

NEW RIVER CLASS FERRY

Tonnage Assessment

Prepared for: North Carolina DOT • Raleigh, NC

Ref: 16101-200-835-1

Rev. -

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PREPARED BY

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GENERAL NOTES

- 1. This report is not intended for regulatory submittal.

REVISIONS

| REV | DESCRIPTION | DATE | APPROVED |
|-----|---------------|--------|--------------|
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RESERVATION NOTES

Tonnage calculations are estimated based on the vessel as designed. Shipyard shall be responsible for final tonnage admeasurement.

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1 PURPOSE

This report details the anticipated tonnage admeasurement calculations for the subject vessel; the New River Class Ferry design for the North Carolina Department of Transportation. The subject vessel is a 183 feet 7 inch length by 46 feet beam by 11 feet depth passenger and vehicle ferry intended for service within the Outer Banks of North Carolina, and the associated rivers. The subject vessel is designed to carry a maximum of 40 cars and 300 passengers, and will be regulated under Subchapter H of Title 46 of the U.S. Code of Federal Regulations (CFR) [1].

For purposes of manning requirements, the vessel must have a Gross Regulatory Tonnage (GRT) admeasurement value of less than 400 tons. This report provides the approximate GRT measurement for the vessel design, and outlines the requirements used in calculating this value which must be followed for construction of the vessel.

2 PROCEDURE

2.1 Hull Methodology

The GRT value for the hull is calculated using the methodology outlined in 46 CFR Section 69 (Reference [1]), and as further described in United States Coast Guard's Marine Technical Note (MTN) 01-99, CH-9 (Reference [2]). Simpson's Rule is used to determine the volume within the hull structure by integration of the hull sectional areas.

Tonnage length is measured from the intersection of the inboard faces of the hull framing with the stem bar at each end of the vessel. Conservatively, this is assumed to be 5 inches aft of the extreme face of the stem bar at each end of the vessel, resulting in an assumed tonnage length of 182 feet 9 inches. Actual tonnage length may be slightly lower based on final construction.

Based on the tonnage length the hull is divided into 12 divisions. The hull Rhino model (Reference [3]) is used to take sections at each tonnage division location. The area at each section is calculated using Simpson's Rule; and because the depth is less than 16 feet, each section is divided into four parts.

2.2 Superstructure Tonnage

Tonnage volumes above main deck are conservatively calculated using the gross overall dimensions as shown in the vessel arrangements (Reference [3]), as opposed to using net dimensions accounting for stiffener thickness. The passenger spaces must be exempted from the tonnage volume via tonnage openings. Furthermore, the uptakes, EOS access, passenger heads, and the pilot house spaces are exempted from tonnage admeasurement as described in References [1] and [2]. All other spaces in the superstructure are included in the tonnage volume for the vessel, including the cleaning gear locker and crew space.

The crew space is calculated using the gross overall dimensions, which includes a portion of the uptakes that pass through this volume. Thus the volume of the uptakes in the crew space is subtracted out to correctly calculate the actual volume of the crew space.

3 GIVEN AND ASSUMED PARAMETERS

The hull is longitudinally framed within the engine room. Section areas within the engine room are measured to the hull longitudinal frames, 5 inches off the bottom shell and 4 inches off the side shell. Section depths are measured to the underside of the deck plating, including two-thirds of the deck camber. See Figure 1 on page 5 for a sample section as calculated within the engine room.

Outside of the engine room the hull is transversely framed on 48 inch centers, tonnage framing is employed to limit the open width within the structure of the hull to no more than five feet off centerline. Tonnage frames are located on each web frame, 8 feet apart, and half frames are located on the alternating 4 feet.

To ensure the tonnage framing is not 'penetrated by an intersecting frame', the longitudinal bottom and side shell framing within the tonnage framing must be intercostal to the tonnage frames and half frames, or be continuously welded so as to be fully tight at each intersection. Inboard of the tonnage framing the depth is measured to the top of the ordinary hull framing, 5 inches off the bottom shell. See Figure 2 on page 5 for a sample section as calculated for sections outside of the engine room.

The deck beams penetrate all transverse framing, but are not expected to be collared at each tonnage frame and half frame. Thus the topmost portion of each tonnage frame is considered ineffective from the longitudinal girder cutouts upward; and the full breadth out to the deck brackets is used at the topmost interval for all sections outside of the engine room.

4 CONCLUSIONS

The estimated GRT value for the vessel is approximately 360 tons, which meets the required goal of under 400 tons. There is some margin for adjustment, but it shall be the responsibility of the shipyard to ensure the final tonnage admeasurement value remains under 400 tons.

5 REFERENCES

- [1] U.S. Government Publishing Office, Code of Federal Regulations; Title 46 - Shipping, Subchapter H, October 1, 2015.
- [2] United States Coast Guard, "Tonnage Technical Policy," MTN 01-99, CH-9, January 17, 2017.
- [3] Elliott Bay Design Group, *Hullform Model*, 16101-200-100-0, Rev. -, July 19, 2017.
- [4] Elliott Bay Design Group, *Profiles and Deck Arrangements*, 16101-200-101-1, Rev. -, July 28, 2017.

6 CALCULATIONS

TONNAGE CALCULATIONS

| | | | |
|---|----------------------|--------------------------|-----------------------|
| Tonnage length: | 182.75 | Number of decks: | 2 |
| Number of divisions of length: | 12.00 | Number of Masts: | 0 |
| Common interval: | 15.229 | Stem | Plumb |
| 1/3 common interval: | 5.076 | Stern: | Plumb |
| Tonnage depth: | 8.96 | 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 | 81.56 | 326.25 |
| 3 | 2 | 94.68 | 189.37 |
| 4 | 4 | 112.09 | 448.35 |
| 5 | 2 | 127.40 | 254.80 |
| 6 | 4 | 421.35 | 1685.41 |
| 7 | 2 | 425.12 | 850.23 |
| 8 | 4 | 421.35 | 1685.41 |
| 9 | 2 | 127.40 | 254.80 |
| 10 | 4 | 112.09 | 448.35 |
| 11 | 2 | 94.68 | 189.37 |
| 12 | 4 | 81.56 | 326.25 |
| 13 | 1 | 0.00 | 0.00 |
| Total: | | | 6658.57 |
| 1/3 common interval: | | | 5.076 |
| Under Deck Volume: | | | 33801.48 |
| Ballast Tank Volume: | | | 0.00 |
| Under Deck Volume w/ Ballast Exemption: | | | 33801.48 |
| UNDER DECK TONNAGE AS MEASURED: | | 338.01 | GROSS TONNAGE: 359.37 |

| 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: 6.80 | | Depth: 7.68 | | Depth: 8.85 | | Depth: 9.93 | | Depth: 10.40 | | |
| Interval: 0.00 | | | Interval: 1.699 | | Interval: 1.919 | | Interval: 2.212 | | Interval: 2.482 | | Interval: 2.599 | | |
| Simpson's | Breadth | Product | Breadth | Product | Breadth | Product | Breadth | Product | Breadth | Product | Breadth | Product | |
| Multiplier | | | | | | | | | | | | | |
| 1 | 0.00 | 0.00 | 34.00 | 34.00 | 38.00 | 38.00 | 42.00 | 42.00 | 44.00 | 44.00 | 45.33 | 45.33 | |
| 4 | 0.00 | 0.00 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | 45.03 | 180.10 | |
| 2 | 0.00 | 0.00 | 10.00 | 20.00 | 10.00 | 20.00 | 10.00 | 20.00 | 10.00 | 20.00 | 44.08 | 88.16 | |
| 4 | 0.00 | 0.00 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | 40.74 | 162.96 | |
| 1 | 0.00 | 0.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 9.82 | 9.82 | |
| 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 | 144.0 | 148.0 | 152.0 | 154.0 | 486.4 | | | | | | |
| 1/3 interval: | | 0.00 | 0.57 | 0.64 | 0.74 | 0.83 | 0.87 | | | | | | |
| Area in square feet: | | 0.0 | 81.6 | 94.7 | 112.1 | 127.4 | 421.4 | | | | | | |
| Section No: 7 | | | Section No: 8 | | Section No: 9 | | Section No: 10 | | Section No: 11 | | Section No: 12 | | |
| Depth: 10.42 | | | Depth: 10.40 | | Depth: 9.93 | | Depth: 8.85 | | Depth: 7.68 | | Depth: 6.80 | | |
| Interval: 2.605 | | | Interval: 2.599 | | Interval: 2.482 | | Interval: 2.212 | | Interval: 1.919 | | Interval: 1.699 | | |
| Simpson's | Breadth | Product | Breadth | Product | Breadth | Product | Breadth | Product | Breadth | Product | Breadth | Product | |
| Multiplier | | | | | | | | | | | | | |
| 1 | 45.33 | 45.33 | 45.33 | 45.33 | 44.00 | 44.00 | 42.00 | 42.00 | 38.00 | 38.00 | 34.00 | 34.00 | |
| 4 | 45.13 | 180.50 | 45.03 | 180.10 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | |
| 2 | 44.57 | 89.14 | 44.08 | 88.16 | 10.00 | 20.00 | 10.00 | 20.00 | 10.00 | 20.00 | 10.00 | 20.00 | |
| 4 | 41.18 | 164.71 | 40.74 | 162.96 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | |
| 1 | 9.81 | 9.81 | 9.82 | 9.82 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | |
| 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: | | 489.5 | 486.4 | 154.0 | 152.0 | 148.0 | 144.0 | | | | | | |
| 1/3 interval: | | 0.87 | 0.87 | 0.83 | 0.74 | 0.64 | 0.57 | | | | | | |
| Area in square feet: | | 425.1 | 421.4 | 127.4 | 112.1 | 94.7 | 81.6 | | | | | | |
| Deckhouse/Superstructures: | | | L | W | H | V | | | | | | | |
| Cleaning Gear Locker | | | 4.00 | 4.00 | 10.00 | 160.0 | <u>Note:</u> | | | | | | |
| 01 Deck Crew Space | | | 24.00 | 10.00 | 9.50 | 2280.0 | 1. The superstructure admeasurement assumes: | | | | | | |
| Uptake (deduction) | | | 8.00 | 4.00 | 9.50 | -304.0 | -Tonnage openings in passenger space | | | | | | |
| | | | | | | | -Uptake trunks, HVAC spaces and wheelhouse exempt. | | | | | | |
| Total Volume | | | | | | | 2136.0 | | | | | | |
| Total Gross Tons | | | | | | | 21.36 | | | | | | |

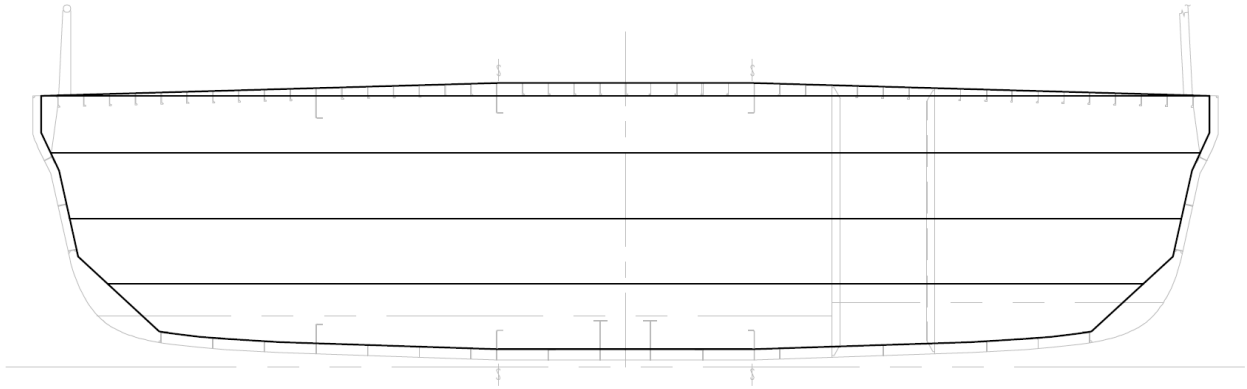


Figure 1 – Typical Engine Room Tonnage Section (not to scale)

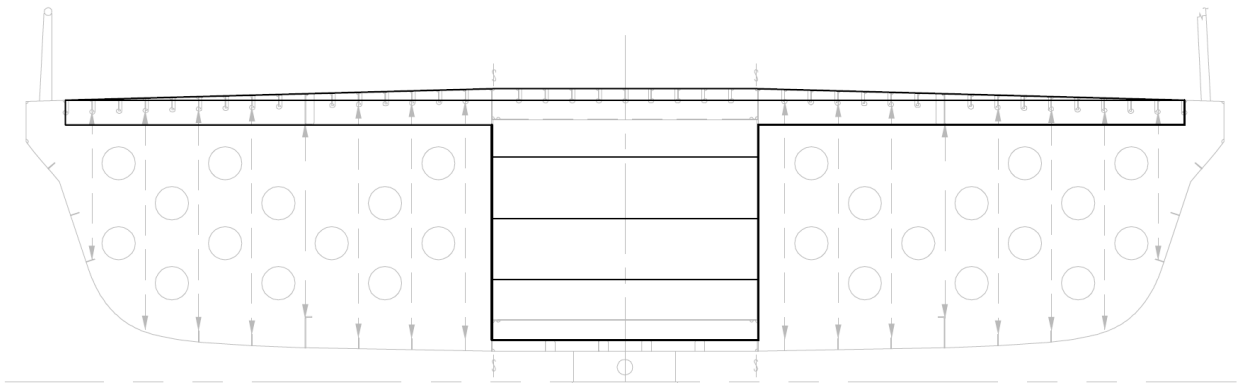


Figure 2 – Outside Engine Room Tonnage Section (not to scale)