Urban movers – elevated railway structures and urban life

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urban movERS
ELEVATED RAILWAY STRUCTURES
AND URBAN LIFE
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Elevated railway structures (ERS) have for more than a century been evolving as an urban archetype. Present in various forms in cities across the globe, to transport the increasing number of citizens, ERS are urban infrastructures that perform a vital role in curbing congestion and pollution that plague cities so often. In spite of their sustainable transport benefits, ERS are often viewed negatively as noisy, ugly and severing urban form, amongst other problems which will be elaborated on - problematising ERS. A theorisation of these problems follows, looking at ERS as an urban type, an infrastructural type and other typologies. 39 types of ERS interventions are described as the result of a global literary and experiential search of various instances of ERS and projects that seek their urban integration. It is a search for the potentials of ERS to contribute to urban life and urban form, beyond their main transport function - potentialising ERS.
FIELD SKETCH - ARRIVING IN ASIA (BANGKOK & HANOI)

Having set foot in Asia for the first time, my first experience outside one of the Bangkok airports, (after a quick encounter with the tropical, humid heat outside one of the exits) is the BTS skytrain ride into the city. At first perplexed by the queue that formed at the station, I would later come to understand that the density of people in this city requires such choreography. The air-conditioned train is a relief against the heat and I am surprised that despite this heat, there is no smell of sweat. The name Ratchapraprop sounds familiar and I head there, later doubting my memory, I got off at a station, I battle myself and my luggage through the densely peopled train. Again the heat and a crowd of people at each point along the platform where the train doors will open. I am anxious about the entry squeeze and realize that I might have to wait for the second train to come. The view from the elevated station allows one to see across this part of the city with plenty trees and tall buildings. After a ramped exchange from one station to another, I get down to the street where I am immersed in the reality of Bangkok traffic beneath the railway - a fast flow of motorbikes, cars, buses, trucks and pedestrians confined to narrow sidewalks shared with vendors and parked bikes. The presence of the concrete elevated railway structures are overhead are an integral part of the image of Bangkok’s urbanity and experience.

HANOI METRO

It was in Hao Nam (a wide double street in Dong Da, Hanoi), amidst many music instrument shops, the Vietnam National Academy of Music and the Vietnam National Institute of Culture and Art Studies, that I first encountered the elevated structure of the Hanoi Metro (Line 2A, near La Thanh station). Large concrete columns rise from rubble traffic islands to carry the heavy concrete beams, tracks and eventually trains with commuters above. These traffic islands - post-construction sites - will likely be filled with plants. However, especially within this arts and cultural context, could the Hanoi Metro structures not become something more? Could the context around the metro lines not influence and differentiate the relentless sameness of these metro structures?

The Hanoi Metro is currently under construction. Eight routes are planned, of which the first line is scheduled to open in November 2018. (Hanoimetro n.d.) Construction on a second line is well underway and this line is scheduled to open in 2021. The system is an elevated rail system. Most people in Hanoi currently get around using motorbikes. There are around five million motorbikes on the roads of Hanoi, causing heavy traffic congestion and pollution at times. The department of transport wants to ban motorbikes and scooters by 2030. It aims to do so with the introduction of a BRT system and the new Hanoi Metro (Hodal 2017).

Although the metro system should free-up schedules, provide safe, quiet and cool transport to those who can afford to use the metro, this system also in a sense restricts movement along the lines it operates. Together with the proposed ban on motorcycles, it will also impose on Hanoians’ freedom of movement. When considering urban development, land and housing costs, etc. the metro is also likely to inflate the cost of owning and renting space around its stations, as it happened in other cities like Bangkok.

URBAN INFRASTRUCTURES

With the urbanization and densification of people, comes the infrastructures necessary to service them. These infrastructures are often large-scale centralized, engineered projects that feed cities with water, power, transport, treat their waste, etc. Infrastructures are often inaccessible and hidden from view from citizens. Infrastructures are seldomly ‘made architectural’, like other city-building projects are. Transport infrastructures permit a slightly closer interaction with citizens, since they move along them, on foot and in private and public vehicles. Streets have been studied extensively in the urbanism and planning discourse. Elevated railway systems (ERS) have recently become focus features of urban, architectural and landscape projects, notably the Highline project in New York and similar. However, these projects happened at abandoned sites, while the discussion is moving towards functional ERS and how these could become ‘architectural’ and ‘urban’.

problematising

Elevated railway structures

Within existing research, ERS are problematised in various modes: landscapes with a negative effect on the image of the city (Hormigo & Mori-to 2004), residual or left-over spaces (Qamaruz-Zaman, et al 2013; Shi 2016), mono-functionality (Gabrielle et al 2016), urban segregation (Jensen 2007; Karis 2017)

Problem 1 - Un-architectural infrastructure

Infrastructures are often engineered and planned with a purely functional purpose. This limits the potential of urban structures to contribute to the positive image of the city and to support several forms of urban life. Elevated railway structures are usually very visible structures but very seldomly designed architecturally - to produce aesthetic effects. There are exceptions, like the ERS in Vienna and Berlin that were in a sense designed like linear buildings.

Temmen’s article (Temmen 2017) aims to decipher the urban design strategies that were used in the design of the Berlin Stadtbahn railway viaduct in Berlin. He sets out to find the value that architecture adds to this ‘building-viaduct’, where the role of architects in infrastructural projects are usually obscure.

Problem 2 - Neglected / residual / left-over spaces

Elevated railway structures by being separated from the ground, allow for a free-flow of trains without interruption by traffic on the ground. They also span across boundaries like rivers and valleys or existing roads, rails and highways. The spaces beneath these elevated structures are however often neglected, left-over and residual that could be utilized by citizens. A study of left-over space beneath two flyovers in Kuala Lumpur was conducted in 2013 (Qamaruz-Zaman, et al 4). The researchers found various activities occurring here, at different times of day. They observe informal activities such as food stalls, cafes, sports and recreational activities (including chess playing, carom and ping pong), businesses and services (eg. toys and clothes stalls, as well as movers, a car wash and workshop services), a bi-weekly evening market with fresh food.

Cultural activities included traditional performances with traditional musical instruments. (Qamaruz-Zaman, et al 2013:96-101)

Hormigo and Morita did a study of left-over spaces in Tokyo. They invented a term for such spaces. Gapspaces are defined as spaces that emerged from density-increasing processes in urban areas were space is limited. For growth to take place in the same geographic area, activities need to happen at different heights or at different times. The infrastructures that perform this distinction cause functional separations and spatial interruptions in their surroundings. Gapspaces interrupt continuity, either spatially, temporally or functionally. Gapscapes, in turn, are the landscapes consisting of gapspaces. (Hormigo & Morita 2004:182).

The authors construed a typology of 16 types along the JR Yamanote line in Tokyo. These types considered permeability and interactivity between gapscapes and the city (Hormigo & Morita 2004:185-187). A detailed review of these typologies will follow in the following section.

Problem 3 - Mono-functionality

Elevated railway structures are most often designed for a single purpose only - for transport. If other activities occur around these structures, these are usually unplanned for, and emergent.

A paper delivered at the World Congress on Railway Research, held in Milan in 2016 (Gabrielle et al 2016) investigates how functional diversity could be incorporated into the design of elevated transit structures by designing viaducts simultaneously with the spaces beneath them. The authors analyse theoretical urban planning approaches; they apply the concept of mixed-use development to elevated transport infrastructures by defining criteria for functional diversity and apply these criteria to three projects. (Gabrielle et al 2016:2). The criteria: 1) combining at least two functions at the same place; 2) physical integration, 3) functional integration, 4) construction according to a coherent masterplan (Gabrielle et all 2016:4-5). They apply these criteria in a comparative analysis of three ERS renovation projects in Europe (Isy-les-Moulineaux, Zurich and Darmen). They conclude that the integration of transport infrastructure with other urban functions could bring economic returns, be of social benefit and improved urban quality. The spaces beneath ERS should be designed simultaneously with infrastructures in order to accommodate diverse functions. With functional diversity, however, interested stakeholders multiply and collaboration is required for successful projects (Gabrielle et all 2016:6-7).

Problem 4 - Dividing / segregating

Transport systems that use elevated railways are sometimes criticised for segregating and gentrifying communities and neighbourhoods. The process of their construction often require acquisition of land and the landowners are not necessarily fairly compensated. The cost of using the rail system also excludes people without the means to pay regularly for tickets. The Bangkok Skyrail is one such example that was investigated by Jensen (2007) as much more than just an infrastructure project to overcome traffic congestion and pollution. The skyrail participates in urban segregation, by dividing citizens along lines of economic ability. Tourists and the elite tend to use this system, while poor and immigrant workers are left behind in the dark and polluted ‘tunnels’ beneath the skyrails (Jensen 2007). The way that elevated rail systems segregate is through having expensive fares only payable by some people, by increasing property values around its stations and through connections to spaces of consumption.

Research Question

The four-pronged problematization of elevated railway structures could show the way to better urban integration of these structures. The question becomes - in what ways can elevated railway structures become better integrated within urban contexts and become productive to urban life? What kind of interventions can remedy the problems of disciplinary design, residual spaces, mono-functionality and segregation in both existing ERS and the design of new ERS.

Method

1. search for a variety and multiplicity of ways ERS can integrate with urban environments.
2. illustrate with images, descriptions, case studies, personal experiences.
3. from these strategies/concepts emerge of how to improve existing ERS and how to better design future ones.
Elevated transit structures are an urban type, similarly to how streets, plazas, parks, etc. are urban types. More specifically they are an infrastructural type, that sometimes perform like other urban typologies - the viaduct, the bridge, the city wall, the portal, the colonnade, etc.

West8’s proposal for the redevelopment of the Gardiner Expressway and urban surrounds, declares that with building the railway and highway infrastructures, an ‘infrastructural wall’ was built. “Seemingly without notice, the city accumulated a thick band of infrastructures that have cumulatively created a ‘wall’ separating city and lakefront.” (West8 et al 2013:31)

They trace the historical evolution of the city wall. With the urbanization of the city wall, it has served different purposes (symbolic, ceremonial, defense) and became hybrid structures.

The building-viaduct.

Temtem’s article aims to decipher the urban design strategies that were used in the design of the Berlin Stadtbahn railway viaduct in Berlin. He sets out to find the value that architecture adds to this ‘building-viaduct’, where the role of architects in infrastructural projects are usually obscure. The ‘building-viaduct’ of the Berlin Stadtbahn is morphologically linear. Designed by architect August Orth and civil engineer, Ernst Dirksen and built between 1875 and 1882. An elevated structure was selected to avoid conflict with existing buildings, while the sandy soil and high water table of Berlin made a subway system problematic. Apart from linking peripheral areas with the centre, the project was also the urban addition of an ‘inhabited arcade’. The scenic effects of a ‘well-ordered facade’ would give a new face to the public spaces of Berlin. The project was conceived to urban theories of the time that were concerned with urban physiognomy. In contrast, the Chicago elevated railway, with ‘planning limited by an engineering vision, conceiving it as a structural bridge with nothing below, leaving an undetermined space that became residual and useless’ (Temtem 2017:5).

What the linear building-viaduct with its well-ordered facade then achieves within its urban setting are unique streets bordered on the one side with older and more contemporary 5-6 floors Berlin buildings, and on the other with the linear archway facade of the railway. The result is a ‘kind of hybrid conduit flanked by chains of built elements with highly uneven edges...’ On the side you have the infrastructural model and on the other side the continuity of urban blocks, formed with building facades. (Temtem 2017:10)

Le Corbusier’s first point of architecture - freeing the ground, for what?

In a conference paper, entitled ‘The Typological Burden’, Tarsha Finney cites Kenneth Frampton’s critique of a New York housing project built on pilots. The ‘city on piles’ brought about a ‘typological burden’ - what would the inhabitants have done with all the space beneath the floating ‘building on piles’. Elevated Railway Structures suffer from a similar ‘typological burden’. By virtue of being elevated, they allow the continuity of pedestrian and vehicular flows beneath. However their ‘typological burden’ lies in the question of what these freed-up spaces could become - how they are used, and how they form urban space. (Finney 2014)

URBAN (LANDSCAPE) INFRASTRUCTURE

Flowscapes - spaces of flows and spaces of places

Nijhuis and Jaulin (2015) puts forward ‘urban landscape infrastructure’ as a design concept. As a critique of engineered infrastructures that are often designed for a single purpose, ‘urban landscape infrastructures’ have the potential to additionally shape urban landscapes for social and ecological benefit.

They propose four approaches to the design of landscape infrastructures: spatial approach - as architectual spatio-visual experiences; ecological approach - green infrastructures that sustain natural resources; technical approach - civil and agricultural techniques and social approach - participatory and human-centered design (Nijhuis and Jaulin 2015:19-20). A theory

Architectural / Urban Typologies

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of ‘Flowscapes’ was developed with TU Delft. In addition to the ‘spaces of places’, urban landscapes consist of ‘spaces of flows’. Urban landscapes are complex and dynamic systems with various elements and processes in interaction. ‘Flowscapes’ are “the formal expression of structures for the (1) provision of food, energy, and fresh water; (2) support for transportation, production, nutrient recycling; (3) social services such as recreation, health, arts; and (4) regulation of climate, floods and waste water.” Spaces of flows are emerging as a new field and design discipline. (Nijhuis and Jauslin 2015:24)

Nijhuis and Jauslin considers three potential fields where urban landscape infrastructure could operate: 1) transport landscape infrastructures, 2) green landscape infrastructures and 3) water landscape infrastructures (Nijhuis and Jauslin 2015:26-30). Relevant to the present paper, the field of transport landscape infrastructure design includes various modes of transportation, energy, waste and information systems. When these functional infrastructures are viewed as ‘urban landscape infrastructures’ they have the potential to integrate technical, aesthetic and social values into multi-use designs that create new forms of public space. (Nijhuis and Jauslin 2015:26).

ELEVATED RAILWAY STATION TYPOLOGIES

A study by Loukaitou-Sideris et al. (2013:331), looked at a number of different station typologies. Elevated railway stations are difficult to physically integrate with their surrounding urban contexts. The study was conducted along the Green and Gold elevated railway lines in Los Angeles, USA. They looked at the 14 elevated railway stations and came up with challenges and remedies for better urban integration of these stations. The extant literature on urban integration of transit stations are mainly about street-level stations. This paper however focused on elevated stations. Most of strategies that emerged from this study are relevant to not only elevated stations, but the rest of the elevated railway lines too. From assessing the accessibility of elevated stations around the world, the researchers have recognised four types of interventions: 1) architectural interventions, 2) landscape interventions, 3) mobile urbanisms and 4) perceptual links. Within each of these four types of interventions, specific strategies to integrate stations with their urban fabric emerged. The diagram is a summary of these interventions.
Architectural interventions:
1) Full knot: The station is enveloped within a building that houses various functions, while different levels are accessed from within the building.
2) Side access: Similar to the Full knot, but the building is only on one side of the station, requiring less available land.
3) Viaduct (path below): Making use of the spaces beneath elevated railways for other activities, outside or in built structures.
4) Viaduct (path above): Utilizing the space above elevated stations, this strategy doesn’t fully enclose the station, but wraps above and beside the station, requiring less urban land.
5) Bridge: This type of intervention spans over transport infrastructure (typically where these are located beneath street-level). (Loukaitou-Sideris et al. 2013:320-324)

Landscape interventions:
1) ‘Layered ground’ accommodates landscapes on a new plane constructed over transport infrastructure.
2) ‘Underspace’ converts spaces beneath urban infrastructures into landscapes for recreational or other uses.
3) ‘New Paths’ form new, mostly non-motorized connections between areas that were divided by transport infrastructures. (Loukaitou-Sideris et al. 2013:324-326)
4) Architectural and landscape interventions require enough land and capital in order to realize, there are more modest types of interventions that could be implemented with less land and capital available:
   Mobile urbanisms:
   1) ‘Remote urbanism’ fits new programs or events into railway carriages - a mobile museum.
   2) ‘Off-site nodes’ connect platforms in various ways (foot and bicycle bridges, moving sidewalks, shuttles, escalators, etc) to other places.

Perceptual links:
1) ‘Nodal Networks’ use wayfinding markers that define paths that link places within a large urban scale.
2) ‘Privileged Path’ uses recurring markers to show the route to stations.
3) ‘Urban Narratives’ connect stations to each other and to their surrounding neighborhoods, using visual graphics or art that ‘tell stories’.
4) ‘Graphic connections’ -
5) ‘Perceptual Stimuli’ or the stimulation of the senses (sound, light, steam) by effects that define and connect spaces.
6) ‘Perceptual Extension’ - architectural view-framing to connect disconnected spaces.
7) ‘Inclusive Cover’ - a net of light and graphics are used to ‘wrap’ urban infrastructure. (Loukaitou-Sideris et al. 2013:326-329)

UNDER THE ELEVATED - Design Trust for Public Space. New York, USA. 2015
A collaboration between the New York City Department of Transportation and the Design Trust for Public Space undertook to study the elevated highways, elevated railways and bridges of New York. The project was published as a book, entitled ‘Under the elevated: reclaiming space, connecting communities’ (2015). In New York alone there is about 700 miles of elevated transportation infrastructure leaving in its shadow ‘dark, noisy and forbidding’ spaces (Bauer et al. 2015:6).

This project explored ways in which the ‘spaces under the elevated’ - or ‘el spaces’ could be developed into multi-functional public places that enrich the surrounding neighbourhoods. Although the ‘Under the Elevated’ project is embedded in New York, it will be studied here to get insight into the methodology used; the universal typologies that emerged from inventing elevated transit structures and the urban strategies of improving el-spaces for public benefit.

Typical el-spaces are under jurisdiction of a whole number of different actors - departments of planning, transportation, parks, environment, etc.

Potential: “ecological and technical infrastructure initiatives, new forms of connective public space, strategically located recreational areas, and innovative models of public-private land use.” (Bauer et al. 2015:33)

El-space assets: space (the vertical dimension ranging from human-scaled to lofty urban), land (physical space and ownership), structures (architectural, sheltered space) and locations (a connective network for alternate travel modes, linear public space, and environmental use). (Bauer et al. 2015:38-39)

An inventory of the 700 miles of elevated transit structures was mapped. Typical sections were drawn and seven distinct formal types emerged from the inventory: landing, trestle, park, highway, cluster, clover, span. Case studies were then selected to represent each of the el-space types.

Landing - ‘The barriers formed by ramps, abutments, off-ramps, etc. that connect elevated structures with the ground level. Trestle - the overhead structures of the elevated railways. Park - where the elevated infrastructure runs across publicly accessible or less accessible parkland. Highway - that often form sheltered, dark and physical and visual barriers. Cluster - the many transit systems converge, creating large footprints that divide neighbourhoods; Clover - typical massive highway cloverleafs that leave difficult to access landscape patches; Span - bridges that span across geographic and legal boundaries offer opportunities to link.” (Bauer et al. 2015:40-41)

In addition to the seven types, the Design Trust team also put forward an incremental phased approach to transforming these sites - pop-up > pilot > permanent. Low-cost, small, pop-up interventions could initiate discussion and workshops and gather information. After which short-term pilot projects could test significant spatial, programmatic and operational changes under elevated infrastructure. Before investments in permanent interventions are made. (Bauer et al. 2015:42). ‘Permanent’ improvements could then be made with evidence-based designs that are derived from communities and their contexts.
The elevated transit structures of Philadelphia was studied PennDesign City and Regional Planning Studio of Fall 2016 (PennDesign 2016.22-31). The typology was arranged according to three categories - above, below and beside. “Above refers to the function of the structure, its width, frequency of use, condition, and other characteristics of the activity occurring on the structure. Below includes aspects relating to the environment underneath the structure, including light levels and passage through. Beside includes the environment immediately adjacent to the structure, including the land use and density of structures.” (PennDesign 2016-25) The study then did an analysis of elevated transit structures based on adjacent land-use, average adjacent parcel size and elevated structure type. Three sites - one at a high-way, one at a freight railway and one at a passenger railway line – were selected in areas of high environmental, economic and socio-economic vulnerability (PennDesign 2016.28-37). These three elevated transit sites then served as case studies for proposals to implement green stormwater infrastructure, while also addressing neighbourhood concerns. The strategies that were suggested for these sites included: 1) establishing green corridors by linking new stormwater infrastructure adjacent to the elevated structure to a network of rain gardens, street trees and parks; 2) targeting large landowners and private land-owners to invest in stormwater retention schemes; 3) educating the public about GSI at transit stations through public art installations.

SUMMARY OF THEORIES

Within this section - theorising ERS - elevated railway structures was elaborated on as an urban type. These structures are infrastructures that take part in urban form, sometimes behaving like viaducts, city walls or portals. West8 et al have shown the typological evolution of the city wall from ancient fortification to contemporary hybrid types and how elevated transit structures in Toronto embody the city-wall-type. Temtem viewed ERS in Berlin as building-bridges. These hybrid structures were integrated with the urban form through facades, while accommodating additional uses in ‘inhabited arcades’. Finney exposed the ‘typological burden’ that structures on pilonis cause - what to do with the underdened spaces between the columns. Nijhuis & Jauslin critiqued engineered infrastructures and suggested that thinking in terms of ‘urban landscape infrastructures’ would include ecological and social uses too. They introduce ‘flowscapes’, or spaces-of-flows, as a new design discipline, in addition to spaces-of-places. Transport landscape infrastructures are one type of flowscapes that could integrate different functions and produce new kinds of public spaces. Hormigo & Morito’s ‘gapscapes’ considered access, permeability and interaction beneath ERS. They derived a typology of gapspaces in Tokyo. In Los Angeles, Loukaitou-Sideris et al constructed a typology of ways to integrate elevated railway stations to their contexts that are equally useful in thinking about the urban integration of elevated railway structures. The ‘Under the elevated’ study derived seven formal types of elevated transit structures from New York. Through an incremental approach they initiated a series of projects at sites that represent each of these types. The ‘Greening the elevated’ study also devised a typology of ERS, but combined this with a mapping of areas of high environmental, economic and socio-economic vulnerability in the selection of project sites in Philadelphia. The strategies they suggested were specifically focused on Green stormwater infrastructure.
The structures of elevated railways are great canvases for both organised and unorganised graffiti-type art. Paint projects could re-animate neglected spaces and when designed in unison, they could form graphic connections or tell urban narratives (see numbers 5 and 7).

The Underground at Ink Block project in Boston invited 12 prominent artists to do murals and inaugurate a Mural Project in 2017. The murals covered around 14,000 m$^2$ of surface on nine walls beneath a highway (Undergroundinkblock 2018).

In an effort to put the ‘jungle’ back into the ‘concrete jungle’, there are projects that cover up the concrete structures of elevated transit structures with plants. A project like Via Verde in Mexico City creates an image of ‘greenness’ or an ecological imperative by adding planting around the existing concrete piers of elevated transit structures. However, at what cost? With the cost of one of these green columns, 300 trees could have been planted elsewhere. (Archdaily 2016). These ‘greening’ projects are perhaps more about the image of elevated structures in the city, and less about ecological benefit.

Reflective surfaces reflect their surroundings and as such they could have the effect of disappearance. Sean Hogan suggested such a reflective surface to cover the ERS in Melbourne. (Masanauskas & Carmona 2017). Early renderings of the the Davenport Grade Separation in Ontario, Canada showed reflective surfaces applied to the sides of noise barriers of new elevated railways to reflect the surrounding context. (Metrolinx 2016).

There is no lack of projects that sought to liven up the spaces beneath elevated transit structures with the use of lighting. (Bill Fitz Gibbons in Birmingham, Alabama; Herman Kuijers did two permanent light installation for two underpases - Marstrunnel and Kostverloren - in the Dutch town, Zutphen. The lights change colour, creating visual movement through the tunnels, while pedestrians, cyclists and motorists ‘experience the relationship between time and space’. (Azzarello 2015)

There was a project in San Antonio, Texas. Designed by Joe O’Connell and Blessing Hancock, the art work is ‘meant to thrive in the unpredictable elements of the public rather than inside a sterile gallery”. Chandeliers were made of junk metals and bike parts and each were fitted with a bright LED light source to throw projections on the structure of the highway. The lights are switched on two hours before sunset and a gradual change of light from natural to artificial happens during this time. The project is a result of a wider public art initiative to mark destinations of neighbourhood or cultural-historical importance. (Moret 2013)

Recently a project was launched where Vietnamese and Korean artists painted frescoes in seventeen of these archways with scenes depicting Hanoi’s 1000 years’ history. The artworks were opened in February 2018 as part of the Lunar New Year celebrations. The project was a collaboration between the People’s Committee of Hoan Kiem, the United Nations Human Settlements Program (UN-Habitat) and the Korea Foundation (Hanoitimes 2018).
The surfaces of elevated railway structures can become the hosts for graphic works of art. Continuity can be created through graphic consistency, while differences between environments and neighbourhoods can inform variation.

The Davenport Grade Separation project have invited artists to submit proposals for adorning the elevated sides. Alex McCleod have won the bid with his project ‘Secret Park Gate’. A 1.4 km long ‘mural’ - or massive 3D-rendered image - will depict six scenes in response to its urban environment (Hampton 2018).

The wayfinding strategy for the Underline project in Miami by James Corner Field Operations (2015), is closely tied to the branding and identity of the Underline, forming a continuous graphic identity. Wayfinding are designed to encourage walking along the trail; connect to surrounding trails and neighbourhoods; encourage multimodal transport and minimize free-standing signage. The signage provides information on ‘Where I am’, ‘Which direction am I facing’, ‘Where can I go from here’, ‘What is around me’, completed with distances. Additional-ly, facts and information on specific areas and artworks by local Miami artists are included. Signage is mostly applied directly to ERS (columns and beams) and to the bicycle and walking paths directly, minimizing the need for additional structures. (James Corner Field Operations 2015:158-213)

Elevated railway structures are by nature linear and they create routes between places. The spaces beneath ERS can follow their route or connect to other routes that connect green spaces, for example. These routes are marked using surface treatments or “recurring markers within a continuous infrastructure to establish and highlight a particular route or path...” (Loukaitou-Sideris et al 2013:328).

The Atlanta Beltine is an ambitious project aiming to connect parks, trails, transit and affordable housing into a loop through Atlanta, Georgia. The project originated with Ryan Gravel’s Master thesis, entitled ‘Beltline - Atlanta : design of infrastructure as a reflection of public policy’ (1999).

A study of left-over space beneath two flyovers in Kuala Lumpur was conducted in 2013 (Qamaruz-Zaman, et al). The researchers found various activities occurring here, at different times of day. They observe informal activities such as food stalls, cafes, sports and recreational activities (including chess playing, carom and ping pong), businesses and services (eg. toys and clothes stalls, as well as movers, a car wash and workshop services), a bi-weekly evening market with fresh food. Cultural activities included traditional performances with traditional musical instruments. (Qamaruz-Zaman, et al 2013:96-101)

Apart from all the murals done as part of the Underground Mural Project, the Underground Inkblock in Boston, MA is a space that have hosted all kind of events. There are regular fitness and yoga classes, dog parades or doodling days happening. The Octacofest combined beer, tacos and music into a festival beneath the overhead structure. (Underground at Inkblock 2018). After the success of this event, a seasonal beer garden was opened by a local brewery. Long tables, weather-resistant lounge furniture and lawn games can accommodate around 400 people. Food trucks and ‘pop-up shops’ will also be invited, providing an informal trading platform. (Cain 2018). The park and event space was a combined effort between MassDOT (Massachusetts Department of Transport) and a development company, National Development.

‘Das Küchenmonument’ or The Kitchen Monument by Raumlabor and Plastique Fantastique was a travelling inflatable and inhabitable sculpture that were inflated in various locations with various events occurring in it. In Duisburg it was even inflated beneath a flyover, hosting a public cooking and dining hall. (Raumlaborberlin 2016)
The cover that elevated structures provide makes the spaces beneath ideal for camping out. During events or festivals visitors could be accommodated here. The ‘Urban Campscape’ was such a campsite during the Dutch Design Week 2012. The space beneath a flyover in Eindhoven’s Strijp-S district was converted into a campsite, providing accommodation and cultural programs such as “guerrilla gardening workshops, an exhibition about the Green Corridor, breakfast with products from the Philips Fruit Garden, bicycle tours…” (Knitel 2012)

The programming of railway carriages for different purposes - eg. a mobile museum or mobile classrooms - or establishing connections between elevated railway structures and other places via bridges, ramps, escalators etc. Loukaitou-Sideris et al (2013:326-329) call these type of measures ‘Mobile Urbanisms’. Pictured above here are the carriages of the ‘Nomadic Railway City’ by Swedish architects Jagnefalt Milton.

Spaces beneath elevated railways are ideally suited for public spaces, since they are usually closeby railway stations and the cover overhead shelters against sun and rain or snow. Of this variety, example projects include ‘Under the viaduct’ by Renzo Piano and G124 in Rome; A8erna in Zaanstad, Netherlands; De Hofbogen in Rotterdam; the Crossroads Project in Milwaukee, USA; the Bentway in Toronto.

The Minhocão Marquise, a project by Triptyque Architects in São Paulo, Brasil. A transformation of 3km of the Minhocão Viaduct built in the 1970s. In addition to the plants added and stormwater retention, the project will make public space in the 33m in-between spaces between columns. These spaces will be filled with four kinds of programs modules - culture, food, services and shops. (Trippyque 2017)

Beneath the Bentway in Toronto, an ice skating route was installed to mark the space beneath the Gardiner Expressway as a new urban space and outdoor art gallery. (Hague, 2018)

Skate parks are popular use of space under elevated structures (Gardens station, Cape Town, South Africa; Ralambshovsparken, Stockholm, Sweden; Burnside Skate Park, Portland, Oregon; Northbank, Melbourne, Australia; Hanespark, Stade, Germany; Heidelberger Bridge Park, Berlin, Germany, etc. an extensive collection is available at www.skateboard.com.au). Scob Architecture and Landscape have designed a number of ‘Landskate parks’ in Barcelona. One of these, Skate Park Les Corts, is located beneath an elevated transit structure. The design is conceived to form a continuity between the skatepark elements, the vegetation and public space - rather than bulky, isolated elements. (Scob 2018)

Kosmos architects, in collaboration with Ekaerina Zavyalova, transforms the typology of the billboard with their Queensway Billboards project. Instead of advertising products, the billboards make possible vertical circulation with stairs, ramps, lifts, slides, etc. and perform social functions such as elevated sports, vertical gardens, art spaces, cinema, etc. In the project, a ‘billboard’ structure is located at each of the intersections of a portion of the abandoned Queensway railway. (Divisare 2016)
The High Line project in New York received a lot of press for converting a disused railway tracks into an elevated park. It should be noted that Paris initiated this type of urban intervention with the Promenade Plantée, designed by architect Philippe Matthieu and landscape architect Jacques Vergely in 1988 after they won the competition for repurposing an abandoned railway as a greenway. (Heathcot 2013:285).

After the High Line, a number of similar projects were launched in the USA and elsewhere: the 606 (Bloomingdale Trail) in Chicago, the RailPark (at Reading Viaduct) in Philadelphia, the St Thomas Elevated Park in Ontario, Canada, the Goods Line in Sydney, Australia. Although these are certainly exciting projects in re-invigorating neighbourhoods and cities, the question remains - what to do about elevated railway structures that are still in use?

Barcelona didn’t wait for its railways to become derelict before they added an elevated park space. The Rambla des Sants, designed by Ana Molino and Sergi Godia, added a second deck above a railway line in the Sants neighbourhood. The project aimed to ‘heal the wound’ between neighbourhoods that the railway tracks severed. The new park deck ranges from 4-12 m above the adjacent street levels and is supported on a prefabricated concrete structure that recalls traditional Warren beams associated with railway structures. (Landezine 2017)

Rambla de Sants, Barcelona, Spain. 2016. Ana Molino Sergi Godia

The Rambla de Sants project healed a portion of Barcelona that was severed by train tracks. The existing train tracks were roofed with a new linear park, giving panoramic visual access along two routes - a shaded one and a sunny one. Between the two paths, an artificial topography is densely planted with shrubs and trees. Climbing plants grow along the pre-cast concrete ‘infra-structural facades’ with cable systems to guide them (Landezine 2016)

Rambla de Sants, Barcelona, Spain. 2016. Ana Molino Sergi Godia

The Underline Park in Miami is designed around seven ‘character zones’ - ‘active recreation’, ‘green tech’, ‘art & craft incubator’, and ‘nature & play’. “The Underline will have character zones that draw from the surrounding neighborhoods and provide a varied experience including a number of unique programmed spaces along the way.” (James Corner Field operations 2015:103). Within these character zones there will also be half-mile ‘areas of intensity’ that become destinations. These include a play-focused area; an area of nature-oriented play beyond traditional playgrounds; an area of arts and crafts with outdoor galleries and connections to existing business; an area for the public to ‘create, display and teach crafts that enhances the public realm’; an area that caters for the student population ‘by creating a place to hang out, with social seating, food and drink and fun recreational activities such as roller skating and skateboarding’ (JCFO 2015:128); an area that caters for the student population ‘by creating a place to hang out, with social seating, food and drink and fun recreational activities such as roller skating and skateboarding’ (JCFO 2015:128); an area with health and wellbeing themed gardens such as butterfly habitats, or healing and aromatic plants; an area for group and individual fitness - outdoor workouts, soccer, frisbee, running and racing. (JCFO 2015:110-139)

21
Make a park beneath it

22
Attach trees to it

By virtue of their height, ERS, create the potential for attaching things up in the air. The festive temporary hanging of flags or lights comes to mind, but more permanent suspensions are also possible. Diller Scofidio + Renfro developed an interesting way to have trees attaching to the sides of elevated structures. The design was proposed as part of the competition entry for the redevelopment of the Gardiner Expressway in Toronto. ‘Suspended root ball trees’ would be suspended from the concrete structure, as if lifted together with the highway. Trees are planted in round bags that fit in steel ring baskets attached to the concrete structure. Once the trees outgrow their bags they are transplanted to streets. (Diller, Scofidio + Renfro 2010:8-9).
Chieu Lieu trees (Terminalia bel- 
lirica) or small-leave Bang (Bucida mo-
lineti) trees are being planted beneath 
the Cat Linh - Ha Dong line of the 
Hanoi urban railway. These trees are 
suitable for planting beneath railways 
when they are pruned to grow horizon-
tally, instead of vertically. (Dat 2016)

In some instances the height afforded 
by ERS, allow for structures to be 
hung from them. The Marsupial Bridge, 
part of the Crossroads project in Mil-
waukee, Wisconsin, USA, is one such 
example. A bicycle lane and pedestrian 
track is suspended from and ‘hosted’ by the steel railway bridge above. The 
bridge provides a close-up experience of 
both the water and the steel structure 
above. It reconnects neighbourhoods 
across the river, while also becoming an 
attractive visual centre-piece to the 
Crossroads project and adding an iconic 
urban infrastructure to Milwaukee 
(La and Dallman 2009), (King 2010) 
(Bruner Foundation 2008)

Radbahn, Berlin. A non-profit or-
ganization, called Paper Planes, formed 
by eight Berliners in 2016. They want 
to realize a 9 km cycling track beneath 
the elevated structure of the U1 line in Berlin. Ancillary spaces like green 
spaces, recreational spaces and bike 
service stations will line the cycle route. 
(Finger 2017)

At the Koiwa station in Tokyo, 
bicycle parking for about 1500 bikes 
were built beneath the elevated railway 
tracks. The facility now serves the train 
estation, a local shopping centre and the 
surrounding neighbourhood. (Ecosta-
tion21 2006)

Stormwater and rainwater (collect, 
prevent flooding and filter oil, heavy 
metals and gases) eg. Highway Outfall 
Landscape Detention HOLD system 
in Queens (Bauer et al. 2015:33).

The ‘Greening the elevated’ pro-
ject by the PennDesign studio of 2016 
proposed strategies to improve spaces 
around elevated transit structures, 
mainly through the implementation 
of Stormwater Green Infrastructure 
(PennDesign 2016).

The SGR (Standard Gauge Rail-
way) is being built through Nairobi 
National Park in Kenya. Initially 
planned to run through a rhino breed-
ing ground, the railway has been di-
verted over grassland. Although the 
railway has been raised above ground 
by 7m to 40m to allow animals to 
pass, there are still concerns that the 
6km railway will affect animal migra-
tion patterns. (Rajab 2018). The Kenya 
Railways Company chose this route to 
avoid high land compensation costs.
Building beneath elevated railway structures poses limitations, in terms of dimensions and in terms of ownership, safety regulations, etc. Despite these limitations, various uses could be accommodated in interior spaces beneath elevated railway lines. These functions are a product of the context. MySpace Architects in Delhi did a study and found that 60% of the spaces beneath the Noida metro line could be developed into functional spaces (Dovey 2017), that could include: Start-up and small scale businesses, co-working spaces, government offices, community centres and night shelters (Rethinking the future 2017).

CAATstudio made a proposal to convert the space beneath the Mirdamad bridge into an open-air anthropology museum for pedestrians. By covering columns an acoustic space could be created. (Santos 2017; CAATstudio 2017)

The serial spatial bays beneath ERS as well as the sensitivity of site - construction would interrupt traffic - makes modular construction techniques ideal for building interior spaces beneath ERS. In Tokyo an entire nursery school was built beneath the JR Chuo Line. The ‘Global Kids Musashi-gakuen’ school was built to fit in a space of 90 x 11.5 metres, fitting in-between concrete piers spaced 15m apart. The school looks like a five car train, with each of the ‘cars’ containing a classroom. To minimize the on-site construction time, lightweight steel construction was used that could be assembled by hand on site. (Ishijima Architecture 2014)

Interior spaces beneath railway viaducts are often created by closing-off viaduct arches. Where-ever there is a city with viaducts there are likely parts of these viaducts that have been converted into shops, restaurants or other interior spaces. The Promenade Plantée in Paris, Inviadukt in Zurich, the Noble restaurant in Berlin, the McDonalds in Vienna.

The Shimokitazawa Cage in Tokyo is a 12m x 10m cage built beneath an ERS. The space in the cage can be configured to become different kind of event spaces - theater, movie theatre, market, round stage, bazaar, ring or runway. (Keiobridge 2017:18)

This urban type is manifested in the well-known medieval bridge, the Ponte Vecchio in Florence, Italy. This type occurs when a bridge, or elevated structure, includes a building above it. Steven Holl designed at least two projects of the ‘inhabited bridge’ type. He curated the Pamphlet Architecture #7 issue, which included his project for a landmark in Melbourne, Australia. The Melbourne project consisted of seven inhabited bridges - or ‘urban arms’ - that extended streets over a railway and connecting these to a river - Bridge of Pools and Baths; Cultural Bridge; Bridge of Piazzas; Bridge of Ancient/Modern Columns; Bridge of International Trade; Bridge of Odd Flowers and the Bridge of Houses. The seventh bridge, the Bridge of Houses, was later adapted to a project for the disused Highline in New York - the ‘Bridge of Houses’, 1981. (Hyde 2008).
The idea of living in a building with a railway running through it, may not sound very appealing. This was the reality for residents of the ‘Durchbrochenes Haus’, in Berlin, until the building was bombed during WW1. To this day the U1 line at Dennewitzstrasse runs through an apartment building. (secretcitytravel 2014) The Chinese city of Qhongqing built the Libiza station on the sixth to eighth floors of an apartment building. The sound insulation fitted reduces the sound of trains to about the noise of a washing machine. This under-exploited typology could mean continuity of urban form and facades, despite of railways passing perpendicularly through them. (Molloy 2017)

The Heron Quays station of the Docklands Light Railway in Canary Wharf, London (2012) is another example of this type.

The Siam Paragon shopping mall in Bangkok is directly linked with bridges and plazas to the Siam Station of the Bangkok Skytrain. In August 2017 a further skywalk bridge was opened over the Pathum-Wan intersection. Case engineers and Urban Architects, designed a pedestrian link across the intersection. A plaza-like space, with colourful green tiles, umbrella-like structures and comfortable seats, was created that connects to the four corner buildings and the Skytrain station. These buildings that include shopping malls and an arts center are made into side-access buildings, connected to the train station (Case 2017; Loukaitou-Sideris et al 2013).

Where there is limited space available beside elevated structures, a building could be built on columns or piers right above the elevated railway line. The Standard Highline hotel was built on sculptural piers to hover over the abandoned railway line and new linear High Line park. The hotel challenges traditional notions of privacy and the transparency of hotel rooms reach from both inside-out (panoramic views) and outside in (visual proximity of pedestrians on the high line) (Ennead, 2009).

Elevated railway structures are designed to accommodate other uses above, beneath or beside them. The position and spacing of columns have a definite effect on how the spaces underneath can be used. Large concrete piers in the middle, forces movement around them, while if they are placed off-centre or if two smaller piers are used, movement can continue along the centre line. This aspect is especially important where there are roads on either side of the columns. A double or off-centre column configuration could add a protective zone for pedestrians, cyclists, etc. from surrounding vehicular traffic. The height of horizontal elements determines what the spaces beneath can be used for - if high enough, two levels could be added - an open ground plane with a second enclosed level or double storey enclosures.

ERS has the potential for a continuous variation or differentiation along its different lines and different stations. This could pick-up on local contextual differences, while also aiding way-finding and place-attachment. Why is that the metro structures look the same everywhere? An economy of scale, professional laziness, lack of ambition? The Metamorphosis paintings of MC Escher show a gradual evolution of a form or pattern. What if the metro lines gradually transform along its route through different parts of the city, mimicking the differences of densities and ages in its surroundings.
ERS ARE TRENDY

The last two decades have seen many projects arise that sought to improve residual urban spaces. The value of urban land has necessitated the better use of left-over space around elevated railway structures. Projects everywhere have come up with various ways to bring urban life to these residual spaces. These typologies are mostly also applicable to other elevated urban structures, like highway structures.

ERS ARE PART OF THE URBAN LANDSCAPE

More disciplines (urbanism, architecture, landscape, events, parks, recreation) should be involved with its design - not the exclusive domain of transport departments and engineers.

ERS SHOULD BE MULTI-FUNCTIONAL

Elevated railway structures should perform more functions than only transportation. They should also contribute to the city in one or more of the following ways: hosting public art, forming public spaces, forming event spaces, forming landscapes, forming recreational spaces, become integrated with building fabric (beneath, beside or above).

ERS SHOULD INTEGRATE URBAN FABRIC

ERS don't have to sever the urban fabric. With careful design (and attention to 'gapspaces') ERS could be designed to integrate urban fabric. This could be done in various ways - graphic and perceptual links, continuity and programming of the urban ground, 'wrapping' new build- ings around ERS, accommodating addi- tional formal and informal uses beneath the structures. The ways to integrate ERS present themselves as types.

ERS ARE HYBRID TYPES

Elevated transport infrastructures are hybrid urban types (sometimes acting as city walls, portals, bridges, etc). They are also a type of ‘urban landscape infrastruc- ture’ that form ‘flowscape’, performing architectural, landscape, urban and ecological functions in addition to transportation. By pay- ing attention to the type of ‘gapspaces’ these elevated structures create, urban accessibility, permeability and interac- tion could be ensured. The 39 types of interventions have multiplied the various potential ways that ERS could become integrated with urban life.

ERS IN CONTEXT

The danger of a typological approach to design is that it becomes a duplication of static types. The 39 types (or concepts) presented in this paper were more to open-up the multiple potentials of ERS to form part of urban life. For interventions to be appropri- ate, they necessarily need to be derived from the context - physical, social, cultural, historical etc. The con- text could also become the informant for context-specific concepts to emerge.

EARLIER THE BETTER

Although there are numerous strategies of integrating elevated railway structures within urban contexts, the physical limitations of specific instances, often exclude many of these strategies, especially once the structures have already been built. If in the planning and design of these structures, the prob- lems of mono-function, residual space and division are considered earlier, these structures could be better inte- grated and allow for more open-ended uses around them.
36


Author, 2018. ‘New elevated railway in Hao Nam, Hanoi, Vietnam.’ POTENTIALIZING ERS

1. Undergroundinkblock, 2018. ‘Spring temperatures are (finally) arriving - it’s the perfect weather to come out and explore #undergroundinkblock’, Instagram, 12 April 2018. <https://www.instagram.com/p/BhekQjZ8BWR/> [accessed 10 June 2018].


picture credits

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