ASSOCIATION INTERNATIONALE DES TRAVAUX EN SOUTERRAIN
AITES
ITA
INTERNATIONAL TUNNELLING ASSOCIATION

Towards an improved use of underground Space

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Study of Access ways to underground space

-Examples of spatial requirement

Final Report

May 2004

ITA Working group No. 4
"Subsurface planning"

International Tunnelling Association
(ITA)

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Foreword

The theme of this report, design criteria for Access Ways To Underground Structures, was proposed by the representatives of Japan and Spain during the ITA Working Group No.4 meeting, held in Sao Paulo in 1998. Around the globe an increased application of Underground Space has been experienced and the design of access ways is an important aspect of underground structures. The participants in the meeting in Sao Paolo, representing their member nations, supported the theme. Following the Working Group meetings in Oslo (1999) and Durban (2000) a questionnaire was prepared by Japan and Spain and distributed amongst the ITA member nations. The questions raised were basically dealing with the theme of access ways, but dealt also with the wider scope of design criteria for underground structures, such as:

- Road (transport) tunnels;
- Underground (metro) railway stations;
- Underground parking areas and
- Underground shopping malls and other facilities.

The main intention of the Working Group No.4 Subsurface Planning was that the answers to the questions raised could be of great help in the field of assisting, developing and harmonizing subsurface planning.

Not Surprisingly, the member nations who replied to the questionnaires addressed the various aspects of this topic in different ways. Nevertheless, the diverse views clearly show differences in opinions and details by which various countries approach these issues. The report is intended to aid subsurface planners who wish to gain a broad view on how matters are dealt with in other countries or seek guidance in comparable situations – and also for the benefit and understanding of owners and operators of such facilities.

The fire and life safety issues in road and railway tunnels are of course of great importance for public confidence in such structures. These issues have been specifically dealt with in a previous report by Working Group No. 4; “Fire and Life Safety for Underground Facilities” published in the journal “Tunnelling and Underground Space Technology” (TUST), volume 13/3 July/September 1998.

The ITA expresses the appreciation to the member nations who made contributions and especially to Japan who assembled and presented the material. The ITA also wish to thank Norway and the Netherlands for assisting in finalizing the report, which was completed under remaining Working Group 4 responsibilities.

Annica Nordmark
Animateur WG 4 (1993-2001)

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Part 1. Main Report

1 Introduction

This report presents the results and output from a questionnaire undertaken by the ITA Working Group No. 4 regarding "Design Criteria for Access ways" to different types of underground structures. This theme was considered an important issue as the design and layout of access ways and installed mechanical equipment have great influence on constructability and construction costs, maintenance and operation of the underground structures and also on the safety and comfort experienced by the users. As the use of underground structures depends on their functions, a split up is made as follows:

- Road tunnels;
- Underground (metro) railway stations;
- Underground parking areas;
- Underground shopping mall.

In total 11 countries (Table 1) reported on their state of the art.

Table 1. Underground facilities and answers from each country

Underground Facilities / Nation	Road Tunnel	Underground Stations	Underground Parking Area	Underground Shopping Mall and other facilities
Italy			○	
Japan	○	○	○	○
Sweden	○	○	○	
Finland	○	○	○	○
Egypt	○	○		
Turkey	○	○		○
Czech	○	○	○	
Denmark	○	○		
France		○	○	

Netherlands	○	○	○	
Norway	○	○	○	
Total	9	10	8	3

In order to enable analysis of the output of these questionnaires they were divided into and listed according to a number of different topics. (See questions and answers presented in the Tables to follow in this report.) It should be noted that the questions raised not only deal with access ways, but also with general design criteria for underground structures.

It is evident that underground structures are designed mainly depending on local standards and regulations and geological conditions. However, the designs are significantly diverse and in some cases standards and regulations are absent. This report shows clearly that whereas a number of issues are treated seriously in certain countries, they do not (yet) receive appropriate attention in other countries. The different practices between member nations are not explained in this report. However, the analysis made and the output of the questionnaire provide useful assistance, particularly for planners, to see how some issues are dealt with in other countries in comparable situations and, where assistance maybe sought for information in others.

Assuming that the answers provided by those member nations responding to the questionnaire represent an adequate technical and legislative level and that standards and regulations have not since been altered, this report provides a current status in this aspect of tunnelling and underground space use. It is important to point out that such standards and regulations are solely a local responsibility and thus they are subject to changes.

Participants in the report (in alphabetical order by country)

V. Vales	Metroprjekt Praha a.s.	Czech Republic
P. Minarik	Road and Motorway Directorate	Czech Republic
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J. Ylinen	Kaupunkisuunnittelu Oy	Finland
K. Sorjonen	Oy Suoraplan Ltd	Finland
J. Roinisto	Kalliosuunnittelu Oy, Rockplan Ltd	Finland
E. Magne	GTM Construction TP	France
Ph. Fauvel	SNCF	France
Claps	COMUNE TRINO	Italy
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G. Amdam	Molde kommun	Norway
B Freiholtz	Swedish National Road Administration	Sweden
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L. Dahlqvist	Stockholm Stads Parkerings AB	Sweden
G. Gökham	EGO-Electric Ga & Bus Services Org	Turkey

2. Analysis of Road Tunnel

2.1 Participating countries

The member nations that answered the questionnaire are all listed in Table 1. Although the answers differ significantly, a number of conclusions and comments can be made based on the answers.
The responses and details from the questionnaire are listed in Tables 2-1 (please see end of the report.)

2.2 Geometry

* *Gradient:* Although all participating countries have regulations regarding maximum gradients it is interesting to notice that there is a great variation of from 3 to 6 (even 7) %. A number of countries stated that the permissible gradient is dependent on design speeds.
* *Horizontal radius:* Most countries have regulations depending on design speeds. It is remarkable that Japan is the only country that has a compulsory horizontal radius at the tunnel entrance and exit.

2.3 Pavement Material

All countries use asphalt as pavement, while a few use concrete as an alternative solution.

2.4 Lane markings

* *Bi-directional traffic:* The applied color varies from white to yellow. In very few countries do regulations exist regarding the dimensions of the lane markings.
  It is important to note that The Netherlands does not allow bi-directional traffic in road tunnels because of safety reasons.
* *Unidirectional traffic:* All countries use white colored markings. In a few countries there are regulations regarding lane mark size and it may vary depending on allowable speed.

2.5 Tunnel entrance design

Among the participating countries only Finland and The Netherlands have regulations for entrance design. Very remarkable is the information that the Finnish entrance is of light color and the Dutch entrance is a dark color. Obviously such regulations deal with local light and climate conditions.

2.6 Tunnel visual environment

* *Tunnel illumination:* Most countries have regulations regarding this topic. Some apply local guidelines while the majority follows the CIE guidelines.
* *Tunnel cladding:* Only half of the responding countries report having regulations on claddings. From the replies it is obvious that cladding is applied for various reasons such as:
    - Fire protection;
    - High reflection ratio;
    - Cleaning possibilities;
    - Material and installation costs;

From the replies it appears that countries like Egypt, Finland, The Netherlands and Norway use regulations based upon fire resistance whereas other countries use criteria in relation with climate or costs. The materials being used show a wide variety which is likely an outcome of trial and error in the responding member nations.

2.7 Safety structures

* *Guidelines*: All participating countries have guidelines regarding safety issues, but the area covered by these guidelines differs widely. Many countries use local standards whereby a lot of variations appears in the fields of cross passages (diameters from 1.2 to 2.3 metre) and the distance between emergency exits, which varies from 100m to 400m. From the reports it seems that iris not unusual that each individual tunnel is considered as a separate structure.
* *Structure for disabled people*: In a negative sense this topic is, in most countries, dealt with in the same way where neither regulations nor practical solutions exist. It seems that only in Sweden and Finland have efforts been made to deal with safety issues for disabled people.
* *Other structures*: In the Czech Republic, inside the tunnel structures, cross passages for vehicles are foreseen every 1400 metre.
* *Emergency access for rescue vehicles*: The majority of the responding nations have special routes from outside whilst the location and the typical dimensions of such emergency access for rescue vehicles are not given.

3. Analysis of Underground Stations

3.1 Participating countries and variety of structures

As can be seen from Table 1, 9 countries responded to the questionnaire. From the responses as presented in Tables 3.1-3.13 (end of this report), it is clear that the responses cover a variety of

structures, both in structural dimension and function:

- Variation in depth from minus 37.5 to minus 13.10 metre;
- Platform length from 44 to 225 metre;
- Number of floors from 1 to 6;
- Metro, railway, and light rail stations.

The variety in the stations guarantees an appropriate and representative number of existing regulations in the participating countries.

3.2 Design standards for station equipment

* *General:* Except for Norway and France, it appears that in the other countries national and/or local design standards are in use. These also include standards for accessibility equipment.
* *Illumination:* In most countries regulations exist for illumination, whereby the level of illumination, depending on the location in the station, varies from minimum 100 to 150 lux (Egypt) to maximum 300 to 600 lux (Sweden). A number of countries require levels around 300 lux.
* *Safety equipment:* All responding countries have standards for safety equipment, except Finland where requirements are determined case by case according to specific use. A number of countries reported that the standards are developed in collaboration with fire authorities. In all countries a wide variety of equipment is used.
* *Equipment for disabled people:* 6 out of the 10 responding countries have local standards for such equipment.

3.3 Design standards for spatial layout of access ways

* *Entrance and exit connections:* A majority of the participating countries have standard rules for the number of and distances between the entrance and exit connections. Distances vary considerably from 20 metre (Denmark) to 200 metre (Norway).
* *Shape of the routes:* From the replies given it can be concluded that all countries have many (local) standards with much variation:
    - Size of stairways differs in width from 1.50 metre (Japan) to 2.70 metre (Egypt, The Netherlands and Turkey) and
    - in height from 2.10 metre (Czech republic and Finland) to 2.70 metre (Egypt, The Netherlands and Turkey).

Stairways, escalators and elevators are widely used, sloped staircases and inclined elevators sometimes.

3.4 Safety

* *General:* The answers show clearly that although major differences appear, all countries have design rules for safety aspects. However, it is concluded that many of these safety provisions are based on conventional routine and not on prevention. Fire (heat) is fought with all kinds

of equipment and systems but protection from smoke or removal is mentioned only by Norway.

* *Evacuation time:* All countries have requirements regarding the maximum evacuation time in which the public should reach safe places. Seven minutes is considered the maximum time to reach safe open air.
* *Equipment:* Virtually all types and systems of fire fighting equipment are in use (dry, wet and CO2 extinguishers), sprinklers, foam installations etc. Methods to deal with smoke protection or smoke removal are not always clear from the answers given.
* W*ater leakage:* Although not all countries have firm design rules related to water leakage, measures are taken to prevent dangerous situations. The applicability of rules generally depends on the (ground) water level with respect to the foundation layout.
* *Disabled persons:* Equipment, signs, passages, or special measures are specifically designed for disabled people, however such measures do not appear in a standardized way. Japan reports a most comprehensive approach in supplying equipment to help the disabled, but only the Czech Republic mentions "barrier free access for disabled people and paths for blind people." From the responses it is not clear if the special measures address an emergency situation where the maximum evacuation period of 7 minutes includes evacuation for disabled people too.

For detailed responses from participating countries, please Tables 3-1.

4 Analysis of Underground Parking Area

4.1 Participating nations and variety of structures

In total 8 countries replied whereby the structures reported by the respondants vary from 1 to 7 floors in height with total areas of 5,680 to 50,000 m^2. The service hours of the reported parking areas vary.

The responses and details from the questionnaire are listed in Tables 4-1.

4.2 Design standards for Underground Parking Area

* *General:* All member nations that have replied to the questionnaire indicate that general design recommendations or rules (national and/or local) have been used.

4.3 Design standards for accessibility and equipment

* *Connection between a garage and open space:* All countries have standards dealing with the dimension of the access ways. The width varies from 0.90 (Czech republic) to 2.00 metre (Norway) and the height of ceiling from 2.10 to 2.5 metre. Majority reports 2.10 or 2.20 metre.
* *Distances between accesses:* All countries, except Sweden, reported maximum distances between access ways varying between 40 metre (Italy) and 200 metre(Norway)
* *Equipment:* 5 out of 7 countries have standard rules for transportation equipment.
* *Illumination:* In 4 out of 7 countries the minimum level of illumination is standardized. (50 to

60 lx)

4.4 Safety

* *General:* Similar to Underground Railway Stations, many safety rules apply (mostly suppression oriented).
* *Evacuation time:* Two systems exist:
  - Maximum distance to safe space (open air) reported as 60 – 90 metre;
  - Maximum time to reach safe place 2 to 3 minutes.
* *Equipment:* As with underground stations, a wide variety of extinguishers and systems are used.
* *Water leakage:* Countries with high water levels have standard rules for water leakage prevention. (particularly The Netherlands and Japan).
* *Disabled persons:* From the projects reported upon it seems that the design of access ways and equipment includes provisions for disabled people to safely and conveniently use underground parking garages.

5 Analysis of Underground Shopping Mall and other facilites

5.1 Participating nations

Only three countries reported. The malls cover an area of 2 500 to 81 000 m^2. The number of users varies between 10 0000 and 130 000 per day. Shopping malls underground have not been widely introduced amongst the member nations, although a number of metro line stations have smaller scale shopping areas, such facilities may have fallen outside of this study.

The response and details from the questionnaire are listed in Tables 5-1.

5.2 Design standards for underground Shopping Malls

* *General:* The design of the reported projects is based upon standard national rules.

5.3 Design standards for accessibility and equipment

- *Connection between mall and open space:* The reporting countries have national standards dealing with the dimensions of the access ways. The width of the stairways varies from 1.50 to 2.40 metre and the minimum ceiling height from 2.10 to 2.70 metre.

* *Distances between accesses:* Only Japan reports on a minimum distance of 30 metre between access facilities.
* *Equipment:* Japan and Turkey have national standards for the required equipment.
* *Illumination:* Japan and Turkey have national standards for illumination.

5.4 Safety

* *General:* Although the reported projects show that the designs are subject to many rules in which safety considerations play an important role, It should be noted that only Turkey reports

a maximum evacuation time. This differs from structures like stations and parking garages.

* *Equipment:* Safety equipment is subject to standards except in Finland. It seems that mostly sprinkler and hydrants are used for fire fighting. Smoke control is not mentioned.
* *Water leakage:* No standard design rules regarding water leakage were included in the designs.
* *Disabled persons:* Despite the fact that no maximum evacuation time has been mentioned for 2 out of the 3 projects, it appears that much consideration has been given to access way standards for shopping malls for disabled people.

6 Overall conclusions

- The answers supplied to the questionnaire give a reasonable overview of the existence and use of standard rules for the design of access ways to underground structures.
- In most cases, reporting countries use local and/or national standards. International standards are seldom referred to.
- In few cases, countries use standard design rules based upon other national rules.
- Not only do the standards vary between countries, but also within a particular country. Standard rules may differ depending upon the type of underground structure.
- Rules are often based on geological, climatic, social and economic conditions.
- The effects of smoke in case of fire are not sufficiently present in the design standards.

Readers are encouraged to further investigate the questionnaire and the complete responses, which are included in full in the attachments. The above conclusions only summarize and identify the general and main trends of this study.

It is concluded from this report that there is a lack of national standards. Therefore, the Working Group No.4 hopes that this report may serve as an international reference document for the use of access ways where national regulations need to be developed

Part 2 Information collection in detail from participating Nations.

Technical information for Underground Facilities cover the following four applications

2-1. Road Tunnel

2-2. Underground Railway Stations

2-3. Underground Parking Areas

2-4. Underground Shopping Mall and Other Facilities

2-1 ROAD TUNNEL

2-1-1 DENMARK
The fixed link across Øresund

2-1-2 EGYPT
Typical Cross Sections of Bored and Cut-and-Cover Road Tunnels

2-1-3 FINLAND
Illustration of Ring Road II, Helsinki

2-1-4 JAPAN
Basic Configuration of Central Circular of Shinjuku Line
Metropolitan Expressway Public Corporation

2-1-5 NORWAY
The Oslo fjord Tunnel and Guidelines for Road Tunnel Design

2-1-6 SWEDEN
Examples of requirements for the Stockholm Ring Road Tunnels

2-1-7 Questions and Answers for Accessibility to Vehicular Road Tunnels (Tables)

2-1-1 DENMARK The fixed link across Øresund

The Drogden channel will be crossed by an immersed tunnel of concrete located beneath the seabed. The tunnel will consist of four tubes and one ventral galley. Two tubes, each with a width of 9.7m, for road traffic, and the two others, each with a breadth of 6.5m, for the railway. The railway tubes is located in the southern part of the runnel. The total height of the tunnel will be 8.75m.

The central gallery between the two road rubes will function as an emergency route and as a cable and service runnel.

The elements will be sealed at each end and floated out to the tunnel alignment where they will be immersed and connected up under water.

The tunnel will be placed in an excavated trench below the current level of the seabed and will then be covered by a layer of stoned 1.5m which to protect against the impact of ships, anchors, etc. The tunnel will be approx. 3.7km long, which means that a ventilation system will be necessary to maintain acceptable levels of air quality.

At the tunnel entrance there are service buildings as well as a large collection well for drainage. Next to the well there are water reservoirs for fire extinguishing purposes.

The service building is an underground structure with no permanent staff. The tunnel should be operated from a control building, e.g. the toll station on the Swedish side.

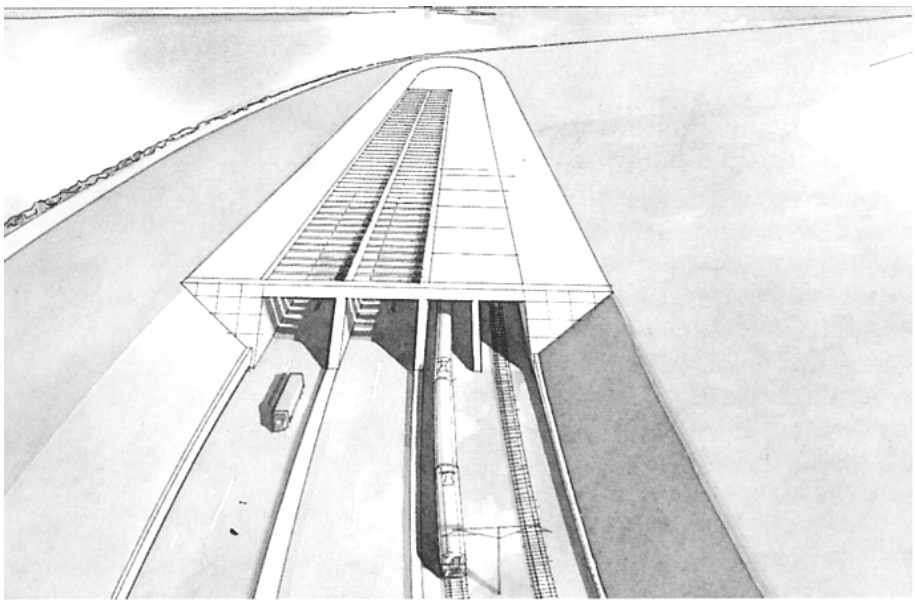


Figure 1-1 Schematic Structure of Tunnel entrance on Danish side

Figure 1-2 Tunnel entrance

Tunnel portal structure at the artificial peninsula at Kastrup. Note the sun latticing above the motorway to soften the transition from the artificial light in the tunnel to daylight, and vice-versa.
Figure 1-3 presents the typical cross section of immersed tunnel part.

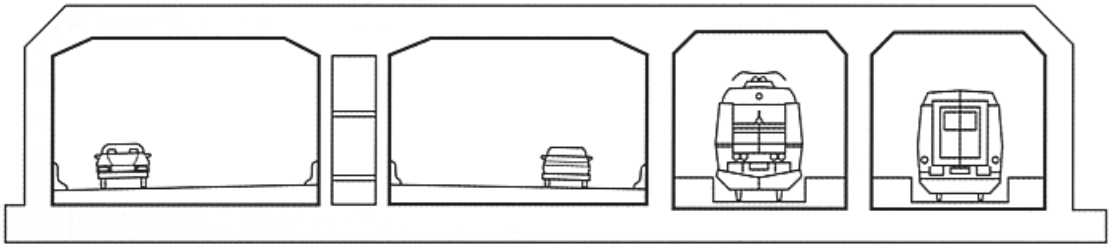


Figure1-3 Cross section of immersed tunnel

2-1-2 EGYPT Typical Cross Sections of Bored and Cut-and-Cover Tunnels

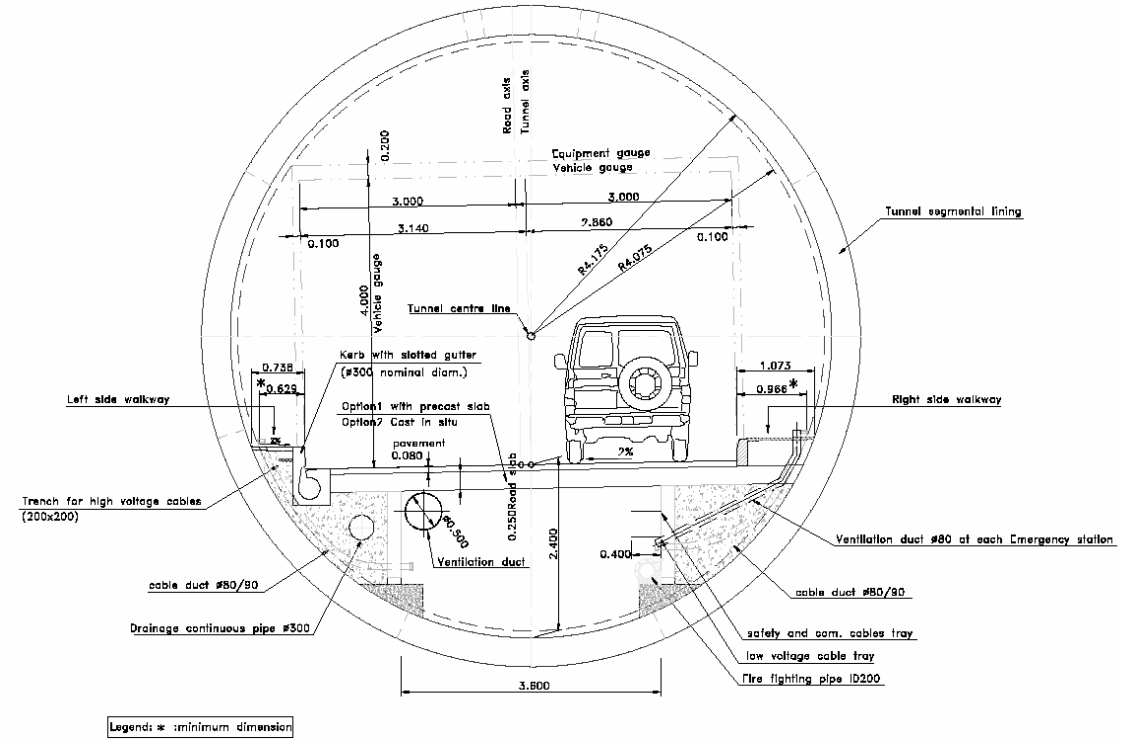


Figure 2-1 Bored Tunnel - Section Type

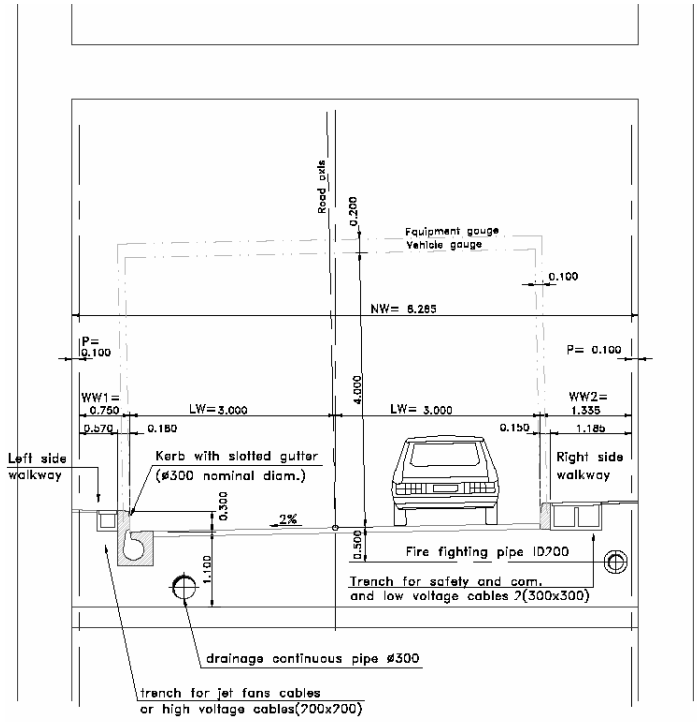


Figure 2-3 Cut & Cover – Section Type

2-1-3 FINLAND Illustration of Ring Road II, Helsinki

Typical cross section of main tunnel with pumping station and control room above ground.

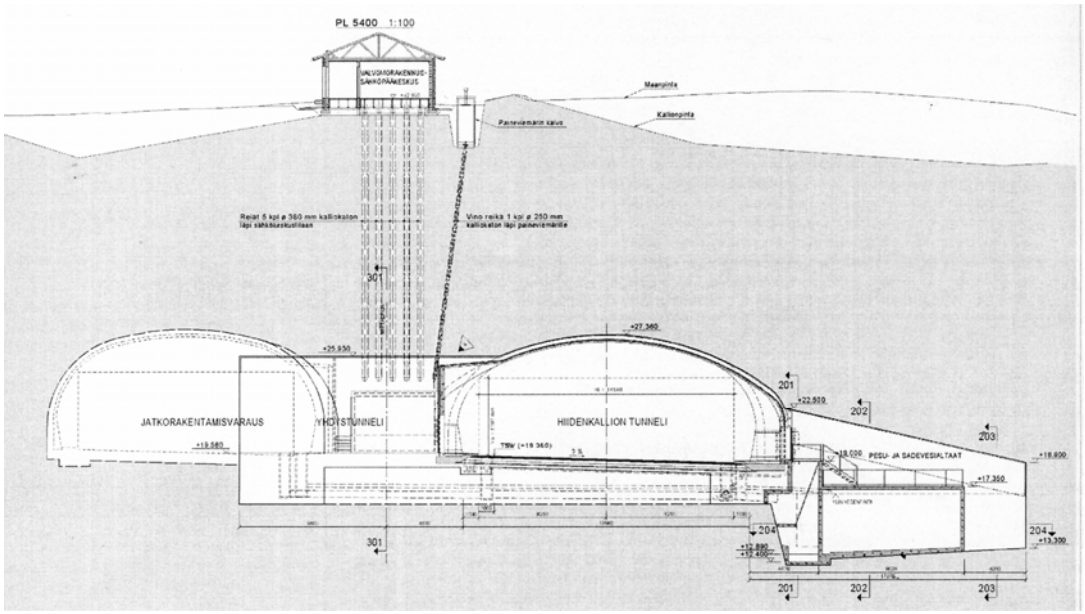


Figure 3-1 Typical cross section with access ramp, control room and pumping station

Figure 3-1 presents the typical cross section for Helsinki Ring Road Ⅱ with access ramp, control room and pumping station.

Figure3-2　Northern Portal of Helsinki Ring Road Ⅱ

2-1-4 JAPAN Basic Configuration of Central Circular of Shinjuku Line
Metropolitan Expressway Public Corporation

Shinjuku Line in URBAN EXPRESSWAY NETWORK OF TOKYO, JAPAN

The 11km Shinjuku Line occupies the western part of the central circular route.
The fully transverse ventilation system will be employed consist with 8 ventilation stations.
Since it is located in a heavily populated area, the Shinjuku Line is designed to be a long underground expressway just under an arterial rig road (Yamate-Dori Street) to avoid deteriorating the roadside environment and to make full use of limited urban space. The surface road, which was originally 22m.

The construction should be done mainly by cut-and-cover method, shield tunneling and other methods will be used where possible and necessary.

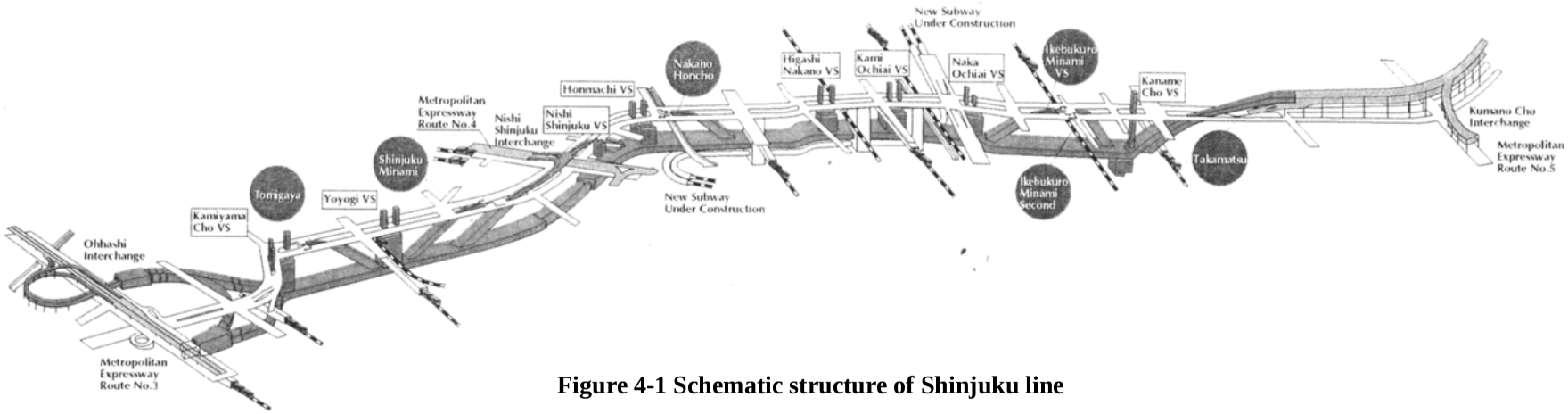


Figure 4-1 Schematic structure of Shinjuku line

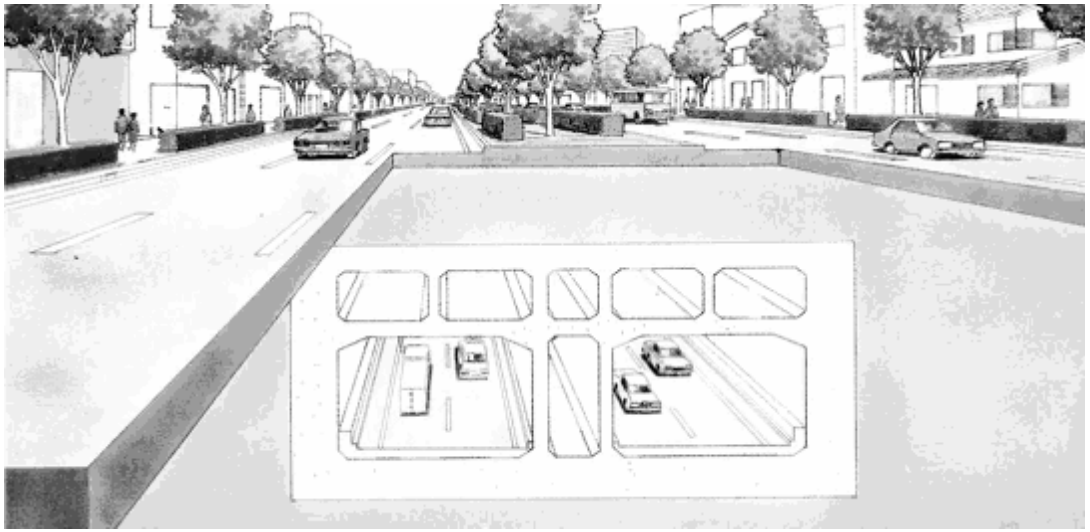


Figure 4-2. Typical cross section of Rectangular Part

Figure 4-3 Typical tunnel structure of circular part

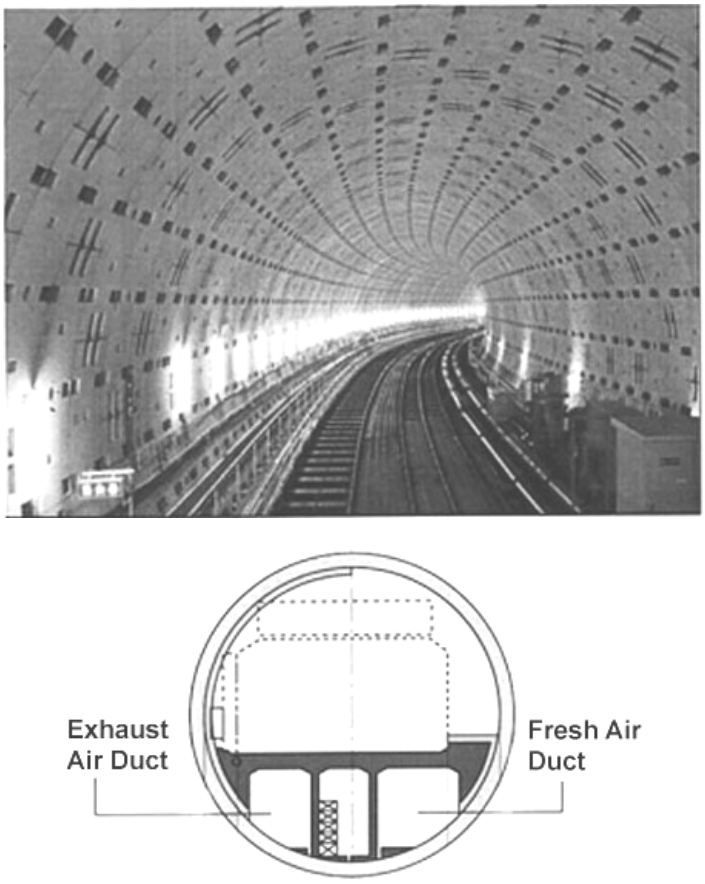
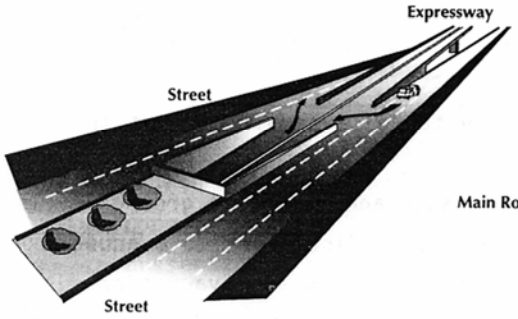
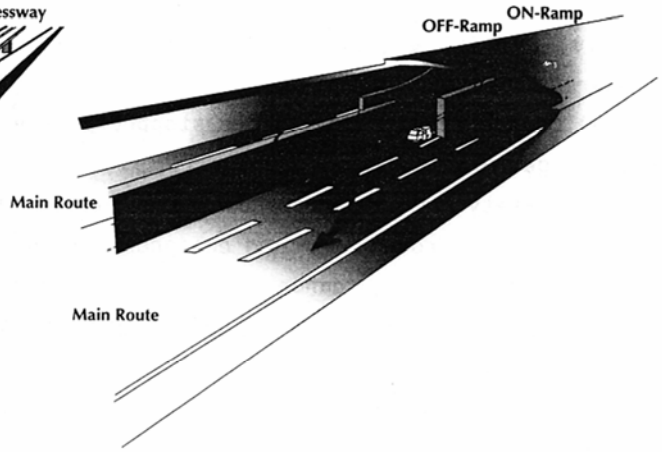


Figure 4-4 Inside of circular section

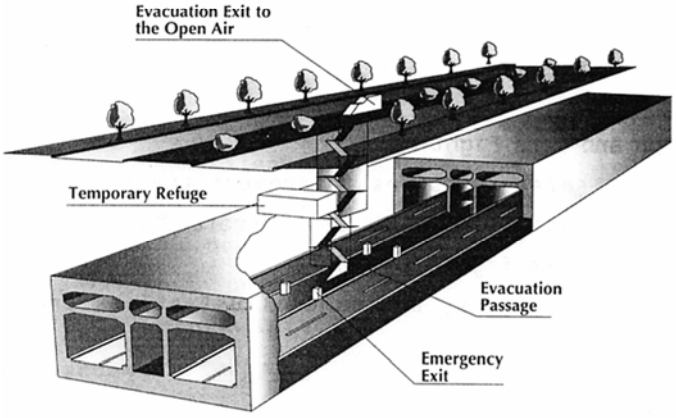
Entrance for Emergency Vehicles



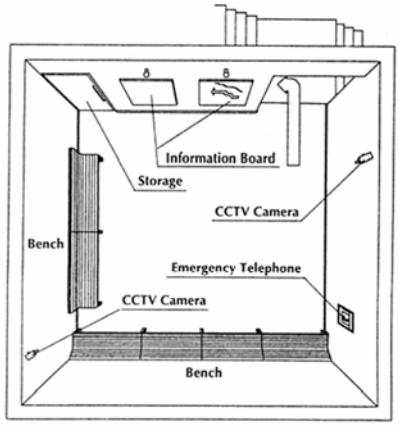
Opening section for U-turn space



Evacuation Passage and Stairs



Temporary Refuge chamber



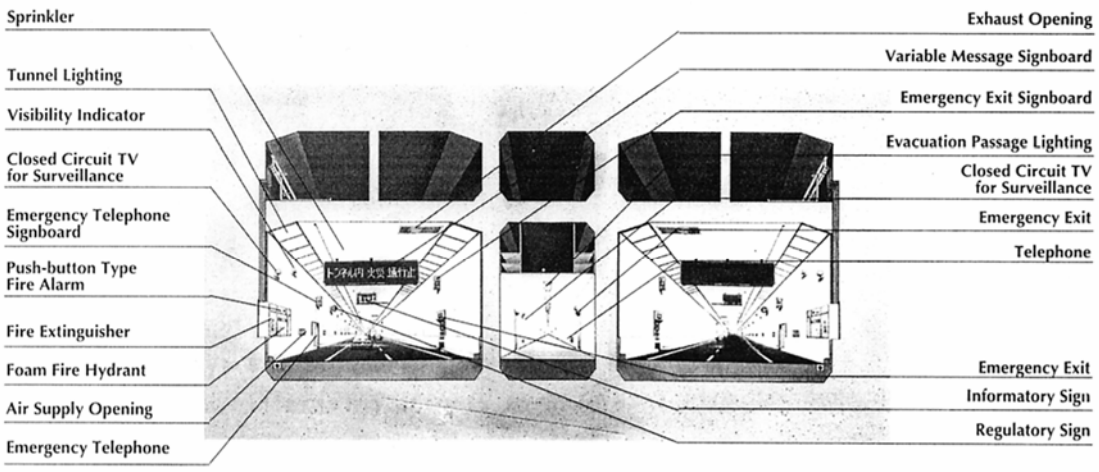
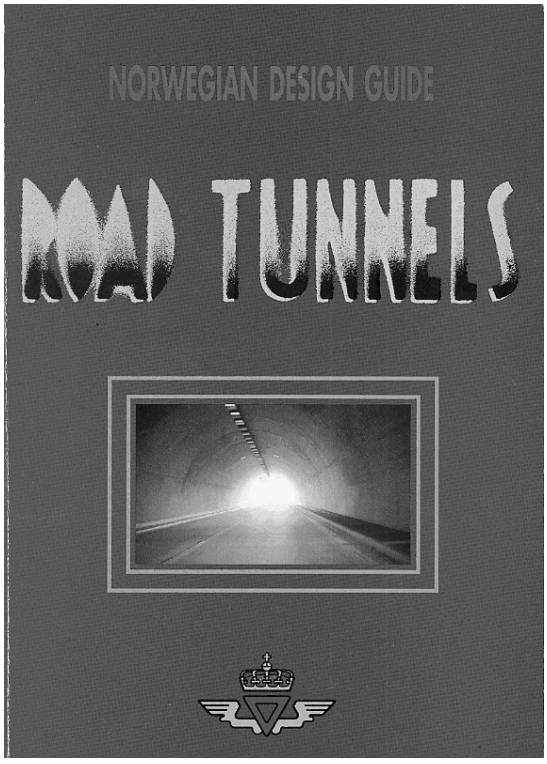


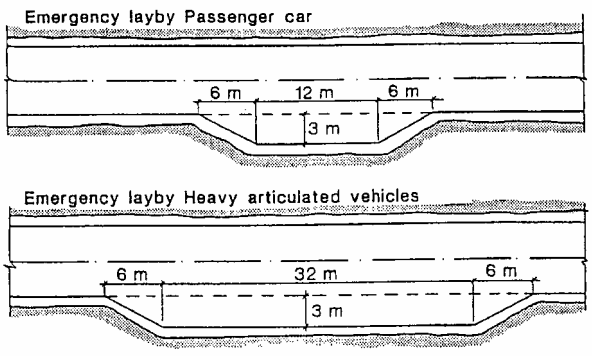
Figure4-5Several types of safety facilities

2-1-5 NORWAY The Oslo Fjord Tunnel and Guidelines for Road Tunnel Design

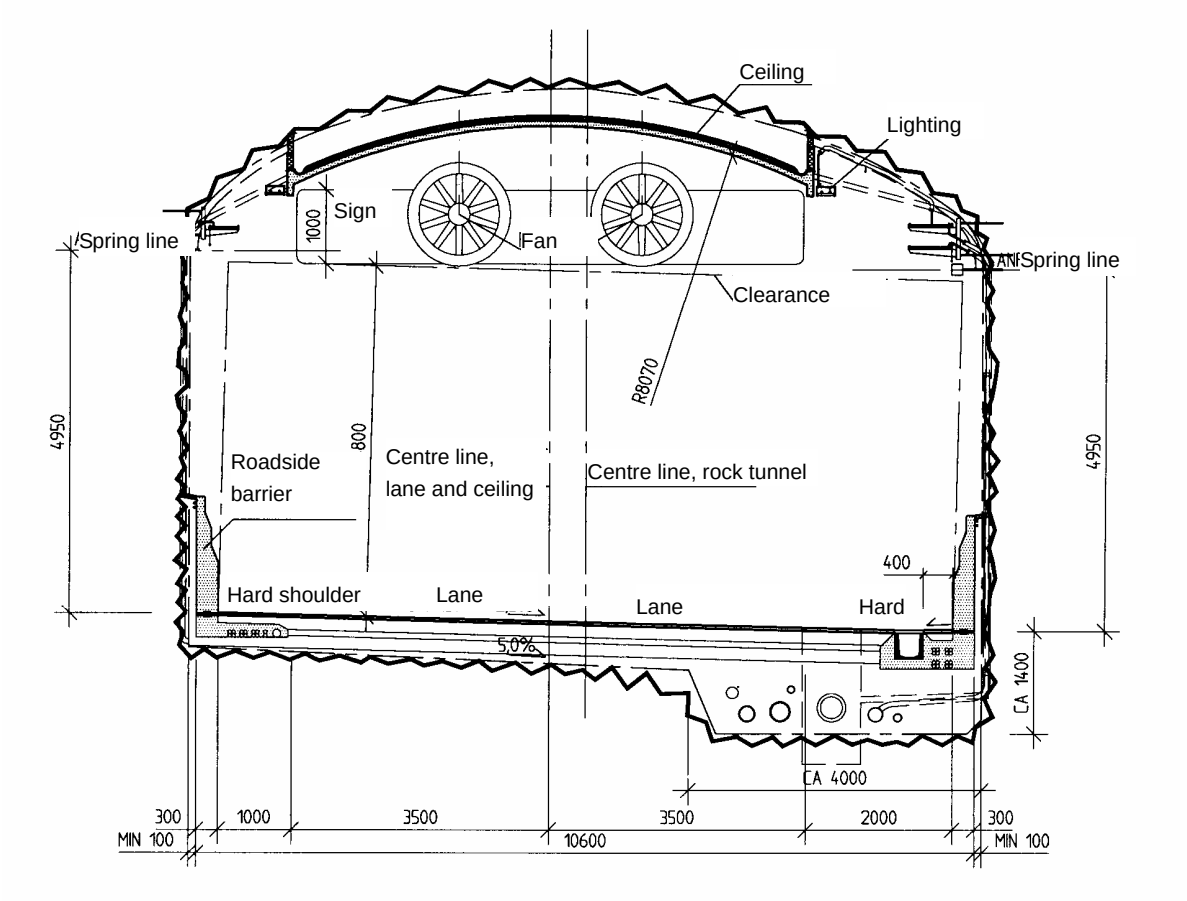
The 7.3km long Oslo fjord tunnel under the sea between Drobak and Hurum



Examples of design for
emergency laybys
(Norwegian Design Guide)



2-1-6 SWEDEN Examples of requirement for the Stockholm Ring Road Tunnels



Example of type section for dual-lane main tunnel and dual-lane ramp tunnel. (Common Ring Road Building Specification RiBB), Swedish National Road Administration, 1996-1

Interior of the Södra Länken road tunnel in Stockholm, Sweden (showing the light ceiling, the lightning, roch texture rock walls, amber distance markers, collision protection, emergency exits and the light-coloured asphalt) Total length of tunnel system including access tunnels 16.6 Km. Open for traffic October 24, 2004

Swedish National Road Administration
Bernt Freiholtz, +46 243 757 88

2000-08-11

Requirements for the Stockholm Ring Road regarding Evacuation Routes: from Common Ring Road Building Specification (RiBB)

Evacuation Routes

5.3.1 General

It shall also be possible for evacuation routes to serve as access routes for rescue personnel. The concept of the evacuation route includes an emergency equipment room, fire lock, rescue room and intermediate sections of the connection. See also Chapter 11, Section 11.3, Fire Protection and Fire Resistance.

5.3.2 Evacuation Principle

The evacuation principle is based on horizontal escape with self-rescue, first into a safe area and then to the outside world.

The safe area includes a rescue room or another road tunnel, on condition that the tunnels are not linked to each other in such away that fire, smoke or fumes can spread from one road tunnel to another.

5.3.3 Evacuation Routes

In an evacuation route, the area nearest the road tunnel shall be arranged in the form of an emergency equipment room containing safety equipment. On the other side of the emergency equipment room, the evacuation route shall be provided with a fire lock.

However, the distance between evacuation routes may amount at most to approx. 100 m in main tunnels and approx. 150 m in ramp tunnels. In ramp tunnels which constitute common access or exit roads to separate main tunnel tubes, the maximum size for main tunnels shall be applied.

Vertical connections in evacuation routes shall be avoided. Where vertical connections are required, they shall be built in the form of straight flights of steps with landings. Lifts or other forms of mechanical passenger transport device may not be constructed.

Evacuation routes shall be designed so that it is possible to carry people on stretchers without jeopardising the function of fire locks or emergency equipment rooms. Fire locks shall have a length of at least 4 m. However, the length may not exceed 30 m. Emergency equipment rooms shall have a length of at least 3 m.

The vertical clearance in evacuation routes shall be at least 2.5 m.

The demands for horizontal clearance are indicated in the table below.

	Doors	Steps	Evacuation route in rock tunnel	Evacuation route in concrete tunnel
Min. horizontal clearance	0.9 m	1.2 m	2.0 m	1.2 m

5.3.4 Rescue Rooms

Rescue rooms shall be built at steps and in those cases where the requirements for adaptation to the needs of the disabled in accordance with 5.3.5 cannot be met. Fire locks shall be located between emergency equipment rooms and the rescue rooms.

Rescue rooms shall normally be built as a local widening of the evacuation route. The local widening shall be designed so that evacuation past the rescue room is not prevented. Detached rescue rooms, which do not take the form of a local widening of the evacuation route, shall constitute separate fire cells.

Rescue rooms shall be designed to allow people evacuating to remain in the area until evacuation can be carried out without danger, but for at least 2 hours.

The size of the rescue room shall be determined on the basis of the table below. Specified area dimensions include space for people going past.

The size of rescue room depending on the number of lanes in tunnel from which evacuation shall be possible:

	Evacuation from main tunnel	Evacuation from ramp tunnel
3 lanes	approx. 45 m2	
2 lanes	approx. 30 m2	approx. 36 m2
1 lane		approx. 18 m2

Irrespective of the size of the room, rescue rooms shall be provided with permanent benches for approx. 10 people.

No sanitary equipment shall be installed in the rescue room.

5.3.5 Provisions for the Disabled

Evacuation routes from road tunnels to safe areas shall be adapted to the needs of the disabled.

No curbs, steps or high thresholds may be installed in road tunnels or in evacuation routes to safe areas.

The max. gradient of evacuation routes shall be 8 %. In the case of larger gradients, and at steps, rescue rooms shall be built. In the case of gradients exceeding 3 %, hand-rails and landings shall be provided. Landings shall be arranged in accordance with "Tunnel 95", Table 4.4.2.5.

Gradient, %	**Maximum distance between intermediate landings (metre)**	**Maximum height difference between adjacent intermediate landings (metre)**
8	5.0	0.40
6	7.5	0.45
4	12.5	0.50
3	20.0	0.60

2-1-7 Questions and Answers for Accessibility to Vehicular Road Tunnels

Table 2-1(1) ~ Table 2-1(5) presents the items of questions and answers from 9 Nations for accessibility to Vehicular Road tunnels.

Table 2-1 Questions and Answers for Accessibility to Vehicular Road Tunnels (1)

This questionnaire is for motorized vehicle tunnels and excludes tunnels for pedestrians or cycle tunnels

	Czech	Denmark	Egypt	Finland	Japan	Netherlands	Norway	Sweden	Turkey
	Pavel Minarík Road and motorway directorate	Egon Sgrensen COWI	M El Ogaizy National Authority for Tunnel	Kari Sorvonen JP-INFRA SUORAPLAN	Ichiro Kurohara Metropolitan Express way Public Corp	Ir. G. Arends Ddpt Technical University	Kjell Davik Norw. Public Roads Adm	Bernt Freiholtz Swedish National Road Administration	Nefise AKCELIK General Directorate of Highways
(1) Geometrical standard for tunnel section									
・Geometrical cross section		7.7× 20.6	circular and squire					same as open section 1m hand shoulder required	
・Longitudinal gradient									
maximum gradient : %	3.75% without additional climbing lane	3.20%	5.10%	design speed ≦ 50km/h I ≦ 7% design speed ≧ 50km/h I ≦ 5%	5%(60km/h)	4.5% (sometimes 6)	6%(max) AADT>25000	>6%	3%
・Horizontal figure		straight						No specific tunnels rules	
Minimum Radius of tunnel section : m	according to the design speed and cross fall of the pavement-surface	-	100m	Depends on sight distance and speed E.G. design speed 100km/h, tunnel width 9m R≦ 2300m	200m(60km/h)	750m	according to the design speed and cross fall of the pavement-surface. Standardized by design guide book	-	1000m
Is there an obligatory radius at entrance or exit of tunnel section									
Entrance : yes/no if yes, min. R : m	no	no	no	no	yes 50m(40km/h)	no	no	-	no
Exit : yes/no if yes, min. R : m	no	no	no	no	yes 50(40km/h)m	no	-	-	no
・Traffic gauge of tunnel section Please insert detail drawing with dimensions	Lanewidth 3.75m Height 4.50m	Tunnelwidth 8.0m Height 4.6m	-	-	-	-	-	Lanewidth 3.50m Height 4.80m	-

Table 2-1 Questions and Answers for Accessibility to Vehicular Road Tunnels (2)

	Czech	Denmark	Egypt	Finland	Japan	Netherlands	Norway	Sweden	Turkey
(2) Material of pavement									
What kind of material is used?									
・Concrete : yes/no	yes	no	no	yes	no	no	yes	no	yes
・Asphalt : yes/no	yes	yes	yes	yes	yes	yes	yes	yes	yes
・Color of pavement : yes/no	yes - bright as possible	yes - black	yes - black	yes	no	no	no	no	no
(3) Lane mark (center line)									
・Bi-directional traffic			under study			no			
color :	white	-	-	white or yellow	-	-	yellow	white	white
width : cm	12.5cm	-	-	10cm	-	-	-	No specific lane marking requirements. White colour. Often thermo plastic.Edge lines width; from 0,10 m to 0,30 m. International agreements followed on spacing. From 1 to 9 m.	12cm(state roads) 15cm(motorways)
length : m	- full line	-	-	1m	-	-	-	-	7.5m(state roads) 9m(motorways)
spacing : m	-	-	-	3m	-	-	-	1m ~ 9m	4.5m(state roads) 6m(motorways)
・Uni-directional traffic									
color :	white	white	-	white	white	white	white	white	white
width : cm	12.5cm	-	-	10cm	15cm	15cm	-	10cm ~ 30 ㎝	12cm(state roads) 15cm(motorways)
length : m	according to the type of the road	-	-	1m	4m(60km/h)	3m	-	-	7.5m(state roads) 9m(motorways)
spacing : m	according to the type of the road	-	-	3m	6m(60km/h)	9m	-	1m ~ 9m	4.5m(state roads) 6m(motorways)
(4) Tunnel entrance design									
・Are there specialized regulations? : yes/no	no	no	-	yes	no	yes CEN TC169	no	no	no
if yes color :	-	-	-	light	-	outside dark colors	-	-	-
shape :	-	-	-	to right water leakage, snow, freezing to fit in with surroundings	-	-	-	-	-

Table 2-1 Questions and Answers for Accessibility to Vehicular Road Tunnels (3)

	Czech	Denmark	Egypt	Finland	Japan	Netherlands	Norway	Sweden	Turkey
title of standard (please enclose related pages) :	-	-	-	under preparation	-	CEN standards TL169 12th Draft	-	-	-
(5) Tunnel visual environment									
①Tunnel lighting. Are there standards or guidelines? : yes/no	yes	no	no	yes	-	no	yes	yes CIE Guideline	no
if yes title (please enclose related pages) :	Technical specification TP 98 "Technological equipment of road tunnels" 1997	-	-	under preparation	-	-	Guideline 021 "Road Tunnel"	CIE Guideline VU 94 part 14	-
if no, how is the tunnel lighting designed? :	-	according to CIE	according toFrench standards (CETU)	-	-	-	according to CIE report	-	CIE Guideline
②Tunnel cladding									
・Are there setandards or guidelines? : yes/no	-	no	no	yes	no	no	yes	yes	no
if yes title (please enclose related pages) :	-	-	-	in preparation	-	-	Water and Frost protection	General Techinical Specification, Tunnel 99	-
・Are there design criteria? : yes/no	no	no	no	yes	no	no	yes	no	no
if yes Minimum tunnel length : m	-	-	-	-	-	-	-	-	-
Minimum traffic	-	-	-	-	-	-	×AADT	-	-
・Material of cladding :	-	paint on concrete walls	Fire lining (cementitious)	Frost isolated lining structure when needed. Generally polyethylen + shotcreate	tiles, color enameled steal plate, etc.	(wall) ceramic tiles	aluminium concrete	-	Ceramic cover
・Height of the cladding from carriage way : m	-	-	varies	4.8m ~ 5.1m	3m	3m	3.5m	-	2.0m
・Colour of cladding :	-	white	beige	light	white, yellow, light blue, etc.	white (not glossy)	light	light color	white
・Other performances of cladding :									
- Strength	-	-	3mpa min	shotcreate min 35KPa	-	-	special approve of construction	-	-
- Fire resistance	-	-	RWS curve (1350℃) to reach 200℃ at	Thickenes of shotcreate min 70mm	-	(root clapping) 2 hours standarded fire	ISO 9705	-	-

Table2-1 Questions and Answers for Accessibility to Vehicular Road Tunnels (4)

	Czech	Denmark	Egypt	Finland	Japan	Netherlands	Norway	Sweden	Turkey
- Optical reflection ratio (%)	-	-	-	-	over 80%	>50%	-	-	-
- Total cost : US$/m	-	-	US$150/㎡	US$100/㎡	-	-	-	-	-
③Other specified remarks for visual environment (special signs or sign boards, wall patterns, etc.)	-	-	under study	The lower part of the wall to resist the collision of vehicles	-	-	-	-	-
(6) Safety structures									
①Cross passage for passengers			under study CETU (French						
・Are there standards or guidelines? : yes/no	yes	-	yes	yes	yes	yes guidelines	yes	yes	yes
if yes title (please enclose related pages) :	Standard CSN 73 7507 "Design of highway tunnels" 1999	-	-	in preparation	Standards of planning and design	R.W.S. standards Hazardous goods transportation	021 road tunnel	General Techinical Specification, Tunnel 99	"Design Specification for Road Tunnels"
・Typical cross section of cross passage									
width : m	2.30m	1.2m	1.80m	-	2.0m	-	-	1.2m	2.30m
height : m	2.40m	2.1m	2.60m	-	2.5m	-	-	2.5m	2.5m
・Spacing of cross passage : m (tunnel length over : m)	350approx (700approx)	50m	400m (1500m)	-	250 ~ 400m	(perenaing on tunnel type) 100m	-	150m	250m (500m)
②Emergency exit for urban tunnel									
・Are there standards or guidelines? : yes/no	no	no	no	yes	yes	yes guidelines	-	yes	no
if yes title (please enclose related pages) :	-	-	-	in preparation	same above	-	-	Tunnel 99 VU 94	-
・Typical cross section of									
width : m	-	-	0.80m	3m	2.0m	-	-	1.2m ~ 2.0m	-
height : m	-	-	1.90m	4m	2.5m	-	-	2.5m	-
・Spacing of emergency exit : (tunnel length over : m)	-	-	200m (1500m)	every 150m (300m)	250 ~ 400m	100m	-	150m ramp tunnel 100m main tunnel	-
・Facilities of exit :									
- Stairway : yes/no	-	-	yes	maybe	yes	no	-	yes	no
- Elevator : yes/no	-	-	yes	no	no	no	-	-	no
- Escalator : yes/no	-	-	no	no	no	no	-	-	no
- Combination of above facilities (and)	-	-	stair and elevator	no	-	-	-	-	-

Table 2-1 Questions and Answers for Accessibility to Vehicular Road Tunnels (5)

	Czech	Denmark	Egypt	Finland	Japan	Netherlands	Norway	Sweden	Turkey
③Emergency accessway for rescue vehicle of Fire Brigade (special route from outside or U-turn in tunnel) : yes/no	yes	no	yes	yes	yes	yes	-	yes Crossing at the tunnel opening for emergency vehicles	no
if yes location	at tunnel location	-	850m apart, approx 450m fnm	every 12km	at tunnel entrance u-turn section in tunnel	just before entarance on both sides	-	not specified will redecided in each project	-
typical dimension	-	-	-	4 × 5 m	-	-	-	-	-
tunnel length over : m	-	-	1500m	1200m	-	-	-	-	-
remark	-	-	u-turn from adjoinig tunnel	-	-	-	-	-	-
(7) Special structure and facilities for disabled users									
・Are there standards or guidelines? : yes/no	no	no	no	yes	no	no	no	yes	no
if yes title (please enclose related pages)	-	-	-	in preparation	-	-	-	Tunnel 99 VU 94	-
・Are SOS bays accessible to travelers on wheelchairs? : yes/no	-	yes	no	under discussion	no	-	no	yes	no
・Are SOS telephones or intercom systems adapted to allow deaf people or people with hearing difficulties to communicate? :yes /no	-	no	no		Yes (Trans-tokyo bay tunnel)	no	no	no	no
・Are emergency parking areas designed in such a way that passengers on wheelchairs can get in and out of vehicles safety? : yes/no	-	no	no		yes	no	no	yes	no
・Other measures for disabled users.	-	-	none		-	-	-	Walking speed 0.7m/s No threshhold	-
(8) Other supporting systems for accessibility									
・(please comment)	Cross passage for vehicles : width 6.5m, height 4.20m, spacing 1400m								

2-2 UNDERGROUND RAILWAY STATIONS

2-2-1 FINLAND
Project Description of Ruoholahti Subway Station

2-2-2 JAPAN
Access way between elevated station and underground railway station. (Sendai station)

2-2-3 SWEDEN
Stockholm metro stations underground

2-2-4 Questions and Answers for Accessibility and Barrier Free Design for Underground Station (Tables)

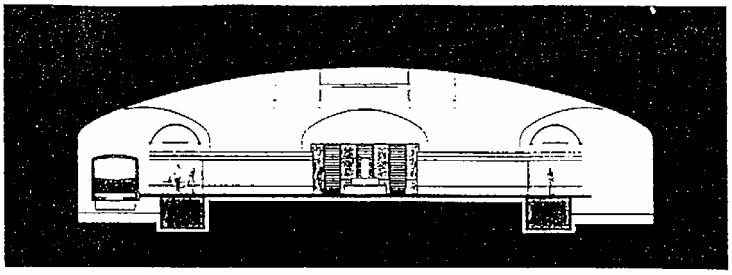
2-2-1 FINLAND Ruoholahti Subway Station -1

This picture presents the platform to the trains at Ruoholahti Subway Station, Finland.
The platform level is 30metre below surface and 26metre below sea level.
The subway tunnels and escalator ravine can be closed by steel doors to make the place function as a bomb shelter for 3500 people, completed in 1993.
The central part of the platform high bending concrete sprayed ceiling was painted blue.
Heges are made of glass and lights are used to emphasize the concrete sprayed rock

Project Description of Ruoholahti Subway Station -2

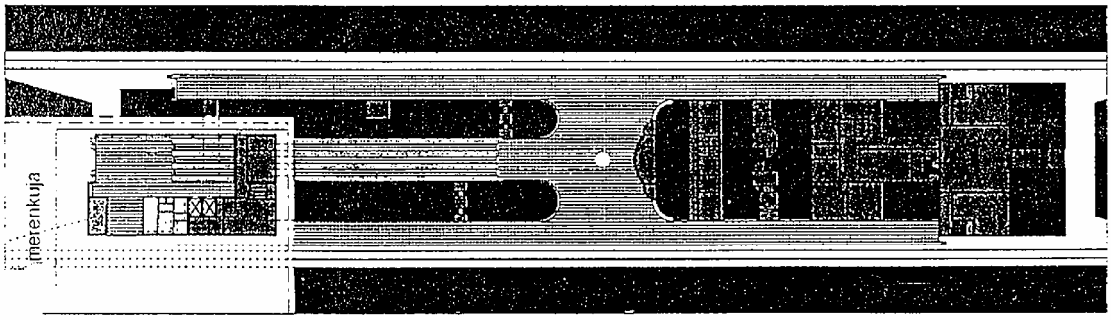
Technical data of the station

Platform length	135 m
Total width of the platform hall	38 m
Total floor area	10 150 m²
Area of surface part	1 495 m²
Area of underground part	8 655 m²
Public shelter area	4 370 m²



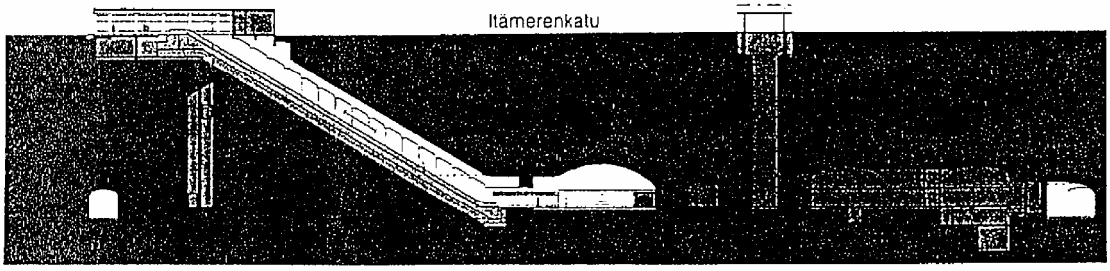
Cut through the platform hall

0 5 10 20m



A plan of the entrance hall and the platform

0 5 10 50m

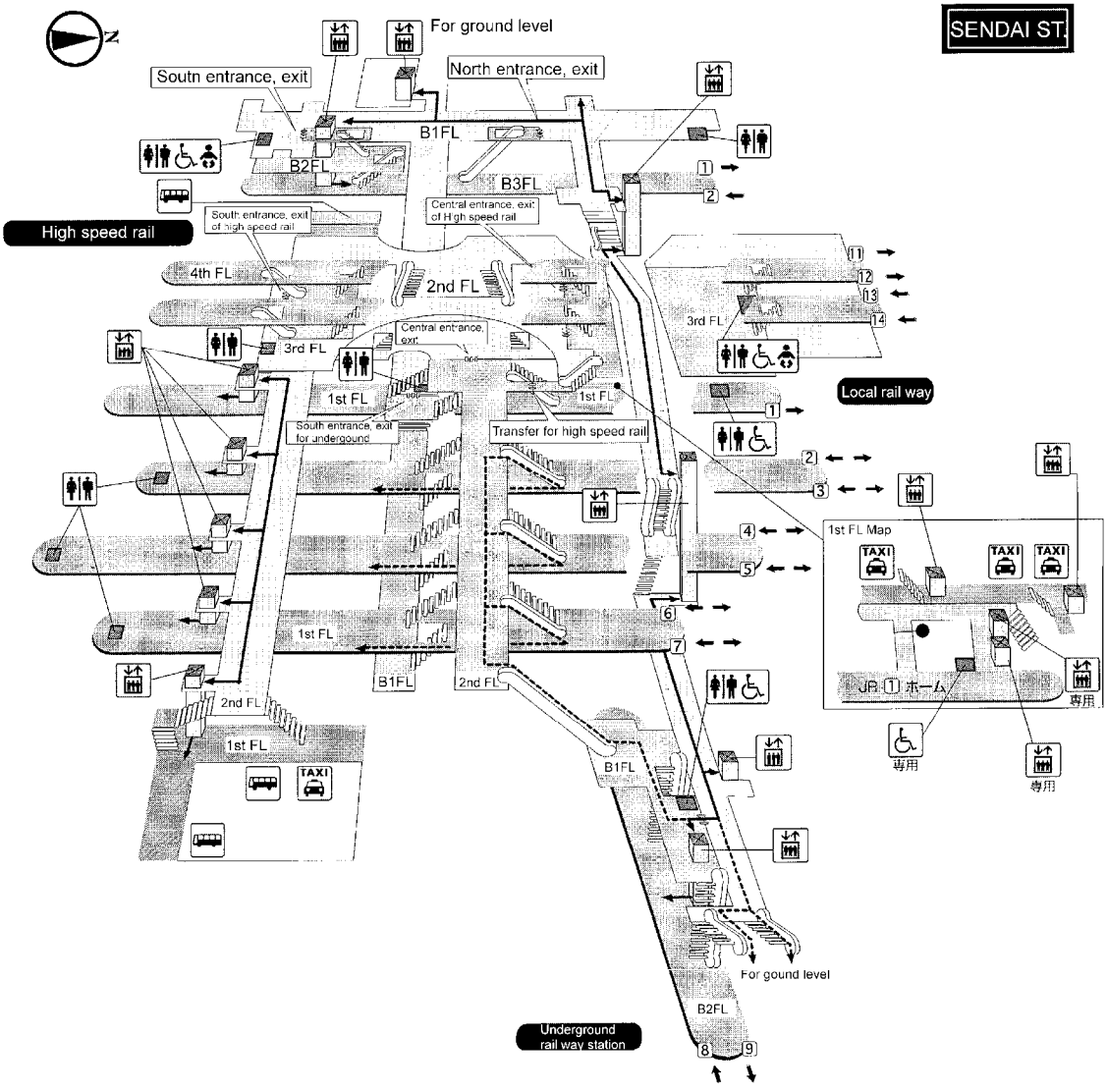


Length cut through the station

Promotor: Helsinki City Public Works Department 1993,
Bauherr: Baumant der Stadt Helsinki, 1993

2-2-2 JAPAN Access way between elevated station and underground railway station (Sendai station)

This figure presents the typical underground railway station in Japan with connections to ground level.



Schematic structure of railway station

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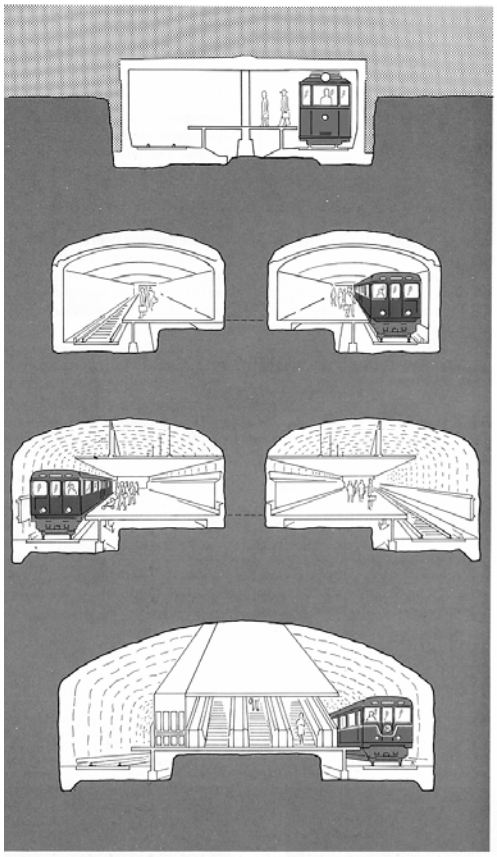
2-2-3 SWEDEN Stockholm Metro stations underground –design development

The Stockholm underground network was built as three systems. For both economic and technical reasons, later development has been towards deeper levels, with long rock tunnels in the third and last system. The network is 112 km with 99 stations. 10.5 km are in concrete tunnels and 54.4 km are in rock tunnels with underground stations.



1930s
Traditional cut-and-cover concrete station below street level, built in 1930 and later converted for the underground railway. The same technique was used in the 1950's.

1950s
Stations in rock caverns with concrete arches and brick walls covering the rock.

1970s
Underground stations on the third railway line with the rock surface exposed, both for economic and artistic reasons.

1980s
Large spans instead of dividing rock pillars provide good visibility and an open ambience.

Artists have been involved in everything from colour selection, sculptures and painted "landmarks", to wall panels behind the tracks

(Source: GOING UNDERGROUND, Royal Academy of Engineering Sciences, Stockholm 1988)

2-2-4 Questions and Answers for Accessibility and Barrier Free Design for Underground Station

Table 3-1(1) ~ Table 3-1(13) presents the items of question and answers from 8 Nations for accessibility and barrier free design for underground station.

Table 3-1 Questions and Answers for Accessibility and Barrier Free Design for Underground Station (1)

	Czech	Denmark	Egypt	Japan	Netherlands	Norway	Finland	Turkey	France
1.General									
>Name of Station	Stodulky	KONGENS NYTORU STATION	All Underground Station	Kourakuen St.	WILHELMINAPLEIN	NATIONALTHEATRET	RUOHOLAHTI	KIZILAY	MAGENTA
>Name of City	Prague	Copenhagen.Denmark	CAIRO	Bunkyo,Tokyo	Rotterdam	Oslo	Helsinki,Finland	Ankara	Paris
>Name of Line	Line B	Copenhagen Metro	Greater Cairo Metro Line No.2	Nanboku Line	Erasmusline	MAIN Oslo-DRAMMEN line	Ruoholahti-Itakeskus	Ankaray & Metro lines	EOLE (ligue E du RER)
>Year of construction	1994	2000	1993	Opened to traffic 1996	1997	1980/1999	1993	Ankaray 30.8.1996	1993-1998
>Means of transportation	Metro	Trains	Heavy Rail	Subway	Metro	Railway (local & intercity)	Underground (Metro)	Light rail	Suburb railway /Express Metro
>No.of passengers per coach	185 passengers/ coach	Max 324 passengers/ coach		6 coaches of 864 passengers/ coach			130 passengers/ coach	990/1785 passengers/ coach	
>No.of passengers stepping on/off train	15560 pass./ 3 hours-peak period			(1997)21810 pass/day/station		35000 approx	14000		6000
>Station area	11875 m^2	concourse 225m^2 cycle storage 16m^2 stairs/access 250m^2 platform 400m^2 escape stairs not included in the above		9208.03 m^2	± 2500 m^2	approx 6000m^2	10150 m^2	(140×2m) & Platform area (90×21m) /30000m^2 including mall	15000 m^2
>Platform length	100 m	44 m	150 m	130 m	125 m	250 m	135 m	Ankaray 90 m Metro 140 m	225 m
>Depth of lowest	13,10 m below	19 m below	15 m below	37.5 m below	14 m below	20 m below	~ 30 m below	~ 20 m below	30 m below
platform level	ground level	ground level	ground level	ground level	ground level	ground level	ground level	ground level	ground level
>Number of underground floors	4	2 public + 2 add.technical levels	3	5 floors (one section 6 floors)	1	2	2	3	3

Table 3-1 Questions and Answers for Accessibility and Barrier Free Design for Underground Station (2)

	Czech	Denmark	Egypt	Japan	Netherlands	Norway	Finland	Turkey	France
2.Design Standards									
2.1 Design Standars for Station Equipment									
･Is the design of station, including its accessibility, based on design standards? If yes Title of standard and name of issuer.	YES Construction and Technical Regulation for Railways (Ministra of Transport Intimation No.177/1995	YES Issues regerding passenger safety Bostras,NFPA130(93)	YES Document technique unifie-dtu(French standards)	YES Fire Counter Measure Standard (MOT), Welfare City Planning (Tokyo Metr.Govn.), Utility of Underground Stations (MOT)	YES (own) GTM-RET infrastructure	NO	YES Design guidelines of Helsinki metro (By the Helsinki transit authority), National building code (By min.of environment), Helsinki building code (By the city of Helsinki)	Turkish standards, Canada,USA standards for different Paris	NO
2.2.Design Standars for Accessibility Equipment									
(1) Are there specialized design standards for connection between the underground and the open space(width, ceiling height, slope,etc)?; yes/no If yes Title of standard and name of issuer.	YES see AD 2)	BS95,NFPA for escape routes	YES Document technique Unifie-dtu	YES As item2.1(above)	YES own standard GTM-RET infrastructure	NO	YES Design guidelines of Helsinki metro(By the Helsinki transit authority), National building code(By min.of environment), Helsinki building code(By the city of Helsinki)	The contract sums of the above atandards	
Minimum width of stairway	xa 0.75 m		2.4 m	1.5 m	2100 m		2.25 m	2.40 m	
Minimum ceiling height of stairway	2.5(2.1) m		2.7 m	2.5 m	2.7 m		2.1 m	2.70 m	
Slope of stairway min.step area	— cm		65 cm	33 cm	31 cm		>30 cm	30 cm	
max.step height	16 cm		15 cm	16.5 cm	16 cm		≦ 16 cm	16.7 m	
max slope	30 %		30 %	50 %	51,35 %		～50%(30°)	30 %	

Table 3-1 Questions and Answers for Accessibility and Barrier Free Design for Underground Station (3)

	Czech	Denmark	Egypt	Japan	Netherlands	Norway	Finland	Turkey	France
(2) How are the entrance/exit connections between the underground structure and the open space positioned?							Determined case by case		
>Maximum distance between facilities (underground structure)	— m	~ 20 m	4.5 m	80 m	average 80m	200m	45 m		
>minimum number of connections	—	2	4	2	2	2	2-3	10	
(3) Are there standards for the luminance intensity? If yes Title of standard and name of issuer.	YES Reguration for metro technical operation (Ministry of Transport)		YES British(BS) and French(NF) standards	YES Electrical Equipment Design Standard	YES GMT-RET	NO	Design guidelines of Helsinki metro	YES	YES
Minimum Hall	140 lxs	200 lx	150 lx	300 lx	300 lx		300-600 lx	150 lx	
Escalators	300 lx	200 lx	100 lx	300 lx	200 lx		300 lx	entrance 200 or 150 lx	
Ramps	300 lx		100 lx	300 lx	300 lx		300 lx	entrance 200 or 150 lx	
Corridors	200 lx		100 lx	300 lx	300 lx		300 lx	150 lx	
platform	300 lx	180-250 lx	150 lx	300 lx	300 lx		300-600 lx	150 lx	
(4) Are there standards for the safety equipment? If yes Title of standard and name of issuer.	YES Reguration for metro technical operation (Ministry of Transport)	YES NFPA 130(93)	BS and NF	YES Fire Counter Measure Standard (MOT) Fire Brigade Regulations (Min,of Home Affairs)	YES GMT-RET	Standards & design of safety heasures developed in cooperation with fire authorities	NO Determined case by case	YES Institute of Turkish standards	YES
What kind of fire extinguishers are placed?	Hydrants	Water/special water (allowed 1000volt) /foam/Co2 Inergen gas in escalator + lift motor room	CO^2	Fire hydrant,fire extinguisher,sprinkler,continuous water supplying pipe	Hoses Dry extinguisher	Sprinklers+water hoses+dry extinguishers smoke ventilation system installed		Hydrants sprinklers, halon or approved equal gas	

Table 3-1 Questions and Answers for Accessibility and Barrier Free Design for Underground Station (4)

	Czech	Denmark	Egypt	Japan	Netherlands	Norway	Finland	Turkey	France
(5) Are there standards for measures against water leakage? If yes Title of standard and name of issuer.		Dry hydrant system installed,filling time 1resp. 5 min.pressure detective station tunnel	YES Engineering Design standards-NAT	NO In collection with Min.or tunnel owner	YES GMT-RET		NO	NO	NO
What kind of equipment is placed?			Dampproofing and membrane waterproofing	Water resistant panels,moist resistant doors,increase height of entrances/exits	Pumps	Entire underground structure has concrete of rock surface (Waterproof after initial two- period of injection		Water drains collected and dispose with water pumps of platform level	
(6) Are there design standards for equipment for disabled people? If yes Title of standard and name of issuer.	YES Czech Standard		YES NF French Standard	YES Guideline,Facilities of Elderly and Disabled at Public Transport Terminals (MOC) Welfare City Planning (Tokyo Metr.Govn.)	YES GET-RET		YES National building code (Min.of environment)	YES Institute of Turkish standards	YES
(7) Are there special considerations for safety measures in general? If yes What kind of considerations:	YES barrierless Access for disabled people+path for blind people	YES Stations to be approved by danish building authorities, who have requirements additional to NFPA 130	YES Fire fighting equipment's	YES For safety reasons,doors are installed between platform and train links	GMT/Calamity procedures		NO Determined case by case	YES	YES

Table 3-1 Questions and Answers for Accessibility and Barrier Free Design for Underground Station (5)

	Czech	Denmark	Egypt	Japan	Netherlands	Norway	Finland	Turkey	France
2.3 Access Routes									
(1) Is there an aimed escape time(from underground structure to open space)? If yes What kind of considerations:	YES approx.6 minutes from platform to open space according to fire protection…CSN 730838	YES 3 minutes to leave platform,7minutes to leave station calculated as per NFPA 130(93), however time intervals between trains are 7 minutes	YES NFPA 6 minutes escape time	NO Necessary escape time is decided in collaboration with Fire Brigade	YES Within 5 min to platform, Within 7 min to station	YES 2700 people to safe area within 7 minutes	NO	YES	
(2) How are the routes									
· Staircase	YES	YES	YES	YES	YES	NO	YES	YES	YES
· Fixed slope	NO	NO	YES	NO	YES	NO	NO	YES	
· Mobile slope	NO	NO	NO	NO	NO	NO	NO	NO	
· Escalator	YES	YES	YES	YES	YES	YES	YES	YES	YES
· Elevator	YES	YES	YES	YES	YES	YES	YES	YES	YES
· Inclined elevator	NO		NO	NO	NO	YES	NO	NO	YES
· Conveyor belt	NO		NO	NO	NO	NO	NO	NO	
· Elevating platforms	NO		NO	NO	NO	NO	NO	NO	
(3) Details of access routes									
· Staircase									
Number of steps between landings		13 main stairs 15 escape stairs	17 average	227	18		~ 15	Max 14	
Size of tread		280 mm	30 cm	33 cm(min.)	310 mm		~ 30-33 cm	Min 30 cm	
Size of rise		175-172 mm	15 cm	16.5 cm(max.)	160 mm		~ 14-16 cm	Max 16.7 cm	
Flooring/non slip band		Tactiles YES	YES	YES	YES		YES	YES	YES
Handrails		YES	YES	YES	YES		YES	YES	YES
Braille/high relief signs indicating each level	NO	NO	NO	YES	NO		NO	NO	NO
· Fixed slope									
Longitudinal gradient			Max 5%			5 %		Max 6 %	
Transverse gradient						3 %		0	
Length of ramp			Max 10m			90/30 m			
Width of ramp			1.2 m			5 m		2.40	
Lower base			1.0 m						

Table 3-1 Questions and Answers for Accessibility and Barrier Free Design for Underground Station (6)

	Czech	Denmark	Egypt	Japan	Netherlands	Norway	Finland	Turkey	France
Non-slip flooring			YES			YES		YES	
Handrails			YES			YES		YES	
· Mobile slope									
Longitudinal gradient									
Transverse gradient									
Length ramp									
Lower base									
Non-slip flooring									
Handrails									
· Escalator									
No.of leveled-up steps at either end		2	3	3	5 m/11 m		3-4	3	
Speed	0.65 m/s		3.6 m/min	30 m/min	0.65 m/s		0.6-0.7 m/s	150 persons/min	
Gradient	30%	30%	30 %	30°	27°18'	30°	30°	30%	
· Elevator									
Is there car diaphanous?	NO		NO	NO	YES	YES	YES	YES	
Elevator capacity			800 kg	750 kg	800 kg	1950 kg	1000 kg		
Size of car at base		L=2.3m(stretcher)	1.10 × 1.40	140 ×135 cm	1400 ×1350 mm	2.7 × 1.2 m	135×170 cm	various	
Height of button panel		~ 1 m	1.00 to 1.20 m	100 cm	1200-1700 mm	1.2 m	~ 1 m	110 cm	
Is button panel in braille/ high relief?	NO	YES	NO	YES		YES	YES	NO	YES
Distance between button panel and door			0.40 m	60 cm(about)	Side panel	1.3 m			Close
SOS intercom system									
height			1.20 m	100 cm	1200-1700 mm	1.2 m		2.40	
accessible for deaf people or people with hearing difficulties?			NO	YES	NO	YES	?	NO	YES
accessible for blind people or people with visual deficiencies?	YES		NO	YES	NO	YES	?	NO	YES
Handrails inside the elevator?	YES		YES	YES	YES	NO	YES	YES	
Is there a lower base?	YES		YES	YES	NO	YES	?	YES	
Is the floor non-slip?	YES		YES	YES	YES	YES	YES	YES	YES

Table 3-1 Questions and Answers for Accessibility and Barrier Free Design for Underground Station (7)

	Czech	Denmark	Egypt	Japan	Netherlands	Norway	Finland	Turkey	France
Is there any visual indication of stops?	YES		YES	YES	YES	YES	YES		
Inside cars	YES		YES	YES	YES	YES	YES	YES	
Outside cars	YES		YES	YES	YES	YES	YES	YES	
Is there any indication of stops?	YES			YES					
Inside cars			YES	YES	YES	YES	NO	YES	
Outside cars			YES	YES	YES	YES	YES	YES	
Can outside button panel be reached by wheelchair users			YES	YES	YES		Generally YES	YES	
Is Braille/high relief used on outside button panel?			NO	YES	YES	YES	NO	NO	
Vertical gap between car and bottom of shaft?				20 cm ~ 30 cm	5 mm		?	2.00 m min	
Horizontal gap between car and bottom of shaft?			3.5 cm	20 cm ~ 30 cm	20-50 mm		?		
Is the car fireproof			YES	YES		NO	YES	YES	
· Inclined elevator									
Is there car diaphanous?						YES			
Elevator capacity						1350 kg			
Size of car at base						1.5 × 2.5 m			
Height of button panel						1 m			
Is button panel in braille/ high relief?						NO			
Distance between button panel and door						1.2 m			
SOS intercom system									
height						1m			
accessible for deaf people or people with hearing difficulties?						NO			
accessible for blind people or people with visual deficiencies?						NO			
Handrails inside the elevator?						YES			

Table 3-1 Questions and Answers for Accessibility and Barrier Free Design for Underground Station (8)

	Czech	Denmark	Egypt	Japan	Netherlands	Norway	Finland	Turkey	France
Is there a lower base?						NO			
Is the floor non-slip?						YES			
Is there any visual indication of stops?									
Inside cars						YES			
Outside cars						YES			
Is there any indication of stops?									
Inside cars						NO			
Outside cars						NO			
Can outside button panel be reached by wheelchair users?						YES			
Is Braille/high relief used on outside button panel?						NO			
Vertical gap between car and bottom of shaft?									
Horizontal gap between car and bottom of shaft?									
Is the car fireproof						NO			
· Conveyor belt									
Width								120 cm	
maximum length per								20 m	
· Elevating platforms									
Are there any elevating platforms?				NO			NO	NO	
2.4 Configuration of Access Routes									
· What kind of configuration do the access routes (to open space) have?	separate access in combination with other underground facilities	independent access	in combination with building access	in combination with building access/ in combination with other underground facilities	in combination with building access	independent access	independent access	independent access/ in combination with building access	in combination with building access/ in combination with other underground facilities
· To what kind of open space does the access route lead to? In case of 'other',please specify	road/park	Open square	road		road/private area	road/park	road	road	road

Table 3-1 Questions and Answers for Accessibility and Barrier Free Design for Underground Station (9)

	Czech	Denmark	Egypt	Japan	Netherlands	Norway	Finland	Turkey	France
2.5 Facilities to underground station									
(1) Access to station space									
・Are there turnstiles or automatic access doors	turnstiles		turnstiles	automatic door		turnstiles	automatic access doors	turnstiles	turnstiles
・Do these elements facilitate wheelchair users?	YES		NO	YES	YES	YES	YES	YES	YES
・Is great effort required to operate these elements?			Separate swing gate provided	NO	YES	NO	NO	NO	NO
(2) Ticket offices					YES				
・Are ticket machines and ticket offices accessible for disabled people?			YES	YES	NO	YES	YES	YES	NO
・Do ticket offices have induction loops?			YES	YES	YES	YES	?	YES	
(3) Rest areas									
・Do stations have rest areas fitted with benches? If yes,indicate location		NO Benches placed at the station area on	YES Platform level	NO	YES Platform	YES platform,lobby	YES Entrance pavilions, Platforms	YES Platforms	YES Platform
・Do these areas interfere pedestrian movement?			NO		YES	NO	NO	NO	NO
・What is the average distance between two rest areas?			30-50 m		± 15 m	50 m	~ 20 m	non specific	
・Do benches have a back support and arm rests?			YES		YES	NO	YES	YES	NO
(4) Public toilet									
・Does the station have public toilets?	YES	NO At ground level there	NO	YES	YES	YES	YES	YES	YES
・Are these accessible to disabled people?	YES			YES	NO	YES	YES	YES	YES
(5) Platforms									
・Are station platforms 24 hours open?	NO	YES	NO	NO	NO	NO	NO	NO	NO
・Are they closed (protected by partitions and automatic doors)?	NO		NO	YES	NO	NO	YES	NO	YES

Table 3-1 Questions and Answers for Accessibility and Barrier Free Design for Underground Station (10)

	Czech	Denmark	Egypt	Japan	Netherlands	Norway	Finland	Turkey	France
・How are the platforms arranged within the station?	Single central platform	Single central platform	side platform	Single central platform	side platform	Single central platform	Single central platform/side platform Because of the geometry of the rock platform ,the central platform is on fact partly a side platform	Single central platform/side platform/side platform and one central platform	Double central platforms
・How wide are the platforms?	Central platform:Min 8m Side platform:Min 4m	9 m	Min 3.0m to 4.5m max	15.9 m	3-7.5 m	10.5m	Central platform:Min 6m Side platform:Min 4m	Min 2.50m	2 × 7 m
・Is there a warming and safety band along the edge of platforms?		YES Platform screen	NO	YES	YES	YES	YES	YES	YES
・Are the color and texture of the band highlighting the platform edge different from the rest of the platform area?	YES		YES	YES	YES	YES	YES	YES	NO
・Does the band highlighting the platform edge have inserted lights indicating the immediate arrival of a train?	NO		NO	NO	NO	NO	NO	NO	NO
・Do platforms have boards with information in real	NO		NO	YES	YES	YES	YES	YES	YES
・Is this information also given on the public address			NO	YES		NO	NO	YES	YES
・Do platforms have life saving niches next to the rails in case of someone falling on the rails?	NO	YES	YES	YES	YES	NO	YES	NO	?

Table 3-1 Questions and Answers for Accessibility and Barrier Free Design for Underground Station (11)

	Czech	Denmark	Egypt	Japan	Netherlands	Norway	Finland	Turkey	France
·Does the station have electronic devices to stop trains in the case that obstacles are detected on the rails	YES		YES	NO	NO	NO	YES	NO	NO
(6) Platforms-train-link									
·What is the vertical gap between train and platform?	5 cm	Small	10 cm	8 cm(about)	25 mm±5 mm		±0	max ± 1 cm	0
·What is the horizontal gap between train and platform?		Small	10 cm	8 cm(about)	25 mm±5 mm		3～5cm	max 5 cm(now 3)	< 10 cm
·Do trains have collapsible platforms at the doors to facilitate access to disabled people?		NO	NO	NO	NO	YES	NO	No need	NO
(7) Trains									
·Do trains have reserved seats to be used primarily by disabled passengers?	YES		NO	special space for wheelchairs,priority seats	YES 2 per train	YES on some trains	YES		YES
·Are these seats properly signed?	YES			YES	YES	YES	YES	NO	YES
·Do trains have spaces fit for passengers travelling on wheelchairs?	YES	YES		YES	YES	YES	YES	YES	YES
·Do trains have information signs indicating the name of the next stop and changes?						on some trains			
Visual signs	YES	YES	YES	YES	YES	YES	NO	YES	NO
Sound signs			YES	YES	YES	YES	YES	YES	NO

Table 3-1 Questions and Answers for Accessibility and Barrier Free Design for Underground Station (12)

	Czech	Denmark	Egypt	Japan	Netherlands	Norway	Finland	Turkey	France
3. Other information									
・What kind of equipment for sign and information are applied to the underground station?									
Sign boards	Information board,illuminated inf.board		Signage	Information board, illuminated information	Only plain text	Extensive signposting of lines,exits etc.	YES In entrance halls and platforms	We have properly designed signal system	YES
Information boards	pictographs,information panel	At street level and concourse and platform level	Maps	Automatic information panel(text),pictographs Information panel,Braille panel(high relief sign) with vocal information,posters,etc.	Only plain text	Large board showing departure times in lobby boards on platform	YES Real-time displays	We are put platform and are at hall	YES
・How are the operation times for underground facilities regulated(are there regulations for night time)?	closed during night (24.00-5.00) full operation during otherhours		00:50 to 00:10	Closed during night (24:30-05:00) Full operation during other hours	from 5am to 1am	Station opening hours 04:30-01:30	Station operating 5:30-23:30	6:00-24:00 operation hours 2.5min at and 8 min minimum between trains	
・Do evacuation plans take into account the needs of passengers with disabilities?		YES	YES	YES	YES	YES	YES	NO	YES
・Do cars have devices for the evacuation of disabled or injured people?			YES	NO	NO	On same trains			
・Are guide dogs for blind people allowed to the underground station?		YES	YES		YES	YES	YES	NO	YES
・Are there information leaflets about timetables, lines,maps etc.with different formats?									
Large characters			NO	YES	NO	NO	YES	NO	NO

Table 3-1 Questions and Answers for Accessibility and Barrier Free Design for Underground Station (13)

	Czech	Denmark	Egypt	Japan	Netherlands	Norway	Finland	Turkey	France
Braille			NO	YES	NO	YES		NO	YES(inside lifts)
Cassette			NO	YES	NO	NO		NO	
·Are there any information-leaflets about the accessibility facilities?			NO	YES	YES	NO	?	NO	NO
·Are there future prospects to improve the standards for accessibility?	YES		YES	As the equipment for disabled passengers, elevator and sign system improved				With the questions of this questionnaire YES	
·Are there special remarks concerning planning and installation (including environment) of access facilities?			NONE	·As the railway auxiliary equipment for disabled passengers,first elevator system with two ways for getting on and off is installed in Japan. ·The elevating platform system(RAKUUPU) for wheelchairs use,ajust vertical gaps between platform and train entrance floor level is projected.					

2-3 UNDERGROUND PARKING AREAS

2-3-1 JAPAN
Underground Parking Area at Yokohama Station West

2-3-2 SWEDEN
Illustration of The HÖGALID Garage

2-3-3 Questions and Answers for Accessibility to Underground Parking Area (Tables)

2-3-1 JAPAN UNDERGROUND PARKING AREA IN JAPAN (Yokohama station West)

This underground parking area and second underground parking area of Yokohama underground shopping mall are located at the center of an integrated shopping area.
The scale of these underground parking areas are upper ranking in Japan.

2nd off ramp to ground level

Underground parking space at B-3

Total capacity for parking : 1,000 vehicles

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2-3-2 SWEDEN Illustration of the HÖGALID Garage

Special Issues :

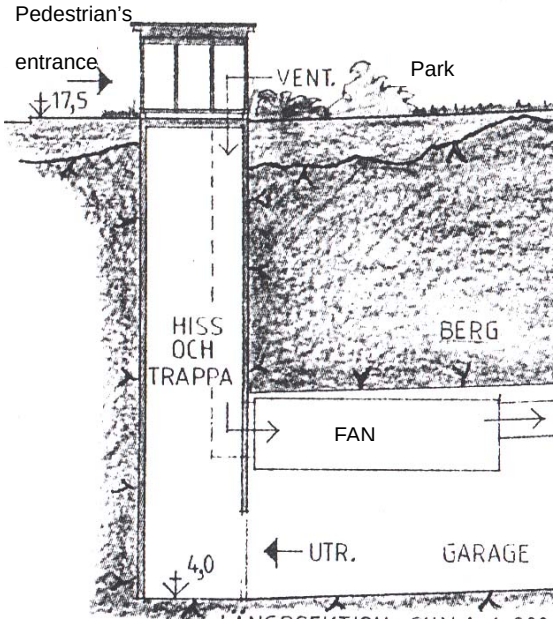
Entrance lined (surrounded) with natural rock
Garage doors and entrance mainly in glass
Designed for a minimum inside temperature of +8 Centigrade.
Noise from air treatment installations according to norms
Spill water led by wells and pipes to an oil separator and then pumped up to the public sewage water net.
Heating coils under entrance and exit ramps.
Additional information:

Fire protection: Water sprinkler system. Walking distance till nearest exit less than 60m.
Two pedestrian exits and entrance ramp
Glass will in parts be used to separate walkways and ramps to make the garage “airy and comfortable” for the visitor. Also the elevators and staircase will be built-in with glass/
The garage will be painted I light colours. Loud speaker installations for soft music.
Elevator at exit also made for wheel chairs. Handicap car parking on each level.

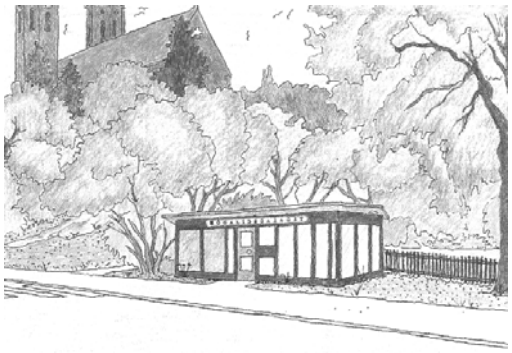
Underground parking area in Stockholm

Surface exit/entrance Elevator shaft for pedestrians; with artistic wall-work,; ventilation; exit/entrance from garage

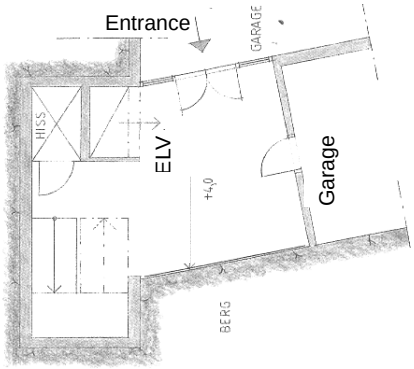
Longitudinal section of vehicle access



Longitudinal section of Pedestrian's Shaft



Perspective view of pedestrian's access



Plan of pedestrian's shaft

The underground Högalid garage for 200 cars in central Stockholm. Construction is expected to start in 2004.

2-3-3 Questions and Answers for Accessibility to Underground Parking Area

Table 4-1(1) ~ Table 4-1(5) presents the items of questions and answers from 8 Nations for accessibility to underground parking area.

Table 4-1 Questions and Answers for Accessibility to Underground Parking Area (1)

	Czech	Finland	France	Italy	Japan	Netherland	Norway	Sweden
		Jarmo Roinisto Kalliosuunnittelu Oy Rockpaln Ltd	E Magne GTM Contruction TP Fdf	CLAMPS COMUNE TORINO	S Hamanaka			Lennart Dahlguist Stockholm Parking
1. General								
>Name of Parking Area	Garaze Prokesovo nam	P-Kluuvi Kluuve underground car park	Porte Maillot - Palais des corgres	Park BOLZANO	Sakurabashi Car Parking	Museum Square	Molde Parkeringshus	Hoqalid, Hoqberg, Stigberg
>Name of City	Ostrava	Helsinki	Paris	Trino	Osaka	Amsterdam	Molde	Stockholm
>Year of construction	1998	1998-2000	1997	2000	1998	1999	1988	2001
>Capacity of parking area:cars	203	725	300	858	200	600	750	200, 125, >186
>Total area : m^2	5,680	19,600	50,000	23,170	11,000		21,000	6,000, 4,400, 5,500-6,000
>Number of underground floors	2	3	2 new floors	3	1	2	1 floor and 7	2
2. Design Standards								
2.1 Design Standards for Underground Parking Area								
Is the design of the parking area, including its accessibility, based on design standards?: yes/no if yes, title of standard and name of issuer:	yes CSN 73058 Parking areas - General provisions CSN 730838 Fire Protection of	yes National construction standards of Finland	yes Cahier des Prescrphenes Techniqu - Ville de Paris (CPT)	yes DECRAT MINIST 1/2/.86 l.legge 13/89	yes Guideline for Car Parking Design and Construction: Japan Road Association	yes Several	yes Normal standard for parking areas, And normal profits for tunnell standards	no Reccomendations according to TFK-report, 1991:5
2.2 Design Standards for Accessibility Equipment								
(1) Are there specialized design standards for connection between the underground and the open space (width, ceiling height, slope, etc.)?: yes/no if yes, title of standard and name of issuer:	yes CSN 73058 Parking areas - General provisions	yes NCS of /post E1 fire security	yes CPT		yes Guideline for Car Parking Design and Construction	yes Several	no	yes BBR and BBK (building and construction rules)
Miminum width of stairway: m	0.9	1.2	1.9	1.2	1.5	1.1	2.0	1.2

Table 4-1 Questions and Answers for Accessibility to Underground Parking Area (2)

	Czech	Finland	France	Italy	Japan	Netherland	Norway	Sweden
Minimum ceiling height of stairway: m	2.1	2.1	2.1	2.4	2.5	2.2		2.1
Slope of stairway (min. step area): cm		270		30	30<	21	100	
max. step height: cm		180	17	17	15>	18	30	
max. slope: %	42 (15/36cm)	7.9	4				30	
(2) How are the entrance / exit connections between the underground structure and the open space positioned?								
>Maximum distance between facilities (underground structure):	2 x 25	145 horizontal	80	40	120>	50	200	
>Minimum number of connections	2	3		2		2	3	
(3) Are there specialized design standards for transportation equipment (escalator, elevator)?: yes/no if yes, title of standard and name of issuer:	yes CSN EN 115 Escalators - Czech Standard Institute 81-1,2 Elevators	no	yes		yes	yes Liftenbesluit	no	yes Name of standard not known
Elevator Capacity: people	8		8					6
Velocity: m/min	0.65 - 1.0							
Escalator Effective width: cm	60							
Velocity: m/min	0.65							
(4) Are there standards for the luminance intensity?: yes/no if yes, title of standard and name of issuer:	yes CSN 736058 Parking Areas - General	no	yes CPT	yes	yes Guideline for Car Parking Design and Construction	yes Nen 2443	no	no
Minimum luminance: lx	50 (emergency:2)		60		50	50		4 watt/m^2
(5) Are there standards for the safety equipment?: yes/no if yes, title of standard and name of issuer:	yes CSN 730804 Fire Protection of Buildings - Multi-storey gara	yes NCS of /G1 fire security	yes Cicculaice 331 Bis	yes D.M. dell' 1/2/86	yes Guideline for Car Parking Design and Construction, Fire Prevention Act	yes Bouwbesluit	no	yes BBR and BBK (building and construction rules)

Table 4-1 Questions and Answers for Accessibility to Underground Parking Area (3)

	Czech	Finland	France	Italy	Japan	Netherland	Norway	Sweden
What kind of fire extinguishers are placed?	fire detection, detection for CO, CO_2	water sprinkler system, water hydrants		Drant ed Estintori	Bubble fire extinguisher		Every 25m an emergency station and locate with manual alarm, emergency telephone and fire extinguisher	Normally sprinklers
(6) Are there standards for measures against water leakage?: yes/no if yes, title of standard and name of issuer:	no	no	no		yes Guideline for Car Parking Design and Construction	yes Bouwbesluit	no	decided how case to case
What kind of equipment is placed?					sheet		In the low point, there is a pumping station	
(7) Are there standards for equipment for disabled people?: yes/no if yes, title of standard and name of issuer:	yes Ministry of ecinimy intimation No.174/94	yes NCS of /post F1 disabled people		yes L.13/89	yes Guideline for Car Parking Design and Construction	yes Bouwbesluit	no	yes BBR
(8) Are there special considerations for safety measures in general?: yes/no if yes, what kind of considerations:	no	no		yes D.M. dell' 1/2/86	yes	yes CO-detection, Fire alarm system	yes Direct alarm and monitor	yes BBR
2.3 Access Routes								
(1) Is there an aimed escape time (from underground structure to open space)?: yes/no If yes, what kind of considerations:	yes 4 minutes for escape ways, 2.5 minutes for 1 escape way	yes Max distance 90m	no	yes 2 %	yes Max distance 60m	yes	no Any person/viecle be out in max 2 min. using the 3 access entrances	no Max walking distance to exit 60m
(2)How are the access routes shaped? >Staircase: yes/no	yes	yes	yes	yes	yes	yes	yes	yes

Table 4-1 Questions and Answers for Accessibility to Underground Parking Area (4)

	Czech	Finland	France	Italy	Japan	Netherland	Norway	Sweden
>Slope: yes/no	yes	no	yes	yes	no	yes	yes	yes
>Escalator: yes/no	yes	no	no	no	yes			no
>Elevator: yes/no	yes	yes	yes	yes	yes			no
(3) What kind of measures for disabled people exist?				yes	Esclator, Elevator			
>Are pedestrian accesses to Parking Area accessible to wheelchair users?: yes/no	yes	yes		yes	yes	yes	yes	yes
>Does the transit gauge for vehicles allow access to vans adapted for passengers on wheelchairs?: yes/no		yes	yes	yes	yes	no	yes	yes
>Are there any parking spaces reserved to users with special needs?: yes/no If yes, percentage of accessible parking spaces: %		yes 1.5% (11/725)	yes 2 %	yes 2 %		yes 2%	yes 0%	yes 1 or 2
Indicated from the entrance of the Parking Area?		no	no	yes	yes	yes	yes	
Properly designed?		yes	yes	yes	yes	yes	yes	yes
Located next to pedestrian access?		yes	yes	yes	yes	yes	yes	yes
>Do Parking Areas have corridors for pedestrian movement?: yes/no If yes, are these corridors protected from vehicle traffic?: yes/no		no	yes	no	yes	yes yes	yes yes	yes yes
Are they properly signed?: yes/no			yes		yes	yes	yes	yes
Do they facilitate movement of wheelchair users?: yes/no			yes		yes	yes	yes	yes
>Are ticket machines accessible to people on wheelchairs?: yes/no		yes	yes	yes	yes	yes	yes	yes
>Are there accessible toilets in the parking Areas?: yes/no If yes, is there at least one toilet for disabled on each floor?: yes/no		no	yes yes	yes no	yes	yes yes	yes yes	no
>Other measures for disabled users				?	Yes, but not all			

Table 4-1 Questions and Answers for Accessibility to Underground Parking Area (5)

	Czech	Finland	France	Italy	Japan	Netherland	Norway	Sweden
2.4 Configuration of Access Routes								
>What kind of configuration do the access routes (to the open space) have?	separate access	in combination with building access, in combination with other underground facilities	in combination with building access, in combination with other underground facilities		in combination with other underground facilities	separate access		
>To what kind of open space does the access route lead to?	road, park	road, other: shopping center, underground metro station			road, park station fo public transportaions.	road, park	road, park	road
3. Other information								
>What kind of equipment for sign and information are applied to the underground station? Sign boards	Information board (illuminated)	Illuminated	Lighted boards	not clear	Information board		Illuminated boards at the entrance	Sign boards - Yes
Information boards	Pictographs, information panel	Aluminium Boards showing number of free space	Printed boards	not clear	Information system			Information boards - No
>How are the operation times for underground facilities regulated (are there regulations for night time)?		mon - sat 6 - 24 Night time acces to open stace			7 am - 2 am	in 6 am - 12 pm out 24 hours	day and night open	6:30 - 24:00 for visitors All day and night for rented parking places
>Are there future prospects to improve the standards for accessibility?				no	Proper instalation of Elevaters and Escalaters	no	We are working on a new pedestrian access	Local illuminated signs showing "Full"; "Free Space"; "Closed"
>Are there special remarks concerning planning and installation (including environment) of access facilities?				no	Consideration of the appearance on the ground			Demands for ou deflecters

2-4 UNDERGROUND SHOPPING MALL AND OTHER FACILITIES

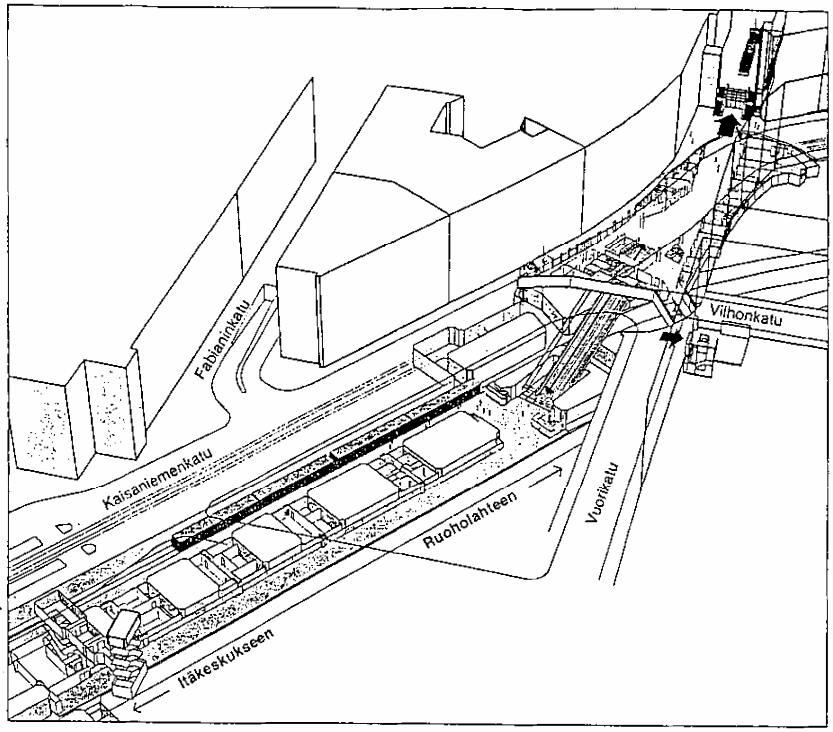
2-4-1 FINLAND
Illustration of Kaisaniemi Metro Station

2-4-2 JAPAN
Whity Umede, Underground Shopping Mall in City of Osaka

2-4-3 NORWAY
The Holmia Sports Hall & Swimming Pool in Rock

2-4-4 Questions and Answers for Accessibility to Underground Shopping Malls and Other Facilities (Tables)

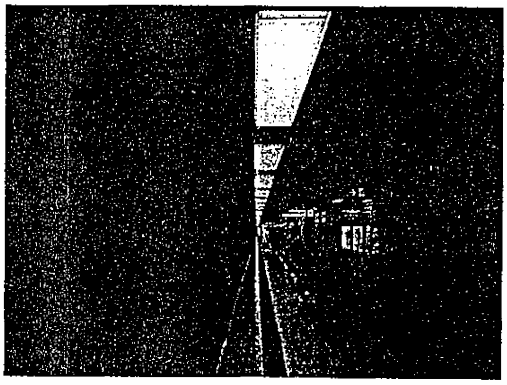
2-4-1 FINLAND Illustration of Kaisaniemi Metro Station



Technical information about the Kaisaniemi Metro station:

Cubic capacity	39 500 m³
- entrance hall	11 300 m³
- platform hall	28 200 m³
Total floor area	9 400 m²
- entrance hall	4 260 m²
- platform hall	5 140 m²
- waiting platform	1 660 m²
Technical and service space	2 050 m²
Staff rooms	120 m²
Entrance hall business space	800 m²
Entrance hall public space	1 732 m²
Platform length	135 m
Total platform hall width	34 m
Platform hall shelter area	3 500 m²

Entrance hall design: Architects Kontio - Kilpiä - Valjento Oy
Platform hall and escalator shaft design: Architects Esa Piironen Oy



The gunite rock wall is painted midnight blue.

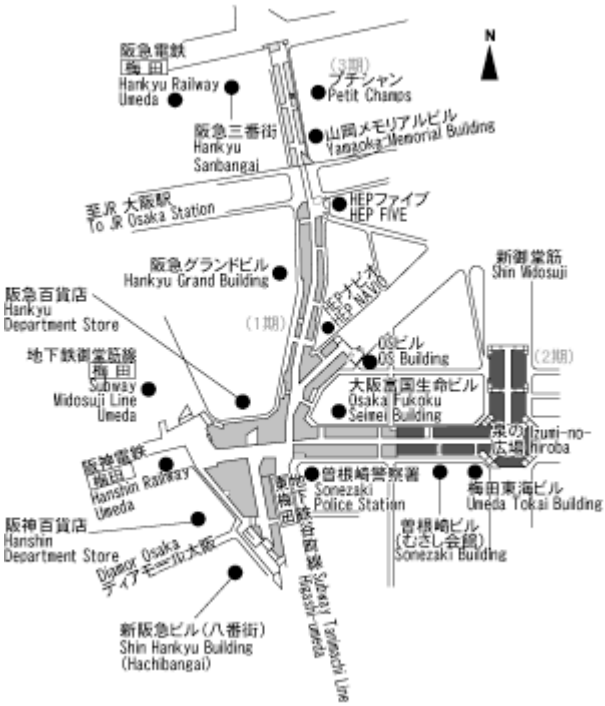
Promotor: Helsinki City Public Works Department, 1995

2-4-2 JAPAN Whity Umeda, Underground Shopping Mall in City of Osaka

In originally , Japanese underground shopping mall is built in public space on cooperate with private land and building sectors.

This underground shopping mall at city of Osaka is on of the latest and largest facilities in Japan which was built in cooperate with Ministy of land. Infrastructure and Transport.

Osaka Municipal Government and each private sectors.



Date of Completion :

1st Stage 29th Nov. 1963

2nd Stage 20th Mar. 1970

28th Mar. 1974

Total Area : 31,333 m^2

Visitor/Day :

600,000 visitors (approx)

Fountain Plaza

Petit Champs Mall

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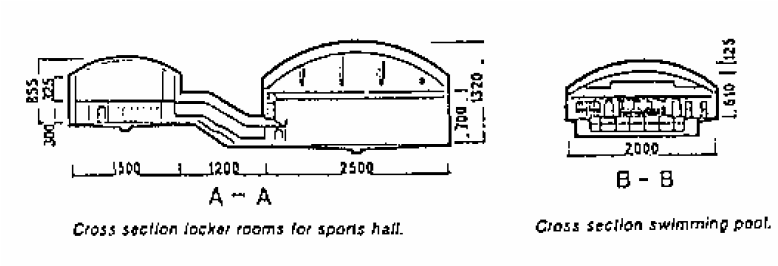
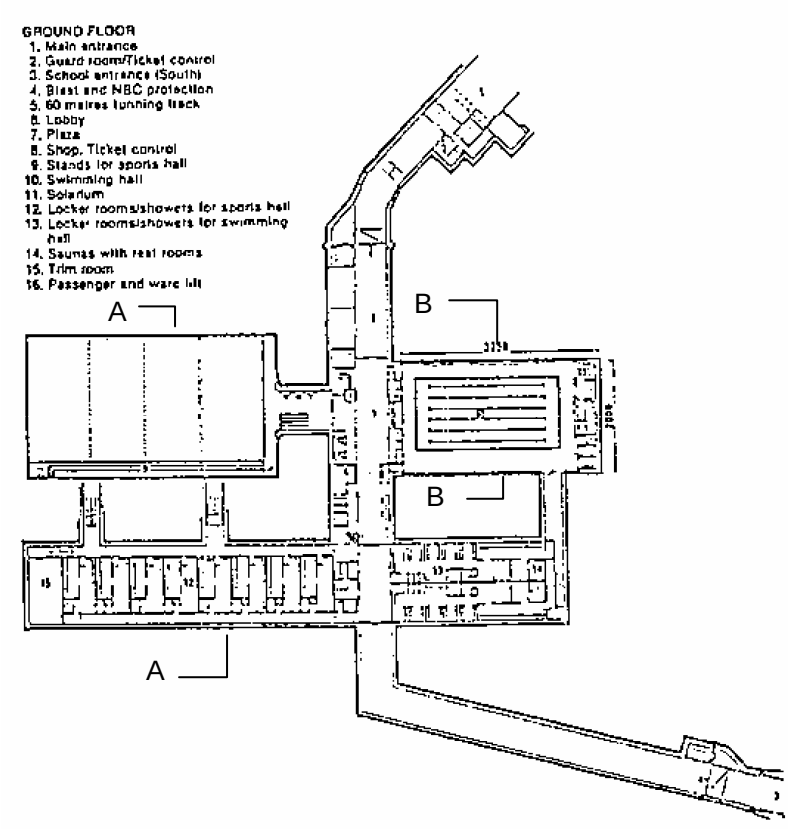
http://chikagai.osaka-chikagai.co.jp/chikagai/index.html

2-4-3 NORWAY The Holmia Sports Hall & Swimming Pool in Rock

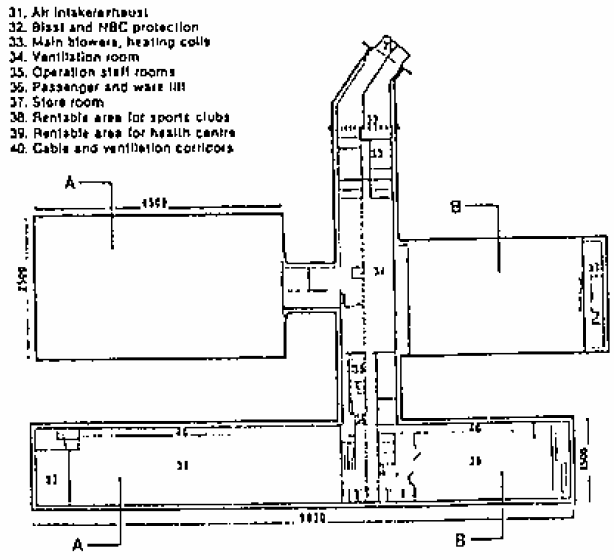
The Holmia Sports Hall and Swimming Pool is one of several large installations in rock in the Oslo region. The facilities are serving in peace time as gymnasiums, swimming pools, bowling halls, shooting ranges etc., and can in very short time be converted into wartime civil defence shelters.
Total floor area (basement, ground floor and 1st floor) is 7,550 square metres. Construction time: 1979 to 1983.



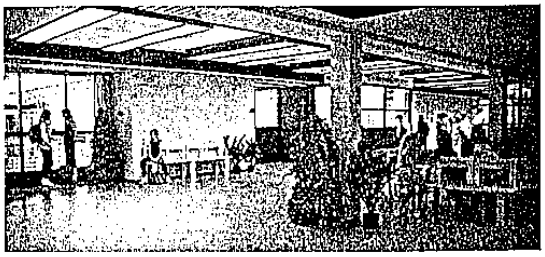
Plan – Basement /1st floor Lower part



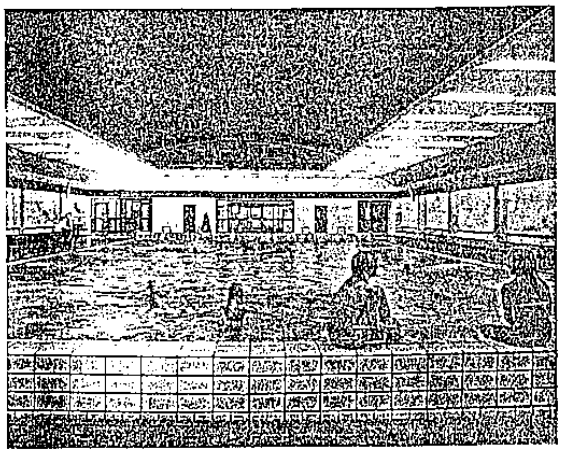
Plan – 1st floor



Plan 2nd floor



Plaza



Swimming pool

2-4-4 Questions and Answers for Accessibility to Underground Shopping Malls and Other Facilities

Table 5-1(1) ~ Table 5-1(4) presents the items of questions and answers from 3 Nations for accessibility to underground shopping mall and other facilities.

Table 5-1 Questions and Answers for Accessibility to Underground Shopping Malls and Other Facilities (1)

	Finland	Japan	Turkey
1. General			
>Name of Shopping Mall	Shopping level at KAISANIEMI station	Kurisuta Nagabori	KIZILAY ORTAK station
>Name of City	Helsinki, Finland	Osaka	Ankara
>Year of construction	1995	1997	December, 1997
>Means of transportation	Underground (Metro)		2 underground lines
>No. of users: people/day	10,000 - 15,000	130,000	
>Shopping Mall area: m^2	2,500 (of 4260)	81,818	20,000
>Number of underground floors	1 of 3	1 of 4	1
2. Design Standards			
2.1 Design Standards for Underground Shopping Malls			
Is the design of the shopping mall, including its accessibility, based on design standards? If yes, title of standard and name of issuer:	yes, Design guidelines of Helsinki Metro (by the transit authority of Helsinki) National building code (Ministry of environment) Helsinki building code (City of Helsinki)	yes, the Underground Shopping Mall Building Regulation, the Building Standards Act	yes, Institute of Turkish Standards
2.2 Design Standards for Accessibility Equipment			
(1) Are there specialized design standards for connection between the underground and the open space (width, ceiling height, slope, etc.)?: yes/no If yes, title of standard and name of issuer:	yes, Design guidelines of Helsinki Metro (by the transit authority of Helsinki) National building code (Ministry of environment) Helsinki building code (City of Helsinki)	yes, the Building Standards Act	yes, I.T.S., TSE
Miminum width of stairway: m	1.5	1.5	2.4
Minimum ceiling height of stairway: m	2.5	2.1	2.7
Slope of stairway (min. step area): cm	30	26	30
max. step height: cm	16	18	16.7
max. slope: %	50 (30 deg.)		30
(2) How are the entrance / exit connections between the underground structure and the open space positioned?			

Table 5-1 Questions and Answers for Accessibility to Underground Shopping Malls and Other Facilities (2)

	Finland	Japan	Turkey
Maximum distance between facilities (underground structure): m		30	-, direct entry to the mall from ground
Minimum number of connections	8	2	14
(3) Are there specialized design standards for transportation equipment (escalator, elevator)?: yes/no If yes, title of standard and name of issuer:	no	yes Summary of building gentle town for people	yes, I.T.S., TSE
Elevator Capacity: people	1,000 kg	11 (for wheelchair)	10
Velocity: m/min		-	
Escalator Effective width: cm		101	110
Velocity: m/min		30	150 pers/min
(4) Are there standards for the luminance intensity?: yes/no If yes, title of standard and name of issuer:	no	yes, the Building Standards Act	yes, I.T.S., TSE
Minimum luminance: lx	150 - 300	10 (for emergency light)	150
(5) Are there standards for the safety equipment?: yes/no if yes, title of standard and name of issuer:	no	yes, the Underground Shopping Mall Building Regulation, the Building Standards Act	yes, I.T.S., TSE
What kind of fire extinguishers are placed?		Sprinkler, fire extinguisher, fire	hydrant, sprinklers
(6) Are there standards for measures against water leakage?: yes/no if yes, title of standard and name of issuer:	no	no	no
What kind of equipment is placed?		Water stopage board	water pumps only at platform level
(7) Are there standards for equipment for disabled people?: yes/no if yes, title of standard and name of issuer:	yes	yes Summary of building gentle town for people	yes, I.T.S., TSE
(8) Do shopping malls have efficient and accessible information signs?: yes/no	yes	yes	yes
If yes, does the signing system facilitate orientation: yes/no	yes	yes	yes

Table 5-1 Questions and Answers for Accessibility to Underground Shopping Malls and Other Facilities (3)

	Finland	Japan	Turkey
Does the signing system show evacuation routes?: yes/no	yes	yes	yes
Does the signing system have interactive Information Points?: yes/no	yes	yes	yes
Are these elements accessible?: yes/no		yes	yes
(9) Are there special considerations for safety measures in general?: yes/no if yes, what kind of considerations:	yes, the rescue section of the Helsinki, Fire Dept. is consulted inf the design of facilities and equipment	yes, emergency push buttons in the lavatory, 181 ITVs in the shopping mall	yes, non slip floors, special elements for tread edges
2.3 Access Routes			
(1) Is there an aimed escape time (from underground structure to open space)?: yes/no	no	no	yes
If yes, what kind of considerations:			4 minites
(2) How are the access routes shaped? >Staircase: yes/no	yes	yes	yes
>Slope: yes/no	yes	no	yes
>Escalator: yes/no	yes	yes	yes
>Elevator: yes/no	yes	yes	yes
(3) What measures for disabled people are taken?			
Are establishments and equipment for public use in the shopping mall accessible to disabled people?: yes/no	yes	yes	yes
Are the areas for location of mobile element (tables, chairs, standing boards, etc.) arranged and marked such that they are easy to detect by blind people or people with visual difficulty?: yes/no	yes	yes	no
they do not interfere with the free movement of pedestrians?: yes/no	yes	yes	
Other measures for disabled users:		escalator, elevator, moving pavement, textured paving block	wheel chair users are considered, blind persons and can use the mall with regular people

Table 5-1 Questions and Answers for Accessibility to Underground Shopping Malls and Other Facilities (4)

	Finland	Japan	Turkey
2.4 Configuration of Access Routes			
(1) What kind of configuration do the access routes (to the open space) have?	separate access, in combination with building access, in combination with other underground facilities	sparate access	sparate access
(2) To what kind of open space does the access route lead to?	road, shops in the neighbouring buildings	road	road
3. Other information			
>What kind of equipment for sign and information are applied to the underground shopping mall?			
Sign boards	in the entrances, on shopping level and station platforms	general information, destination board	Signage system
Information boards	real-time displays on station platform only	3 multi-vision, FM satellite studio, voice navigation system, broardcasting system	On necessary locations
>How are the operation times for underground facilities regulated (are there regulations for night time)?	stations operating 5:30 - 23:30, but the shops genrally 9:00 - 20:00	close between 0:00 - 5:00	the mall open between 6:30 - 21:00 train oparations between 6:00 - 24-00
>Are there future prospects to improve the standards for accessibility?		connection to the other buildings	yes
>Are there special remarks concerning planning and installation (including environment) of access facilities?		this shopping mall connects to 4 subway lines and 5 subway stations basement 2-4th flore are the underground parking area, capacity 1,030 cars	