

CIE4801 Transportation and spatial modelling

Estimating base year matrices: NRM West 2004

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17/4/13

Content

- Background
- Process
- Some results
- Concluding remarks

1.

Background

Introduction

- LMS and NRM's are strategic transport models of the Ministry of Infrastructure and Environment
- LMS and NRM's are based on the pivot-point method
- Base-year matrices are thus crucial
- Base-year matrix calibration for 5 models simultaneously
- Main goal is maximal consistency
 - Between synthetic model and base-year matrices
 - Between NRM's and LMS and between NRM's



Simple project?

- Lot's of data
 - National travel survey (estimation of production and attraction models, trip length distributions, per travel purpose and total);
 - Road site interviews (as a target or for quality checks);
 - Special information for the harbours and airports;
 - Counts per time-of-day, separate for car and freight;
 - Networks;
 - Socio-economic data;
 - Other empirical information that can be of use
- Consistent data and modelling techniques for all projects
 - Zonal data, networks, counts, choice models, assignment, OD-estimation, procedures

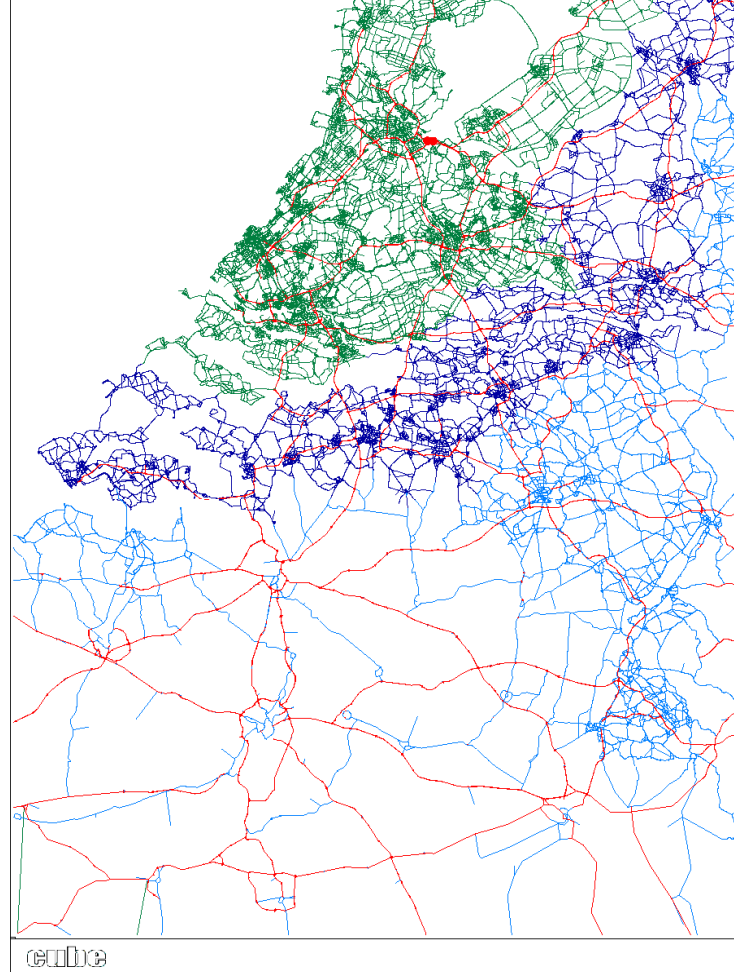
Size of the project

	# zones	# links	# counts
LMS	1.600	74.000	1.800
NRM North	2.900	100.000	1.900
NRM East	2.600	106.000	2.300
NRM West	3.500	130.000	2.900
NRM South	3.200	120.000	2.300

For each project 12 OD-matrices

- Freight and car (commuting, business, other)
- Morning peak, Evening peak, 24-hour

Network



Figuur 3.1: Afbakening studiegebied, invloedsgebied en buit

Mutaties tellingen

Het gebruikte tellingenbestand is gebaseerd op de eindversie van het t
schattingsproject dat eindigde in het najaar van 2009 en uitvoerig is besch
*Randstad 2004, Technische Rapportage 04 vs. 01, Basismatrices 2004, p
2009*.

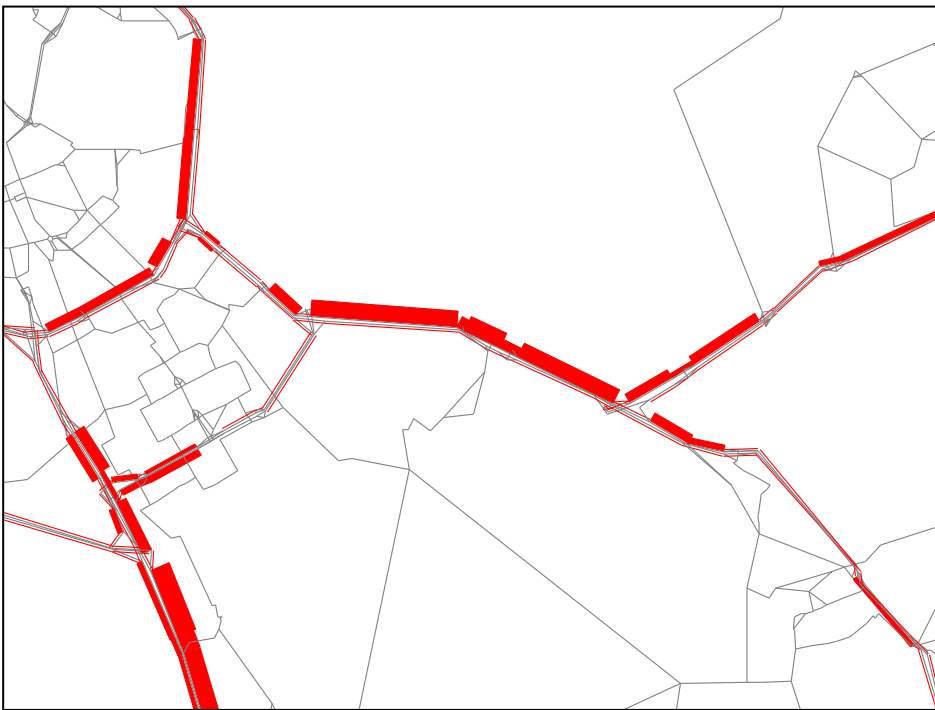
Vervolgens zijn hier gedurende het project de volgende bewerkingen op uitge

Assignment method: Qblok

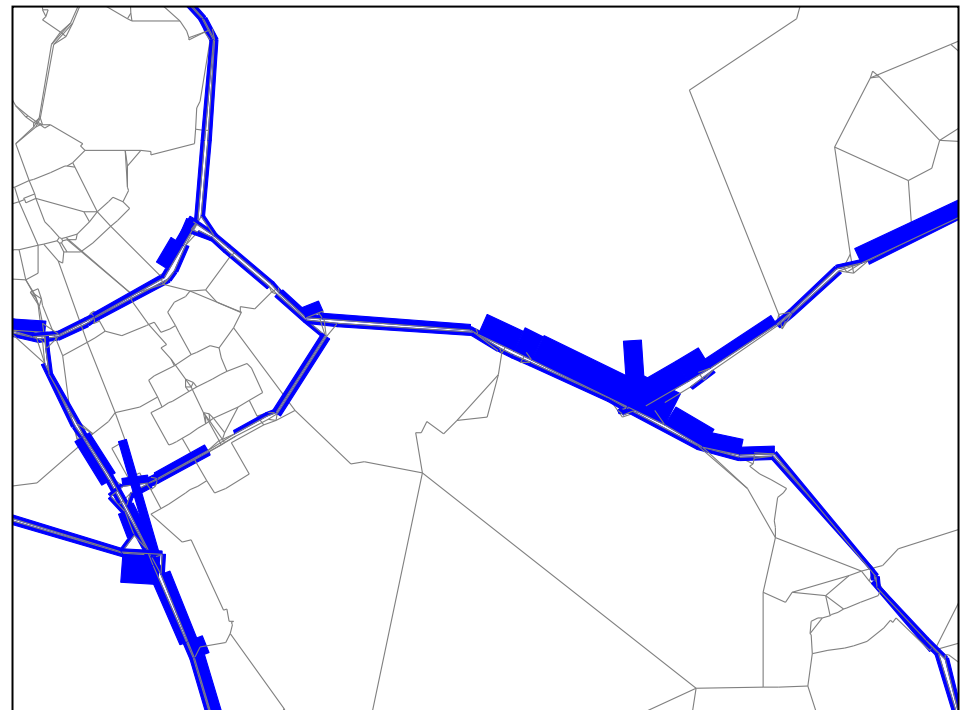
- Qblok is a multi-class DUE-assignment that considers blocking back
- Consequence is that vehicles are blocked and can thus not reach their destination within the period that is modelled
- Thus a difference between actual flow on the network and the potential flow that wants to use the network in that period
=> **potential demand concept**
- OD matrix describes potential demand and Qblok determines which trips “fit” within the peak
- So which counts should be used: Observed flows or potential flows?

Impact of blocking back

Without blocking back



With blocking back

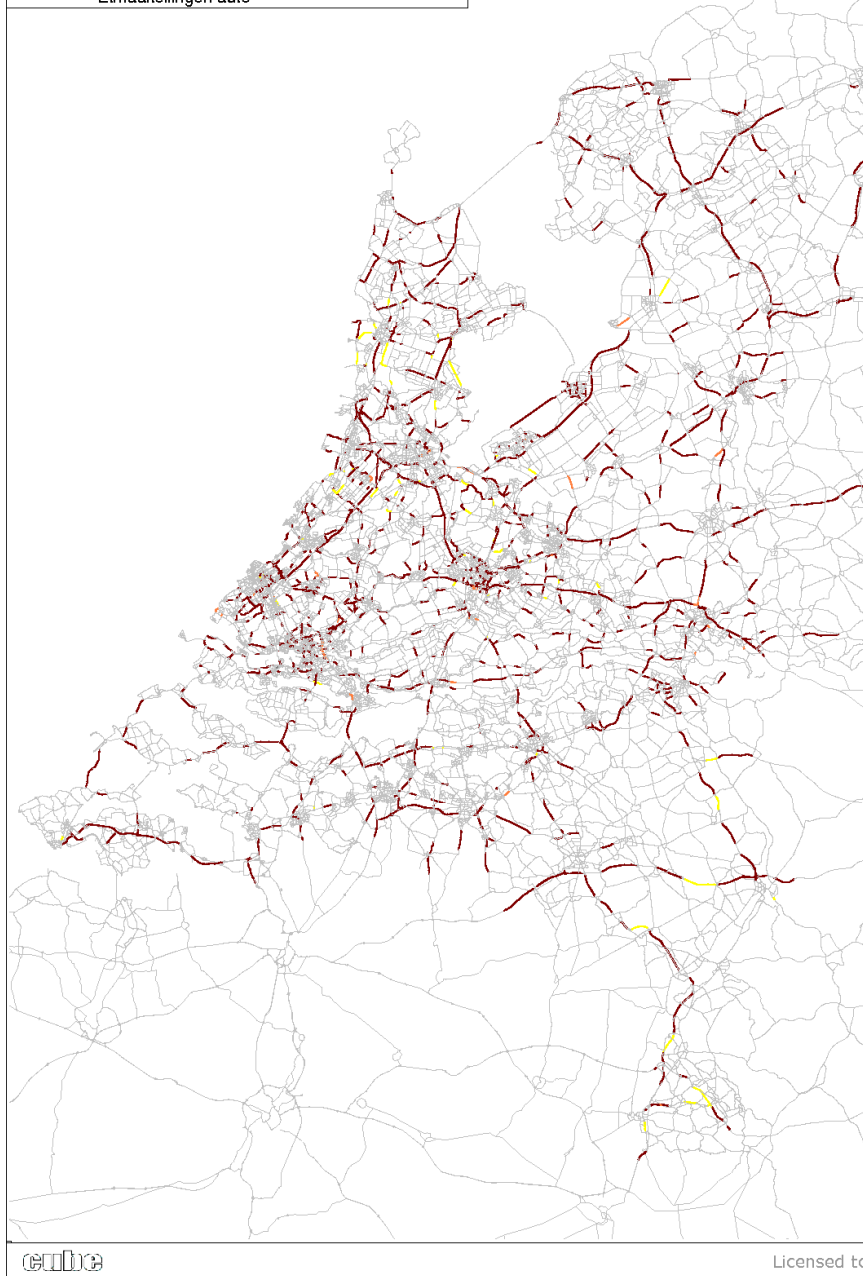


Important component in the analysis

- Comparison of flows with counts

- NL: $T - value = \ln \left(\frac{(q_a - S_a)^2}{S_a} \right)$ UK: $GEH = \sqrt{\frac{2 \cdot (q_a - S_a)^2}{(q_a + S_a)}}$

Fit	peak	24-hour
Good match	< 3.5	<4.5
	3.5-4.5	4.5-5.5
	4.5-5.5	5.5-6.5
Poor match	>5.5	>6.5



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Figuur 3.2: Beschikbaarheid van telcijfers op het netwerk van het NRM West

2.

Base-year estimation process

(based on the BASMAT Manual from Rijkswaterstaat (DVS))

Calibration process

1. Generating a-priori matrices for freight and passenger cars separately
2. Improving a-priori matrices using additional data for freight and passenger cars separately
3. Simultaneous OD-estimation for freight and passenger cars
4. Check with other data sources (esp. license plate surveys)

Generating a-priori matrices freight

- Starting point: National OD-matrix for trucks
 - Output of a national freight model
- First step: matrix expansion to the correct zoning system
 - Using the number of jobs in each zone (agriculture, industry, retail and other)
- Second step: from yearly total to periods
 - Using fixed percentages
- Third step: adjust the total volume in the matrix to the counts
 - OD-estimation (using AON) using a “super screenline”

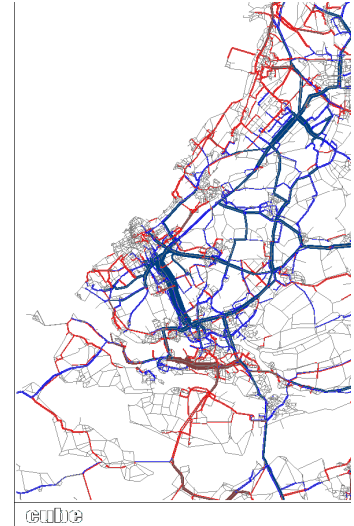
Generating a-priori matrices passenger car

- Based on the choice models of LMS/NRM (Groeimodel)
 - Integrated choice of destination, mode and time of day
- Including separate models for cross border trips and for travellers to and from airports (i.e. Schiphol airport)
- Aggregation of trip purposes to commuting, business and other
- Note: for the 2004 calibration the a-priori matrices were based on intermediate version of the choice models

Improving a-priori freight

- OD-estimation based on counts using an AON-assignment

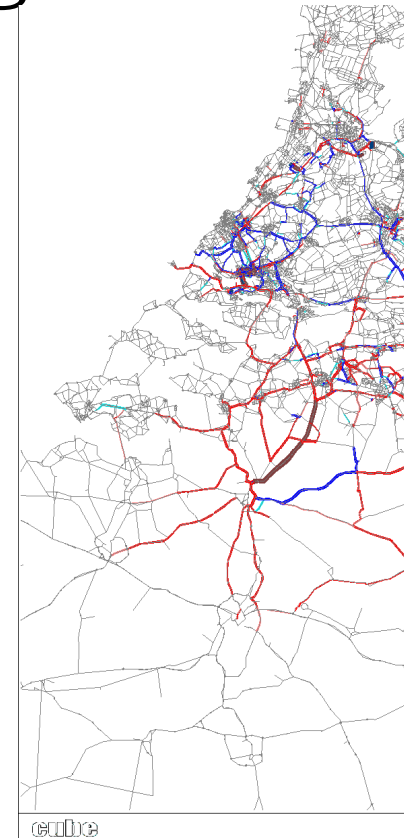
daling van het vrachtpercentage zichtbaar, met name in het
onderliggend wegennet komen na de vrachtverrijking meer
neemt het vrachtpercentage op met name de A15 en A27 t



Figuur 5.4: Vershilplot toedeling vrachtverkeer opzichte van de toedeling a priori

Improving a-priori passenger car

- OD-estimation for cross-border links using an AON-assignment
- Originally it was intended to use information of road site surveys as well



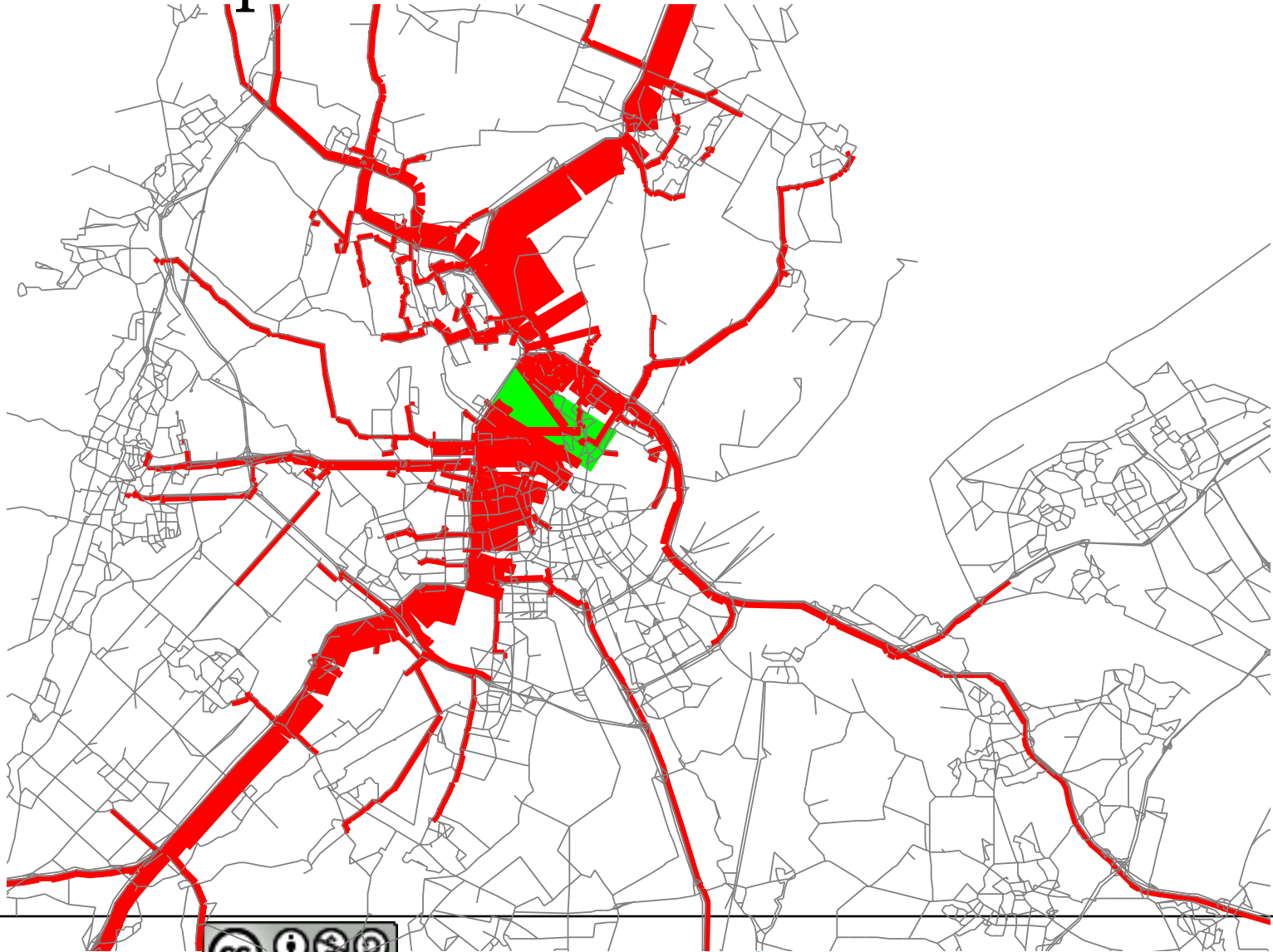
Figuur 5.13: Verschilplot toedeling personenve opzichte van de toedeling a priori

Bij de toedeling van de matrix na de verrijking van grensover in de avondspits (te) grote stromen zijn tussen de Randstad ontstaat rond bruggen en veren over de grote rivieren. Dit i

Simultaneous OD-estimation

- Simultaneous assignment of matrices using Qblok
=> "Footprint": (fraction of) OD-pairs using links having counts
- OD-estimation freight using counts (programme AVVMAT)
- OD-estimation passenger car using counts and production and attraction per trip purpose (programme AVVMAT)
- Extensive analysis of results
- If necessary adjustment of input data, e.g. network or counts, and assign matrices again (new "footprint")
 - Three iterations

A Footprint.....



Differences with intended process

- Originally a two step procedure was intended: first calibration using screenlines and second using individual counts
- However, there were not enough counts to define a proper set of screenlines
- Originally it was intended to use trip lengths as constraints as well
- However, that led to computational problems
=> NRM North showed that this constraint didn't have much influence

AVVMAT

- Powerful mathematical optimisation
- Minimising difference between a-priori matrix and estimated matrix while matching constraints
- Constraints have a probability distribution, which is defined using a standard deviation

Reliability counts

- Variation in standard deviation between 2.5% and 50%

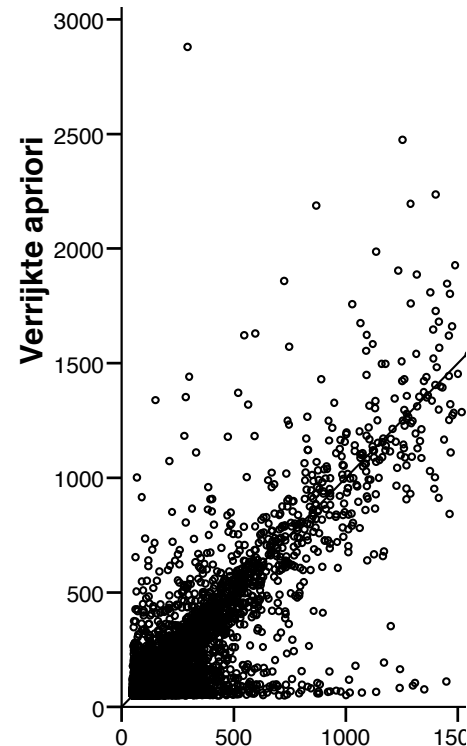


Figuur 3.3: Betrouwbaarheid van de beschikbare telcijfers

NRM West 2004 - Technische Rapportage D4 - Basismetris 2004

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Changes in OD-matrix: iteration 1



Figuur 6.21: Scattergram ontwikkeling pers

NRM West 2004 - Technische Rapportage 04 - Basismatrices 2004

Note that in later iterations some of these changes might be reversed

Analysis of results: topics

- Matrix totals and subtotals
 - Including comparison with OVG/MON
- Asymmetry
- Empty cells
- Trip length distribution
- Aggregated OD-matrices (provinces, COROP)
- Match with counts (T-value)
- Congestion site
- Assignment results

Consistency: reprise

- After second iteration in OD-estimation all models were synchronised with respect to network and counts
- Special attention for the definition of the capacity

Check with empirical surveys

- Road site or licence plate surveys
 - Amsterdam region, Utrecht region, Rotterdam region, A13/N13, Flevoland
- Household survey
 - Amsterdam
- Employee survey
 - Schiphol
- Comparison is not straightforward
 - Average year versus a specific day or period
 - All trips versus inhabitants of Amsterdam
 - Regular commuting versus 24-hour organisation

3.

Some results for NRM West 2004
(report by Significance, commissioned by Rijkswaterstaat (DVS))

Some results for NRM West 2004

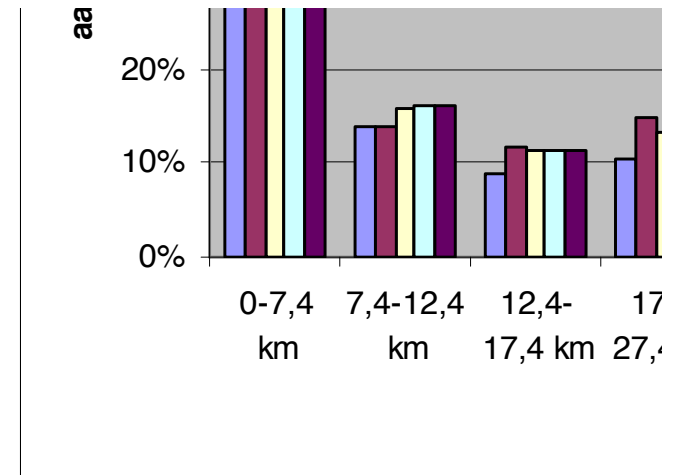
- Changes in matrix (study area only)
 - Commuting: -2.9%
 - Business: +7.7%
 - Other: +2.5%
- Empty cells (study area only)
 - Commuting: from 34.5 to 50.3%
 - Business: from 35.9 to 52.7%
 - Other: from 63.0 to 70.8%
- Asymmetry increases in every step

Condensed matrices

Changes > 5.000 and > 10%

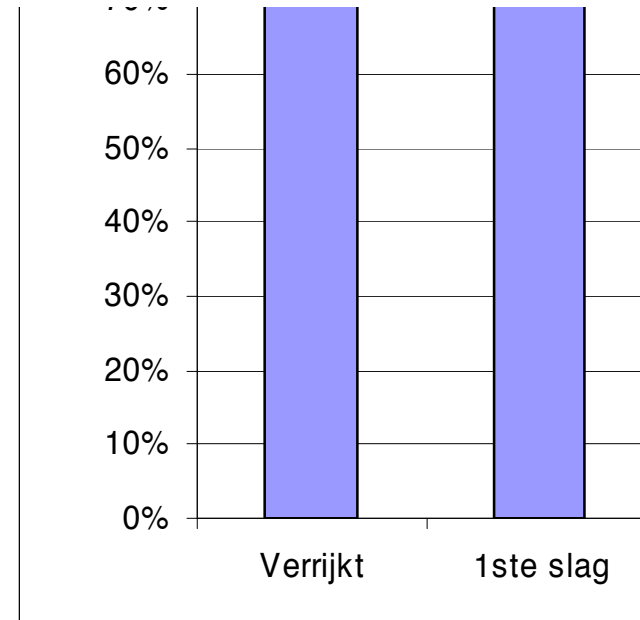
⁷ Hierbij wordt aangetekend dat de brondata juist op het vlak van de kortere vracht kwaliteit zijn dan de brondata die voorheen beschikbaar waren.

Trip length distribution



Figuur 6.127: Ritlengteverdeling t/m

T-values for both peak periods



Figuur 6.140: T- toets per kalibratieslag op :
voor vrachtauto's

Overview of T-values



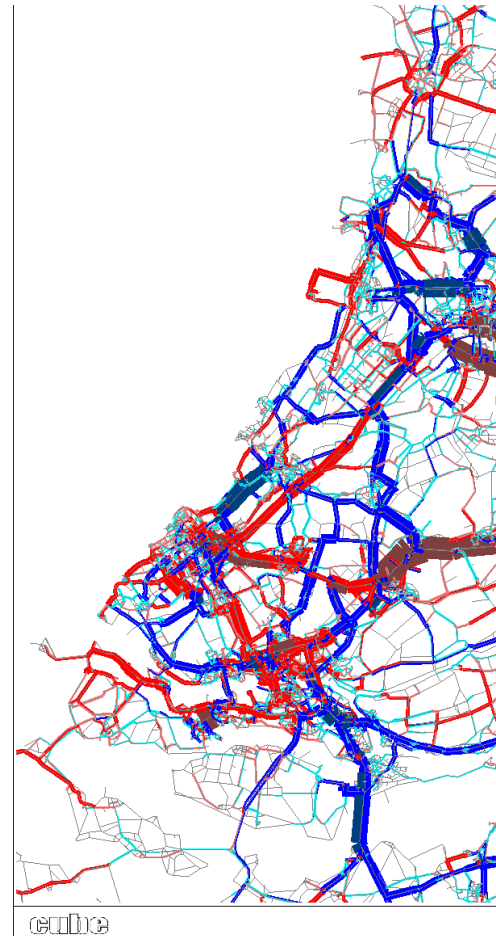
Figure 6.104: T-toets avondspitstellingen voor p

Congestion sites



Figuur 6.109: Filebeeld ochtendspits na iteratie 1

Impact on flows



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Figuur 6.141: Verschilplot toedeling gekalibreerde personenauto's

Conclusion calibration NRM West

- Process converged successfully
- Resulting matrices match constraints
- Calibration process led to some systematic changes in the OD-matrices
- N.B. a new OD-estimation is being made for the base-year 2010

4.

Concluding remarks

To conclude: a few fairy tales

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- The 24 hour base matrix is fully symmetric
- Base matrices are fully observed
- There exists only one unique base matrix
- Base matrices can be estimated in a short period
- The base matrices are of good quality when they replicate the traffic counts
- The more empirical information available the better the quality
- Base matrices can be transferred easily to other model systems