

# DATA and DIGITAL Projects

Region, Country, Location

EMU, Netherlands, Amsterdam

Solution

Design & Engineering

Market Sector

Manufacturing & Technology

## PROBLEM...



## APPROACH...



## BENEFITS!

- Add here a description of the issue we resolved. This could be on a project level or a client relationship level and relate to the client's performance drivers, key market driver, etc. Also include how we identified the challenge and what tools where used, e.g. business review meeting together with executive sponsor.

- Add here a high level description how we developed the solution (ideally together with the client).

Faster

**Three times** faster production of the panels and construction of the walls

Reduction

**Of wood** and cutting errors (material / sustainability)

Cheaper

**process** and **better quality** of the end products.

Safer

**work environment** due to total remove of manual work while cutting the panels

- Impact: must and should include numbers and percentages ->
- Time: Client saves time (f.e. inspection time reduced by X)
- Cost: Client saves costs
- Impact: Client satisfaction



# Data Visualization & Dash boarding

## E-Discovery Tool Zylab

Region, Country, Location  
South America, Columbia

Solution  
Water Management

Market Sector  
Central / Federal Government

### PROBLEM...

- The main challenge of this project was processing 70 gigabytes of unstructured files like: Excel sheets, PDF's, Word documents and more file formats.
- A clear structure in the files needed to be constructed to make a consistent and trustworthy master plan.
- To develop a clear structure, contextual search within files needed to be established. By establishing this, keywords can be used to find documents based on their contextual information.

### APPROACH...

- Organization was asked to construct a national inland waterway transport master plan for the department of nation planning in Colombia.
- The department provided amongst other information a total of 70 GB of documents that were necessary to write the master plan, but these files were highly unstructured.
- To ensure quality, the documents were imported into an E-Discovery Tool called Zylab, that brought structure and contextual search into the project.
- Thanks to the structure and contextual search in the project, it was possible to write the Master Plan on inland waterway transport.
- With this tool, the client has the ability to see what documents are read and which documents are being used in the master plan.

### IMPACT!

- Ensure** that maintenance can be held based on the models predictions.
- Increase** of efficiency cost, reduction, and the increase of track performance.
- Growth** in precision and consistency.
- More** accurate. The model learns from the data.



# Data Strategy & Architecture

## Data Organization

Region, Country, Location  
EMU, The Netherlands

Solution  
Rail & Urban Transport Solutions

Market Sector  
Transportation

### PROBLEM...

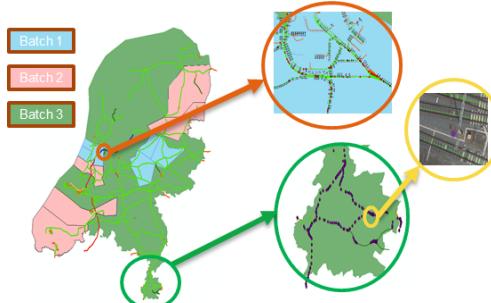


### APPROACH...



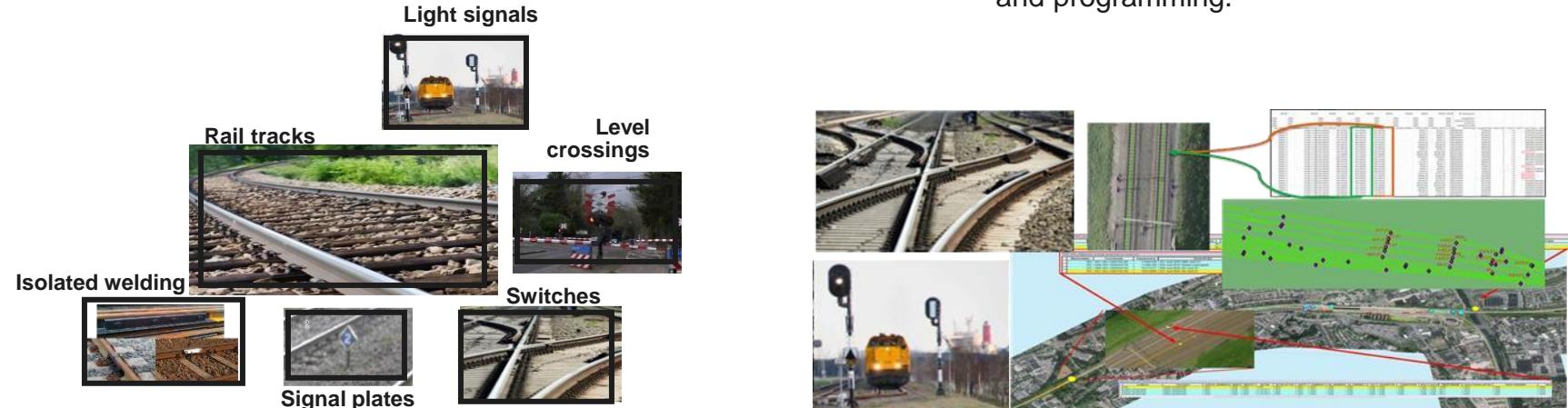
### IMPACT!

- The main goal was to provide high quality data for ProRail, by upgrading the old database with a new one with information that our client could rely on.
- In order to do that, several tools and business rules have been developed by Dutch team in closed collaboration with Romanian team.



- By combining multiple datasets, which were projected in GIS software it was possible to determine the location of different objects with a precision of 28 cm.
- Use of data analysis, data gathering and pattern recognition to increase copying the 'outside' to the inside.

Data was improved for the following systems:



>95%

precision in determining the population and location of different systems.

Increase

data quality by combining multiple software and scripts.

High

accuracy by combining multiple sources, software and scripts.

Gained

experience in "big data" management and programming.

# Data Management, IMP Holy City of Makkah

Region, Country, Location

EMU, Sauda Arabia, Mecca

Solution

Resiliency & Water Management

Market Sector

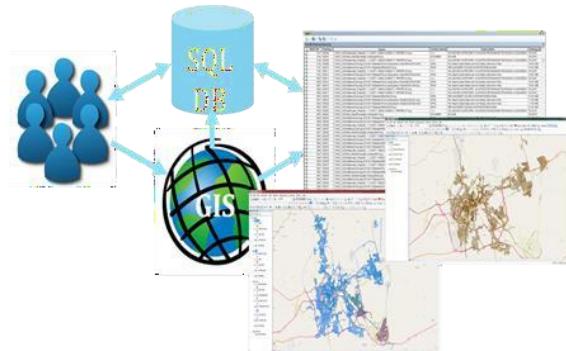
Manufacturing & Technology

## PROBLEM...

- The Holy City of Makkah is experiencing tremendous growth, which is expected to continue for the coming decades.
- In support of National Water Company's (NWC) challenge to meet the growth, they issued a request for proposal with two main objectives:
  - Develop an Asset Database
  - Produce an Integrated Master Plan for Water, Wastewater and TSE for development of the system through to 2050.

## APPROACH...

- Development of the catalogue of drawings and the asset inventory for horizontal assets (water, fire, cooling and wastewater networks).
- The final GIS model contains 116 feature classes grouped into seven feature datasets plus one standalone table, representing the Utility's linear distributed assets and background layers.



## IMPACT!

Correct

assignment of asset information so NWC staff can perform analysis to make effective decisions and ensure the most critical infrastructure needs are being addressed to **reduce risk** and **maximize customer service levels**.

Greater

**understanding** of the true costs to provide service through lifecycle cost analysis and performance management.

Improving

capital project and investment prioritization through formal business case analysis.

Understanding

long-term financial decision-making.

# Image Recognition

## Image recognition pilot on roads

Region, Country, Location  
EMU, The Netherlands

Solution  
Operations & Maintenance

Market Sector  
Manufacturing & Technology

### PROBLEM...

- In 2017 Organization and Capgemini joined forces in a pilot to identify irregularities for road maintenance by using image recognition.
- The goal of this project was to identify irregularities for road maintenance by using image recognition, in order to implement machine learning in our camera inspections.

### APPROACH...

- By applying artificial intelligence we can teach an algorithm (for example IBM Watson) which defects we need to identify in a camera inspection.
- We collect all data that shows what the defect is (asset, defect, size, severity, location, pictures etc.).
- If the algorithm learns what the defect is, it might be able to detect the defects automatically by just examining a data set or a set of pictures.

### IMPACT!

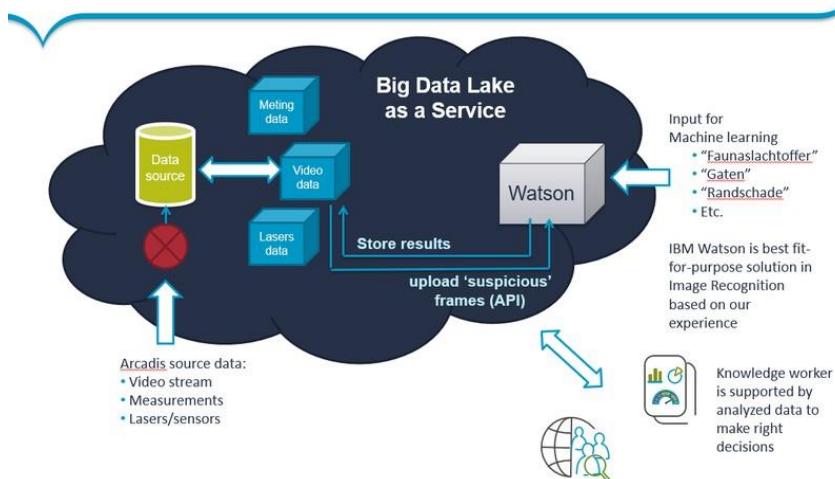
**80%** Watson recognizes 80% of potholes

**Reduction** of time and costs spent on our inspections

**Increase** quality of our inspections

**Decrease** of error rate

Proposed solution High Level Architecture



The cognitive journey with Capgemini

- Starting with a PoC to Demonstrate



# Image Recognition

# Image recognition for road defects

Region, Country, Location  
EMU, The Netherlands

Solution  
Rail & Urban Transport

Market Sector  
Central / Federal Government

## PROBLEM...

- The inspectors of roads waste a large part of their time with looking at roads with no defects.
- The goal was to minimize this time by building a model which selects only the locations that need to be looked at.
- The model must be relatively easy to use, both input (video) and output (report), with a direct linkage to their own management systems.



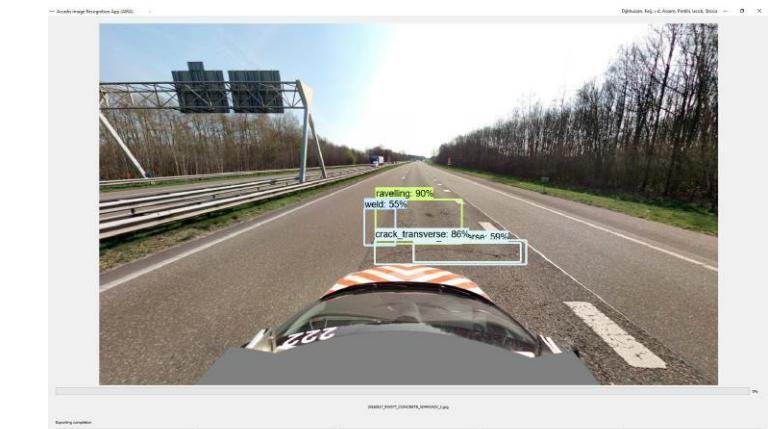
## APPROACH...

- Historical assessments and reports are labeled to build the training set on expert knowledge.
- A Deep Learning Neural Network (Faster R-CNN) learns on this training set what defects and road signs are.
- A software module makes image recognition easy, with 'detect on image' and 'export report' as build functions. The report can be customized.
- The exact location of a defect, its severity and past maintenance can be detected automatically.



## IMPACT!

- Faster** 50% faster than 'traditional' digital inspections. Ready in a minute.
- Efficient** Insight in degeneration and can be executed with just a single GoPro
- Reproducible** Quantitative and reproducible results which enable the asset owner to act right. Saves billions in NL alone.



# Optimization

## Predictive Maintenance Switch Failures

Region, Country, Location  
EMU, The Netherlands

Solution  
Rail & Urban Transport

Market Sector  
Contractors

### PROBLEM...

- Switches and maintenance are the biggest cost drivers for a contractor, predictive maintenance save huge amount of costs.
- Predicting where failures would occur based on data accumulated by ProRail.
- The large amount of data had to be used for purposes other than initially intended.
- This step from preventive (qualitative) to predictive (quantitative) maintenance.
- The most challenging was to predict outliers. Normally these values are excluded but in the case they are the relevant ones. The most failing switches.
- Three models are combined, one Radom Forest (RF) for predicting failures and two Support Vector Machines (SVM) for outliers.

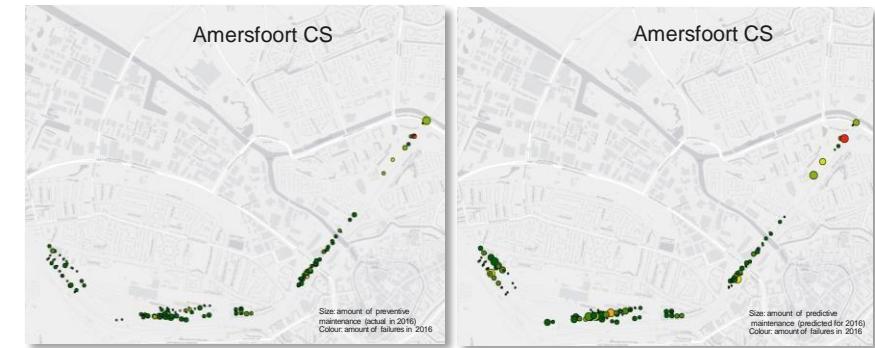
### APPROACH...

- A railway switch has several properties, like how many times it has been used, when it was fabricated and what soil it has been build. These can all impact the cause of a failure.
- The model has been developed on data from recent years and calculates the amount of failures for the next year.
- The client was involved by organizing workshops throughout the entire project.
- The project had to be fully transparent to prevent the project of becoming a black box and to assure the client that the results are reliable.



### IMPACT!

- |                 |  |
|-----------------|--|
| <b>Save</b>     | more than 30% on switch failures alone to focus. The predicting is in general less than half a failure of.   |
| <b>Accurate</b> | High precision and consistency of the results due to the countless number of variables taken into account by the model. The coefficient of determination ( $R^2$ ) is 70%. |
| <b>Increase</b> | accuracy of the model as more data is added, due to the learning from the data or Artificial Intelligence the model will be smarter over time.                             |



# Optimization

## Predicting Switch Failures

Region, Country, Location  
EMU, The Netherlands

Solution  
Rail & Urban Transport

Market Sector  
Contractors

### PROBLEM...

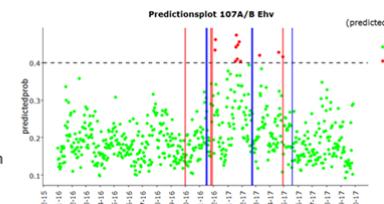
- Predicting where switches would fail based on electrical currents which run through an engine that is responsible for flipping the switch.
- The few exchange failures per switch. This makes it difficult to make a good model per switch. That is why the possibilities were explored to make a generic model, by grouping multiple, similar switches and the corresponding failures.



### APPROACH...

- Organization was asked to produce a predictive model, that could predict switch failures based on measuring electrical currents.
- Machine Learning was used to train the model with data of electrical currents of ten switches before 2016. With data from 2017, the model could be put to the test to validate if it would be predictive.
- A pilot was done covering 10 railway switches, using 8 years of data.
- An automated model was made that shifts accordingly with the seasons (because temperature affects the model).
- The model is optimized to achieve a maximum business case. This was done in close collaboration with the client.

- No failures predicted
- Failures predicted
- Maintenance
- Actual failure
- Maintenance in response to prediction
- Threshold between failure / no failure



### IMPACT!

#### Accurate

Predicts 40% of the failures, with an accuracy of more than 20%.

#### Increase

Machine learning can take a large amount of variables into account, this creates a model that can achieve near-human performance.

#### Efficiency

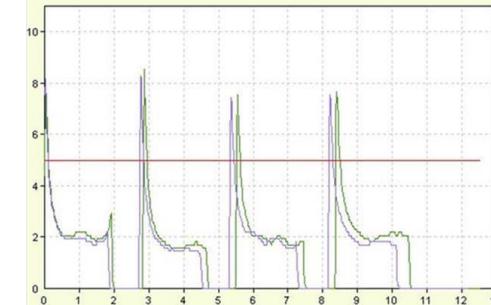
clear and efficient approach, which makes it faster and cost efficient.

#### Clear

visuals that are generated by R give clients a clear understanding of the predictions.

### Switch 295 A/B

■ Ref, R (A>B-t),22-03-16,10 C  
■ 20-05-16, 14:52:25, R (A>B-t),17.1 C,-14%  
■ slipstream



## Low-Loader Crossing Risk Assessment

Region, Country, Location  
EMU, The Netherlands

Solution  
Rail & Urban Transport

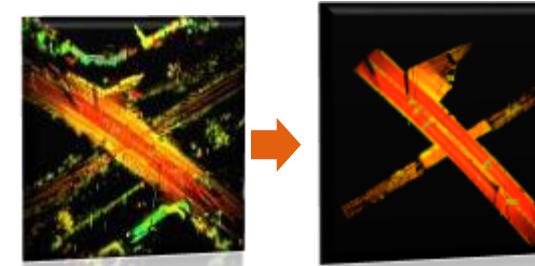
Market Sector  
Transportation

### PROBLEM...

- Organization had to inspect several rail crossings from The Netherlands, belonging to ProRail, in order to determine if there was a risk for the low-loaders to remain stuck on the railway during crossing
- The output was the clearance profile for each crossing, depending on the length between the vehicle's axes. There were at least 252 crossings that had to be evaluated before the end of 2016. The process was divided in 4 phases.

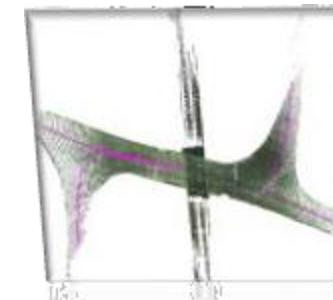
### APPROACH...

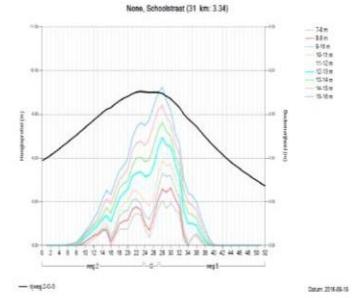
- Process Acquisition of field data by 3D Laser Scanning
  - Enrich a GIS dataset with the geometry and metadata of the crossings, using an ArcGIS Online viewer on the field;
- Registry of the point clouds to geo-referenced point clouds.
- Output
  - Registered point cloud data of the Leica P30;
  - GIS database with metadata and point feature geometry for each scanned crossing.



### IMPACT!

- 5x** **Less time** for achieving the end product, due to:
- Avoidance of precise 3D modelling of the point cloud
  - Automated creation of the clearance profiles
- 
- 95%** **Reduction of human** error in the process of generating the clearance profiles
- 
- 100%** **Proof of concept** that could be reapplied for further automation developments





# Data Visualization & Dash boarding

# Data Quality Audit

# Region, Country, Location EMU, The Netherlands

# Solution Port & Waterways

## Market Sector Manufacturing & Technology

## PROBLEM...



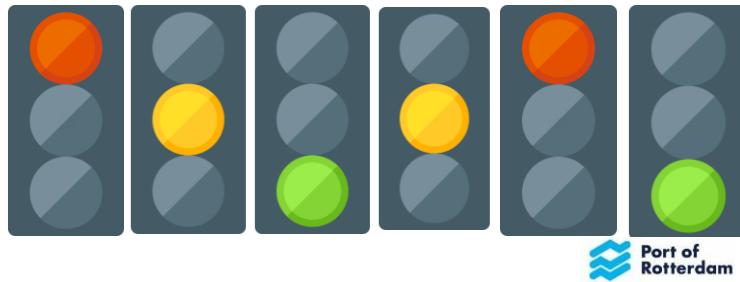
## APPROACH...



IMPACT!

- The measuring of the data quality was not yet uniform within Organization.
  - With this automatic tool, the quality will be done in a uniform manner and is easy for non-technical people to use.

- Within Organization an uniform Data Quality Audit was needed to assess what the data quality of datasets is.
  - Together with colleagues the most important requirements of the audit were drawn up. After that the course participants tested the Data Science course so enough feedback was received from the rest of the colleagues.
  - An R Shiny tool (<https://shiny.rstudio.com/>) that can quickly determine the data quality of a dataset so that there is a standard for data quality.



**Uniform** way to assess the quality of the data

to import datasets and create data quality rules and tests.

**Quickly** determine the data quality of a dataset with the *R Shiny tool*, so that there is a standard for data quality.

# Data Strategy & Architecture

## AM-Standards

Region, Country, Location  
EMU, The Netherlands

Solution  
Business Advisory

Market Sector  
Power

### PROBLEM...

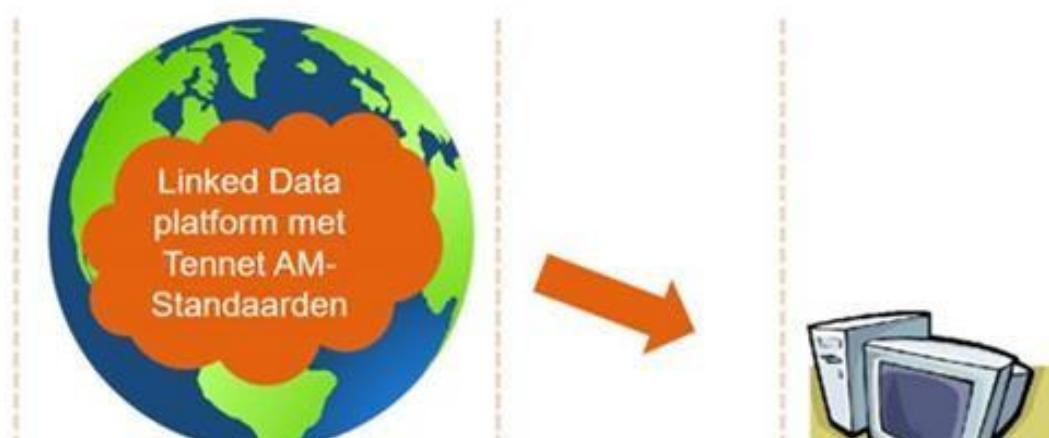
- The main challenge in this project was setting up an Object Type Library (OTL) for TenneT.
- This OTL had to contain object types, requirements types, interface types, system types and risk types. All structurally arranged.
- How people should work with the OTL and how they can find the required information, were challenging aspects of the project.

### APPROACH...

- Organization developed an Object Type Library (OTL) for TenneT based on Organization' own OTL,in which standardization is possible.
- Every contractor of TenneT can now request information via this OTL, which contains, among other things, standard requirements, objects and functions.

### IMPACT!

<b>Standardize</b>	Requirements, objects and functions and other concepts
<b>Contextual</b>	Information can be searched.
<b>Efficient</b>	Information management can be done much more efficiently.



# Data Strategy & Architecture

## Profile for Free Space

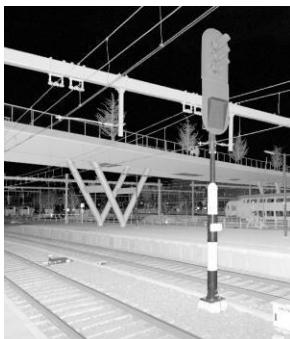
Region, Country, Location  
EMU, The Netherlands

Solution  
Rail & Urban Transport

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Repetitively acquire large amounts of 3D pointcloud, administrative and image data in the field, of the various objects situated along the railroad, in a time saving mode.
- Data management and process the pointclouds, images and GIS dataset of the various objects with the correct attributes, in a controlled, checked and error-free database.
- Generate.xml output files that have to gather, for each PVR object, GIS data & CAD geometry & encoded.jpg cross-section.



### APPROACH...

- Make a digital field data acquisition tool to collect all the varies kinds of information in one database
- Make a Python tool to perform multiple geoprocesses and computations for generation of attributes in the GIS PVR dataset
- Make a Python tool to create the output .xml file



### IMPACT!

95%	Removing human error & very high accuracy of the end product due to the automatized processing.
100%	Easily adaptable tools & output to various requirements
4x	Enabling collaboration between different pieces of software and file formats due to Python coding
100%	<b>Proof of concept</b> that could be reapplied for further automation developments

# Optimization Cleaning Regime Optimization

Region, Country, Location  
EMU, The Netherlands

Solution  
Rail & Urban Transport

Market Sector  
Transportation

## PROBLEM...

- The objective of the asset manager HTM was to search for improvements in the cleaning regime, routes and locations using the existing resources.
- The challenge of this project is expressed by the integrated approach in which the combination of: plan, execution and quality is essential. This underlines the strength of combining Data Analytics and an integrated Asset Management approach.



## APPROACH...

- The project team audited the cleaning regime of the tram tracks in The Hague in order to get an integrated view of the track cleaning and resulting performance.
- The audit consisted of two parts:
  - an analyses of the cleaning routes and frequency.
  - a quality inspection of 75 locations to gather data on the effectiveness of cleaning.
- Using available GPS-data, which main purpose was to prevent the theft of the cleaning vehicles.
- The geographical data were put in a GIS, tracking the cleaning frequency of the vehicles throughout the network.
- An algorithm revealed the intensity of cleaning.

## IMPACT!

- Accurate** solid diagnosis of the cohesion of maintenance, execution and quality of the cleaning regime
- Efficient** and effective cleaning performance and making lean use of public funds

## Risk assessment of Maintenance Inspection

Region, Country, Location  
EMU, The Netherlands

Solution  
Rail & Urban Transport

Market Sector  
Central / Federal Government

### PROBLEM...

- In 2006, Rijkswaterstaat launched a new inspection strategy called: "the inspection house", where a risk based inspection method has taken a major role in the programming of strategic maintenance of bridges, tunnels and viaducts.
- In 2012 the risk based program has been expanded to include more "line" objects, such as embankments and noise barriers. Organization was involved in this program from the beginning and won the tender for the expansion project



### APPROACH...

- Organization was contracted to adapt the inspection strategy to several new types of "line" assets to assure the objects' conservation.
- Every object needed to be examined on details like its history, characteristics and maintenance. Interviews were held with the administrators to provide more data. A risk analysis was made based on this data to see if an inspection was mandatory.
- All this data needed to be structurally organized. SEm was used as a central point of information.
- Specific programming based on the project had to be applied in order to use SEm within the project, because SEm wasn't previously used for projects regarding inspections.
- The client was able to log in to SEm, where dashboards gave an indication of the projects' progress.

### IMPACT!

- Process** an advantage of using SEm is the ability to build the **process** of the project around mandatory requirements of the client.
- Efficient** SEm enables the client to see that the mandatory requirements are being met throughout the project.
- Quality** assurance is easier to be managed by using SEm, since SEm shows the connection of process and requirements on a structural level.
- Module** SEm can be made very project-specific by using modules. Modules can also be made very specific by a SEm-consultant that programs the modules to specific needs



## Program Field Replacement

Region, Country, Location  
EMU, The Netherlands

Solution  
Rail & Urban Transport

Market Sector  
Manufacturing & Technology

### PROBLEM...

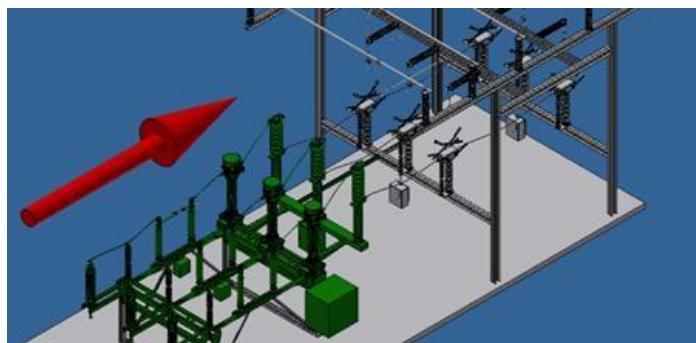
- The main challenge in this project was to increase the efficiency in regards to the maintenance of high voltage fields.
- To increase the efficiency, a modular system had to be developed.
- Modules are constructed by factories. For the construction of these modules, energy related contracts needed to be established.
- These contracts were established through clever use of model-based system engineering. Generating specific contracts for specific modules was simplified.

### APPROACH...

- Pilots were devised for the construction of the modules.
- The modules have to be built by factories. Contracts are required for this.
- TenneT approached Organization for content and information management regarding contracts. The program consisted of thousands of requirements and objects.
- SEm was used to accommodate the large amount of requirements and objects.
- SEm was tailor-made for the processes of TenneT.

### IMPACT!

<b>Process</b>	an advantage of using SEm is the ability to build the <b>process</b> of the project around mandatory requirements of the client.
<b>Efficient</b>	SEm enables the client to see that the mandatory requirements are being met throughout the project.
<b>Quality</b>	assurance is easier to be managed by using SEm, since SEm shows the connection of process and requirements on a structural level.
<b>Module</b>	SEm can be made very project-specific by using modules. Modules can also be made very specific by a SEm-consultant that programs the modules to specific needs



# Data Strategy & Architecture

## Eemshaven 110kV

Region, Country, Location  
EMU, The Netherlands

Solution  
Performance Driven Engineering

Market Sector  
Power

### PROBLEM...

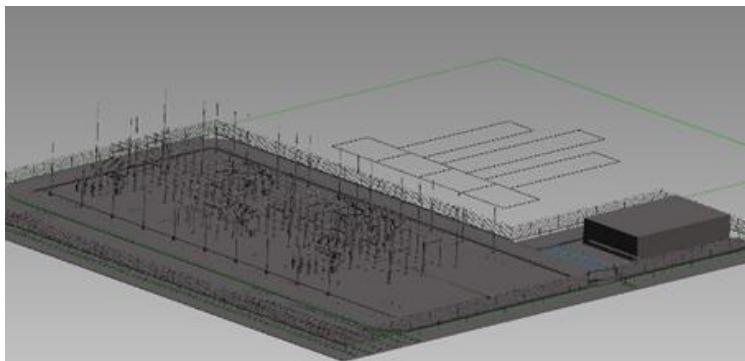
- The main challenge in this project was to create a connection between System Engineering (SEm) and BIM (Revit).
- The connection had to be used in a design of a new high voltage station.
- A new design requires a contract consisting of requirements, objects and functions.
- These contracts have to be drafted efficiently by using the OTL..

### APPROACH...

- Organization was asked to make a connection between SEm and BIM to design a new highvoltage station.
- This was done by using tooling like the I-BIM connector.
- By using the OTL, the System Engineering setup was efficient and fast.
- The OTL made it easy to draft up contracts. These contracts serve as a reference for the design.
- By using the I-BIM connector, requirements were easy to apply to the design.

### IMPACT!

<b>Define</b>	With a tool like the I-BIM connector it is possible to define requirements of the objects in Relatics and make them visible in a tool like Revit.
<b>Easy</b>	The tool makes it easy to see if the design meets the requirements in BIM.
<b>Quality</b>	The designer receives a notification in Revit when a requirement is changed, which improves the quality assurance.
<b>Efficient</b>	By means of an OTL, the System Engineering setup is more efficient and contracts can be realized faster.



# Data Strategy & Architecture

# Utrecht Underground Electric Conduit Network

# Region, Country, Location EMU, The Netherlands

## Solution Rail & Urban Transport

# Market Sector Contractors

## PROBLEM...

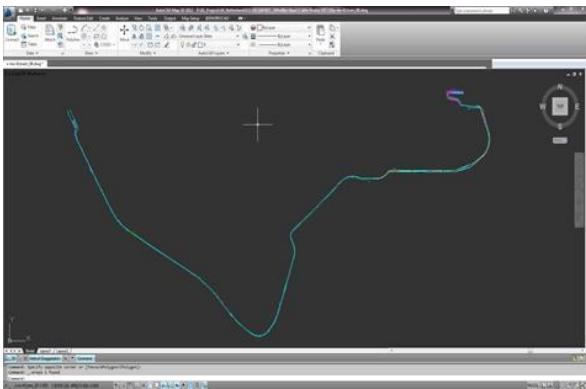


## APPROACH...

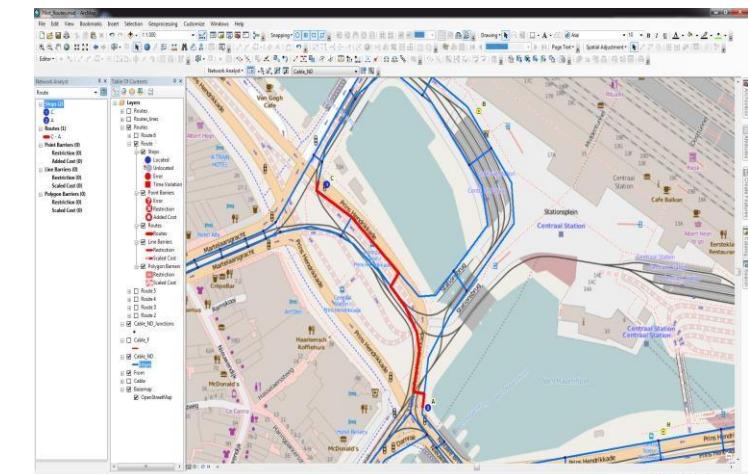


# IMPACT!

- Making the underground electrical conduit network for a new railway line of 9 km in Utrecht, using the shortest route between connection points.



- Using ArcGIS with the Network Analyst extension to make the network model and locations for determining the shortest paths and the sequence of the tubes used for the routes.
  - Filling the capacity calculation for each pipe using the sequences from GIS and also making a CAD model with labeled network



**50%** Time reduction on determining the sequence of the routes.

**30%** More quality control over data by eliminating manual steps.

# Data Strategy & Architecture

## OK3 Cables and Ducts

## Region, Country, Location EMU, The Netherlands,

# Solution Rail & Urban Transport

# Market Sector Manufacturing & Technology

# PROBLEM...



## APPROACH...



IMPACT!

- Diverse clients asked Organization and other companies to make an inventory of the cables and ducts on specific locations in the Netherlands for different kind of infrastructure projects. Making the inventory meant downloading the information from Cadaster.
  - Cadaster is a comprehensive land recording of the real estate or real property's metes-and-bounds of a country
  - In order for the information to be useful, the data has to be vectorized and processed.
  - The data was converted in CAD data and was manually labeled.

- Creation of a data model to connect information from different sources
  - Different software was created for managing and transforming data such as, InfraCAD, Civil3D, ArcGIS, Python.
  - Development of a toolbox in ArcGIS with model builder tools and Python scripts to automatize the processing of data



100%

Increase in process and data complexity (visibility)

75%

Automation of process and reusability on different areas Roads, Rails, Civil works etc.

30%

More quality control over data and

oh



## University of Groningen, New Building Design

Region, Country, Location

EMU, The Netherlands, Groningen

Solution

Rail & Urban Transport

Market Sector

Education

### PROBLEM...

- The goal of the project was to design all mechanical, electrical and plumbing (MEP) services for the new 62000 sq. meter building of the University of Groningen.
- Our initial approach was to use building blocks, meaning that we only design one type of room once and then create a map of the rest of the identical rooms in the building.
- Due to last minute changes, the client requested that all the rooms should be modeled in Revit. This caused a lot of copying/pasting which resulted in a lot of clashes.
- Therefore, our problem was to solve 12 544 clashes in 2 weeks. Most clashes were identical but in different locations

### APPROACH...

- In order to solve this issue, we developed a very simple and basic excel file that could find and count identical clashes based on multiple factors (element ID, type of element, etc.)
- We created a representative sample population of clashes (unique types of clashes) that will be manually solved.
- Write down the time (in seconds) used to solve each clash from the sample population into the online excel file;
- Enable real-time updating by creating an excel spreadsheet on Organization 365 SharePoint.
- Find solutions to solve each type of clash and issue an official disclaimer to the client stating that each type of clash is solved in our detailed drawings.

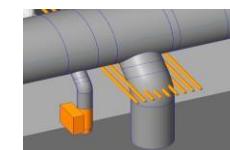


### IMPACT!

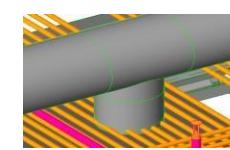
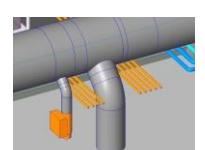
**300%** Increase in the time that we delivered the products (10 days) versus the time that it usually takes to do in a traditional manner (34 days)

**100%** Increase in communication with the region through the shared real-time updated excel file.

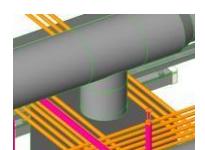
**OK** Proved that data-analytics and automation processes can be applied to the MEP field and therefore started to develop more complex scripts.



600+ times



500+ times



# Data Visualization & Dash boarding MS4 Planning and Maintenance

Region, Country, Location

ANA, United States, Georgia

Solution

Resiliency & Water Management

Market Sector

Manufacturing & Technology

## PROBLEM...

- MS4 is a storm water management program for Georgia that aims at preventing the contamination of natural water bodies.
- Under this contract Organization is supporting the client on several fronts –in surveying their current assets, monitoring compliance, maintaining a repository of all assets and their conditions, reviewing future plans and coordinating the MS4 review effort.
- The problem at hand was to use the acquired data from all the diverse sources to bring out insights that would be useful to our clients.

## APPROACH...

- We engaged with the project team to identify the key performance indicators that would add value to our clients.
- We modified and cleaned the data to streamline it to answer these key questions.
- We used a business analytics tool to visualize the key performance indicators.
- We created automated excel reports that monitor new projects added to the program and changes to the current project schedule.

## IMPACT!

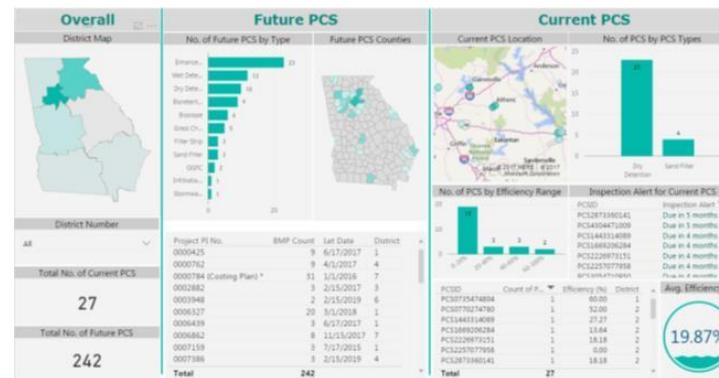
**Insight** into tracking

**Best** Management practices

**Efficiency** Monitoring efficiencies in current asset maintenance strategies

**Prioritization** projects

**Improvement** of risk management



## Data Visualization & Dash boarding

# Augmented Reality Visualization of Groundwater Plume Risk

Region, Country, Location  
ANA, United States

Solution  
Environmental Restoration

Market Sector  
Manufacturing & Technology

### PROBLEM...

- While remediating a sub-surface polluted site, understanding the concentration, shape and spread of the contaminant plume is of prime importance.
- The complete understanding of the contaminant levels and volumes helps in determining the best strategy to mitigate risk and reduce costs.
- We were posed with a unique problem of finding new ways of enhancing the understanding of the contaminated plume to show our client and state agency that the groundwater plume in question posed no health or environmental risk.

### APPROACH...

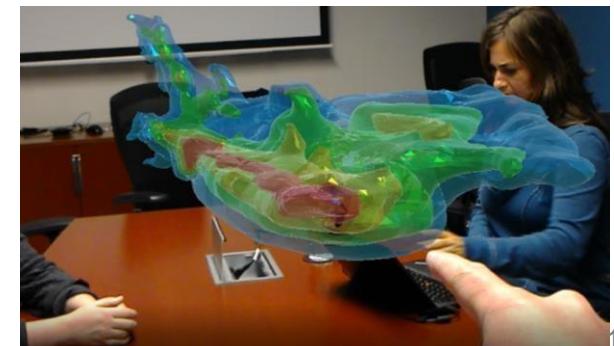
- Organization converted an environmental 3D model from the project site to an augmented reality (AR) hologram that our team, our clients, and the state agency could really get their hands – and eyes – around.
- By viewing the 3D model through immersive AR glasses (Microsoft HoloLens), our clients could see the groundwater plume as a full 3D object ‘floating’ over the conference table. (AR technology superimposes digital information on a user’s view of the real world).
- The AR model made it much more of an experience, and more interactive. With added voice commands, you can ‘talk’ to the model to show different contaminants, concentration levels, and geological information.

### IMPACT!

**Increase** engagement with our client and state agency throughout meetings

**High** AR model was used in closure meetings with the state agency. Through this digital experience, the state agency achieved a **higher level of understanding** of the plume.

**Save** Our team demonstrated the plume posed no health or environmental risk. The site was closed with no required remediation, **saving our client tens of millions of dollars** for a traditional pump and treat remediation approach.



## Environmental Compliance Audit Tool

Region, Country, Location  
ANA, United States

Solution  
Strategic Environmental Consulting

Market Sector  
Telecoms

### PROBLEM...

- Organization was tasked to help one of the leading cellular service providers in the US to audit environmental compliance requirements for all of its 183 locations that housed variety of assets.
- Each of the 3000+ assets had to be in compliance in terms of permits and registrations which further depend on many more factors and conditions.
- Imaginably doing an analysis for each of these facilities was not only cumbersome for our scientists but also very difficult for our clients to consume.

### APPROACH...

- We took all the data from the Environmental Management Information System (EMIS) that the cellular service provided used for saving all their environmental compliance data and absorbed it into a business intelligence tool.
- We then used this for displaying all the assets and the related information in a graphic format that was easier to use for analysis.
- Additionally we created alerts and triggers for items that were outdated , that had missing information or the ones that needed immediate attention.

### IMPACT!

#### Best

asset and condition visibility

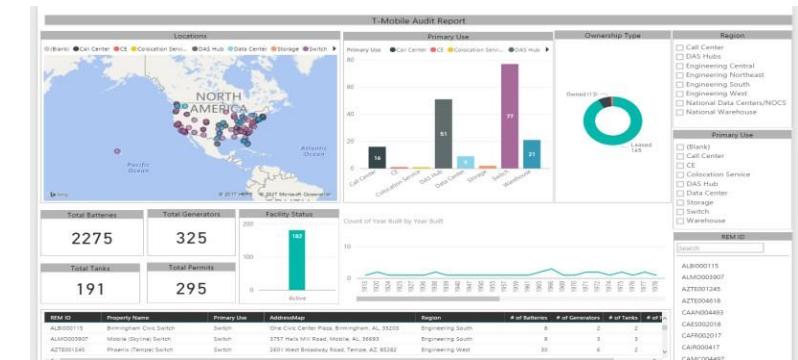
#### Truth

Since this is a web-based interface , it also provided all the stakeholders with

**one version truth.**

#### Management

We were able to take a lot of data and decisions to represent in a way that answered the questions and concerns of our stakeholders.





# Data Visualization & Dash boarding

## Registration Search

Region, Country, Location  
ANA, United States

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

### PROBLEM...

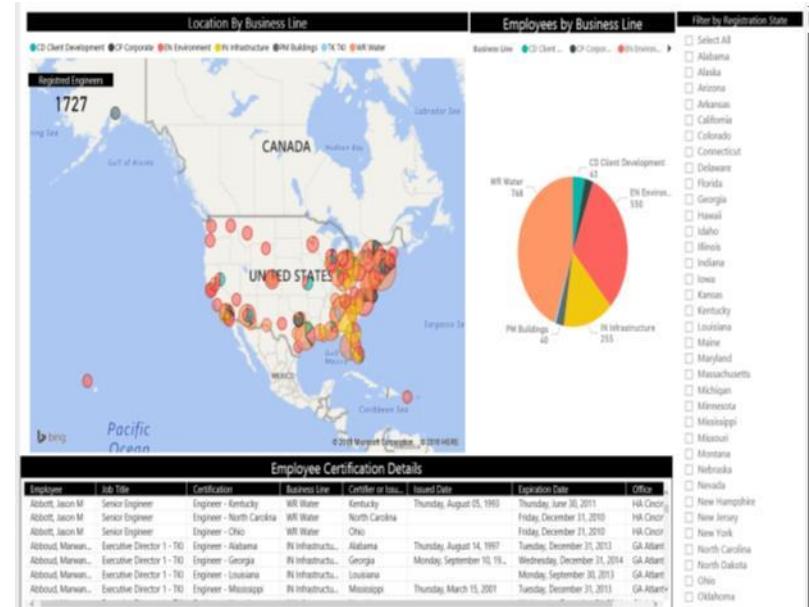
- Organization US is a 5000+ people enterprise with over 2000 people registered and certified in several specialty areas.
- These registrations are necessary to prove qualifications for doing work with clients.
- It was of importance to be able to know the certifications of these individuals and the validity of their licenses while forming a delivery team for a project opportunity.

### APPROACH...

- We used the current data from the registrations database to view this data spatially with an ability to further filter by state or registration or the line of business.
- So that way if someone was looking for an expert in water treatment with the license in a particular state , they could ask this to the dashboard and view all the details of these individuals

### IMPACT!

**Proper** We were able to help the client in **properly** choose the right candidate for a certain project.



# Data Visualization & Dash boarding

## Region wide Signal Timing

Region, Country, Location  
ANA, United States

Solution  
Rail & Urban Transport

Market Sector  
State / Regional Government

### PROBLEM...

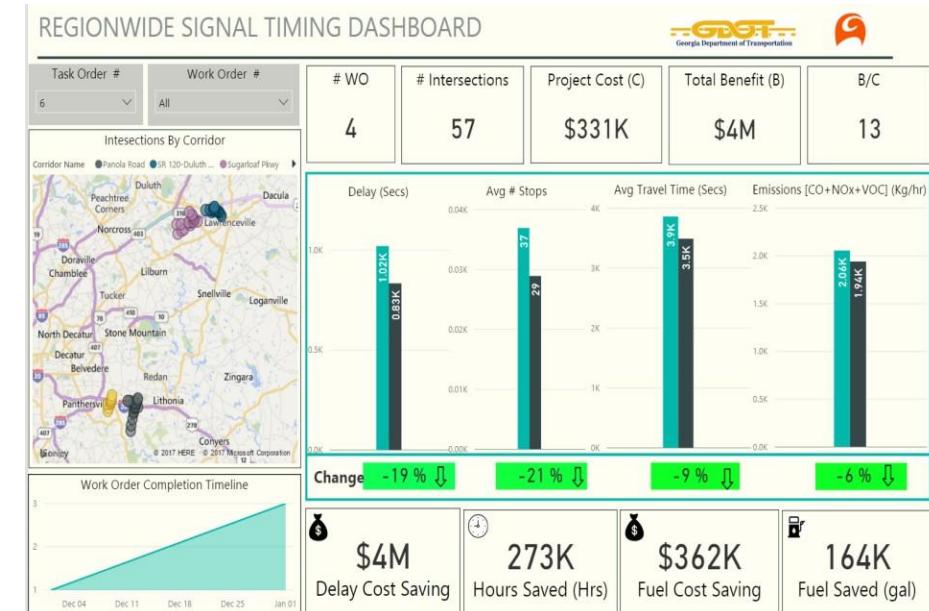
- Under the current signal timing contract, Organization is in charge of calibrating signal efficiencies for more than 1000 intersections in 50+ corridors.
- Organization has been showing performance improvements across these corridors and they are measured in terms of cost savings, travel time savings and fuel saved.
- As the number of intersections grew, the performance improvements became harder to track.

### APPROACH...

- The team decided to create a dashboard to track project performance.
- We took the data that the team was maintaining in the spreadsheets and connected it to the data model.
- We created measures to track the performance in the model and associated the geographic locations of the intersections to plot them on a map.
- We added relevant filters, slicers and indicators to give the client an ability to interact with the data.

### IMPACT!

**Performance** We provided the client an ability to track performance of several consultants working on different projects across the state of Georgia by just toggling a few buttons.



# Data Visualization & Dash boarding

## Sandy Springs Accident Data Visualization

Region, Country, Location

ANA, United States, Georgia

Solution

Rail & Urban Transport

Market Sector

State / Regional Government

### PROBLEM...

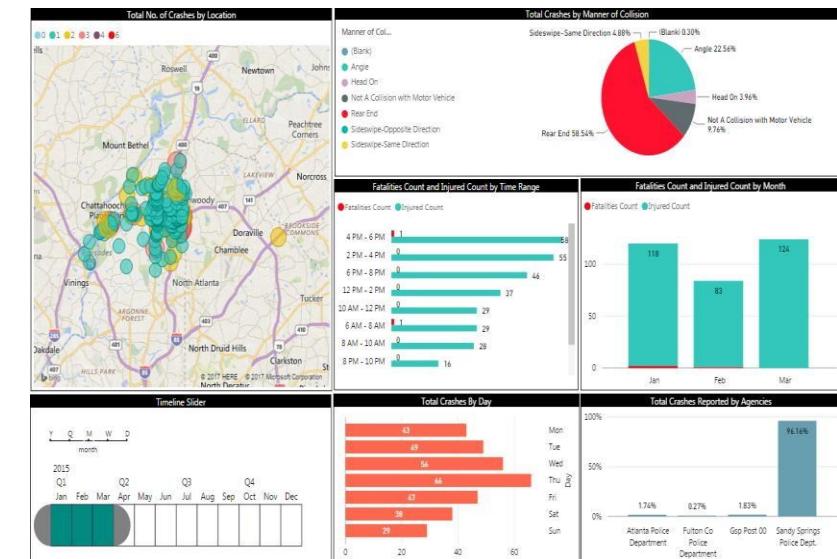
- Organization was tasked to demonstrate the use of open source data and categorized it into different types based on timelines, the reporting agencies and manners of collision.
- We then unriddled into deeper granularity of categorization to obtain detailed insights.
- An interactive dashboard was made to visualize each accident category at different hierarchy levels, and most importantly to answer different questions that aim at reducing the number of accidents.

### APPROACH...

- We used open source data and categorized it into different types based on timelines, the reporting agencies and manners of collision.
- We then unriddled into deeper granularity of categorization to obtain detailed insights.
- An interactive dashboard was made to visualize each accident category at different hierarchy levels, and most importantly to answer different questions that aim at reducing the number of accidents.

### IMPACT!

**Awareness** We helped the client make decisions that aid in creating **awareness** to decrease the number of accidents that happen at major hotspots in the city.



# Data Visualization & Dash boarding

## Questa ERL Head Gate

Region, Country, Location

ANA, United States, New Mexico

Solution

Environmental Restoration

Market Sector

Oil &amp; Gas

### PROBLEM...

- Acid rock drainage (ARD) sediment loading into a recreational lake in the Red River watershed in northern New Mexico.
- Red River drains a mining district that contains multiple naturally occurring hydrothermal alteration zones that release ARD and sediment to the river during episodic summer rain storms.
- As the lakes source of water is from the Red River, sediment loading occurred over several years carrying a high sediment load.
- This ARD sediment resulted in a detrimental aquatic habitat for the fishery and benthic macroinvertebrate community in the lake.

### APPROACH...

- An automated actuator was installed on the sluice gate to close when the river is impacted by high-suspended sediment.
- Water quality probes were installed at the sluice gate to monitor the river water for turbidity, specific conductivity and water depth. If high turbidity is measured, the sluice gate closes automatically.
- Remote access is setup to review the real-time system status and control the system remotely
- Raw data is securely sent via forward transfer protocol (FTP) to Power BI for quick conversion into reviewable 10 minutes interval water quality data and gate status data.

### IMPACT!

**Reduction** The reduction in sediment loading of the lake provided by the automated sluice gate has resulted in an improved aquatic habitat for the fishery and benthic macroinvertebrate community in the lake.

**Award** In 2016, the project received the U.S. Environmental Protection Agency Region



# Data Visualization & Dashboarding

## Risk Life Safety Management Analytics

Region, Country, Location  
ANA, United States

Solution  
Environmental Restoration

Market Sector  
Healthcare

### PROBLEM...

- As part of the (Environmental, health and safety) EHS advisory, asbestos and mold remediation services we provide to a leading healthcare company.
- Organization observed an opportunity to review their current EHS losses (workmen's compensation, general liability, professional liability and automobile liability insurance claims) to unlock loss prevention opportunities.
- This organization had no immediate visibility to areas of functional and locational EHS losses and inherent risk, primarily due to challenges gaining access to claims and audit data for their vast global portfolio.

### APPROACH...

- With the help of the analytics provided by the intuitive business intelligence dashboard we developed using the organization's own technology solution suite, the organization could rapidly see where they had non-financial (compliance and risk) issues.



### IMPACT!

**Financial** This approach of using data analytics to showcase problem areas of EHS loss, risk and compliance became a real game changer in terms of also defining **financial opportunity** and information-driven performance.

**Reduction** We are working to influence direct financial reduction in Insurable Claims with this organization now, through a process-based approach to EHS performance management – to drive up their ROI in EHS investment



# Data Visualization & Dashboarding

## Downtown Connector Study

Region, Country, Location

ANA, North America, Georgia

Solution

Rail &amp; Urban Transport

Market Sector

State / Regional Government

### PROBLEM...

- The Downtown Connector carries over 400,000 vehicles per day with significant congestion and delay at any point throughout the day.
- Closely spaced ramps, frequent traffic conflict areas, and substandard roadway geometry contribute to daily/recurring congestion, while crashes, incidents, and special events contribute to irregular/non-recurring congestion.

### APPROACH...

- The study has involved data gathering, a study of existing conditions, and a tiered analysis of alternatives.
- During the study of existing conditions, crash and incident analyses were conducted using the assistance of the GEC to develop dashboards.
- Crash frequency, incident frequency and clearance, congestion, and geometric deficiencies were all data points that contributed to the identification of hot spots along the corridor.
- These hot spots formed the foundation for identifying alternatives to address the areas of the Downtown Connector in greatest need for improvement.
- With regard to the crash and incident analysis, we conducted a clustering exercise with the geo-referenced sets of data, and then created dashboards showing the high-frequency segments, temporal variations, top N filters, etc.

### IMPACT!

**Financial** Areas of high crash concentration and high incident clearance time were identified to address the areas of highest need/attention.

**Improve** These data points will factor into the final list of alternatives to improve the corridor.

# Optimization

## City Analytics Manchester

Region, Country, Location  
EMU, UK, Manchester

Solution  
Business Advisory

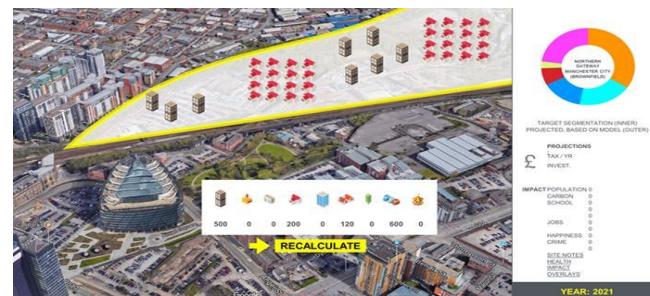
Market Sector  
Municipalities / Local Government

### PROBLEM...

- GMCA's target is deliver 10,000 new homes each year, but they're currently on course to deliver just 2,500. Yet it's not as simple as building more homes. GMCA needs the right types of housing, in the right areas, with the right infrastructure and investment from the right developers.
- The existing process to marry these demands is complex, time-consuming and involves multiple teams, data sets and approvals.

### APPROACH...

- By integrating data held across multiple GMCA systems – alongside publicly available data and valuable data sets from external providers and companies – and combining this within a simplified interface, GMCA can use City Analytics to create robust and defensible plans.
- Importantly too, through the development of the platform, the underlying processes have been streamlined and simplified bringing consistency of approach across the ten district planning authorities. Future extensions will tackle other challenging aspects of the UK planning system as well as employing advanced analytical techniques to guide investment across regions to build more of the right type of homes



### IMPACT!

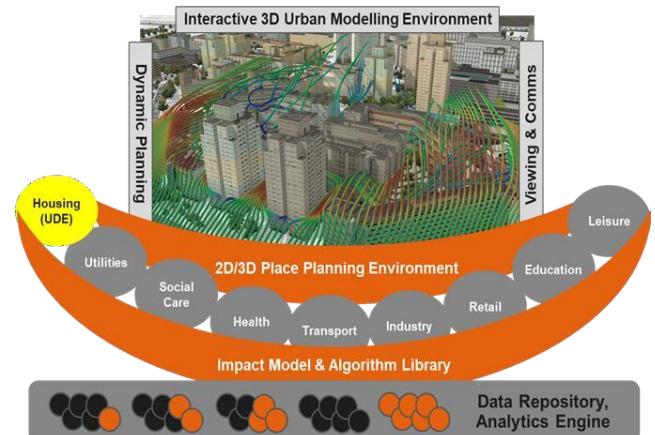
**Forward looking and predictive**

**Based on fact, driven by data**

**Investment-focused approach** to optimizing site plans and delivery

Flexible, responsive, **more collaborative approach** to housing planning

**Evidenced planning decisions** and their implications for policy compliance.



# Computational Design Water Treatment Works, SWW

Region, Country, Location  
EMU, UK, England

Solution  
Performance Driven Engineering

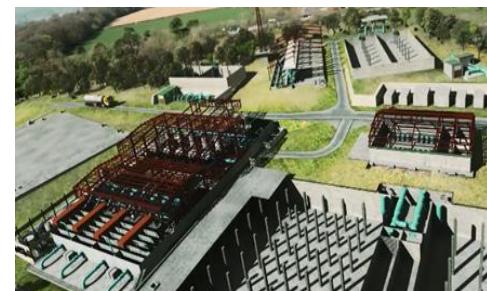
Market Sector  
Water

## PROBLEM...

- SWW's aim is to continue to provide good, safe drinking water that has the trust of its customers, while minimizing the cost of water treatment and our impact on the environment.
- The processes required to produce high-quality drinking water have traditionally been both energy and chemical-intensive and produce a lot of waste. Advances in drinking water technology and new approaches to the management of raw water supplies are now offering cheaper and sustainable alternatives to how drinking water is produced.

## APPROACH...

- SWW commissioned a Dutch company PWN Technologies (PWNT) to design a new drinking water treatment works in Plymouth, using PWN's combined ion exchange and ceramic microfiltration technology. The combined ion exchange (ILCA) and ceramic microfiltration CeraMac technology (Figure 1) will form the core of the new treatment train, which will also consist of granular activated carbon and ultraviolet treatment technology.
- PWN Technologies working with SWW's H5O, its capital delivery alliance that consists of Hyder Consulting, Pell Frischmann Consultants, Balfour Beatty Construction and Interserve Project Services, with Hyder role to provide design management leadership and technical support.



## IMPACT!

- The new North-Plymouth Water Treatment Works will treat water from the Burrator reservoir and rivers Tavy and Tamar. These waters have a high content of humic substances. The new plant will have a capacity of 90,000 m3/day output. The WTW is a strategic supply point for circa 250,000 domestic customers, key businesses, hospitals and a defense establishment.



# Data Visualization & Dashboarding

## Water Network Renewal in Singapore

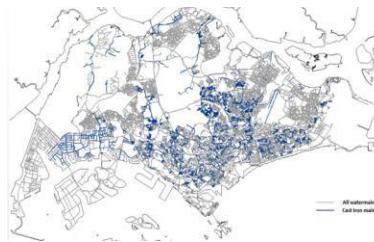
Region, Country, Location  
Asia, Singapore

Solution  
Intelligent Water Networks

Market Sector  
Institutional Agencies

### PROBLEM...

- Apply a risk-based analytic for the client to priorities the renewal of 673 km of Cast Iron pipelines from Singapore (older and with higher failure rate) remaining in the network.
- The pilot, which was due for completion in December 2017, was envisioned to eventually augment PUB's ability to predict leak-prone stretches in its network and allow better planning of network maintenance/rehabilitation works.

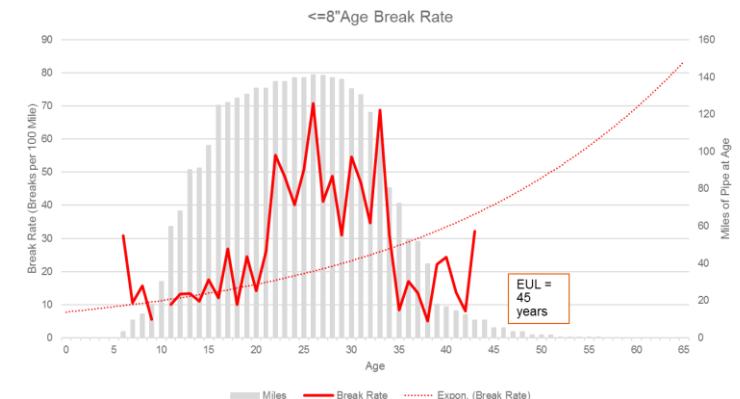


### APPROACH...

- A risk measurement framework was established to drive investment decisions.
- Consequence scoring was developed to evaluate asset criticality and priorities replacement budgets of water networks, based on triple bottom line factors of economic, social and environmental.
- The risk-based approach to the pilot was hosted within a non-proprietary software called Organization Rehabilitation and Replacement Planning System(ARRPS). An ESRI GIS-based planning tool which applies service level, consequence of failure, condition and replacement cost criteria in conjunction with budget constraints to plan the optimal rehabilitation and replacement program of linear assets.

### IMPACT!

- |  |  |
|--|--|
| <b>Reduction</b><br><br><b>Transparent</b><br><br><b>Maintenance</b> | in field inspection cost.<br><br><b>fully optimised</b> capital investment plans.<br><br>of <b>service levels</b> and <b>consistent reduction</b> of programmes' whilst maintaining line of sight with utility objectives. |
|--|--|



DIGITAL THEME: GENERATE

# Data Visualization & Dashboarding

## TenneT SüdOst Link

Region, Country, Location  
EMU, Europe, Germany

## Solution Operations & Maintenance

## Market Sector Power

## PROBLEM...



## APPROACH...



IMPACT!

- 241 raster maps conversion from color to high contrast black & white and reprojection.
  - 290 datasets, containing approx. 1,8 million objects from third parties are used for the project WebGIS. All of these need to conform to the same standard.
  - Provide quality assurance and control checking of all datasets used for valid attributes and geometries.

- Developing of an action script in Adobe Photoshop to achieve the successful conversion of all maps. The solution from reprojection came by using a functionality integrated in ArcGIS called Model Builder.
  - Python in conjunction with ArcGIS geoprocessing toolbox was used to create a script to check the data and to generate a detailed report on its conformity.

## Reduction

of **65% of estimated time** for achieving the end result.

Faster

All maps have been converted and projected in approximately **2 hours** instead of a **couple of days** for manual conversion.

# Data Visualization & Dashboarding

## Britain's construction labor crisis

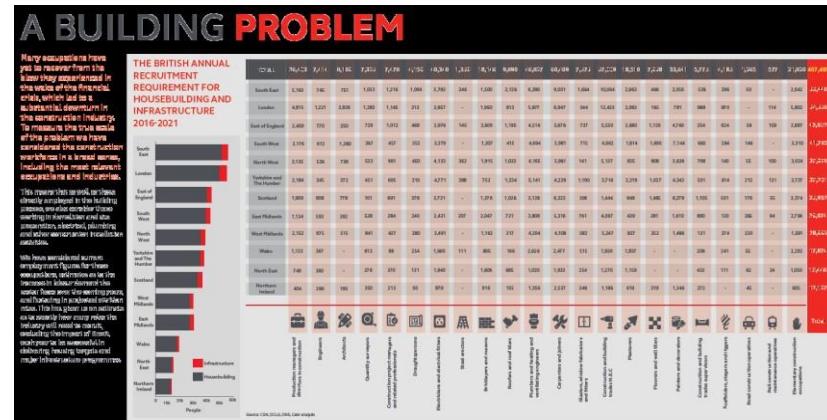
Region, Country, Location  
EMU, Europe, UK

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Organization developed an industry report to evidence the scale of labour crisis in the building, homes and transportation hubs of Britain with particular focus on the impact of "Brexit" in the construction labour market.
- This study won multiple awards such as 'Best Use of Data', Best one of Content Campaign and 'The Grand Prix'.



### APPROACH...

- Obtain large data sets from sources such as Office of National Statistics and created certain assumptions and hypothesis to derive key findings.
- Derived number of people required to deliver the housing and infrastructure needs of the nation.

### IMPACT!

#### Identified

regions within the country that may have **the greatest needs of people**.

#### Showed

**effects** and **impacts** of hard **Brexit** on construction workforce and resolution for the same.



# Data Visualization & Dashboarding

## Energy Management System Implementation

Region, Country, Location  
ANA, United States

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Optimize the operation of their assets and the consumption of energy throughout their conveyance system.
- The client needed actionable information from data generated by disparate sources, internal and external to the organization, to reduce power consumption and plan future operational conditions.

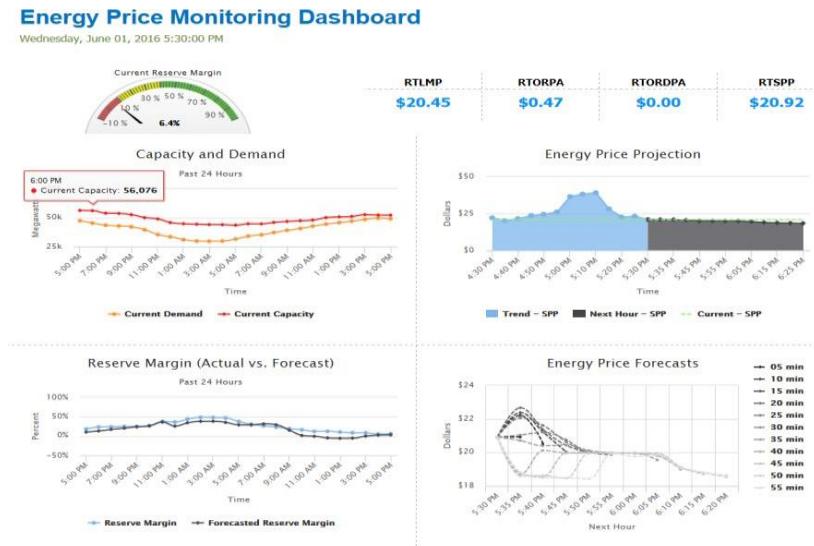
### APPROACH...

- Create an energy price monitoring dashboard to view and track real time energy market conditions and predict market trends.
- The tool alerts operators when they need to adjust operating conditions during a price spike.
- A power monitoring and scenario analysis tool was also created to simulate operating conditions and understand the effect on power consumption over the long term, before the operational change was implemented.

### IMPACT!

#### Simplifying

and **integrating access** to disperse relevant information that allows tracking real time energy market conditions and current energy consumption levels of assets in operation.



# Data Visualization & Dashboarding

## GSK Pharmaceuticals

Region, Country, Location  
ANA, United States

Solution  
Business Advisory

Market Sector  
Chemical & Life Science

### PROBLEM...

- Organization is supporting one of the biggest pharmaceutical clients in the US in designing a tool to pool the resources for all of their building programs to ensure efficient utilisation and fit of purpose for each project according to its needs.

### APPROACH...

- Built a resource planning tool to pool the resources with different selection parameters like level of interest, experience, education background and primary sector experience.
- We then showed them the most important measures (KPIs) for decision making while spatially showing the properties and assets they affect.
- We also did additional analysis to prioritize their most important sites for them which will be used in the implementation plan for reducing the risks pertaining to lead and mercury in the next 5 years.

### IMPACT!

#### Added

value to the project **by designing an online survey** to interview potential candidates for relocation.

#### More flexible

**dashboard** which **reflects changes** in the dashboard when any details of resources gets updated.



# Data Strategy & Architecture

## Lead and Mercury Abatement

Region, Country, Location  
ANA, United States

Solution  
Business Advisory

Market Sector  
Oil & Gas

### PROBLEM...

- Organization is helping a leading gas and energy utility in minimizing the lead and mercury risks across several assets across the state of California. This includes electric transmission towers, generators, power plant components and office assets.
- Both the compounds have a profound environmental and health impacts. Since each of these assets has several attributes that are critical in determining the abatement strategy, consolidating and analyzing this data became very essential.

### APPROACH...

- We identified the underlying patterns by visualizing the data spatially. We were able to show the client the most important measures (KPIs) for decision making while mapping the properties and assets they affect.
- We also did additional analysis to prioritize their most important sites, which aided the development of an implementation plan for reducing risks pertaining to lead and mercury over the next five years.

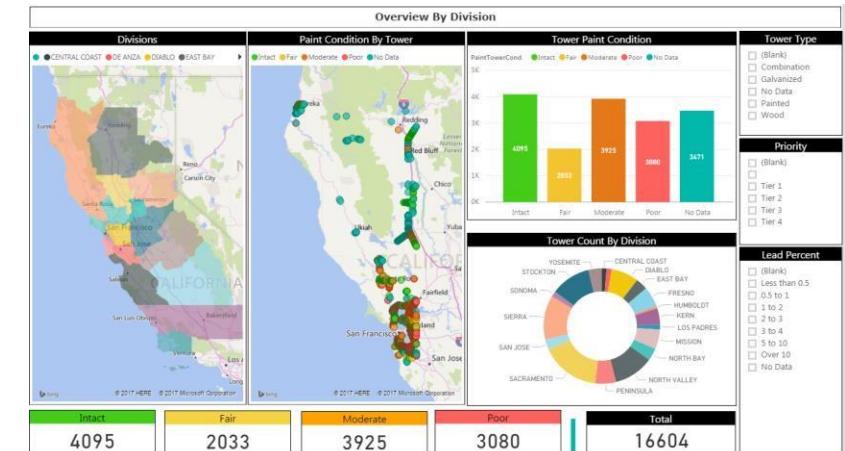
### IMPACT!

Properly

planning and maintaining the assets from the analysis we performed.

Effectively

perform schedule maintenance and risk management due to database reporting.



# Data Strategy & Architecture

# Orange County Public Works

Region, Country, Location  
ANA, United States

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

## PROBLEM...

- The Client recognized the need to efficiently manage their resources to be able to deliver the current planned capital projects.
- They also wanted to gain additional insight into the potential to maximize delivery from the current resource levels and also understand where they could be potentially constrained.

## APPROACH...

- Created a resource assessment dashboard that provides an interactive view of the important KPIs taken from Employee Time Management Reports.
- The dashboard acts as a consolidated report which compares the projects, budget and utilization data of the company.

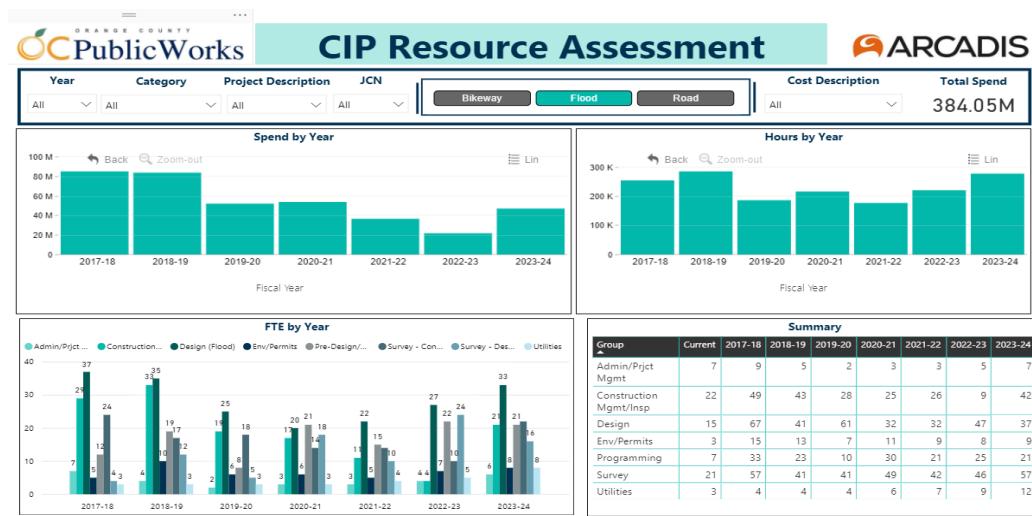
## IMPACT!

### Ability

to **drill down to details**. Dashboard allows **for analysis of summary** and detail-level data without running and comparing multiple reports.

### Intuitive

**user experience**, providing **better understanding** of the compilation of the company's workforce and budget.



# Data Strategy & Architecture

## PMG AGOL viewer

Region, Country, Location  
EMU, The Netherlands

Solution  
Rail & Urban Transport Solutions

Market Sector  
Transportation

### PROBLEM...

- Create an AGOL viewer containing all the PMG points, with the corresponding metadata and documents attached to each feature.
- The purpose of the viewer was to ease the work of the surveyor on the field, in order to have a better overview to the data and to easily manipulate and update the existing dataset of the PMG points, without being necessary to have access to or knowledge of using a specialized GIS software.

### APPROACH...

- Update the PMG dataset from ProRail according to requirements and attach to the corresponding PDF files.
- Split the data on layers using queries based on the points order and measuring date.
- Publish the data on the ArcGIS server, create a map with the newly feature service and update the map with other relevant layers.



### IMPACT!

**Easy**

**manipulation of the map** for a non-GIS user and **updating the data set** with new attributes.

**Mobile**

**access** to GIS data.

**Better**

**overview on the data** due to the various layers.



# Optimization

## Severn Trent Water, SEAMS

Region, Country, Location  
EMU, UK

Solution  
Resiliency & Water Management

Market Sector  
Water

### PROBLEM...

- Offering support to STW for justifying the tariff proposals to the English & Welsh water regulator, Ofwat.
- Software and services were required to support the tariff proposals by identifying investments and costs linked to risk and impact plans within the upcoming five year Asset Management Plan (AMP) 2010 to 2015.
- Create a robust and scalable solution flexible enough to account for future changes in the most significant factors of the solution.

### APPROACH...

- Predictive analytics capability which provides asset modelling, cost optimization, and stakeholder decision-support across the business
- Top-down corporate performance decision-making facility which has empowered the executive management team to understand the optimal path to deliver the strategic direction statement
- Installing SEAMS' WiLCO technology on-site at STW and training STW staff to operate the software and manage the decision-making process.

### IMPACT!

#### Scalable

The solution implemented is continually being enhanced to meet with the needs of the client and the regulator.

#### Unified view

of **the assets** and **predicted asset** performance/consequences, and **risk** for a range of possible investment scenarios.

#### Improved

**communication** of business plan inputs and outputs between senior managers in asset management, finance, operations, and engineering.

#### Optimized

**solutions** in line with regulatory, business and clients requirements.

# Optimization

## Bristol Water, SEAMS

Region, Country, Location  
EMU, UK

Solution  
Resiliency & Water Management

Market Sector  
Water

### PROBLEM...

- Following their regulatory review in 2009, Bristol Water wanted to challenge their Ofwat determination and significantly improve their results for the next planning period.

### APPROACH...

- The team recognized that, in order to meet their objectives, they would need to bring in specialized skills and software to develop their analytic modelling capability. The team put out a tender to bring in specialized modelling software and services to improve strategic planning and prepare for the next Ofwat Price Review (PR14).
- Bristol Water wanted to find a tool that could optimize scenarios across their asset stock.
- The software needed to be able to identify the lowest cost option for decision makers, whilst considering factors such as customers' willingness to pay and level of risk.

### IMPACT!

<b>Cheaper</b>	The expected cost savings of £10M equates to a ROI of <b>400% over 5 years</b> .
<b>Better</b>	<b>understanding</b> uncertainty and risks and the ability to complete sensitivity analysis.
<b>Optimized</b>	PR14 <b>business plan</b> with investment balanced across the full suite of assets.
<b>Eliminates</b>	<b>modelling gaps</b> across Bristol Water's asset stock.
<b>Ability</b>	to <b>meet and exceed</b> customer service levels and customer expectations.
<b>Increase</b>	of <b>certainty of outcome</b> , improving confidence in the business plan.

# Optimization Dunea, SEAMS

Region, Country, Location  
EMU, The Netherlands

Solution  
Resiliency & Water Management

Market Sector  
Water

## PROBLEM...

- Dunea wanted to maintain their leading position in terms of asset management decisions within the Netherlands' water industry, however they wanted to take the step into using analytics to improve decision making.
- They saw working with SEAMS Enterprise Decision Analytics (EDA) technology and consultancy team as a key part of achieving this goal.

## APPROACH...

- An initial pilot project in 2011 helped Dunea better understand how to invest in assets to achieve the desired performance and risk outcomes.
- The pilot was used to derive a corporate investment strategy and a tactical plan for a single operating region.
- The success of the pilot led to Dunea commissioning SEAMS to roll the methodology out to the entire company and across all regions.

## IMPACT!

**Cheaper**

Dunea has realized cost savings of approximately **€ 2 million** on their annual budget – equivalent to more than **17% + of CAPEX** for distribution mains.

**Improved**

**mains performance:** Consolidation of number of customer interruptions (OLM), reduced bursts and reduced OPEX (reactive repair costs).

**Saving**

**€2 million** CAPEX saving:  
Achieving the **same outcomes for lower cost** through better targeted investment has led to a reduction of approximately 7 Km of pipe replacement/annum saving €2m CAPEX per annum.

## Optimization

# South West Water, SEAMS

Region, Country, Location  
EMU, UK

Solution  
Resiliency & Water Management

Market Sector  
Water

### PROBLEM...

- Asset management plays an important role in South West Water's (SWW) ability to deliver a balance between demand for its services and the impact on the natural environment.
- It operates within a region surrounded by some of the UK's most important heritage coastline, a National Park, a home to diverse wildlife and a popular destination for tourists.
- As a result it has to manage one of the most dynamic water cycle systems within the UK water industry.

### APPROACH...

- For a solution, SWW have looked to SEAMS and AECOM, to assist in the development of asset management practice for the delivery of more cost effective investment and maintenance strategies across a range of buried infrastructure assets.
- Communication pipes have been one asset group that have proved a conundrum for asset managers. These are small bore pipes connecting water from the main to the customer boundary.

### IMPACT!

Faster

**Saves time** in preparing investment cases over traditional physical models and spreadsheet calculations.

Cheaper

**Saves money** by using an algorithm to seek out the least whole life cost strategy.

# Optimization

## Northumbrian Water, SEAMS

Region, Country, Location  
EMU, UK

Solution  
Resiliency & Water Management

Market Sector  
Water

### PROBLEM...

- Embed analytical and modelling capability into NWG's organization to ensure flexible and timely decision making and reduce dependence on external contractors.
- Transform NWG's analytic environment into a business as usual state where models were reviewed and refreshed on a regular basis.



### APPROACH...

- SEAMS brought analytical modelling capabilities in-house through jointly developing and building the models, continual development of the software functionality and training of the in-house modelling team.
- SEAMS developed the initial models for NWG to optimize asset investments for their AMP4 business plan.
- The first model focused on clean water infrastructure assets, predicting forward the investment needed to maintain service levels for customers including bursts, interruptions and repairs on assets.
- Following the success of the initial model, SEAMS then developed a waste water model for their gravity network.

### IMPACT!

<b>Optimized</b>	investments give <b>better value</b> to NWG customers.
<b>Reduced</b>	reliance on external consultancy.
<b>Included</b>	<b>Analytics and modelling</b> built into the business as usual process.
<b>Flexible</b>	Respond <b>quickly</b> for input into business plans.
<b>Control</b>	Software housed internally giving <b>complete control</b> .
<b>Improved</b>	<b>decision making</b> due to the ability to run multiple investment scenarios.
<b>Maintained</b>	customer service levels by investing in the right assets <b>at the right time</b>

# Optimization Icon Water, SEAMS

Region, Country, Location  
Australia

Solution  
Resiliency & Water Management

Market Sector  
Water

## PROBLEM...

- Over the past decade Icon Water's sewer network has benchmarked poorly against other Australian city networks in terms of sewer pipe collapse, blockage rates and overflow events.
- The existing proactive approach to understanding the Icon Water asset condition and determining priority intervention or maintenance needs has been by pipe cleaning and CCTV investigations.
- Icon Water recognized that the worst condition pipes were not necessarily being identified for repair or replacement.

## APPROACH...

- Using advanced analytics, a new overarching methodology for driving investment by risk, performance and total cost was developed for Icon Water.
- SEAMS' structured and established process was adopted for the project, working through our standard work packages for investment planning projects.
- SEAMS guided the client through these work packages, managing the process and ensuring delivery to time and quality.

## IMPACT!

- |                    |                               |
|--------------------|-------------------------------|
| <b>Efficient</b>   | investments.                  |
| <b>Improved</b>    | performance and reduced risk. |
| <b>Informed</b>    | dialogue.                     |
| <b>Deliverable</b> | plan.                         |
| <b>Targeted</b>    | data collection.              |

## Optimization

# Yorkshire Water, Decision Making Framework

Region, Country, Location  
EMU, UK

Solution  
Resiliency & Water Management

Market Sector  
Water

### PROBLEM...

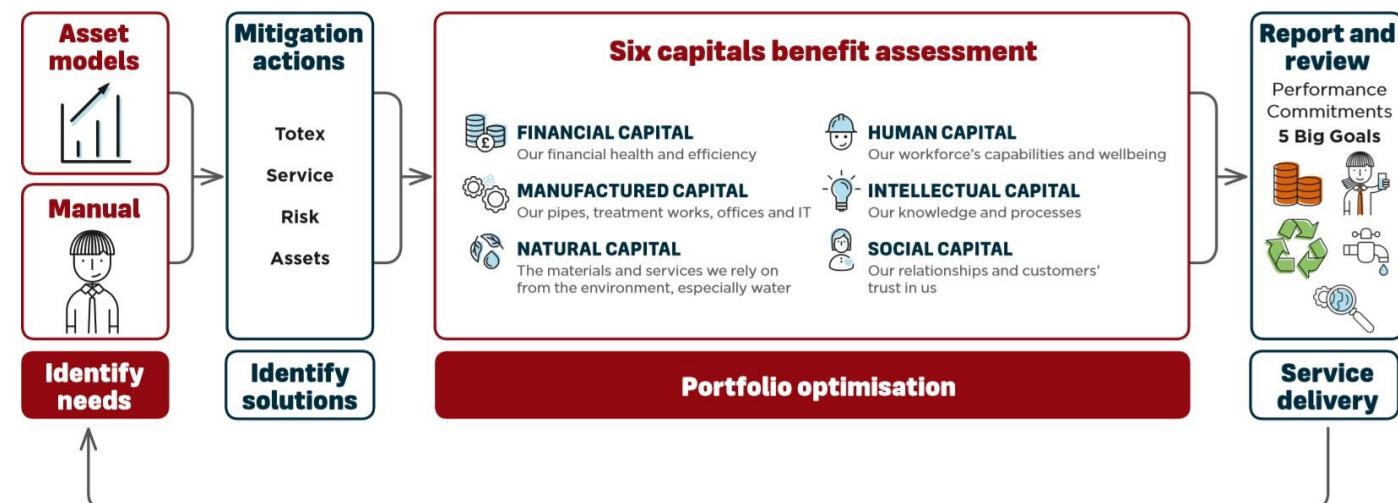
- Since 2016, SEAMS have been supporting Yorkshire Water with the introduction of software and services that will meet their transformational Totex decision making vision for the future.
- The Decision-Making Framework (DMF) is a next generation replacement for an existing system.
- The asset deterioration models and supporting processes were no longer considered flexible, or powerful, enough to handle the future demands of the business.

### APPROACH...

- SEAMS' approach ensures strategic business plans are generated using a standardized approach to value the cost, risk and benefit of investment decisions that are needed across the business, now and in to the future.
- Asset models use predictive and prescriptive analytics with optimization to identify the best value asset investments to meet short- and long-term performance commitments.

### IMPACT!

<b>Reduction</b>	<b>100% reduced errors</b> , improved consistency
<b>Ability</b>	<b>75% ability to evaluate</b> myriad what if scenarios and deliver more robust plans.
<b>Flexible</b>	<b>30% more flexible system</b> that is able to respond and evolve to the changing regulatory climate.



# Optimization

## North Umbria Water, SEAMS

Region, Country, Location  
EMU, UK

Solution  
Resiliency & Water Management

Market Sector  
Water

### PROBLEM...

- SEAMS continue to support NWG in an advisory role by providing ongoing advice and support on developing new product features.

Achieving business success together

**SEAMS**  
AN  ARCADIS COMPANY

**NWG**  
*living water*

### APPROACH...

- In order to achieve their objectives, SEAMS developed the initial models for NWG to optimize asset investments for their AMP4 business plan.
- The first model focused on clean water infrastructure assets, predicting forward the investment needed to maintain service levels for customers including bursts, interruptions and repairs on assets.
- Following the success of the initial model, SEAMS then developed a waste water model for their gravity network which helped NWG understand the impact of sustainable, long-term investment over 25 years, on collapsed sewers, blockages, flooding and pollution.
- NWG has used models developed in SEAMS Enterprise Decision Analytics during the last three price reviews. The models continue to be evolved by NWG's team to reflect new guidelines and learning.

### IMPACT!

Optimized	<b>investments</b> give <b>better value</b> to NWG customers.
Reduced	<b>reliance</b> on external consultancy.
Integrated	<b>Analytics and modelling</b> built into the business as usual process.
Flexible	Ability to be <b>flexible</b> and <b>respond quickly</b> for input into business plans.
Control	Software housed internally giving <b>complete control</b> .
Improved	<b>decision making</b> due to the ability to run multiple investment scenarios.
Maintained	<b>customer service</b> levels by investing in the right assets at the right time.

# Optimization EPCOR, SEAMS

Region, Country, Location  
ANA, Canada

Solution  
Resiliency & Water Management

Market Sector  
Power

## PROBLEM...

- Enhance how EPCOR plans to invest on the needs of its water network, piloting a project that focused on the City of Edmonton, also its sole shareholder.



## APPROACH...

- The project used SEAMS' Enterprise Decision Analytics® (EDA®) platform to develop an optioneering tool which forecasted budgets for maintaining low-lift pumps in water plants to ask the question if EPCOR is spending on the right assets at the right time.
- This project sought to find the 'sweet spot' for investment by deep diving in to the underlying causes of reliability and identifying how this manifests as risk now and in the future.
- The modelling approach used information about assets, including: reliability, redundancy, age, useful life, cost, and impact of maintenance to form a view on whole life cost and forecast performance of each asset.

## IMPACT!

Better

ability to **meet the demands** of regulation **by providing multiple scenarios** for how asset performance impacts revenue requirements.

Quick

**assessment of how reliability and performance change** in response to different spend levels to provide an informed and justifiable view for investment, and therefore revenue needs.

# Optimization Energy, SEAMS

Region, Country, Location  
ANA,

# Solution Business Advisory

## Market Sector Power

## PROBLEM...



## APPROACH...



IMPACT!

- Supporting the client (Northern Gas Networks) into investigating how analytics could help the organization build long-term efficiencies and achieve key strategic objectives.
  - Meet the client's high-level goals:
    - ✓ uncover potential opportunities where analytics can add value.
    - ✓ evaluate and understand the potential risks and rewards for each opportunity.
    - ✓ define a long-term strategy for analytics with measurable results.
    - ✓ understand what skills and software will be required to achieve the outlined goals.
    - ✓ develop a business case to support the analytics strategy.

- Together with NGN, SEAMS ran a series of one-to-one interviews with a cross section of the business, to discover where analytics could help NGN achieve the key objectives.
  - Working with SEAMS, NGN looked to understand the skills, data and software required to deliver each opportunity for analytics, any risks or barriers to success as well as technical considerations.
  - For building a long-term strategy for developing analytical skills, there have been explored the skills gaps, external versus internal resources, associated costs etc.
  - A detailed strategy and planning document was developed including clear strategic goals to measure, quantify and aid success.

## Efficient

Validating the **potential of structured data analytics** to add real value to the business, help the organization work more efficiently and deliver to the customers and stakeholders.

## Development

of a **roadmap** and a robust **strategy** for embedding structured data analytics into the organization.



# Optimization

## LBB Transport, SEAMS

Region, Country, Location  
ANA, Canada

Solution  
Rail & Urban Transport

Market Sector  
Municipalities / Local Government

### PROBLEM...

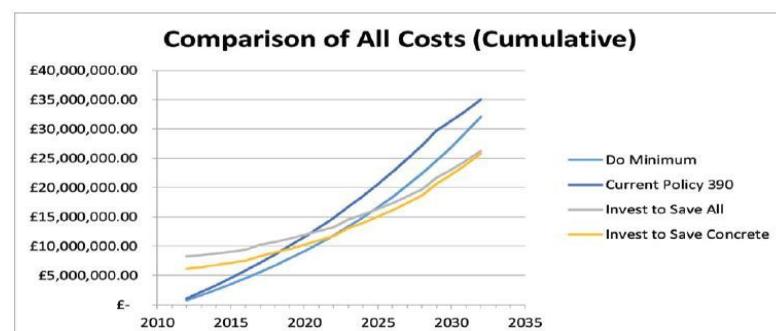
- Supporting the client (London Borough of Bromley – Transport & Highway division) in investigating whether investing in street lighting assets earlier than planned would return future cost savings and determine three potential strategies against the current plan from “Do Nothing” scenario to replacing all streets lighting assets within a 12 months period.
- This was part of the “invest to save” programmed in 2011, which identifies areas where the borough can realize cost savings by investing in capital assets earlier.

### APPROACH...

- SEAMS consultants worked with the LBB staff to analyze the different scenarios and SEAMS’ Enterprise Decision Analytics software was used to calculate future costs for each asset. The analysis took into consideration electricity, carbon dioxide, maintenance, structural testing and emergency replacement costs
- SEAMS’ analysis showed that significant savings could be realized by increasing investment in columns replacement and that these strategies would begin to deliver return on investment between six and eight years.

### IMPACT!

<b>Cheaper</b>	Cost savings to approximately <b>£1 million per annum</b> , by investing <b>£7.5 million</b> .
<b>Saved Money</b>	<b>Save</b> a total of <b>£17.5 million</b> over the desired life of the assets, following a pay-back period of 7.5 years. <b>Significant expected savings</b> at approximately <b>233%</b> of the initial investment.
<b>Better</b>	lighting levels, <b>lower energy consumption, reduced risk</b> of collapse.



# Data Visualization & Dash boarding

## Trip Advisor Data Analysis for Hotels

Region, Country, Location  
EMU, UK

Solution  
Business Advisory

Market Sector  
TBA

### PROBLEM...

- Thinking of booking without checking TripAdvisor first?
- Extracting volumes of data from publicly available data sources



### APPROACH...

- Descriptive – using PowerBI
- Using software tools to scrape the data, then using scripting / algorithms to extract the nouns from review, analyze the associated adjectives to ascertain whether feedback was negative, neutral or positive.



### IMPACT!

- n/a – currently just a proof of concept.

# Data Visualization & Dashboarding

## ACTIVITY TRACKING SYSTEM, RPA

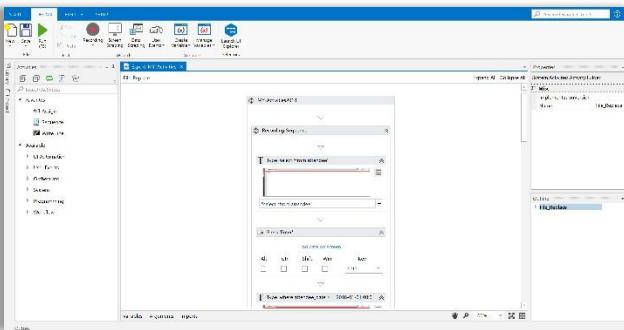
Region, Country, Location  
Asia

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

### PROBLEM...

- To automate and visualized employee's activity data which is tied to various proprietary system.



### APPROACH...

- Creation of a robotic process automation (RPA) workflow to automatize the extraction and processing of data from, proprietary systems.
- Creation of a data model to connect, analyze and visualize information from different sources.



100%

**Automation** for data extraction and visualization

### IMPACT!

# Data Visualization & Dashboarding

## Tender Analysis

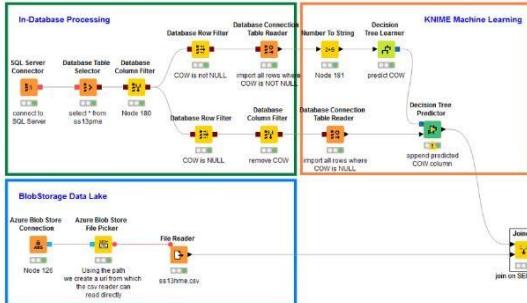
Region, Country, Location  
Asia

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

### PROBLEM...

- The need to automate and visualize tender data in Atles Pro to identify the material trends in terms of type of materials, the costing involved (rate, amount), measurements and quantity.
- No visual reports on the tender trends and its indicators.
- Inability to forecast trends and identify competitive pricing in the market



### APPROACH...

- ETL using KNIME to transform and prepare the dataset.
- Creation of a data model to connect, analyze and visualize information from different sources using Microsoft Power BI, R and Python.
- Create models to forecast trends to facilitate fast decision making.
- Identify key indicators such as
  - Time
  - Economy
  - Bulk Purchasing
  - Vendors & Suppliers

### IMPACT!



Increase in process and data complexity



More quality control over data and standardization



Enable easy interpretation and facilitate faster decision making



# Optimization

# DSNY Commercial Waste Zones Routing Analysis

Region, Country, Location  
ANA, USA, New York City

Solution  
Mobility

Market Sector  
Transport & Modelling

## PROBLEM...

- New York City currently has an open market commercial waste collection system with over 90 collection companies, resulting in high overlap in waste truck traffic.
- Some streets have over 25 collection companies providing the same service, a lot of inefficiency.

## APPROACH...

- Route Analysis: translate client data into routes to understand the baseline industry condition.
- Data formats .shp, .csv, .xls
- Python Script to calculate traffic of current status and modelling the traffic after zoning. Routing API for calculating shortest routes

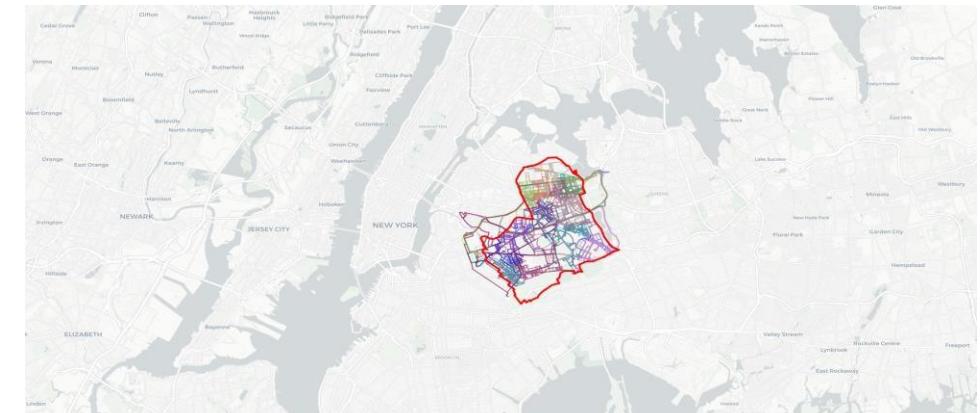
## BENEFITS!

**60-70%** **Reduction** in city-wide commercial waste truck traffic.

**Routes Currently Servicing Customers in the Highlighted Area**  
Each color is a unique collection company.



**Routes Servicing Same Customers After Zoning**  
System is still competitive and routes overlap, but in a tighter geographic area.



# Data Visualization & Dash boarding

## Workforce Analysis for the Construction Industry

Region, Country, Location  
Asia, Hong Kong

Solution  
Business Advisory

## Market Sector Manufacturing & Technology

## PROBLEM...



## APPROACH..



## BENEFITS!

- Understand the characteristics of the workforce based on activity levels
  - Develop indicators and visual trends that will help develop labour strategies

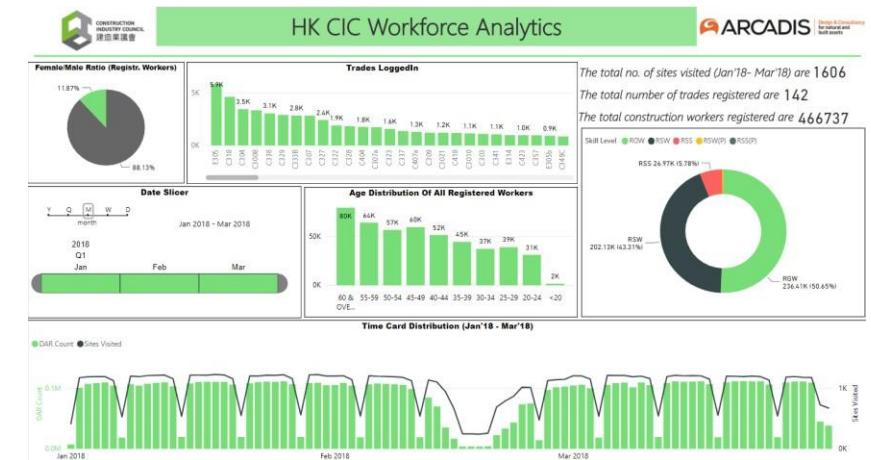
Enhance data management

  - Evaluate and secure the reliability of the existing data and collection system
  - Benchmark against third party collection methods
  - Capture obscure worker segments

Data Visualisation

  - Develop dashboards and visual reports formats for easy understanding by multiple parties
  - Standardize the dashboard format of critical workforce indicators for the industry

- Collect 4 sources of data on workforce; CWRG, CWRS, applicants information and telephone survey.
  - Identifying and standardising key indicators that will help develop Labour strategy in relation to
  - Work retention
  - Attracting new workers
  - Understanding retirement trends
  - Training/ retraining
  - Data collection and management
  - Re-definition of activity levels to reflect the workforce's engagement levels
  - Data visualisation and publication to enable easy interpretation and facilitate industry level decisions.



# Data Visualization & Dashboarding

## Leading Electric Utility, SoC

Region, Country, Location  
ANA, United States

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

### PROBLEM...

- A major electric utility wanted to increase data-driven management of safety behaviors within their asset portfolio.
- This utility wanted to understand the "diagnostic" indicators from their safety data, to get more value and insights out of a previously unused data set, and wanted key risk performance indicators visible to facility executives and safety management teams to drive actionable insights on what was working well, and what was not within their organization

### APPROACH...

- The utility invested in the development of a visual, interactive tool that utilized existing Safety Observation data, so they could learn from and use about 65K+ observations resulting annually from their safety observation program.
- Not just look back on safety incidents (lagging indicators), but look forward on observed behaviors and trends (leading indicators) to proactively manage health & safety processes & culture within their portfolio.



### IMPACT!

\$1M

More

The ability to mine the data from existing systems and bring it to life allowed this utility leverage their investment in existing systems (about \$1M).

do more with less, and make data-driven decisions - all the while linking their operations and performance indicators to their EHS strategy.

# Data Visualization & Dash boarding

## HR Analytics, Staff Retention

Region, Country, Location  
EMU, UK

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

### PROBLEM...

- At Organization, there is a high voluntary turnover resulting in high costs.
- Organization UK wanted to analyze why the people are leaving, where do they go after (what company do they switch to).
- Organization wants to analyze how to improve this situation.

### APPROACH...

- Collection of data associated to employees
- Run classification model to determine the likelihood of an employee to leave
- Collected data from Organization
- Data was not centralized, had to be handpicked
- R and Shiny were used.

### IMPACT!

<b>Understand</b>	the voluntary turnover and why it happens
<b>Identify</b>	the problem and have the ability to tailor initiatives around that
<b>Predict</b>	when it will happen in the future
<b>Retain</b>	Be able to hinder it before it happens and retain employees.

# Data Visualization & Dash boarding

## Revenue Forecast by Business Control

Region, Country, Location  
EMU, The Netherlands

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

### PROBLEM...

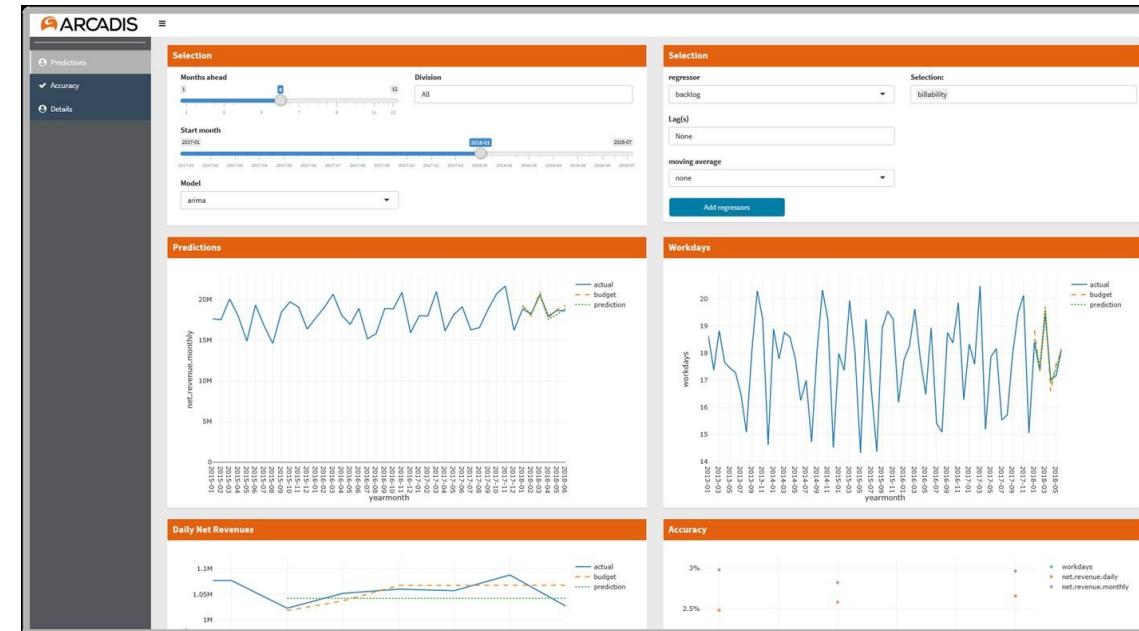
- At Organization, the predication accuracy is not veryhigh of the net revenue.
- We do not always understand the net revenue development

### APPROACH...

- Collected the data
- Created a forecasting model with Arima and Random Forest
- Knime, R, Shiny, and Power BI were used.

### IMPACT!

- |          |   |
|----------|---|
| Predict  | Future revenues   |
| Identify | And explain why the development of the net revenue and why it changes |



# Data Visualization & Dash boarding

# South West Water, InSite Pilot Project

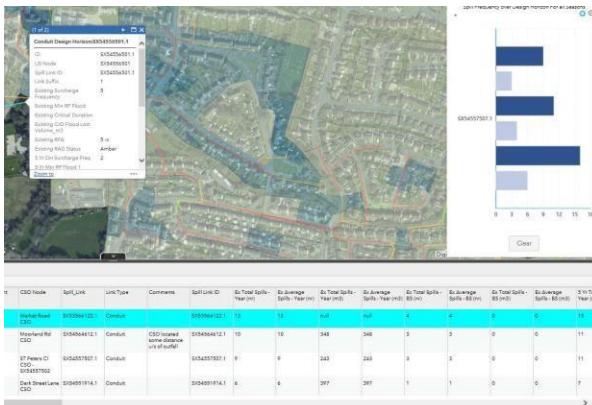
Region, Country, Location  
EMU, UK, England

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

## PROBLEM...

- Determining the level of detail and catchment scale that data would be displayed is critical to avoid an oversized database, which can affect performance of the GIS platform.



## APPROACH...

- Working closely with the client Organization developed a technical concept to integrate hydraulic modelling results and other asset information within an online cloud environment to generate practical insight into the performance and capacity of wastewater systems.
- Our approach integrated previous work on STW headroom evaluation, high-level catchment planning and 21st Century Drainage principals, to create a highly efficient and innovative proposition for SWW, which they subsequently funded.
- Organization have developed a pilot technical framework for a GIS platform, which involved the creation of a secure online environment, navigation and interactivity tools, and the standardization of key datasets. Frequent workshops were held with the client to evaluate and define key functionalities, the look of the user interface, input / output processes and logistics of data management.

## IMPACT!

- The overall concept demonstrates innovation in the water sector and a significant technical step towards Big Data analytics, providing an efficient system for the client to access key performance metrics and operational insight to aid asset and investment planning.

# Optimization

# Whole Networking Modeling on Bay Area Rapid Transit

Region, Country, Location  
ANA, United States

Solution  
Mobility

Market Sector  
Manufacturing & Technology

## PROBLEM...

- SEAMS has been working with BART since 2017 to develop a **whole network renewal optimisation model** using Enterprise Decision Analytics (**EDA**).



## APPROACH...

- This model predicts the changing condition of every asset on the BART network, from the **rolling stock** and **track assets**, to the **staff vehicles** and **computer terminals**.
- The model uses **optimisation techniques** to identify the **optimal mix of asset renewals** to deliver the best overall **reduction in network risk**, while complying with the highly complex funding rules imposed on BART.



## IMPACT!

- Developed model can **account for the impact** of the introduction of a **new fleet of trains** and CBTC signalling system and the associated disposal of **legacy assets** and optimise around them to **deliver the best overall network plan**.
- **EDA** can handle the **highly complex** funding eligibility rules that apply to BART assets.
- **EDA** is currently the **only solution** that has been demonstrated to be **powerful enough to solve this**.

# Data Visualization & Dash boarding

## Power and Market Monitoring Tool

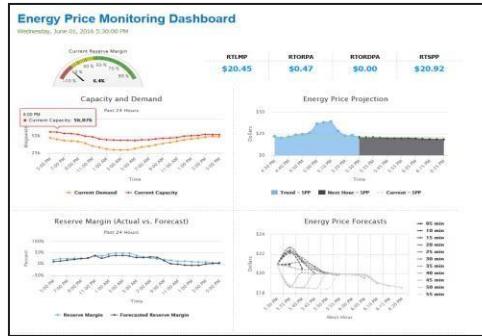
Region, Country, Location  
ANA, United States

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Pumping typically represents more than 80 percent of a water utility's electrical energy usage.
- The Tarrant Regional Water District (TRWD) operates in a deregulated power market with power cost spikes reaching \$9000/MWh (up from a typical \$35-45/MWh) in peak demand periods.
- Anticipating market prices can result in significant cost savings.



### APPROACH...

- The Power and Market Monitoring tool (PAMM) was developed as part of a larger asset management program
- Python and C#.NET leveraging an agile software development methodology
- Single data repository integrating disparate data sources – weather, energy market conditions, SCADA
- Modular approach including scenario planning, demand and market monitoring
- Predictive analytics:** Advanced modules enabled by PAMM predict market conditions and allow operators to test hypothetical scenarios to better understand and predict how operational changes will affect power tariffs in the future.
- Data consolidation:** PAMM created single data repository for all energy related analysis, and establish the foundation of a formal energy management program using ISO 50001

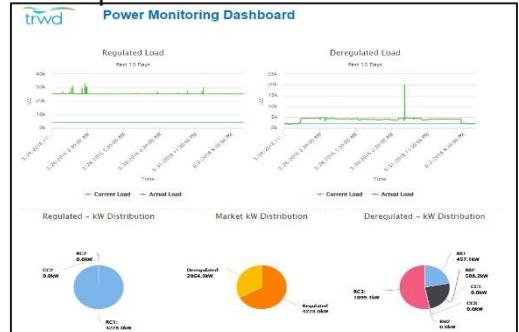
### IMPACT!

#### OpEx Savings

PAMM actively supported operational optimization that resulted in savings of more than **\$80,000** in peak demand periods.

#### Custom

Advanced modules enabled by PAMM predict market conditions and allow operators to test hypothetical scenarios to better understand and predict how operational changes will affect power tariffs in the future.



#### Faster

Faster way to assess and manage vegetation around the Chicago River

## Data Visualization & Dash boarding

# Image Processing to Detect Vegetative Health and Species

Region, Country, Location  
ANA, United States

Solution  
Strategic Environmental Consulting

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Friends of Chicago River (FoCR), an NGO in Chicago, wants to better understand the condition and species of vegetation around the Chicago River.
- However, the size of the Chicago River makes it extremely costly to manually survey the area.

### APPROACH...

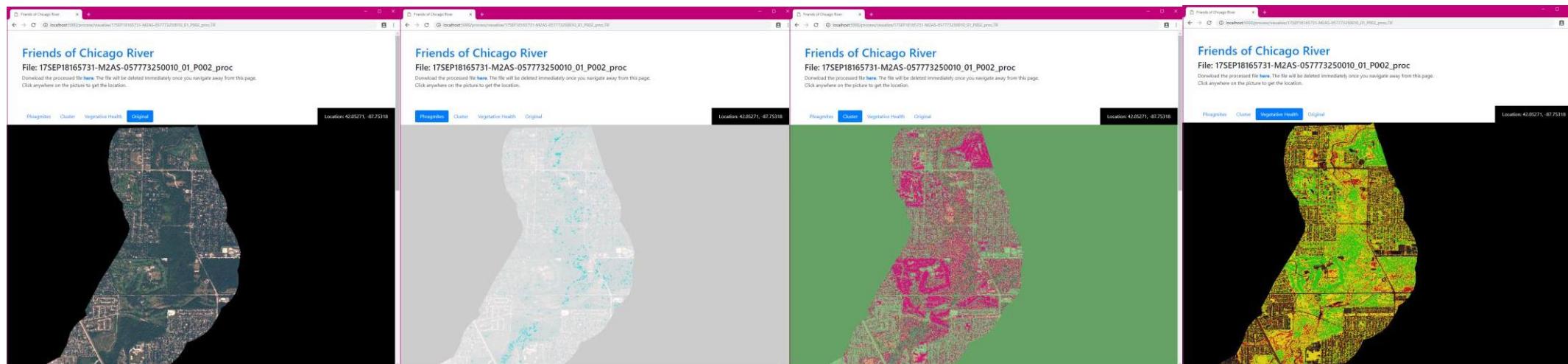
- Use image processing on satellite images to detect species (currently only phragmites), determine vegetative health, and cluster vegetation based on similarities.
- Create a web tool so that the client can easily convert and visualize satellite images whenever new data becomes available.

### IMPACT!

<b>Time Saved</b>	Hundreds of hours saved on manual surveys
<b>Custom</b>	<a href="#">web tool</a> for client to view and process images
<b>Faster</b>	Faster way to assess and manage vegetation around the Chicago River

#### An overview of the visualization feature of the app.

Images from left to right: original satellite images, phragmites detected (blue), clusters, and vegetative health



# Data Visualization & Dashboarding

# NYC Green Infrastructure – Research & Development

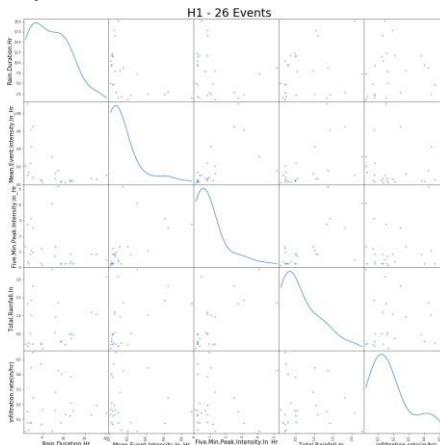
Region, Country, Location  
ANA, United States

Solution  
Strategic Environmental Consulting

Market Sector  
Manufacturing & Technology

## PROBLEM...

- NYC has installed green infrastructure throughout the City to improve cleanliness of waterways and stormwater resiliency.
- The City must assess the performance of millions of dollars worth of green infrastructure and learn how to improve future installations.



## APPROACH...

- Install hundreds of sensors in green infrastructure sites to monitor performance.
- 10 sites include live sensor technology with 16 sensors per location. Data transmissions occur every 1 minute.
- Data is hosted and processed via Microsoft Azure and shown via a live interactive dashboard.
- Data is modeled and processed in SWMM and Python.

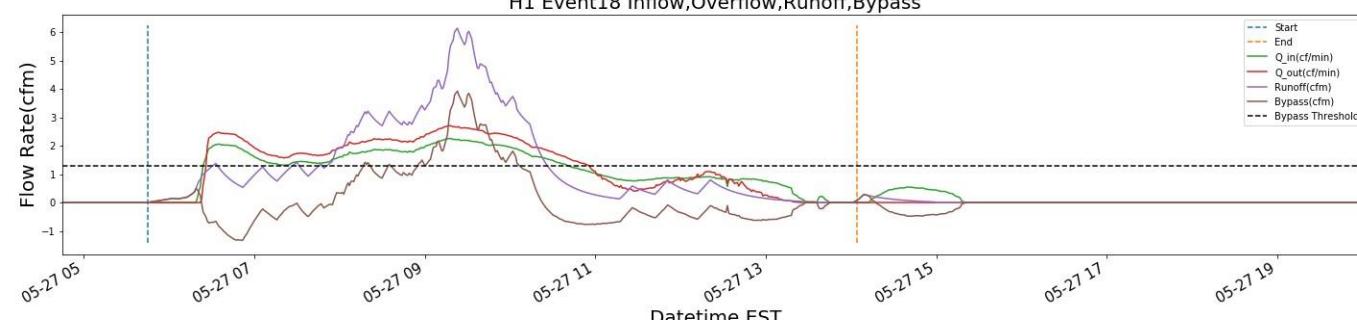
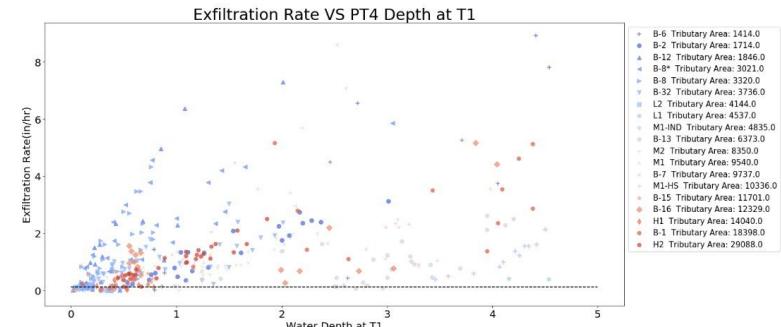
## IMPACT!

### Live

**data access** for the client and the consultant team

### Interactive

**dashboard** to visualize and monitor site activity in real time



## Optimization

# Mobility Disruptions Analysis For London TFL

Region, Country, Location  
EMU, UK, London

Solution  
Mobility

Market Sector  
Manufacturing & Technology

## PROBLEM...

## APPROACH...

## IMPACT!

- Transport for London (TFL) is contending with increasing disruptive and fiscal impact of transportation network companies (TNCs) like Uber and Lyft and the rise of new technologies such as Autonomous Vehicles (AVs).
- Meanwhile, it is also losing its subsidy for the 2018/2019 fiscal year, causing further vulnerability to London's public transit infrastructure.

- Evaluate areas most vulnerable to disruptions from TNCs and AVs using data from London public transit, APIs, etc. to build a value experience model.
- Tool: Python

**Predictive** that helps city agencies assess at-risk transit infrastructure and assists in transit planning in the face of emerging transportation technologies.

## Transportation Value Experience Model



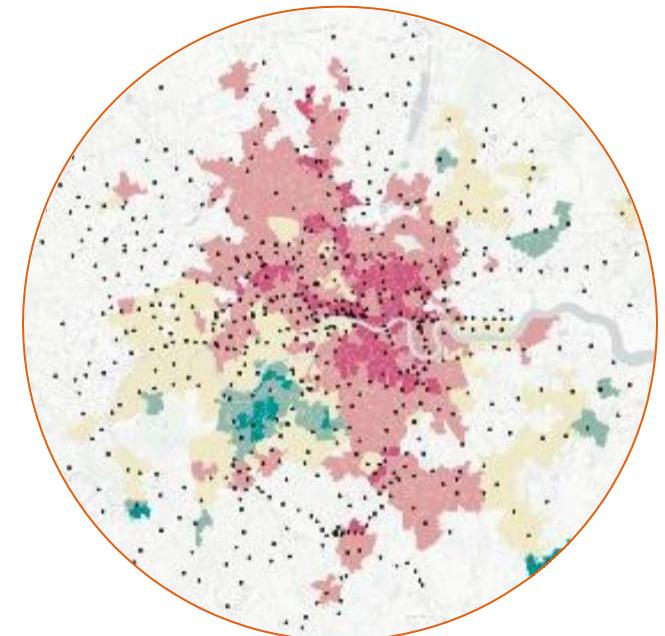
Project future transportation ecosystem



Value experience based on cost, trip time, distance



Revenue risk assessment



## Optimization

# Manchester Airport Transformation Program

Region, Country, Location  
EMU, UK, Manchester

Solution  
Program Management

Market Sector  
Manufacturing & Technology

### PROBLEM...

- To accommodate an extra 10 million passengers by 2023 MAG is planning to undertake expansion through a diverse range of projects covering all parts of the customer journey.
- The scale of work requires expertise in delivering major transformation programs.



### APPROACH...

- By providing a multidisciplinary team, including Program and Project Management, Cost & Commercial, Risk & Opportunity and Change Management experts.
- We are successfully managing and delivering the program.
- We are also utilizing our Stakeholder Engagement capability to support MAG in defining requirements and protocols needed for bringing new assets into operation.
- This approach has enabled us to provide a truly joined up service from strategy to delivery, bringing best practice major programme delivery processes and embedding these within an established organization.

### IMPACT!

<b>Increase</b>	of <b>10 million</b> passenger capacity
<b>Confidence</b>	<b>Using experts</b> from a diverse range of expertise enables MAG to have <b>confidence</b> that are <b>truly efficient and integrated</b> service is being run, innovative design solutions are being explored whilst ensuring business case demands are met.
<b>Realization</b>	Our insight into managing major programmes has allowed us to set up an <b>achievable</b> yet challenging fast-track program to <b>realize results</b> .

# Robotic Process Automation

## Optimizing water network resilience

Region, Country, Location  
EMU, UK, England

Solution  
Intelligent Water Networks

Market Sector  
Manufacturing and Technology

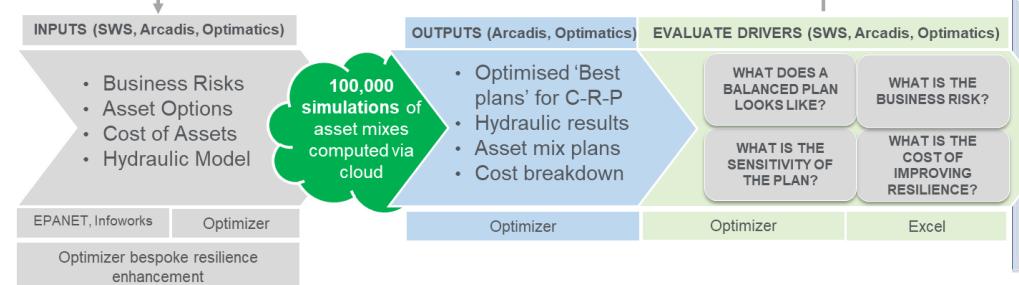
### PROBLEM...

- Planning and investment processes are generally manual and iterative exercises, and multiple parameters need to be considered including hydraulic operations, performance, resilience, business risk, capex and opex.
- Water utilities in the UK have a regulatory focus on efficiency, innovation and resilience and hence there is an increased need for transparent and robust investment decision making.
- We asked ourselves the challenge questions:
  - What does a 'balanced' asset plan look like?
  - What is the business risk exposure for a given asset plan?
  - What is the sensitivity of the plan to changing environmental parameters?
  - What is the cost of improving resilience?



### APPROACH...

- The objective of the pilot project was to understand if we can derive an optimized strategic network plan which will address the key business drivers simultaneously for a defined set of potential options.
- We adopted an outcomes-driven data analytics platform, optimizer, which uses genetic algorithms coupled with hydraulic model to simulate 100,000s of future water asset investment scenarios to provide a pareto front of the most efficient planning options. User defined parameters of cost, water network performance and resilience were included in these simulations.
- Complex asset operational control limits and additional bespoke scripts have been developed to automate planning process.



### BENEFITS!

#### Improvement

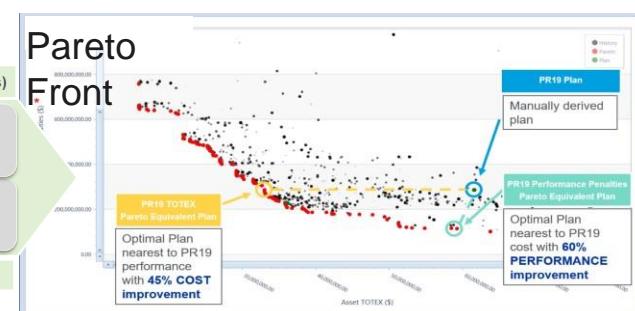
**Over 50% performance improvement** compared to manually derived asset business plan of the same cost.

#### Cheaper

**Over 30% cost improvement** compared to the manually derived asset business plan of the same level of hydraulic performance.

#### Transparency

**Transparent and auditable decision making** for asset solutions which include cost-performance-resilience simultaneously.



## Optimization

# Improved insight in rail network conditions

Region, Country, Location

EMU, The Netherlands, Amsterdam

Solution

Rail & Urban Transport

Market Sector

Manufacturing & Technology

### PROBLEM...

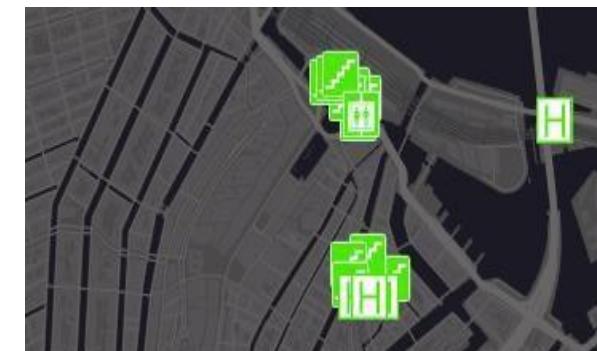


### APPROACH...



### IMPACT!

- Taking on the task of doing a visual condition assessment for the light-rail network of Amsterdam on behalf of Amsterdam's light rail department of infrastructure.
- The project is characterized by the large amount of inspected assets in relation to the large amount of data. This resulted in vast amounts of processed data and data analysis.
- Disclosing huge amounts of data geographically and banning paper from the process.
- Making everything available for the client on a smaller budget than what used to be spent on this type of work avoiding public scrutiny.



- Digital inspection and mapping the performance online. Making the inspection progress and results available real-time.

**Reduction** of **40%** of the inspection and processing costs.

**Improving** the **functionality** of the gathered data.

**Longer life** Making the effective **maintenance timeframe longer**

# Optimization

## Residual Life Rail Track Aquitaine

Region, Country, Location  
EMU, France

Solution  
Rail & Urban Transport

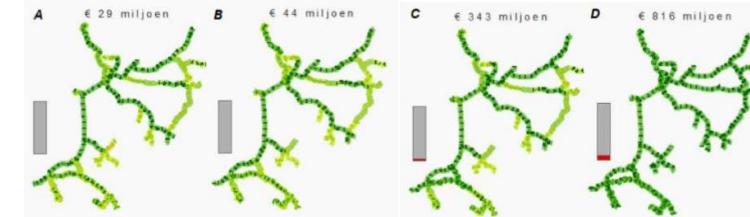
Market Sector  
Manufacturing & Technology

### PROBLEM...

- To achieve the optimum M&R strategy, research of the degradation mechanisms were needed. The degradation mechanisms explain when maintenance or renewal is needed for the track components. The components included track, switches and overhead contact lines.
- Organization was approached to model the existing using the knowledge of predictive capability to support infrastructure managers like the French RFF. Considering the desired performance of the infrastructure manager helps to reduce the M&R costs.
- The priority of the high-speed and local lines differ and so the costs to maintain them. This so-called 'value engineering' reduces the unnecessary costs.

### APPROACH...

- The technical conditions of the components were linked to their residual life conform NEN 2767-4. This Dutch code describes condition assessment.
- The periodic performed condition assessments were translated to their residual life. Besides the assessments, data about track loads and failures of the components were also taken in consideration.
- The residual life was used to determine the actions of maintenance and renewal in time. However, this is not an M&R strategy directly.
- The M&R strategy consist the M&R actions and are weighed against the importance of each rail track, the so-called UIC classes. Using scenario-analysis the M&R-strategy is applied to different scenarios containing different costs.



### IMPACT!

**Optimizing**

**maintenance** and renewal strategies by track importance.

**Improved**

**balance** between M&R, performance and costs.

**Determined**

the **M&R strategy** by the residual life of the assets and the importance of assets.



# Machine Learning & Predictive Asphalt degeneration model, Port of Rotterdam

Region, Country, Location

EMU, The Netherlands, Rotterdam

Solution

Port & Waterways

Market Sector

Manufacturing & Technology

## PROBLEM...



## APPROACH...



## IMPACT!

- The challenge in this project was in combining all different datasets throughout the company in one integral data model.
- This large amount of data had to be used for purposes other than initially intended.
- The quality of multiple data sources proved to be insufficient to use in practice. Different machine learning enabled us to create a sufficient data set.
- A large part of the data couldn't be joined with the assets, GIS proved to be essential for doing so.
- Asphalt degeneration is caused by a variety of characteristics, multivariate statistical models are used to get insights.

- An integral data model is built to integrate all possible predictors and influencers in one database.
- Organization added also 'general' data sources as the soil type, salinization, ground height, ground waterlevel and other local environmental characteristics.
- The model is trained on historical data and tested on 2017 to give insights in possible predictors for defects.
- Focus is given on which inspection methods are essential, savings can be made on non essential methods.
- The client was involved by organizing workshops throughout the entire project.
- The client has received advise about the improving points and is trained in testing the quality of data sources on its own.

Easier

Programming (R) and database modelling created a dataset with all **data sources joined** which can be **assessed quite easily**.

Overview

The data sources are statistically assessed **on multiple data quality aspects creating a fact-based overview** of the quality of all data sources.

Visualize

Underlying **correlations and relations between variables are shown** in different manners to see hidden patterns.

Insights

Advanced **data models give insight** in multivariate relations.

# Data Visualization & Dashboarding

## Asset Maintenance, Soil Restoration

Region, Country, Location  
ANA, United States

Solution  
Environmental Restoration

Market Sector  
Manufacturing & Technology

### PROBLEM...

- program providing program management, technical/industrial hygiene support, soil sampling, soil restoration, data reporting and analytics.

### APPROACH...

- First wave of programs to implement electronic field data collection and automated standardized reporting.
- Utilized the GECs to prepare >500 reports with quick delivery (from field collection to final reports within 7 days).
- Our digital data team integrated Power BI to provide detailed analytics and work progress tracking to support our clients business planning and decision making.



### IMPACT!

**Cheaper**

**Significant cost savings** realized through use of digital solutions was a primary differentiator for being awarded the 2018 contract.

**Development**

**Proof of concept** that could possibly set up further developments of automation.



# Data Visualization & Dash boarding

## GDOT | MS4

Region, Country, Location

ANA, United States, Georgia

Solution

Business Advisory

Market Sector

Manufacturing & Technology

### PROBLEM...

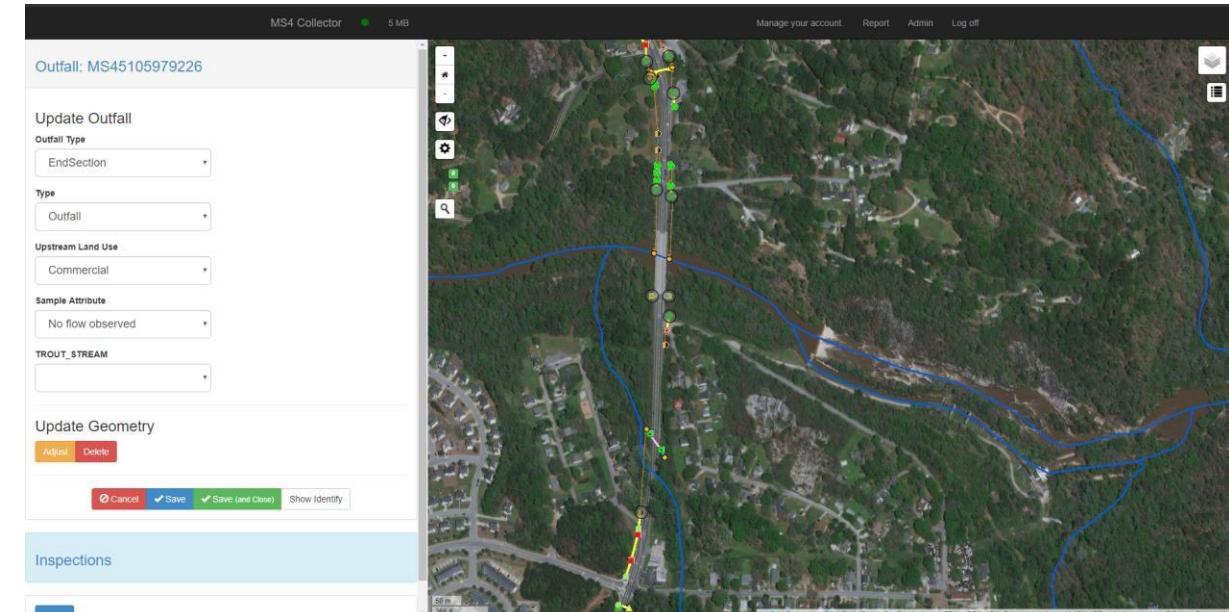
- Organization provides comprehensive support for GDOT MS4 permit compliance including field inventory and inspection services, design project evaluation, and public outreach to increase awareness of the MS4 program.

### APPROACH...

- Implementing mobile applications, integrating GDOT systems, and automating workflows all contributed to Organization winning the recompete to this project in 2018.

### IMPACT!

**Proof** of concept



# Data Visualization & Dash boarding GOASIS

Region, Country, Location

ANA, North America, Georgia

**PROBLEM...**

Solution  
Program Management

Market Sector  
Manufacturing & Technology

**APPROACH...**

**IMPACT!**

- GDOT developed an Operational Improvements Program to implement innovative and cost-efficient solutions to address specific operational deficiencies.
- The Program uses dedicated annual funding to evaluate, design and construct high benefit-to-cost projects.

- To help win this contract, we developed GOASIS. GOASIS is web-based system to track operational improvement projects, safety improvement projects, and roadway safety audits for GDOT.
- GOASIS is being used statewide by GDOT.
- GOASIS provides a single portal for information regarding status, cost, and responsible agency for all operational improvement and safety projects statewide.
- GOASIS also has the ability to pull project and infrastructure information from other GDOT systems.



This table lists 627 records of infrastructure projects. Each row includes a progress bar for '% Complete', project ID ('ID'), district ('District'), county ('County'), mainline ('Mainline'), minor street ('Minor Street'), program type ('Program Type'), priority ('Priority'), PI number ('PI #'), current phase ('Current Phase'), GDOT PM ('GDOT PM'), and a 'Consult' link. The table is fully scrollable.

# Data Collection with IOT Water and AMI Portfolio | WSSC

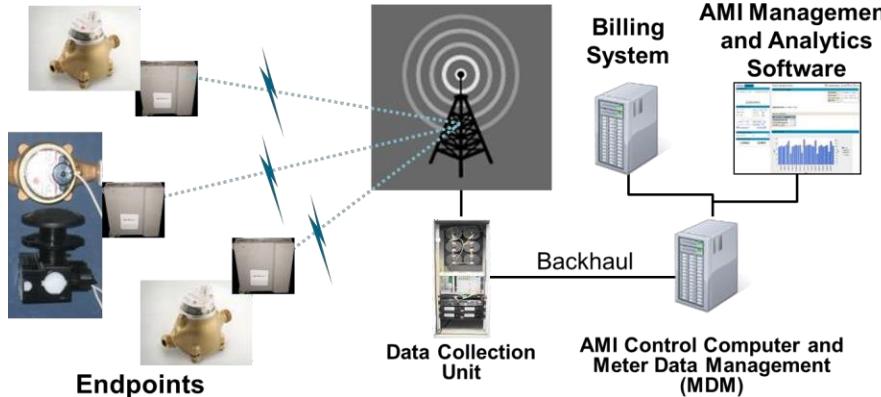
Region, Country, Location  
ANA, United States

Solution  
Intelligent Water Networks

Market Sector  
Manufacturing & Technology

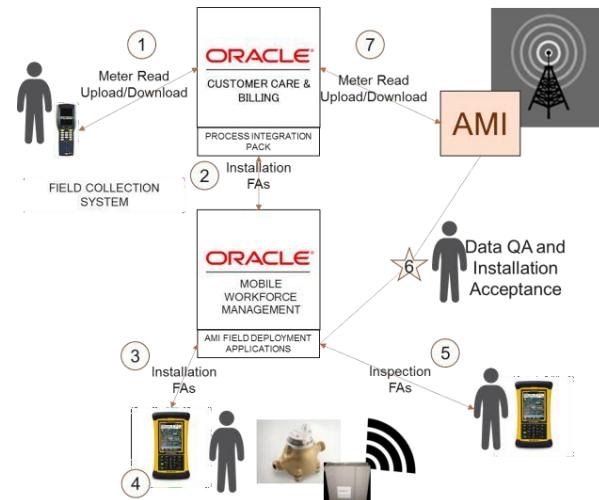
## PROBLEM...

- Responsible for leading the planning, selection, procurement, integration and installation of over 450,000 smart water meters.

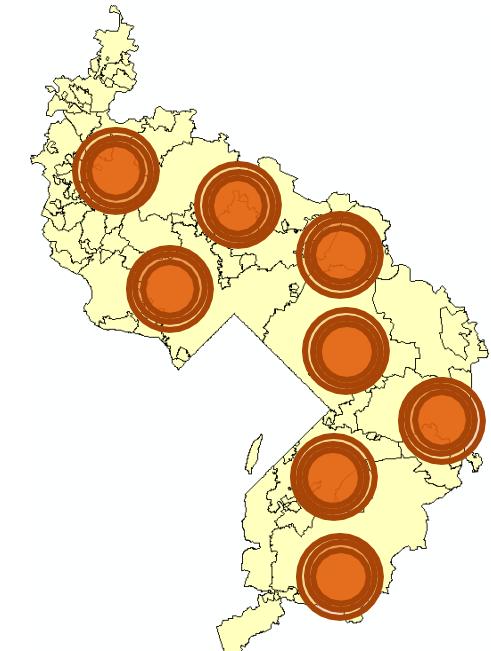


## APPROACH...

- This win is a major advancement in our smart-water and AMI portfolio and is a big digital win for Organization.



## IMPACT!



# Optimization

# Integrated (Digital) Governance Program

Region, Country, Location  
ANA, United States

Solution  
Program Management

Market Sector  
Manufacturing & Technology

## PROBLEM...

- Organization is providing integrated digital governance and program management office services to manage the Audit, Inspection, Testing, and Maintenance planned at ~200 business units for multiple business functions (HSE, Security, Sustainability etc.) providing holistic and robust understanding of enterprise and facility risks, issues, and priorities and minimizing facility disruptions enabled through a technology stack called Digital Powerpack.

## APPROACH...

- Integrated (Digital) Governance is the differentiator that helped us win this work, and is the key enabler to adding new streams of work to this growing client account, in addition to a strong alignment with the client's salient principles of operations.

## IMPACT!

### Cheaper

Organization is **increasing efficiencies** (up to **20-25% cost savings**) across multiple functions or project portfolios.

### Reduction

of **risk**.

### Optimized

Through our domain expertise, digital knowledge and problem solving capabilities, we are **optimizing processes, schedule & cost** to manage the portfolio in a data-driven manner.

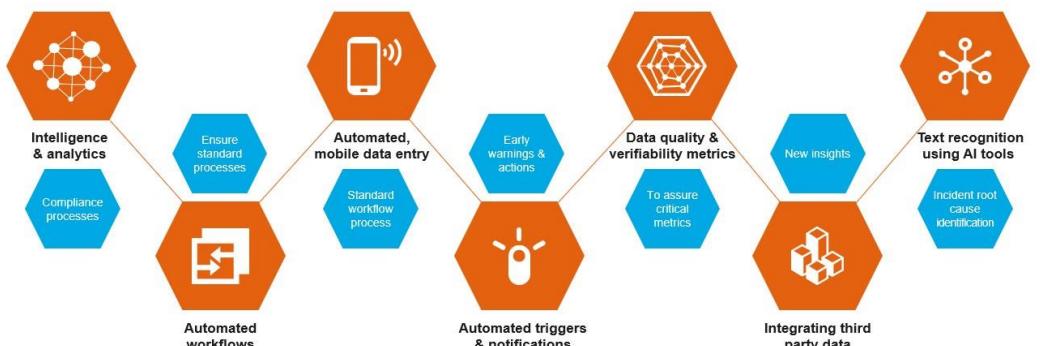
### ALIGNMENT WITH CLIENT'S SALIENT PRINCIPLES



QUALITY	RESPONSIBILITY	MUTUALITY	EFFICIENCY	FREEDOM
Increased effectiveness. Consistent quality of processes, standards and data, better value from data and information assets	Improved prioritization of corrective action. Knowledge of what is closed out, and what's pending. Data-driven focus for strategic and tactical improvements	Shared benefits across all audit programs. Systematic audit scheduling across the facilities to minimize disruption. Knowledge sharing on best practices. Enhanced local through global awareness of audits and mutual responsibilities to correct issues	Master schedule means that resources are maximized, and disruption is minimized. Reporting streamlining for cohesive data management, availability of one-stop shop analytics to Mars stakeholders and staff	Supports growth of the business with increased portfolio of assets. Empowers facility teams with increased awareness of portfolio risk and mitigation strategies/best practices

### DIGITAL POWERPACK

We conceptualized the “Digital Powerpack” for this client, and are delivering it successfully. The Powerpack is suite of tools that increases efficiency and customer experience



# Optimization Organization Analytics Solutions

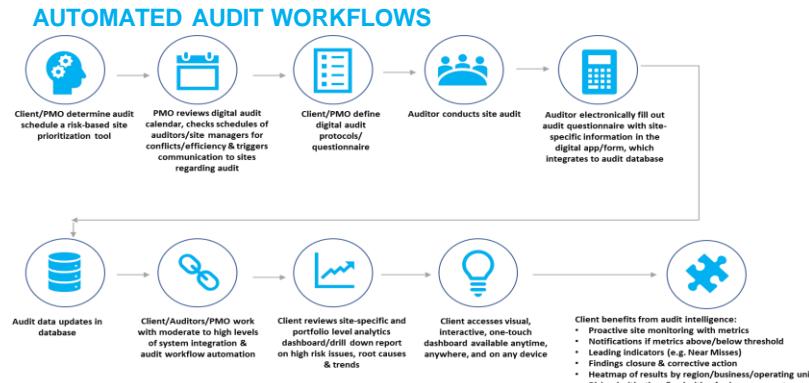
Region, Country, Location  
ANA, United States

Solution  
Business Advisory

Market Sector  
Contractors

## PROBLEM...

- Organization is supporting deliver overall vision and strategy for program execution through a joint governance approach for managing 350 Office EHS Compliance / Fire Safety/ FM Operational Readiness Assessments enabled through a technology stack called Digital Powerpack.



## APPROACH...

- Our Analytics Solutions (portfolio and site level view of assessment results as single version of truth, in single pane of glass) is the differentiator that helped us win this work.

## IMPACT!

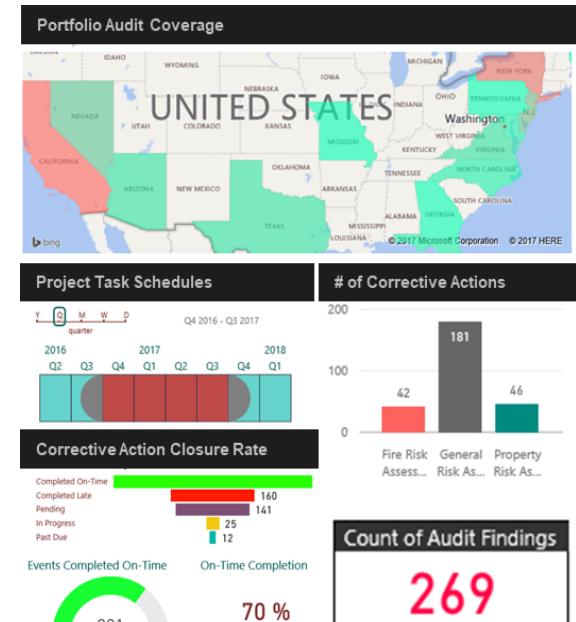
**Standardization** of **functions**.

**Harmonization** of **process & protocol**.

**Support**

Organization is **helping with an initial global audit assessment** to determine a baseline of compliance followed by an **on-going management plan** through Data Management & Analytics, Master Schedule Management, Dashboard Reporting, Trend Analysis and Lessons Learned

## PORTFOLIO AND SITE LEVEL VIEWS



# Optimization Orion Program Management

Region, Country, Location  
ANA, United States, Long Beach

Solution  
Program Management

Market Sector  
Contractors

**PROBLEM...**

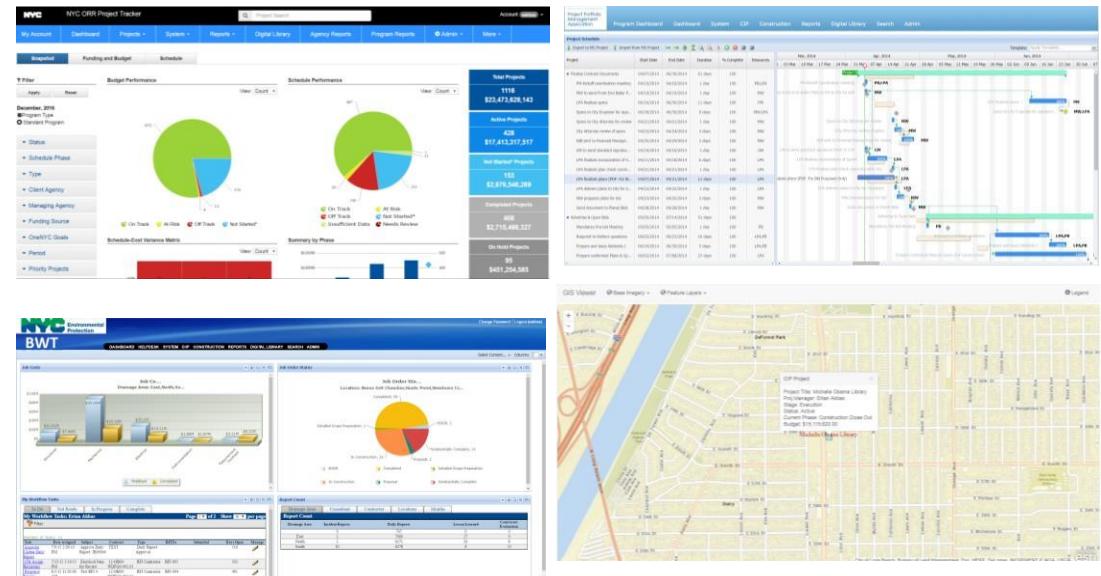
**APPROACH...**

**IMPACT!**

- Implementation of the Orion Program Management Information System, built by Organization, to support the City's four main departments (Public Works, Airport, Water, Energy Resources) with planning and tracking capital projects throughout the city.



- This win was against the big Project Management software firms and primarily due to Organization's Program and Project Management expertise and the Digital solution, Orion.



# Data Strategy & Architecture

# Digital Quantity Extraction

Region, Country, Location  
EMU, Belgium

Solution  
Cost & Commercial Management

Market Sector  
Manufacturing & Technology

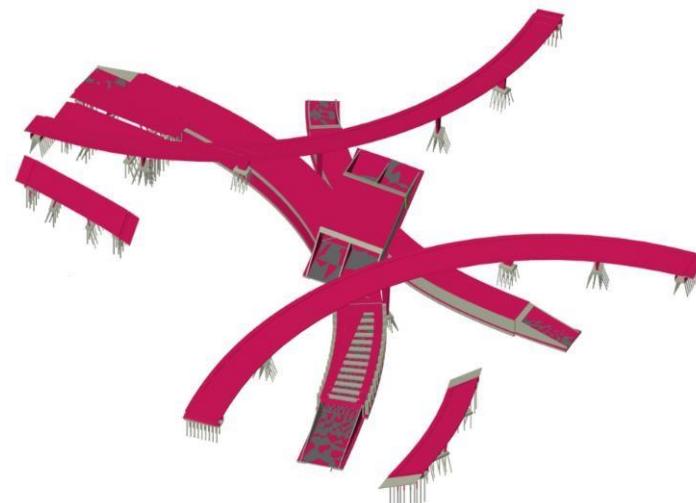
## PROBLEM...

- Traditional quantity surveying by measuring in PDFs or CAD files.
- Time consuming process.
- Unstructured quantities.
- Lack of available time to invest on the increase of quality and improve performance in the cost estimation process.
- Tedious process in complex designs, especially upon design updates.



## APPROACH...

- Definition of an object tree to identify the objects in Revit.
- Creation of a set of parameter requirements to fulfil the cost estimation.
- After the quantity extraction, simple verification of compliance with the criteria.



## IMPACT!

### Increased

Quality due to **80% estimated decrease of human errors**.

### Saves time

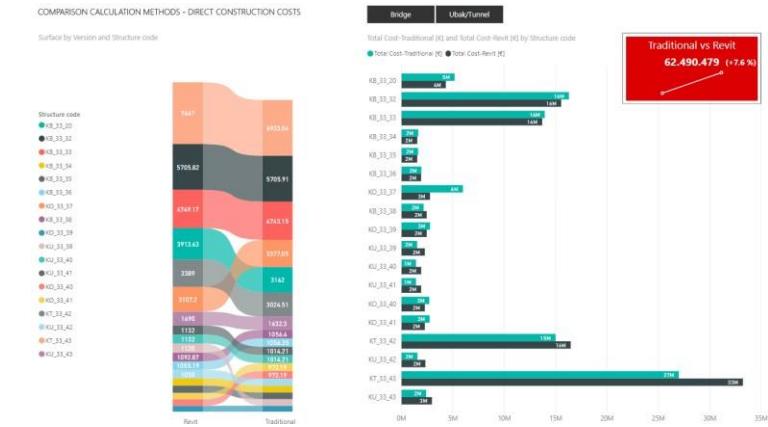
**80% increase in time saving** during the process of quantity surveying.

### Speed up

**100% speed up** the generation of cost impact after design changes.

### Evaluation

**80% increase in tracking design changes** and evaluation of the main cost drivers.



# Data Strategy & Architecture

## Digital Costing

Region, Country, Location  
EMU, Belgium

Solution  
Cost & Commercial Management

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Upon costing a new project.
- Time consuming search of standard or non standard item prices.
- No bulk search possible.
- No relation of unit prices to requested quantities.
- No indexation on applied prices.

### APPROACH...

- Standardizing tender process to allow data capturing.
- Easy to use import and extraction of data linked to the excel workflow.
- Allowing indexation per item.
- Statistical analysis on each item to provide price fit per quantity range.

### IMPACT!

#### Reduction

**80% time reduction** in costing items in a new project by ad hoc or bulk search.

#### Accuracy

**50% more accurate costing** by analysing the price of cost drivers and applying the indexation on historical costs

#### Spot trends

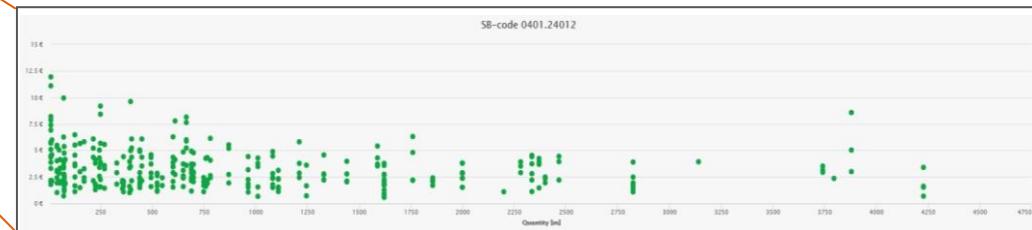
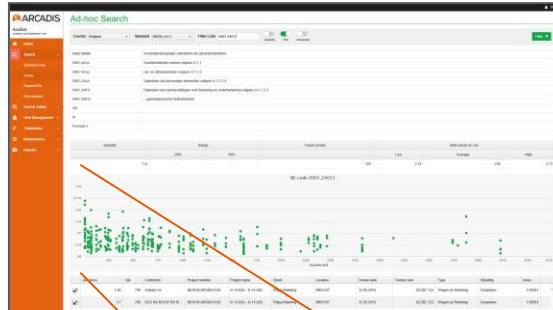
**100% increase** in the ability to spot trends in tender prices.

#### Increase

**100% increase** in accessibility of the unit prices to Organization global

#### Involvement

**100% increase in involvement** of the project teams of importing cost data by direct benefits in the project workflow.



# Data Visualization & Dash boarding

# Digital Cost Management Reporting

Region, Country, Location  
EMU, Belgium

Solution  
Cost & Commercial Management

Market Sector  
Manufacturing & Technology

## PROBLEM...

- Time consuming cost reporting upon design changes.
- Static cost reports, without drilldown functions and transparency.
- Cost reports unfit for all stakeholders.
- Difficulty recognizing trends, making root cause analysis and allowing traceability.



## APPROACH...

- Standardisation cost reports.
- Definition reporting parameters and integration into the cost reports.
- Construction of data model for a dashboard for multiple stakeholders to interrogate.
- Integration of risk management and planning.

## IMPACT!

### Faster

**100% decrease in time** of generating cost comparisons.

### Benefit

**80% increase in benefit to the design process** by; allowing swift insightful cost-driven design decisions; keeping changes traceable.

### Complexity

**100% increase in reporting complexity** by adding multiple cost effecting reporting parameters in one view

### Transparency

**100% increase in transparency:** Allow stakeholders to go from high level information to object level information

### Reduction

**80% reduction in reporting errors** due to the single source of truth principle.

### Access

**100% Custom tailored reporting** in a blink accessible from the customers smartphone.

## Data Visualization & Dash boarding

# Asset Maintenance, Holobuilder

Region, Country, Location  
ANA, United States

Solution  
Environmental Restoration

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Organization U.S., Inc. (Organization) is supporting our client with soil sampling and soil restoration activities associated with aged steel structures that were coated with lead-based paint.
- In support of this soil restoration program, soil sampling was conducted to collect and field test soil samples in accordance with industry standards to assess lead impacts in shallow soil.
- Based on results of sampling, soil restoration, removal and replacement of the soil is performed.

### APPROACH...

- Based on a field sampling schedule, office staff would setup a holobuilder project in advance and provide an aerial imagery for the field team to use.
- During the initial sampling phase, the field staff would access the aerial, take pictures and add them to different locations on the aerial to provide enough images to create a virtual tour of the site.
- During restoration activities, field staff would add pictures to show the restored area to provide a before and after comparison.
- After an asset is visited, the holobuilder project is archived to free up the storage space.
- We use a 360-degree camera to take site photos and use Holobuilder to view them as 360-degree pictures on their website or create a virtual tour of the site for project manager and client.

### IMPACT!

#### Better

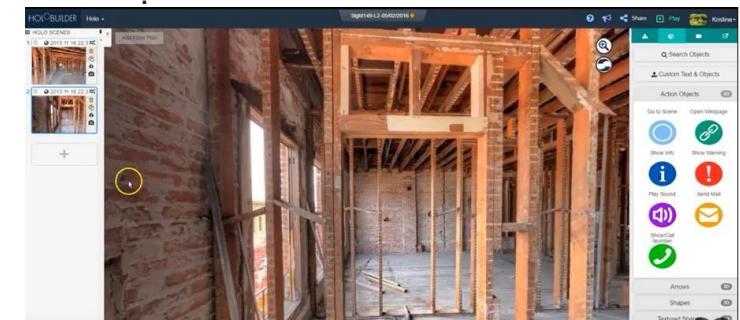
A virtual tour of site has been very valuable to **understand access better** and to supplement site reconnaissance activities.

#### Savings

With the help of holobuilder pictures for our project, we estimate an **internal savings** of 1 site inspection unit for every 3 restoration sites (**\$5,775 USD**).

#### Progress

We were also able to show **progress** of field activities to client and PM without organizing formal site visits.



# Data Visualization & Dash boarding

# Global Office Assessments

Region, Country, Location  
ANA, United States

# Solution Strategic Environmental Consulting

## Market Sector Manufacturing & Technology

# PROBLEM...



## APPROACH...



## IMPACT!

- As part of its risk management process, a global Life Sciences corporation approached Organization to assess and manage data on Operational Readiness, EHS Compliance and Fire Safety compliance at over 250 offices in 60 countries in a 7 month period.



- Customized and Standardized global data collection tools
  - Consistent data governance across all assessments.
  - On-going management plan through the following:
    - Process & protocol harmonization
    - Data management & analytics
    - Master schedule management
  - Dashboard reporting, trends analysis, and lessons learned
  - Development of a document control and analytics solution, the Digital Powerpack, that is a combination of integrated Microsoft Office 365 suite products such as:



# SharePoint



Power BI



## Microsoft Flow



The logo for Microsoft Visual Basic for Applications. It features the Microsoft logo at the top left, followed by the word "Visual" in a stylized font, "Basic" in a bold sans-serif font, and "for Applications" in a smaller sans-serif font. To the right of the text is a graphic element consisting of four 3D-style cubes in orange, blue, yellow, and purple arranged in a cluster.

# Truth

## Automation

## Identify

Single version of the **truth** for program status, schedule, findings, and corrective action implementation.

Automation of processes and notification alerts:

- Email notifications for changes in audit schedule, site's information, and other relevant information for the project's outcome.
  - Email notifications to site contacts for client audit report reviews (+500)
  - Scheduled daily refresh for dashboards

Client is able to draw on our use of analytics to identify trends, track issue resolution and support internal reporting.



# Modeling and simulation Change of Earthing Concept

Region, Country, Location  
EMU, The Netherlands,

Solution  
Operations & Maintenance

Market Sector  
Manufacturing & Technology

## PROBLEM...

- TenneT, The Dutch High Voltage Transmission line operator, wants to change their way of earthing the 150 kV voltage grid in the whole southern part of the country in order to better accommodate the adoption of cable infrastructure rather than overhead lines, localize faults and assimilation to surrounding nets.
- 8 disciplines in the design ("BO", "basisontwerp") for this change of earthing had been put on the market, with Organization winning 7 of them, involving earth grid design of 86 substations, inventory of components and determining the electromagnetic influence on 300 stakeholders
- The enormous complexity and scale required strong coordination, resourcefulness and inventiveness..

## APPROACH...

- A 3D simulation program (Isabel) was developed and validated, enabling fast and testable designs of the earth grids, the latter to be carried out by the GEC in Lasi, where AutoCAD was incorporated in the design.
- A multitude of programs in a mathematical program language and ArcGIS were developed in close coordination to analyze and exchange over 1000 GByte of data of nearby infrastructure (cables, pipelines, rails, traffic regulation systems, ...) nearby the transmission lines. Here too, the GEC in Lasi has delivered an important contribution.
- A dedicated stakeholder management was conceived to open and maintain relations with them to involve them in the process, to exchange detailed data of the infrastructure / assets involved and to report to them the results of the analyses.
- Whenever needed, detailed models of the stakeholder assets were developed in order to tailor measures to mitigate risks of dangerous voltages.

## IMPACT!

**Faster**

Parts (notably "BO1") could be delivered weeks before the deadline.

**Reduction**

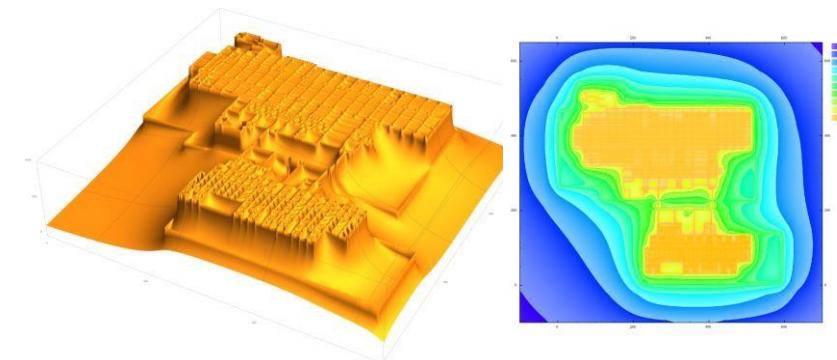
of number of estimated measures on stakeholder side (see "cheaper")

**Cheaper**

A coarse estimate for stakeholder costs of € 40 M reduced to € 5 - 10 M after our analysis

**Safer**

Risks of dangerous touch- and step voltages are mitigated



# Data Visualization & Dash boarding

## Public Land Natural Area Assessment

Region, Country, Location  
ANA, United States, Ohio

Solution  
Strategic Environmental Consulting

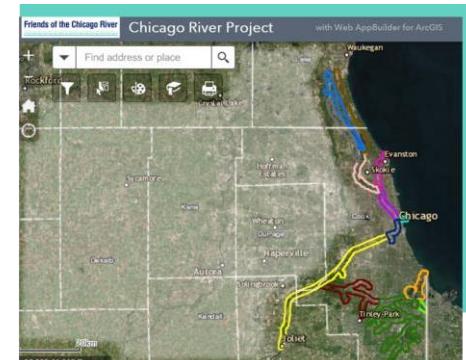
Market Sector  
Manufacturing & Technology

### PROBLEM...

- Friends of the Chicago River (Friends) partnered with Organization U.S., Inc. to conduct a comprehensive assessment of all publicly-owned lands along 156 miles of the Chicago River system through Lake, Cook, DuPage and Will Counties.
- Data of different types and sources was gathered, processed and analyzed to get the big picture. We are now able to identify opportunities to bring people and wildlife together and establish plans for protection and connection. Natural assets, trails and natural shorelines, this is the Chicago River.

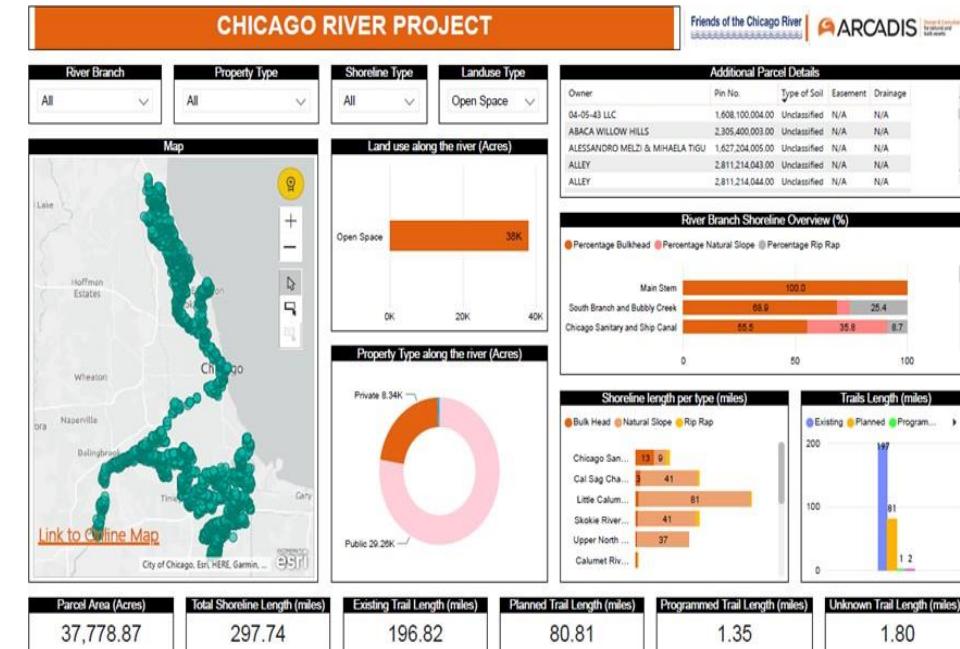
### APPROACH...

- Existing data were collected from public records, state and federal agencies. The collected data included land use, soil classification, natural communities, existing trails, natural preserves, etc.
- Satellite imagery was used to “walk” the river to discover the type of shoreline (i.e., bulkhead, rip rap, or natural slope) of the Chicago River system within the project area.
- Every pixel of high-resolution satellite imagery was used to calculate the vegetation health along the project area and to find specific color-signature clusters that can be correlated to specific plant species.



### IMPACT!

- Meaningful** Meaningful insights of the existing conditions can be obtained from the dynamic dashboard. The dashboard allows you to filter through vast information to dive into single-parcel-level information, or groups of parcels, that meet certain criteria.



# Regulatory Monitoring for Lab Instruments & Chemicals Company

Region, Country, Location  
ANA, United States

Solution  
Business Advisory

Market Sector  
Chemical & Life Science

## PROBLEM...

- Core sales of lab instruments being hampered by limited regulatory compliance of accessory reagents & kits.
- Rapidly changing regulatory landscape affecting chemical and biological reagents & kits in 30+ market countries.
- Limited visibility into upcoming regulatory changes.
- Reactive rather than pro-active organizational responses to regulatory changes.

## APPROACH...

- Working with an ecosystem partner providing global regulatory content, developed tailored regulatory summaries targeting key issues for product portfolio.
- Performed high-level applicability analyses of the regulatory change to the product portfolio.
- Assigned priorities to regulatory changes to focus compliance activities on most business-critical regulatory changes.
- Developed and maintained custom digital dashboard to track regulatory trends by region, country, product type, and regulatory change type to enhance understanding of impact of regulatory changes to the business.

## IMPACT!

Understanding the rapidly evolving regulatory landscape, the potential impacts of regulatory changes to the product portfolio and being able to visualize regulatory change helped this client move from a reactive to a proactive regulatory compliance strategy.

As a result, this client experienced a reduced number of Customs holds and an increase in the speed with which they were able to get new products to market.

# Data Visualization & Dash boarding

## Make Every Project Count

Region, Country, Location  
ANA, United States

Solution  
Business Advisory

Market Sector  
Manufacturing and Technology

### PROBLEM...

- Providing insights into which projects and clients are loss making on an P&L level is a challenge because of the way our accounting is set up (direct costing).
- This insight is needed in the business for operations, client development, as well as individual PM's to be able to judge how well their projects are contributing to the bottom line.

### APPROACH...

- Instead of doing manual analysis at the end of every month we used the built-in ELT capabilities of Power BI to perform the analysis on the profitability of projects automatically at the end of month.
- The data prepared then served to create several dashboards (Client Focused, Project View, Project Manager) to inform a larger audience in Organization North America how we really are doing financially on projects.

### BENEFITS!

**Cheaper**

Time spent in data preparation went down from **1-3 days** per months to a **5 min** process.

**Faster**

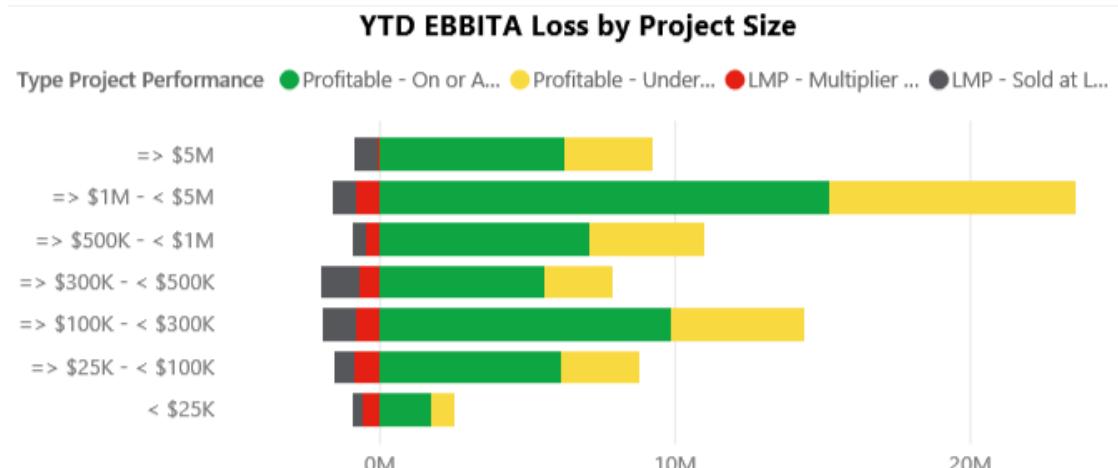
Results are now available right after month close, vs. up to a week after previously

ELT process led to less unexplained variation month on month due to **reduced errors**.

**Quality**

More visualization and information is now readily available that improve decisions making. The increased speed allows for more analysis and focus of the team on measures that can be taken to improve projects.

**Analysis**



# Data Visualization & Dash boarding

## Joint Base, McGuire Dix Lakehurst

Region, Country, Location  
ANA, United States

Solution  
Business Advisory

Market Sector  
Manufacturing and Technology

### PROBLEM...

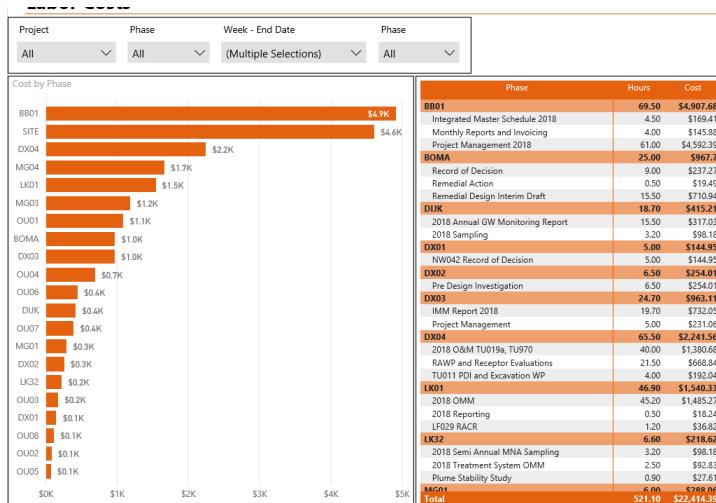
- Financial data for this \$80M environmental restoration project was scattered and made project controls time consuming and challenging. The financial metrics need to ensure tight financial control did not have the required granularity without considerable data cleaning
- Careful risk management is required for this 10-year environmental restoration project.
- The contract is fixed price and the nature of the work is high risk as conditions can change in the field beyond our control. These changes may lead to future negative impacts to net revenue as there are limited mechanisms for change orders under the Performance Based Contract vehicle.

### APPROACH...

- Data from numerous stand-alone reports and several areas were cleaned and combined into a Business Intelligence platform that integrates all the required data into a single interactive tool to manage the day-to-day project metrics
- Business intelligence tools were also used to integrate risk management scenarios into a Monte Carlo simulation.

### IMPACT!

The BI tool for project controls and saves the CPM time and allows for better controls over this large project. Data can be assessed weekly in 5 to 10 minutes instead of 1 to 2 hours and potential problems flagged and addressed as they occur.



The risk management tool allows a proactive approach to managing project risks and provides forward looking indicators through the lifespan of the project (ending in 2024). Potential impacts to net revenue in the future can be identified and mitigated through additional BI modelling and revised approaches as needed.

# Data Visualization & Dash boarding

## Lower Thames Crossing, LTC

Region, Country, Location  
EMU, United Kingdom, London

Solution  
Environmental Restoration

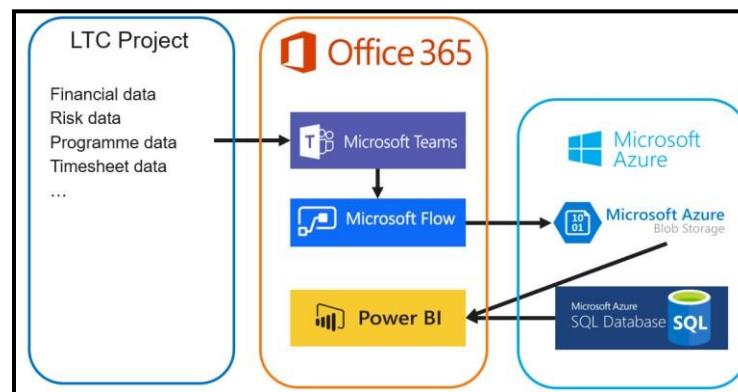
Market Sector  
Manufacturing & Technology

### PROBLEM...

- No control over Financial information, spread over too many spreadsheets and versions.
- Financial projections expected to be 50% over budget midway through the financial year
- No visibility over Risk register, many actions and risk reviews overdue
- No trackability of critical work package delivery
- No standardized way of slicing the project by workstreams, disciplines etc....
- No cross-analysis between project programs and its affect on finances, risk register, etc.
- All projects reports are done manually with too many FTEs involved in crushing numbers and drafting reports

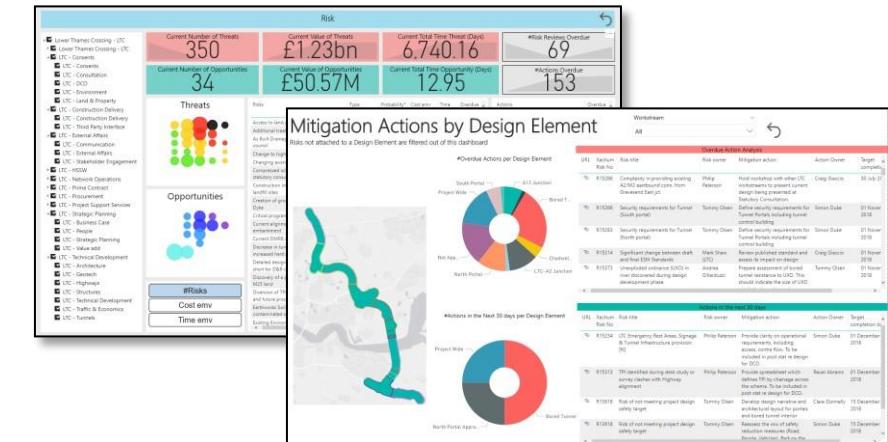
### APPROACH...

- Business Intelligence reports using Power BI have been introduced to standardize ways of reporting information
- Information database introduced and back-up into the cloud to avoid data temperance using Microsoft Azure
- Introduction of automated ways of updating datasets using Microsoft Flow
- Information dashboards are refreshed as many times as necessary for “always-live” reports
- All datasets linked together using the central database to create a master project hub



### IMPACT!

- Project finances brought under control with cutbacks operated based on the dashboard analyses
- Key insight into each individual workstreams for Finances, Risk, Programme, Work package delivery etc.
- Senior Management now understands 'health' of project, at project level and workstream by workstream.
- Overdue risk reviews and actions down 50%
- FTEs to draft reports no longer necessary



# Data Visualization & Dash boarding

## Street Lighting Database

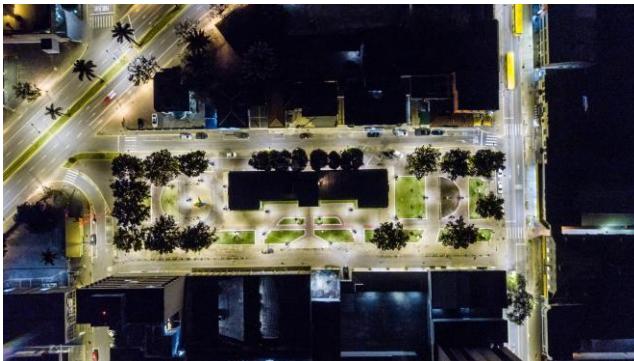
Region, Country, Location  
South America, Brazil

Solution  
Operations & Maintenance

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Lack of knowledge of existing street lighting infrastructure in municipalities reflects on distortions in the planning process.
- In order to propose a strategic planning related to street lighting in urban context, it is essential to know the exact position where the assets are installed. It allows to anticipate demands and propose energy saving plans.



### APPROACH...

- Register all poles in town and keep the information updated as the city grows or modernizes its lighting system.
- In case of initial registration, many electrical (e.g. type of electrical control) and lighting characteristics (e.g. type of luminaire, type of lamp, wattage) must be collected in the field using a mobile application developed by Organization, named GipDroid. Besides these basic characteristics, we collect the installation architecture (e.g. place of installation - street, square, bridge, etc.) and the Geographical Coordinates using a GPS device.
- All services and materials applied on the street lighting maintenance or repair are associated with the Street Lighting ID. Thus we can map where the failures are concentrated, including the damage type, the location and the frequency of failures, proposing maintenance master plans.
- The street lighting database is an important step towards a Smart City, since many technologies and sensors can be associated to remote monitor systems of street lighting.

### IMPACT!

#### Accurate

The data is a crucial decision-making tool for public managers as they can have a complete and accurate overview of the street lighting system of a city.

#### Increase

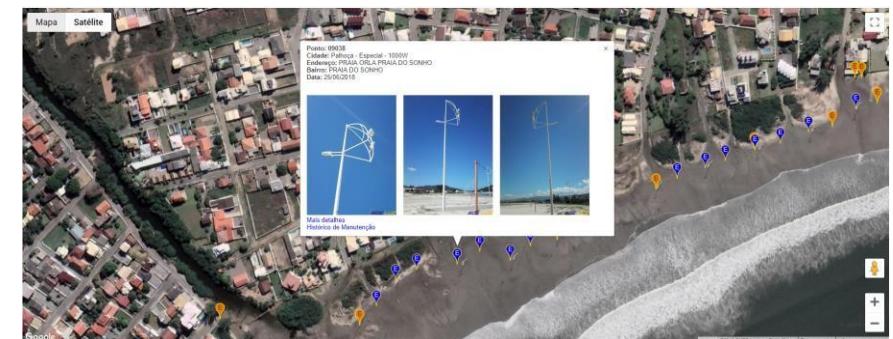
Assertiveness in investments planning in the long term.

#### Smart

Contributes to the transition from traditional cities to smart ones, since you have the spatial distribution of installed devices.

#### Clear

A dynamic, interactive and online map may be also associated to the image of street lighting poles and hence accessed from any device connected to the WEB.



# Data Visualization & Dashboarding

## Cost Database and Benchmarking

Region, Country, Location

Asia, Middle East, The Netherlands

Solution

Business Advisory

Market Sector

Manufacturing & Technology

### PROBLEM...



### APPROACH...



### IMPACT!

- Organization ME has a wealth of cost data but this has not been turned into a meaningful information.
- No consistency in rate to use for estimate on various similar projects specifically for generic items i.e. concrete, reinforcement, formwork, masonry works, etc.
- Lack of information from data lake.
- Method of measurement vary for every project.
- Not sure who will validate the rates?
- Not certain on what stage of Estimate to use i.e. Cost Plan, PTE, BQ, VO, etc.?
- There is no cost data base governance to validate quality of rates and who will be responsible for I.P. and liability.

- We collected all data, rates and cost per GIA of all accomplished projects per sector.
- Assign a unique code for each unit rate in the cost library to consolidate and compare the rates of identical items from various projects.
- Generate a Project Data Sheet where important information like GIA, height of building, type of building, etc. to produce other KPIs/design economic indicators such as concrete/rebar ratio, skin ration, floor to wall ratio, no. of fixtures/m<sup>2</sup> and no. of elevators/GIA.
- ME region created a data lake with catalogues and foldering structure.
- ME region should appoint a team to validate rates to determine what stage of estimate to use and how to protect our data.

Today

GEC is able to assist in pricing of various BOQs for ME region projects, preparing PTEs (pre tender estimates) and valuing VOs (variation orders).

Tomorrow

Create a central cost library to be shared via Sharepoint where staff can refer to in their pricing.

Prepare a Cost Model Guide to ensure consistency in modelling and in accordance with standard method of measurements in order to reduce time for validation.

Achieve 100% 5D BIM environment by creating Unique Cost Code Identifier using global and national standard classification such as ICMS loaded onto BIM models and linked to quantities extracted from a BIM Model to generate a Cost Estimate in real time.



# Data Strategy & Architecture

## Wuhan Sponge city, Wuhan

Region, Country, Location  
Asia, China

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

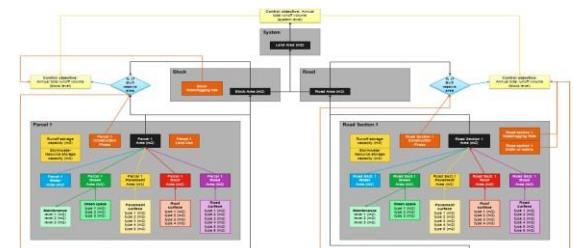
### PROBLEM...

- Address the challenges of flooding, drought and pollution with integrated system of comprehensive management structures, green infrastructure, an upgraded urban drainage system, water storage ad purification facilities across the city.
- No previous experience /projects can be referenced, it is the first batches of experiments in China. It's experience will be duplicated by other cities.



### APPROACH...

- Providing consultancy service on the use of models to analysis both the geographical and historical data to predict the performance of sponge city and guiding on the calibration procedures.
- Making a numerical model to digitalize the local Sponge City guidelines and help local design institutes to fast evaluate the benchmark of its designs on several criteria.
- Giving suggestions on the selection of LID measures and good practices. Advising on the draw up of local sponge city technical guidance.
- Giving advices on policy and regulation aspects. Introducing water management policies and regulations in EU, Netherlands and Australia. Proposing water assessment methods for local authorities.



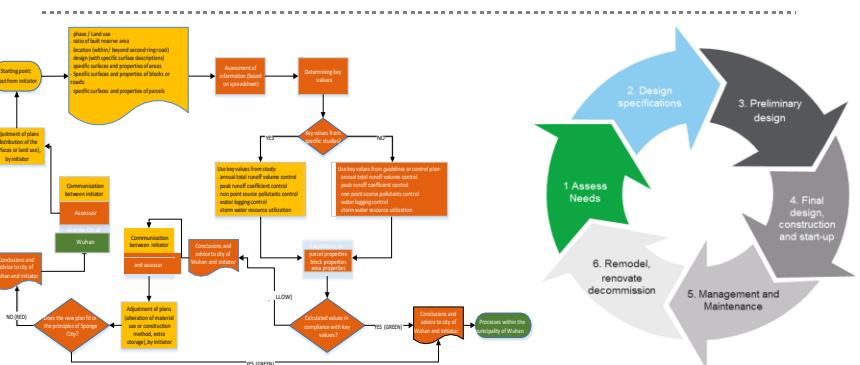
### IMPACT!

**Reduce** the runoff of rainfall, the diffuse pollution, the stress on sewer system and risk of flooding on building areas.

**Increase** the green spaces, the infiltration capacities, the use of rainwater, the open water qualities and water safety on building areas.

**Protect** water ecologies, water safeties, water environments and water resources.

**Add** value for environment, society, ecology and economic.



## Data Strategy & Architecture

# Real time insight in noise pollution from wind parks

Region, Country, Location  
EMU, The Netherlands

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

### PROBLEM...

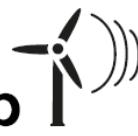
- Energy companies face a lot of opposition when developing wind energy projects
- Local residents worry about noise pollution and feel they are not being heard by the wind industry and authorities
- The production and propagation of wind turbine noise very much depends on the weather. Residents haven no idea how much noise to expect from wind turbines

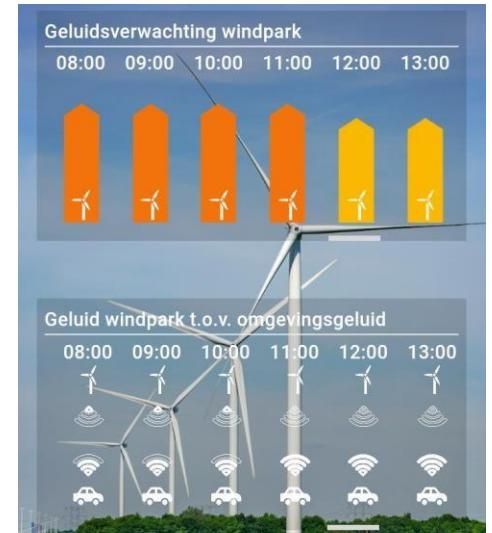
### APPROACH...

- Organization has developed a worldwide unique model to predict weather condition and site specific noise pollution by wind turbines
- This model is used to provide local residents with a short term noise forecast for their individual residence. The forecast is delivered by means of a smartphone app
- Residents can provide real-time feedback on how they perceive the noise at a specific time and location

### IMPACT!

- |   |
|---|
| <b>Increase</b> <ul style="list-style-type: none"> <li>▪ More insight into expected noise pollution for residents and other stakeholders</li> <li>▪ More insight into perceived nuisance for wind farm operators, authorities and other stakeholders and residents</li> <li>▪ More involvement and acceptance from residents</li> <li>▪ Less annoyance</li> </ul> |
| <b>Less</b>   |

Noiseforecast.app 



# Data Visualization & Dashboarding

# GDOT Operational Improvements and Safety Programs

Region, Country, Location

North America, USA, Georgia

Solution

Program Management

Market Sector

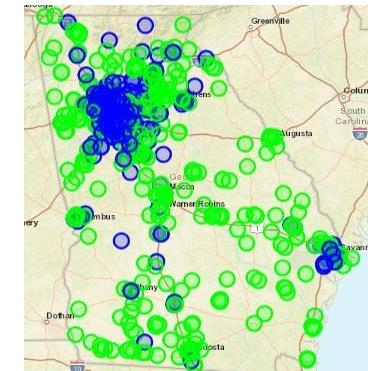
Manufacturing &amp; Technology

## PROBLEM...

- GDOT funding for Operational and Safety Programs increased dramatically in 2016 resulting in the need for additional construction projects.
- GDOT's internal tracking system was based on programmed projects only and did not account for projects which were in identification/scoping phase
- GDOT had multiple consultants working on the Operational and Safety programs which resulted in numerous lists of potential projects with little coordination between consultants

## APPROACH...

- Organization developed an online database to track all improvement requests which comethrough the Operational and Safety Improvement Programs.
- Online portal allows access to data by GDOT consultant teams and internal GDOT staff.
- Real-time updates on task order status, deliverable schedules, and action items
- Online file storage for final reports, concept layouts, and traffic volumes so that teams have access to latest available data
- Dashboard for tracking program spending by fiscal year, district, and project phase



## IMPACT!

**Analysis** GOASIS provided a dashboard for program funding management, project tracking, and project prioritization

**Efficiency** GDOT no longer has to maintain multiple project lists and regularly consolidate them

**Cost Savings** GOASIS has improved coordination between consultants which results in lower engineering costs to GDOT and less duplicative effort

**Transparency** Action item tracking makes it clear as to who is responsible for the next step to keep the projects moving.

Task List					
1. Traffic Data Collection					
2. Existing No-Build Analysis					
3. Build Analysis					
4. Draft Layout					
5. GDOT Review					
6. Committee Presentation					
7. Programming Decision					

Action Items					
+ New					
Action					
Discuss at Meeting	jfisher @ 10/16/2018				Completed @ 10/16/2018
GDOT Sign WA	jpeace @ 8/20/2018				Completed @ 8/20/2018
Arcade: Review potential improvements	jpeace @ 7/25/2018				Completed @ 7/25/2018
GDOT: Sign WA	jpeace @ 7/11/2018				Completed @ 7/11/2018

Phase History					
Phase	Status	Study Type	Work Auth	Approved	Authorized
Synopsis	Active		16.6		9/6/2018
Screening	Complete				

# Computational Design Global Design CVW Project

Region, Country, Location  
EMU, The Netherlands

Solution  
Performance Driven Engineering

Market Sector  
Manufacturing & Technology

## PROBLEM...

- As a consequence of the production of natural gas in the Groningen gas field induced earthquakes occur. This may damage buildings and therefore structural safety can not be guaranteed.
- Therefore, buildings need to be retrofitted with structural upgrading measures.
- Organization is the company that has the resources, knowledge and competences for a multidisciplinary approach of this task.
- The amount of work is huge: the entire scope is in the Groningen area entails thousands of buildings.
- Short deadlines, shifting priorities.
- Developing methods of performing seismic analysis



## APPROACH...

- Working closely together with the GECs
- 3D Modelling for calculations and graphics
- Concept design of structural upgrading methodology for unreinforced masonry houses in the Groningen region
- Revit modelling after Point Cloud scans
- Visualizations
- Dynamo script for work process optimization

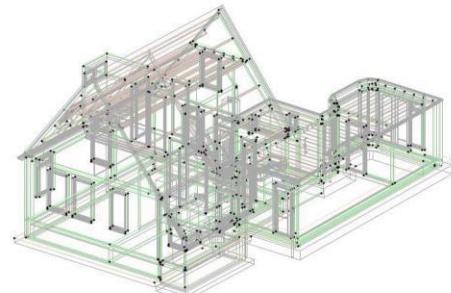
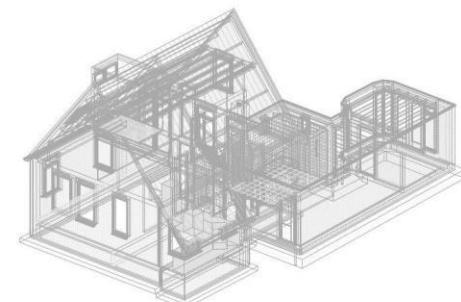
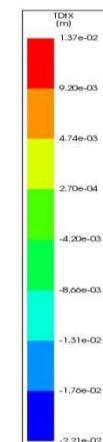
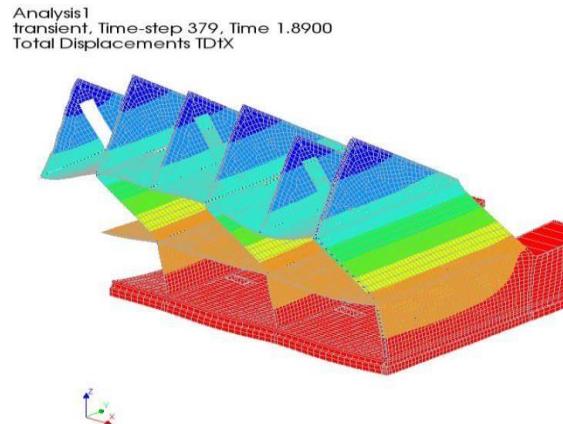


## IMPACT!

**Efficient** Way of working

**Smart** Visual solutions

**Clear** visuals that are generated give clients / homeowners a clear understanding of the retrofitting.



Figuur 41: Bezwijkmecanisme NLTH-analyse 25% PGA

## Computational Design

# Earthquake Project Province of Groningen

Region, Country, Location  
EMU, The Netherlands

Solution  
Performance Driven Engineering

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Due to earthquakes many houses could get damaged in a way it would become too dangerous to live in.
- By scanning each house with point cloud technology and doing surveys of each house, Organization gathered enough data to generate BIM models for each home.
- With this info structural engineers were able to simulate earthquakes and see how each house behaves separately. With this output structural engineers were able to make a unique reinforcement design for each house.
- Translating all point cloud scans and surveys one to one to a very accurate model which could be used for simulations



### APPROACH...

- Organization was asked to speed up the process of engineering.
- By generating point clouds, unique surveys, Revit and earthquake simulation software this was possible.
- The 3d Revit models are being used in the calculation programs such as 3muri and DIANA. By modeling 3d we good help the structural engineers with their calculations.



### IMPACT!

#### Accurate

Generating a very accurate model which can be used for simulations to create tailor made reinforcements for each house

#### Efficiency

By using a point cloud we could reduce our modeling time and be more accurate.

#### Increase

Increase a better understanding of the structure of the house and give a more accurate reinforcement advise.

# Data Strategy & Architecture

## ITS Corridor Strategies Package B

Region, Country, Location  
Australia,

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

### PROBLEM...

- RMS' Easing Sydney's Congestion (ESC) program has previously investigated ITS infrastructure requirements for Pinch Point corridors throughout Sydney.
- This project provided an ITS Strategy for 3 of these corridors included in Package B (following our work on 13 corridors in Package A)
- These corridor plans were developed through a process that follows the RMS guideline and builds on the earlier ITS investigations by ESC.
- The project outputs provided the basis used to inform the development of an ITS Concept of Operations, and the design and implementation of ITS assets to service the corridor.

### APPROACH...

- To deliver the outputs, the team undertook:
  - Requirements Capture from the Network Operations team/multi-agency project team including workshop facilitation and documenting the assessment of road operations services existing & proposed,
  - Prioritization the needs through hazard and risk assessment,
  - Undertaking an audit of existing ITS assets and systems through desktop and drive through surveys,
  - future works) Carrying out of a Gap Analysis between the current state and future state requirements, and
  - (future works) Preparing the ITS Strategy to include the ITS conceptual plans and a prioritized deployment schedule.

### IMPACT!

<b>Rapid</b>	Automation of the internal process enabled us to perform rapid updates and reviews of the corridors, data and identified assets
<b>Simple</b>	Export of the GPS tagged video capture to a map <b>simplified the evaluation process</b> , and <b>provides a quick interface</b> to the reviewer for validation of the results
<b>Accurate</b>	Creation of the reports from a single word template and excel spreadsheet provided consistency and accuracy when updating reports

## Data Strategy and Architecture

# Development of Highways England Sub-Regional Models

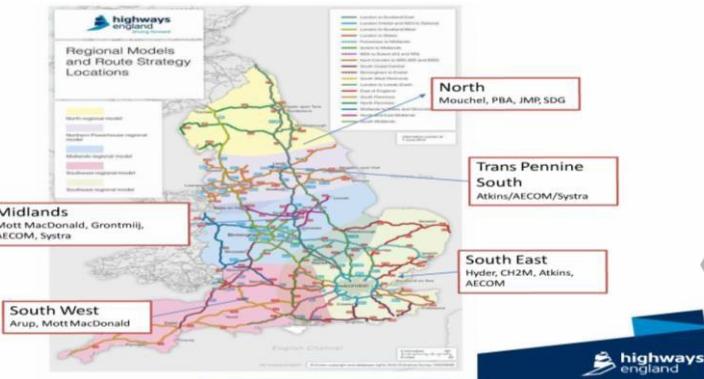
Region, Country, Location  
EMU, England

Solution  
Rail and Urban Transport

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Highways England is responsible for modernizing, maintaining and operating the strategic road network.
- Highways England wanted to develop a core modelling suite to create a consistent and structured approach to appraising all major enhancement investments under consideration.



Client: Highways England

### APPROACH...

- Use of mobile phone and GPS data and various surveys in developing various transport models, including Highways England's South-East Regional Transport Model (SERTM), in collaboration with various partners.
- This approach allowed Highways England to more accurately than ever capture user demands on strategic networks in the UK.



### IMPACT!

#### Forecasting Tools

We helped our clients to build a number of models which they use to forecast how traffic flows and vehicle speeds change over time following infrastructure investment.

We have used and applied such models to test a number of schemes, including Smart Motorways (SM) M3 and M27 schemes.

SM schemes will lead to increased road capacity faster and less cost than traditional road widening schemes, and will minimize the environmental "footprint" of the scheme and improve safety.



## Data Strategy and Architecture

# Highways England Radio Communications

Region, Country, Location  
EMU, England

Solution  
Rail and Urban Transport

Market Sector  
Manufacturing & Technology

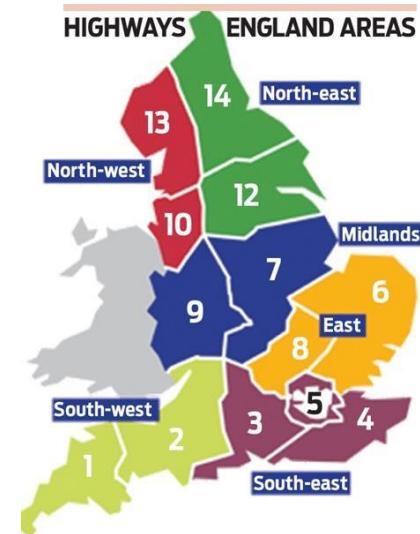
### PROBLEM...

- Organization provides telecommunications consultancy for Highways England under The Expert Support for Control Room Technology (ESCoRT) contract.
- A key requirement on Organization is to ensure that communication technology is configured and optimised to deliver operational requirements and business benefits at an affordable price.



### APPROACH...

- Analysis and reporting on service usage is key to identifying issues so that mitigation can be proposed. Examples include
- Analysing the deployment and usage of Airwave terminals and providing monthly reports for Highways England
  - Developing a MS Access Database to pull together disparate sources of information from the Highways England Service Providers

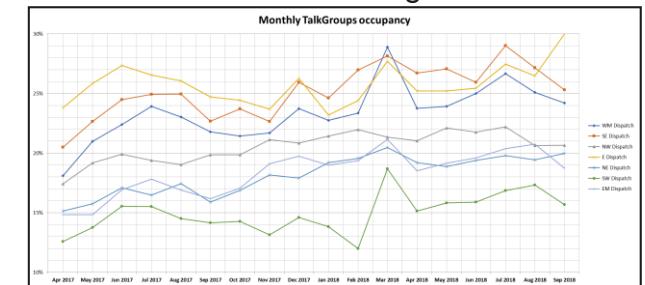


### IMPACT!

#### Single Source of Information

By accessing data from Airwave's monthly Call Data Records and web-based network Insite tool Organization provides monthly reporting on Airwave usage. These reports sent to stakeholders help to ensure that Airwave is meeting Highways England's evolving business needs.

The Database is facilitating the management of Service Provider contracts, key personnel, equipment deployment to ensure an accurate record of key information is available from a single source.



This sheet is to help generate the list of devices not being used per region and by asset type (SPs or TOS). The list will be generated in the worksheet "Unused ISSI".	
Please choose the required asset location or area	Area 06*
<input type="button" value="Generate List"/>	
Click on the next button to generate the required list in the "Unused ISSI" Worksheet	
<input type="button" value="Clear Filter"/>	

## Data Visualization

# ESFA Asset Management Data Analysis and Visualization

Region, Country, Location  
EMU, England

Solution  
Operations & Maintenance

Market Sector  
Manufacturing & Technology

### PROBLEM...

- The Education and Skills Funding Agency (ESFA) is running the Condition Data Collection programs, collecting data on all government-maintained schools in England about the physical condition of school buildings and how they are managed.
- Organization were appointed to assist the ESFA in interrogating the datasets from the surveys in order to inform decisions about capital allocations to each school and capital bids to the treasury
- Analysis of the historic and current condition data required development of a comparator model, as the two datasets were not consistent and varied significantly



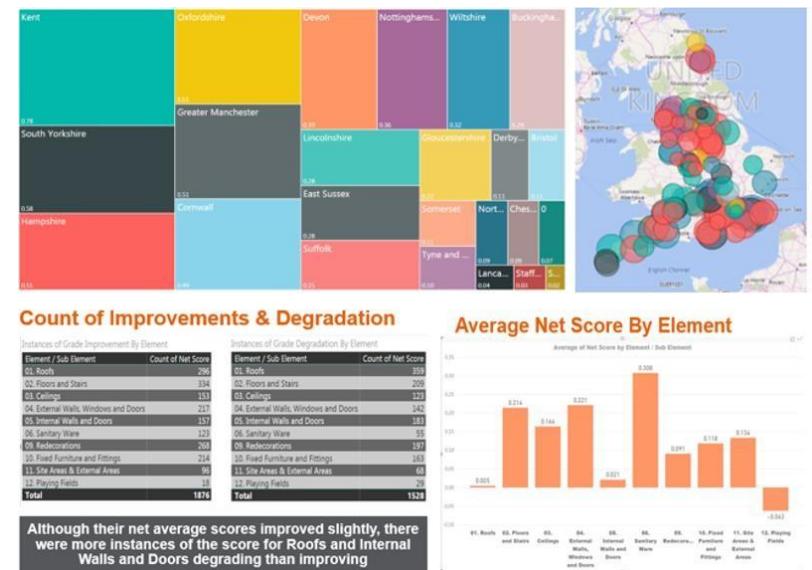
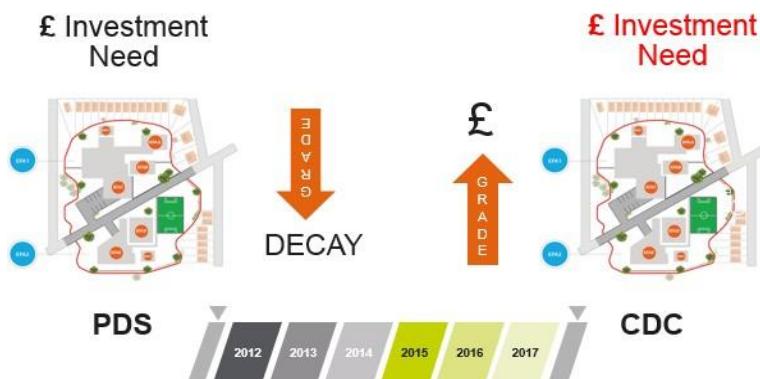
### APPROACH...

- A search for correspondence between the datasets was undertaken, with matches analyzed for an initial dataset of 100 schools
- The matching data was compared to calculate a 'net' score between the previous and current conditional data
- This was aimed at addressing whether the investment in the school estate over time has delivered a net benefit



### IMPACT!

**Analyze** The analysis and visualization of the data offers unique insights in to the scale of improvement/deterioration of the school estate as a whole, and can help identify potential causes and trends based on a number of geographical and economic factors associated with individual schools or groups/regions of schools



## Data Strategy and Architecture

# Dartford Free-Flow Charging

Region, Country, Location  
EMU, England

Solution  
Rail and Urban Transport

Market Sector  
Manufacturing & Technology

### PROBLEM...

- In May 2014, Organization was asked by Highways England to provide support with the monitoring, analyses and evaluation of journey times across the Dartford Crossing.
- The Dartford Crossing is being equipped with a new electronic payment system so that motorists will no longer have to stop at a toll booth to pay their charge.
- The Business Case for implementing Free-Flow Charging was constructed around the forecast reduction in journey times. These reduced journey times have been estimated from the M25 traffic model.
- The purpose of the work was to quantify the changes in actual travel times and journey time reliability which have resulted from the introduction of the Dart Charge.

### APPROACH...

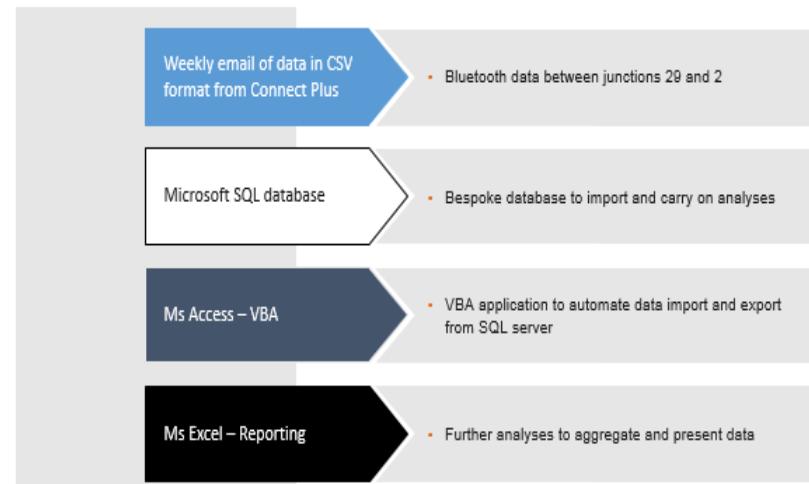
- For PA Consulting and Highways England: weekly data collection, SQL Server database creation and management, TTMS/Bluetooth correlation report, and ongoing reporting system
- SQL import, queries, output results via management studio or access form based application

### IMPACT!

**Proof** Our work helped the client to provide proof that the journey times reduced as forecasted, and to measure the reduction achieved.



### Bluetooth data processing components:



DARTFORD CROSSING ANPR SYSTEM WITHOUT THE PAYMENT BOOTHS



# Data Analytics

## Silvertown Impact Assessment

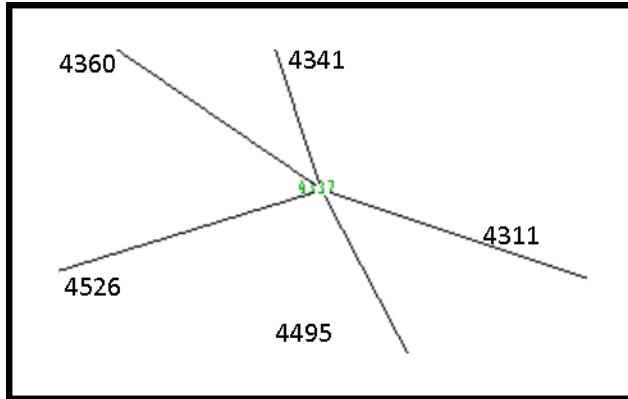
Region, Country, Location  
EMU, England

Solution  
Rail and Urban Transport

Market Sector  
Manufacturing & Technology

### PROBLEM...

- ORGANIZATION provided an environmental assessment and impact analysis of Silvertown schemes.
- In some cases models of roundabouts, calculated by SATURN software, do not provide breakdown inside the roundabout sections, called arms.

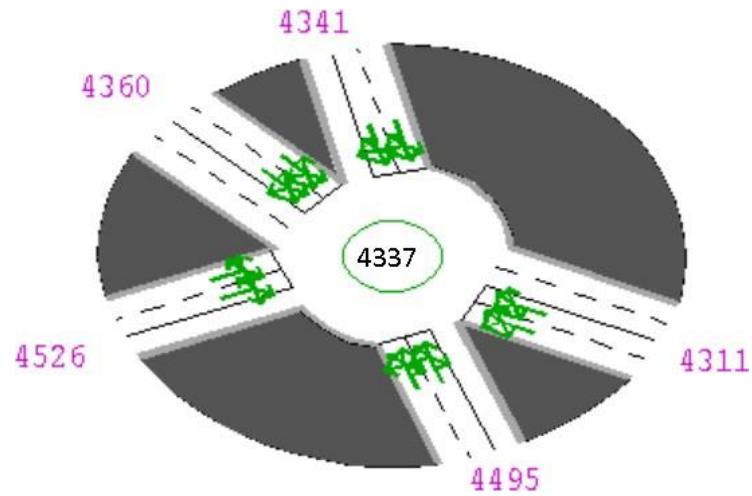


### APPROACH...

In order to “expand” and calculate flows between the arms of the roundabout two steps are required:

- Extraction of flows from SATURN network
- Aggregation of all origin and destination flows on each arm

A semi-automated tool developed in VBA was created and adopted to help with production of expanded flows for any roundabout.



### IMPACT!

#### Efficiency

The bespoke tool can be used and has been used by Organization and Organization clients for other projects.

Minimum configuration plus ease of use shrinks the time required to accomplish a typical task from a few days down to a few hours.

No software installation is needed as Microsoft built-in functionality has been adopted.

Period	Start Node	End Node	LDVs	HDVs	peakLDVs	peakHDVs
AM	4337	4340	1809.55	118	4073.08	267.47
AM	4340	4511	1711.58	111.24	3852.56	252.14
AM	4511	4307	1850.13	105.61	4164.42	239.38
AM	4307	4337	1962.46	106.18	4417.26	240.67
IP	4337	4340	1663.07	114.63	9146.89	630.47
IP	4340	4511	1580.13	117.37	8690.72	645.54
IP	4511	4307	1492.2	102.18	8207.10	561.99
IP	4307	4337	1662.15	103.24	9141.83	567.82
PM	4337	4340	1944.44	78.63	7252.18	270.44
PM	4340	4511	1951.91	75.02	7280.04	258.02
PM	4511	4307	1628.65	57.6	6074.37	198.11
PM	4307	4337	2073.12	63.92	7732.11	219.84

## Data Strategy and Architecture

# Provision of Data Analytics Services

Region, Country, Location  
EMU, England

Solution  
Strategic Environmental Consulting

Market Sector  
Oil & Gas

### PROBLEM...

- BP is facing a new challenge. Today's growing world is demanding more energy as well as a path to a low carbon future.
- There are no easy answers to achieving this dual challenge, which is why BP have developed an accreditation program, namely, the Sustainable Emissions Reduction program to encourage every part of their business to transition towards low carbon.



### APPROACH...

- Support performance analysis and ad-hoc data requests to produce graphics for segment specific environmental performance packs, prep charts and commentary for 3Q analysis and year-end reporting.
- A member of Organization was embedded in BP's operations when the opportunity was presented to Organization to support the client's Environmental team.



### IMPACT!

#### Efficient analysis tools and reporting

Organization was contracted primarily to support Performance Analysis and ad-hoc data requests, update analysis workbooks, and support end-year reporting.

#### New Initiatives

But more importantly, these have fed into a variety of new low carbon projects and initiatives, such as setting emissions targets and limiting operational emissions.

Team's deep technical expertise supporting a high-profile strategic priority has received plaudits both within BP, as well as back at Organization.



# Data Analytics

## Water Analytics

Region, Country, Location  
EMU, England

Solution  
Resiliency & Water Management

Market Sector  
Manufacturing & Technology

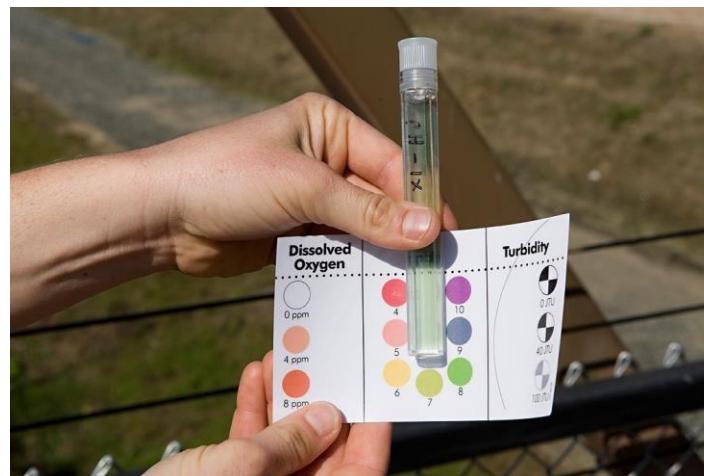
### PROBLEM...

- Abnormalities and inconsistencies were found in our client's datasets which required further investigation.
- Organization was asked to provide data analytics support to analyze water quality number of Water Supply Works.



### APPROACH...

- Analytics-statistical tools for data quality checking, looking for events, anomalies, unusual conditions, complex relationship, visualization and quantification of uncertainty.
- We provided detailed reports to our clients for each site and a consolidated overview of findings for all the investigated sites, as well as summarized our findings in the existing Executive Report.



### IMPACT!

**Resilience** The Water industry is facing increasing challenges, including pressure from regulators, governments and the public to meet service outcomes and provide resilience.

**Efficiency** Organization helped the client to make informed decisions, deliver value and improve efficiency in the system operation and performance.

| 101



# Data Strategy and Architecture

## Road Network Condition Analysis

Region, Country, Location  
EMU, England

Solution  
Operations & Maintenance

Market Sector  
Automotive

### PROBLEM...

- Using a large dataset of various measures of road condition, the client asked Organization to calculate the capital cost of upgrading all necessary sections of road and footway in a regional network to the required minimum standard to meet contractual obligations.
- The raw data contained several anomalies which required complex excel formulae to deal with them and ensure the processing of the raw data and analysis of the outputs were consistent with contractual output specification



### APPROACH...

- Raw data structures were compared against industry standard calculation rules as a sense check.
- Sub-section data was aggregated to calculate an overall condition index for each section of the network
- The capital cost was calculated based on the type and scale of upgrade required for each network section.



### IMPACT!

- Improve** The client will have a better understanding of the magnitude of capital cost required to bring the road network up to the required standard.



Data

Relationships and Trends

Assumptions to Test



# Data Strategy and Architecture

## Trans-Pennine Road Safety

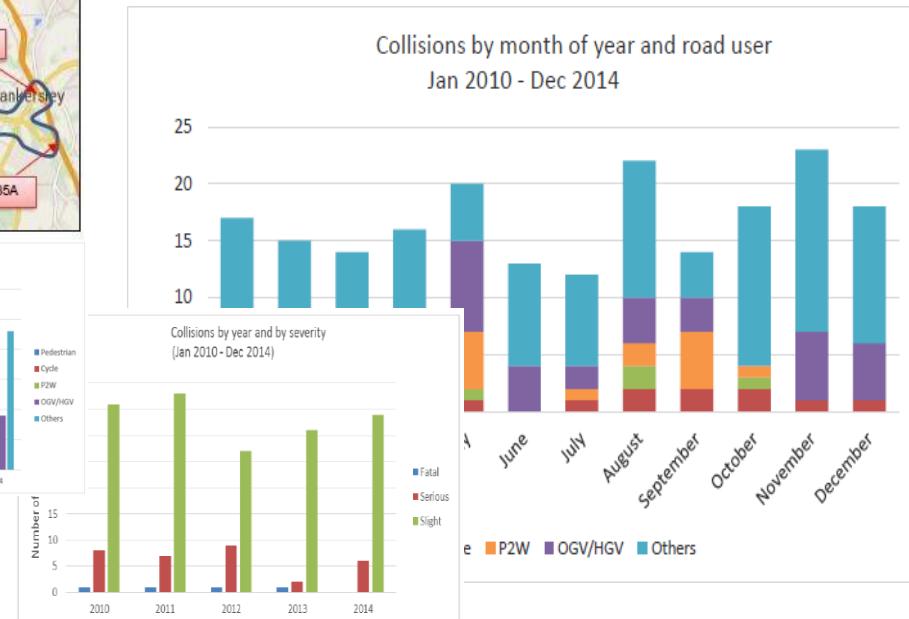
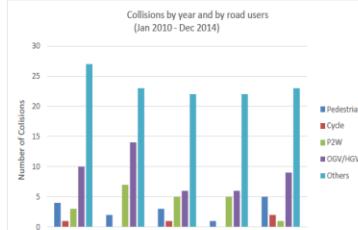
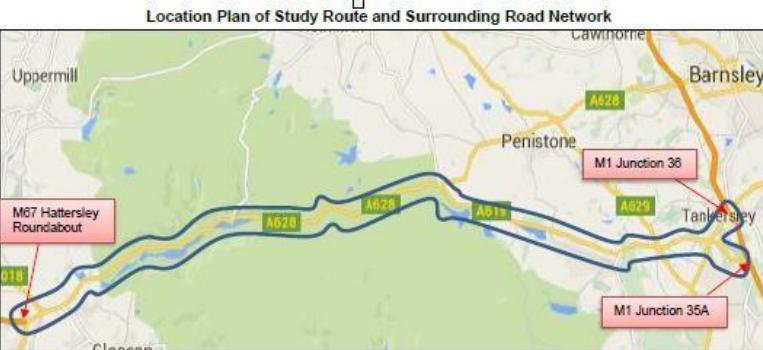
Region, Country, Location  
EMU, England

Solution  
Operations & Maintenance

Market Sector  
Automotive

### PROBLEM...

- Using Data Analytics to Mitigate Road Accidents
- Acquiring collision data and analyzing, incorporating previously undertaken collision studies.



### APPROACH...

- Stage 1: Collision analysis of existing highway along study route over latest 5 years
- Stage 2: Review of collision studies and comparison of previous studies with present.
- Stage 3: Development of remedial measure which aim to improve road safety.

### IMPACT!

#### Improve

Safer roads effective and comprehensive road safety strategies can reduce the number of people killed or injured on the road, despite increasing traffic levels



## Data Strategy and Architecture

# Technical and Traffic Advisory

Region, Country, Location  
EMU, England

Solution  
Rail and Urban Transport

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Organization was appointed to act as the Technical Advisor to a number of buyers and future lenders to various consortia in relation to the consortia' bids for infrastructure assets or for providing independent due diligence services of the assets already owned by our clients.



### APPROACH...

- Use of data analytics and statistical techniques in due diligence projects for various customers, mostly investment funds and major banks.
- We operate in the investment, development and transaction advisory space, building on the synergies and technical expertise.



### IMPACT!

#### Data-driven Investment Decisions

We helped our clients to enable their investment and development decisions whilst maximizing value.

Advised our clients on complex infrastructure deals to minimize their exposure and maximize returns through modelling, getting insight from the data and a full understanding of costs and risks.

Dispute resolutions using the data-driven approach.

#### M25 DBFO, UK



Commercial Advice to Maximising Bid Value

## Data Strategy and Architecture

# Human FACTORS Assessment in Road Design

Region, Country, Location  
EMU, England

Solution  
Rail and Urban Transport

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Following the design guidelines does not always guarantee the best or safest design
- Challenges need to be understood as conditions to be managed, instead of problems to be resolved.
- Not to ignore the implication of unidentified hazards either via conjecture or because of cost constraints. This issue is ultimate when exploring resilience and risk.
- Current design guidance often ignores the risk of unknown or emergent hazards, and leads to incremental evolution of design, rather than inspiring innovations

### APPROACH...

- Systematic evaluation of the design from a drivers perspective, taking into account different characteristics, route choices and conditions
- Smoother design process: better understanding between client and consultant
- Better justification of the design to the public

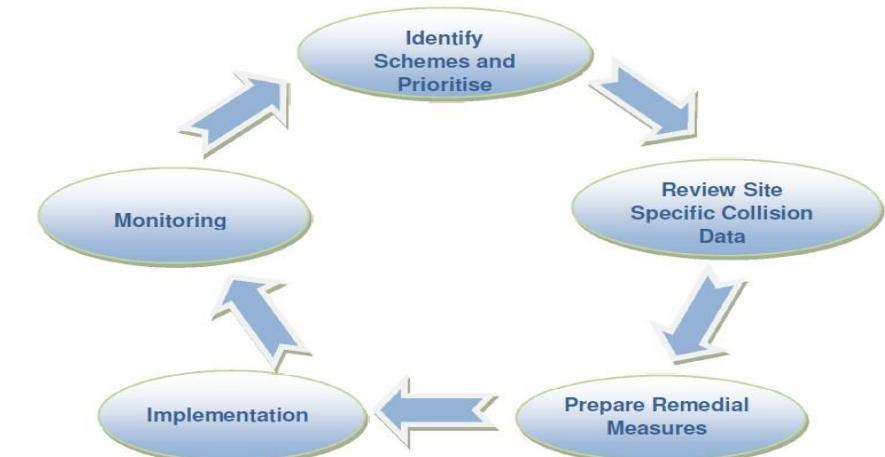
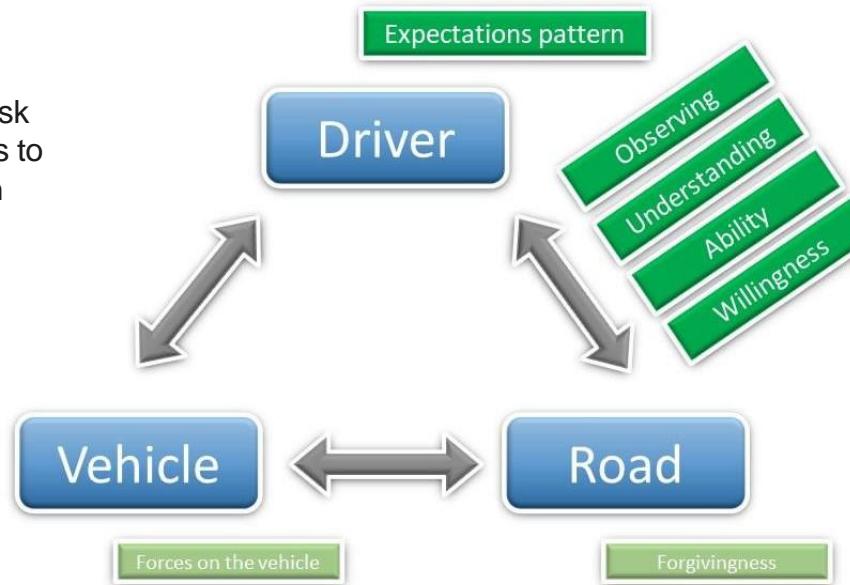
### IMPACT!

#### Optimization

Evaluation results are a starting point for design optimisations and countermeasures

#### Risk Reduction

Solid base for risk assessments, design trade-off's and design decisions



# Data Strategy and Architecture

# Enhancing Climate and Disaster Resilience

Region, Country, Location  
Asia, Laos,

Solution  
Strategic Environmental Consultancy

Market Sector  
Manufacturing & Technology

## PROBLEM...

- The project objective is to enhance the climate and disaster resilience of the most vulnerable human settlements in Southern Laos by increasing sustainable access to basic infrastructure systems and services, emphasizing resilience to storms, floods, droughts, landslides and disease outbreaks.
- The initial safeguard screening undertaken by the project was a mostly quantitative, data-intensive exercise. It narrowed down a list of over 1200 possible activities to a “short-list” of around 240. However, considering that each activity will be screened in each village against the Adaptation Fund’s 15 environmental and social safeguard area, and that each of these 15 areas has several sub-questions, the screenings will produce a very large database.



## APPROACH...

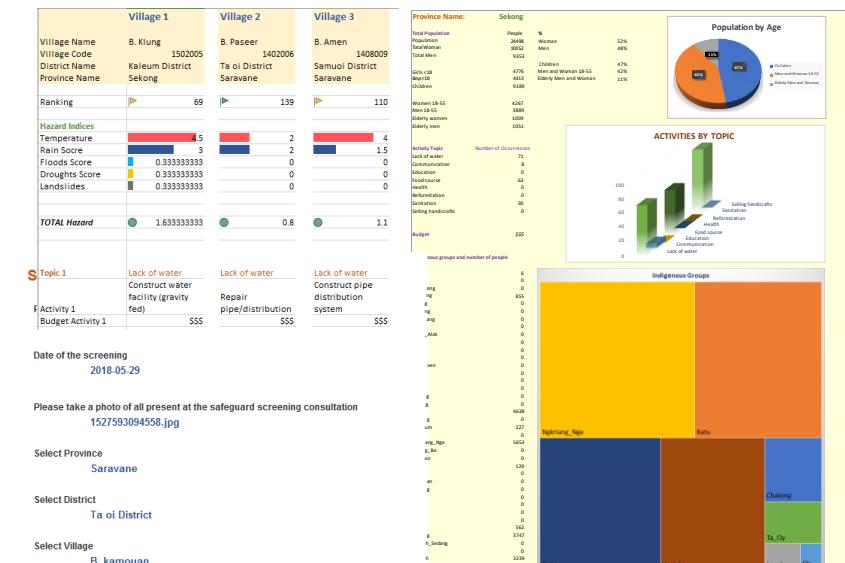
- Using environmental data from many sources, particularly data collected by UN-Habitat to prescribe environmental safeguards to some of the most vulnerable villages in Laos.
- Liaising with local villagers and validating data sets with on-site measurements, some of which were remote and difficult to reach.
- A dashboard was created to help analyze individual villages and a tool was developed to help produce environmental reports. Development of products such as management tools, Database, Analytics and Visualization work and updates to the Environmental and Social Safeguards Strategy.
- Collected data was validated by site visits and prescriptive tools were generated from available data. From this, improvements could be made to individual villages based on their specific needs.

**UN HABITAT**  
FOR A BETTER URBAN FUTURE

## IMPACT!

- Upgrade** Villages have been able to upgrade their infrastructure to provide the most basic amenities in a more sustainable way. It has provided help to some of the most vulnerable people.

- Update** It is also helping to update the Environmental and Social Safeguards.



# Data Strategy and Architecture

## ORR Tender and INRIX Data

Region, Country, Location  
EMU, England

Solution  
Rail and Urban Transport

Market Sector  
Manufacturing & Technology

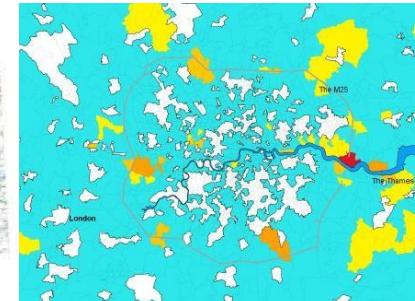
### PROBLEM...

- Measure vehicle delay in England and 12 other European countries using traffic data collation and manipulation
- Identify a suitable dataset such as mobile phone data or in-vehicle navigation system.
- Acquire consistent data across all countries
- Map effort: matching probe data, speed publication segments and count data
- Potentially huge time/cost investment for lead consultant



### APPROACH...

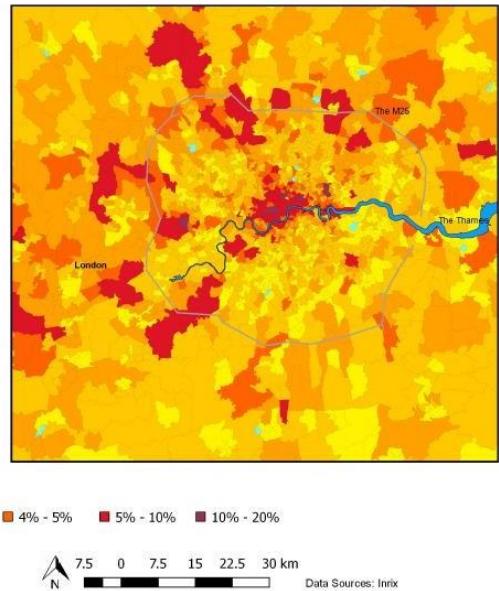
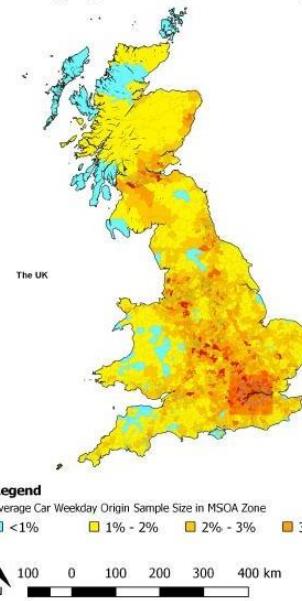
- Use a consistent but similar measure to highways England's operations metrics manual (OMM) June 2016.
- Aggregate average delays across HE's 6 regions including DBFO operated London M25 orbital motorway.
- Report can be run to produce speed profile data and static data across 12 months to give:
  - 1) 1 record per hour per day per segment (where data has been observed)
  - 2) Data can be used in a database to derive the metrics directly without need for further processes (Mapping work)



### IMPACT!

- Analyze** Flow-weighted delay metric so any speed publications would need to be combined with traffic count data

Mapping of Average Car Weekday Origin Sample Size recorded by Inrix, at the MSOA zone level.



# Modeling and Simulation Schiphol A landside

Region, Country, Location  
EMU, The Netherlands, Amsterdam

Solution  
Integrated Airport

Market Sector  
Manufacturing & Technology

## PROBLEM...

- The “A landside” part of Schiphol is a relatively small area with very little space. Because Schiphol has many risks and stakeholders at the same time, they wanted to have an overview of the existing situation in 3D. 3D BIM was utilized to fit a new road design in the model.



## APPROACH...

- Organization was approached to model the existing situation of the A landside of Schiphol, but also to add an additional road design to improve the infrastructure.
- Schiphol had the requirement of using open standards, such as IFC.
- To ensure quality, clashing was done on the model.

## IMPACT!

### Quality

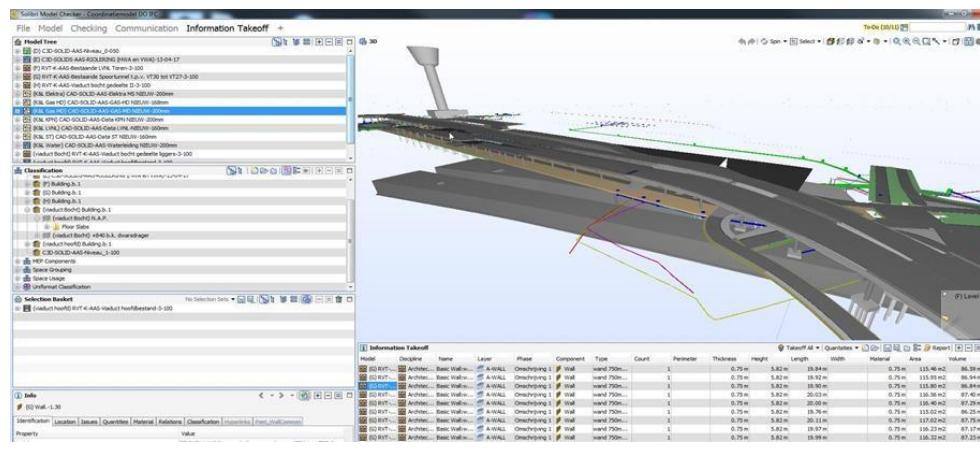
**BIM ensures precision and quality** on a relatively small area with very little space.

### Reduced

failure costs.

### Combined

**I-BIM defines requirements** of the objects in Relatics and make them visible in a tool such as Revit while **Navisworks** can be used to do a **clash detection**.



# Computational Design Climbing Wall| Mountain Network

Region, Country, Location

EMU, The Netherlands, Amsterdam

Solution

Performance Driven Engineering

Market Sector

Manufacturing & Technology

## PROBLEM...



## APPROACH...



## IMPACT!

- Developing a digital strategy for building climbing walls that are faster in production and simple to construct.
- The developed system has to instruct the woodcutting machine how to effectively cut the panels without human interference, to be able to calculate the optimal use of wood for cutting the panels and to be advanced enough in order to take the machines restrictions and the walls' requirements into account.
- Each wall is different, therefore the system for the woodcutting machine needed to be very generic to be applicable on newly designed walls.

- BIM was used to ensure collaboration between the architects (ONL), the client, the woodcutter and Organization.
- ONL made the 3D model in BIM. Organization carriedout the calculations within the BIM model with SCIA. This resulted in the basis on which the woodcutter was programmed.
- From this model, data was exported and imported into the woodcutting machine system. From there, the machine could cut the panels for the climbing wall.
- Within the design process the panels were made in a specific way, so they would fit perfectly and would only need nine bolts for each panel.

Faster

**Three times** faster production of the panels and construction of the walls

Reduction

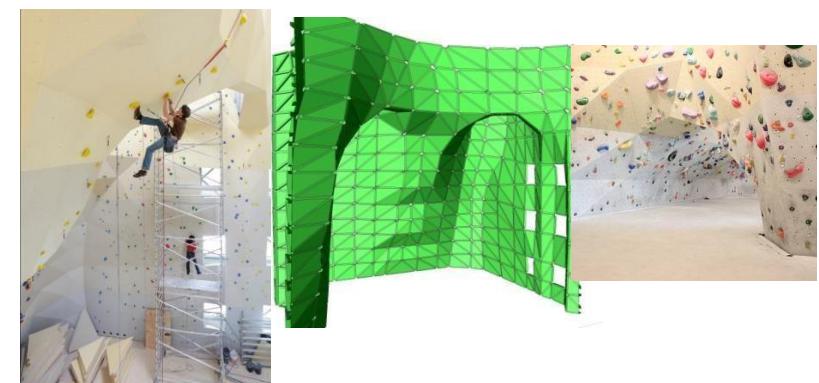
of wood and cutting errors

Cheaper

**process** and **better quality** of the end products.

Safer

**work environment** due to total remove of manual work while cutting the panels



# Computational Design Theunis Bridge

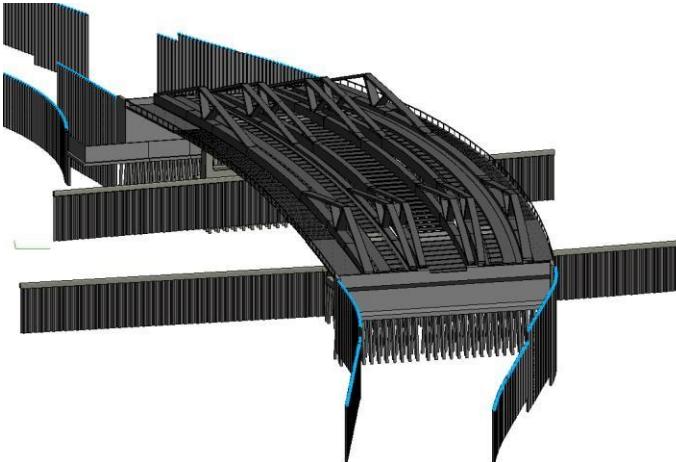
Region, Country, Location  
EMU, Belgium

Solution  
Performance Driven Engineering

Market Sector  
Manufacturing & Technology

## PROBLEM...

- Create 3 double curved bridges and obtain drawings and schedules.
- Create 1 generic solution for all 3 bridges



## APPROACH...

- We implemented parametric design to create dynamic dispatch of data into code.
- We used small scalable modules to accommodate variations
- We moved large pieces of code to python increase modularity



## IMPACT!

**4x** Enabling collaboration between 4 disciplines (Infra, Structural Design, 3D Modelling, Cost Estimation)

**100%** Data generated model adapting to new requirements (the model turned from being a model to being a model-state provider)

**30%** **Estimated time** reduction in achieving the end result

**OK** Complex geometry became realizable, enabling full advantage of BIM (cost, manage, etc.)

# Computational Design

## Space Plan Generator | Paris Network

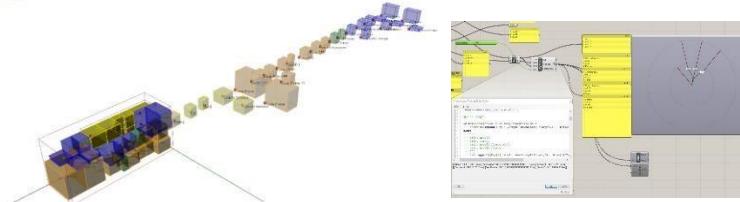
Region, Country, Location  
EMU, France

Solution  
Performance Driven Engineering

Market Sector  
Manufacturing & Technology

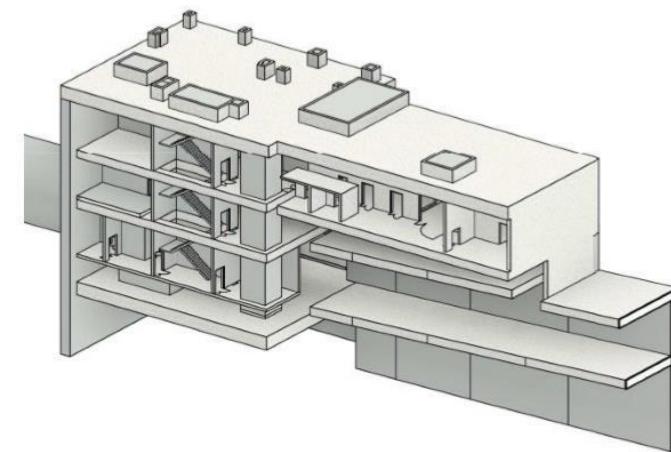
### PROBLEM...

- Automate the planning of technical buildings with strict room requirements.
- Automation script of the required planning process of technical buildings for the Metro Paris Extension, Line 18.
- To maintain desired hierarchical relationships in-between rooms with very different dimensions and heights even in the given confined excavation volumes.



### APPROACH...

- We changed processes from 1 day to minutes.
- Changed mindsets to adopt new tech.
- Adopt computational workflows for better version control.



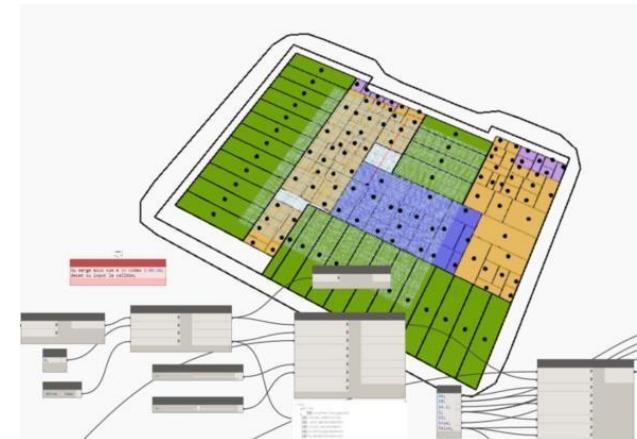
### IMPACT!

Faster

**Ten times** faster generation of alternative **plan scenarios** in 3D and BIM.

Increase

in **accuracy**, in terms of maintaining relationships between rooms and departments.



# Computational Design Leopold 2 Tunnel

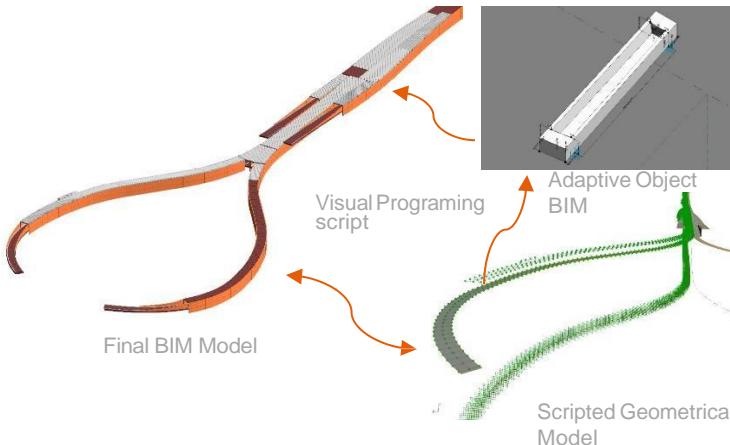
Region, Country, Location  
EMU, Belgium

Solution  
Performance Driven Engineering

Market Sector  
Manufacturing & Technology

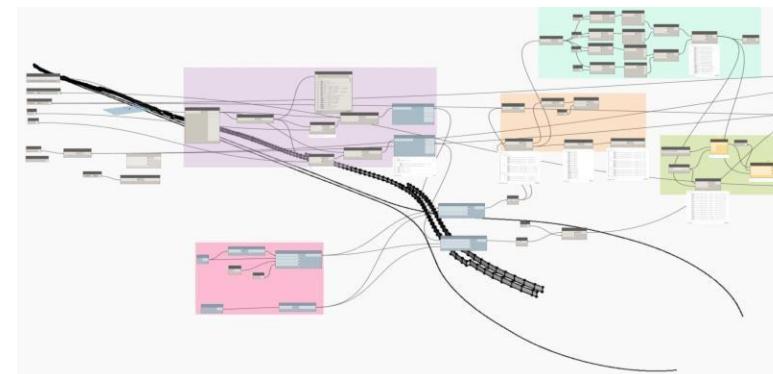
## PROBLEM...

- From existing data in form of Topo Survey points, Point Value Table and Slope Value Tables and partial data of the Initial Project from 1970's.
- Generated first through topo points and checked against values.



## APPROACH...

- To speed up tunnel and shafts BIM modelling and define an accurate existing stage model by comparing data from different sources: pdf, CAD, tables.
- Changed processes from 1000 hours (as initially allocated for tunnel modelling) to less than 500 hours for the tunnel structure itself.
- Initiated new workflow in BIM environment with precise modelling in 3D and 2D extracts for linear structure.



## IMPACT!

Faster

**Two times** faster modelling and drawing extraction.

More precise

**Three times** more precise due to three data sources compared in 3D.

Increase

in **coordination accuracy** between tunnel and existing/ new connecting structures due to BIM.

Bid won

**Finalist in Tender Stage** achieved due to BIM and client satisfaction.

# Optimization

# Decision making & automation for camera placement

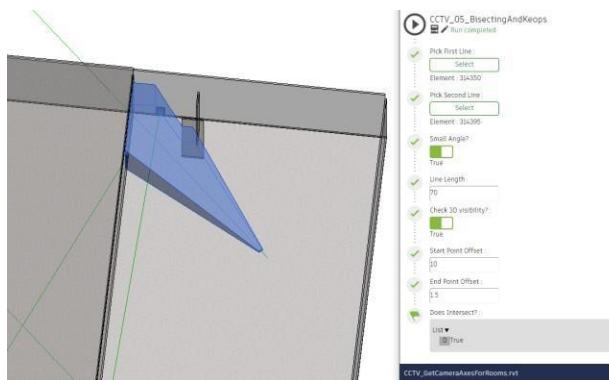
Region, Country, Location  
EMU, UK

Solution  
Performance Driven Engineering

Market Sector  
Manufacturing & Technology

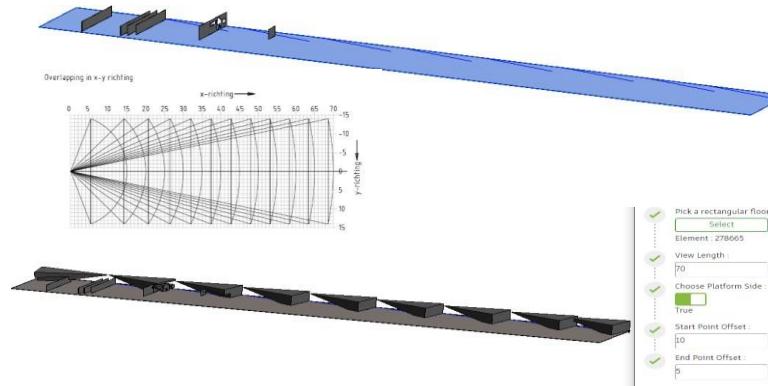
## PROBLEM...

- Automate security camera placement scenarios in train stations and along the platforms.
- Compare and identify field of views, obstacles and ways around them.



## APPROACH...

- Script efficiently for the 4 different placement/camera position types in order to create a Revit 3D visual volumetric representation of the resulted unobstructed field of view to see the impact of obstacles.



## IMPACT!

### Classification

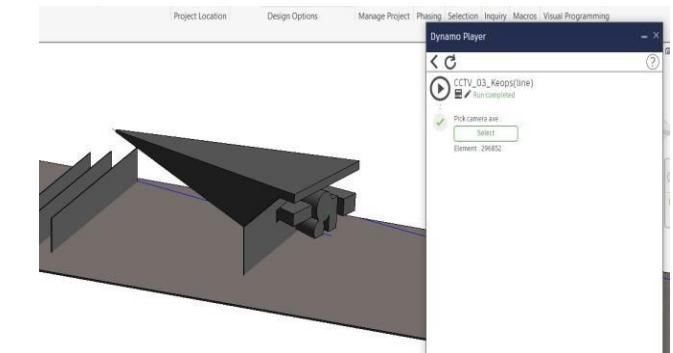
of the **possible scenarios**.

### Visualization

of the **advantages and problems** associated with each camera position with provided scripts that makes it possible to see them in 3D.

### Better & More

**predictable outcomes** with faster scenario iteration and comparison.



# Computational Design

## Automation of Steel Composite Design/BIM Model

Region, Country, Location  
EMU

Solution  
Performance Driven Engineering

Market Sector  
Highways & Transportation

### PROBLEM...

- Generation of multi span steel composite structures with complex alignment geometry is not directly achievable in Revit.
- Significant modeling time is required and the ability to adapt to design changes is very limited.
- Manual process is prone to error and is difficult to achieve standardization across multiple structures.

### APPROACH...

- We created a user design template in excel which allows input for design parameters and semi-automation of section sizing.
- Dynamo (Python) is used to generate the bridge model and it automatically extracts the bridge parameters and alignment data from the excel interface.
- The script is highly complex but the user interface and model generation procedure is very simple.

### IMPACT!

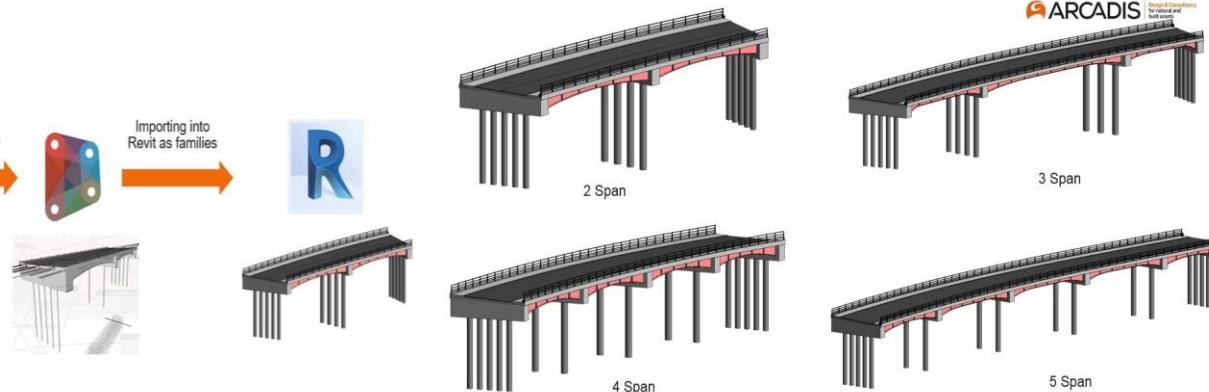
 **Possible to model complex bridge structures** in Revit with dual curvature and changes in super elevation.

 **Significant Time Saving** potential on future schemes requiring steel composite structures.

 **Can adapt to change** quickly during the project life cycle. Easy link to highway alignment data.

 **Automation & Standardization** is achieved with significant reduction in human error.

 **Can be modified for different structure types** Library of scripts for different bridge types can be developed, utilizing existing methodology



For more details about created script flexibilities [click here](#)

## Computational Design

# A5036 Port of Liverpool Scheme – Gantry Model Automation

Region, Country, Location  
EMU,

Solution  
Performance Driven Engineering

Market Sector  
Highways & Transportation

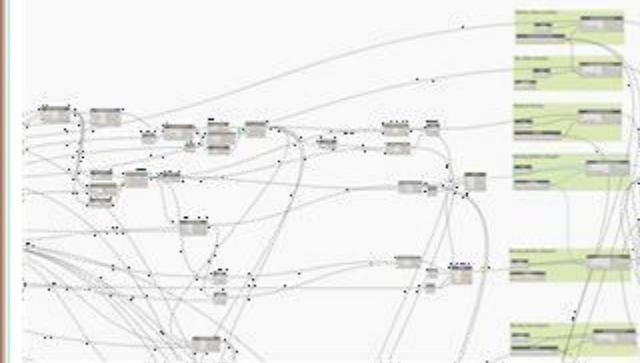
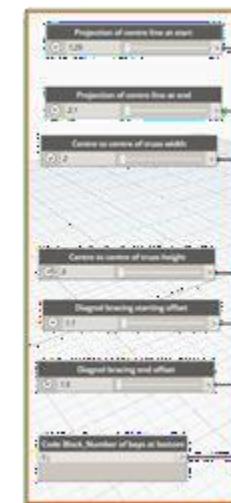
### PROBLEM...

- Generation of gantry BIM models for Stage 3 preliminary design federated model.
- Gantry size/spans varied throughout the scheme
- Models needed to be located relative to the highway alignment on specific chainages
- Manual generation would be time consuming and prone to error.



### APPROACH...

- Dynamo script created to automate the gantry modelling in global location.
- Global co-ordinates of the gantry will be picked from the alignment and used as the parameter for the gantry modelling.
- Model will be generated with the various input parameters like no. of bays, truss member sizes, foundation details etc.,



### IMPACT!

**Possible to model** any type of gantry very easily

**60% Reduction** in time for developing the models with error free.

**In Future projects** the existing script will be sufficient to create models with no time.



# Computational Design

## HS2 Architectural Footbridges – BIM Model Automation



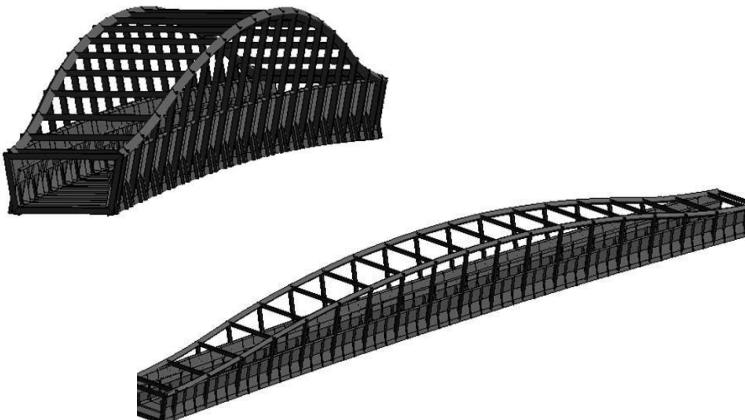
Region, Country, Location  
EMU,

Solution  
Performance Driven Engineering

Market Sector  
Highways & Transportation

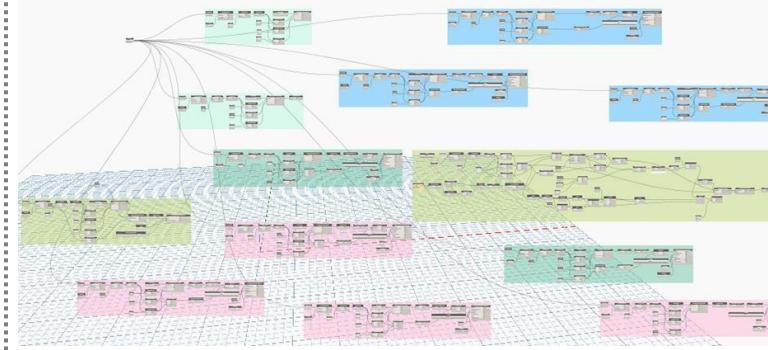
### PROBLEM...

- Footbridges with complex geometry including truss top chords in double curvature and non-linear parapet features.
- Early design phase required a level of adaptability including ability to lengthen/widen the structures.
- Manual generation was time consuming and prone to error.



### APPROACH...

- Dynamo script created to automate the model production.
- Excel user interface used schedule key geometric parameters which were pulled automatically into the Dynamo project.



### IMPACT!

- ✓ Possible to model complex bridge structures in Revit with longitudinal curvature and changes in longer gradient.
- ✓ Significant Time Saving potential on future schemes requiring steel structures.
- ✓ Automation & Standardization is achieved with significant reduction in human error.

# Computational Design DUFFEL Bridge

Region, Country, Location  
EMU, UK

Solution  
Performance Driven Engineering

Market Sector  
Manufacturing & Technology

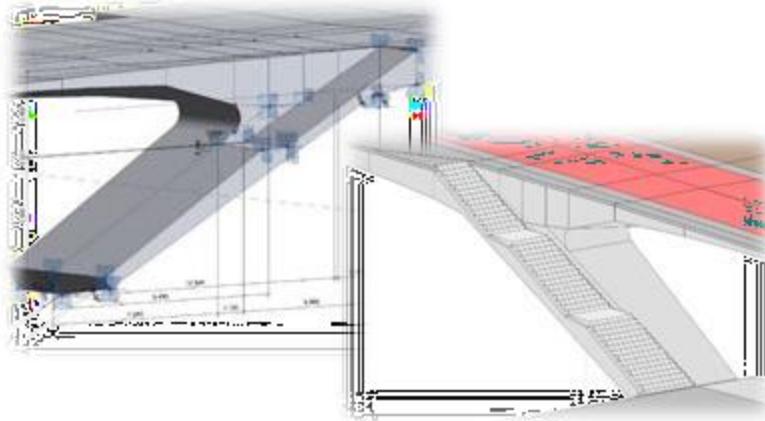
## PROBLEM...

- Create the BIM Model for a challenging bridge structure that was in it's third design iteration



## APPROACH...

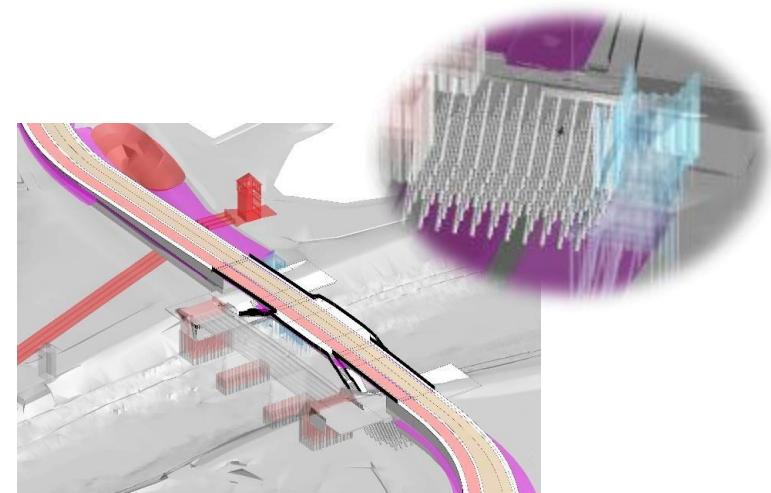
- Split the project into pieces of manageable geometry following the design rules
- Change the way modelling is done by using scripts and algorithms in the most efficient way by not excluding the designer touch



## IMPACT!

**10x** Faster to generate geometry and updates, less prone to error

**4x** Better BIM process and model less heavy (from 1Gb to below 200Mb)



# Computational Design

## Abstract of Structural Characteristics

Region, Country, Location  
EMU, Belgium

Solution  
Performance Driven Engineering

Market Sector  
Manufacturing & Technology

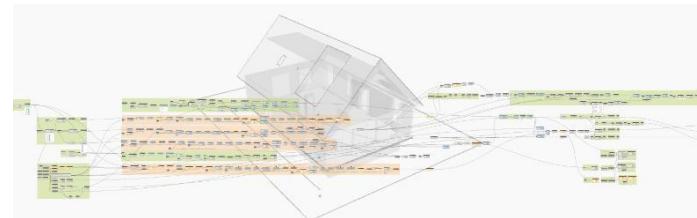
### PROBLEM...

- Automate the abstracts of structural characteristic which are important to understand the behavior of a building during an earthquake.

Street name & number:		Tweelmen 17	Postal code:		3060	City:		EMU	Country:		Belgium	Spreadsheets:		0.1 - 4.7 - 2018	Data modified:		0.1 - 2018	Page:		1									
Basic registration:			Building:			Brick wall:			House number:		17	Reinforced concrete:			Frost code:			Type of construction:											
<b>Abstract of structural characteristics</b>																													
Basic registration: Building: Brick wall: House number: Reinforced concrete: Frost code: Type of construction:  Seismic actions (Aad 2010): Psd including per horizon (g): A <sub>1</sub> = 0.10 Ratio between planes and roof (g): g <sub>1</sub> = 2.00 Ratio between roof and floor (g): g <sub>2</sub> = 2.00 Usual time period of seismic (T <sub>1</sub> ): T <sub>1</sub> = 0.98 Degree of concrete displacement (D <sub>c</sub> ): D <sub>c</sub> = 0.78 Influence distance of seismic building: -  Weights: Weight of floor per unit area (kg/m <sup>2</sup> ): A <sub>11</sub> = 0.00 Live load of floor per unit area (kg/m <sup>2</sup> ): A <sub>12</sub> = 2.00 Weight of roof per unit area (kg/m <sup>2</sup> ): A <sub>21</sub> = 0.00 Weight of roof (kg): A <sub>22</sub> = 88 Weight of roof sheet (kg): A <sub>31</sub> = 84 Weight of roof panel (kg/m <sup>2</sup> ): A <sub>32</sub> = 4 Weight of roof panel with floor (kg/m <sup>2</sup> ): A <sub>41</sub> = 0 Weight of roof panels (kg): A <sub>42</sub> = 160 Coefficient of conversion to weight (kg): 30%																													
Floor type: Type of roof type: Type of roof coverage: Area of roof (m <sup>2</sup> ): A <sub>13</sub> = 40.0 Area of roof (m <sup>2</sup> ): A <sub>14</sub> = 40.0  First floor type: Number of full rooms and hallways: n = 1 Type of floor slab: Length of floor slab (m): L <sub>1</sub> = 10.20 Ratio between end and long side: L <sub>12</sub> = 2.01 Area of floor slab (m <sup>2</sup> ): A <sub>15</sub> = 12 Ratio between end and long side: R <sub>1</sub> = 0.2 Ratio between end and long side: R <sub>2</sub> = 0.2 Ratio between end and plan area: R <sub>3</sub> = 0.00 Size of floor opening (m <sup>2</sup> ): T <sub>11</sub> = 0.00																													

### APPROACH...

- We changed processes from days to minutes.



### IMPACT!

- 10x Faster of checking the structure of the buildings.

- 2x Increase in **accuracy**, of calculations, **reduce** human errors and produce better strengthening's proposals.

# Computational Design

## Wind turbine foundation reinforcement

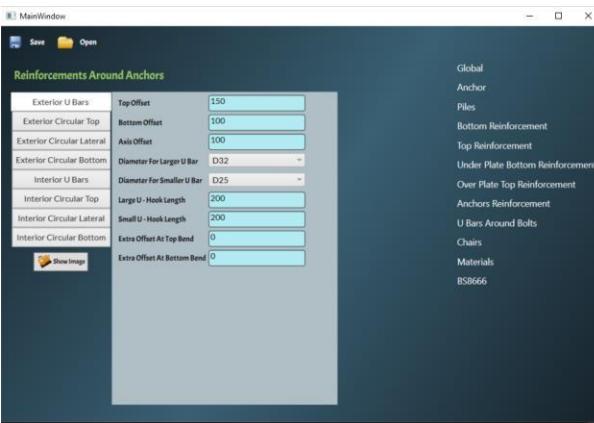
Region, Country, Location  
EMU, Belgium

Solution  
Performance Driven Engineering

Market Sector  
Manufacturing & Technology

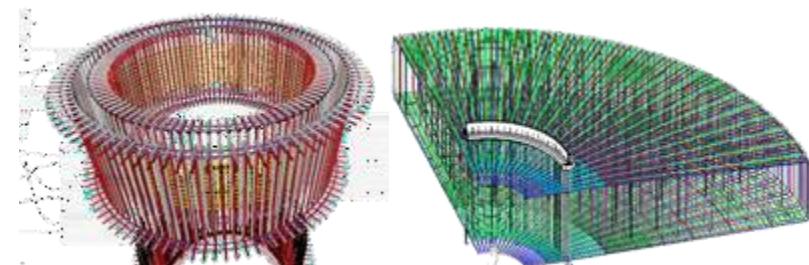
### PROBLEM...

- Parametric design in combination with Python to automate rebar generation for wind mill turbine foundation
- Find alternative solution to excel as data input means



### APPROACH...

- We defined geometric variations of rebars possible outcomes and set up necessary parameters for the process
- We build up 9 scripts to approach 3 areas (reading/generating/finalizing)
- We created a template with premade sheets to accommodate needed layouts
- We created a Windows interface for data input



### IMPACT!

**100%** **increase** in process complexity. ~400 parameters needed in process

**50%** **Reduction** of human errors in the process of generating the rebars (user interaction limited to data input and drawings setup)

**70%** **Estimate decrease** in terms of time needed to generate 3d rebars in Revit

**XP+** **Proof of concept** that could possibly set up further developments of automation

# Computational Design Soil and groundwater Data Modelling

Region, Country, Location  
EMU, Belgium

Solution  
Performance Driven Engineering

Market Sector  
Manufacturing & Technology

## PROBLEM...

- Currently, in most of the EU countries, people still write their observations manually on paper.
- This data is put in an Excel file and a separate mail is sent to the lab to order the analysis of a specific sample. The lab then returns the analysis that were done on the sample.
- There is no central data management system that stores the results, which means that everyone has potentially different files stored locally.
- This workflow has four moments where errors can occur and where manual work has to be done.

## APPROACH...

- Organization has already implemented TerraIndex in several countries that makes the soil investigation workflow fully automated and much more efficient. This tool will be rolled out over Europe in the coming months.
- The tool sends this data to a central database that is accessible to everyone of Organization. This makes the workflow much more efficient and errorproof.
- With this data, 3D models can be made that give valuable insights.
- In addition to these 3D models, certain models can also be specifically developed for the Augmented Virtual Reality environment, which enables the viewer to inspect the model from different angles.



## IMPACT!

<b>Efficient</b>	TerraIndex and Geodin provide efficient workflows for the data acquisition and data management of soil and groundwater data.
<b>Increase</b>	They increase data quality and the avoidance of loss of data. The tools also enable a uniform way of working all over continental Europe and provide more flexibility.
<b>Gain</b>	The tool provides efficient workflows, there is more time available for interpretation. Geodin provides an enlarged information pool for data mining and research.
<b>Access</b>	Since the tools are accessible from anywhere, expert knowledge is available cross-border and the use of the Organization GECs can be increased.

# Computational Design

## Plymouth South West Water

Region, Country, Location  
EMU, UK, Plymouth

Solution  
Performance Driven Engineering

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Plymouth Central STW provides wastewater treatment for the coastal region of Plymouth and serves a population of around 110,000.
- The majority of flows arrive at the works through a deep tunnel network which runs under the city and beyond.
- Shaft 16 is the Terminal Pumping Station at the downstream end of the Plymouth Tunnels system located within the site boundary at Plymouth Central STW.
- At 30m deep, the pumping station has experienced problems due to the exceptional depth of the sump and the aggressive and demanding performance conditions in which the pumps operate.

### APPROACH...

- The adoption of hydro-dynamic modelling for Plymouth was able to demonstrate a more practical approach to avoid the need to construct large volumes of storage which.
- The alternative approach involved a combination of storm UV treatment at Plymouth Central STW, surface water separation, catchment storage optimization and a small volume of additional storage.
- This approach is referred to as the 'Betterment Strategy' which was discussed and agreed with the Environment Agency.

### IMPACT!

#### Reduce

The continuous development of this 'betterment' initiative has reduced the program cost estimate by circa **£14M** from **£42M to £28M**.

# Computational Design ZAC Porte de Vincennes

Region, Country, Location  
EMU, France,

Solution  
Operations & Maintenance

Market Sector  
Manufacturing & Technology

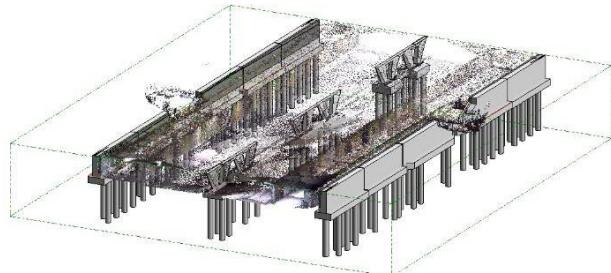
## PROBLEM...



- To accurately model in BIM an existing bridge structure and the newly proposed deck

## APPROACH...

- We define the deck in BIM by comparing the Point Cloud and PDF construction drawings
- Change mindset regarding coordination in 3d and 2d
- Adopted new Modelling techniques involving parametric relations in BIM



## IMPACT!

<b>2x</b>	<b>faster</b> for changes in the proposed deck structure
<b>2x</b>	Ease in the creation of <b>alternative models</b> for determining the best scenario.
<b>50%</b>	<b>Better control</b> in the generation of accurate construction drawings

## Geospatial Solution

# Flood Compensation Area – Cut Fill Analysis

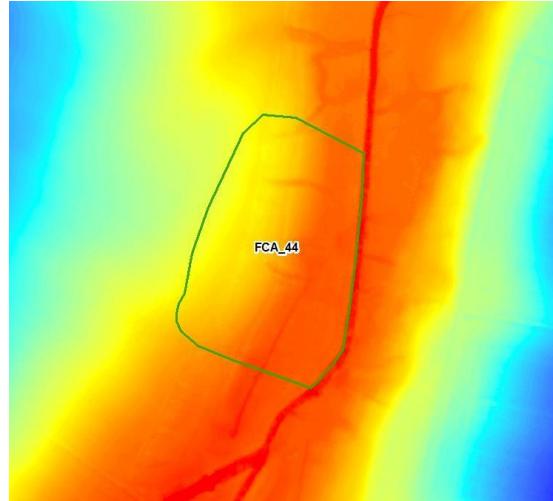
Region, Country, Location

Solution  
Strategic Environmental Consulting

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Calculating the volume of land needed to be excavated in Flood Compensation Areas (FCA) to enable the business to forecast costs

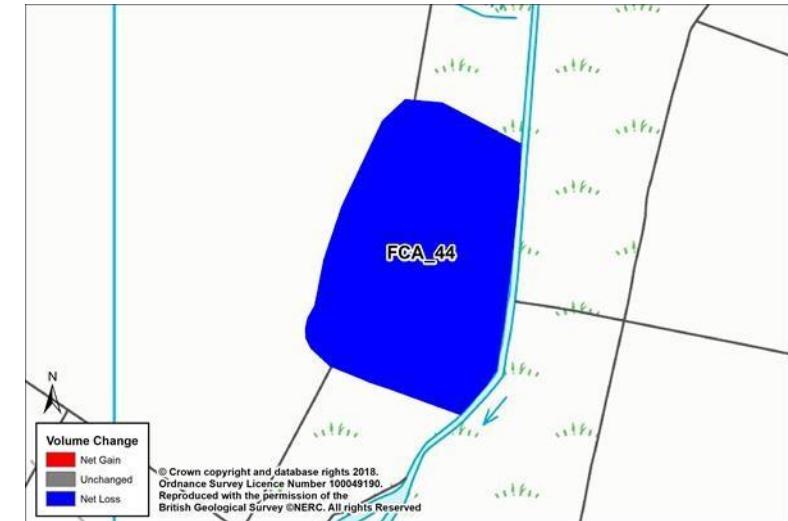


### APPROACH...

- Identify the 'Low-Point' (lowest point above sea level of nearby watercourse) of the nearby watercourse based on LiDAR data.
- Apply to shape of FCA and run tools within GIS to calculate the volumetric difference between current landscape heights and proposed 'Low-Point' height.
- Automation of the process created in GIS model builder. Allowing for multiple areas to be processed concurrently.

### BENEFITS!

- |                |   |
|----------------|---|
| <b>Upgrade</b> | Polygons produced showing areas which experience 'Net Gain' in volume, 'Net Loss' in volume or no change. |
| <b>Update</b>  | Creation of schedule of compensation area to allow for forecasting of cost of land.                       |



## Geospatial Solution

# Organization - Digital Land Referencing Solution

Region, Country, Location

EMU, United Kingdom, England

Solution

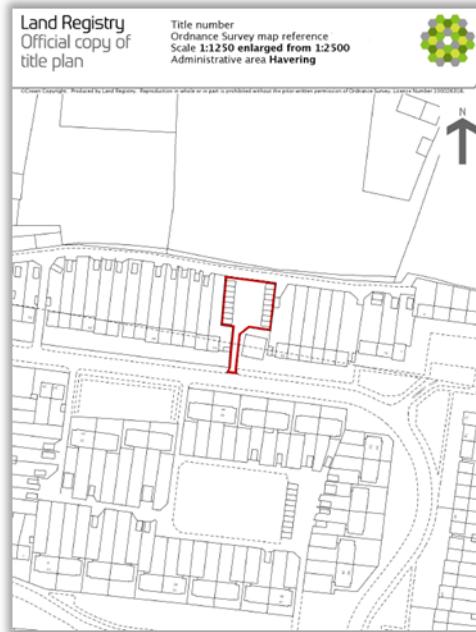
Rail & Urban Transport

Market Sector

Manufacturing & Technology

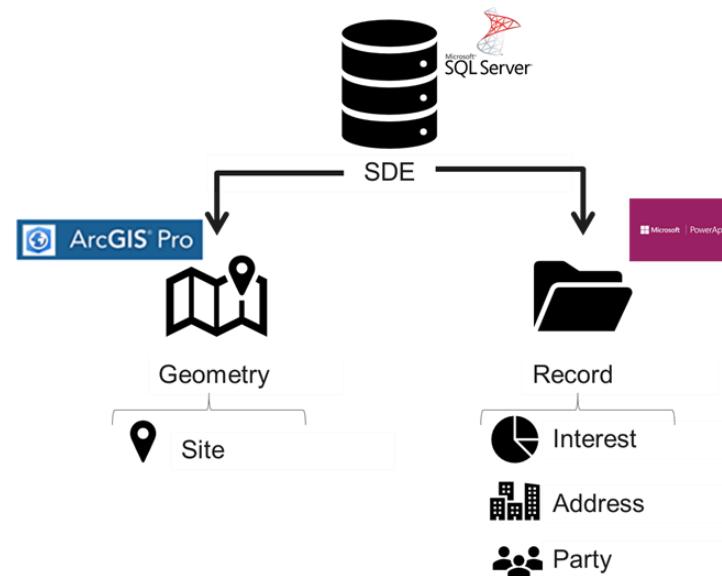
### PROBLEM...

- Organization was tasked with the development of a digital land referencing solution.
- Users needed to:
- Import
- Query
- Update
- Validate



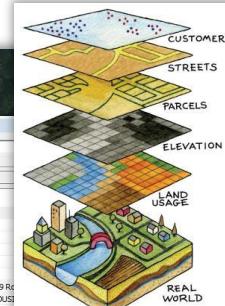
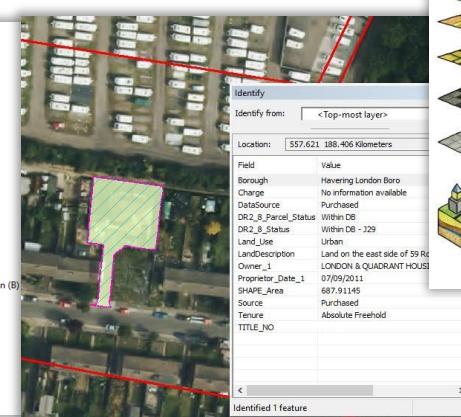
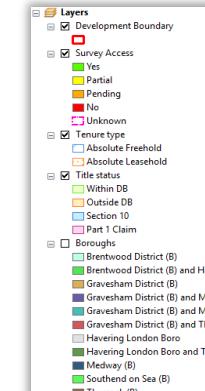
### APPROACH...

- We designed an SQL relational database management system to contain all relevant land referencing information



### BENEFITS!

<b>Best</b>	Standardization of best practice
<b>Increased</b>	Automation of tasks
<b>Update</b>	Sustainable approach
Data governance & assurance	
	<ul style="list-style-type: none"> <li>▪ Reduce Risk</li> <li>▪ Improve Efficiency</li> <li>▪ Cut Cost</li> <li>▪ Meet Client Needs</li> </ul>



## Geospatial Solution

# Custom tools to analyze rising main burst risk

Region, Country, Location

EMU, United Kingdom, England

Solution

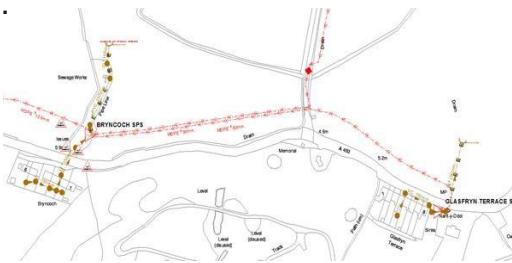
Rail & Urban Transport

Market Sector

Manufacturing & Technology

### PROBLEM...

- DCWW rising main network is divided in sections and there is no data to identify the upstream main nor the origin pump station. It is a complex network with several rising mains merge into single ones.
- Bursts records are associated to mains, but they may be result of a malfunctioning pump station.
- Identify the origin pump station is key to assist in the decision making for investment.
- Solution will be re-run periodically by non-GIS experts.



### APPROACH...

- A set of custom tools were created with ArcGIS Model Builder in order to:
- Identify the upstream rising main of each rising main section and assign a pump station to each rising main route.
- Calculate burst frequency by pump station.
- Estimate the likelihood of burst associated to mains length, diameter and material.
- Analyze the potential impact of burst considering protected sites, properties and water bodies.

### BENEFITS!

#### Automation

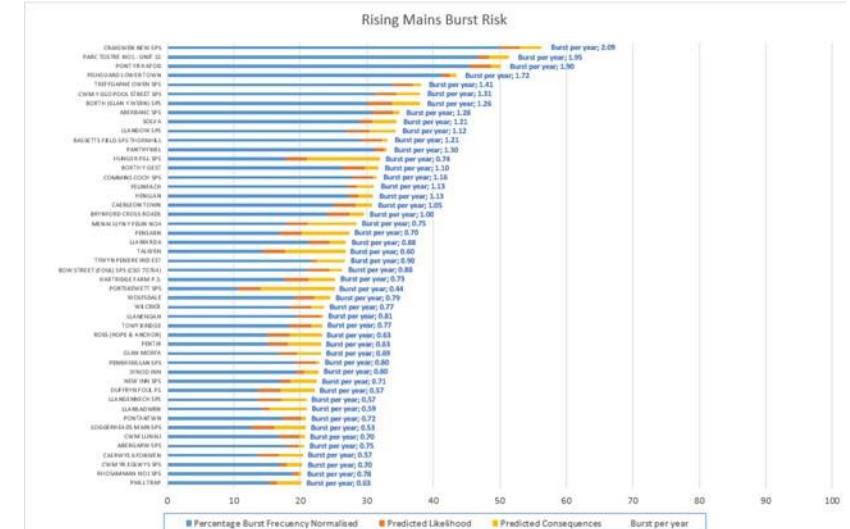
Report and graph automatically generated.

#### Accessible

Easy to run tool by non-GIS experts and connected to enterprise database to use most up-to-date data.

#### Prioritize

Help to prioritize investment on rising mains and pump station by ranking their risk of burst.



## Geospatial Solution

# Automating Transportation Planning Workflows

Region, Country, Location

EMU, United Kingdom, England

Solution

Rail & Urban Transport

Market Sector

Manufacturing & Technology

### PROBLEM...

- The Highways Transportation Planning team historically had to undertake the manual process of reshaping the SATURN (Simulation and Assignment of Traffic on Urban Road Networks) road links to extract Ordnance Survey ITN (Integrated Transport Network). This is required for journey time analysis and validation.



### APPROACH...

- Development of an automated methodology to reduce manual processing using ArcGIS Pro.
- Network Analytics routing techniques was used to automate the manual approach by generating shortest navigational paths with respect to ITN layer, while using SATURN start and destination nodes.
- Spatial Analytics was used to extract ITN links information between two Saturn Nodes.

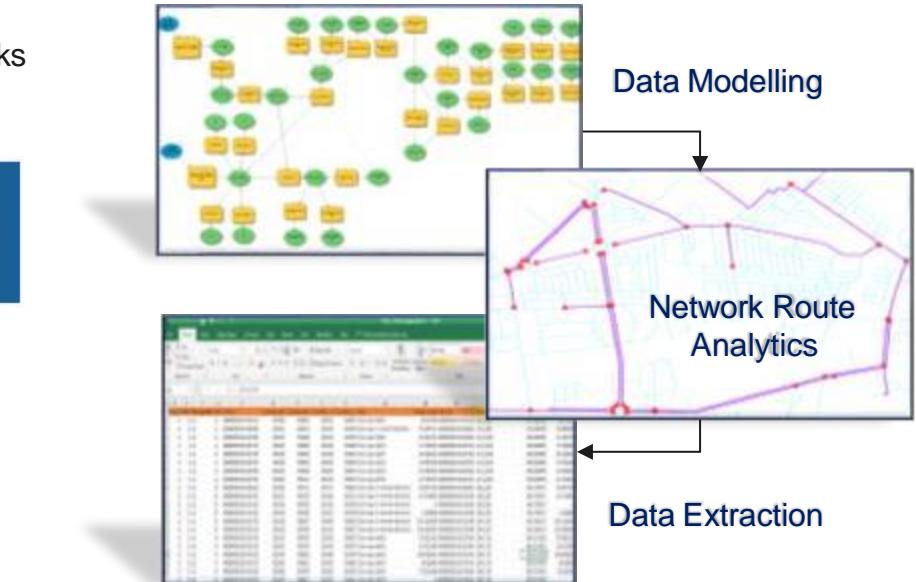


**ArcGIS® Pro**

### BENEFITS!

#### Automation

Our automated solution enhanced the planning inputs for transportation modelling provided 80% efficiency gains vs existing workflows.



## Geospatial Solution

# Geographic Data Catalogue, Lower Thames Crossing

Region, Country, Location

EMU, United Kingdom, England

Solution

Rail & Urban Transport

Market Sector

Manufacturing & Technology

### PROBLEM...

- Large volumes of spatial data were being received for the project from different workstreams and third parties.
- Requirement to store and manage this information in easy accessible manner to allow the supply chain to view and understand spatial data available for the Lower Thames Crossing.

### APPROACH...

- We setup a relational database using Microsoft Azure and developed a PowerApps end to provide a user friendly interface for editing, adding and searching for datasets, users, services, apps and maps.

### BENEFITS!

#### Automation

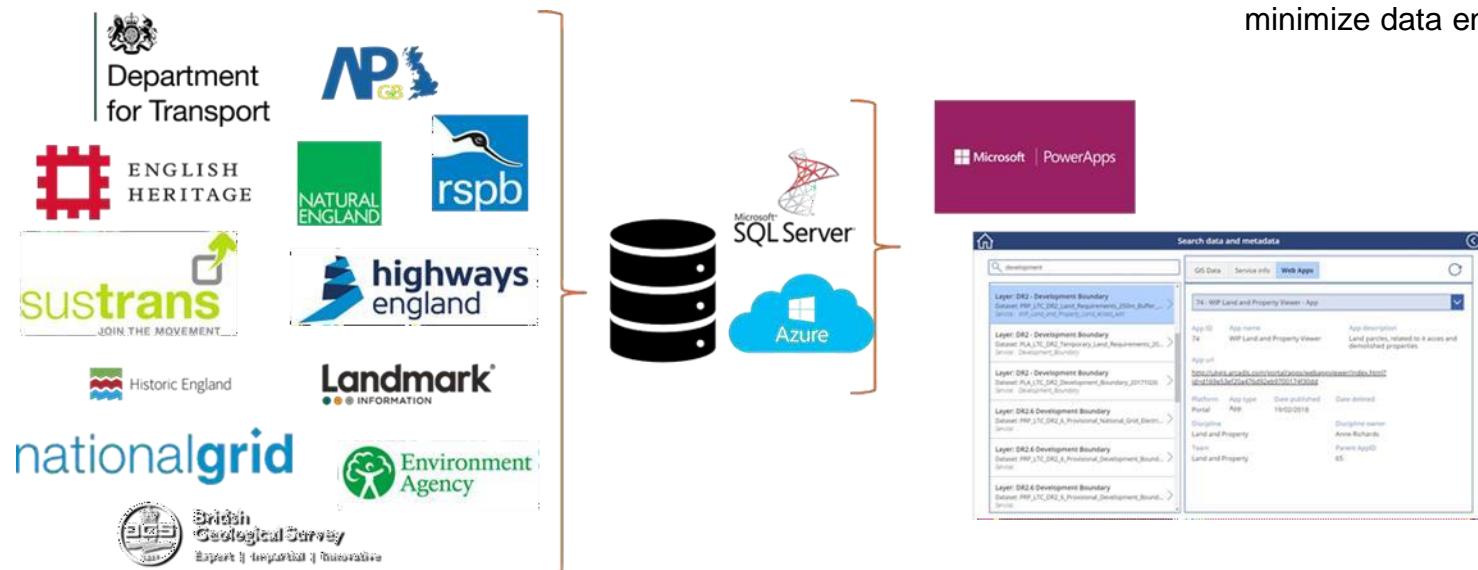
Users are now able to search available project data, review the metadata and web service.

#### Optimization

Automated reporting with analysis, quality control and optimization of GIS services.

#### Minimal

Validation tools were incorporated into forms within PowerApps to minimize data entry errors.



# Geospatial Solution

## Rail PDSW Platform

Region, Country, Location  
EMU, United Kingdom, England

Solution  
Rail & Urban Transport

Market Sector  
Manufacturing & Technology

### PROBLEM...

- The rail team had no auditable trail for health and safety, site visit information
- The rail team wanted a solution that they could manage and run themselves



### APPROACH...

- We created a central database on Office 365 for the data using a PowerApps front end where managers, users and reviewers can store and record all of the site visit health and safety project information.

Arcadis GIS Team Creation

Arcadis  
Rail PDSW  
Platform

Get started

New Site

Start Date of Works	10/2/2018
End Date of Works	10/2/2018
NWR Week Number	
Project Manager	
Oracle Project Number	
SWP Supplier	
Works	<input type="checkbox"/> General Site Visit / Walkout <input type="checkbox"/> Survey Non Instrusive

Start Date	End Date	NWR Week Number	Project Manager	Project Number	Supplier	Works	WorksCSV	WorksSurveyIntrusive
09/10/2018	7/18/2018	UA000234	Claire Miner				General Site Visit / Walkout	
30/09/2017		UA009162	Jeff Lynn				Survey Intrusive	
26/09/2017		UA009162	Jeff Lynn				Survey Intrusive	
11/1/2017								
October 10, 2017			Claire Miner	UA005167	PBH		Survey Intrusive	
03/01/2018			40 Chris Janik	100016306	PBH		Survey Intrusive	
16/01/2018			42 Carl Elam	UA0091739	PBH		General Site Visit / Walkout	
06/02/2018			Tom Constantine	100018041			General Site Visit / Walkout	Survey Intrusive
15/01/2018			Chris Janik	41078			General Site Visit / Walkout	
09/03/2018			Jon Marsh	41200				
02/02/2017			Richard Shinnell	42361			General Site Visit / Walkout	
26/02/2017			Tom Faith	41084			General Site Visit / Walkout	
25/02/2017			Jon Marsh	041045-6511			General Site Visit / Walkout	Survey Intrusive
05/03/2017			Tom Faith	41084			General Site Visit / Walkout	
12/03/2017			Jon Marsh	041045-6511			General Site Visit / Walkout	Survey Intrusive
14/03/2017			Richard Shinnell	42054			General Site Visit / Walkout	
15/03/2017			Miguel Moreno	41264			General Site Visit / Walkout	
08/03/2017			Richard Shinnell	41264			General Site Visit / Walkout	
08/04/2017			Jon Marsh	041045-6511			General Site Visit / Walkout	Survey Intrusive
15/04/2017			Tom Faith	41083			General Site Visit / Walkout	
16/04/2017			Tom Faith	41084			General Site Visit / Walkout	
15/05/2017			Jon Marsh	041045-6511			General Site Visit / Walkout	
5/16/2017			Helen Aston	41084			General Site Visit / Walkout	
5/22/2017			Mariya Padova	041045-6511			General Site Visit / Walkout	

## Geospatial Solution

# Remote Sensing Assessment of Geo-Hazards, LTC

Region, Country, Location

EMU, United Kingdom, England

Solution

Environmental Restoration

Market Sector

Manufacturing & Technology

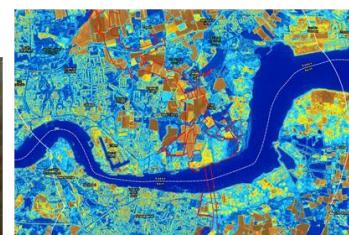
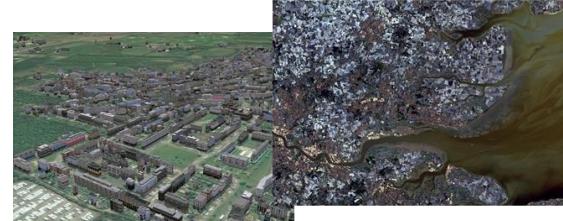
### PROBLEM...

- GI unit required supporting information on high risk engineering geo-hazards along the proposed LTC route.
- Traditional assessment techniques focus on smaller extents – remote sensing is capable of detecting trends along large areas (LTC – 35km long corridor).
- We needed to develop a innovative approach. A GIS-based system was capable of processing and visualizing very large volumes of data.



### APPROACH...

- Created a web-based GIS system utilizing ArcGIS Pro and Image Server to dynamically visualize spectral phenomena related to particular geo-hazards, i.e. spectral band combination showing karstic solution features, on the fly indices mapping showing dry vs wet land.
- Integrated publicly available satellite data sources (i.e. Sentinel-2, Landsat-8) with third party data (i.e. WorldView-2, BGS, Landmark) in ArcGIS Online environment;
- Produce sequence of geo-hazard inventory maps based upon data analysis and interpretation of imagery and ancillary datasets and make this available via 3D Web Scenes.



### BENEFITS!

#### Savings

Provided cost savings to GI unit by identifying the hot spot areas (cost c.50k per borehole).

#### Optimization

Optimized understanding of ground conditions over the large development area at a uniform spatial resolution (0.5m) from the multispectral imagery over the whole route.

#### Increased

Increased productivity by providing an interactive 2D and 3D GIS web mapping application system, capable of integrating Remote Sensing and ETL processes in a single environment.

## Geospatial Solution

# SET Earth Farms – Survey 123

Region, Country, Location

EMU, United Kingdom, England

Solution

Rail & Urban Transport

Market Sector

Manufacturing & Technology

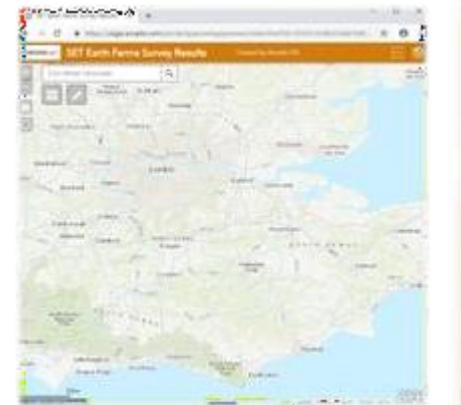
### PROBLEM...

- Mobile GIS solution required to undertake Survey Asset Monitoring of Network Rail Sub Stations in the South East Region for eleven sites. The solution needed to:
- Capture site assurance.
- Provide reports to Site Manager.
- Provide client to survey data.



### APPROACH...

- Delivered a GIS solution deployed via mobile and web apps.
- Used ESRI Survey 123 mobile application to facilitate data collection on iPads.
- Web app to allow the project team and Network Rail to view the results.



### BENEFITS!

<b>Efficient</b>	Efficient collection of asset survey data and linked photos.
<b>Saved</b>	Saved costs normally associated with back office processing and double handling of data.
<b>Increased</b>	Increased client confidence with access to web application.
<b>Improved</b>	Improved health and safety with reduction in survey time.

## Geospatial Solution

# Web App for GI Design in Railway Project

Region, Country, Location

EMU, United Kingdom, England

Solution

Rail & Urban Transport

Market Sector

Manufacturing & Technology

### PROBLEM...

- Geotechnical Engineers needed to design Ground Investigation works along 80km route.
- High Speed Railway with high standards requiring to design the Ground Investigation based on the study of large number of data sources and constraints.
- Tight deadlines with client expecting an update on progress in a weekly basis.
- Digital data and maps series to be delivered.

**Project Assets**  
**Ecology**  
**Cultural Heritage**  
**Geology**  
**Land Quality**  
**Land Access**  
**Hydrology**  
**Utilities**

**100+**  
**data sources**  
**to consider**

### APPROACH...

- GIS web based App was developed.
- All the necessary data sources shared to be interrogated and checked against route formation, base map and aerial imagery.
- Editable layers available for data collection.
- Tools to facilitate navigation and data searches enabled.
- Simultaneous access for multiple people allowing:
- Engineers to add GI locations.
- Discipline leaders to check progress.
- GIS Team to assist with issues.
- Secure environment for data, hosted on Organization servers and not in third party cloud.
- Quick turnarounds to add data or edit App capabilities under Geotech staff request.

### BENEFITS!

#### Improve

Improves timescales for data study and decision making.

#### Efficient

Clear picture to identify areas where GI locations are required for project design.

#### Accurate

Live information, allowing accurate knowledge on numbers and associated costs at any time.

#### Generation

Reports and maps generated for client with proposed GI at any time.

#### Accessible

Ease to move/edit/delete proposed locations based on feedback.



# Geospatial Solution

## Sign In Register App

Region, Country, Location

EMU, United Kingdom, England

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Manage Induction List and the Sign In register for staff working on site

### APPROACH...

- Multiuser database to store site information: MS SQL Server.
- Induction List App for on-site data collection: Survey123 for ArcGIS.
- Read Induction List and generate QR codes: Python.
- Record employee information: Name, Company and Employee no. : QR codes.
- Storage of QR codes: SharePoint Site.
- Sign In Register App for on-site data collection: Survey123 for ArcGIS



### BENEFITS!

<b>Reduction</b>	Digital approach – reduced paper on site.
<b>Safety</b>	Managing site safety - Only inducted staff in possession of a QR code can sign in.
<b>Savings</b>	Time saving during sign in process.
<b>Accurate</b>	Single source of truth. Site information stored in a central database.
<b>Automatic</b>	Automatic leaving time calculation – to ensure staff stay within safe total working hours.

## Geospatial Solution

# Managing Third Party Infrastructure – Lower Thames Crossing

Region, Country, Location

EMU, United Kingdom, England

Solution

Rail & Urban Transport

Market Sector

Manufacturing & Technology

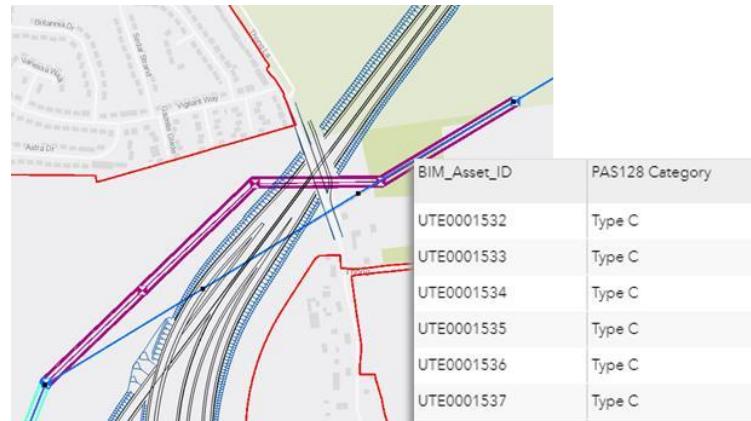
### PROBLEM...

- The Lower Thames Crossing was seeking an innovative way to visualize and interrogate third party asset data directly affected by the proposed road and tunneling development.
- This included utility assets and land ownership boundaries of key stakeholders.
- There was no single location for the wider project to access such information in an user friendly way.



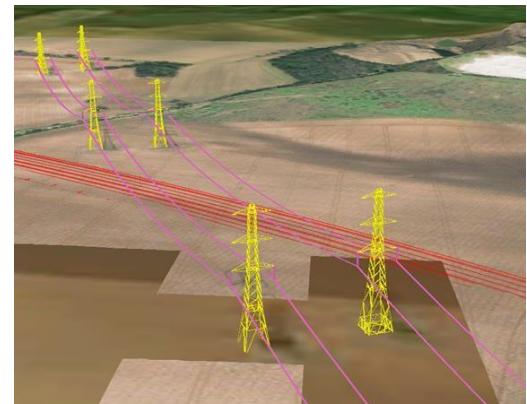
### APPROACH...

- A dynamic, query-able GIS Viewer developed for wider project access.
- Spatial information on individual assets gathered from key stakeholders and processed to project level standards.
- Asset IDs assigned for GIS/BIM integration.
- Confidence levels applied based on PAS128 standard <http://www.pas128.co.uk/> to assure the detection, verification and location of individual assets.
- Key stakeholder utility diversions added for quick and easy comparisons with design layouts.



### BENEFITS!

Improved	Improved efficiency
Reduction	Reduced risk
Savings	Increased project awareness of services
Accurate	A single source of truth.
Automatic	Meeting the ultimate client's requirements
Future	Future opportunities to integrate 3D data



# DIGITAL SOLUTION

## Title

Region, Country, Location  
EMU, Netherlands,

Solution  
Design & Engineering

Market Sector  
Manufacturing and Technology

### PROBLEM...

- Gathering of publicly available data to identify emerging issues and consumer concern as it relates to product stewardship issues within the market place. (Substance controls, straws etc.)

### APPROACH...

- Connected to multiple sources (twitter, rss feeds, etc.) collect and analyze data.

### IMPACT!

Insights into emerging themes, allowing actions and positioning for client before issues come to the forefront.

# Business Analysis, Strategic Sourcing

Region, Country, Location

EMU, United Kingdom, London

Solution

Business Advisory

Market Sector

Manufacturing & Technology

### PROBLEM...

- Complexity of the package in terms:
- 1) number of line items (over 1500 items)
- 2) number of variables (including delivery models, prices, criticality, alternative products, bulk purchasing offers and fulfilment period)
- 3) number of lots in this package (9 lots were identified)
- 4) number of suppliers and the restriction in terms of the overall contract values against different lots for each supplier

### APPROACH...

- Comparison of the price and delivery model for all the line items against all the suppliers
- Baseline comparison of all the line items against the most economically advantageous product for supporting the negotiation strategy
- Identified the top 20 critical items for negotiation and supported the negotiation strategy for this purpose.

### IMPACT!

<b>Saving</b>	9% commercial benefit in the procurement package (target saving of 5%)
<b>Lower</b>	rates on delivery of products, value for money was ensured for TW,
<b>Lower</b>	alternative products identified with a better suitability, quality and lower cost
<b>Most</b>	advantageous delivery model was obtained for the client

## DIGITAL SOLUTION

# Bells Line of Road, Castlereagh Connection Corridor Assessment Study

Region, Country, Location  
APAC, Australia,

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

### PROBLEM...

- This project has been initiated to reserve a transport corridor that will extend from the M7 at Colebee to Kurrajong Heights, to provide an alternative route across the Blue Mountains.
- GIS was used for a multiplicity for planning and design decisions, to determine long list options, which were then narrowed to a short list, and preferred option, using a series of spatial data analytics.
- Extremely constrained location.
- Options were essentially between World Heritage Listed National Parks, and significantly developed areas, as well as sharp terrain.

### APPROACH...

- GIS was used for a multiplicity for planning and design decisions, to determine long list options, which were then narrowed to a short list, and preferred option, using a series of spatial data analytics.
- Analysis of constraints through GIS.

### IMPACT!

**Analysis** A very high number of socioeconomic and cultural factors could be considered rapidly through a desktop analysis.

**High** Allowed for a significant amount of information to be provided to planners and the community in a short time frame.

## DIGITAL SOLUTION

# Waste and Recycling Infrastructure Network Review

Region, Country, Location  
APAC, Australia,

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

### PROBLEM...



### APPROACH...



### IMPACT!

- Network analysis of waste facilities across the large area proved fairly difficult in the budget and time constraints of the project.

- We decided to use a different, cloud based approach as an alternative to developing our own transport network for this task..

**Savings** Much **cheaper** and **quicker** way of performing network analysis.

**High** The project found that there were significant inefficiencies in the current waste infrastructure networks. We managed to make them significantly more sustainable, and efficient, reducing costs.

## DIGITAL SOLUTION

# United Nations Habitat Program

Region, Country, Location

APAC, Australia, Pacific Islands

Solution

Business Advisory

Market Sector

Manufacturing & Technology

### PROBLEM...



### APPROACH...



### IMPACT!

- UN-Habitat is a mission to provide socially and environmentally sustainable towns and cities by improving the quality of life of citizens around the works.
- Organization supports this program by providing probono expertise through the Organization Shelter program.
- The terrain, buildings, and water tank locations were required in order to determine the potential impacts of sea level rise.
- For those in the know of GIS, we had no idea what coordinate system to use for the region.
- Additionally, the amount of international liaising was difficult. There was absolutely no available data for these islands prior.

- We used drone captured imagery, supervised classification of imagery, and semi-automated linkages of buildings to water tanks.
- This helped to keep the budget impacts as low as possible.

#### Savings

This provided an unprecedeted level of information to field engineers. We managed to do this exceptionally affordably and have since won more work with the UN.

## INSERT DIGITAL SOLUTION

# Gold Line Underground, Doha, Qatar

Region, Country, Location  
Asia, Middle East,

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

**PROBLEM...**

- Extremely tight program & difficult client
- De-scoping of lead designer
- Standard design geometry with a high degree of accuracy and detail based on Architectural Branding Manual of Qatar Rail

**APPROACH...**

- Automate repetitive tasks by Computational BIM Design approach
- GEC RO team built a database that includes a script library using dynamo and other automation tools, has driven innovative solutions that allowed us to deliver the complex geometries and architectural forms required, reducing time and cost.

**IMPACT!**

<b>Easy</b>	Data attributes have been applied to all parametric components for easy data extraction for costing and BOQ/quantity take off
<b>Good</b>	Provide a good approach for a common data environment
<b>Analysis</b>	Provide analysis and simulation to optimize the designs while increasing the productivity & Improved decision-making for our clients

## DIGITAL SOLUTION

# Various green building projects

Region, Country, Location  
APAC,

Solution  
Business Advisory

Market Sector  
Manufacturing & Technology

### PROBLEM...

- Provide whole building energy simulations to test efficiency of equipment; we've been trying to collect data to compare results of the simulation to actual energy consumption once the project is built.
- Energy simulations are not enough to provide accurate data to clients who want to know the payback period of having energy efficient equipment.

### APPROACH...

- We gather and analyze data of build projects and compare that to results of energy simulations.
- Data is recorded on the Energy Star website where LEED project owners are required to enter 2 years worth of energy and water data post-construction.

### IMPACT!

**Accurate** Although this is still in the works, by gathering data we can more accurately give our clients information that can help them make decisions about investing in equipment instead of simply complying with green building requirements.

## DIGITAL SOLUTION

# City Plan for City of Chicago

Region, Country, Location

North America, Illinois, Chicago

Solution

Business Advisory

Market Sector

Manufacturing & Technology

### PROBLEM...



### APPROACH...



### IMPACT!

- Gather data using GIS for the City of Chicago to help the City plan for future water main installations or replacements.
- Scaling infrastructure (from a network traffic/IT perspective) to make the data available to the client.

- Gather information on a planning level from assets (water piping, fire hydrants, water services, etc.) and customer service requests to help the client make the best decision on where to install new water utilities.

#### Save

Save money by correctly determining which utilities need to be replaced and how long existing utilities can remain in place.