BUILT & SPATIAL DATA FOR TECHNOLOGY-DRIVEN INFRASTRUCTURE PLANNING & DEVELOPMENT

Anthony Tuffour
Director – Global Lead GIS and Digital Twins
Cities

October 2021
SCOPE
ABOUT BURO HAPPOLD LTD
WHERE WE ARE
WHO
WE ARE

An independent, global practice of over 1,900 engineering and consulting professionals working in the built environment.
WHERE WE MAKE A DIFFERENCE
OUR SPECIALISMS

ACOUSTICS
AIRPORT PLANNING
ANALYTICS
ASSET CONSULTANCY
BIM AND DATA MANAGEMENT
BRIDGE ENGINEERING AND CIVIL STRUCTURES
BUILDING SERVICES ENGINEERING (MEP)
DELIVERING BUILDING PERFORMANCE
DESIGN PROJECT MANAGEMENT
ECONOMICS
ENERGY CONSULTING
ENVIRONMENTAL CONSULTANCY
FACADE ENGINEERING
FIRE ENGINEERING
GROUND ENGINEERING
HEALTH, WELLBEING AND PRODUCTIVITY
INCLUSIVE DESIGN
INFRASTRUCTURE
LIGHTING DESIGN
ORGANISATIONAL TRANSFORMATION
PEOPLE MOVEMENT
RISK AND RESILIENCE
SECURITY AND TECHNOLOGY
STRATEGIC PLANNING
STRUCTURAL ENGINEERING
SUSTAINABILITY
TRANSPORT AND MOBILITY
VISUALISATION
WASTE MANAGEMENT
WATER
INTER-DISCIPLINARY AND HOLISTIC

Our inter-disciplinary way of working inspires a truly holistic approach to solving the complex problems facing an ever changing world.
PURPOSE AND CHALLENGES OF INFRASTRUCTURE PLANNING AND DEVELOPMENT
Purpose of Infrastructure Planning and Development

- Economic Development
- Creation of liveable spaces and places
- Connectivity
- Pathways to Net Zero
- Attraction of people and investments to certain locations
- Balancing spatial distribution of infrastructure
- Understanding of what infrastructure is needed and how to deliver
- Environmental Sustainability
Timely and Accurate Data

Understanding of accurate infrastructure requirements against limited resources

Intended Beneficiaries

Stakeholder Engagement and Collaboration

Environmental Impact

Competing demands and interests

Power, Politics and Governance

Challenges of Infrastructure Planning and Development in the Built Environment
SPATIAL DATA AND ITS ROLE IN INFRASTRUCTURE PLANNING AND DEVELOPMENT
Built & Spatial Data – Geometric And Topological Constructs Of Spaces, Places and Locations Representing Complex Systems

Opportunities  Survival  Electricity  Energy  Net Zero  Transportation  Potable Water  Housing

Environmental Sustainability

Source: https://www.cgal.org/

BURO HAPPO LD
The use of Geospatial Big Data, Urban Analytics, Computation and Digital Twins to Design, Improve and Use Smart & Sustainable Spaces, Places, Location
Strategic Focus - A Smarter Approach to Data

- Choice of Deployment of Data Warehouse based on organisational resources and expertise
- Technology Infrastructure Stack – On Prem and Cloud
- Interface with disparate systems and platforms: Ensures Cross-Analysis and insights, Data Exchange
- Integration and Interoperability
- Collaboration and Engagement: Transparency and Wider Access to Data and Information
- Geospatial Data and Information Governance
- Computational Engineering
- Automation of repeated processes and tasks to minimise errors, achieve efficiency and increase the speed of projects delivery
- Analytics and Insights with Machine Learning and Artificial Intelligence
- Simulation, Modelling and Prediction: Understanding of current and future behaviours of assets to underpin proactive maintenance and investments
- Data Visualisation, Communication and Sharing
- Accuracy, Consistency, Efficiency and Interoperability in the use of data and information
Making Sense of Vast Quantities of Spatial Data From a Variety of Sources

- Clients
- Consumers
- Operators
- Industry
- Influencing stakeholders
- 3rd party commercial arrangements
- Open-source and public domain sources
- Derived data through a combination of the above using computation and analytics methods
Role of Spatial Data in Infrastructure Planning and Delivery

- Site Context Analysis
- Alternative Scenario Analysis
- Multi-stakeholder analysis
- Optimisation of Investment Costs and Decisions
- Assessment of existing Infrastructure capacity and condition
- Identification of the need for what infrastructure at where, when, intended beneficiaries and expected performance
- Impact and Interrelationships with existing assets and the environment
USE CASES AND EXAMPLES
Guest blog: Pathways to Net Zero – Smart Energy Digital Twin the Natural Evolution

Guest blog by Anthony Tuffour and Phil Proctor, Buro Happold Ltd

Data the new oil and Oil bad for the Environment

Buro Happold: Generative design and game engine technologies for Energy Network Design as pathways to Net-Zero communities

The problem: Dealing with the complexity of developing net zero pathways for communities by using generative design and game engine technologies for Energy Network Design.

The action: Buro Happold with strategic partners have developed a smart energy digital twin for Bingley County Borough Council and Barcombe. It enables intelligent selection and validation of domestic heat network solutions by incorporating real-world data, generative design, gaming and 3D visualisation technologies.

The result: The tool uses an automated approach for a complex phased development plan and comparison of multiple options including distributed vs centralised systems. The outputs can be presented to multiple stakeholders to support decision making including local government, supply chain, and community energy organisations. For Barcombe, “the scheme will see an entire village switched from oil to electric heating that could become a blueprint for millions of homes.”

“The scheme will see an entire village switched from oil to electric heating that could become a blueprint for millions of homes.”
Smart Energy Digital Twin – Pathways to Net Zero
Smart Energy Digital Twin – Energy Network Design, Optimisation, Development and Operationalization
Digital Masterplanning – District Heating and Potable Requirements Assessments
Digital Masterplanning – District Heating and Potable Requirements Assessments
- District Heating Network Design Computation and Automation output
- Potable Water Network Design Computation and Automation
Transportation and Access to Built Environment Services
Transportation - Linear Infrastructure Planning, Condition Assessment and Improvement Investments
Video Demo – Spatial Data and Game Engine Technology: Immersive Experience
VALUE
Where might the value lie?

**INVESTMENTS, EFFICIENCIES AND EMPLOYMENT CREATION**
- Efficiency in design & operations
- Improvements in efficiency through removal of duplication of efforts
- Improved resource management
- Reduced maintenance costs of assets
- Potential to encourage 3rd party investment to innovate and create new products and services from the data and information collected within the City
- Partner with industry R&D centres, incubators, etc.
  - Enhanced brand value

**COMMUNICATION AND ACCESSIBILITY**
- Openness, transparency and accessibility to relevant data and information
- Real time data and information analysis, alerts and notifications
- Use of AR/VR to engage primary stakeholders

**PLANNING, DESIGN, CONSTRUCTION, OPERATIONS & MAINTENANCE**
- Master model to facilitate cradle to cradle information across all lifecycle stages with appropriate governance, architecture and infrastructure to support
- Underpins future planning applications, development appraisals, and decisions outcome using real time data and information
- Development control operations and environmental management.
- Provide the ability to rapidly prototype and simulate options, and determine impacts
- Improvements in services delivery
- Improved and more resilient infrastructure

**CREATION OF LIVABLE ENVIRONMENTS (HEALTH AND WELLBEING)**
- Environmental improvements and quality of life analysis and improvements
- Improvements to health and safety
- Improvements in quality of life

**INVESTMENTS, EFFICIENCIES AND EMPLOYMENT CREATION**
- Efficiency in design & operations
- Improvements in efficiency through removal of duplication of efforts
- Improved resource management
- Reduced maintenance costs of assets
- Potential to encourage 3rd party investment to innovate and create new products and services from the data and information collected within the City
- Partner with industry R&D centres, incubators, etc.
  - Enhanced brand value

**COMMUNICATION AND ACCESSIBILITY**
- Openness, transparency and accessibility to relevant data and information
- Real time data and information analysis, alerts and notifications
- Use of AR/VR to engage primary stakeholders

**PLANNING, DESIGN, CONSTRUCTION, OPERATIONS & MAINTENANCE**
- Master model to facilitate cradle to cradle information across all lifecycle stages with appropriate governance, architecture and infrastructure to support
- Underpins future planning applications, development appraisals, and decisions outcome using real time data and information
- Development control operations and environmental management.
- Provide the ability to rapidly prototype and simulate options, and determine impacts
- Improvements in services delivery
- Improved and more resilient infrastructure

**CREATION OF LIVABLE ENVIRONMENTS (HEALTH AND WELLBEING)**
- Environmental improvements and quality of life analysis and improvements
- Improvements to health and safety
- Improvements in quality of life

**PARTICIPATORY PLANNING & STAKEHOLDER ENGAGEMENT**
- Platform to highlight local initiatives and engender community involvement
- Project collaboration and innovative digital environment to solicit community feedback on local issues and planning applications
- Open data initiatives for individuals and community groups to undertake their own analysis of local issues
JUMP ON BOARD!

We’d love to hear from you

Anthony Tuffour
Anthony.Tuffour@burohappold.com

www.burohappold.com