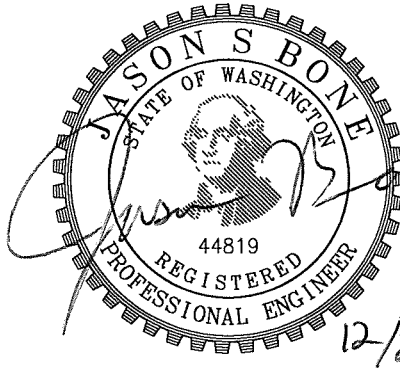


ALASKA CLASS FERRY



Preliminary Intact Stability Assessment

Prepared for: Alaska Marine Highway System • Ketchikan, AK

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Rev. -

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GENERAL NOTES

1. This report is NOT intended for submittal to regulatory bodies for approval of stability characteristics.

REVISIONS

REV	DESCRIPTION	DATE	APPROVED
-	Initial issue	12/21/09	JSB 44819

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PURPOSE

The purpose of this report assesses intact stability for the ALASKA CLASS FERRY design. The subject vessel is a 350 ft long × 74 ft wide × 24 ft deep passenger vehicle ferry, and will be owned and operated by the Alaska Marine Highway System. The vessel is intended for operation on inside-waters routes in the state of Alaska, and on international voyages to Canada.

PROCEDURE

General

The vessel is a USCG subchapter H vessel subject to the applicable intact stability requirements of Subchapter S in Reference 1. These include the CFR wind heel criterion (46 CFR 170.170), the CFR unusual proportion and form criterion (46 CFR 170.173), and the CFR passenger heel criterion (46 CFR 171.050).

Though not currently mandatory, the vessel is also evaluated against the International Code of Intact Stability, 2008 (ISC) (Reference 2). There is a proposed rule change (Reference 3) that would require a vessel to meet these criteria if the vessel is issued a SOLAS Passenger Ship Safety Certificate (PSSC). The vessel is required to obtain a PSSC per 46 CFR 71.75. It is unknown at this time if and when this rule will take affect. The USCG is not allowed to comment on the probability of this proposed rule being enacted.

General HydroStatics (GHS) software, version 11.74 and Excel are used to evaluate all applicable intact stability criteria. The GHS computer model of the subject vessel (Reference 4) includes tanks and a sail profile. This model was created from the bare hull preliminary design GHS computer model (Reference 5), and the preliminary profile and arrangements (Reference 6).

Intact Stability Curves Graph

The following intact stability criteria are applicable to this vessel:

1. 46 CFR 170.173(b), Unusual proportion and form criterion.
2. 46 CFR 171.050, Passenger heel criterion (current).
3. 46 CFR 170.170, Wind heel criterion (current).
4. 46 CFR 170.170, Wind heel criterion (proposed).
5. ISC Part A 2.2, Righting lever criterion.
6. ISC Part A 2.3.1.2, Initial wind heel criterion.
7. ISC Part A 2.3, Severe wind and rolling criterion.
8. ISC Part A 3.1, Passenger/turning heel criterion.

Intact stability is analyzed using maximum allowable keel to vertical center of gravity (VCG) versus displacement curves as shown in the Intact Stability Curves Graph on page 7. GHS is used to produce points of maximum allowable VCG versus displacement for criterion 1, and criteria 4 through 8. Excel worksheets are used to produce points of maximum allowable VCG versus displacement for criteria 2 and 3. Displacements range from light ship to the subdivision draft and

trims from 1 degree forward to 1 degree aft. The GHS output and Excel worksheets, used to create the Intact Stability Curves are included in Appendix A.

The subdivision draft is also shown on the graph for reference.

Sample loading conditions are created and their VCGs/displacements points are plotted on this graph to evaluate the vessel's intact stability.

There is a proposed rule change (Reference 3) for the CFR wind heel criterion. This vessel is evaluated against both the current and the proposed wind heel criterion.

There is also a proposed rule change (Reference 3) for the CFR passenger heel criterion. This proposed rule change however includes language stating that if the vessel meets ISC Part A 3.1 while using the proposed passenger weight (185 lbs), then the proposed CFR passenger heel criterion is not required. Since this is true, the vessel is not evaluated against the proposed CFR passenger heel criterion.

GIVEN AND ASSUMED PARAMETERS

Vessel Particulars

LOA	350'-0"
B (over guards)	74'-0"
Depth	24'-0"
Subdivision Draft	17'-0"
Displacement @ Subdivision Draft	4,685 LT

Reference Origin

Longitudinal locations are referenced from frame 0 at the forward point of the design waterline, positive aft. Transverse locations are measured from centerline, positive to starboard. Vertical locations are referenced from the baseline at the molded bottom of the keel, positive up.

Route

The vessel is assumed to operate on exposed waters.

Light Ship Weight

A preliminary weight estimate, Reference 7, is calculated to determine the vessel light ship weight and center of gravity. The results are:

Light ship weight:	3,269	long tons
VCG:	30.55	ft above baseline
LCG:	163.70	ft aft of frame 0
TCG:	0.49	ft stbd of centerline

Service Life Margin

A service life margin (SLM) of 331 LT is included (separate from the light ship weight above). This is located at the light ship LCG, on centerline, at a VCG that results in a 1 foot increase in the vessel VCG at the full load condition. The service life margin accounts for vessel light ship growth over 60 years of service life.

The SLM weight and SLM VCG were determined after consideration of Reference 8.

See the Future Work section for more information.

Vehicle Load

The maximum available space for vehicles is about 1,209 linear feet.

Alaska Standard Vehicles require 20.0 feet to park, short (truck-top) campers are assumed to require 20.0 feet, WB-50 intermediate semi-trailers require 55.0 ft, and WB-67 semi-trailers required 73.5 ft (per Reference 8).

Alaska Standard Vehicles weigh 6,000 lbs (per Reference 9). Short campers are assumed to weigh 12,000 lbs. Semi-trailers (regardless of length) are assumed to be the legal maximum weight in the western United States of 80,000 lbs based on WASHTO published truck limits (Reference 10).

Loading Condition 1 includes the heaviest full load vehicle combination with (7) WB-50 intermediate semi-trailers, (10) campers, and (31) Alaska Standard Vehicles. The vessel is designed to accommodate 7 semi-trailers in accordance with Reference 9.

The first six semi-trailers are located in the center two lanes, as far aft as possible to allow the trucks to exit without reversing. The seventh semi-trailer is located immediately to port in line with the forward most other semi-trailers. Cars/light trucks and short campers are located in the area surrounding the semi-trailers.

For reference, the vessel can fit 60 Alaska Standard Vehicles (cars and light trucks) with no semi-trailers.

Passengers and Crew

Per USCG, individual passengers and crew are assumed to weigh an average of 185 lbs. Passenger and crew effects are assumed to weight 140 lbs each.

The vessel carries a maximum of 499 passengers (41.21 LT) located at centerline amidships at a height of 46.00 feet above baseline. Passengers are evenly distributed on the passenger deck.

The vessel carries a maximum of 33 crew and their effects (4.79 LT) located at centerline amidships at a height of 55.00 feet above baseline.

Stores and Outfit

The vessel is assumed to carry 25 LT of ship stores 17.50 ft ABL, 10 LT of galley stores at 35 ft ABL, and 15 LT of outfit at 35 ft ABL.

Weather Ice

The vessel is assumed to carry 55 LT of weather ice located 53.84 ft ABL, on centerline, 154.04 ft aft of frame 0. The Icing Calculation in the appendix shows how this is determined.

Heel and Trim

The vessel is assumed loaded to minimize heel and trim.

Free Surface Correction

The requirements of 46 CFR 170.285, 46 CFR 170.290, and ISC Part B 3.1 are followed to calculate a free surface correction that can be used in both intact and damaged stability regulations. The free surface correction is used to increase the loading condition vertical center of gravity.

The maximum free surface moment for all consumable and non-consumable liquid tanks are included. The maximum free surface moment of each tank at either 0 or 5 degrees of heel is used. The calculation below shows the total free surface moment for the vessel is 3307.5 ft-LT. The maximum free surface moment for each tank is obtained from the Tank List found on pages 13 and 14.

Type	GHS Tank Name (s)	Free Surface Moment (ft-LT)
Fuel Oil Storage	FO2.C	522.0
Fuel Oil Storage	FOD.S	75.7
Urea Storage Estimate	Not Applicable	75.7
Fuel Oil Storage	FOSETTLE.C	20.3
Fuel Oil Storage	FOAUX.C	4.9
Technical Water	DBTECH.P/S	738.6
Grey Water	GREY.S	240.3
Black Water	BLACK.P	0.6
Potable	POTABLE.C	151.6
Ballast Water	AFTBAL.P/S	1177.1
Total		3006.8

Downflooding Points

The table below lists the downflooding points used.

Description	Longitudinal Location [ft]	Transverse Location [ft]	Vertical Location [ft]
Passenger Deck Elevator Aft	271.25 aft	16.25 s	43.00

Engineer's Workshop and Storeroom Vents	227.00 aft	19.00 p/s	40.75
EOS Vent	175.67 aft	19.00 p/s	40.75
MSD Vent	104.50 aft	19.00 p/s	40.75

The engineer's stores, EOS, and MSD room vents do not have weather tight covers and are downflooding points. The vehicle stowage space vents have weather tight covers and are not downflooding points. The vehicle doors are watertight.

Deck Edge

The car deck edge is considered the deck edge in the ISC Part A 2.3 severe wind and rolling criterion.

It is probable that the deck edge can be moved to the passenger deck; however this deck edge shift is not needed at this time. This shift would be in accordance with ISC 3.5.2.1. All openings below the passenger deck would be required to be at least weather tight.

Loading Conditions

Five loading condition types are included to cover the range of ship loading conditions. These conditions are also in accordance with ISC 3.4.1.1. The loading conditions included are as follows:

Condition 1A:	Departure with SLM,	7 Max Semi-Trailers, 10 Campers, 31 Cars
Condition 1B:	Departure without SLM,	7 Max Semi-Trailers, 10 Campers, 31 Cars
Condition 2A:	Arrival with SLM,	7 Max Semi-Trailers, 10 Campers 31 Cars
Condition 2B:	Arrival without SLM,	7 Max Semi-Trailers, 10 Campers 31 Cars
Condition 3A:	Departure with SLM,	0 Max Semi-Trailers, 0 Campers, 0 Cars
Condition 3B:	Departure without SLM,	0 Max Semi-Trailers, 0 Campers, 0 Cars
Condition 4A:	Arrival with SLM,	0 Max Semi-Trailers, 0 Campers, 0 Cars
Condition 4B:	Arrival without SLM,	0 Max Semi-Trailers, 0 Campers, 0 Cars
Condition 5B:	Arrival without SLM,	Operational Light Ship

The Loading Condition Summaries are included in Appendix A.

CONCLUSIONS

Stability

The subject vessel design exhibits satisfactory stability characteristics for its proposed service and route. The following operating restrictions shall be observed:

1. The vessel shall operate on inside-water routes only.
2. The vessel shall carry a maximum of 499 persons.

3. The vessel's draft shall nowhere exceed 17 feet 0 inches.
4. The vessel's tanks and vehicles shall be loaded to minimize heel and trim. Heel shall be zeroed. Trim shall be kept to within 1 degree of zero (this is about 5-1/2 feet of trim).
5. The vessel shall carry a maximum vehicle load of 386 LT of vehicles, of which 250 LT may be semi-trailers. This weight is equal to approximately 7 semi-trailers.

The vessel is shown to meet intact stability criteria in the Intact Stability Curves on page 7.

The vehicle stowage space vents are required to have weather tight covers per USCG requirements.

The hold vent cutout downflooding points in the curtain plate limit the attained vessel stability. The lower edge of these cutouts shall be at least 40 feet 9 inches above the baseline (This is 27 inches below the passenger deck).

The ISC initial wind heel is the limiting criterion. This criterion curve could be raised further if weather tight covers were installed on all openings below the passenger deck (including the vents for the engineer's ship and storeroom, the EOS, and the MSD room). This, however, is not required at this design stage.

FUTURE WORK

The following future work remains to be completed:

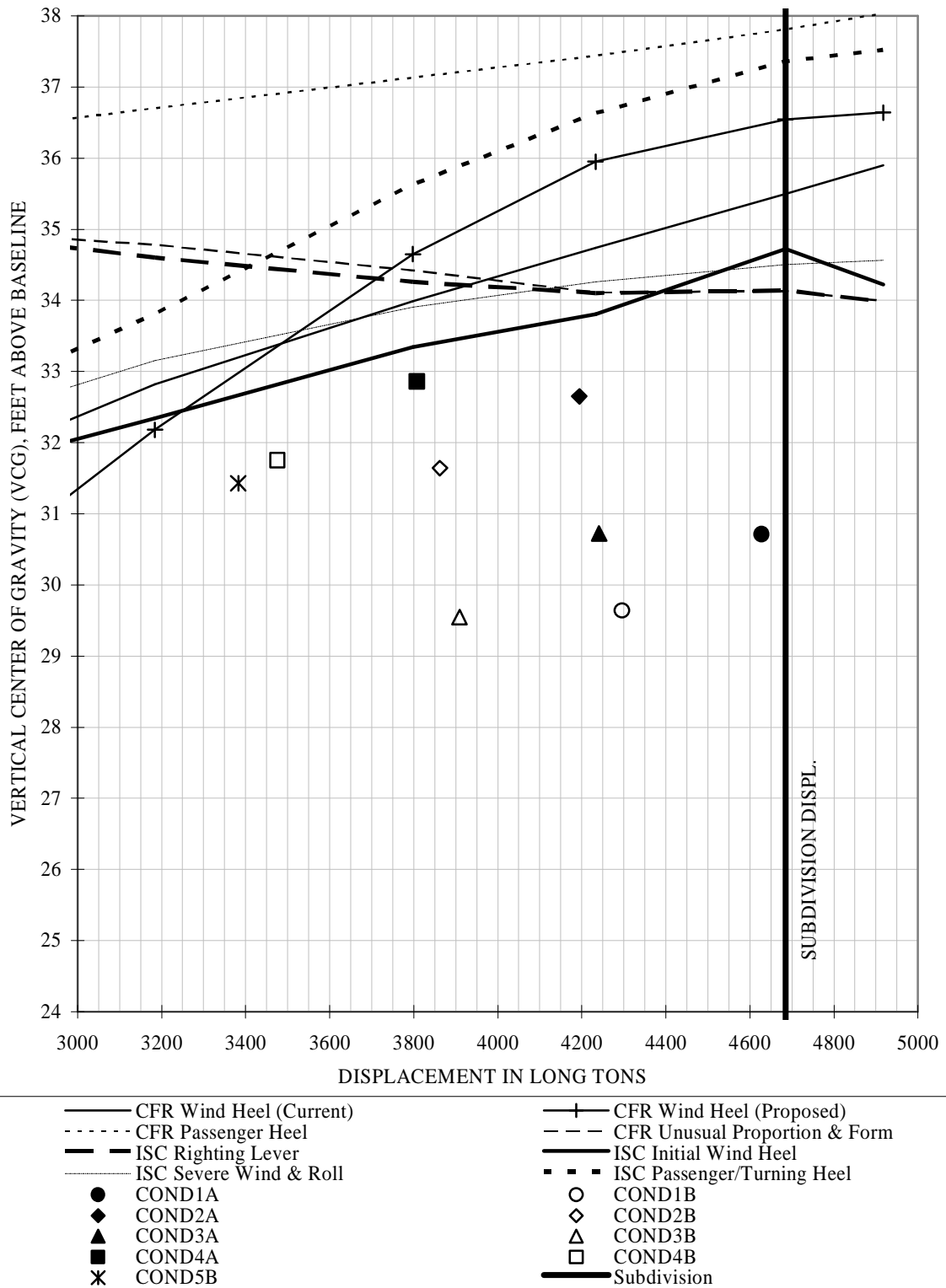
- Research AMHS fleet historical service life weight and VCG growth.

REFERENCES

1. Code of Federal Regulations (CFR) Title 46.
2. International Code on Intact Stability, IMO, 2008.
3. Passenger Weight and Inspected Vessel Stability Requirements; Proposed Rule, Federal Register, USCG, 08/20/08.
4. GHS Computer Hull Model, 06137P13.GFT, EBDG, 11/06/09.
5. GHS Computer Hull Model, 06137P13.GF, EBDG, 10/21/09.
6. Preliminary Profile and Arrangements, 06137-005-101-1, Rev. A, EBDG, as of 11/04/09.
7. Preliminary Weight Estimate, 06137-005-833-1, Rev. -, EBDG, 10/30/09.
8. Marine Vehicle Weight Engineering, Society of Allied Weight Engineers, 2007.
9. Design Study Report, 06137-002-070-1, Rev. -, EBDG, 06/09/09.
10. Guide for Uniform Laws and Regulations Governing Truck Size and Weight Among the WASHTO States, WASHTO, May 2005.

INTACT STABILITY CURVES GRAPH

Note: Trim range from 1.0 degree fwd to 1.0 degree aft.



HYDROSTATIC PROPERTIES

11/05/09 09:02:46
GHS 11.74

Elliott Bay Design Group
ALASKA CLASS FERRY

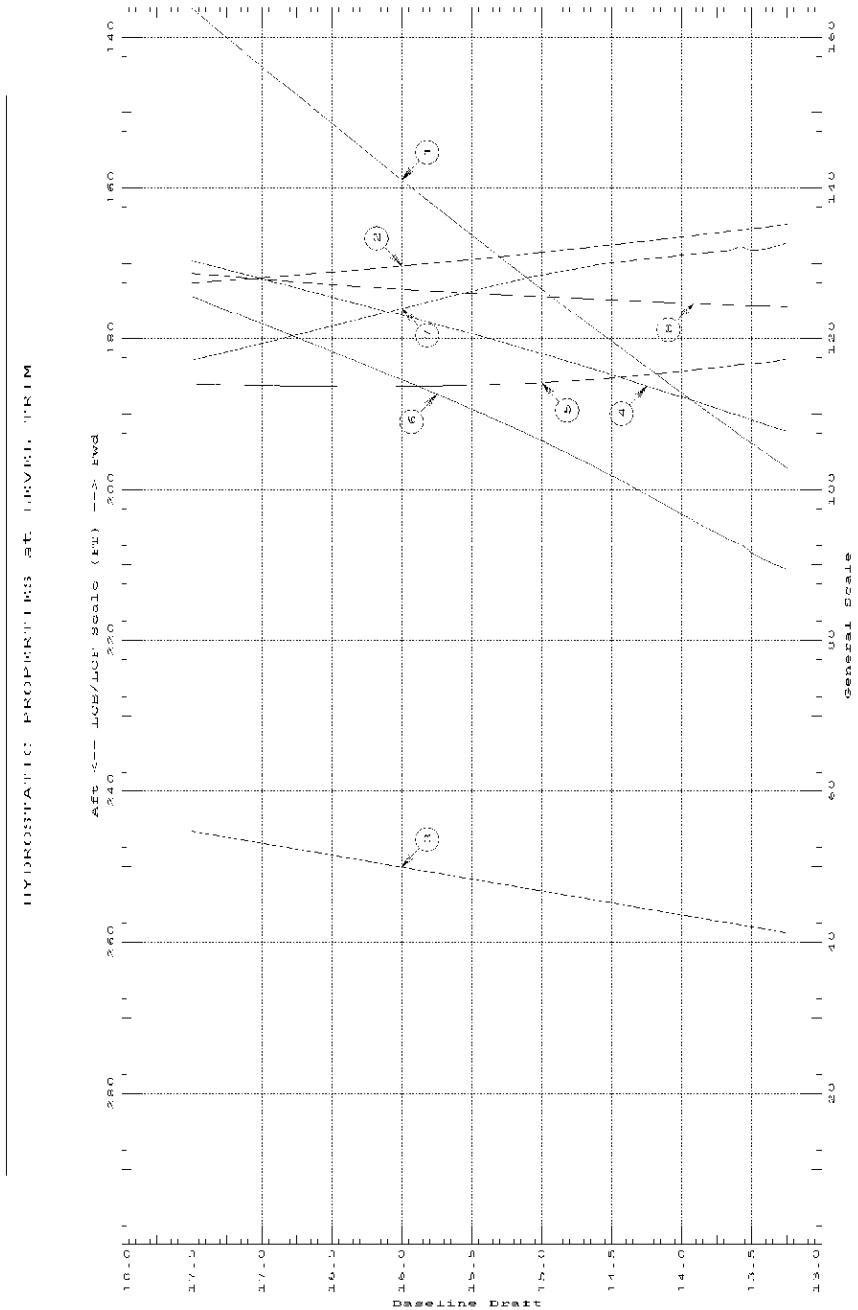
HYDROSTATIC PROPERTIES
No Trim, No Heel, VCG = 0.00

LCF Draft	Displacement Weight (LT)	Buoyancy-Ctr.		Weight/ Inch	Moment/ Deg trim		KML	KMT
		LCB	VCB		LCF			
13.250	3,086.90	164.81a	8.25	32.33	182.72a	35762	663.7	37.29
13.333	3,119.26	165.00a	8.30	32.46	182.97a	36014	661.5	37.31
13.417	3,151.78	165.19a	8.35	32.61	183.19a	36297	659.8	37.32
13.500	3,184.46	165.37a	8.40	32.76	183.37a	36626	658.9	37.34
13.583	3,217.30	165.56a	8.46	32.93	183.42a	37118	661.0	37.36
13.667	3,250.30	165.74a	8.51	33.07	183.67a	37368	658.7	37.37
13.750	3,283.46	165.92a	8.56	33.23	183.84a	37707	657.9	37.39
13.833	3,316.76	166.10a	8.61	33.38	184.01a	38045	657.1	37.41
13.917	3,350.21	166.28a	8.67	33.53	184.17a	38384	656.4	37.43
14.000	3,383.81	166.46a	8.72	33.68	184.33a	38721	655.6	37.44
14.083	3,417.56	166.64a	8.77	33.82	184.49a	39060	654.8	37.46
14.167	3,451.46	166.81a	8.83	33.97	184.64a	39398	654.0	37.48
14.250	3,485.51	166.99a	8.88	34.12	184.79a	39739	653.2	37.50
14.333	3,519.71	167.16a	8.93	34.27	184.94a	40081	652.4	37.52
14.417	3,554.05	167.34a	8.98	34.42	185.09a	40422	651.6	37.54
14.500	3,588.54	167.51a	9.04	34.57	185.22a	40752	650.6	37.56
14.583	3,623.18	167.68a	9.09	34.71	185.35a	41075	649.5	37.58
14.667	3,657.96	167.85a	9.14	34.85	185.46a	41391	648.3	37.60
14.750	3,692.88	168.01a	9.19	34.99	185.56a	41702	646.9	37.62
14.833	3,727.94	168.18a	9.25	35.13	185.66a	42005	645.5	37.64
14.917	3,763.14	168.34a	9.30	35.26	185.75a	42304	644.0	37.66
15.000	3,798.47	168.50a	9.35	35.40	185.83a	42601	642.5	37.68
15.083	3,833.94	168.66a	9.40	35.54	185.91a	42892	640.9	37.71
15.167	3,869.54	168.82a	9.46	35.67	185.97a	43176	639.2	37.73
15.250	3,905.27	168.98a	9.51	35.80	186.03a	43457	637.5	37.75
15.333	3,941.14	169.14a	9.56	35.93	186.08a	43733	635.7	37.78
15.417	3,977.13	169.29a	9.62	36.06	186.13a	44000	633.8	37.80
15.500	4,013.25	169.44a	9.67	36.18	186.17a	44269	632.0	37.83
15.583	4,049.50	169.59a	9.72	36.31	186.21a	44534	630.0	37.85
15.667	4,085.87	169.74a	9.77	36.44	186.24a	44797	628.1	37.88
15.750	4,122.37	169.89a	9.83	36.56	186.26a	45057	626.2	37.91
15.833	4,159.00	170.03a	9.88	36.69	186.28a	45315	624.2	37.93
15.917	4,195.75	170.17a	9.93	36.81	186.30a	45570	622.2	37.96
16.000	4,232.62	170.31a	9.98	36.94	186.31a	45823	620.2	37.99
16.083	4,269.62	170.45a	10.04	37.06	186.32a	46076	618.2	38.02
16.167	4,306.74	170.59a	10.09	37.18	186.33a	46323	616.2	38.05
16.250	4,343.98	170.72a	10.14	37.30	186.33a	46575	614.2	38.08
16.333	4,381.35	170.86a	10.19	37.43	186.33a	46824	612.3	38.11
16.417	4,418.83	170.99a	10.25	37.55	186.32a	47072	610.3	38.14
16.500	4,456.44	171.12a	10.30	37.67	186.31a	47319	608.3	38.17
16.583	4,494.17	171.24a	10.35	37.79	186.30a	47566	606.4	38.21
16.667	4,532.02	171.37a	10.40	37.91	186.29a	47812	604.4	38.24
16.750	4,570.00	171.49a	10.46	38.04	186.28a	48059	602.5	38.28
16.833	4,608.09	171.62a	10.51	38.16	186.26a	48306	600.6	38.31
16.917	4,646.31	171.74a	10.56	38.28	186.23a	48553	598.7	38.35
17.000	4,684.65	171.86a	10.61	38.40	186.21a	48797	596.8	38.38
17.083	4,723.11	171.97a	10.66	38.52	186.18a	49041	594.9	38.42
17.167	4,761.69	172.09a	10.72	38.64	186.15a	49286	593.0	38.46
17.250	4,800.39	172.20a	10.77	38.76	186.12a	49531	591.1	38.50
17.333	4,839.22	172.31a	10.82	38.89	186.09a	49776	589.3	38.54
17.417	4,878.17	172.42a	10.87	39.01	186.05a	50023	587.5	38.58
17.500	4,917.23	172.53a	10.93	39.13	186.01a	50271	585.7	38.62

Distances in FEET.-----Specific Gravity = 1.025.-----Moment in Ft-LT.

11/05/09 09:02:46
GHS 11.74

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ALASKA CLASS FERRY



- ① Displacement 1=30 Lr
- ② LCB (use top scale)
- ③ VCB (KH) 1=2 FT
- ④ Immersion 1=.3 Lr/IN
- ⑤ WPA 1=126 Sq.Ft
- ⑥ LCB (use top scale)
- ⑦ Moment/trim 1=400 FT Lr/Deg
- ⑧ KML 1=5 FT
- ⑨ KMI 1=.3 FT

Specific Gravity = 1.025 Assumed KG = 0.00 FT
"K" Baseline

CROSS CURVES OF STABILITY

11/05/09 09:04:44
GHS 11.74

Elliott Bay Design Group
ALASKA CLASS FERRY

CROSS CURVES OF STABILITY
Showing righting arms in heel at VCG = 0.00
Trim: zero at zero heel (trim righting arm held at zero)

Displacement LONG TONS	Heel Angles in Degrees							
	5.00s	10.00s	15.00s	20.00s	30.00s	40.00s	50.00s	60.00s
3,086.90	3.26s	6.54s	9.92s	13.35s	18.92s	23.50s	27.86s	31.04s
3,119.26	3.26s	6.55s	9.93s	13.35s	18.92s	23.50s	27.86s	31.03s
3,151.78	3.26s	6.55s	9.94s	13.36s	18.92s	23.49s	27.85s	31.01s
3,184.45	3.27s	6.56s	9.96s	13.37s	18.92s	23.49s	27.85s	30.99s
3,217.29	3.27s	6.56s	9.97s	13.37s	18.92s	23.48s	27.85s	30.97s
3,250.30	3.27s	6.56s	9.99s	13.38s	18.91s	23.48s	27.84s	30.95s
3,283.45	3.27s	6.57s	10.00s	13.38s	18.91s	23.48s	27.84s	30.93s
3,316.75	3.27s	6.58s	10.01s	13.38s	18.91s	23.47s	27.83s	30.91s
3,350.20	3.27s	6.58s	10.03s	13.39s	18.91s	23.47s	27.83s	30.89s
3,383.80	3.28s	6.59s	10.04s	13.39s	18.91s	23.46s	27.82s	30.86s
3,417.55	3.28s	6.59s	10.05s	13.39s	18.90s	23.46s	27.82s	30.84s
3,451.45	3.28s	6.60s	10.07s	13.39s	18.90s	23.46s	27.81s	30.82s
3,485.50	3.28s	6.60s	10.08s	13.40s	18.90s	23.45s	27.80s	30.80s
3,519.69	3.28s	6.61s	10.09s	13.40s	18.89s	23.45s	27.80s	30.77s
3,554.03	3.29s	6.61s	10.10s	13.40s	18.89s	23.45s	27.79s	30.75s
3,588.53	3.29s	6.62s	10.12s	13.40s	18.89s	23.44s	27.78s	30.73s
3,623.16	3.29s	6.63s	10.13s	13.40s	18.88s	23.44s	27.77s	30.70s
3,657.94	3.29s	6.63s	10.14s	13.40s	18.88s	23.44s	27.76s	30.68s
3,692.86	3.29s	6.64s	10.15s	13.40s	18.88s	23.43s	27.75s	30.66s
3,727.92	3.30s	6.64s	10.16s	13.40s	18.87s	23.43s	27.74s	30.63s
3,763.11	3.30s	6.65s	10.17s	13.40s	18.87s	23.43s	27.73s	30.61s
3,798.44	3.30s	6.66s	10.18s	13.40s	18.86s	23.43s	27.72s	30.58s
3,833.91	3.30s	6.66s	10.19s	13.39s	18.86s	23.42s	27.71s	30.56s
3,869.51	3.30s	6.67s	10.20s	13.39s	18.86s	23.42s	27.70s	30.54s
3,905.24	3.31s	6.68s	10.21s	13.39s	18.85s	23.42s	27.69s	30.51s
3,941.10	3.31s	6.68s	10.21s	13.39s	18.85s	23.42s	27.68s	30.48s
3,977.10	3.31s	6.69s	10.22s	13.38s	18.84s	23.41s	27.66s	30.46s
4,013.21	3.31s	6.70s	10.22s	13.38s	18.84s	23.41s	27.65s	30.43s
4,049.46	3.32s	6.71s	10.23s	13.38s	18.83s	23.41s	27.64s	30.41s
4,085.83	3.32s	6.71s	10.23s	13.38s	18.82s	23.41s	27.63s	30.38s
4,122.33	3.32s	6.72s	10.24s	13.37s	18.82s	23.40s	27.61s	30.36s
4,158.96	3.32s	6.73s	10.24s	13.37s	18.81s	23.40s	27.60s	30.33s
4,195.71	3.33s	6.74s	10.25s	13.36s	18.81s	23.40s	27.59s	30.30s
4,232.58	3.33s	6.75s	10.25s	13.36s	18.80s	23.40s	27.58s	30.28s
4,269.57	3.33s	6.76s	10.25s	13.36s	18.80s	23.40s	27.57s	30.25s
4,306.69	3.34s	6.77s	10.25s	13.35s	18.79s	23.39s	27.55s	30.22s
4,343.93	3.34s	6.78s	10.25s	13.35s	18.78s	23.39s	27.54s	30.20s
4,381.30	3.34s	6.79s	10.26s	13.34s	18.78s	23.39s	27.53s	30.17s
4,418.78	3.34s	6.80s	10.26s	13.34s	18.77s	23.39s	27.52s	30.14s
4,456.39	3.35s	6.81s	10.26s	13.33s	18.77s	23.39s	27.50s	30.11s
4,494.12	3.35s	6.82s	10.26s	13.33s	18.76s	23.38s	27.49s	30.09s
4,531.97	3.35s	6.83s	10.26s	13.32s	18.75s	23.38s	27.48s	30.06s
4,569.94	3.36s	6.84s	10.26s	13.32s	18.75s	23.38s	27.46s	30.03s
4,608.04	3.36s	6.85s	10.26s	13.31s	18.74s	23.38s	27.45s	30.00s
4,646.26	3.36s	6.86s	10.26s	13.31s	18.73s	23.38s	27.44s	29.97s
4,684.60	3.37s	6.87s	10.25s	13.30s	18.73s	23.37s	27.42s	29.94s
4,723.05	3.37s	6.88s	10.25s	13.30s	18.72s	23.37s	27.41s	29.91s
4,761.64	3.38s	6.89s	10.25s	13.29s	18.71s	23.37s	27.39s	29.88s
4,800.34	3.38s	6.90s	10.25s	13.28s	18.71s	23.37s	27.38s	29.85s
4,839.16	3.38s	6.90s	10.25s	13.28s	18.70s	23.37s	27.37s	29.82s
4,878.11	3.39s	6.91s	10.24s	13.27s	18.69s	23.37s	27.35s	29.79s

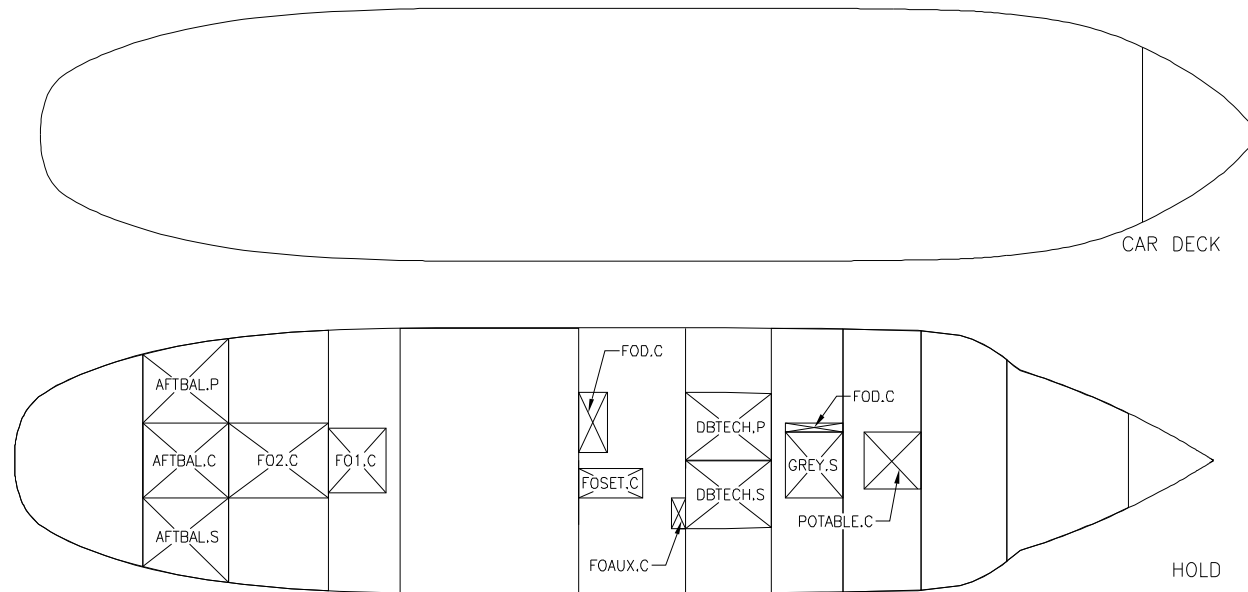
FRAME TABLE

<u>Frame Number</u>	<u>Feet from Frame 0</u>	<u>Frame Number</u>	<u>Feet from Frame 0</u>	<u>Frame Number</u>	<u>Feet from Frame 0</u>	<u>Frame Number</u>	<u>Feet from Frame 0</u>
E	-10	38	76	81	162	124	248
D	-8	39	78	82	164	125	250
C	-6	40	80	83	166	126	252
B	-4	41	82	84	168	127	254
A	-2	42	84	85	170	128	256
0	0	43	86	86	172	129	258
1	2	44	88	87	174	130	260
2	4	45	90	88	176	131	262
3	6	46	92	89	178	132	264
4	8	47	94	90	180	133	266
5	10	48	96	91	182	134	268
6	12	49	98	92	184	135	270
7	14	50	100	93	186	136	272
8	16	51	102	94	188	137	274
9	18	52	104	95	190	138	276
10	20	53	106	96	192	139	278
11	22	54	108	97	194	140	280
12	24	55	110	98	196	141	282
13	26	56	112	99	198	142	284
14	28	57	114	100	200	143	286
15	30	58	116	101	202	144	288
16	32	59	118	102	204	145	290
17	34	60	120	103	206	146	292
18	36	61	122	104	208	147	294
19	38	62	124	105	210	148	296
20	40	63	126	106	212	149	298
21	42	64	128	107	214	150	300
22	44	65	130	108	216	151	302
23	46	66	132	109	218	152	304
24	48	67	134	110	220	153	306
25	50	68	136	111	222	154	308
26	52	69	138	112	224	155	310
27	54	70	140	113	226	156	312
28	56	71	142	114	228	157	314
29	58	72	144	115	230	158	316
30	60	73	146	116	232	159	318
31	62	74	148	117	234	160	320
32	64	75	150	118	236	161	322
33	66	76	152	119	238	162	324
34	68	77	154	120	240	163	326
35	70	78	156	121	242	164	328
36	72	79	158	122	244	165	330
37	74	80	160	123	246		

Note:

1. Frame spacing is 24 inches.
2. GHS origin is at frame 0.

TANK SKETCH AND LISTS



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GHS 11.74

Elliott Bay Design Group
ALASKA CLASS FERRY

-----TANK LIST-----
-----Capacities at 100%-----

TANK STATUS
Trim: zero, Heel: zero

Part	Gals.	SpGr	Weight (LT)	LCG	TCG	VCG	FSM
AFTBAL.C	56133	1.025	214.36	283.61a	0.00	16.41	521.2*
AFTBAL.P	40084	1.025	153.07	283.19a	19.43p	18.17	582.5*
AFTBAL.S	40084	1.025	153.07	283.19a	19.43s	18.17	582.5*
FO2.C	47883	0.870	155.20	257.37a	0.00	14.43	516.1*
FO1.C	18810	0.870	60.97	235.78a	0.00	11.05	185.7*
FOD.P	7405.2	0.870	24.00	170.00a	10.62p	8.75	74.8*
FOSET.S	8206.5	0.870	26.60	165.00a	6.37s	8.75	20.1*
FOAUX.S	1252.6	0.870	4.06	146.00a	14.75s	7.50	4.9*
DBTECH.P	11482	1.000	42.78	132.19a	7.65p	3.09	369.3*
DBTECH.S	11482	1.000	42.78	132.19a	7.65s	3.09	369.3*
GREY.S	22899	1.025	87.45	108.00a	1.25s	10.25	237.5*
BLACK.P	3095.4	1.025	11.82	108.00a	9.25p	10.25	0.6*
POTABLE.C	28294	1.000	105.41	86.00a	0.00	12.50	149.9*
Total Tanks	----->		1,081.57	223.72a	0.02p	13.93	3614.5

Distances in FEET.-----+-----Moments in Ft-LT.

* Note: FSM values marked with the asterisk are formal values which are not the same as the true values in the present condition.

-----TANK LIST-----
 -----Capacities at 100%-----

TANK STATUS

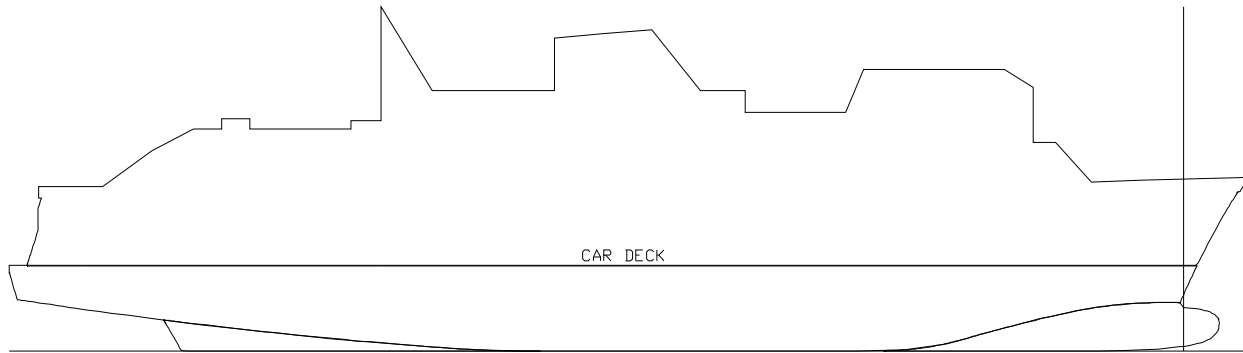
Trim: zero, Heel: Stbd 5.00 deg.

Part	Gals.	SpGr	Weight (LT)	LCG	TCG	VCG	FSM	
AFTBAL.C	56133	1.025	214.36	283.61a	0.00	16.41	527.2*	
AFTBAL.P	40084	1.025	153.07	283.19a	19.43p	18.17	587.9*	
AFTBAL.S	40084	1.025	153.07	283.19a	19.43s	18.17	589.2*	
FO2.C	47883	0.870	155.20	257.37a	0.00	14.43	522.0*	
FO1.C	18810	0.870	60.97	235.78a	0.00	11.05	187.8*	
FOD.P	7405.2	0.870	24.00	170.00a	10.62p	8.75	75.7*	
FOSET.S	8206.5	0.870	26.60	165.00a	6.37s	8.75	20.3*	
FOAUX.S	1252.6	0.870	4.06	146.00a	14.75s	7.50	4.9*	
DBTECH.P	11482	1.000	42.78	132.19a	7.65p	3.09	293.2*	
DBTECH.S	11482	1.000	42.78	132.19a	7.65s	3.09	374.0*	
GREY.S	22899	1.025	87.45	108.00a	1.25s	10.25	240.3*	
BLACK.P	3095.4	1.025	11.82	108.00a	9.25p	10.25	0.6*	
POTABLE.C	28294	1.000	105.41	86.00a	0.00	12.50	151.6*	
Total Tanks			1,081.57	223.72a	0.02p	13.93	3575.7	
Distances in FEET.								Moments in Ft-LT.

+
 * Note: FSM values marked with the asterisk are formal values which are not the same as the true values in the present condition.

+

WIND PROFILE AND AREAS



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GHS 11.74

Elliott Bay Design Group
ALASKA CLASS FERRY

Page 1

----- WIND PROFILE AREAS AND CENTERS -----

Baseline draft: 12.000
Trim: zero, Heel: zero

Part-----	LPA-----	LCP-----	HCP-----	LPA-----	LCP-----	HCP-----
HULL	3561.2	142.03a	-5.89	10370.5	159.47a	15.66
PROFILE				8236.0	154.24a	46.95
Total Lateral Plane->	3561.2	142.03a	-5.89	18606.4	157.16a	29.51

Baseline draft: 13.500
Trim: zero, Heel: zero

Part-----	LPA-----	LCP-----	HCP-----	LPA-----	LCP-----	HCP-----
HULL	4038.3	144.07a	-6.60	9893.4	159.48a	14.88
PROFILE				8236.0	154.24a	45.45
Total Lateral Plane->	4038.3	144.07a	-6.60	18129.4	157.10a	28.77

Baseline draft: 15.000
Trim: zero, Heel: zero

Part-----	LPA-----	LCP-----	HCP-----	LPA-----	LCP-----	HCP-----
HULL	4529.5	146.24a	-7.31	9402.2	159.24a	14.12
PROFILE				8236.0	154.24a	43.95
Total Lateral Plane->	4529.5	146.24a	-7.31	17638.1	156.90a	28.05

Baseline draft: 16.000
Trim: zero, Heel: zero

Part-----	LPA-----	LCP-----	HCP-----	LPA-----	LCP-----	HCP-----
HULL	4859.5	147.53a	-7.78	9072.2	159.03a	13.61
PROFILE				8236.0	154.24a	42.95
Total Lateral Plane->	4859.5	147.53a	-7.78	17308.2	156.75a	27.57

Baseline draft: 17.000
Trim: zero, Heel: zero

Part-----	LPA-----	LCP-----	HCP-----	LPA-----	LCP-----	HCP-----
HULL	5190.2	148.65a	-8.25	8741.5	158.80a	13.11
PROFILE				8236.0	154.24a	41.95
Total Lateral Plane->	5190.2	148.65a	-8.25	16977.5	156.58a	27.10

Baseline draft: 17.500
Trim: zero, Heel: zero

Part-----	LPA-----	LCP-----	HCP-----	LPA-----	LCP-----	HCP-----
HULL	5355.7	149.15a	-8.49	8576.0	158.68a	12.85
PROFILE				8236.0	154.24a	41.45
Total Lateral Plane->	5355.7	149.15a	-8.49	16812.0	156.50a	26.86

Appendix A

GHS Loading Conditions

Icing Calculation

GHS Max VCG Data

Excel Max VCG Data

LOADING CONDITION SUMMARIES

12/15/09 13:30:24
GHS 11.74

Elliott Bay Design Group
ALASKA CLASS FERRY

***** COND1A - Departure with SLM, 7 Max Semi-Trailers, 10 Campers, 31 Cars **

WEIGHT STATUS

Baseline draft: 16.877
Trim: zero, Heel: zero

Part-----	Weight (LT)---	LCG----	TCG----	VCG----	FSM-----		
LIGHT SHIP	3,269.00	163.70a	0.49s	30.55			
SERVICE LIFE MARGIN	331.80	163.70a	0.49s	44.44			
ICE	54.99	154.04a	0.00	53.84			
7 MAXIMUM SEMI-TRAILERS	250.00	228.19a	2.64p	32.00			
10 SHORT CAMPERS	53.57	169.75a	1.20p	29.50			
31 CARS AND LIGHT TRUCKS	83.03	169.75a	1.20p	27.00			
499 PASSENGERS AND EFFECT	72.40	165.67a	0.00	46.00			
33 CREW AND EFFECTS	4.79	160.00a	0.00	55.00			
SHIP STORES	25.00	234.50a	0.00	17.50			
GALLEY STORES	10.00	292.00a	21.33s	35.00			
OUTFIT	15.00	292.00a	0.00	35.00			
Total Fixed----->	4,169.58	168.86a	0.28s	32.21			
	Load-----	SpGr-----	Weight (LT)---	LCG----	TCG----	VCG----	FSM-----
FO2.C	0.950	0.870	147.44	257.34a	0.00	14.15	0.0*
FO1.C	0.950	0.870	57.92	235.77a	0.00	10.82	0.0*
FOD.P	0.950	0.870	22.80	170.00a	10.62p	8.56	0.0*
FOSET.S	0.950	0.870	25.27	165.00a	6.37s	8.56	0.0*
FOAUX.S	0.950	0.870	3.86	146.00a	14.75s	7.37	0.0*
DBTECH.P	1.000	1.000	42.78	132.19a	7.65p	3.09	0.0
DBTECH.S	1.000	1.000	42.78	132.19a	7.65s	3.09	0.0
GREY.S	0.100	1.025	8.74	108.00a	1.25s	5.53	0.0*
BLACK.P	0.100	1.025	1.18	108.00a	9.25p	5.53	0.0*
POTABLE.C	1.000	1.000	105.41	86.00a	0.00	12.50	0.0
Total Tanks----->			458.19	178.21a	0.05p	10.45	3006.8*
Total Weight----->			4,627.77	169.79a	0.24s	30.06	
Free Surface Adjustment----->						0.65	
Adjusted CG----->				169.79a	0.24s	30.71	
Distances in FEET.-----				Moments in Ft-LT.			

* Note: FSM values marked with the asterisk are formal values which are not the same as the true values in the present condition.

FREEBOARD STATUS

Baseline draft: 16.877
Trim: zero, Heel: zero

Least freeboard is 7.16 Ft located at 50.30a

Least extra freeboard (to margin line) is 6.41 Ft located at 159.95a

CRITICAL POINT STATUS

Baseline draft: 16.877
Trim: zero, Heel: zero

Critical Points-----	LCP----	TCP----	VCP----	Height
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25s	43.00	26.12
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25p	43.00	26.12
(2) Engineer's Workshop and S FLOOD	227.00a	19.00s	40.75	23.87
(2) Engineer's Workshop and S FLOOD	227.00a	19.00p	40.75	23.87
(3) EOS Vent	FLOOD	175.67a	19.00s	40.75
(3) EOS Vent	FLOOD	175.67a	19.00p	40.75
(4) MSD Vent	FLOOD	104.50a	19.00s	40.75
(4) MSD Vent	FLOOD	104.50a	19.00p	40.75
(5) Aft Ramp	TIGHT	332.00a	0.00	24.00
(6) Port Ramp	TIGHT	80.00a	28.83p	24.00

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Elliott Bay Design Group
ALASKA CLASS FERRY

Critical Points, continued-----LCP-----TCP-----VCP-----Height
(7) STBD Ramp TIGHT 80.00a 28.83s 24.00 7.12
Distances in FEET.-----

HYDROSTATIC PROPERTIES
No Trim, No Heel, VCG = 30.06

LCF Displacement Buoyancy-Ctr. Weight/ Moment/
Draft---Weight(LT)---LCB---VCB---Inch---LCF---Deg trim---GML---GMT
16.877 4,627.92 171.68a 10.53 38.22 186.25a 45982 569.2 7.62
Distances in FEET.-----Specific Gravity = 1.025.-----Moment in Ft-LT.
Draft is from Baseline. Formal Free Surface included.

Note: GMT includes the formal free surface moment 3006.8 Ft-LT

RESIDUAL RIGHTING ARMS vs HEEL ANGLE
Total CG: LCG = 169.79a TCG = 0.24s VCG = 30.06
Free Surface Adjustment: 0.65
Adjusted CG: LCG = 169.79a TCG = 0.24s VCG = 30.71

Origin Depth	Degrees of Trim	Degrees of Heel	Displacement Weight(LT)	Residual Arms in Trim	Residual Arms in Heel	Flood Pt Area	Flood Pt Height
16.877	0.00	0.00	4,627.92	1.89a	-0.244	0.00	23.87(2)
16.856	0.00	1.82s	4,628.39	1.90a	0.000	-0.22	6.22(7)
16.710	0.00	5.00s	4,626.78	1.93a	0.443	0.48	22.23(2)
16.196	0.00	10.00s	4,627.64	1.89a	1.281	4.73	20.64(2)
15.395	0.00	15.00s	4,627.87	1.63a	2.074	13.13	19.05(2)
15.251	0.00	15.80s	4,627.79	1.63a	2.167	14.83	-0.01(7)
14.401	0.00	20.00s	4,626.22	1.74a	2.578	24.86	17.39(2)
13.191	0.00	25.00s	4,627.81	2.01a	2.935	38.73	15.71(2)
11.751	0.00	30.00s	4,627.85	2.43a	3.177	54.05	14.04(2)
10.081	0.00	35.00s	4,626.32	2.99a	3.340	70.38	12.40(2)
8.202	0.00	40.00s	4,627.20	3.79a	3.483	87.44	10.80(2)
6.112	0.00	45.00s	4,629.44	4.68a	3.709	105.39	9.27(2)
3.907	0.00	50.00s	4,628.04	5.61a	3.825	124.27	7.73(2)
3.352	0.00	51.25s	4,627.74	5.84a	3.817	129.04	7.34(2)
1.691	0.00	55.00s	4,627.83	6.49a	3.713	143.20	6.12(2)
-0.538	0.00	60.00s	4,628.45	7.16a	3.367	161.00	4.46(2)

Distances in FEET.-----Specific Gravity = 1.025.-----Area in Ft-Deg.
+

Note: The Weight and Center of Gravity used for the righting arms above include tank loads. However, the tank load centers were NOT ALLOWED TO SHIFT with heel and trim changes. Rather, a constant Free Surface Moment of 3006.8 Ft-LT was applied to artificially modify the CG.
+

Note: The Residual Righting Arms shown above are in excess of the overturning arms derived from these moments (in Ft-LT):
Stbd heeling moment = 0.00
+

Critical Points-----LCP-----TCP-----VCP
(2) Engineer's Workshop and S FLOOD 227.00a 19.00 40.75
(7) STBD Ramp TIGHT 80.00a 28.83s 24.00

Note: Weight item "SERVICE LIFE MARGIN" replaced.

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Elliott Bay Design Group
ALASKA CLASS FERRY

***** COND1B - Departure without SLM, 7 Max Semi-Trailers, 10 Campers, 31 Cars
WEIGHT STATUS

Baseline draft: 16.143
Trim: zero, Heel: zero

Part	Weight (LT)	LCG	TCG	VCG	FSM		
LIGHT SHIP	3,269.00	163.70a	0.49s	30.55			
ICE	54.99	154.04a	0.00	53.84			
7 MAXIMUM SEMI-TRAILERS	250.00	228.19a	2.64p	32.00			
10 SHORT CAMPERS	53.57	169.75a	1.20p	29.50			
31 CARS AND LIGHT TRUCKS	83.03	169.75a	1.20p	27.00			
499 PASSENGERS AND EFFECT	72.40	165.67a	0.00	46.00			
33 CREW AND EFFECTS	4.79	160.00a	0.00	55.00			
SHIP STORES	25.00	234.50a	0.00	17.50			
GALLEY STORES	10.00	292.00a	21.33s	35.00			
OUTFIT	15.00	292.00a	0.00	35.00			
Total Fixed	3,837.78	169.31a	0.26s	31.15			
Load	SpGr	Weight (LT)	LCG	TCG	VCG	FSM	
FO2.C	0.950	0.870	147.44	257.34a	0.00	14.15	0.0*
FO1.C	0.950	0.870	57.92	235.77a	0.00	10.82	0.0*
FOD.P	0.950	0.870	22.80	170.00a	10.62p	8.56	0.0*
FOSET.S	0.950	0.870	25.27	165.00a	6.37s	8.56	0.0*
FOAUX.S	0.950	0.870	3.86	146.00a	14.75s	7.37	0.0*
DBTECH.P	1.000	1.000	42.78	132.19a	7.65p	3.09	0.0
DBTECH.S	1.000	1.000	42.78	132.19a	7.65s	3.09	0.0
GREY.S	0.100	1.025	8.74	108.00a	1.25s	5.53	0.0*
BLACK.P	0.100	1.025	1.18	108.00a	9.25p	5.53	0.0*
POTABLE.C	1.000	1.000	105.41	86.00a	0.00	12.50	0.0
Total Tanks			458.19	178.21a	0.05p	10.45	3006.8*
Total Weight			4,295.97	170.26a	0.23s	28.95	
Free Surface Adjustment						0.70	
Adjusted CG				170.26a	0.23s	29.64	

Distances in FEET.-----Moments in Ft-LT.

* Note: FSM values marked with the asterisk are formal values which are not the same as the true values in the present condition.

FREEBOARD STATUS

Baseline draft: 16.143
Trim: zero, Heel: zero

Least freeboard is 7.90 Ft located at 50.30a

Least extra freeboard (to margin line) is 7.15 Ft located at 159.95a

CRITICAL POINT STATUS

Baseline draft: 16.143
Trim: zero, Heel: zero

Critical Points	LCP	TCP	VCP	Height
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25s	43.00	26.86
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25p	43.00	26.86
(2) Engineer's Workshop and S FLOOD	227.00a	19.00s	40.75	24.61
(2) Engineer's Workshop and S FLOOD	227.00a	19.00p	40.75	24.61
(3) EOS Vent	FLOOD 175.67a	19.00s	40.75	24.61
(3) EOS Vent	FLOOD 175.67a	19.00p	40.75	24.61
(4) MSD Vent	FLOOD 104.50a	19.00s	40.75	24.61
(4) MSD Vent	FLOOD 104.50a	19.00p	40.75	24.61
(5) Aft Ramp	TIGHT 332.00a	0.00	24.00	7.86
(6) Port Ramp	TIGHT 80.00a	28.83p	24.00	7.86
(7) STBD Ramp	TIGHT 80.00a	28.83s	24.00	7.86

Distances in FEET.-----

HYDROSTATIC PROPERTIES

No Trim, No Heel, VCG = 28.95

LCF	Displacement	Buoyancy-Ctr.	Weight/	Moment/				
Draft	Weight (LT)	LCB	VCB	Inch	LCF	Deg trim	GML	GMT
16.143	4,296.03	170.55a	10.07	37.15	186.32a	44056	587.5	8.39

Distances in FEET.-----Specific Gravity = 1.025.-----Moment in Ft-LT.
Draft is from Baseline. Formal Free Surface included.

Note: GMT includes the formal free surface moment 3006.8 Ft-LT

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GHS 11.74

Elliott Bay Design Group
ALASKA CLASS FERRY

***** COND2A - Arrival with SLM, 7 Max Semi-Trailers, 10 Campers 31 Cars *****

WEIGHT STATUS

Baseline draft: 15.914
Trim: zero, Heel: zero

Part	Weight (LT)	LCG	TCG	VCG	FSM		
LIGHT SHIP	3,269.00	163.70a	0.49s	30.55			
SERVICE LIFE MARGIN	331.80	163.70a	0.49s	44.44			
ICE	54.99	154.04a	0.00	53.84			
7 MAXIMUM SEMI-TRAILERS	250.00	172.50a	2.64p	32.00			
10 SHORT CAMPERS	53.57	172.50a	4.33p	29.50			
31 CARS AND LIGHT TRUCKS	83.03	172.50a	4.33p	27.00			
499 PASSENGERS AND EFFECT	72.40	165.67a	0.00	46.00			
33 CREW AND EFFECTS	4.79	160.00a	0.00	55.00			
SHIP STORES	2.50	234.50a	0.00	17.50			
GALLEY STORES	1.00	292.00a	21.33s	35.00			
OUTFIT	15.00	292.00a	0.00	35.00			
Total Fixed	4,138.08	164.96a	0.13s	32.28			
Load	SpGr	Weight (LT)	LCG	TCG	VCG	FSM	
FO2.C	0.100	0.870	15.52	252.72a	0.00	9.03	0.0*
FO1.C	0.100	0.870	6.10	233.98a	0.00	6.84	0.0*
FOD.P	0.100	0.870	2.40	170.00a	10.62p	5.37	0.0*
FOSET.S	0.100	0.870	2.66	165.00a	6.37s	5.37	0.0*
FOAUX.S	0.100	0.870	0.41	146.00a	14.75s	5.25	0.0*
DBTECH.P	0.100	1.000	4.28	132.13a	2.94p	0.79	0.0*
DBTECH.S	0.100	1.000	4.28	132.13a	2.94s	0.79	0.0*
GREY.S	0.100	1.025	8.74	108.00a	1.25s	5.53	0.0*
BLACK.P	0.100	1.025	1.18	108.00a	9.25p	5.53	0.0*
POTABLE.C	0.100	1.000	10.54	86.00a	0.00	5.75	0.0*
Total Tanks			56.12	166.90a	0.05p	5.94	3006.8*
Total Weight			4,194.20	164.99a	0.13s	31.93	
Free Surface Adjustment						0.72	
Adjusted CG				164.99a	0.13s	32.65	

* Note: FSM values marked with the asterisk are formal values which are not the same as the true values in the present condition.

FREEBOARD STATUS

Baseline draft: 15.914
Trim: zero, Heel: zero

Least freeboard is 8.13 Ft located at 50.30a

Least extra freeboard (to margin line) is 7.38 Ft located at 159.95a

CRITICAL POINT STATUS

Baseline draft: 15.914
Trim: zero, Heel: zero

Critical Points	LCP	TCP	VCP	Height
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25s	43.00	27.09
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25p	43.00	27.09
(2) Engineer's Workshop and S FLOOD	227.00a	19.00s	40.75	24.84
(2) Engineer's Workshop and S FLOOD	227.00a	19.00p	40.75	24.84
(3) EOS Vent FLOOD	175.67a	19.00s	40.75	24.84
(3) EOS Vent FLOOD	175.67a	19.00p	40.75	24.84
(4) MSD Vent FLOOD	104.50a	19.00s	40.75	24.84
(4) MSD Vent FLOOD	104.50a	19.00p	40.75	24.84
(5) Aft Ramp TIGHT	332.00a	0.00	24.00	8.09
(6) Port Ramp TIGHT	80.00a	28.83p	24.00	8.09

Critical Points, continued	LCP	TCP	VCP	Height
(7) STBD Ramp TIGHT	80.00a	28.83s	24.00	8.09

HYDROSTATIC PROPERTIES

No Trim, No Heel, VCG = 31.93

LCF	Displacement	Buoyancy-Ctr.	Weight/	Moment/				
Draft	Weight (LT)	LCB	VCB	Inch	LCF	Deg trim	GML	GMT
15.914	4,194.66	170.17a	9.93	36.81	186.30a	43195	589.9	5.31

Distances in FEET.-----Specific Gravity = 1.025.-----Moment in Ft-LT.
Draft is from Baseline. Formal Free Surface included.

Note: GMT includes the formal free surface moment 3006.8 Ft-LT

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GHS 11.74

Elliott Bay Design Group
ALASKA CLASS FERRY

***** COND2B - Arrival without SLM, 7 Max Semi-Trailers, 10 Campers 31 Cars **

WEIGHT STATUS

Baseline draft: 15.150
Trim: zero, Heel: zero

Part	Weight (LT)	LCG	TCG	VCG	FSM		
LIGHT SHIP	3,269.00	163.70a	0.49s	30.55			
ICE	54.99	154.04a	0.00	53.84			
7 MAXIMUM SEMI-TRAILERS	250.00	172.50a	2.64p	32.00			
10 SHORT CAMPERS	53.57	172.50a	4.33p	29.50			
31 CARS AND LIGHT TRUCKS	83.03	172.50a	4.33p	27.00			
499 PASSENGERS AND EFFECT	72.40	165.67a	0.00	46.00			
33 CREW AND EFFECTS	4.79	160.00a	0.00	55.00			
SHIP STORES	2.50	234.50a	0.00	17.50			
GALLEY STORES	1.00	292.00a	21.33s	35.00			
OUTFIT	15.00	292.00a	0.00	35.00			
Total Fixed	3,806.28	165.07a	0.10s	31.22			
Load	SpGr	Weight (LT)	LCG	TCG	VCG	FSM	
FO2.C	0.100	0.870	15.52	252.72a	0.00	9.03	0.0*
FO1.C	0.100	0.870	6.10	233.98a	0.00	6.84	0.0*
FOD.P	0.100	0.870	2.40	170.00a	10.62p	5.37	0.0*
FOSET.S	0.100	0.870	2.66	165.00a	6.37s	5.37	0.0*
FOAUX.S	0.100	0.870	0.41	146.00a	14.75s	5.25	0.0*
DBTECH.P	0.100	1.000	4.28	132.13a	2.94p	0.79	0.0*
DBTECH.S	0.100	1.000	4.28	132.13a	2.94s	0.79	0.0*
GREY.S	0.100	1.025	8.74	108.00a	1.25s	5.53	0.0*
BLACK.P	0.100	1.025	1.18	108.00a	9.25p	5.53	0.0*
POTABLE.C	0.100	1.000	10.54	86.00a	0.00	5.75	0.0*
Total Tanks			56.12	166.90a	0.05p	5.94	3006.8*
Total Weight			3,862.40	165.10a	0.10s	30.86	
Free Surface Adjustment						0.78	
Adjusted CG				165.10a	0.10s	31.64	

Distances in FEET.-----Moments in Ft-LT.

* Note: FSM values marked with the asterisk are formal values which are not the same as the true values in the present condition.

FREEBOARD STATUS

Baseline draft: 15.150
Trim: zero, Heel: zero

Least freeboard is 8.89 Ft located at 50.30a

Least extra freeboard (to margin line) is 8.14 Ft located at 159.95a

CRITICAL POINT STATUS

Baseline draft: 15.150
Trim: zero, Heel: zero

Critical Points	LCP	TCP	VCP	Height
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25s	43.00	27.85
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25p	43.00	27.85
(2) Engineer's Workshop and S FLOOD	227.00a	19.00s	40.75	25.60
(2) Engineer's Workshop and S FLOOD	227.00a	19.00p	40.75	25.60
(3) EOS Vent	FLOOD 175.67a	19.00s	40.75	25.60
(3) EOS Vent	FLOOD 175.67a	19.00p	40.75	25.60
(4) MSD Vent	FLOOD 104.50a	19.00s	40.75	25.60
(4) MSD Vent	FLOOD 104.50a	19.00p	40.75	25.60
(5) Aft Ramp	TIGHT 332.00a	0.00	24.00	8.85
(6) Port Ramp	TIGHT 80.00a	28.83p	24.00	8.85
(7) STBD Ramp	TIGHT 80.00a	28.83s	24.00	8.85

Distances in FEET.-----

HYDROSTATIC PROPERTIES

No Trim, No Heel, VCG = 30.86

LCF	Displacement	Buoyancy-Ctr.	Weight/	Moment/				
Draft	Weight (LT)	LCB	VCB	Inch	LCF	Deg trim	GML	GMT
15.150	3,862.48	168.79a	9.45	35.64	185.96a	41010	608.3	6.09
Distances in FEET.-----Specific Gravity = 1.025.-----Moment in Ft-LT.								
Draft is from Baseline.				Formal Free Surface included.				

Note: GMT includes the formal free surface moment 3006.8 Ft-LT

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GHS 11.74

Elliott Bay Design Group
ALASKA CLASS FERRY

***** COND3A - Departure with SLM, 0 Max Semi-Trailers, 0 Campers, 0 Cars *****

WEIGHT STATUS

Baseline draft: 16.019
Trim: zero, Heel: zero

Part	Weight (LT)	LCG	TCG	VCG	FSM		
LIGHT SHIP	3,269.00	163.70a	0.49s	30.55			
SERVICE LIFE MARGIN	331.80	163.70a	0.49s	44.44			
ICE	54.99	154.04a	0.00	53.84			
499 PASSENGERS AND EFFECT	72.40	165.67a	0.00	46.00			
33 CREW AND EFFECTS	4.79	160.00a	0.00	55.00			
SHIP STORES	25.00	234.50a	0.00	17.50			
GALLEY STORES	10.00	292.00a	21.33s	35.00			
OUTFIT	15.00	292.00a	0.00	35.00			
Total Fixed	3,782.98	164.91a	0.52s	32.38			
Load	SpGr	Weight (LT)	LCG	TCG	VCG	FSM	
FO2.C	0.950	0.870	147.44	257.34a	0.00	14.15	0.0*
FO1.C	0.950	0.870	57.92	235.77a	0.00	10.82	0.0*
FOD.P	0.950	0.870	22.80	170.00a	10.62p	8.56	0.0*
FOSET.S	0.950	0.870	25.27	165.00a	6.37s	8.56	0.0*
FOAUX.S	0.950	0.870	3.86	146.00a	14.75s	7.37	0.0*
DBTECH.P	1.000	1.000	42.78	132.19a	7.65p	3.09	0.0
DBTECH.S	1.000	1.000	42.78	132.19a	7.65s	3.09	0.0
GREY.S	0.100	1.025	8.74	108.00a	1.25s	5.53	0.0*
BLACK.P	0.100	1.025	1.18	108.00a	9.25p	5.53	0.0*
POTABLE.C	1.000	1.000	105.41	86.00a	0.00	12.50	0.0
Total Tanks			458.19	178.21a	0.05p	10.45	3006.8*
Total Weight			4,241.17	166.35a	0.46s	30.01	
Free Surface Adjustment						0.71	
Adjusted CG				166.35a	0.46s	30.72	

* Note: FSM values marked with the asterisk are formal values which are not the same as the true values in the present condition.

FREEBOARD STATUS

Baseline draft: 16.019
Trim: zero, Heel: zero

Least freeboard is 8.02 Ft located at 50.30a

Least extra freeboard (to margin line) is 7.27 Ft located at 159.95a

CRITICAL POINT STATUS

Baseline draft: 16.019
Trim: zero, Heel: zero

Critical Points	LCP	TCP	VCP	Height
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25s	43.00	26.98
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25p	43.00	26.98
(2) Engineer's Workshop and S FLOOD	227.00a	19.00s	40.75	24.73
(2) Engineer's Workshop and S FLOOD	227.00a	19.00p	40.75	24.73
(3) EOS Vent	FLOOD 175.67a	19.00s	40.75	24.73
(3) EOS Vent	FLOOD 175.67a	19.00p	40.75	24.73
(4) MSD Vent	FLOOD 104.50a	19.00s	40.75	24.73
(4) MSD Vent	FLOOD 104.50a	19.00p	40.75	24.73
(5) Aft Ramp	TIGHT 332.00a	0.00	24.00	7.98
(6) Port Ramp	TIGHT 80.00a	28.83p	24.00	7.98
(7) STBD Ramp	TIGHT 80.00a	28.83s	24.00	7.98

HYDROSTATIC PROPERTIES

No Trim, No Heel, VCG = 30.01

LCF	Displacement	Buoyancy-Ctr.	Weight/	Moment/
Draft	Weight (LT)	LCB	VCB	Inch
16.019	4,241.04	170.34a	10.00	36.96
				186.32a
				43635
				589.4
				7.28

Distances in FEET.-----Specific Gravity = 1.025.-----Moment in Ft-LT.
Draft is from Baseline. Formal Free Surface included.

Note: GMT includes the formal free surface moment 3006.8 Ft-LT

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GHS 11.74

Elliott Bay Design Group
ALASKA CLASS FERRY

***** COND4A - Arrival with SLM, 0 Max Semi-Trailers, 0 Campers, 0 Cars *****

WEIGHT STATUS

Baseline draft: 15.023
Trim: zero, Heel: zero

Part	Weight (LT)	LCG	TCG	VCG	FSM		
LIGHT SHIP	3,269.00	163.70a	0.49s	30.55			
SERVICE LIFE MARGIN	331.80	163.70a	0.49s	44.44			
ICE	54.99	154.04a	0.00	53.84			
499 PASSENGERS AND EFFECT	72.40	165.67a	0.00	46.00			
33 CREW AND EFFECTS	4.79	160.00a	0.00	55.00			
SHIP STORES	2.50	234.50a	0.00	17.50			
GALLEY STORES	1.00	292.00a	21.33s	35.00			
OUTFIT	15.00	292.00a	0.00	35.00			
Total Fixed	3,751.48	164.19a	0.48s	32.46			
Load	SpGr	Weight (LT)	LCG	TCG	VCG	FSM	
FO2.C	0.100	0.870	15.52	252.72a	0.00	9.03	0.0*
FO1.C	0.100	0.870	6.10	233.98a	0.00	6.84	0.0*
FOD.P	0.100	0.870	2.40	170.00a	10.62p	5.37	0.0*
FOSET.S	0.100	0.870	2.66	165.00a	6.37s	5.37	0.0*
FOAUX.S	0.100	0.870	0.41	146.00a	14.75s	5.25	0.0*
DBTECH.P	0.100	1.000	4.28	132.13a	2.94p	0.79	0.0*
DBTECH.S	0.100	1.000	4.28	132.13a	2.94s	0.79	0.0*
GREY.S	0.100	1.025	8.74	108.00a	1.25s	5.53	0.0*
BLACK.P	0.100	1.025	1.18	108.00a	9.25p	5.53	0.0*
POTABLE.C	0.100	1.000	10.54	86.00a	0.00	5.75	0.0*
Total Tanks			56.12	166.90a	0.05p	5.94	3006.8*
Total Weight			3,807.60	164.23a	0.47s	32.07	
Free Surface Adjustment						0.79	
Adjusted CG				164.23a	0.47s	32.86	

* Note: FSM values marked with the asterisk are formal values which are not the same as the true values in the present condition.

FREEBOARD STATUS

Baseline draft: 15.023
Trim: zero, Heel: zero

Least freeboard is 9.02 Ft located at 50.30a

Least extra freeboard (to margin line) is 8.27 Ft located at 159.95a

CRITICAL POINT STATUS

Baseline draft: 15.023
Trim: zero, Heel: zero

Critical Points	LCP	TCP	VCP	Height
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25s	43.00	27.98
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25p	43.00	27.98
(2) Engineer's Workshop and S FLOOD	227.00a	19.00s	40.75	25.73
(2) Engineer's Workshop and S FLOOD	227.00a	19.00p	40.75	25.73
(3) EOS Vent	FLOOD	175.67a	19.00s	40.75
(3) EOS Vent	FLOOD	175.67a	19.00p	40.75
(4) MSD Vent	FLOOD	104.50a	19.00s	40.75
(4) MSD Vent	FLOOD	104.50a	19.00p	40.75
(5) Aft Ramp	TIGHT	332.00a	0.00	24.00
(6) Port Ramp	TIGHT	80.00a	28.83p	24.00
(7) STBD Ramp	TIGHT	80.00a	28.83s	24.00

HYDROSTATIC PROPERTIES

No Trim, No Heel, VCG = 32.07

LCF	Displacement	Buoyancy-Ctr.	Weight/	Moment/				
Draft	Weight (LT)	LCB	VCB	Inch	LCF	Deg trim	GML	GMT
15.023	3,808.13	168.55a	9.37	35.44	185.85a	40520	609.6	4.83

Distances in FEET.-----Specific Gravity = 1.025.-----Moment in Ft-LT.
Draft is from Baseline. Formal Free Surface included.

Note: GMT includes the formal free surface moment 3006.8 Ft-LT

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GHS 11.74

Elliott Bay Design Group
ALASKA CLASS FERRY

***** COND4B - Arrival without SLM, 0 Max Semi-Trailers, 0 Campers, 0 Cars ***

WEIGHT STATUS
Baseline draft: 14.227
Trim: zero, Heel: zero

Part	Weight (LT)	LCG	TCG	VCG	FSM		
LIGHT SHIP	3,269.00	163.70a	0.49s	30.55			
ICE	54.99	154.04a	0.00	53.84			
499 PASSENGERS AND EFFECT	72.40	165.67a	0.00	46.00			
33 CREW AND EFFECTS	4.79	160.00a	0.00	55.00			
SHIP STORES	2.50	234.50a	0.00	17.50			
GALLEY STORES	1.00	292.00a	21.33s	35.00			
OUTFIT	15.00	292.00a	0.00	35.00			
Total Fixed	3,419.68	164.23a	0.47s	31.30			
Load	SpGr	Weight (LT)	LCG	TCG	VCG	FSM	
FO2.C	0.100	0.870	15.52	252.72a	0.00	9.03	0.0*
FO1.C	0.100	0.870	6.10	233.98a	0.00	6.84	0.0*
FOD.P	0.100	0.870	2.40	170.00a	10.62p	5.37	0.0*
FOSET.S	0.100	0.870	2.66	165.00a	6.37s	5.37	0.0*
FOAUX.S	0.100	0.870	0.41	146.00a	14.75s	5.25	0.0*
DBTECH.P	0.100	1.000	4.28	132.13a	2.94p	0.79	0.0*
DBTECH.S	0.100	1.000	4.28	132.13a	2.94s	0.79	0.0*
GREY.S	0.100	1.025	8.74	108.00a	1.25s	5.53	0.0*
BLACK.P	0.100	1.025	1.18	108.00a	9.25p	5.53	0.0*
POTABLE.C	0.100	1.000	10.54	86.00a	0.00	5.75	0.0*
Total Tanks			56.12	166.90a	0.05p	5.94	3006.8*
Total Weight			3,475.80	164.28a	0.47s	30.89	
Free Surface Adjustment						0.87	
Adjusted CG				164.28a	0.47s	31.75	

Distances in FEET.-----Moments in Ft-LT.

* Note: FSM values marked with the asterisk are formal values which are not the same as the true values in the present condition.

FREEBOARD STATUS

Baseline draft: 14.227
Trim: zero, Heel: zero

Least freeboard is 9.81 Ft located at 50.30a
Least extra freeboard (to margin line) is 9.06 Ft located at 159.95a

CRITICAL POINT STATUS

Baseline draft: 14.227
Trim: zero, Heel: zero

Critical Points	LCP	TCP	VCP	Height	
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25s	43.00	28.77	
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25p	43.00	28.77	
(2) Engineer's Workshop and S FLOOD	227.00a	19.00s	40.75	26.52	
(2) Engineer's Workshop and S FLOOD	227.00a	19.00p	40.75	26.52	
(3) EOS Vent	FLOOD	175.67a	19.00s	40.75	26.52
(3) EOS Vent	FLOOD	175.67a	19.00p	40.75	26.52
(4) MSD Vent	FLOOD	104.50a	19.00s	40.75	26.52
(4) MSD Vent	FLOOD	104.50a	19.00p	40.75	26.52
(5) Aft Ramp	TIGHT	332.00a	0.00	24.00	9.77
(6) Port Ramp	TIGHT	80.00a	28.83p	24.00	9.77
(7) STBD Ramp	TIGHT	80.00a	28.83s	24.00	9.77

Distances in FEET.-----

HYDROSTATIC PROPERTIES

No Trim, No Heel, VCG = 30.89

LCF	Displacement	Buoyancy-Ctr.	Weight/	Moment/				
Draft	Weight (LT)	LCB	VCB	Inch	LCF	Deg trim	GML	GMT
14.227	3,475.92	166.94a	8.86	34.08	184.75a	37739	622.0	5.74

Distances in FEET.-----Specific Gravity = 1.025.-----Moment in Ft-LT.
Draft is from Baseline. Formal Free Surface included.

Note: GMT includes the formal free surface moment 3006.8 Ft-LT

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GHS 11.74

Elliott Bay Design Group
ALASKA CLASS FERRY

***** CONDS5B - Arrival without SLM, Operational Light Ship *****

WEIGHT STATUS
Baseline draft: 13.999
Trim: zero, Heel: zero

Part	Weight (LT)	LCG	TCG	VCG	FSM		
LIGHT SHIP	3,269.00	163.70a	0.49s	30.55			
ICE	54.99	154.04a	0.00	53.84			
18 CREW AND EFFECTS	2.61	160.00a	0.00	55.00			
Total Fixed	3,326.60	163.54a	0.48s	30.95			
Load	SpGr	Weight (LT)	LCG	TCG	VCG	FSM	
FO2.C	0.100	0.870	15.52	252.72a	0.00	9.03	0.0*
FO1.C	0.100	0.870	6.10	233.98a	0.00	6.84	0.0*
FOD.P	0.100	0.870	2.40	170.00a	10.62p	5.37	0.0*
FOSET.S	0.100	0.870	2.66	165.00a	6.37s	5.37	0.0*
FOAUX.S	0.100	0.870	0.41	146.00a	14.75s	5.25	0.0*
DBTECH.P	0.100	1.000	4.28	132.13a	2.94p	0.79	0.0*
DBTECH.S	0.100	1.000	4.28	132.13a	2.94s	0.79	0.0*
GREY.S	0.100	1.025	8.74	108.00a	1.25s	5.53	0.0*
BLACK.P	0.100	1.025	1.18	108.00a	9.25p	5.53	0.0*
POTABLE.C	0.100	1.000	10.54	86.00a	0.00	5.75	0.0*
Total Tanks			56.12	166.90a	0.05p	5.94	3006.8*
Total Weight			3,382.72	163.59a	0.47s	30.54	
Free Surface Adjustment							0.89
Adjusted CG				163.59a	0.47s		31.43

Distances in FEET.-----Moments in Ft-LT.
+
* Note: FSM values marked with the asterisk are formal values which are not the same as the true values in the present condition.
+

FREEBOARD STATUS

Baseline draft: 13.999
Trim: zero, Heel: zero
Least freeboard is 10.04 Ft located at 50.30a
Least extra freeboard (to margin line) is 9.29 Ft located at 159.95a

CRITICAL POINT STATUS

Baseline draft: 13.999
Trim: zero, Heel: zero

Critical Points	LCP	TCP	VCP	Height
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25s	43.00	29.00
(1) Passenger Deck Elevator A FLOOD	271.25a	16.25p	43.00	29.00
(2) Engineer's Workshop and S FLOOD	227.00a	19.00s	40.75	26.75
(2) Engineer's Workshop and S FLOOD	227.00a	19.00p	40.75	26.75
(3) EOS Vent	FLOOD 175.67a	19.00s	40.75	26.75
(3) EOS Vent	FLOOD 175.67a	19.00p	40.75	26.75
(4) MSD Vent	FLOOD 104.50a	19.00s	40.75	26.75
(4) MSD Vent	FLOOD 104.50a	19.00p	40.75	26.75
(5) Aft Ramp	TIGHT 332.00a	0.00	24.00	10.00
(6) Port Ramp	TIGHT 80.00a	28.83p	24.00	10.00
(7) STBD Ramp	TIGHT 80.00a	28.83s	24.00	10.00

HYDROSTATIC PROPERTIES
No Trim, No Heel, VCG = 30.54

LCF	Displacement	Buoyancy-Ctr.	Weight/	Moment/				
Draft	Weight (LT)	LCB	VCB	Inch	LCF	Deg trim	GML	GMT
13.999	3,383.27	166.46a	8.72	33.67	184.33a	36883	624.5	6.01

Distances in FEET.-----Specific Gravity = 1.025.-----Moment in Ft-LT.
Draft is from Baseline. Formal Free Surface included.

Note: GMT includes the formal free surface moment 3006.8 Ft-LT

ICING CALCULATIONS

46 CFR 28.550

- (1) 6.14 pounds per square foot on horizontal projected area. Which corresponds to a thickness of 1.30 inches.
- (2) 3.07 pounds per square foot on vertical projected area. Which corresponds to a thickness of 0.65 inches.
- (d) The projected horizontal and vertical area of each small discontinuous surface such as a rail, a spar, and rigging with no sail can be accounted for by increasing the calculated area by 15%.

Horizontal Surfaces: 3.07 lbs/ft²

Description	Area (ft)	Weight (lb)	LCG (ft)	VCG (ft)	L _{MOM} (ft lbs)	V _{MOM} (ft lbs)
Car Deck	1,312	4027	196.14	24.00	789810	96642
Passenger Deck	5,929	18203	122.38	43.00	2227768	782737
Sun Deck	5,638	17308	159.50	53.00	2760636	917327.34
House Top	8,527	26176	199.50	62.00	5222191	1622937
Bridge Deck	867	2662	64.67	68.00	172116	180988
Fidley Top	2,605	7996	161.08	70	1288096	559752
Pilot House Top	2,260	6938	65.92	76	457305	527259
<hr/>						
Sub Total =	20961	79283	152.97	57.91	12128111	4591000
Margin =	15%	11892				
Horizontal Total =		91176	152.97	57.91		
		40.70 LT				

Vertical Surfaces: 1.535 lbs/ft²

Description	Area (ft)	Weight (lb)	LCG (ft)	VCG (ft)	L _{MOM} (ft lbs)	V _{MOM} (ft lbs)
Outboard Profile	18129	27828	157.10	42.27	4371781	1176290
<hr/>						
Sub Total =	18129	27828	157.10	42.27	4371781	1176290
Margin =	15%	4174				
Vertical Total =		32002	157.10	42.27		
		14.29 LT				

Note:

Projected area from outboard profile, included masts and railings, at 13' - 6" draft.

Description	Area (ft)	Weight (lb)	LCG (ft)	VCG (ft)	L _{MOM} (ft lbs)	V _{MOM} (ft lbs)
Horizontal Total =		91176	152.97	57.91	13947328	5279650.3
Vertical Total =		32002	157.10	42.27	5027548	1352733.7
TOTAL ICING =		123178	154.04	53.84	18974876	6632384
		54.99 LT				

GHS OUTPUT MAX VCG DATA

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----- 46 CFR 170.170 Wind Heel Criterion Maxvcg -----

MAXIMUM VCG vs. DISPLACEMENT

Heeling moment is present from: wind
Trim = Fwd 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement	Max VCG	Margins	
LONG TONS		LIM1	LIM2
2,619.40	29.62	2d	0d

Heeling moment is present from: wind
Trim = zero at zero heel (trim righting arm held at zero)

Displacement	Max VCG	Margins	
LONG TONS		LIM1	LIM2
2,619.40	31.88	0d	1d

Heeling moment is present from: wind
Trim = Aft 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement	Max VCG	Margins	
LONG TONS		LIM1	LIM2
2,619.40	33.54	0d	0d

Distances in FEET.---Specific Gravity = 1.025.---d = degrees.

LIM-----170.170 WIND HEEL CRITERION-----Min/Max	
(1) Absolute Angle at Equilibrium	< 14.00 deg
(2) Angle from Equilibrium to Flood	> 0.00 deg

NOTE: FLOOD POINT DENOTES ONE-HALF OF AUGMENTED FREEBOARD HEIGHT

MAXIMUM VCG vs. DISPLACEMENT

Heeling moment is present from: wind
Trim = Fwd 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement	Max VCG	Margins	
LONG TONS		LIM1	LIM2
3,184.46	32.18	2d	0d

Heeling moment is present from: wind
Trim = zero at zero heel (trim righting arm held at zero)

Displacement	Max VCG	Margins	
LONG TONS		LIM1	LIM2
3,184.46	33.70	0d	1d

Heeling moment is present from: wind
Trim = Aft 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement	Max VCG	Margins	
LONG TONS		LIM1	LIM2
3,184.46	34.81	0d	0d

Distances in FEET.---Specific Gravity = 1.025.---d = degrees.

LIM-----170.170 WIND HEEL CRITERION-----Min/Max	
(1) Absolute Angle at Equilibrium	< 14.00 deg
(2) Angle from Equilibrium to Flood	> 0.00 deg

NOTE: FLOOD POINT DENOTES ONE-HALF OF AUGMENTED FREEBOARD HEIGHT

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----- 46 CFR 170.170 Wind Heel Criterion Maxvcg -----

MAXIMUM VCG vs. DISPLACEMENT
Heeling moment is present from: wind
Trim = Fwd 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement	Max VCG	Margins	
LONG TONS		LIM1	LIM2
3,798.47	34.65	2d	0d

Heeling moment is present from: wind
Trim = zero at zero heel (trim righting arm held at zero)

Displacement	Max VCG	Margins	
LONG TONS		LIM1	LIM2
3,798.47	35.50	0d	1d

Heeling moment is present from: wind
Trim = Aft 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement	Max VCG	Margins	
LONG TONS		LIM1	LIM2
3,798.47	35.79	0d	0d

Distances in FEET.---Specific Gravity = 1.025.---d = degrees.
+

LIM-----170.170 WIND HEEL CRITERION-----Min/Max
(1) Absolute Angle at Equilibrium < 14.00 deg
(2) Angle from Equilibrium to Flood > 0.00 deg

NOTE: FLOOD POINT DENOTES ONE-HALF OF AUGMENTED FREEBOARD HEIGHT

MAXIMUM VCG vs. DISPLACEMENT
Heeling moment is present from: wind
Trim = Fwd 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement	Max VCG	Margins	
LONG TONS		LIM1	LIM2
4,232.63	35.95	1d	0d

Heeling moment is present from: wind
Trim = zero at zero heel (trim righting arm held at zero)

Displacement	Max VCG	Margins	
LONG TONS		LIM1	LIM2
4,232.63	36.36	0d	2d

Heeling moment is present from: wind
Trim = Aft 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement	Max VCG	Margins	
LONG TONS		LIM1	LIM2
4,232.63	36.23	0d	0d

Distances in FEET.---Specific Gravity = 1.025.---d = degrees.
+

LIM-----170.170 WIND HEEL CRITERION-----Min/Max
(1) Absolute Angle at Equilibrium < 14.00 deg
(2) Angle from Equilibrium to Flood > 0.00 deg

NOTE: FLOOD POINT DENOTES ONE-HALF OF AUGMENTED FREEBOARD HEIGHT

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----- 46 CFR 170.173(b) Intact Righting Energy Criterion Maxvcg -----

MAXIMUM VCG vs. DISPLACEMENT

Trim = Fwd 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement	Margins								
LONG TONS	Max VCG	LIM1	LIM2	LIM3	LIM4	LIM5	LIM6	LIM7	
2,619.40	35.00	0%	56%	1d	52%	45%	57%	26d	
3,184.46	34.78	185%	87%	0d	120%	96%	87%	25d	
3,798.47	34.42	423%	120%	0d	183%	148%	129%	23d	
4,232.63	34.11	614%	144%	0d	224%	184%	163%	23d	
4,684.66	34.13	758%	138%	0d	233%	189%	160%	21d	
4,917.25	33.99	877%	146%	0d	248%	203%	175%	21d	

Trim = zero at zero heel (trim righting arm held at zero)

Displacement	Margins								
LONG TONS	Max VCG	LIM1	LIM2	LIM3	LIM4	LIM5	LIM6	LIM7	
2,619.40	35.85	149%	48%	0d	62%	43%	35%	22d	
3,184.46	34.83	411%	126%	0d	166%	139%	132%	25d	
3,798.47	34.55	540%	140%	0d	203%	168%	152%	24d	
4,232.63	34.40	632%	143%	0d	218%	179%	159%	23d	
4,684.66	34.31	732%	138%	0d	224%	183%	159%	21d	
4,917.25	34.29	784%	133%	0d	223%	182%	156%	20d	

Trim = Aft 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement	Margins								
LONG TONS	Max VCG	LIM1	LIM2	LIM3	LIM4	LIM5	LIM6	LIM7	
2,619.40	37.07	268%	32%	0d	67%	35%	0%	7d	
3,184.46	36.09	393%	85%	0d	135%	100%	71%	19d	
3,798.47	35.40	512%	111%	0d	172%	136%	112%	20d	
4,232.63	34.97	617%	124%	0d	192%	156%	137%	21d	
4,684.66	34.86	682%	112%	0d	186%	150%	129%	19d	
4,917.25	34.87	710%	102%	0d	177%	141%	119%	18d	

Distances in FEET.---Specific Gravity = 1.025.----d = degrees.

LIM-----170.173B RIGHTING ENERGY CRITERION-----Min/Max:

- (1) GM Upright > 0.49 Ft
- (2) Righting Arm at 30 deg > 0.66 Ft
- (3) Angle from 0 deg to MaxRA > 25.00 deg
- (4) Area from 0 deg to 30 > 10.30 Ft-deg
- (5) Area from 0 deg to 40 or Flood > 16.90 Ft-deg
- (6) Area from 30 deg to 40 or Flood > 5.60 Ft-deg
- (7) Angle from 0 deg to RAzero > 40.00 deg

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----- SOLAS 2008 - MSC267 - Section 2.2 Criteria -----
----- Regarding Righting Lever Curve Properties -----

MAXIMUM VCG vs. DISPLACEMENT

Trim = Fwd 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement		----- Margins -----							
LONG TONS	Max VCG	LIM1	LIM2	LIM3	LIM4	LIM5	LIM6		
2,619.40	35.00	52%	45%	56%	57%	1d	0%		
3,184.46	34.60	132%	110%	104%	102%	0d	220%		
3,798.47	34.26	194%	161%	143%	134%	0d	453%		
4,232.63	34.10	223%	185%	162%	146%	0d	612%		
4,684.66	34.14	232%	189%	158%	139%	0d	753%		
4,917.25	33.98	247%	204%	174%	149%	0d	875%		

Trim = zero at zero heel (trim righting arm held at zero)

Displacement		----- Margins -----							
LONG TONS	Max VCG	LIM1	LIM2	LIM3	LIM4	LIM5	LIM6		
2,619.40	36.19	37%	17%	0%	24%	0d	80%		
3,184.46	34.99	153%	126%	114%	116%	0d	378%		
3,798.47	34.49	206%	173%	156%	146%	0d	550%		
4,232.63	34.37	219%	182%	160%	146%	0d	635%		
4,684.66	34.39	216%	176%	149%	133%	0d	711%		
4,917.25	34.27	224%	184%	157%	137%	0d	785%		

Trim = Aft 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement		----- Margins -----							
LONG TONS	Max VCG	LIM1	LIM2	LIM3	LIM4	LIM5	LIM6		
2,619.40	37.07	67%	35%	0%	33%	0d	267%		
3,184.46	35.77	158%	125%	103%	111%	0d	457%		
3,798.47	35.27	181%	146%	124%	122%	0d	536%		
4,232.63	35.08	183%	148%	125%	117%	0d	593%		
4,684.66	34.90	181%	146%	123%	111%	0d	670%		
4,917.25	34.94	171%	136%	110%	98%	0d	693%		

Distances in FEET.---Specific Gravity = 1.025.---d = degrees.

LIM-----SOLAS - MSC 267 - SEC 2.2 CRITERION-----Min/Max:

(1) Area from 0 deg to 30	>	10.34 Ft-deg
(2) Area from 0 deg to 40 or Flood	>	16.92 Ft-deg
(3) Area from 30 deg to 40 or Flood	>	5.64 Ft-deg
(4) Righting Arm at 30 deg	>	0.66 Ft
(5) Absolute Angle at MaxRA	>	25.00 deg
(6) GM at Equilibrium	>	0.49 Ft

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----- SOLAS 2008 - MSC267 - Section 2.3 -----
----- Initial Wind Heel Criterion -----

MAXIMUM VCG vs. DISPLACEMENT

Heeling moment is present from: wind

Trim = Fwd 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement LONG TONS	Max VCG	Margins	
		LIM1	LIM2
2,619.40	31.45	2d	0d
3,184.46	32.34	4d	0d
3,798.47	33.34	6d	0d
4,232.63	33.80	8d	0d
4,684.66	34.72	9d	0d
4,917.25	34.89	10d	0d

Heeling moment is present from: wind

Trim = zero at zero heel (trim righting arm held at zero)

Displacement LONG TONS	Max VCG	Margins	
		LIM1	LIM2
2,619.40	33.34	0d	0d
3,184.46	34.10	2d	0d
3,798.47	34.99	4d	0d
4,232.63	35.27	6d	0d
4,684.66	35.69	7d	0d
4,917.25	35.78	7d	0d

Heeling moment is present from: wind

Trim = Aft 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement LONG TONS	Max VCG	Margins	
		LIM1	LIM2
2,619.40	34.97	0d	0d
3,184.46	35.39	2d	0d
3,798.47	35.20	5d	0d
4,232.63	34.83	7d	0d
4,684.66	34.83	8d	0d
4,917.25	34.22	9d	0d

Distances in FEET.---Specific Gravity = 1.025.---d = degrees.

LIM-----SOLAS - MSC 267 - SEC 2.3 CRITERION-----Min/Max
(1) Absolute Angle at Equilibrium < 16.00 deg
(2) Angle from Equilibrium to 80% Dk Imm Angle > 0.00 deg

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----- SOLAS 2008 - MSC267 - Section 2.3 -----
----- Severe Wind and Rolling Criterion -----

MAXIMUM VCG vs. DISPLACEMENT with ROLL

Heeling moment is present from: wind
Trim = Fwd 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement LONG TONS	Max VCG	Margins	
		LIM1	LIM2
2,619.40	32.11	0%	108%
3,184.46	33.15	0%	49%
3,798.47	33.90	0%	12%
4,232.63	34.26	0%	2%
4,684.66	34.50	0%	0%
4,917.25	34.56	0%	0%

Heeling moment is present from: wind
Trim = zero at zero heel (trim righting arm held at zero)

Displacement LONG TONS	Max VCG	Margins	
		LIM1	LIM2
2,619.40	32.71	0%	76%
3,184.46	33.61	0%	42%
3,798.47	34.22	0%	14%
4,232.63	34.51	0%	2%
4,684.66	34.70	0%	0%
4,917.25	34.76	0%	0%

Heeling moment is present from: wind
Trim = Aft 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement LONG TONS	Max VCG	Margins	
		LIM1	LIM2
2,619.40	33.18	0%	42%
3,184.46	34.08	0%	26%
3,798.47	34.55	0%	10%
4,232.63	34.73	0%	1%
4,684.66	34.82	0%	0%
4,917.25	34.84	0%	0%

Distances in FEET.---Specific Gravity = 1.025.---d = degrees.

LIM-----SOLAS - MSC 267 - SEC 2.3 CRITERION-----Min/Max
(1) Res. Ratio from Roll to abs 50 deg or RAzero > 1.000
(2) Res. Area Ratio from Roll to Flood or RAzero > 1.000

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----- SOLAS 2008 - MSC267 - Section 3.1 -----
----- Passenger Vessel Heeling Moment Criteria -----

MAXIMUM VCG vs. DISPLACEMENT

Heeling moment is present from: user specification
Trim = Fwd 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement	Max: VCG	Margin
LONG TONS		LIM1
2,619.40	32.35	0d
3,184.46	33.86	0d
3,798.47	35.67	0d
4,232.63	37.03	0d
4,684.66	38.07	0d
4,917.25	38.26	1d

Heeling moment is present from: user specification
Trim = zero at zero heel (trim righting arm held at zero)

Displacement	Max: VCG	Margin
LONG TONS		LIM1
2,619.40	33.83	0d
3,184.46	34.90	0d
3,798.47	35.95	0d
4,232.63	36.68	0d
4,684.66	37.58	0d
4,917.25	38.01	0d

Heeling moment is present from: user specification
Trim = Aft 1.00 deg. at zero heel (trim righting arm held at zero)

Displacement	Max: VCG	Margin
LONG TONS		LIM1
2,619.40	35.55	0d
3,184.46	36.09	0d
3,798.47	36.66	0d
4,232.63	37.05	0d
4,684.66	37.39	0d
4,917.25	37.55	0d

Distances in FEET.---Specific Gravity = 1.025.---d = degrees.

LIM-----SOLAS - MSC 267 - SEC 3.1 CRITERION-----Min/Max:
(1) Absolute Angle at Equilibrium < 10.00 deg

EXCEL MAX VCG DATA**WEATHER CRITERION MAXIMUM VCG CALCULATION**

(with bulb, re-lengthened stern, widened to 58' on 16' WL, and superstructure added)
 from 46 CFR 170.170 (**current**)
 For Service on Exposed Waters

$$GM_{\text{reqd}} = \frac{PAH}{W \tan(T)}$$

$$P = 0.0050 + (L/14200)^2 = 0.006 \quad \text{Long tons / Ft}^2$$

A = lateral area above waterline

H = vertical distance from centroid of A to 1/2 draft point

W = displacement in long tons

T = 14 degrees or angle of heel where 1/2 freeboard is submerged,
 whichever is less.

Length on max waterline:	340.56 ft					
Depth to freeboard deck: (low point, at edge)	24.00 ft					
Beam:	74.00 ft					
Draft, T:	12.00	13.50	15.00	16.00	17.00	17.50
Displacement to T:	2619	3184	3798	4233	4685	4917
Area above waterline:	18606	18129	17638	17308	16978	16812
h of area above waterline:	29.51	28.77	28.05	27.57	27.10	26.86
h of area to baseline:	41.51	42.27	43.05	43.57	44.10	44.36
Vertical distance, H:	35.51	35.52	35.55	35.57	35.60	35.61
Freeboard:	12.00	10.50	9.00	8.00	7.00	6.50
Augmented Freeboard:	18.50	18.50	18.50	18.50	18.50	18.50
Tangent to 1/2 freeboard:	0.250	0.250	0.250	0.250	0.250	0.250
Tangent 14 deg:	0.249	0.249	0.249	0.249	0.249	0.249
GM required:	5.64	4.52	3.69	3.25	2.88	2.72
KMt at draft T:	37.07	37.34	37.68	37.99	38.38	38.62
Max VCG incl. free surface:	31.43	32.82	33.99	34.74	35.50	35.90

DRAFT	DISP	MAX VCG
-----	-----	-----
12.00	2619.40	31.43
13.50	3184.46	32.82
15.00	3798.47	33.99
16.00	4232.63	34.74
17.00	4684.66	35.50
17.50	4917.25	35.90

FREEBOARD AUGMENTATION

from Marine Safety Manual 6.B.4-b.(2)
Freeboard Augmentation for "less than full length" raised deck

$$\text{Augmented Freeboard} = f + (a/b) * [(B/4) - f]$$

f= normal freeboard

a= additional allowed superstructure area

b= reference freeboard deck area

B= beam

Draft, T:	12.00	13.50	15.00	16.00	17.00	17.50
Normal Freeboard:	12.00	10.50	9.00	8.00	7.00	6.50

$$a = 1 \text{ ft}^2$$

$$b = 1 \text{ ft}^2$$

Augmented Freeboard (f+h):	18.50	18.50	18.50	18.50	18.50	18.50
Fld Pt ABL = 0.5 x (f+h) + T =	21.25	22.75	24.25	25.25	26.25	26.75

- Note: 1) "Fld Pt ABL" is used for evaluating the vessel against the proposed CFR wind heel criterion. These heights above baseline are used to set floodpoints in GHS that correspond to half the augmented freeboard.
2) Values for 'a' and 'b' are not used. The full length superstructure of the vessel covers 100% of the deck.

4. Weather Criterion (46 CFR 170.170). When demonstrating compliance with the weather criterion in 46 CFR 170.170, calculations of the required metacentric height for particular loading conditions should be performed assuming the vessel is on an even keel.
- a. The angle of heel (T) in the GM-Required formula is defined as 14 degrees, or the angle of heel at which one-half the freeboard to the deck edge is immersed, whichever is less. Normally, the deck referred to is the freeboard deck. For some vessels, this could be a severe penalty when the designated freeboard deck is significantly lower than the main (weather) deck. The freeboard may be measured to the higher weather deck if the hull above the freeboard deck is watertight and the hull penetration requirements in 46 CFR 56.50-95 are met, substituting the weather deck for the freeboard deck for the purpose of those regulations.
- b. The angle of heel (T) may also be increased, as follows, if a vessel has a superstructure extending from shell to shell with adequate strength, tightness, and closures, as follows:
- (1) If a vessel has a superstructure of height "k" for the full length of the vessel, the freeboard "f" to the freeboard deck may be increased by a height "h" where "h" is equal to or less than "k":
- $$\text{Then } \tan(T) = \frac{f+h}{B/2} = \frac{f+h}{B} \quad (\text{not to exceed } \tan 14 \text{ degrees, i.e., } 0.25).$$
- From $\frac{f+h}{B} = .25$ maximum,
- the permissible freeboard addition "h" (max.) = (B/4)-f.
- (2) If a vessel has a superstructure of less than the full length of the vessel, the freeboard addition "h" is limited by two considerations. The first is the relative length of the superstructure; the second is the transverse distribution of the

PASSENGER CRITERION MAXIMUM VCG CALCULATION

from 46 CFR 171.050 (current)

$$GM_{\text{reqd}} = \frac{N b}{K W \tan(T)}$$

N = number of passengers

b = distance off centerline to centroid of passenger deck
(beam/4 used to be conservative)

K = constant (varies with passenger weight)

W = displacement in long tons

T = 14 degrees or angle of heel where freeboard is submerged,
whichever is less.

Number of passengers:	499					
Depth to freeboard deck: (low point, at edge)	24.00 ft					
Beam:	74.00 ft					
b:	18.50 ft					
K:	18.16		(185 lbs per passenger)			
Draft, T:	12.00	13.50	15.00	16.00	17.00	17.50
Displacement to T:	2619	3184	3798	4233	4685	4917
Freeboard:	12.00	10.50	9.00	8.00	7.00	6.50
Tangent to freeboard:	0.324	0.284	0.243	0.216	0.189	0.176
Tangent 14 deg:	0.249	0.249	0.249	0.249	0.249	0.249
GM required:	0.78	0.64	0.55	0.56	0.57	0.59
KMt at draft T:	37.07	37.34	37.68	37.99	38.38	38.62
Max VCG incl. free surfac	36.29	36.70	37.13	37.43	37.81	38.03

SUMMARY TABLE

DRAFT	DISP	MAX VCG
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12.00	2619	36.29
13.50	3184	36.70
15.00	3798	37.13
16.00	4233	37.43
17.00	4685	37.81
17.50	4917	38.03