order to conserve fuel.

[48] The exception to this practice is the medium 124-auto Issaquah class vessels, which are at idle speed when pushing the dock.

3. Vessel Design

The following design adjustments would improve fuel efficiency:

- aluminum superstructure, reducing weight; and
- longer length-to-beam ratio, reducing drag.

Ferries' baseline vessel acquisition included $8.0 million in 2008 dollars for engineering of the Super class replacement vessels. The consultants agree that this funding is needed and might be used to consider the above design adjustments.

Assuming an aluminum superstructure on the 144-auto vessels would increase the cost of each vessel by approximately $4 million.

> ***Recommendation #9.*** As part of the pre-design process for constructing 144-auto vessels in the 2021-2030 time period (four vessels in the baseline fleet or six in the recommended fleet), Ferries should provide the legislature with a cost-benefit analysis of an aluminum superstructure and other design modifications that might increase fuel efficiency.

P. Ferries Response to Section V.

1. Recommendation 5: Change Vessel Deployments

If only smaller vessels are operated at night there will be no time to perform needed maintenance on those two large vessels. The vessels must be alternated so that adequate time is provided to conduct maintenance.

- ***Assignment of the 24-hour and 16-hour vessels on four routes***: This is done by necessity for part of the week currently for vessel maintenance purposes at night. It is undesirable to leave any one particular vessel on a 24 hour schedule as that vessel would get very little or no routine maintenance during the course of the week. Currently, on most routes with a 24 hour and a 16 hour vessel, the vessels alternate to more evenly spread the time available for maintenance.
- ***Bainbridge/Bremerton route recommendation:*** Although desirable from a matching capacity-to-demand standpoint as well as a cost savings perspective, running graveyard crews on both of the 144 car vessels on the Bremerton route so one can provide night service to the Bainbridge route in lieu of a jumbo ferry would create a maintenance issue on the two 144 car vessels. It is likely that the Jumbo ferry would need to run the late night schedule on the Bainbridge three or more nights per week to allow sufficient down time for the 144 car vessels; this would reduce the cost savings of that particular recommendation.

2. Recommendation 6: Plan for a 21-Vessel Fleet

- WSDOT Ferries Division recommends a 22-vessel 2030 fleet composed of five jumbo (188-202 auto), eight large (144-auto), five medium (124-auto), one mid-size (90-auto) and three small (64-auto) vessels for

delivery of baseline services (includes the 144-auto Hyak as a stand by vessel). This is a reduction from the current 23-vessel baseline fleet.

- As the vessels continue to age, maintenance and repair needs will increase, not decrease. Furthermore, incorporation of the mandated hull inspection and documentation program may result in increased maintenance needs and repair. More preservation work will be necessary.

3. Recommendation 7: Analyze the Potential for Slowing Vessels 0.5 to 1.0 Knots

WSDOT Ferries Division has already started to save fuel through a number of fuel conservation initiatives including:

- **Jumbo Mark II ferries:** Started running Jumbo Mark IIs on two engines, except during landings, in May-June 20007. When all 3 Mark IIs are running, we are saving 45,000 gallons per month from what they used to consume
- **Jumbo Mark I ferries*:*** Will be incorporating changes into the engine control system that will enable the vessels to run on 3 engines instead of the normal four in 2009. Doing so provides a potential savings of 142,000 gallons of fuel per year total for the two vessels.
- **Super ferries:** Upgrading engines and generators for Kaleetan & Yakima that will enable running on 2 engines instead of the normal 4. Kaleetan to be completed in late 2009 and Yakima planned for 2010. Doing so provides a potential savings of 387,000 gallons of fuel per year per vessel.
- **Issaquah ferries:** Will be changing the heating system from oil-burning boilers to one that uses waste heat from the engines. Changes to be made to each vessel starting with Issaquah in early 2009. Incorporating this change provides a potential to save 80,000 gallons of fuel per year per vessel.
- **Positive Restraint:** (also see recommendation #8). WSF is currently evaluating alternatives for holding the vessels in dock while loading/unloading that will enable slowing down shaft speeds or enabling stopping of the shaft entirely to determine the most cost beneficial approach to pursue.
- **Slowing vessels:** WSDOT Ferries Division has already identified the potential savings from slowing vessels on the Edmonds-Kingston route with the intention of implementing a new schedule in Spring 2009 which could potentially save up to 800 gallons of fuel per day total for the route. WSF is studying potential savings for other routes.

SECTION VI.
TIMING

This section addresses the fourth part of the fleet planning model: "When should the 10 new vessels needed for the 21-vessel fleet between 2009 and 2030 be acquired?"

Considerations in developing the optimal timing for vessels to be acquired include:

- *Vessel retirement schedule.* The vessel retirement schedule provides a baseline for when new vessels must come into service due to the scheduled retirement of existing vessels and the return of the vessel leased from Pierce County.
- *Restoration of Keystone service.* Since the retirement of the Steel Electric class vessels, the Keystone route has had reduced service in the shoulder and summer seasons.
- *Vessel acquisition costs.* The design and construction costs of vessels should be lower when more than one of the same class of vessel is built at a time. These economies of scale are the result of spreading design and engineering costs across more vessels, and from the efficiencies shipyards experience when building more than one vessel. Nationally, the cost of a second vessel is typically 82 percent of the cost of the first vessel, the third is 77 percent of the first, the fourth 73 percent of the first and the fifth and beyond 69 percent of the first. The amount of cost reduction for Ferries may differ from these percentages because: 1) the available pool of shipyards that build in Washington, which is a legislative requirement, is relatively small; 2) Washington state shipyards have had difficulty meeting the state's current bonding requirements for multiple ship bids; and 3) the supply of experienced ship building personnel that could continuously build a class of ships is limited in Washington state.
- *Fleet uniformity.* As uniform a fleet as possible provides the opportunity to reduce maintenance costs, improve fleet staff cross-training, and provide uniform service as vessels go in and out of service due to scheduled maintenance or emergencies.

Recommendation #10. Ferries should acquire vessels in two waves:

- 2009–2012: Four (4) new 64-auto vessels; and
- 2020–2030: Six (6) new 144-auto vessels.[49]

[49] Ferries' retirement range for the four (4) Super class vessels extends to 2033. It is possible that not all six (6) new 144s would need to be on-line by 2030. For this analysis, the consultants have assumed that all Super class vessels would be retired by 2030, which is the mid-point of the 2025-2033 retirement range for these vessels. The two (2) Evergreen State class vessels that are being replaced by these new 144-auto vessels are due for retirement in the 2022-2028 time period.

A. 2008 Fleet Retirement/Restoration of Service Schedule

The table below shows the vessels in the 2008 fleet that are due for retirement. The table also anticipates the replacement of the leased Pierce County vessel and the restoration of full service to the Keystone route.

As can be seen from the table, the needs between 2009 and 2020 are to replace the smaller vessels in the system and to restore full service to Keystone. The consultants recommend that Ferries acquire four (4) 64-auto vessels to replace the Pierce County leased vessel and restore shoulder and summer service on the Keystone route; replace the small *Rhododendron* on the Point Defiance route; and replace the *Evergreen State* on the Interisland route segment.

The two remaining Evergreen State class vessels (87-auto) and the Super class vessels (144-auto) are due for retirement in the 2021 to 2030 time period. The consultants recommend that these vessels be replaced with 144-auto vessels.

Table 44.
Recommended Fleet Replacement Schedule – Retirement 2008 Fleet

Class	# of vessels	Autos Existing Vessels	Year Built / Rebuilt	Route	Retirement Range of Existing Vessel	Recommended Replacement
First Acquisitions 2009-2012	*4*					
Replace leased Pierce County vessel	1	50		Keystone	Immediate	64-auto vessel
Restore Keystone service	1			Keystone	Immediate	64-auto vessel
Rhododendron replacement	1	48	1947 / 1991	Point Defiance	2011	64-auto vessel
Evergreen State replacement	1	87	1954 / 1988	Interisland	2010-15	64-auto vessel
Second Acquisitions 2021-2030	*6*					
Evergreen State Class	*2*	87	1958 / 1995	Various	2022-2028	144-auto vessel
Super Class*	4	144	1967/--	Various	2025-2033	144-auto vessel
Retire from System	*1*					
Hiyu	1	34	1967 / --		2008-13	No replacement

* Assumes Hyak rebuilt to have the same life as the rest of the vessels in the Super class.

B. Vessel Class Acquisition

As noted above, vessel acquisition costs per vessel are reduced if more than one vessel in a class is designed and constructed as a group.

With the baseline fleet, Ferries has assumed that it would design and construct: two (2) 64-auto vessels and three (3) 144-auto vessels in the 2009-2012 time period; and four (4) 144-auto vessels, two (2) 87-auto vessels, and one (1) 34 auto-vessel in the 2020-2030 time period.

In the recommended vessel acquisition plan, Ferries would design and construct four (4) 64-auto vessels as a class in the 2009-2012 time period, and six (6) new 144-auto vessels as a class in the 2020-2030 time period.

The recommended acquisition plan has greater economies of scale as a consequence of ordering more vessels in a class as a group. For example, the per-vessel cost of acquiring new 64-auto vessels drops from $50.0 million per vessel in the baseline acquisition plan to $43.8 million per vessel in the recommended plan. Similarly the per-vessel cost of the 144-auto vessels drops from $115.0 million per vessel in the baseline plan to $100.0 million per vessel under the recommended acquisition plan.

C. Fleet Uniformity

The recommended fleet has more standardization than the baseline fleet. With the recommended fleet, Ferries would by 2030 have five (5) classes of vessels rather than seven (7): the Jumbo Mark II, Jumbo Mark I, New 144, Issaquah class, and the Island Home class. All new vessels would have the same main and auxiliary engines, reducing maintenance and repair, and staff training costs.

In the baseline plan, Ferries would have had seven (7) vessel classes: the five listed above plus an Evergreen State replacement and a Hiyu replacement class.

D. Staggered Fleet Size

It is important to note that Ferries' fleet size will expand after the initial acquisitions in the 2010-2012 time period to 22 vessels and then be reduced to the recommended 21 vessel fleet in 2024. This will allow Ferries time to adjust the out-of-service time to the recommended average of six (6) weeks per year per vessel.

The tables below show the staggering of the fleet size between 2009 and 2030 for the baseline fleet and for the recommended fleet.

Table 45.
Baseline Fleet Size 2009-2030

Size/Class/Auto Capacity	Retire	# of vessels 2009-2020											# of vessels 2021-2030										
		2009	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Jumbo																							
Jumbo Mark II (202)	2055-60	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Jumbo Mark I (188)	2031-37	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
														Planning and design 2 Jumbo Mark I									
Large																							
Super (144)	2025-33	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
New (144)				1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		Build 3 new 144-atuo vessels											Design and build 4 new 144-auto vessels										
Medium																							
Issaquah (124)	2037-45	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Mid-Size																							
Evergreen State (87)	2010-15	1	1	1																			
Evergreen State Class (87)	2022-28	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
													Design and build 2 new 87-auto vessels										
Issaquah (90)	2040-45	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Small																							
Pierce County Leased	Return	1																					
Island Home (64)	New		1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		Build 2 new Island Home																					
Rhododendron (48)	2011	1	1																				
Hiyu (34)	2023-27	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
						Design and build 1 new 34-auto vessel																	
Total vessels:		21	21	22	22	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
		No de-crewed		1 de-crewed		2 de-crewed																	

Table 46.
Recommended Fleet Size 2009-2030

		# of vessels 2009-2020												# of vessels 2021-2030									
Size/Class/Auto Capacity	Retire	2009	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Jumbo																							
Jumbo Mark II (202)	2055-60	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Jumbo Mark I (188)	2031-37	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
																Planning and design 2 Jumbo Mark I							
Large																							
Super (144)	2025-33	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	6	6	6
														Design and build 6 new 144-auto vessels									
Medium																							
Issaquah (124)	2037-45	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Mid-Size																							
Evergreen State (87)	2010-15	1	1	1																			
Evergreen State Class (87)	2022-28	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	0	0	0
Issaquah (90)	2040-45	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Small																							
Pierce County Leased	Return	1																					
Island Home (64)	New		1	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Build 4 new Island Home																					
Rhododendron (48)	2011	1	1	1																			
Hiyu (34)	2023-27	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1							
Total vessels:		21	21	22	22	22	22	22	22	22	22	22	22	22	22	22	21	21	21	21	21	21	21
Difference from Baseline Fleet		0	0	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-2	-2	-2	-2	-2	-2	-2
		No de-crewed vessels		1 de-crewed vessel													No de- crewed vessels						

E. Ferries Response to Section VI.

1. Recommendation 10: Acquire Vessels in Two Waves

Regarding sequencing of vessels as addressed in the Report, see the letter by WSF.

SECTION VII.
LONG-TERM FERRY FINANCES

This section addresses the last question in the fleet planning model: "What is the impact of the 21-vessel fleet recommendations on Ferries' long-range operating and capital finance plans and service?"

As summarized in the table below, the consultants' recommended fleet would reduce capital costs during the 2009-2030 time period by $161.6 million. The consultants have identified the potential for additional savings of $166.6 million if the legislature opened vessel construction to national competition.

The recommended fleet would reduce operating costs during the 2009-2030 period by $106.4 million. The consultants have identified potential fuel savings of $159.4 million from reducing average vessel speed by 1 knot and modifying docking procedures.

Table 47.
Recommended Fleet and Potential Savings 2009-2030
($ 2008 millions)

	$ Saved 21-Vessel Fleet	$ Other Potential Savings	Total
Capital Cost (Program W)			
Vessel Acquisition	-133.0	-166.6	-299.6
Vessel Preservation & Improvement	-28.6		-28.6
Terminal Preservation & Improvement	TBD		
Sub-total Capital	-161.6	-166.6	-328.2
Operating Cost (Program X)			
Fixed Operating Costs	-15.4		-15.4
Variable Operating Costs	-91.0	-159.4	-250.4
Sub-total Operating	-106.4	-159.4	-265.8
Total	-268.0	-326.0	-594.0

The consultants' recommended fleet timing would delay additional 20-auto capacity on two routes—Bremerton and Clinton—and the addition of 74-auto capacity on the Fauntleroy-Vashon-Southworth Triangle route from the 2009-2020 time period to the 2021-2030 time period. If Ferries implements the consultants' recommended deployment on the San Juans-Sidney route, a large 144-auto vessel could be deployed to either the Bremerton or the Clinton route in the 2009-2020 time period.

The consultants have also assessed ways to improve service beyond the baseline service.

A. Capital Budget (Program W) Costs

Capital budget areas affected by the consultants' recommended fleet size are vessel acquisition, vessel preservation and improvement, and terminal preservation and improvement.

1. Vessel Acquisition Costs

As shown in Table 40 acquisition costs for the recommended fleet are $298.9 million lower in 2008 dollars than for the baseline line fleet included in Ferries' Long-Range Plan. The consultants have reviewed two questions with regard to fleet acquisition costs that could affect this reduction:

- Are Ferries' vessel construction estimates reasonable?
- How might vessel acquisition costs be affected if vessel construction bidding were opened up to national competition?

a. Vessel Construction Cost Estimates

The consultants have reviewed the cost estimates provided by Ferries. The consultants used a construction management program developed by Spar Associates of Annapolis, Maryland (SPAR). SPAR has been on the cutting edge of the changing shipbuilding industry for many years. Their systems help shipyards coordinate their resources and give management better visibility of problems long before they become critical.

In addition to offering ship construction management software, SPAR can provide independent cost estimating as a service to design agents, ship owners and government agencies. These estimates have proved to be valuable cross-checks to help ensure that the client better understands the full potential costs of a new vessel acquisition program. Alternately, shipyards have purchased estimating software from SPAR to make these estimates themselves.

SPAR's software, called ESTI-MATE, can be used to estimate vessel cost accurately, regardless of the U.S. geographic area of potential construction, as SPAR maintains recent data on labor, overhead and other cost components of individual and area shipyards. As Ferries' vessels can be built only in the State of Washington, shipyards in other areas are willing to estimate Pacific Northwest construction costs as they will not be giving away any competing data; they are not in the competition.

The consultants have worked with these shipyards, using ESTI-MATE, in reviewing Ferries' vessel construction estimates.

- *Small Island Home (64-auto) Vessel Cost Estimate* – Ferries assumed a cost of $50 million each in 2008 dollars of two new Island Home class vessels. This cost does not include engines, which have been previously purchased by Ferries.[50] Ferries is in the bid process for these vessels. The consultants independently reviewed the $50 million cost estimate for the small Island Home class vessel and believe that it is reasonable.

[50] Ferries purchased four (4) engine sets for the anticipated new-144 auto vessels. These engine sets can be used in the small 64-auto Island Home class vessels.

- *Small Hiyu (34-auto) and Mid-Size (87-auto) Vessel Cost Estimates* – Unlike the baseline fleet, the consultants' recommended fleet does not include replacements in-kind of these vessels. The consultants concur that the cost estimate for the small 34-auto vessel of $30 million is reasonable, as is the cost estimate for the two mid-size 87-auto vessel at $79 million each. Ferries has included in the estimates $3.0 million for engineering costs for the small vessel and $6.0 million for the mid-size vessel program.
- *Large (144-Auto) Vessel Cost Estimate* – Ferries assumed a cost for each of three (3) or four (4) 144-auto vessels of $115 million in 2008 dollars, including $14 million for the propulsion systems. Based on the consultants' review, it appears that this cost estimate may be low. A more realistic estimate for this size vessel as currently designed is an average of $134.9 million for each of three (3) or $130.2 million for each of four (4). The cost for each vessel for the recommended six (6) is $123.7 million.

  Ferries' baseline vessel acquisition included $8.0 million in 2008 dollars for engineering of the Super class replacement vessels. The consultants agree that this funding is needed and might be used to consider design adjustments, such as aluminum superstructure and longer length-to-beam ratio, which would improve fuel efficiency.

  Assuming an aluminum superstructure on the 144-auto vessels, to improve fuel efficiency, would increase the cost of each vessel by approximately $4 million.

  It should also be noted that Ferries' baseline plan is to have a large 144-auto vessel on the Sidney route in the summer, but funding was not included to make the approximately $5.0 million investment needed to make one of the new large 144-auto vessels SOLAS compliant. (See section V.H.3.b. above on the need for compliance with SOLAS.)

Table 48.
Revised Cost Estimate for Large (144-Auto) Vessels
(2008 $ millions)

	Baseline Fleet		Recommended Fleet	
Cost of 144 auto vessels	# of Vessels	$ millions	# of Vessels	$ millions
Ferries cost estimate	7	785.0	6	608.1
Consultant's cost estimate	7	905.4	6	750.0
Increased Cost		120.4		141.9
Increased Cost with aluminum superstructure @ $4 million each		148.4		165.9

Recommendation #11. Ferries should review the estimated cost of the 144-auto vessels as it finalizes its long-range plan.

b. National Bidding for Vessel Construction

The legislature has adopted a procurement process for each of Ferries' major vessel acquisitions. To enhance the state's economy and meet other public policy goals, the legislature has required that Ferries' vessels be built in the State of Washington. It has also been assumed that in-state construction of vessels makes it easier to maintain the vessels here. Ferries' cost estimates and the consultants' review of them are based on the assumption that the legislature will continue to require that new vessels be constructed in the State of Washington.

The consultants' assessment is that Ferries could achieve an approximately 20 percent savings in vessel construction, excluding machinery costs, if out-of-state shipyards were permitted to bid on these vessels.

An example of the cost differential is Ferries' recent experience in bidding for a 50-auto vessel similar to the one it is leasing from Pierce County. In March 2008 Ferries received a single bid for construction of the vessel for $25.9 million. North Carolina Ferries opened bids for a similarly sized vessel in April 2008. They received two bids—one from Mississippi and one from Texas—with the low bid $37.2 million for two vessels.[51] The equivalent North Carolina bid for only one vessel would be $22.0 million, 18 percent lower than the bid received by Ferries in March.

Under the recommended fleet with the consultants' revised costs for the large 144-auto vessels assuming aluminum superstructures, the potential cost savings from allowing out-of-state competition for vessel construction is $166.6 million in 2008 dollars, assuming a 20 percent reduction in costs.

In addition to potential cost savings, allowing national competition would also make Ferries' vessel construction eligible for federal funding.

> ***Recommendation #12.*** The legislature should consider opening vessel construction to national competition by determining the appropriate balance between Ferries' new vessel construction costs, the potential for federal funding, and the policy goals of the State.

2. Vessel Preservation and Improvement Costs

Vessel preservation and improvement funding is $28.6 million lower with the recommended fleet than with the baseline fleet in the 2009-2030 time period.

As shown in Table 39, the consultants estimate that the costs of preserving and improving a 21-vessel fleet would be the same as that of a 23-vessel fleet—assuming a 5 percent per

[51] North Carolina Ferries did not award this bid due to lack of state funding. When re-bid and awarded, the costs were similar to the original bid.

vessel increase in preservation funding for the smaller fleet.[52] In the recommended fleet, Ferries would have a 21-vessel fleet starting in 2024. The $28.6 million savings in vessel preservation and improvement costs shown in Table 47 occurs between 2011 and 2023, when the recommended fleet has 22 vessels and Ferries would not need to budget for the additional per vessel preservation funding.

3. Terminal Capital Costs

As discussed in Section III.H., the only terminal likely to be affected by the baseline fleet is Point Defiance, which would operate with a mid-size 87-auto vessel. Under the recommended fleet, the Point Defiance–Tahlequah route would have a small 64-auto vessel assigned to replace the retiring 48-auto vessel. This would reduce the investment needed for additional vehicle holding and for more robust dolphins.

The consultants will review the cost impact of these changes at Point Defiance in their report on Ferries' full capital program.

Table 49.
Summary Vessel Capital Cost Savings – Recommended Fleet
(2008 $ millions)

Vessel Acquisition	$
Projected cost reduction - recommended fleet	-298.9
Consultant revised cost estimate - large vessels	165.9
Sub-total - Revised cost savings with recommended fleet	*-133.0*
Vessel Preservation & Improvement	-28.6
Total Vessel Capital Cost Savings	-161.6
Option - Revise Build in Washington Requirement	-166.6
Total Potential Vessel Capital Cost Savings	-328.2
Terminal Capital Costs	TBD

B. Operating Budget (Program X) Costs

Savings in the operating program come from savings in fixed costs (i.e., engine room labor, insurance, maintenance) and variable costs (i.e., fuel and deck labor). Additional savings could be realized through fuel conservation efforts, including slowing down vessels and modifying docking procedures.

1. Fixed Operating Cost Reduction

Table 39 shows that the annual fixed operating costs with the recommended fleet would be $0.8 million per year less in 2030 than for the baseline fleet. If consistently realized over the 22 year 2009-2030 time period, the savings would be $17.6 million in 2008 dollars. However, the savings are reduced to $15.4 million because of the staggering of fleet reduction from 22 to 21 vessels between 2009 and 2030.

[52] This increased cost for the smaller fleet is in anticipation that reducing the out-of-service time to six (6) weeks per vessel per year might require an increase in preservation funding.

2. Variable Operating Cost Reduction

Table 38 shows that variable costs with the recommended fleet would be $5.9 million less per year in 2008 dollars in 2030. If consistently realized over the 22-year 2009-2030 time period, the savings would be $129.8 million in 2008 dollars. The total savings over the 2009-2030 time period is reduced to $91.0 million because in the recommended fleet four (4) large Super class vessels (144-auto) are all in service until the new 144-auto vessels are built. The Super class vessels are more expensive to operate than the new-144 auto vessels, which reduces the variable cost savings.

In addition the consultants have identified potential cost reductions of $159.4 million over the 2009-2030 time period in 2008 dollars from fuel conservation strategies. (See Section V. O. above.)

C. Ferry Service

The recommended fleet will have an impact on the timing of service improvements on three routes: Bremerton, Clinton, and Fauntleroy-Vashon-Southworth Triangle.

The consultants assessment of ways to improve service if funding is available indicates that service improvements could be made by increasing the number of sailings within existing service hours, adding service hours to existing vessels, and/or by adding vessels to the fleet.

1. Service Impact of Recommended Fleet Acquisition Timing

Ferries' long-range planning assumes that Ferries will acquire three new 144-auto vessels in the 2009-2020 time period, with the fleet then having seven (7) large 144-auto vessels. One of the seven (7) would be a de-crewed vessel; six (6) large 144-auto vessels would be assigned to routes. With the recommended fleet, Ferries would not have six (6) large 144-auto vessels in the fleet until the 2021-2030 time period.

The delay in adding two (2) large vessels to the fleet from the 2009-2020 time period to the 2021-30 time period will affect three routes:

- *Bremerton* – The replacement of one medium 124-auto vessel with a large 144-auto vessel would be delayed to the 2021-2030 time period. There is low auto utilization on the Bremerton route but high passenger ridership on this route. The large vessel can accommodate 300 more passengers than the medium size 124-auto vessel.
- *Clinton* – The replacement of one medium 124-auto vessel with a large 144-auto vessel would be delayed to the 2021-2030 time period. This route has a high auto capacity utilization.
- *Fauntleroy-Vashon-Southworth* – The deployment of two additional 124-auto vessels would be delayed to the 2021-2030 time period when the replacement of the 87-auto vessels would take place. The Triangle route has moderate auto utilization.

To address either the Bremerton or the Clinton situation, Ferries could modify its vessel deployment on the San Juan-Sidney routes in conformance with the consultants' recommended vessel deployment. Implementing the change on the San Juan-Sidney routes would allow Ferries to deploy a large 144-auto vessel on either the Bremerton or the Clinton route in exchange for a medium 124-auto vessel.

2. Improved Service

The analysis in this report is focused on existing service levels. If there are opportunities to improve service, Ferries could do it by increasing the number of sailings within the service hours, increasing service hours or adding vessels to the fleet.

Adding vessels to the fleet to improve service should be the last resort. It is most cost-efficient to add sailings within existing service hours—in which case the marginal cost is only for fuel. The next most cost-efficient way to improve service is to extend service hours with an existing vessel—in which case the marginal cost is for deck labor and fuel. The least cost-efficient way to improve service is to add a vessel, with its attendant fixed costs.

> ***Recommendation #13.*** Ferries should consider additional sailings and/or modification to vessel service hours as ways to improve service before considering adding vessels to the fleet to improve service.

a. Expanded Sailings Within Existing Service Hours

Bremerton has large gaps in its mid-day schedule that could be filled with additional sailings. The cost per sailing for fuel is approximately $758 or $1,516 per route trip at existing vessel speeds and 2008 fuel prices. The cost to add additional sailings is fuel, with one additional round trip per day costing $0.6 million per year. If the average vessel speed on the route were 1 knot slower, the cost to add one additional round trip per day would be reduced to $0.4 million. Modifications to labor agreements to allow for ten hour shifts would be needed to avoid extra staffing costs.

b. Expanded Service Hours with Existing Vessels

Routes where expanded service hours could be considered as a way to improve service include those routes where there are no vessels operating 24 hours a day. These routes are: Point Defiance, Port Townsend, San Juans, and Sidney. In addition, one of the vessels assigned to Port Townsend only operates eight (8) hours a day in the shoulder and summer seasons.

The routes with the highest auto capacity utilization that could extend service hours are Port Townsend and summer service in the San Juans.

- *Port Townsend:* To extend service hours at Port Townsend costs $3,858 per eight-hour[53] extension of service. The cost to add eight (8) hours per day during the

[53] The minimum deck crew call-out is eight (8) hours.

summer season is $0.4 million, with an additional $0.2 million to add eight (8) hours a day of service in the shoulder season.

- *San Juans:* To extend service hours on the San Juan route with a large vessel in the summer costs $6,675 per eight-hour extension of service. The cost to add eight (8) hours per day during the summer season is $0.7 million.

c. Expanded Service Requiring New Vessels

Routes where service could be expanded only by adding additional vessels to the route include Kingston, Clinton, and the Triangle Fauntleroy-Southworth-Vashon routes. Vessels could be added to these routes only if service were reduced elsewhere in the system or if additional vessels were added to the fleet.

- *Clinton and Kingston:* Adding a third vessel on the Kingston route or the Clinton would require relocation of the Edmonds terminal and the Mukilteo terminal.[54]
- *Triangle Route:* Ferries has considered breaking the triangle route into three distinct routes: Southworth-Vashon, Southworth-Fauntleroy,[55] and Vashon-Fauntleroy. In order to accomplish this, Ferries would operate a small (34-auto) vessel between Southworth and Vashon. If a small (34-auto) vessel were to operate on that route, Ferries could consider operating the same size vessel on the Interisland route, which could help offset some of the increased cost of the additional vessel.

Table 50.
Service Improvement Opportunities

Service Improvement Action	Route
Expand Sailings	Bremerton
Expand Service Hours (at least one vessel operate 24 hours)	Point Defiance
	Port Townsend
	San Juans
	Sidney
Add Vessels	Clinton*
	Kingston*
	Triangle

* Requires new terminal.

[54] Ferries has purchased property for a potential re-location of the Edmonds and the Mukilteo terminals.
[55] Ferries has also considered Southworth – Seattle service, but that would involve an expansion of the Seattle terminal.