The development of the van Leeuwenhoekpark – Spoorzone Delft assessed by the geodesign framework

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Introduction

Since 1965, the municipality of Delft has had to contend with a railway viaduct that caused nuisance and cut the city in half and could not cope with the future growth in train traffic. Not only did the viaduct cause noise and environmental nuisance for residents, it also created a physical barrier between neighbourhoods and had a negative impact on social safety.

In 1988, work was carried out on a solution to the problems outlined in the form of an urban development vision of the railway zone: *Spoorzone Delft* by the Spanish architect Joan Busquets. The result was a railway tunnel and an underground railway station opened in 2015. Above ground, council offices have been realised. The area will be redeveloped in the coming years, named: '*Nieuw Delft*'. A list of historical facts is given in Appendix A. An essential and connecting part of the area will be the *van Leeuwenhoekpark*.

The development of the *van Leeuwenhoekpark* is a compelling case to test against the Geodesign Framework of Steinitz (Steinitz, 2012). This essay discusses the division of roles of the actors during the second iteration sequence and what role GIS technology could have played in the design process.

In this context, geodesign seeks to implement (digital) tools and approaches, using geographic knowledge in order to collaboratively design and improve future environments informed by systems thinking (Batty, 2013; Ervin, 2014; Flaxman, 2010; Goodchild, 2010; Steinitz, 2012).

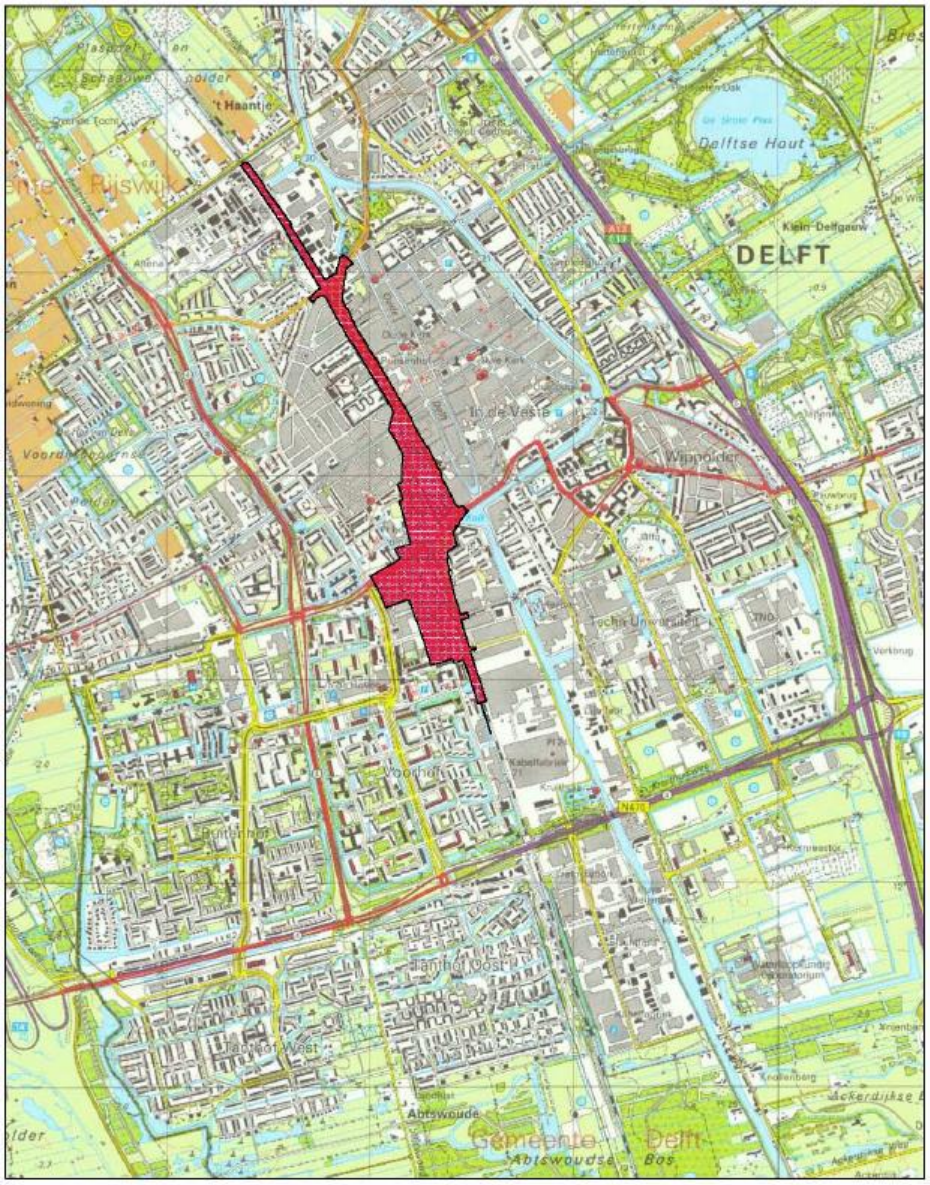

Figure 1:Plan area Spoorzone Delft (Gemeente Delft, 2006)

Van Leeuwenhoekpark

The *van Leeuwenhoekpark* is located in the centre of the *Spoorzone Delft*. The northern part of the park is 215 metres long, 49 metres wide on average and runs from the bus platform to the future *Ireneboulevard*. The southern part of the park runs from the *Ireneboulevard* to the new *Van Leeuwenhoekkwartier* building near the *Drukkerijlaan* and has a length of 310 metres and an average width of 40 metres. The city park will be enclosed by new homes, a canal and the public transport hub.

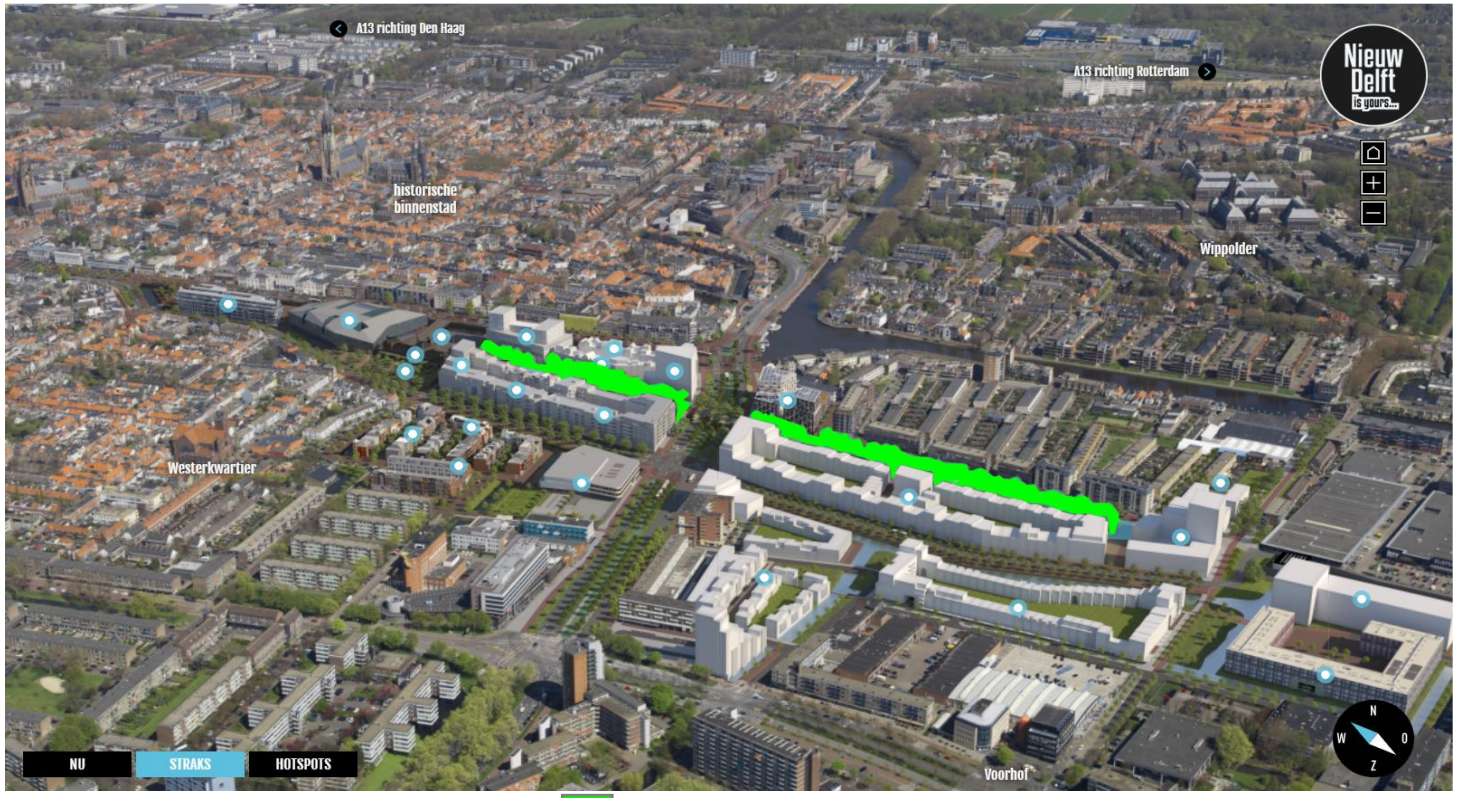

Figure 2: Nieuw Delft area – van Leeuwenhoekpark (click on the image to view an interactive map) (Nieuw Delft, 2016)

Because it is an entirely new area that is being delivered ready for construction by the contractor of the roof of the railway tunnel, only the technical and safety aspects of the layout of the area have to be taken into account. Therefore the focus is on the second iteration sequence of the geodesign framework.

Stakeholder involvement

The complexity of developing a park on a railway tunnel arises not only from the technical challenges but also from the wide variety of stakeholders. The interdependence of the construction of an underground infrastructure with the development of an above-ground area in the centre of a city requires close cooperation between a large number of parties. A list of all stakeholders is given in Appendix B.

During the second iterative phase in the design process, we distinguish the following groups in the geodesign team (Steinitz, 2012) operating in the context below.

People of the place

After the financial crisis manifested itself in 2008, the municipality of Delft realised that the involvement of future residents and people living in the neighbourhood of *Nieuw Delft* was essential to the successful development of the area (Heurkens, E., Daamen, et al., 2015).

For one of the subareas in *Nieuw Delft*, the *van Leeuwenhoekpark*, an inspiration evening was organised in March 2016. 70 inhabitants, entrepreneurs, developers, architects and some council members participated in the design process. Participants could design the park in small groups on a map using model materials. The proposals were presented to the municipality and to the urban development agency Palmbout, which was responsible for the Integrated Development Plan for *Nieuw Delft*. The ideas were then presented for inspiration to the landscape architecture firm Lodewijk Baljon, who incorporated them as far as possible in a preliminary design for the park. During residents' evenings, the preliminary design was presented to the residents again using 3D models made in SketchUp (Vaartjes, 2018).

The final decision on the design of the park lies with the municipality of Delft. The proposals are tested against Busquets' vision and the integral development plan for *Nieuw Delft*. Costs, restrictions (technical, legal and from a safety point of view), benefits (quality of life, the attractiveness of the area), wishes of residents, planning and the connection to the visions of Busquets and Palmbout are the most critical drivers in this process.

Figure 3: Inspiration meeting v*an Leeuwenhoekpark* (click on the image to watch the video) (Ontwikkelingsbedrijf Spoorzone Delft, 2016)

The strength of the chosen approach is the low threshold for participants ‘to play’ with the layout of the area. There is no need to learn complex systems and everyone can embroider on the ideas of another participant. Preconditions did not hinder creativity. Conversely, during this design phase, no multi-criteria analysis was performed to carry out a rational assessment of options. By applying spatial multi-criteria analysis, the participant immediately sees which alternatives there are and what the effect is of a specific choice in the area (Van Herwijnen, 1999). Proposals by residents were strongly based on personal preferences and emotion. Another shortcoming in this process was the absence of Busquets and the landscape architect. They could have explained the environmental vision and could have brought along new insights.

Design professions

Busquets used the railway tunnel as the starting point for his vision (2010, Busquets). The preconditions for building on the railway tunnel had an impact on the design choices. For example, the park has been shifted eastwards about the original vision (Gemeente Delft, 2006). Also, a one-metre layer of soil will be laid on the railway tunnel roof on which trees can be planned. The position of the underground station has also influenced the location of the park.

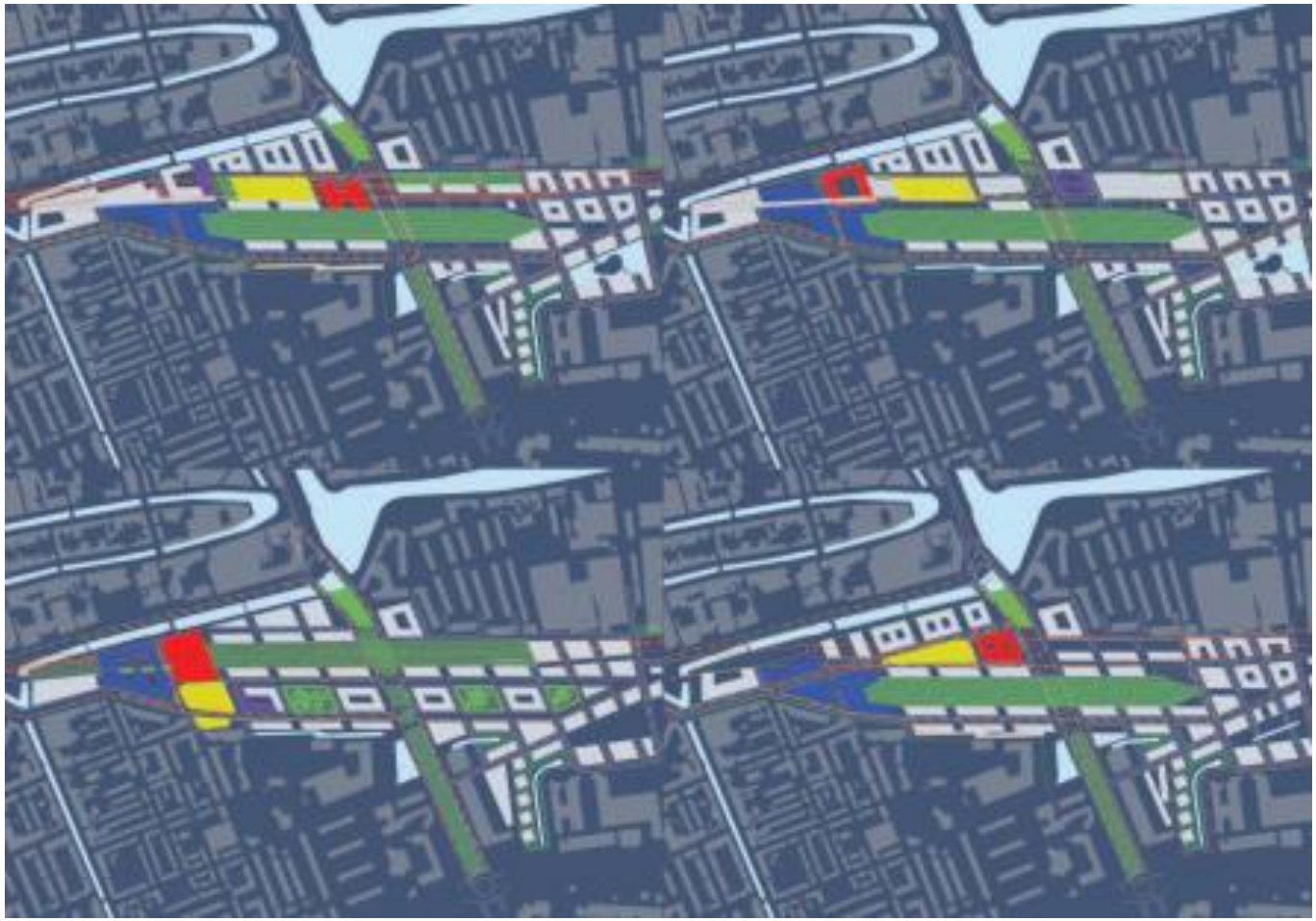

Figure 4: and the influence of the position of the park (Busquets, 2010)

In order to realise a high-quality city park, Palmbout has looked at the impact of the environment (types of trees and plants), water resources (water features, water drainage and water storage), safety (lighting, sightlines) and recreational facilities (Gemeente Delft, 2013).

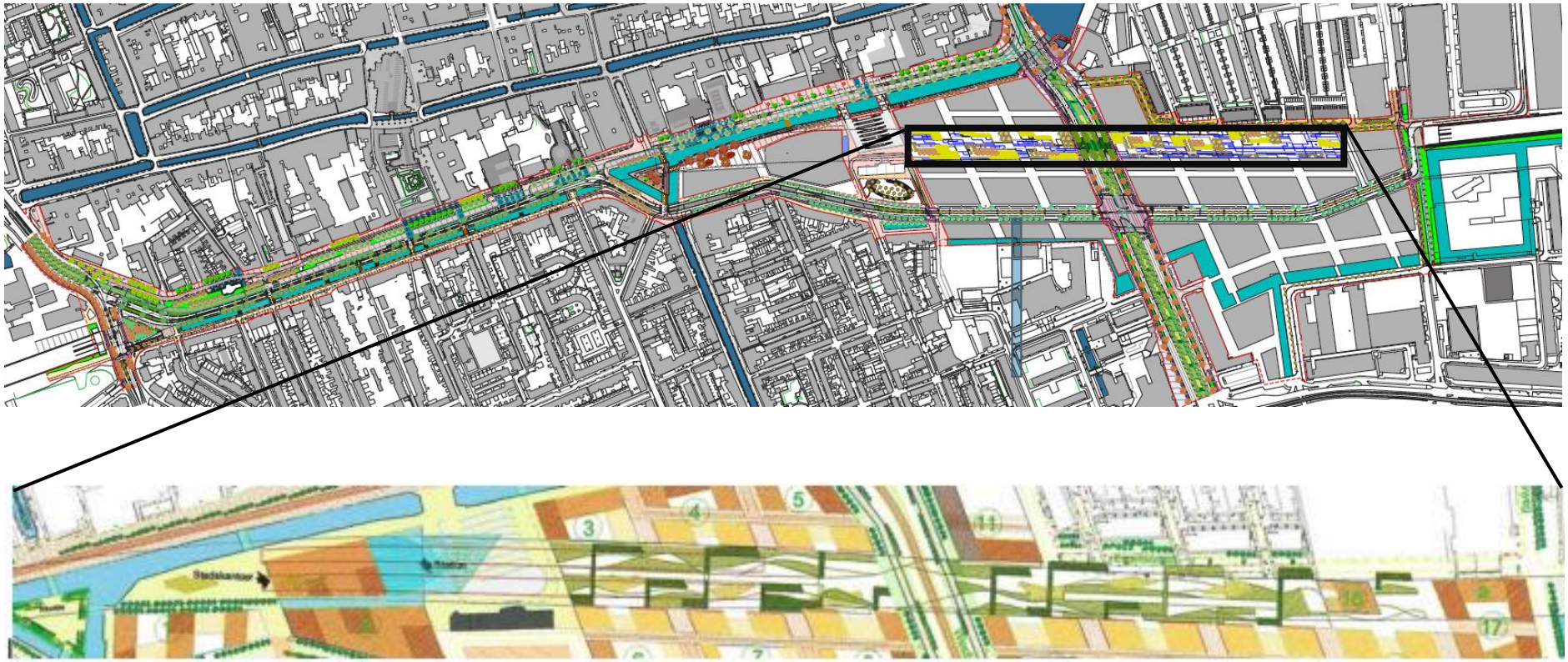

Figure 5: *van Leeuwenhoekpark* (Gemeente Delft, 2013)

A shortcoming in this approach is that already known limitations are not centrally stored in a central information system like a GIS. Each time a designer had to find out what is and is not possible in the park based on the specifications. It increases the chance of errors and costly repairs. Artist impressions were also used in the visualisation process, creating certain expectations using distorted pictures (Pojani, D. and Stead, D., 2015). The use of photorealistic 3D images and images of materials to be used will increase credibility.

Geographic science

Partly due to the small scale of the project, the involvement of geographic science is limited. Both Busquets and Palmbout have looked at the integration and connection of the *Nieuw Delft* area into the urban environment. The most explicit relationship with geographic science is in the role of hydrologists and ecologists. The area must also supply functions for water storage and cooling the environment. The cooperation with TU Delft in the field of climate and heat resistance is a smart choice. For example, measuring instruments are placed in the park for climate research (Vaartjes, 2018)

Information technologies

The application of information technology in the development process of the *van Leeuwenhoekpark* was limited to converting CAD drawings in pdf from ProRail (client railway tunnel) to artist impressions, georeferenced 2D floor plans, 3D SketchUp models and a Virtual Reality application for visitors of the information centre *Delft Bouwt*. During the analysis of the design process, it becomes clear that no central digital platform was used to exchange information between all clients, suppliers and other stakeholders (Vaartjes, 2018). The innovative application of the cadastral registration of the *Spoorzone* in 3D could have been fed from a GIS instead of a pdf (Stoter, Jantien, et al., 2016).

Methods of the study

During the second iteration through the geodesign framework different models could have been operationalised to achieve the best possible design.

Method	Interpretation
Decision models	Zoning plan and committee architectural quality at the municipal level to make a fit in the urban environment taking historical (old city), culture and social aspects in consideration. Citizens are involved in the decision-making process.
Impact models	Establish metrics regarding technical requirements to build on top of the train tunnel roof, accessibility of the park for disabled persons and emergency services. Determine critical figures about light, shadow, air quality and maintenance costs.
Change models	Offensive strategy to change the space on the roof of the tunnel into an attractive park connecting neighbourhoods and provoking residents to explore different kinds of interpretations of the van Leeuwenhoekpark through visualising the ideas.
Evaluation models	Measuring the metrics that have been established: accessibility, level of social security, maintenance costs, water storage capacity, attractiveness to the residents.
Process models	The current process can be described as a sequential process. The requirements of the municipality have been translated to preconditions for public participants during the inspiration meetings. Next the output of the participants was passed on to the landscape architect at a horizontal level (Steinitz, 2012)
Representation models	At a scale of 1:400 the park area and its environment is depicted. 3D SketchUp models have been made to gain insights in dimensions and lines of sight.

Table 1: Operationalization of the second iteration of the Geodesign Framework (Steinitz, 2012)

Conclusion

The development of the *van Leeuwenhoekpark* is a compelling case where stakeholders work together to create an attractive living environment. Partly thanks to the financial crisis, the municipality of Delft has noticed at the decisive moment that citizens play an essential role in this process.

As far as geodesign is concerned, it can be concluded that 'the people of the place' and the 'design professionals' are well represented in the development process. Experts from the fields of geographical science and information technology are barely involved.

Designers and architects have only been using GIS technology for a few years now, and recently also in combination with BIM (Schaller, J., Gnaedinger, et al. 2017). In future urban development projects with complexity such as the *Spoorzone*, it is desirable that also geographic science, information technology systems and data exchange used in all layers of the process are geared to one another. Geodesign helps stakeholders to understand the connections between social, economic and ecologic aspects within a urban area. It would not only saves costs and reduces risks, but also enables the collaborators in the geodesign team to work together more efficiently in order to achieve a better result for the end user.

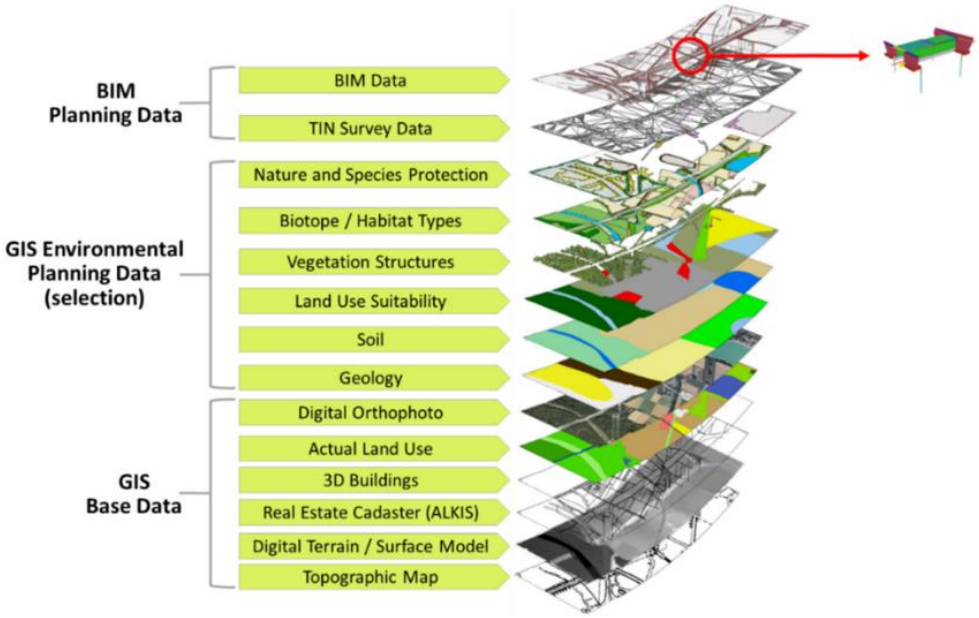

Figure 6: Integrating BIM and GIS data (Schaller, J., Gnaedinger, et al. 2017)

References

Batty, M., (2013) *“Defining Geodesign (=gis design?),” Environment and Planning B: Planning and Design*, 40(1), pp. 1–2. doi: 10.1068/b4001ed.

Busquets, J., (2010) *Spoorzone Delft Railway Zone Public Space Project*

Busquets, J., (2010) *Spoorzone Delft: ontwerp openbare ruimte.* Artyplan

Ervin, S., (2014) *BioComplexity, Systems Thinking, and Multi-Scale Dynamic Simulation: Foundations of Geodesign*. Peer Reviewed Proceedings of Digital Landscape Architecture

Flaxman, M., (2010) *Fundamentals of geodesign*. In E. Buhmann, M. Pietsch, & E.Kretzler (Eds.), Peer Reviewed Proceedings of Digital Landscape Architecture 2010at Anhalt University of Applied Sciences (pp. 28–41).

Gemeente Delft, (2006) *Spoorzone bestemmingsplan.* Delft: Gemeente Delft.

Gemeente Delft, (2013) *Nieuw Delft: Integraal ontwikkelingsplan 2025.* Delft: Gemeente Delft.

Goodchild, M.F., (2010) *Towards geodesign repurposing cartography and GIS?* Cartographic Perspectives, 66, 7–21.

Heurkens E, Daamen T., et al. (2015) *“City Tour Delft: The Making of a Knowledge City,” DISP*, 51(2), pp. 6–15. doi: 10.1080/02513625.2015.1064608

Nieuw Delft (2018) *Ontdek Nieuw Delft – Virtuele Plankaart* [Online] [Accessed on 4th October 2018] https://media.xkp.nl/PZH/nieuwdelft/

Ontwikkelingsbedrijf Spoorzone Delft, (2016) *van Leeuwenhoekpark – Basisdocument Programma van Eisen*

Pojani, D. and Stead, D. (2015) *“Urban Planning and Design As Verbal and Visual Rhetoric,”* Journal of Urban Design, 20(5), pp. 582–614. doi: 10.1080/13574809.2015.1071653.

Schaller, J., Gnaedinger, et al. (2017). *GeoDesign: Concept for Integration of BIM and GIS in Landscape Planning*. Journal of Digital Landscape Architecture, 102-112.

Steinitz, C., (2012) *A framework for geodesign : changing geography by design*. First edn. Redlands, Calf.: Esri.

Stoter, Jantien, et al., (2016) *"First 3D cadastral registration of multi-level ownerships rights in the Netherlands."* Proceedings of the 5th International FIG 3D Cadastre Workshop, Athens, Greece.

Vaartjes, R., (2018) *The application of information technology during the development of the Spoorzone Delft - van Leeuwenhoekpark*. Phone call to Sanne Allersma, Lodewijk Baljon Landschapsarchitecten, 12th October 2018

Vaartjes, R., (2018) *The application of information technology during the development of the Spoorzone Delft - van Leeuwenhoekpark*. Email to Ad Broeders, ProRail, 11th October 2018

Vaartjes, R., (2018) *Climate research van Leeuwenhoekpark*. Email to Marjolein Pijpers-Van Esch, TU Delft, 7th October 2018

van Herwijnen, M. and Rietveld, P., (1999) *Spatial Dimensions in Multicriteria Analysis.* in JC Thill (ed.), Spatial Multicriteria Decision Making and Analysis; A geographic information sciences approach. Ashgate, Brookfield, pp*. 77-102.*

Appendix A – Timeline *Spoorzone Delft – van Leeuwenhoekpark*

1847 – Construction of the first railway line between The Hague and Rotterdam
The *Hollandse IJzeren Spoorweg-Maatschappij* (HIJSM) built a railway line that ran along the city canal of Delft's old town.

1965 – Completion of the railway viaduct
The ground-level railway connection, which cut through the old city centre and the new western districts, resulted in dangerous situations due to the growth of traffic. In 1961 a start was made with the construction of the railway viaduct right through Delft. The railway viaduct ran from the *Kampenveldweg* to Delft station. In addition to the construction of the railway viaduct, the city canal parallel to the viaduct was also filled in and set up as the main road, the *Phoenixstraat*.

1988 – Vision NS
In its vision, the Dutch Railways (NS) wrote a document: Rail21. It stated that the track between Amsterdam and Dordrecht should be expanded from two to four tracks in order to handle future passenger growth and expansion of the timetable. For Delft, NS proposed an above-ground doubling, a viaduct on the existing viaduct. The municipality of Delft and its inhabitants strongly opposed to this vision. Urban planner Frits Palmboom was asked by the municipality of Delft to investigate the opportunities and threats of doubling the railway line.

1991 - Urban exploration
Urban design agency Palmboom en van den Bout concluded that the only sustainable solution is to tunnel and expand to four tracks. The advantage of the tunnel is that the redevelopment of the area (approximately 30 hectares) in the geographical heart of Delft, on top of the tunnel, will provide the municipality of Delft with money. A railway tunnel will bring the following benefits to residents:

- Elimination of noise pollution (between 85 and 95 dbA on the facades of the neighbouring houses)
- Elimination of vibrations and deposits of metal particles by passing trains
- No more pollution by toilet paper from passing trains
- Improvement of social safety in the area through the demolition of the railway viaduct
- Better connections between the city centre and the western districts

1992 – Postponement of extension to four tracks
NS decides not to extend the track to four tracks for the time being. As a result, there is no need for NS to investigate the construction of a railway tunnel. The Lower House of the Dutch Parliament asked the Dutch government to investigate which sustainable four-track rail system is still feasible.

1993 – 1995 Support for railway tunnel grows
Next to the Minister of Transport, also Railned and the Lower House of Parliament are asking again to investigating the feasibility of a sustainable solution for the railway area in Delft.

1996 – First Dutch internet petition for the railway tunnel
Approximately 500 statements of support are collected online for the construction of a railway tunnel. The petition will be presented to the Minister of Transport.

1999 – Urban vision
The municipality of Delft asks Spanish architect Joan Busquets to develop a vision for the entire *Spoorzone*.

By putting much detail in his design, Busquets wanted to prevent parties from giving too much of their interpretation to the design in the execution process.

1999 – Municipality of Delft buys properties in the *Spoorzone* area
To enable the development of the *Spoorzone* area, the municipality will consult with residents and start purchasing buildings that need to be demolished.

2002 – Process agreement Delft railway zone
The Ministries of Transport, Housing, Spatial Planning and the Environment, the Province of South Holland, the metropolitan district Haaglanden and the municipality of Delft confirm the need for a solution to the railway viaduct by concluding a process agreement on the Delft railway zone. The purpose of the agreement is to limit noise pollution, to achieve high-quality urban development and to enable the future expansion of rail capacity (Ministry of Transport, 2002). The agreement focuses on stakeholder management.

2003 – Delay threatened by new insights from the Dutch government
Unfortunately, there is a risk of a delay in the development of the railway zone in 2003. The current cabinet prefers to invest in the extension of the A4 motorway west of Delft and a railway repair plan instead of spending money on a train tunnel. Residents set up the Delft Rail Tunnel Action Committee 'NU', and collect more than 10,000 signatures. The petition is presented to the Lower House for the discussion of the budget for Transport. The Lower House requests the Minister to reserve an amount of € 344 million for the period after 2010, in order to make the construction of the railway tunnel possible. In 2004, Minister Peijs of Transport decided that the railway tunnel in Delft would be built.

2003 – Masterplan *Spoorzone*
The municipality of Delft, together with architect Joan Busquets, is completing the master plan for the Delft Railway Zone. The plan includes:

Below ground

- a 2.3 km railway tunnel
- an underground railway station
- underground bicycle shed
- a parking garage

Above ground

- 30 Hectares public space to be redeveloped

2005 – Amendment of the zoning plan
The municipality of Delft starts with a preliminary design of the zoning plan. The municipality received 150 responses. Two meetings have been organised to explain the *Spoorzone* project. The zoning plan will be adjusted by some reactions.

2006 – Final version zoning plan
The City Council of Delft adopts the zoning plan for the *Spoorzone*. A separate entity, *Ontwikkelbedrijf Spoorzone Delft*, is established for the project coordination. The selection procedure for an architect for the station and city office is started. In 2007 this was awarded to Mecanoo Architects. The construction of the railway tunnel, the underground station and the layout of the above-ground space was put out to tender. In 2006, the quality framework has been drawn up. The quality framework is the overview of the urban planning rules for the *Spoorzone* plan area. This partly determines the desired atmosphere and appearance of the area.

2008 – Financial crisis
The global economic crisis means that the sale of land to project developers is lagging. As a result, the ambition of 1,200 homes in *Nieuw Delft*, the new district in the *Spoorzone*, has been adjusted. The area will be developed in smaller parts over a more extended period.

2008 – A digital platform for residents and stakeholders
The website *Spoorzone Delft* is launched. A digital platform for residents and stakeholders. ProRail has awarded the contract for the construction of the railway tunnel, the underground station, a parking garage and the preparation of the aboveground *Spoorzone* area to the building consortium CrommeLijn.

2009 – Opening information centre
The construction of the railway tunnel starts. Environmental managers will be appointed to contact residents and entrepreneurs around the *Spoorzone* area. The information centre is opened depicting a model of the development area, information material is provided and neighbourhood meetings are organised to inform stakeholders about the progress of the project. A separate damage desk is opened where residents and entrepreneurs can report damage to their home, business premises or properties that occur during construction.

2009 – Image quality plan
The image quality plan elaborates further on the quality framework drawn up in 2006. The plan describes the choice of materials, quality level and specific architectural rules about expression, rhythm and scale.

2010 – Participation
The municipality of Delft realises that the inhabitants are still not sufficiently involved in the development of the *Spoorzone* area. An online dialogue is started in order to give residents the possibility to put forward ideas for the development of the area.

2013 – Integral Development Plan *Nieuw Delft*
Urban development agency Palmbout is asked to draw up an integral development plan for the area above the railway tunnel. The vision of Joan Busquets is still visible in this plan. However, it is more focused on the approach that the *Spoorzone* area will be developed step by step and that subareas can first be given a temporary function.

2015 – Completion of Delft station
As of 28 February 2015, passengers will drive through the Delft railway tunnel. The construction of the first houses in the *Spoorzone* start. The district is called "Nieuw Delft".

2016 –Participation meeting *van Leeuwenhoekpark*
During a meeting of residents and council members, ideas are put forward for the interpretation and design of the city park. Partly on the basis of these ideas and the preconditions for building on the roof of the railway tunnel, a programme of requirements is drawn up.

2016 - First 3D Cadastral Registration of Multi-level Ownerships Rights in the Netherlands

2017 – Railway tunnel ready
The second tube of the railway tunnel has been completed. The railway tunnel is now completely ready.

2017 – Preliminary design of *van Leeuwenhoekpark* completed by Lodewijk Baljon Landschapsarchitecten

2020 – Final design *van Leeuwenhoekpark*

2021 – Start creation Park North – Northside

2022 – Start creation Park Nord – Southside

2025 – Start creation Park South

2025 – 2035 Depending on market developments, urban development will be completed between 2025 and 2035.

Appendix B – Stakeholders

Stakeholder – interested party/person	Role
The Municipality of Delft	- Responsible for urban development - Landowner - Client for new municipal offices - Responsible for the living environment in Delft - Responsible for accessibility - Final control over the realisation and development of the *Spoorzone* - Risk bearer for the entire project, in which a large part of the risk was transferred to the Ministry of Transport halfway through the project.
Ontwikkelingsbedrijf Spoorzone Delft (OSD)	Responsible for the preparation, implementation and project management of the development of the *Spoorzone* area
Metropolitan district Haaglanden	Responsible for improving regional public transport, including the public transport hub Delft by contributing € 11.3 million to the development costs.
Province South Holland	- Stimulates high-quality urban developments by contributing € 30 million to the development of the *Spoorzone* area. - Advocate and strong supporter of the project - Encourage regional partners to participate in the discussion on the content of the area
Ministry of Housing, Spatial Planning and the Environment (*VROM*)	Subsidiser for the railway tunnel, the city park and underground bicycle parking facilities through a contribution of € 80 million.
Ministry of Transport	- Reducing noise pollution in the Railway Zone Area - Expanding rail capacity on the Delft section by contributing € 392 million.
ProRail	- Responsible for the tendering and construction of the railway tunnel and grant applicant at the Ministry of Transport.
Construction consortium CrommeLijn (CFE, Mobilis, Dura Vermeer)	- Construction of railway tunnel and roof - Preparation for construction city park environment
Dutch Railways (NS) / NS Poort	- Above-ground area development - Testing rail and station infrastructure
Public transport operators (HTM, Arriva, Connexxion, RET)	It is in the interest of public transport companies to have an easily accessible public transport node with transfer possibilities to other modalities both during the development phase and after the realisation of the Railway Zone.
Architect Joan Busquets	The architect of the urban development vision and the master plan *Spoorzone* Delft
Architect Benthem Crouwel	The architect of the underground station building
Mecanoo architects	The architect of the station hall and the town hall
Lodewijk Baljon Landscape Architects	Design *van Leeuwenhoekpark*
Developers and contractors	Performance of construction work
Entrepreneurs / retail	For entrepreneurs in and around the *Spoorzone* area it is important that their company is as easily accessible as possible for employees, customers and logistics parties. The delivery of the *Spoorzone* can

	increase the customer base, improve accessibility by public transport, car and bicycle and attract more potential employees.
Travellers/commuters	During the development of the *Spoorzone* (the new NS station, public transport hub, underground bicycle parking facilities and car parks) passengers must be well informed about the accessibility of the surroundings and the timetables of the public transport companies. Once the *Spoorzone* has been completed, the transport flows must be well connected in order to travel to and from a destination as efficiently as possible.
Citizens	The realisation of the *Spoorzone* causes a lot of inconvenience for the inhabitants of Delft who want to travel via the area from the west to the centre and east of Delft and back again. The *Spoorzone* connects the districts of Delft and increases the cohesion between the inhabitants.
The people living in the neighbourhood of the *Spoorzone* area	During the development of the Spoorzone, the surrounding area is less accessible to local residents, demolition and construction work causes noise and building material nuisance and there is a risk of subsidence and cracks in homes. Residents strongly support the demolition of the railway viaduct and the construction of the railway tunnel. The residents have united in interest groups per district to communicate with the municipality of Delft about the development of the area.
Stakeholder organisations and neighbourhood communities (environmental groups, residents, ROVER)	Interest groups look at and participate in the realisation of the *Spoorzone* area by their areas of interest. Besides residents, these are passenger and environmental organisations.
Emergency services (police, ambulance, fire service)	Both during and after the realisation of the Spoorzone, the area must be easily accessible to the emergency services. During the tests in the railway tunnel, the emergency services play an important role in testing the safety procedures and scenarios.
Archaeologists	Delft has a rich history dating back to the 11th century. When excavating the railway tunnel, archaeologists must be given time and space to preserve their mineral resources.
Knowledge Institutes	TU Delft and TNO offer a great deal of knowledge and experience in the field of construction projects such as the railway tunnel and area development.
Students	The *Spoorzone* project offers a challenging case for students. Students from the faculties of Civil Engineering, Architecture or Industrial Design, among others, use the *Spoorzone* with both hands to increase their knowledge based on a project directly in their environment.