Use of Underground Space

Subsurface planning

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Content

Use of (underground) space in city environment.

- 1. International perspective
- 2. National developments
- 3. From Urban planning to integral planning



1- Use of the underground (international perspective)

Focus: use of the underground in city environment.

- Increase of claims on public space (crowded)
- Soil conditions
- Law
 - Ownership
 - Presence of a form of city planning



1- Use of the underground (international perspective)

- Prosperity and growth
- Spatial conflicts
- (quality of public space)



Metro's Londen & Parijs





London



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OR OF LONDON



London









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Rotterdam





Amsterdam







London & Paris

Strong development of use of the underground due to:

- A- Soil conditions
- B- Size of the city
- C- Pressure on public space
- D- Way ownership is regulated
- E- Spatial planning



Tokyo









Tokyo





MILU ?

Multifunctional Intensive Land Use

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Japan : Tokyo

A- Many claims on public space (infrastructure)B- Difficult soil conditionsC- Land could not be expropriated (till recently)D- No city plan, very little spatial planning



Use of Underground Space in the Netherlands

The growing interest for underground space technology, despite of the unfavourable circumstances in the Netherlands, is the result of:

- The environmental complexity and the growing numbers of infrastructural and environmental planning problems
- The continuing demand for better **quality** of environment, nature and liveability
- Economical growth



Reasons for Using & Developing Underground Space

Taking away/ reducing nuisance and thereby improving liveability

- Reducing/ eliminating the security risks and damage to the environment
- Complex infrastructural/ environmental planning problems, especially in areas where space is becoming rare
- Strategic consideration



2- National developments

Developments in the Netherlands:

- Large infrastructure
- Small infrastructure
- Underground storage
- Underground buildings
- Underground logistic systems



2- Tunnels (large infrastructure)



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2- Tunnels (large infrastructure)

Two developments:

1- Application:

From strictly use as a functional application towards solution of spatial problems.

Development of new technology:

From building from surface (immersed tunnels) towards underground construction (TBM)

Piet Heintunnel





2- TBM driven tunnels

Built since 1996:

- 2^{de} Heinenoordtunnel (941 m, 2 ø 8,3 m)
- Westerscheldetunnel (6700 m, 2 ø 11,0 m)
- Botlekspoortunnel (1835 m, 2 ø 9,45 m)
- Sophiaspoortunnel (4000 m, 2 ø 9,45 m)
- Tunnel Pannerdensch kanaal (1615 m, 2 ø 9,45 m)
- HSL-Zuid Groene Harttunnel (7160 m, ø 14,87 m)



2- TBM driven tunnels

Under construction:

- Randstadrail Rotterdam (2 ø 6,5 m, 2400 m)
- Hubertustunnel (2 ø 10,2 m, 1495 m)
- Noord/Zuidlijn Amsterdam (2 ø 7,1 m, 3100 m)





2- TBM driven tunnels

Feasible (early 1990)



Being built (early 2000)



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Illustratie uit: Ondergronds. Het verhaal van onzichtbare constructies.





"It's crowded in the underground"

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Alternative?

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Rapid increase of parties involved.

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Technology development: Trench less technology

- Horizontal directional drilling
- Horizontal micro tunneling







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2- Underground storage

• Waste collection







Almere



2- Underground buildings

• Car parking



Delft, traditional

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Amsterdam, mechanical





2- Logistic systems

Network:

Pipe line: Ring pipe line Shuttle pipe line

Interchanges: Logistic City Park (LCP) Distribution Center (DC) Distribution Points (DP)





2- Cold & heat storage



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3- The underground is crowded



Illustratie uit: Ondergronds. Het verhaal van onzichtbare constructies.

Use of the underground, more than infrastructure:

- -Foundations
- -Biotopes
- -Archeological archive
- -Water storage
- -Ground water flow

-Etc.



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3- Trends

- Increasing pressure on the use of the underground.
- Working from level becomes less acceptable Small infrastructure:
- Increase of use of trench less technology
- (tunnels for cable & ducts?)
 Large infrastructure:
- Development of shallow tunnels (TDT)



3-Subsurface planning

Why subsurface planning?

Reserve
 Regulate
 Reduce risks

4. Direct



3-Subsurface planning

Why subsurface planning?

Reserve
 Regulate
 Reduce risks
 Direct

scarce; don't waste
many parties=many interest
just coordinating≠sufficient
quality doesn't come by itself



3-Subsurface planning

Spatial planning Spatial planning of the underground Integrated spatial planning

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3-Integral subsurface planning



