FOOTBRIDGES AS INSTRUMENTS FOR URBAN GENERATION

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Abstract. The modern world is custodian of “wealth” that are not quantifiable or exchangeable only as an accumulation of things, but that are based on internal and external relationships between man and the urban landscape. If we consider the associations between individuals, different communities, human beings and their environment as the true mechanism of the world, we can understand how important it is to build bridges not only to connect sites, but also to bring together people, cultures, nations and generations, as the motto "bridging cultures and sharing hearts" claims. In this way, how can a small bridge be the "maker" of the transformation a place’s transformation? What might be the reasons for a project, its meanings and the consequences of the choices? What can the effects be of a new project in an urban landscape, not only from the perceptual but also from the social and economic point of view? What can the relationship be linking together the internal quality of the work with the external one? The paper will explore and try to give some answers to these questions, through the analysis of the possible meanings of a place and the possible transformations that a small-medium bridge can generate in the context.

Keywords: urban landscape, footbridges, project, significances, urban regeneration.
1. The Bridge as Cultural Signal in the Landscape History

It is interesting to notice how man, until prehistory, worked to modify nature through his intelligence and building of the first constructions. The primitives solved the problems of living using great technical and artistic ability. In the big hall of the Lascaux cave, France, or in the ceilings painted in the ravines of Altamira, Spain, are found signs of their work where darkness is perpetual. In a cavern, man has demonstrated he does not have to passively accept the space that nature offers to him: he takes possession, equips, decorates and modifies it, marking the distances and the limits which subdivide it. That’s why the vault of the cavern of Altamira – with its representative designs, battles between animals and hunting scenes and abstract symbols - has been defined as the “Cappella Sistina” of prehistory. But it is with the passage from the Palaeolithic to the Neolithic that the first great revolution of human history occurred; that men so creating, are striven to construct, to complete and to modify what nature offered. With this revolution begins the relative upsetting of society: that is the transformation from the shape of tribal life, with men dedicated to hunting and harvesting of fruits, then to the nomadic shepherd, and then to the shape of settled villages, over agricultural lands whose fertility was renewable through the irrigation of the fields. From then the two aspects, the nomad and the settled ones, together with other dualisms (magic-rationality, instinct-reflection, etc.) that still today find dwelling in our subconscious, pushed man to use his wits to give an answer to his needs, also in aesthetic ways. Thus the first stilt houses – complex structural constructions - were built, connected to land by movable footbridges, and between them were simple wood bridges, all in a particular relationship with nature. Exploring the landscape in which these men built the first “infrastructures”, such as dams and deviations of the water course for cultivation of fields; and pushing themselves beyond this, they still had the problem of facilitating communications with other villages, without wading across rivers or avoiding obstacles: from this, the first footbridges and bridges were born. Sometimes these bridges were just fallen logs, sometimes they were made using ropes and wood, taking advantage of the elementary principles of the cables tensions, using structural solutions with stressed cables, cable stayed and suspension bridges, frequently in combination and, where possible, with wood trunks under a bridge. All of this occurred before the ancient invention of the arch was codified and made famous by the Romans. Structures that were in particular agreement with nature and landscape, not only for the materials or the reduced dimensions, but also because they were signs of the landscape and not just residing in a landscape, as often happens today; works whose presence, like all the great ones, determines and creates a landscape,
animating a nature not hostile, maternal, able to receive and not like a stepmother, sometimes seen with fear.

As was noted previously, we find these fundamental values seem to be lost by man in his step from natural world to the artificial one. Only in the avant-garde works and in experimental structures, is man going towards new discovery and modifying history.

Under the architectonic profile, only architects and engineers are recovering the organic spaces today, using material expressivity, the lightly applied concepts found in the “primitive” aspects of their modern projects.

All cultures felt the need to build bridges, and still today primitive pigmy populations build bridges with lianas and poles to cross the African equatorial forest, in order to be connected with other men, to know themselves and to survive. In Tibet some people used to suspend three connected ropes between the sides of the mountains in order to get over the deep crevice. Modern engineers are by from the same attempts when they plan transparent footbridges in structural glass and imagine the lightest made cables structures or they experiment with new materials. Building bridges has always meant connecting, joining and therefore progress for people of all cultures, every place and age. For that reason, in a footbridge, there is a noble idea of progress, the one that pushes men to be “near”. Moreover the function of a bridge can sometimes mysteriously multiply in fascinating ways. In central Italy, fishermen used to build long footbridges over the Adriatic Sea. Those bridges go towards the water through complex structures on poles, then rise in projection or supported with cables. These structures, called “trabucchi”, (that we could find in other Countries), are included in the topic of the bridge. Numerous other uses, like the inhabited one - to shelter from the sun, the wind, and water- the fishing use, and also to be an observatory between beach and sea far away. Because of this the bridge represents a fascinating design topic. However, the aesthetic problem remains. We know that art cannot be taught, cannot be forced, willed or ordered, but consciousness of art can observed throughout history. It’s a task of every architect or engineer to develop a critical spirit as a method of mind, an attitude of their personality. The technique can be acquired, can be shared, but has cultural meaning only when the historical and critical spirit is connected to the problem of each piece of art. From these small things built by man and nature, all of us might get an important instruction: lessons of simplicity and expressiveness, lightness and boldness that are what the new generations demonstrate they want to know and make. Only then, who plans and constructs bridges (the Pontifex was in, Roman culture, one of the maximum authorities of the Empire) will be able to cross a bridge without risking the loss of his soul, like happened in the ancient Medieval tales (bridges of the "devil"). Today, as in
the past, bridges are therefore important elements, not only from the structural point of view, but also from the cultural one, in relation to their ability to create or modify important functional, social, economic relations in a place. If we put the associations among individuals, different communities, human beings and their environment as the true mechanism of the world, we can understand how important it is to build bridges not only to connect sites, but also to bring together people, cultures, nations and generations, as the motto "Bridging culture and sharing heart" declares. In this way, how can a small bridge be the "maker" of a place’s transformation? What might be the reasons for a project, its meanings, and the consequences of the choices? When we talk about the word "value" of a bridge, we mustn't refer exclusively to the economic significance of the thing. Indeed, we should think about value as a result of a process of recognition of specific qualities of the infrastructure and the relationship between a work and its landscape. In general, a piece of infrastructure can create important relationships between man and landscape from perceptive, social, economic, and functional points of view. It can also generate negative or positive impacts, alterations or benefits to the urban landscape. It can become a symbol of the place or an important element of connection among different parts of territory from the social and economic points of view. This way, it is fundamental to think about bridges as infrastructures of the landscape, able to connect people and culture and that have been conceived and designed to become part of the culture and of the place and to connect people and culture. An emblematic example is the Bridge of Mostar, which was rebuilt after the Bosnia-Herzegovina war, and which represents a symbol of reconciliation, international co-operation and of the coexistence of diverse cultural, ethnic and religious communities.

2. The Theme of Perception

Reflecting on the social value of bridges, an important role is the perception of the theme that highlights the extent of the design. In fact, apart from a few rare examples, engineers and architects alike focus on the subject which, first designed and then given virtual form, becomes a physical object. Despite the land survey techniques, 3D modelling and photo inserts are able to give good results of the final outcome, the project subject remains the bridge which is what attention and creative forces tend to focus on. Thus, the result is generally the contextualised bridge. However, with this design approach not only is the landscape, a highly discussed topic in recent years with a general growing awareness, put in the background, but, no less important, the overall quality that should also be queried is how the bridge functions are realised, regarding the context of the strategic design, how many and which ties the
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bridge manages to create with its context (historic, economic, functional, local and network, perceptive, cultural and other points of significance).

Rather in operational terms, where the bridge is contextualised, there is still no idea of the transformed context, i.e. the outcome of a design process that considers the characteristics and vocations engaged in the location and the site for the project, where the continuous symbolic exchanges between the bridge and context can be recognised, until the bridge actually becomes the context, as if it had always been there and to which nothing can be added nor taken away. Consequently, by focusing design attention on the bridge and specifically investigating the context, there is the risk of altering the location, of not going beyond that fine conceptual dividing line of the passage from “Contextualised infrastructure”, where the point of view of the infrastructure dominates, to the “transformed context” where the point of view is directed to the location, to the area overall that is used and affected by the relations. The result is that the bridge often is seen as an intruder, with the resulting public protests.

3. The Quantity of Perception

There are numerous variables that affect perception of bridges: the season, the type and quality of light during the day and night, when there may be artificial lighting, the light diffusion, and its intensity during the day and night, the orientation of the bridge with respect to its geographic position, any external observation points of the bridge, and the speed with which it is crossed. So, from how a bridge is sculptured by time, light and shade, we move on to “how much”. How much of the bridge do we perceive? Obviously the answer is subjective to each single case, and even though it is complicated to theorise analysis models that are generally valid, we can at least identify those components that come into play in perception and which enable measuring it. One of the main aspects is proximity. Proximity is also affected by scale, based on the relative position between the plane where the visible surfaces of the bridge stand and the observer’s plane. This means that the view of the area from the bridge and of the bridge from the area, a continuing play of marquetry where perspectives and vanishing points are dominating factors. Elevation and central perspective dominate the scene we see if we observe a bridge in the distance on a scale with the landscape, which is amplified in the reflected image if there a river running beneath it. As we get closer to the bridge, foreshortenings and gradual progressive changes in form accompany us until we lose the perception of the structure beneath us and are able to see it in detail. But, if this path, this gradual change in scale, is read as continuity it is just as virtual as the 3D graphic models we mentioned
previously. In fact, the problem of accessibility of perception arises. To understand this problem, it is sufficient to take one of the most glaring cases – the organization of the areas around the tallest bridge in the world: Millau in France. Downstream between the two riverbanks a small temporary bridge had been built to enable the heavy vehicles to work on the bridge piers. When the bridge was finally finished, the temporary bridge was not demolished but was included in the new landscape layout as a viewpoint to admire the surroundings which, in this case, is this monumental construction. Apart from the unusual view upwards, the small bridge also offers the chance of understanding the size of the tallest bridge in the world and to grasp its scale with respect to its surroundings. This case leads us to reflect on the modulation of the ratio of the “quality of the work” / “number of viewpoints” to observe it. Theoretically, the poorer formal quality of the bridge, the more we attempt to deny its visibility, hiding it symmetrically and with attempts of camouflage, also considering the valorisation principles in our “Cultural Heritage Code” – the greater capacity of being a “cultural heritage” the greater accessibility to perception it should have. If we move from the landscape scale to the urban and architectonic scale, the chance of getting a glimpse of the bridge is high, and from the perception of depth given by its width, which we previously saw, now we have the perception of depth given by its length up to the point where the bridge ends on the riverbank or embankment.

The regular lines are distorted; the spaces between the horizontal lines of the planking and the arch holding the bridge become “triangle-like”. There is a change in range, a linguistic flexibility that should not be taken as a limitation but as expressive potential.

4. The Everyday Modellers: Shade and Time

Another aspect that comes into play in perceiving a bridge is shade, especially in our country where there are not many bridges with large or very large spans, which impose the use of suspended bridges, here the majority are deck bridges or deck arch bridges, where the structural frame is all or partially beneath the deck. Consequently, for the greater part of the day we are only able to recognise the design of the bridge, or structural architecture holding it up, in the half-light or with difficult backlights. This means that shade is also a component that gives depth and substance, but also one that limits perception. Shade also helps to momentarily sculpture other elements in the context: the shade that the bridge throws when it is struck by sunlight, creating fascinating or invasive effects on the surrounding land.
The perception time is another “gap” which has been little explored. It is fundamental in the perception of a bridge and has two main ranges of variables. One is of moments, a few seconds or a few minutes we need to catch a glimpse of the slenderness of the structural weave or the convergent lines of a parapet, which, with the deck, guide one’s sight to other spaces and places. This is the time of the person who uses the bridge, who crosses over it. The other temporal range varies from days to a lifetime, and mainly concerns those who live close to the bridge and experience, or suffer it, as part of their everyday life.

5. The Social Meaning in Structural Shape Searching

Retracing the various social meanings that a bridge can assume, another key point can be surely represented by the relationship between form and structure. As a typical engineering topic, a bridge’s form design is a fundamental step for the success or the failure of a project.

If a building's architecture often hides its “true structure”, this never happens for bridges. Structures that actually draw the flow of forces in space and the static channels called to convey these forces to the ground. And that’s the reason why Bridges are also called “naked structures”.

So, the relationship of form to structure in bridges, is tightly connected to form a functional relationship, which rarely takes second place during the concept of a work within its context. Talking about bridge architecture necessarily implies a multidisciplinary approach to design, a unique opportunity to play with delicate static and formal equilibrium.

The bold equilibrium of some recent light and slender footbridges inevitably captures the attention of people who pass across them or just observe them, especially the attention of people who have never studied statistics, and naturally ask themselves how it works, answering with static intuition only and their personal experience. Nobody can think that a suspension bridge can stand by cutting the main suspension cable, but much more complex and less obvious is to understand if a building can stand without a pillar! This confirms the structural truth of bridges. Architecture made to amaze, to fascinate, to surprise, no matter how often justifiably criticized, appears to have a fundamental role in the modern world. It is no coincidence that so-called “Archistars” are requested all around the world to create exceptional works, in the literal sense of the term ‘exceptional’.

The environmental and the economic impact that this kind of work may have, is often a subject of discussion, but at the same time the positive impact that that have on tourism, on the economy and on the idea and the im-
The Campo Volantín footbridge in Bilbao by Santiago Calatrava was strongly supported by the local administration for the 700th anniversary of the city, and falls within a wider urban regeneration project that has affected the city of Bilbao, especially along the course of the river that runs through it. In this case, the main objective of the project is to characterize the site in which it is inserted, contributing to the creation of new urban meanings and relationships. Although often criticized, this approach developed through a clever game of balance to create the architectural form, can achieve this goal. Of course this approach never represents the most economical solution, but the main aim of this project is to explore the civic and social impact that significant infrastructures can have on a declining urban environment.

The Campo Volantín footbridge is situated approximately 900m upstream of Frank Gehry’s Guggenheim Museum. This footbridge and the Guggenheim, along with Norman Foster’s underground line, Calatrava’s new airport terminal, and the Isozaki towers just in front of the footbridge, are all landmark features representing the regenerative ambitions of this Basque city. The introduction of this footbridge symbolizes the infrastructural improvements being made to the disused areas along the river left by the now obsolete maritime industry, and forms a city renewal bridging the gap between two previously socially divided parts of the city. The footbridge, along with the other cited landmarks, gives its contribution to the great successful policy of the local government that, in collaboration with private society, made Bilbao a very good example of urban rehabilitation, as the current economic indicators and the great number of visitors to the city can confirm.

The complexity of the three-dimensional geometric form is obtained by the use of curved elements, but not only in the arch, but even in the deck, and the corresponding family of stays. The deck has a significant longitudinal curvature and a smaller one in the vertical plane too. A linear element, crossing down the deck, realizes a tie for the arch. The arch is not oriented in a vertical plane; it is inclined by 14° from it. The high visual effect of the footbridge is empha-
sized by the two support structures of the steel footbridge, basically constituted by two pre-cast concrete cantilevered beams, creating an interesting effect of void in the place of the typical presence of a soil embankment.

6. Footbridges as Instruments for Urban Regeneration

The footbridge can be an instrument for the requalification of a place through the perceptive, cultural, social relations that it can establish in the context in which it is inserted. Here below are some examples of footbridges which are emblematic for their ability to create new relations with the place and to be instruments for its revitalization.

The **Pedro e Ines footbridge** in Coimbra, Portugal, with its two staggered semi-arches becomes a meeting place and also a symbol linked to the memory of the love between man and woman and a path to be lived that creates a new landscape offer through the suggestion of the water view.

The **Ponte del Mare in Pescara** is a virtuous example of footbridge that has defined an anthropological place both by historicizing relations and characterizing its space identity. This work, which links two parts of the city that were once separated by the Pescara river and which were lacking collective identity, is now the symbol of Pescara and the Abruzzo Region.

But as well as having a symbolical identity it has become an instrument for knowing the territory. From here we can see the parts of territory that were once separated and the wide diversity of the elements: the strands, the port, the sea, the river, the urban area and the hills. From this footbridge it is possible to create new visual relations and to establish new boundaries. For this reason it is both an attractive pole of the city and a meeting point not only for the inhabitants but also for cyclists, runners and tourists. This new common sign has also radically changed the identity of the place (from empty to full, from not being used to being used) and set the necessity to requalify the surrounding areas. By setting changes that brought the city to a more competitive level, this work has been a mean of an urban regeneration process.

The **Pelosa footbridge in Padova** is an example of the valorisation process of urban quality. The ancient Roman Pelosa way was interrupted in the 12th century by the construction of the Brentella canal, which created a true fracture between the inhabitants of Padua and those of Selvazzano and Rubano. This footbridge restores the ancient link between the parts of the Pelosa way collocated in the eastern and western part of the canal. The characteristics of the site and the beauty of the banks were the meanings for the creation of this unusual and light work, which is a sign connected to the surrounding environment and shaped by the 'meander' morphology.
The **LDV Kazan footbridge project** is placed in a new urban area, once upon a time abandoned, and now designed for new urban functionalities, as a park. The footbridge has been developed with the thinking that a connection is able to act as a crossing both physically and culturally. The cultural values of the historic areas, present in the Kazan territory, overlooking the natural inlet of

the Kazanka river could be considered in parallel with the historic geography of the Golden Horn, in Istanbul. Here, in Kazan, the two banks of the Kazanka river give room to spaces that can be considered as belvederes pointing at the historic and cultural core of the city.

A modern interpretation of the footbridge designed by Leonardo Da Vinci in 1502, made of duplex stainless steel, with a slightly tilted couple of arches, spans an urban road and maintains continuity with the green areas on the Kazanka shoreline just before it joins the Volga river.

The footbridge axis is inclined in relation to the project park axis and it develops in a sinuous double curvature. The choice to differentiate the footbridge axis strengthens the concept design assumption of the park and, at the same time, acts as a connecting element, which connects the formal axis design of the park with the footpath’s soft lines in the green spaces beyond the road in front of the Kazanka water.

By adopting Leonardo’s approach, considering today’s materials and achievable forms that could be implemented, the working team defined a generally stimulating design which allows the perception of the new place, wanted by inhabitants, in the urban daily living landscape.

The **Şirinevler footbridge project**, placed in an urban context formed of different identities, has been developed thinking of not only a physical but also a cultural connection. The reasons for the steel and wooden structures were based on this founding principle.

The design of the footbridge in Şirinevler, like those for the Istanbul Park in Kazan and the Gezi Park in Istanbul, is a design experience which combined an in-depth technological study with an anthropological approach.

People have given the name of Civilization Bridge to this structure because it connects two different areas of the city, differently characterized in their physical and social-urban aspects. The study was driven towards defining an element that could give tangibility to this cultural connection felt by the people: the wooden canopy in the middle. From a physical point of view, in its tangible appearance, the footbridge starts from a new residential area characterized by an extensive green belt. This first part lies in a warm green area alongside a car park. The second part passes over the entire E5 highway connecting the subway station, in the new residential area, the metro bus station, in the centre of the road, and the bus stop located at the edge of a dense
and crowded historic residential area. The footbridge project has been studied in order to fully maintain the function of the existing historical connection: an inadequate structure which tries to handle the growing flow of people during rush hours. The project, standing in a context formed of different urban identities, has been developed considering the bridge acts as a connection not only from a physical but also a cultural point of view. Using this basic principle the reasons have been defined for the main elements which characterize the footbridge appearance. The wooden structure, which forms a fluid continuum with the footpath starting from the green area of the new residential side, and the very peculiar lattice beams of the hybrid steel structure coming from the crowded historical side. The first section along the path acts as a parapet in the viaduct, the second section supports the trussed beam deck. These two elements, arising from the interpretation of how the two places collaborate and meet each other, form the canopy in the central part of the connection where the metro bus station is situated.

The Gezi footbridge is expected very close to one of the main centres of life in Istanbul: Taksim Square. From this square, a major metropolitan hub, a significant flow of people reaches the important and nearby headquarters of Istanbul Technical University. The path between these two poles goes through the urban park designed by Prost. Even in the original design, in this context, there was a lack in the continuity of the park in correspondence with a two-lane street bearing heavy traffic placed below the plane of footpath.

The two sides of the park were joined by the badly scratched concrete structure, which showed different points of damage with partial loss of material. The structures crossed the total distance with three spans: main central one and two laterals. The piers were formed of a series of four concrete pillars, which supported the structure of the deck. In accordance with the city’s transformation needs, the decision was taken to work on the valorisation of the cultural heritage of the urban texture by implementing a structure able to incorporate Prost’s vision thus simultaneously including historic and natural issues as well as technological aspects.

The first input project was to use materials very close to the Turkish culture. Wood was a material widely used in constructions in the core of Istanbul and the Wooden Houses are one of the most important examples. The predominant use of natural materials was also dictated by the presence of the characteristic stone water tower, standing as testimony of technological achievement. The slender shape of the segmental arch is made by a structural section of laminated wood reinforced with steel bars. The new footbridge was designed with the aim of giving a sign of tangible and intangible continuity to the connection between the historic past and the living present, using wood with the potentialities offered by current technology. In addition, from
a functional standpoint, the footbridge offers two possibilities allowing the continuity of the footpath and the continuity of the park as a green area. The paving stones and vegetation accompany the people as they stroll through the park and do not stop at the footbridge, thus giving continuity.

The central pair of arches, observed along the path, rises and opens up to the green grassy areas, until the arches re-converge on the deck to form a seat.

7. Final Considerations

The landscape can be considered composed of two fundamental meanings, the subjective and objective ones. The first one involves one of our perceptive faculties, the other one involves the whole elements and processes that are collocated in the territory as parts of a complex system.

Understanding, knowing, studying all perceptive, symbolic and identity aspects of the landscape and also working on the landscape project – in particular on the infrastructure project, which is a fundamental part of it -, means making valorisation interventions.

From this point of view, footbridges are instruments for knowing the landscape and its meanings, and they can become an opportunity to define the requalification of large urban areas.

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