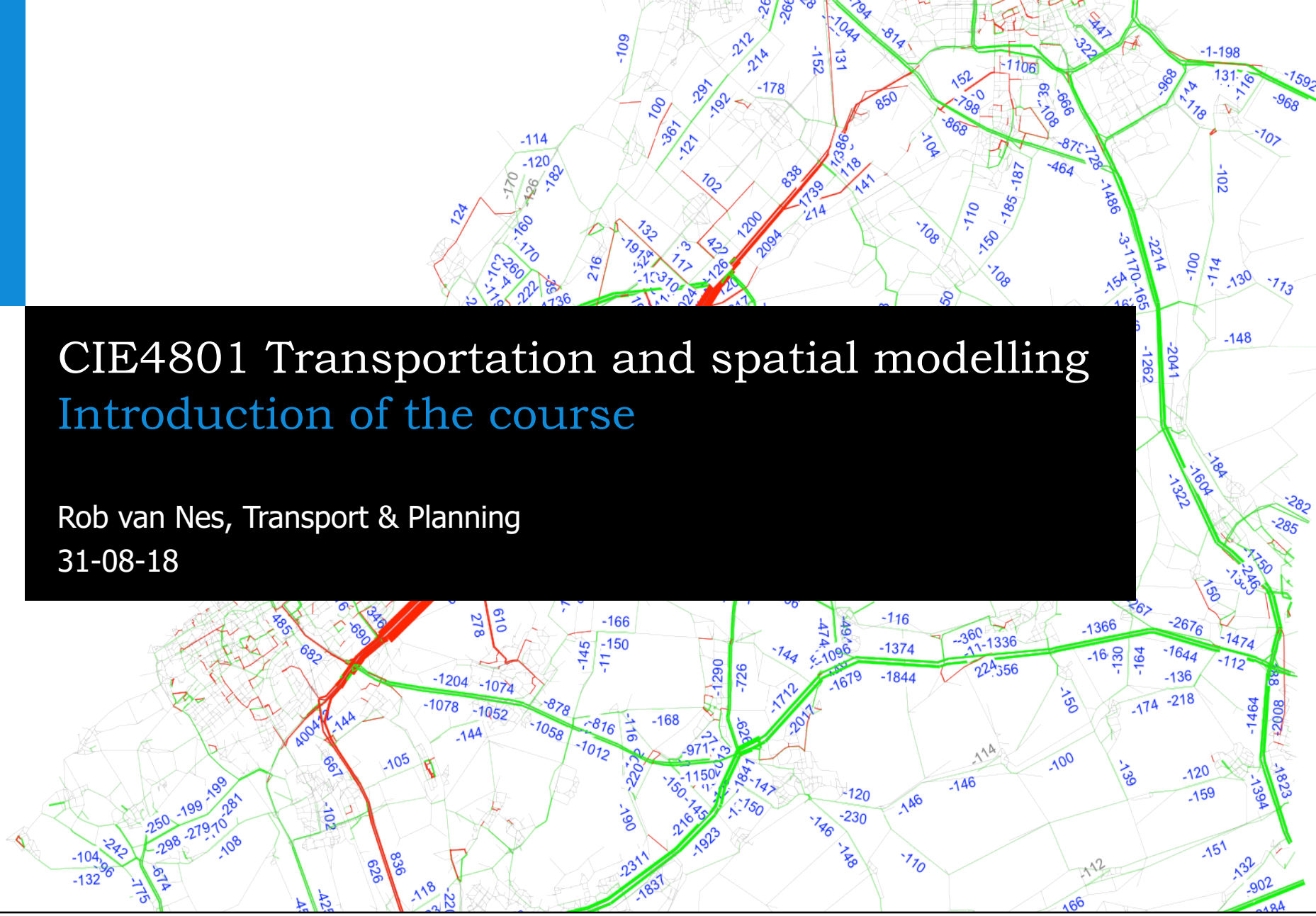


CIE4801 Transportation and spatial modelling

Introduction of the course

Rob van Nes, Transport & Planning

31-08-18

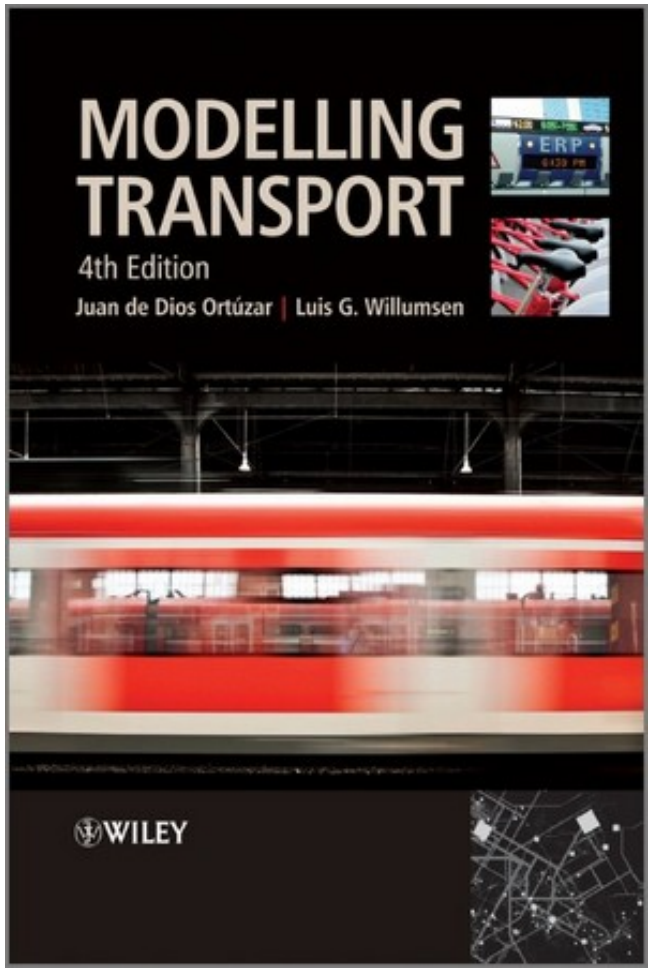
Topic of this course

- Transportation and spatial modelling
  - Theory
  - Concepts
  - Algorithms
  - Application
- Focus on how it is done today
  - Don’t let that stop you from being critical
- Focus on how it is might be done tomorrow?
  - CIE5802-09 Advanced transportation modelling (Q2)

What do I want to achieve?

- Know and understand the main modelling structures
- Know and understand the modelling components
  - Theoretical aspects as well as practical issues!!
- Can apply basic algorithms
- Analyse and discuss today's transport and land-use models
- Can set up, perform and assess a realistic modelling study

Course material



Course material:

- Ortuzar, J. de Dios, L.G. Willumsen (2011), Modelling transport, 4th edition, John Wiley & Sons, Chichester
- Selected papers on Spatial Modelling
- Lecture slides
- Exam questions

Textbook is available at Boekhandel Waltman (bookshop Industrial Design)
Links for papers can be found on Blackboard
Slides will be available on Blackboard (after the lecture)

Set-up lectures

Lectures	Topic	
1, 2 and 4	Main concepts and building blocks	4-stage model, zones, networks, choice modelling
3, 5-7	Demand models	Generation, distribution, modal split, time of day
8-11	Supply models	Assignment: uncongested, congested and special topics
12-13	Using transport models	OD-estimation, forecasting, reflection
14-15	Land-use models	Classic models, integrated models, disaggregate models
16-18	Modelling in practice	National, regional and local models
19	New developments	
20-21	Q&A	

Three comments to conclude

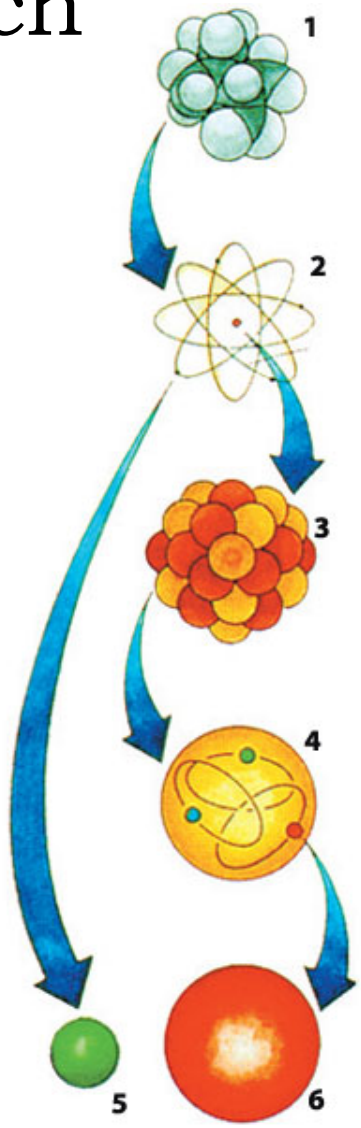
- Modelling as a concept
- Civil engineering approach
- There's math in this course

1: Modelling as a concept

- Models are tools you use for different purposes
- It is not only about having an as accurate model as possible, it is also about usefulness
- And there are more comments to make on modelling. Please read this short essay:
  - Epstein, J. M. (2008). Why model? *Journal of Artificial Societies and Social Simulation, 11(4),* 12. http://jasss.soc.surrey.ac.uk/11/4/12.html.

2: “Civil engineering” approach

- Decomposition
  - Material
  - Molecule
  - Atom
  - Protons, neutrons, electrons
  - Etc.
- For each component there might be different options

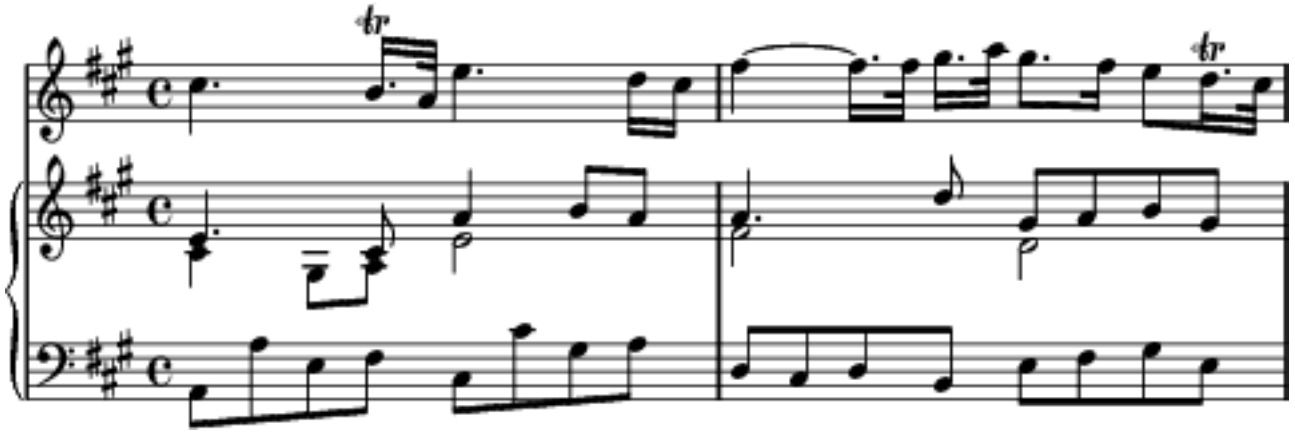


Overview of approaches for demand modelling

"Material"	"Molecule"	"Atoms"		
		Descriptive models/ Aggregate models		Choice modelling/ Disaggregate models
Transport demand models	Trip generation	A	B	I
	Distribution	C	D	II
	Modal split	E		III
	Time of day	F		IV
	Assignment	G	H	V

3: There's math in this course….

$$\ln(T!) - \sum_{ij} \ln(T_{ij}!) + \sum_i \lambda_i \cdot \left(P_i - \sum_j T_{ij} \right) + \sum_j \lambda_j \cdot \left(A_j - \sum_i T_{ij} \right) + \beta \cdot \left(C - \sum_i \sum_j T_{ij} \cdot c_{ij} \right)$$



Why math?

- Math provides the most accurate description of models
- Mathematical derivations demonstrate essential assumptions
- For those of you who would like to go in more detail the basics of the model formulations should be familiar
- Of course there will also be students having different interests
- Therefore:
  - Derivations are not part of the exam
  - You're allowed to bring a formula sheet

So what kind of math do we use?

- Indices, summation and multiplication
- Exponential functions and logarithms
- Derivatives and integrals
- Maximisation and minimisation of objective functions
- Lagrange multipliers
- Maximum likelihood estimation, regression
- A bit of statistics: distribution function, mean, standard deviation

Check chapter 2 of the book for an update, if necessary