STRUCTURAL GYMNASTICS

Restoring a treasure jumpstarts economic redevelopment

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A GREENER NATIONAL MALL
ASSESSING THE BUSINESS CASE FOR A MULTIPURPOSE INFRASTRUCTURE SOLUTION.
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ONE OF THE most renowned civic spaces in the world, the National Mall in Washington, D.C., stretches roughly two miles from the U.S. Capitol to the Lincoln Memorial and Potomac River. This historic property attracts approximately 25 million visitors annually — more than Yellowstone, Yosemite, and Grand Canyon National Parks combined. The setting for many significant monuments, memorials, and museums, “America’s Front Yard” also hosts more than 3,000 festivals, performances, demonstrations, and other events each year.

However, the National Mall’s popularity creates a number of challenges in the capital city, including traffic congestion and parking shortages. Approximately 200,000 tour buses bring visitors to the mall each year.

Many of the buses idle along Constitution and Independence Avenues and side streets, clogging the road network, polluting the air, and blocking views of the mall’s iconic buildings.

In addition, the National Mall has been plagued with problems due to extensive flooding. In 2006, a major three-day storm overwhelmed the capacity of the city’s storm sewers and damaged many buildings within the mall and Federal Triangle area, including the Smithsonian’s Natural History and American History museums, the National Archives, and several federal agency headquarters. The flooding caused millions of dollars in damages.
Multipurpose infrastructure
An innovative and highly sustainable concept has been proposed to help remedy these persistent problems and provide a more enjoyable experience for visitors to the downtown area. Known as the National Mall Underground, this subterranean parking structure will also be designed to operate as a stormwater detention system during major storm events (see Figure 1). The multipurpose facility will address traffic, parking, air quality, flooding, and long-term sustainability issues while also providing venues for visitor information and amenities.

The National Mall Underground is the vision of Washington, D.C., real estate developer and philanthropist Albert H. Small and architect Arthur Cotton Moore, FAIA, working together with the nonprofit National Mall Coalition. Joined by the consulting firm of Dewberry for civil engineering and development of a business case evaluation for sustainability and functionality, the team has proposed a three-level underground structure that will offer approximately 1,000 parking spaces on the lower two levels for cars and buses. The top level will serve as a visitor center with amenities including food service, information on the National Mall and Memorial Parks, restrooms, and first aid. New turf grass will top the structure as a green roof.

During minor storm events (less than 50-year storms), large cisterns at the perimeter will collect rainwater and graywater flow from adjacent buildings for use in irrigation to reduce consumption of the city’s drinking water supply. Prior to major storm events (50-plus-year storm events), the National Mall Underground would be closed, allowing the lower levels of the parking garage to operate as stormwater detention vaults.

As a multipurpose infrastructure concept, the National Mall Underground has no precedent in the United States. The design team studied dual-purpose traffic and flood control projects in Rotterdam and the Kuala Lumpur Smart Tunnel as examples, as well as several underground parking facilities in the U.S. that serve to protect historic sites, but no project to date matches the National Mall Underground’s complexity and scope. The project’s versatility, however, is critical to its viability — ensuring that this unique infrastructure concept makes sense financially.

Making the case
The design team recognized that the National Mall Underground is poised to set an example for ambitious infrastructure projects moving forward through intelligent, multipurpose solutions. It was clear that an expensive flood protection system would not be viable without a vehicle for revenue. On the other hand, a large-scale underground parking structure was also untenable from a cost standpoint. Bring the solutions together, however, and the return on investment becomes much greater. The multipurpose design will allow the National Mall Underground to operate as a flood mitigation system at a fraction of the cost of a standalone system, and provide sustainability and resiliency benefits to the city. The District of Columbia, demonstrating its interest in the project, included the National Mall Underground in its recent submission to the U.S. Housing and Urban Development National Disaster Resilience Competition.

Throughout the planning phase, Dewberry developed business case analyses to help determine the benefits of various green and resiliency strategies. Valuation of the social and environmental impact was added to the analysis, helping to address the ecological impact of a decision or investment. This approach provided insight into the benefits of the National Mall Underground by evaluating direct financial performance as well as the project’s benefits to society, the community, and the environment. A monetary value was assigned to features of the project.
that provide benefits such as a reduction in water use, reduction in stormwater runoff, recreational use, water quality enhancement, and greenhouse gas reduction.

This approach led Dewberry’s team to use the new Business Case Evaluator tool (BCE) for Stormwater Management, a companion tool for the Institute for Sustainable Infrastructure (ISI) Envision rating system. The BCE, developed by Impact Infrastructure (www.impactinfrastructure.com) in conjunction with the ISI’s Economics Committee, incorporates research-based economic approaches to determine the monetized value of a project’s economic, social, and environmental impact.

For example, the reuse of rainwater for irrigation can be evaluated against reuse toward potable water use reduction at the visitor center lavatories. The monetary value for both direct cash and non-cash costs and benefits provides a standardized metric that allows stakeholders to make informed design decisions. This process has revealed the full value of sustainability initiatives and enables project designs to be honed to achieve certain outcomes, such as maximizing total stakeholder value. Dewberry has also begun preliminary work to explore the benefits of an additional feature — geothermal rods beneath the facility — that would also enhance the project in terms of resiliency and value.

In a scenario such as the National Mall Underground where a project does not have an immediate positive return on investment through a direct financial analysis, a Triple Bottom Line business case approach identifies the equivalent financial benefits provided by sustainable or resilience features. There are a number of advantages to using this process, including fully incorporating non-cash benefits and other factors into the decision-making process, and integrating risk and uncertainty analysis to help shape designs for optimal outcomes.

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TRIPLE BOTTOM LINE ANALYSIS TOOLS

The BCE for Stormwater uses a standard Cost-Benefit Analysis approach and research-based methodologies to monetize traditionally “intangible” benefits of projects. The BCE for Stormwater is a part of a family of tools that includes the BCE for Transit and AutoCASE, a cloud-based software application that integrates directly with Autodesk AutoCAD Civil 3D software to provide real-time feedback on a design’s social and environmental value.

The BCE for Stormwater has been peer reviewed by members of the ISI and the ISI Economics Committee, and undergoes an annual update process to ensure that the tool uses the most up-to-date research in its methodologies. With a first release in 2013, this enhancement to the design process enables engineers and architects to create more sustainable and resilient designs while staying within tight budget requirements.