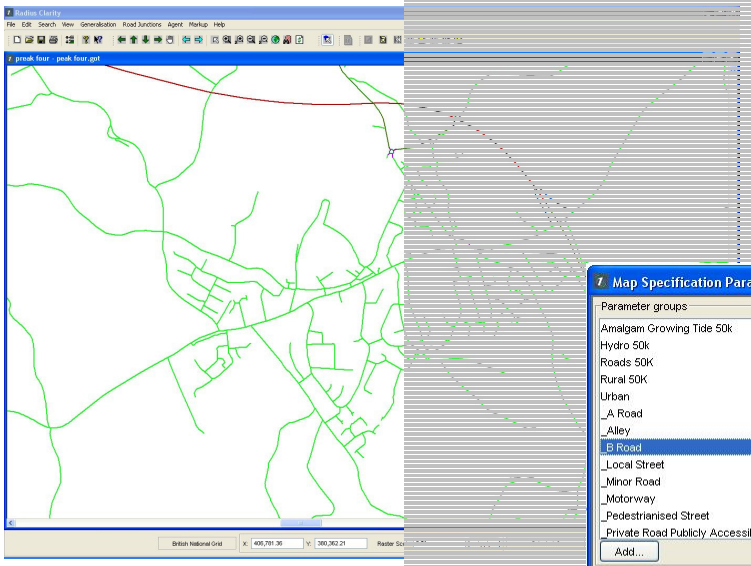
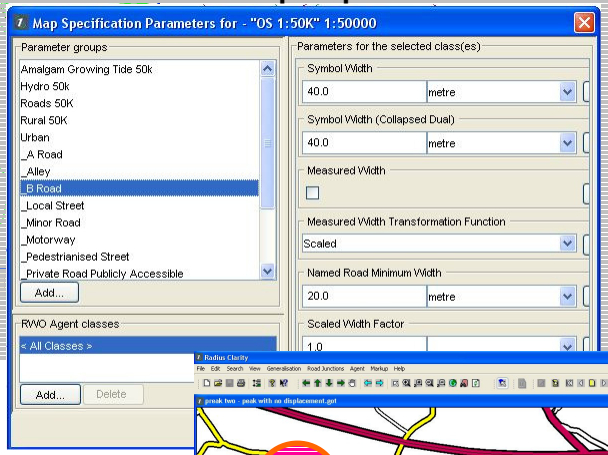

# Automatic Resolution of Road Network Conflicts using Displacement Algorithms Orchestrated by Geographical Agents

Stuart Thom

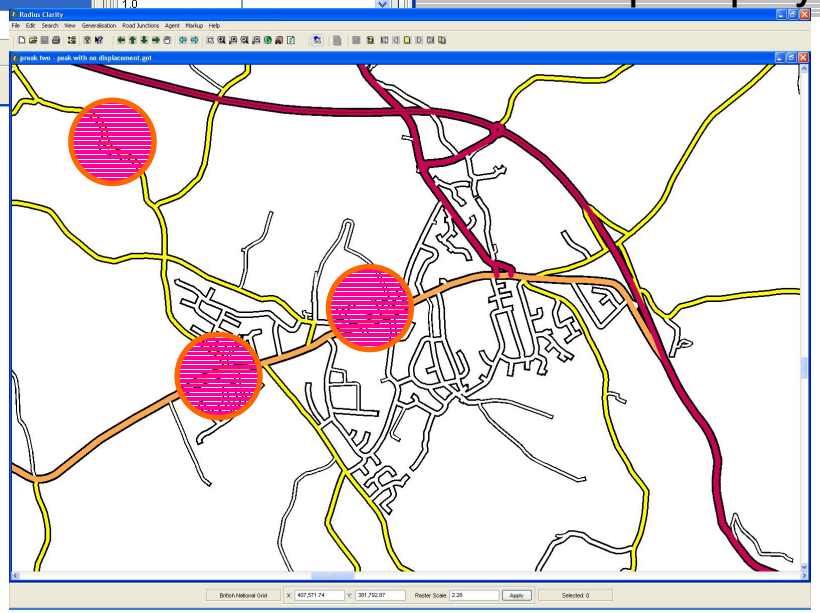
Vector dataset



+ Map specification



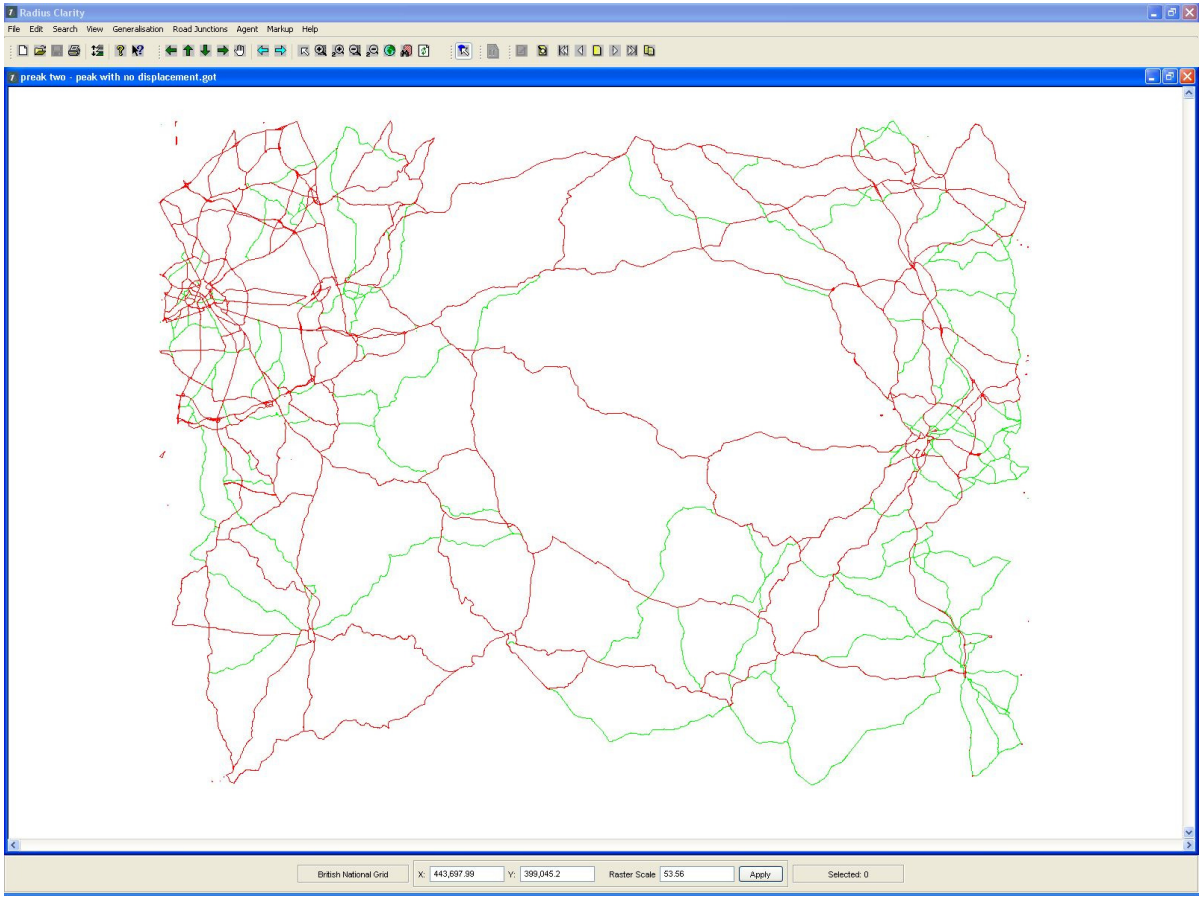

= Map display



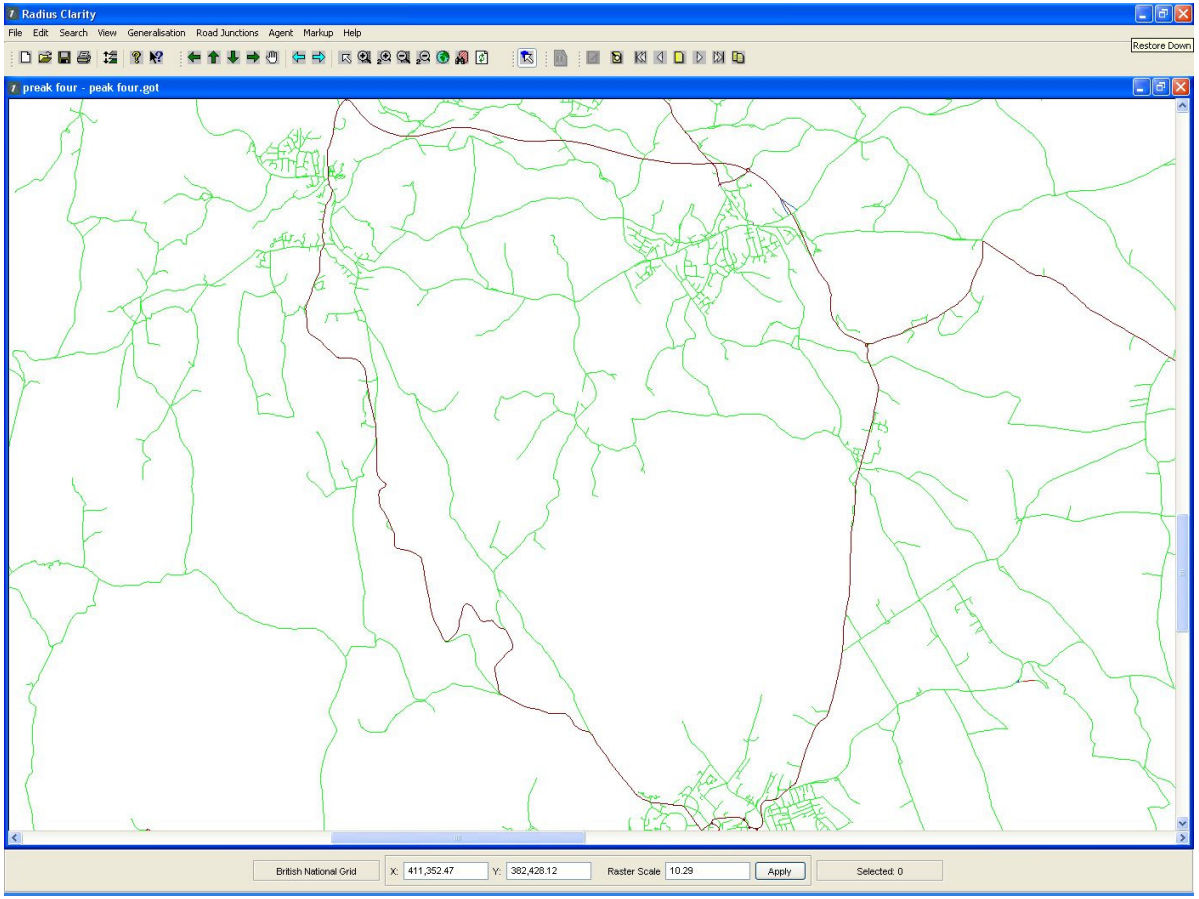
## Automatic displacement of road networks using a divide and conquer approach.

- Five steps
  - Collapse dual carriageways to a single centreline
  - Scan the network looking for conflicts
  - Create clusters of road sections involved or likely to be involved in the detected conflicts
  - Resolve the conflicts
  - Check for any fresh conflicts
- Requisite algorithms
  - For collapse
  - For displacement – Push and Beams
  - For detection and measurement of conflicts - **NEW**
  - To detect data errors in the displaced road sections
  - An agent system to oversee the process - Clarity

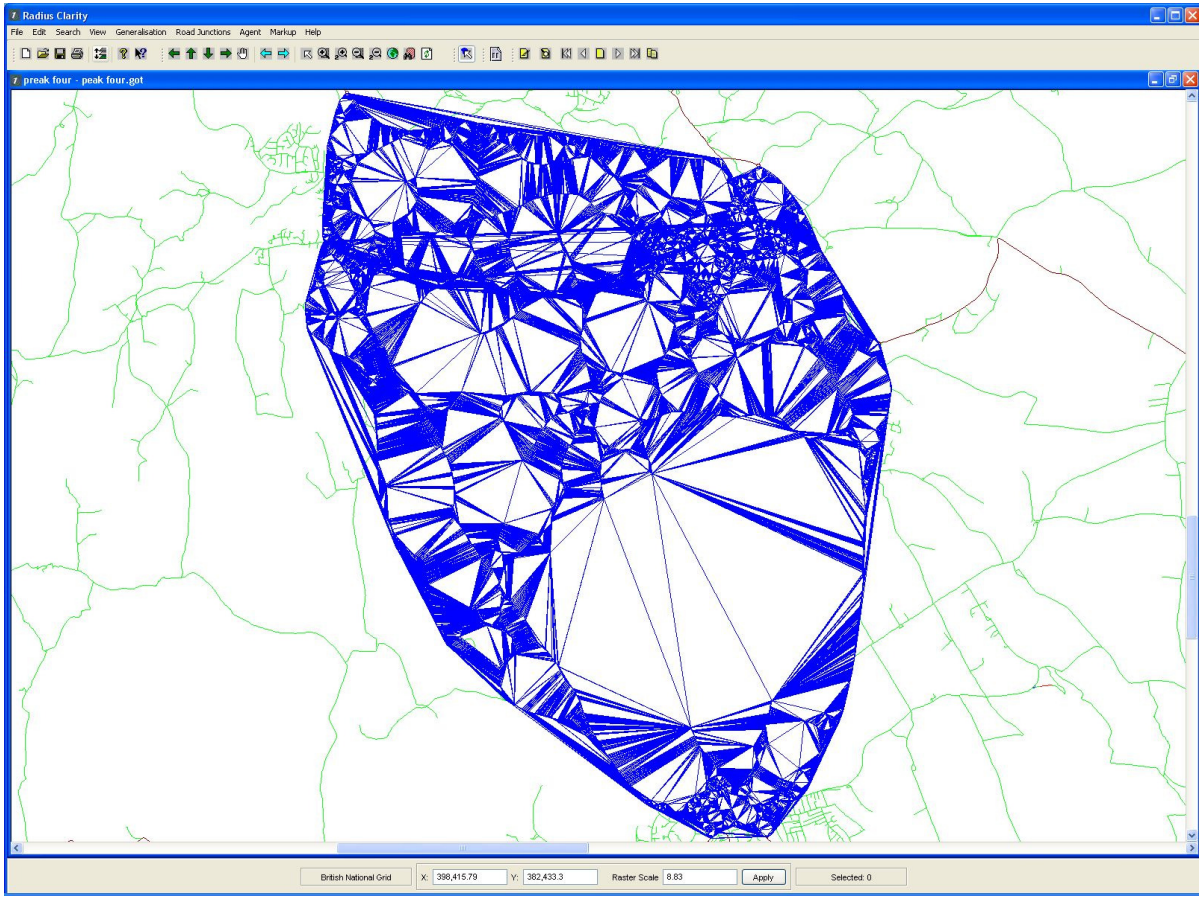
# Scanning the network looking for conflicts



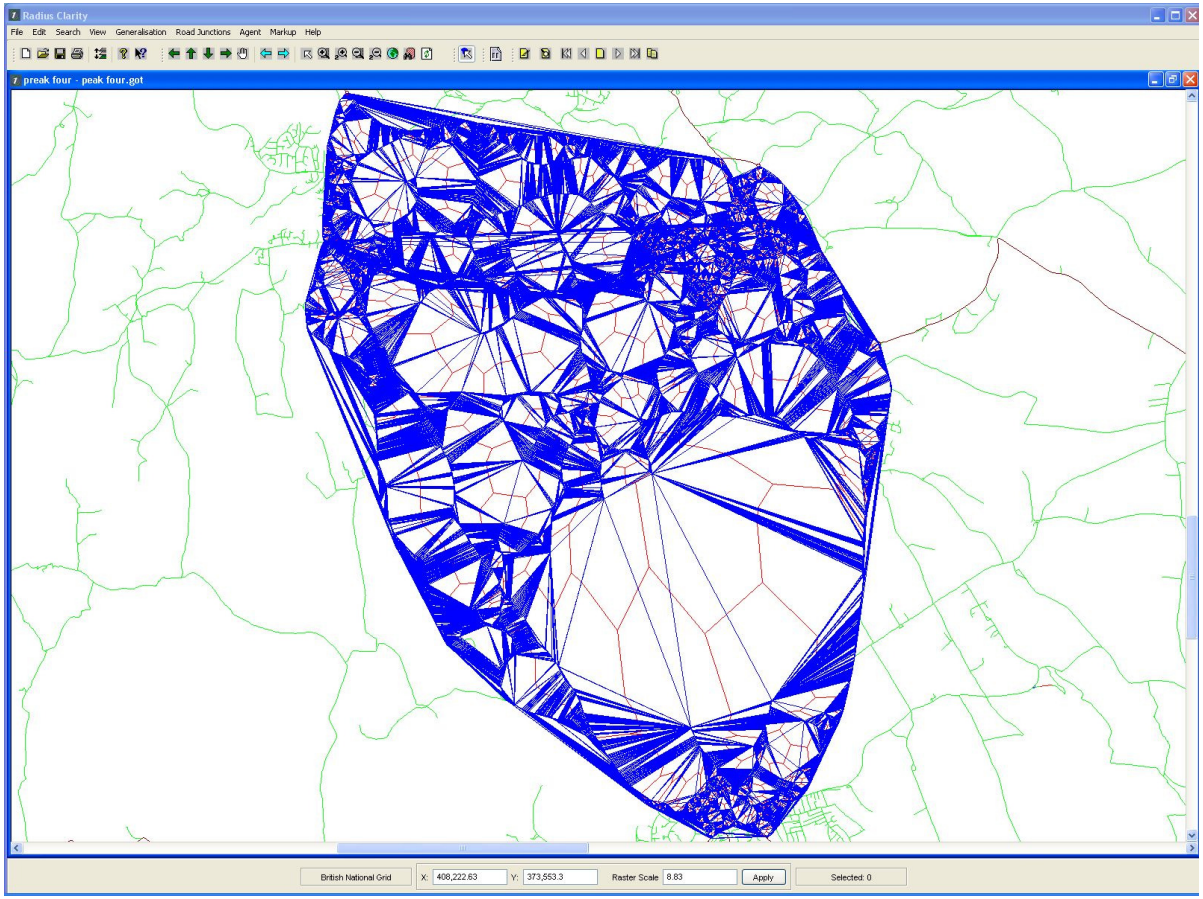
# Take a partition area



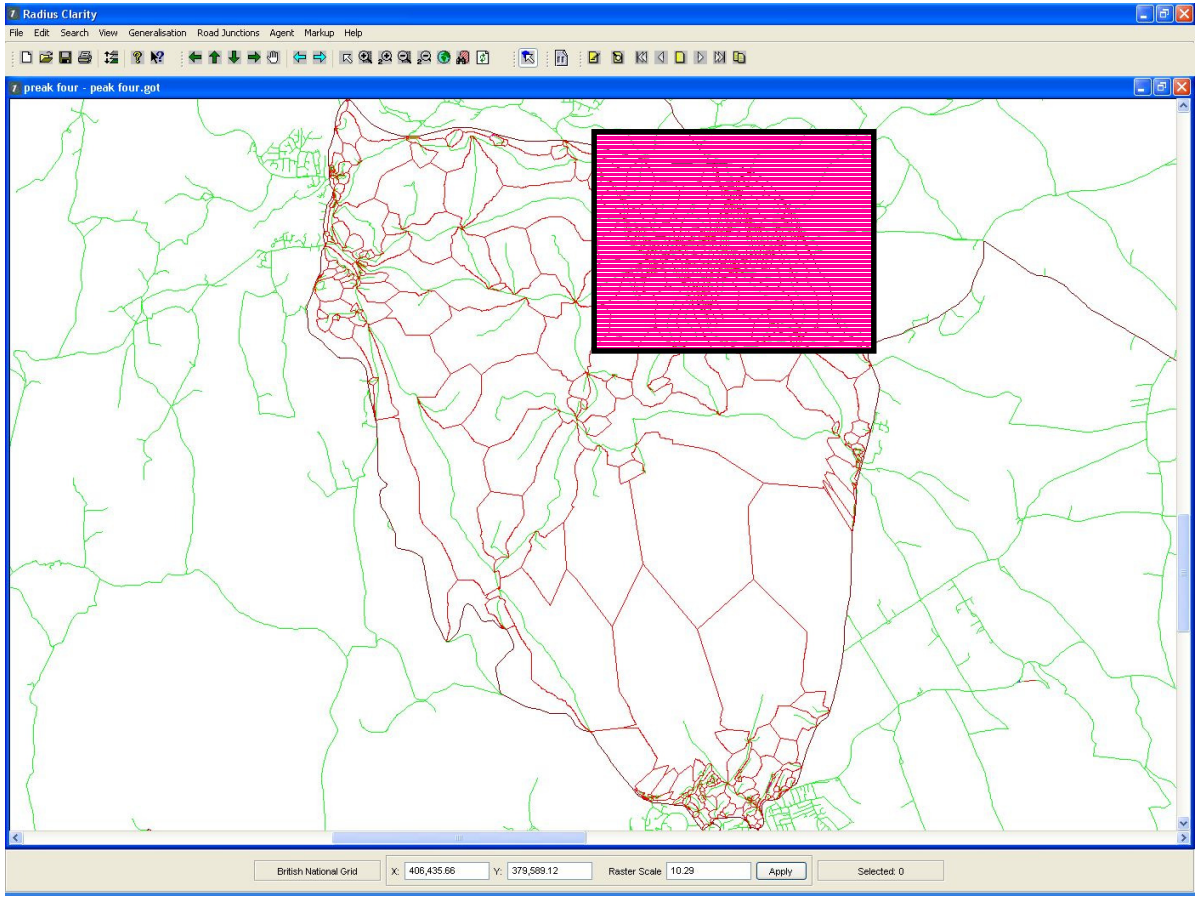
# Create a Delaunay constrained triangulation for the enclosed road network



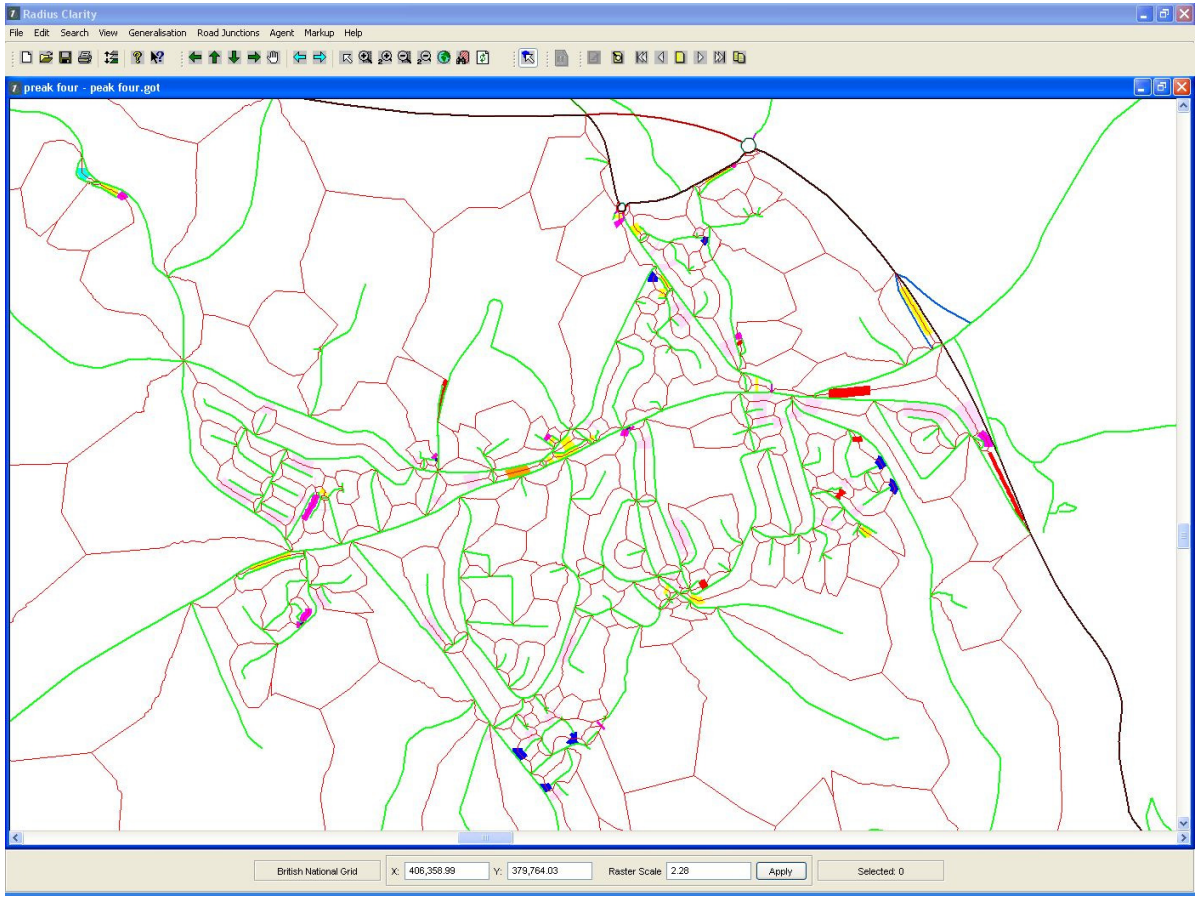
# From the triangulation create the skeleton for the road network



# From the skeleton create the conflicts



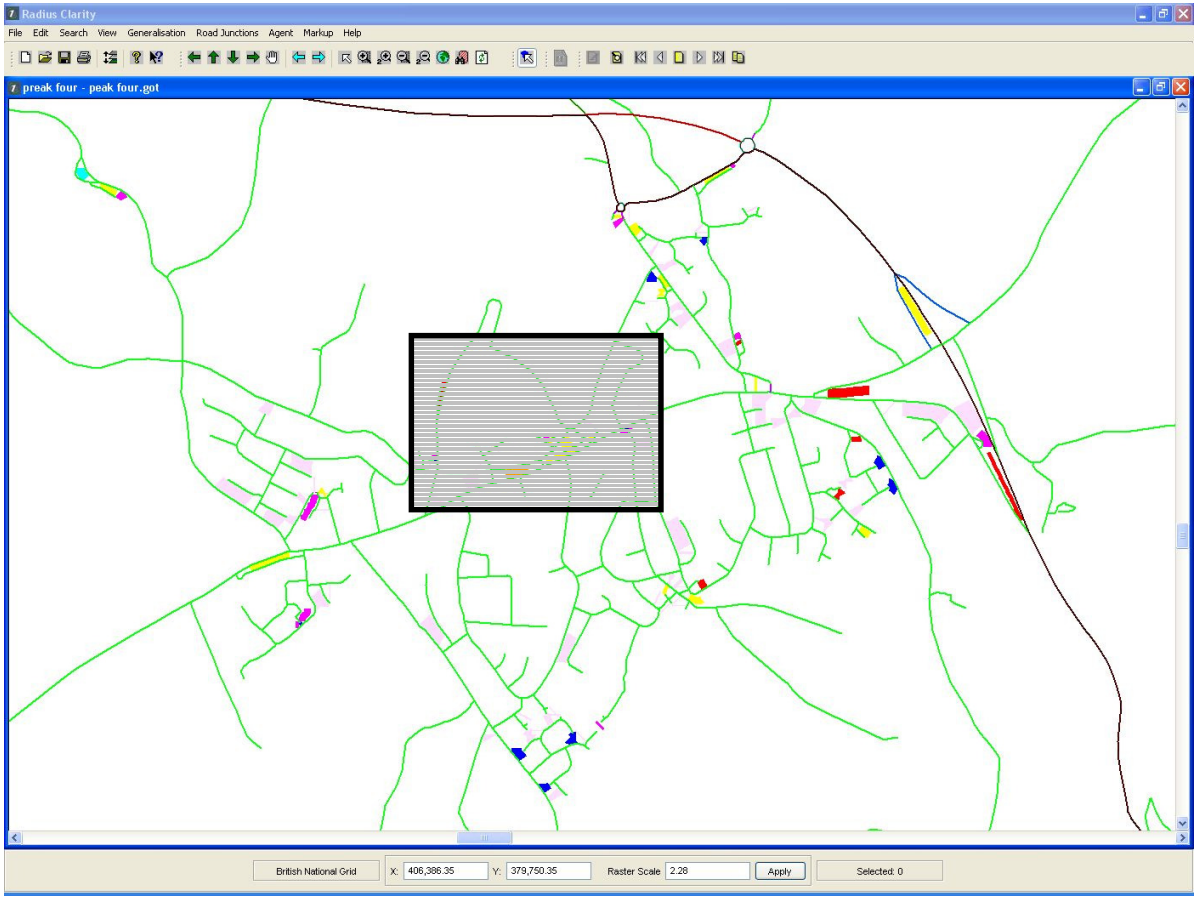
# Skeleton and conflicts



# Conflicts

- Each conflict region stores
  - type – as shown by the different colours
  - angle between end span & conflicting link (cul-de-sac conflicts only)
  - closest separation
  - threshold distance (obtained from the two half symbol widths plus the required gap between the symbols)
  - up to four adjacency lists:
    - road section(s) to the left
    - road section(s) to the right
    - road section(s) to the start (parallel conflicts only)
    - road section(s) to the end (parallel conflicts only)

# Creating clusters using the conflict regions



# Showing four clusters and their anchor points

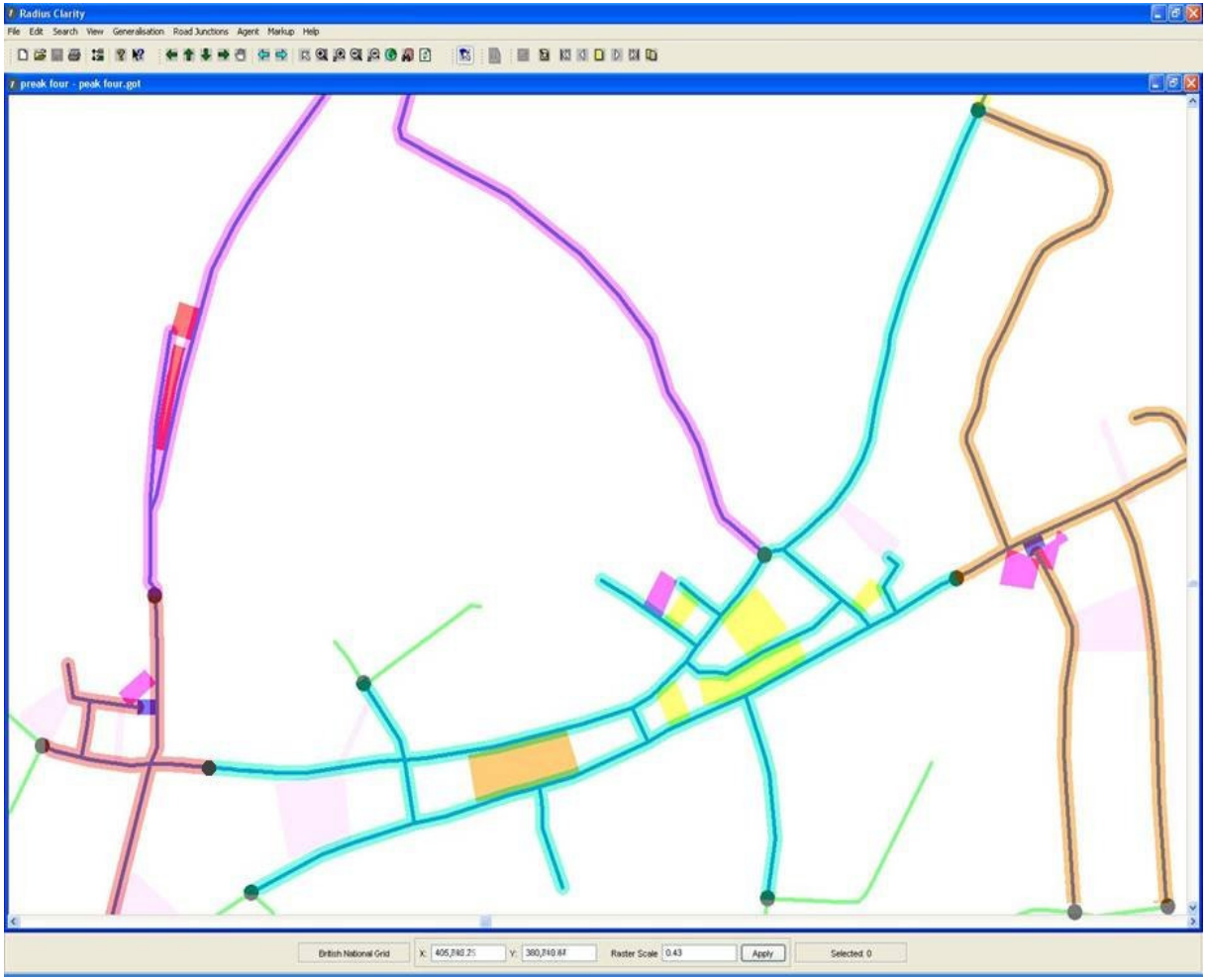
We use the adjacency lists to decide on the road sections to place in the various clusters.

If a cluster has two (or more) conflicting road sections joining at a node we ensure all the road sections at the node are included in the cluster

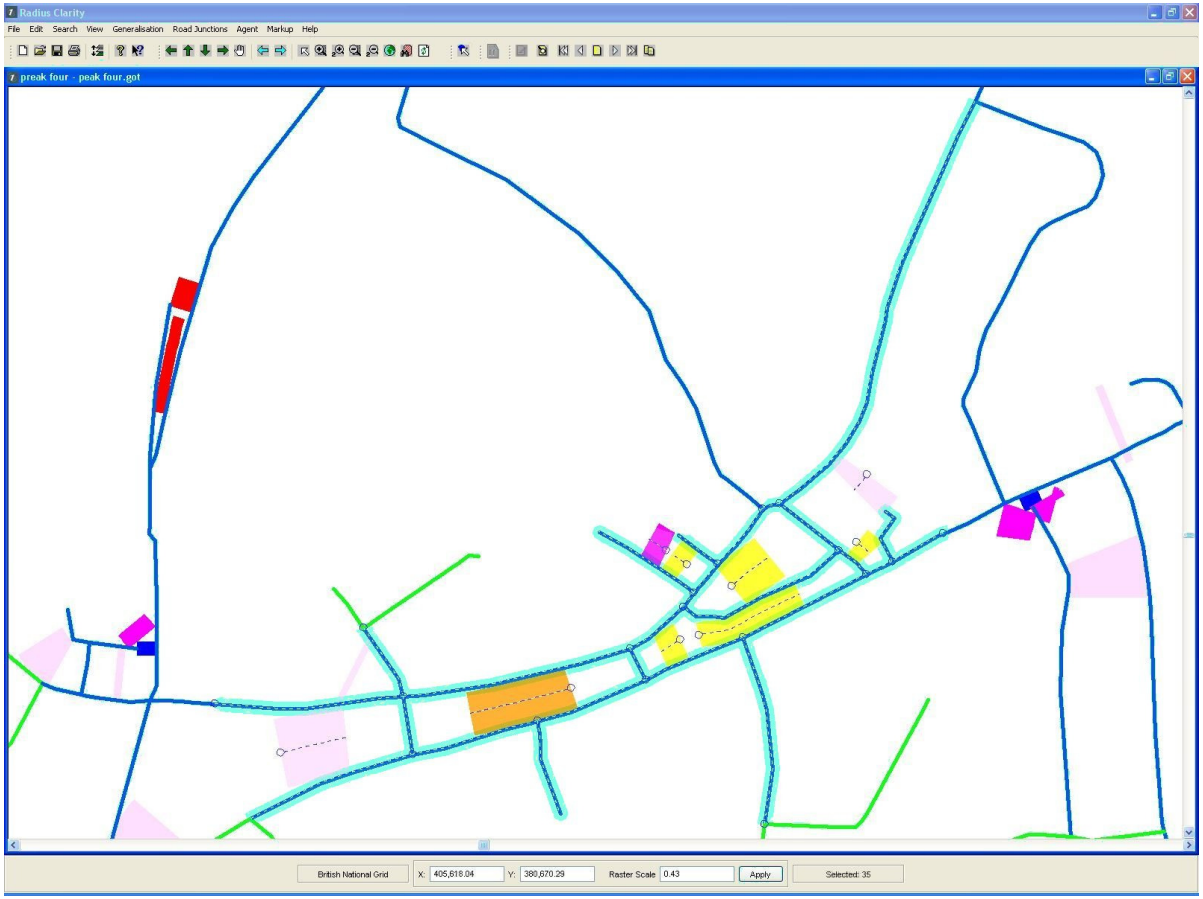
During scanning we have located two types of conflicts;
**definite** ones :
closest separation is $\leq$ threshold
**possible** ones :
closest separation > (scan factor×threshold)

The **possibles** (coloured pink) are only used to expand a cluster when adjacent to **definite** conflicts.

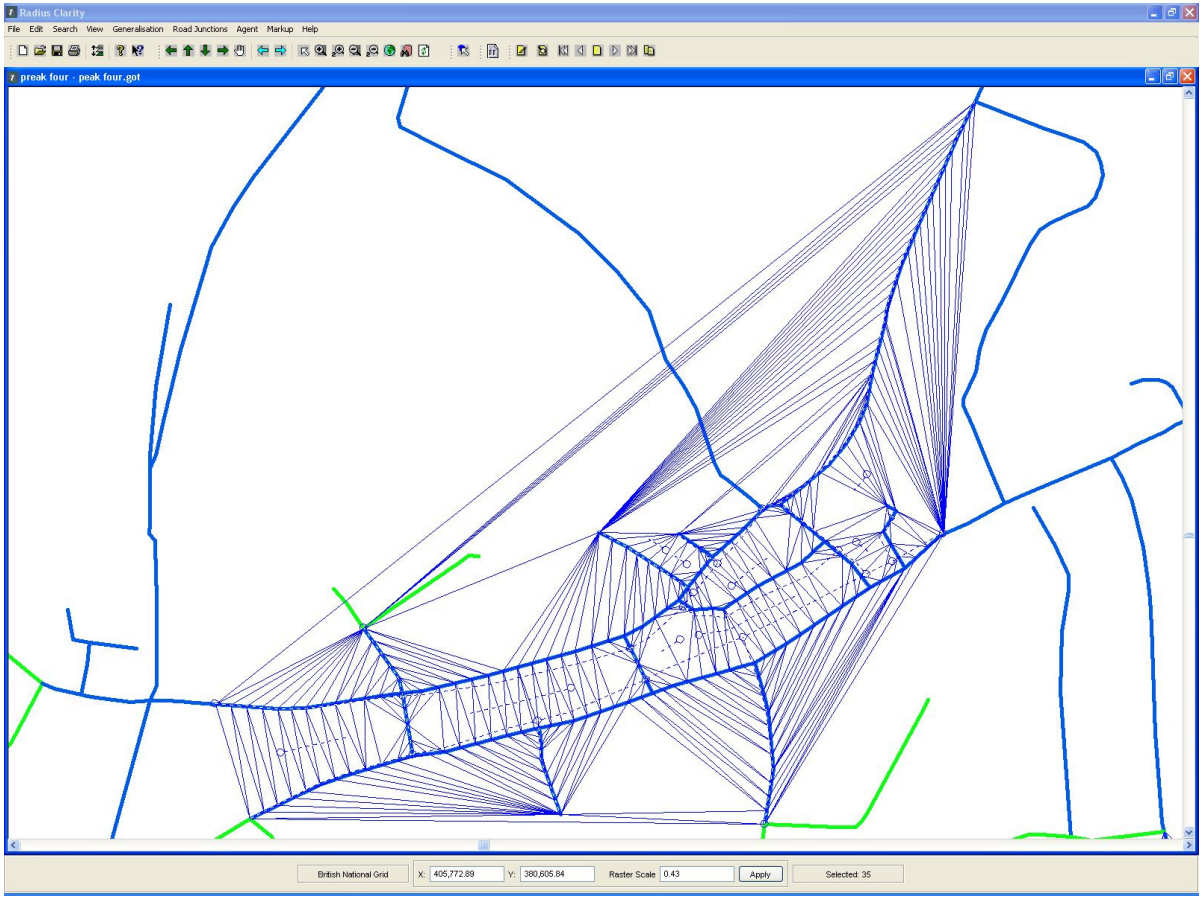
Where necessary we split the road section geometry to prevent the clusters growing too large. The splitting process pays attention to the positions of the conflicts.



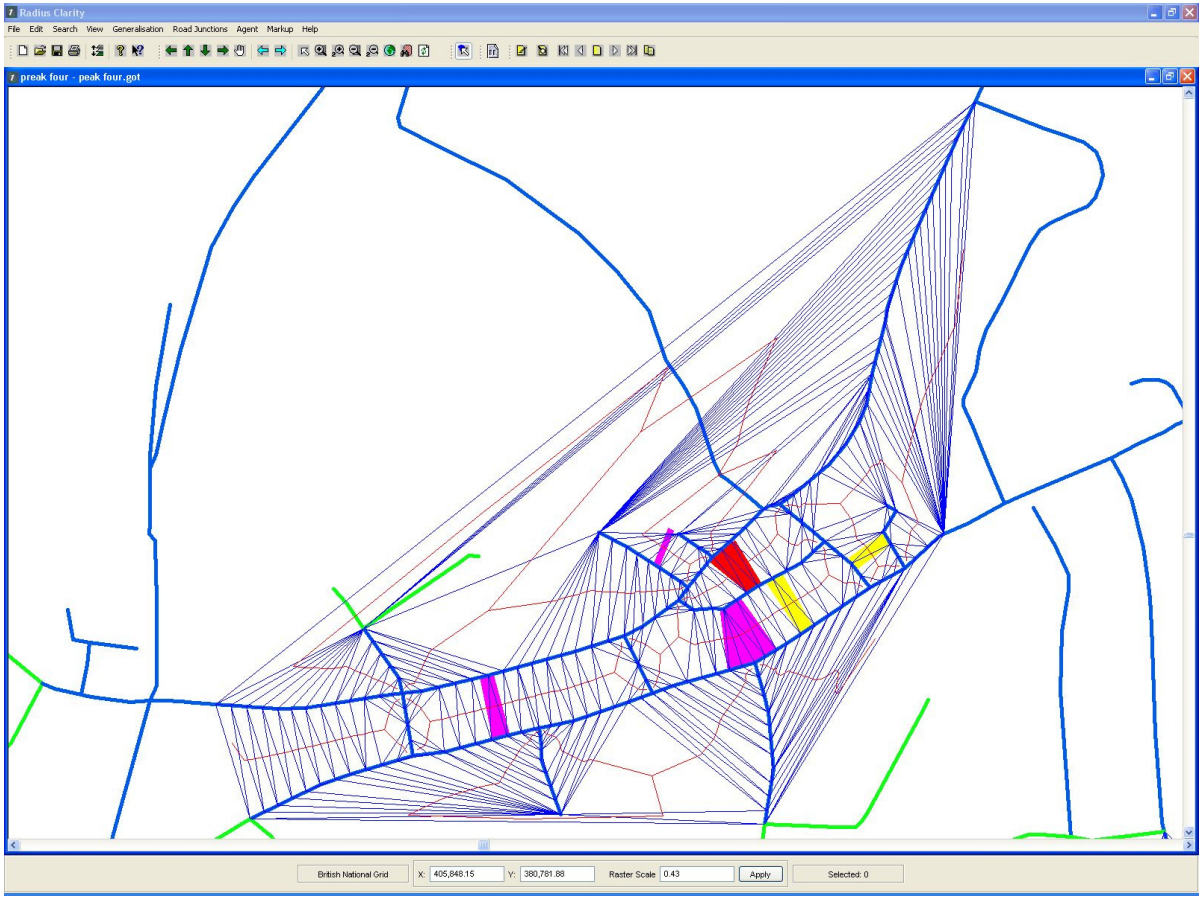
# Take a single conflict cluster



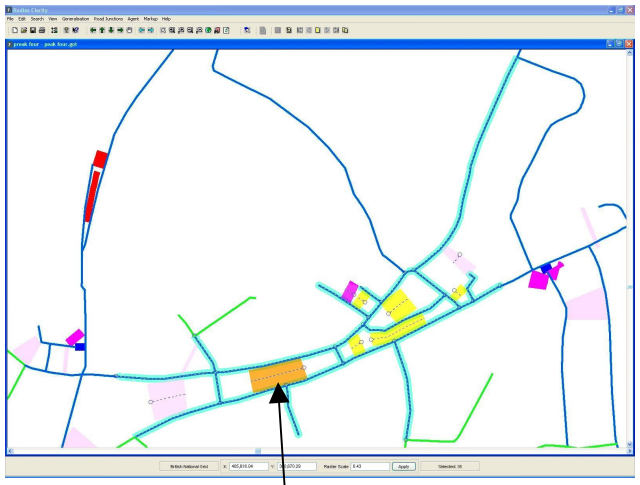
# Single conflict cluster after displacement



# Create conflicts for the displaced cluster



# Measuring a cluster's conflicts



displacement

Minimum separation 25·4

Threshold 37

Length 60

Conflict measure = 60 × (37–25·4)

= 696 sq. metres

Single conflict

Minimum separation 36·9

Threshold 37

Length 9·3

Conflict measure = 9·3 × (37–36·9)

= 0·93 sq. metres

Total measure for all cluster's conflicts = 2396 sq. metres

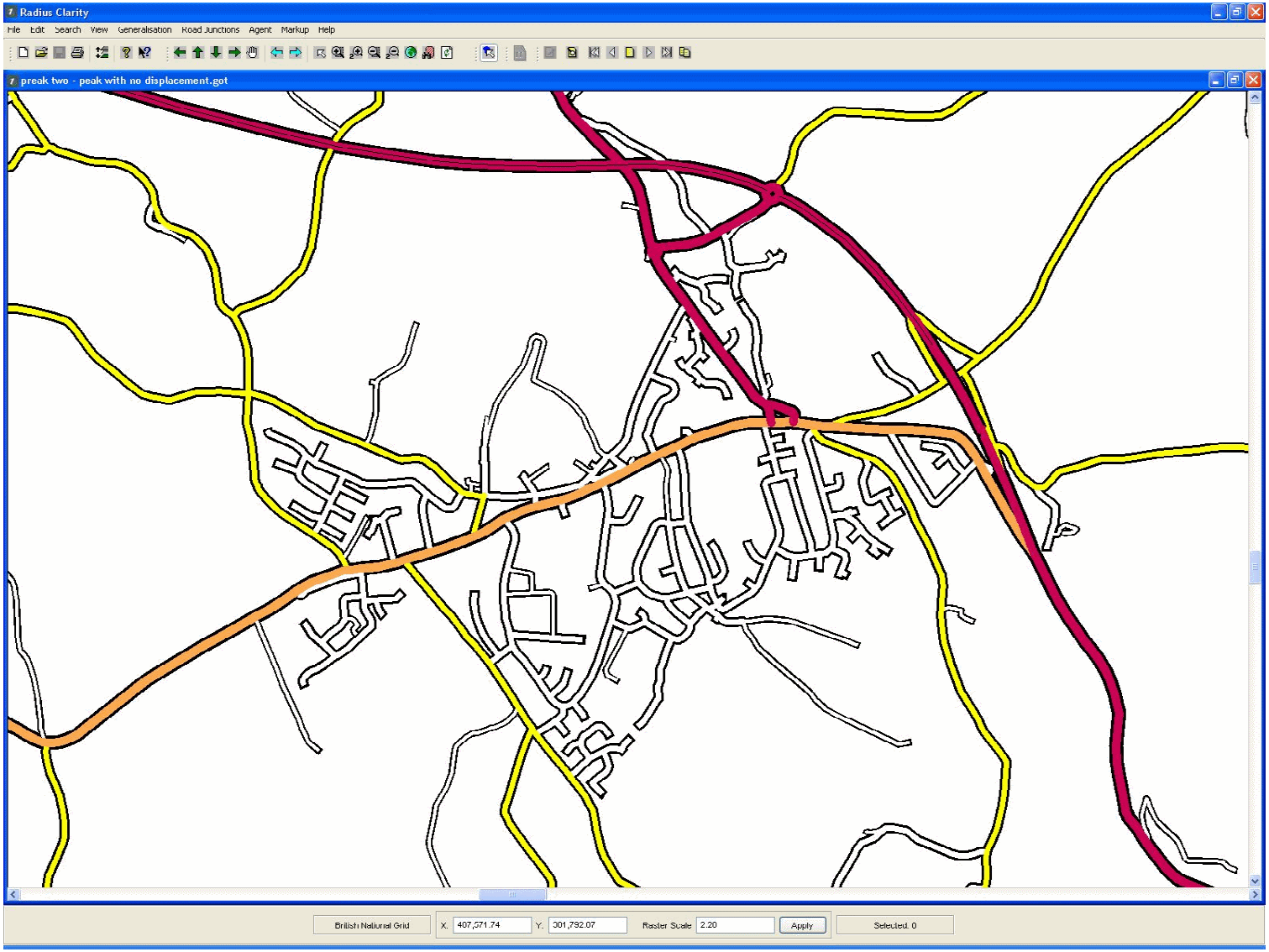
Total measure for all cluster's conflicts = 150 sq. metres

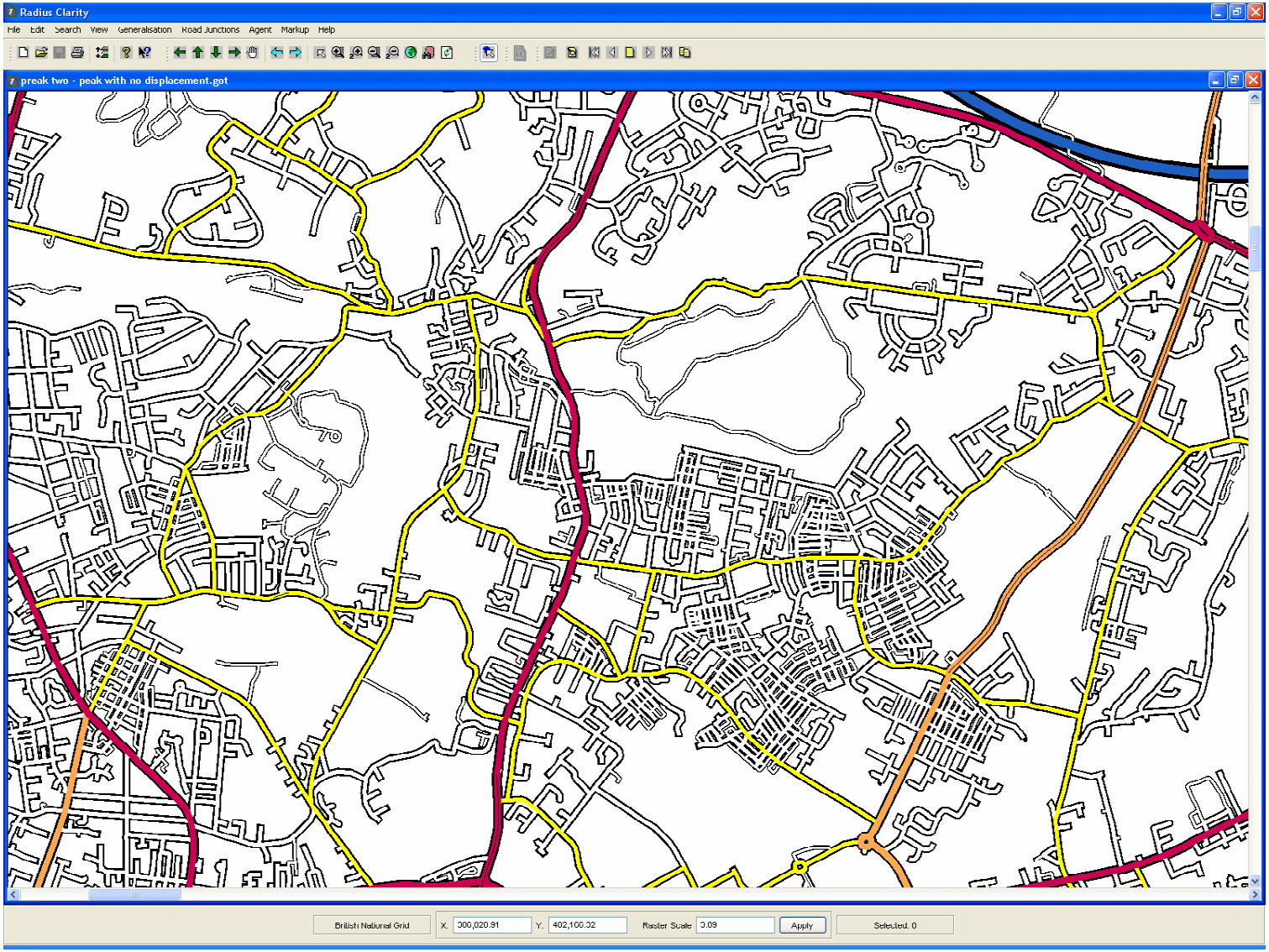
# Multi-agent system to apply displacements

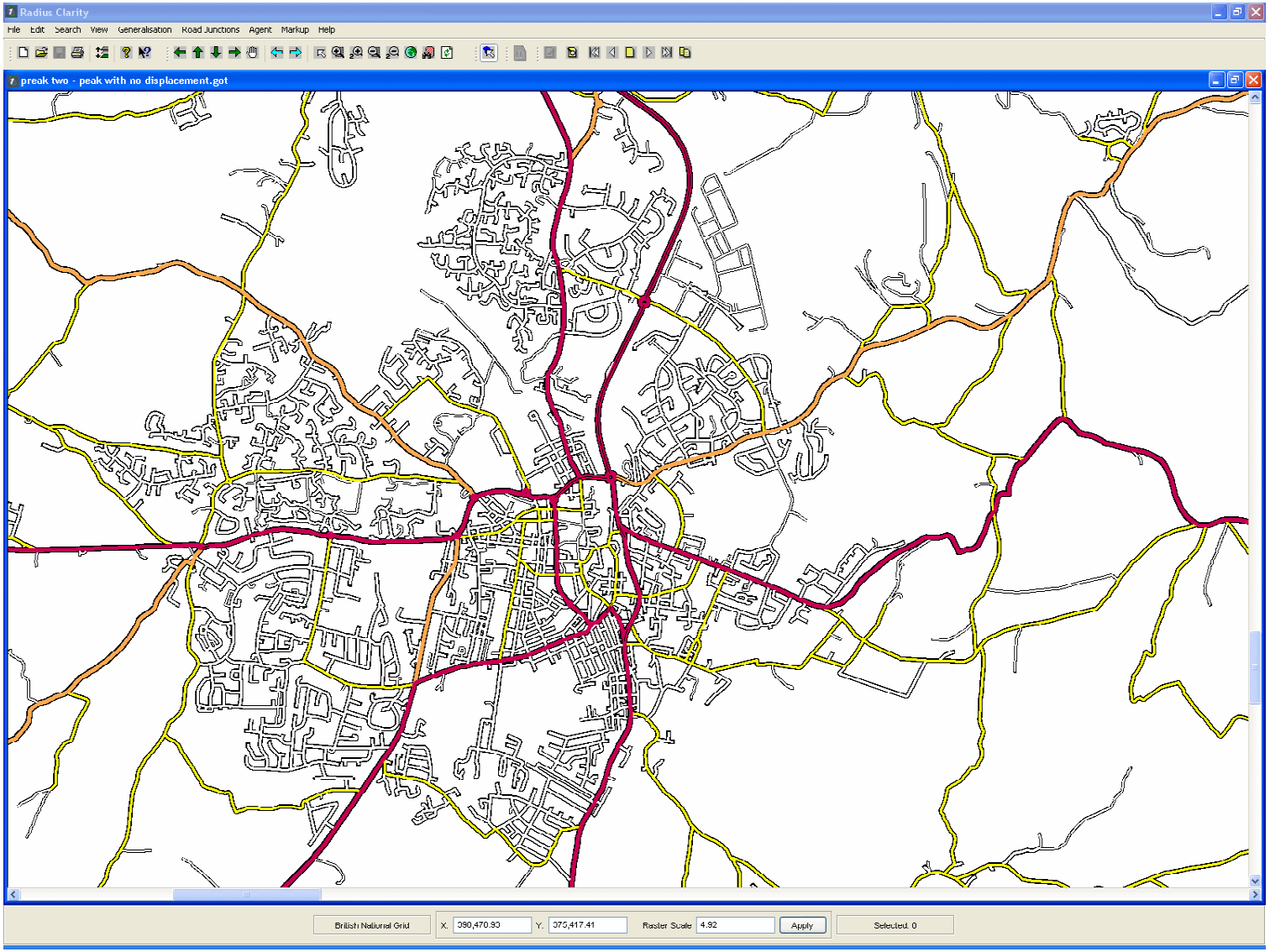
- Clarity multi-agent system was used to resolve the conflicts of each cluster in turn.
- First Push is applied repeatedly until there is no further improvement, them Beams is applied to all successful ‘Push’ed displacements looking for possible further resolution.
- After each application of a displacement the resulting geometries are cleaned, removing spikes and duplicate points. They are also checked for self intersections and for intersections with other sections within the cluster. If such errors are found, repairs are attempted.
- Not only does there need to be significant improvement in the conflict measure for the cluster. Using the underlying topology we must check and ensure none of the new geometries intersect with road sections outside the cluster. Only then are the cluster’s new geometries written into the dataset as solutions to the cluster’s conflicts.

# Results

- Our dataset contained 100,000 road links.
- This produced 3000 conflict clusters.
- The study suggests that multiple applications of displacement algorithms are going to be necessary for good resolution of conflicts.
- The total percentage resolution of conflicts as determined by our method of measurement was 88%.
- This value is much more a characteristic of the desired symbol widths, symbol separation gap, the map scale and road density than of the effectiveness of the algorithms.
- New secondary conflicts were created, equal to 1.67% of the initial conflict measure. Their number could be reduced by using a larger scan factor (1.25 was the value chosen in this trial).
- The main point of the study is that displacements have been applied, automatically, without corruption of the network.


Radius Clarity
File Edit Search View Generalisation Road Junctions Agent Markup Help
preak two - peak with no displacement.got
British National Grid
X: 407,571.74
Y: 301,792.07
Raster Scale 2.20
Apply
Selected: 0


Radius Clarity
File Edit Search View Generalisation Road Junctions Agent Markup Help
preak two - peak with no displacement.got
British National Grid
X. 300,020.91
Y. 402,100.32
Raster Scale 3.09
Apply
Selected: 0


Radius Clarity
File Edit Search View Generalisation Road Junctions Agent Markup Help
peak two - peak with no displacement.gst
British National Grid
X: 390,470.93
Y: 375,417.41
Raster Scale
4.92
Apply
Selected: 0

Без перевода ?

Questions?