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The Compelling Case for a 24-car Ferry

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Over the past two months there has been a great deal of community discussion about the ferry replacement analysis recently provided to LIFAC and the County by the Kpff consultant group. Their report offers detailed analysis of three alternative options for replacing the aging Whatcom Chief: a 20-car boat, a 28-car boat, and a 34-car boat. No particular explanation is offered for limiting the range of options to these three design capacities, and recent information from LIFAC suggests that Kpff has now taken the 28-car vessel off the table, leaving us to choose between a new 20-car design and the 34-car design, neither of which seems to meet our goals.

While there is enough data buried in the study to help us make a fairly intelligent decision about choosing a vessel to best serve County and Island needs over the next several decades, this information is confounded by several critical and erroneous assumptions by Kpff that have led them to significant underestimation of the performance characteristics of each of their vessel options on this route.

The most glaring of these errors is the assumption that *peak loadinsg happens in both directions at the same time*, despite years of historical data that clearly show that peak loading happens from island to mainland in the morning and from mainland to island in the afternoon, with full loads going in the peak direction and half-loads going in the non-peak direction.

Questioning Assumptions

In Table 1 below we have reproduced the Kpff Voyage Model data *(Table 2 in their report)* that forms the basis for their projections of the peak number of cars/hour attainable with each option they consider. Their assumption of peak loads going in both directions is tacitly embedded in their projection of equal loading and unloading times going both ways on each afternoon round trip.

Table 1. Maximum cars/hour per Kpff

Note: *Assumes full loads both ways during peak demand hours*

ferry option	**chief**	**20**	**24**	**28**	**34**
loading time, min	4	2.25	2.85	3.45	4.1
loading time per car, sec	12	7	7	7	7
departure, transit, arrival	6	5.3	5.3	5.3	5.3
unload, mins	2	2.25	2.85	3.45	4.1
unloading time per car, sec	6	6.75	7.1	7.4	7.2
total mins one way	12	9.8	11	12.2	13.5
total mins rt	24	20	22	24	26
trips/ 2hr	5	6	5	4	4
Maximum cars/hr	50	60	60	56	68

We have also used their data to project results for a hypothetical 24-car design option by averaging their numbers for the 20 and 28 car vessels. The disappointing implication from the bottom line of their table is that any performance advantage from being able to carry more cars per load on a larger vessel is largely negated by its increased loading time.

However, implicit in their table are three *critical and erroneous assumptions* which strongly underestimate the viability of all the ferry options they consider:

- That peak loading happens in both directions at the same time;
- That there are no viable ferry sizes between 20 and 28 cars;
- That scheduling can include "slack time" during peak demand hours.

Peak loading

The primary reason the Whatcom Chief has been so successful at meeting demand for so many years is that peak loading has been *asymmetrical*, with heavier demand in the morning *from* the Island and in the afternoon *to* the Island. At peak periods the Chief can often move close to 60 cars per hour, because the peak load run can "borrow" loading time saved on the off-peak run. In Table 2 below we have recomputed the transit times in the Kpff Voyage Model Table by subtracting the loading and unloading times of half the vehicles in the non-peak direction from each round trip, consistent with historic data.

Smaller ferry options

Correcting peak loading calculations by assuming full loads only on the peak demand side of round trips and half-loads on the return trips saves enough time per round trip to allow each vessel option to carry significantly more cars per hour during peak demand than projected in the kpff Voyage Model. When correctly computed *every* vessel option increases its peak load performance, making all ferry sizes more feasible than they appear in the original Kpff table.

Continuous operation during peaks

On weekends the Whatcom Chief has scheduled runs only once per hour. At Captain's discretion, the boat makes extra runs when vehicles are left at the dock on any run. In practice this translates into continuous running for periods up to two hours during peak demand periods. Therefore it is useful to calculate maximum capacity by computing the number of vehicles/hour that could be carried by each boat when operating continuously over a two-hour period.

Efficient design

Kpff mentions the possibility of other design features that could save additional time in loading and transit, such as increased maneuverability with diesel-electric hybrid propulsion: *"The combination of electric motors and batteries can provide more torque at low propeller speeds, and can respond faster than a diesel engine, leading to better maneuverability while docking or undocking."* Similarly, they suggest that additional time savings are likely available from the simultaneous loading of passengers and vehicles and the streamlining of loading and offloading areas at the dock.

In Table 2 below we have recalculated the maximum two-hour throughput for each vessel option shown in Table 1, assuming:

- full loads in the peak direction and half-loads in the off-peak direction;
- each vessel running back and forth continuously for two hours; and
- a modest additional 30-second per round trip efficiency gain from engineering and design improvements.

Table 2. Maximum cars/hour running back and forth for two hours.

***Note*:** *Assuming full load one way, half load return*

ferry option	**20**	**24**	**28**	**34**
total mins/ rt (from Table 1 above)	20	22	24	26
less mins saved/rt full out half back	2.2	2.8	3.4	-2.1
less mins saved from efficient design	0.5	0.5	0.5	0.5
adjusted total mins/ rt	18.3	19.7	21.1	23.4
Adjusted trips/2 hr	6.6	6.1	5.7	5
Adj max cars/hr back and forth	**66**	**73**	**80**	**85**

As the table clearly shows, adjusted performance estimates for any of these options would significantly improve service over the coming decades compared to the Whatcom Chief.

Costs and Fares

Between 2006 and 2011, Whatcom County raised ferry fares by about 500% while drastically diminishing ferry parking and parking security on the mainland. These fare increases raised the commuting expenses of many Lummi Island households from a few hundred dollars per year to several thousand dollars per year. Many renters, commuters, and families with school-age children were compelled to move to the mainland, bringing more retired couples, telecommuters, VRBO renters, and others with better options to economize on ferry use to the island.

These demographic shifts have had a profound effect on the Island community. Fewer young families has meant fewer volunteers for the Fire Department, fewer young people willing to do odd jobs, more demand for emergency services, and more weekend visitors, with increasing peak loading of the ferry on Fridays and Sundays.

These changes have been driven by County ferry fare policy. Islanders cannot possibly make an intelligent decision about which vessel is best for them without knowing how much of the costs will be passed on to riders or to residents via taxation. In the absence of this knowledge, it is generally in all stakeholders' economic interest to support the vessel with the lowest operating and maintenance costs that will do the job, thereby minimizing pressure on fares to rise in the future.

Recommendations

Corrected data in Table 2 shows that the 24-car option could almost certainly follow the same schedule the Whatcom Chief now sails, but with significantly lower annual maintenance costs and a significantly higher maximum throughput of 72 cars per hour.

Also, given that a carbon tax on fossil fuels is very likely in the future, the diesel-electric hybrid option holds significant promise for being the lowest-cost propulsion option over the next several decades, as well as providing better maneuverability while docking.

Therefore, we believe the corrected data shown in Table 2 presents a compelling case for serious consideration of a 24-car diesel-electric hybrid vessel to serve the County over the next several decades.