

# Visualization of Regional Material Flow using Over-flow Potential Maps

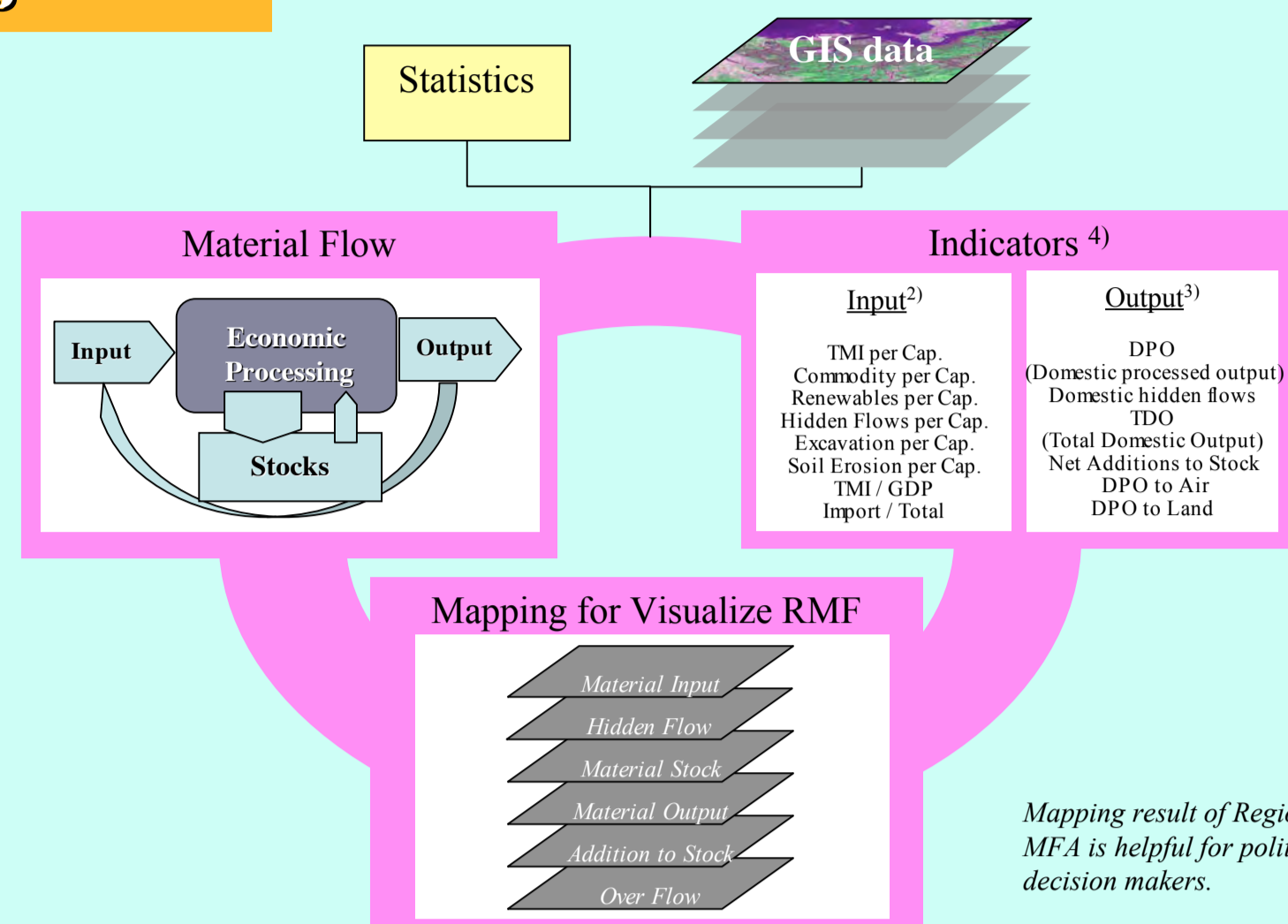
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## Objective

### Visualizing Regional MFA



Material Flow Analysis can elucidate the size and balance of material circulation on local as well as nationwide scales.

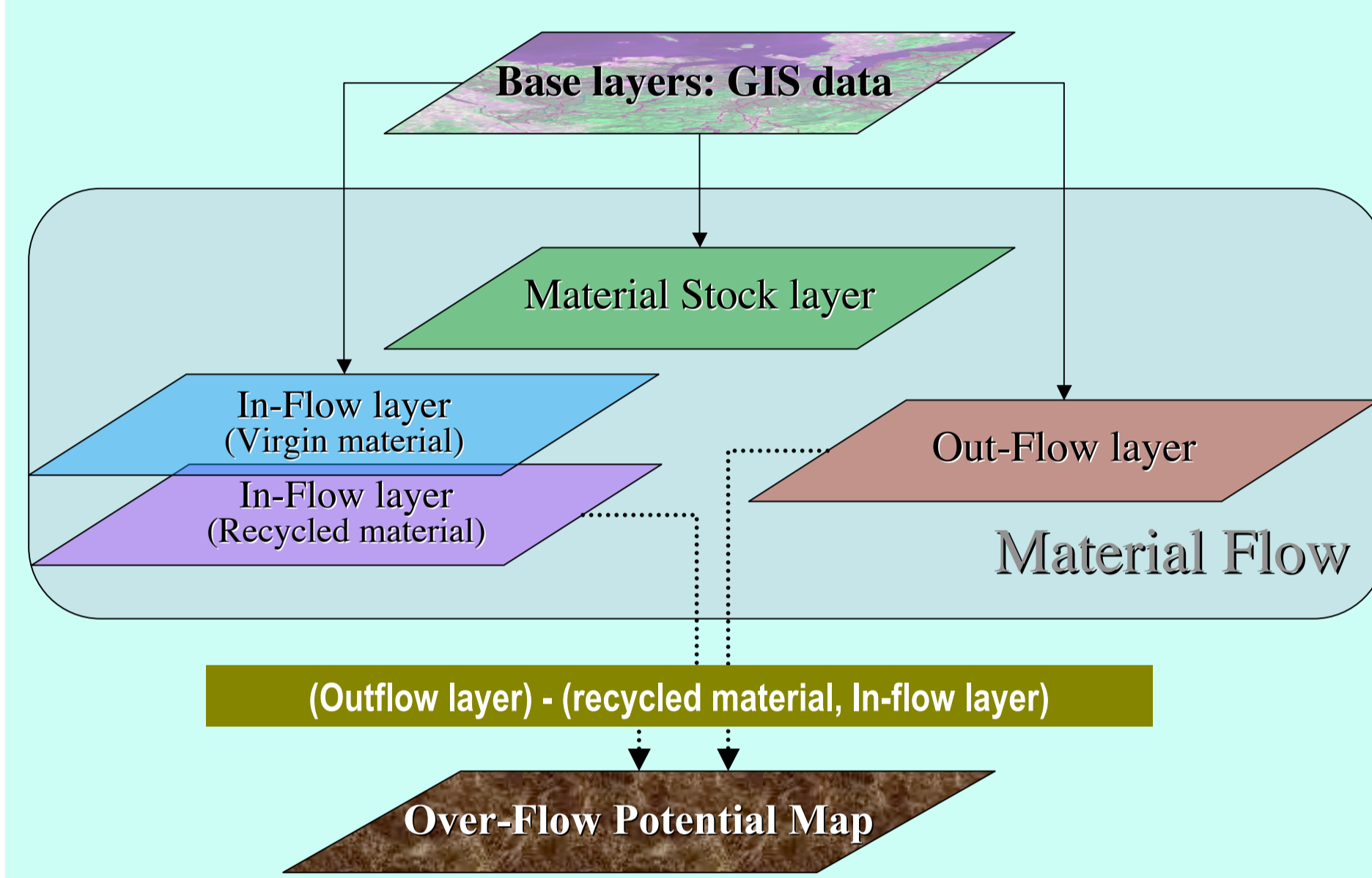
On a local level, we found that to display material flow "spatially" and "successively" was helpful for all concerned. Local and future material balance was easier to consider with area-specific MFA mapping. Visualizing material flow was an effective way to convey and reflect the concept of MFA into local policy. We considered ways to express the questions of "Where and When do material stocks cause flow?" and "How much flow volume will occur?"

In this study,

1. RMF (Regional Material Flow) is applied on a city scale.
2. The material stock of buildings and infrastructure is quantified using GIS. (geographical information system)
3. Over-flow potential of a city is made readily apparent using GIS map layers.

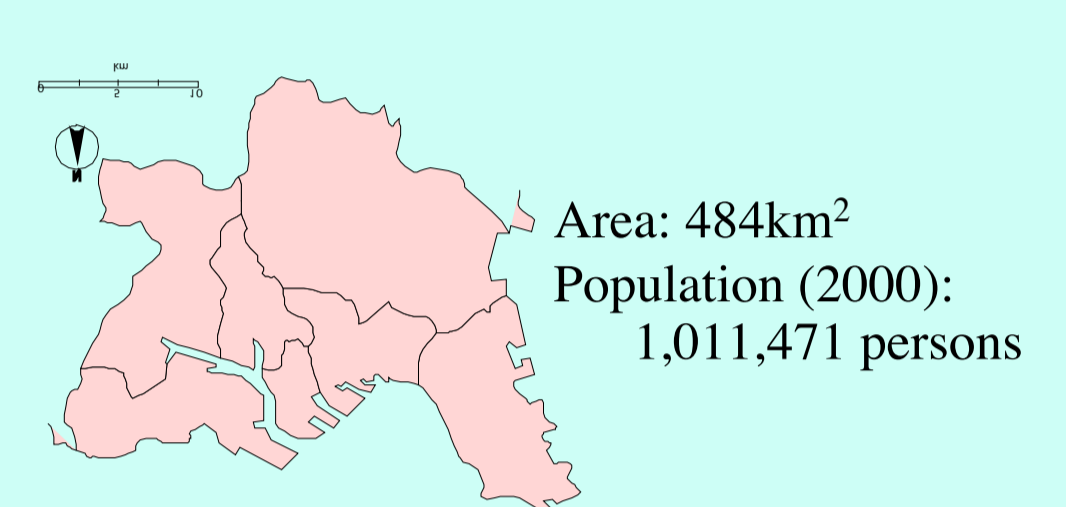
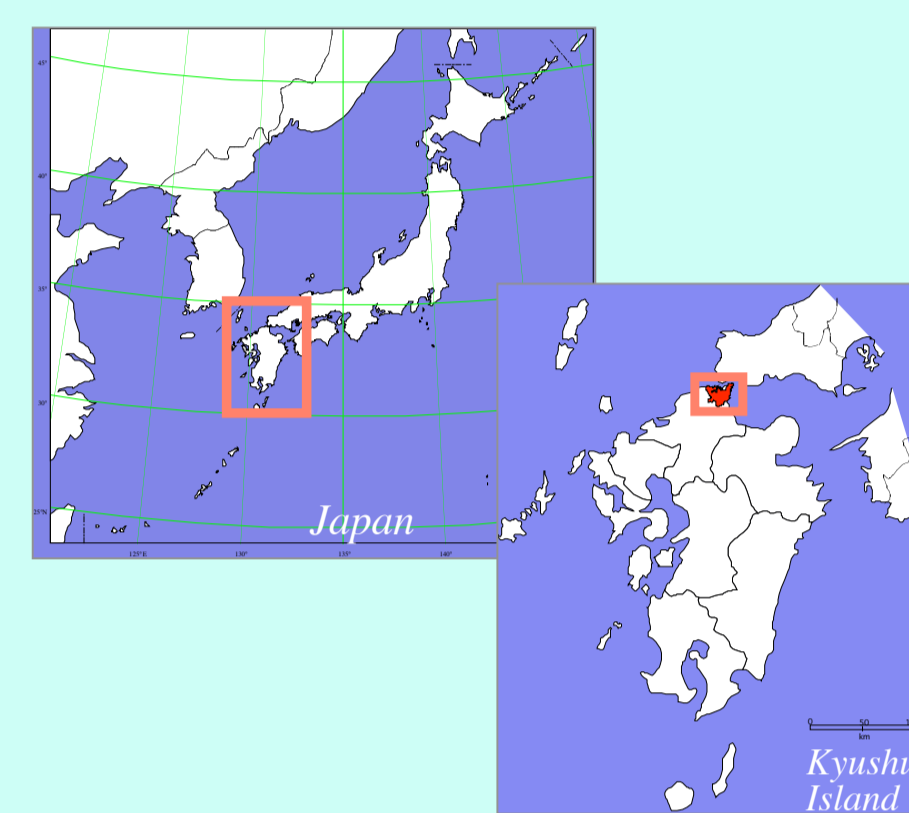
## Method and Data

### Spatial calculation for establishing an Over-flow Potential Map



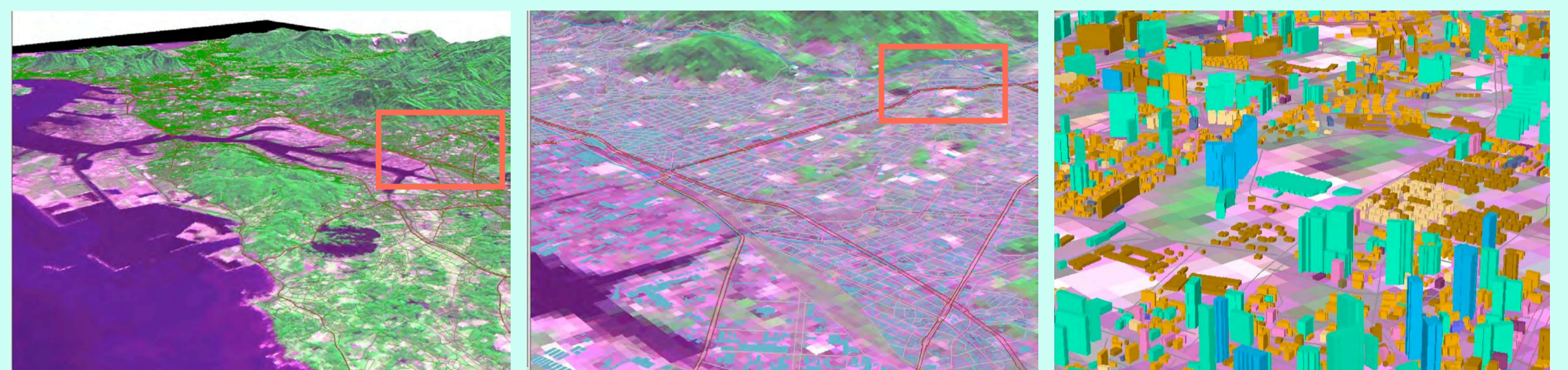
An OPM is produced by taking the "Recycled In-flow layer" away from the "Outflow layer". OPM can show the volume and variety of over-flow construction materials (such as wood, iron, concrete), even for small areas on GIS maps.

To visualize the Over-flow potential of a city, an OPM is made from the Material Input and Recycled Material in Input layers. Using OPM with any map scale, the quantity of unused materials, can be seen even those yet to be claimed by the recycling process, such as crushed concrete.



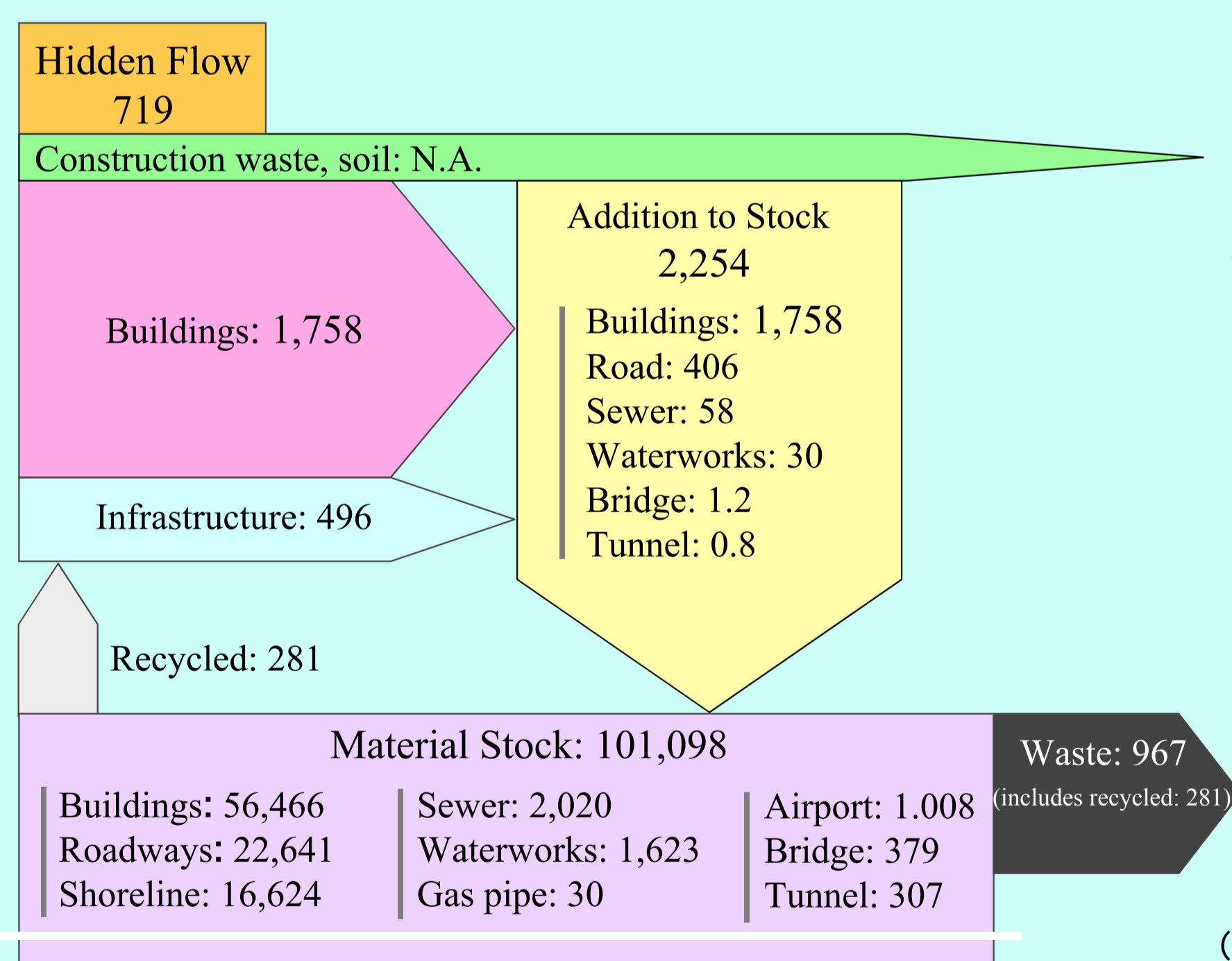
Kitakyushu City (Fukuoka Pref., Kyushu Island in Japan) was selected for a case study since good quality spatial data are available for this city.

### OPM analysis base layers



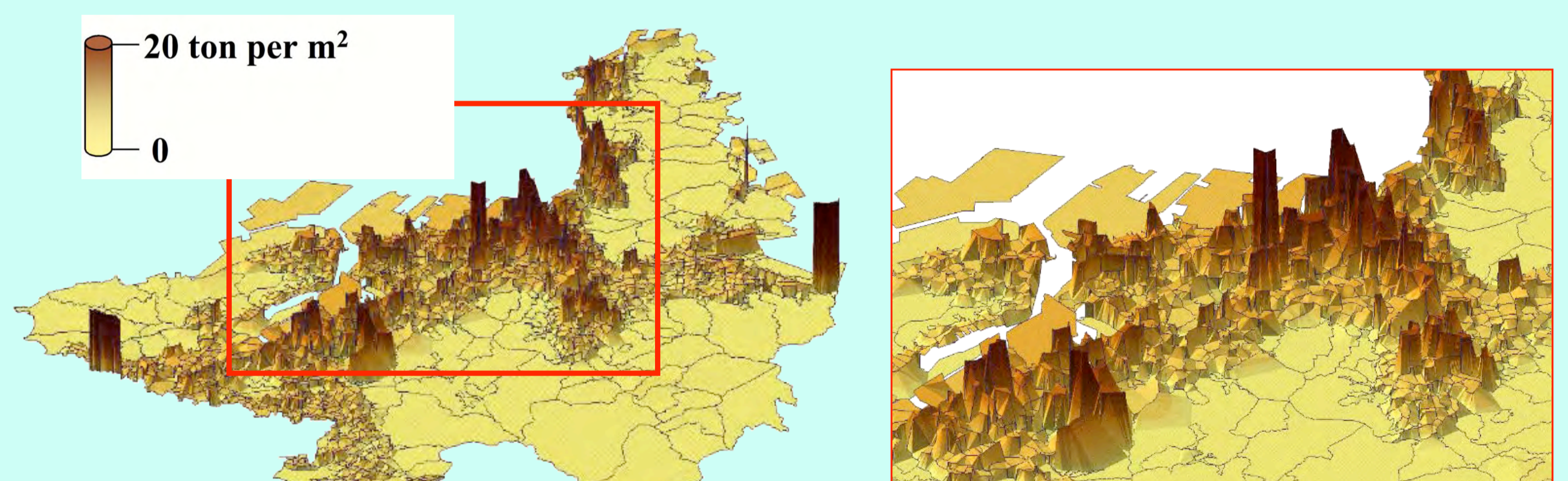
## Result: Estimation of Material Stock

### Material Flow of Kitakyushu City (Construction sector, 2000)



The material stock for all buildings and infrastructures was 101million tons: 56 million tons for buildings, and 22 million tons for roads. This means that the weight of structures that support the lives of citizens in Kitakyushu City was approximately 100 tons per capita material stock.

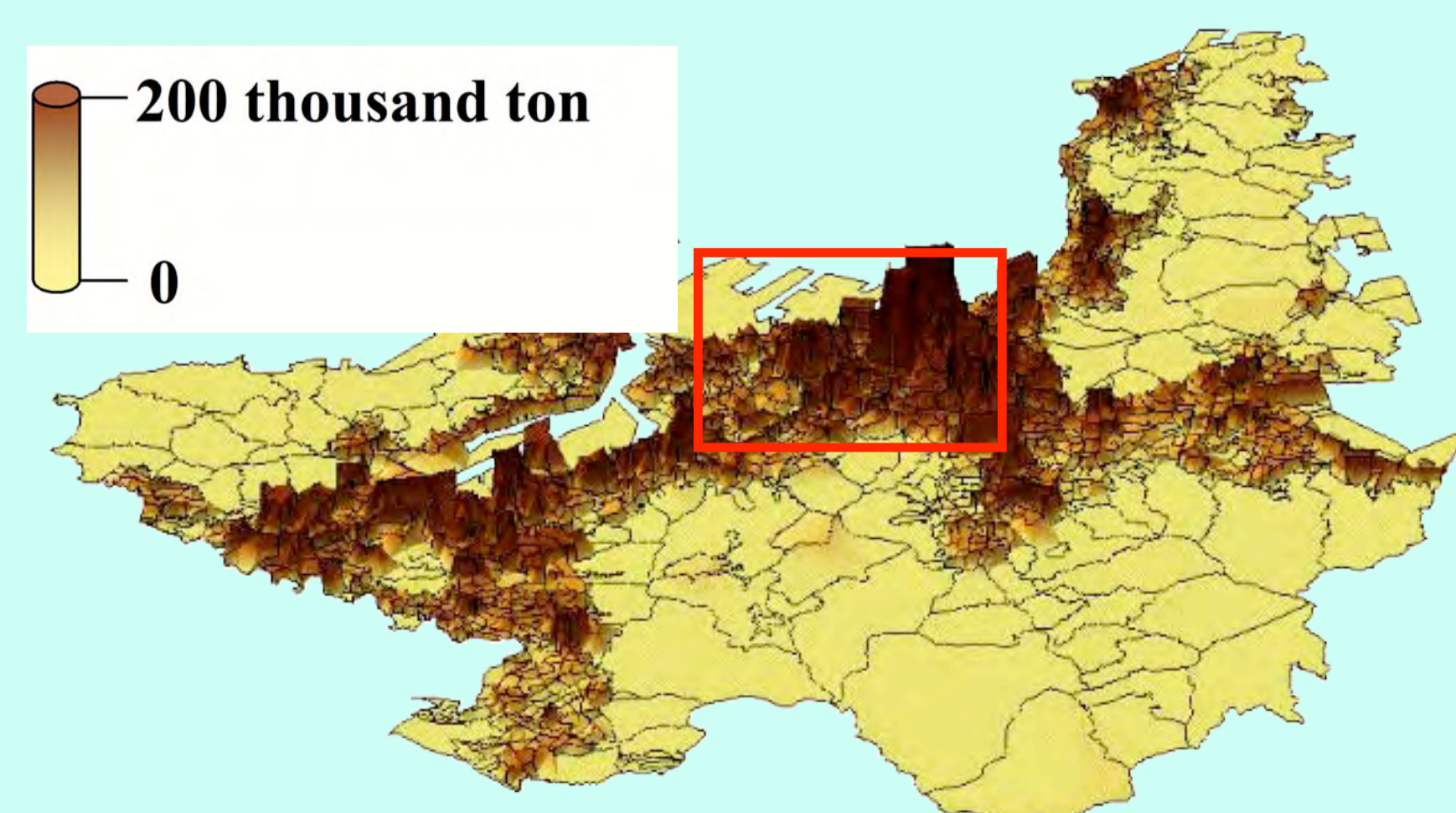
### WDM: City Weight Density Map (Kitakyushu City, 2000)



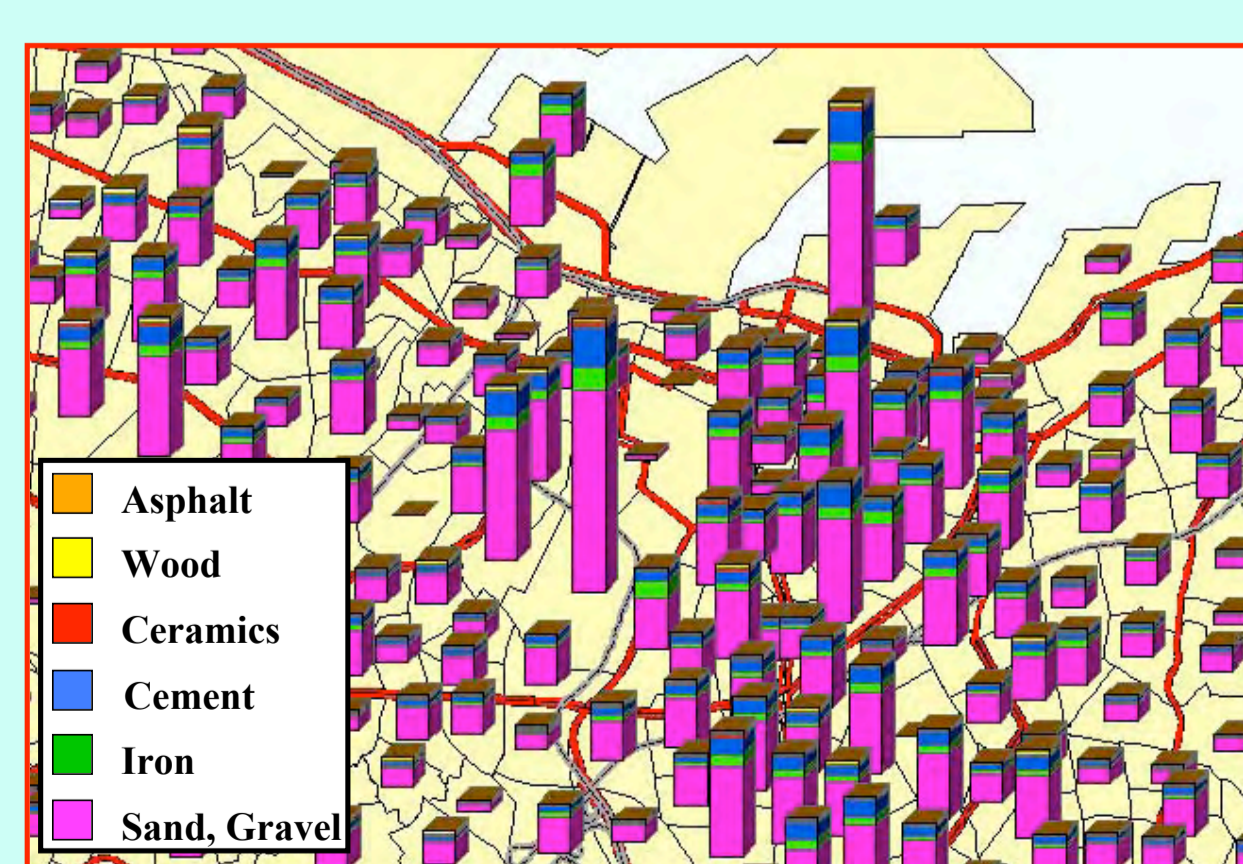
Using this map, we can know the distribution material weight that supports our lives. We can see the distribution of construction materials that has been accumulated in our structures. By zooming in, this GIS map can also show the density of classified materials plus their respective weights and composition throughout the city.

## Result: Overflow Potential Map

### 2020 OPM for Kitakyushu City

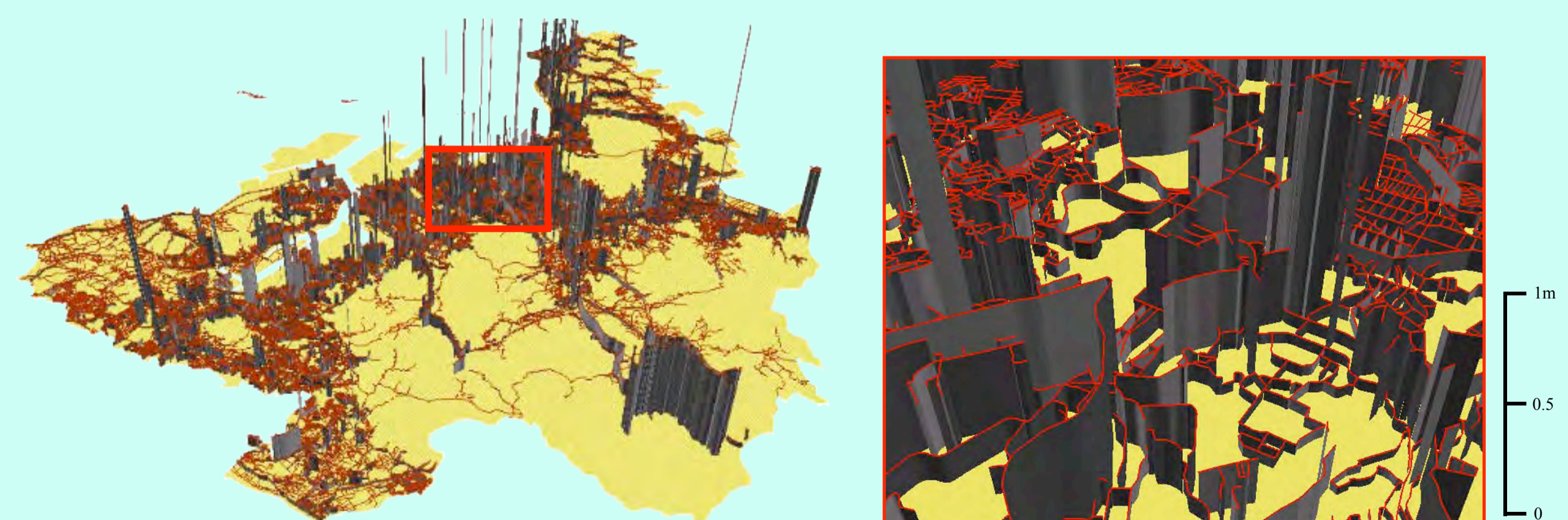


For this map, we estimated over-flow possibilities up until the year 2020. These values are based on the result of future estimates of MF in 2020. With OPM, it becomes easy to grasp which areas will have high potential for emerging new flows, such as areas with many old structures that will thus be going through renewal at a higher rate.



In this OPM (left), the darker areas have high Outflow potential, which concerns the age of structures, the construction material used, and the maintenance required. In the detailed map (right), the contents of the outflow can be seen. Overall the largest component is Sand and Gravel.

### An example of OPM indexing: Street Accumulation



1:4500

We propose an index for accumulate overflow from a base layer of roads "How much road material must be dealt with?" Comparing administrative ward, minimum accumulate average is Wakamatsu ward (0.21m), and max is Kokura kita accumulate average (0.89m). The city average came to the average (0.41m).