Bridge a Gulf, Light a Pandemic

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Journal of Urban Design, Vol. 26, No. 4, 2021, pp. 412–438

ABSTRACT

Bridges have long been understood as infrastructure for crossing water, but they also function as infrastructure for crossing time. This article examines how bridge projects can be used to accelerate urban change by concentrating investment, attention, and political will around a single visible intervention. Drawing on case studies of three bridge projects in Southeast Asia and the Pacific Rim, it argues that the most successful bridges are those that connect not only two banks but also two futures that a city has been unable to reach on its own. The article develops a framework for evaluating bridge projects along four dimensions: connectivity, capacity, symbolism, and resilience. It concludes that bridges are most effective when they are designed as part of a broader network rather than as isolated monuments.

1. FROM ONE SIDE TO BOTH

The Gulf of Tonkin Bridge, completed in 2018, is the longest cross-sea bridge in Southeast Asia. It connects the city of Haiphong on the mainland with the island district of Cat Hai, a journey that previously required a ferry crossing of about forty minutes in good weather and could be suspended entirely during the typhoon season. The bridge is 5.4 kilometers long, with a main span of 1,200 meters, and it was built in four years at a cost of roughly $1.4 billion. Its opening was treated as a national event, and for the first few months traffic was so heavy that the toll booths on the Cat Hai side had to be expanded.

The bridge is the subject of this article because it is a clear example of a project whose effects were felt long before it was finished. Land prices on Cat Hai began to rise as soon as construction was announced, and by the time the bridge opened, several large developments were already under way. The bridge did not create these changes on its own, but it made them possible at a scale that would not have been imaginable otherwise. It is therefore a useful case for thinking about how infrastructure and urban change relate to one another.

The central argument of this article is that bridges should be evaluated not only by the traffic they carry but by the futures they open. A bridge that carries many vehicles but connects two places that have little reason to interact may be a technical success and an urban failure. A smaller bridge that connects two communities with a strong relationship can be transformative even if its traffic numbers are modest. The article develops this argument through a framework and then applies it to three cases.

The remainder of the article is organized as follows. Section 2 reviews the literature on infrastructure and urban change. Section 3 introduces the framework. Section 4 applies it to the Gulf of Tonkin Bridge and two comparison cases. Section 5 discusses the implications for planning practice. Section 6 concludes.

2. INFRASTRUCTURE AND URBAN CHANGE

The relationship between infrastructure and urban change has been a central concern of urban scholarship for more than a century. Early work tended to treat infrastructure as a cause and urban change as an effect, in a relationship that was largely one-directional. More recent work has emphasized that the relationship is reciprocal: cities build infrastructure in response to existing pressures, and the infrastructure then reshapes those pressures in ways that were not always intended.

Within this literature, bridges have received relatively little attention compared to roads, railways, and ports. This is surprising, because bridges are among the most visible and symbolically charged infrastructures a city can build. They are also among the most expensive per unit of capacity, which means that the decision to build one is rarely taken lightly. The combination of high visibility and high cost makes bridges a particularly interesting object of study.

2.1 Bridges as Connectors

The most basic function of a bridge is to connect. But connection is not a simple matter. Two places can be physically connected and still remain socially and economically distant if the bridge is too narrow, too slow, too expensive, or too unreliable. Conversely, a bridge can create a strong relationship between two places that were previously only weakly connected. The difference between these outcomes depends on factors that are not visible in the bridge itself.

Several authors have argued that the value of a connection is not proportional to the capacity of the infrastructure that provides it. A bridge with twice the capacity of another will not necessarily produce twice the urban change. What matters is whether the people and firms on each side have a reason to use the bridge often enough to change their behavior. This is why bridges that open to a trickle of traffic can be more transformative than bridges that open to a flood.

2.2 Bridges as Symbols

Bridges are also symbols, and their symbolic role is inseparable from their physical one. A bridge can signal that a city is ambitious, that it is open for business, that it has overcome a geographic obstacle, or that it belongs to the modern world. These meanings are not added after the fact; they are built into the design, the scale, and the ceremony that surrounds the opening.

The symbolic role of bridges can be both a strength and a weakness. It is a strength because it helps to mobilize political support and to attract attention from investors and visitors. It is a weakness because it can lead to projects that are larger than they need to be, or that are built in the wrong place, because the symbolic payoff is concentrated in a single location. The framework in Section 3 is designed to help distinguish between these cases.

2.3 Bridges as Risk

Finally, bridges are risky. They are expensive, they take a long time to build, and they are exposed to the full force of the environment for their entire lifetime. A bridge that fails, or that is closed for repair, can cut off a community from its livelihood. The risk is not only physical; it is also financial, because the revenue from tolls or fares may not cover the cost of construction and maintenance.

The literature on infrastructure risk has developed a vocabulary for talking about these issues, including terms like "lock-in," "stranded asset," and "path dependence." These terms are useful for thinking about bridges because they help to explain why a bridge that was built for one purpose can end up serving another, or why a bridge that was built to last can become obsolete before it is worn out. The framework in Section 3 includes a resilience dimension that is intended to capture these risks.

3. A FRAMEWORK FOR BRIDGE PROJECTS

The framework developed in this section is intended to help planners, designers, and policymakers think about bridge projects before they are built. It is not a substitute for detailed engineering or financial analysis, but it is a way of asking the right questions early, when there is still time to change the design. The framework has four dimensions: connectivity, capacity, symbolism, and resilience.

3.1 Connectivity

Connectivity asks whether the bridge connects two places that have a reason to interact. The relevant question is not how many vehicles the bridge can carry, but how many trips it is likely to attract that would not have been made otherwise. A bridge that connects two dense, complementary districts will have a high connectivity score even if it is relatively short. A bridge that connects two sparsely populated areas will have a low score even if it is very long.

Connectivity can be measured in several ways. One is to look at the number of trips that cross the water before the bridge is built, and to estimate how many of those trips will shift to the bridge. Another is to look at the number of trips that are suppressed by the current crossing, and to estimate how many of those will be induced by the bridge. The second measure is harder to estimate but often more important, because induced trips are the ones that change the city.

3.2 Capacity

Capacity asks whether the bridge is the right size for the connectivity it is meant to serve. A bridge that is too small will create congestion and will not realize its potential. A bridge that is too large will be underused and will not pay for itself. The right size depends on the connectivity, but it also depends on the design of the approaches, the number of lanes, and the way the bridge is integrated into the surrounding road network.

Capacity is also a question of flexibility. A bridge that can be widened or that has spare capacity built into its foundations can adapt to changing conditions. A bridge that is built to the exact specification of today's traffic may be obsolete in twenty years. The framework therefore asks whether the bridge has been designed with room to grow.

3.3 Symbolism

Symbolism asks what the bridge means to the people who will see it every day. A bridge that is a source of pride can help to build a sense of place and to attract visitors. A bridge that is a source of resentment can create political problems that last for years. The symbolic dimension is the most subjective of the four, but it is also the most important for the long-term success of the project.

The symbolic dimension includes the design of the bridge, the name, the ceremony at the opening, and the way the bridge is represented in maps and guidebooks. It also includes the way the bridge is treated after it is built: whether it is maintained well, whether it is lit at night, whether it is closed to traffic on certain days. These details are small, but they add up to a message about how much the city cares about the bridge.

3.4 Resilience

Resilience asks what happens when the bridge is damaged or destroyed. A bridge that is the only crossing for a large population is a single point of failure, and the consequences of its failure can be severe. A bridge that has a ferry or a second bridge nearby is more resilient, because the traffic can be diverted. The framework therefore asks whether the bridge has a backup, and if not, whether one should be built.

Resilience is also a question of maintenance. A bridge that is well maintained will last longer and will be safer. A bridge that is neglected will deteriorate quickly and will eventually require a much more expensive repair. The framework asks whether the maintenance plan is adequate and whether the funding for it is secure.

4. THREE CASES

The three cases in this section were chosen to illustrate different combinations of the four dimensions. The Gulf of Tonkin Bridge is a case of high connectivity and high capacity, with a strong symbolic role. The Pearl River Crossing is a case of high connectivity and low capacity, with a weak symbolic role. The Harbor Bridge is a case of low connectivity and high capacity, with a strong symbolic role. Each case is described briefly and then evaluated using the framework.

4.1 Gulf of Tonkin Bridge

The Gulf of Tonkin Bridge connects Haiphong with Cat Hai. Before the bridge, the crossing was by ferry, and the ferry was slow, unreliable, and expensive. The bridge has four lanes and a main span of 1,200 meters. It was built in four years at a cost of about $1.4 billion. Its opening was treated as a national event, and for the first few months traffic was so heavy that the toll booths on the Cat Hai side had to be expanded.

On connectivity, the bridge scores high. The two sides have a strong relationship, and the bridge has made it possible for people to live on one side and work on the other. On capacity, the bridge is adequate for now but may need to be widened in the future. On symbolism, the bridge is a source of pride for the region and has become a landmark. On resilience, the bridge is the only crossing, and a backup ferry has been proposed but not yet built.

4.2 Pearl River Crossing

The Pearl River Crossing connects two districts of a large city. It has six lanes and a main span of 800 meters. It was built in three years at a cost of about $900 million. It was opened quietly, with little ceremony, and it has never been the subject of much public attention.

On connectivity, the bridge scores low. The two districts have a weak relationship, and the bridge has not changed the way people live or work. On capacity, the bridge is underused and has plenty of room to grow. On symbolism, the bridge is almost invisible. On resilience, the bridge is one of several crossings, so its failure would not be catastrophic.

4.3 Harbor Bridge

The Harbor Bridge connects the mainland with a peninsula that was previously only reachable by a long detour. It has four lanes and a main span of 1,500 meters. It was built in five years at a cost of about $1.8 billion. Its opening was delayed by a dispute over the design, and the final bridge is a compromise between the original proposal and the objections of the local residents.

On connectivity, the bridge scores low. The peninsula is sparsely populated, and the bridge has not yet attracted the development that was expected. On capacity, the bridge is larger than it needs to be, and the toll revenue is not enough to pay for the maintenance. On symbolism, the bridge is a source of pride for the region and has become a landmark. On resilience, the bridge is the only crossing, and a backup ferry has been proposed but not yet built.

5. DISCUSSION

The three cases illustrate that the four dimensions of the framework can vary independently. A bridge can be high on connectivity and low on capacity, or high on symbolism and low on resilience, and the combination matters. The framework is not intended to produce a single score for each bridge, but to help planners see where the strengths and weaknesses of a project lie.

One implication is that bridges should be designed as part of a network, not as isolated monuments. A bridge that is built to connect two places should be considered in relation to the roads, the transit, and the land use that will surround it. A bridge that is built to be a landmark should be considered in relation to the view from the water and from the shore. The framework is a way of making these relationships explicit.

Another implication is that bridges should be built with room to grow. The cost of adding a lane to a bridge that was designed for it is small compared to the cost of building a new bridge. The framework therefore asks whether the bridge has been designed with room to grow, and whether the funding for the future lanes is secure.

A third implication is that bridges should be maintained well. The cost of maintenance is small compared to the cost of replacement, and a bridge that is neglected will deteriorate quickly. The framework asks whether the maintenance plan is adequate and whether the funding for it is secure.

6. CONCLUSION

Bridges are infrastructure for crossing time as well as water. They can accelerate urban change by concentrating investment, attention, and political will around a single visible intervention. The most successful bridges are those that connect not only two banks but also two futures that a city has been unable to reach on its own.

The framework developed in this article is intended to help planners, designers, and policymakers think about bridge projects before they are built. It is not a substitute for detailed engineering or financial analysis, but it is a way of asking the right questions early, when there is still time to change the design. The framework has four dimensions: connectivity, capacity, symbolism, and resilience.

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