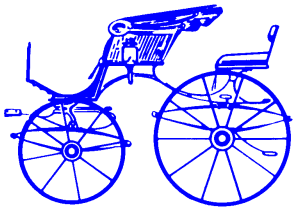
ARAF – 13 05 2013

Congestion costs: from definitions to implementation

Pr. Yves Crozet
Laboratory of Transport Economics
University of Lyon - France
yves.crozet@let.ish-lyon.cnrs.fr



UNIVERSITÉ DE LYON

Introduction

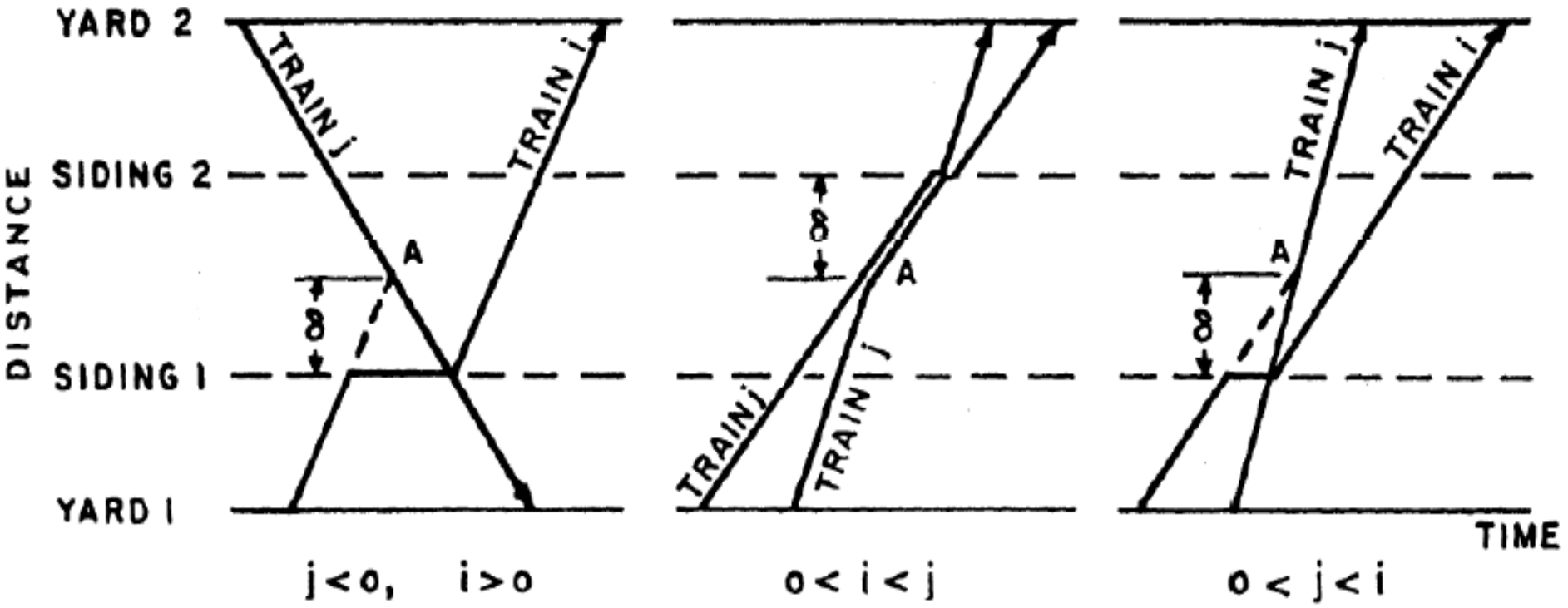
- A lot of academic papers on road congestion
- But less on rail congestion
- Rail is not an open network, access is subject to an *ex ante* planning, a graph has to be drawn by the planners (i.e. engineer's issue)
- But there is also an *ex post* congestion, due to the fact that the graph is a trade-off between different objectives. Assessment of this congestion cost is an economist's issue

Contents

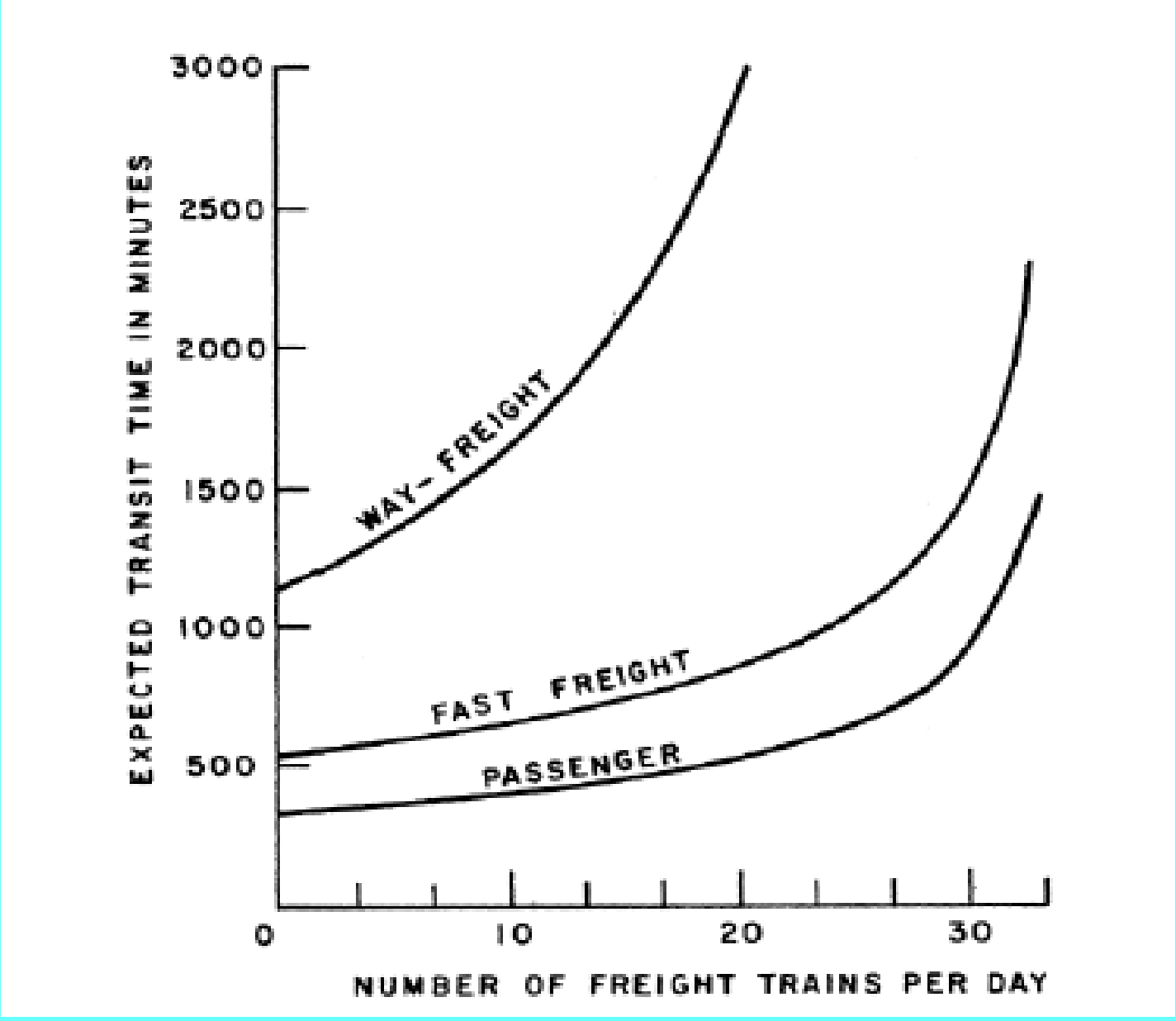
- 1) Saturation an graph design: the "*ex ante*" congestion
  - Rail and technical saturation
  - From technical to commercial saturation

- 2) "*Ex post*" congestion and implementation of congestion costs

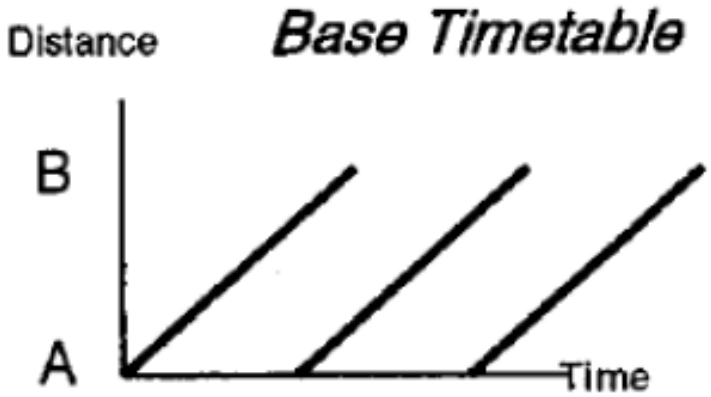
Interference delays (Petersen 1974)

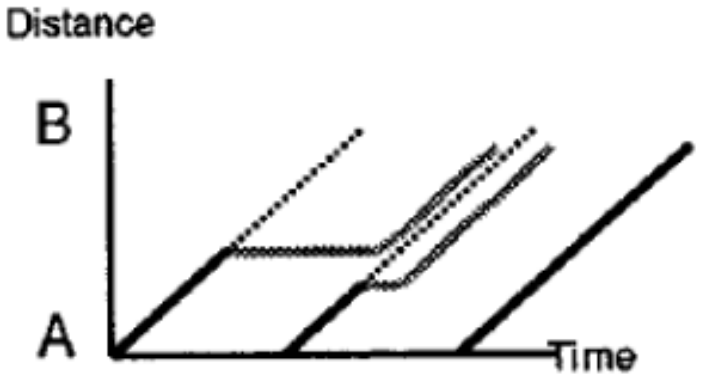


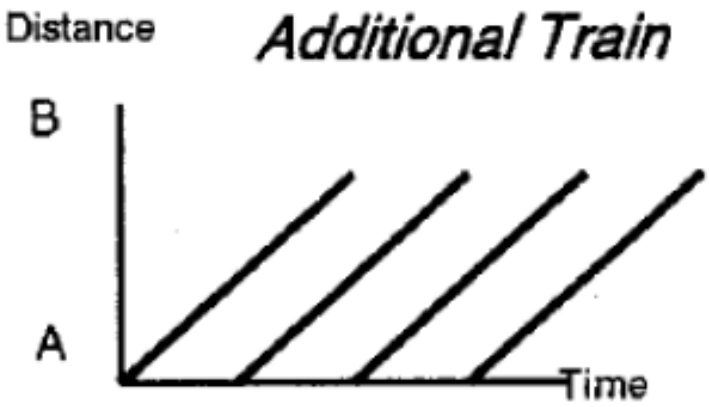
Rail congestion (Petersen 1974)

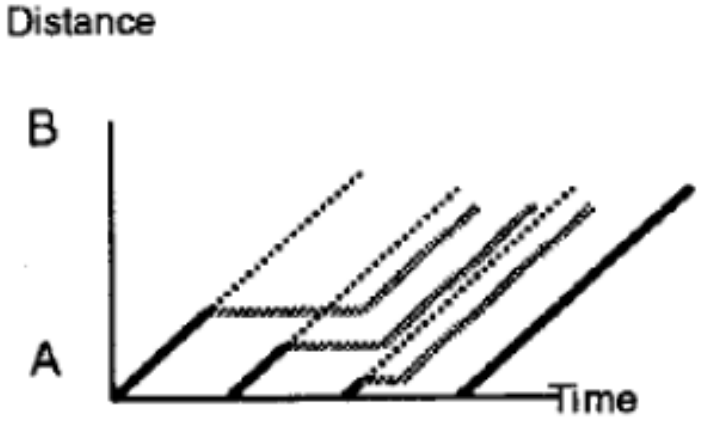


From exogeneous delay to reactionary delay (Gibson 2002)

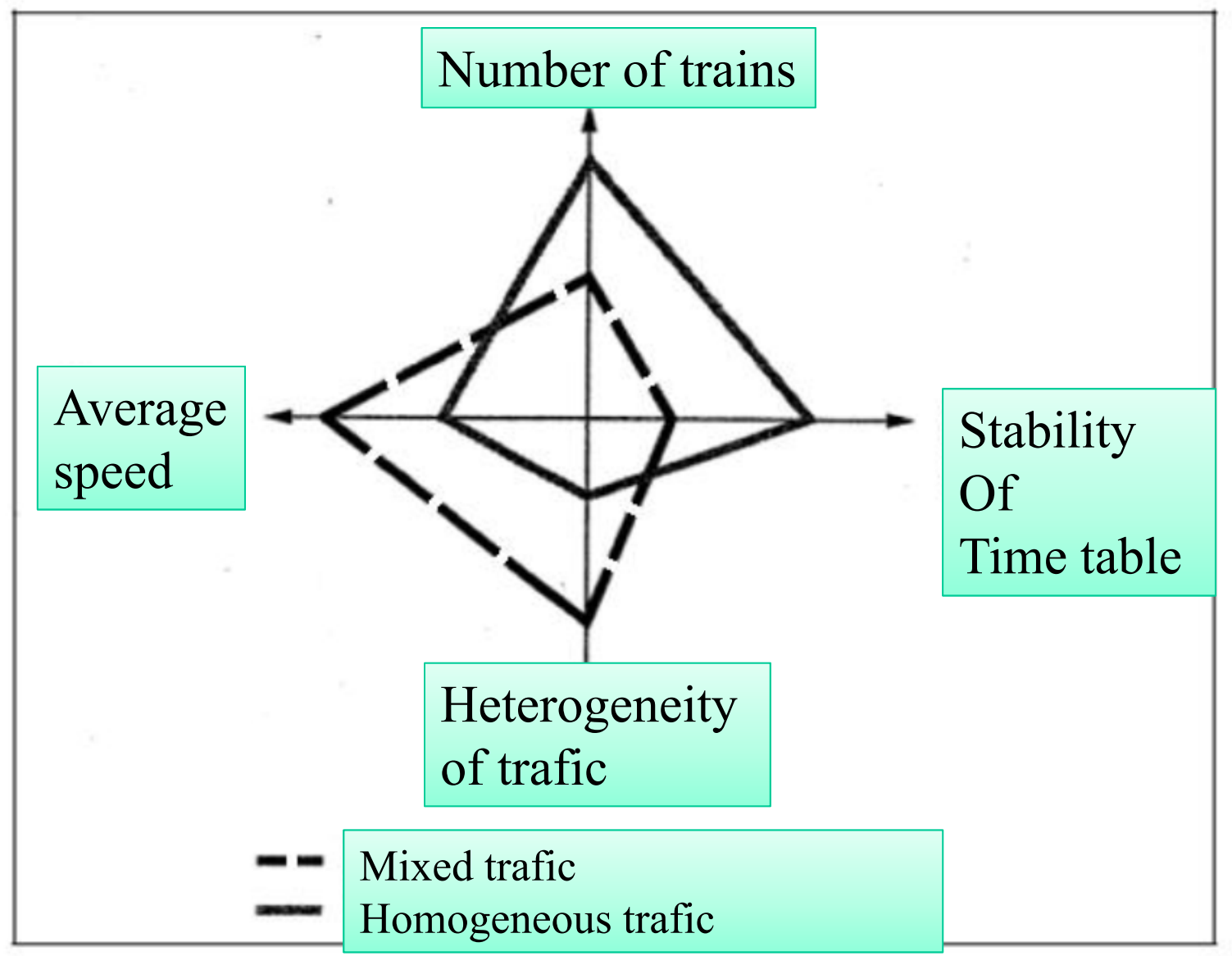




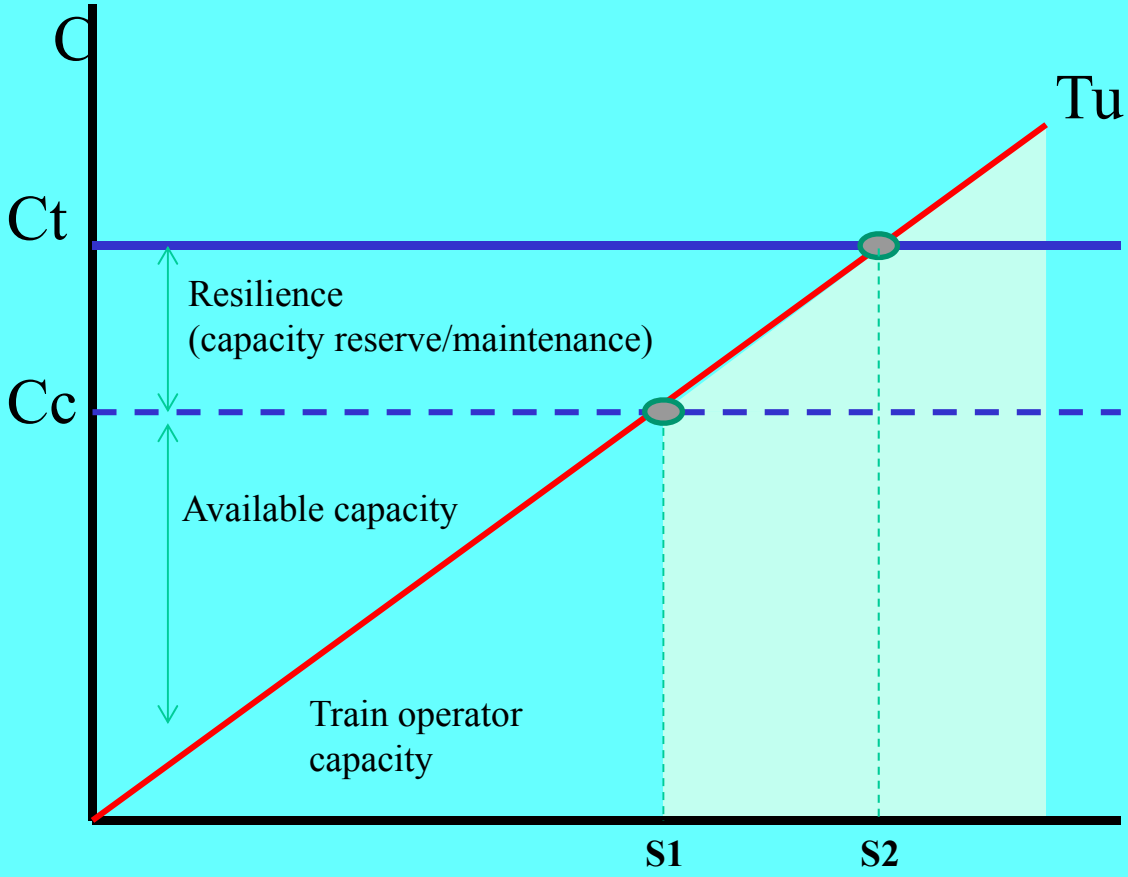




Which trade-offs?



A first trade-off between capacity and resilience



Technical capacity (Ct)
Maximum number of trains/hour

Commercial Capacity (Cc)
Maximum number of trains/hour on the graph

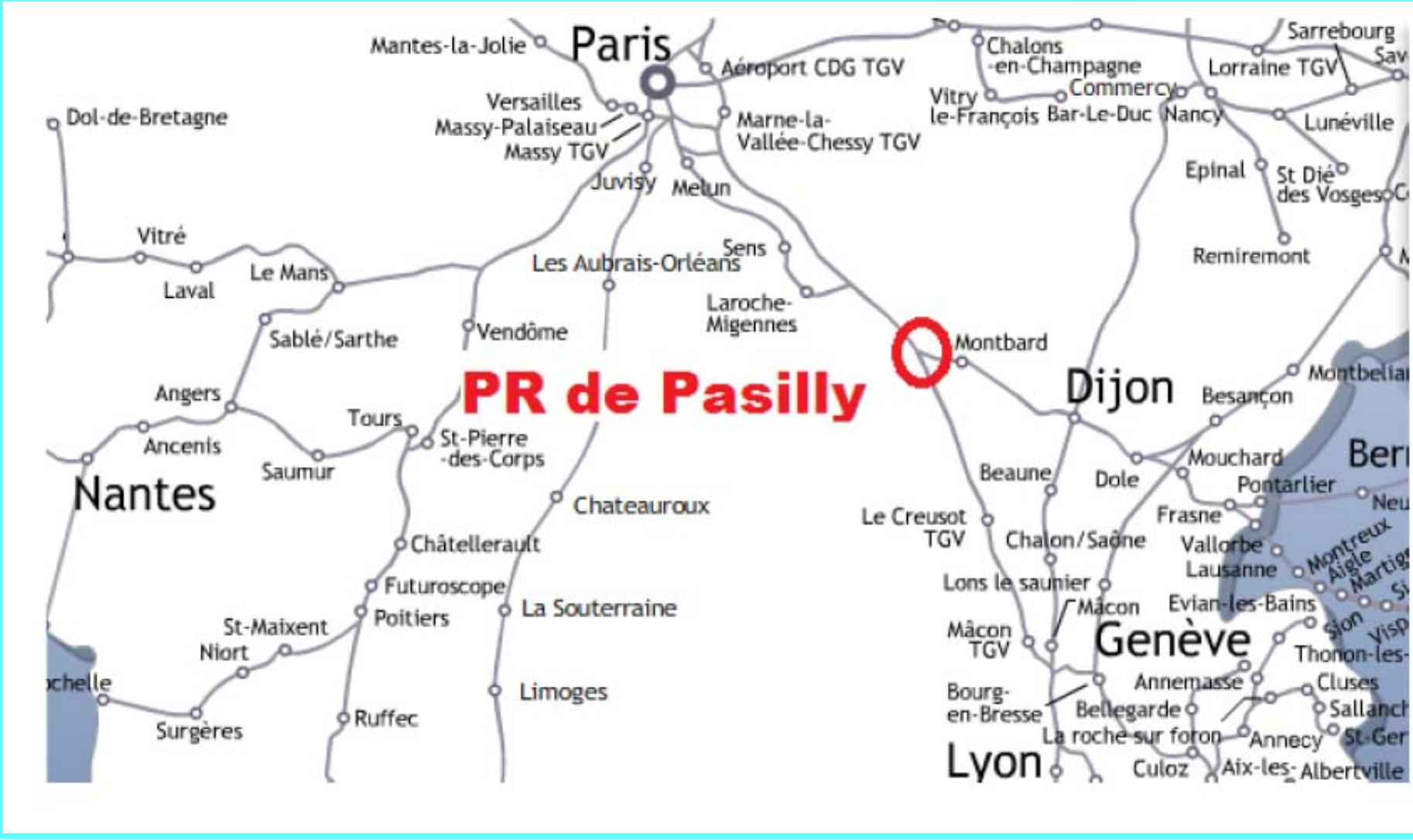
Train capacity

Contents

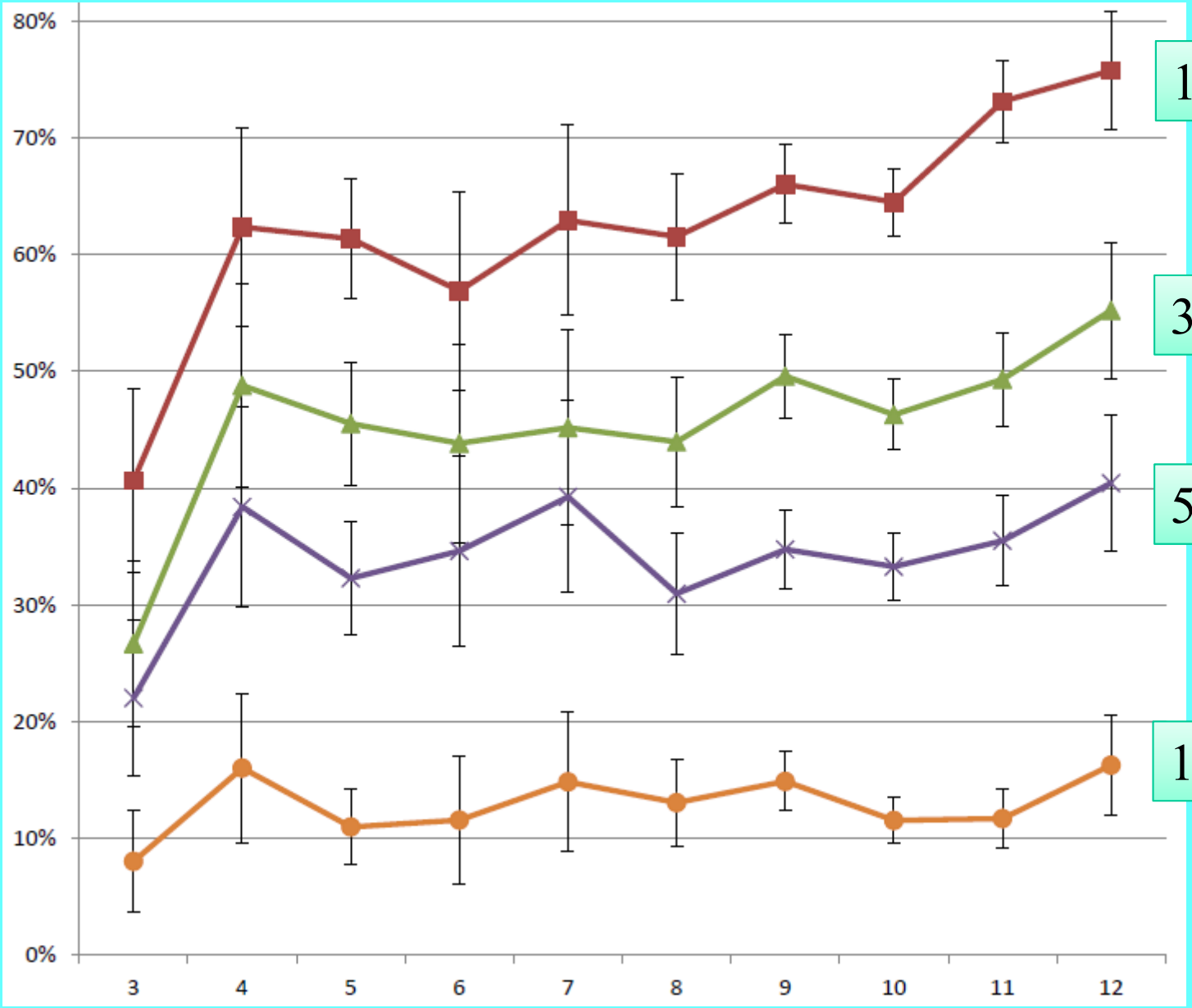
- 1) Saturation an graph design: the "*ex ante*" congestion

- 2) "*Ex post*" congestion and implementation of congestion costs
  - Observed delays on Paris-Lyon line
  - Assessments of congestion costs on Paris-Lyon

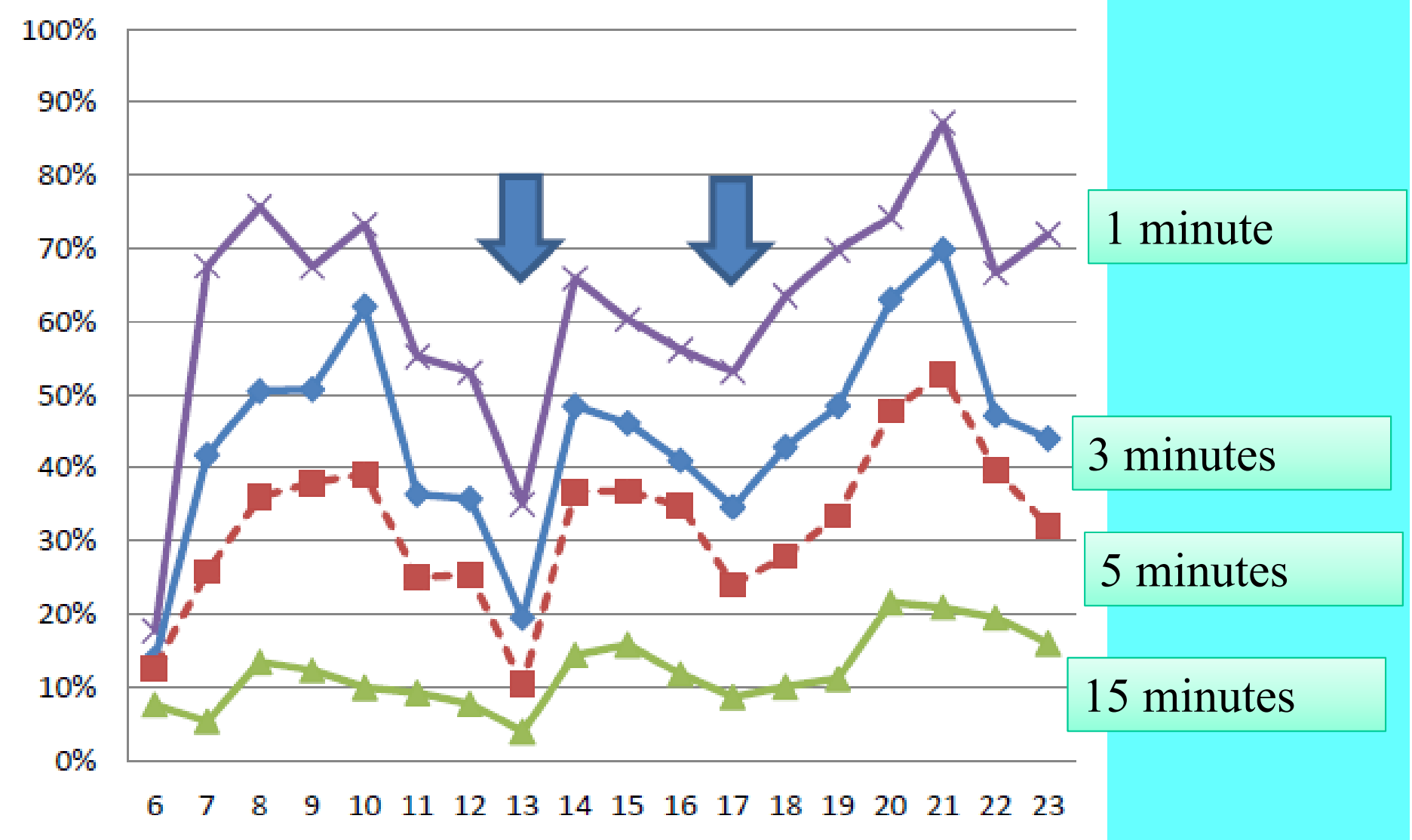
Observed delays on Paris-Lyon line March 2010 (2 x 4000 trains)



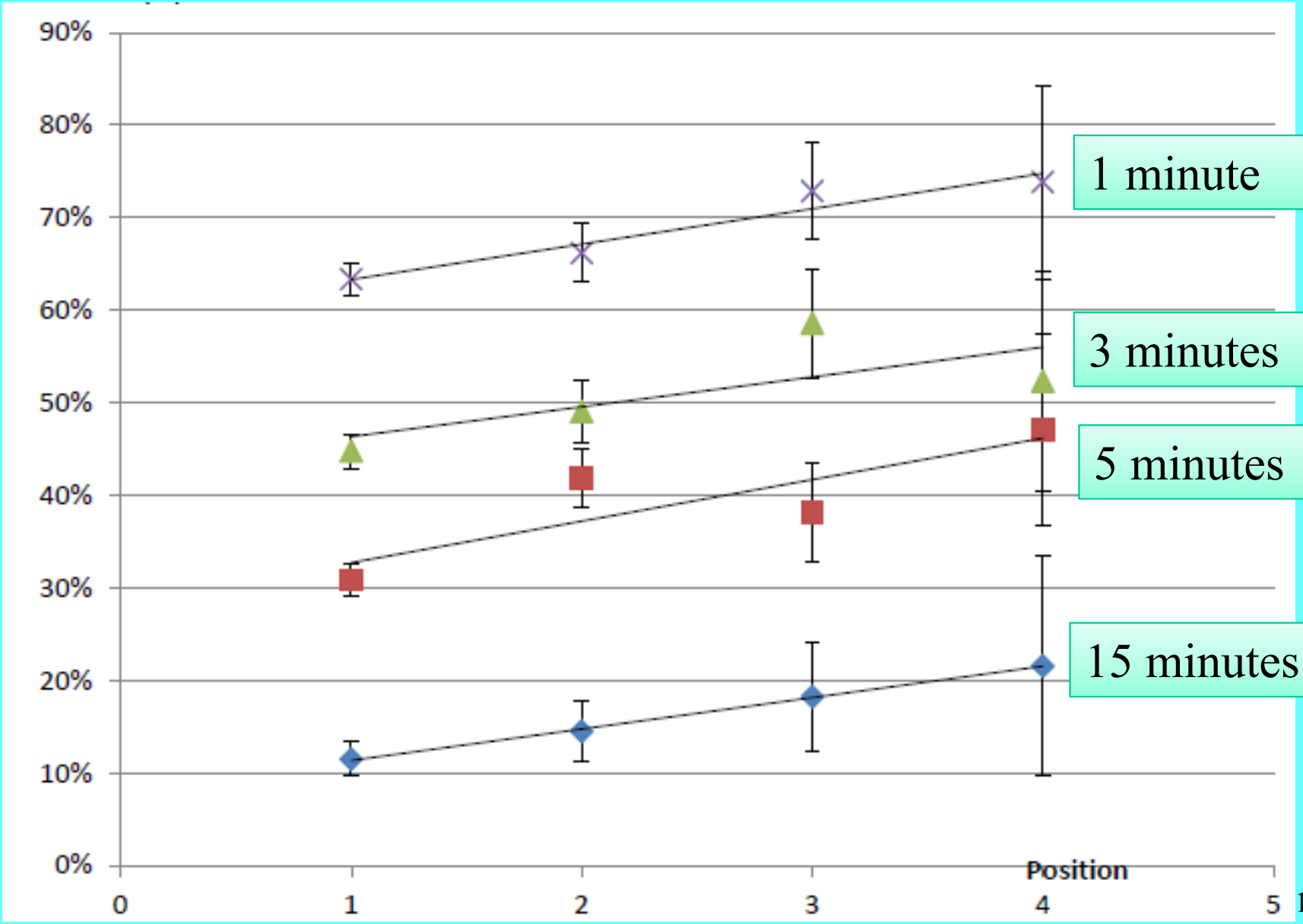
Delays and number of trains/hour



Delays and daily cycle



Delays and position of the train



Congestion costs (1)

Scenario	Methodology # 1		
	Low	Median	High
Nbre of passengers	1 416 667	1 666 667	1 916 667
Yearly nbre of passengers	17	20	23
Ratio 2nd class/1st class	85/15	70/30	60/40
Total cost (Million euros 2012)	3,1	6,6	11,2
Total cost with penibility	4,7	9,9	16,8
Cost / train-kilometre (2012)	1,2	2,6	4,5
Cost per tr-km with penibility	1,9	4,0	6,9

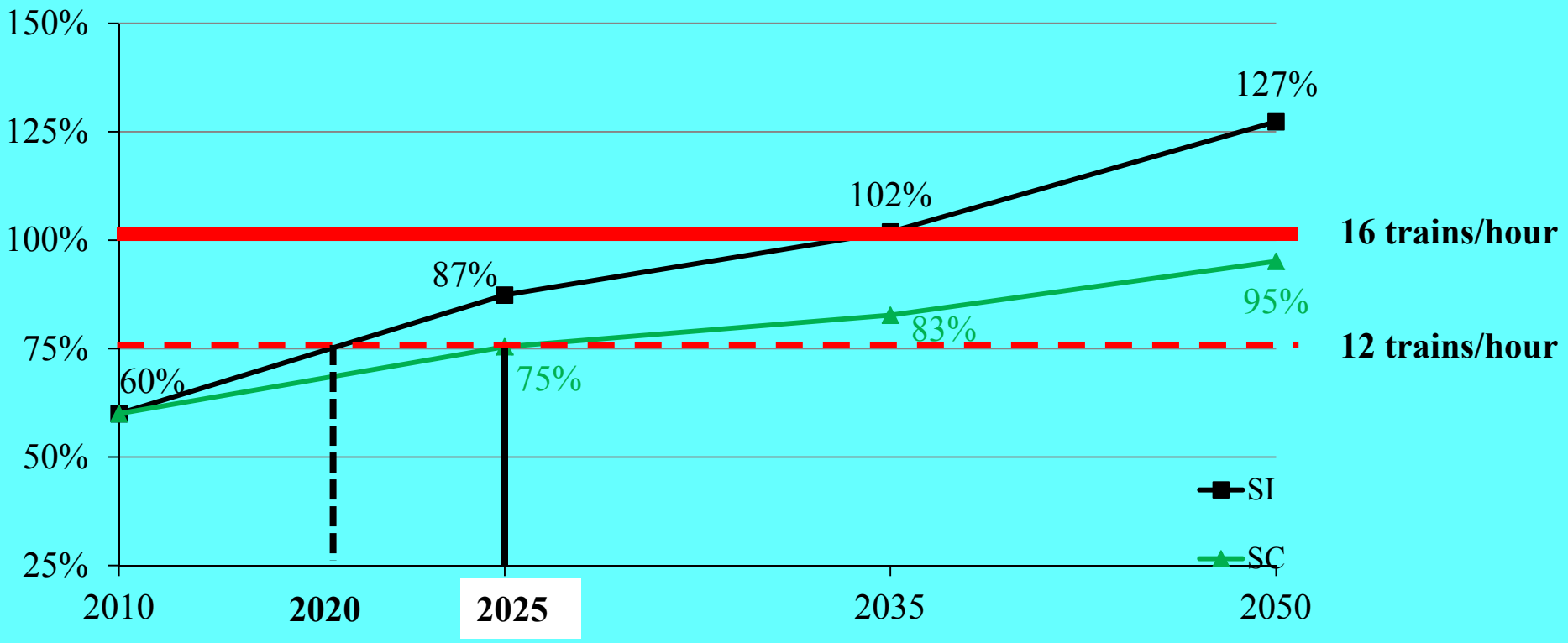
Congestion costs (2)

	Methodology # 2		
Scenario	Low	Median	High
Load factor	65%	75%	85%
Nbre of passengers	1 414 670	1 622 929	1 832 259
Yearly nbre of passengers	17, 0	19,5	22
Ratio 1st cass/2nd class	85/15	70/30	60/40
Total cost (Million euros 2012	5,5	9,4	14,0
Total cost with penibility	8,4	14,1	20,8
Cost / train-kilometre (2012)	2,2	3,7	5,6
Cost per tr-km with penibility	3,4	5,7	8,5

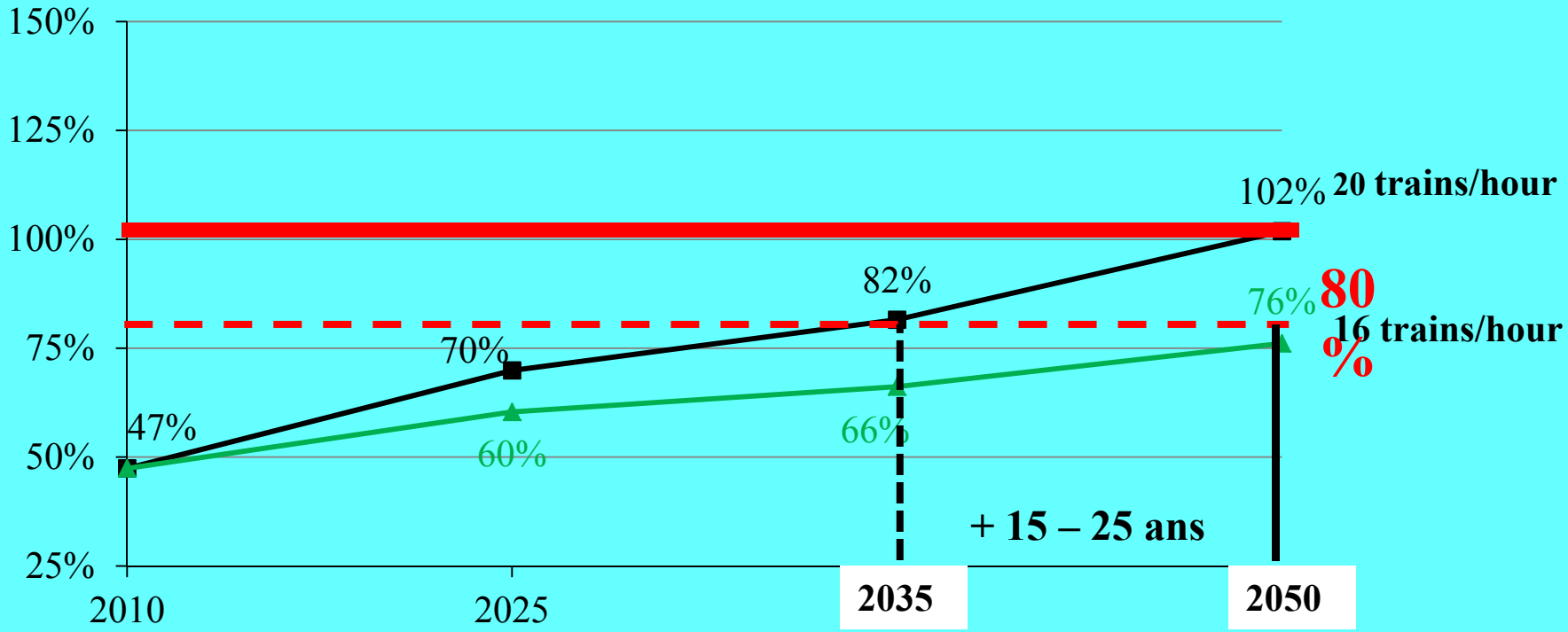
Congestion costs (3)
euro/train-km

Scenario	Low	Median	High
Off peak hour	1,2	2,0	3,0
Normal hour	1,6	2,6	3,9
Peak hour	2,1	3,5	5,2
Peak hour Friday and Sunday	4,6	7,7	11,2

Paris – Lyon : Traffic and saturation within 2050



PARIS – LYON: Traffic and saturation within 2050



(SC)

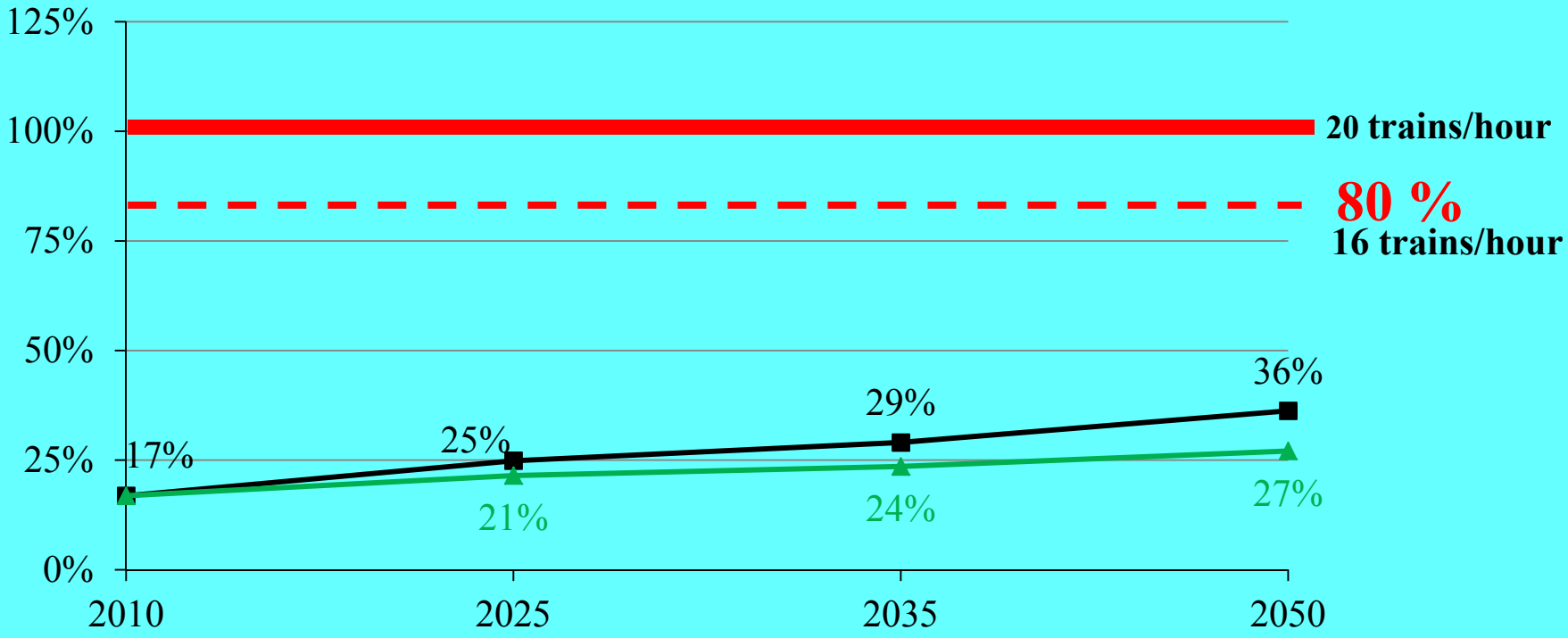
Capacity gain: + 33%

Cost : infrastructure (255M€)

/ rolling stock (250M€)

« ERTMS 2 »		
Technical capacity	16	**20**
Resilience	75%	**80%**
Commercial capacity	12	**16**

PARIS – LYON: Traffic and saturation within 2050



« ERTMS 2 »		
Technical capacity	16	**20**
Resilience	75%	**80%**
Commercial capacity	12	**16**

+

Option « Ouigo »		
Number of passengers/train	450	**600**
Twin/single trainset	1,3	**2**
Load factor	80%	**90%**

Conclusion

- *Ex post* congestion costs are rather high in comparison with infrastructure marginal cost (close to 2 euros/ train-km)
- Implementation of congestion costs would lead to a big variability of rail access charges during peak hours
- But some non expensive changes in train capacity or signaling system (ERTMS) can totally change the *ex ante* and therefore *ex post* congestion…
- The main issue is therefore the definition of incentives in favor of these changes