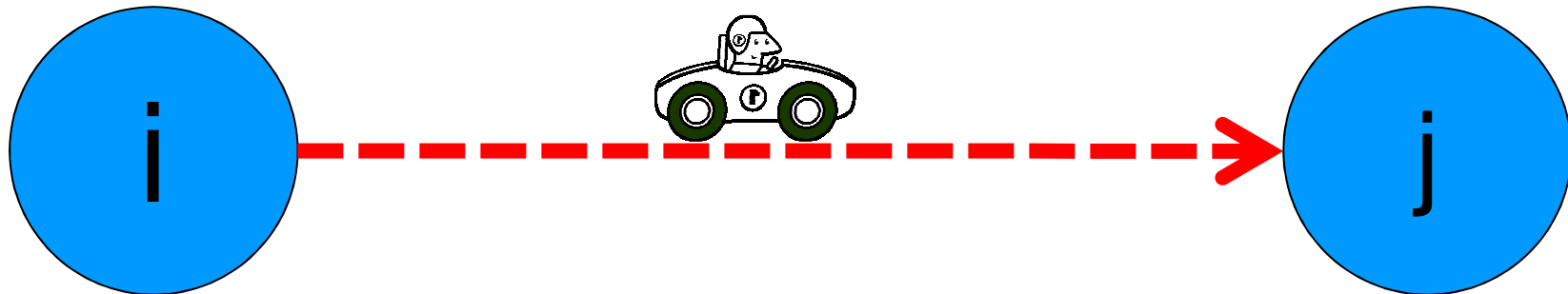




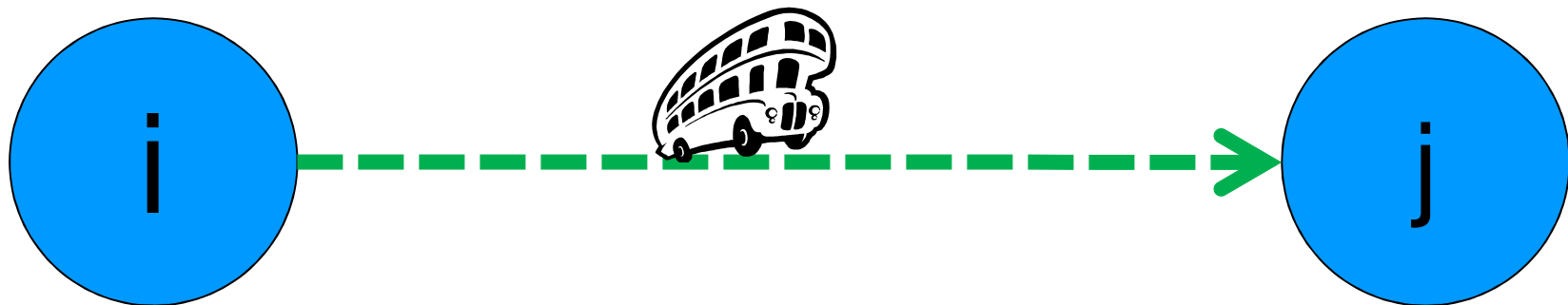
## Established systems for private and public assignments



### Private transport assignment

- > Find and store paths
- > Calculate link loads
- > Calculate costs (distance covered, time and dollars spent)
- > Very good at considering congestion and its effects
- > Not very good at mixing systems but it does not matter...mostly.

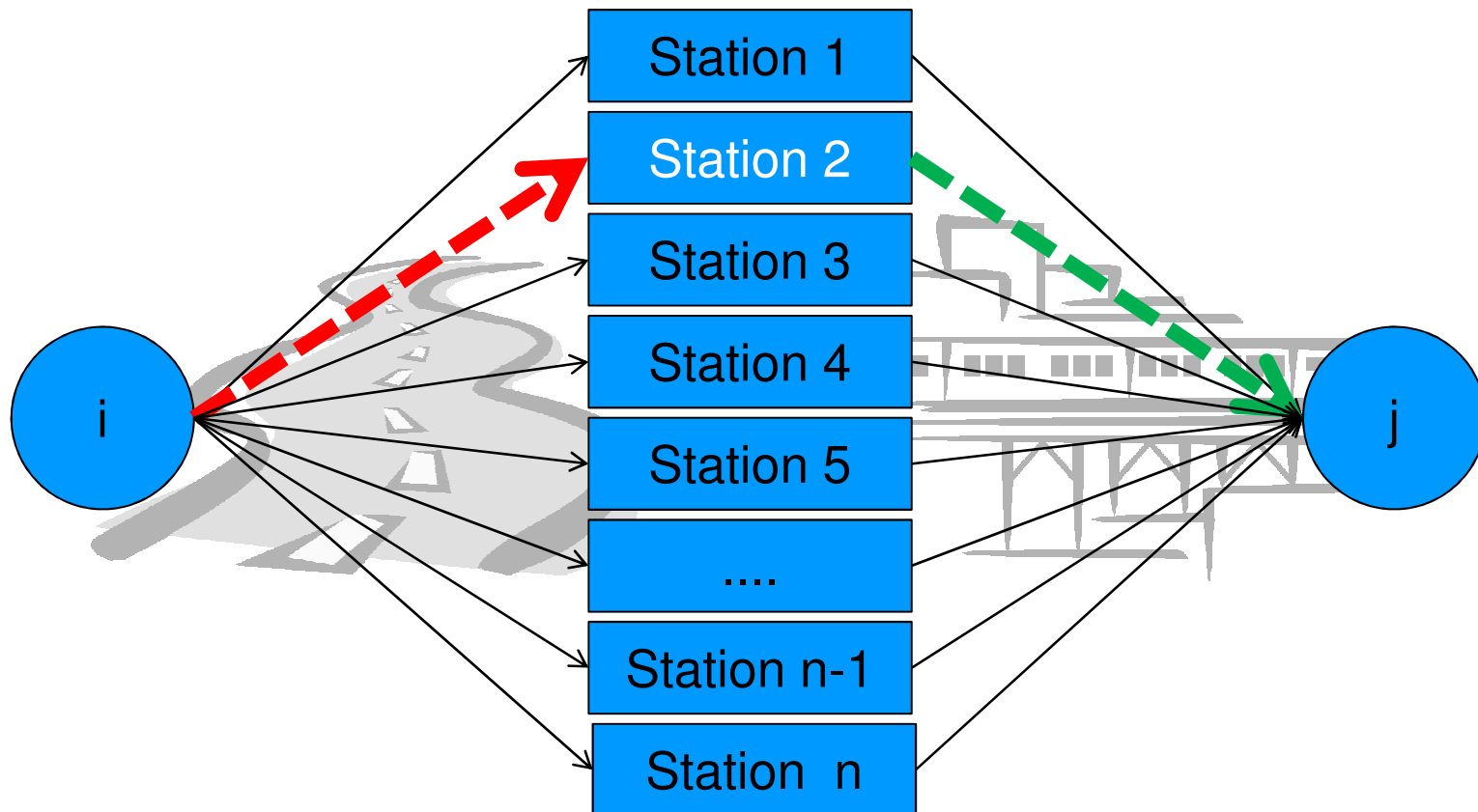
## Established systems for private and public assignments



### Public transport assignment

- > Find and store paths
- > Calculate link loads
- > Calculate costs (distance covered, time and dollars spent)
- > Very good at mixing different kind of systems (Walk, bus, tram, metro etc)
- > Not very good at handling congestion but it does not matter...mostly

## Choice of the P&R site an additional problem



**No standard solution when private and public systems mix**

## Solutions

### **1. Fix the station to a set of zones**

> Simplistic (can be outright wrong)

### **2. Consider the private leg a 'auxiliary' PT system (like walk or bicycling)**

> Still simplistic

### **3. Have direct connectors from zones to stations with costs copied from private paths**

> Complicated and requires lot of additional coding

### **4. Create and compare two-leg chains**

> Let us discuss this more

## How do we go about this 'two-leg chain' process? Three **easy** steps....

- 1. Recognise P&R as a distinct mode in its own right**
  - > Car, PT, Exclusive Walk, Bicycle.....P&R
  - > Integration of mode P&R into the demand model
- 2. Have P&R sites (stations with parking) carved as additional zones**
  - > A procedural necessity .... no other importance!
- 3. Have a marker (flag) to distinguish P&R zones from other zones**

...and three **difficult** steps

**4. Calculation of “best” P&R site for each OD pair**

**5. Calculation of (dis)utility for P&R (skim matrix)**

> Calculation of P&R demand (Mode choice)

**6. Split of P&R demand into two matrices according to legs**

> Assignment of P&R demand as part of matrices for PrT and PuT

What's the problem...

~~|     |  |          |  |
|-----|--|----------|--|
|     |  | $j$      |  |
|     |  |          |  |
| $i$ |  | $t_{ij}$ |  |
|     |  |          |  |~~

		$j$	
$S_?$		$t_{2ij}$	

Output No 1

		$S_?$	
$i$		$t_{1ij}$	

		$j$	
$i$		$T_{ij}$	

Output No 2

		$j$	
$i$		$S_n$	

For every OD pair...

	S1	S2	
i	$t_{ij}^{s1}$	$t_{ij}^{s2}$	

+

		j	
S1		$t_{ij}^{s1}$	
S2		$t_{ij}^{s2}$	

=

		j	
		j	
i		$T_{ij}^{s1}$	
i		$T_{ij}^{s2}$	

$$\text{Min}(T_{ij}^{s1}, T_{ij}^{s2}, T_{ij}^{s3} \dots T_{ij}^{sn})$$

## Add-Ins for Park & Ride

### Calculation of (dis)utility for mode P&R

- > utility must have been calculated for PrT and PuT (one skim matrix each)
- > zone attribute for P&R sites -> value > 0 indicates P&R site
- > two output matrices
  - > Utility matrix
  - > Matrix of „best“ P&R sites

### Split P&R demand

- > PrT matrix -> trips between Home and P&R site
- > PuT matrix -> trips between P&R site and destination zone

# Add-In: Matrix Convolution

Parameters of Matrix Convolution

Matrix 1	152.0   Sum PrT MC
Matrix 2	130.0   Sum PuT MC
Inner operation	add
Outer (contraction) operation	minimum
Result matrix	140.0   Sum P&R all
<input checked="" type="checkbox"/> Matrix for optimal via zone	142.0   P&R ZNo
<input checked="" type="checkbox"/> Only via zones with attribute > 0	PRSITE

Help    Cancel    OK

## Remark

extract utility of 1<sup>st</sup> leg (here: PrT)

extract utility of 2<sup>nd</sup> leg (here: PuT)

defines the combination of utilities of the two legs (here: sum)

criterion for the selection of best P&R site

P&R (dis)utility

matrix of best P&R sites per OD pair

restricts P&R sites (zone)

## Add-In: Split P&R demand

Parameters of P+R Matrices

P+R trips from origin to destination	32.0   P&R-HB
Optimal P+R lot matrix	142.0   P&R ZNo
Matrix for PrT part of trips	33.0   P&R-HB_Car
Matrix for PuT part of trips	34.0   P&R-HB_PuT

Help Cancel OK

### Remark

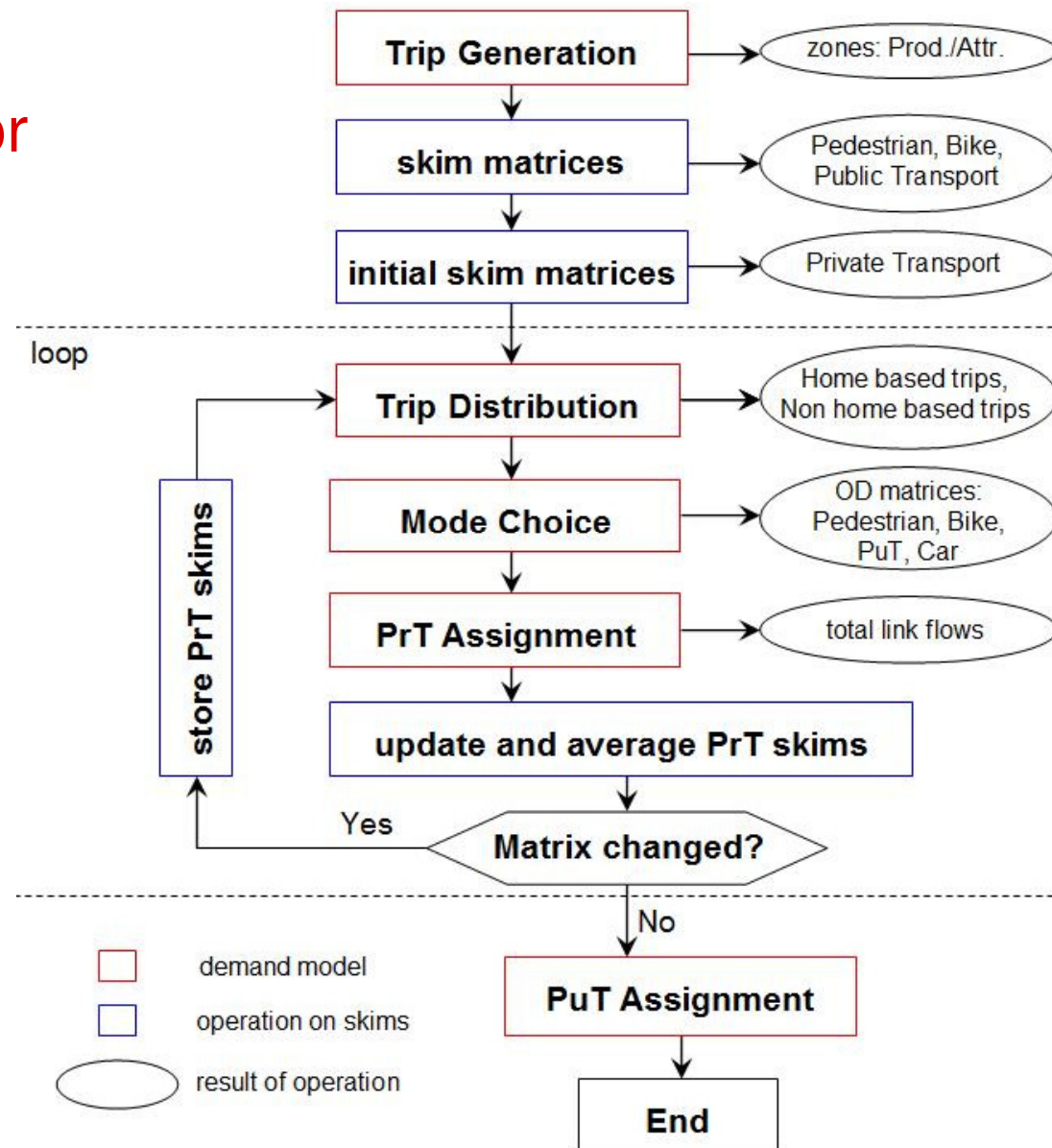
P&R demand matrix (O – D)

matrix of best P&R sites per OD pair

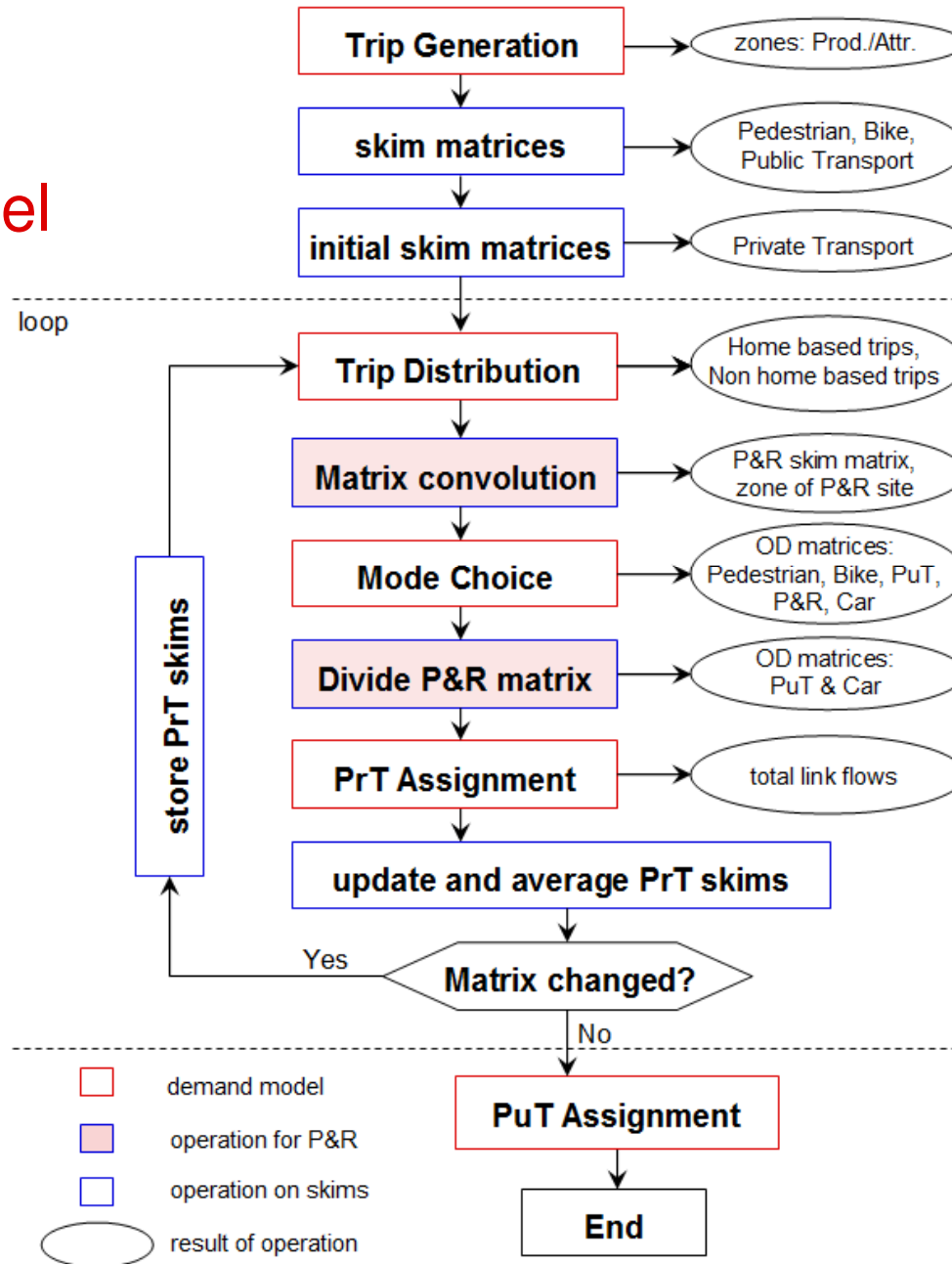
matrix of PrT legs (O – P&R site)

matrix of PuT leg (P&R site – D)

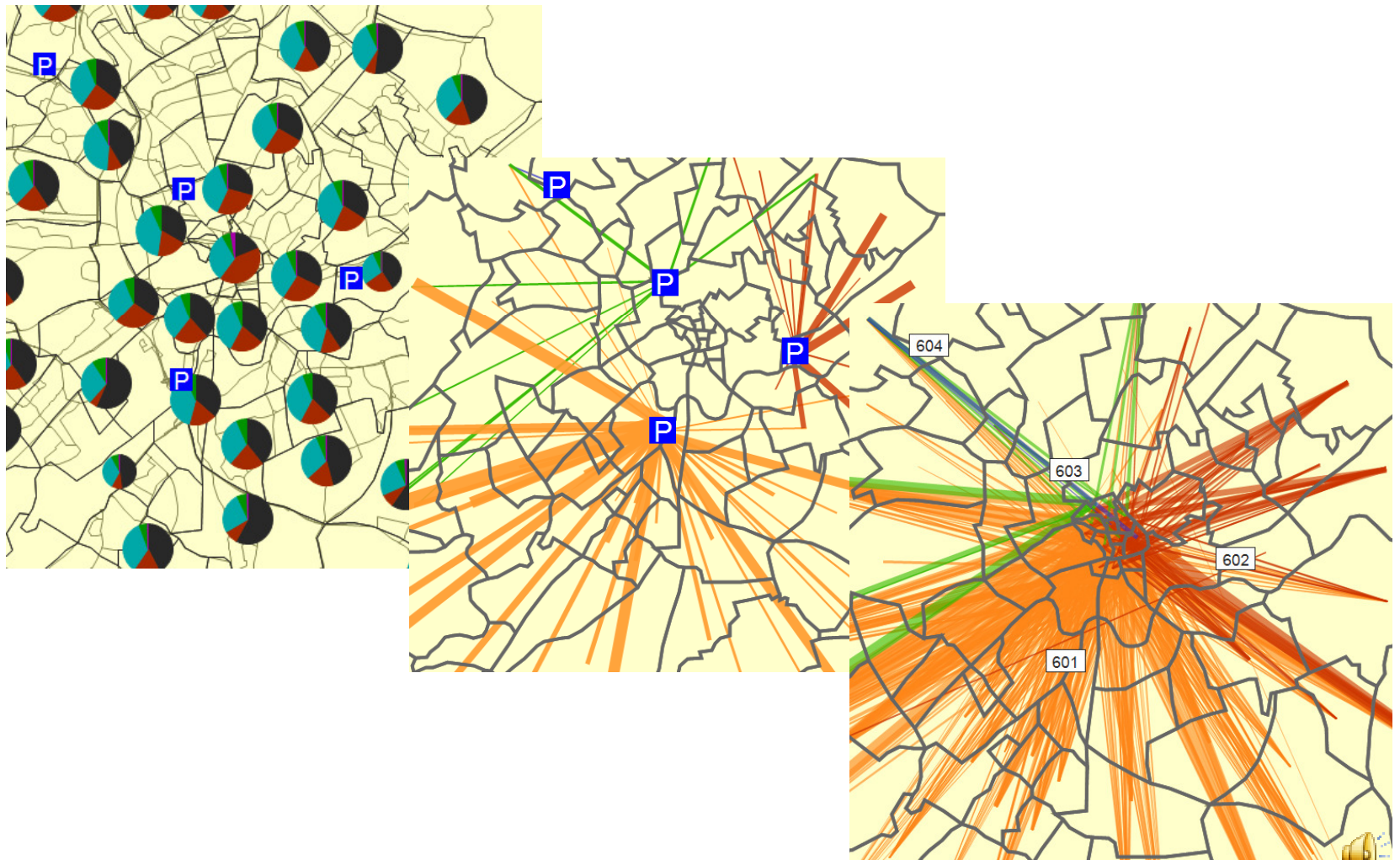
# Flow chart for initial model



# Flow chart for extended Model



## Graphical Display of Results



# PTV – Solutions for Sustainable Transport

