Virginia Coastal Zone Management Program Semi-Annual Success Story ("Section C")

Determining 1ˢᵗ Floor Elevations for Coastal Hazards Planning

THE PROBLEM:

Coastal Virginia continues to experience flooding from both periodic storm events and more common "sunny day flooding." Relatively good data exist on where flooding occurs in Virginia's Coastal Zone, but it is more difficult to determine the potential impact of flooding in these areas because of limited data on the 1ˢᵗ floor elevations of buildings. This lack of data makes it difficult for localities to effectively plan to address coastal hazards, coordinate emergency responses to flood events, and implement resilience-building projects.

Vulnerability assessments can provide critical insights to inform local flood mitigation efforts. A key data set for assessing structural flood vulnerability is building finished first floor elevation (FFE). By comparing building FFEs to anticipated flood water levels, the depth of water within a structure can be determined and converted into dollar losses. In Virginia, however, there was no broadly accepted methodology for conducting such an assessment or good information on the data needs and availability. In the Hampton Roads region for example, elevation certificates are the primary source of FFE data but these certificates are only available for approximately 7% of residential structures in the Special Flood Hazard Area (SFHA).

THE FIX:

Feedback from Virginia Coastal Zone Management Program partners identified this challenge as a priority for the Program to address through its coastal resilience initiatives. The Hampton Roads Planning District Commission (HRPDC) submitted a proposal for a pilot project to evaluate methods of determining building elevations in a cost-effective manner. The Virginia Coastal Policy Team agreed that this was the best approach and recommended funding through the Virginia CZM Program's Resilience Focal Area initiative.
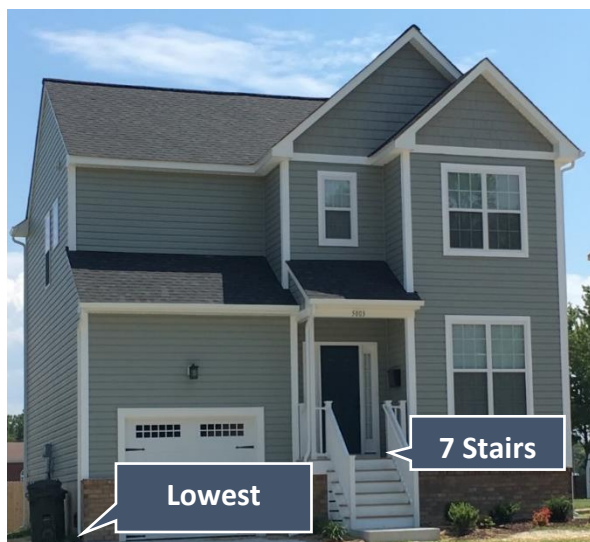
During the first phase of the Hampton Roads regional FFE data initiative, digital elevation certificates were collected from local governments to develop a geospatial database of elevation certificate data. This database provides FFE measurements in a format that can readily be applied in flooding vulnerability assessments and spatial analysis. To estimate FFE for structures without elevation certificates, a predictive modeling approach was piloted in Chesapeake, Hampton, and York County. The models for each pilot community used building attributes, including foundation type and year built, and land elevation data to inform first floor height (FFE – lowest adjacent grade) predictions for residential structures in each community's SFHA, or the 1% annual chance floodplain. The first floor height (FFH) estimates were then applied in a flooding vulnerability assessment, which identified that changing FFH by less than a foot can increase or decrease flood damage estimates by hundreds of structures and millions of dollars.
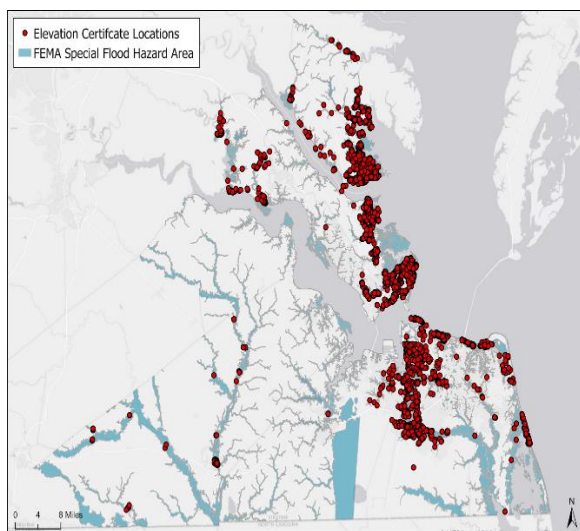
The HRPDC built upon this modeling approach and vulnerability assessments in the three pilot communities to produce the regional scale analysis. The primary objectives included: (1) updating and expanding the online elevation certificate spatial database to include additional Hampton Roads localities, (2) developing a regional FFE database for single-family, residential structures that includes elevation certificate data, model predictions, and alternative FFE estimation methods, (3) applying the regional FFE database in a flooding vulnerability assessment that accounts for sea level rise, and (4) synthesizing results from the multi-year effort to inform recommended data management and data development methods.

The elevation certificate inventory now includes approximately 4,000 elevation certificates from 12 Hampton Roads localities. To develop FFH estimates for structures without an existing value in the SFHA, a suite of estimation methods was applied in the following order of preference: (1) predictive model estimates, (2) stair counting, and (3) Hazus default estimates. Newport News, Norfolk, and Virginia Beach had additional data sources available respectively from Old Dominion University, the U.S. Army Corp of Engineers, and Dewberry. The regional FFH database is focused on single-family residential structures and contains nearly 34,000 buildings from thirteen different Hampton Roads localities. Attributes required for the flooding vulnerability assessment were also recorded in the database, including building area, number of stories, foundation type, and estimated replacement cost.

The FFH estimates developed for the single-family residential structures within the SFHA were used in the following flooding scenarios: (1) 1% annual chance flood, (2) 1.5ft of sea level rise plus the 1%

annual chance flood, (3) 3ft of sea level rise plus the 1% annual chance flood. In agreement with the conclusions of the pilot community vulnerability assessment results, the regional scale vulnerability analysis supports that building damage estimates are highly sensitive to the FFH input. Under the sea level rise scenarios, the estimated building losses increased with sea level rise for all localities. When accounting for 1.5ft of sea level rise, the overall estimated damages increased by more than double, and with 3ft of sea level rise, the total estimated damages were nearly six times the initial baseline damage estimate.

THE IMPACT:

The lessons learned through the regional FFE effort served as a resource for the Hampton Roads Hazard Mitigation Plan update, which is expected to be completed by April 2022. The regional FFE database is designed to be adaptive and continued research and coordination across the Hampton Roads region to improve FFE data will support regional coastal resiliency planning efforts. It is also designed to be a potential model for vulnerability assessment for the remainder of Virginia's coastal zone.

By helping coastal localities better assess their ability to deal with increased flooding and the other challenges of climate change, the Virginia CZM Program is hoping to identify the key steps necessary to build community resilience.

The project provided some important insights into approaches for organizing and applying elevation certificate data and developing FFE estimates**.** The final report recommends that localities maintain digital copies of elevation certificates and host this information on their local websites or GIS portals to support earning credit in the National Flood Insurance Program's Community Rating System (CRS). It also recommends developing a streamlined approach of collecting elevation certificates and joining them to structure locations in GIS at the regional or state-level for long-term database management.

The report recommends that when developing FFE inventories, existing survey data and building attribute data should be evaluated in addition to elevation certificates. The HRPDC regional structure inventory included a combination of various methodologies such as predictive statistical modeling and imagery-based stair counting. When determining what FFE estimation approaches may be suitable, tradeoffs between time, cost, required level of expertise, and data availability for each methodology should be considered.

MORE INFORMATION:

The report is available online at the HRPDC's website: https://www.hrpdcva.gov

PARTNERS:

This initiative was undertaken by the Hampton Roads Planning District Commission with funding support from the Virginia Coastal Zone Management Program. The Program works with its network of agency and locality partners to identify coastal hazards priorities and to provide funding for these projects. In addition to the Hampton Roads Planning District Commission, the seven other regional planning district commissions provide a key link between the Virginia CZM Program and its local government partners in addressing coastal resilience issues and may be able to use the methodology developed by the HRPDC.

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