Rotterdam Blaak station.

Going underground: light, air and space!

Building underground is becoming more common. For transport infrastructure and retail, commercial and leisure functions, underground spaces can offer surprising advantages – and save money. Design and safety are key components in making underground facilities successful. Inge van Berkel of the Netherlands Centre for Underground Construction reviews the case for going below ground.

Inge van Berkel, Netherlands Centre for the Underground Construction (COB), Gouda
Photos: Netherlands Centre for the Underground Construction (COB), Gouda

During an unexpected diversion on the Rotterdam metro I passed Beurs, Oostplein, Voorschoterlaan, Gerdesiaweg and Capelsebrug stations. For me and my fellow stranded train passengers, the alternative metro routes were well signposted and clear, and the brightly lit stations soon cleared up my morning sleepiness. But at Kralingse Zoom it was suddenly much darker; here the station is above ground and the day was still dawning. The next day a lorry crashed into a metro train further up the same stretch of line. These two experiences in one week do not seem to fit our expectations about the underground. The benefits of going underground often go unnoticed.

More and more developments are going underground. Not everywhere, but where land is in great demand. Economics and safety are the main reasons. Countless examples already exist: dwellings wholly or partly underground, offices, tunnels for all possible modes of transport, car parks, public records and archives, museums and water storage facilities. They all show that the restrictions on working underground can be exploited to raise quality. Many examples can be found in a book published in 2002 by the Netherlands Centre for Underground Construction (COB),[1] which showcases buildings that could never have been built above ground, such as the Guggenheim Museum in Salzburg, a museum without an exterior but with a uniquely sculptured interior – a work of art in itself.

EXTRA VALUE FOR MONEY

The benefits of going underground can be counted in euros recovered per square metre. Making double use of the land returns a profit, once the initial investments costs have been written off. The underground functions free up space above ground for a range →

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of other activities, from intensive uses, such as homes and offices (above underground car parks, for example) to more extensive activities, such as boulevards and wildlife sites/nature parks.
The extra benefits in these cases comes from the above-ground uses or combination of uses. Value added can be measured in terms of improved quality, too. Under certain conditions the underground element creates a multiplier effect: a successful underground function can become an attraction in itself and generate increased flows of shoppers, for example, or museum-goers. Examples include the much talked about Koopgoot in Rotterdam, the Souterrain in The Hague and the Beelden aan Zee museum in Scheveningen.
The central theme of Connected Cities – sustainable solutions for transport nodes – can be given added value by making innovative and inspired use of the underground space.

The underground environment creates opportunities not possible above ground. As Lao Tse pointed out, 'Architecture is what is left when you take away the walls.' Designers of underground places are faced with a challenging task: in essence, to design the inner and underground 'outer' spaces together in a way that creates a safe, well-organised and attractive experience. These are the most widely used ways to raise quality:

- Daylight access: the Artez Hogeschool voor de Kunsten (HKU University of Professional Education) in Arnhem, the underground office extension to a historic building on the Maliebaan in Utrecht, the Koopgoot in Rotterdam and the Louvre in Paris, to name just a few. 'Light, sightlines and legibility are the three fundamental principles that underpin the layout of the underground space.'[2]
- Use of materials: the Beelden aan Zee museum in Scheveningen, the Souterrain in The Hague, the Moscow Metro.
- Noise control: prevention of noise reverberation, for example in the Second Heinenoord Tunnel under the Oude Maas river.
- Orientation aids: sightlines, orientation features, for example the prize-winning underground car park at Arnhem Central Station.
- Physical environmental quality: constant temperature and humidity, noise insulation, as in the Zeeland Record Office in Middelburg, the National Archives in Limburg and the underground houses at the 'Kleine Aarde' in Boxtel.

Designs should pay particular attention to (social) safety, maintenance and management, and the transition between the surface and the underground environment.

Transitional areas
Design aspects that play an important role in the transition from surface to below ground are:

- Envelope/interior
- Views, sightlines, legibility
- Daylight, lighting, colours
- Integration in the surroundings, identity

Some of the best designed transitional areas are underground stations. For example: Canary Wharf, where the curving signature glass canopies allow natural light to penetrate deep below ground, enhanced by functionally designed artificial lighting; the lighting built into the escalators accentuates sightlines and orientation. Or the Bilbao metro, where escalators rapidly transport travellers to street entrances covered by tree-shaped glass canopies. In the Netherlands, the 'lid' above Blaak station both signals the location of this transport node and forms a landmark that is recognisable a long way off.

Designs can also be inspired by very different forms and uses. The roof of the oval Water Temple in Japan, for example, is at ground level and consists of a pond full of lotus plants. The entrance is a concrete stairway which cuts the pool into two as it descends, the stillness of the surrounding water preparing the visitor for the inner sanctuary. Or the long descent into the underground Volcano Centre at Saint-Ours les Roches in the Auvergne, where a funnel-shaped artificial crater forms the heart of the museum.

Safety

Our deep-seated fear of going below ground, apart from the need to seek shelter or protection (such as hiding in caves), has been reaffirmed with regularity in recent years by several accidents and even some attacks in tunnels. In the Netherlands, these events have partly been responsible for the drafting of the Addition Road Safety Regulations bill, which contains standards to be met by tunnel designs. A new Commission has also been established to advise on tunnel safety. But the need to improve the safety and image of underground buildings is not restricted to tunnels. In densely populated areas with high levels of mobility the motto is 'cars underground' and, luckily, we are seeing more and more well-designed underground car parks. Well-known examples in the Netherlands are Laakhaven in The Hague, Ossenmarkt in Groningen, the Van Heekgarage in Enschede, Souterrain in The Hague and the Museumplein in Amsterdam. What makes all these successful is their spacious design and use of light. The 'Safety concept for underground car parks'[3] is a useful aid for integrating safety into the design right from the start. A similar safety concept was drawn up for underground retail areas at the end of 2005, and another is being contemplated for underground transport nodes, such as stations.

Transport nodes

Underground transport nodes can vary from the almost unnoticed, such as viaducts, to highly complex 'human hubs', such as Blaak and Schiphol stations. For a station to qualify as 'underground' at least part of the transfer or transport activities must have no visual relation with the surrounding area; they must be covered by other functions and/or located below ground. Sometimes the transfer function is combined with commercial or leisure activities, such as shopping and amusements. Most metro stations are underground. Significant differences between train and metro are that metro trains tend top be shorter than heavy rail and have shorter breaking distances, they stop at every station (in general there are no 'stopping-train station') and the timetable is more frequent. That is why every world city has an easily accessible metro system. The decision to go underground is generally made for one or more of the following reasons:

- Compact interchange between transport modes
- Avoiding the barriers presented by the city
- The only physical option
- Economic potential

The design of the entrances to the stations may be the decisive factor in their ease of use. Good examples are both diverse and numerous. Some are industrial in character, such as the Wilhelminastation in Rotterdam and the Jubilee Line in London, others are grand or monumental, as in Moscow, and a few are almost homely, like the Souterrain in The Hague. Important factors are a feel for scale and dimensions; visual calm; use of sustainable, high quality building materials and products; avoiding dead corners, reverberations or draughts; and – always – regular maintenance and good management.

UNDERGROUND WINS ON QUALITY

Underground use of space can be the vital solution for connected cities where no realistic options are available above ground. The challenge of working underground inspires original design and sustainable solutions for urban nodes, which in turn benefits the city. One expression of this are the popular underground museums found the world over, such as the Museonder in the Hoge Veluwe National Park, the Water Museum in Arnhem, the volcano museum in Auvergne mentioned earlier, the Noashima Contemporary Art Museum in Kagawa and the underground extension of the Van Gogh Museum in Amsterdam. Another are the public transport nodes that are attractions in themselves, like the metros on Moscow, London and The Hague; and the pedestrian tunnel at the Wilheminastation in Rotterdam, which won a Dutch Design Award. Even the underground shopping centres that attract huge numbers of visitors. By making the necessary investments in quality, the benefits of underground development, below as well as above the ground, can be counted out in hard cash – and, above all, experienced.

This article is based partly on a presentation by R.G.M. Stringa (Holland Railconsult) at the COB-Middag in 2002. Other material is drawn from Verborgen ruimte by Von Meijenfeldt et al., COB/V+K, 2002.

Notes

1 Von Meijenfeldt et al., Verborgen ruimte, COB, Gouda, 2002.

2 Jaap Huisman, in Verborgen ruimte (p.106).

3 Veiligheidsconcept voor ondergrondse parkeergarages, Nienke Maas, Richard Kleefman, TNO Bouw COB/BZK, 2004.

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