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Session XII: Mass Transport and Subways.

MEGACITIES – HIGH-SPEED RAIL CONNECTIONS, UNDERGROUND METRO SYSTEMS & OTHER RAIL TRANSPORT

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1.RECENT METROPOLITAN RAIL TRANSPORT DEVELOPEMENTS

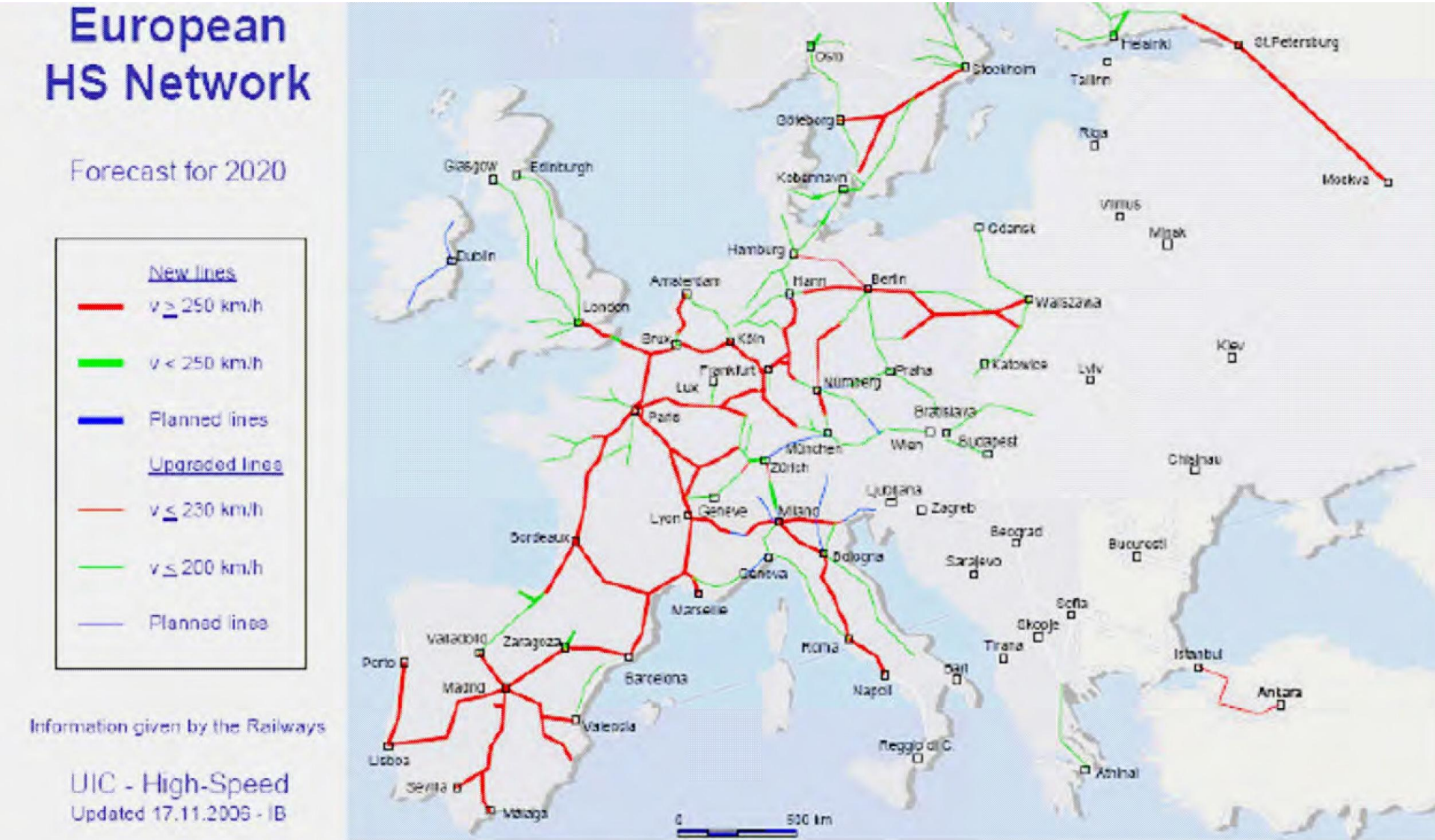
1.1. HIGH-SPEED RAIL: JAPAN, FRANCE AND GERMANY

Faster trains and the new railway age.

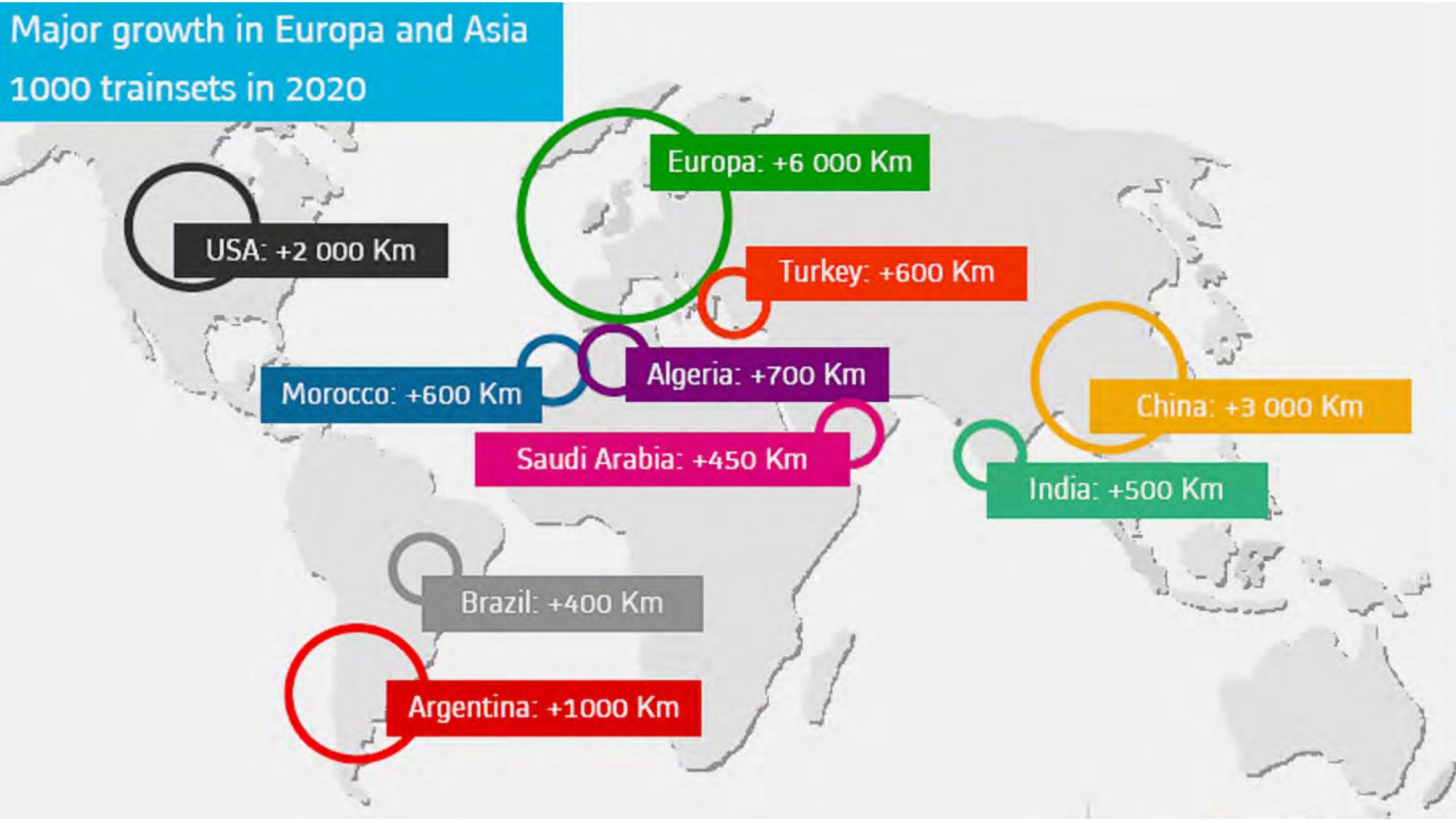
A revolution in rail transport started in Japan in 1962: the Shinkansen (220 km/h), followed in 1976 by the European HS train : in France, the TGV PSE (270 Km/h), followed in 1991 by the German ICE (300 km/h) and the new ICX (250 km/h). The latest models allow a speed of up to 350 km/hour on dedicated straight track.

Higher capacity. Double-deck rolling stock allows the capacity of trains to be adapted to traffic growth on existing high-speed lines.

Expanding the network. Meanwhile the network is constantly expanding, the main equipment suppliers being Alstom, Ansaldo/Bombardier, Bombardier/Talgo and Siemens.



Expanding supply. The number of train sets and the length of track is expanding mainly in Europe and Asia (but also in Morocco, Turkey, Argentina, etc).



In the US and UK.

Lack of political support has inhibited HSR in finding the right conditions for its develop-ment.

“High-speed rail: running rapidly right off the rails

The Birmingham-London supertrain is being proclaimed as the totem of a new golden age in British transport. Already, however, it looks a safe bet that the reality will fail to match the rhetoric.”

“'High-speed' rail will, in fact, almost certainly slow down the journeys of more rail users than it speeds up.” Photo: REX. Source: The Telegraph.

1.2. HIGH-SPEED ON EXISTING RAIL: TILTING TRAIN OF SPAIN AND UK

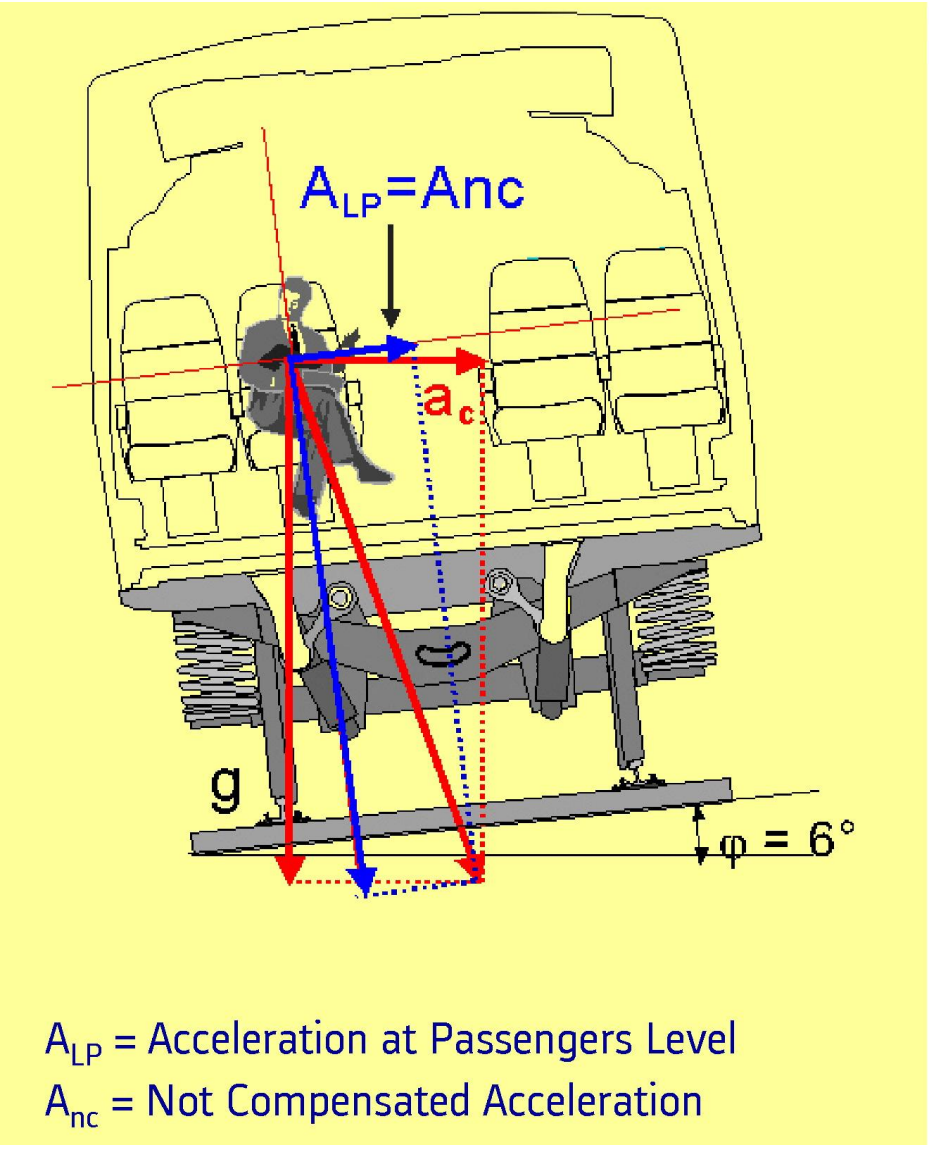
The Advanced Passenger Train.

However in the 80's the UK developed a medium speed rail system (the Advanced Passenger Train) based on increasing speed on existing tracks, thanks to a system allowing the trains to tilt when travelling around curves. This technology had been pioneered in Spain by the Talgo trains (APT – 1980).

Virgin. The pioneering UK technology was abandoned, but a similar continental technology developed by Fiat Ferroviaria ("Pendolino") was introduced nearly 20 years later. Tilting trains designed in Italy were successfully adopted by Virgin for the West Coast main line.

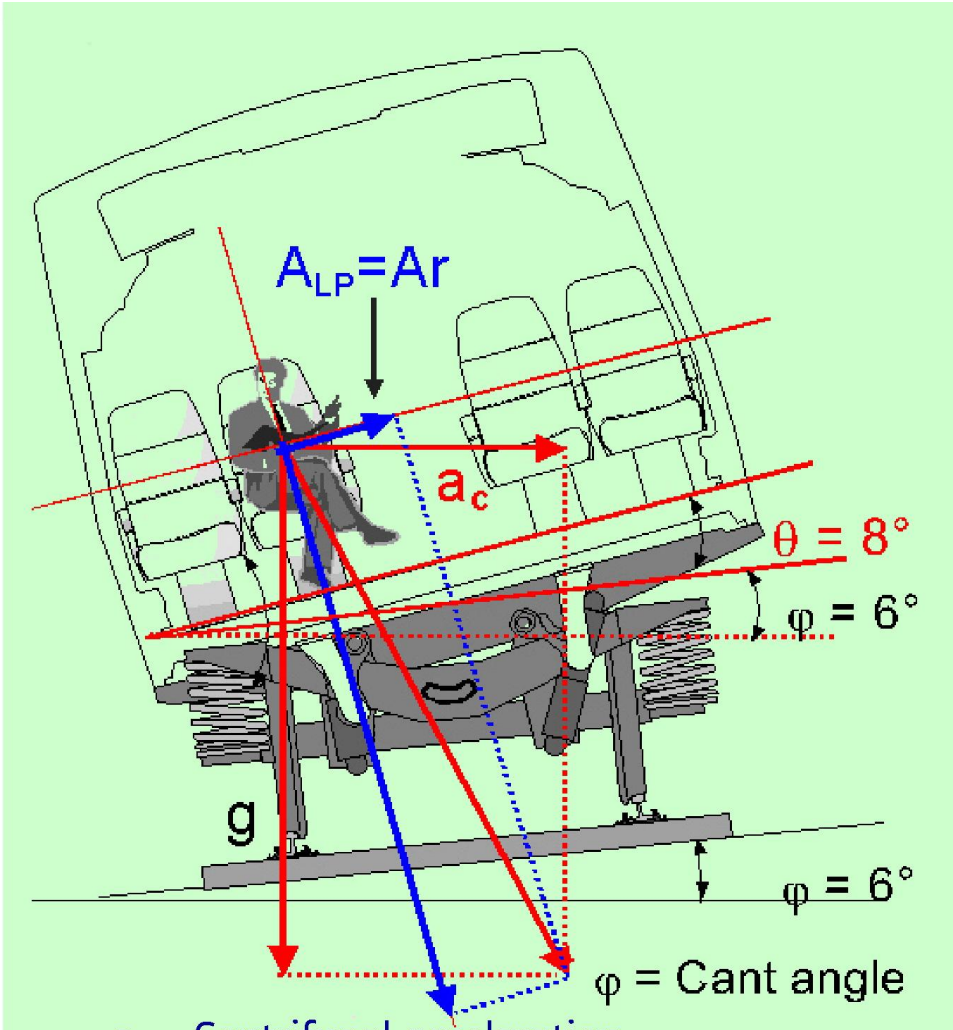
Photo by G-Man, June 2005

The tilting principle. The system allows Virgin's trains to handle sharp curves much faster than before, increasing their commercial speed by some 30%.



A_{LP} = Acceleration at Passengers Level

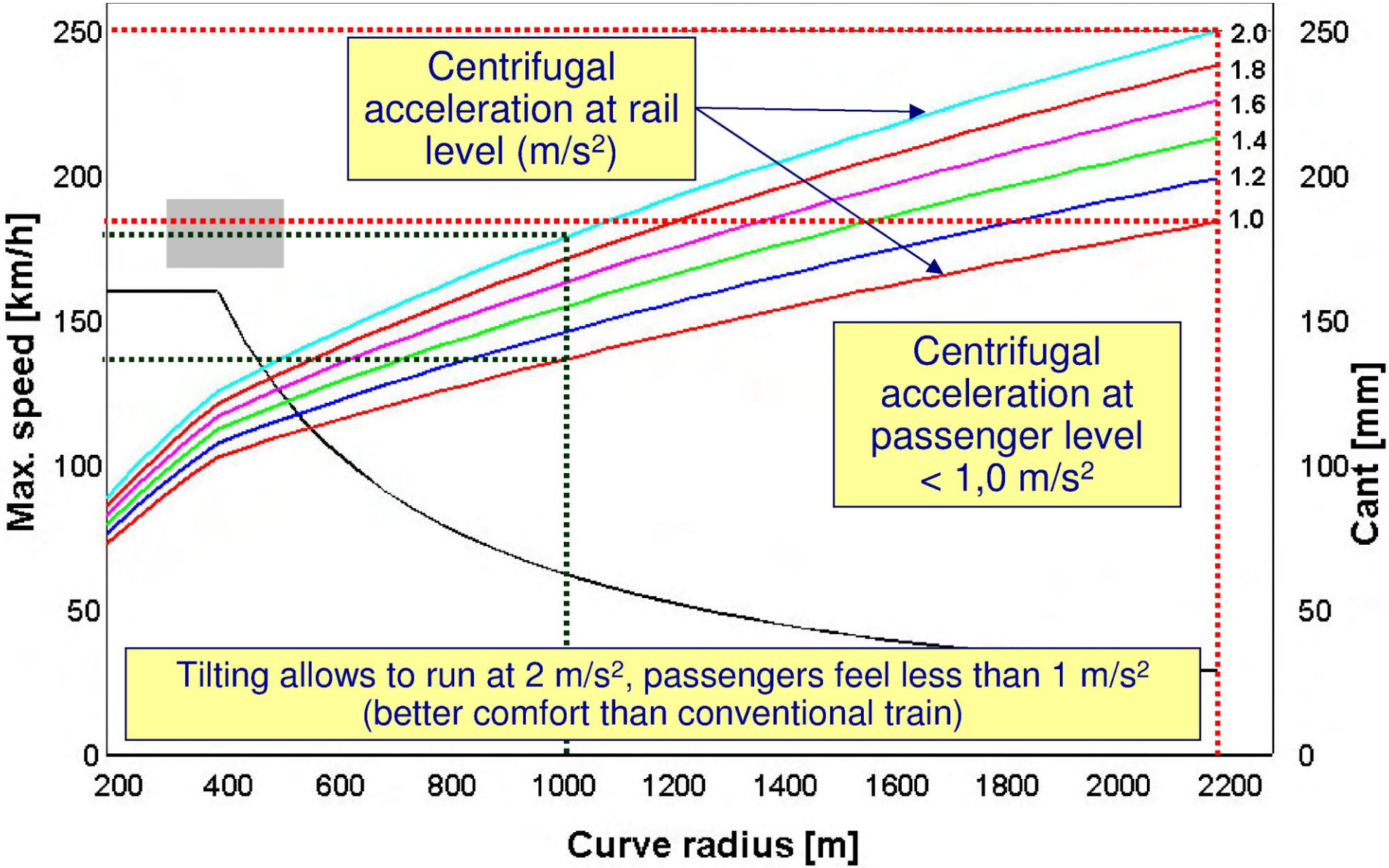
A_{nc} = Not Compensated Acceleration



a_c = Centrifugal acceleration

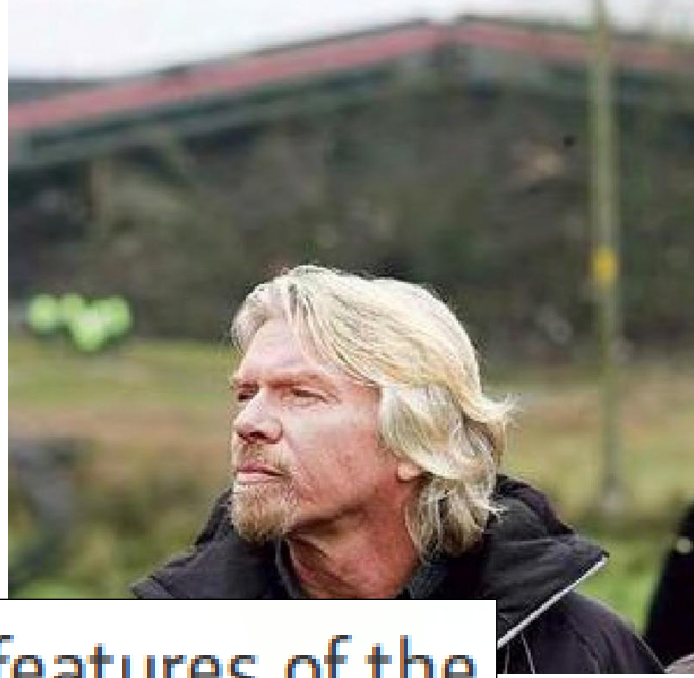
A_r = Residual Acceleration

Passenger comfort. Passenger comfort is also higher than conventional trains when traversing curves.



Safety. In the event of a crash, passenger safety is higher - as was shown by this spectacular accident which resulted in only one fatality.

“Built like a tank”.

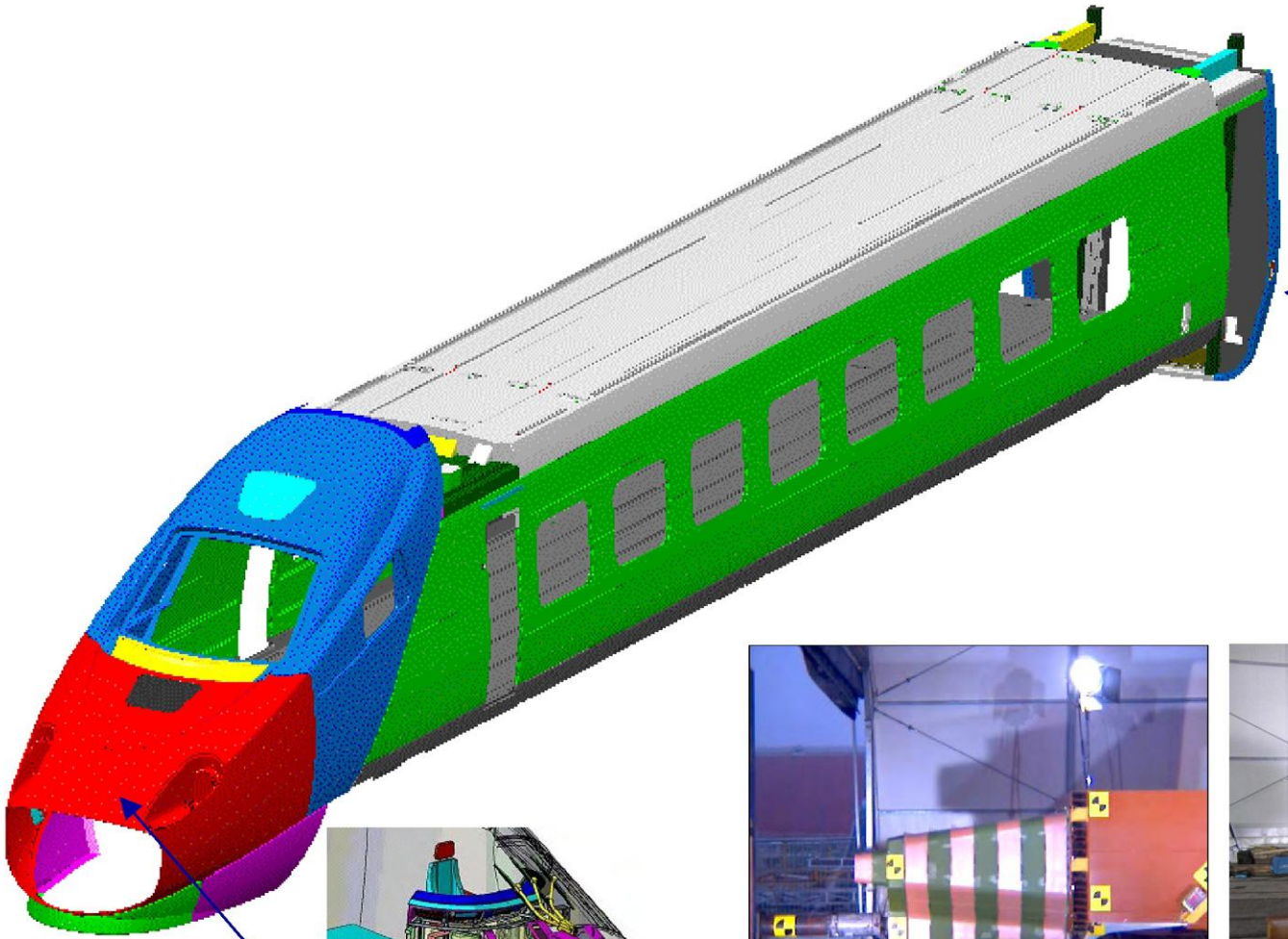


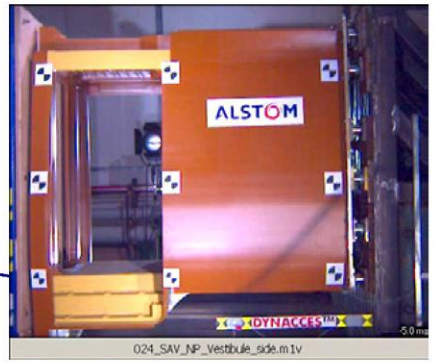
Sir Richard has stressed the safety features of the Virgin Pendolino train involved, saying he feared the accident would have been much worse if an old service had been in operation.

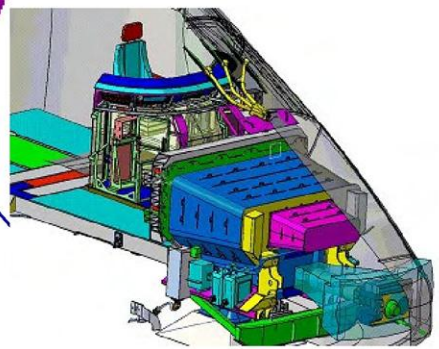
He said the train was "built like a tank", the carriages stayed together, remained in one piece and many windows did not even break.

Source: RailNews.co.UK

Shock absorption. The carriages remain intact and shock absorption is concentrated at the front.







The tilting market today.

About 500 tilting train sets have been sold and their supply is becoming ever more diversified. Delivery is notoriously slow, which in the UK slows down their expansion to other trunk lines (see Railnews 13/8/2010: Virgin opposed “its” trains being used for the East Coast main line).

Modus operandi.

Operating experience suggests that service is better secured by a single operator (as in the UK and Switzerland). Cross-border services between Italy, Switzerland and Germany have revealed problems of coordination between the national operators involved.

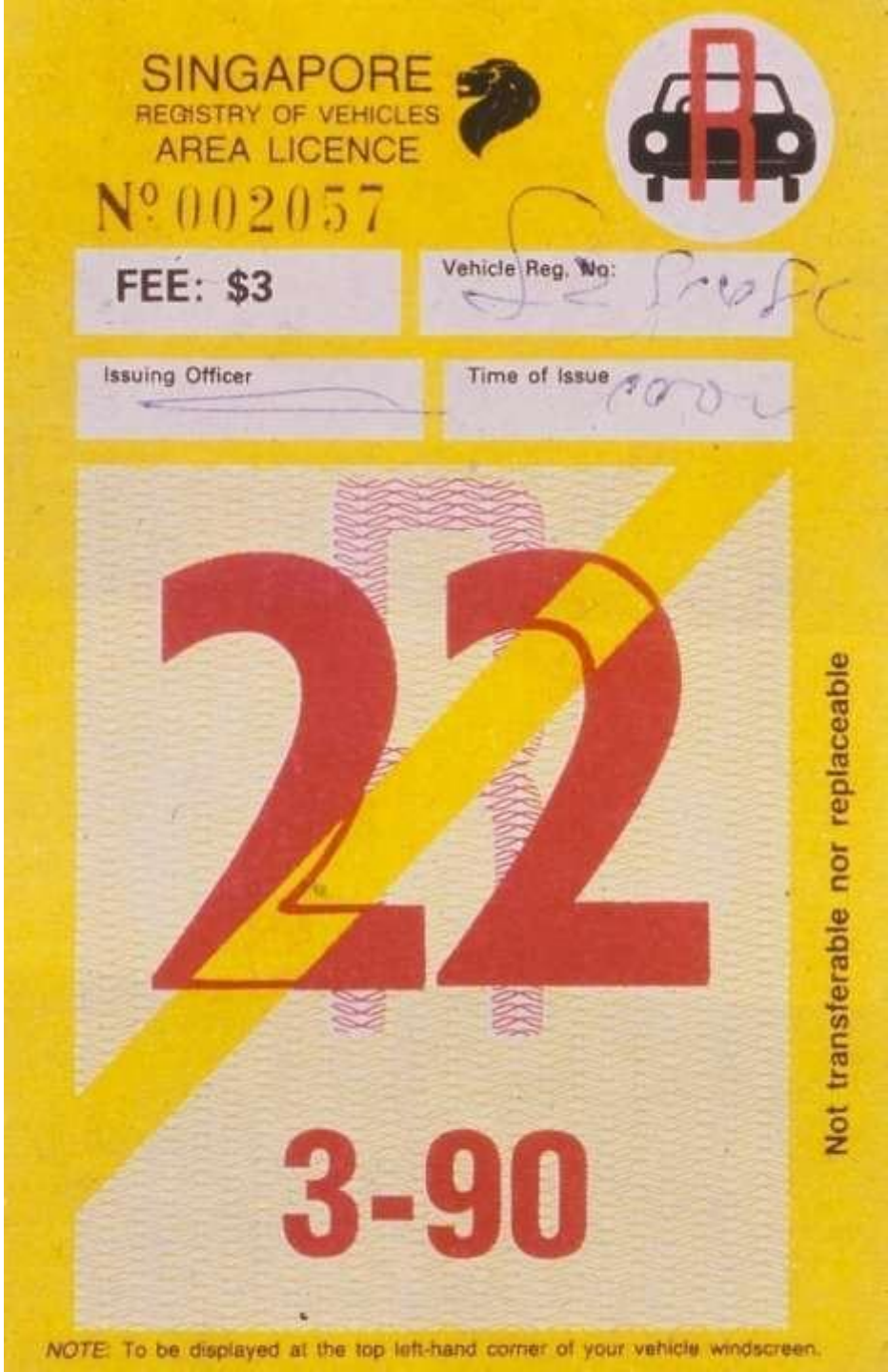
The tilting market tomorrow.

The main potential market for tilting trains is on lines complementing the HS network.

A case in point is the link between Brussels, Strasbourg and Zurich, presently served by three national operators, with a combination of traditional rolling stock. The trip takes more than 5 hours for a distance of 450 km. However, the fast increase of the HSR network strongly restricts the medium speed rail market.

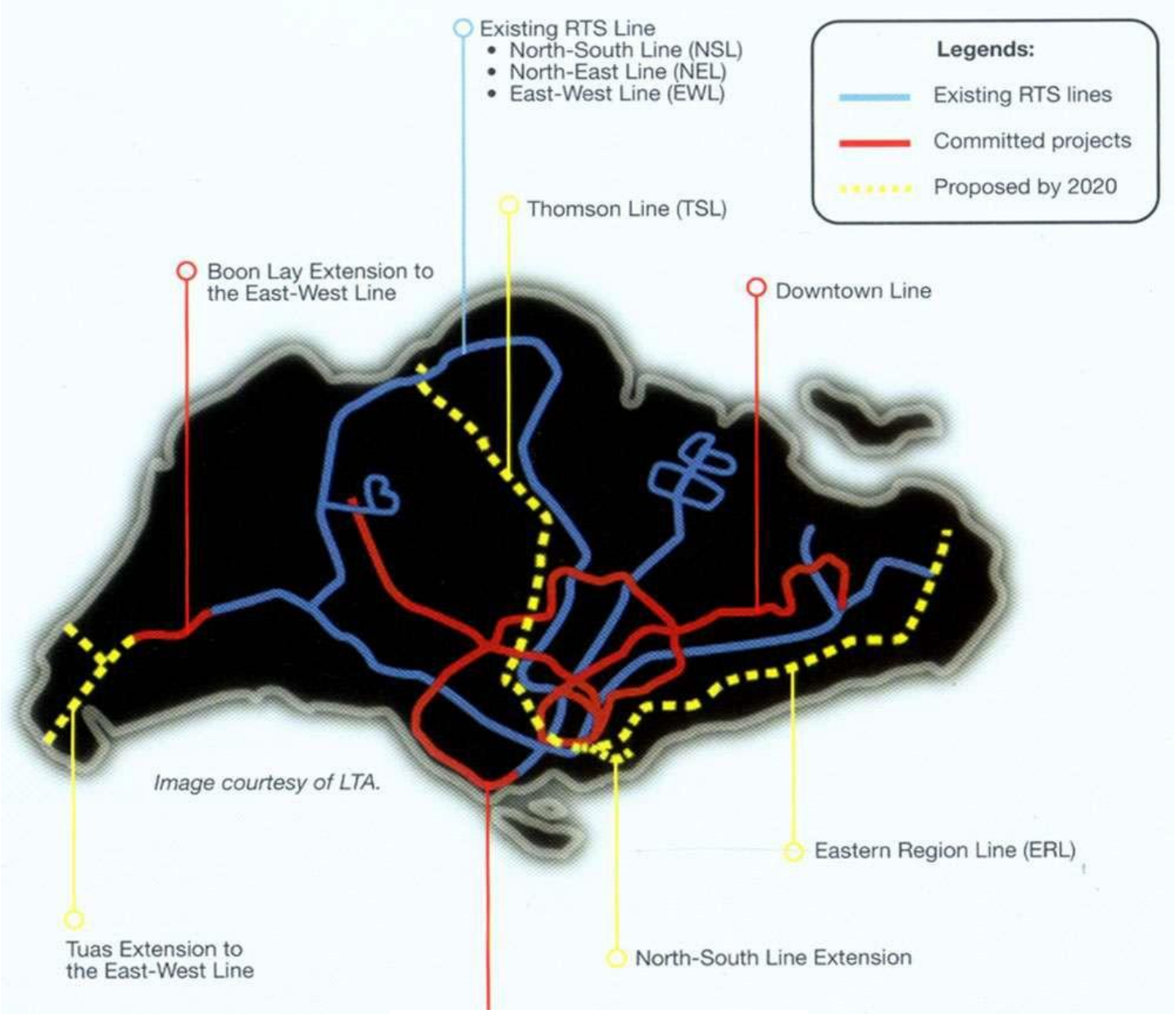
1.3. METROS, DRIVERLESS SYSTEMS: JAPAN, SINGAPORE AND FRANCE

- **SINGAPORE**
- From 1975 Singapore has endeavoured to save scarce land and natural resources through market mechanisms such as auctioning of new car plates (replicated in Shanghai), and pricing of road access to the city for solo drivers (no fee if there are 3 passengers). This was easily accepted as it gave drivers the choice of paying for solo driving or accepting 3 passengers.



In 1998 the system was replaced by electronic road pricing, achieved through pre-paid cards debited when used (so no invoice-related privacy problem).

- Level of charges can change at any moment, according to the level of congestion (easily accepted as it is not an additional tax). In the future, the ERP will be operated from satellite at any point of road congestion (gantries no longer needed).



Singapore minimizes the space used for road transport while maximizing the space for parks and recreation, water reserves and recycling used water. It opened the world largest unmanned metro in the world (2003). The automated people mover started both in Kobe and Lille in 1982 (176 today).

1.4. LIGHT RAIL ON DEDICATED TRACKS: KARLSRUHE AND MANCHESTER

Karlsruhe tram-train 1982 on railway network.

Karlsruhe tram-train 1982 on city street.

Manchester. The new light-rail network was a 20 mile tram system linking two city centre stations on-street and taking over two former British Rail commuter rail lines (total cost US$ 200 million).

1990

The winning consortium agreed to provide US$ 10 million (5% of capital costs) and to operate the system for a period of 15 years, with an escape clause after 4 years.

1992-1996

Operating results:

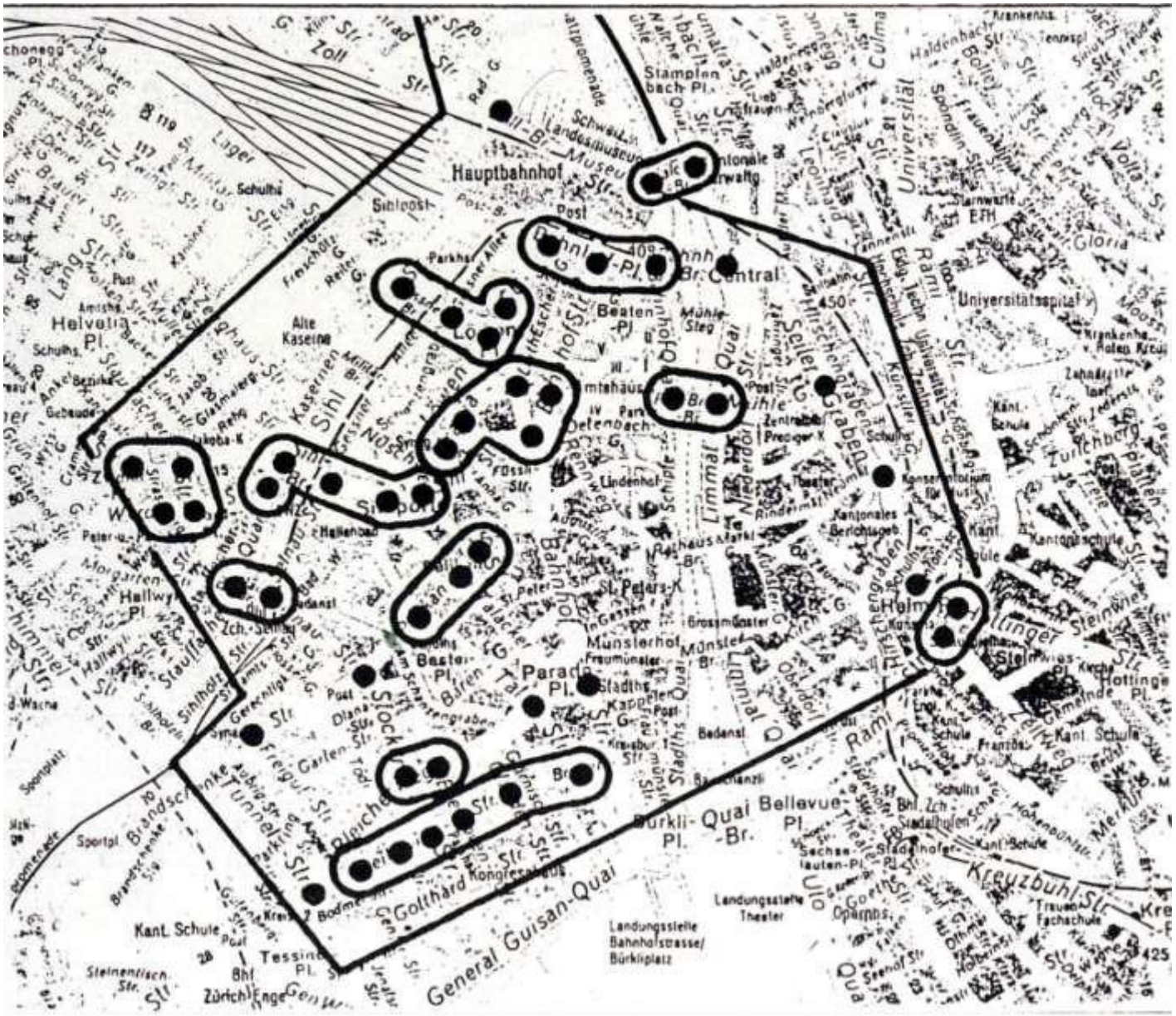
- fare box recovery ratio well above 100%
- US$ 5 million operating profit in 1995 (no subsidies except for concessions).

2. TOWARDS AN INTEGRATED METROPOLITAN MOBILITY CONCEPT

2.1. Decoupling income progression from increase in energy use through the transport system: the case of Zürich

Zurich mobility management

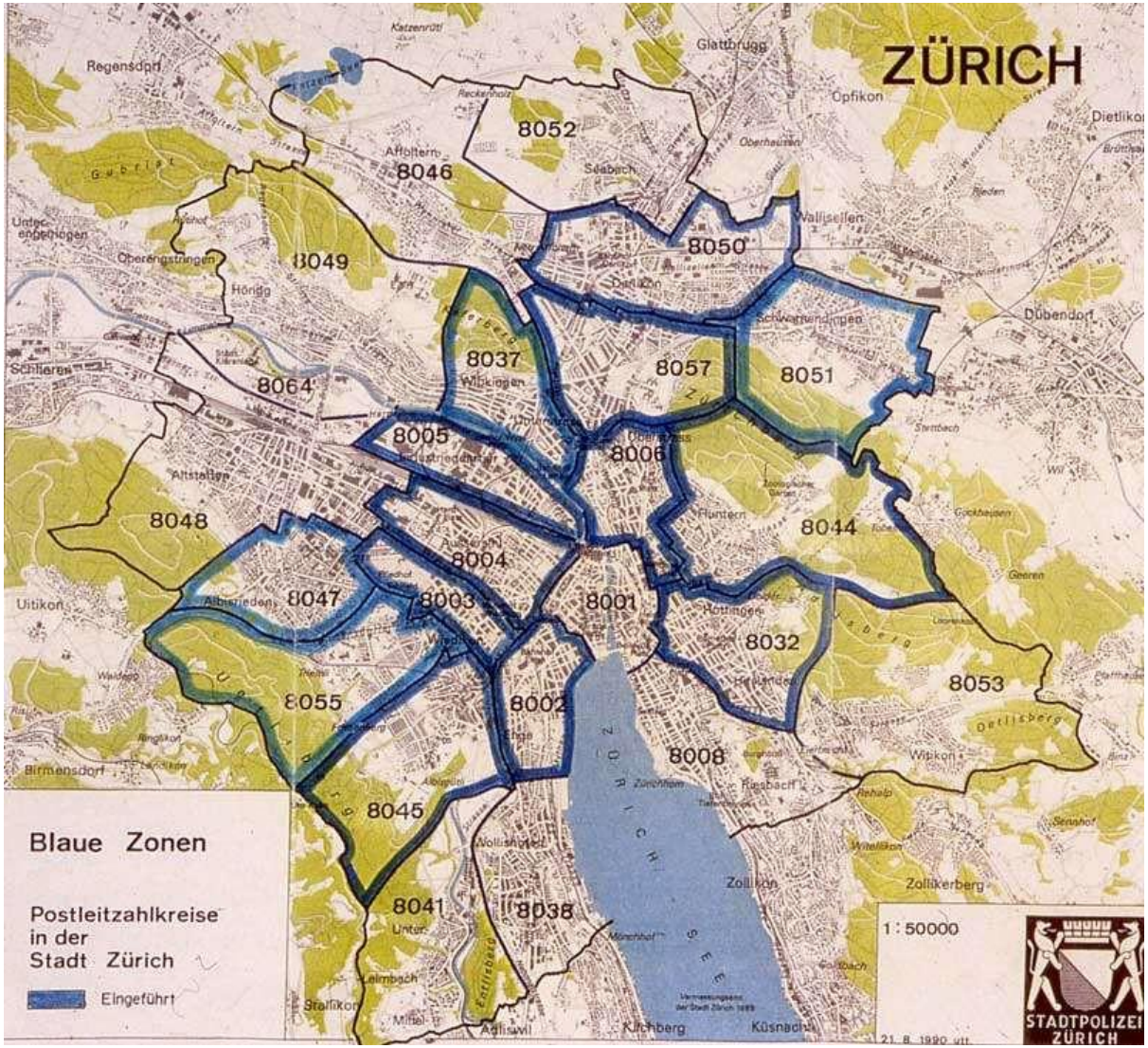
In Zurich, trams and buses enjoy absolute priority on street. When approaching a traffic light the sensor (shown on the lower left) ensures they have a green light at any time of the day. The reliability of timetables makes public transport the city's fastest mode of transport. Modal split is around 80% in favour of public transport.



The “Green wave” and long traffic light cycles have been replaced by very short traffic light cycles, favouring pedestrians.

Zurich parking management

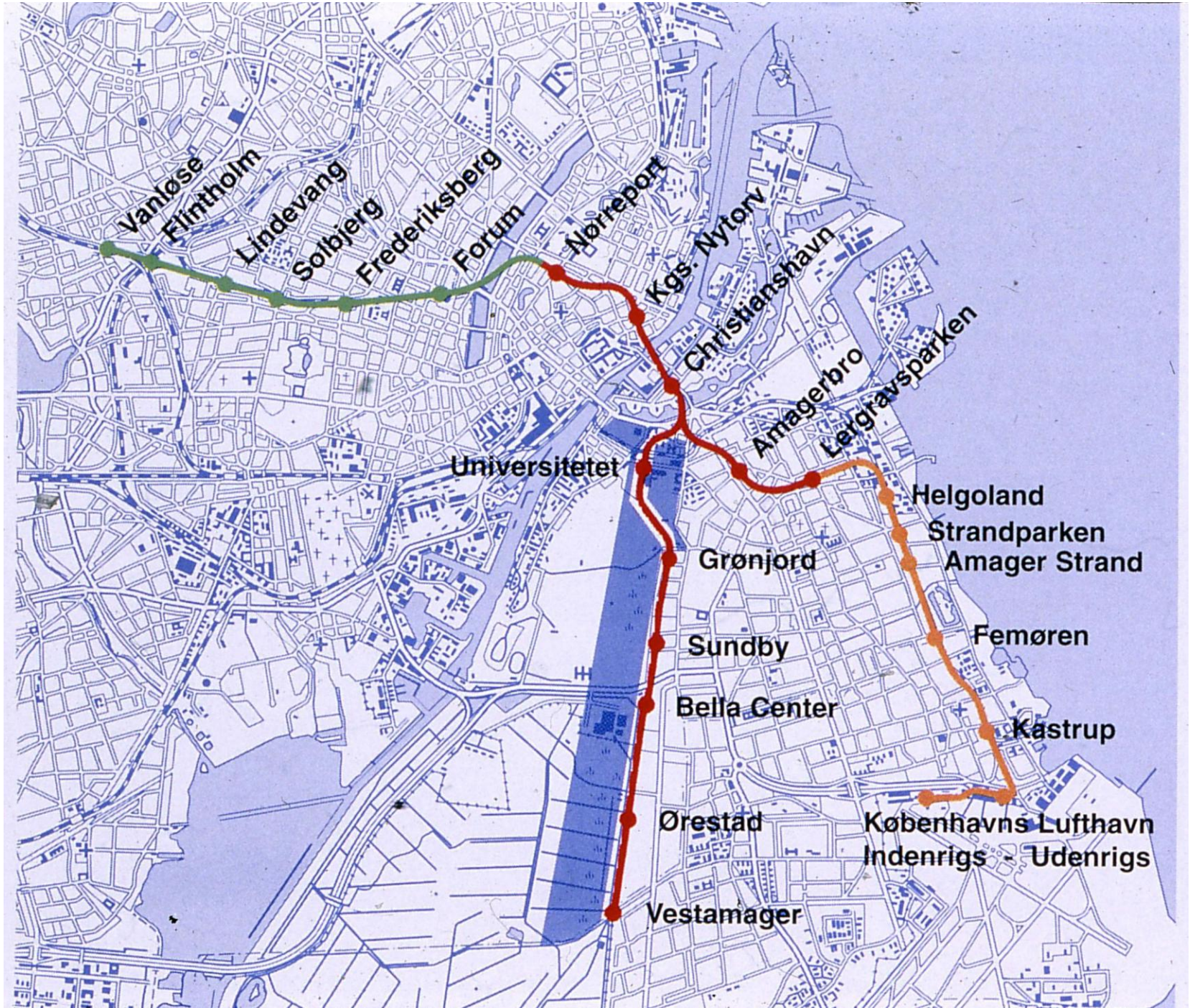
Unrestricted on-street parking is exclusively reserved for Zurich-registered residents, while car commuters entering the city from other municipalities are subject to limits on their parking time (90’ max). This parking measure has allowed a large-scale return of inhabitants to the city, has benefitted the public car parks and has been politically rewarding for the city fathers, while suburban rail travel has been made easier.



2.2. Lifestyles favouring public and non motorised transport: the case of Copenhagen


KAFE
RESTAURANT


København
København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Helgoland
Strandparken
Amager Strand
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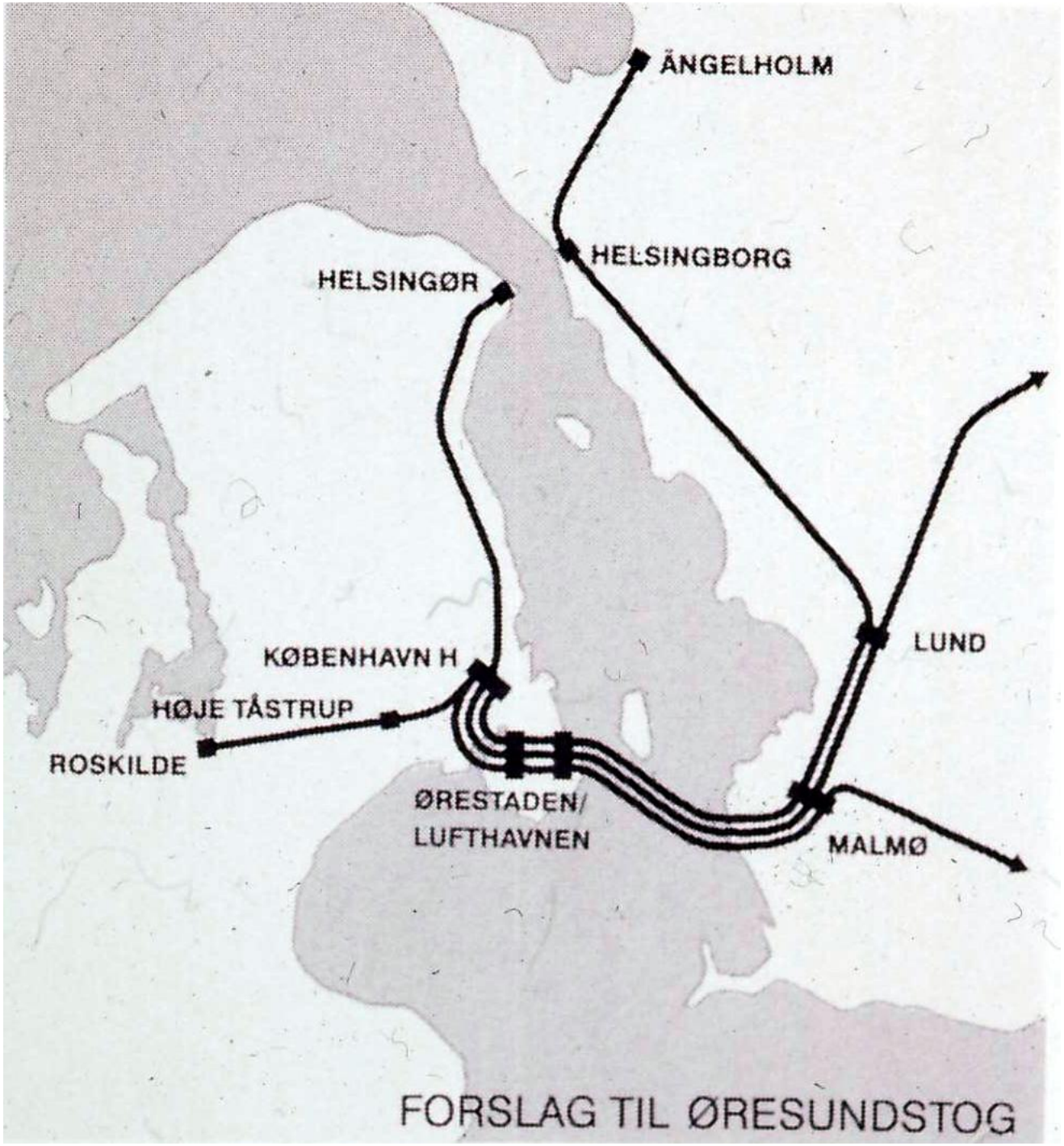
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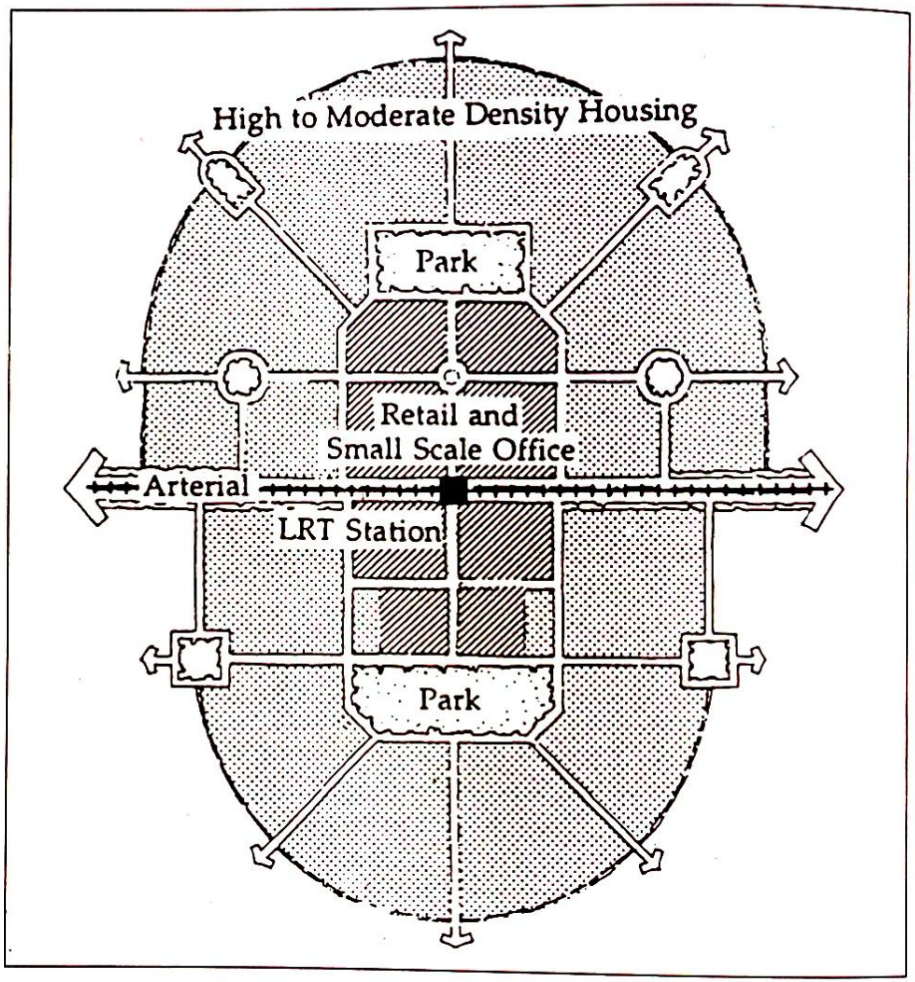
2.3. The compact and green city: the case of Portland (Oregon)

Portland: long term control of urbanised areas.

In 1975, the State of Oregon, at the request of a group of farmers, passed a legislation instituting a development cordon around the city of Portland.

3. Fuel taxes (which are the main source of transport funding) can only be used to fund road investment. More flexibility would require a change in Federal law.

Figure 66: Urban transit oriented development*[1]



*Source: *Cambridge Systematics et al.*, The LUTRAQ Alternative: Analysis of Alternatives, 1000 Friends of Oregon, Portland 1992.

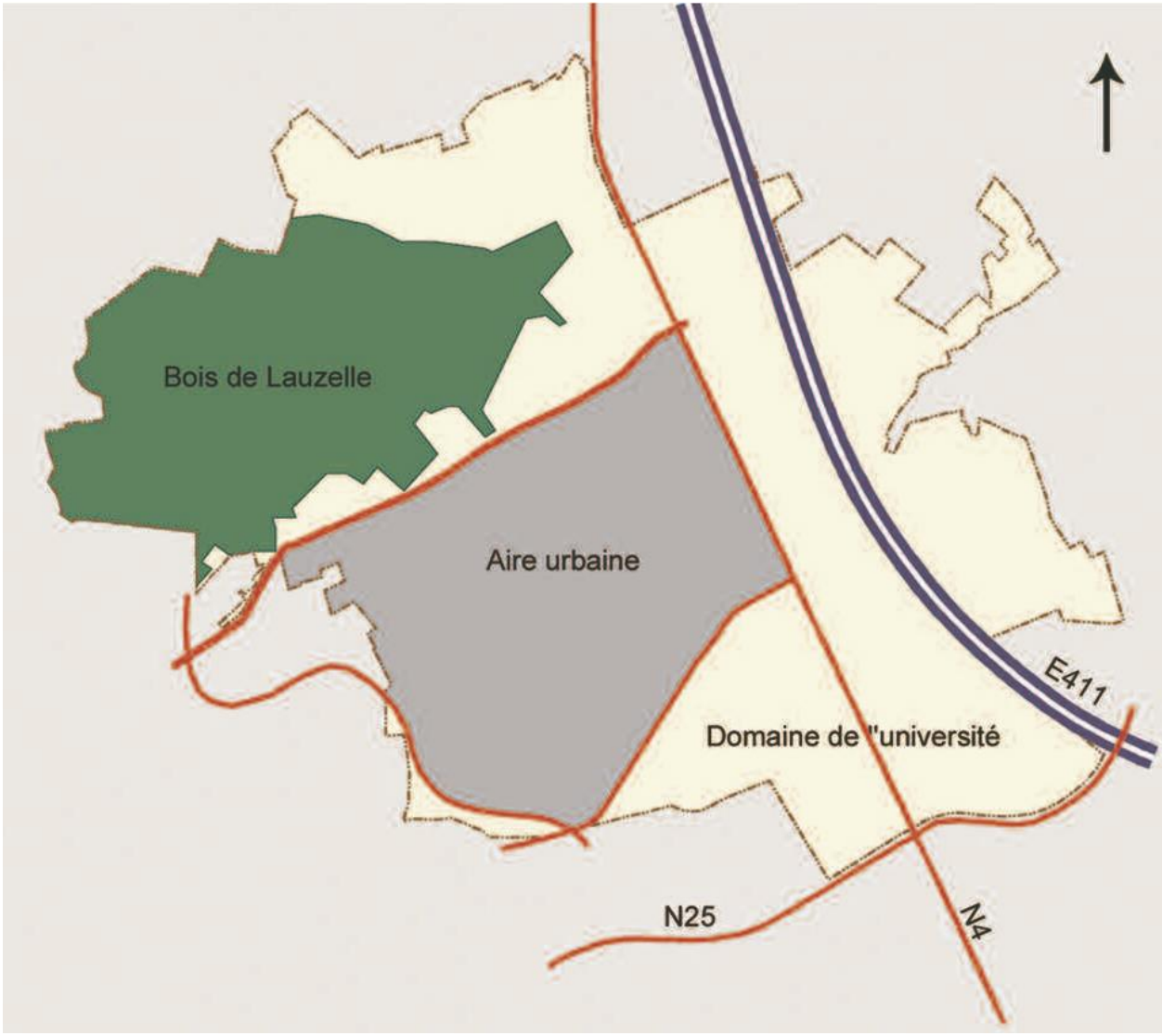
1 An indicative arrangement of development around light rail transit stops, with a mix of moderate to high density housing, shopping and civiv facilities, and parks.

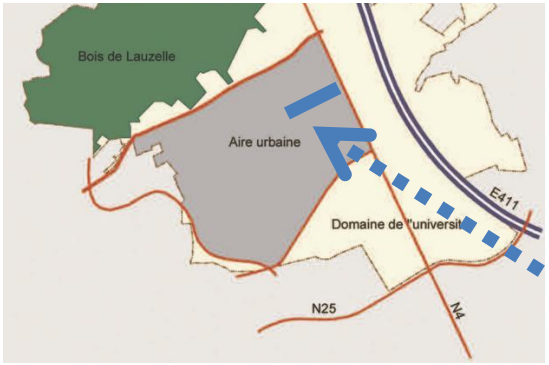
This cordon has resulted in a strong increase of density inside its limits and increased tax income, allowing the construction of a double urban rail system, public spaces and an increased liveability, confirmed by comparative surveys.

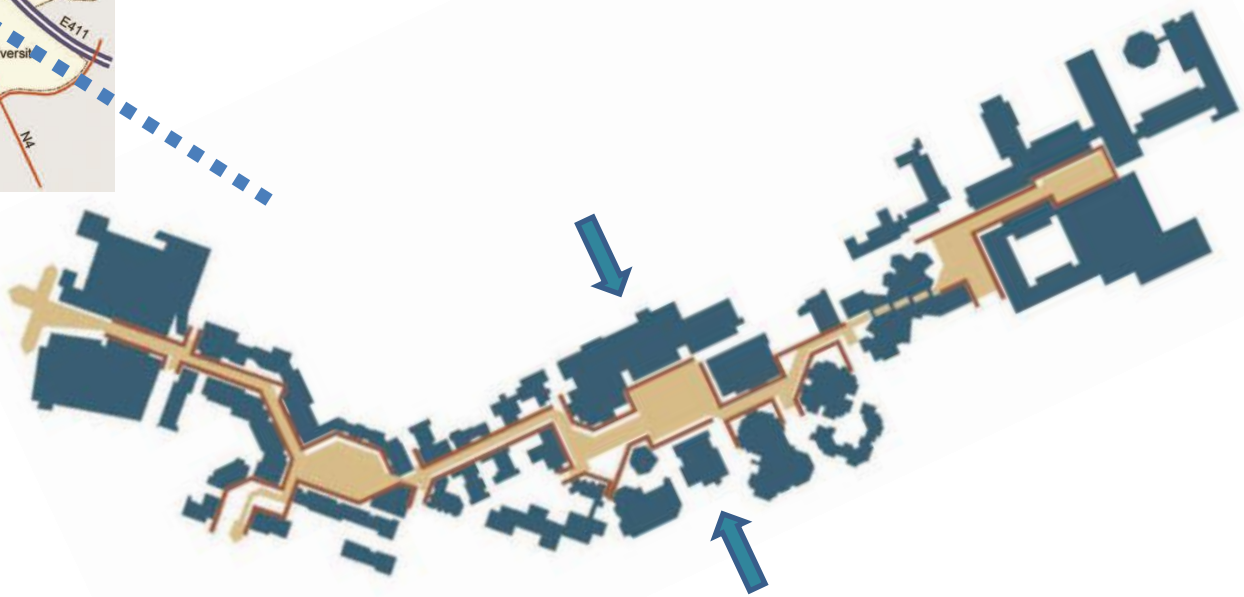
Former industrial buildings have been gradually transformed into public service, commercial and residential uses. There has been no transfer of development rights but benefit sharing through the tax system.

2.4. Transit oriented development: Louvain new university town

The case of the new university town - The university bought ca 1000 ha of agricultural and forest land in a rural area close to Brussels Namur road (N4): the central part was set aside for urban development; forest land in the North was preserved. The overall master plan and architectural coordination was entrusted to the Groupe Urbanisme- architecture (R. Lemaire, J-P. Blondel and P. Laconte).







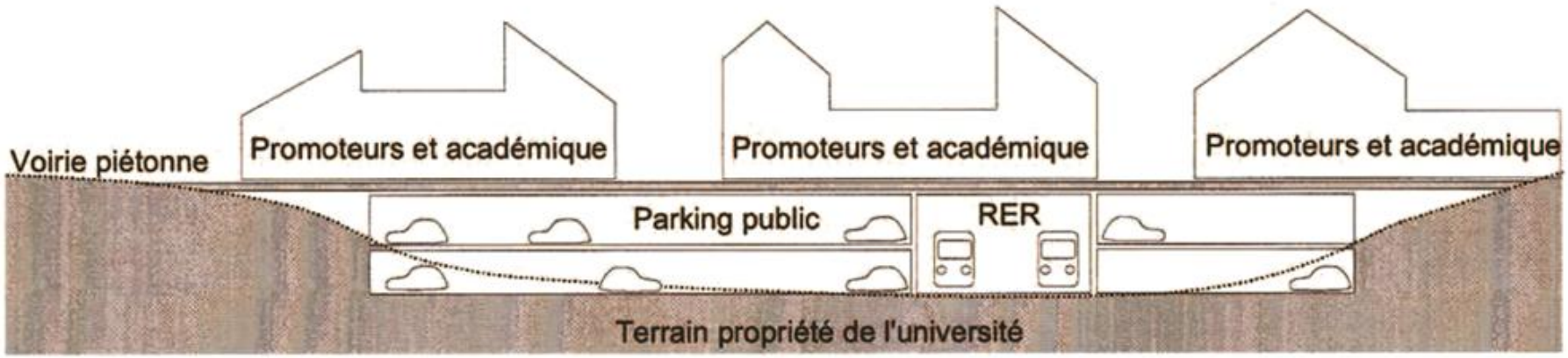
The pedestrian place-making. It was implemented in the main pedestrian street in the first phase, starting from the existing road east of the site, in 1972 (lower part of the picture), and later extended to the railway station opened in 1976 (upper part), the centre of the city, and the extension towards the western part of the site. Car access to buildings and parking is placed outside the spine, with some underpasses. Property development of the whole university-owned site (1000 ha) is by long term leases (75 to 99 years).

A string a public spaces for movement of leisure. The centre of the first phase was the Science Library, a huge concrete building seen as the cathedral of a university town with its plaza (parvis), above an automobile underpass. It is a social gathering place with university buildings, shops and restaurants (arch. A. Jacqmain).

All parking spaces are planted with different tree species in order to attract different kinds of birds. They have become an ornithological reserve.

Transit oriented development. A new station was built, by the national railway company in 1976. It was entirely underground, in view of being covered at a later stage. The full development of the East-West spine includes a slab on the lower part of the site, hosting the services, the parking and their underground access, in addition to the rail tracks.

The Station. The arcaded entrance of the station (arch. Y. Lepere) on the pedestrian spine is the place where the slab starts.



The functioning of the slab. The diagram shows how the underground remains property of the university while the infrastructure and buildings are leased (leases of up to 99 years) to public and private investors.

Latest developments. An aerial view of the city taken in 2003 shows the overall high-density low-rise development and the potential for further extensions close to the lake.