

Elevating Assets

Relocation of MDOT MTA assets may be evaluated in cases of high and very high risk of inundation. Simply put, this measure involves relocating the asset above the threat of rising waters. Implementation of this measure should first be analyzed for the affordability, constructability, impact, and most of all reduction to risk from flooding. Understanding the structural constraints and feasible design strategies will help ensure the viability of a specific asset identified as very high risk. Factors such as foundation type, soil type and bearing capacity, weight of the building, lateral forces on the structure, structural condition, and height of the desired elevation above grade, determine the feasibility of elevating the structure.

Relation to Adaptation and Resiliency

Helps achieve continuous operation of the facilities in the event of floods or natural disasters at the ground level.

Benefits

The implementation of this measure guarantees the integrity and operation of the asset in the event of a flood and mitigates any water intrusion. Elevating assets maintains operation of the equipment during an emergency, which can ensure continued system performance. This measure ensures long term protection.

Limiting Factors (Constraints)

Before carrying out this measure, as indicated by MDOT MTA, a detailed benefit-cost analysis for the asset should be conducted. This analysis should consider the equipment that is a priority to raise, since the cost of the response will be a constraint, along with the time it takes to implement and the associated costs of delayed operations/provisional equipment. Procuring and using provisional equipment may also delay the measure. Existing structures and site conditions may limit the amount by which equipment may be raised, without having to make significant modifications. It can be challenging to retrofit assets that are already in place, especially when system operations need to continue business as usual and therefore not always a feasible option. For example, the Port Authority of NYNJ were not able to retroactively raise certain assets (e.g. stations, some switching stations).

Design & Preliminary Costs

It is essential to consider the minimum distances and safety spaces for the correct installation and maintenance of the equipment, in strict compliance with national regulations. Additionally, all conduits must be properly sealed and anchored guaranteeing the integrity of the conductors in the event of a flood. This measure is site-specific and dependent upon asset (i.e. if it is a linear asset). Linear assets will be much more costly and difficult to elevate as it requires raising an entire system.

If raising a generator set (which is recommended in a location with a high risk of flooding), the appropriate structure with the necessary inertia block must be considered to guarantee the correct operation of the equipment together with the continuous supply of fuel during the state of emergency from the corresponding tank. This tank must be protected against flooding with the necessary adequacy to contain a spill and prevent damage to the environment. When lifting the equipment, the minimum safety distances and working space stipulated in the national regulations must be guaranteed, in order to properly carry out the installation and maintenance routines, together with the appropriate adaptations for safe work at heights if required.

The preliminary costs associated with this activity correspond to all the considerations in the benefit-cost analysis. An important cost consideration is that all the routes that feed the service from the elevated equipment to the final installation must be strictly



sealed and verified to guarantee the good operation of the final equipment in the event of a flood. The capital cost will also be highly dependent on the need to modify or replace roofs, equipment pads, platforms, etc.

Permits & Approvals

Depending on the location where the measure is to be implemented, permission may be required from the MDE. Internal MDOT requirements and standards may also come into play.

Implementation

The implementation of this type of measure can take a long time depending on the equipment to be relocated and the adequacy of available, safe space for relocation. In the process of moving equipment and facilities, implement provisional facilities so as not to interrupt operations during asset relocation. This requires consideration of the best available locations to relocate assets and ensuring that there is space. For example, the Port Authority of NYNJ is identifying safe locations in its yards to store rolling stock during storm events.

Maintenance Requirements

After elevating the asset, the asset should undergo the same maintenance routine that was carried out before being relocated. It is important to always consider the recommendations of each manufacturer. Once the asset has been elevated, it is suggested to advance a day of torque verification after one month of operation in the new location since hot spots may appear in electrical equipment. Proper access for maintenance is an important consideration for new equipment elevations, so it may be necessary to construct platforms, access ladders, or elevators for personnel access.

Useful Life

Depending on the location and exposure to climatic conditions, the useful life of the asset would remain within the manufacturer's original specifications. This is a very long-term response, protecting the asset over its useful life.

References/Specifications

National Fire Protection Association (NFPA) links can be found on MadCad (*Subscription is required*)

- o NFPA 70
- o NFPA 70e
- o NFPA 110
- o NFPA 101

