TRAFFIC ARCHITECTURES: chaining architectural tools in transport infrastructures planning

Following present-day concern for interdiscipline, and based on a sum of historical and contemporary examples, the text argues that architecture can offer valuable tools to the design of engineering infrastructures, especially in road design cases.

The die wohlgeordnete fassade of Berlin’s Stadtbahn

Berlin’s Stadtbahn is a railway that crosses the center of the German capital in the east-west direction, connecting with the Ringbahn in Ostkreuz and Westkreuz crossing stations. Its design included proposals of several authors, although the implementation of the final project was made as a joint venture between the architect August Orth and the civil engineer Ernst Dirksen, oberbaurat of the Metropolitan Railway Company of Berlin. The construction began in 1875, being opened for local trains on February 7th, 1882, and for long-distance trains on May 15th of the same year. The aim was to connect the eastern and western part of the city through the center and not only by the beltway. This would bind peripheral areas of Berlin’s territory with the capital’s most significant centralities, strengthening the outskirts connectivity with the financial district, which was understood as the core in which all the economic activity of Berlin is concentrated (Hegemann, 1988).

Although sources don’t explicitly indicate why the Stadtbahn project was forced to discard the former iron construction proposal to be replaced by a massive brick viaduct, some reasons have been uncovered. Technical problems would have resulted from building iron framework constructions on Berlin’s sandy underground and high ground water table (Boberg et al., 1984). The existing building conditions would also have presented significant
implications for the development of an underground tunnel-based system, specially considering the technical capabilities at the time – for instance, dealing with waterways or the removal of train smoke emissions, which would have significantly increased construction costs. Although the typical solution used in London, Paris or Barcelona – cutting a path through the ground – would have facilitated the implementation of the Stadtbahn avoiding interference with the city’s general traffic, this option was discarded (Alfaro d’Alençon, 2013). These adversities could only be overcome using a massive arched structure in regular intervals with additional bridges. Thus, the decision to elevate the system was made, building most of the line with arched brick viaducts that could be crossed by metropolitan traffic at the street level (Knödler-Bunte, 1984) (Fig. 1). This system intended to support urban traffic, adapting itself to the existing city grid with bridges spanning over streets, consequently connecting the center with the periphery and offering the possibility of developing ‘inhabited spaces’ in the arches of the transport infrastructure (Alfaro d’Alençon, 2013).

However, in addition to constituting a strategic instrument to address a series of technical/constructive difficulties, this maneuver implied an intention to reconfigure the city center. But the projection of an ‘inhabited arch’ under the railway in Berlin also evidences an urban design strategy linked to the elevation of the Stadtbahn. In his influential manuscript, Orth underlined the importance of developing a “pleasantly-ordered façade” (wohlgeordnete Fassade) for the city (Orth, 1871:34). The viaduct itself would provide an answer to these requirements (Fig. 2). The intention, then, was to subordinate the urban composition of Berlin’s center to the scenic effects of a linear facade, choosing to integrate the sinuous perspective of its architectonic frontispiece in the composition of the public space adjacent to the railway line (Temtem, 2016).

The following reasoning is further supported in 1896’s Chronicle of Berlin and its Railways, a document explain-
ing that the viaduct was specifically designed to improve the appearance of the urban space through a strong and well-formed arcade system. In fact, the arches collectively represent, to date, the biggest built structure in Berlin and the Stadtbahn was one of the first projects that completely ‘refilled’ the open spaces of the viaduct, creating usable rooms defined by urban façades (Alfaro d’Alençon, 2013).

Hence, with the inauguration of the Stadtbahn in 1882 the proposal for the viaduct’s open spaces was already clear. Of the original 731 viaduct arches, 597 were available for additional uses. Their sequential numbering began at Schlesischer Bahnhof and ended at Savignyplatz, immediately before Bleibtreustrasse.

The building-viaduct as a harmonious synthesis between technology and architecture

According to this approach, Berlin’s viaduct railway project necessarily translates into the construction of an architectural chain crowned by rails, in which the ‘well-ordered façade’ is a key element of urban design. This tool can be recognized at the synchronic example of the Crescents of Bath, which proposed the construction of public space through architecture. The scenic proposal by the architects John Palmer and John Wood circumscribes the curvilinear and rectilinear streets of Bath through long built rows, drawing a backdrop for the public space. We speak of a linear urban morphology that interprets the city as an architectural fact, considering that the construction of public space is necessarily subordinated to the architecture (Lamas, 1992). In this way we can say the organic line of the Crescents of Bath, like the infrastructural body of Berlin’s railway viaduct (Fig. 3), constructs an edified chain that breaks the urban baroque form, putting the emphasis of urban space in the perspective and undulation of a Palladian façade (Temtem, 2016). “That is to say that the neoclassical façade of the Crescents of Bath, like the neo-roman arcade of the Stadtbahn (Fig. 4), structures the urban composition of the center of Berlin, functioning as a backbone that combines transport infrastructure and architecture in a single built element” (Temtem, 2017).

Through this instrument, the city is pictorially conceived, subordinating the railroad to the physical appearance of an architectural façade. This, because in accordance with the urban theories of the period, “the ‘city’s physiognomy’ has the greatest influence upon the image of the city. It has the difficult task of making the first impression, which has to be as favorable as possible” (Pizza & Pla, 2002). Otto Wagner (1993:68) explains that this urban physiognomy

FIG 2 Fotografía de la «fachada agradablemente ordenada» del viaducto ferroviario junto a la estación Friedrichstrasse, Berlin, 1885. / Photograph of the “well-ordered façade” of the railway viaduct nearby Friedrichstrasse Station, Berlin, 1885. © Creative Commons

FIG 3 Fotomontaje de comparación entre la morfología urbana de los Crescents de Bath y la del viaducto –edificio, realizada por el autor Filipe Temtem. Photomontage of comparison between the urban morphology of the Crescents of Bath and the one of the building-viaduct, made by the author Filipe Temtem.
the perfect synthesis between technology and architecture. Also, Fritz Neumeyer mentioned that in a period where an array of urban theories related to the construction of the image of the city emerged, the projection of an urban façade associated with the metropolitan railway, synthesizes the mission of reconciling the utilitarian and realistic orientation of transport as well as the new constructive technologies with the idealistic forms of pediment and artistic expression derived from architecture (Pizza & Pla, 2002).

Drawing upon these urban theories, we can say that the urban morphology orchestrated by August Orth combines the engineering of the railway route with the architecture of the viaduct, composing a mega-structure rhythmically stretched along the capital, providing a linear succession of inhabitable spaces destined for the local trade (Temtem, 2016:130). We refer to a long and sinuous “building-viaduct”5 with 757 arches and roughly 25 km of extension. A modular construction crowned with 12,145 km of rails, built with 1,823 km of bridges of iron, 1,683 km of sand embankments and 7,964 km of viaducts walled between the stations (Hoffmann-Axthelm, 1984).

However, this modular distribution occurs in a different way in the crossing points, where the available area is considerably expanded to install the interconnection stations. Through the cross section of the Friedrichstrasse station (FIG. 5), built in 1878 under Johannes Vollmer’s design, we can see how the station introduced a structural and material antithesis in the building-viaduct. “With the introduction of the station the new emerging building typology would be significantly underlined: two spaces and two materials were embodied – one belonging to the city and the other to the railway – the palace made of stone (entrance hall and passenger space) and the factory made of glass and steel (train hall)” (Alfaro, 2013).

The proliferation of traffic architectures
This idea of a building-viaduct would serve as an instrument for another example: the Vienna Stadtbahn projected by Otto Wagner (FIG. 6). Sharing the same perspective than Orth, Wagner idealizes the railway as a profitable and livable structure, projecting the arched openings of the Viennese railway viaduct through a historicist façade, where any kind of equipment can be installed (Temtem, 2016). With this new instrument “a paradigm shift occurs in the railway design of that period, facing the train line not as a simple track, but as a mega-covering of a longitudinal building under which a multiplicity of facilities is installed, anticipating
the utopian designs of the so-called 'traffic architectures' enunciated by Colin Buchanan in his 1963 report 'Traffic in towns,' which rightly tried to explore the synergies between mobility and urban form” (Temtem, 2017).

A similar instrument is used in Le Corbusier’s Obus Plan (FIG. 7), who proposes a segregated mobility system embedded in a linear mega-block that extends along the several kilometers of the city. This perspective posits a "highway (...) one hundred meters above the ground of the city, or even more (...), which rises (...), not by arches, but by cubes of constructions for men, a crowd of men” (Le Corbusier, 2003).

Le Corbusier transforms the brick arcade that supports the railway into a concrete building in which, underneath the transport infrastructure, life can unfold. This is explicit in one of his sketches, published in Urbanism, entitled: "Byzantium: Valens aqueduct, an immense horizontal that creates a rigid backbone for the seven hills" (Le Corbusier, 1992). The Valens aqueduct design announced a preliminary image of the 1931’s proposals, anticipating the projection of the linear mega-block, horizontally stretched along the city of Algiers (FIG. 7). In this way 'collecting' and 'reusing' architectural references from his several travels are the instruments the author uses to intervene in different contexts. As stated by Volker (1998), since the 1920s the architect followed with enthusiasm the development of road works and autodromes, demonstrating a special interest to incorporate architecture as an essential instrument for road engineering progress.

The 1923 building for the Fiat factory in Turin by Giacomo Matteo Trucco (FIG. 8), with a test track for cars on the rooftop, is already an indication of this idea of ‘inhabitable viaduct’, which Le Corbusier would replicate in some urban proposals for Latin America. This Corbusian symbiosis between architectural and road design is also inspired by the Crescents of Bath. That is, almost three decades later, Le Corbusier mobilized the same instru-
ments Palmer and Wood used, in order to design a new road system that combines engineering’s technical efficiency with architecture’s aesthetic character, proposing long rows articulated with the landscape (Volker, 1998). As Sigfried Giedion (1958) mentioned, the buildings-viaduct by Le Corbusier are based on the urban morphology of the Crescents of Bath, emphasizing that the Swiss architect understood that “a track is not just a kilometric entity, it is a plastic event” (Volker, 1998:110).

However, this chain of architectural instruments does not end in the work of Palmer and Wood. There is also a connection with Roadtown, the American model designed by Edgar Chambless and published in the newspaper The Independent in 1910, nineteen years before Le Corbusier’s project (Fig. 9). As a linear city over a railway that reached thousands of kilometers, the design emerged from the idea of an horizontal modern skyscraper laying over the tracks, with lifts and pipelines facilities distributed in parallel to the ground (Segal, 2005). While the Corbusian proposal places the traffic in the rooftops, Chambless takes it to the bottom of his linear building, composing a ‘mega-plinth’ where convenient, fast and effective means of transport circulate.

**Merge and hybridization as contemporary planning tools for the transport infrastructure**

This mainstream of traffic architectures serves as a tool for proposals like the Sawy in Cairo or the Koog aan de Zaan in Holland (Fig. 10), designed by NL Architects, introducing “a planning system (...) capable of gathering not only road infrastructure and its interactions with the context but also the technical aspects that underpin it” (Koolhaas, 2001). As Marco Navarra has pointed out, the Sawy can be understood as “a sort of graft architecture over a preexistence that proposes a new order given its function and dimension. This way it not only connects different scales but also links infrastructure with building” (Navarra, 2013). Bouman describes the proposal by NL Architects as a “hybrid solution” that “connects a series of public facilities in one single gesture. A public space to go shopping, play, relax, stroll and skid (Bouman, 2011). A place that embraces the movement generated by traffic, yet also fulfills the aspirations of those who happen to stroll by.

Facing the building as a ‘hybrid’ represents a conceptual development combining two materials: one belonging to the transportation space itself and one concerning the city. As Vesely (2004:124) indicates, “the complexity of these spaces, [...] their arbitrary chaotic nature, reveals a certain logic: the logic of the intersection of two different horizons of order and rationality.” In the same way, considering the cases by NL Architects (Fig. 11), these two orders combine their diversity, unifying them in one single building. Smets
designates this ‘hybridization,’ a reciprocal change followed by typological developments, reaching a new spatial expression, one which comprehends a (new) aesthetic: "the hybrids present an aesthetic that combines the fascination for motion and the constant variation it entails, with a configuration that absorbs tranquility and conveys a sense of permanence" (Smets, 2000). In other words, the transportation project shapes its surrounding landscape with a footprint and vice-versa, producing a unique building typology, a result of the interaction of different architectural instruments, uses and orders.

Simultaneously, Koolhaas provides an improved definition for this new *modus operandi* for traffic architecture, naming it ‘merge.’ The project can be understood as an interaction of interdisciplinary instruments, whose spatial product are typologies made of "architecture that doesn’t have any longer forms or development of forms, nor are they subject or the formation of subject. There is no structure, anymore than there is genesis" (Koolhaas, 2001). Hence, both architecture and infrastructure represent a unique shape, whose goal is the reciprocity between the spatial and functional. Smets describes this symbiosis as buildings that must meet not only urban but also transportation requirements. Therefore, they are made of many layers, expressing and uniting many meanings incorporated into one building. This conception can be exemplified by Washington DC’s 11th Street Bridge Park (FIG. 12), projected by OMA + OLIN, which was response to both urban and transportation necessities. As OMA Partner-in-Charge Jason Long explains, "our design creates a literal intersection and a dynamic, multi-layered amenity for both sides of the river. It simultaneously functions as a road, as a gateway to both sides of the river, a lookout point with expansive views, a canopy that can shelter programs and a public plaza where the two paths meet" (Stott, 2014).

**Conclusions**

According to this chain of architectural tools, hybrids appear as a typology that introduces a paradigm shift in the contemporary planning of transport infrastructure, in the way that "the incorporation of this change (...) sets a standard for the only viable idea of integrating infrastructure in
its spatial environment” (Smets, 2000). This can be read as a 'disciplinary hybridization' that allows to cross the impenetrable line posed by Gropius, for whom architecture would only begin where the engineering ends, contradicting the theoretical stance of Alexander Cuthbert (2003), who defends that architecture, urban design and urban planning have a coterminous existence as praxis, yet remain both theoretically and professionally isolated from each other. Within this new technical-spatial relationship, architects contribute to the design of road projects that would otherwise be relegated to the world of transport engineering. From contemporaneous projects by OMA or NL Architects to Edgar Chambliss mega-structures, Le Corbusier building-viaducts and the railway works of August Orth and Otto Wagner, we can recognize an interdisciplinary field of work, where ‘non-experts’ offer specific instruments that add innovative perspectives to the traditional knowledge of engineering.

In other words, in all the previous examples architecture arises as a fundamental instrument for transport engineering, emphasizing the role of the architect in the design of roads. While engineers are focused on the modeling of mathematical, physical and economic principles by rationally replicating the behavior of transport systems, architects work with creativity – which does not belong only to scientific variables or structures, but emerges from human consciousness. The architect engages in a dialogue with new materials, new techniques and industry, combining them with his/her creative inclinations to generate a project. He/she uses technique as a means, dominating it through a cultural process that manifests itself spatially and formally. In this way, architecture works simultaneously with abstract images and material realities. As Allen explains, it is in material practices where architects begin to redirect their own imaginative and spatial efforts toward the questions of transport infrastructure. Therefore they expand engineering instruments with new procedures by referencing
The Ringbahn (circular railway) is a 37.5 km long railway running in a large loop around Berlin’s center. This railway is formed by an S-Bahn (urban train) and a parallel freight line. Along with the Stadtbahn and Nord-Süd Bahn, the Ringbahn constitutes one of the three main lines of the S-Bahn, an urban transport system operated by S-Bahn Berlin GmbH, a subsidiary of Deutsche Bahn. The S-Bahn of Berlin consists of 15 lines integrated with the U-Bahn (underground train) forming the backbone of Berlin’s rapid transport system.

In all of the German states, the term baurat specified a structural expert that worked for the government or state authority, whether railway, municipal or ecclesiastical. Other labels derived from this are regierungsbaurat or generaldirektionsrat (construction official of the district); oberbaurat (construction official of a building or public work); or kirchenbaurat (construction official of the church).

The Crescents of Bath planning took place in the eighteenth-century England, at the beginning of the Industrial Revolution; the Crescent Royal was designed by John Wood in 1769 and the Lansdowne Crescent by John Palmer in 1794.

The idea of urban physiognomy matches the city concept proposed by Otto Wagner in Vienna’s urban planning, where his urban rail network was built. It is a concept perfectly described in both his books, Moderne Architektur and Die Grosstadt.

In Filipe Temtem Doctorate research, “Inhabited Infrastructures: Projecting new relationships between segregated transport infrastructures and urban fabric,” the author states that the Stadtbahn was designed as a ‘building-viaduct,’ introducing the term so as to explain the construction of the urban physiognomy of Berlin through the architectural façade of the railway viaduct.

In order to justify how the benefits of this paradigm shift might accrue, Cuthbert (2003) made an assessment of the three major theoretical movements of the third millennium, namely Postmodernism, Postcolonialism and Globalisation, the latter offering some key insights into questions of urban form in the information age.
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