Workshop 1-2 March, 2010
Donostia

Düsseldorf Light Rail System
More Mobility, More Quality of Life

Marc Herkenrath
LRTC GmbH / Rheinbahn AG

Rheinbahn

LRTC

Düsseldorf Light Rail System
Table of Content

I Düsseldorf Metropolitan Area

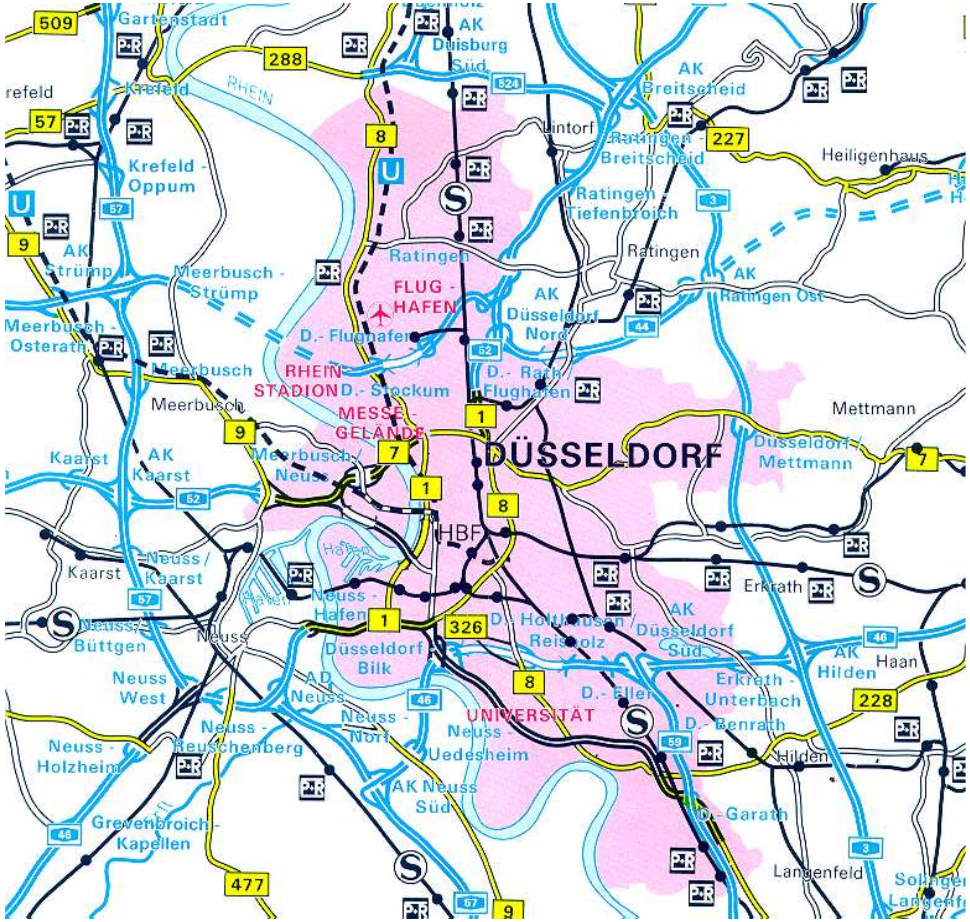
Düsseldorf Metropolitan Area
City Figures

Düsseldorf, Capital of Northrhine-Westfalia

Area: 217 km²

Inhabitants: 590.000

Important Institutions:
- Regional Government
- International Airport
- Heinrich-Heine-University
- Museum of Modern Arts
- Fair Ground

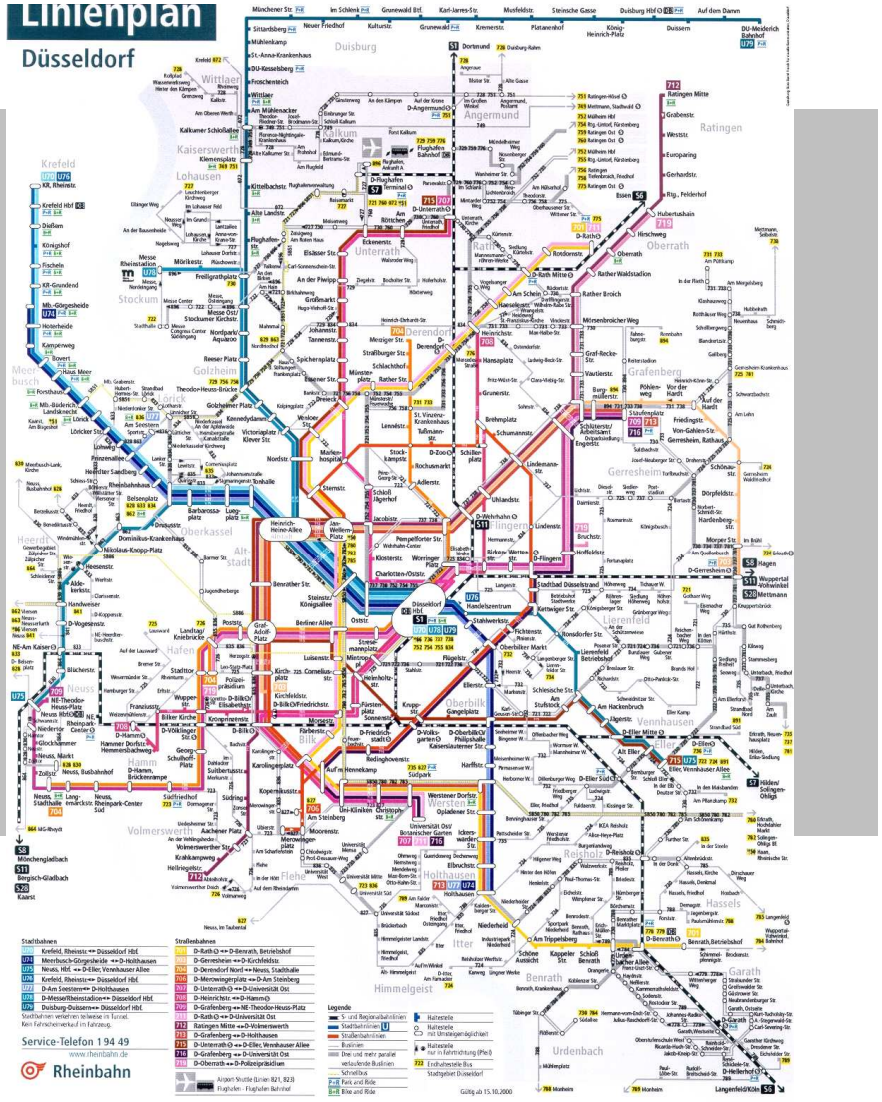


Düsseldorf Metropolitan Area
Urban LRT-, Tram- and Bus-Network

7 LRT-Lines

13 Tram-Lines

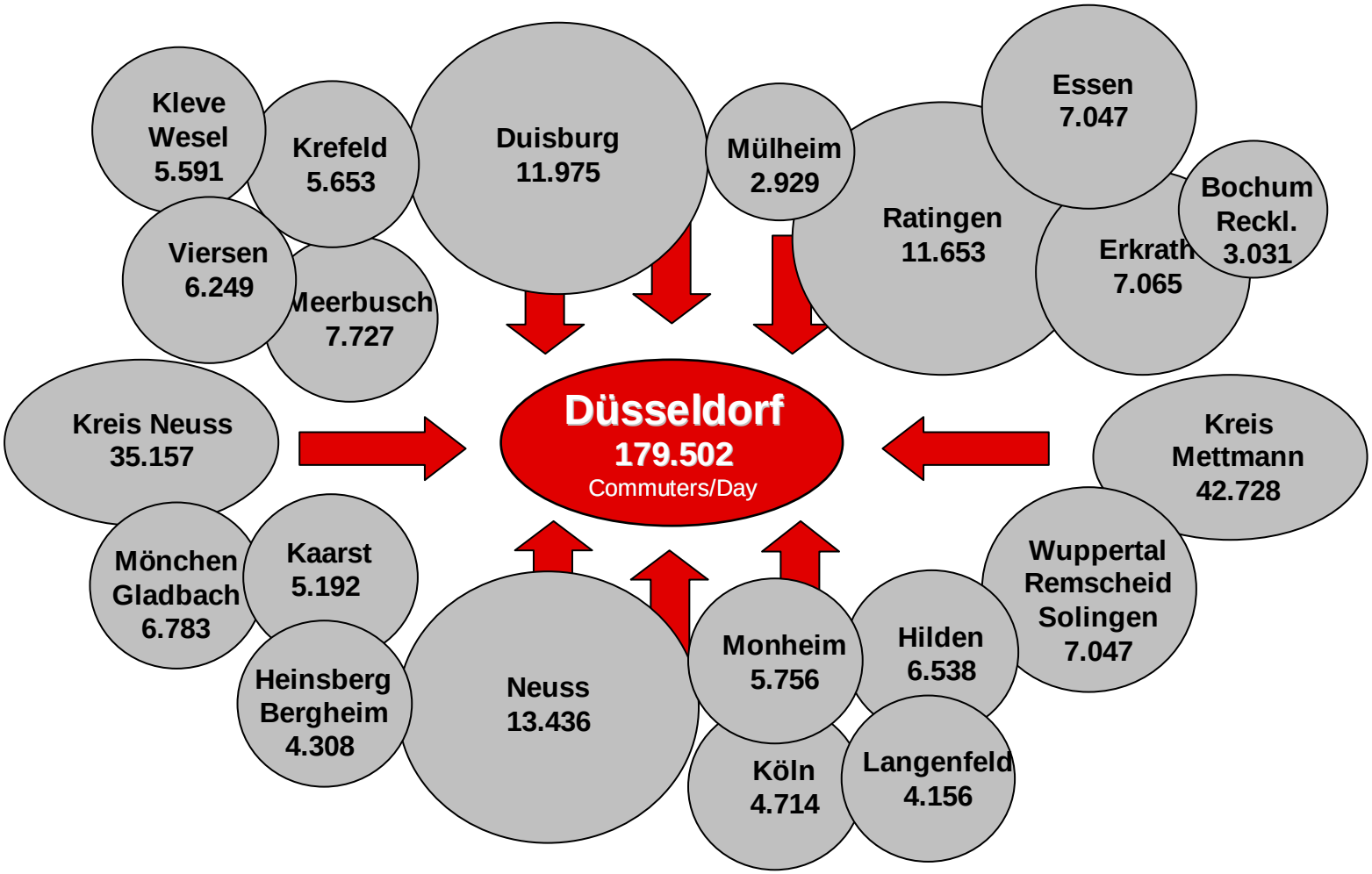
91 Bus-Lines



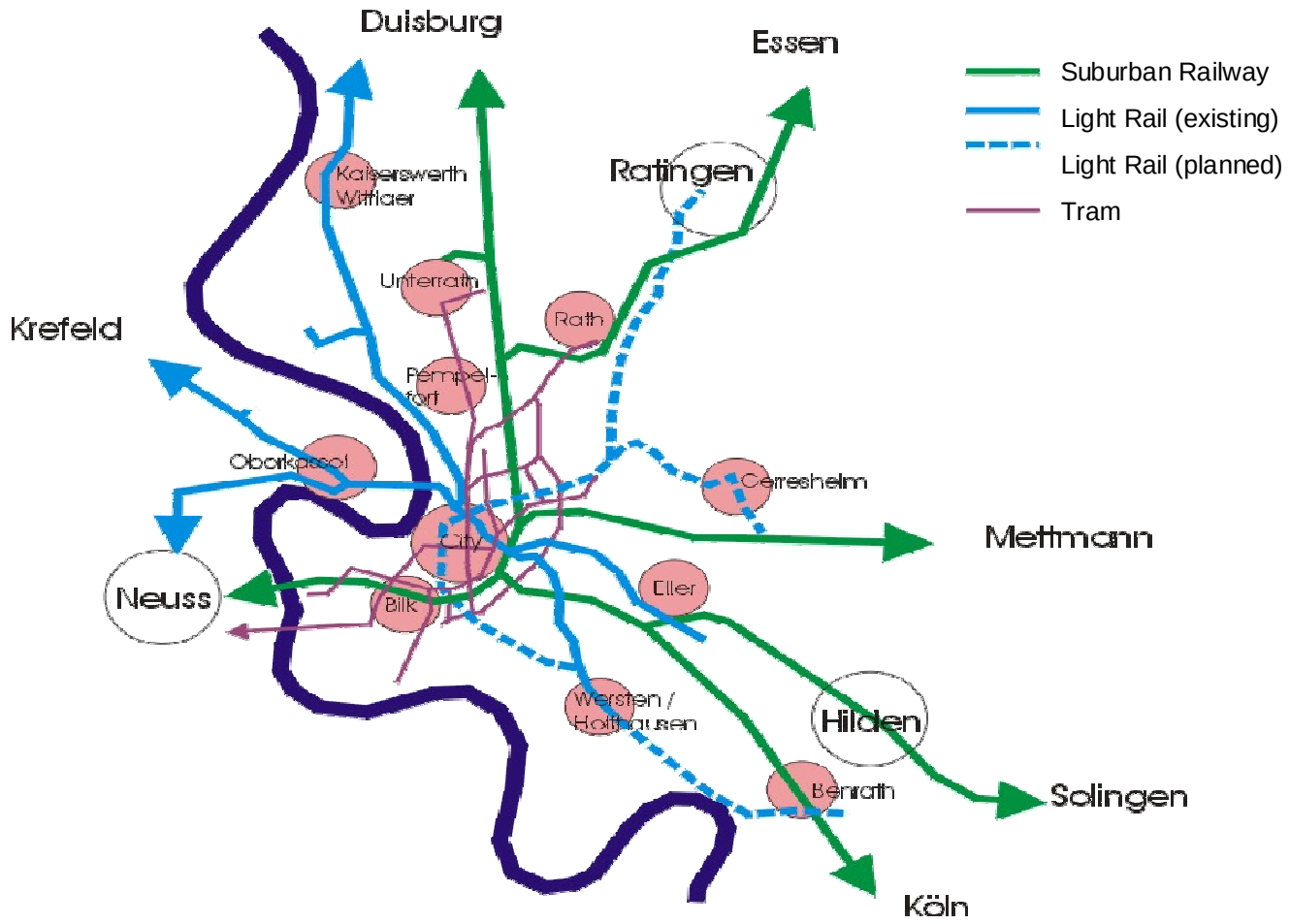
Rheinbahn LRTC

Public Transport for Düsseldorf

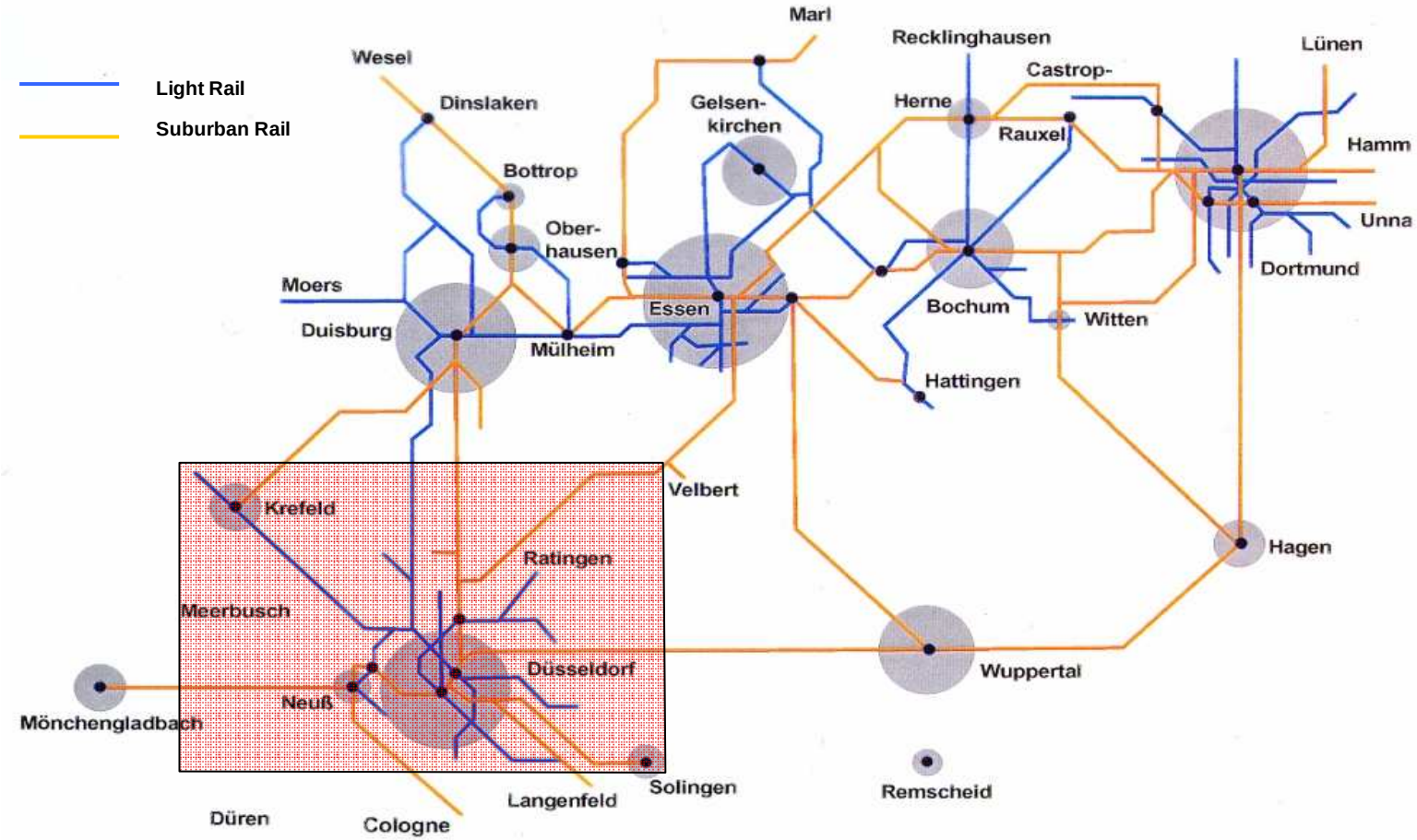
Düsseldorf Metropolitan Area „Commuter City“



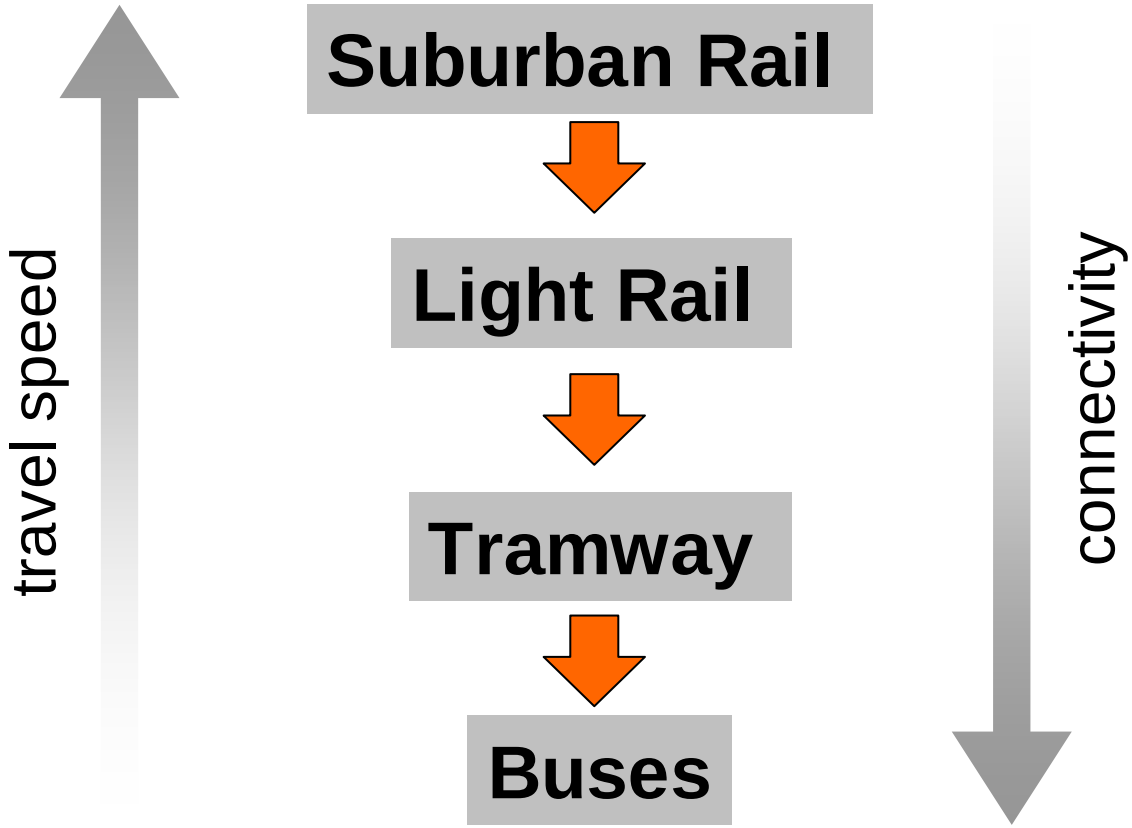
Düsseldorf Metropolitan Area
Main Regional Axles



Düsseldorf Metropolitan Area
Rhine-Ruhr-Area Network

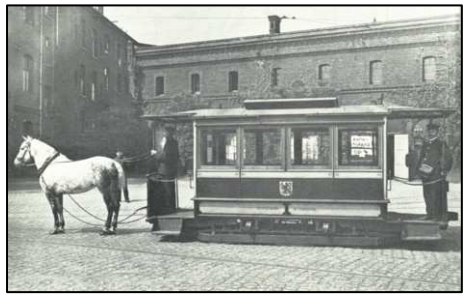


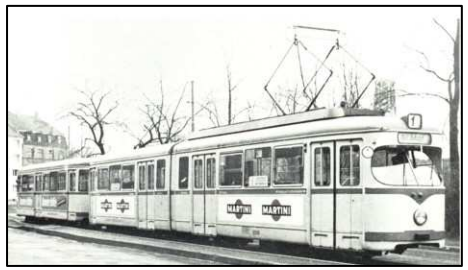
Düsseldorf Metropolitan Area
Cascade of Transport Modes



II Rheinbahn AG – Public Transport Company

Rheinbahn AG
History





- **1875: First Horsetrams in Düsseldorf**
- **1896: First Electric Trams in Düsseldorf**
- **1896: Foundation of Rheinbahn**
- **1898: First solid bridge in Düsseldorf**
- **1898: First electric interurban tram-train (Düsseldorf – Krefeld)**
- **1924: Introduction Interurban Bus-Services**
- **1926: Introduction Restaurant-Cars on Tram**
- **1956: First articulated Tram**
- **1981: Start LRT-Operation, Sectional Tunnel**
- **1988: Inauguration of complete Tunnel**
- **1996: First 100 % Low-Floor-Tram**

Rheinbahn AG
Operation Area

Area:	**569 km²**
Inhabitants:	**1,000,000**
No. of Lines:	**111**
Length of Lines:	**1,627 km**
Passengers / d:	**700,000**
Passengers / a:	**214 Mio.**
Vehicles:	**745**
Train-/Bus-km/ a:	**130,000**

Rheinbahn AG
Performance (2008)

	Light Rail	*Tram*	*Bus*
Length of routes:	**61.2**	**85.3**	**762.5**
Lines:	**7**	**13**	**91**
Length of lines:	**137**	**161**	**1,322**
Stops:	**99**	**178**	**1,341**
Average Stop Distance:	**771 m**	**454 m**	**540 m**
Vehicles:	**135**	**201**	**409**
Depots:	**1**	**2**	**2 + 3**
Train-/Bus-km (Mio.):	**4.75**	**7.8**	**28.3**
Passengers / a (Mio.):	**54.6**	**75.6**	**79.8**

III LRTC GmbH – Public Transport Consultants

LRTC GmbH
At a Glance

- **Founded in 1985**
- **JV of major public transit consultants**
- **Fully independent**
- **Total staff: >200**
- **Operational experience**
- **All transport modes**
- **Numerous international reference projects**

LRTC GmbH
Solutions for Urban Transport

Consulting

- Operational Concepts
- System Layouts
- Environmental Appraisals
- Stations and Transfer Facilities
- Route and Track Alignment
- Signalling and Communications
- Electric Power Supply
- Rolling Stock
- Depots and Workshops
- Traffic Telematics

Traffic Planning

- Market Surveys
- Transportation Plans
- Feasibility Studies
- Cost-Benefit Analyses
- Design Standards
- Tariff Structures

LRTC GmbH
Solutions for Urban Transport

Design & Engineering

- Systems Engineering
- Project Management
- Tendering and Contracting
- Site Supervision
- Factory Inspections
- Marketing Concepts

Operation & Maintenance

- Operation Start-up
- Management Assistance
- Know-how Transfer
- Rules and Regulations
- Operating Procedures
- Staff Training

IV Düsseldorf Light Rail System - Characteristics

What do we mean by „Light Rail Transit“?

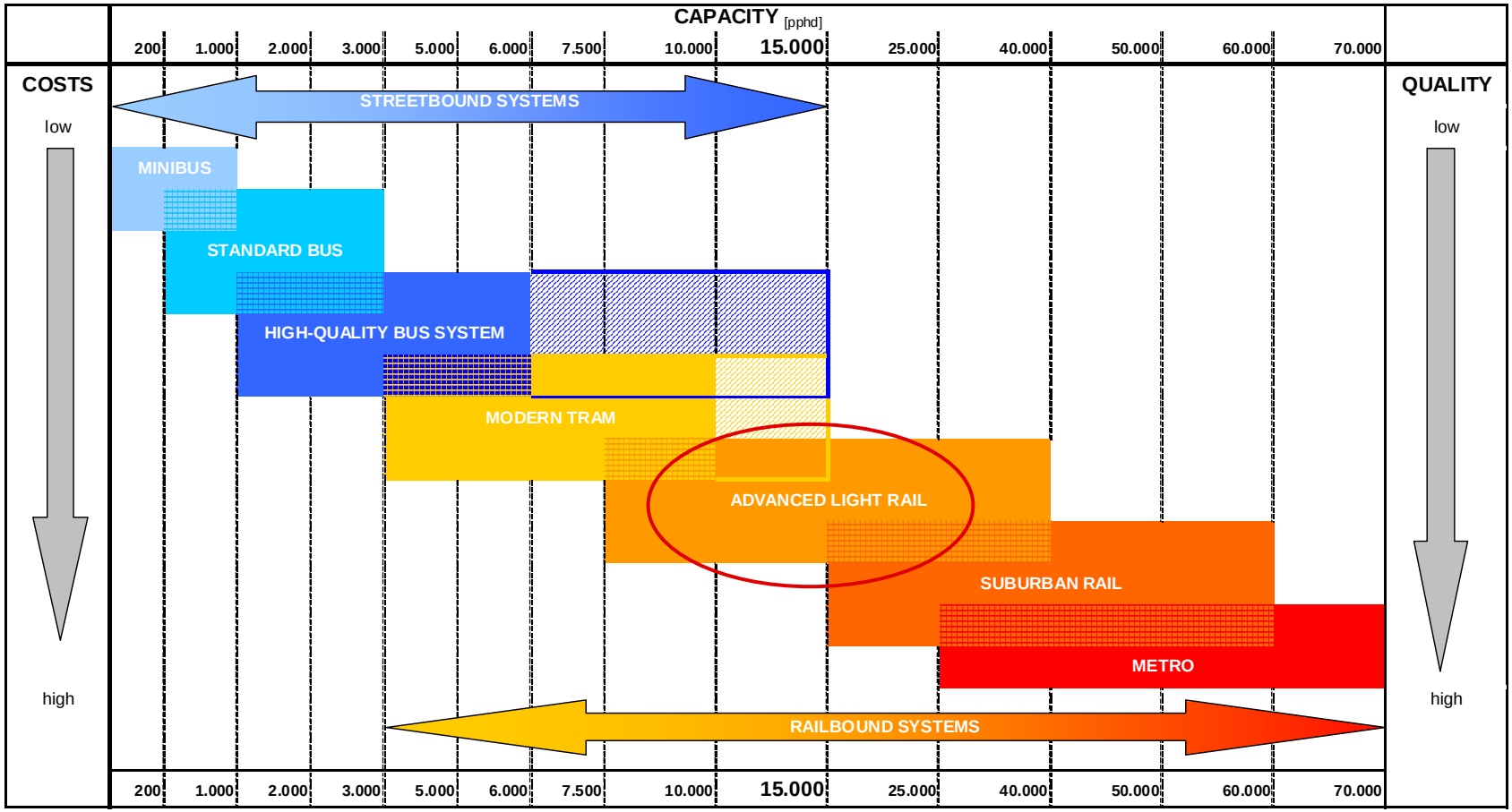
The „Düsseldorf Approach“ of Light Rail Transit:

Most effective combination of **Metro** (newly built tunnel sections in areas of high density) and **Tram** (using existing at-grade routes in areas of lower density).

Advantages:

- **Increasing capacity, speed, availability and punctuality** by creating independend route sections
- **Making operation easier** by avoiding conflicts with other traffic modes
- **Saving money** by reducing the invest mainly to the core sections
- LRT can be implemented **step by step**

Düsseldorf Light Rail System
Capacities of Transport Modes



Düsseldorf Light Rail System
Best-of-All Philosophy

Metro
- high capacity
- high reliability
- high travel speed

Tramway
- high accessibility
- high visibility
- low costs

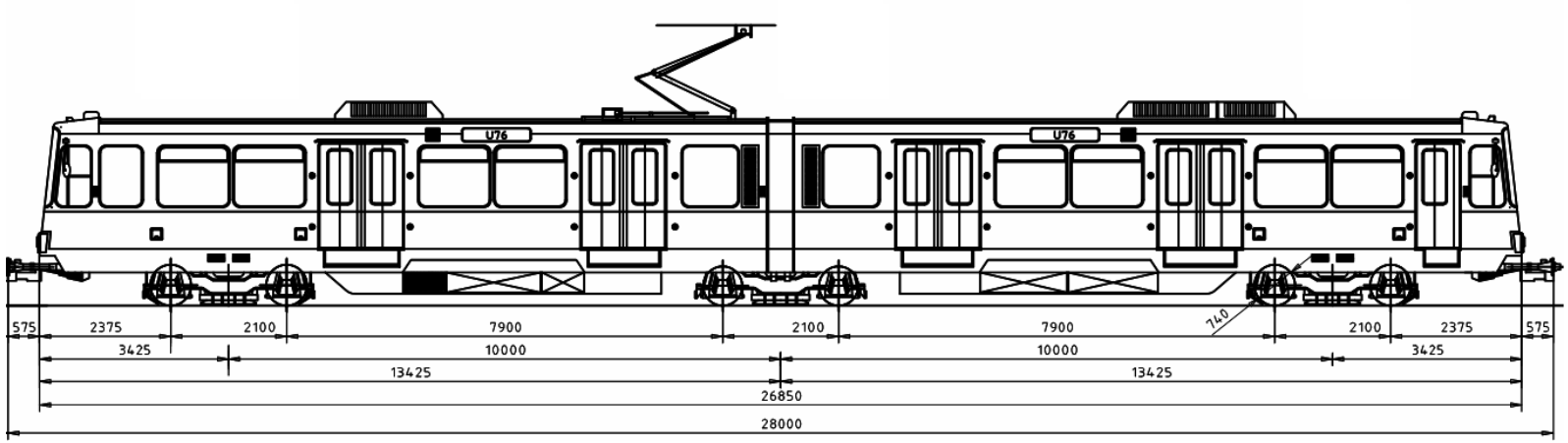
Light Rail Transit (LRT)

Düsseldorf Light Rail System
High- / Low-floor LRT

	High-Floor LRT	Low-Floor LRT
Entrance Height	**1,000 mm**	**300 mm**
Train Length	**60 – 90 m**	**60 m**
Vehicle Width	**2.65 m**	**2.4 m**
Max. Capacity	**24,000 pphpd**	**10,000 pphpd**
Min. Headway	**90 sec**	**150 sec**
Tunnel Operation	**Automatic**	**Manual**

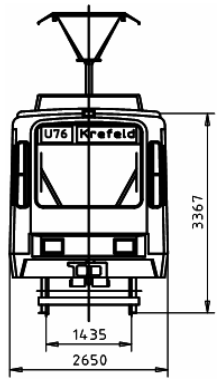
Düsseldorf Light Rail System
Light-Rail-Vehicle Type B80

Düsseldorf Light Rail System
Light-Rail-Vehicle Type B80

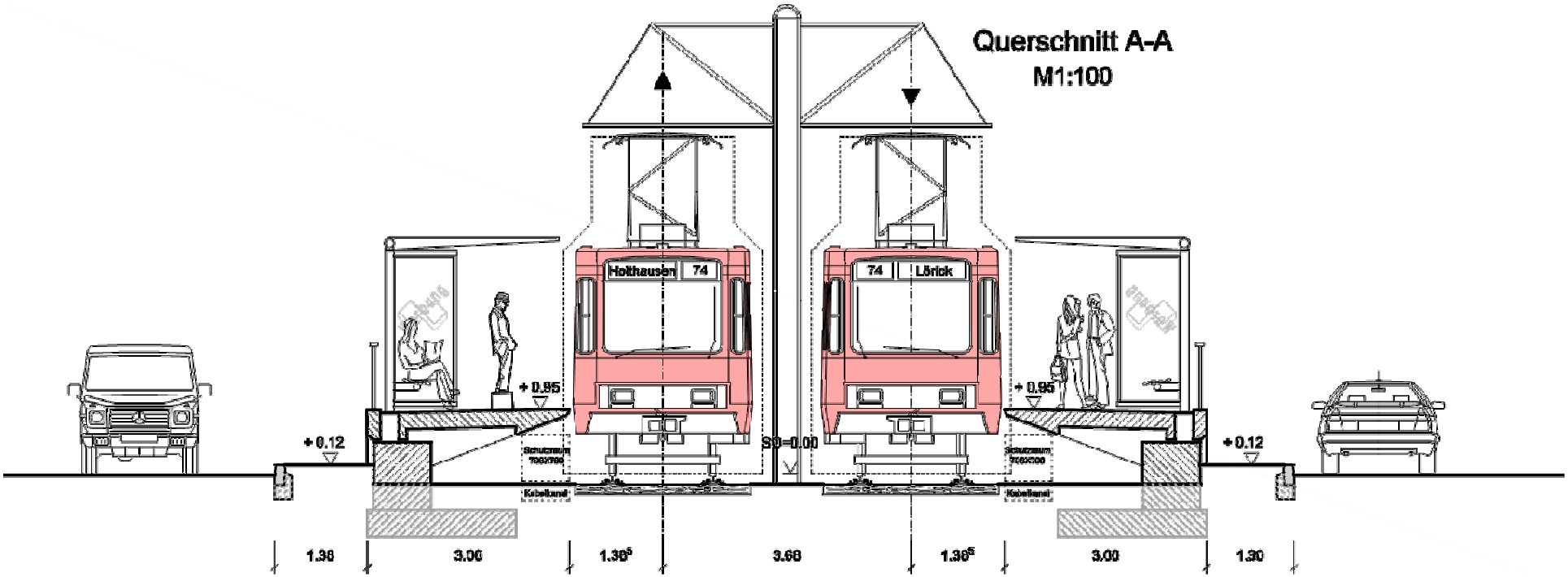


Type B 80 (104 units)
Floor Height: 1.000 mm

Foldable Steps for various platform levels

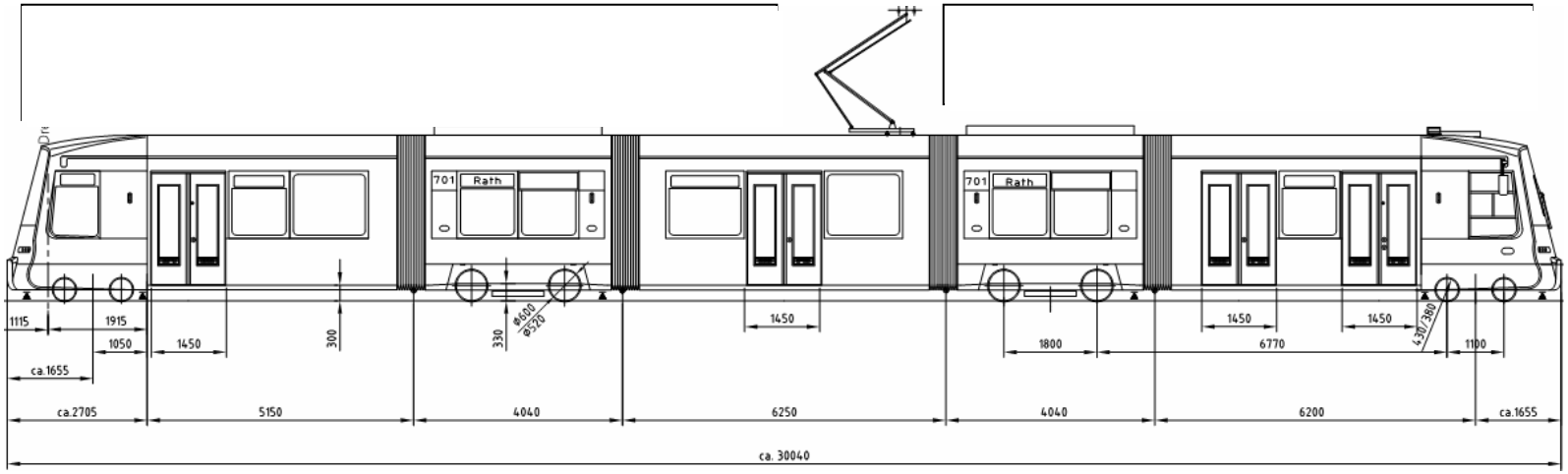


Düsseldorf Light Rail System
High-Floor Station Profile

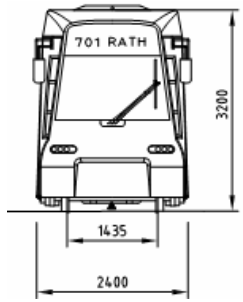


Rheinbahn Rolling Stock
Light-Rail-Vehicle Type NF-U

Rheinbahn Rolling Stock
Light-Rail-Vehicle Type NF-U

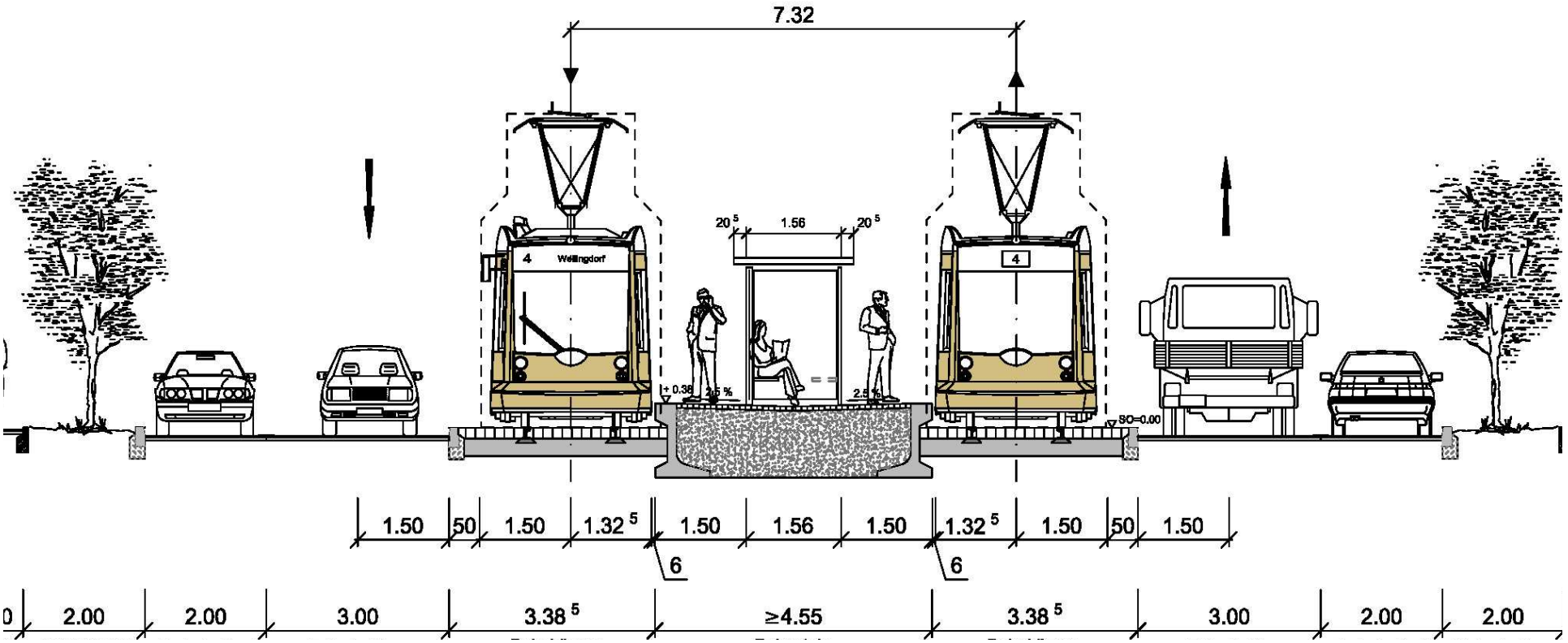


Type NF-U (76 units)
Floor Level: 350 mm
Entrance Level: 300 mm



Bi-directional 30m-tramcar (doors on both sides) with one driver‘s cab only. LRT operation will be two cars coupled back-to-back.

Düsseldorf Light Rail System
Low-Floor Station Profile



Düsseldorf Light Rail System
Facilities for disabled People

Platform Level according to the vehicle: Low-floor…

…or High-floor

Düsseldorf Light Rail System
Facilities for disabled People

Admittance via Ramps or Stairs

at Low-floor Stop…

Düsseldorf Light Rail System
Facilities for disabled People

… or at High-floor Stop

Düsseldorf Light Rail System
Facilities for disabled People

Tactile Guiding System for Visually Impaired

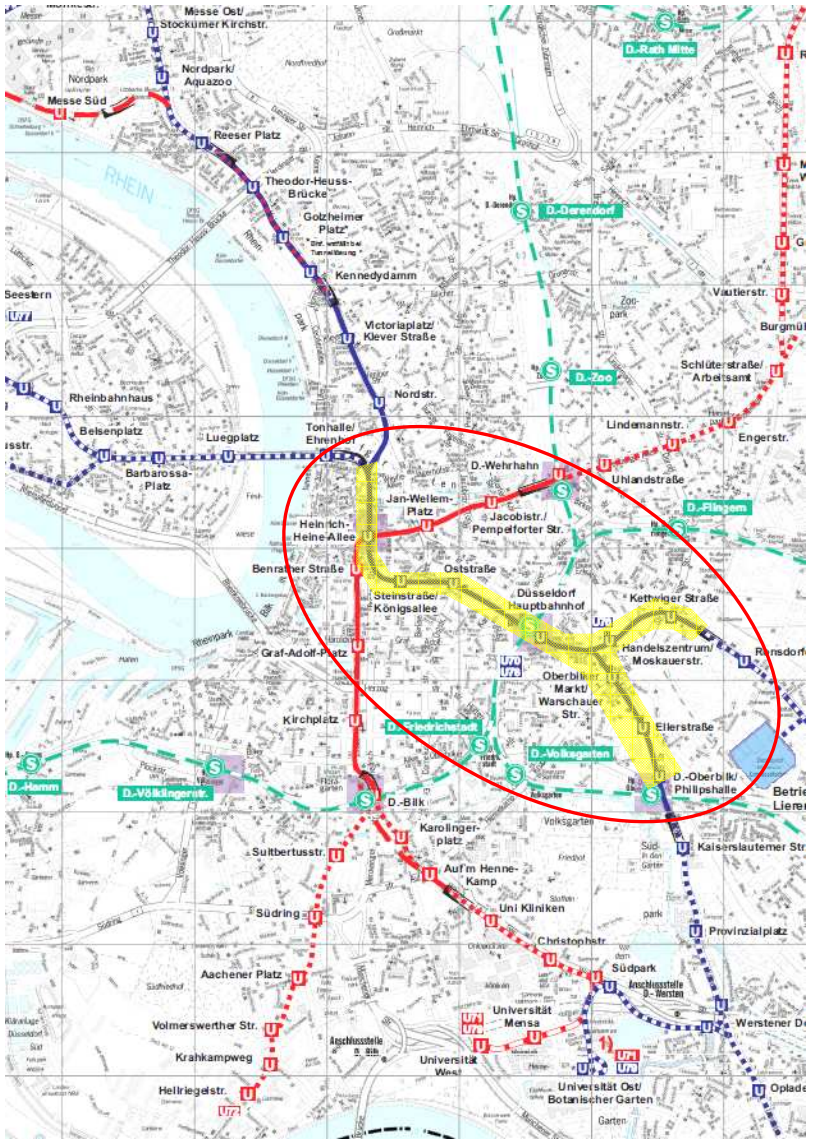
V Present Situation – High-floor LRT (North-South Tunnel)

Ambassador from Underground…

North-South Tunnel
Integration into today‘s LRT Network

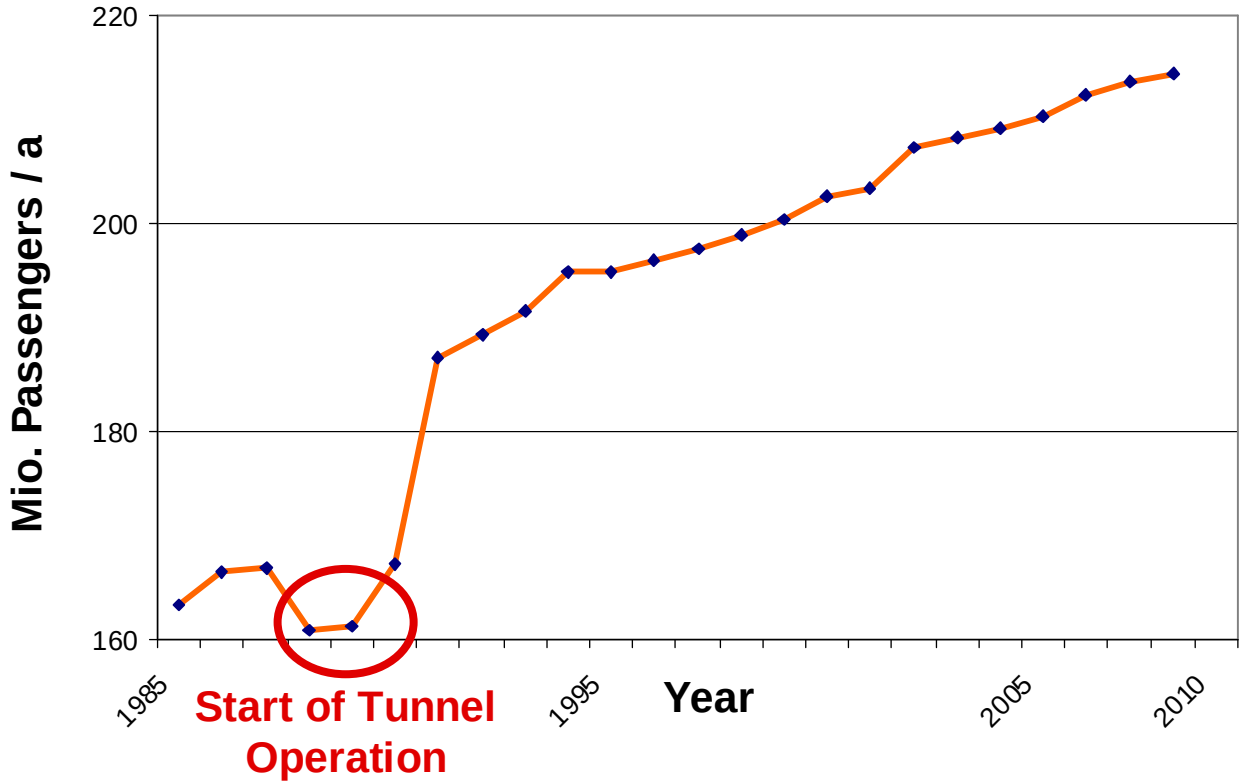
Features

- 11 km total tunnel length
- 9 tunnel stations
- 5 bundled LRT lines
- 4 separated tracks in core section
- 33 trains/h peak workdays
- 60 trains/h max.
- Operation by STO
  (semi-automatic train operation)



Inauguration of Tunnel Service
Effects – What Happened?

- **Saved Travel Time of up to 10 Minutes**
- **Considerable Increase of Passenger Demand**
- **Reduced Traffic Congestion in City Centre**



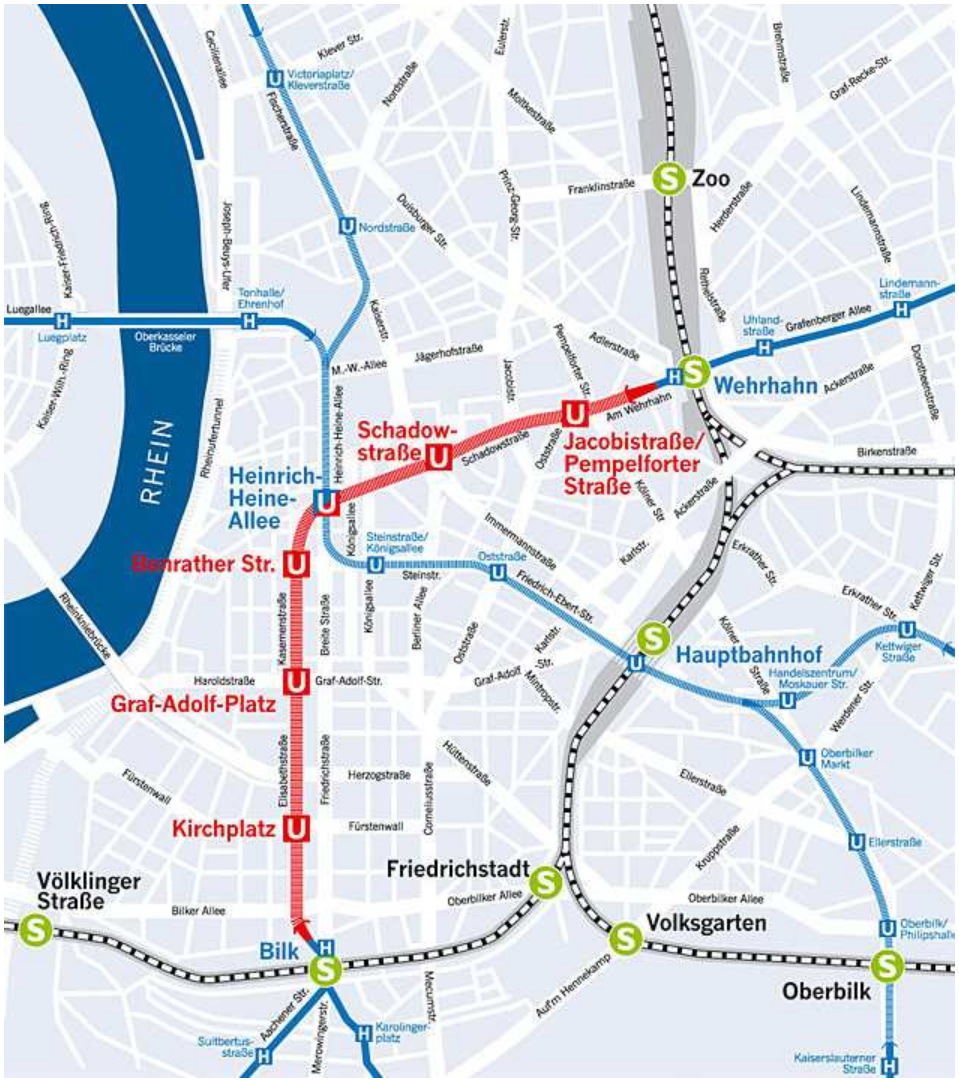
VI Future Situation – Low-floor LRT (East-West Tunnel)

Düsseldorf Light Rail System
Present Situation: Rush Hour Chaos

East-West Tunnel
Integration into today‘s LRT Network

Features

- 3.4 km new tunnel section
- 6 new tunnel stations
- New Visiting-Card for Düsseldorf by extraordinary architectural station design
- Construction time: 2007 – 2014
- Total invest: 650 Mio. €



East-West Tunnel
New LRT „Wehrhahn-Linie“

Schedule:

1997 Registration for Financing Scheme in Northrhine-Westfalia

1999 Düsseldorf City Council decides to start basic design

2001 State transportation board grants 332 Mio. € subsidies for construction works

2003 Municipality revises the planning to make implementation faster and reduce costs

2004 Start of plan approval procedure

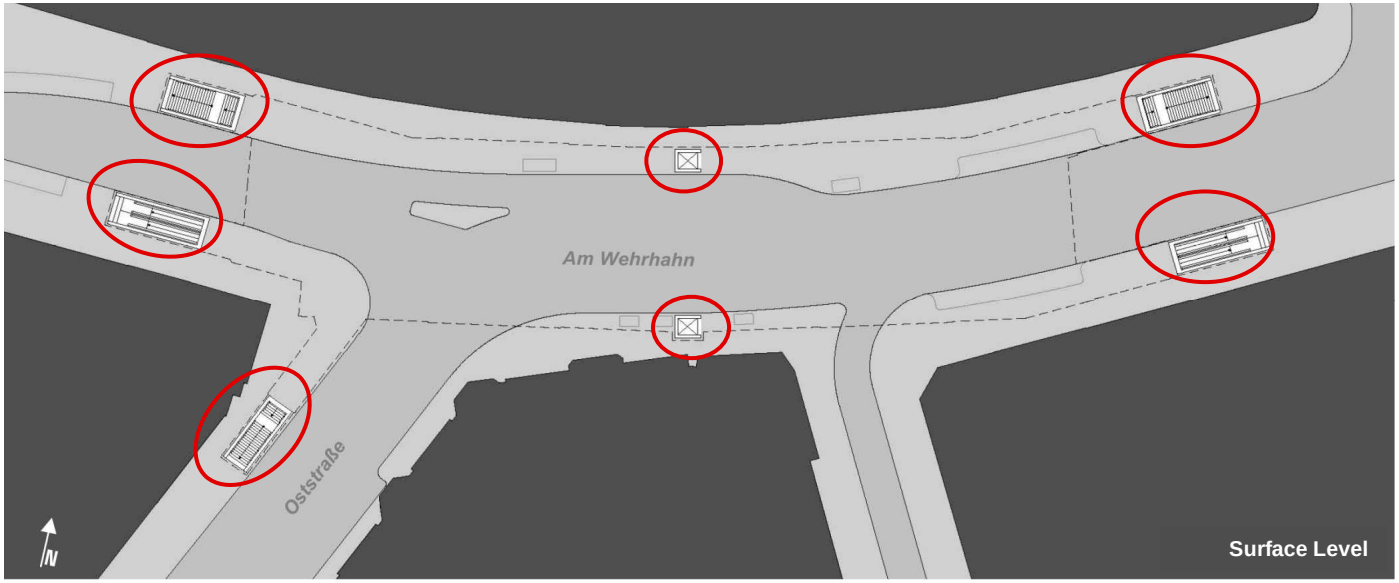
2007 Plan approval order and ground-breaking ceremony

East-West-Tunnel
Station Impressions

East-West-Tunnel
Station Impressions

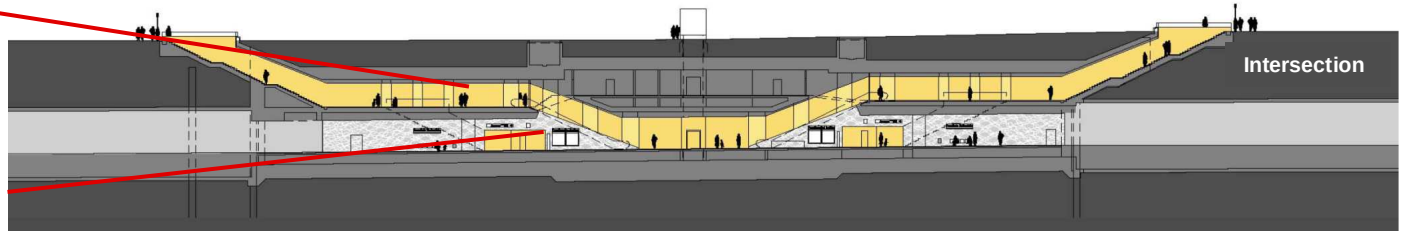
East-West-Tunnel
Tunnel Station „Am Wehrhahn“

Entrances

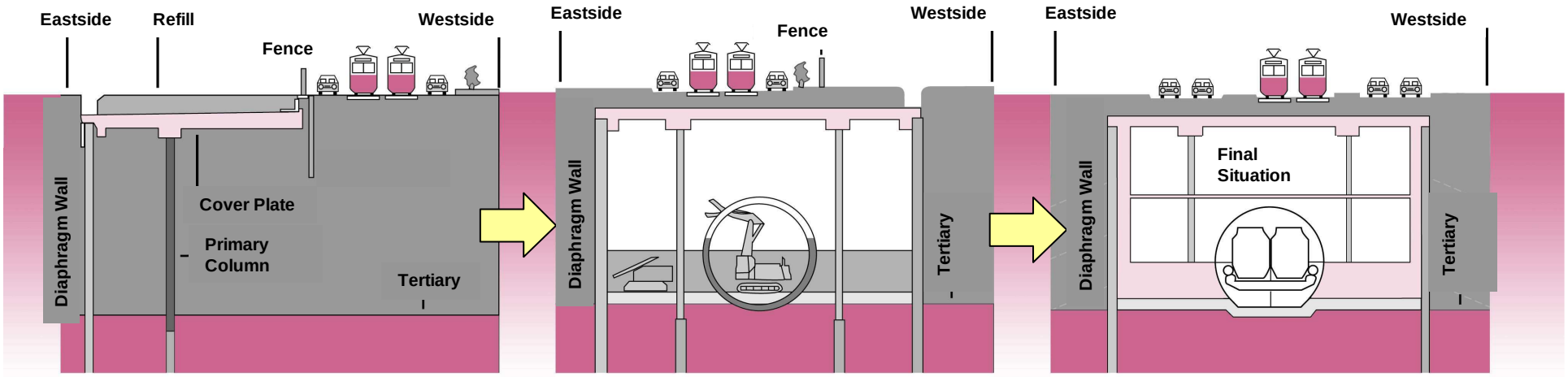


Concourse Level

Track Level



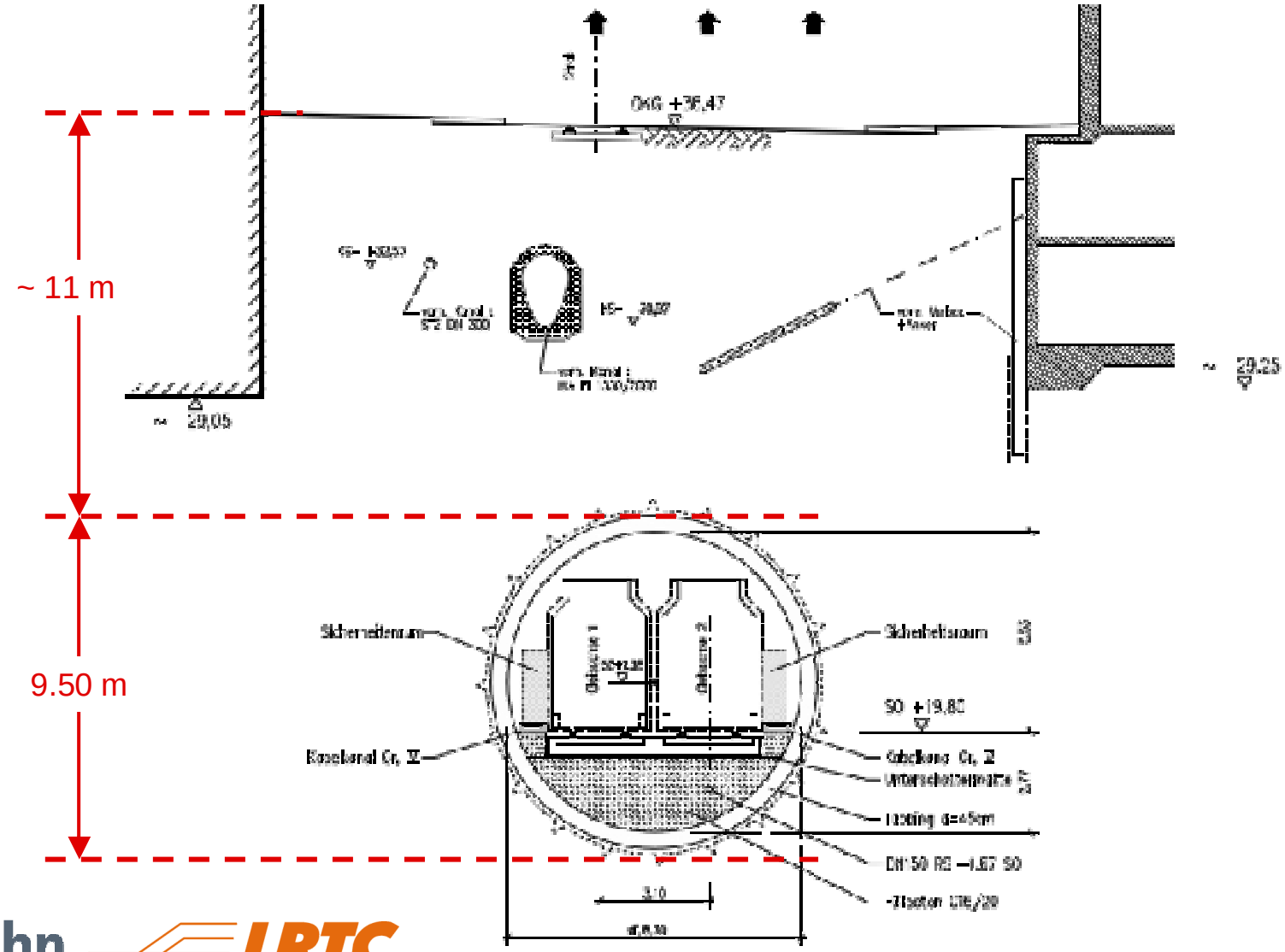
Cut-and-Cover Method



Shield Drive with segmental lining

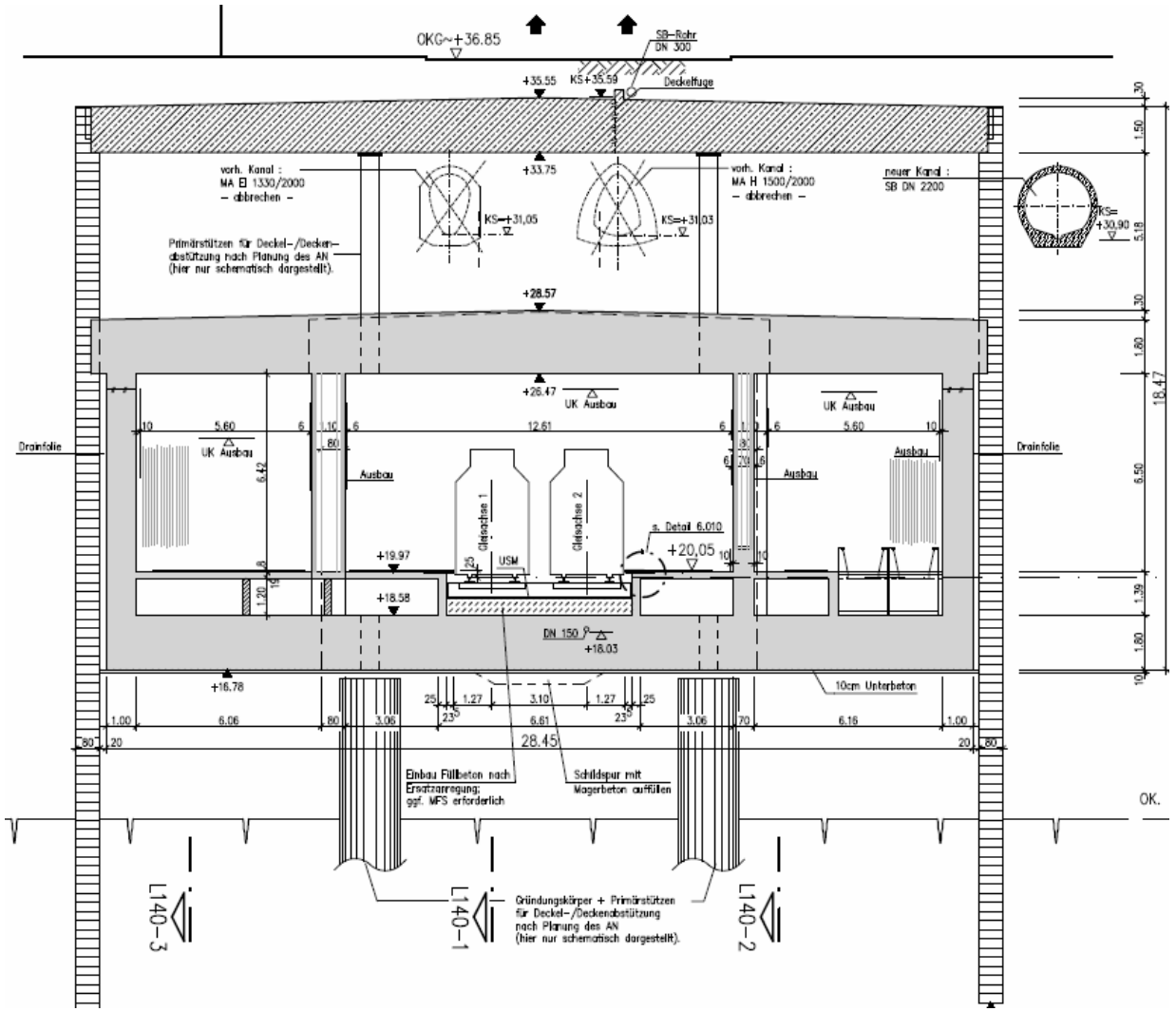
East-West-Tunnel
Examplary Tunnel Cross Section

Surface Level



East-West-Tunnel
Examplary Station Cross Section

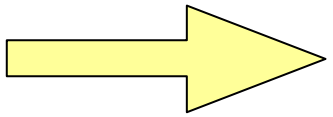
Surface Level



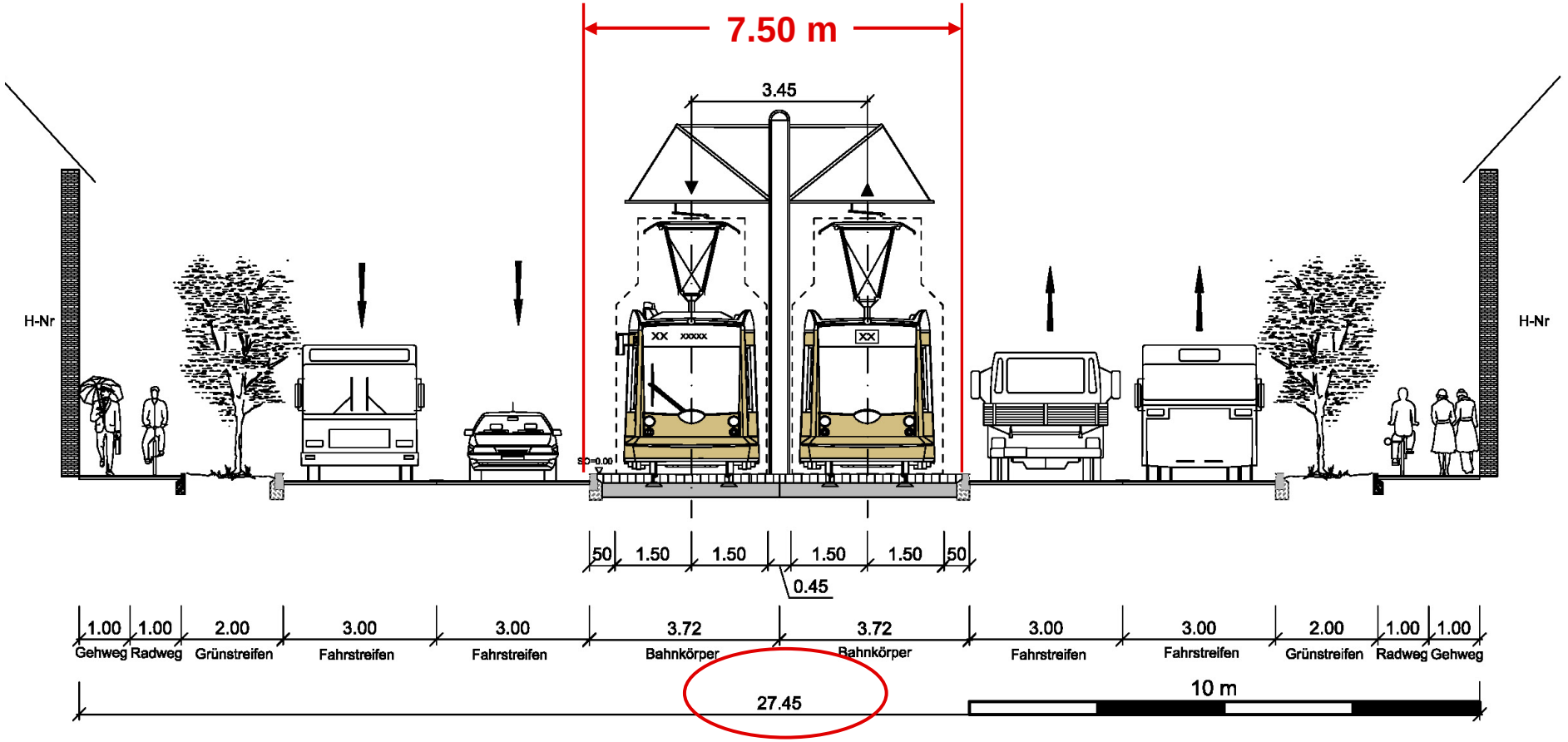
Alternatives:

Independant Right-of-Way at grade 

Segregated Right-of-Way at grade 

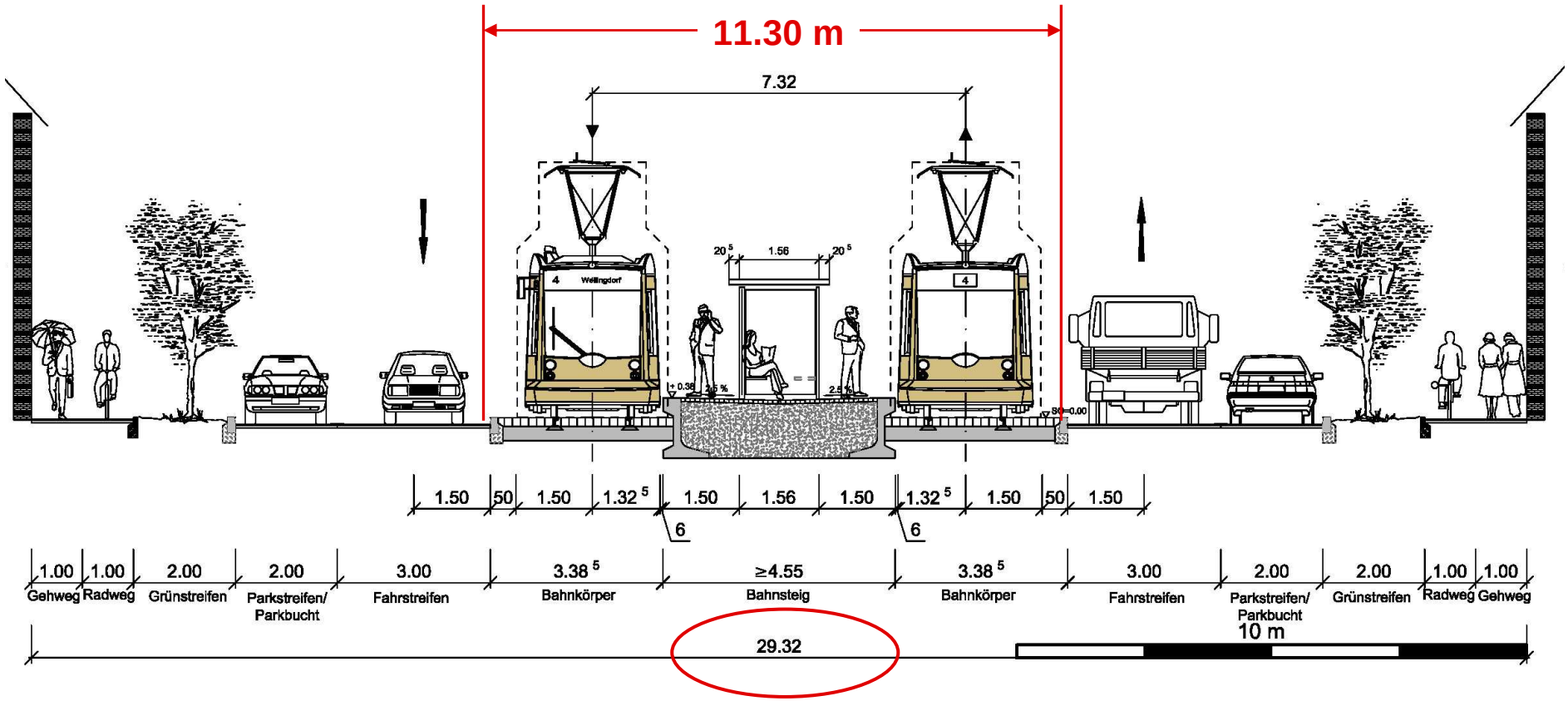
But: 

Tunnel Alternatives
Segregated Right-of-Way in Center Location



requires wide street profiles

Tunnel Alternatives
Segregated Right-of-Way in Center Location



requires wide street profiles

Rheinbahn LRTC

Public Transport for Düsseldorf

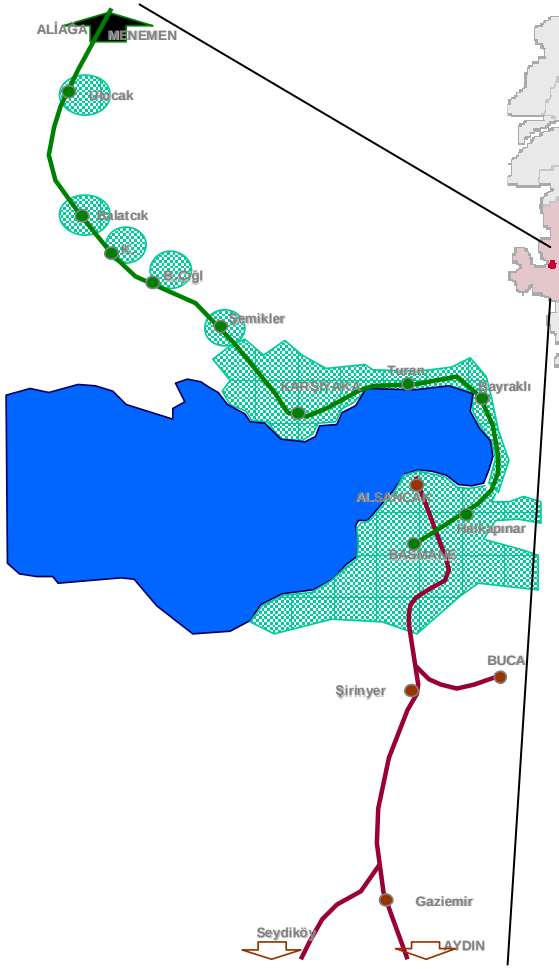
VII Excursion – Izmir Commuter Rail System (Turkey)

Excursion
Izmir Commuter Rail System (ICRS)

In Izmir Metropolitan Area, Western Turkey, LRTC is currently planning and performing the „upgrade“ of a regional railway line to a modern Metro System:

- 3.2 Mio. inhabitants within the city boundaries
- 80 km of double track
- Electrification with 25 kV catenary
- Implementation of Automatic Train Guidance System
- Procurement of 33 3-car EMUs of 70 m length
- Erection of central Depot Site and Stabling Yards
- 2 Tunnel Sections of 4 km and 1 km each

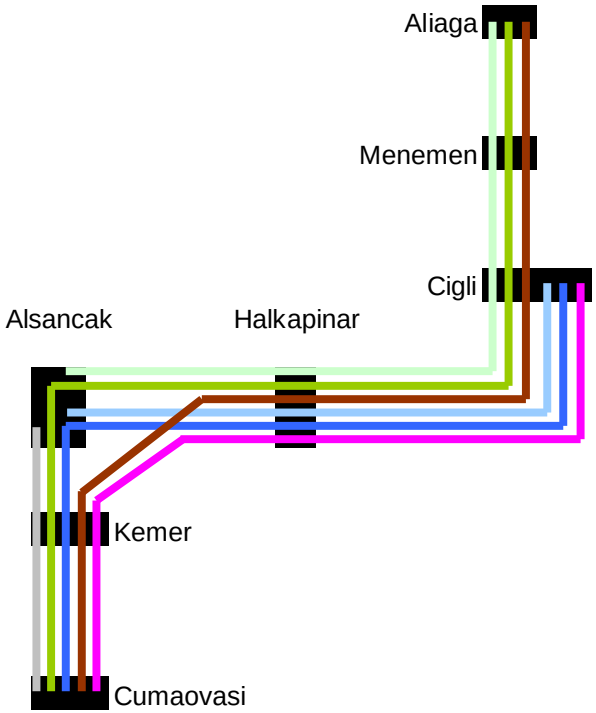
Excursion
Izmir Commuter Rail System (ICRS)



- North Section **(Aliaga-Alsancak)**
  - **57 kms.**
  - **22 stations**
  - **67 minutes travel time**
- **South Section** (Alsancak-Cumaovası)
  - **22 kms.**
  - **11 stations**
  - **31 minutes travel time**

- **Total** (Aliağa-Cumaovası)
  - ***79 kms.***
  - ***33 stations***
  - ***100 minutes travel time***
  - ***10 minutes peak headway***
  - ***550.000 daily passengers***

Operation Concept



	Cumaovasi <-> Alsancak	Alsancak <-> Cigli	Alsancak <-> Cigli <-> Aliaga
Length [km]	21,42	17,14	56,31
No. of Stops	11	13	22
Commercial Speed [km/h]	41,5	34,3	50,4
Trip Time per Direction [min]	31 *)	30	67
Min. Layover Time at each Terminus [min]	5	5	5
Min. Roundtrip Time [min]	72	70	144

North Section (Karsiyaka) – **Past Situation**

Crossing of Urban Area with dense Population and multiple Crossings

North Section (Karsiyaka) – **Future Situation**

Implementation of 4 km Tunnel Section

North Section (Karsiyaka District)

Past

Future

North Section (Karsiyaka District)

Classic **Cut-and-cover Construction**

Tunnel vs. At-Grade-Systems
Summary

Benefit of tunnel implementation has to be evaluated considering the following main parameters:

- **Performance Aspects**
  - Train Capacity
  - Train Length
  - Headway
- **Environmental Aspects**
  - Pedestrian Zones
  - Recreational Areas
- **Urbanistic Aspects**
  - Narrow Street Profiles
  - Population / Building Density
  - Traffic Relations

Eskerrik Asko!

Gracias!

Thank You!

Danke!

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