# Appendix I
# Navigation Study Memorandum

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ANCHOR QEA

# Memorandum

October 16, 2020

To: Chris Miller, City of Newport Beach

From: Fred Massabki, PE, and Adam Gale, Anchor QEA, LLC

**Re: Navigation Study for the Proposed West Anchorage in the Turning Basin - Update**

The Newport Harbor Main Navigation Channel stretches from the Entrance Channel at the jetty to the Turning Basin adjacent to the Newport Boulevard bridge between Lido Village and Mariners' Mile. The 200-foot-wide Main Navigation Channel and Turning Basin are maintained at a depth of -20 feet mean lower low water (MLLW, Epoch 83-01). Large vessels up to 250 feet in length with up to 40-foot beams and up to 14-foot drafts—such as the 216-foot-long *M/V Invictus* with a 13-foot draft and 40-foot beam—may safely navigate the Main Navigation Channel and turn around at the Turning Basin. In addition, charter vessels in the 100 to 140-foot range are also currently berthed in the Turning Basin area and rely on this area for navigation as do the multitude of other vessels in the harbor.

The purpose of this study is to demonstrate that the Main Navigation Channel provides sufficient room for vessel navigation for boats of all sizes. In addition, with the proposed west anchorage in place, there is sufficient room for vessel turnaround while maintaining safe back-up distance from all surrounding existing docks and berthed vessels.

## Design Criteria

The following design parameters were used to perform calculations provided in the next section:

**Newport Harbor Main Navigation Channel**

$Width, W_{Channel} = 200\ feet$
$Depth, D_{Channel} = -20\ feet\ mean\ lower\ low\ water\ (MLLW, Epoch\ 83-01)$

**Largest Berthed Design Vessel**
Based on Hornblower and Electra event cruise vessels berthed at Lido Village and Mariners' Mile marinas

$Length, L_{OA,Berthed} = 140\ feet$
$Beam, B_{Berthed} = 33\ feet$
$Draft, d_{Berthed} = 8\ feet$

**Maximum Design Vessel**
Visiting vessel to use proposed mooring field

$Length, L_{OA,Max} = 250\ feet$
$Beam, B_{Max} = 40\ feet$
$Draft, d_{Max} = 14\ feet$

**M/V Invictus**

$Length, L_{OA,Invictus} = 216\ feet$
$Beam, B_{Invictus} = 40\ feet$
$Draft, d_{Invictus} = 13\ feet$

# Design Calculations

## Channel Width

Section 4-2.2 of UFC-4-152-07 states that the minimum channel width for two-way traffic should be 100 feet or $5B_{Max}$, whichever is greater. *M/V Invictus* has a beam of 40 feet, which means the navigation channel is equal to $5B_{Invictus}$ or 200 feet wide. The Main Navigation Channel meets this criterion. The 200-foot channel width limits the size of vessels within the harbor. Based on mega yacht design (as needed for *M/V Invictus*), 250 feet is the theoretical length limit of vessels with beams ($B_{Max} = 40\ feet$) that conform to the channel width design criterion.

Based on the American Society of Civil Engineers' Planning and Design Guidelines for Small Craft Harbors (ASCE 2012; herein USACE MOP 50) and PIANC's Harbour Approach Channels Design Guidelines (PIANC 2014; herein MarCom 212), navigation lanes within Newport Harbor should be $1.5B_{Berthed}$. More than 4,000 vessels are berthed within Newport Harbor, with the largest vessel (an

event cruise boat) having a beam of 33 feet ($B_{Berthed}$). Using the ASCE MOP 50 and MarCom 121 design criteria, the channel width calculation is provided below.

$$Lane\ Width, W_{Lane} = 1.5B_{Berthed} = 1.5(33) = 50\ feet$$

Therefore, a 50-foot-wide lane is required to accommodate the largest vessel permanently berthed in Newport Harbor. This 50-foot lane width results in ten lanes at the 500-foot-wide Entrance Channel and four lanes at the 200-foot-wide Main Navigation Channel.

## Vessel Traffic

The 500-foot-wide, 20-foot-deep Entrance Channel splits at Peninsula Point, at a navigational feature known as the Corona del Mar Bend, into the 200-foot-wide, 10-foot-deep Balboa Island Channel and the 200-foot-wide, 20-foot-deep Main Navigation Channel, which extends to the Turning Basin at the Newport Boulevard bridge. Most of the more than 4,000 vessels berthed in Newport Harbor will use the Main Navigation Channel to access berths and mooring fields. If the 200-foot-wide Main Navigation Channel is of sufficient width to serve more than 2,500 vessels along its entire length, then it should be of sufficient width to serve the more than 700 vessels along Mariners' Mile, Lido Isle, and West Newport including the Balboa Coves. Furthermore, using an average vessel length, $L_{average} = 35\ feet$ and four boat lengths between vessels, 120 vessels can use the Main Navigation Channel between Mariners' Mile and Lido Isle, which is approximately 15% of the total number of vessels berthed in this area. This percentage is high even for a summer weekend. The vessel traffic calculation is provided below.

$$L_{Average} = 35\ feet$$

$$L_{Spacing} = 4L_{Average} = 140\ feet$$

$$L_{Total} = L_{Average} + L_{Spacing} = 175\ feet$$

$$L_{Channel} = 5{,}280\ feet, No.\ of\ Lanes = 4$$

$$L_{Channel,Total} = 4 \times 5{,}280\ feet = 21{,}120\ feet$$

$$Vessels = \frac{21{,}120\ feet}{175\ feet'} = 120$$

Although the 20-foot-deep Main Navigation Channel is 200 feet wide with four 50-foot-wide design lanes, the channel between Mariners' Mile and Lido Isle, known as the Lido Isle Reach, is *600 feet wide between pierhead lines*. Therefore, shallower draft vessels, particularly the Duffy electric boats and most of the power boats in Newport Harbor, can make full use of the channel, which is critical when a wide-beam vessel, including event cruise vessels, require a navigation lane 45 to 60 feet wide.

### Turning Basin

According to ASCE MOP 50, different turning circle design guidelines are used depending on whether a vessel has bow thrusters or not. For vessels without bow thrusters, the diameter of a turning circle should be $3.5L_{OA}$. For vessels with bow thrusters, the turning circle diameter can be reduced to a minimum size of $1.3L_{OA}$, with a preferable diameter of $2L_{OA}$. Most mega yachts, which are typically defined as vessels with lengths 100 feet or more, have bow thrusters. However, for these calculations, vessels permanently berthed in Newport Harbor are assumed to not have bow thrusters, while visiting large vessels are assumed have bow thrusters. The turning circle diameter is calculated below using both equations to determine the greater dimension.

$$Turning\ Circle\ Diameter, \emptyset_{TC,1} = 3.5L_{OA,Berthed} = 3.5\ \times 140 = 490\ feet$$

$$Turning\ Circle\ Diameter, \emptyset_{TC,2} = 2L_{OA,Max} = 2\ \times 250 = 500\ feet$$

Based on these calculations, a turning circle diameter of 500 feet should be used and can accommodate vessels with bow thrusters up to 250 feet in length and vessels without bow thrusters up to 140 feet in length.

## Conclusion

As demonstrated in the references and equations provided, the existing Turning Basin in Newport Harbor can accommodate the proposed west anchorage shown in Figure 1 and provide a 500-foot-diameter turning circle. Furthermore, creation of the proposed west anchorage would not impact vessel navigation in Newport Harbor, particularly the Main Navigation Channel.

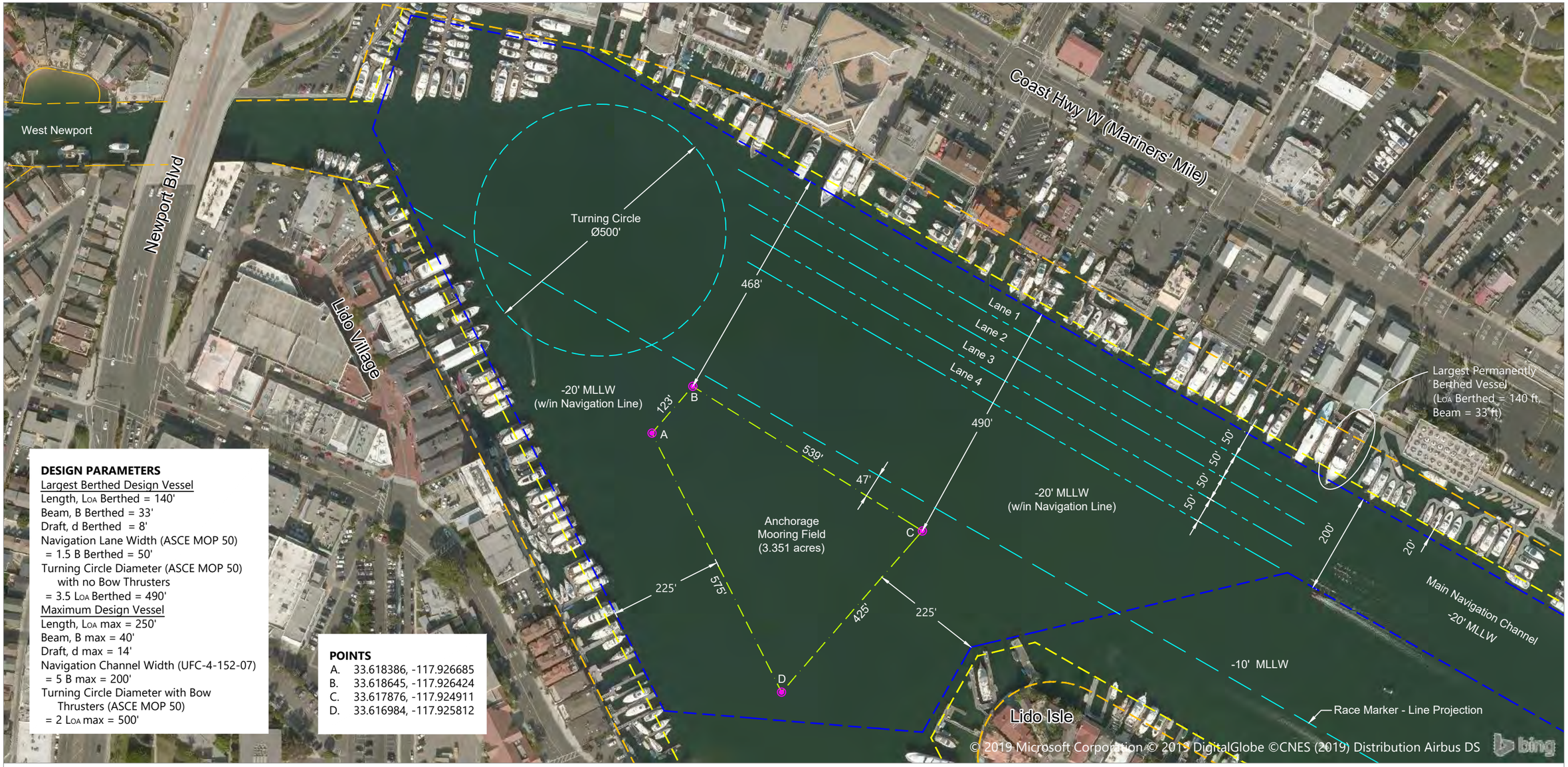
## References

ASCE (American Society of Civil Engineers), 2012. *Planning and Design Guidelines for Small Craft Harbors*. ASCE Manuals and Reports on Engineering Practice No. 50.

PIANC, 2014. *Harbour Approach Channels Design Guidelines.* PIANC Maritime Navigation Commission Report No. 121.

USDOD (U.S. Department of Defense), 2012. *Unified Facilities Criteria for Design: Small Craft Berthing Facilities*. UFC-4-152-07. September 2012.

# Figure




**DESIGN PARAMETERS**
Largest Berthed Design Vessel
Length, LOA Berthed = 140'
Beam, B Berthed = 33'
Draft, d Berthed = 8'
Navigation Lane Width (ASCE MOP 50)
= 1.5 B Berthed = 50'
Turning Circle Diameter (ASCE MOP 50)
with no Bow Thrusters
= 3.5 LOA Berthed = 490'
Maximum Design Vessel
Length, LOA max = 250'
Beam, B max = 40'
Draft, d max = 14'
Navigation Channel Width (UFC-4-152-07)
= 5 B max = 200'
Turning Circle Diameter with Bow
Thrusters (ASCE MOP 50)
= 2 LOA max = 500'

**POINTS**

| | |
|---|---|
| A. | 33.618386, -117.926685 |
| B. | 33.618645, -117.926424 |
| C. | 33.617876, -117.924911 |
| D. | 33.616984, -117.925812 |

**SOURCE:** Aerial map by Bing. Pierhead, bulkhead, and navigational lines from City of Newport Beach Data Catalog.
**HORIZONTAL DATUM:** California State Plane, Zone VI, NAD83, U.S. Feet.
**VERTICAL DATUM:** Mean Lower Low Water (MLLW) (83-01).

**LEGEND:**
- Bulkhead Line
- Pierhead Line
- Navigation Line

**ABBREVIATIONS:**

| | |
|---|---|
| ASCE MOP 50 | ASCE Manual of Practice 50: Planning and Guidelines for Small Craft Harbors |
| UFC-4-152-07 | United Facilities Criteria for Design: Small Craft Berthing Facilities |

0 200
Feet

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**Figure 1**
**Newport Harbor Turning Basin Anchorage Pilot Study**