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EBEI-8: Building Code Revisions and Infrastructure Design Standards

Option Description

This option involves strengthening existing building codes and construction techniques for new infrastructure and structures in vulnerable coastal areas. This will involve evaluating existing codes and design standards with respect to their proven effectiveness in past storm events, identifying causes of failure, and implementing changes to codes to improve performance in the future. In addition to past performance, codes and standards should be reviewed and strengthened by taking into account future increased hazards caused by sea level rise and the associated possible increase in storm frequency and intensity caused by climate change. All types of development (residential, commercial, institutional, etc.), as well as public infrastructure such as roads and bridges, should be analyzed. Standards for marine-related structures such as piers and wharves should be included in this review.

In addition to the overall evaluation and strengthening of codes, the entire development process must begin to recognize the potential impacts of sea level rise and climate change. Design professionals must look for ways to reduce future impacts, and local governments must increase plan review, inspection and enforcement efforts.

This effort is ongoing at several levels. FEMA regularly publishes a “Summary Report on Building Performance” after major natural disasters (such as Hurricane Andrew and Hurricane Katrina). These reports study the damage resulting from the event, identify areas of strength and weakness in building design and construction, and recommend improvements. The International Code Council also studies code effectiveness and regularly makes improvements to its codes. It is imperative that these reviews begin to consider the effects of climate change and sea levels rise on the long-term sustainability of structures and infrastructure.

Option Design

Targets: All construction-related codes and design standards should be evaluated for their effectiveness in protecting against the future effects of climate change and sea level rise. This will include the following issues:

- ❑ Elevation of buildings – FEMA and local governments should mandate freeboard for all construction in coastal flood hazard zones. Freeboard is an elevation above a design high water level (base flood elevation). For example, the bottom of the lowest horizontal structural member should be elevated a minimum of two feet (or more) above the base flood elevation. This is especially pertinent with regard to sea level rise, since base flood elevations

will be higher in the future. The required freeboard should relate to the amount of sea level rise expected, potential wave height, and the expected life of the structure. Experience from Hurricane Katrina shows that building elevation is the most effective deterrent to flood damage.

- ❑ Foundation design – Certain types of foundations are more effective in flood situations than others. Deep pile or column foundations are desired if significant erosion is possible in oceanfront locations as well as bay locations where the following conditions exist: erodibility of the soil; exposure to “damaging” waves (greater than 1.5 feet high); potential for velocity flow; potential for flood borne debris; and required resistance to wind forces. These locations include FEMA identified V-zones as well as A-zones
- ❑ Long-duration flood impacts – Long-duration flooding, which may be a result of sea level rise in the future, can cause extensive damage to interior contents and building materials. Moisture entrapment within walls and floors can impact structural integrity as well as cause biological and chemical contamination. Elevation will avoid this problem, as will the use of flood resistant building materials above the minimum elevation
- ❑ Debris impact – Substantial damage can be caused by floating or wind-driven debris in a flood or storm event. Current codes and construction standards should be evaluated with regard to debris resistance
- ❑ Building envelope – Building envelope is the entire exterior surface of a building, including walls, windows, doors and roofs. All parts of the building envelope must provide protection from wind, wind pressure, and windborne debris. Building codes are very specific regarding these issues, but they should continually be reviewed and improved as needed
- ❑ Design of future public projects, including roads, bridges, tunnels, landfills, water and wastewater treatment plants, etc., should consider the effects of climate change and sea level rise. In addition, standards should be developed for the modification of existing facilities in response to sea level rise
- ❑ Abandoned facilities – Provisions should be made to minimize the negative impacts of structures and facilities that may be abandoned due to sea level rise. Such impacts may include navigational and environmental hazards

Timing: This is primarily an ongoing effort. Codes are currently in place, and should be implemented and enforced by everyone involved in the design and construction process. FEMA and the code agencies continually evaluate the effectiveness of the code requirements, especially after a major event such as a hurricane or flood. These events provide essential information regarding the performance of code complaint structures and reveal areas in need of improvement. Training of enforcement personnel should also be an ongoing effort. Codes and design standards should be reviewed periodically in light of new science and evidence of climate change and sea level rise.

Parties involved: All parties involved in the design and construction process should be involved in this effort, including for example the International Code Council, design professionals such as architects and engineers, building materials manufacturers, building trade associations, the Federal government (FEMA, National Weather Service, NOHH, Corps of Engineers), state government (MEMA, DOE, DNR), and local governments. Property owners

also need to be aware of potential hazards and know how to evaluate the strengths and weaknesses of their properties.

Other: NA

Implementation Mechanisms

Implementation of this option will initially involve an evaluation of existing codes and regulations with specific regard to the threats associated with climate change and sea level rise. To account for the expected lifespan of newly constructed buildings, this will involve looking many decades into the future and trying to predict these impacts. If deficiencies are found, changes to codes, regulations and laws will be necessary. Enforcement of these codes is usually the responsibility of local governments; funding assistance is needed to ensure that an adequate number of trained code officials and inspectors are available.

Related Policies/Programs in Place

Codes are currently in place to regulate construction. The International Building Code is the primary building code. FEMA's flood insurance program is the primary source of flood protection regulations. State and local governments often compliment these general programs with more site-specific regulations.

Estimation of Adaptation Benefits and Costs

Implementing a program for strengthening existing building codes and construction techniques for new infrastructure and structures in vulnerable areas will be subject to a variety of costs and produce distinct benefits. As noted above, this option is focused on the evaluation of existing codes and standards for their effectiveness in protecting against the future effects of climate change and sea level rise. The types of costs considered here are incremental to those that have already been incurred to develop and maintain the existing framework of codes and standards in place in Maryland.

Incremental costs to address climate change through the implementation of strengthened codes fall into three major categories: assessment, new design requirements, training, and inspection. Assessment involves the costs for the comprehensive evaluation of existing statewide and local building codes and standards. New design requirements involve the future costs associated with meeting more stringent code requirements (e.g., freeboard requirements, higher safety factors for foundation design in coastal areas). Training involves the incremental costs associated with meeting the technical capacity needs of inspectors who will be charged with ensuring compliance with new codes. Finally, inspection involves new funding to ensure that an adequate number of trained code officials and inspectors are available.

The benefits associated with strengthened building and infrastructure codes in Maryland center on the degree to which they integrate climate change risks into the state's codes and standards framework. Future state building stock and infrastructure will be designed and installed subject to standards established in response to emerging knowledge about climate change. Insofar as uncertainties remain, an implicit precautionary approach will be applied. The gradual transition of building and infrastructure stock should better position Maryland to plan for and mitigate against future climate change risks. These benefits, while difficult to quantify, are nevertheless substantial and likely to be higher than the incremental costs associated with the implementation of the option.

Feasibility Issues

TBD.

Status of Group Approval

TBD.

Barriers to Consensus

TBD