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Using Autodesk and Esri for Smart Cities: The Intersection of Engineering and GIS

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Learning Objectives

- Discover use cases that bring together BIM and GIS for improved planning processes
- Learn how to access approved data sources for engineering projects
- Learn how to use engineering designs to update approved GIS resources for municipalities and engineering
- Discover typical functions for engineering that include ArcGIS integrated workflows

Description

A city can employ a variety of smart gadgets and consider itself a “smart city.” But to increase efficiency and productivity, a smart city uses data and integrated technologies to improve internal processes—ultimately improving the lives of the citizens and businesses that fill it. With the increasing collaboration between Autodesk and Esri, a city or organization can better use geographic information system (GIS) data throughout the project lifecycle. BIM (Building Information Modeling) and GIS integrations empower users to introduce geographic context within a project to assess the environmental impact, collect and analyze data from the field, and improve communication with stakeholders. This session will show users integrations that can benefit them throughout the engineering process. We’ll demo the connections between Autodesk and Esri, specifically focusing on functions in the planning and design process. We’ll demonstrate specific workflows, showing the business value of integrating engineering workflows with BIM and GIS.

Speaker(s)

Stephen Brockwell started as an ArcInfo developer in 1987. Since then, he has held leadership positions in software engineering management, product management, and business development at Geovision, Autodesk, Brockwell IT Consulting, and, most recently, Esri, who acquired Brockwell IT in 2019. At Esri, Stephen is working to define the future of GIS-BIM integration for horizontal and vertical infrastructure for developers, engineering firms, and owner/operators with a focus on data and application integration, and transformative workflows across the full-stack architecture—from mobile to desktop to cloud.

Richard Horrocks focuses on AEC integration with BIM as a senior Product Engineer in the AEC team at Esri. Richard has extensive experience in the analysis and development of spatial data and GIS. Richard has a dynamic, multi-disciplinary, customer-focused approach to technology and infrastructure, with many years of experience in varying working environments. He is highly versatile and able to engage in any type of task, technology or technology usage, with extensive experience in the North America and Latin-America markets.

Supplementary Information on Smart Cities

Theatre Talk Transcript: How Smart Cities can Improve Wellness for Citizens and Businesses

Introduction

This document is a transcript of a theatre talk I gave (How Smart Cities Improve Wellness for Citizens and Businesses – 333571) at this year's AU. It's relates to the business background for the material we provide in this class and gives it context I thought attendees might find valuable.

I want to provide practical knowledge that can help you apply Smart City thinking if you're a planner or engineer working in a city, or help you augment the products and services you provide to help cities achieve Smart City goals if you work for a consulting or engineering firm.

Let's start with the notion of wellness—we all think we know what it means; it means something different for many of us—but there will be common features of these that influence Smart City thinking.

1. Health—this is more than freedom from illness—good health is invigorating, inspiring, increases personal, business, and collective productivity. Good health reduces stress, generally improves social cohesion, maximizes mobility, and facilitates learning.
2. Prosperity—everyone wants their wealth to improve over time. Economic insecurity is an enormous drag on our economic future and the health of citizens. Seems obvious—but the impact is underestimated by many. See this article for details.
3. Family and Community—unless you're a wilderness survivalist full time, you live in a social world inhabited by a network of friends, neighbors, family. The quality of social interactions—the physical ones so much more important than the virtual ones. Evidence suggests communities with cohesive social bonds have substantially higher longevity. Susan Pinker elaborates here.
4. Security—this ranges from freedom from imminent harm to the predictability of your daily actions, which is more important. I want to be able to walk to school without fear; I want to know that my income is not precarious; I want to know that financial status is secure.
5. Purpose—whether it be spiritual, artistic, communal, entrepreneurial, or familial, human beings need to feel a sense of purpose in their lives to ensure long-term wellness.

These qualities of life support each other—prosperity correlates with health; community correlates with longevity; security correlates with prosperity, and so on. Underpinning these factors of well-being are other social needs: education, social housing, employment insurance, pensions that help support the criteria for wellness for citizens on a broad scale.

See other definitions of wellness at the Wellness Council of America, and the Global Wellness Institute.

Challenges and Opportunities

Given the rate of urbanization that the planet will undergo in the next fifteen years—from 50% of people living in urban environments today to 70%—an unprecedented mobilization of public and private financing, creative architecture, new challenges of engineering, and collaborative innovation across disciplines.

There are innovations in Smart City technology that can help. On one hand, we can now consider computing to be a utility—we can use as much as we want. We can solve computation problems using off-the-shelf platforms that would have been impossible and unaffordable only ten years ago using cloud computing platforms.

These computing innovations are driving three key improvements in the design of cities.

1. Visualization. Unprecedented ability to have insight into the current state, trends, and urgent issues using big data, analytics, machine learning, and artificial intelligence. Augmented and virtual reality visualizations combined with business intelligence, dashboards, and time-based 4D, and time-cost based 5D visualizations composed from live data sources make understanding the context of change and design possible.
2. Generative design. Tools like Dynamo combined with highly accurate geospatial data and machine learning can create designs that are beautiful, least-cost, and most efficient. Innovations in materials and construction techniques apply here too.
3. Simulation. The ability to use agent-based simulation to predict the impact of design changes in proactive ways in a timely fashion.

Together, these approaches can reduce the cost and duration of transportation infrastructure projects while taking better care of the social, health, and economic consequences of our designs. Without these innovations, it is unlikely we will be able to keep up with the level of urbanization that is coming.

Technology and Outcomes

I strongly believe the Smart in Smart Cities comes from the human participants in the community and the industry collaborators who understand that any such undertaking is fundamentally an application of human ingenuity that uses technology to improve the lives of citizens, allowing citizens and businesses to work together in vibrant communities. Technology enables stakeholders to make smart decisions: it facilitates smarter engineering, provides situational awareness that increases safety, identifies patterns of disease that improve health, shows patterns of movement that are diminish commerce. But *we* collaborate to make the decisions with this information and these tools. We need to educate ourselves on the possibilities of Smart City technology and its implications.

Outcomes are always local—every city has existing conditions, zoning biases, political history. These must limit and guide the implementation of Smart City technology. Without deep understanding of the local conditions, investments in Smart Cities risks failure. Ottawa example with frozen exterior water fountains at new LRT stations.

Digital Twin

I haven't talked about the digital twin because the digital twin can be a barrier to getting started. A digital twin does not have to exist for all horizontal and vertical infrastructure for the entire city before you even get started. A digital twin can exist at the community level to solve a specific problem, such as smart street lighting that conserves energy and promotes safety. It can be

applied to a sub-network in the transportation network to increase safety. It is true that the level of detail in the modeling for a digital twin is a substantial undertaking. All the more reason to undertake it on an incremental basis, to learn from success and challenges and apply those to the next project.

Case Study 1—Songdo

The City of Songdo was conceived as a new kind of city—one designed from first principles to provide an international commerce hub where diverse communities would aggregate in an innovation center with affordable housing, extensive green space, and multi-modal transportation. All of these features supported by state-of-the-art Smart City infrastructure—sensors, control centers, smart apartments, waste disposal systems that require no garbage trucks and convert the garbage to electricity.

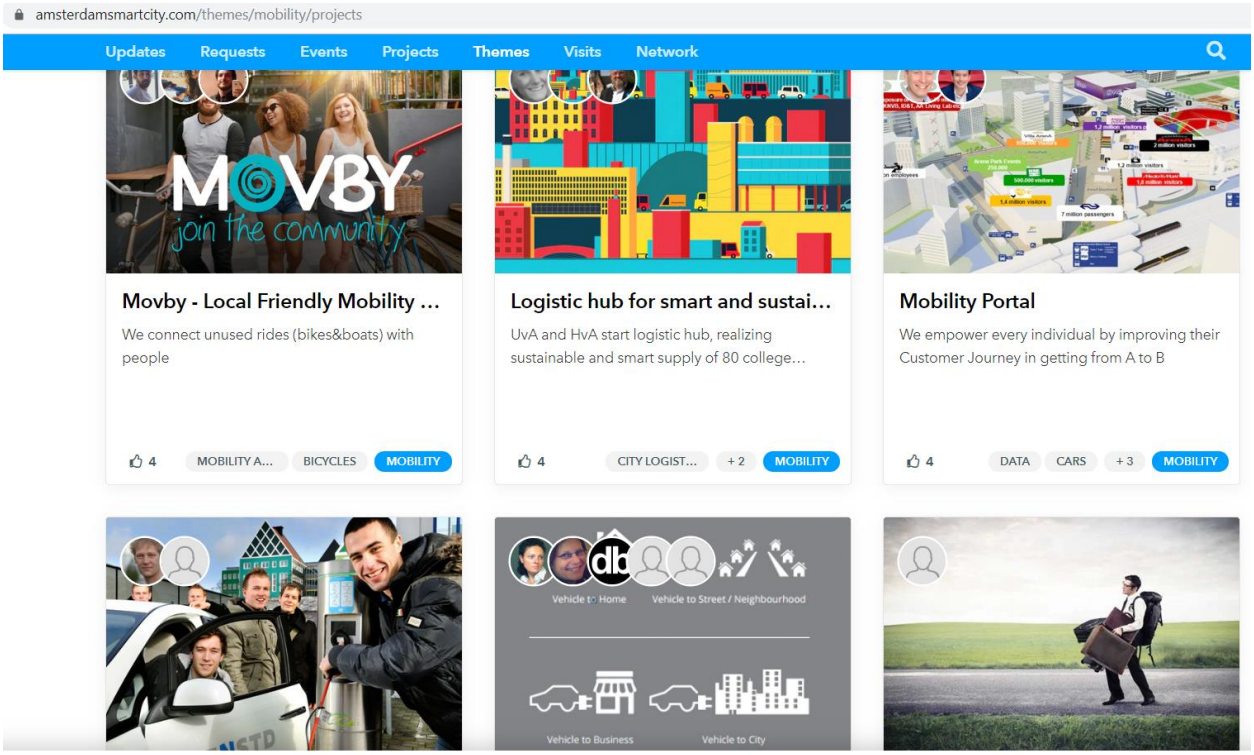
Unfortunately, Songdo seems empty—there appears to be little sense of community. The natural evolution of organic cities hasn't been seeded here and as a result, the city is far behind its goals. The population has increased to about 100,000 people but the goals are much higher—300,000 or more. Cross-city public transit has issues—getting to Seoul is a two-hour trek, a distance of 35 kilometers.

The completion date for the Smart City of Songdo, originally set for 2015, has been pushed back to 2022. Photo: Chris White

For more information on some of the growing pains at Songdo, see https://www.citylab.com/life/2018/06/sleepy-in-songdo-koreas-smartest-city/561374/.

Case Study 2—Amsterdam

By contrast, the city of Amsterdam has embraced such innovation in an old city that already had many of the best features of urban living.



A very important aspect of this program—it is broad, but it is also local and somewhat loosely coupled. Amsterdam is not starting from a top-down mega-project; they are putting policies, platforms, and education in place. Small businesses, large enterprises, and citizens are actively participating. The result is continuous innovation and continuous improvement in the life of the city.

Governance Models for Successful Smart Cities

As reported by the SBA, 44% of US economic activity is from small businesses, much of it tied closely to the community.

PRESS RELEASES

Small Businesses Generate 44 Percent Of U.S. Economic Activity

Release No. 19-1 ADV

By Office Of Advocacy — On Jan 30, 2019

WASHINGTON, D.C. – Small businesses are the lifeblood of the U.S. economy: they create two-thirds of net new jobs and drive U.S. innovation and competitiveness. A new report shows that they account for 44 percent of U.S. economic activity. This is a significant contribution, however this overall share has declined gradually.

In a major PWC report, Singapore, New York, and Boston, among others, were identified as cities that had proactively planned the relationship between businesses and citizens to stimulate not only growth but improved social outcomes.

The factors that make projects of this kind work include:

- Clearly communicated strategic priorities that were developed collaboratively.
- Cultivating shared interest between businesses and the communities in which they operate.
- Engaging business leaders directly in the development and execution of municipal plans.
- Persistent overcommunication.

Mobility Revolution, Walkable Cities, and Simulation

This is urgent—out transportation infrastructure needs an unprecedented overhaul in two diverging dimensions.

We need to design multi-model transportation systems that maximize the ability of neighborhoods to thrive while ensuring commerce is conducted both at the local, the metropolitan, and the state and national levels.

We also need new modes of transportation that are safer, less polluting, more efficient, and less expensive both from a time-spent and from an infrastructure perspective. This must include walkable cities, cycling, autonomous vehicles, and public transit.

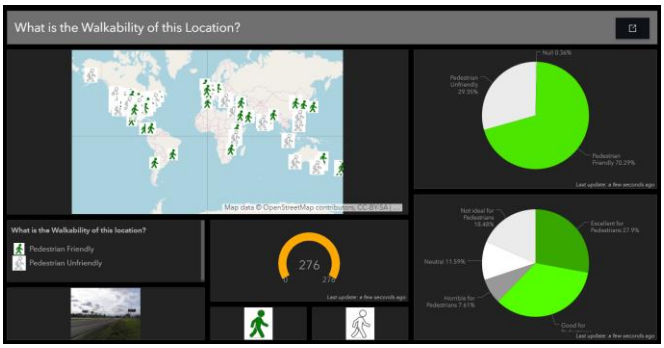
Both aspects of mobility are crucial for a sustainable, prosperous future. This is also crucial for health—pollution, excessive driving, the stress of commuting all have negative health implications. The time lost in long commutes impedes productivity.

But many of the tools available today make it more possible than you might think to take on these challenges. This brings me to three product-related points I want to make.

ArcGIS Geospatial Cloud, ArcGIS Urban, and ArcGIS AEC Collections

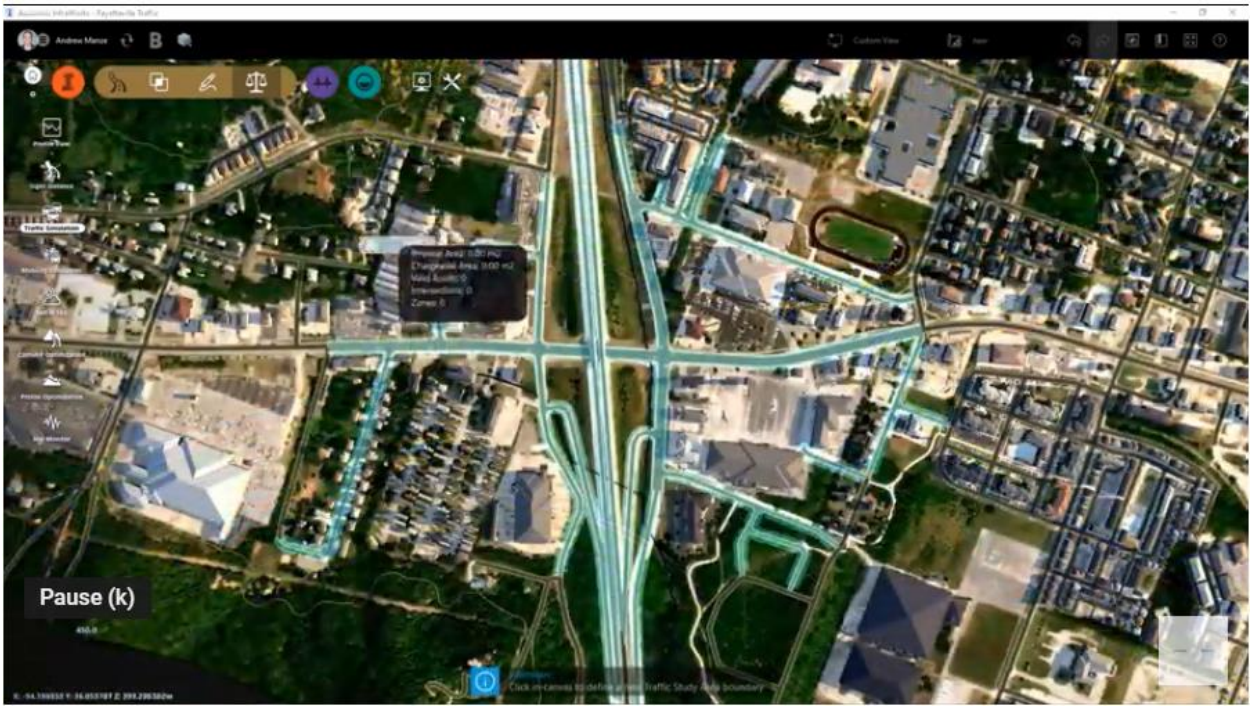
Esri has a broad set of platform and workflow specific solutions for transportation data management, storage, visualization, analysis, and operational insight. The combination of ArcGIS Pro for data integration and analysis, ArcGIS Online for geospatial cloud services, mobile workflows with Collector, citizen engagement with Survey 123 and Story Maps, and ArcGIS Urban for conceptual design. There are forty Esri staff here at the conference—talk to

us. A lovely, simple example of the power of ArcGIS to represent information in ways stakeholders can understand is a walkable cities site available here.



Autodesk Infraworks, Civil3D, Revit, and BIM360

Autodesk has engineering tools that are rapidly advancing the engineering of transportation including multimodal simulation. One of the most exciting aspects of this year's AU, for me, is the continuous improvement in conceptual design with Infraworks, to engineering detailing with Civil3D, to construction design with Revit, and to collaborative workflows and project insights with BIM360. In fact, Infraworks transportation simulations continue to improve in ease of use. We also have the addition of Dynamo for generative Civil Engineering design.

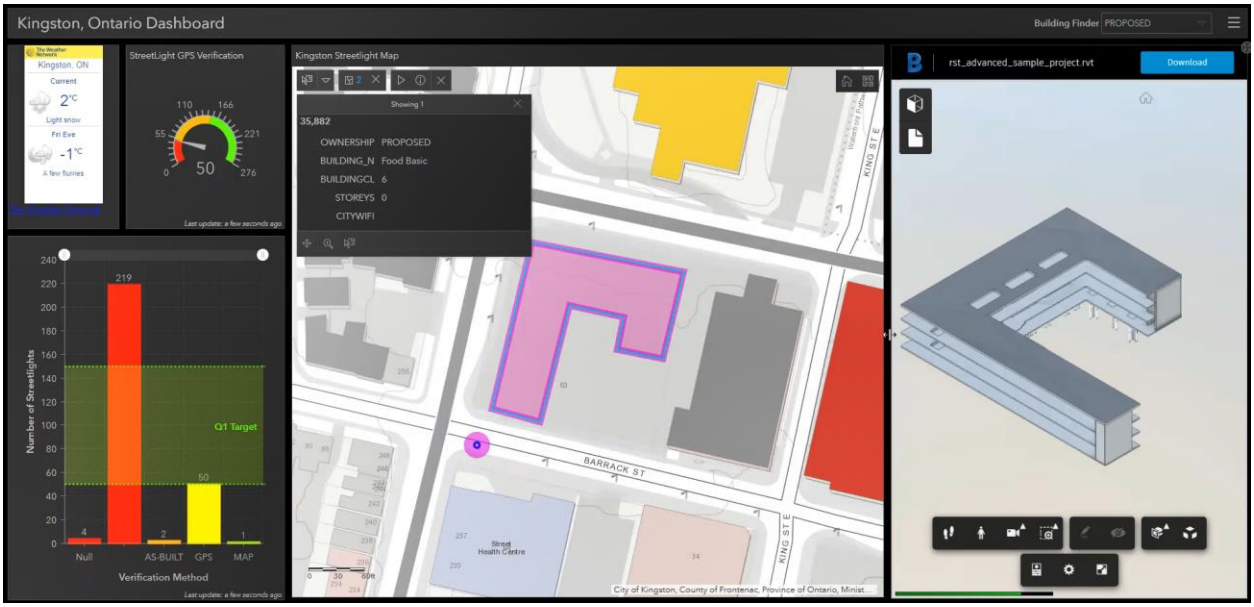


Esri and Autodesk

The collaboration between Esri and Autodesk magnifies the best aspects of the two companies. Engineering and design professionals can gather live data from ArcGIS, including data updated dynamically from Collector, or from feeds with the ArcGIS GeoEvent Server.

This not file exchange—this is service-level data integration.

For example, a user in the field could collect sinkhole locations and attributes for a project using ArcGIS Collector. The results of those sinkhole locations can be used immediately by an engineer or designer with Autodesk Infraworks or AutoCAD Civil3D. Additionally, as the design evolves, those changes can be published back to the GIS. Dashboards can be used to visualize the projects as they change and to identify risk. If, for example, a certain sinkhole poses a specific risk to a project, that can be clearly identified for stakeholders.



Conclusion

I urge you to embarking on Smart City projects by incrementally establishing success first: solve real problems that are urgent but manageable in scope and leverage the success to cultivate trust and to sustain and increase funding.

Megaprojects risk failure; capital will be wasted; trust will be broken. Anthony Townsend raises this in his superb book Smart Cities: he cites the example of a city in South America where a major investment in Smart Cities was half-finished, burnishing the credentials of certain officials, but achieving no meaningful impact on the quality of life of citizens.

Every city has distinct geography, weather, economic specialties, culture. Every smart city implementation must accommodate the local conditions as a primary design objective. Dynamic, thriving cities have never been more possible—and the technologies available can make smart planners, designers, citizens, and engineers better able to build the cities of the future that create prosperous businesses and citizens who work together to achieve sustainable growth.