Global Future Cities Programme

Smart GIS Training: Session 2
Data Derivation for Urban & Transport Planning

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Introductions

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Agenda

1. Overview
2. Derivation of Data
3. Application
4. Practical

Overview

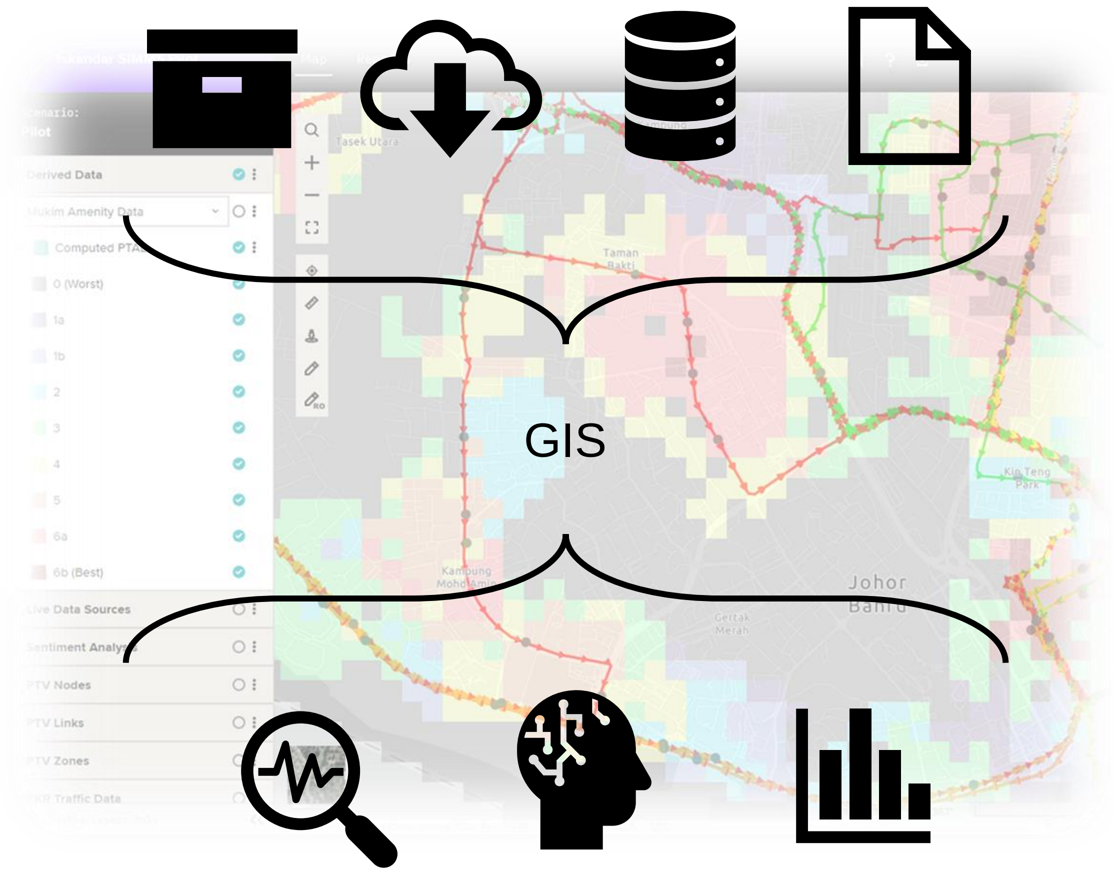
Overview

Over the next 3 sessions we will look at the work performed to produce the Smart GIS as part of the pilot project on the Iskandar intervention:

- Collect Data
- Process it into GIS formats
- Apply analytics
- Produce visualisations
- Generate additional functionality

We will cover:

- GIS Fundamentals
- Derivation of Data
- Advanced Analytics



Overview

Recap from Session 1

Theory

- GIS Fundamentals (best practice, naming conventions, data formats)
- Online storage and interaction (direct links, APIs)

Application (via SIMMS)

- ArcGIS servers (Moata Platform)
- Data collection

Practical

- Basic GIS operations
- Publishing to ArcGIS Online for data collection

Derivation of Data

Derivation of Data

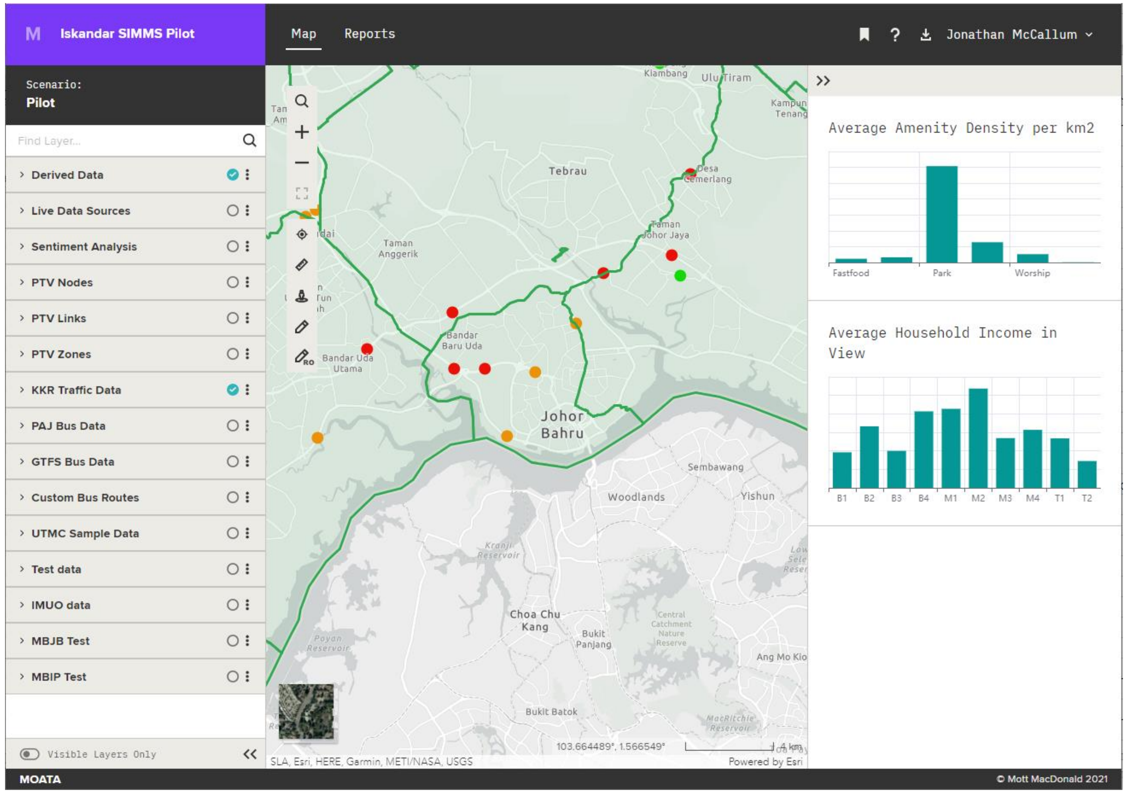
Raw data

Data preparation for SIMMS

Multiple data sources collected:

- IMUO data (amenities, land-use, population)
- PTV (transport models)
- KKR Traffic (accidents, traffic volumes)
- Air quality/Weather forecast
- Bus route data (PAJ)
- UTMC Sample (ITS data)
- Socio-economic data
- User feedback/collections

Data is checked and cleaned then loaded to GIS portal as per details from 1st workshop



Derivation of Data

SIMMS Pilot

Urban and Transport Planning

The intention of the SIMMS pilot was to focus on urban and transport planning

- What metrics would urban and transport planners find useful when making decisions in their work?
- How are cities being planned in a sustainable way and fitting with the UN SDGs?
- What makes a city more “liveable”?

The raw data will provide insights into some of these aspects

However, we need to derive new metrics to getting greater insights into the

Some key aspects to consider in urban and transport planning are:

Connectivity – how easy is it to get from one place to another (concepts of the 30 minute city)

Entropy – how evenly dispersed are assets (are all the shops clustered in one area leaving other areas with none?)

Mobility – transport needs to be available and affordable; just being able to get from A to B might fulfil connectivity requirements but fall short when mobility is considered (this is why “walkability” is critical for a sustainable city)

Derivation of Data

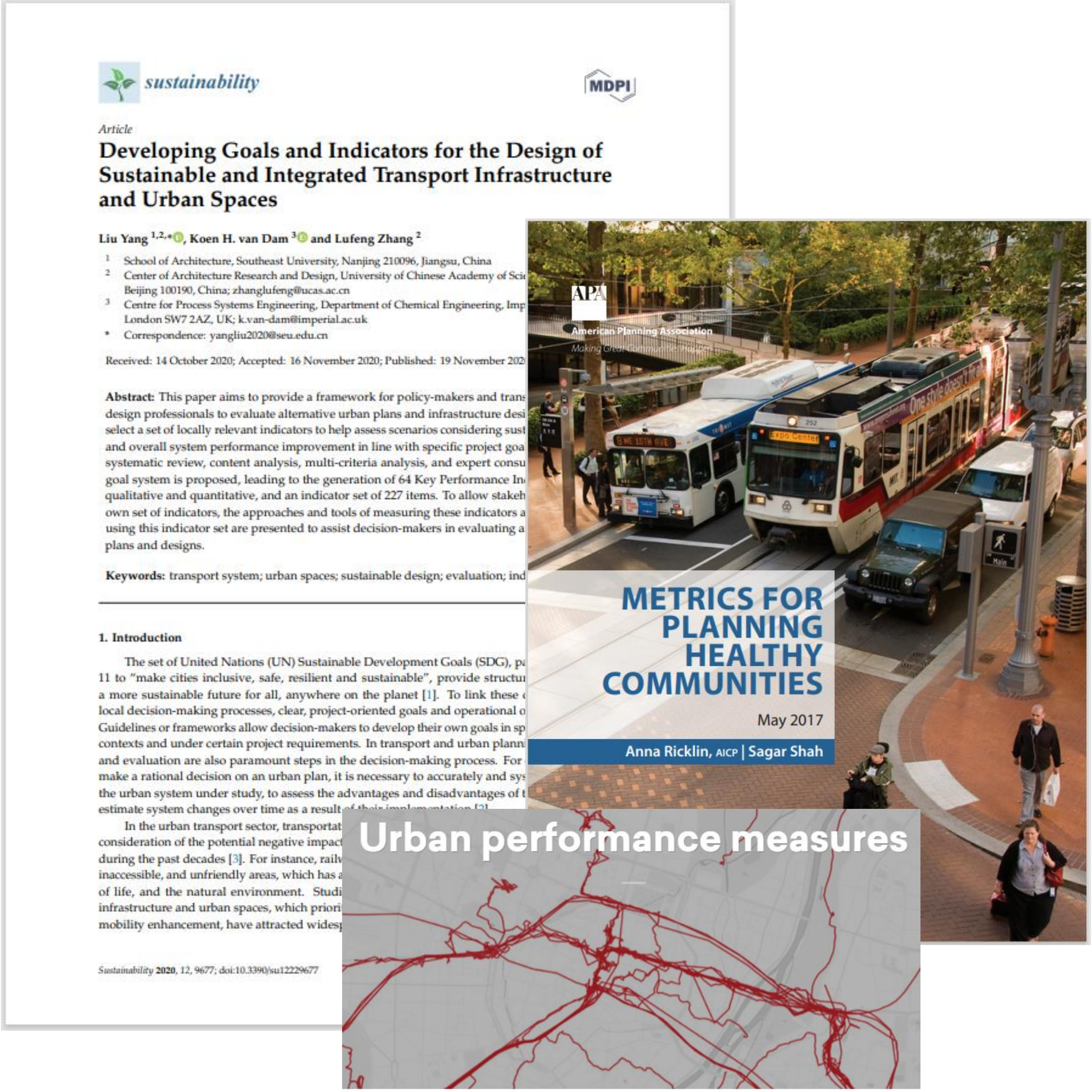
Urban Planning

International papers reviewed and different measures explored

Over 200 metrics across the different papers refined down to about 30 to derive based on available data

The derivation involves spatial queries and in particular considering the density of assets in relation to walking distances

Some overlap with the transport metrics



Peter Drucker laid the foundations of modern management insisting that you can't improve, what you can't measure. In urban planning, this line of thought has transformed the way we set goals, track progress and analyze the effects of implemented projects and policies. Urban performance measures help communities make informed decisions and measure results against goals.

Derivation of Data

Transport Planning

As with urban planning, international papers reviewed and different measures explored

Nearly 200 metrics across the different papers refined down to about 30 to derive based on available data

The derivation involves spatial queries and in particular considering the density of assets in relation to walking distances

Some overlap with urban metrics, but obviously with more focus on the transport

Derivation of Data

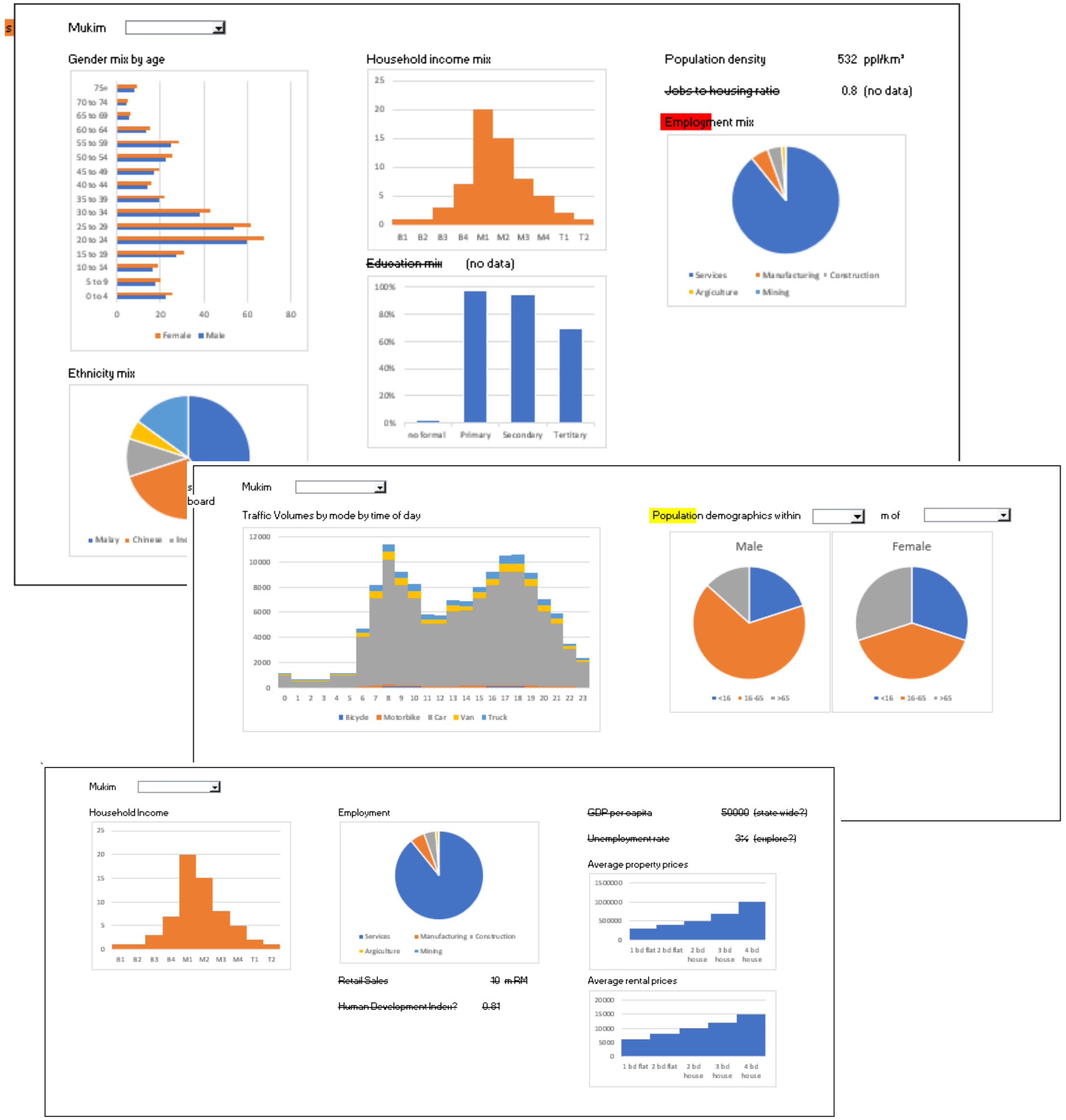
Data Visualisation and Dashboard

Develop a series of dashboard “wireframes” to collect similar data together for the planner to see everything in one place and facilitate data exploration

These were grouped into:

- Urban Planning
- Transport Planning
- Economics
- Environmental
- Quality of Life

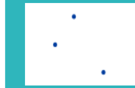
Other dashboards were added later for other more advanced analytics (such as the bus route assessment tool)



Application

Application

Data Preparation - Spatial queries

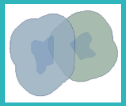
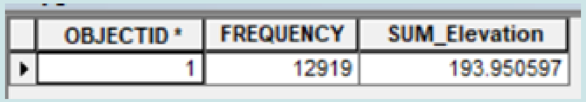
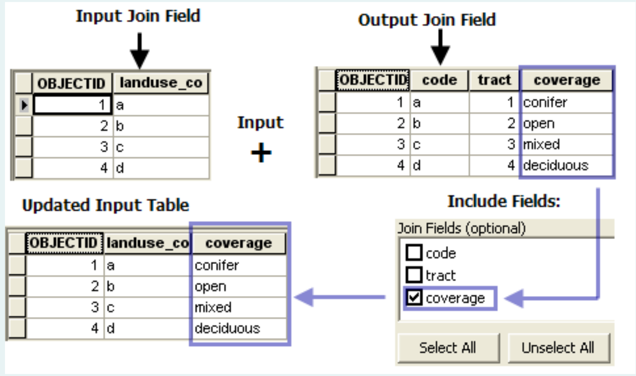
Input data	Process	Theory	Output Geometry	Output Table
 Point  Line  Polygon	Buffer	This algorithm computes a buffer area for all the features in an input layer, using a fixed or dynamic distance.	Non-Dissolve  Dissolved 	Same as input
	Spatial Join	Joins attributes from one feature to another based on the spatial relationship. The target features and the joined attributes from the join features are written to the output feature class.	Same as target features	Field from target + join features

Tracts_SpatialJoin

OBJECTID *	Shape *	Join_Count
1	Polygon	1
2	Polygon	1
3	Polygon	1
4	Polygon	1
5	Polygon	1
6	Polygon	0

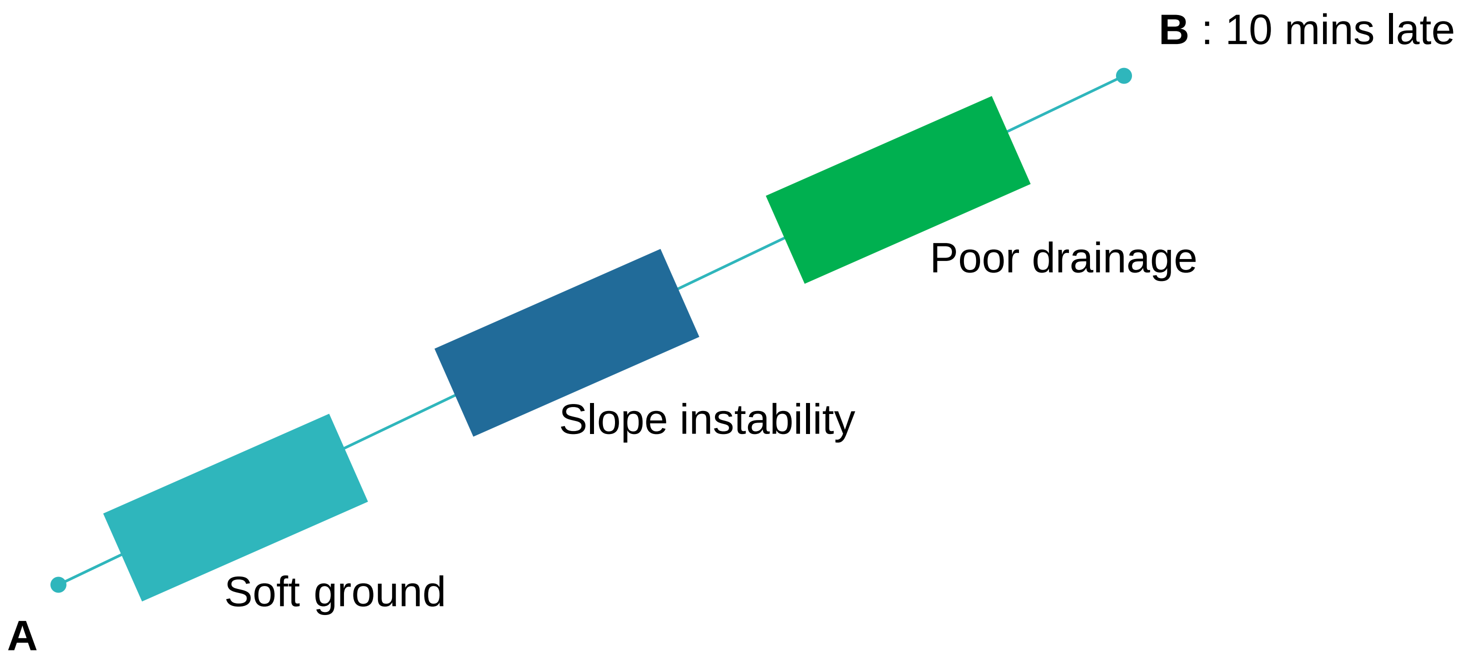
Application

Derivation – aggregation and calculations

<table>
<tr><th>Input data</th><th>Process</th><th>Theory</th><th>Output Geometry</th><th>Output Table</th></tr>
<tr>
<td rowspan="2"> Buffer Point
 Buffer Line
 Buffer Polygon</td>
<td>Summarize Fields - Per Mukim</td>
<td>Calculates summary statistics for field(s) in a table.
Available statistics types are as follows:
• SUM
• MEAN
• MIN
• MAX
• RANGE
• STD
• COUNT
• FIRST, LAST</td>
<td>Table</td>
<td>
| OBJECTID * | FREQUENCY | SUM_Elevation |
| 1 | 12919 | 193.950597 |</td>
</tr>
<tr>
<td>Append data to Master data set
- Join Field</td>
<td>Joins the contents of a table to another table based on a common attribute field. The input table is updated to contain the fields from the join table.
The records in the Input Table are matched to the records in the Join Table based on the values of Input Join Field and the Output Join Field</td>
<td>Mukim Polygon</td>
<td></td>
</tr>
</table>

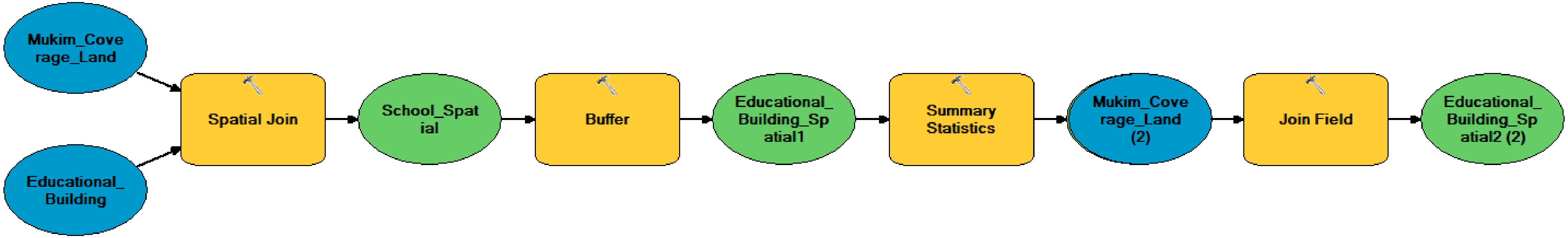
A quick diversion on granularity

Network Rail Example



Application

Model Builder



Model Builder is a visual programming language for building geoprocessing workflows. Geoprocessing models automate and document spatial analysis and data management processes.

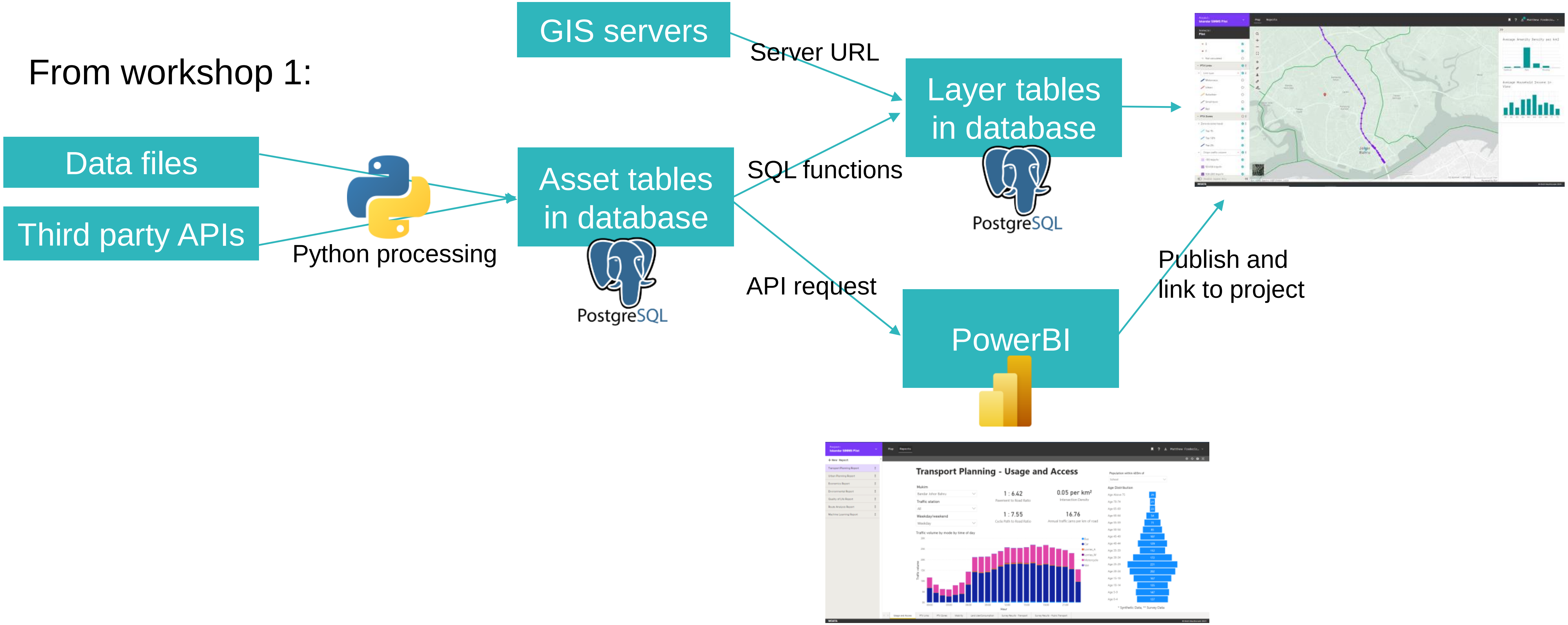
The model runs the following tools in sequence:

1. Spatial Join
2. Buffer
3. Summary Statistics
4. Join Field

Application

Dashboards

- From workshop 1:



- Updating the asset info automatically updates both map and PowerBI reports

Application

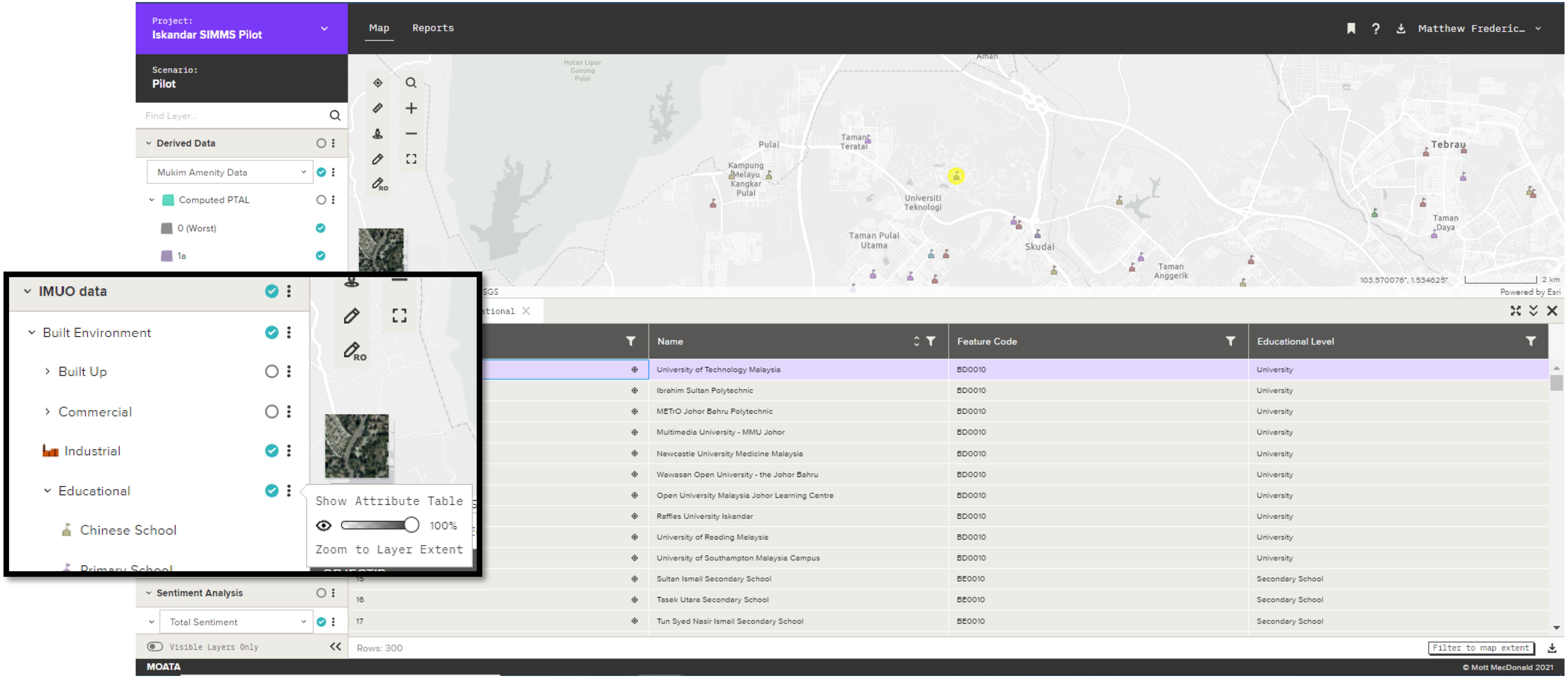
Display/Interface

Using the Moata interface allows us to take advantage of its built-in features:

- PowerBI dashboard integration
- Geospatial tools e.g. table tools, split view tool, Google Maps street view.
- Time series data visualization
- Dynamic charts

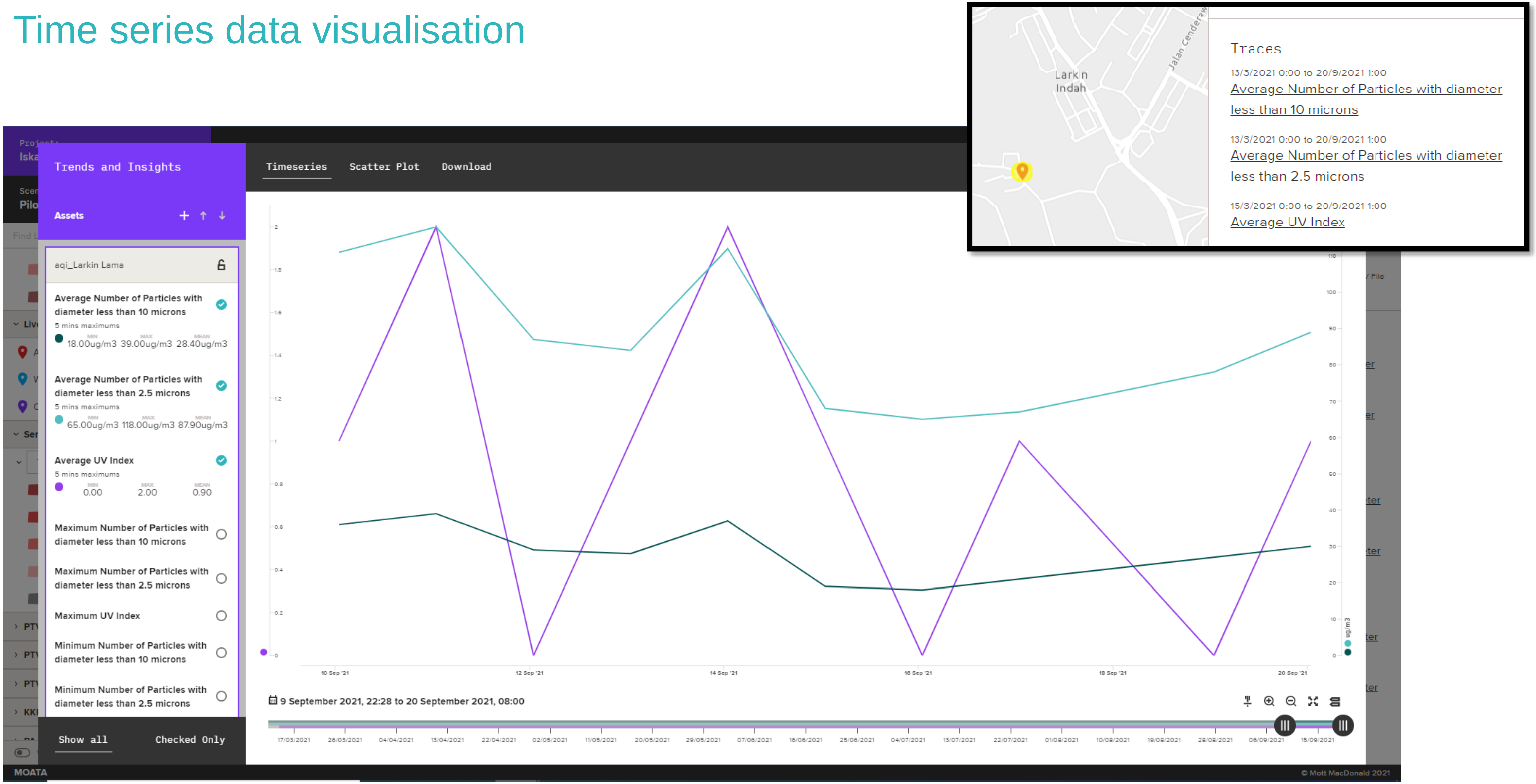
Interface

Geospatial tools



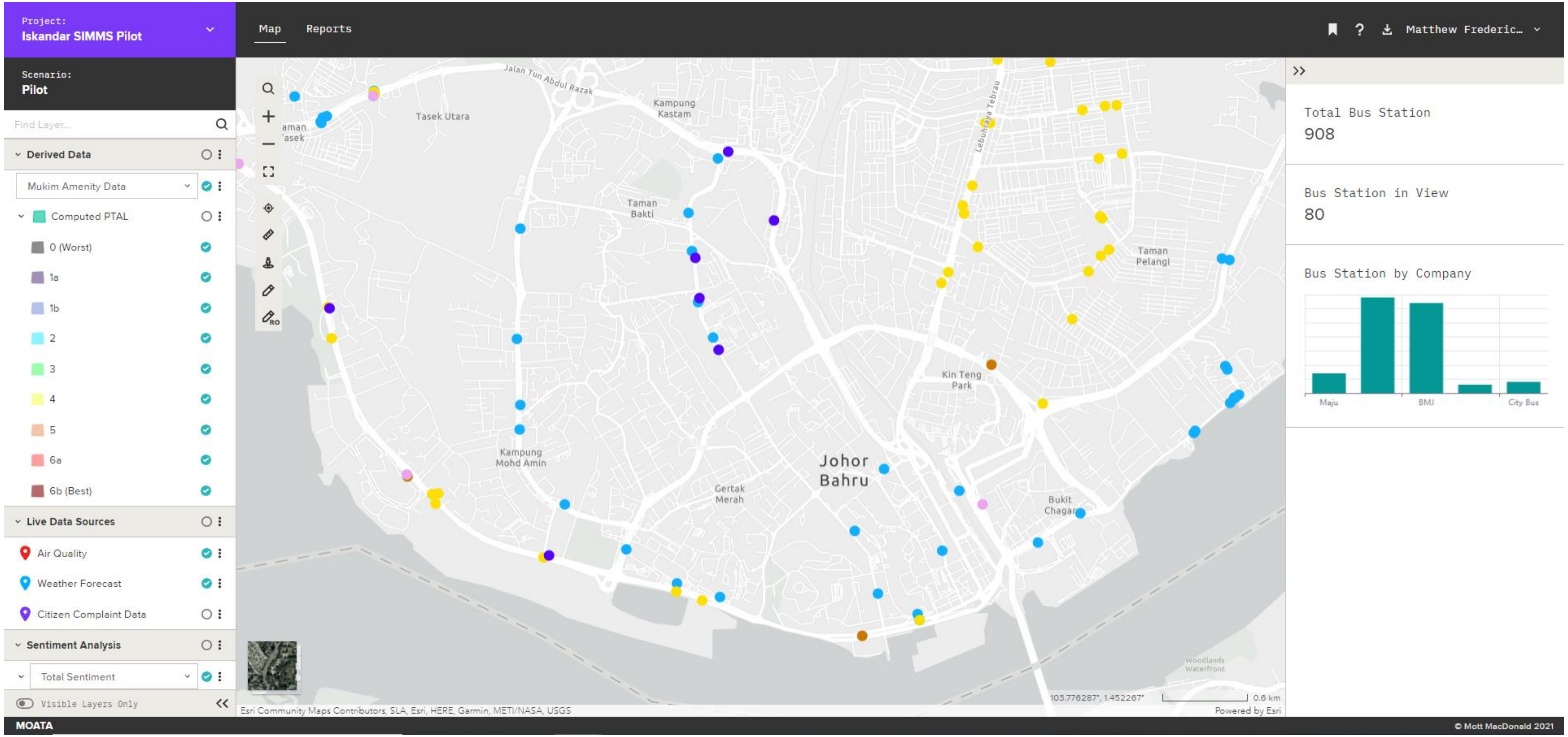
Interface

Time series data visualisation



Interface

Dynamic charts



Practical

Practical

Population demographics within 100m of schools per Mukim

Data

- Mukim with Population info polygon
- School point

Workflow

- School Intersect with Mukim (get Mukim name & area)
- Create Buffer 50m
- Calculation: Buffer Area/ Mukim Area * Population (Age group, Population, Ethnicity)

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Summary

Summary

Theory

- Urban and transport planning metrics
- Concepts of connectivity, entropy and mobility

Application (via SIMMS)

- How the metrics were derived and use of a master shapefile
- Granularity as a critical aspect of work
- Dashboards and geospatial tools

Practical

- Performing spatial queries to derive new metrics

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Thank you