

“Superbuss” – definitions and characteristics

Presentation Trondheim
January 22nd, 2015

The authors:

Who is Axel Kuehn?

- ▶ Independent Consultant from Germany,
- ▶ Transport planner with urban planning touch,
- ▶ 28 years in business, 21 years consulting
- ▶ Strategic advice HQPT
- ▶ Bus > Tramway > Light rail > Railway,
- ▶ Working strongly international (Belgium, Canada, Denmark, Netherlands, Norway, Spain, UK)
- ▶ Best practice Europe and beyond ...

The authors:

Who is Werner Nüchterlein?

- ▶ Independent Consultant from Sweden,
- ▶ Economist with international PT-experience in leading management positions,
- ▶ 22 years in business, both on operator and PTA sides,
- ▶ Strategic advice, project management
- ▶ Innovation and New Energies, all modes of transport
- ▶ Working internationally (e.g. Nordics and Central Europe)
- ▶ Example: PM “Nordic Bus” project (“standardization” bus procurement requirements)

Superbuss ≠ buss? We will try to clarify...



THIS IS NOT A BUS !

PTP – Barcelona- 02 de febrero 2006



Superbuss \neq buss? We will try to clarify... ... and start with some “icebreaking”



Source: DPA

Superbuss – icebreaking (1)



Tours

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

6

Superbuss – icebreaking (2)



St.Nazaire

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

7

Superbuss – icebreaking (3)



Metz

Superbuss – icebreaking (4)



Douai

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

9

Superbuss – icebreaking (5)



Nantes

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

10

Superbuss – icebreaking (6)



Lorient

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

11

Superbuss – icebreaking (7)



Mainz

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

12

Superbuss – icebreaking (8)



Utrecht

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

13

Superbuss – icebreaking (9)



Utrecht

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

14

Superbuss – icebreaking (10)



Zuidtangent

Superbuss – icebreaking (11)



January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

16

Superbuss – icebreaking (12)



Zuidtangent

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

117

Superbuss – icebreaking (13)



Stavanger

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

18

Superbuss – icebreaking (14)



Douai

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

19

Superbuss – icebreaking (15)



Eugene

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

20

Superbuss – icebreaking (16)



Eugene

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

21

Superbuss – icebreaking (17)



Eugene

Superbuss – icebreaking (18)



Padua

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

23

Superbuss – icebreaking (19)



Padua

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

24

Superbuss – icebreaking (20)



Nancy

January 2015

Axel Kuehn, Karlsruhe – Werner Nüchterlein, Stockholm

25

Superbuss “tag cloud” ?

- ... with or without green ...off-road...
- ... city centre and sub-urban ... guided...
- ... single lanes ...shared by other buses...
- ... platform on left side ...island stops...
- ... partially shared with car-lane...
- ... cyclists/pedestrians on bus-lane...
- ... overhead wires ...more/less fancy...
- ... more tram than bus ...central/lateral...

Superbuss “first conclusions” ?

There is not just one approach to achieve a high quality bus system... (a “superbuss”)!

“What do you want from life?” Is it ...

...a tram on rubber tyres? ...a high quality

bus on largely segregated alignments?

...infrastructure open for all buses?

...” one size fits all” or well integrated?

Superbuss “best practice” ?

Best practice “for Trondheim” !

Necessary to distinguish between:

▶ BRT-systems in 3rd world mega-cities,

▶ Purely sub-urban “add-on” systems in larger agglos (backbone function by other modes),

▶ Systems in medium-sized cities where the HQ-bus should be “premium product”.

Some “best practice” cases

Metz

St.Nazaire

Lorient

Douai

Eugene

Nantes – technical layout relevant

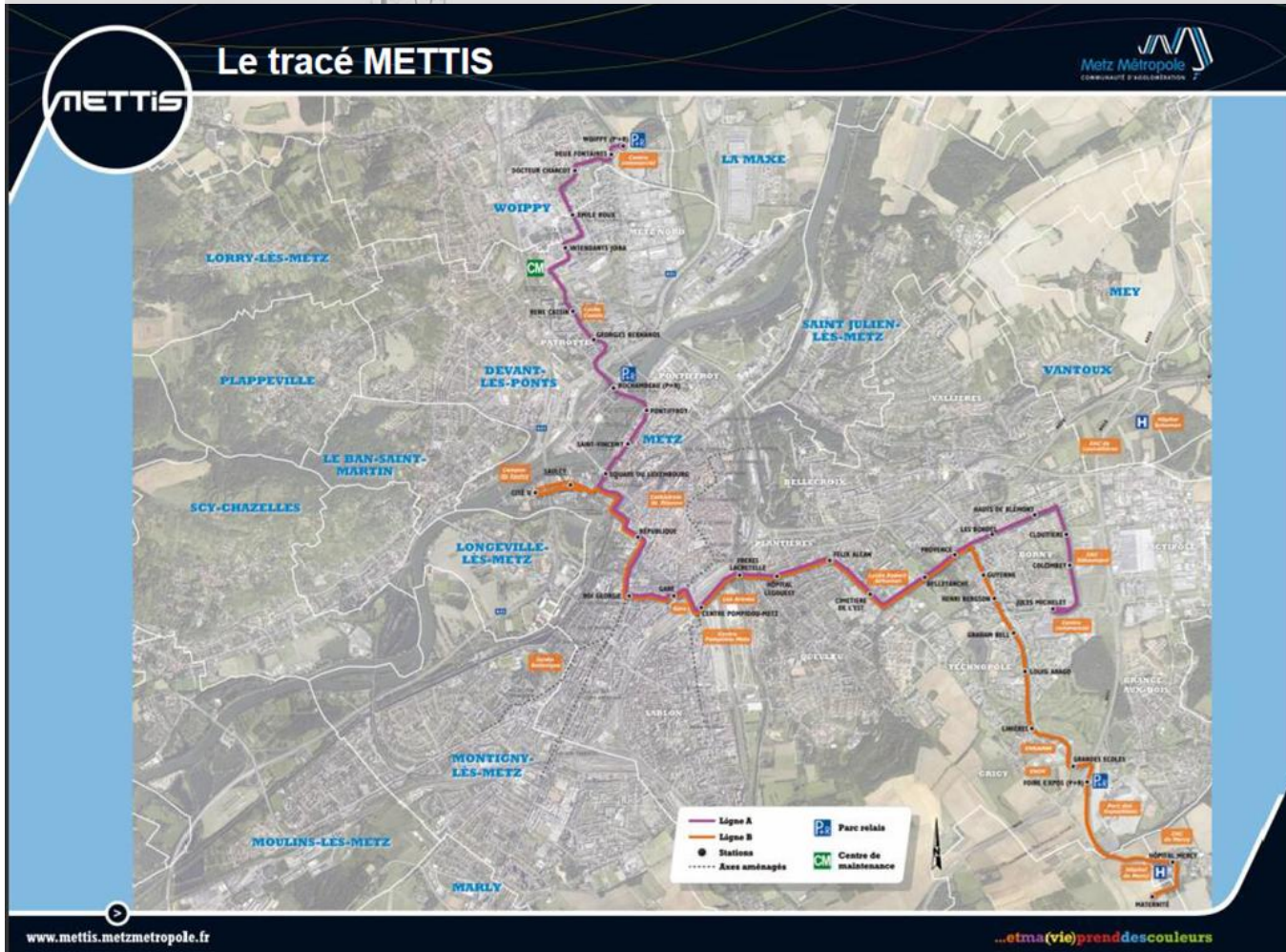
Zuidtangent – technical layout relevant

Metz

Key facts:

Location:	North-East France (near Lux)
Population:	119 000 city – 230 000 agglo
Density:	2 850 inh./km ²
PT-offer:	HQ-bus/bus
Project:	18 km busway / 2 lines 230 Mio.€ / 12.8 Mio.€/km
Service:	10 min weekdays (5 min joint)
Passengers:	36 000 pass./day (forecast)

Metz



Two lines overlapping in centre...

Source: METTIS

Metz



The “tram” vehicle (VAN HOOL)... Doors on right side... Fancy...

Metz



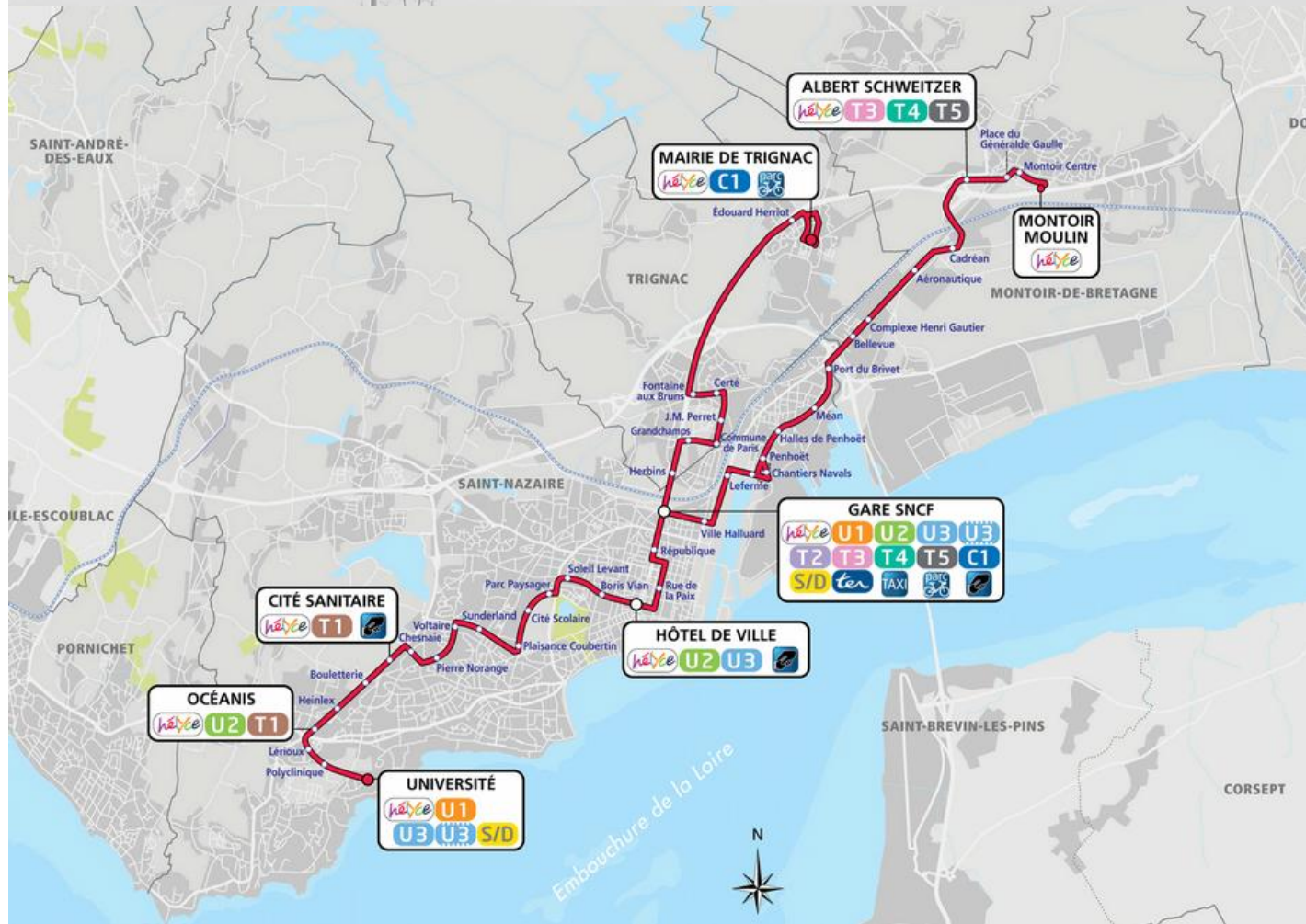
Vehicle + infrastructure = integrated premium product

St. Nazaire

Key facts:

Location:	Western France (near Nantes)
Population:	68 000 city - ...000 agglo
Density:	1 450 inh./km ²
PT-offer:	HQ-bus/bus
Project:	6 km busway (of 9km) 55 Mio.€ (=6.1 Mio.€/km)
Service:	10 min (joint)/20min (branches)
Passengers:	10 000 pass./day (forecast)

St. Nazaire



Two lines overlapping - partly on dedicated infrastructure

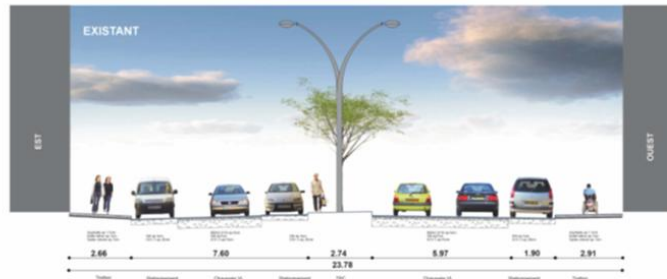
Source: CARENE

St. Nazaire

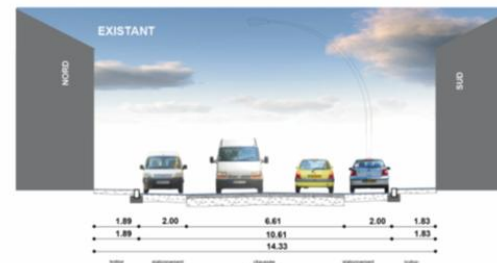


Quality infrastructure, standard vehicle

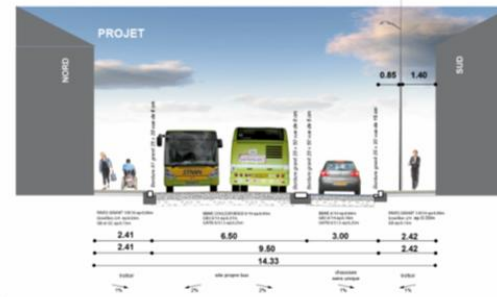
St. Nazaire



PROFIL TYPE A-A



PROFIL TYPE D-D



Source: CARENE

Bus infrastructure adapted to different road spaces...

Lorient

Key facts:

Location: Western France (near Brest)

Population: 57 000 city – 114 000 aggro

Density: 3 300 inh./km²

PT-offer: HQ-bus/bus

Project: 5 km busway (1st phase)

31 Mio.€ (=6.2 Mio.€/km)

Service: 30 min

Lorient



Nothing over-fancy but functional/well integrated...

Douai

Key facts:

Location: Northern France (near Lille)

Population: 42 000 city - ?? agglo

Density: 2 483 inh./km²

PT-offer: HQ-bus/bus

Project: 19.5 km busway (1st phase)

137 Mio.€ (= 7 Mio.€/km)

Service: 8-12 min

Passengers: 10 000 passengers/day

Douai



Project branding: “For a new quality of the city”

Source: SMTD

Douai

PARTS MODALES DE LA SITUATION ACTUELLE		
MODE	Dépl./jour	part modale (%)
Marche	171200	28,0
Vélo	30615	5,0
Transport public	36001	5,9
Voiture	367380	60,1
autre	6100	1,0
Total	611296	100,0

EVOLUTION TENDANCIELLE, SANS PDU A L'HORIZON 2012		
MODE	Dépl./jour	part modale (%)
Marche	174500	26,2
Vélo	30300	4,5
Transport public	36700	5,5
Voiture	419300	62,9
autre	6200	0,9
Total	667000	100,0

OBJECTIF DU PDU A L'HORIZON 2012		
MODE	Dépl./jour	part modale (%)
Marche	185000	27,7
Vélo	42000	6,3
Transport public	69000	10,3
Voiture	365000	54,7
autre	6000	0,9
Total	667000	100,0

COUT D'INVESTISSEMENT DU TCSP (en millions d'Euros)					
Phases	Phase 1	Phase 2	Phase 3	Phase 4	Total
Origine	Aniche	Douai	Douai	Douai	
Destination	Douai	Hôpital	Auby	Waziers	
Longueur de ligne (en ml)	19 495	5 195	4 785	5 270	34 745
voie simple (en ml)	7 200	210	4 785	5 270	17 465
voie double (en ml)	12 295	4 985	0	0	17 280
stations	24	8	7	7	46
matériel roulant	11	6	2	2	21
ponts	2	1	0	1	4
chaussée complète	53,86	13,60	12,96	11,89	92,31
système rail	13,93	3,87	2,96	3,26	24,03
total chantier	71,09	18,17	16,65	15,89	121,79
ponts	4,54	1,65	0,00	1,34	7,53
divers	2,29	0,76	0,76	0,76	4,57
stations	7,32	2,44	2,10	2,13	13,99
matériel roulant	16,77	9,15	3,05	3,05	32,01
dépôt, PCC, câblage et équipement	11,28	3,96	2,59	2,29	20,12
aléas	11,28	3,66	2,59	2,59	20,12
Moe	12,96	3,66	2,87	2,92	22,40
Total	137,52	43,45	32,69	30,97	244,63
Prix au km	7,05	8,36	6,83	5,88	7,04
Prix au km sans MR	6,19	6,60	6,19	5,30	6,12

Source: SMTD

Modal-split targets...

...project phases and estimated costs

Douai



The bus is called a bus ...
... the HQ-bus is called a tram!?

Douai



Bus infrastructure split in single lanes in parallel streets to allow penetration of city centre...

Douai



The “tram” vehicle (PHILEAS)... Doors on both sides... Fancy...

Douai



But... Too complicated and to be replaced...

Douai



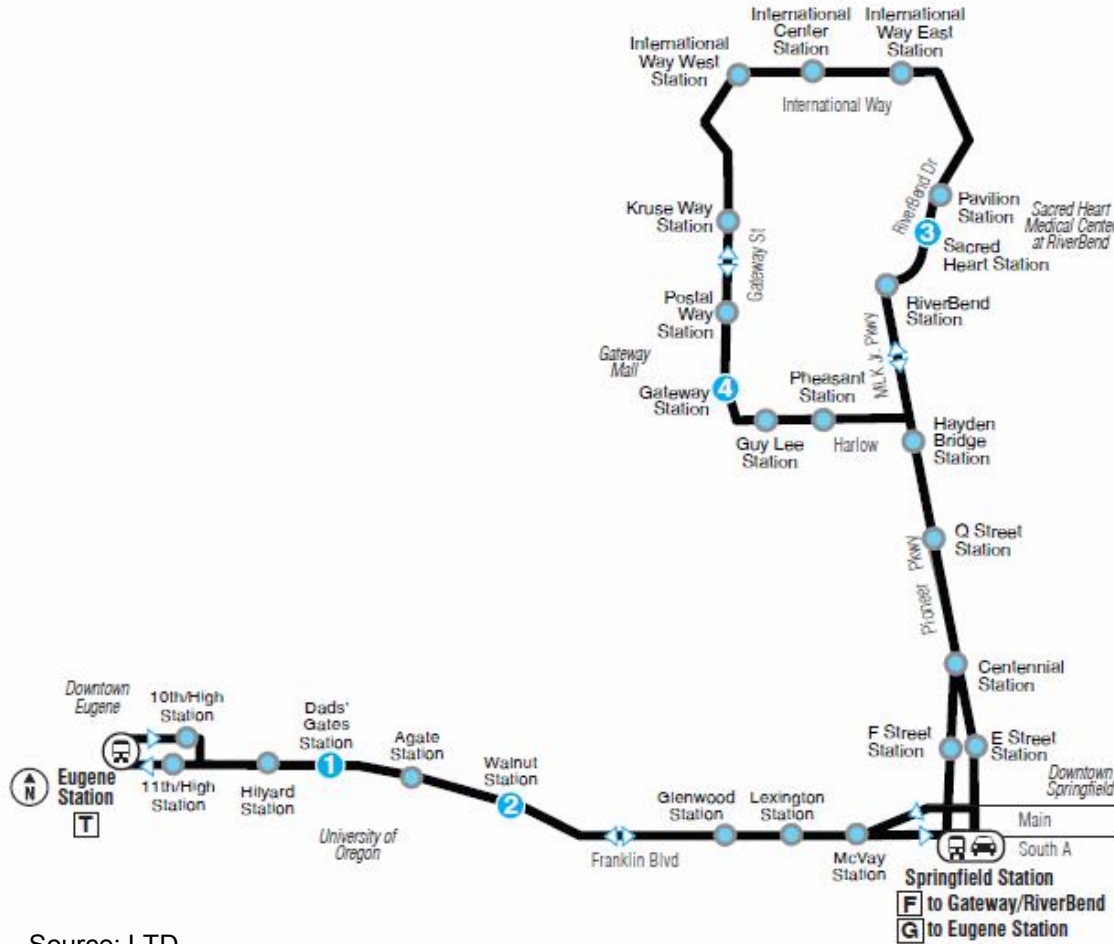
Pragmatic solution for a narrow section...

Eugene / Springfield

Key facts:

Location:	North-Western US (Oregon)
Population:	216 000 city – 350 000 agglo
Density:	1 520 inh./km ²
PT-offer:	HQ-bus/bus
Project:	6.4 km busway (1st phase) 25 Mio.\$ (= 3.9 Mio. \$/km)
Service:	10 min weekdays
Passengers:	2 650/day > 5 400/day (2008)

Eugene/Springfield



Phase 1:
Eugene-Springfield

Phase 2:
Springfield > North

Eugene/Springfield



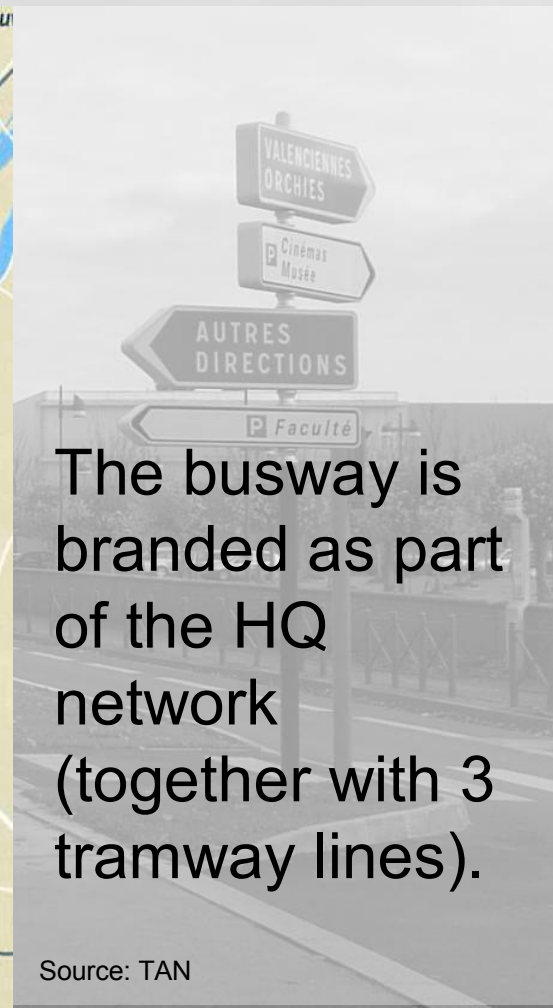
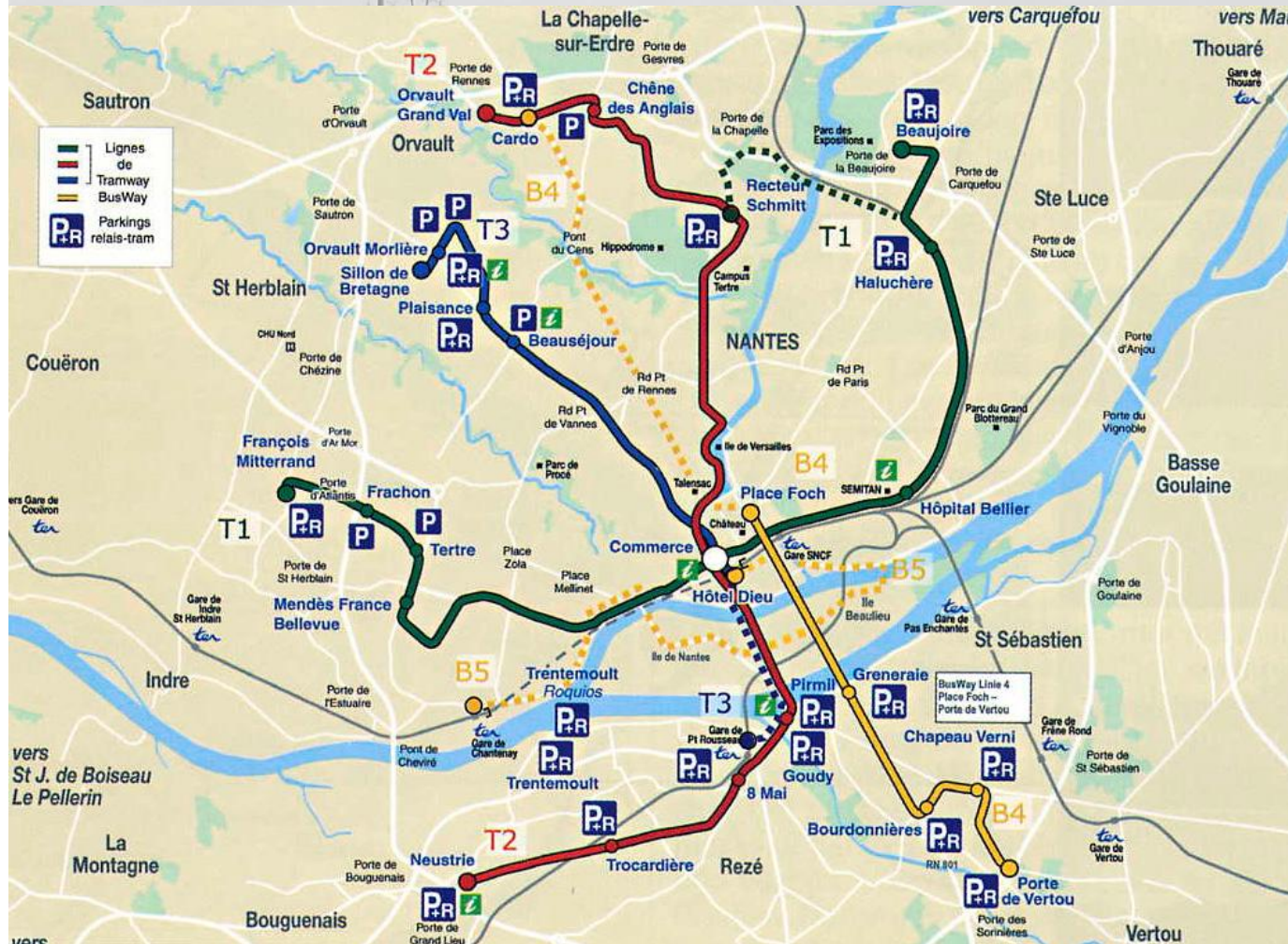
“Single track (lane)” approach in Eugene centre...

Information



Attractive stop environments...

Nantes



The busway is branded as part of the HQ network (together with 3 tramway lines).

Source: TAN

Nantes

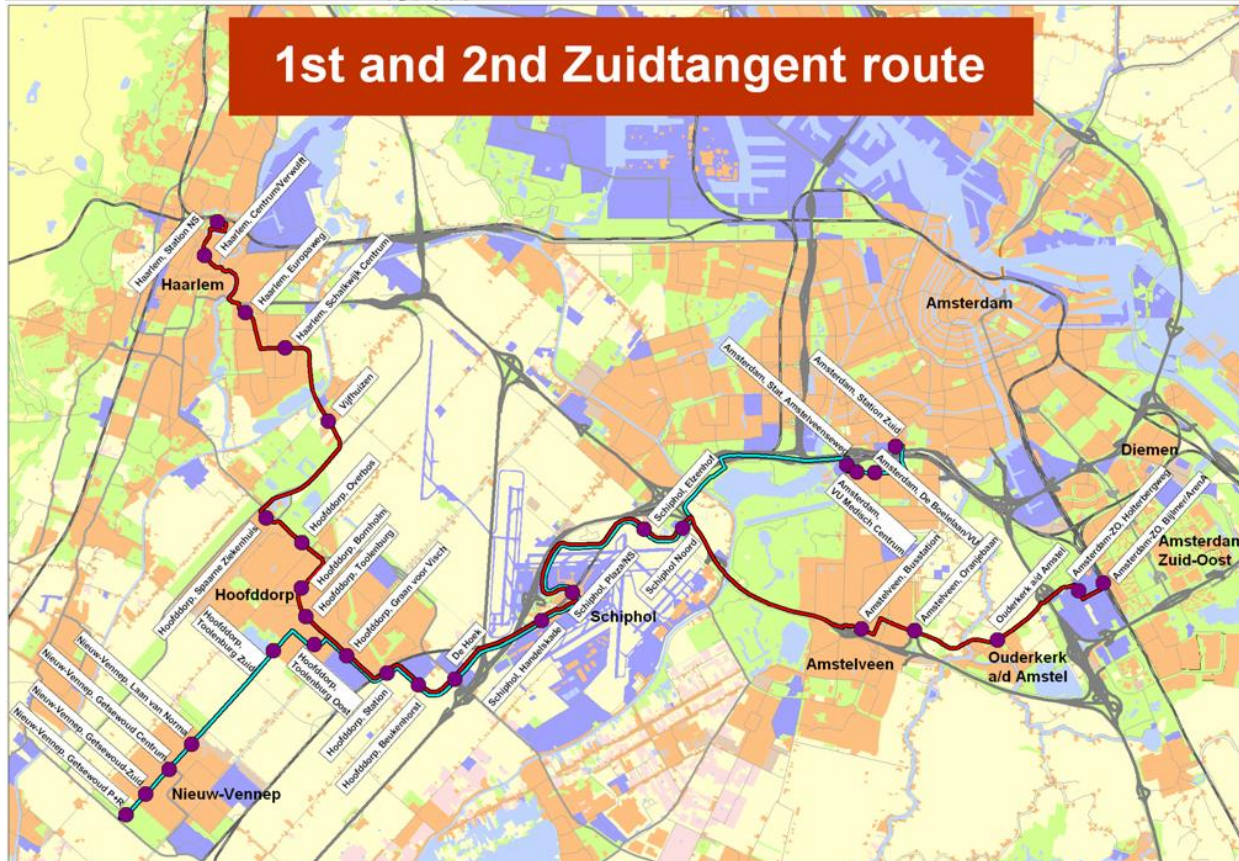


The “busway” vehicle ... Ordinary CITARO... A bit fancy...

Nantes



Zuidtangent



Source: Stadsregio Amsterdam

A tangential busway system in the South of Amsterdam agglomeration. Links Haarlem via Hoofddorp with Schiphol Airport and further to Amstelveen and Amsterdam Zuid-Oost (football stadium, shopping centre etc).

Zuidtangent



Standard buses... Fancy stops, but...

Components of a “Superbuss” system

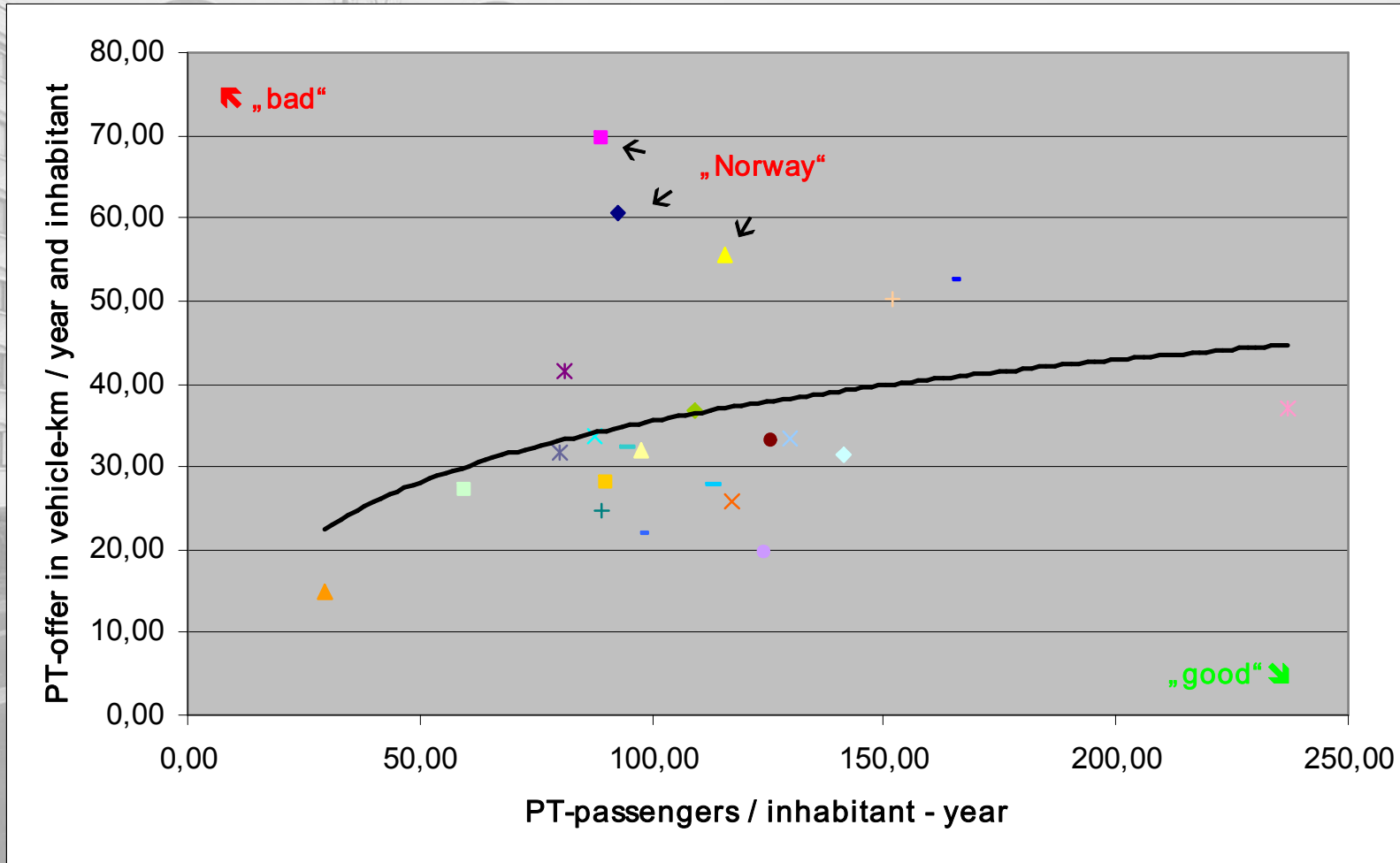
- ▶ Strategic issues
- ▶ Technical issues
- ▶ Operational issues
- ▶ Service issues

Strategic issues of a “Superbuss” system

Project targets? Explain why!

- ▶ Modal shift?
- ▶ Reduction of car traffic?
- ▶ Better economy of public transport offer?
- ▶ Reduced operational costs?
- ▶ Support of land-use developments?

PT-inputs and outputs!



Norway:
High input, but ...

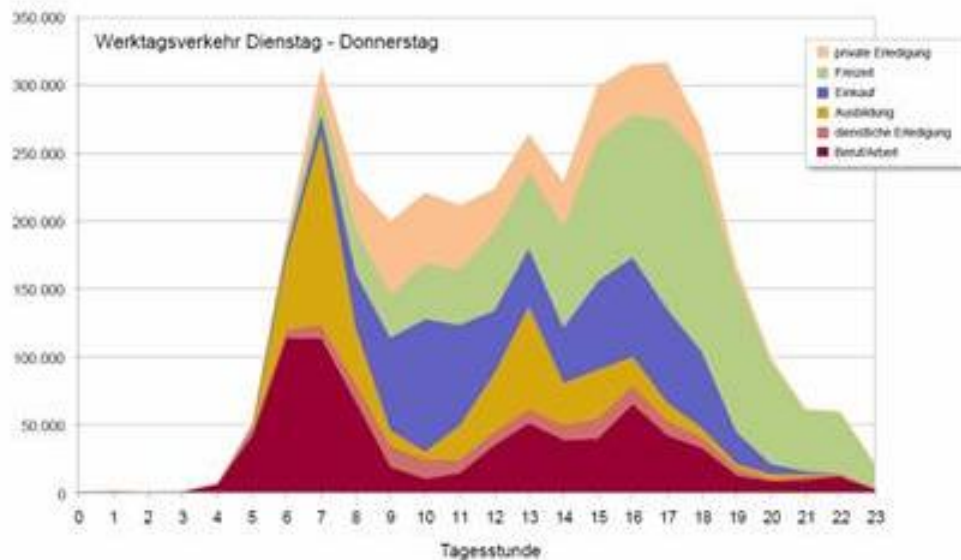
Density is a core issue!

Impact of settlement patterns and densities

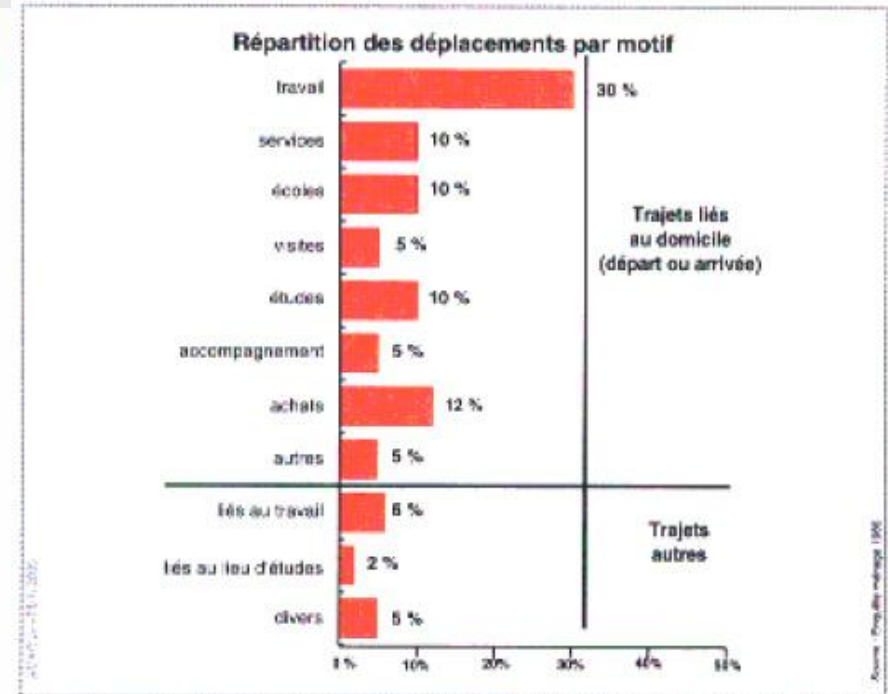
	Population	Area (km ²)	Density (inhabitants/km ²)
Edmonton:	812 000	683	1 187
Oslo:	634 000	454	1 397
Lyon:	636 000	62	10 197
Le Mans:	143 200	53	2 712
Cadiz:	123 000	12	10 164
Metz:	120 000	42	2 860
Besancon:	115 900	65	1 781
Douai:	41 900	17	2 483
St. Nazaire:	67 100	47	1 434
Tromsø:	70 800	2 566	28
Tromsøya:	38 100	23	1 583
Trondheim:	181 000	322	560

More than just commuter traffic...

Ergebnisse der Haushaltsbefragung ZGB 2010
Tagesganglinie nach Wegezweck



Source: WVI/ZGB



Source: Communauté d'agglomération Orléans Val de Loire / AUAO

HQPT these days can't concentrate just on work trips!

Technical issues of a “Superbuss” system:

- ▶ Alignments
- ▶ Stops
- ▶ Junctions with other traffic
- ▶ Vehicles
- ▶ Propulsion + environment

Alignments



Technical issues of a “Superbuss” system:

Alignments

- ▶ Dogmatic “double track in middle of the road” approach?
- ▶ “One size fits all”?
- ▶ Pragmatic compromises appreciated?
- ▶ Future upgrade/conversion to tramway to be kept open?

Technical issues of a “Superbuss” system:



Stops

- ▶ What about level access?
- ▶ Stop quality and kerb heights?

Technical issues of a “Superbuss” system:



Stops

- ▶ What about level access?
- ▶ Stop quality and kerb heights?

Stops: level access

Source: Düsseldorf municipality

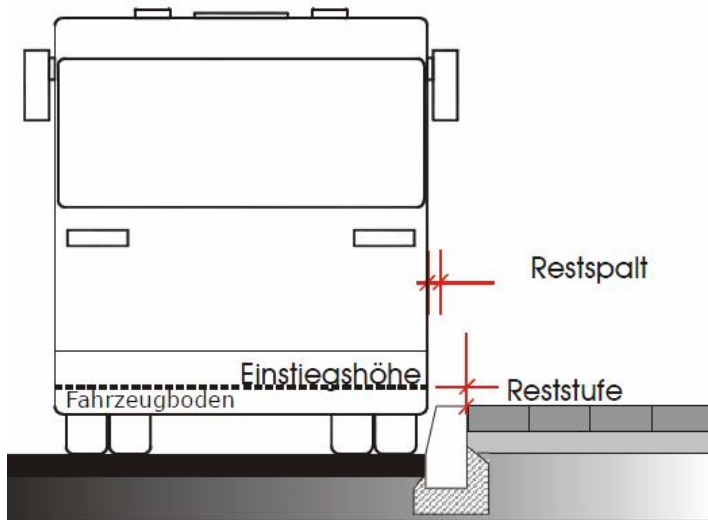


Abbildung 1: Zusammenhang von Reststufe und Restspalt

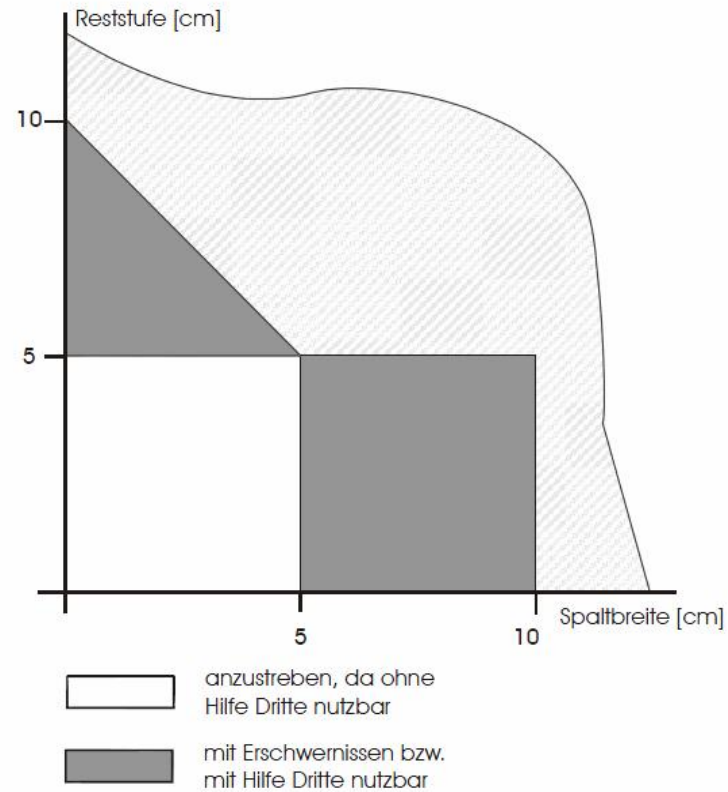


Abbildung 2: Empfohlene Reststufenhöhe und Spaltbreite (vgl. u.a. BMV 1997, S. 24 oder auch Entwurf DIN 18030, Pkt. 5.2.5)

Vertical and horizontal gaps?

Stops: level access



Specific kerb designs?

Stops: level access



BUNDESAMT FÜR VERKEHR
OFFICE FEDERAL DES TRANSPORT
UFFICIO FEDERAL F. DEI TRANSPORTI
FEDERAL OFFICE OF TRANSPORT

Kanton Zug



Auftraggeber Bundesamt für Verkehr BAV

AöV / VBZ

Erhöhtes Kasseler-Sonderbord
Untersuchung für einen behindertengerechten Buseinstieg
sowie eine kombinierte Haltekante Bus/Tram

Projektname Studienbericht
"Hohe Kante" bei Bushaltestellen

Schlussbericht

Berichtstitel Busverkehr mit
niveaugleicher Schnittstelle zwischen
Bordsteinkante und Bus



Photo Fiat SA Locarno



Rollstuhlgerechter Buseinstieg

Studie
Technischer Bericht

Zürich, 16. März 2006

Source: Basler&Hofmann/BAV

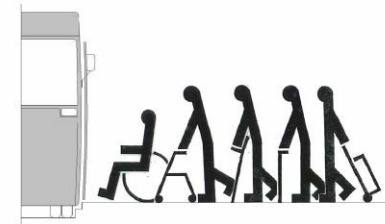
Vernehmlassung

Plan Nr.: 3736-B01 Datum: 12.04.2010
Rev.: - Visum: Mo
Auftrag-Nr.: 3736.1 Planformat: A4

Planer: **SNZ** SNZ Ingenieure und Planer AG
Dörflistrasse 112, CH-8050 Zürich • Tel.: 044 318 78 78 • Fax 044 312 64 11 • www.snz.ch

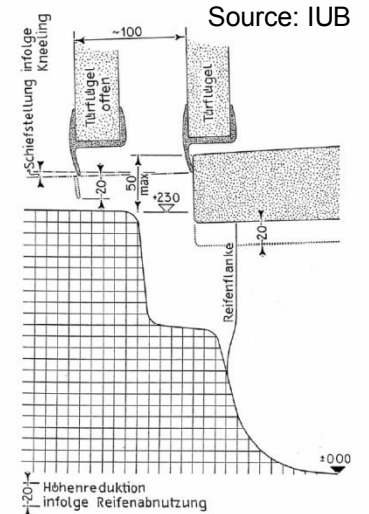
Bauherr: Amt für öffentlichen Verkehr des Kantons Zug, Aabachstrasse 5, 6300 Zug
Verkehrsbetriebe Zürich, Luggwegstrasse 65, 8048 Zürich

Source: SNZ/VBZ/ZVB

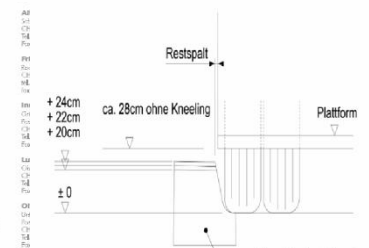


IUB
IUB INGENIEUR-UNTERNEHMUNG AG

Source: IUB/BAV



Source: IUB



Source: Profilbeton/B&H

Swiss research! 26cm bus platforms feasible!

Technical issues of a “Superbuss” system:

Junctions with other traffic

- ▶ What about roundabouts?
- ▶ How to achieve priority without creating capacity restraints?

Junctions with other traffic



In France identical signals for busway/tramway?
Only crossing traffic impacted by signalling...

Junctions with other traffic



Stavanger pilot project? “All red” approach?

Junctions with other traffic



Otherwise: standard junctions... no roundabouts...

Technical issues of a “Superbuss” system:

Vehicles

- ▶ Dimensions / capacity
- ▶ Guidance
- ▶ Propulsion
- ▶ Environment

Dimensions / Capacity



25m
Possible?
Required?

Guidance



Source: Werner Nüchterlein



Source: TCAR

Attention!

Suppliers market limited...

Beneficial for docking quality at stops (horizontal gap) but no absolute requirement...

Propulsion

► Combustion engine

- Diesel
- Gas (Otto)

► Electric engine

- Battery/Super-cap
- Fuel Cell
- Trolley (+ mixed forms)

► Hybrid

- Combustion engine + Electric (braking energy recovery)
- Electric bus + combustion engine (as back -up)

Environment

► Resource saving

- Less use of non-renewable energy
- Use of alternative (renewable) energy, CO₂ neutral energy
- Energy saving (technology, driving style, ...)

► Emission reduction

- Global emissions (green house gases): ↓CO₂
- Local emissions:
 - Particles, NO_x, etc.
 - Noise

Operational issues of a “Superbuss” system:

- ▶ Network configuration and hierarchies
- ▶ Stop strategy
- ▶ Commercial speed

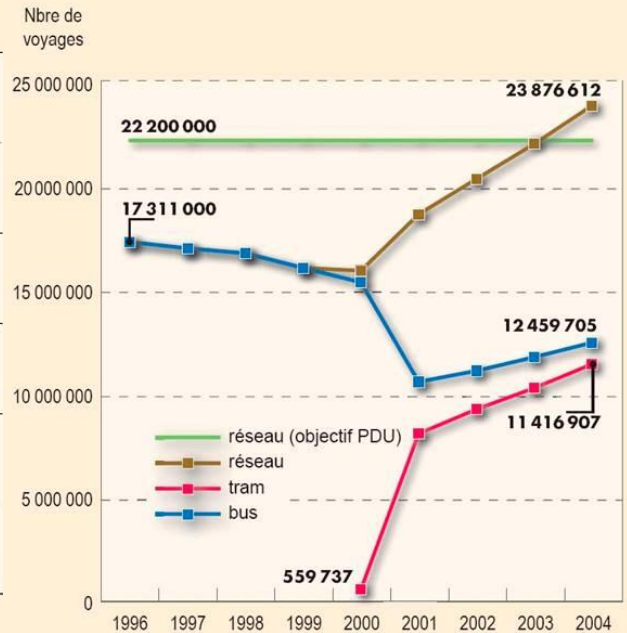
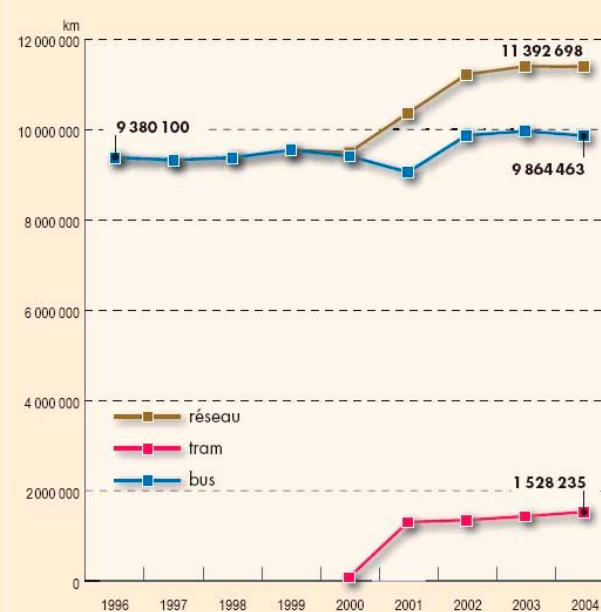
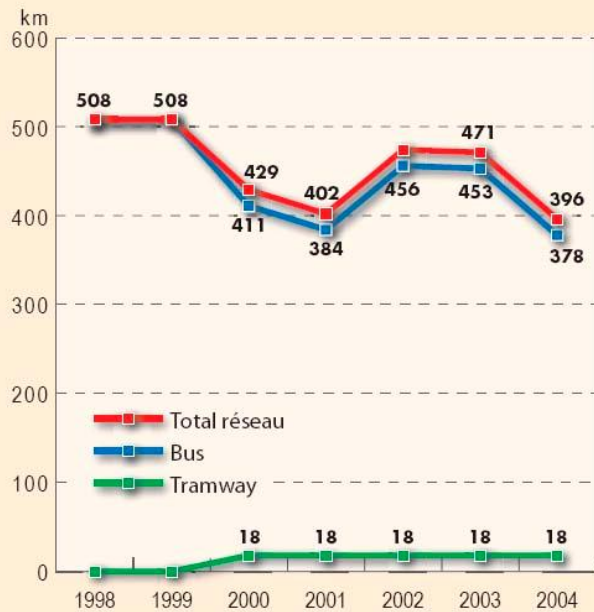
Network configuration and hierarchies

”There is no bad weather – there is only wrong clothes!”

There are no good or bad PT-modes – there are only modes which aren't properly used...

Who is doing what? And where? Think network!

Network configuration and hierarchies

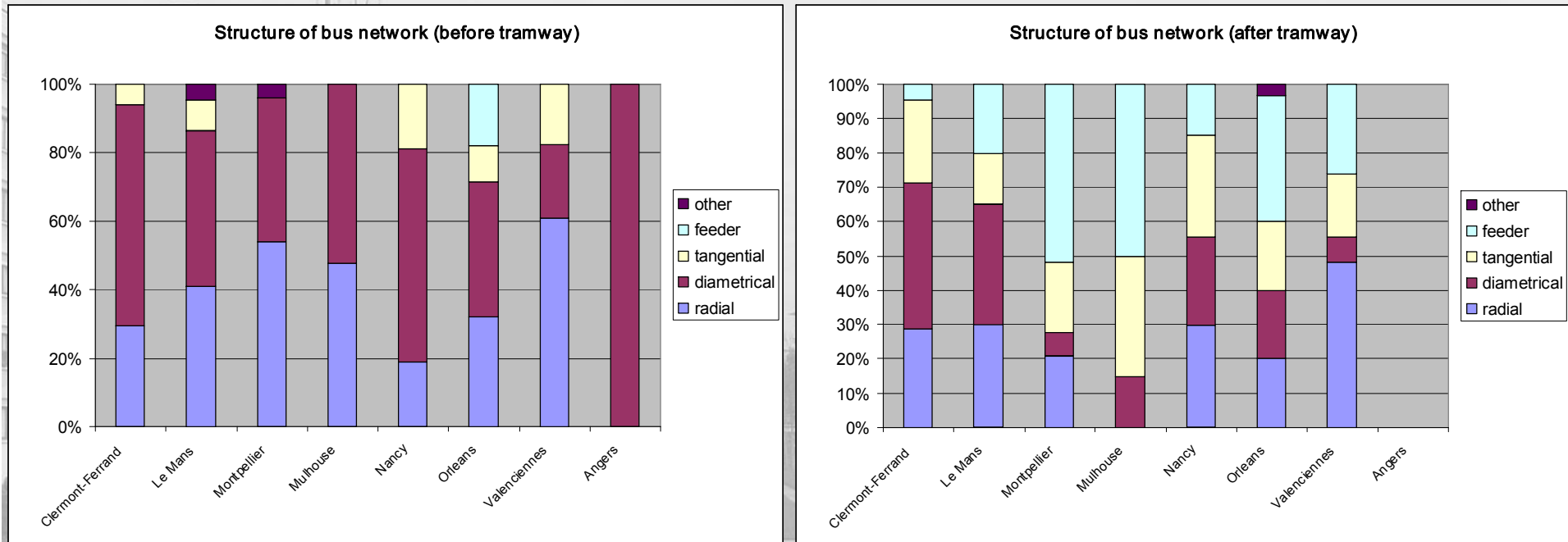


Source: AUAO - PDU2005

Example Orleans:

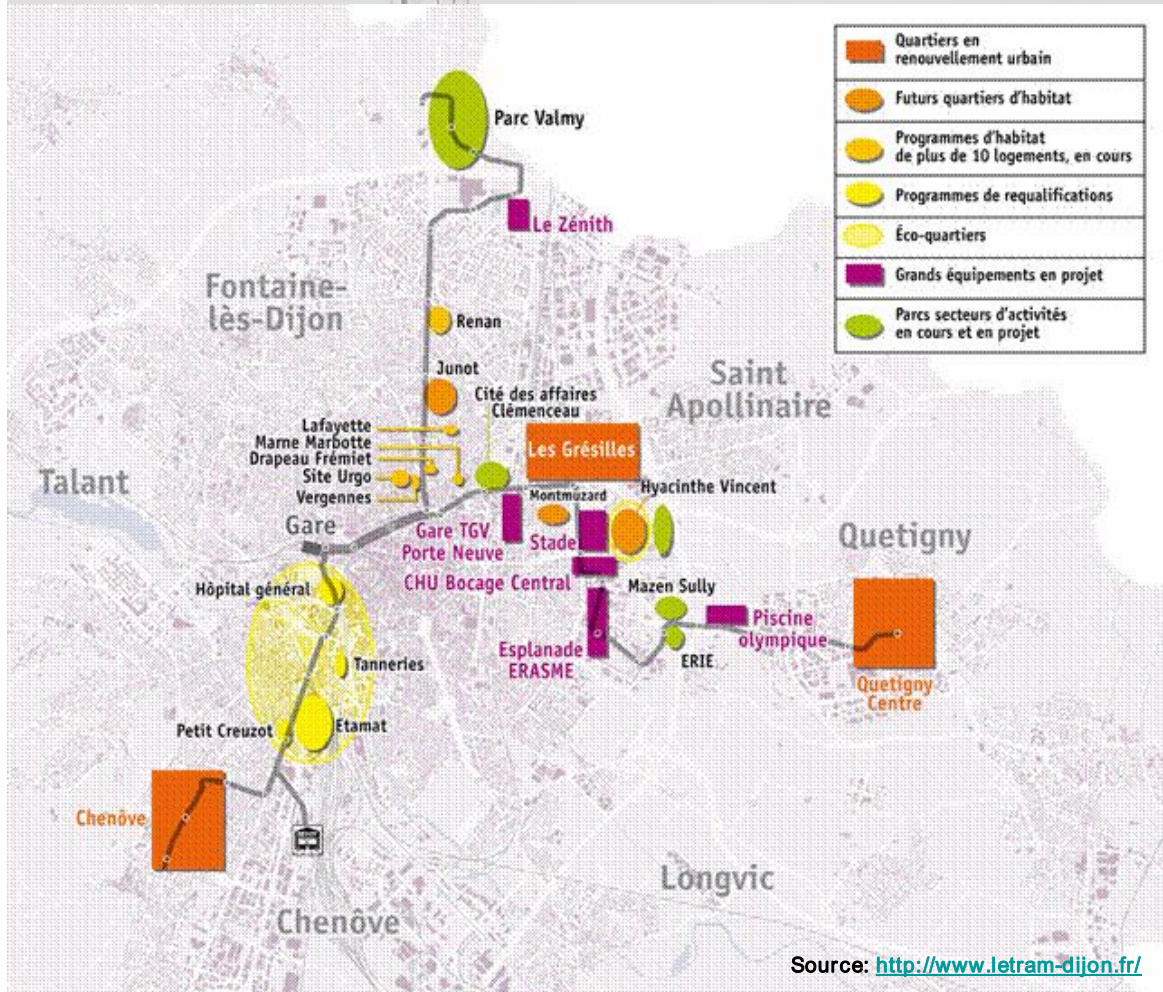
Tramway produces 48% of PT-trips with only 13% of all vehicle-kms invested! Backbone role - restructured bus network ...

Network configuration and hierarchies



- Diametrical bus lines replaced by feeder services!
- Interchange compensated by higher feeder frequency.
- No parallel bus services in tramway corridor.

Stop strategy



Stop categories

- Crucial
- Important
- Useful

Accessibility vs speed?

Stop strategy

1st lines of HQPT in French cities - what they serve:

City	Mode	Operation	Centre	Housing area (dense)	Main Railway Station	Shopping area /centre	University	Hospital	Administration	Museum, library, cinema ...	Sports Ground (big)	Exhibition / Fair / Congress Centre	Score	
Angers	Tramway	construction	100%										7,5	
Bordeaux	Tramway	operation	100%		2nd line								6,5	
Caen	"Rubber Tyre" Tramway	operation	100%										6	
Clermont-Ferrand	"Rubber Tyre" Tramway	operation	100%										8	
Douai	Bus Rapid Transit (BRT)	construction	100%										3,5	
Grenoble	Tramway	operation	100%				2nd line	2nd line					6	
Le Mans	Tramway	operation	100%										8,5	
Marseille	Tramway	operation	100%										3	
Montpellier	Tramway	operation	100%										9,5	
Mulhouse	Tramway	operation	100%										8	
Nancy	"Rubber Tyre" Tramway	operation	100%										6,5	
Nantes	Tramway	operation	100%				2nd line	2nd line					7,5	
Nice	Tramway	operation	100%										8,5	
Orleans	Tramway	operation	100%										7	
Reims	Tramway	construction	100%										6	
Rennes	Metro (VAL)	operation	100%										6	
Rouen	Light Rail	operation	100%										3	
Strasbourg	Tramway	operation	100%							2nd line		2nd line	6	
Toulon	Tramway	planned	100%										5	
Tours	Tramway	planned	100%										6	
Valenciennes	Tramway	operation	100%					2nd line					6	
													6,4	
				21	20	19	16	14	13	12,5	11	9	6,5	14,2
				100%	95%	90%	76%	67%	62%	60%	52%	43%	31%	68%

© Axel Kuehn 2008

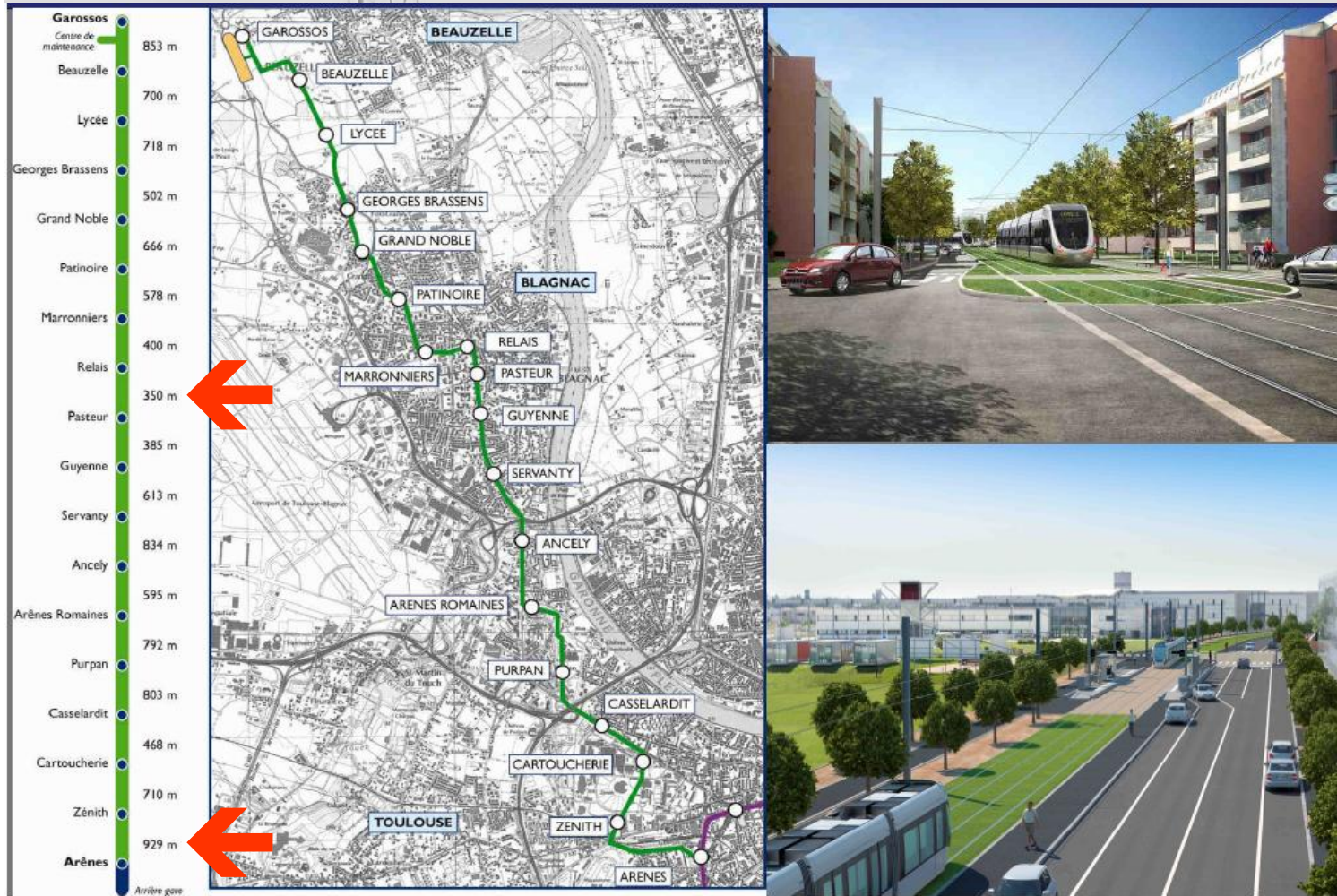
Stop strategy

Stop distance

If one speaks of an “average stop spacing” of 500m on a 10km line with 20 stops such may result from very different conditions:

- 20 stops with all exactly 500m distance
- 10 stops on 4km (centre!) with 400m distance + 10 stops on 6km outside with 600m distance
- ... (reality is a mix!)

Stop strategy

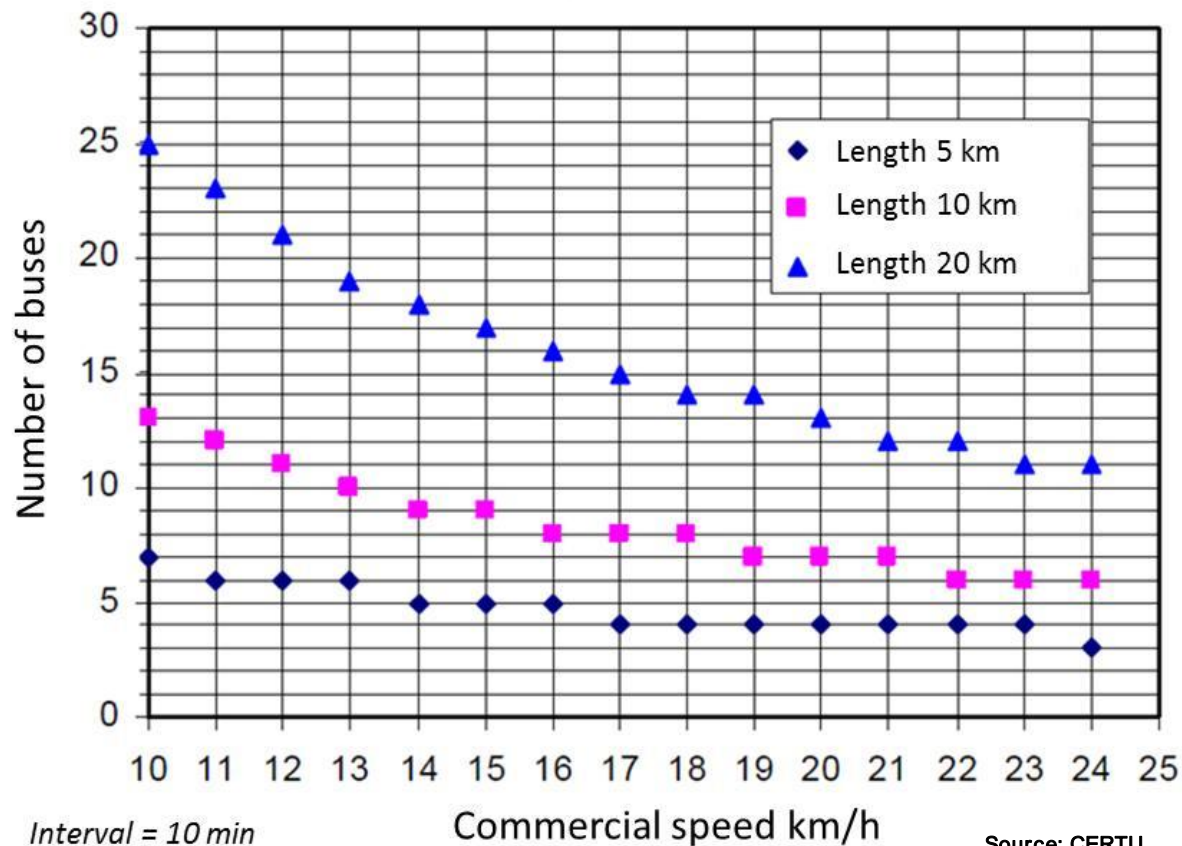


Source: SEM CONSTELLATION/TISSEO

Example from tramway world (Toulouse)

Commercial speed

Number of buses required to ensure at least an equivalent capacity

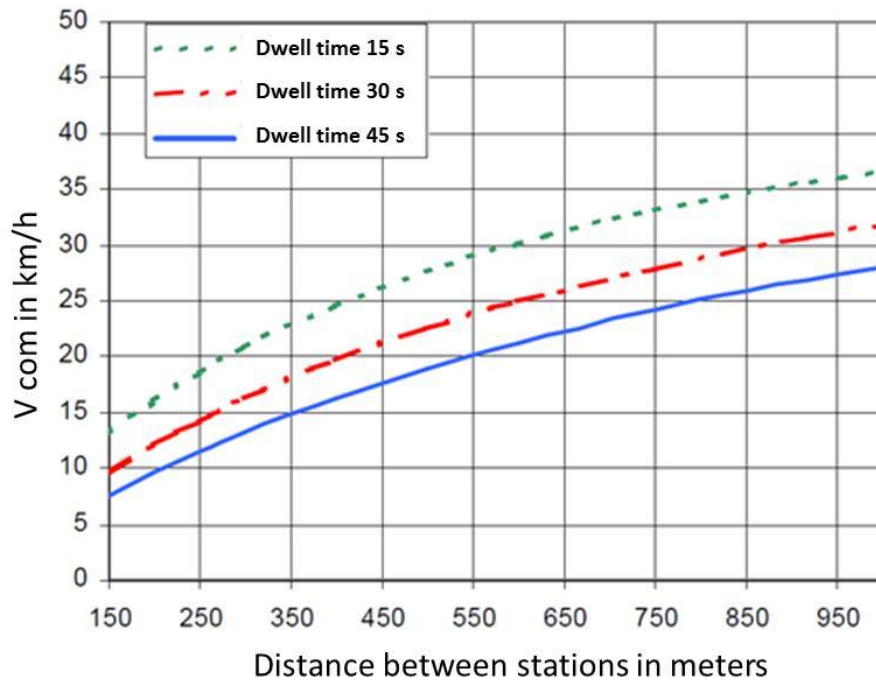


Increase of V_{com} means...

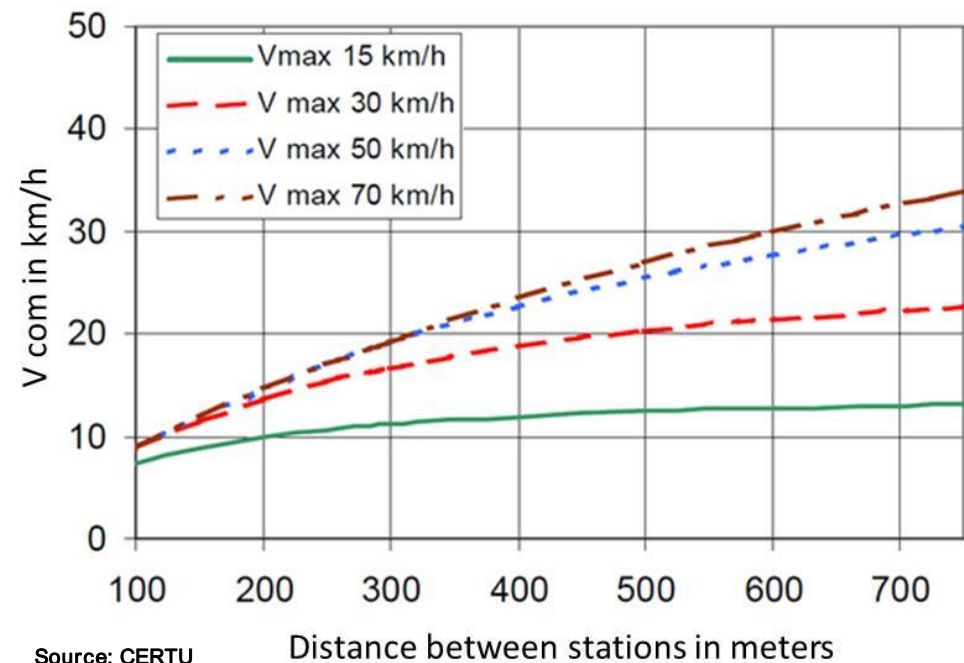
- ▶ less operational costs (less buses, less driver costs),
- ▶ higher attractiveness and competitiveness (passenger demand)

Commercial speed

Commercial speed in relation to dwell time and distance between stations



Commercial speed in relation to the maximum speed and the distance between stations



Source: CERTU

Influence of station distance, dwell time and max. speed...

Commercial speed (influenced by ...)

- ▶ Average distance between stations
- ▶ Dwell time (at stations)
 - Bus layout (seats, aisles, doors) and capacity
 - Station platform (accessibility)
 - Ticketing sales and validation
 - Embarking- and disembarking (how many doors are used)
- ▶ Separation from individual traffic
- ▶ Priority at traffic lights (waiting time)
- ▶ Station approaching- and leaving time
- ▶ Max. speed
- ▶ Vehicle performance

Commercial speed

But be aware:

High speed with no stops is no solution either!

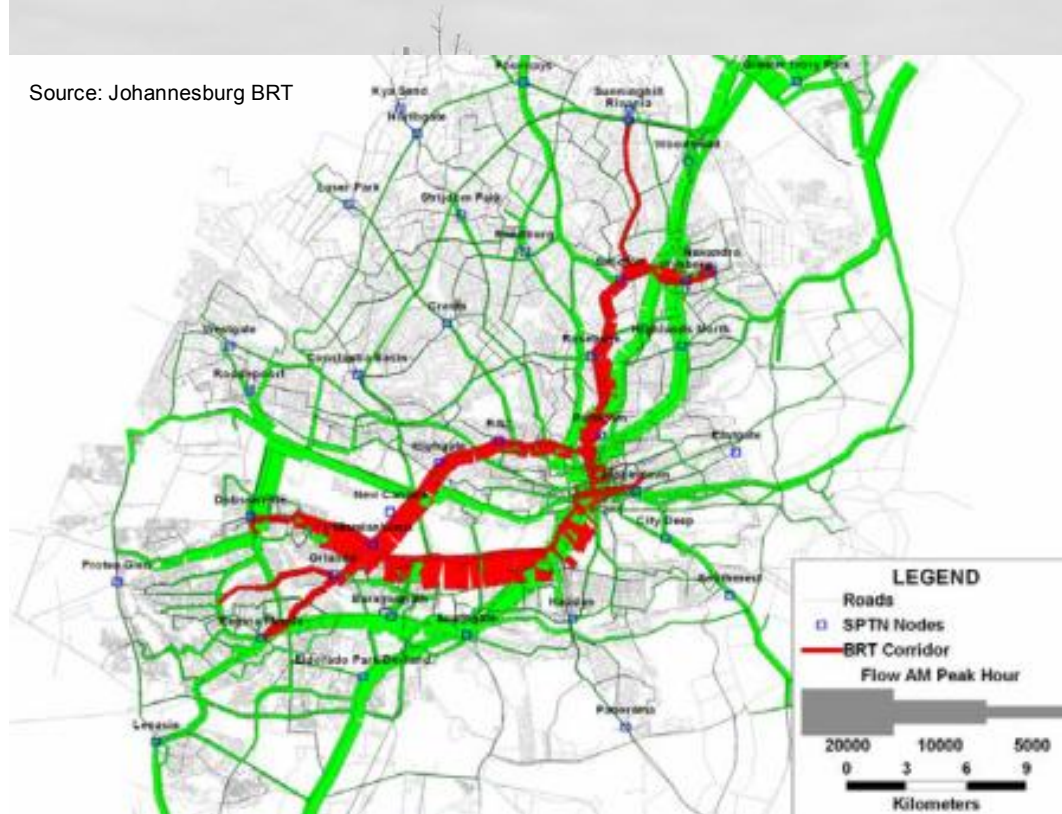
City centres will likely require different approaches than sub-urban corridors...

Service issues of a “Superbuss” system:

- ▶ Offer and demand
- ▶ Integration with other modes
- ▶ Information
- ▶ Ticketing

Offer and demand

Source: Johannesburg BRT



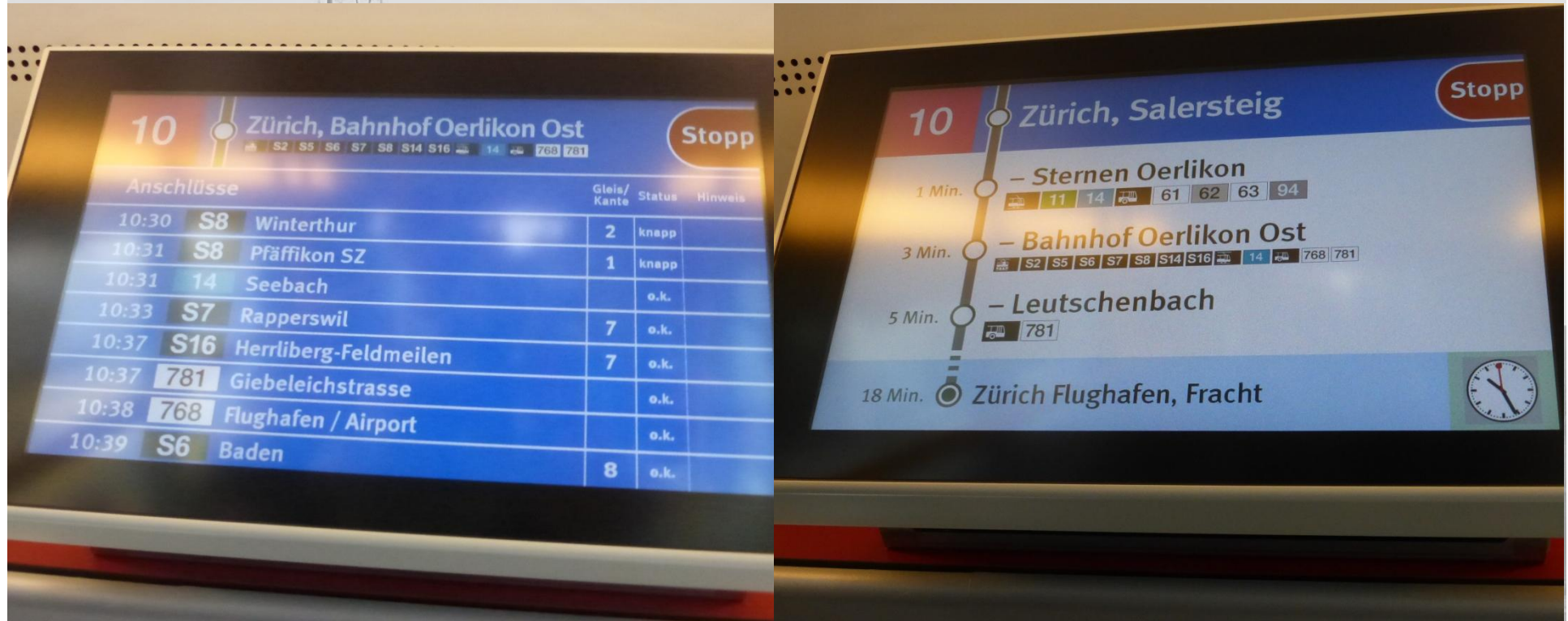
Service patterns adapted to demand, improved frequency, reliability and accessibility, attractive service and travel times

Integration with other modes



Easy start- to final destination travelling with attractive interchange hubs, minimized total travel time, integrated fares/information...

Information



Real time information, travel planning, facilitating regularity etc

Ticketing



Source: MAX, Las Vegas

- Simplicity and efficiency of fare collection (off- and on board)
- Ticket control (fare evasion)
- Purchase time (reduction of dwell time)
- Information on passenger flows

Ticketing



The widest doors don't help when entry at the driver is required...

Identity and branding



Source: Viva

- Specific branding of the (new or premium) system
- Contribution to city embellishment
- Contribution to public transport attractiveness

Identity and branding



Source: Valenciennes Métropole

Example Valenciennes

Logo:
The Tram
– a new line of life

Identity and branding



Source: Le Mans Métropole

le Mans – le traM:
a play with words (or with the city name), but clearly showing the weight given to the tramway project in Le Mans.

Identity and branding



Source: ALSTOM

Example Reims

The Champagne flute...



“This is our tram” – creating identification of citizens by participation in design choice!

Identity and branding

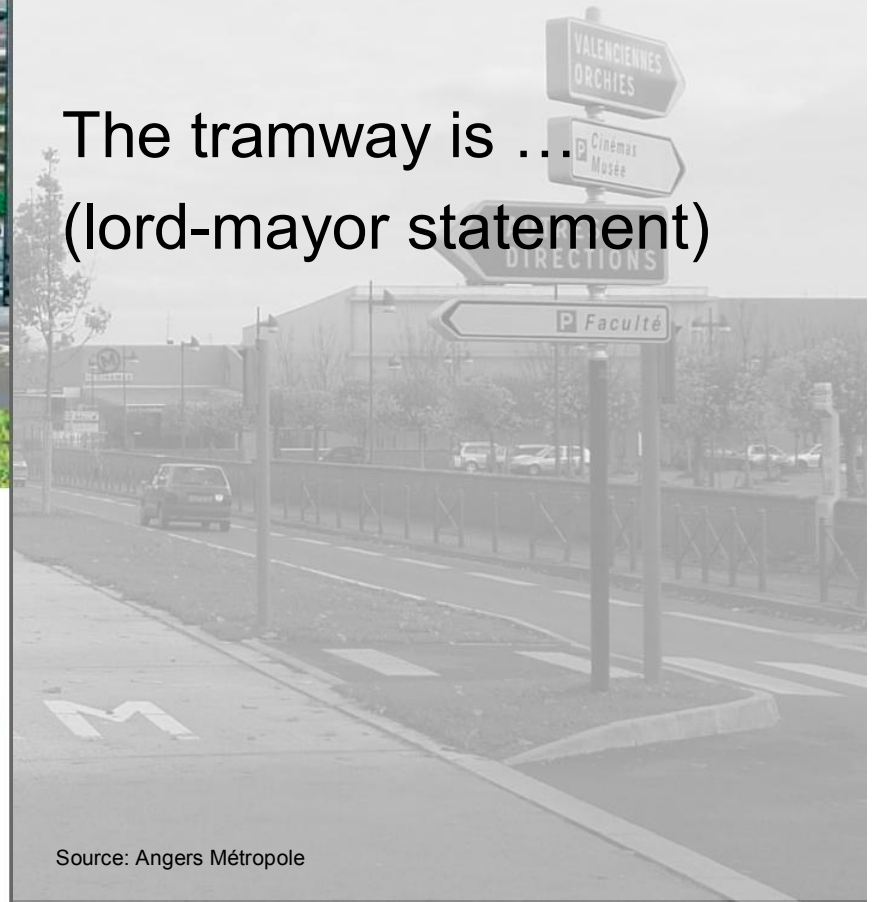


“Le tramway est un outil attractif, qui dope les affaires, retient l’attention des entreprises et participe fortement au développement du territoire.”

Thierry Borneau/Ville d'Angers

Example Angers

The tramway is ...
(lord-mayor statement)



Source: Angers Métropole

Livable city... (with HQPT)



And finally ...



... don't forget information for the public and quality stakeholder management!

Copyright notice



All unsourced pictures or diagrams are © of Axel Kuehn

Thank you for your attention!



Axel Kuehn
Independent Consultant / PT-expert
Karlsruhe 127
76137 Karlsruhe
Tel: +49-721-3525267
Mob: +49-170-2003385
E-Mail: kuehn.axel@web.de

Werner Nüchterlein
P&N-Consult AB
Enkärrsvägen 45
134 63 INGARÖ
Tel: +46-8-51512262
Mob: +46-761422262
E-Mail: werner.nuchterlein@pn-consult.com