



PROJECT MEMORANDUM

Guemes Island Ferry Replacement Project

15 February 2019

TO: Skagit County Board of Skagit County Commissioners
FROM: Dan Berentson, Public Works Director
Paul Randall-Grutter, P.E., County Engineer
RE: Replacement Ferry Size

Overview

Skagit County proposes to replace its 40-year old diesel powered ferry, *Guemes*, with a larger electric ferry to serve the needs of the route for another 40 years. Glosten, Skagit County's naval architecture firm has completed concept design studies, including a vessel capacity study and a transportation system assessment, and has made the recommendation to the replace the *Guemes* with a 32-car ferry.

In order to progress with the next phase of design, a determination needs to be made to replace the 21-vehicle, 100-passenger ferry with either a 32 or 28-car ferry, both of which will carry 150 passengers. Glosten has prepared a program capital cost estimate for both options. We recommend proceeding with the 28-car ferry based on construction and operational cost savings, throughput limits, growth, and land use.

Figure 1 - Program Capital Cost Estimate

Design & Construction	32-Car Ferry	28-Car Ferry
Terminal	\$ 1,700,000	\$ 1,700,000
Electrical	\$ 4,200,000	\$ 4,000,000
Vessel	\$ 15,900,000	\$ 13,300,000
Total	\$ 21,800,000	\$ 19,000,000

Considerations

Capital cost is one of several considerations in selecting the vehicle capacity of the new ferry. This project memorandum addresses two remaining questions the Commissioners have regarding vessel size.

1. What is the difference in operating and maintenance costs between a 32 and 28-car ferry?
2. Will a 32-car ferry, if selected, meet the two round trips per hour design requirement?

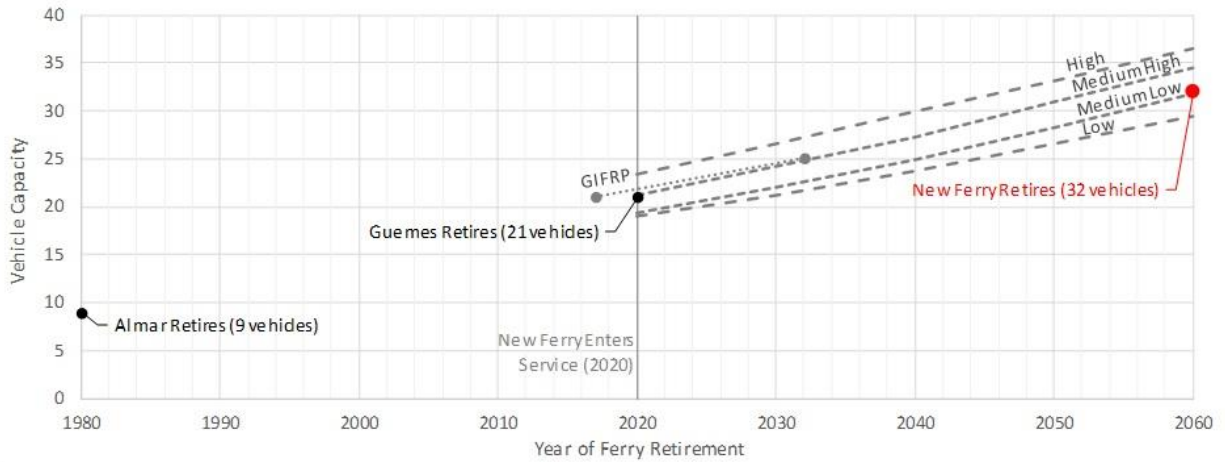
Glosten and Skagit County have provided two attachments to this memorandum to address these questions. The remainder of this project memo discusses growth and capacity projections.

Glosten, in the [Guemes Island Ferry Replacement Vessel Capacity Study](#), and Berk Consulting, in the [Guemes Ferry Replacement Environmental Assessment](#), analyzed growth projections to determine an appropriate vehicle capacity for the new ferry.

Glosten based their recommendation for a 32-car ferry on capacity history and a medium low growth trend over a 40-year planning period.

Glosten’s vessel capacity study concludes that, “There is no “perfect” capacity for the new Guemes Island Ferry. Historical ridership records indicate that there is almost certainly ongoing elasticity in rider demand. Given incentives and alternatives, riders have found a way to share *Guemes* harmoniously with more than twice the number of people who used it in its first year of service.” Ultimately, the Guemes Island Ferry’s future success depends largely on the way that riders decide to use it.

Figure 2 – Glosten’s estimated vehicle capacity



Berk Consulting, Inc. conducted an environmental assessment to evaluate a range of vessel alternatives: 32 cars (Glosten proposal), 28 cars (reduced ferry size alternative) and 21 cars (no action). Berk concluded that, “Growth trends do not support the idea that a ferry size induces growth. Growth trends and ridership analysis do support considering an alternative in the range that accommodates growth in the middle of the planning period for a medium or lower historic rate paired with demand management and transit measures.”

Figure 3 – Berk’s estimated vehicle capacity

Scenario	Vehicle Ridership R/T 2036	Vehicle Capacity Needed 2036	Vehicle Ridership R/T 2060	Vehicle Capacity Needed 2060
Historic Trends High	131,000	25	188,000	35
Glosten Vessel Capacity Study 2017			170,000	32
County Comp Plan Medium	119,000	22	158,000	30
Historic Trends Low	105,000	20	119,000	22

Berk further concluded that a 32-car ferry or a 28-car ferry would meet Skagit County’s Comprehensive Plan Policy Goal 8A-5 to maintain County ferry services. However, a vessel sized for a projected growth rate at a medium or lower level, or for the mid-point of the 2060 planning horizon, could reflect the following trends and uncertainties:

- Declining rates of ridership
- Changing nature of vehicle travel (e.g. driverless cars, car sharing), and
- Potential for additional demand management measures (pricing, parking, etc.).



ATTACHMENT 1

Operational Cost Estimate – 32 and 28 Car Electric Ferry

15 February 2019

TO: Capt. Rachel Rowe, Skagit County
 FROM: Will Moon, PE/Dave Larsen, PE
 JOB/FILE NO. 17097.01

Summary

As requested, Glosten has estimated the annual operating cost for a 32-car electric ferry and a 28-car electric ferry for comparison to the average annual operating cost for Skagit County’s existing diesel power ferry, the M/V *Guemes*.

Skagit County provided financial budgets and actual cost returns for operating the *Guemes* for the past 6 years (2012-2017). These costs have been brought to present value, analyzed, and compared to the predicted operating costs for two new, larger all-electric ferries operating on the same schedule. This comparative analysis predicts that replacing the existing diesel-powered ferry with either a 32-car or 28-car electric ferry should allow Skagit County to realize significant savings from both lower energy costs (electricity versus diesel fuel) and lower maintenance and repair costs. These operating cost savings are expected to range from about 46% of the annual operating budget, or \$577,000 (Table 1) for the 32-car electric ferry to about 51% of the annual operating budget, or \$635,000 for the 28-car electric ferry. Both analyses exclude personnel costs.

Table 1 Annual operating cost comparison – M/V *Guemes* versus 32-car or 28-car electric ferry

Comparison of Annual Operating Costs for <i>Guemes</i> ¹ and a new All Electric Ferry						
Item	<i>Guemes</i> ¹		32 Car Electric Ferry		28 Car Electric Ferry	
	Cost	% of Total	Cost	% of Total	Cost	% of Total
Fuel/Lube/Supplies ²	\$ 295,685	23.7%	\$ 130,000	19.4%	\$ 108,000	17.7%
Maintenance/Repair	\$ 649,792	52.1%	\$ 306,210	45.8%	\$ 280,806	46.0%
Rentals ³	\$ 77,262	6.2%	\$ 21,000	3.1%	\$ 21,000	3.4%
Other Obj 540 items ⁴	\$ 118,509	9.5%	\$ 106,658	15.9%	\$ 95,872	15.7%
Interfund Transfers	\$ 105,207	8.4%	\$ 105,207	15.7%	\$ 105,207	17.2%
Total Costs	\$ 1,246,455	100%	\$ 669,075	100%	\$ 610,886	100%

- (1) Six-year average of M/V *Guemes* costs (2012-2017)
- (2) For the electric ferry, this line item is the cost of electricity
- (3) This is the cost of the passenger-only relief vessel.
- (4) Professional services, utilities, travel, communications, etc.

Methodology

The *Guemes* costs were obtained by averaging the six years of data received from Skagit County. Maintenance and repair costs were brought to present value using factors from the Bureau of Labor Statistics, Non-Military Ship Repair Cost Index. Other costs, such as fuel, were left at their historical market price. It should be emphasized that this is not a predictive tool for forecasting the costs for 2019, but rather an average of 2012-2017 costs.

Personnel Labor/Benefit Costs – (Skagit County budget codes 510 and 520)

Since the crewing levels and operating schedules for the proposed 32-car or 28-car electric ferry and for the *Guemes* are assumed to be the same, the labor/benefit costs for the various options were the same. Consequently, the personnel costs were not considered in the evaluation.

Fuel/Lube/Supplies – (Skagit County budget code 530)

For the *Guemes*, this line item includes the cost of diesel fuel, lube oil, operating supplies (filters, etc.), small tools, and minor equipment. The Skagit County budget assumes the *Guemes* burns 66,300 gallons of diesel fuel per year. For the two electric ferry options, this line item is the cost of energy and is based on projected power grid connection fees and the cost of electric power using current rate information from Puget Sound Energy.

The electric ferry options are expected to save about \$165,000 to \$187,000 annually on energy costs compared to the diesel-powered *Guemes*. This analysis uses the County's average cost of diesel for the last 6 years, which averaged \$3.09/gallon. Diesel fuel prices fluctuate far more than electricity prices; should the cost of diesel fuel increase, the energy cost savings of the electric ferry would increase accordingly.

Repairs and Maintenance – (Part of Skagit County Budget code 540)

This budget category is dominated by repair and maintenance costs for the ferry, but also includes other items such as filters and cleaning supplies. Efforts were made to compare the maintenance and repairs costs of an electric ferry to the those experienced by the County on the *Guemes*. Based on a combination of budgets and actual expenses over the past 6 years, maintenance and repairs have averaged about \$650,000/year when adjusted for inflation. Budget values were modified to reflect actual expenditures where the actual data was easily available.

Looking through several of the shipyard invoices, it was determined that standard drydocking, cleaning and painting, checks of propellers/alignment and safety systems, and other routine shipyard maintenance items averaged about \$360,000 per shipyard event for the *Guemes*. The County dry docks the *Guemes* about three times every five years, resulting in an average cost of \$210,000 per year.

The remainder of the code 540 repair budget ($\$650,000 - \$210,000 = \$440,000$) was attributed to the propulsion system and other machinery items. This implies that over the past 6 years, Skagit County has been spending about \$440,000 annually on the machinery on the *Guemes*. These are the costs for the diesel engines, outdrives, generator, and related machinery. These costs were assumed to continue at this average value for the foreseeable future.

The two electric ferry options will require similar maintenance for the hull and other routine shipyard maintenance items as the *Guemes*. The vessels have a similar beam and draft, so to account for the larger size of the new all electric ferry options, the \$210,000 per year was multiplied by the length ratio of the vessels (178'/124' and 160'/124'). The new vessel would only be expected to be drydocked every other year as required by the US Coast Guard. This results in about \$250,000 annual average for the electric ferry or \$500,000 per shipyard event.

The annual propulsion system maintenance and repair costs were estimated to be \$55,000 year for the new 32-car electric ferry, as discussed in the Concept Design Report. Since the 32-car and 28-car electric ferries have the same propulsion system, the costs were assumed to be the same for the two options as well.

Rentals - (Part of Skagit County Budget code 540)

This budget category is the cost of renting a passenger-only ferry during periods when the *Guemes* is out of service. At a daily cost of about \$3,000/day, the annual cost has averaged \$77,000/year over the last six years with the *Guemes*. For the two electric ferry options, it was assumed that the vessel would remain in service except during shipyard periods. The duration of these shipyard periods is estimated at two weeks per event; for one shipyard period every other year, an annualized budget of \$21,000 is required to cover the cost of renting the passenger-only ferry.

Capital Costs - (Part of Skagit County Budget code 560)

This budget category is primarily for equipment over \$5,000 in cost. For the *Guemes*, this budget category has averaged about \$74,000/year for the 2012-2017 time period.

For the electric ferry options, this is where the cost for battery replacement has been placed. The cost of the replacement batteries for the 32 car electric ferry is estimated at \$874,000 total for both the batteries on the ferry and those on shore. The cost of the replacement batteries for the 28 car electric ferry is estimated at \$727,000 total for both the batteries on the ferry and those on shore. As reported in the Concept Design Report, the batteries have an 8-year life expectancy and there is an assumed 5% annual discount for battery technology advancements. This results in an annualized capital cost of \$109,250 for the battery replacement on the 32 car electric ferry and \$90,875 for the battery replacement on the 28 car electric ferry.

Table 2 Annual capital cost comparison – M/V *Guemes* versus 32-car electric ferry

	Guemes ¹		32 Car Electric Ferry		28 Car Electric Ferry	
	Cost	% of Total	Cost	% of Total	Cost	% of Total
Capital Costs (Obj 560)	\$ 74,167	6.0%	\$ 109,250	16.3%	\$ 90,875	14.9%
(1) Six-year average of M/V <i>Guemes</i> costs (2012-2017)						

Interfund Transfers and Taxes - (Skagit County Budget codes 550 and 590)

These budgets are for items such the cost of marine insurance for the ferry, sales tax on ferry purchases, using a vehicle from the County motor pool or using County personnel for ferry projects. These costs are not expected to change with a new ferry.



ATTACHMENT 2

Ferry Replacement Throughput Limits

15 February 2019

TO: Capt. Rachel Rowe
FROM: William L. Moon, PE
JOB/FILE NO. 17097.01

References

1. *Guemes Island Ferry Replacement Vessel Capacity Study*, Glosten, Inc., Report No. 17097-000-01, Rev. -, 20 October 2017.
2. *Guemes Island Ferry Replacement Transportation System Assessment*, Glosten, Inc., Report No. 17097-000-02, Rev. -, 14 December 2017.

Ferry Throughput Limits

As part of the development of a concept design for the Guemes Island ferry replacement, Glosten conducted a Capacity Study (Reference 1) to calculate the appropriate passenger and vehicle capacity of the new ferry based on two round trips per hour and forecasted ridership over its intended service life. A 32-vehicle ferry size was recommended as a result of this work.

Glosten also conducted a throughput assessment as part of a Transportation System Assessment (Reference 2) to understand limitations to vessel capacity based on terminal infrastructure and other factors.

In performing this study, Glosten made two critical assumptions, which allows a 32-vehicle ferry to reliably perform two round-trips per hour:

1. **Ticketing will not be a bottleneck.** Ticketing can at times be a bottleneck in the current operation. Ticketing will become the primary bottleneck with a larger ferry if the ticketing system is not changed. There are many opportunities for improving the efficiency of the ticketing system, and with reasonable investment, ticketing need not be the bottleneck. The requirement: all cued vehicles must have their tickets purchased and in hand when loading commences.
2. **Vehicles and passengers can load concurrently.** Currently, passengers and vehicles cannot load concurrently due to the geometry of the terminal transfer span aprons (see Figure 1), which narrow at the ends, causing the vehicle lane and passenger walkway to merge. This forces vehicles and passengers to take turns when loading and unloading, creating significant overall delays in the time required to load and unload the ferry. Widening the transfer span aprons will eliminate this delay.

Together, these studies revealed that up to 22 vehicles can be reliably carried while operating on a schedule of two round-trips per hour without changes to the transfer span apron (see Figure 2).

If the apron is improved to permit concurrent passenger and vehicle loading, up to 33 vehicles can be reliably carried while operating on a schedule of two round-trips per hour (see Figure 3).



Figure 1 Transfer span components (Ref 2)

Figure 2 shows how the time segments of the average round trip are predicted by the throughput model for a 22-vehicle ferry.

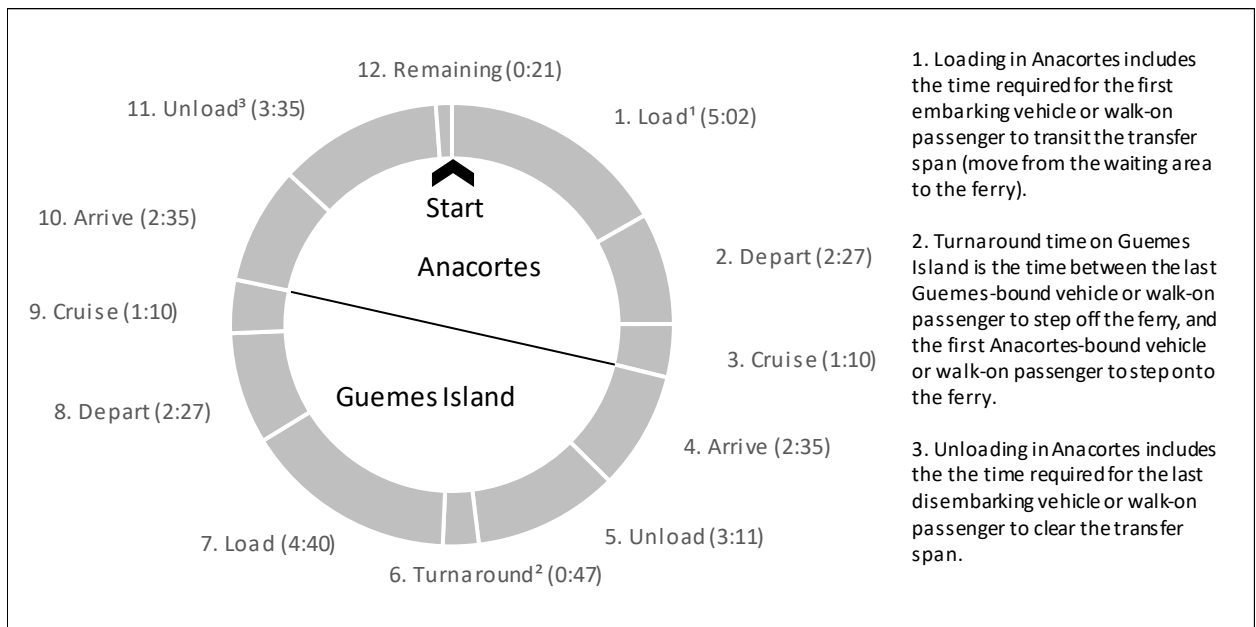


Figure 2 Typical round-trip transit: 22 vehicle ferry, existing loading operations (Ref 2)

Figure 3 shows how the time segments of the average round trip are predicted by the throughput model for a 33-vehicle ferry, assuming concurrent vehicle and walk-on passenger loading is enabled.

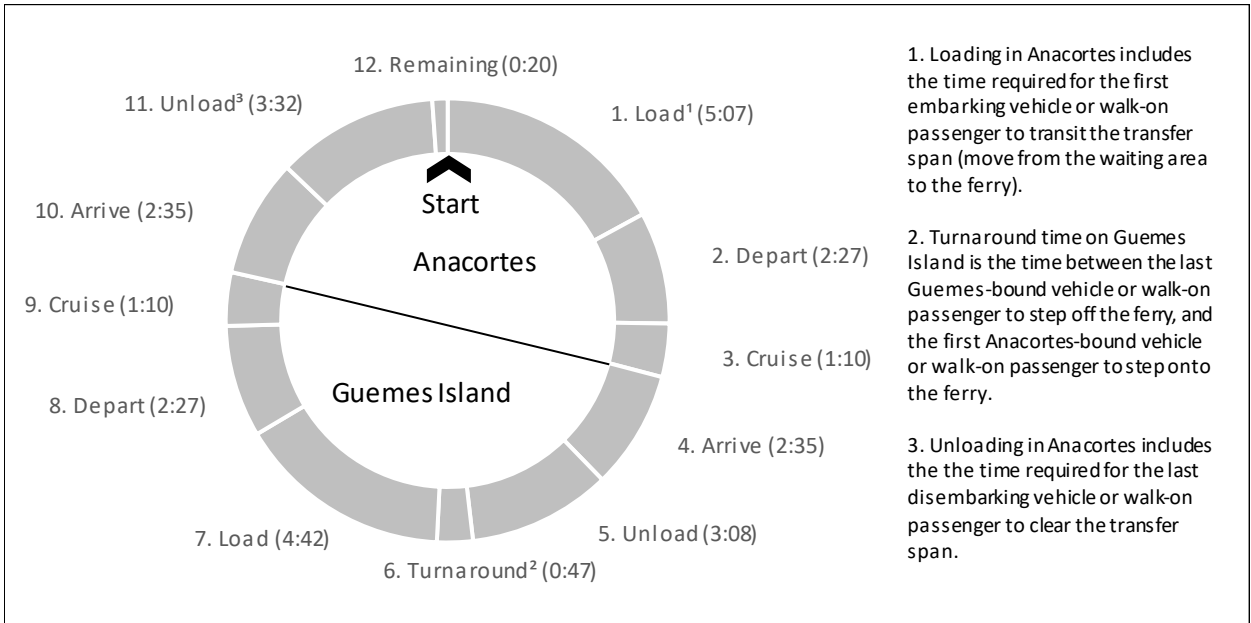


Figure 3 Typical round-trip transit – 33 vehicle ferry, concurrent passenger and vehicle loading (Ref 2)