Conditions for the Emergence of an Indoor City

Panel Contribution by **Ray Sterling**

My contribution to this panel discussion will focus on the use of the underground in urban areas as part of the emergence of indoor cities. These remarks are taken from a Colloquium on Underground Space Utilization held in Monticello, Minnesota in July 1995 and organized by the University of Minnesota.

The colloquium brought together a diverse group of people -- leaders in shaping our built environment -- for a three-fold purpose: (1) to assess the importance of underground space in future efforts to achieve sustainable human development, (2) to identify impediments to achieving the greatest value of underground space as an element of our built environment, and (3) to identify opportunities for government policy, research and technology, and other initiatives to enhance our abilities to develop and use underground space.

This general review and evaluation of the role of underground facilities in our future is an essential underpinning for consideration of more specific actions to improve the cost-effectiveness or wider implementation of underground solutions. If underground space utilization is expected to diminish in relative importance in the future, or if it is felt to be a mature technology with little prospect for further efficiency enhancements, then there is considerably less need or value for programs to address the opportunities that underground construction affords or the problems that it presents. If, however, a broadly-formed group of experts covering all the facets of our built environment were to agree that underground space utilization was increasing in relative importance (and would continue to increase), this would form a more secure underpinning for assumptions that are often made in this regard by people active in the field itself.

Further, it would highlight the need to rapidly develop improved technologies and administrative procedures to allow a more effective future use of underground space.

The findings of the colloquium were that:

(1) Use of the underground will grow relatively more important in the future (increasing as a proportion of our infrastructure expenditures).

(2) In order to plan cities effectively for the future, the underground must be understood, considered as an alternative for many functions, and its uses properly planned.

(3) Underground planning and space utilization can make an increasing contribution to:

- Enhanced liveability of cities

- Improved public health

- Multiple use and reuse of land through synergistic surface and subsurface development

- Rehabilitating/re-energizing older core cities

- Efficient transport and provision of services

(4) There is a growing rationale for increased underground space utilization because of:

- Urban growth worldwide

- Need for infrastructure renewal in older cities

- Need for basic infrastructure in developing countries

- Congested and deteriorating utility and transportation corridors

- Current improvements in underground construction technology

(5) Steps to improve both the technologies available and the administrative handling of underground space utilization would reap large rewards for society in the future. Increased use of the underground, appropriately developed and managed, will provide increased mobility of people, goods and services, improved environmental quality, and can solve unique national needs such as isolating radioactive waste.

(7)* Use of the underground is becoming increasingly competitive with surface strategies for providing services and facilities, because:

- Improved technologies provide more alternatives and improve existing alternatives

- The public is insisting on including non-economic criteria rather than using lowest construction (or even life-cycle) financial cost in choosing project alternatives

(8) An increase in competitiveness of the underground option and benefits derived from underground use can be accelerated by the concerted action of government, industry, and the research and education communities.

Comments on City Development Issues

Major infrastructure projects have profound impacts on the shape of development on a local, regional and national scale. Public infrastructure can lead the form of development rather than be a follower. It also can have unintended consequences such as the growth of low density suburbs following the construction of urban freeway systems. Problems become compounded when further public resources are used to follow private development which takes advantage of cheaper land at reasonable travel distances from city centers. A profound redistribution of jobs and wealth can occur and transportation problems -- initially eased -- can become far less tractable when congestion of low-density metropolitan regions (Los Angeles, for example) finally reaches crisis proportions.

Public infrastructure also offers one of the few possibilities to reverse development problems but communities are increasingly unwilling to accept radical redevelopment or new infrastructure in their local areas.

Underground infrastructure may be one of the few infrastructure alternatives acceptable to communities when re-engineering our urban areas.

Major underground systems and developments are expensive, however. It is thus necessary to try to capture some of the value created by major new infrastructure through public/private partnerships and the creation of Aaddresses@ which attract users through the concentration of needed and effective services.

It is hard to generalize about where underground facilities should be used: their application is case- and site-specific. Application costs and hence to a large extent feasibility depend on the local geology and topography.

The extensive use of underground facilities is most likely in areas of high density and where a premium is placed on high amenity, high security, and similar factors for which the underground offers advantages. Such advantages need to be factored into economic development decisionmaking.

Although fundamental changes in population growth and distribution are possible, it is unlikely that a major reversal of world urbanization will occur in the foreseeable future. In developed countries where there are predictions of major impacts due to the impacts of technological changes such as the Ainformation superhighway,@ the long-term future of development is perhaps least clear. Nevertheless, although the potential is there for reduced travel and less need to congregate in large, dense cities, past and current trends continue to show only a substitution of travel purpose rather than a reduction.

In terms of underground utilization, the greatest opportunities for major restructuring of cities through underground development occur in dense development where land availability for redevelopment is scarce and surface land prices high. If low density development continues to be viable or becomes more highly preferred in terms of overall land use patterns as well as transportation and social issues, there will be fewer large scale underground projects (except for topographic reasons). However, even in this scenario, the provision of normal underground facilities (such as utilities) can be expected to increase and in fact become a larger comparative burden than at present because of the inefficiency of providing comprehensive utilities to low density development.

Choosing to Build Underground

In order to choose properly between building a facility underground or on the surface, between various design and construction options for the facility, and whether to build the facility at all, it is necessary to understand the full range of costs and benefits for the facility. Life cycle costing and social cost accounting are important elements in this assessment. This is not an easy task -- the impacts on maintenance, longevity and operating costs of various design options may not be readily available and the value of improvements in the safety, the environment and quality of life for individuals have been assessed at widely different levels. It is also difficult to assess the performance and Ahealth@ of existing underground systems or to properly address potential differences in the performance of underground systems during infrequent but high risk natural disasters.

It is important to present an honest story in this regard. Building structures underground can be expensive and prone to unexpected conditions which raise costs and can cause surface disruption. However, such problems can be reduced and more cost effective technologies and designs developed when the problem is viewed as a major opportunity to be tackled.

The competitiveness of underground construction is increasing with time. This is good news but costs are still high and design issues as well as improved technologies must be addressed to reach the most cost effective solutions.

Under some conditions, it is reasonable to examine use of the underground as one which involves the choice between a surface facility and one placed underground. In an increasing number of cases, however, public opposition to surface construction of major new developments and infrastructure are forcing a choice between building underground or not building at all. By a similar argument, it is not necessary to choose between building up or down in dense urban areas. Building dense aboveground developments requires at a minimum the underground infrastructure needed to serve the developments.

In fact, the ability to create effective underground facilities provides the basis for creating the added value above ground. This has been termed creating an Address@ and has been used effectively to spur redevelopment in projects such as the La Defense project in Paris, Crystal City near Washington D.C. and Battery Park City in New York. In the last case, the Battery Park City Authority not only placed the infrastructure but also owned the land that benefited from the increase in value.

* (6) is missing ?

Reference

Sterling, R.L. (Ed.) 1995. Going Under to Stay on Top, Revisited: Results of a Colloquium on Underground Space Utilization, July 7-9, 1995, Monticello, MN, University of Minnesota, Minneapolis MN.

- **Present Condition and Future of Indoor City**
  (Focusing on Comparison between Montreal and Large Cities in Japan)

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1. Indoor City in Montreal

   In 1987, I visited the underground pedestrian network in Montreal, an "Indoor City", for the first time. An underground pedestrian network of about 12km long had been formed and a project to create a comfortable city which is not influenced by the severe winter climate was progressing actively. At that time in Japan, underground use was confronted by difficulties, for example, construction of underground shopping mall was prohibited in principle. If construction of underground was approved, the network with surrounding buildings were prohibited in Japan. That is why I was strongly impressed by the Indoor City of Montreal.
   One of the backgrounds which formed such an underground pedestrian network in Montreal is the redevelopment of "Place Ville Marie". In this redevelopment project, it was planned to establish a retail

centre under hotel and office buildings, and connect them with Central station through underground passages. This project was a great success. Underground pedestrian network raised the floor value of the buildings and also use of underground floors, which had not produced any profits before, began to draw interests considerably. Combined with the construction of underground railways which was synchronized with the opening of EXPO'67, private developers themselves bore the cost for the redevelopment to extend these pedestrian network. Consequently the large-scale indoor city of today has been formed.

Indoor City in Japan

On the other hand, the process of forming underground pedestrian network in Japan is completely different from Montreal. In Japan, underground passages and underground plazas have been constructed for the purpose to separate pedestrians and vehicles in order to lighten the traffic congestion on the ground, and to keep safety of pedestrians. Underground railways were constructed mainly under the roads, making the second basement the floor for railway tracks and the first basement for pedestrian passages and ticket barriers, which were connected to the above-mentioned underground plazas and underground passages. Also, at first, underground malls were constructed on the pretext to house the open-air markets along the streets. But today, the basic way of thinking is that the development of public passages and public underground car parks is to be done by the proceeds gained by renting the underground of public lands, such as roads and plazas, to private enterprises for retails. And it is prohibited to connect them to surrounding buildings with underground passages. At present, the total floor area of underground malls in large cities is reaching one million square meters.

Thus, as opposed to the indoor city in Montreal which has been developed not only due to climate conditions but also based on economic principles, the ones in Japan have been developed so far by the process that underground passages, plazas, stations and malls were constructed for the respective purposes and then connected each other as a consequence. The forms of underground pedestrian networks in Montreal and in Japan clearly show this difference (Fig. 1). In Montreal, the blocks are connected by underground passages which cross the ground streets, and those passages pass through blocks to go to the next blocks. In Japan, underground passages are formed along the ground streets, and by these passages a block is connected with surrounding blocks. Generally in Montreal, the main entrances of a building are both above the ground and underground, while in Japan, underground entrance is considered as only supplementary.

Viewpoints to form Indoor Cities

Based on the above-mentioned processes of forming indoor cities in Montreal and Japan, the following points are important to consider indoor cities in the future.

Should the Leadership taken by Authorities or by Private?

The development of indoor city in Montreal was led by private enterprises under the instruction by the authorities with a redevelopment project as a start, while in Japan the development was done in the opposite way. This gives influences over the consciousness of citizens on "city building". It is indispensable that private side gets to grips with city building actively, not just relies on authorities.

Incentives to Private Development

In Montreal, the consensus that underground linkage should put the additional values to their buildings has been gained basically. On the other hand, in Japan, this kind of consciousness is weak and also, in principle, it is difficult to build public underground passages in private buildings from the point of prevention of crimes and disasters. If they are to be built, incentives such as floor-area ratio are necessary.

Comfortableness in Indoor Cities (Scenery-making in underground space)

For the people who use indoor cities, comfortableness is very important. For that purpose, it is necessary to create forms to combine underground passages and open spaces and produce various scenery in the underground. Viewing from this point, as the underground malls in Japan are mostly using the underground of public lands such as roads and plazas, it is very difficult to produce scenery. In contrast, it is easy in Montreal, and also unique cities could be made because they can take in the atriums or others of private buildings to create one scenery jointly.

(4) Unification of Control Including Sign Plan

For the indoor cities which expand increasingly, it is very important to unify the signs combined with underground scenery making. Especially in the cases where private enterprises take the leadership, unification is apt to fail, therefore suitable instruction by authorities is indispensable.

Prevention of Crimes and Disasters

As the indoor cities expand, which network public and private facilities, countermeasures against crimes and disasters become more important. "The Underground Sarin Affair", occurred in Tokyo in the spring of 1995, was

a great disaster causing several thousand casualties. This extraordinary affair that deadly poison sarin was spread in the closed space like underground stations was also an affair that the minus factors of underground space were used. Comprehensive control to prevent crimes and disasters needs to be conducted from this point as well.

The Latest Indoor City in Japan -Queen's Square Yokohama-

After this visit to Europe and North America focusing on Montreal in 1987, the public interest to the way of comfortable use of the underground space began to increase in Japan from the viewpoint of effective use of the small country, as well as due to the effects of bubble economy. Here I introduce the latest indoor city in Japan, mainly on the development of "Queen's Square Yokohama" which has just been completed recently.

This development is a project planned in the Yokohama Minato Mirai (Future Port) 21 District, which is a project of compound development combining architectural facilities including offices, a hotel and halls, and civil facilities including public passages, underground railways, underground car parks, regional air-conditioning plants and utility tunnels (Fig. 2). At first, the blocks on the both sides of a road, under which an underground station was going to be introduced, were to be developed separately. But then this project decided to cut out this road plan and develop the blocks on both sides of it jointly taking it as one full site. The scale of this project is the site area of 45,000m^2, total floor area of 400,000m^2, and construction cost reaches 200 billion yen. And its most remarkable feature is that the underground station at the fifth basement floor and the public mall (Queen's Mall) which runs through the second floor above the ground of the same building are made to one united body by a grand atrium called Station Core (Fig.3). This makes it possible to recognize the underground station platform from around the atrium including above and under the ground, and also ground scenery can be seen from the underground platform through the atrium. A minus aspect of underground space was successfully wiped out by this scenery making of the underground space.

However, numerous issues were demanded to be solved for realization of this project. The issues included adjustment of technical standards caused by compound of civil and architectural facilities, effects of winds to the atrium and effects of vibration to the music hall caused by underground railways, the way of thinking on disaster prevention due to the compound of public and private facilities as one body, division of property, and so on.

The idea of the atrium "Station Core" was originally developed considering the underground station of Montreal as a guidance. On its opening day, July 18th, about 200 thousand visitors came and presented a lively appearance.