Multiple use of land in The Netherlands

***Sebastiaan de Wilde**, Holland Railconsult, Delft University of Technology, and **Shahid Suddle**, Delft University of Technology, Corsmit Consulting Engineers, The Netherlands*

Photo: dRO, Amsterdam.

Figure 1: The Amsterdam Zuidas in 1998. The infrastructure consists of a motorway on both sides of two railway tracks and four light rail tracks in the middle.

A shortage of land across The Netherlands has led to the development of design and construction techniques that make intensive and multiple use of the limited space. The space available above transport infrastructure is seldom exploited, although it is quite possible to use this, especially in city centres. The only problem is that projects using land in multiple ways are complex, and little research has been undertaken on their engineering, safety, and finance[1].

Why multiple use?

Projects of this nature arise from the lack of free building sites within inner city areas and government policy dissuading construction outside city conurbations. The limited green areas that remain can be saved by optimising the amount of buildings constructed within the city. Apart from the expected commercial benefits of construction on prime city locations, multiple use has social benefits, such as increasing the use of public transport as important office blocks and other buildings are close to each other[2]. Two projects where buildings have been constructed above infrastructure, enabling multiple use of land, are profiled in this article.

Amsterdam Zuidas

The Amsterdam Zuidas lies between the districts of Amsterdam South and Buitenveldert. Within this area, the development of a second city centre of more than two million square metres is planned and will be completed in 20–30 years. The objective is to increase the infrastructure and relocate it underground[3]. As the aim is to construct above this infrastructure at a later stage, the grid systems of infrastructure and buildings must be combined.

To make building construction economically viable after the infrastructure has been completed, early investment is recommended. An example is the laying of concrete foundations when relocating the infrastructure so that precast structures may be economically constructed in the future. Precast construction is also the most efficient construction method. However, such pre-investments should be rationalised to take into account the projected costs of preparing them later and the resulting lost capital interest.

The Utrechtse Baan, The Hague

Five buildings have been constructed in The Hague above the motorway known as the Utrechtse Baan. The motorway divides the city, and constructing these buildings above the motorway largely restored the unity of the city. For companies, the location is attractive because of the accessibility and exposure. Safety issues were very important during construction and the projects demonstrated that specifying safety requirements at an early stage reduced later problems. The buildings above the Utrechtse Baan are hybrid structures, combining precast concrete and steel frames.

Safety issues and reliability

Safety aspects are significant during both construction and use of the buildings[4]. An accident, like a small

Figure 2: The Haagse Poort office building constructed above the Utrechtse Baan motorway while still in use.

fire in the building or the infrastructure, can lead to a major disaster.

Risk analysis can be undertaken to examine safety requirements in combination with intensive use of space. The results then have to be checked for risk acceptance criteria. If the results do not comply, measures can be taken to increase the level of safety. However, these measurements have to be economically viable. The risk analysis should look at the construction phase and when the building is in use, for three different situations:

- external safety and risks from the building in relation to the infrastructure beneath (e.g. falling elements)
- external safety and risks from the infrastructure towards the building (e.g. explosions and accidents)
- internal safety and risks from the constructions enclosing the infrastructure (e.g. explosions and accidents).

Measures, verified by this risk analysis, have been drawn up to increase the level of safety. These can be structural measures, such as additional floor area around the building to protect the infrastructure from construction elements falling directly onto it. Such a shelter can be integrated in the architectural and functional design of the building, while normal safety measures are only a cost-raising factor. It is a good alternative to balance costs and profits of such measures and their contribution to safety.

Financial aspects

Projects concerning multiple use of land, especially involving railway stations, are often large-scale. Building above railway infrastructure frequently leads the railway companies to renovate and upgrade the station area at the same time. They profit from their landowner status in relation to the existing railway station locations, which are sold, and partially re-invest the benefits in the railway station project. The redevelopment of Liverpool Street Station, London, is an example of this process[5]. Where this happens in inner city areas, the different landowners should take into account the location of their land in relation to the new railway station area when planning developments on the site. It will play an important role in aligning the stakeholders, dividing future financial benefits, and establishing the feasibility of the project.

The large amounts of floor area are constructed over a long period, and this must be taken into account when assessing the market price of the land and optimal construction for that area. The phasing of each aspect is an important issue, both for the construction and when assessing costs and revenues[6]. A problem with phasing is that underlying infrastructure preferably has to be first taken into account. Interest costs relating to pre-investments establish the boundaries for structural solutions. They will have an impact on the project funding that must not be underestimated.

Figure 3: The Equinox building in the Hague was cost-effective as it used the existing motorway trough as a foundation.

To stimulate investment, local government can be a catalyst. It can take the first step in organising and initiating investment in locations where multiple use of land is most feasible. In return, a high price for the new building sites may be realised on prime locations, accessed by public transport. Indirect profits are the safeguarding of green spaces outside city limits, the stimulation of public transport and the improvement of inner city areas. These are more interesting to the government than to individual developers.

Conclusion

The surroundings of historic city centres hamper construction flexibility. The demands are set at a high level as buildings constructed over infrastructure are expensive and must comply with the requirements of our developing human society. Safety and financial issues set boundaries for structural solutions. There are examples from which designers can learn, although they relate ostensibly to specific situations and not to a general design principle. Investment in foundations to facilitate the construction of prefabricated structures may help cut construction time in a later phase. Safety measures, which are taken for the construction phase, can be integrated in the architectural and functional design of the building. In large-scale projects, land ownership guides the design of real estate developments and has a major influence on feasibility. The government has a clear task in the initial phase, by facilitating the project initiative.

It is clear that the problems should not be underestimated, but the possible commercial and social benefits should also be borne in mind. There are a lot of potential locations for multiple use of land that, when developed, benefit society both by creating additional space and retaining the existing areas of green landscape.

References

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