

MULTIPLE USE OF SPACE: SPATIAL PERCEPTION AND COMPLEXITY

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Abstract

Lack of space leads to the design and construction of projects which make intensive and optimal use of the limited space. Buildings above roads, railways and buildings are examples of multiple use of space projects. However, realising such projects is very complex thus the knowledge hereabout is essential. Before realising such projects one has to consider: Under which conditions is the concept of multiple use of space applied in some cities of Western Europe? The scope of this paper contributes to illustrate the application of multiple use of space.

1. Introduction

The combination of growing welfare and the awareness of spatial quality leads to a rising need of space. Intensifying of available space by means of multiple use of space, is an option to satisfy and fulfil this need [Jansen & Südmeier, 1999]. In the The Fifth National Policy Document on Spatial Planning of the Netherlands [VROM, 2001] a key issue is suggested; there is a need for space and spatial quality. Accordingly, future projects are meant to be realised within urban contours with a goal to utilise existing urban spaces more efficiently and effectively and at the same time provide better spatial quality. Therefore, the main strategies for future developments are *intensification, combination and transformation*. These strategies are the basic elements for multiple use of space, which occurs often on the social and political agenda [Vriesman, 2001].

In spite of many obstructions, there has been already a number of different multiple use of space projects realised in The Netherlands. Buildings above roads, railway tracks and existing buildings are examples of such projects. It is, however, not likely that the concept of multiple use of space is automatically applied, particularly not in urban areas that are not featured by lack of space. Still, examples of such projects can be found in some cities of Europe. Having this all in mind, it comes down to these questions:

- What are the characteristics of multiple use of space when one suggests lack of space in urban areas?
- Under which reasons is the concept of multiple use of space applied in some cities of Western Europe?

This paper will set out both questions.

2. Driving forces of multiple use of space

To answer these questions, one has to supersede the driving forces behind multiple use of space. In [Priemus et al., 2000; Harts et al, 1999] three scenarios for future social decors are suggested; Divided Europe, European Co-ordination and Global Competition. These scenarios differ from each other by the input for the driving forces with regard to demographic, socio-economic, socio-cultural, technological and environmental developments. These driving forces are the basis for the concept multiple use of space [Priemus et al., 2000; Harts et al, 1999]. As mentioned, multiple use of space is associated with spatial quality, which is a subjective description [Hooimeijer et al., 2001]. All parties concerned have their own conceptions about spatial quality:

	Social interests	Economical	Social	Ecological	Cultural
Aspects of spatial quality	Users value	Allocation- efficiency Accessibility External effects Multi-purpose	Access Distribution Interest Choice	Safety, Nuisance Dry out Shred	Freedom of choice Variety Meeting
	Experience value	Image Attractiveness	Inequality Solidarity Safety	Space, calmness Beauty Health	Singularity Beauty Contrast
	Future value	Stability/flexibility Agglomeration Cumulative attraction	Surrounding Cultures of poverty	Supplies Ecosystems	Heritage Integration Renewal

Table 1: Spatial quality depends both on social interests and aspects of spatial quality [Hooimeijer et al., 2001].

According to [Hooimeijer et al., 2001], spatial quality depends both on social interests and aspects of spatial quality. The aspects of spatial quality, presented in the matrix above, join social interests with design requirements; demand of space is a balance between economical, social, ecological and cultural interests [Perrels, 1999; Puyleart, 1999]. The social interests suggested in [Hooimeijer et al., 2001], are roughly the same as the driving forces of multiple use of space. For realisation of multiple use of space projects, a stimulation of government, which depends on cultural aspects [Wilde 2002^C], is desirable (see section 4.5). The (local) government can contribute to the quality of spatial structure. Yet, this quality mainly depends on the market. According to [Chapin & Kaiser, 1979; Vliet, 2000] the market consists of an *activity, developing* and *environmental system*. The government is part of this market. Actors of the *activity system* determine the demand of space. Individuals and companies also governmental sectors are the actors of the activity system. Actors of the *environmental system*, such as biotic and a-biotic processes in nature, determine the supply of space. The *developing system* enables spaces to be developed for use. Multiple use of space can be considered as a part of this market.

In that respect, developing system functions as a tool for equilibrium between demand (activity system) and supply (environmental system) of space. Basically, the spatial planning depends on the political planning process, which controls the use of space to serve the public interests [Vliet, 2000].

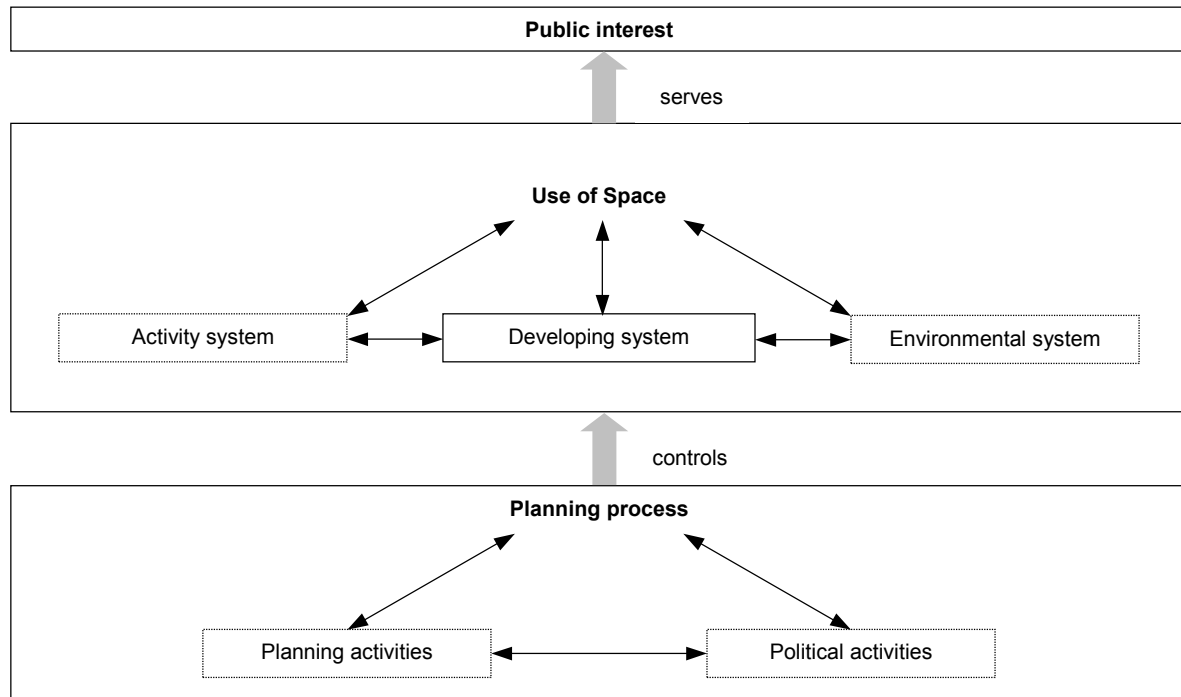


Figure 1: The spatial planning: the political planning process controls the use of space to serve the public interests.

3 Examples of multiple use of space projects in The Netherlands

3.1 History of multiple use of space projects

Multiple use of space projects can be found in history. The Ponte Vecchio (1245 - 1335AD) is an example of such projects [Suddle, 2001]. The Ponte Vecchio is a bridge constructed over the river with buildings in Florence (Italy). Throughout the centuries, the city centres were featured by shortage of space. As a result of accelerated developments in the city centres this shortage has rapidly increased. Nowadays, one demands different quality aspects to space as well. Therefore, one prefers to realise projects at attractive locations in city centres. Hence, realising buildings above roads, railway(stations) and even existing buildings are an option to satisfy both the demand of spatial quality and the lack of space in city centres.

3.2 Buildings above roads

In The Netherlands several multiple and intensive use of space projects have already been realised [VROM, 2000; @1]. Examples of such projects are buildings situated over the motorway the "Utrechtse Baan" in The Hague and NewMetropolis in Amsterdam. Both examples were characterised by a lack of space in the city.

Besides, the Utrechtse Baan was an obstruction in the inner city, which divided the city into two parts. After realising buildings above the Utrechtse Baan these two parts were connected.



Figure 2: Buildings situated over the motorway in The Netherlands; the "Utrechtse Baan" in The Hague (left) and NewMetropolis in Amsterdam (right).

3.3 Buildings above railways

In Rijswijk, an office building and a residential building have been constructed over the railway. Rijswijk Station was developed and realised because the city was divided into two parts. Besides, covering the railway track resulted in decreasing of noise hindrance, which was a barrier to people who lived near the railway track. Applying multiple use of space increased the spatial quality. If more buildings are realised above and near railway tracks public transport can be stimulated [Wilde, 2002^C].



Figure 3: Railway station Rijswijk in The Netherlands covered by buildings; residential building (left) and an office building (right).

3.4 Buildings above buildings

Two examples of buildings realised above existing buildings can be found in Rotterdam and The Hague. In Rotterdam, the WTC has been constructed above an existing hall. The WTC was realised because of the combination of both lack of space and a unique possibility to establish in the city centre. Similarly, in The Hague, a hotel has been built above a congress centre. At a later stadium in the exploitation phase, the owner of the Congress Centre decided to build a hotel on the Congress Centre.



Figure 4: Buildings realised above existing buildings in The Netherlands; the World Trade Centre in Rotterdam (left) and Netherlands Congress Centre in The Hague (right).

3.5 Multiple use of space in Europe

Projects which carry out multiple use of space are not only applied in The Netherlands, but also in Europe. In Germany, France and the United Kingdom, projects are realised over motorways and railway stations [Wilde, 2002^A; Hoeven, 2001]. In the UK, several railway stations are covered with buildings (Charing Cross Station, Liverpool Street Station) [Wilde, 2002^B]. Considering the increase of the world population, one may expect that in the future the lack of space will increase. Therefore, such projects will often occur in the future.

4 The concept multiple use of space

4.1 Introduction

According to [Kreukels & Vliet, 2001], it may be concluded from an international study about multiple use of space, that an absolute and even a relative lack of space, except in few urban areas, is not decisive for applying the concept of multiple use of space. This study represents also that a specific quality is characteristic for each country; in The Netherlands, one attaches significance for spatial quality and therefore experiences a lack of space. The spatial perception, which can be divided into the quality and quantity of space, is characteristic for each country. Moreover, factors such as economical, cultural, social and environmental aspects are associated to the application of multiple use of space. According to [Kreukels, 1997; Kreukels & Vliet, 2001] major issues for multiple use of space are:

1. Economic, social and ecological values or combinations of these values are decisive for inception for efficient and multiple use of space;
2. These economic, social and ecological standards or combinations of them are decisively for cultural and social values of the users and for private parties in real estate and the infrastructure sector;
3. A (national and local) government can be an initiator.

4.2 *Multiple and intensive use of space*

The multiple use of space characterizes with several descriptions and views [Jansen & Südmeier, 1999; Priemus et al., 2000; Harts et al., 1999; Vliet, 2000; Wilde, 2002^B; Hoeven, 2001; VROM, 2000; NC, 2000; Delft et al., 22; Nijhof, 1998]. In order to analyze multiple use of space in objective terms, these definitions can be restricted to the following (see fig. 6) [Wilde, 2002^B]:

- 2nd dimension: mixed use of space; different functions next to one another in a particular space;
- 3rd dimension: multiple use of land; different functions layered in a particular space;
- 4th dimension: multiple use in time; a set amount of floor area is used for different functions in the time dimension;

Intensive use of space can be measured by density, like the amount of floor area that is realised per hectare of building surface. Projects of intensive use of space do not include multiple use of space by definition. Intensive use of space is furthermore partly defined by culture.

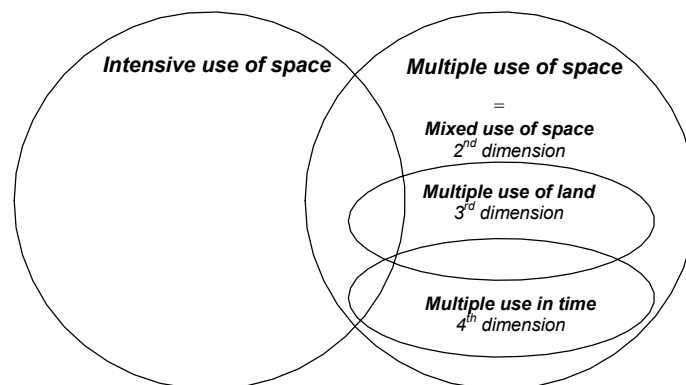


Figure 6: *Different types of intensive space use [Wilde, 2002^B].*

4.3 *Model for application multiple use of space regarding spatial perception*

Considering the previous traditional theorems regarding multiple use of space, a model for the concept multiple use of space regarding spatial perception can be deduced (fig. 7). This model gives an approach of "when the concept is applied in some cities" when considering spatial perception.

First, the model starts with social interests and developments, which can be divided into terms of economic, ecological, cultural or social, on a national scale. Mostly, these developments are combinations of each other. These developments determine the demand of space locally, in terms of both quality and quantity of space, which can be considered as *spatial perception* specific for each country. Quality of space concerns spatial demands set on quality of the maintained space, which is actually the early mentioned environmental system. Quantity of space contains the available land in urban areas, which can be created for multiple use of space. In case of an insignificant demand for space, one will not apply multiple use of space therefore is not interesting. If the demand for space is sound, one will reconsider space in urban areas.

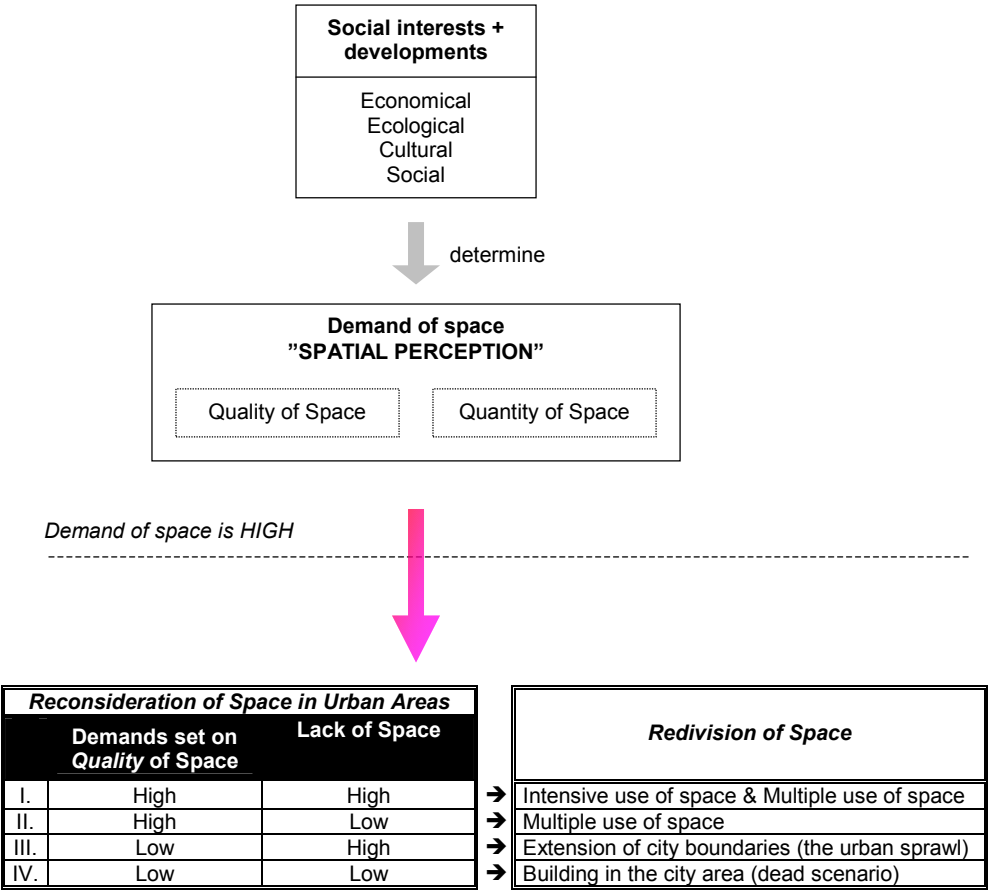


Figure 7: Model for multiple use of space when considering spatial perception.

When reconsidering the space in urban areas, four types of scenarios for redivision of space are possible. Private parties, such as real estate developers and parties from the infrastructure sector, and the national and local government command these scenarios for redivision.

4.4 *Scenarios for redivision of space*

When descriptions about space and the possible scenarios are considered from a *spatial perception point of view*, one can define and tackle the reconsideration of space in urban areas as following:

1. *Demands sets on quality high and lack of space high*: This scenario is characterised by high demands sets on quality and a lack of space. Such circumstances will often appear in the future. In this scenario there is a real lack of space in urban areas. Consequently, one will utilize the available space effectively and efficiently. Intensifying the available space is an option to solve the high lack of space by means of high-rise buildings. If this is not possible, one can apply the concept of multiple use of space. Realising projects in the 3rd dimension (multiple use of land) is a logical consequence and therefore attractive. As a consequence, the available space will be used intensively. Examples of such projects are the Utrechtse Baan in The Hague.

2. *Demands sets on quality high and lack of space low*: According to this scenario, one multiple use of space will not appear, because there is no sign for lack of space in urban areas. Yet, one attaches great significance to both aspects of spatial quality and the question about the redivision of space. As mentioned earlier, typically, there are examples of projects in which multiple use of land is applied in case of no lack of space. The reasons for applying multiple use of space in such circumstances could be prestige, accessibility, attraction, local interests and ambition. This scenario represents that a lack of space is not always the reason for multiple use of space. One can apply all types of multiple use of space. If one will switch over to the 3rd dimension of multiple use of space, it will be realised purely for prestige and (local) economic, sustainable city [Dobbelsteen et. al, 2002], social and physical interests and benefits.

3. *Demands sets on quality low and lack of space high*: This scenario also regards a real lack of space in urban areas. However, the spatial quality is insignificant and the social interests are subordinate as well. Hence, one will reconsider land at boundaries of the city and one will continue constructing at boundaries of cities, also called "the urban sprawl".

4. *Demands sets on quality low and lack of space low*: This scenario can be called the "dead scenario" in which nothing remarkable will happen. One can build everywhere one likes. After all, there is land enough and the economic situation of the country is below normal level.

One has to consider that these scenario's are not the only the basic elements for the application of multiple use of space.

4.5 *Parties and government*

Obviously, multiple use of space is not only a matter of spatial perception. A large number of actors are involved by reconsideration and redivision of space in urban areas. Parties and the government are the two main actors that play an important role when sentiments of social developments and increasing demand of space can be found. The private parties originate from the developing system (see section 2).

When reconsidering space in urban areas, these real estate parties can make profit, so they can make investments. While parties of infrastructure sector have to make investments. In order to initiate such large-scale and expensive projects, the government should act as a catalyst in this process by initiating and facilitating the projects [Wilde & Suddle, 2002]. The national government can desire space and spatial quality, e.g. the Fifth National Policy Document on Spatial Planning of the Netherlands [VROM, 2001]. The local government, such as municipalities, is availed when the position of its city is strengthened internationally by means of redeveloping their inner city efficiently. The main purpose of realising such project is to stimulate economic, social, ecologic and cultural advantages locally. In addition to these advantages, one can increase spatial quality. Subsequently, social developments can make progress [Suddle, 2002].

5 Critical issues multiple use of space

Realising projects, which carry out the concept of multiple use of space, especially the 3rd dimension, e.g. building over roads, railways and existing buildings, are extremely complicated. The critical issues in such projects can be subdivided into four different categories [Wilde, 2001]:

- Engineering;
- Safety;
- Finance;
- Organisation.

Multiple use of space projects can only be realized successfully, if these categories are managed extensively [V & W, 2001; Tanja & Wijnen, 2001; Suddle, 2002]. In this respect, multiple use of space can be considered as a diamond, because the use of space is effectively and efficiently. The diamond will shine brightly, if one pays attention to aspects of engineering, safety, finance and organisation during the design process of a project (see fig.8).

Regarding the complexity of multiple use of space projects, one can assume that building above infrastructure is expensive. Thus, a financial support is recommendable in such projects for the stimulation of such projects. The organisation of such projects is difficult as a result of several participants. Engineering such projects is rather complicated [Vamberský, 1999]. It is recommendable, that the infrastructure must be maintained during the construction phase.

As a result, safety is a critical issue. Association with the safety aspect is significant to ensure the safety of people, not only in the construction phase, but also in the exploitation phase. A number of people and several multiple risk dimensions are involved.

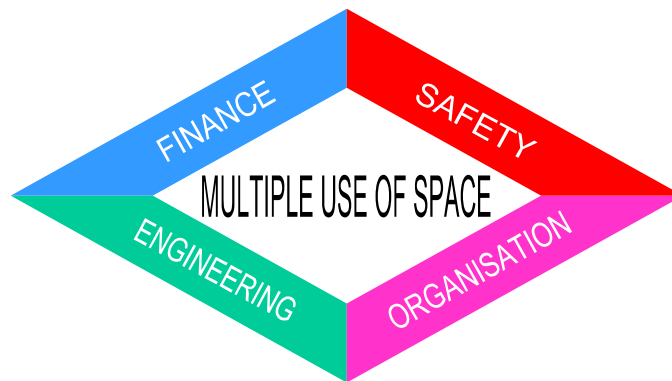


Figure 8: Multiple use of land diamond.

In The Netherlands, the safety issue is an extra difficulty, because of transport of hazardous materials. Several places are characterised by exceeding the acceptability and tolerability criterion of safety. Remarkably, these areas are exactly the areas for which the Fifth National Policy Document on Spatial Planning of the Netherlands desires intensification, combination and transformation (fig. 9).

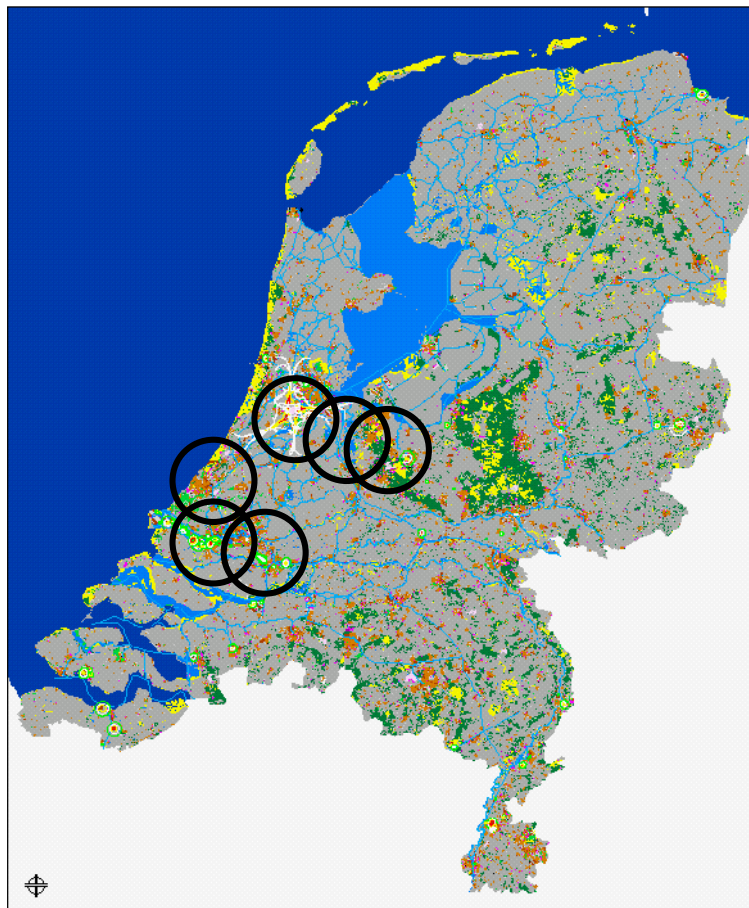


Figure 9: Risk contours in The Netherlands [RIVM, 1998].

6 Conclusions and discussion

The scope of this paper contributes to illustrate the application of multiple use of space regarding spatial perception, which can be divided into the quality and quantity of space, in Western Europe. It may be concluded that a lack of space is not always the condition for applying multiple use of space [Kreukels & Vliet, 2001]. Furthermore, there are a lot of elements that leads to the concept of multiple use of space. One may consider that applying the concept of multiple use of space is a solution to many obstructions. Multiple use of space is an effective instrument to add to sustainability [Wilde, 2002C; Dobbelsteen et. al, 2002]. Synergistically, an additional advantage multiple use of space near railway stations can be the stimulation of public transport [Wilde, 2002^C]. Multiple use of space provides (local) economical improvement [Primus, et. al, 2000]. Cultural, social and environmental aspects can be improved as well. Remarkably, these are also the driving forces behind multiple use of space.

Additionally, realising such projects e.g. constructing buildings over roads, railways and existing buildings, are extremely complicated. The critical issues of such projects, which are of significant importance, have been outlined.

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Literatue

- Chapin, F.S. & E. Kaiser, *Urban Land Use Planning*, Urbana, Chicago, London, University of Illinois Press, 1979.
- Delft, H.van, P. Nijkamp, en R. Vreeker, *Electronische Interactieve Consultatie EMR: Een gezelschapsdiscussie over het begrip Meervoudig Ruimtegebruik.*, Vrije Universiteit Amsterdam, september 2000, 29 pp.
- Dobbelsteen, A.A.J.F., & Wilde, Th.S. de, & Arets, M.J.P., Sustainability in three dimensions, the importance of improving the use of space and life span beside technological efficiency, The sustainable city II, Urban regeneration and sustainability (Brescia, C.A., e.a., eds.), WIT Press, Southampton, 2002, pp. 305-314.
- Harts, J.J., C. Maat, D. Zeijlmans van Emmichoven, *Meervoudig Ruimtegebruik; Methode en analyse*, Onderzoeksinstituut OTB, Delft University Press, 1999, 118 pp.
- Hoeven, F. van der, *RingRing, ondergronds bouwen voor meervoudig ruimtegebruik boven en langs de RING in Rotterdam en Amsterdam*, dissertatie, Technische Universiteit Delft, 8 mei 2001, 369 pp.
- Hooimeijer, P, H. Kroon, J. Luttik, *Kwaliteit in meervoud*, Habiforum, Expertisenetwerk Meervoudig Ruimtegebruik, 2001, 104 pp.
- Jansen, E. en I.Südmeier, *Het gelaagde landschap, Meervoudig Ruimtegebruik in perspectief*, EMR, Gouda, augustus 1999, 88 pp.
- Kreukels, T. en M. van Vliet, *Verruimd perspectief, Een internationale verkenning naar ruimtelijke inrichting en meervoudig ruimtegebruik.*, Habiforum, Gouda, 1 augustus 2001, 101 pp.

Kreukels, A.M.J. *Een Persectief voor de Stad*, Vierde van Eesteren lezing. Amsterdam: BNSP, Beroepsvereniging van Nederlandse Stedenbouwkundigen en Planologen, 1997.

Nijhof, A.G., *Gedeelde ruimte is dubbele ruimte, meervoudig ruimtegebruik verbeeld en besproken*, Gouda, CUR, 1998, 43 pp.

Nova Curra, over meervoudig ruimtegebruik, Habiforum, Gouda, 2000, 128 pp.

Perrels, A.H. et al., *Economische effecten van meervoudig ruimtegebruik*, TNO report, Delft, juni 1999, pp. 28.

Priemus, H., P. Nijkamp, F. Dieleman, *Meervoudig Ruimtegebruik; Stimuleringen en belemmeringen*, Onderzoeksinstituut OTB, Delft University Press, 2000, 116 pp.

Puylaert, H. et al., *Innovatie in meervoudig ruimtegebruik*, TNO report, Delft, juli 1999, pp. 68.

RIVM, *Yearly environmental report 1998*, 1998.

Suddle, S.I., *Veiligheid van bouwen bij Meervoudig Ruimtegebruik*, afstudeerrapport, TU-Delft, april 2001, 298 pp.

Suddle, S.I., *Waarom Meervoudig Ruimtegebruik?*, TU-Delft & Corsmit Raadgevend Ingenieursbureau, november 2002, 26 pp.

Tanja, J.F., P.E.V. van Wijnen, *Overkappingen & Overkluizingen: Stand van zaken onderzoek en beleid*, juli 2001, 34 pp.

Ministerie van V en W, *Problemen en kansen bij het overbouwen van weginfrastructuur*, Utrecht, oktober 2001, 55 pp.

Vamberský, J.N.J.A., *Meervoudig Ruimtegebruik bij toekomstige tunnelbouw*, Cement, no. 8/2001, pp. 64 - 66, 1999.

Vliet, E. van, *Dubbel zinnig; onderzoek naar de bijdrage van meervoudig ruimtegebruik aan ruimtelijke kwaliteit*, Habiforum, Gouda, november 2000, 82 pp.

Vriesman, C., *Dubbel grondgebruik geen doel op zich*, Buildingbusiness, Volume 5, no. 5/2001, pp. 45.

Ministerie van VROM, *Inspiratieboek, Intensief Ruimtegebruik op bedrijfterreinen*, Ministerie van VROM, StiR, november 2000, 96 pp.

Ministerie van VROM, *40x Intensief, innovatief, Inspirerend Ruimtegebruik Nominaties 2000*, Ministerie van VROM, StiR, november 2000, 100 pp.

Ministerie van VROM, *Ruimte maken, ruimte delen: Vijfde Nota over de Ruimtelijke Ordening 2000/2020*, Ministerie van VROM, Den Haag, 2001, 300 pp.

Wilde, Th.S de, *Bouwen boven sporen, meervoudig ruimtegebruik in spooromgeving*, Symposiumverslag, Stichting Hoogbouw, Den Haag, 2001.

Wilde, Th.S de, *Meervoudig Ruimtegebruik en binnenstedelijke verdichting rond treinstations*, Cement, Volume 54, no. 1/2002, februari 2002^A, pp. 33 - 36.

Wilde, Th.S. de, *Luxe kantoren boven het station*, no. 1, Nova Terra, Volume 2, no. 1/2002, maart 2002^B.

Wilde, Th.S. de, & S.I. Suddle, *Multiple Use of Land in The Netherlands*, Concrete, Volume 36, no. 9/2002, april 2002.

Wilde, Th.S. de, *Multiple use of space in railway station areas*, *The sustainable city II*, Urban regeneration and sustainability (Brebba, C.A., e.a. eds.), WIT Press, Southampton, 2002^C, pp. 529-538.

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