PTV GROUP

the mind of movement

GÖTEBORG STRATEGIC MODEL – TRAINING WEBINAR 1

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11.05.2020

GÖTEBORG STRATEGIC MODEL – TRAINING SESSIONS

Overview of the 4 Webinars

- 11.5.2020
  - Overview of the calculation procedures
  - Congestion Charging Implementation
  - PrT and PuT Assignment
- 18.5.2020
  - Scenario Manager – General Presentation
  - Updating future year person groups
- 25.5.2020
  - Scenario Manager – a practical example
- 1.6.2020
  - Model Management: how users should work with the model

CONTENT

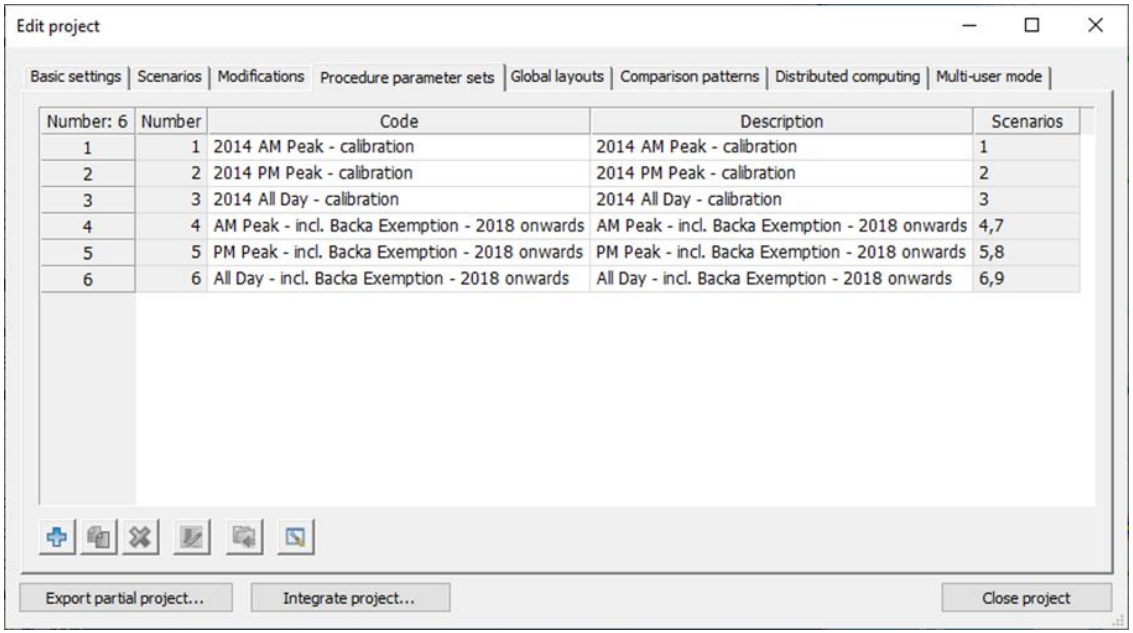
1. Overview of the procedures
2. Congestion Charging Implementation
3. PrT and PuT Assignment

1. OVERVIEW OF THE CALCULATION PROCEDURES

Procedures in the model

- 2 x 3 parameter sets
  - 2014 AM Peak
  - 2014 PM Peak
  - 2014 All Day

  - AM Peak – 2018 onwards
  - PM Peak – 2018 onwards
  - All Day – 2018 onwards



Number: 6	Number	Code	Description	Scenarios
1	1	2014 AM Peak - calibration	2014 AM Peak - calibration	1
2	2	2014 PM Peak - calibration	2014 PM Peak - calibration	2
3	3	2014 All Day - calibration	2014 All Day - calibration	3
4	4	AM Peak - incl. Backa Exemption - 2018 onwards	AM Peak - incl. Backa Exemption - 2018 onwards	4,7
5	5	PM Peak - incl. Backa Exemption - 2018 onwards	PM Peak - incl. Backa Exemption - 2018 onwards	5,8
6	6	All Day - incl. Backa Exemption - 2018 onwards	All Day - incl. Backa Exemption - 2018 onwards	6,9

- Difference between 2014 and 2018 onwards:
  - CC System
    - 2014: initial CC system
    - 2018: introduction of « Backa Exemption »

- Calculation Time
  - 2-3h per scenario, can be done in parallel with Scenario Manager

1. OVERVIEW OF THE CALCULATION PROCEDURES

Stages of Calculation Procedures

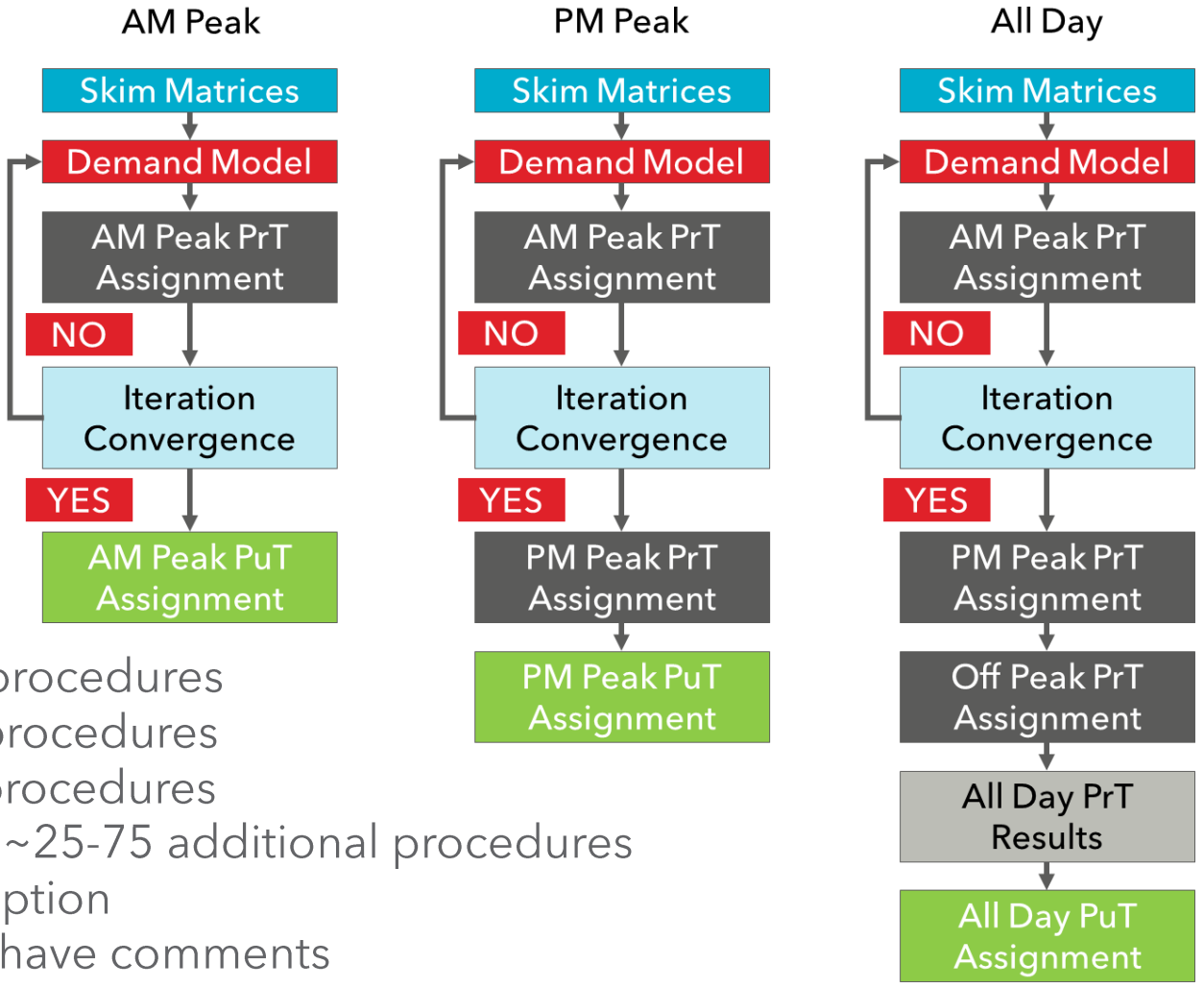
- Network Indicator Calculation (Skim)
- Demand Model
- Assignment Model

- AM Peak, PM Peak and All-Day use the same structure, only assignment periods change
- Allows for
  - Consistency of the procedures between time periods
  - Less error prone
  - Always same results of demand model

- All Time Periods use
  - same AM Peak skim matrices, symmetrised, values depending on scenarios PrT and PuT offer
  - same demand model parameters
  - same assignment parameters

1. OVERVIEW OF THE CALCULATION PROCEDURES

Stages of Calculation Procedures



- AM Peak: ~70 procedures
- PM Peak: ~85 procedures
- All Day: ~115 procedures
- 2018 onwards: ~25-75 additional procedures for Backa Exemption
- All procedures have comments

1. OVERVIEW OF THE CALCULATION PROCEDURES

Procedure Groups

- Procedures put in groups for better readability

Procedure sequence

Number: 145	Execution	Active	Procedure	eference object(	Comment
1	▷	☒	Group Network Preparation ...	2 - 12	Network Preparation
13		☒	Group Precharge Car ...	14 - 21	Precharge Car
22		☒	Group Convergence Assistance ...	23	Convergence Assistance
24		☒	Group Indicator Calculation ...	25 - 30	Indicator Calculation
31		☒	Group Indicator Correction ...	32 - 49	Indicator Correction
50		☒	Group Municipality Correction per trip pur	51 - 52	Municipality Correction per trip purpose
53		■	Group Set Congestion Charge Price for va	54 - 57	Set Congestion Charge Price for valid ODs
58		☒	Group Demand Model ...	59 - 61	Demand Model
62		☒	Group AM Peak - from Peak Period - Dem	63 - 65	AM Peak - from Peak Period - Demand Split Congestion Charging
66		☒	Group AM Peak - from Peak Period - Prep	67 - 72	AM Peak - from Peak Period - Preparation PrT Assignment matrices
73		☒	Group AM Peak - from Peak Period - PrT	74 - 76	AM Peak - from Peak Period - PrT Assignment
77		☒	Group AM Peak - from Peak Period - Itera	78 - 87	AM Peak - from Peak Period - Iteration Car
88		☐	Group AM Peak PuT Assignment ...	89 - 91	AM Peak PuT Assignment
92		☒	Group PM Peak Demand Split Congestion	93 - 95	PM Peak Demand Split Congestion Charging
96		☒	Group PM Peak Preparation PrT Assignme	97 - 102	PM Peak Preparation PrT Assignment matrices
103		☒	Group PM Peak PrT Assignment ...	104 - 111	PM Peak PrT Assignment
112		☐	Group PM Peak PuT Assignment ...	113 - 115	PM Peak PuT Assignment
116		☒	Group Daily PrT Charge - Off-Peak Deman	117 - 119	Daily PrT Charge - Off-Peak Demand Split Congestion Charging
120		☒	Group Daily PrT Charge - Off-Peak Prepar	121 - 126	Daily PrT Charge - Off-Peak Preparation PrT Assignment matrices
127		☒	Group Daily PrT Charge - Off-Peak PrT As	128 - 135	Daily PrT Charge - Off-Peak PrT Assignment

73		☒	Group AM Peak - from Peak Period - PrT Assignment	74 - 76		AM Peak - from Peak Period - PrT Assignment
74		☒	Init assignment		All	
75		☒	PrT assignment	T Truck, T no CC Truck no CC	Equilibrium assignment	PrT Assignment Trucks
76		☒	PrT assignment	C Car Driver, C no CC Car Driver no CC	Equilibrium assignment	PrT Assignment Cars

1. OVERVIEW OF THE CALCULATION PROCEDURES

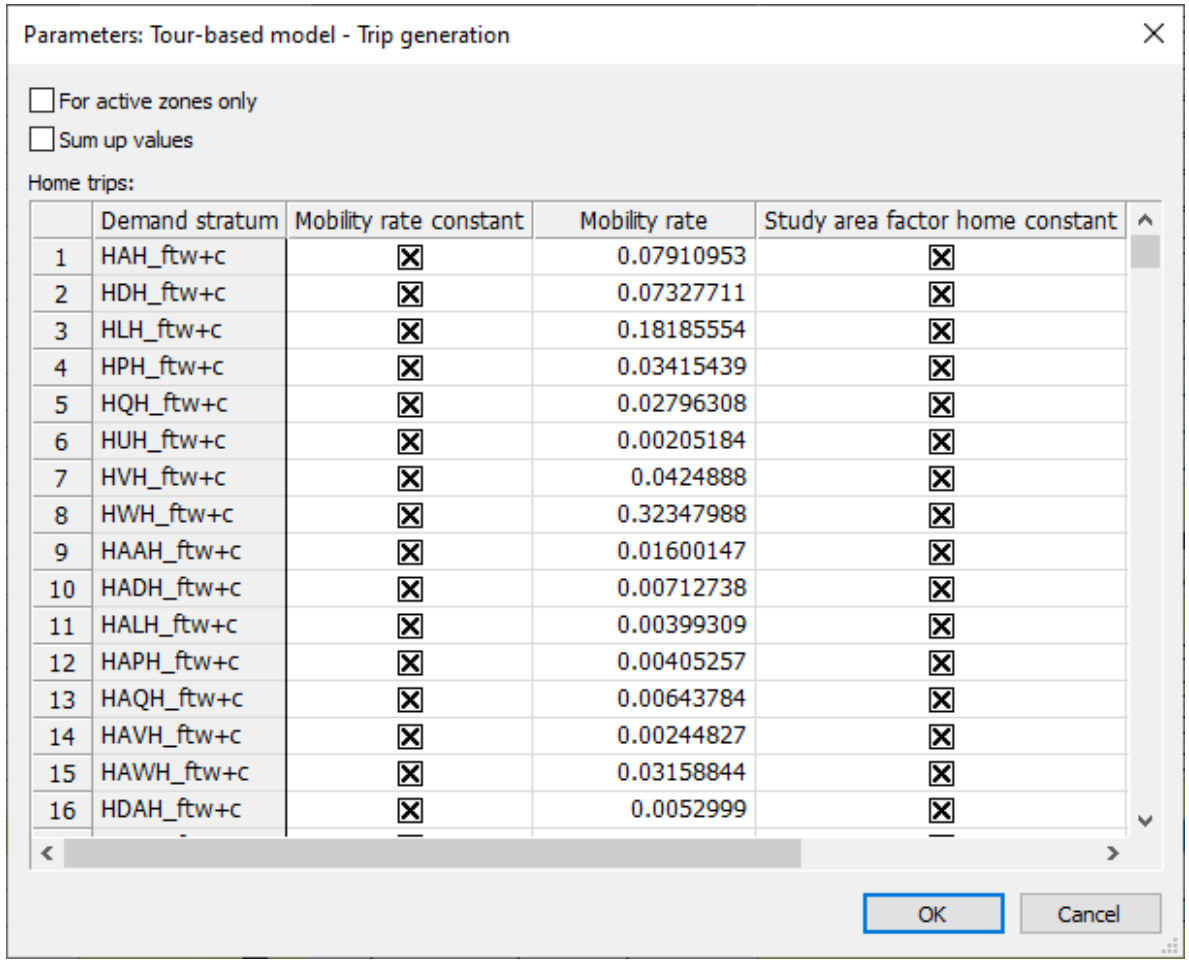
Procedure Groups

Procedure Group	Description of Procedure Steps
Network Preparation	Setting of connector travel times: Walk, PuTWalk and Ferry-Car Demand: min 1 min or 4kph, Bike: 15 kph + 1min, Car 30 kph + 1min, limit t0 PuT to 15 (Bus/Tram) or 20 min(Rail)
Precharge Car	Loading Precharge Car and Truck Matrix and Equilibrium Assignment
Convergence Assistance	Copy last iterations AM Peak car demand matrix into temporary matrix 30
Indicator Calculation	Calculation of Indicators for modes Walk, Bike, PuT and Car/Car no CC
Indicator Correction	Correction of skim matrices: internal distances, internal T0/TTC for Walk, Bike, PuT, Car depending on zone attribute "Internal Travel Time MODE" , symmetrisation of skim matrices
Municipality Correction per trip purpose	Adjusting attractivity of Municipalities with Bonus/Malus for Work and non-Work trip purposes
Set Congestion Charge Price for valid ODs	Identification of OD trips necessitating Congestion Charge and setting CC price to an indicator matrix
Demand Model	Trip Distribution and Mode Choice, deleting of internal trips in outer model area
AM Peak - from Peak Period - Demand Split Congestion Charging	Splitting overall AM Peak car demand into CC paying and non-CC paying demand by calculating Alpha and using it in LogNormal distribution
AM Peak - from Peak Period - Preparation PrT Assignment matrices	Setting up AM Peak Assignment matrices (adding external demand), using 30/70 split from demand of iteration N-1
AM Peak - from Peak Period - PrT Assignment	AM Peak PrT Assignment of modes Truck, Truck no CC, Car, Car no CC, using equilibrium assignment
AM Peak - from Peak Period - Iteration Car	Convergence Control using AM Peak car demand matrix
AM Peak PuT Assignment	AM Peak Period PuT Assignment, time-table based

1. OVERVIEW OF THE CALCULATION PROCEDURES

Demand Model

- Visem Trip Generation
  - Mobility rate identical for all procedures
  - ~700 demand strata

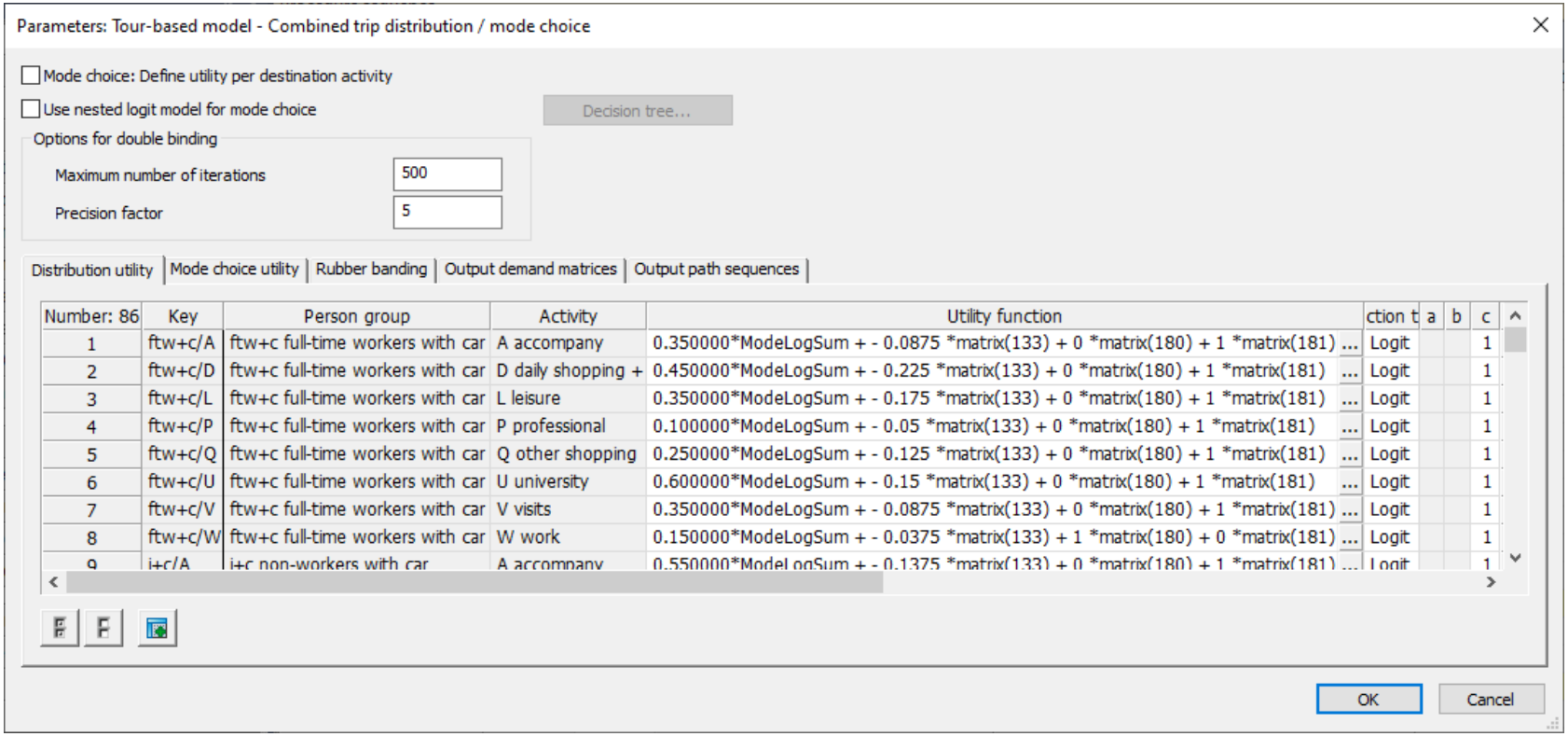


	Demand stratum	Mobility rate constant	Mobility rate	Study area factor home constant
1	HAH_ftw+c	☒	0.07910953	☒
2	HDH_ftw+c	☒	0.07327711	☒
3	HLH_ftw+c	☒	0.18185554	☒
4	HPH_ftw+c	☒	0.03415439	☒
5	HQH_ftw+c	☒	0.02796308	☒
6	HUH_ftw+c	☒	0.00205184	☒
7	HVH_ftw+c	☒	0.0424888	☒
8	HWH_ftw+c	☒	0.32347988	☒
9	HAAH_ftw+c	☒	0.01600147	☒
10	HADH_ftw+c	☒	0.00712738	☒
11	HALH_ftw+c	☒	0.00399309	☒
12	HAPH_ftw+c	☒	0.00405257	☒
13	HAQH_ftw+c	☒	0.00643784	☒
14	HAVH_ftw+c	☒	0.00244827	☒
15	HAWH_ftw+c	☒	0.03158844	☒
16	HDAH_ftw+c	☒	0.0052999	☒

1. OVERVIEW OF THE CALCULATION PROCEDURES

Demand Model

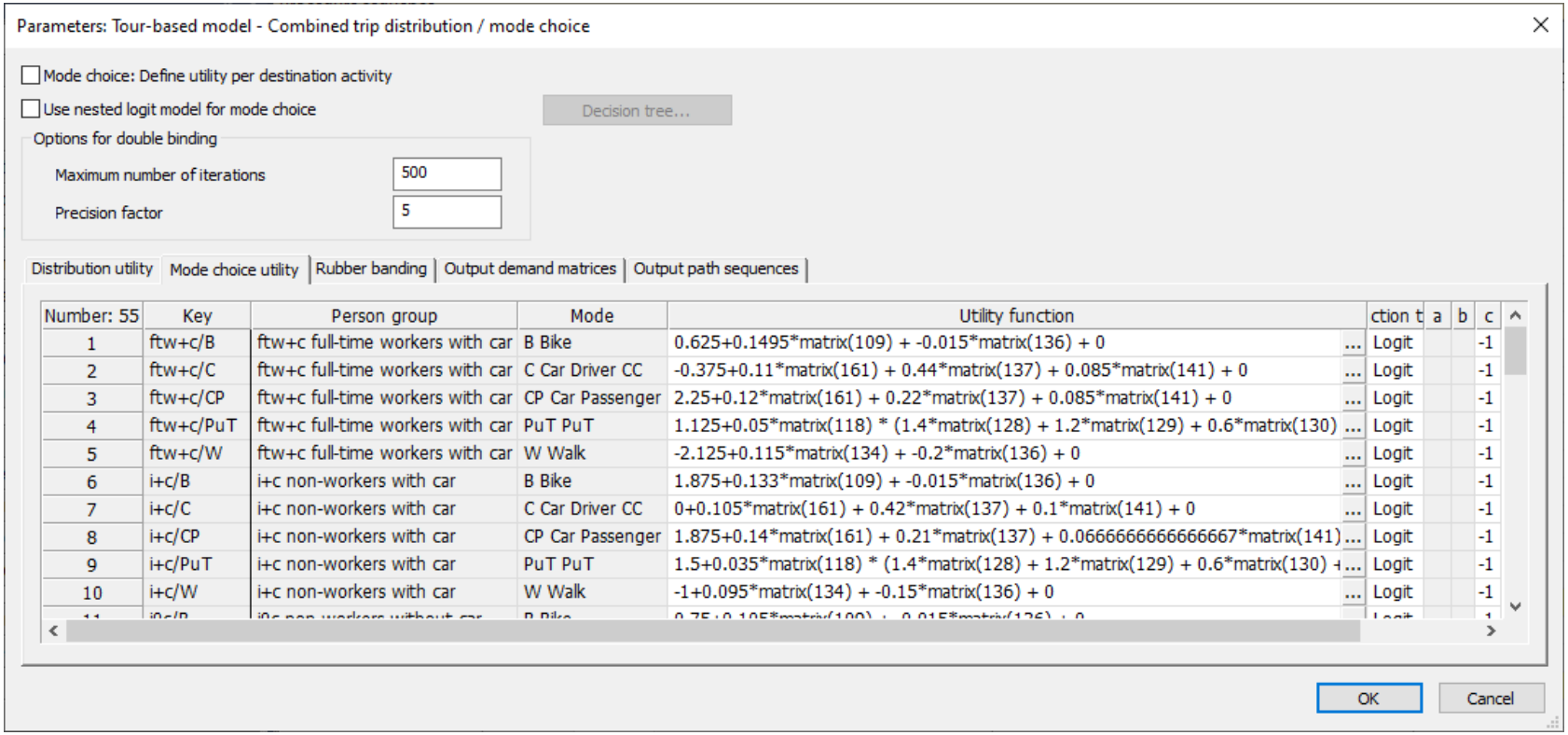
- Visem Trip Distribution
  - One utility function for each combination of person group and activity
  - Logsum and Adjustment of Municipality attraction per trip purpose here



1. OVERVIEW OF THE CALCULATION PROCEDURES

Demand Model

- Visem Mode Choice
  - One utility function for each combination of person group and mode
  - Utility expressed as impedance: the lower the value, the less attractive it is

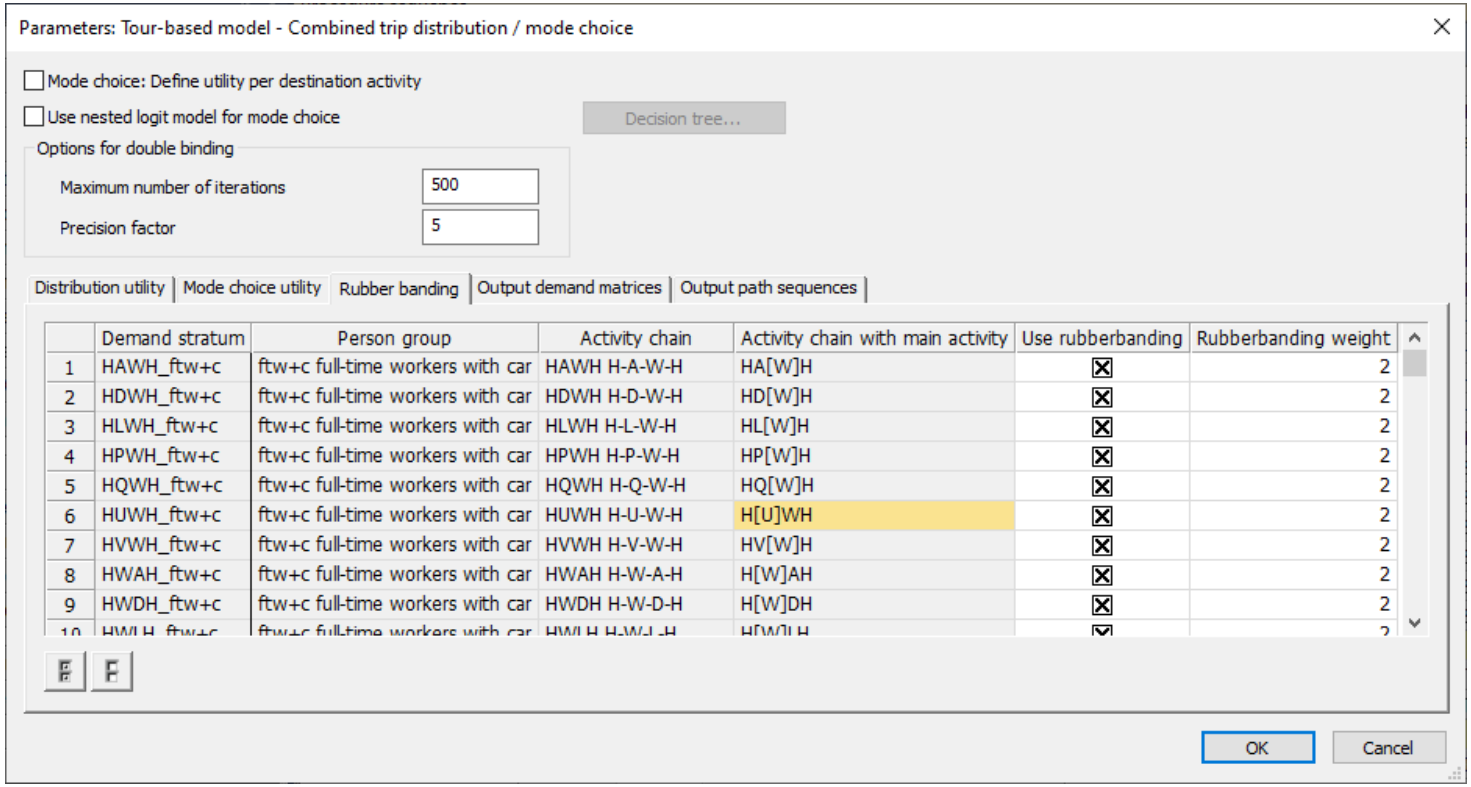


Number: 55	Key	Person group	Mode	Utility function	ction t	a	b	c
1	ftw+c/B	ftw+c full-time workers with car	B Bike	0.625+0.1495*matrix(109) + -0.015*matrix(136) + 0	Logit			-1
2	ftw+c/C	ftw+c full-time workers with car	C Car Driver CC	-0.375+0.11*matrix(161) + 0.44*matrix(137) + 0.085*matrix(141) + 0	Logit			-1
3	ftw+c/CP	ftw+c full-time workers with car	CP Car Passenger	2.25+0.12*matrix(161) + 0.22*matrix(137) + 0.085*matrix(141) + 0	Logit			-1
4	ftw+c/PuT	ftw+c full-time workers with car	PuT PuT	1.125+0.05*matrix(118) * (1.4*matrix(128) + 1.2*matrix(129) + 0.6*matrix(130)	Logit			-1
5	ftw+c/W	ftw+c full-time workers with car	W Walk	-2.125+0.115*matrix(134) + -0.2*matrix(136) + 0	Logit			-1
6	i+c/B	i+c non-workers with car	B Bike	1.875+0.133*matrix(109) + -0.015*matrix(136) + 0	Logit			-1
7	i+c/C	i+c non-workers with car	C Car Driver CC	0+0.105*matrix(161) + 0.42*matrix(137) + 0.1*matrix(141) + 0	Logit			-1
8	i+c/CP	i+c non-workers with car	CP Car Passenger	1.875+0.14*matrix(161) + 0.21*matrix(137) + 0.0666666666666667*matrix(141)	Logit			-1
9	i+c/PuT	i+c non-workers with car	PuT PuT	1.5+0.035*matrix(118) * (1.4*matrix(128) + 1.2*matrix(129) + 0.6*matrix(130) +	Logit			-1
10	i+c/W	i+c non-workers with car	W Walk	-1+0.095*matrix(134) + -0.15*matrix(136) + 0	Logit			-1

1. OVERVIEW OF THE CALCULATION PROCEDURES

Demand Model

- Visem Rubberbanding
  - Dependent on main activity in chain (for example work)
  - Higher weight → secondary purpose closer between home and main activity

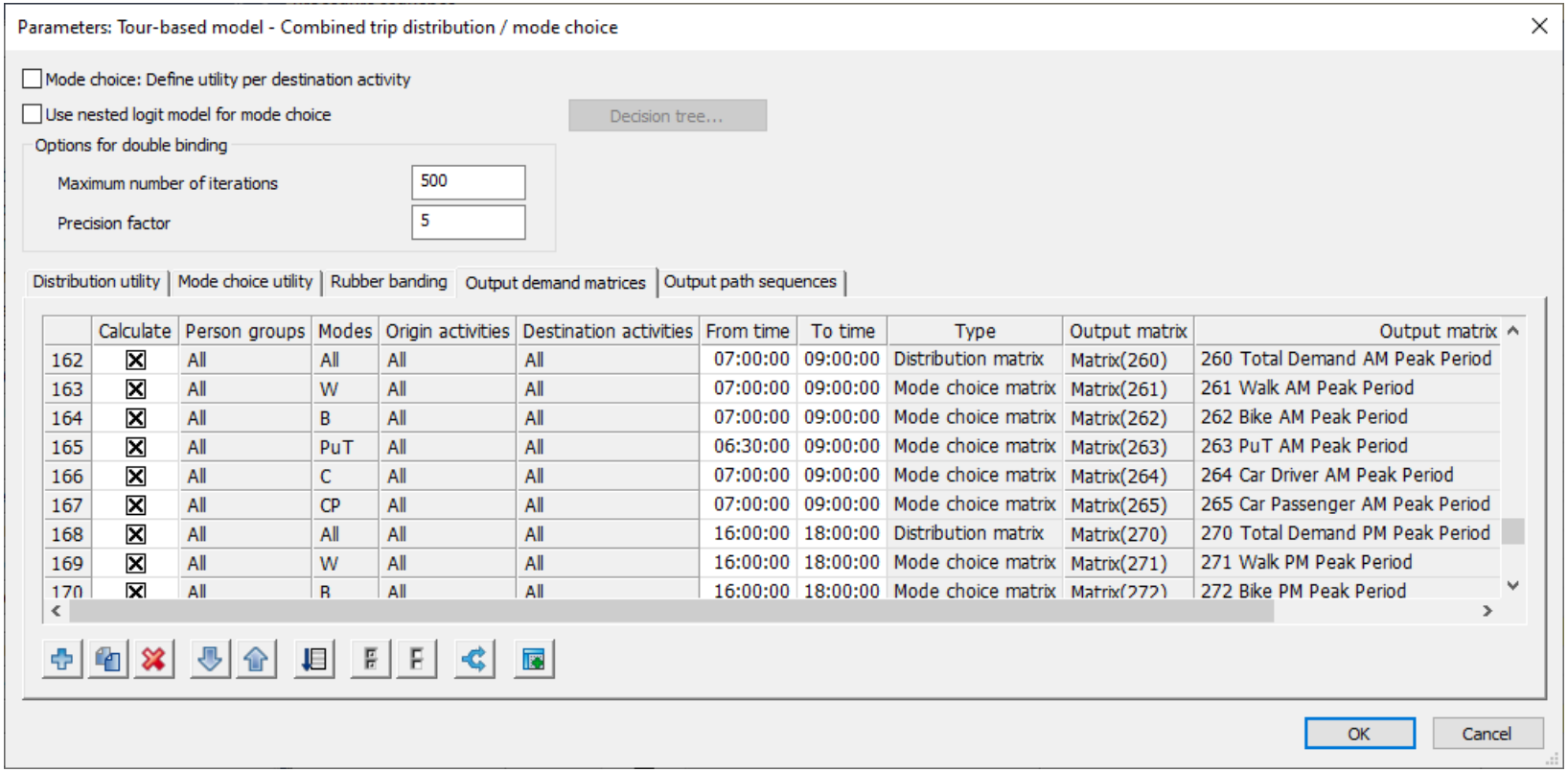


	Demand stratum	Person group	Activity chain	Activity chain with main activity	Use rubberbanding	Rubberbanding weight
1	HAWH_ftw+c	ftw+c full-time workers with car	HAWH H-A-W-H	HA[W]H	☒	2
2	HDWH_ftw+c	ftw+c full-time workers with car	HDWH H-D-W-H	HD[W]H	☒	2
3	HLWH_ftw+c	ftw+c full-time workers with car	HLWH H-L-W-H	HL[W]H	☒	2
4	HPWH_ftw+c	ftw+c full-time workers with car	HPWH H-P-W-H	HP[W]H	☒	2
5	HQWH_ftw+c	ftw+c full-time workers with car	HQWH H-Q-W-H	HQ[W]H	☒	2
6	HUWH_ftw+c	ftw+c full-time workers with car	HUWH H-U-W-H	H[U]WH	☒	2
7	HVWH_ftw+c	ftw+c full-time workers with car	HVWH H-V-W-H	HV[W]H	☒	2
8	HWAH_ftw+c	ftw+c full-time workers with car	HWAH H-W-A-H	H[W]AH	☒	2
9	HWDH_ftw+c	ftw+c full-time workers with car	HWDH H-W-D-H	H[W]DH	☒	2
10	HWLH_ftw+c	ftw+c full-time workers with car	HWLH H-W-L-H	H[W]LH	☒	2

1. OVERVIEW OF THE CALCULATION PROCEDURES

Demand Model

- Visem Output Matrice
  - Possible for each combination of person group, mode, origin or destination activities, time periods



	Calculate	Person groups	Modes	Origin activities	Destination activities	From time	To time	Type	Output matrix	Output matrix
162	☒	All	All	All	All	07:00:00	09:00:00	Distribution matrix	Matrix(260)	260 Total Demand AM Peak Period
163	☒	All	W	All	All	07:00:00	09:00:00	Mode choice matrix	Matrix(261)	261 Walk AM Peak Period
164	☒	All	B	All	All	07:00:00	09:00:00	Mode choice matrix	Matrix(262)	262 Bike AM Peak Period
165	☒	All	PuT	All	All	06:30:00	09:00:00	Mode choice matrix	Matrix(263)	263 PuT AM Peak Period
166	☒	All	C	All	All	07:00:00	09:00:00	Mode choice matrix	Matrix(264)	264 Car Driver AM Peak Period
167	☒	All	CP	All	All	07:00:00	09:00:00	Mode choice matrix	Matrix(265)	265 Car Passenger AM Peak Period
168	☒	All	All	All	All	16:00:00	18:00:00	Distribution matrix	Matrix(270)	270 Total Demand PM Peak Period
169	☒	All	W	All	All	16:00:00	18:00:00	Mode choice matrix	Matrix(271)	271 Walk PM Peak Period
170	☒	All	B	All	All	16:00:00	18:00:00	Mode choice matrix	Matrix(272)	272 Bike PM Peak Period

2. CONGESTION CHARGING IMPLEMENTATION

Implementation - Approach

- CC taken into account in Demand Model and in Assignment Model

- 3 Steps to calculate CC cost for demand model:
  - Identify ODs passing CC stations → PrT Skims using link type UDAs
  - Verification of ODs passing/in/out Backa → Skim Matrix 0 (no CC) /1 (CC)
  - Application of CC Toll Value to 0/1 skim → OD Skim Matrix with CC Value for demand model

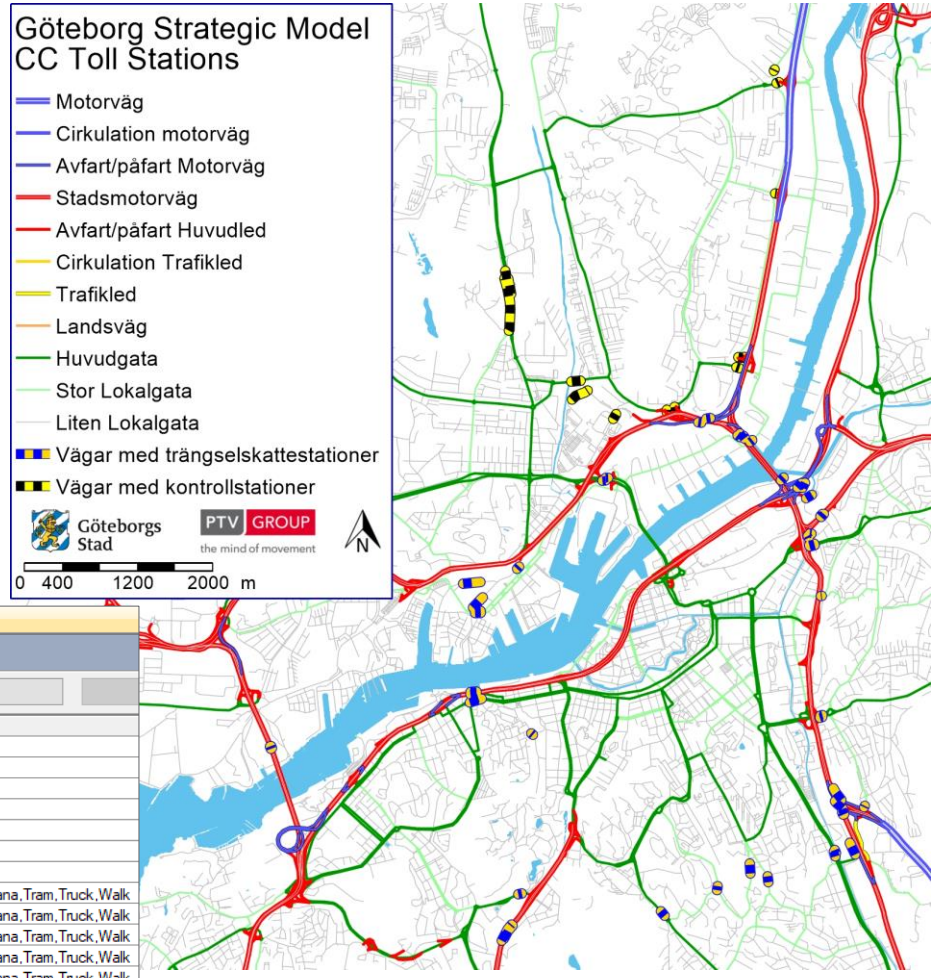
- Demand Model uses CC skim as one of the factors influencing mode choice and distribution

- Assignment Model
  - Calculation of threshold value between routes passing CC Toll stations and routes not passing CC Toll stations
  - Using Value of time and the threshold value in a lognormal function, the share between paying and not-paying demand for each OD is calculated
    - → Split of car demand according to share paying/not paying
  - Assignment of paying and not-paying demand segments

2. CONGESTION CHARGING IMPLEMENTATION

Implementation - Network

- Network
  - 13x3 specific link types closed to non-paying demand with “marker” UDA (Toll Station, Backa Exemption, Backa Control Point)
  - CC UDAs used in PrT skims, influencing demand model and assignment route choice



List (Link types)

Select list layout... | Min. Max. Ø Σ

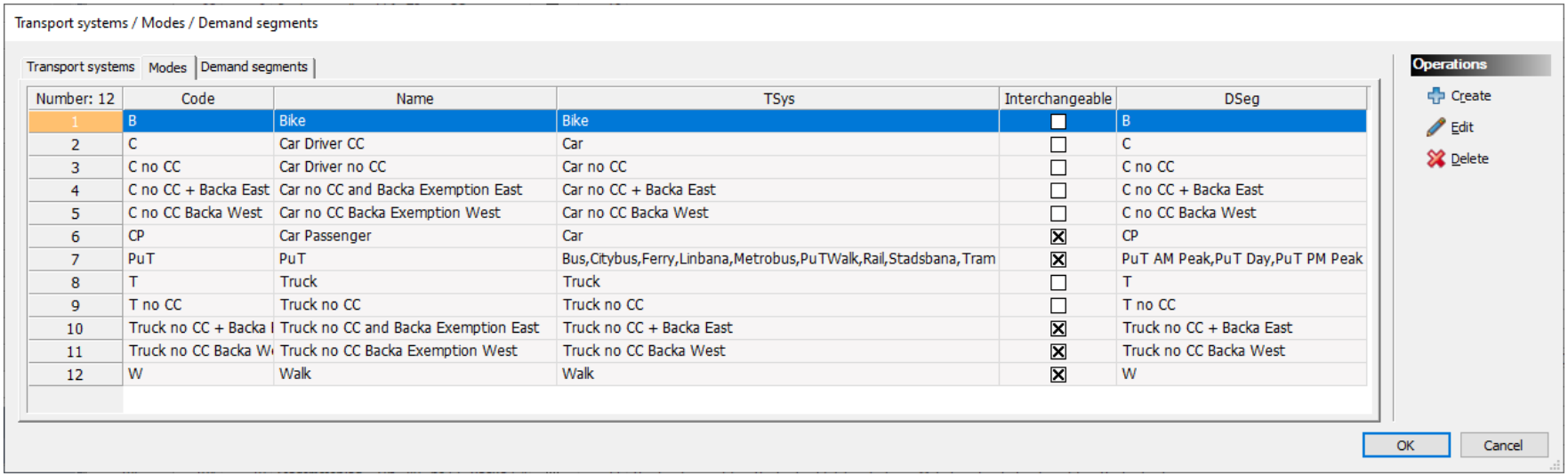
Links: Standard values... | Adjust link types... | Group by global type

Number: 128	No	GType	Name	Strict	Rank	TSysSet
76	75	7	Avfart/påfart, Motorväg - 2 kf - 70 - no CC	☒	8	Bus,Car,Citybus,Linbana,Metrobus,Truck
77	76	7	Avfart/påfart, Motorväg - 1 kf - 70 - no CC	☒	9	Bus,Car,Citybus,Linbana,Metrobus,Truck
78	77	7	Stadsmotorväg - 3 kf - 70 - no CC	☒	12	Bus,Car,Citybus,Linbana,Metrobus,Truck
79	78	7	Stadsmotorväg - 2 kf - 80 - no CC	☒	14	Bus,Car,Citybus,Linbana,Metrobus,Truck
80	79	7	Stadsmotorväg - 2 kf - 70 - no CC	☒	15	Bus,Car,Citybus,Linbana,Metrobus,Truck
81	80	8	Stadsmotorväg - 1 kf - 70 - no CC	☒	16	Bus,Car,Citybus,Linbana,Metrobus,Truck
82	81	8	Avfart/påfart, Huvudled - 1 kf - 50 - no CC	☒	18	Bus,Car,Citybus,Linbana,Metrobus,Truck,Walk
83	82	8	Huvudgata - 3 kf - 50 - no CC	☒	41	Bike,Bus,Car,Citybus,Linbana,Metrobus,Stadsbana,Tram,Truck,Walk
84	83	8	Huvudgata - 2 kf - 50 - no CC	☒	42	Bike,Bus,Car,Citybus,Linbana,Metrobus,Stadsbana,Tram,Truck,Walk
85	84	8	Huvudgata - 1 kf - 50 - no CC	☒	43	Bike,Bus,Car,Citybus,Linbana,Metrobus,Stadsbana,Tram,Truck,Walk
86	85	8	Stor Lokalgata - 2 kf - 50 - no CC	☒	52	Bike,Bus,Car,Citybus,Linbana,Metrobus,Stadsbana,Tram,Truck,Walk
87	86	8	Stor Lokalgata - 1 kf - 50 - no CC	☒	53	Bike,Bus,Car,Citybus,Linbana,Metrobus,Stadsbana,Tram,Truck,Walk
88	87	8	Liten Lokalgata - 1 kf - 50 - no CC	☒	61	Bike,Bus,Car,Citybus,Linbana,Metrobus,Stadsbana,Tram,Truck,Walk

2. CONGESTION CHARGING IMPLEMENTATION

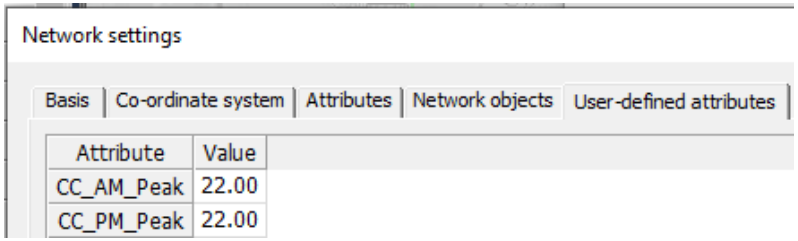
Implementation - Network

- Demand segments/Modes/Transport Systems
  - Car/Truck paying
  - Car/Truck not paying (2014)
  - Car/Truck not paying + access Backa East (2018 onwards)
  - Car/Truck not paying access Backa West (2018 onwards)



Number: 12	Code	Name	TSys	Interchangeable	DSeg
1	B	Bike	Bike	☐	B
2	C	Car Driver CC	Car	☐	C
3	C no CC	Car Driver no CC	Car no CC	☐	C no CC
4	C no CC + Backa East	Car no CC and Backa Exemption East	Car no CC + Backa East	☐	C no CC + Backa East
5	C no CC Backa West	Car no CC Backa Exemption West	Car no CC Backa West	☐	C no CC Backa West
6	CP	Car Passenger	Car	☒	CP
7	PuT	PuT	Bus,Citybus,Ferry,Linbana,Metrobus,PuTWalk,Rail,Stadsbana,Tram	☒	PuT AM Peak,PuT Day,PuT PM Peak
8	T	Truck	Truck	☐	T
9	T no CC	Truck no CC	Truck no CC	☐	T no CC
10	Truck no CC + Backa I	Truck no CC and Backa Exemption East	Truck no CC + Backa East	☒	Truck no CC + Backa East
11	Truck no CC Backa W	Truck no CC Backa Exemption West	Truck no CC Backa West	☒	Truck no CC Backa West
12	W	Walk	Walk	☒	W

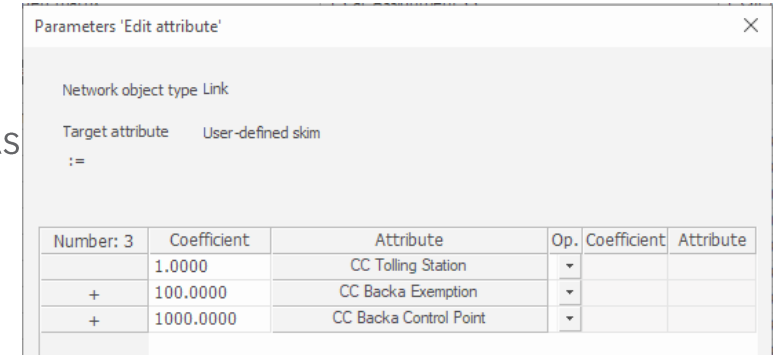
- CC Toll Value stored as network UDA in SEK



Attribute	Value
CC_AM_Peak	22.00
CC_PM_Peak	22.00

2. CONGESTION CHARGING IMPLEMENTATION

Implementation – Demand Model



- PrT Skim matrix for CC OD's using Link Type UDAs
  - CC Tolling Station (value 1)
  - CC Backa Exemption (value 1)
  - CC Backa Control Point (value 1)
- Skim matrix formula:
  - 1x CC Tolling Station + 100x CC Backa Exemption + 1000x Backa Control Point
  - Possible Results
    - Paths passing no CC Tolling Station: value 0 ➔ no CC
    - Paths passing Backa Exemption Tolling Station or Backa Control Point: values like 100, 200… 1000, 200 ➔ no CC
    - Paths passing one or more regular CC Tolling Station: values 0.5 – 99 ➔ CC
    - Passing one or more regular and one or more Backa Exemption or Backa Control Point station: values like 101, 1101, 2203 ➔ CC

```
Matrix([NO]=140):=
IF(Matrix([NO] = 139)=0 |Matrix([NO] = 139)= 100|
Matrix([NO] = 139)= 200|Matrix([NO] = 139)= 300|
Matrix([NO] = 139)= 400|Matrix([NO] = 139)= 500|
Matrix([NO] = 139)= 600|Matrix([NO] = 139)= 700|
Matrix([NO] = 139)= 800|Matrix([NO] = 139)= 900|
Matrix([NO] = 139)= 1000|Matrix([NO] = 139)= 2000|
Matrix([NO] = 139)= 3000|Matrix([NO] = 139)= 4000|
Matrix([NO] = 139)= 5000|Matrix([NO] = 139)= 6000|
Matrix([NO] = 139)= 7000|Matrix([NO] = 139)= 8000|
Matrix([NO] = 139)= 9000,0,1)
```

- Value written into Skim matrix
- Multiplied with CC value to be used in Demand Model
  - Value of Time depending on Person Group
  - Less important for employed persons (0.085)
  - More important for non-working persons (0.100)
  - Different for car passengers

2. CONGESTION CHARGING IMPLEMENTATION

Implementation – Assignment Model

- Choice of Road User
  - Using toll road to reach destination or to shorten travel time, incurring costs
  - Avoiding toll road on a usually longer route

- Model needs to distinguish 3 (2014-2017 or 4 (2018 onwards situations)
  - 1. ODs that need to pass Congestion Charge Stations: Backa to Göteborg Centrum
  - 2. ODs that do not need to pass Congestion Charge Stations: Borås to Partille
  - 3. ODs than can, but do not need to pass Congestion Charge Stations: Kungälv to Torslanda via E6 (paying) or via Norrleden/Hisingsleden (not paying)
  - 4. ODs from Backa to the north or vice versa (Backa Exemption from 2018 onwards)

2. CONGESTION CHARGING IMPLEMENTATION

Implementation – Assignment Model

- Standard VISUM road toll assignment procedure (link, area or matrix toll) currently not feasible for Vignette style CC system
  - ➔ Implementation of Sampers approach
  - Demand model calculates car demand for trip purposes "work", "professional", remaining trip purposes grouped into "other"
  - splitting car demand using lognormal function into CC-paying and non-CC-paying demand
  - Assign car demand separately onto network, where links with CC-Toll stations are closed to non-CC-paying demand

- Threshold value calculated in VISUM for each OD, value used in lognormal function

$$\hat{\alpha} = \frac{C + \beta D_P - \beta D_N}{T_N - T_P}$$

  - C: Congestion Charge,
  - D: Distance paying (p) or non-paying(n)
  - T: Travel Time paying (p) or non-paying(n)
  - β: coefficient

2. CONGESTION CHARGING IMPLEMENTATION

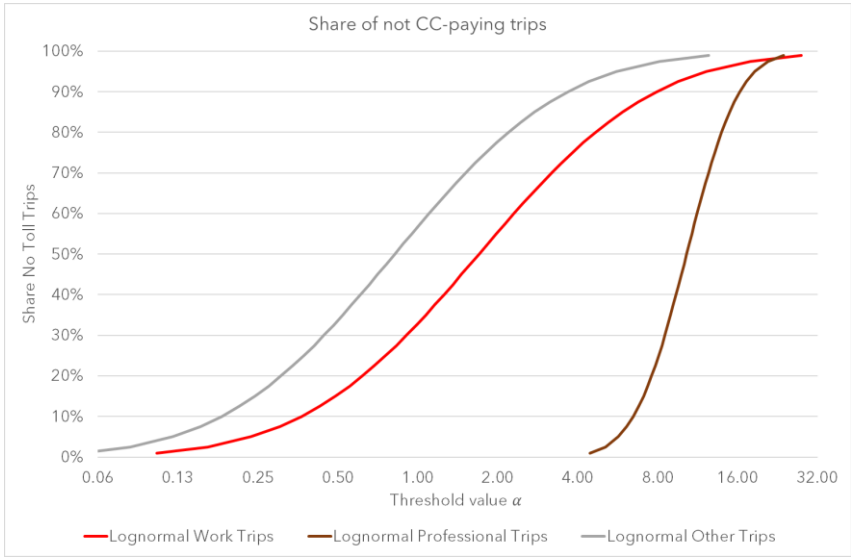
Implementation – Assignment Model

- Lognormal function not available standalone in VISUM (only as part of Tribut) ➔ values precalculated in Excel
  - Needs VoT, StDev, beta (from Sampers), Toll cost (peak hour),

Trip Purpose	VoT (SEK/h)	StDev	Toll cost (SEK)	beta
Work	102	1.22	22.00	1.04
Professional Trips	617	0.36	22.00	1.04
Other	49	1.17	22.00	1.04

- High Alpha = Low share of CC

- Example "other trips":
  - D_p: 10 km
  - D_n: 15 km
  - T_p: 10 min
  - T_n: 30 min
  - $\hat{\alpha}$: 0.85
    - 50% paying CC

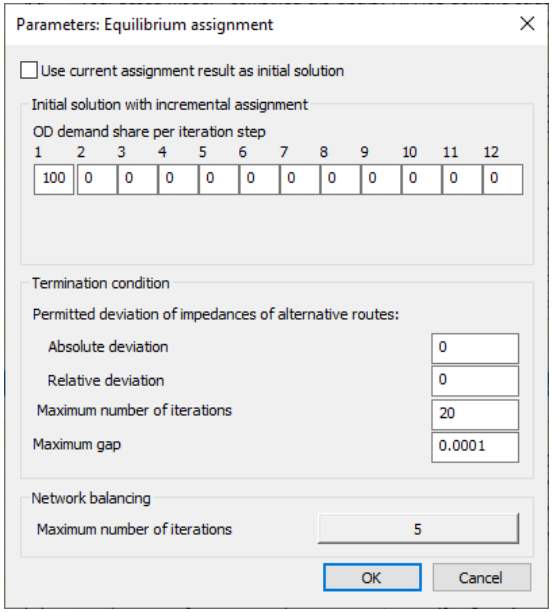


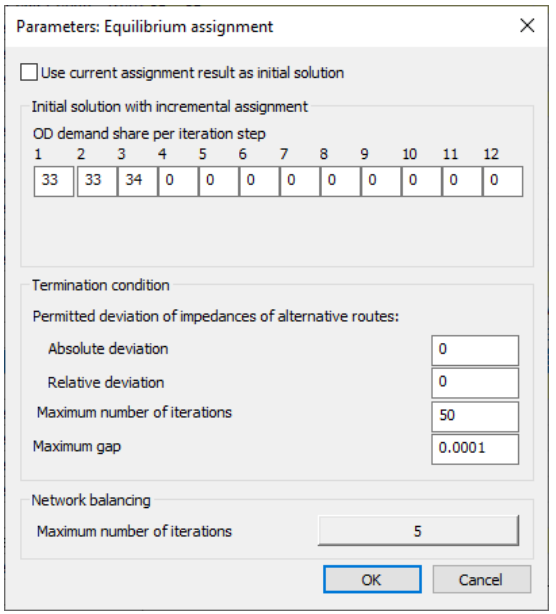
- Demand Split into CC paying and no-CC-paying ➔ standard EQ assignment

3. PRT AND PUT ASSIGNMENT

PrT Assignment

- Standard equilibrium assignment
  - Truck
    - Demand: CC-paying and non-CC-paying demand from Sampers
    - 100% split (= no demand split per iteration)
    - Max 20 iterations
    - Standard maximum gap 0.0001
    - Procedure duration: 40s, 2 iterations
  - Cars
    - Demand: CC-paying and non-CC-paying demand (from demand model), external matrices for exchange traffic and internal commercial traffic
    - 33/33/34 split per iteration step to help balancing routes
    - Max 50 iterations
    - Standard maximum gap 0.0001
    - Procedure duration: 10 min, 35 iterations

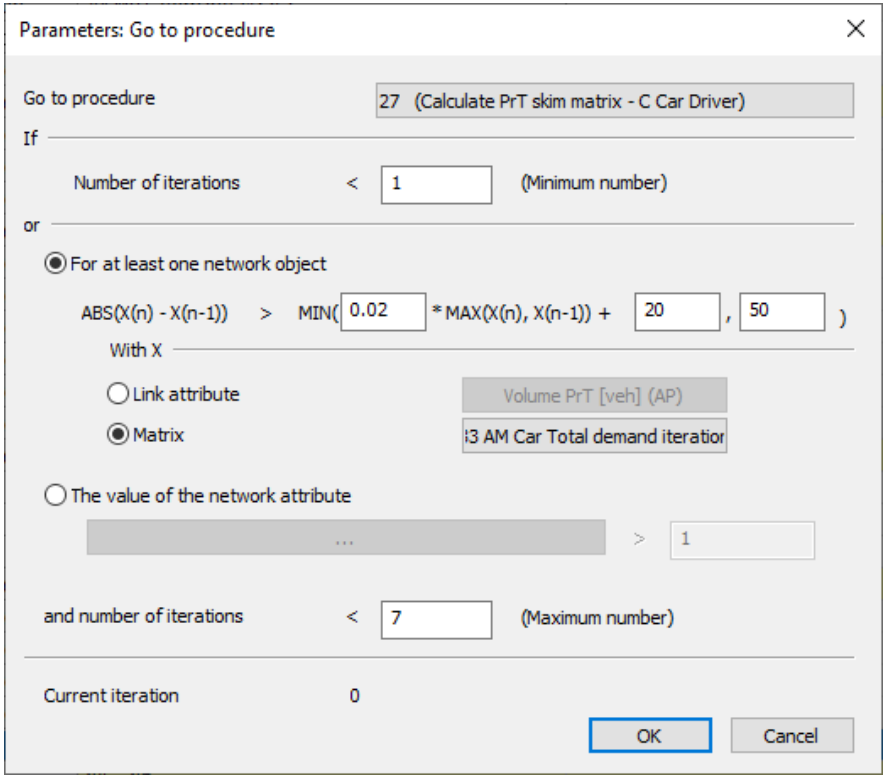




3. PRT AND PUT ASSIGNMENT

PrT Assignment

- Feedback loop for demand model
  - AM Peak used for all time periods, as the mode choice is usually done at the beginning of the trip chain
  - feedback loop using 30% of current AM Peak demand (cars) + 70% of last iterations AM Peak demand (cars)
    → Quicker stabilization of demand model
  - 4 iterations in 2014 AM Peak



3. PRT AND PUT ASSIGNMENT

PuT Assignment

- PuT Offer
  - 2014:
    - 3 operators
      - Västtrafik
      - Öresundståg
      - SJ
    - 290 lines
    - 1400 line routes
    - 2300 time profiles
    - 16000 vehicle journeys
  - 2035:
    - 3 operators
    - 315 lines
    - 1400 line routes
    - 2200 time profiles
    - 33000 vehicle journeys

Timetable (tabular)

108 vehicle journeys					
No	498403	498404	498405	498406	498407
Name					
LineName	279_5001_SLT_2	279_5001_SLT_2	279_5001_SLT_2	279_5001_SLT_2	279_5001_SLT_2
DirectionCode	>	>	>	>	>
Concatenate:VehJourneySections\ValidDays\Code	tägl.	tägl.	tägl.	tägl.	tägl.
FromTProfItemIdentifier	1: 7425668 74256	1: 7425668 74256	1: 7425668 74256	1: 7425668 74256	1: 7425668 74256
Dep	06:54:00	07:04:00	07:14:00	07:22:00	07:31:00
Arr	07:38:00	07:48:00	07:58:00	08:06:00	08:15:00
ToTProfItemIdentifier	29: 7416368 7416	29: 7416368 7416	29: 7416368 7416	29: 7416368 7416	29: 7416368 7416
OperatorIdentifier	24 Västtrafik	24 Västtrafik	24 Västtrafik	24 Västtrafik	24 Västtrafik
Count:VehJourneySections	1	1	1	1	1
IsCoupled	☐	☐	☐	☐	☐

108 vehicle journey sections					
VehCombIdentifier	2 M31	2 M31	2 M31	2 M31	2 M31
ValidDaysIdentifier	1 tägl.	1 tägl.	1 tägl.	1 tägl.	1 tägl.
FromTProfItemIdentifier	1: 7425668 74256	1: 7425668 74256	1: 7425668 74256	1: 7425668 74256	1: 7425668 74256
Dep	06:54:00	07:04:00	07:14:00	07:22:00	07:31:00
Arr	07:38:00	07:48:00	07:58:00	08:06:00	08:15:00
ToTProfItemIdentifier	29: 7416368 7416	29: 7416368 7416	29: 7416368 7416	29: 7416368 7416	29: 7416368 7416
PrePrepTime	0min	0min	0min	0min	0min
PostPrepTime	0min	0min	0min	0min	0min

ObjNo	ObjCode	ObjName	Arr / Dep	Arr / Dep	Arr / Dep	Arr / Dep	Arr / Dep
7425668	7425668	Tynnered Opaltorget	06:54:00	07:04:00	07:14:00	07:22:00	07:31:00
7425684	7425684	Tynnered Smaragdgata	06:55:00	07:05:00	07:15:00	07:23:00	07:32:00
7425613	7425613	Tynnered Briljantgatan	06:56:00	07:06:00	07:16:00	07:24:00	07:33:00
7415565	7415565	Frölunda Torg	06:58:00	07:08:00	07:18:00	07:26:00	07:35:00
7420480	7420480	Frölunda Positivgatan	06:59:00	07:09:00	07:19:00	07:27:00	07:36:00
7425662	7425662	Frölunda Musikvägen	07:00:00	07:10:00	07:20:00	07:28:00	07:37:00

3. PRT AND PUT ASSIGNMENT

PuT Assignment

- PuT Demand
  - Demand straight from Demand Model, no external data available
  - Added 30 min to demand period to take into account long distance trips
    - AM Peak: demand from 06:30 – 09:00
    - PM Peak: demand from 15:30 – 18:00
    - All-Day: demand from 00:00 – 24:00
  - Assignment period
    - AM Peak: 07:00 – 09:00 with 24h arrival extension
    - PM Peak: 16:00 – 18:00 with 24h arrival extension
    - All-Day: 00:00 – 24:00 with 24h arrival extension

3. PRT AND PUT ASSIGNMENT

PuT Assignment

- Timetable
  - Sets the departure time and stop of each vehicle journey
  - Uses Travel Time Profiles for runtimes between stop points

→ Departure times for each vehicle journey and each stop point

Timetable (tabular)

108 vehicle journeys				
No	498403	498404	498405	498406
Name				
LineName	279_5001_SLT_2	279_5001_SLT_2	279_5001_SLT_2	279_5001_SLT_2
DirectionCode	>	>	>	>
Concatenate:VehJourneySections\ValidDays\Code	tägl.	tägl.	tägl.	tägl.
FromTProfItemIdentifier	1: 7425668 74256	1: 7425668 74256	1: 7425668 74256	1: 7425668 74256
Dep	06:54:00	07:04:00	07:14:00	07:22:00
Arr	07:38:00	07:48:00	07:58:00	08:06:00
ToTProfItemIdentifier	29: 7416368 7416	29: 7416368 7416	29: 7416368 7416	29: 7416368 7416
OperatorIdentifier	24 Västtrafik	24 Västtrafik	24 Västtrafik	24 Västtrafik
Count:VehJourneySections	1	1	1	1
IsCoupled	☐	☐	☐	☐

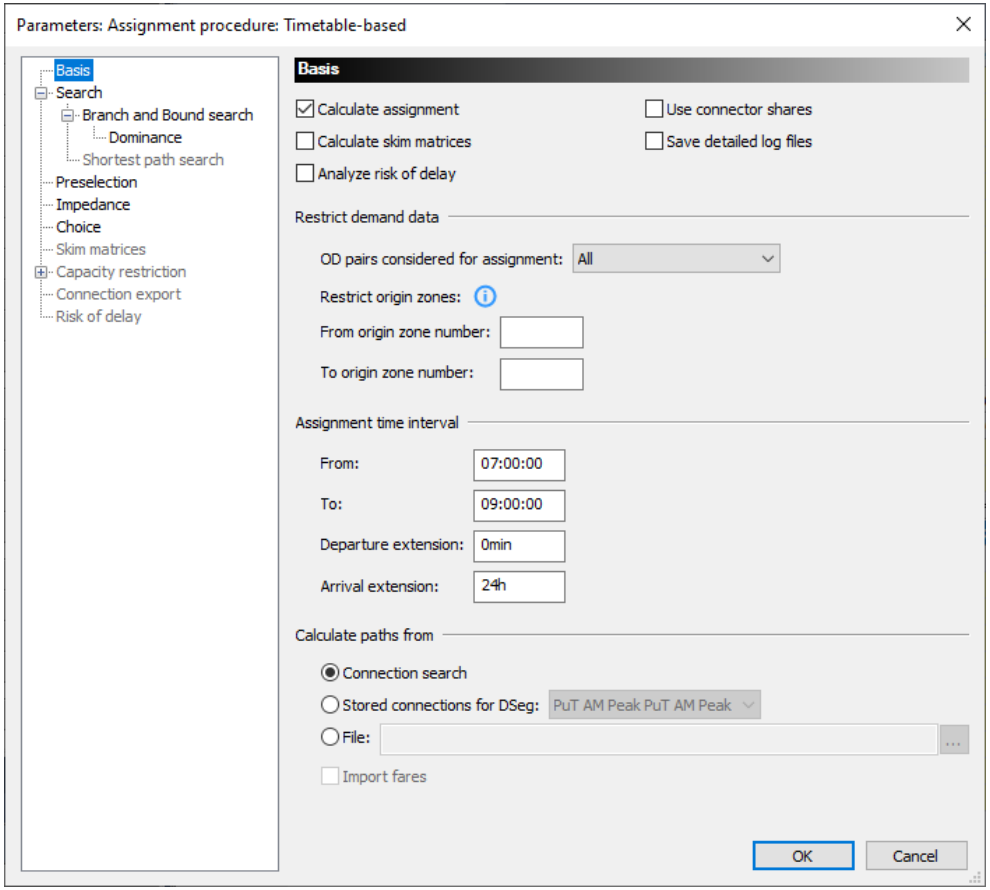
108 vehicle journey sections				
VehCombIdentifier	2 M31	2 M31	2 M31	2 M31
ValidDaysIdentifier	1 tägl.	1 tägl.	1 tägl.	1 tägl.
FromTProfItemIdentifier	1: 7425668 74256	1: 7425668 74256	1: 7425668 74256	1: 7425668 74256
Dep	06:54:00	07:04:00	07:14:00	07:22:00
Arr	07:38:00	07:48:00	07:58:00	08:06:00
ToTProfItemIdentifier	29: 7416368 7416	29: 7416368 7416	29: 7416368 7416	29: 7416368 7416
PrePrepTime	0min	0min	0min	0min
PostPrepTime	0min	0min	0min	0min

ObjNo	ObjCode	ObjName	Arr / Dep	Arr / Dep	Arr / Dep	Arr / Dep
7425668	7425668	Tynnered Opaltorget	06:54:00	07:04:00	07:14:00	07:22:00
7425684	7425684	Tynnered Smaragdgata	06:55:00	07:05:00	07:15:00	07:23:00
7425613	7425613	Tynnered Briljantgatan	06:56:00	07:06:00	07:16:00	07:24:00
7415565	7415565	Frölunda Torg	06:58:00	07:08:00	07:18:00	07:26:00
7420480	7420480	Frölunda Positivgatan	06:59:00	07:09:00	07:19:00	07:27:00
7425662	7425662	Frölunda Musikvägen	07:00:00	07:10:00	07:20:00	07:28:00

3. PRT AND PUT ASSIGNMENT

PuT Assignment

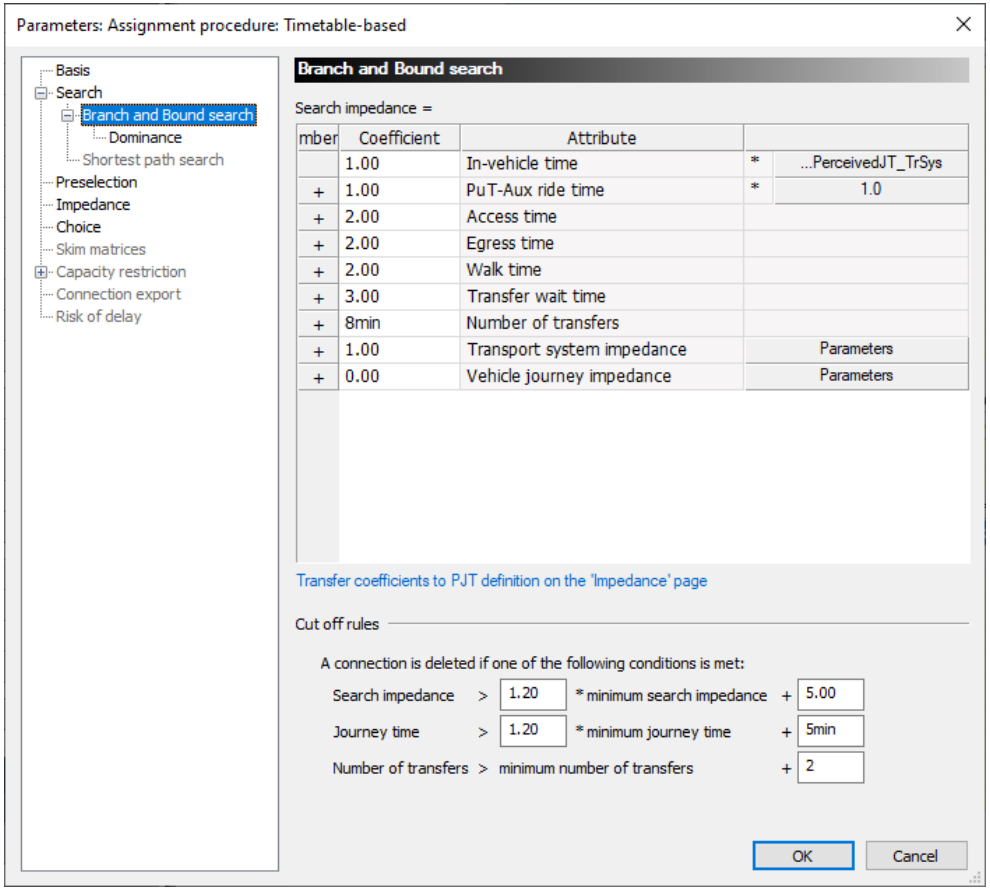
- Assignment parameters
  - Type “Timetable based assignment”
  - Stages:
    1. Connection Search for each OD
    2. Preselection filters out lower quality connections from step 1
    3. Impedance calculates utility of remaining connections from step 2
    4. Choice shares the demand over the remaining connections, using the utility from step 3



3. PRT AND PUT ASSIGNMENT

PuT Assignment

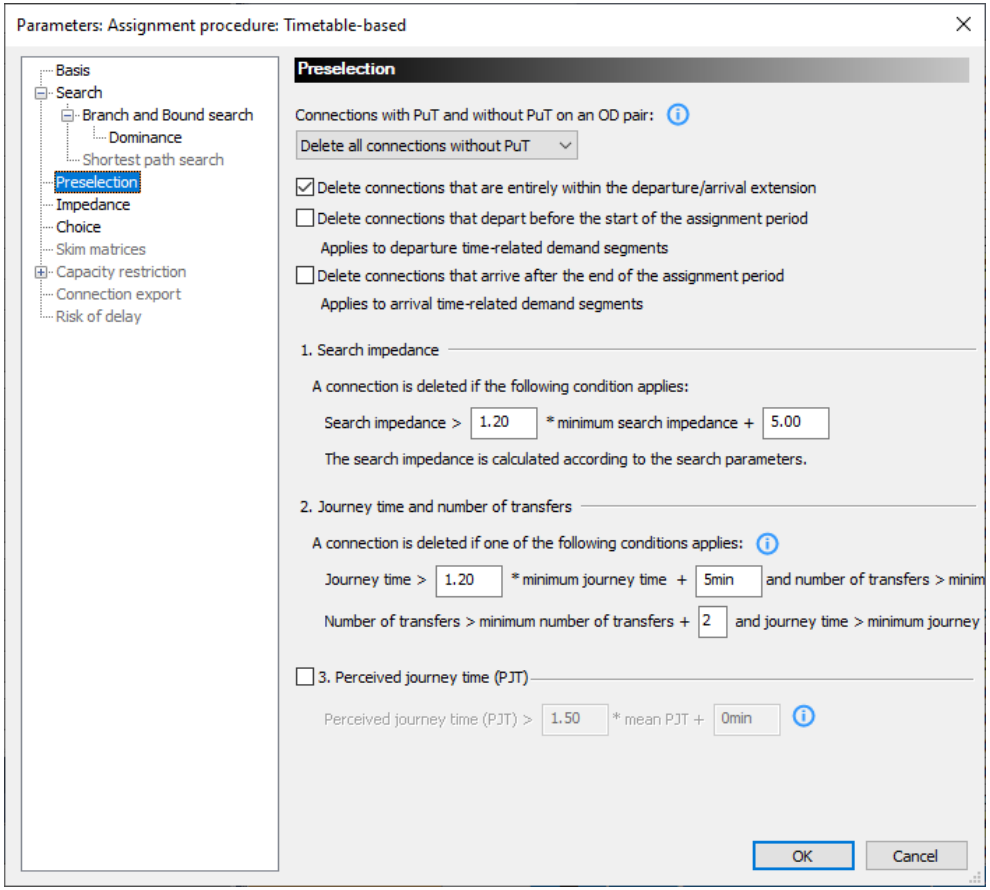
- Assignment parameters
  - Connection Search
    - Max 3 transfers
    - Walk times count double
    - Transfer wait times count triple
    - Each transfer adds 8 min
    - No specific transport system or vehicle journey impedance



3. PRT AND PUT ASSIGNMENT

PuT Assignment

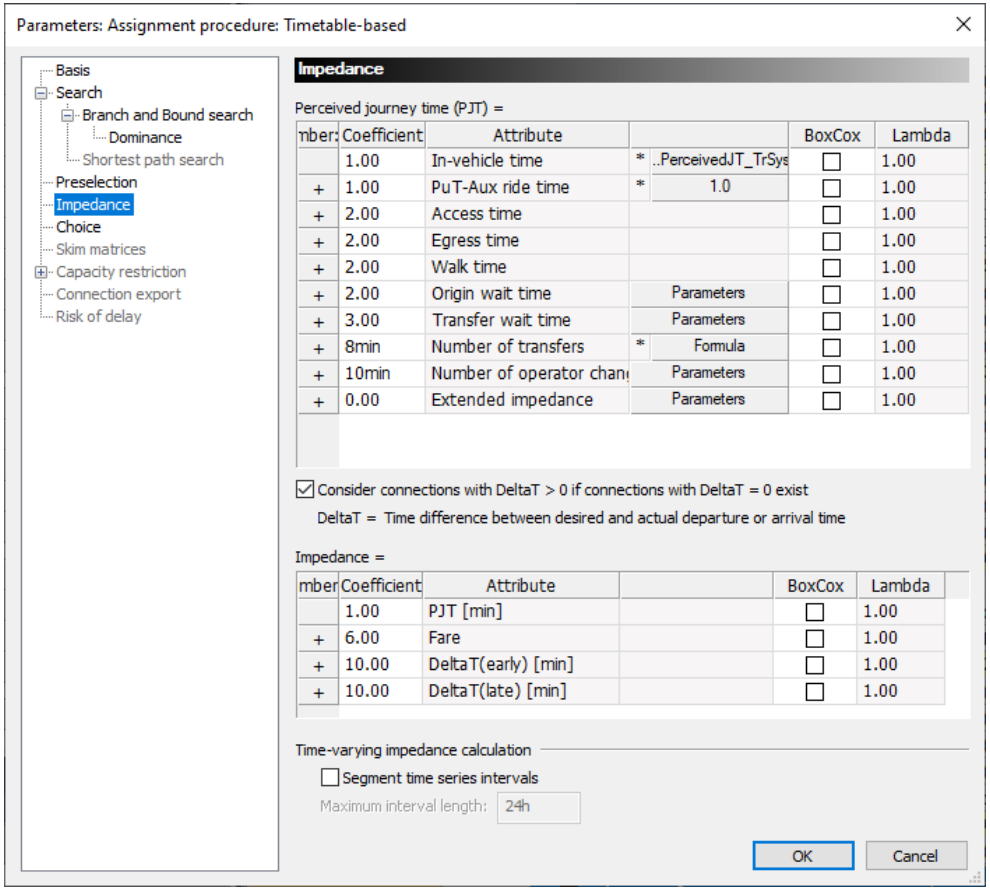
- Assignment parameters
  - Preselection
    - Connections only available in the departure or arrival extension are deleted
    - Connection is deleted if route is 20% + 5min longer than min search impedance or min journey time
    - Connection is deleted if number of transfers is 2 + min number of transfers



3. PRT AND PUT ASSIGNMENT

PuT Assignment

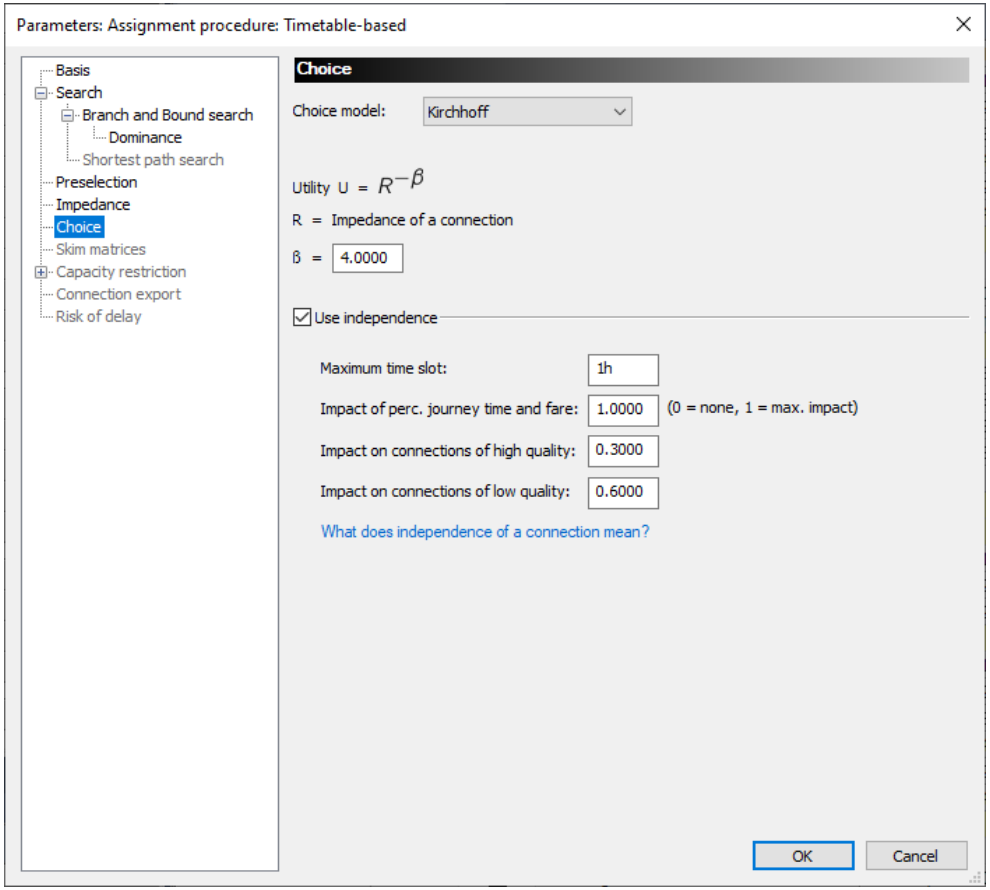
- Assignment parameters
  - Impedance
    - Utility = perceived journey time + Fare + time difference between desired and actual departure time
    - Same values as for connection search
    - + origin wait time counts double
    - + Operator change adds 10 min



3. PRT AND PUT ASSIGNMENT

PuT Assignment

- Assignment parameters
  - Choice
    - Impedance converted to utility
    - From Utility, demand shares are calculated
    - Choice Model: Kirchhoff
      - Uses ratio of impedances of different routes to distribute demand over connections
    - Standard parameters



3. PRT AND PUT ASSIGNMENT

PuT Assignment

- Results
  - Passengers per
    - line
    - line route
    - vehicle journey
    - Stop
      - Boarding
      - Alighting
      - Transfers
  - Number of transfers
  - Passenger.km
  - Vehicle.km

List (Vehicle journeys)

Select list layout...

Number: 16,236	Dep	Arr	LineRoute\Lin	DirectionCode	ServiceKm(AP)	PassKmTrav(AP)	PTripsUnlinked(A
916	15:05:00	16:18:00	6	<	25km	1466km	299
917	15:14:00	16:27:00	6	<	25km	1966km	369
918	15:23:00	16:36:00	6	<	25km	1466km	301
919	15:32:00	16:45:00	6	<	25km	1745km	373
920	15:41:00	16:54:00	6	<	25km	1761km	371
921	15:50:00	17:03:00	6	<	25km	1614km	328
922	15:59:00	17:12:00	6	<	25km	2014km	414
923	16:08:00	17:21:00	6	<	25km	2017km	457
924	16:17:00	17:30:00	6	<	25km	1654km	339
925	16:26:00	17:39:00	6	<	25km	1643km	325
926	16:35:00	17:48:00	6	<	25km	1594km	313
927	16:44:00	17:57:00	6	<	25km	2366km	408
928	16:53:00	18:06:00	6	<	25km	1428km	287
929	17:02:00	18:15:00	6	<	25km	1562km	324
930	17:11:00	18:24:00	6	<	25km	1481km	297
931	17:20:00	18:33:00	6	<	25km	1469km	311
932	17:29:00	18:42:00	6	<	25km	1289km	249
933	17:38:00	18:51:00	6	<	25km	1211km	262
934	17:47:00	19:00:00	6	<	25km	1180km	237
935	17:56:00	19:09:00	6	<	25km	1296km	264
936	18:05:00	19:18:00	6	<	25km	1285km	254

List (Stops)

Stops_TrSys

Number: 4,696	Name	NumLines	PassBoard_TS	PassBoard_TS	PassBoard_TS	PassAlight_TS	PassAlight_TS	PassAlight_TS	PassTransTotal(AP)
1	Centralen med omnejd	141	28864	32758	12588	28929	32018	13720	53476
2	Göteborg Hjalmar Brantingspl	74	15436	6774	0	15771	6398	0	19578
3	Frölunda Torg	46	9048	7371	0	8855	7467	0	11503
4	Göteborg Marklandsgatan	37	7887	7032	0	6791	7979	0	12596
5	Angered centrum	30	6452	5695	0	5904	6119	0	9501
6	Göteborg Brunnsparken	40	6451	18832	0	4436	20172	0	11255
7	Göteborg Svingeln	44	5544	6003	0	6677	5165	0	8445
8	Göteborg Korsvägen	48	5438	12889	0	5835	12514	0	9742
9	Lindholmen	18	5061	0	0	5512	0	0	205
10	Göteborg Vågmästareplatsen	38	4922	4986	0	4896	5069	0	6543
11	Partille centrum	23	3234	0	0	2912	0	0	2063
12	Kungsbacka station	42	3188	0	1987	3405	0	1834	4237
13	Göteborg Eketrägatan	25	2778	3214	0	2756	3212	0	4425
14	Radiomotet	21	2670	0	0	2634	0	0	2483
15	Göteborg Kungssten	32	2358	1866	0	2253	1949	0	3312
16	Göteborg Sahlgrenska Huvudentr	18	2351	8994	0	2774	8851	0	1709
17	Mölndal station	27	2152	0	1680	2178	0	1405	1965
18	Torslandakrysset	20	2136	0	0	2086	0	0	1222
19	Göteborg LinnÃ©platsen	19	2071	1713	0	2210	1774	0	1891
20	Sörredsvägen	34	1721	0	0	1713	0	0	1522

THANKS !

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