Architecture of Infrastructures: Methodologies for Expanding a Discipline

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INTRO: WHY ARCHITECTS IN INFRASTRUCTURE? THE ARCHITECTURAL VIEW AND OTHERWISE

The architect as a grand thinker and overall orchestrator of the city is an appealing role, claiming both literal and metaphorical territory for the architect in the pursuit of a better-designed environment. With the caveat that perhaps the city is an organism too large and complex for any one person to design, the design of infrastructure brings architects closer to this vision: infrastructure as the basic framework of a city and critical to its growth direction, form and pattern. Whether architects want to take on the mundanity and subtlety of infrastructure may be a different question: infrastructure is technically challenging and although it is a prime determiner of the city's form, in many cases its presence is ubiquitous and goes unnoticed by the general public - not the formal gymnastics so celebrated by architectural publications today. The character of infrastructure design could be said to be better suited to the engineer, who habitually works anonymously in the name of public service and safety on highly technical issues. However, there is a strong argument for the involvement of architects within infrastructure design: architects (and landscape architects are included in this designation) are trained to analyze challenging social and cultural problems and to resolve these with the highly technical media of engineering, while at the same time creating a beautiful environment. This is exactly why architects are needed in infrastructure design: infrastructure has very technical challenges and a socially critical role. In order for architects to take on this role fully, the profession itself and the education system for the profession needs to show leadership and re-imagine itself to deal with this change in scale and the technical aspects (i.e. engineering) of infrastructure.

HISTORICAL ROLE OF ARCHITECTS IN INFRASTRUCTURE: A LOSS OF TERRITORY?

Architects may indeed have lost ground by a 'self imposed isolation through pursuit of the formal project' as mentioned in this session's description and this author, with an engineer's perspective, would put forward that the legacy of this attitude impedes architects in discussion with other professionals. However the history of infrastructure design in North America does not show a 'ground-losing' trend by architects but rather the exclusion of architects from the infrastructure design process from the beginning. Granted, the history of infrastructure design in North America dates from perhaps the late 1800s but in general, there has been no territory lost by architects. The history of infrastructure design in North America is a story of feats of engineering and the conquering of nature against great odds.[1] Quickly after the continent's current society took possession, the Army Corps of Engineers was conceived, brought into being in 1802 with the help of the French engineers who had helped during the Revolutionary War. The idea of requiring a military to build infrastructure is therefore inherited from the French tradition of infrastructure building, dating from Louis XIV. This organization and its engineering offspring have dominated the design of infrastructure since its beginnings. They have maintained a firm hold on the field in the name of public safety and efficiency.

The profession of planning has also abdicated its position on infrastructure. Where the discipline initially clearly understood the organizing power of new infrastructures of hydroelectricity and automobiles[2] and their ability to spawn communities, as outlined by the Regional Planning Association of America (conceived in 1923 and lasting 10 years), the current discipline currently focuses on the administration and code writing for the building forms of the city. Again this leaves infrastructure design in the hands of engineers. While planning and transportation engineering are showing nascent signs of becoming a more interconnected discipline, this still deals only with the analysis and large scale 'routing' of the roads and has no connection to the experience of the space and very little with the use and connection of the roads to the surrounding city fabric.

Examination of the methodology of infrastructure design reveals a militaristic and strictly engineering approach considering economy and efficiency, both in functionality of the infrastructure and in its construction. Other considerations, such as the natural environment, are considered by other agencies and brought to the design as concerns: neatly compartmentalized into defined constraints to be dealt with by the engineer. Where other parts of our built environment have a design methodology which responds to contemporary concerns and cultural theories (be it architecture, planning or landscape approaches), the design of transportation infrastructure is still primarily driven by economy, efficiency and safety: a clearly modernist viewpoint which is almost unchanged since the conception of the highway system in North America. The design is imposed on city and the landscape with a zealous egalitarianism. It is this methodology that brings problems to many environments: in the city, the public is wary of impassable and noisy arteries. In more rural areas ecologies are severed, damaging multiple levels of biological chains and impacting water and animal routes.

NEW TERRITORY: CHANGING STRUCTURES AND RAISING BAR

For a discipline to modify its role, the power structure, processes and methodologies which relate to the newly-emerging form of the discipline must all change. So to examine whether architects are participating in infrastructure projects in a radically new way, we can look to project tendering processes and methodologies through which these changes become tangible. Some cities in North America such as New York and Toronto, are changing their power structures and their project methodologies in order to design their cities in a more holistic way, leading the way for architects to take a larger role. Michael Bloomberg in New York City has appointed four commissioners who have a vision for the city and are employing unconventional methodologies to carry it out.[3] They have launched experimental and groundbreaking projects, for example the by now famous High Line as well as the almost equally famous modifications to Broadway. These projects challenge the conventional engineering thinking regarding traffic flow and safety and move the disciplines of architecture and landscape architecture into the design forefront for transportation infrastructure. Their fundamental attitude towards the infrastructural arteries of the street is that this is valuable public space and should be treated as such. Although this seems like an obvious statement to an architect, it is a fundamentally different way of viewing transportation infrastructure. Likewise, they have changed the tendering processes for the city so that smaller design firms can obtain contracts from the city:

Figure 1 : Moose contemplates crossing

> "Design and Construction Excellence enables New York City to aggressively pursue an innovative and ambitious public works program in partnership with the most creative and experienced design professionals in the world. Its strategies focus on new pro-

> curement methods, new business policies aimed at enhancing project management, developing more accurate project scheduling guidelines, tightening the budget process and creating contemporary continuing education and evaluation standards."[4]

This demonstrates a change within the power structure and thereby changes the process of project materialization for infrastructure.

FIgure 2 (left): Sugar Beach at Waterfront Toronto.

Toronto's Waterfront development projects are also demonstrating a change within the methodology for infrastructure design and the design review panel for the organization is a spectacular collection of designers and design thinkers in Toronto[5]. They have commissioned the West Don Lands and the Sugar Beach contracts, with spectacular results. These projects were invited design competitions and are primarily parks but Waterfront Toronto has recently completed a major design competition for what to do with its aging elevated expressway - the Gardiner Expressway[6]. This study was a competition for all design professionals at the schematic stage of the design, held in conjunction with the Environmental Assessment process. No lead profession was specified and the competition dealt with all aspects of public space, transportation, city revitalization and planning. A public competition for design ideas and input was held prior to this process to solicit public input. Waterfront Toronto was interested in great ideas in order to develop a great product and the question was how to engage these ideas by changing the process[7]. The process was used as a lens to study urban design, transport, economic and environmental impact simultaneously. Teams were shortlisted and the shortlisted teams were given a $50,000 budget to develop design ideas. The shortcoming in this process was that the budget for the required work is insufficient and there is no guarantee of future work from the competition.

Figure 3: Spadina Wavedeck, Waterfront Toronto.

This competition methodology is radically different from the normal tendering process for transportation infrastructure, which has a government agency put out an request for proposal to engineers for a fixed preset scope of work which is, in most cases, based on a traffic study or another foundational engineering study: with this typical methodology, all decisions on the project are based on cost and efficiency only. One of the key aspects of the change in process is that it allows for creativity and does so early enough in the process of design development to change key aspects of the project's conception.

These types of projects are important because they demonstrate the significant value of involving architects in infrastructure projects. They also demonstrate that these types of public projects can be completed within budget and time constraints even with architects playing significant roles, thus disproving the commonly voiced concerns about architects in infrastructure design discussions. They raise the bar for the design of the built environment and once a precedent has been set, others can see and aspire to it.

The disadvantage of this methodology to changing the design paradigm of architecture is that it is slow - projects take a long time to build - and the method shows only one singular view of possible solutions: infrastructure design, like building design, reflects the design intent of the designer. This design intent is a cultural and social interpretation and the interpretation is made by one designer for a specific set

Figure 4: An existing condition and three visualizations for Broadway Street in Vancouver, by TIPS Lab, UBC. This street is under consideration by the City for a redesign and requires a major public transportation upgrade along its length.

of circumstances. Given different budgets or balancing of cultural factors, different designs result. A research approach can take on these challenges and approaches and to provide multiple options. The intent of research is to examine a subject or design from multiple viewpoints and not to find a singular solution. Applying a research approach to infrastructure design will open up options and new ways of approaching a problem. The Transportation Infrastructure and Public Space Lab (TIPS Lab) at University of British Columbia founded by the author carries out this type of research on infrastructure. It is a multidisciplinary lab founded in the school of architecture but has collaborative researchers in engineering and planning. The lab chooses transportation infrastructure related projects which have a potential to impact public space in a significant way and works with the authorities involved in the project in order to bring their desires and goals into the research as factors. Students carry out the work of the lab, led by the multi-disciplinary faculty professionals. The main areas of research for the lab include: multimodal transportation flows and public space interaction, interactivity and communication, visual/functional commuter space design, design to encourage human powered transportation/sustainable transportation options, future transportation systems

The lab visualizes all options with the intent of communicating to all parties involved in the process, from designers to the general public. Applying the tools of the architect to transportation infrastructure is important because it can demonstrate the impact of changes to infrastructure in ways that are easily understood. Engineers and planners do not have the skills to visualize changes in infrastructure and yet many of the decision makers and

the general public want to understand the impact of the changes on their environment. Architects provide the ability to visualize potential changes, as well as the ability to imagine and demonstrate a multiplicity of potential option

The lab's position is a think tank who's involvement is positioned at the beginning of the design project, preferable near the project's conception. This allows the maximum creativity and influence of the project's direction. Projects currently under way in the lab include the Georgia/Dunsmuir Viaduct project for City of Vancouver which questions what to do with an aging elevated viaduct in Vancouver's city centre as well as a mapping and brainstorming project for British Columbia Hydro which speculates on the future locations of quick charge stations for the province of British Columbia. Both engage large transportation, planning and architectural issues. The general outcome intended for projects from the lab are a range of options allowing all parties to see the impact of different values on the outcome and provides a basis for parties to make decisions with a range of creative approaches.

THE ACADEMY'S ROLE IN EXPANSION

The 20th century western history of architecture, as well as architectural education in general since its inception, promotes the idea of a single person (or firm)'s design vision: a parti lets say, which then gets carried through the design and is clearly expressed in the final product. There is plenty of room for debate within these statements themselves but for the sake of the discussion of infrastructure, I want to look at what that means for the design of infrastructure. Infrastructure can generally be defined as an underlying foundation or basic framework of a system. More specifically, it is defined as the system of public works of a country, state, or region, or the resources required for an activity: essentially that which supports and facilitates human activity.[8] The question to be asked then is whether a parti can be applied to a framework or support system? A building may also be thought of as an infrastructure, it is true, but a building is photographed the minute it is completed and this is the pinnacle of its design. An infrastructure is much more like a landscape: it develops over time. Its initial condition perhaps anticipates its future but its visible form is not likely to look the same in the future nor to remain recognizable as a 'Design' (with a capital D).

Taking planning and engineering concerns into account as well as communicating with the general public and stakeholders is perhaps too dilute a design problem for architects to be interested in. As well, infrastructure design has a myriad of technical requirements and restrictions and functionality is likely a prime determinate in the design form. In fact, in many cases, the design impact may be subtle or unremarkable in many ways. Infrastructure is often the framework and not the final product. So from the academy's perspective, infrastructure design may not be the ideal focus for architecture. But the academy's complicity is essential if infrastructure is to be a field within architecture. Students require experience and confidence in learning to think at the scale of infrastructure, and understanding the issues involved. These issues include engineering and, like structures and mechanical systems, infrastructure engineering would have to be included as a subject to be studied. For architects to undertake a leading role in mainstream infrastructure design, they must understand the issues of its design and be able to speak convincingly about the factors involved. Just as urban design has become a sub-field of architecture, perhaps infrastructure design deserves the same consideration.

The academy as a place to show leadership and study the potential of infrastructure is also essential. It is being demonstrated today in many institutions that academics are leading the way into infrastructure in many remarkable ways. Without the academy, the movement into infrastructure design would not have begun.

COLLABORATION AS EXPANSIONIST APPROACH

Similar to the issues of demanding technical criteria and communication with the public, collaboration is potentially another 'dilution factor' in the design of infrastructure: collaboration requires input from multiple sources which must inform the design. However, collaboration can be a form of recruitment. Collaborators understand and support the role of the architect and are supportive of a creative process. Engineers and planners, like architects, are great advocators for public space. As well, collaborators bring more confidence to other parties who are outside the discipline of architecture. Collaborators can be disciples of the discipline. Collaboration is an essential aspect in order

for architects to move into the field of infrastructure and there is generally strong support for architects' participation in infrastructure, with the caveat that their inclusion does not cost more or compromise public safety.

Collaborative studios with engineers joining architects in the studio, run by the author[9], have demonstrated that highly creative and technically feasible solutions can result from collaboration and that the collaboration can provide an additive results: using more technical knowledge to push design rather than detract from it.

Figure 5: Robotic landscape - studio work from a collaborative studio on responsive infrastructure

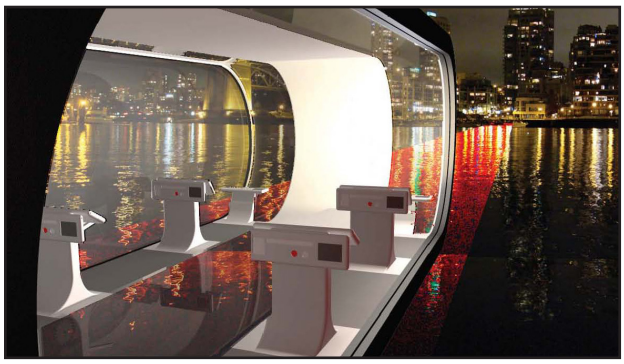

Figure 6: Bridge/ferry hybrid design for a crossing, collaborative studio project

Collaboration may come in many forms: other professors studying fields as diverse as electric car technology find collaboration useful because aspects of the interface of culture and society are outside their field of expertise. Without these considerations, a new technology will not succeed and it is architects who are best trained in such cultural considerations and translations. Collaborations within the university are sometimes challenging due to the sometimes myopic expertise encouraged at universities and so at times it can be useful to look to engineers and planners in industry, who are more broad-based in their focus but equally as supportive of an academic initiative.

CONCLUSION

While we can see the benefit of architects being involved in design of infrastructure, in order for architects to take a larger role, we must assess the discipline, its education system and the power structures that control infrastructure projects themselves. Looking at these three areas, we can see nascent changes which indicate a change in the profession and new territories emerging for the architect. The most direct way of effecting change is perhaps to demonstrate the results when such a methodology is used; this can show that the benefit to public space when infrastructure is designed by an architectural process can be accelerated by the work of architects involved in research in the area. Collaboration brings further opportunities and also accelerates the process. It is not only architects that see a lack of design quality and lost potential in our infrastructure - but it may be only architects who have the training and talent to remedy it.

ENDNOTES

1 Gary L. Strang, "Infrastructure as Landscape", Places 10, n.3, (1996): 12.
2 Keller Easterling, *Organization Space: Landscapes, Highways and Houses in America*, 15.
3 Interview by Claire Weisz of WXY Architecture + Urban Design and AN executive editor Julie V. Iovine for The Architect's Newspaper with New York Parks Commissioner Adrian Benepe; Planning Commissioner Amanda Burden; Design and Construction Commissioner David Burney; and Transportation Commissioner Janette Sadik-Khan, Interview date October 22, 2009: http://archpaper.com/e-board_rev.asp?News_ID=4057, November 11, 2010.
4 New York City Department of Design and Contructtion, "Design and Construction Excellence," accessed November 11, 2010, http://www.nyc.gov/html/ddc/html/design/dc_excellence.shtml.
5 Waterfront Toronto "Design Review Panel Members", accessed November 11, 2010, http://www.waterfrontoronto.ca/our_waterfront_vision/design_excellence/design_review_panel/design_review_panel_members.
6 Waterfront Toronto & City of Toronto, "Request for Qualifications: Competition to Develop Innovative Design Options for the Gardiner Expressway and Lake

Shore Boulevard Reconfiguration," Environmental Assessment, Toronto, December 2009.
7 Kevin Bechard, Director, Environmental Assessments, Waterfront Toronto, interviewed by AnnaLisa Meyboom, January 15, 2010.
8 Merriam Webster On-Line Dictionary, "infrastructure", accessed August 28, 2010: http://www.merriam-webster.com/dictionary/infrastructure.
9 ROBOstudio Project Documentation, School of Architecture & Landscape Architecture, University of British Columbia: http://vds.arch.ubc.ca/vds_ROBOT Website shows the projects in detail and outlines exercises and collaboration.
10 AnnaLisa Meyboom, Greg Johnson and Jerzy Wojtowicz, "Urban Infrastructure & Architectronics", ECAADe 2010: Future Cities, (Zurich, Switzerland, Sept 2010): 15-18.