Urban Underground Space and Benefits of Going Underground

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The Urban Problems

(1) **Growth of the Urban Population**

- 3 Billions in 2003 – 5 Billions in 2030
- 50% of the World’s Population in 2007
- Will double in 38 years
- Mainly in less developed regions
- Very slow in the more developed regions
The Urban Problems

(2) Allocating the «Urban Space» to the various urban functions
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(3) Necessity of favouring economic development
The Urban Problems

(4) Pressures on the urban environment
The Urban Problems

(5) Impacts on global environment
The RELATIONSHIP between the CITY and its UNDERGROUND SPACE
The Relationship between the City and its Underground Space

(1) Immediate underground level or « sub-surface »
The Relationship between the City and its Underground Space

(2) Deep level or « underground »
The Relationship between the City and its Underground Space

(3) The reliefs
BENEFITS
resulting from the use of the
URBAN UNDERGROUND SPACE
BENEFITS
as regards
LAND USE
AND LOCATION PROBLEMS
Benefits as regards
LAND USE AND LOCATION PROBLEMS

PARIS – « AUBER » Station – RER Line A
Benefits as regards
LAND USE AND LOCATION PROBLEMS

SYDNEY – Underground Opera House car park
Benefits as regards
LAND USE AND LOCATION PROBLEMS

PARIS Metro – « Meteor » Line 14
Benefits as regards
LAND USE AND LOCATION PROBLEMS

« Separate conflicting transport activities »
Benefits as regards LAND USE AND LOCATION PROBLEMS

PARIS – Several levels of transport facilities below the « Nation » Square
BENEFITS
as regards
ISOLATION
Benefits as regards ISOLATION

(1) Climate

The « Santa Claus Village » on the Arctic Circle - Finland
Benefits as regards ISOLATION

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Underground storage facilities - Kansas City - USA
Benefits as regards ISOLATION

(2) Earthquakes

Kobe earthquake – Japan - 1995

Severe damage to the City Hall

Almost no damage to the underground shopping mall
Benefits as regards **ISOLATION**

(3) Noise and vibration

Church in the rock – Helsinki - Finland
Benefits as regards ISOLATION

(4) Multi-purpose service tunnels
BENEFITS
as regards
ENVIRONMENTAL PROTECTION
Benefits as regards
ENVIRONMENTAL PROTECTION

(1) Aesthetics

Car park in Marseilles - France

BEFORE
AFTER
Benefits as regards
ENVIRONMENTAL PROTECTION

(2) Public utilities
Benefits as regards ENVIROMENTAL PROTECTION

(3) Traffic tunnels

The « Central Artery » - Boston - USA

ITA Open Session - Singapore - 25 May 2004
Benefits as regards
ENVIRONMENTAL PROTECTION

(4) Underground car parks

Underground car park below a schoolyard – Stockholm - Sweden
BENEFITS

as regards

TOPOGRAPHY
Benefits as regards TOPOGRAPHY CONSTRAINTS

Metro Line crossing the « Butte Montmartre » - Paris
The Trans-Tokyo Bay Highway
Benefits as regards TOPOGRAPHY CONSTRAINTS

« 3D Planning »
How to get
MORE BENEFITS
from the use of the
URBAN UNDERGROUND SPACE?
How to get more benefits from the use of the urban underground space?

(1) Safety, psychological and health aspects
How to get more benefits from the use of the urban underground space?

(2) Protection of the underground environment

Paris - Catacombs

Paris – « Grand Louvre »
How to get more benefits from the use of the urban underground space?

(3) Relations between underground structures and the ground surface

Paris – Metro Line 1 in Neuilly

Lyon – Portal of the Fourviere Tunnel
How to get more benefits from the use of the urban underground space?

(3) Relations between underground structures and the ground surface
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How to get more benefits from the use of the urban underground space?

(4) Construction techniques
How to get more benefits from the use of the urban underground space?

(4) Construction techniques

Paris - Champs Elysées Avenue

Maintaining trees during the construction of an underground car park
How to get more benefits from the use of the urban underground space?

(4) Construction techniques

Construction disruption with Cut & Cover methods
How to get more benefits from the use of the urban underground space?

• Site investigation
• Location and features of existing underground structures, facilities and public utilities
• Economical considerations
• Assessment of the projects
• Risk analysis
Risk analysis

• Financial risks
• Public acceptance for the facility
• Changed ground conditions
• Construction risks
• Contractual risks
• Environmental risks
• Risks in operation
Criteria for an optimum use of Urban Underground Space

Source: R. Sterling & J-P. Godard

- Take into account the needs of the Community
- Maximize the benefits from the use of the underground as developable space
- Reinforce the positive features of the surface urban environment
- Make the most effective use of the features and properties of the geologic setting
- Design for « sustainability » in the use of the subsurface space
From Urban Underground Space Use towards Urban Underground Space Development
Urban Underground Space Development

Henard’s Project - France (1903)

Expanded Use of Underground Space