

都市問題と地下空間利用 THE URBAN PROBLEMS AND THE UNDERGROUND SOLUTIONS

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In this paper we address the question, what kind of construction project to donate to solve the urban problems. And in our analysis we rely considerably on the discussion of IWG13 & WG20 of ITA and the study of the Symposium on underground Space in JSCE.

It is concluded that utilization of underground is important for revitalization and raising attraction in central urban districts. The most important part of this argument is that multilevel utilization of the limited land based on the well coordinated city plan, has special meaning for the wellbeing of the people and for improving the environment including the landscape.

Key Words: Urban problems, Underground Solutions, WG20 of ITA
Multilevel utilization of Land,

1. Introduction

In this paper, the authors considered what are urban problems based on the special theme for urban area. It may have no objection that the subways, underground light rail transit systems, urban road tunnels and underground parking lots contribute to solve the urban problems with considering to these development processes in these own ways. However, as the weakness against disasters, the doubt against comfortableness for staying space of human, the high cost comparing with that of the same structures on the ground are emphasized without the criticize or re-criticize of the underground spaces strictly, the underground space are adopted at the special construction site as a ridiculous answer.

Also, as the authors consider to the present and near future urban area, we would like to discuss about the possibility of solving urban problem by utilizing the underground space.

1. The first question we have to ask is whether there can be an optimal solution to possibility of solving urban problems by utilizing underground space.
2. The second point that requires clarification is why we chose the underground-type in its project instead of aboveground.

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2. Other Studies -WG13 of ITA, WG20 of ITA, JSCE-
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6. Conclusion

キーワード：都市問題、地下空間利用、国際トンネル会議 WG20、土地の多層的利用

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2. Other Studies

At the World Tunnel Congress 2002 in Sydney, Australia, new working group "WG20-Urban Problem, Underground Solutions" is organized.

At that time, the WG20 set to co-work with the affiliated organization, ACUUS (Associated Research Centers for the Urban Underground Space). And the WG20 delivered the simple questionnaire to the Tunnel Association in every nation with the name of the President of Internal Tunnel Association on 12th of December, 2002.

The questions of questionnaire are following: (1) What kind of urban problem does your country have? And how have you solved these problems by utilizing underground space? (2) How does your country think which kind way of underground space utilizations should be selected to solve the urban problems in the future? (3) What kind of construction project do you consider to donate to solve the urban problem your country has?

At the World Tunnel Congress in Amsterdam, Holland in 2003, there is short lecture which is entitled "Utilization of the subsurface in the U.S.A". The lecture quotes the traffic facilities. Smithsonian Library, San Francisco BART, Boston highway overpass and Bus tunnel at Seattle. Boston central overpass and Seattle bus tunnel are specific results against an urban problem such as inefficient transportation. Although a way out of minimize surface disruption may be given by using Metro, the security problem for users is still remaining. There are cases setting the expansion opportunities in Smithsonian Library and Boston post office. And there is a case of living in extreme climate at the Town houses in Minneapolis. The Town houses combine the living facilities with the countermeasure to the noise by road for automobile at the north side of these buildings.

Mr. Sabine Barles who comes from French gave a lecture about French Contribution. He talked about many urban problems are solved by underground utilization through his lecture. It is a good example that the utilization of multi-stories solved the urban problem at 13 district in Paris. But urban policy may be forgotten and urban planner may forget it unfortunately. It is considered that the present urban problem is sustainable development and the control of the urban sprawl. The sewage works below the ground for tracks and field in Marseilles is a example for increasing the artificial area. The improvement of the entrance of the Louvre Museum should be an example for the urban renewal by the underground facilities. Express link which connects between the CDG airport and the downtown of Paris and combines the subways and automobiles is the reduction plan of numbers of automobiles in a part of Urban Trip Plan 2005. This is the problem how the urban problem should be solved after this. There are 4 points (1) To forget the past opinion and debate the advantage and the disadvantage of the solutions. (2) To plan to improve the project with the consideration of constrains of underground spaces. (3) To integrate the urban policy. (4) To cooperate public organization with private organization.

Dr. Junji Nishi of ACUUS reports about the Urban Problem-Underground Solution. One Words for "Underground & Value of a Landscape". It contains (1) the necessary of the case studies in Asian developing countries. (2) necessary of the criticize method for solving urban problem the underground utilization, (3) Drawing the ideal urban structure by the core based on the underground space utilization with the relation of cause and effect, (4) the case study for trial calculation of the landscape preservation in urban area, (5) the estimation of the relation between the population density in cities and the amount of consuming gasoline.

WG13 of ITA studied "Direct and indirect advantages of underground structures". And WG13 reported how the decision is made as to whether to place Urban Mass Transit Systems above ground (either

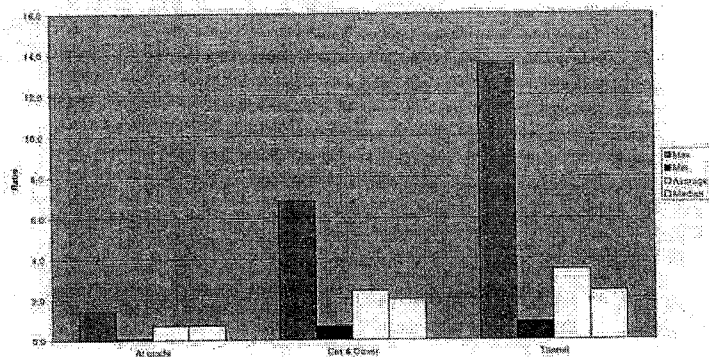


Fig1 Construction costs relative to elevated

at surface or elevated) or underground. The result are as follows:

Findings: (1) Construction costs of underground-type were reported from 2.25 times the cost of elevated-type (TUST 19, p26, 2004). (2) The decision on whether to place an urban mass transit system underground or aboveground is a complex planning, engineering, construction, urban design, economic and political decision.

Recommendations: (1) The choice of underground vs. aboveground for urban mass transit systems must be made

by each city considering each area of the transit system, based on its own specific circumstances (TUST 19, p26, 2004). (2) The critical decision between an underground and an aboveground alignment in many cases is strongly, if not completely, influenced by the issue of perceived high initial capital cost. This decision should, however, consider the benefits of increased long-term social and environmental improvements and beneficial economic development.

In 2006, the Meeting of WG20 has opened at Seoul, Korea. The goal of WG20 will be to prepare a report on following three subjects: (1) typical urban problems, (2) the innovative and sustainable solutions the underground has to offer, (3) the most important factors within the decision making progress for such solutions.


Urban Problems – Underground Solutions

ITA - Working Group 20

in cooperation with
ACUUS – Associated Research Centers for the Urban Underground Space

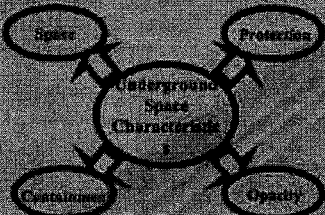
WG20 Focus:

- ✦ The basis for the formation of this Working Group comes from the progressive increase of urban populations around the world.
- ✦ Civilization steadily moves towards urban life as the basis of social organisation, resulting in a continuous growth and increasing density of population in cities.
- ✦ This trend raises a number of serious problems which grow proportionally with the size of a city.
- ✦ An important part of the solutions to these problems is the use of underground space - which increasingly has an important role to play in solving urban problems.





Urban Problems addressed by WG 20:

- ☐ Traffic Congestion
- ☐ Surface Congestion
- ☐ Land Preservation
- ☐ Environmental Concerns
- ☐ Conservation of Cultural Heritage
- ☐ Energy Use
- ☐ Security
- ☐ and many more...



WG 20 Objectives:

- ✦ WG20 is building a comprehensive database of worldwide examples for unique underground solutions to typical urban problems.
- ✦ The ultimate goal of the Working Group is to publish a report on how the subsurface has been used effectively around the world to solve urban problems.
- ✦ The report will be directed to planners and politicians to provide creative and efficient ideas for the solution of urban problems and will serve as a decision aid.
- ✦ The focus of this product will be somewhat less on technical details but more on solutions to urban problems, may they be of social, economical, ecological or

WG 20 Contacts – Participation is welcome!

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Fig2 Poster of WG20 in ITA Istanbul

In recent years, Underground Space Use Committee of JSCE(Japan Society Civil Engineer) is discussing “the urban problems and underground solutions” and it is as follows. The report will be completed by a collection of 10 to 20 worldwide case history examples which will provide a good illustration for the most significant underground solutions to urban problems.

The justification for selection of elevated or underground type of railway in Japan.

- a) 1965~1985: Cost comparison including land acquisition.
- b) 1975~1995: Environment assessment including aesthetics and climate condition.
- c) 1995~present: The reason why they used the underground-type is that local residents saying that the land value along the route would decrease in the future from the negative impacts of the elevated structure and railway operation.
- d) In future: a revival of light rail and a great deep underground railway.
(Ooedo subway line, Tokyo, Ground level minus 50 m)
(JSCE Symposium on Underground Space 2006, Harris Fabillah & Others)



Phot1 WG20 Meeting in Seoul, 2006

3. Problem of Urban Problems

There are many urban problems in urban area, the point of view is different where you are on the stand. Based on many materials for urban problems, Japan had started from the lack of the number of enough facilities against the expansive progress of the economics after the World War II.. Especially there had been the urban problems such as the traffic facilities enterprise around 1955-1975. And the urban problems in London are as follows; (1)housing,(2)economy, (3)increase of a crime, (4)traffic,(5)environment, (6)rich & poor(Towards the London Plan 2001).

Table-1: Urban Problems in Japan

Urban Problems in Japan	
1) After the World War II (1945~1954)	The lack of the number of enough public facilities (Railway, Highway, Housing etc.)
2) 1955~	Traffic congestion, Urban pollution & noise, Slum & Land use,
3) 1975~	Synthetic traffic system (Share between rail & Road), Urban natural environment (Green & Open space), The fascinate urban space with landscape policy,
4) 1990~	- Revival of light rail (Revival of public transportation) - New urban transportation such as a plan of great deep underground railway
5) 2000~present	- The advanced age problem (Facilities for handicapped and age)
6) Unsolved major problems	- Terrorism - Welfare (expansion of a gap between richness and poorness)

Table-2: Urban Problems in London

Urban Problems in London	
1. Housing :	shortage of the house for low income people, the cost for a house rise suddenly.
2. Economy:	shortage of the office space, the cost of business rise suddenly.
3. Social problem:	increase of a crime.
4. Traffic:	traffic congestion, a decrepit infrastructure in transportation.
5. Environment:	air pollution, waste disposal, preservation of view
6. Rich & poor:	expansion of the gulf between rich and poor.
(Reference: Towards the London Plan 2001)	

4. Case Studies on Japan and World

4.1 Minatomirai Line-Interior design of railway station-, Yokohama, Japan

Minatomirai line runs from Yokohama station to old downtown area via newly developed Minatomirai 21 area. Minatomirai station is applied the stair well for creating the united space extending from the platform at the 23m depth to the building at ground level. In Minatomirai station, passengers will not feel any oppression as in the usual underground station. In this station, passengers will not feel any oppression as in the usual underground station, all so they can create an excellent landscape.

Bashamichi station is designed for the dome style structure and the arch style for Motomachi Chukagai station. The arch and dome style create the expressive space with a curved surface and high ceiling. In Bashamichi station, the diameter of the dome is 25m and it becomes a new symbol of the area. In Motomachi-Chukagai station, the arch structure created a large space where it does not seem to be underground. And the concepts of Chukagai(China town) and the settlement era of Yokohama are expressed on the large wall by artists.

4.2 Siodome SIO Site-Redevelopment of city center-, Tokyo, Japan

The last great project in the metropolitan area.31 hectors are transformed into a city of 61,000 people. Its catch phrase is "New Value for Work, Play and Life".

11 districts, for purposes such as business, culture or residence, are divided into 5 blocks. Each block is like a unique small town with 3 levels, 2 aboveground and 1 basement floor below. Promenades, open spaces ,parks and roadways interconnect these block to create an open network. Shiodome Sio-Site promises to become a city representing the future of Japan. Host to world-class facilities, Sio-Site will become a communication hub for worldwide information and culture. On a human scale. Sio-Site offers verdant nature, people-friendly design and ample attractions for comfort and relaxation.

4.3 Oasis21-Reconstruction of central park-, Nagoya, Japan

Site area are 2 ha, and total space of the park are 25,200m². The purpose of this project are as follows: (1) Sakae park district improvement(the past aboveground bus terminal disturbed have the aboveground pedestrian moving line), (2)Underground bus terminal, (3)Shopping mall, (4)Underground open space.

4.4 Keihan Underground Railway-Improvement of traffic congestion , overlap land use and conservation of landscape-, Kyoto, Japan

The plan is that the grade separation of Keihan line to mitigate chronic road traffic congestion by eliminating the railway level crossings and providing an additional city road along Kamogawa river after removal of the at-grade railway.

By comparing only the railway construction costs, the elevated method would be cheaper than the underground method, and will be usually chosen for railway grade separation. However, the underground method was decided by the total project cost being cheaper than the elevated method for the railway and the city road combined construction. Also, the underground method was accepted for preservation of aesthetic view in Kamogawa river area and the popularity of Kyoto City. (Reference: Kyoto City Government: Keihan Main-Line Construction Records,1991).

Table-3 Comparison with elevated & underground construction costs

	elevated	underground
Land	154.0	5.6
Compensation	186.0	18.4
Construction	162.0	461.0
<hr/>		
Total	502.0	485.0 (x 1 0 8 Yen)

*Effectuate land use: above=city road , underground=railway

4.5 Pedestrian underground network, Sapporo, Japan

The purpose of this project are as follows: (1)Redevelopment of city center, Build up a close connection with 2-centers of commerce, (2)Raising attraction and vitality of downtown , (3)Forming walking network which is safety and comfortable in all season including winter season..

In spite of deep snowbound and very cold climate in winter, the population of Sapporo City has 1,850,000 persons that major scale in worldwide of the frigid zone.

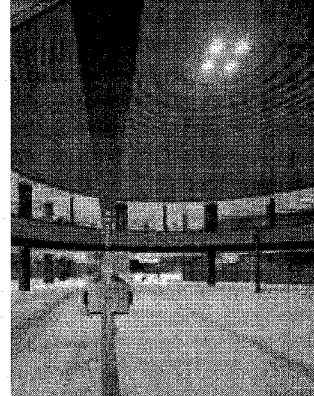
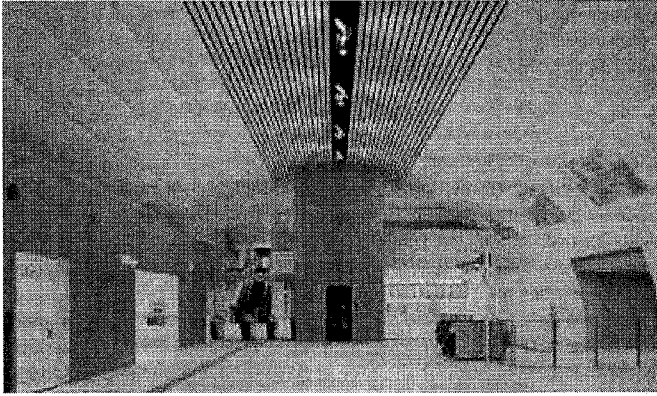


Photo2, 3 Minatomirai Line-Interior design of railway station-, Yokohama, Japan



Photo4, 5 Siódome SIO Site-Redevelopment of city center-, Tokyo, Japan

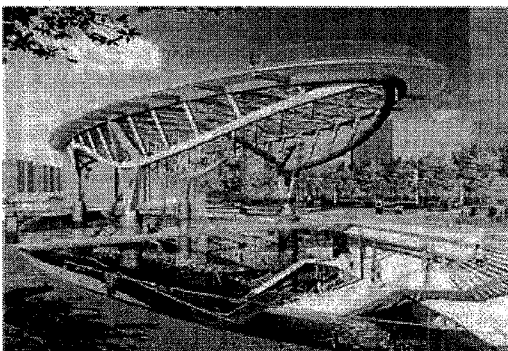


Photo6 Oasis21-Reconstruction of central park-, Nagoya, Japan

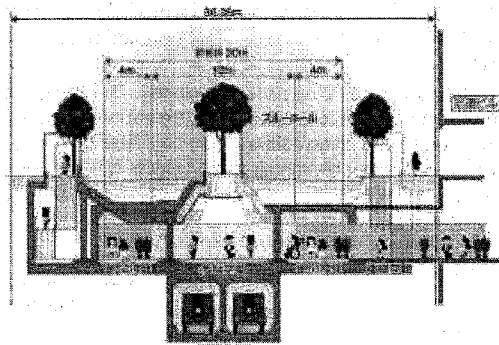
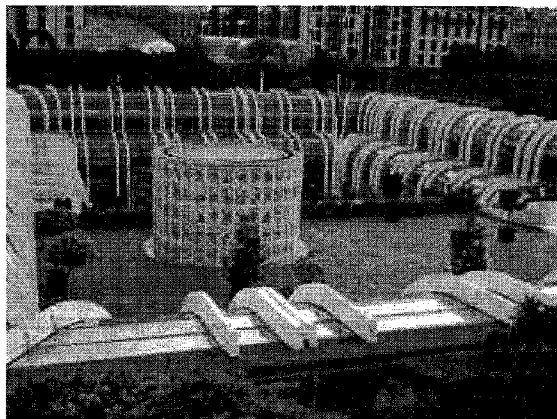


Fig 3 Pedestrian underground network, Sapporo, Japan

4.6 Big Dig Project, Boston, USA

Big Dig project is turning to the underground from the viaduct and it created the open space

The Big Dig is a massive road infrastructure project which was undertaken to improve the flow of traffic, alleviating chronic congestion across Boston and the surrounding commuter areas, and to replace the outmoded elevated Central Artery road that effectively split the city in half, alienating the North End and Waterfront neighborhoods from the economic life of the city (length of underground road=2.6km).



4.7 Les Halles, Paris, France

This project is redevelopment of city center and it created the park and open space.

Construction was completed in 1977 on

Châtelet-Les-Halles, Paris's new urban railway

hub. The Forum des Halles, a partially underground multiple story commercial and shopping center, opened in 1979. The building was criticized for its design and, as of 2005, the City of Paris has undertaken consultations so as to how the area should be remodeled.

The site was to become the point of convergence of the RER, a network of new express underground lines which had been inaugurated in the 1960s. Three lines leading out of the city to the south, east and west were to be extended and connected in a new underground station. For several years, the site of the markets was an enormous open pit, nicknamed "le trou des Halles" (*trou* = hole), and a considerable eyesore at the foot of the historic church of Saint-Eustache.

Les Halles is an area of Paris, France, located in the 1er arrondissement. It is named for the large central wholesale marketplace, which was demolished in 1971, to be replaced with an underground modern shopping precinct, the Forum des Halles. It is notable in that the open air center area is below street level, like a pit and contains sculpture, fountains, and mosaics.

Beneath this lies the underground station Châtelet-Les-Halles, central hub of Paris's express urban rail system, the RER.

Photo 7 Les Halles, Paris, France

4.8 Terrorism in London Subway, England- Unsolved problem-

The simultaneous blast terror attack occurred with three London subways and a double-decker, about 50 or more persons undertook death, and 700 persons got injured at the rushes time around from [on July 7, 2005] 8:51 a.m. to 9:30 time. In the authorities' announcement, it is said that there is doubt in which the radical Islamic group is participating. The blasting time in the subway is regarded as having used the timing device, since all three vehicles were these time mostly.

Tobacco is careless, a fire breaks out and the Kings Cross station from which this time most serious damage was taken out has killed 31 people in November, 1987. Since then, passengers came to participate in disaster prevention of the station where one also use themselves positively, and when those who are smoking tobacco by subway and who are were found, the climate which many passengers are severely careful of had budded. Moreover, it refrained from summit holding and had covered with severe guard system from several months before. However, terrorism was not still able to be prevented. I thought that I was similar with the explosion terror of railway at 2003 in Spain, seeing the first news of this atrocious event.

Anyway, as for any reasons, the indiscriminate terrorism who made the target the man in the street without any crime is not allowed.

5. Possibility of solving urban problems by utilizing underground

5.1 Weakness points of underground

The weakness points of underground space use are following.

- (1) Weakness against disasters for fire or flood etc.
- (2) Doubt against comfortableness for staying space of human.
- (3) High cost comparing with same structure on the ground level or elevated.

5.2 Process for solving urban problems by utilizing underground space

- (1) The urban problems of urban life, urban traffic and infrastructure have the solution based on utilizing

underground spaces. However, in the case of using underground space for the living environment, school, working environment, the lack of the natural light becomes serious problems.

(2) On the many cases, the solving method by underground spaces has effect against the quality for life, the quality for architecture and the quality for environment.

(3) The social agreement can settle easily if the impact against the life space on the ground becomes minimized.

(4) The result with using underground space for urban problem is restricted by social view points such as the safety and the peace of mind, the high cost of the relevant with the underground space management.

(5) In the future, underground space will be maintained project on the urban renaissance project.

(6) In snowy cold and mega cities such as Montreal, Toronto and Sapporo, the underground pedestrian network is valuable in urban area in the city center.

(7) As Japan "the landscape law" is established in 2004, underground space utilization should be reconsidered from the point of view of the urban scene preservation and creation of scene.

(8) There is a possibility that the pedestrian space of underground shopping mall as barrier free pedestrian road becomes high valuable spaces cooperating with facility of private company.

6. Conclusion

Some advantages of the underground projects;

- Multi-level planning for redevelopment in the city center.

- Lower total cost in some cases(compare with purchase the land and compensation for the building).

- Decrease in noise, vibration and air pollution on the ground.

- Creating good landscape.

- Safety against earthquakes.

- In central urban districts, utilization of underground is important for revitalization and raising attraction.

- Multi-level utilization of the limited land based on the well coordinated city plan, has special meaning for the wellbeing of the people and for improving the environment including the landscape.

- Improvement of traffic congestion and increasing traffic capacity for public transportation.

- Although there are many examples for solving urban problem by using underground space, there are a few cases of estimation clearly.

- As the criticizer such the politician, the administration, the entrepreneur and the manager of facilities, taxpayer may change the evaluation of planned or actual underground facilities, we need to discuss about the criticize method of underground spaces.

- To do that, we should found to re-evaluate the actual underground facilities by many methods with case studies.

- In the future, we research the evaluation method of the underground spaces and need to search the possibility for solving urban problems by utilizing the underground spaces.

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