ACADIA 2022

A data-driven approach for urban design and master planning development

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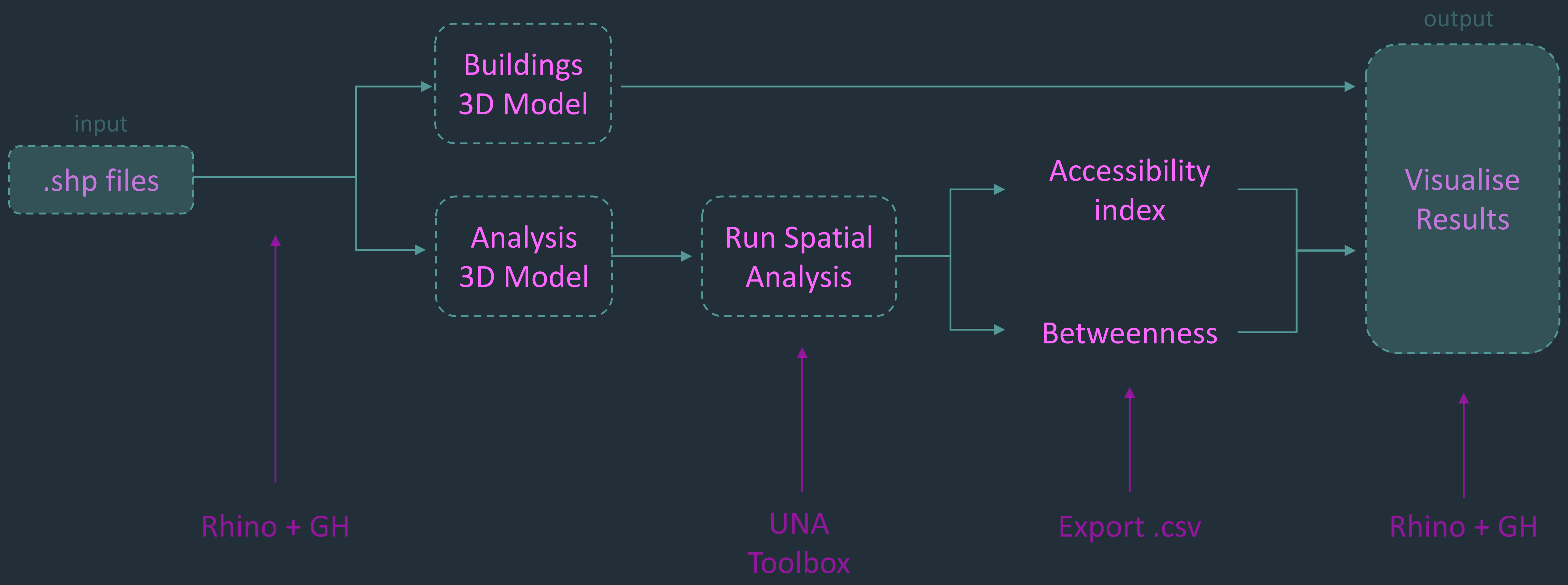
Workflow overview

1. Create a clean 3D model of the selected area
2. Read Data and prepare Model for analysis
3. Run Spatial Analysis with UNA Toolbox in Rhino
4. Read results in GH and visualise



1. Create a clean 3D model of the selected area

input

Building .shp file

Curves

Height

Attributes

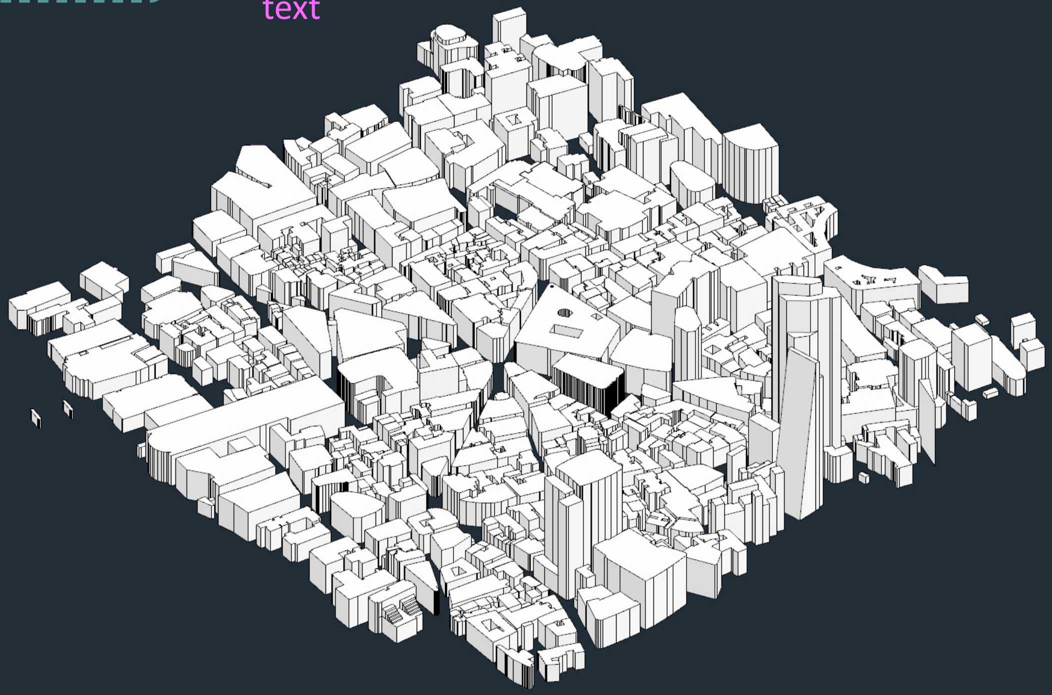
Bake in Rhino

Attributes saved as User text

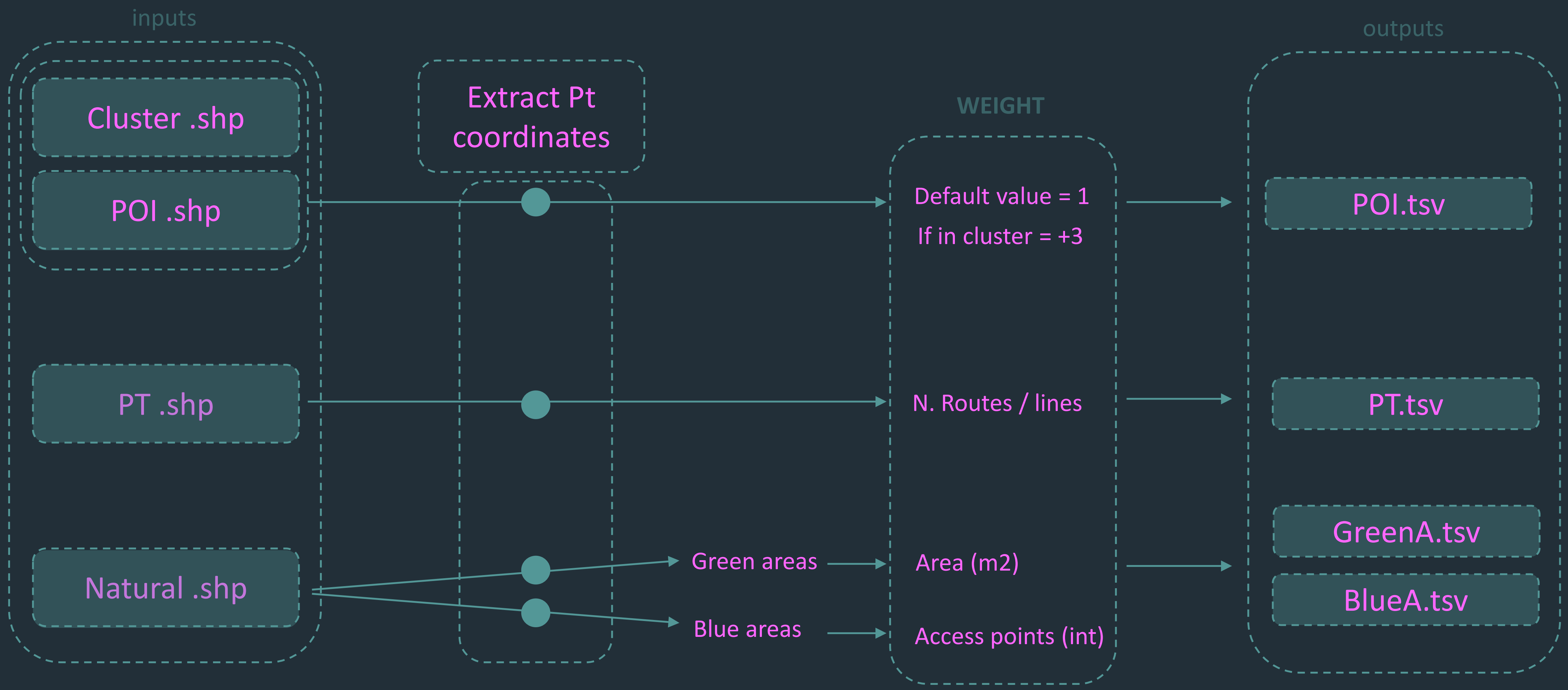
output

Manual final clean in Rhino + GH help

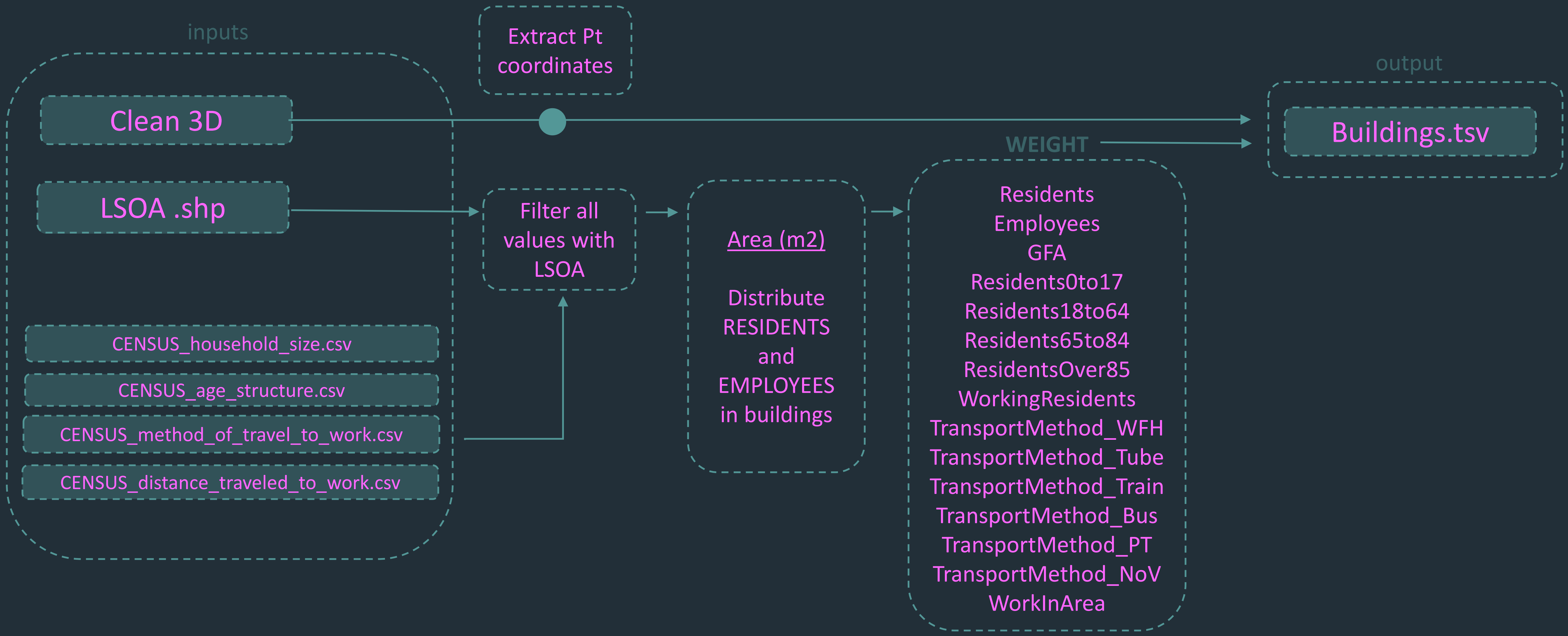
It's important to have a clean Network too before we can start our analyses.



2. Read Data – Clean Data – Create Analysis Model



2. Read Data – Clean Data – Create Analysis Model



3. Run analysis – UNA Toolbox

Accessibility indices

Spatial Analysis

All accessibility measures are calculated based on a catchment radius of 960 m (10 min walking distance), the number of reachable Points of interest, the Straightness of the route and the application of a gravity function in order to evaluate each POI based on the travel effort.

Green Areas – Accessibility index

Green Areas - Reach

REACH

The Reach index, also known as a “cumulative opportunities accessibility index” (Bhat2000; Sevtsuk2010; Jaber and Papaioannou2017) captures how many surrounding destinations(e.g buildings, businesses, jobs, bus stops etc.) can be reached from each Origin within a given Search Radius on the network.

Green Areas - Gravity

GRAVITY

The gravity index assumes that accessibility at Origin “i” is proportional to the attractiveness (weight) of Destinations “j”, and inversely proportional to the distance or travel cost between “i” and “j”.

Green Areas - Straightness

STRAIGHTNESS

The Straightness index (Vragovic, Louis, et al.2005) illustrates the extent to which the shortest paths from Origins to Destinations resemble straight lines. Put alternatively, the Straightness metric captures the positive deviations in travel distances that result from the geometric constraints of the network in comparison to straight-line distances in a featureless plan.

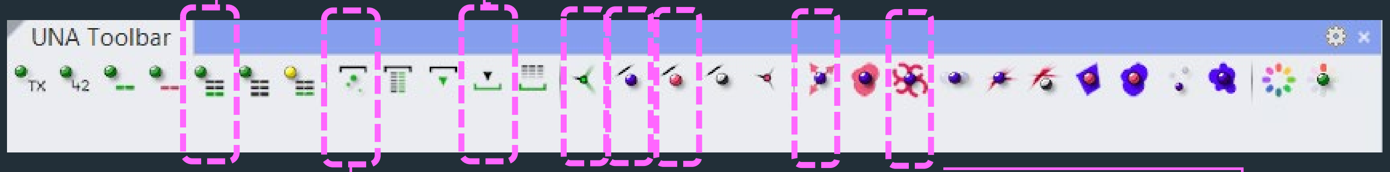
3. Run analysis – UNA Toolbox

Accessibility indices

Now we can use the block data in combination with different spatial data to analyse different space syntax and accessibility analysis

We will be focusing on:

- Green areas
- Blue areas
- Education
- Groceries
- Healthcare
- Shopping
- Amenities + Leisure + Sustenance
- Fitness and sport
- Tourism
- Public transport



After saving the results in the Buildings PTS and exporting them as a .csv file, we will then calculate the totals: for that we should remap all 3 set of values in a range 0 to 1, add the 3 values and divide them by 3.

3. Run analysis – UNA Toolbox

Accessibility indices

Amenities

Green Areas

Blue Areas

Education

Fitness / sports

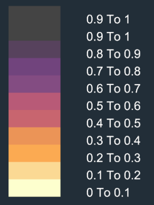
Groceries

Healthcare

Public Transport

Shops

Tourism



3. Run analysis – UNA Toolbox

Betweenness index

It approximates by-passing traffic or footfall at particular locations in a spatial network.

The Betweenness of a building is defined as the fraction of shortest paths between pairs of other origins and destinations in the network that pass by a particular location (Freeman 1977).

If more than one shortest path is found between two nodes, as is frequently the case in a rectangular grid of streets, then each of the equidistant paths is given equal weight such that the weights sum to unity.

The "Detour Ratio"* variable allows walks between origins and destinations to deviate up to the specified % above the shortest paths (the maximum deviation is fixed at 200%). Using a Detour Ratio of "1.1", for instance, allows walks to use paths that are up to 10% longer than the shortest path to reach the destination. Each alternative path that is found is given an equal likelihood, dividing the weights of the Origin point equally between all alternative paths. This is useful since people don't necessarily take shortest paths in the city.

*It will take longer to compute

All residents to Public Transport

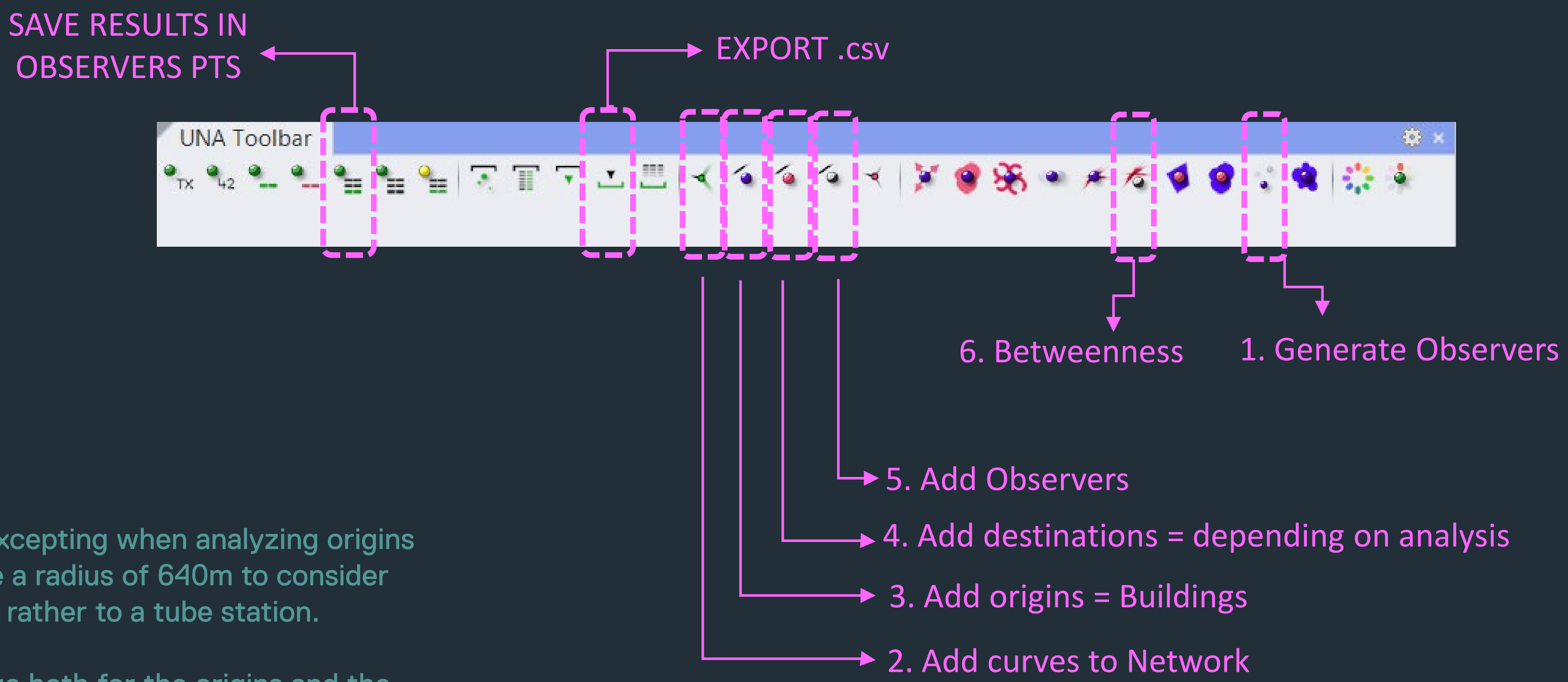
3. Run analysis – UNA Toolbox

Betweenness index

For the Betweenness analysis, we will generate a set of observers: these won't act as origins nor destinations, they will record and save the data of the pedestrian flow in the streets.

We will be focusing on:

- All residents to PT
- Working residents to PT
- Residents to workplace (if they work in the study area)
- Residents to amenities, leisure and sustenance
- Amenities to PT
- Workplace to PT
- Workplace to amenities, leisure and sustenance



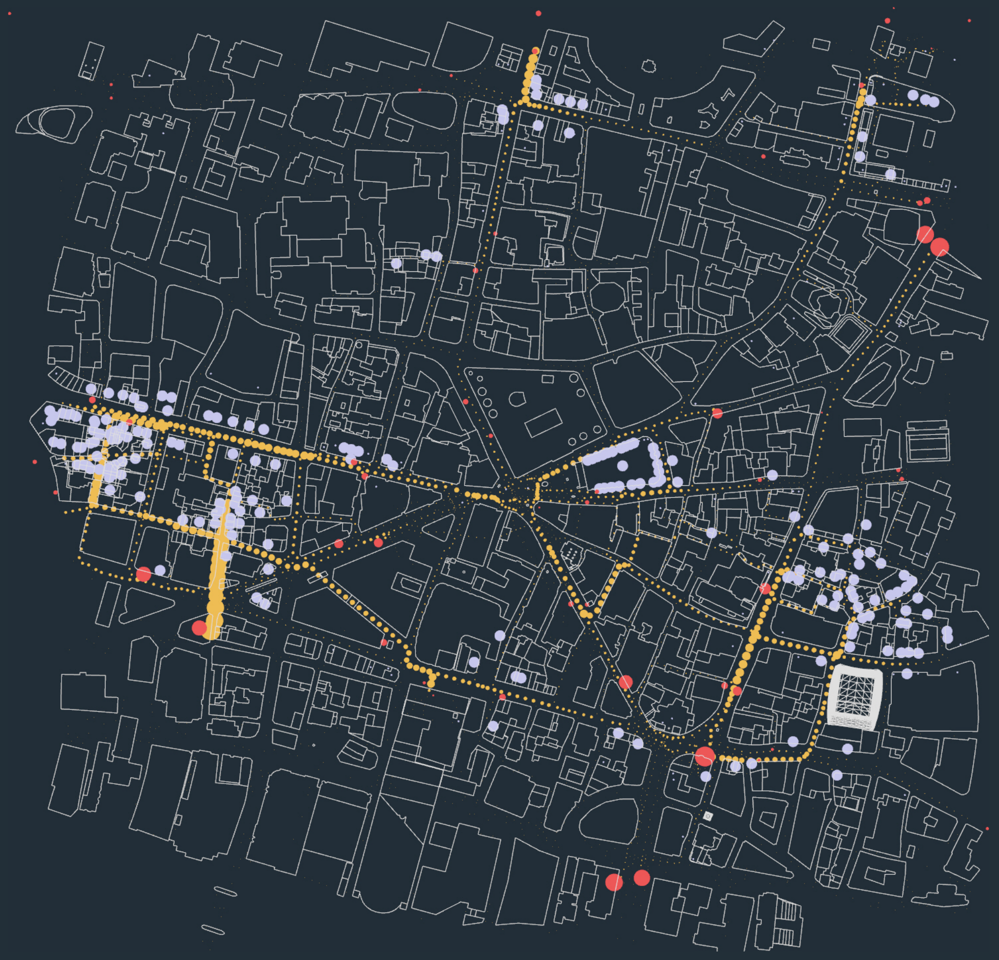
We will use a radius of 960m for all our cases, excepting when analyzing origins to Bus stops – in the bus stops case, we will use a radius of 640m to consider that people are less willing to walk to a bus stop rather to a tube station.

It's important to choose the correct Weight value both for the origins and the destinations.

3. Run analysis – UNA Toolbox

Betweenness index

Amenities to Public Transport



Shops to Public Transport

Expected Pedestrian flow
Public Transport
Amenities / Shops

3. Run analysis – UNA Toolbox

Betweenness index

Workplace to Public Transport

Working residents to Public Transport

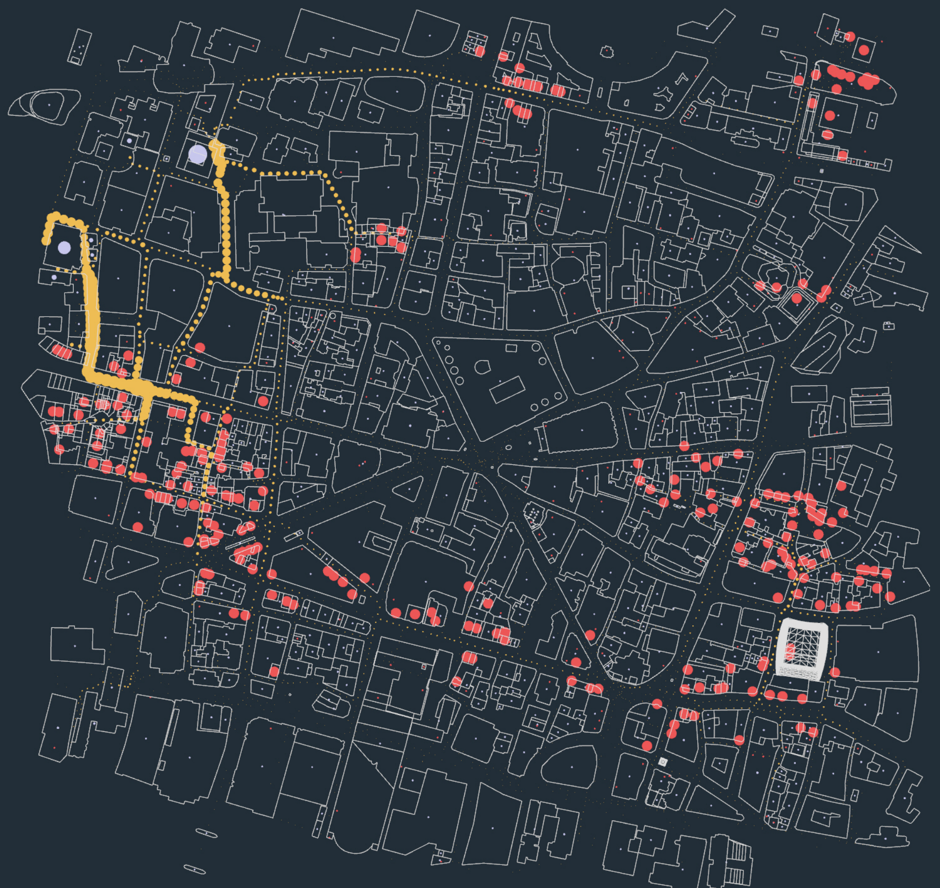
Expected Pedestrian flow

Public Transport

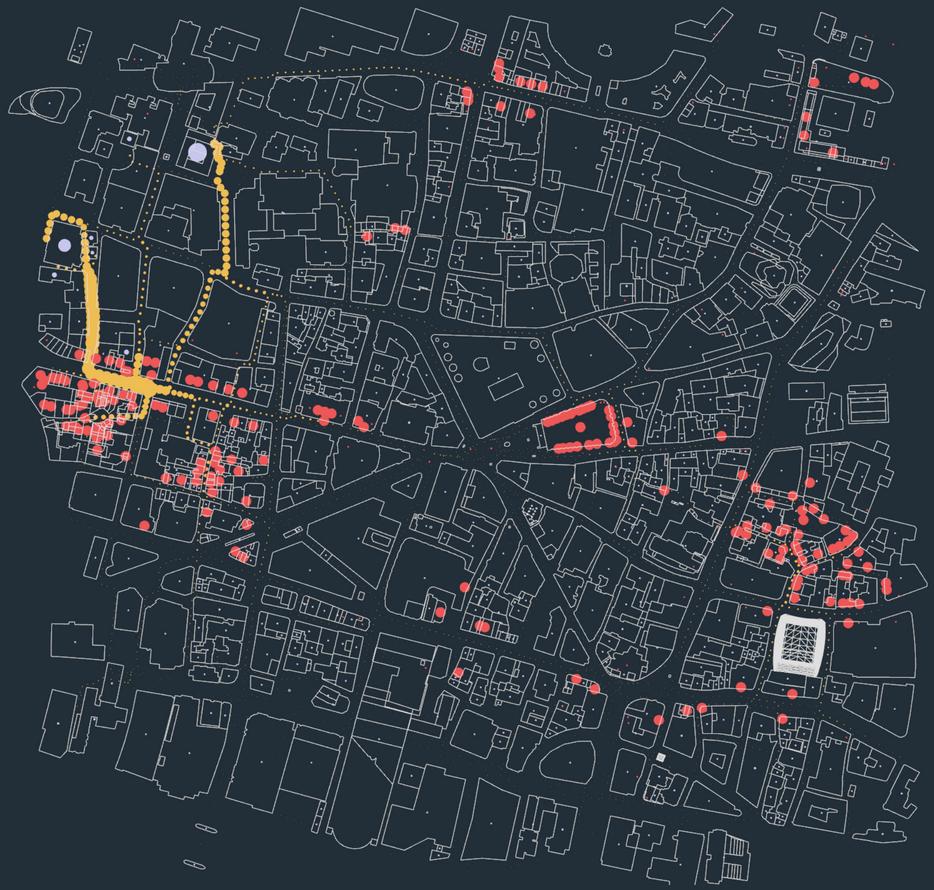
Workplace / Working residents

3. Run analysis – UNA Toolbox

Betweenness index



All Residents to Amenities



All Residents to Shops

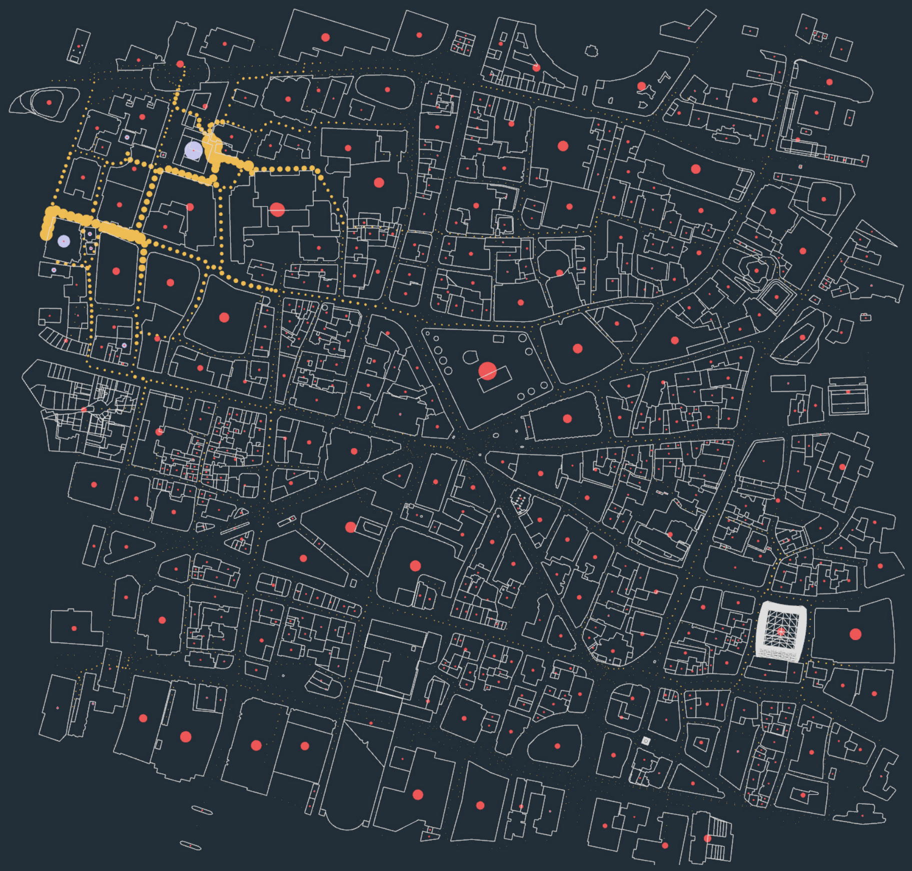
Expected Pedestrian flow

Amenities / Shops

All Residents

3. Run analysis – UNA Toolbox

Betweenness index



Working residents to Workplaces

Workplace to Amenities

Expected Pedestrian flow

Workplaces / amenities

Workplace / Working residents

4. Spatial Analysis – Visualise results