

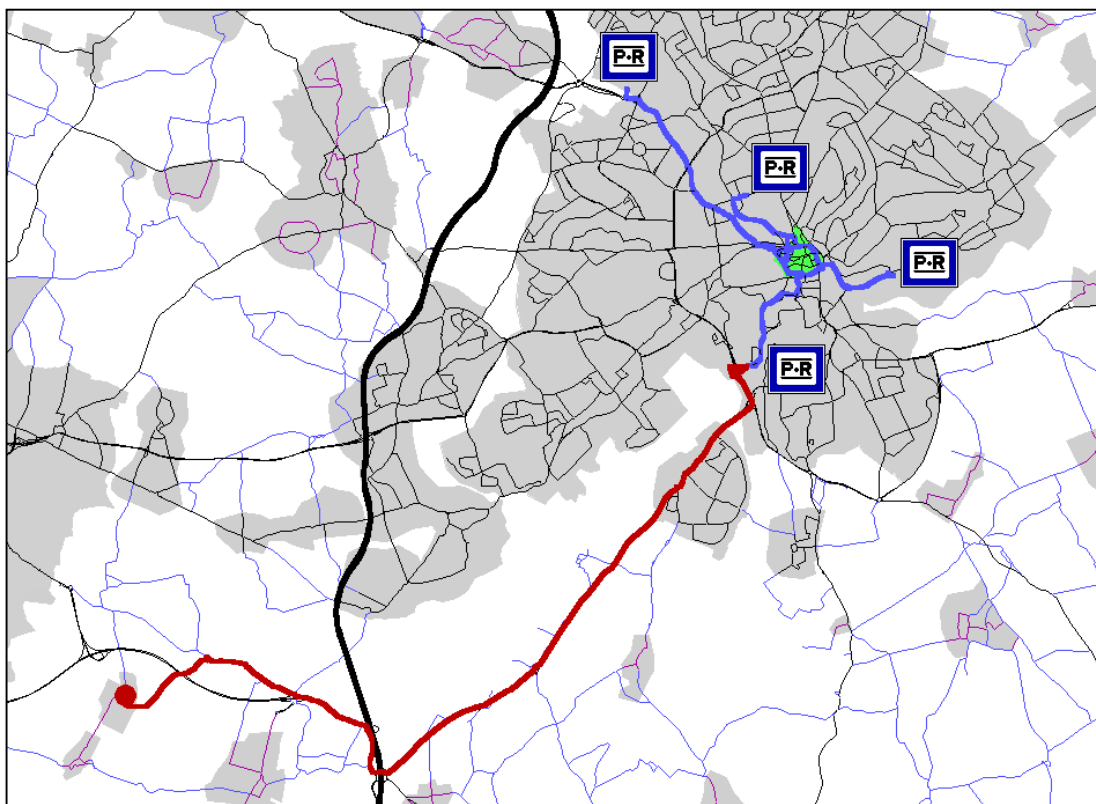
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## Modelling Park and Ride in VISUM



**Figure 1 :** Example for a P+R system

Park+Ride describes travels in conurbations from the outskirts to the centre, which are undertaken partly by private and partly by public transport. The first part in the less dense outer areas with usually less density of public transport is made by car. The car is parked at a station or a stop of a bus or rail service, from where the second part of the journey is continued to the destination in the centre of the city. In this way one tries to combine the advantages and to avoid the disadvantages of both transport systems. Figure 1 shows an example for Park+Ride in an urban area with the private transport part of travel in red and dedicated P+R services in blue. To the potential clients four facilities are available, which are linked to the city centre with bus lines.

Modelling of Park+Ride trips requires a sequence of steps. The approach can be outlined as

follows:

- ▶ Definition of P+R sites
- ▶ Determination of P+R demand
- ▶ Split of P+R demand into private transport and public transport legs
- ▶ Assignment of P+R trips as parts of the demand segments for private and public transport

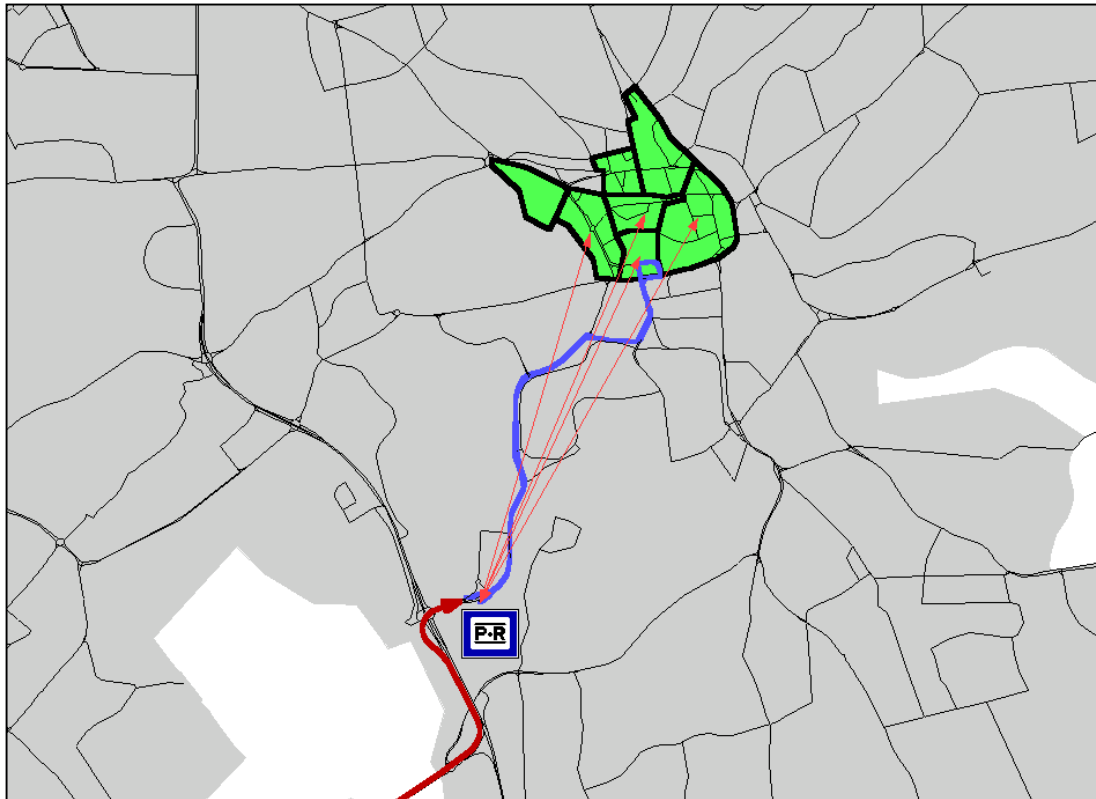
The general modelling assumption is, that P+R trips are genuine private transport travels, which can be shifted to public transport as a consequence of an improved service.

In the network model a P+R site has to be represented as a zone and a link. Zones are necessary as elements, where travels within a transport system start and end. A change between private and public transport therefore requires a zone. In the P+R links of the model two properties have to be included, the capacity of the P+R facility and the costs for using P+R. The P+R links, like all the other links in the network model, have a limited capacity, which is here defined by the number of parking places and number of changes during a day. This allows to include different trip purposes with different durations of stay (commuters, shoppers). Also costs for parking and bus fares can be defined in the impedance of these P+R links.

In a first step the impedances for the public transport legs of P+R trips have to be defined with the Assignment model. This requires a selection of potential destination zones of P+R trips by the modeller. Parameters for this determination would be the destinations and journey times of the available public transport services for the existing or potential P+R sites.

The destination zones have to be connected to the P+R sites. A first assignment run is made in which the numbers of clients using the P+R sites are estimated for the whole modelling area in competition to private transport on the whole journey.

Figure 2 depicts the transport model representation of a P+R facility with the real public transport service and the modelled connections to some of the zones in the city centre.



**Figure 2 : Transport model representation of a P+R facility**

A second assignment however is necessary to assign these travellers to the public transport leg and to provide their correct return trip. As it is not mandatory in the trip assignment that for both directions of a journey the same connection of a zone is used, it has to be guaranteed, that P+R customers start their private transport return trip from the same place where they left their car. Therefore the P+R return trips have to be removed from the original demand matrix for the private transport segment and have to be entered as new relations between the P+R site and their final destination. In this same model run the P+R clients have to be assigned to the public transport services between the P+R facilities and the city centre.

In detail this requires the following steps:

1. Preparation of the network model

- ▶ Definition of the the P+R sites as links and zones
- ▶ Definition of the public transport services for these sites.
- ▶ Estimation of potential P+R destinations through determination of isochrones for the relevant public transport services
- ▶ Definiton of the relevant connectors between the P+R sites and the destinations

1. First assignment to estimate the demand matrix for the P+R clients; validation against

reference data.

## 2. Modification of travel demand

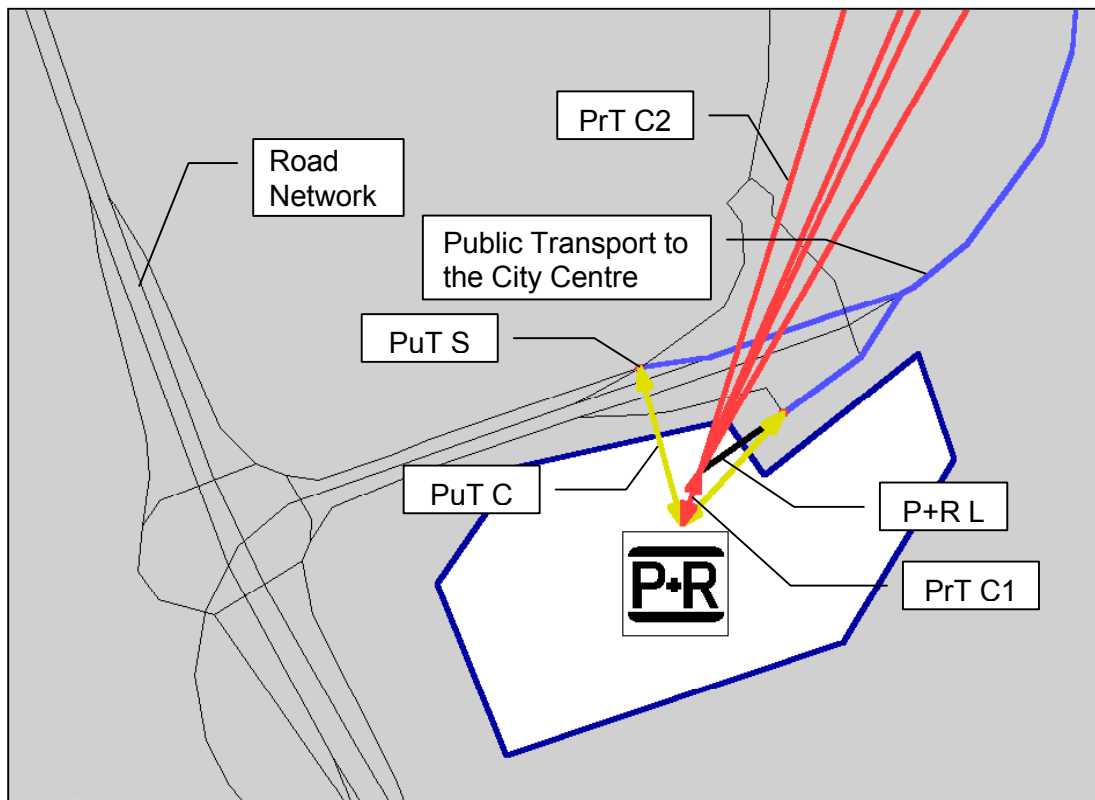
- ▶ Select link analyses for the P+R site links generate the matrices of P+R trips from the origins to the final destinations in the city centre (original P+R trips).
- ▶ These trips are removed from the private transport matrix.
- ▶ The P+R facilities are defined as destinations of the original P+R trips, and these trips are added to the private transport demand.
- ▶ The P+R facilities are defined as origins of the original P+R trips, and these trips are added to the public transport demand.
- ▶ The return trips have to be treated in the same way.

## 3. Second assignment with modified demand for the public and private transport systems.

The whole procedure has to be calibrated in a possible iterative process, if the shift from private to public transport is of a magnitude which has influence on the mode choice decision: if the reduction of private traffic is so big, that congestion is relieved, car usage might be encouraged again.

### Park+Ride – An Example

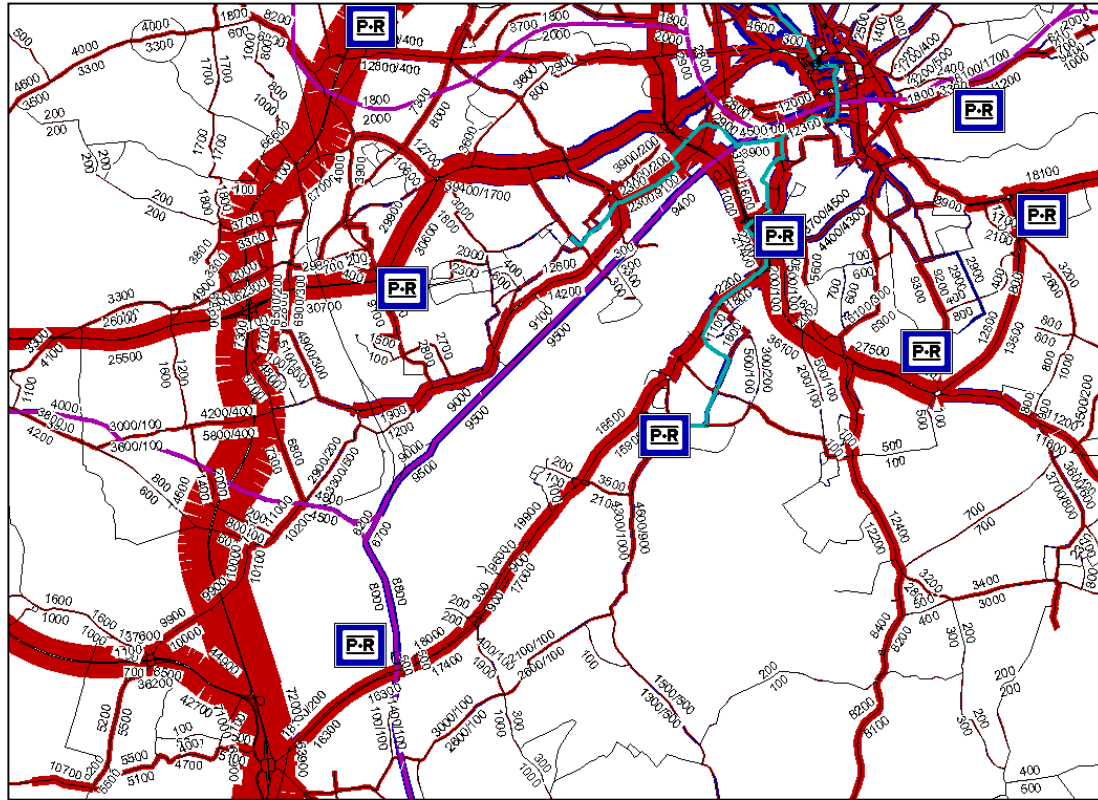
A P+R site is defined by a transport model zone of its own. It is connected with the networks of private and public transport by separate connectors. P+R demand has to be split into a private transport and a public transport leg.



**Figure 3 : Transport model elements of a P+R facility**

|        |  |
|--------|--|
| P+R L  | Park+Ride Link   |
| PuT S  | Public Transport Stop  |
| PuT C  | Public Transport Connector   |
| PrT C1 | Private Transport Connector  |
| PrT C2 | Private Transport Connectors between the P+R zone and the destinations (in the city centre) for the determination of P+R potential |

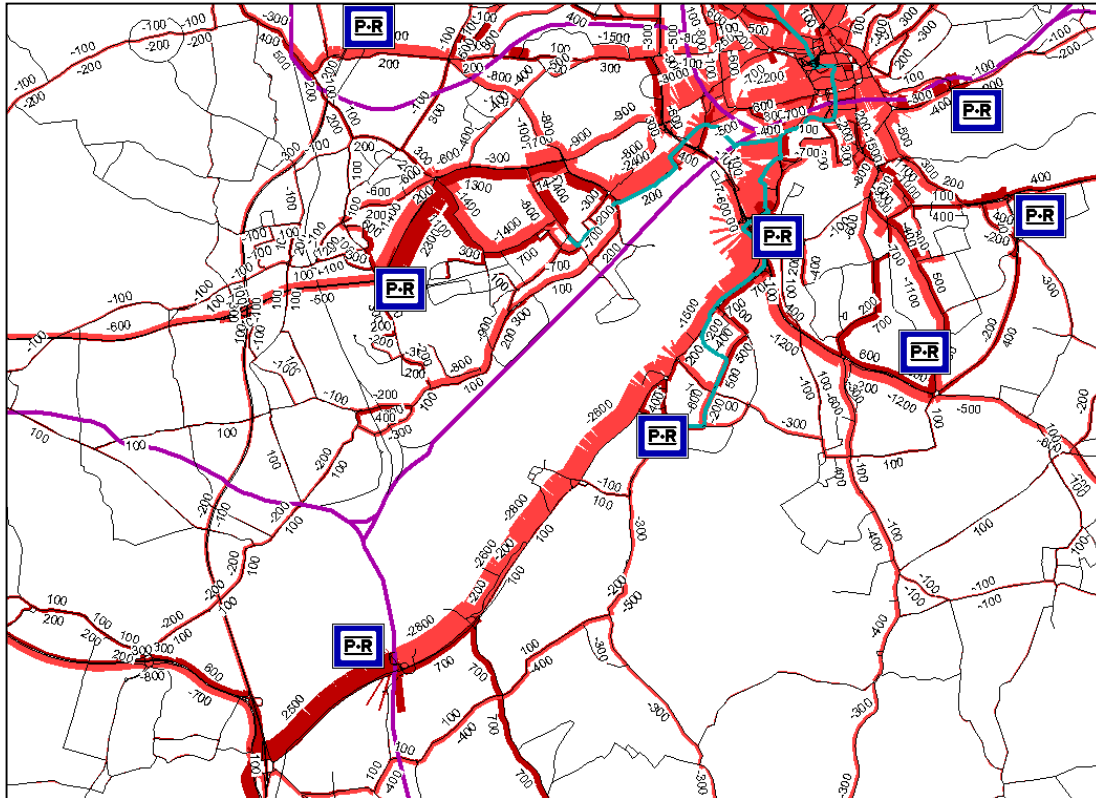
In a first stage an assignment is made without modelling P+R trips.



**Figure 4 : Original Flows and Passenger Figures without P+R traffic**

Displayed are the Park+Ride facilities, the road network (black), railway connections (magenta) and LRT lines (cyan). The private transport vehicle flows are coloured in red, the public transport passenger figures in blue.

In a second stage an assignment determines the potential maximum of P+R clients. These are all trips in private transport, which might have an advantage from using the P+R facilities.



**Figure 5 : Potential Vehicle Flow Changes caused by P+R (direction to the city centre only)**

This figure displays only the one direction of the trips, which is important for the choice situation of the travellers. Dark red are flow increases, light red flow reductions.

This potential demand between the P+R sites and the city centre has to be reduced to actual figures. This can be done based on survey data or through the application of utility models.

Following the determination of the actual P+R demand a final assignment run is necessary to obtain the actual flows in private transport and passenger figures in public transport.

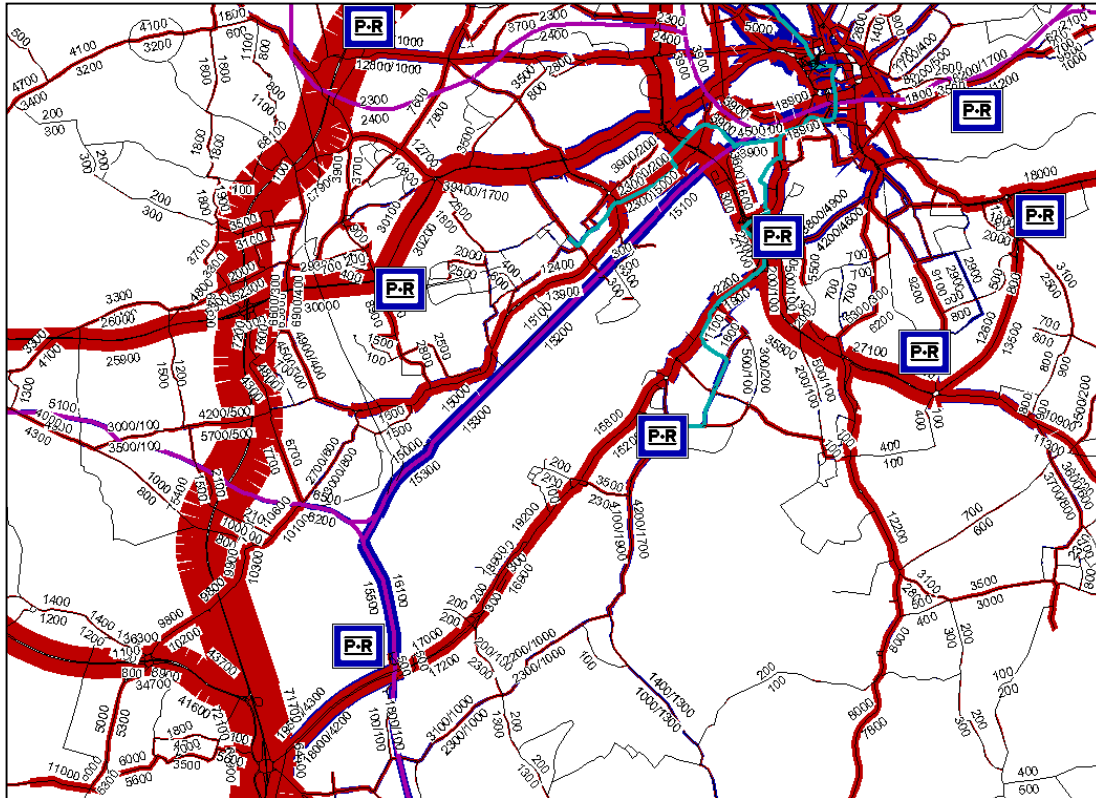
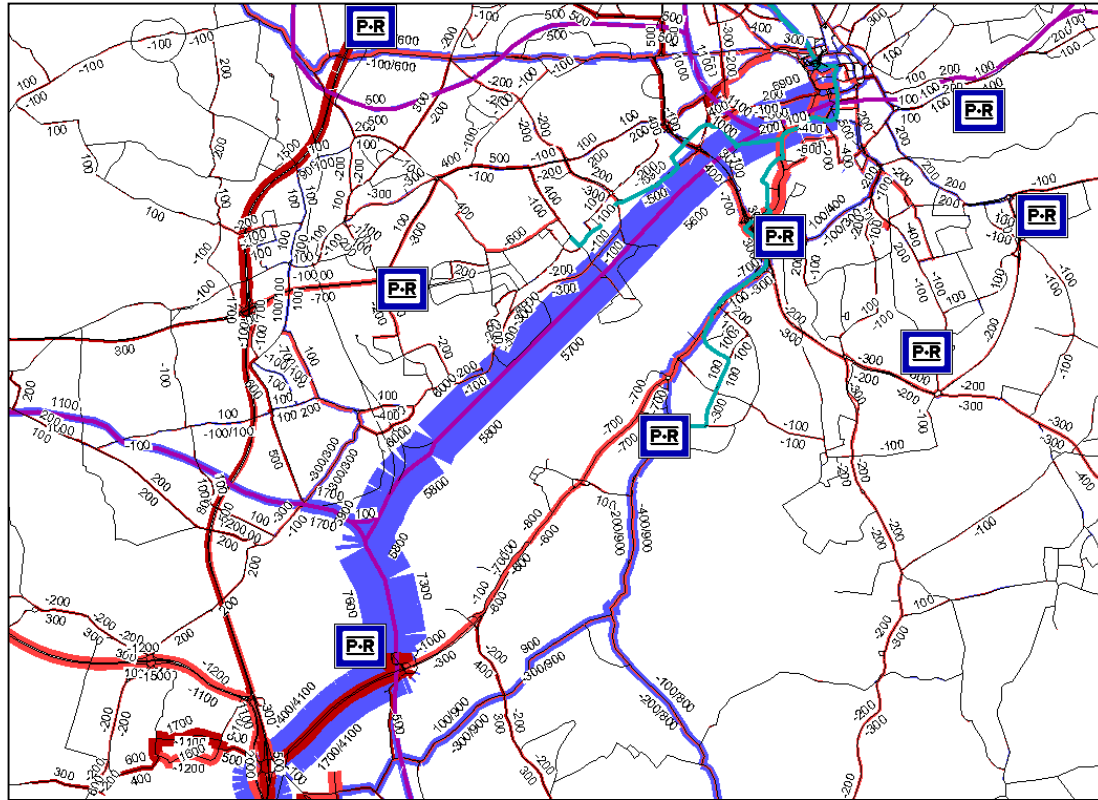


Figure 6 : Actual Flows and Passenger Figures with P+R Modelling

A more detailed figure of the volume changes shows the effects of the individual P+R facilities.



**Figure 7 : Changes in the Flows and Passenger Figures through P+R**

Private transport flows are given in red (dark: growing – light: reduced), passenger figures are given in blue (dark:reduced – light: increasing).