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DRAFT

MEMORANDUM

To:	**Roy Bruce - Lochner**
Cc:	**John Dorney – M&N**
From:	**Jeff Shelden – M&N**
Date:	**July 26, 2019**
Subject:	**Mid-Currituck Bridge – Sea Level Rise**
M&N Job No:	**10555**

Moffatt & Nichol's *Mid-Currituck Bridge Coastal Engineering Design Criteria Report* dated July 31, 2009 made the following recommendation regarding sea level rise and the low-chord elevation for the bridge.

"The recommended low-chord elevation for the proposed Mid-Currituck Bridge is +16 feet-NAVD. This is based on a maximum modeled wave crest elevation of +12.4 feet-NAVD; plus 1.6 feet of projected sea-level rise during the lifespan of the bridge; plus 1.0 feet of clearance as recommended by the AASHTO specifications; plus another 1.0 feet to account for uncertainties of regional land subsidence, additional contributions from polar ice melt, and potential increased storminess."

This recommendation assumed that the bridge would be constructed by 2013 and have a 75-year lifespan. Hence, these sea level rise projections were to the year 2088.

The North Carolina Coastal Resources Commission (CRC) Science Panel prepared the *North Carolina Sea Level Rise Assessment Report (2015 Update to the 2010 Report and 2012 Addendum)* dated March 31, 2015. It presented three relative sea level rise scenarios by 2045 using published tide gauge rates and IPCC (Intergovernmental Panel on Climate Change) scenario projections RCP (Representative Concentration Pathway) 2.6 and RCP 8.5 representing the lowest and highest greenhouse gas emission scenarios, combined with local vertical land movement at each gauge. However, no projections beyond 2045 were provide in the report. Since the bridge is now assumed to be completed by 2026 and having a 75-year lifespan, sea level rise projections for the year 2101 are necessary.

The CRC report was based on global mean sea level rise projections presented in the IPCC's *Climate Change 2013: The Physical Science Basis* report which does present projections for global sea level rise to the year 2100. For the RCP 2.6 and RCP 8.5 scenarios, it estimates a rise of 17.3 inches and 29.1 inches, respectively (relative to the 1986-2005 average). Per the CRC report, a local vertical land movement trend of 1.49mm/yr (0.059 in/yr) is recommended for the north part of the state. Combing these values results in potential relative sea level rises by the year 2101 of 23.5 inches and 35.3 inches respectively for the RCP 2.6 and RCP 8.5 scenarios.

These values, in effect, bracket the original recommendation of 1.6 ft plus 1.0 ft, or 2.6 feet (31.2 inches). Thus, given the additional 1.0 feet of freeboard that was originally assumed at the end of the bridge's lifespan, we do not propose any changes to our original recommendation based on the CRC and IPCC reports.

In addition, the US Federal Highway Administration (FHWA) publication, *HEC 25 Highways in the Coastal Environment: Assessing Extreme Events,* references the use of the U.S Army Corps of Engineers Sea Level Change Curve Calculator. Use of this calculator results in USACE Low, Intermediate and High projections of 0.97 ft (11.6 inches), 2.01 ft (24.1 inches) and 5.29 ft (63.5 inches) respectively. Again, these values in effect bracket the original recommendation of 1.6 ft plus 1.0 ft, or 2.6 feet (31.2 inches). Thus, given the additional 1.0 feet of freeboard that was originally assumed at the end of the bridge's lifespan, we do not propose any changes to our original recommendation based on the USACE projections.

Finally, the most recent Flood Insurance Study for Currituck County dated 12/21/18 was reviewed and it did not contain any substantial differences for the storm surge elevations used previously to determine the wave crest elevation. Therefore, the originally recommended low chord elevation of +16 ft-NAVD remains as our recommendation.