ORGANIZATIONS

DowntownDC Business Improvement District (BID)

D.C. Department of Energy and Environment (DOEE)

Interface Engineering Consultants

Dewberry Engineering Consultants

SOFTWARE

Autodesk® InfraWorks® 360

Green Stormwater Infrastructure Extension for InfraWorks® 360

Autodesk® Rapid Energy Modeling for Existing Buildings

Autodesk® Green Building Studio®

AutoCASE®

Key Findings

- Tools for planning district-scale green stormwater infrastructure can help achieve Sustainable DC goal to capture rainwater using 75% of landscape.

- District-scale Rapid Energy Modeling identifies which buildings in DowntownDC ecoDistrict to target for energy incentives.

- Automated triple bottom line analysis shows how combining underground parking with stormwater storage in the National Mall can reduce traffic congestion and flooding.
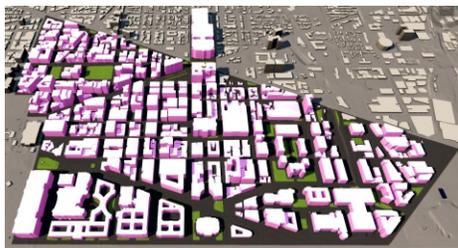

Figure 2: DowntownDC ecoDistrict was used as a lab to test the impacts of city-wide green infrastructure and energy retrofits

Sustainable Strategies for Energy and Stormwater Management

Autodesk Sustainability Solutions empower Washington, D.C. to implement ambitious energy and stormwater management goals

Figure 1: 3D model of Washington, D.C. created in the cloud using Autodesk Infraworks® 360.

Motivation

Washington, D.C. has an ambitious goal to become the healthiest, greenest, and most livable city in the United States by 2032. Among their many sustainability goals, reducing building energy consumption and effectively managing stormwater can have immediate benefits to the climate and the local environment. Therefore, the District aims to retrofit 100% of existing commercial and multi-family buildings to net-zero energy standards, and to capture rainwater on-site across 75% of the District's landscape.

Achieving these goals requires a combination of policy, planning, and design innovations. The DowntownDC Business Improvement District (BID), Interface Engineering Consultants, and the Department of Energy and Environment (DOEE) need a data-rich City Model that captures the energy and water flows within the District to help them measure and predict sustainability benefits.

"We want to use the model to test multiple 'what-if' scenarios for policy changes, technology adoption, or behavior change," explains Bill Updike, Chief, Green Building & Climate Branch, DOEE. "For example, how much energy will lighting retrofits save and which buildings should we target? How much stormwater runoff could we reduce with city-wide green infrastructure?"

To test strategies for the District to meet their goals, the BID partnered with Autodesk and used the Downtown ecoDistrict as a lab for sustainable development.

Investing in Green Infrastructure

When it rains in cities, stormwater washes contaminants from the streets into either the combined sewer system or directly into local water bodies. However green infrastructure, which retains and filters stormwater on-site, can dramatically reduce pollution from the runoff. To accelerate adoption of this approach, DOEE started the first market for Stormwater Retention Credits. Owners gain credits for installing green infrastructure and sell the credits to developers who need them to comply with regulations.

To demonstrate these benefits to stakeholders, engineers can use Autodesk's Green Stormwater Infrastructure (GSI) tool to design and analyze on-site retention. The software automatically calculates stormwater metrics needed for code compliance and the dollar value of stormwater credits attained. Using the re-design of the historic Franklin Park as an example, GSI showed how rain gardens, bioswales, etc. can reduce runoff volumes, and how many credits are generated.

Analyzing the impacts of district-scale green infrastructure in the BID helps the District meet their city-wide sustainability goals. First, GSI determined that the ecoDistrict must manage 2.5 million cubic feet of stormwater during a typical storm. Then it simulated how green infrastructure could manage the stormwater on-site. One analysis showed that a 35% reduction in runoff may be achievable by converting 45% of hard surfaces to natural cover and adding green roofs to 30% of the BID's buildings.

District-scale Rapid Energy Modeling shows retrofit potential

According to the U.S. Energy Information Administration, the commercial building sector in the District accounts for 66% of end use energy consumption. While DOEE gathers annual data through its landmark energy and water benchmarking law, there are no clear strategies on which buildings should be retrofitted first, and the law only applies to buildings that are greater than 50,000 square feet.

The Downtown ecoDistrict applied Rapid Energy Modeling for Existing Buildings (REM), Autodesk's virtual energy assessment tool, to quickly identify which buildings need retrofits. REM used satellite images and weather data to generate energy simulations for 40 buildings (25 Offices, 5 Multifamily, 5 Hotels, and 5 Schools). In only 5-8 minutes per building, REM analysis showed which building systems likely consume the most energy, and how performance upgrades can save on energy costs.
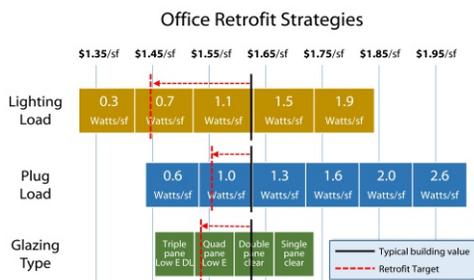

Figure 3: REM analysis shows which building systems to retrofit and potential cost savings

The sample of 25 offices showed that glazing, lighting efficiency, and plug loads are most sensitive to energy consumption, and are good candidates for retrofit. Figure 3 shows how policy-makers can set retrofit targets to estimate potential energy cost savings from improved building systems.

District-scale REM analysis allows policy-makers to predict the impacts of energy retrofits, create data-driven policy measures, and develop investment strategies.

"We want to use the model to test multiple 'what-if' scenarios for policy changes, technology adoption, or behavior change," explains Bill Updike, Chief, Green Building & Climate Branch, DOEE. "For example, how much energy will lighting retrofits save and which buildings should we target? How much stormwater runoff could we reduce with city-wide green infrastructure?"

Bill Updike, Chief, Green Building & Climate Branch, Department of Energy and Environment

Solving flooding and congestion in the National Mall

Washington, D.C. residents are all too familiar with flooding and congestion in the National Mall. Tour buses that idle along the streets cause traffic problems, pollute the air, and limit parking. In 2006 a major storm flooded many prominent museums and caused damages that cost millions to repair. To solve these problems and improve the experience of the National Mall, Dewberry engineering consultants proposed a multipurpose infrastructure solution.

In crafting their unconventional design Dewberry used AutoCASE®, a triple bottom line analysis tool from Autodesk partner Impact Infrastructure, to justify a project that meets the triple bottom line. This entailed green space on the surface level, moving parking below ground, and storing stormwater in an underground irrigation cistern (shown in Figure 4). AutoCASE showed how a comprehensive design with higher upfront costs was more attractive once the full range of social, environmental, and economic benefits were taken into consideration.

Conclusions

Washington, D.C. has set aggressive goals to reduce their environmental footprint, combat climate change, and improve the quality of life for their citizens. Policy-makers and engineers are increasingly relying on data, analysis, and simulation to make critical infrastructure decisions that will have long term economic, social and environmental implications.

With the aid of Autodesk's InfraWorks® 360 and a suite of sustainability analysis tools, the District was able to play out scenarios for how to attain these agenda-setting goals, carving a path for smarter use of technology that other cities can adopt.
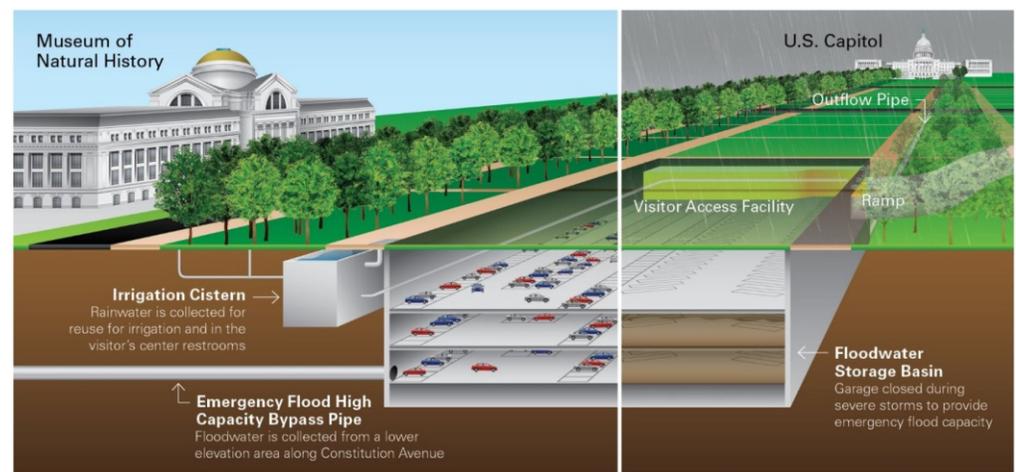

Figure 4: AutoCASE shows the triple bottom line benefits of underground stormwater cisterns and parking spaces, which reduce flooding and congestion at the National Mall

△ AUTODESK.