

DOUBLE-ENDED AZIMUTH DRIVE FERRY

Tonnage Assessment

Prepared for: NCDOT • Raleigh, North Carolina

Ref: 18026-200-835-1

Rev. -

August 15, 2018

PREPARED BY

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GENERAL NOTES

1. This report is not intended for regulatory submittal.
2. The Contractor shall obtain an independent validation of the tonnage scheme, based upon the Contract Guidance Drawings. The independent validation of the tonnage scheme shall be performed by a qualified, Owner approved agent and completed prior to commencing fabrication.
3. The vessel shall admeasure at less than 400 GRT. While included in these calculations, a tonnage opening in the passenger lounge may not be needed to meet this requirement. The tonnage opening may be removed if the independent tonnage validation indicates the tonnage opening is not needed.

REVISIONS

REV	DESCRIPTION	DATE	APPROVED
–	Initial issue	08/15/18	KAJ 55055

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1 PURPOSE

This report details the anticipated tonnage admeasurement calculations for the Double-Ended Azimuth Drive Ferry. The subject vessel is a 183'-7" x 46'-0" x 11'-6" vehicle/passenger ferry which will be operated by the North Carolina Department of Transportation within the Outer Banks of North Carolina and the associated rivers.

For the purposes of manning requirements, the vessel must have a regulatory tonnage of less than 400 gross registered tons (GRT). This report provides the approximate GRT of the subject vessel and outlines the assumptions used in this calculation.

2 PROCEDURE

2.1 Hull Methodology

The regulatory tonnage of the hull is calculated using the methodology in 46 CFR §69 [1] and further described in the United States Coast Guard (USCG) Marine Technical Note (MTN) 01-99 [2]. Simpson's Rules is used to determine the volume within the hull structure by integration of the hull sectional areas.

The tonnage length is measured from the intersection of the hull framing with the stem bar at each end of the vessel. The hull is divided into 12 tonnage stations over the tonnage length. The area of each section is calculated from Reference [3] using four vertical divisions.

The ballast tanks are exempted as described in References [1] and [2].

2.2 Superstructure Tonnage

Tonnage volumes above the main deck are conservatively calculated using the overall dimensions of each space as shown in Reference [4] without accounting for stiffener depth. The uptakes, engineer's operating station access, heads, emergency generator room, and pilot house are exempted as described in References [1] and [2]. The passenger lounge is exempted with a 4'x5' tonnage opening in the aft bulkhead. All other spaces in the superstructure are included in the tonnage admeasurement.

3 GIVEN AND ASSUMED PARAMETERS

The tonnage length is measured to be 182'-3".

The hull is longitudinally framed between Frames 12/A and 16/B. Tonnage station sectional areas are measured to the inside face of the hull longitudinal frames, 4" off the side shell. The hull is transversely framed on 48" centers from Frames 12/A and 16/B to the ends. Alternating deep frames are used to reduce the under-deck tonnage in these areas. Section depths are measured to 2/3 the height of the deck camber above. See Appendix A for details of the measured sectional areas.

Where the hull is transversely framed, the longitudinal stiffeners on the bottom and side shell must be intercostal to the transverse frames, or at minimum be welded on all sides so as to

appear intercostal. The deck stiffeners are assumed to penetrate the transverse frames without collars. Therefore, the uppermost tonnage breadth of every station is measured to the inside face of the side frames.

4 CONCLUSIONS

The estimated regulatory tonnage of the subject vessel is 331.14 GRT. The passenger lounge is exempted with a 4'x5' tonnage opening in the aft bulkhead. As stated in GN 3, this tonnage opening may be omitted if an independent validation of the tonnage shows it is not necessary for the vessel to admeasure at less than 400 GRT. The tonnage calculations are provided in Section 6 and an admeasurement plan is included in Appendix A.

5 REFERENCES

- [1] 46 CFR §69 Measurement of Vessels, March, 2013.
- [2] United States Coast Guard, Tonnage Technical Policy, MTN 01-99 CH-9, January 17, 2017.
- [3] Elliott Bay Design Group, "Vessel 3D Structural Model," 18026-200-061-G, Rev. -, Seattle, WA, June, 2018.
- [4] Elliott Bay Design Group, "Profiles and Deck Arrangements," 18026-200-101-1, Rev. A, Seattle, WA, July 25, 2018.

6 CALCULATIONS

TONNAGE CALCULATIONS

Tonnage length:	182.25	Number of decks:	4
Number of divisions of length:	12.00	Number of Masts:	0
Common interval:	15.188	Stem:	Plumb
1/3 common interval:	5.063	Stern:	Plumb
Tonnage depth:	10.50	Material:	Steel
Number of divisions of depth:	4	Service:	Passenger
UNDER TONNAGE DECK VOLUME		TONNAGE	
Section Number	Simpson's Multiplier	Section Area Square Feet	Product
1	1	0.00	0.00
2	4	36.05	144.22
3	2	235.63	471.27
4	4	69.91	279.64
5	2	71.14	142.27
6	4	431.48	1725.93
7	2	434.90	869.80
8	4	431.48	1725.93
9	2	419.25	838.50
10	4	69.91	279.64
11	2	235.63	471.27
12	4	36.05	144.22
13	1	0.00	0.00
Total:			7092.68
1/3 common interval:			5.063
Under Deck Volume:			35906.69
Ballast Tank Volume:			6008.36
Under Deck Volume w/ Ballast Exemption:			29898.32
UNDER DECK TONNAGE AS MEASURED:		298.98	GROSS TONNAGE: 331.14

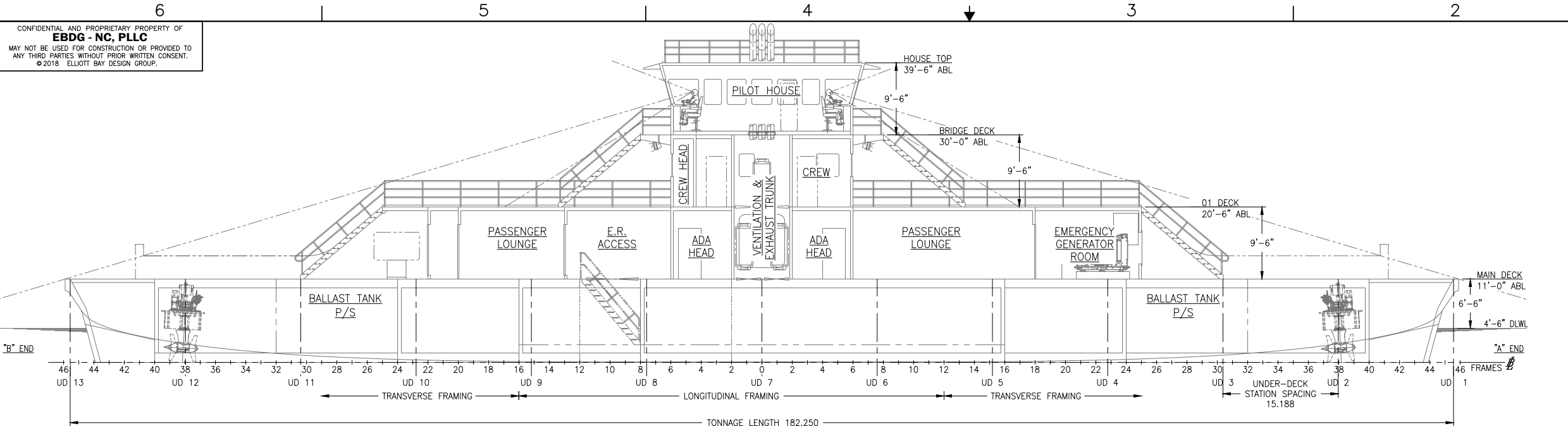
UNDER TONNAGE DECK BREADTHS AND PRODUCTS													
Section No: 1			Section No: 2			Section No: 3		Section No: 4		Section No: 5		Section No: 6	
Depth: 0.00			Depth: 5.41			Depth: 9.58		Depth: 9.58		Depth: 9.58		Depth: 10.50	
Interval: 0.00			Interval: 1.354			Interval: 2.396		Interval: 2.396		Interval: 2.396		Interval: 2.625	
Simpson's													
Multiplier	Breadth	Product	Breadth	Product	Breadth	Product	Breadth	Product	Breadth	Product	Breadth	Product	
1	0.00	0.00	35.92	35.92	40.53	40.53	43.54	43.54	45.08	45.08	45.33	45.33	
4	0.00	0.00	4.00	16.00	36.48	145.91	4.00	16.00	4.00	16.00	45.01	180.03	
2	0.00	0.00	4.00	8.00	34.05	68.11	4.00	8.00	4.00	8.00	44.22	88.45	
4	0.00	0.00	4.00	16.00	10.01	40.02	4.00	16.00	4.00	16.00	43.33	173.32	
1	0.00	0.00	4.00	4.00	0.50	0.50	4.00	4.00	4.00	4.00	6.00	6.00	
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Total:		0.0	79.9		295.1		87.5		89.1		493.1		
1/3 interval:		0.00	0.45		0.80		0.80		0.80		0.88		
Area in square feet:		0.0	36.1		235.6		69.9		71.1		431.5		
Section No: 7			Section No: 8			Section No: 9		Section No: 10		Section No: 11		Section No: 12	
Depth: 10.50			Depth: 10.50			Depth: 10.50		Depth: 9.58		Depth: 9.58		Depth: 5.41	
Interval: 2.625			Interval: 2.625			Interval: 2.625		Interval: 2.396		Interval: 2.396		Interval: 1.354	
Simpson's													
Multiplier	Breadth	Product	Breadth	Product	Breadth	Product	Breadth	Product	Breadth	Product	Breadth	Product	
1	45.33	45.33	45.33	45.33	45.08	45.08	43.54	43.54	40.53	40.53	35.92	35.92	
4	45.16	180.62	45.01	180.03	44.32	177.30	4.00	16.00	36.48	145.91	4.00	16.00	
2	44.64	89.29	44.22	88.45	42.86	85.73	4.00	8.00	34.05	68.11	4.00	8.00	
4	43.95	175.79	43.33	173.32	41.26	165.04	4.00	16.00	10.01	40.02	4.00	16.00	
1	6.00	6.00	6.00	6.00	6.00	6.00	4.00	4.00	0.50	0.50	4.00	4.00	
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Total:		497.0	493.1		479.1		87.5		295.1		79.9		
1/3 interval:		0.88	0.88		0.88		0.80		0.80		0.45		
Area in square feet:		434.9	431.5		419.2		69.9		235.6		36.1		
Section No: 13													
Depth: 0.00													
Interval: 0.00													
Simpson's													
Multiplier	Breadth	Product											
1	0.00	0.00											
4	0.00	0.00											
2	0.00	0.00											
4	0.00	0.00											
2	0.00	0.00											
4	0.00	0.00											
1	0.00	0.00											
Total:		0.00											
1/3 interval:		0.00											
Area in square feet:		0.00											
				L	W	H	V						
Deckhouse/Superstructures:													
Cleaning Gear Locker				4.00	4.00	9.50	152.0	Note: 1. The superstructure admeasurement exemptions: -Uptake trunks due to light and air -Crew and passenger space heads -E-Gen room as machinery room -Pilothouse -B-end passenger lounge					
A End Passenger Lounge				24.00	6.00	9.50	1368.0						
01 Deck Crew Space				24.00	10.00	9.50	2280.0						
01 Uptake (deduction)				8.00	4.00	9.50	-304.0						
01 Crew Head (deduction)							-280.18						
Total Volume							3215.8						
Total Gross Tons							32.16						

BALLAST TANK VOLUME		0.00
Tank Length		16.00
No of Divisions		2.000
Common interval:		8.000
1/3 common interval:		2.667
A	1	0.00
B	4	112.66
C	1	112.66
Total:		563.28
1/3 common interval:		2.667
Ballast Tank Volume:		1502.09

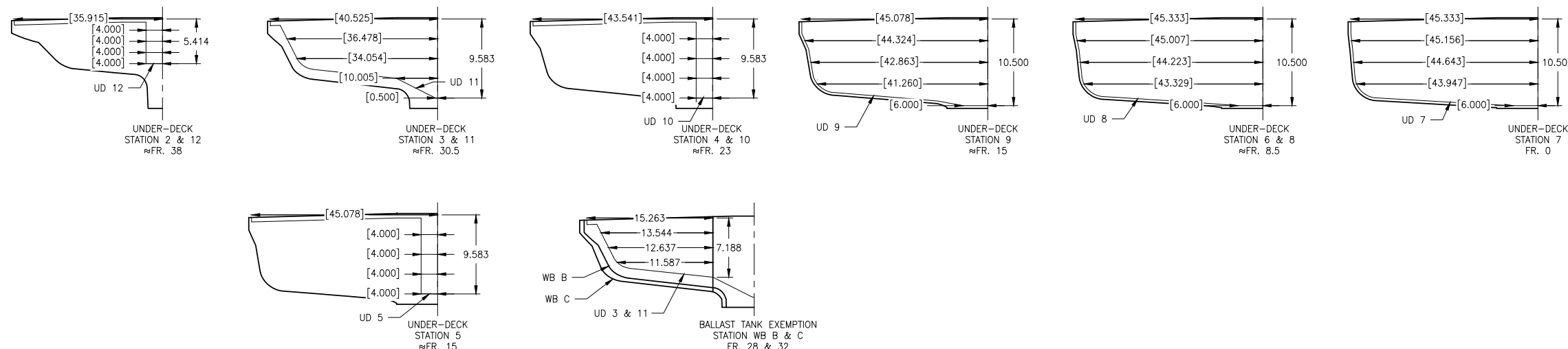
	Section A		Section B		Section C	
	Depth:	7.19	Depth:	7.19	Depth:	7.19
	Interval:	2.40	Interval:	2.40	Interval:	2.40
Simpson's Multiplier	Breadth	Product	Breadth	Product	Breadth	Product
1	0.00	0.00	15.26	15.26	15.26	15.26
4	0.00	0.00	13.54	54.18	13.54	54.18
2	0.00	0.00	12.64	25.27	12.64	25.27
4	0.00	0.00	11.59	46.35	11.59	46.35
1	0.00	0.00	0.00	0.00	0.00	0.00
Total:		0.00	141.06		141.06	
1/3 interval:		0.80	0.80		0.80	
Area in square feet:		0.00	112.66		112.66	

Appendix A

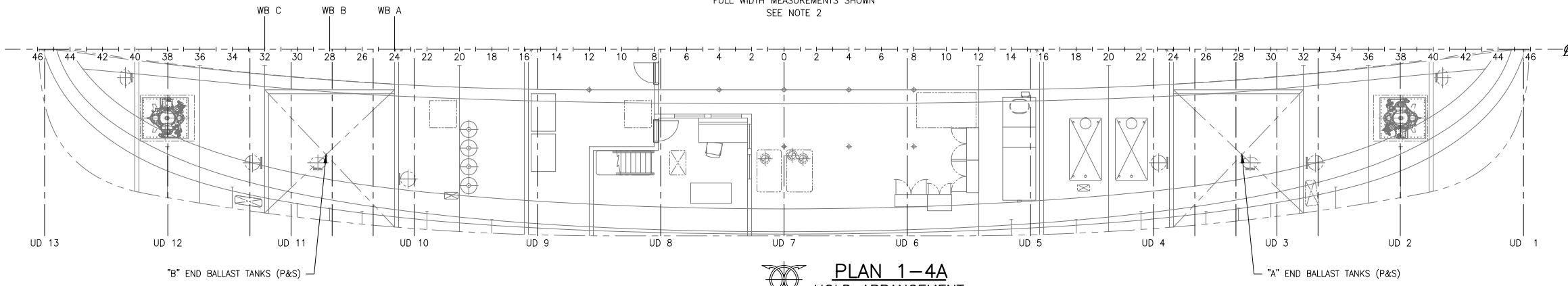
Tonnage Admeasurement Plan



ELEVATION 1-4C
INBOARD PROFILE



DETAIL 1-4B
UNDER-DECK STATIONS
FULL WIDTH MEASUREMENTS SHOWN
SEE NOTE 2



PLAN 1-4A
HOLD ARRANGEMENT

REVISION HISTORY

REV	ZONE	DESCRIPTION	DWN	DATE	APVD

GENERAL NOTES

- VESSEL SHALL ADMEASURE LESS THAN 400 GRT.
- DIMENSIONS IN DECIMAL FEET UNLESS INDICATED OTHERWISE. BREADTH DIMENSIONS IN BRACKETS [] INDICATE FULL BREADTH RATHER THAN HALF BREADTH.
- HULL VOLUMES COMPUTED ASSUMING TRANSVERSE ORDINARY FRAMES WITH THE EXCEPTION OF LONGITUDINAL ORDINARY FRAMING FROM FR 12/A TO FR 16/B.
- SUPERSTRUCTURE VOLUMES COMPUTED TO THE EXTENT OF BULKHEAD PLATE BOUNDARIES.
- ALL TONNAGE OPENINGS ARE 4'X5' MINIMUM.
- BALLAST TANK TONNAGE EXEMPTION IS TAKEN.
- MAIN DECK STIFFENERS ARE INTENDED TO PASS THROUGH TONNAGE FRAMES, THEREFORE THE UPPERMOST TONNAGE BREADTHS ARE TAKEN TO THE LINE OF ORDINARY FRAMES AT THE SHELL.
- WHERE THE VESSEL IS TRANSVERSELY FRAMED, BOTTOM SHELL STIFFENERS SHALL BE INTERCOSTAL. SEE REF 4.
- TONNAGE OPENING MAY BE OMITTED IF AN INDEPENDENT TONNAGE VALIDATION INDICATES IT IS NOT REQUIRED FOR THE VESSEL TO ADMEASURE LESS THAN 400 GRT.

REFERENCES

- 18026-200-832-1 TECHNICAL SPECIFICATION
- 18026-200-101-1 PROFILES AND DECK ARRANGEMENTS
- 18026-200-120-4 HULL TRANSVERSE FRAMES
- 18026-200-110-1 BOTTOM AND SIDE SHELL



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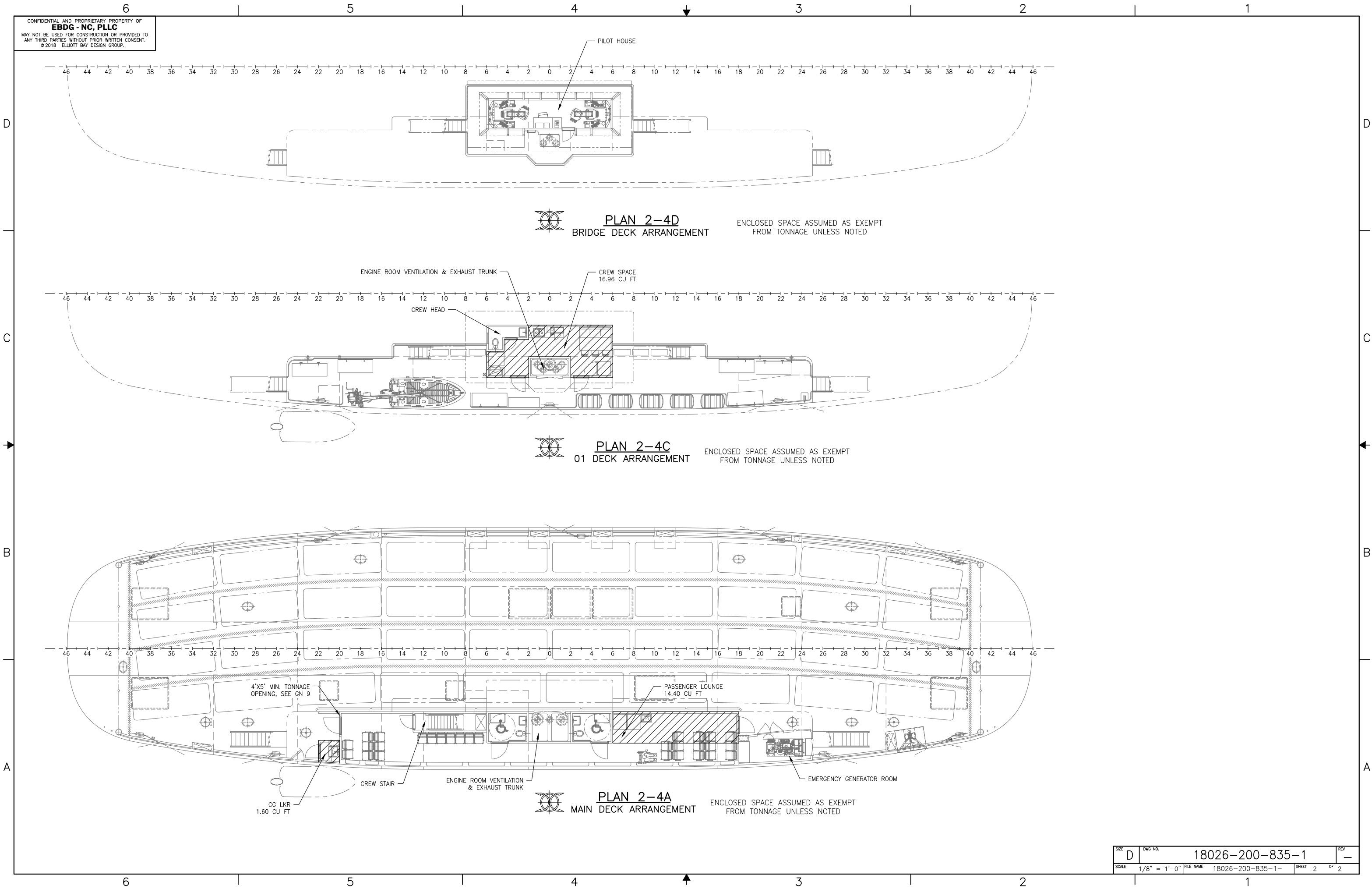
PROJECT: DOUBLE-ENDED AZIMUTH DRIVE FERRY

TONNAGE ASSESSMENT

SIZE	D	DWG NO.	18026-200-835-1	REV	-
SCALE	1/8" = 1'-0"	FILE NAME	18026-200-835-1-	SHEET	1 OF 2
DWN	JEH	MOD	KAJ	CHK	NJB
APVD	KAJ	APVD DATE	08/15/2018		

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SIZE	D	DWG NO.	18026-200-835-1	REV	-
SCALE	1/8" = 1'-0"	FILE NAME	18026-200-835-1-	SHEET	2 OF 2

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