

Legal and Administrative Issues in Underground Space Use: a Preliminary Survey of ITA Member Nations

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Abstract—At the request of the Executive Committee of the International Tunnelling Association (ITA), the Working Group on Subsurface Planning of the ITA undertook a questionnaire survey of ITA member countries to examine legal and administrative issues relating to ownership of subsurface and restrictions on its development. Nineteen responses were received from mailings to thirty-five ITA member countries. This report summarizes these responses as they pertain to the following issues: Limits of Surface Property Ownership; Restrictions on Natural and Mineral Resource Exploitation; Ownership and the Right to Develop Subsurface Space; Major Permits Required; Application of Surface Land Use Regulations; Environmental Controls; and Restrictions due to Surface and Subsurface Structures. An ITA policy statement on subsurface planning also is included.

Résumé—A la demande du bureau exécutif de l'AITES, le groupe de travail "Utilisation du Sous-Sol" a fait circuler un questionnaire interrogeant les pays membres de l'AITES afin d'examiner les problèmes légaux et administratifs se rapportant à la question des droits de propriété des souterrains et des restrictions soumises à leur exploitation. Dix-neuf réponses ont été reçues sur 35 questionnaires adressés par courrier aux pays membres de l'AITES. Ce rapport présente un résumé des réponses concernant les questions suivantes: limites de droits de propriété au terrain, restrictions des exploitations des ressources naturelles et minérales, droits de propriété et droits de développement de l'espace souterrain, permis de construction principaux obligatoires, mise en place des règles sur l'utilisation du terrain, protection de l'environnement, et restrictions dues aux structures en surface et souterraines. Une déclaration sur la politique officielle de l'AITES envers le planning souterrain apparaît également dans ce rapport.

Introduction

Legal and administrative restrictions may act as significant barriers to the development and use of underground space (some examples of large-scale underground space use are shown in Figures 1 through 5). Below are listed some of the major reasons why studying the legal and administrative issues of underground construction is important:

1. *Integrated Planning.* Until a legal and administrative framework is developed to plan, regulate, and permit the use of subsurface space, it will be quite impossible to optimize underground facilities, both for the public and the private sectors. Such a framework will require more than merely extending traditional zoning and other forms of surface controls, because the problems and opportunities associated with underground space development are much more complex. Therefore, it is extremely important to encourage all member nations of the International

Tunnelling Association (ITA) to work toward proper planning functions in their respective governmental systems to attain the goal of integrated planning for underground space (see the

ITA Policy Statement on Subsurface Planning on the following page).

2. *Speculation.* It is generally known that the cost of subsurface construction is higher than the cost of

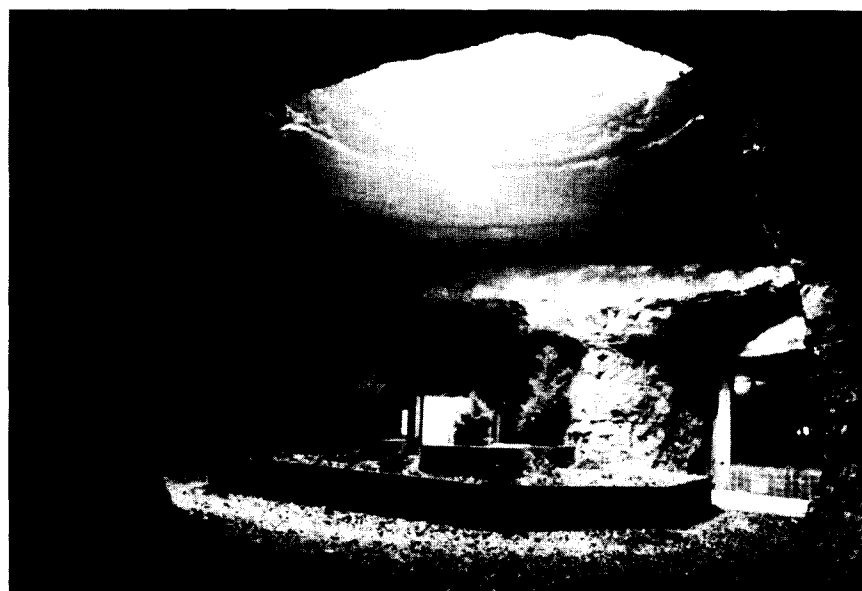


Figure 1. The combination of the textured natural rock walls, an atrium providing natural light, and a large planter adds warmth and interest to this office entrance area in a mined space development in Kansas City (Missouri).

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surface construction. The underground industry has been optimistic that high construction expenses can be offset by economies associated with lower property values below the surface. As underground construction technologies improve, speculation may occur in underground development rights and may serve to increase those costs as a component of development. Such an occurrence would have the net effect of restraining underground construction. It would seem reasonable that, prior to the more widespread use of underground construction, an administrative framework should be established to reduce the potential speculation in subsurface development rights. To leave this problem aside is to invite the under-utilization of underground space technology in the future.

3. *Project Delays.* In cases where no proper legal framework and permitting system is in place, highly beneficial underground projects can be delayed for very long periods of time while vested property interests are sorted out on an individual basis. There have been documented cases where two- to three-year delays have occurred over precisely this issue. While we are not prepared to propose any specific system in this report, this is one of the overriding issues that must be addressed so that both private and public construction can be undertaken without destructive delays.

4. *Environmental Protection.* There are countless examples all over the globe, mostly in industrialized nations, where both waters and soils have been excessively contaminated by irresponsible surface and subsurface construction. The careless utilization of the subsurface can lead to ground instabil-

ity, subsidence, and other potential threats to property and human welfare. A sound administrative and legal framework should certainly address these environmental concerns.

5. *Resource Extraction.* While the subject of our study was mostly directed to urban situations, there is

INTERNATIONAL TUNNELLING ASSOCIATION POLICY STATEMENT ON SUBSURFACE PLANNING

The Working Group on Subsurface Planning of the International Tunnelling Association has adopted the following general policy statement on the needs and benefits for planning of subsurface uses. The Working Group is continuing to refine more specific recommendations for policies and procedures.

The subsurface is a resource for future development similar to surface land or recoverable minerals. Once an underground opening is created, the subsurface can never be restored to its original condition and the presence of this opening can affect all future uses of the surface and the subsurface in its vicinity. These factors require responsible planning for all uses of the underground to ensure that the resource is not damaged or usurped by uncoordinated first uses.

The awareness of the underground option among planners, developers, and financiers should be increased so that subsurface planning issues are properly addressed. Subsurface planning should be an integral part of the normal land use planning process.

National, regional, and local policies should be prepared to provide guidelines, criteria and classifications for assessing appropriate uses of underground space, identifying geologic conditions, defining priority uses and resolving potential utilization conflicts. Site reservation policies should be established for important future uses and for especially favorable geologic conditions.

It is recommended that every region or city establish a permanent record-keeping system for the maintenance of detailed records of the use of the subsurface. This record-keeping should be coordinated by a single agency to ensure compatible and complete records and should include "as built" records rather than project plans. Records should include activities, such as groundwater extraction and deep pile foundations, which affect the potential use of the subsurface but which may not be classed as specific subsurface facilities.

little question that the administrative and legal system should cover the use of underground resources. Often, we see these resources being extracted in urban or urbanizing areas. Critical to the planning for the use of these resources is the development of extraction methods that do not compromise surface use or the further utilization of subsurface resources. There are too many examples of land that is rendered useless for additional development as a result of the exploitive and careless extraction of resources, whereas, had proper planning been done, these lands would still be available for surface uses as well as additional potential extractive activities. Our survey confirms that most extraction processes are considered quite separate in law from those that govern land use in urban systems. Yet these concerns are often inextricably linked. This is an area that will need a considerable amount of attention from experts in law and administration in each of the nations as effective planning and control systems are developed.

6. *Construction Liability*

Closely tied to the issue of development rights is the issue of liability. Problems for surface uses and earlier subsurface uses caused by new subsurface development should be capable of resolution in a speedy and fair manner.



Figure 2. A well-lighted underground shopping area in Tokyo uses rectangular patterns in the floor and wall to add contrast and interest to the space.

This can best be accomplished when laws and administrative procedures are in place to deal with these issues.

Current Study

In 1987, at the request of the Executive Committee of the International Tunnelling Association, the Working Group on Subsurface Planning of the ITA began to collect data on such legal and administrative issues.

A questionnaire was developed and mailed during the early part of 1987 to the 33 ITA member nations existing at that time, and 14 responses were received during mid- to late 1987. A preliminary tabulation of responses was completed during 1988 for review by the working group. In September 1989, the questionnaire was remailed to those ITA member countries that had not previously responded. The questionnaire was also mailed to 2 additional member countries admitted to the ITA since the previous questionnaire had been circulated. Five additional responses were obtained by mid-1990. This report is based on the total of 19 responses received. The names and addresses of the respondents for each country are given in Appendix A. The questionnaire is shown in Appendix B.

The questionnaire was not intended to be definitive in its detail or comprehensive in its coverage because of the complexity of legal issues and administrative law in most countries. Rather, the survey was intended to serve as a means of documenting the major similarities and differences among the countries responding, and of sharing information on how such issues restrict underground development. This report is a compilation of the responses from this first survey and is intended as a basis for future study by the working group.

The following section ("Major Legal and Administrative Issues in Underground Space") provides a brief review of the major legal and administrative issues that exist in most countries concerning underground space use. This material serves as a background for Section 3 ("Synthesis of Questionnaire Responses"), which summarizes the responses to the questionnaire by topic.

Major Legal and Administrative Issues in Underground Space Use

The protection of the rights of existing surface or underground users, the administrative control of mineral reserves of national importance, and the provision of personal safety and environmental protection are issues that must be resolved in all countries involved in underground construction or mining, regardless of their political structure. The major legal and administrative



Figure 3. In this Montreal shopping complex, which is partially below grade, escalators and stairways located within large interior atriums and near major circulation spaces help mitigate feelings of confinement, and improve orientation as well.

issues relating to underground space use are introduced in this section as a background for review of the questionnaire responses in Section 3. They are discussed under the same categorization as that used in the questionnaire (see Appendix B).

Limits of Surface Property Ownership

Because national territories, local jurisdictions and private ownership are normally defined in terms of boundaries of surface land area, it is necessary, for both underground space use and the use of airspaces, to define how surface ownership extends downwards to the underground and upwards to the sky.

The most common maxim applied to

this definition has been *Cujus est solum ejus est usque ad coelum et ad infernos*, meaning, "The owner of the surface also owns to the sky and to the depths". This extension of surface ownership was common in British, French, Germanic, Jewish and Roman law, and was cited as early as 1250 A.D. (Thomas 1979).

In countries that have centrally planned economies and ownership of resources, private land ownership is either nonexistent or very restricted. All of the underground and airspace is publicly owned. However, this does not eliminate the problems of determining the right to develop an underground facility. The rights of existing surface uses must be protected or compensated and competing claims to use

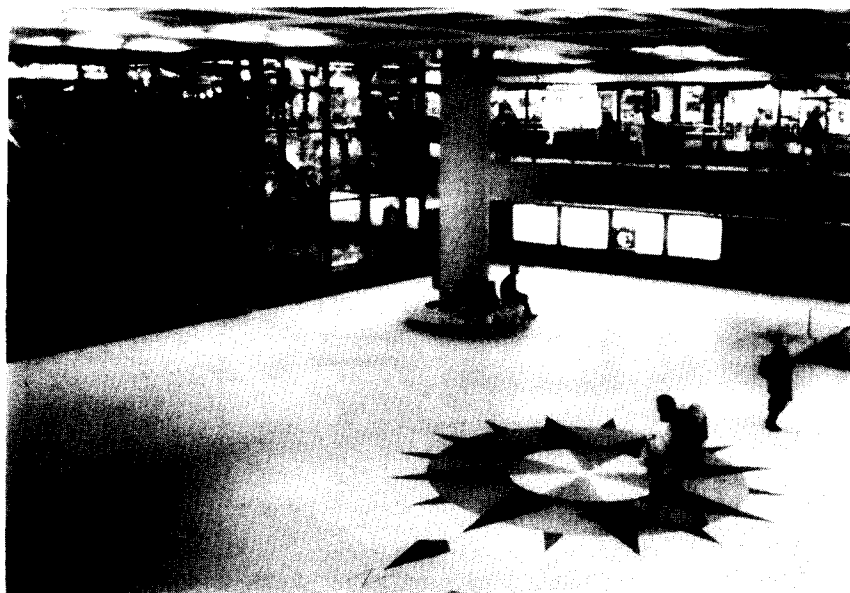


Figure 4. In this Helsinki (Finland) underground shopping and transit complex, a large compass on the floor is intended to assist people in wayfinding.

by different State organizations must be resolved.

A model often proposed to ease restrictions on underground development (especially in urban areas) is that surface ownership would only extend below ground to a distance which the owner could occupy and use in conjunction with the land. Such a restriction in surface ownership rights in the upward direction typically has been made as aviation developed in countries with private land ownership. In the United States, the Congress in 1926 and 1938 and the Supreme Court in 1946 limited the upward ownership of land to that which is needed for the enjoyment of the land. It was decided that trespass by an airplane would only be considered to have occurred if it entered into the immediate airspace above the land and interfered substantially with the owner's use and enjoyment of the land (Thomas 1979). As described in the questionnaire responses in Section 3, examples of both fixed depth and reasonable interest restrictions of underground ownership exist in the various countries responding to the survey.

It is possible to legally separate the ownership of the subsurface from that of the surface at particular depths or well-defined changes in geological formation. It is also common to separate the ownership of minerals from surface ownership (see the following section). When the ownership of underground openings is being defined, it must also be considered that an underground opening depends on a certain volume of soil or rock surrounding the opening for its stability or the overall stability of the ground structure. Thus, it is not likely that two major underground openings can be excavated immediately adjacent but on opposite sides of the same property line.

Exploitation of Natural and Mineral Resources

The occurrence of valuable natural and mineral resources below the surface has given rise to a variety of means of controlling the exploitation of these resources and severing the ownership of these resources from the ownership of the surface land.

The intent of the legal and administrative systems is generally to provide an orderly means for determining claims to the exploitation of mineral resources and preventing the deterioration of natural resources. Regulations differ in their aggressiveness in reserving mineral rights to the State or in the encouragement of private development of minerals of national importance. The questionnaire responses show a substantial variation in the governing structures for resource exploitation among the countries responding.

Some of the problems that have occurred in implementing laws governing resource extraction have included:

- Fluid resources in permeable ground strata are not fixed in space and, hence, are not fully amenable to control by geometric definitions based on surface land ownership. It is possible for one owner to withdraw fluid resources from beneath an adjacent owner's land by pumping from his own land, causing those resources to flow towards his well.
- When mineral rights are severed from the surface ownership rights, it may also be necessary to specify who owns any underground space left by the mining operation—the surface owner or the owner of the mineral rights.
- Extraction of high proportions of a mineral resource may not be

possible without causing surface settlement and damage to surface facilities. The extent to which mineral rights may be exploited with respect to interference with existing and planned surface uses must be specified.

Ownership and the Right to Develop Subsurface Space

In countries where mineral rights are held by the State, permission must be given to a private company or to a State agency to develop the resource. Likewise, in order to develop public underground facilities beneath one or more private surface landowners, the public entity must have the powers to negotiate an easement for the use of the subsurface with the surface landowner(s); or, if negotiation fails, to condemn the easement in the public interest. It is also possible that these powers may be invoked on behalf of a private company that will build or operate a needed public facility.

In many countries, legislation exists that defines the power of local, regional or national government entities to promote commercial development, urban renewal and infrastructure provision. This legislation may assist local units of government by granting condemnation rights for commercial development as part of urban renewal, and by providing favorable tax structures for encouraging such development. Because the implementation of such legislation is often politically sensitive, it is important to specifically identify whether underground development is intended to be included within the scope of those powers (Nelson 1985).

Requirements for Permits

Mining and underground excavation projects often require a wide range of permits for their construction and use.

Underground excavation and resource removal are regulated to control undesirable environmental impacts and excessive depletion of important natural resources. They are also regulated to assure safety for existing surface uses and life safety during construction, as well as to provide a healthy and safe environment in the eventual use of the space.

Because historically most underground excavations were for mining, defence or utility purposes, rather than for occupation and use by the public or a regular work force, underground excavations for non-mining purposes often have not had a well-defined regulatory basis. Building and life safety codes for surface structures usually have poor application to deep underground structures, and mining and construction regulations do not address the eventual use of space created by the

excavation process. This lack of definition in applicable regulations often has a negative impact on the ability to plan subsurface uses effectively.

The nature of the regulatory process varies from country to country and sometimes from region to region within a country. The summary of the questionnaire responses relating to required permits for underground development in the following section gives an indication of the similarities and differences in the permits required in the countries responding.

Application of Surface Land-Use Regulations

Most countries and regions have some forms of planning control that are exerted over the use of the land surface. These controls may take the form of protection of areas of natural beauty, maintenance of agricultural land, or zoning regulations that control the type and density of development in built-up areas.

Since underground space may permit functions to occur within the space independent of the surface land above, questions often arise as to the extent to which surface land-use regulations should apply to the development of underground space.

Land-use regulations may have several aims—for example, to preserve the aesthetic character of an area, to separate incompatible land uses, to avoid overloading community services with new development, or to encourage high-density development in certain areas. It is clear that some of the problems cited are not an issue if a structure is completely underground (e.g., the aesthetic issue), whereas others are not solved simply because the structure is

underground (e.g., overloading the community infrastructure). Even though it is not conceptually difficult to separate whether various land-use regulations have merit when applied to underground space use, it is usually not as easy to obtain a political consensus that allows the land-use or zoning regulations to be modified. Most new developments have some detractors who will oppose the modification of regulations or the granting of variances.

To forestall the need to apply for changes in land-use regulations on a case-by-case basis, some areas with the potential for underground development have developed and gained approval for a statement of the applicability of existing land-use regulations to any future underground developments (Kansas City and Minneapolis are examples in the U.S.A.).

Following a good geological investigation, it would be quite feasible for urban administrations to zone subsurface areas as being most suitable for certain purposes, such as storage, workshops, laboratories, etc. This zoning need not match the surface zoning if there is no conflict with surface uses.

Environmental Controls

The environmental impacts of underground developments may include some of the following problems:

- Lowering of regional or local groundwater tables as a result of pumping or drainage into underground structures. This action may in turn lead to the settlement of surface structures and the deterioration of existing building foundations.
- The potential of pollution of groundwater systems from the

underground facility.

- The provision of unwanted connections between different aquifers in a regional hydrologic system.
- Disposal of the excavated material.
- Introduction of ground vibrations, e.g., from subway systems.
- The usual environmental impacts of the type of facility constructed.

Restrictions Associated with Surface and Subsurface Structures

When mining, tunnelling or creating deep open-pit surface excavations, there is always a potential danger of creating undesirable ground movements that may damage existing surface or underground structures.

There are two parts to this issue:

1. Is it permitted that the underground or the surface structure be constructed if a significant risk exists or if conditions are especially critical (such as damage to a national monument or if a large loss of life would be involved)?

2. If such construction is permitted, who bears the liability for damage to existing structures? This question is not always clear-cut—for example, when development occurs above a mining area with anticipated ground settlement, or if the foundations of existing buildings were inadequate and were causing damage prior to the effect of any underground structure.

How the issues are resolved for various projects, in laws regulating land use, or in legal definitions of liability in different countries, seems to depend in large measure on the importance of the underground development to the country or region in which it is located. Where a mining development or a subway is considered a critical national or local need, regulations will tend to ensure that the project can proceed and that surface uses do not have an automatic priority (see, for example, the response from South Africa).

3. Synthesis of Questionnaire Responses

In this section, the responses to the questionnaire are summarized and arranged by question topic.

Limits of Surface Property Ownership

Four main conditions appear to exist with regard to surface property ownership limits:

1. The surface owner owns to the center of earth.
2. The surface owner owns as far as a reasonable interest exists.
3. The surface owner owns only to a limited depth beneath the land surface (as little as 6 m).



Figure 5. In the Les Halles underground shopping complex in Paris, mirrors along the upper wall make the ceiling appear higher and give the impression of space extending beyond the actual wall surfaces.

4. Private land ownership is almost nonexistent and, hence, the underground is also publicly owned.

Although the question did not distinguish between cases in which the basic presumption of ownership is to the center of the earth, the practical extent is that to which the owner can demonstrate a significant interest.

In the synopsis of responses shown in Table 1, a "yes" is given if the basic presumption is ownership to the center of the earth since, in many cases, it will then be necessary to demonstrate in court that an uncooperative owner, in fact, has no significant ownership right, even at great depth. A "no" is given if the surface rights are explicitly limited

or if there appears to be a presumption of public right below the immediate subsurface, i.e., the surface owner would have to prove otherwise. Countries in which all land is State- or publicly-owned have a "yes" answer because of the way the question was worded.

Table 1 shows the responses, by country, to the question: "For both private and publicly owned land, do rights to use extend to the core of the earth?"

Restrictions on Natural and Mineral Resource Exploitation

Depending on the type of resource - oil, gas, coal, mineral, aggregate, etc. several conditions appear to exist:

- Resources belong to the State—

they are managed by the State or others may obtain a concession to develop.

- Resources belong to the surface landowner.
- Resources may be developed by anyone who discovers them, notwithstanding surface ownership (limitations apply, depending on existing surface or subsurface uses).
- Mineral rights are severed from surface ownership and may be sold separately.
- The State reserves a share of the resource value.

A distinction is often made as to whether the mineral has economic value.

Table 1. Synopsis of responses, by country, to the question, "For both private and publicly owned land, to rights to use extend to the core of the earth?"

Country	Response	
Australia	Yes	
Belgium	Yes	
China	Yes	Land and the underground are publicly owned, but the right of use belongs to every factory, school, etc. Some land is rented to overseas corporations for 50 years. Building heights are restricted near airports indicating limits on airspace use above the land.
Czechoslovakia	No	Surface owner owns only "indispensable space" above and under the surface.
Denmark	No	Even under private land, all the underground (below "till" level - 6 m) is the property of the Nation. The right to use the underground is by concession rights.
Finland	No	In urban areas (covered by a town plan), underground facilities may be constructed beneath private land but the top of underground developments must be deeper than 6 m.
France	Yes	
Germany	Yes	Property owners rights extend into the space above and into the ground below. Owner cannot prohibit intrusion in such height or depth that he "has no interest in the exclusion".
Hungary	No	Land ownership is limited to the surface of the ground. The underground parts of a building (e.g., cellar or garage) also belong to the building owner.
Italy	Yes	In principle, all the underground belongs to the surface owner. In practice, ownership is limited to the extent of an actual interest of the owner in a real usage. Outside this zone, the underground belongs to the state.
Japan	Yes	The land property rights extend upward and downward "as far as any interest might occur".
Mexico	Yes	All property considered to be of public interest is "public (Nation's) property".
Norway	No	In urban areas, without a concession no surface developments can be deeper than 6 m.
South Africa	Yes	
Sweden	Yes	Local authorities may impose restriction within their region of authority.
Switzerland	Yes	Ownership extends as far as a plausible interest can be manifested.
U.K.	Yes	Mineral rights may be severed from surface ownership and surface owner has common law right of support.
U.S.A.	Yes	
Venezuela	Yes	Except when natural resources are discovered.

Groundwater extraction restrictions vary significantly. In South Africa, groundwater may be withdrawn even if it causes damage to a neighbor's property, as long as malice is not intended. In Norway, groundwater may be extracted only as long as no inconvenience is caused to others. In some other countries, groundwater is considered public property and can be used only in amounts and for uses that will not harm the environment.

Tables 2 through 6 show the responses, by country, to questions con-

cerning restrictions on natural and mineral resource exploitation. The responses are grouped by type of resource: water, oil/gas, coal, metals and minerals, and others.

Ownership and the Right to Develop Subsurface Space

The right to develop subsurface space can usually be assigned to any responsible party. Who arranges this development depends on the ownership and resource rights described above.

In Denmark a time-limited concession is given for subsurface development.

Table 7 shows the responses, by country, to the question: "Except for portal or access areas, can subsurface space be developed by any responsible party?"

Major Permits Required

Among the countries responding, many similarities exist in the permit-granting agencies for subsurface development. Sometimes there is a lack of clarity as to which set of regulations

Table 2. Synopsis of responses to questions regarding types of restrictions on water resource exploitation.

Country	Type of Restriction
Australia	Control of use of groundwater vested in State Government
Belgium	According to the laws.
China	State owns both the underground and all resources.
Denmark	Permit required for extracting and discharging water. Restrictions are directed towards protecting the quantity of water available and preventing pollution.
Finland	No restrictions.
France	Any wells over a specified length (depending on local hydrogeology) must have an authorization.
Germany	Regulated by the Water Resources Act. Groundwater is not regarded as the property of the landowner. Landowners can apply at any time to the Federal Authorities for permission to exploit the water resources.
Hungary	Artesian water has a separate law. Permission for exploitation must be obtained from the State.
Italy	Groundwater resources which are or can be used in the public general interest are public property and subject to special authorization for special as well as for catchment usages.
Japan	Groundwater withdrawal regulations for industry or building use exist.
Mexico	Water resources considered to be of public interest are public property.
Norway	Groundwater may be exploited by the land owner as long as no inconvenience is caused to others.
South Africa	A landowner may withdraw water even if it causes prejudice to his neighbor, as long as the water is not taken with the objective of causing harm to the neighbor. The owner of a mine may remove water from the mine area if it is necessary for the efficient carrying on of the mining operation or for the safety of persons involved in the mining operations or use the water for mining operations or domestic purposes connected therewith.
Sweden	Parliamentary sanction needed for using ground-water resources.
Switzerland	A concession must be obtained from the Canton.
U.K.	Underground water not owned unless it flows in a well-defined stream. Extraction governed by law and requires a licence (except in cases where, for example, water extraction is an integral part of mineral extraction).
U.S.A.	Restrictions at both State and National levels. Restrictions on both withdrawal and injection of water from/into the ground.
Venezuela	Government controls the right in public areas.

should apply, e.g., mining or building code. Most countries require several permits, involving each of the governmental levels. State ministries or agencies usually control permits related to the use of the space, e.g., oil storage, rail tunnel, etc. Local planning permission usually must be obtained.

No responses by country are presented herein because the permit requirements are too specific to be summarized

Application of Surface Land-Use Regulations

In most countries responding to the questionnaire, land-use zoning does extend to the subsurface. In a few it does not. For the remainder, zoning does not extend to the subsurface mostly as a result of a lack of clarity in the application of surface-based laws. Land use zoning is usually not as clearly developed for the subsurface as it is for the surface.

Table 8 provides a synopsis of the responses, by country.

Environmental Controls

Environmental controls usually exist or environmental concerns can usually be invoked to restrict subsurface development if necessary. Some mining laws or other laws regulating underground development specifically address environmental protection but

Table 3. Synopsis of responses to a question regarding types of restrictions on oil/gas resource exploitation.

Country	Type of Restriction
Australia	Control of exploitation of oil/gas resources vested in Commonwealth (Australian) Government.
Belgium	According to the laws.
China	State owns both the underground and all resources.
Czechoslovakia	All mineral wealth is government property
Denmark	Exploration and exploitation require permission from the Danish State. The permission is subjected to several restrictions as, in principal, the Danish State owns the Oil and Gas Resources. The restrictions apply to economy, time, safety, use, engineering, environment, etc.
Finland	The Finnish Mining Law does not include provisions for oil and gas.
France	Any research and exploration needs authorization and concession.
Germany	Regulated by the Federal Mining Law. Oil and gas are not regarded as property of the landowner.
Hungary	May be developed only by State-owned organizations.
Italy	Mineral deposits are not privately disposable. They are attributed to the State unless they are in an autonomous region, in which case, they are generally attributed to the region. The State or regional government must authorize either State or private company development of the resources.
Japan	Mining law applies to minerals or resources of economic value. The surface owner should accept the development of mining rights. The surface owner has priority on the surface or in the shallow subsurface
Mexico	Oil and gas are public property.
Norway	Subsurface oil and gas are national property, managed by the Federal Government. Exploration and exploitation permissions are issued after application to the Federal Government.
South Africa	Exploration of oil/gas resources is reserved to the State or its designated agent(s).
Sweden	Parliamentary sanction is needed. A state share is a right.
Switzerland	A concession must be obtained from the Canton.
U.K.	Petroleum resources are the property of the Crown. Exploration and production are licensed and subject to planning permission.
U.S.A.	Private companies may develop the resources under government controls after agreement has been reached with the landowner.
Venezuela	In all cases, the rights belong to the government.

Table 4. Synthesis of responses to a question regarding types of restrictions on coal resource exploitation.

Country	Type of Restriction
Australia	Control of exploitation of coal resources vested in State Government.
Belgium	Exploitation according to the laws.
China	State owns both the underground and all resources.
Czechoslovakia	All mineral wealth is government property.
Denmark	Exploration and exploitation require permission from the Danish Federal Government.
Finland	The Finish Mining Law does not include provisions for coal exploitation.
France	Any research and exploration needs authorization and concession.
Germany	Regulated by the Federal Mining Law. Coal resources are not to be regarded as property of the land owners.
Hungary	May be developed only by State-owned organizations.
Italy	Mineral deposits are not privately disposable. They are attributed to the State unless they are in an autonomous region, in which case, they are generally attributed to the region. The State or regional government must authorize either State or private company development of the resources.
Japan	Mining law applies to minerals or resources of economic value. The surface owner should accept the development of mining rights. The surface owner has priority on the surface or in the shallow subsurface
Mexico	Coal is Public Property.
Norway	Coal is the property of the land owner.
South Africa	The holder of mineral rights enjoys a preference over the owner of the freehold provided that the mining work is exercised in a reasonable manner, least injurious to the surface property. The owner of the land is obliged to do nothing on the surface which would interfere with holder's right to sever and remove the minerals.
Sweden	Parliamentary sanction needed. A state share is a right.
Switzerland	A concession must be obtained from the State.
U.K.	All coal and mines of coal are publicly owned. Extraction may be licensed to other contractors or operators.
U.S.A.	Private companies may develop the resources under government controls after agreement has been reached with the landowner.
Venezuela	In all cases, rights belong to the government.

Table 5. Synthesis of responses to a question regarding types of restrictions on metal and mineral resource exploitation.

Country	Type of Restriction
Australia	Control of exploitation of metal and mineral resources is vested in State Government.
Belgium	Exploitation according to the laws.
China	State owns both the underground and all resources.
Czechoslovakia	All mineral wealth is government property.
Denmark	Exploration and exploitation require permission from the Danish Federal Government.
Finland	A Finnish citizen or company has the right to exploit metal or mineral resources even under another property (with some restrictions). A concession must be approved by the government and compensation paid to the surface landowner.
France	Any research and exploration needs authorization and concession.
Germany	Regulated by the Federal Mining Law. Land owner can at any time submit an application to Federal Authorities for permission to exploit the metal resources.
Hungary	May be developed only by State-owned organizations.
Italy	Mineral deposits are not privately disposable. They are attributed to the State unless they are in an autonomous region, in which case, they are generally attributed to the region. The State or regional government must authorize either State or private company development of the resources.
Japan	Mining law applies to minerals or resources of economic value. The surface owner should accept the development of mining rights. The surface owner has priority on the surface or in the shallow subsurface. Otherwise, the owner of the mining rights possesses the rights for underground use in a mining lot (unless infringing on other's legal profit).
Mexico	Metal and mineral resources are public property.
Norway	All Norwegian citizens may exploit metals. Minerals are the property of the land owner.
South Africa	The holder of mineral rights enjoys a preference over the owner of the freehold provided that the mining work is exercised in a reasonable manner, least injurious to the surface property. The owner of the land is obliged to do nothing on the surface which would interfere with holder's right to sever and remove the minerals.
Sweden	For metals, mining law regulates claims and concessions. State share might be required depending upon costs and income. For minerals, a permission for exploitation is also needed and must obey environmental laws.
Switzerland	A concession must be obtained from the Canton.
U.K.	Surface owner owns other metals and minerals except for gold, silver and uranium minerals which belong to the Crown. Mineral rights may be severed by negotiation. Compulsory rights to work minerals can be obtained in some cases.
U.S.A.	Private companies may develop the resources under government controls after agreement has been reached with the landowner.
Venezuela	In all cases, rights belong to the government.

others do not. Permits may be required at any administrative level according to the aspect of environmental protection being considered.

No responses by country are presented herein because the permit requirements are either too specific to be summarized or apply to all forms of development, whether or not they are underground.

Restrictions Due to Surface and Subsurface Structures

In most countries, subsurface development is restricted so as to cause

the minimum amount of damage to existing structures. The responsibility for the damage usually rests with the underground developer (if cause and effect can be proven). In South Africa, the mining laws reverse this condition for undeveloped land, and restrict surface development above identified mineral resources. Table 9 gives a synopsis of responses, by country.

Additional Comments

Questionnaire respondents were asked to comment on the survey and to cover any items that they felt were

important but were not included in the survey. The areas identified and comments made are summarized below.

Canada: Although no survey was returned, information from Jacques Besner, Director of Planning, City of Montreal, indicates that no easement cost is necessary for sewers more than 10 m deep and subways more than 15 m deep.

China: More participation in the study by experts in architecture, planning, management, construction, underground space use, etc. More information on the establishment of gov-

Table 6. Synthesis of responses to a question regarding restrictions on exploitation of other natural resources. Only differences from restrictions on metals and minerals are noted.

Country	Type of Restriction
Australia	The Australian Government has granted Aboriginal owners overriding rights on mining within their reserves. This does not apply to non-aboriginal owners in some States. Australian Government controls mining in National Parks/World Heritage Areas.
Denmark	Permission from the Danish State is necessary for exploration, extraction and utilization of sand and gravel. The restrictions are mainly to protect existing resources as well as environmental regulations.
France	Construction materials and minerals only require authorization for extraction, not a concession.
Hungary	Surface owner may develop building material resources for his/her own use.
Italy	Quarries belong to the land owner. However, exploitation must be authorized by the Regional Government. If the surface owner stops exploiting these materials, these too may be subject to the Regional Government, treated as mining enterprises and entrusted to other companies.
Japan	Minerals without economic value are at the disposition of the owner of the land property rights.
Norway	Alluvial gold is the property of the Norwegian State.
Venezuela	Any type of subsoil resource needs government authorization to be exploited even if it is located in private property.

ernment structures to plan and manage the long-term development of underground space. Collect and disseminate policies on subsurface development in countries around the world. Study and advocate three-dimensional city planning. Establish case histories of urban underground planning. Research human responses to underground environments. In China, the urban construction department has stipulated that a certain proportion of surface building funds must be used for subsurface construction.

Finland: More consideration of oil and gas storage in underground caverns, semi-underground caverns and storage of nuclear waste.

France: More consideration of the utilization of developed natural cavities.

Germany: More information on the rates of compensation to surface owner depending on the depth of the underground facility. An example of a rate structure from W. Germany was included.

Japan: More consideration of subsurface use in highly built-up areas.

Mexico: More information needed on potential restrictions on subsurface development.

U.K.: Questionnaire is too broad. More detailed study of different types of developments in practice would be useful. Study should differentiate between countries with centralized controls of underground development and those where controls are decentralized and responsive.

4. Conclusions and Future Activities

The survey of legal and administrative issues in ITA member countries was intended as a first step in a continued effort to study the institutional impediments to an increased use and a wise use of underground space.

The responses have indicated a similarity of issues to be addressed in the various countries—as might be expected—but also a significant divergence in the way some of these issues are handled in legislation and administrative structure.

The working group recommends further study of these issues and, in particular, concentration on the following areas:

- Following up on the impact of radically different subsurface ownership policies (such as in Denmark) on the ease of development of underground facilities.
- Comparison of the value assigned to easements for underground facilities at different depths. It is believed that a compilation of the practices of various countries in this regard will be useful to all in establishing precedents for the valuation of contested easements.
- Documentation of the administrative structure and data-keeping practices of selected urban areas with respect to subsurface space use. Urban areas that have made a significant attempt to

coordinate such record-keeping should be targeted.

- A comparison of the building code and life-safety requirements for occupied underground facilities in various countries. The ITA already has a working group concerned with safety during construction; however, there has been little research activity relating to differences in health and safety regulations for the use of underground facilities, although such facilities can have a significant impact on the viability and cost of occupied underground facilities.

Contributions and participation in the study of these and other issues related to the planning of subsurface use are welcomed. Interested parties should contact any of the members or correspondents of the Working Group listed in Appendix A. □

Acknowledgments

The compilers and authors of this report would like to gratefully acknowledge the efforts of the many people who contributed to this report. Foremost are the representatives of each of the member nations of the ITA who responded to the survey (see list below). Michael Barker designed the questionnaire and coordinated the research with the working group members, correspondents and the Executive Council of the ITA. He also wrote the introductory statement in Section 1. Syver Froise compiled

Table 7. Responses to the question, "Except for portal or access areas, can subsurface space be developed by any responsible party?"

Country		Response
Australia	Yes	Party developing space (if private development, this party would normally be the surface property owner).
Belgium	Yes	Generally, exploiting operator must be its owner or tenant.
China	Yes	Right of use can be to the party that developed the space but the State retains the proprietary right.
Czechoslovakia	Yes	
Denmark	No	The right to develop subsurface space is given by the Danish State, usually in the form of a time-limited concession. The Danish State usually exercises supervision on the use of the concession. The surface rights normally apply only to "till" level.
Finland	Yes	A building permit is required for the portal/access areas as well as a deed for the ownership of land or a written permission from the land owner.
France	Yes	The space is owned by the surface owner or any other party having purchased the volume needed for development..
Germany	Yes	The surface owner owns the space unless it is transferred by sale or the granting of an easement.
Hungary	No	Only State-owned firms may have permission for underground development except in cases such as garages, basements, cellars, metro, utilization of caves, etc., where any firm may do the work with the permission of the owner.
Italy	Yes	Surface space may be used by the land owner, or by everybody who has acquired or purchased the real surface right of the ground owner.
Japan	Yes	Space is owned by the owner of the mining rights.
Mexico	Yes	The owner of the property may initiate development if it does not interfere with the Nation's or public interest.
Norway	Yes	Unclear whether or not the party in question owns the space, or only a right of use is acquired.
South Africa	Yes	The subsurface space may be owned by a Surface Right Permit holder on proclaimed mining land as long as it is used for the purpose for which it was granted. On other land, subsurface space may be developed under a registered servitude and the space belongs to the registered owner of the servitude.
Sweden	Yes	Subsurface space is owned by the owner of the surface. Building permits have not normally been required for excavation works.
Switzerland	Yes	The responsible party owns the space.
U.K.	Yes	In general, the subsurface space is owned by the surface owner. Some doubts exist on ownership of space in long-abandoned mines.
U.S.A.	Yes	The surface land owner owns the subsurface space unless specifically transferred to another.
Venezuela	Yes	The private party owns the space.

preliminary results of the first questionnaire responses. Sebastiano Pelizza circulated a questionnaire on "Underground Space as a Georesource" and prepared the basis for the policy statement on subsurface planning. The Underground Space Center, acting as a consultant to the Working Group on Surface Planning, prepared the final report. Raymond Sterling was the principal author. Sara Hanft and Andrea Spartz assisted with the typing. All members of the working group acted as reviewers of the report and many added valuable suggestions.

The questionnaire respondents were: Australia, A. D. Henderson and R. Bushnell; Belgium, L. Van Hove, A. Wittemans and P. Hostyn; China, Q. Gao and X. Hou; Czechoslovakia, J. Gran; Denmark, F. Schaarup; Finland, S. Johansson; France, P. Duffaut and J. Brégeon; Germany, W. Dietz; Hungary, M. Müller; Italy, L. Orusa and S. Pelizza; Japan, K. Matsushita; Mexico, L. V. Utesa; Norway, S. Froise; South Africa, N. Schmidt; Sweden, T. Fránzen, B. Jansson and A. Grönvall; Switzerland, F. Ruckituhl;

U.K., R. N. Craig; U.S.A., R. Sterling; Venezuela, A. D. Aidos.

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Table 8. Responses to the question, "Does land-use zoning extend to the subsurface?"

Country		Response
Australia	Yes	No restrictions.
Belgium	Yes	As a rule, town planning deals with everything related to regional development without depth limitation.
China	Yes	No limits.
Czechoslovakia	No	The Code of Construction law applies only to the surface.
Denmark	No	The State owns the underground and exerts control. Use of the subsurface is regulated by the Danish Subsurface Law.
Finland	Yes	This is applicable to subsurface space where human beings work either temporarily or permanently.
France	No	
Germany	Yes	Each construction activity, including underground activities, must be approved by the responsible authority. Existing legal obligations have to be observed also in connection with underground constructions.
Hungary	No	Only general statements pertain to underground spaces (e.g., references to mining).
Italy	Yes	Within the extent of the real usage of the underground.
Japan	Yes	No distinct prescription of depth. Even for the construction of a deep subway, the establishment of rights of use and earnings is obliged.
Mexico	No	Most land use regulations only deal with surface conditions although consideration is now being given to regulations relating to underground utilities.
Norway	Yes	Zoning extends as deep as the subsurface can be used. In urban areas, one is not allowed to build surface structures that are deeper than 6 m.
South Africa	No	Land use zoning does not normally extend to the subsurface. See discussion of subsurface ownership and mineral exploitation.
Sweden	Yes	The new Swedish Building Code will establish present standards, particularly as regards the avoiding of negative effects on the groundwater table.
Switzerland	Yes	As far as a plausible interest can be manifested.
U.K.	Yes	Planning acts apply to all development in, on, over or under the ground. There is no bar to the use of the subsurface being different from that of the surface.
U.S.A.	No	The situation may vary from one locality to another. Surface zoning regulations must be met at surface access points but, where specifically provided for in statutes or regulations, underground uses do not have to match the surface zoning.
Venezuela	No	Depends on the plans submitted and approved by municipal authorities. Some uses would not be approved for the underground, e.g., underground apartments.

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Table 9. Responses to the question, "Please state restrictions on the use of the subsurface due to existing surface and subsurface structures."

Country	Response
Australia	Restrictions of use of sub-surface same as surface, e.g. Local Government Act covers Public Health and Safety, Dangerous Goods Act covers storage or materials, various Acts exist for control of pollution. Common Law liability in negligence applies. Permitting Authority is also bound by liability in negligence.
Belgium	The legal permissions provide for exploitation limitations from the ground surface and the operator has liability for all consequences of his exploitation. The permissions for the other occupancies must each time provide for all the limitation and liability cases.
China	Government departments determine the standards for the work. The underground structure should not influence the building above, otherwise the contractor must assume financial liability for losses.
Czechoslovakia	No restriction if underground structure will not affect surface use.
Denmark	Danish law allows the possibility of expropriating existing surface and subsurface structures where necessary. Damages to existing surface, etc. are negotiated by the parties involved, but where conditions demand, the existing surface is expropriated under the expropriation law.
Finland	Existing ground water balance shall not be disturbed, e.g. plants, and forests. A protective distance to existing surface and subsurface structures must be left. Generally the liability for any damage caused is with the party that causes this.
France	The owner of the surface controls the use of the subsurface.
Germany	Construction activities under existing buildings have to be tolerated - as long as they are in the interest of the public. If this is not accepted, then the necessary space can be expropriated following a formal lawsuit and the surface owner can be forced to tolerate the construction.
Hungary	Buildings must be protected in advance, if possible. Construction prohibition is ordered over undermined areas until subsidence ends. Mining firm is responsible for any building damage in area affected by mining. Mine tunnels must be backfilled.
Italy	For hazardous waste disposal (under Civil Code Art. 866), the underground cannot be used outside of normally acceptable pollution limits, or if any damage of ground constructions may ensue.
Japan	For subsurface use underneath public spaces such as roads, parks, and so forth, the permission of the superintendent is necessary.
Mexico	Once the public interest is dictated, it overruns other laws and restrictions. There is no retroactive imposition in liability issues and there exists the issue of indemnification or compensation for property affected.
Norway	Use of the underground which could cause damage to existing surface or subsurface structures requires permission (agreement) with the owner of these structures or an expropriation.
South Africa	No mine owner shall carry on mining operations under or within a horizontal distance of 100 metres from buildings, roads, railways or any structure whatever or any surface which it may be necessary to protect, without the permission of the Inspector of Mines. Except in the case of proclaimed land no building, roads, etc., shall be erected or constructed over or within 100 metres from workings except with the written permission of the Government Mining Engineer and on such conditions as he may prescribe.
Sweden	A map of underground installations has been established to provide a basis for planning future use. In detailed development plans, some tunnels are legally provided with protective zones so that the rock mass that is of structural importance for the stability of the tunnel will not be affected by other construction.
Switzerland	None, except if a plausible interest can be manifested by the owner of structures and that these may be touched or endangered.
U.K.	No overriding legal restrictions. Surface owner has common law right of support and may seek an injunction against potential damage or compensation for actual damage. The coal mining authority has a right to withdraw support to the surface but must compensate for damage.
U.S.A.	Unless otherwise stipulated, the party undertaking the underground construction is liable for any damage caused.
Venezuela	There are no restrictions on the government or municipal authorities for public uses. For private use, the land owner is the one who restricts its use.

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QUESTIONNAIRE

Working Group on Subsurface Planning

Please read entire questionnaire before preparing answers

Instructions	Questions														
<p>The purpose of this question is to determine whether there is a depth restriction to surface property rights. In following questions other restrictions will be investigated.</p>	<p>1. For both private and publicly owned land, do rights to use extend to the core of the earth?</p> <p>Yes: _____ No: _____</p> <p>Restrictions:</p> <p>Depth limit: _____</p> <p>Others:</p> <p>Comments:</p>														
<p>This question attempts to determine in broad terms the common kinds of restrictions imposed on surface property owners relative to underground <i>natural resources</i>. We realize that this is a complex question. Please add, in narrative form, as much detail as you feel is appropriate and attach information you feel is relevant.</p>	<p>2. Common restrictions relative to exploiting subsurface resources:</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 40%; text-align: left;">Resources</th><th style="text-align: left;">Describe type of restriction</th></tr> </thead> <tbody> <tr> <td style="padding: 5px;">Water (e.g. all water in public domains)</td><td></td></tr> <tr> <td style="padding: 5px;">Oil/gas</td><td></td></tr> <tr> <td style="padding: 5px;">Coal</td><td></td></tr> <tr> <td style="padding: 5px;">Metals</td><td></td></tr> <tr> <td style="padding: 5px;">Minerals</td><td></td></tr> <tr> <td style="padding: 5px;">Others</td><td></td></tr> </tbody> </table>	Resources	Describe type of restriction	Water (e.g. all water in public domains)		Oil/gas		Coal		Metals		Minerals		Others	
Resources	Describe type of restriction														
Water (e.g. all water in public domains)															
Oil/gas															
Coal															
Metals															
Minerals															
Others															

Instructions	Questions
<p>This question (as opposed to question 2, which deals with the ownership of natural resources) deals with the ownership and right to develop <i>subsurface space</i>. Please feel free to elaborate on the answer since this question is very general.</p>	<p>3. Except for portal or access areas, can subsurface space be developed by any responsible party?</p> <p>Yes: _____ No: _____</p> <p>If yes, who owns the space?</p> <p>If no, explain limits of surface rights:</p>
<p>This question is a first phase of more study of the permitting process. Here we are attempting to generally quantify the source and number of permits required in each country.</p>	<p>4. Major public and private permits required for subsurface development. Please list by permitting authority:</p> <p>a. National</p> <p>b. State or Provincial</p> <p>c. Municipal</p> <p>d. Other</p>

Instructions	Questions
<p>This question covers not only regulations by also issues of <i>liability</i>. Please bear with us on this very general question and be as complete as possible. You might wish to include research materials or references.</p>	<p>7. Please state restrictions on the use of the subsurface due to existing surface and subsurface structures.</p>
<p>This question invites you to comment upon the survey and cover items you feel to be important, but have been left out. Please be frank in your response.</p>	<p>8. Granting that this survey is very general and is just a beginning, are there any major areas you feel were left out? Please describe.</p>

Name: _____

Address: _____

Date: _____