Beyond the Structure;
Footbridge as a Landscape Architectural Design Product

Artan Hysa\textsuperscript{1,2}
\textsuperscript{1}Epoka University/ Rr. Tiranë-Rinas, Km. 12, 1039 Tirana, Albania
ahysa@epoka.edu.al
\textsuperscript{2}Istanbul Technical University/ Taşkışla Kampüsü, 34743, Beyoğlu / İstanbul / Türkiye
hysa@itu.edu.tr

ABSTRACT

Footbridge, by its name, proclaims that it is a special urban access medium for pedestrians. Unfortunately, there are less works that through research highlight this fact. Generally, pedestrian bridges are taken into account not enough differently than the `classical’ bridge\textsuperscript{1} itself. There are many scientific works focusing on the structural properties of footbridges rather than on its architectural and urban values.

This study aims to scrutinize the architectural and urban added values of the footbridge to its context and human life. It will be taken into consideration in this study as an urban furniture, a public space, a pathway, a landmark as well as a landscape feature. The goal of this research hides behind concerning with the user density rather than load bearing capacity, the urban aesthetics rather than large spans, the accessibility rather than constructability.

A selection of ten pedestrian bridges will be the raw input of this research. The selection criteria of these ten projects can be listed as follows; being built, being a recent project- due to the availability of one of the research tools of this study- [within 10 years], being of an urban context and over passing a waterway rather than a motorway. Geography has been intentionally kept wide so that to have cases from different cultures as well.

Apart from general information about the cases, this study will try to highlight the architectural and urban added values of each project to its context by various methods. Some qualitative values of an architectural and urban character of the current state of each project will be evaluated by professionals through Likert scale method. These people will be provided enough written and visual material about each case so that a rational evaluation process can be achieved. Another special method is used to highlight the added values of each footbridge to its neighborhood. Google earth Timeline plugin will be a crucial application to assist us on that. By contrasting and comparing two satellite images of the zone representing its state before and after the construction of the project we may read those values more clearly.

KEYWORDS: footbridge, public space, landscape structure, pedestrian access, urban rivers

\textsuperscript{1} Classical Bridge\textsuperscript{1} is used here to literally represent the traditional bridge in structural means
1 INTRODUCTION

Footbridge or Pedestrian Bridge, as it is implied by its name, is a special urban access medium for pedestrians. Unfortunately, there are less works that through research highlight this fact. Generally, pedestrian bridges are taken into account not enough differently than the `classical’ bridge\(^2\) itself. There are many scientific works focusing on the structural properties of footbridges rather than on its architectural and urban values. It is difficult to find studies that take them as a special typology of urban public access tool. (Idelberger, 2011) (Ursula Baus, 2008) (Equality, 1981) (Schlaich, 2005)

1.1 Objectives

The basic aim of this research work is to highlight the architectural, urban and landscape values of the footbridge rather than its structural properties. Conveying a fast literature review among the academic research data, the lack of similar focuses is obvious. On the other hand, there are many studies focusing on their structural features.

The footbridge in this study is considered as an extension of the pedestrian paths of the urban life rather than as a structural marvelous object as they are. Furthermore, they are not only connections of two urbanized parts of a river- at least the examples that are included here- but as well as providing several perspectives of the city itself to their passengers\(^3\). They have been part of this study as important urban elements that provide to the citizens exceptional and spectacular experiences of walking over / along the interwoven dynamics of a waterway such as the river. The pedestrian bridges have been studied here as one of the rarest urban features that make urbanized man come closer to the nature.

Another goal of this study is to generate a multi criteria analysis model a trial of which have been performed during the research work and will be fully presented through this paper.

2 METHODOLOGY

2.1 Literature Review on Case Studies

In this study there are included 10 footbridges that have been shortlisted as case study. The selection criteria applied for each example can be listed as follows [main ones being in bolt]:

- Being of recent years
- Being built
- Overpassing an urbanized waterway
- Not being similar cases
- Having different scale
- Different geographies
- Information accessibility

According to the pre-defined main selection criteria a list of more than 20 examples have been produced. Considering the other four secondary selection criteria a final list of 10 project have been prepared. The first draft list is represented in the table 1.

\(^2\) Classical Bridge, is used here to literally represent the traditional bridge in structural means

\(^3\) Passenger here is used in a secondary meaning. Thinking of pedestrians carried by the footbridge to cross a water or motor / way.
Table 1. First draft of the Footbridge case study selection

<table>
<thead>
<tr>
<th>name of the project</th>
<th>river</th>
<th>navigable</th>
<th>structural typology</th>
<th>str. mat</th>
<th>fin. Mat</th>
<th>accessibility</th>
<th>1.function</th>
<th>2.function</th>
<th>length</th>
<th>width</th>
<th>span</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duisburg Footbridge</td>
<td>Rhine</td>
<td>yes</td>
<td>suspension-ht</td>
<td>steel</td>
<td>synthetic</td>
<td>Inklage</td>
<td>73.73</td>
<td>3.5</td>
<td>73.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Quay Footbridge</td>
<td>Thames</td>
<td>yes</td>
<td>girders</td>
<td>steel</td>
<td></td>
<td>Inklage</td>
<td>90</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heinrich-Bosch Footbridge</td>
<td>Rhein</td>
<td>yes</td>
<td>girders</td>
<td>steel</td>
<td></td>
<td>Inklage</td>
<td>31</td>
<td>3.3</td>
<td>31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gustav Heinemann Bridge</td>
<td>Spree</td>
<td>yes</td>
<td>girders</td>
<td>steel</td>
<td></td>
<td>Inklage</td>
<td>87.69</td>
<td>4</td>
<td>65.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passerelle des Trois Pajls</td>
<td>Spree</td>
<td>yes</td>
<td>girders</td>
<td>steel</td>
<td></td>
<td>Inklage</td>
<td>105</td>
<td>3.25</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passerelle des Trois Pajls</td>
<td>Arverne</td>
<td>yes</td>
<td>girders</td>
<td>steel</td>
<td></td>
<td>Inklage</td>
<td>346</td>
<td>7</td>
<td>230</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kaiser Bridge</td>
<td>Spree</td>
<td>yes</td>
<td>girders</td>
<td>steel</td>
<td></td>
<td>Inklage</td>
<td>140</td>
<td>5</td>
<td>92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rosenu Footbridge</td>
<td>Iller</td>
<td>no</td>
<td>self-anchored</td>
<td>steel</td>
<td>concrete</td>
<td>Inklage</td>
<td>53.6</td>
<td>3.5</td>
<td>53.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.2 Documentation

2.2.1 General Information

A through research on the final ten examples were done as the next step which comprises the documentation phase. The documentation have been done in three subgroups. There have been created three documentation category for each example. Text based information have been one of the most important sources for the general information about the project. Data such as;

Name of the project
Time and Location
Design team [architect, engineers, landscape architect, etc]
Physical properties [length, span, height, width, etc]
Budget
Its history
Interesting background facts
Process [design and construction phases]

have helped to figure out the project with all its facts and background information. A sample of that general information page is shown in the figure 3.

2.2.2 Satellite Images

The second data package of each case is the satellite images. Firstly, there have been produced four satellite images using the Timeline plugin of Google Earth application.

Altitude 2000 m - year 2000’s [before the project have been built]
Altitude 2000 m - year 2010’s [after the completion]
Altitude 1000/ 500 m - year 2000’s [before the project have been built]
Altitude 1000/ 500 m – year 2010’s [after the completion]

The images of 2000 m aim to be the platform for city scale analysis. Whereas the latter two for the neighborhood scale study. On the other hand the images of before and after being built have been part of
the satellite images data pack to serve as tool for comparative study. Besides these four documents there have been used an integrated image/map with all urban features’ names and details. This image have been produced by the open source Bing Maps application. One example of the satellite images package is represented in the figure 1.

![Satellite images page example](Simone de Beauvoir Footbridge)

Figure 1. Satellite images page example

![Delivered questionnaire and the images](Pasarela del Arganzuela)

Figure 2. Delivered questionnaire and the images

![General information page example](Limmat Footbridge)

Figure 3. General information page example

2.2.3 Selected Shots

The third documented material have been a selected number of shots of each project. The primary source of these photos have been several sources on the internet. These webpages range from image stock service sites to the official webpages of the design team of the project. A seldom of them have been from books and magazines. In the end 5 to 7 images have been selected to be part of the visual information about the project. These images have been selected so that to express as much information about the project as it could. At the end catalogue of 3 pages per each project have been prepared so that to zip up a package of crucial information about the selected ten examples.

2.3 Professional Questionnaire

The next step of the process was preparing a questionnaire consisting of 14 questions sub grouped in four main titles;

**Urban**
- Is this footbridge a landmark for its city?
- How much important is it for its neighborhood?
- Is it contributing to human-river interaction?
- Is it well anchored to city pedestrian routs?
- Is it a generator of alternative civic events?

**Architectural**
- How much architecturally aesthetical is it to you?
- Is the bridge aesthetically related with its context?
- Is this footbridge proper for human scale?
- Is the artificial lighting system appropriate for this bridge?
Environmental
Are the materials environmentally friendly?
Is this design considering the periodical floods?
Does it consume much un-renewable energy?
Is it considering the principles of universal design?

Structural
Are the Structural and Architectural designs in accordance?

3 DISCUSSION

During the next step, the responses have been collected and analyzed so that to draw some findings. A detailed graphical representation of these answers have been included in the appendixes part of this study. These charts have been produced by overlapping each response by a transparency value of 50% making the graphical differentiation of each vote. By this method the differences among answers is more readable. In the appendixes part there are presented the delivered materials accompanying the questionnaire as well.

The questionnaire is of a Likert scale type and each question have been assigned a range of weight from 1-5, from the extremely low to the extremely high option. This questionnaire accompanied by the documentation catalogue of ten examples have been delivered to seven professionals with the backgrounds of architecture [three], urban design and city planning [two], and landscape architecture [two]. An example of the delivered questionnaire is shown in the figure 3. Whereas in the following table 2 it is shown the responded questionnaires of five footbridge projects.

Table 2. Responded questions for the first five projects

<table>
<thead>
<tr>
<th>Question 1</th>
<th>Question 2</th>
<th>Question 3</th>
<th>Question 4</th>
<th>Question 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1</td>
<td>Option 2</td>
<td>Option 3</td>
<td>Option 4</td>
<td>Option 5</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

335-5
Besides that a numerical evaluation of the responses have been performed. In the following tables and charts have been shown the points that each project collected in total as well as correspondingly by each professional. In the table number 3 there have been listed each project in descending order with their respective ordered number of the questionnaire. In the following 8 columns there are the grading of each professional per each project. These values are graphically shown by ratio bars. Apart from that, there have been highlighted the top scores by each professional. It is not surprising here that the top ranked Castleford footbridge project consists of three professionals’ top scores, that of pro 5, pro 6 and pro 2, respectively 66 out of a maximum possible of 70 points. This project have been graded by an average of 4.17 per question.

In the last two columns we have the total score per each project as well as the differences between each consecutive total score. Through the latest column we may understand the breaking point of this evaluation process. In other words the huge differences between projects being evaluated under this questionnaire. It is obvious the difference between Simone de Beauvoir and Quatro Ponte sul Canale Grande which architecturally and in urban means divide the projects into two different groups. The bottom row is the sum of the values of their own corresponding columns highlighting the highest total points by professional number 1. This has score average of 4.10 while the overall score average is 3.75 points per question.

Table 3. Evaluation of each project by each professional

<table>
<thead>
<tr>
<th>Project Name</th>
<th>pro1</th>
<th>pro2</th>
<th>pro3</th>
<th>pro4</th>
<th>pro5</th>
<th>pro6</th>
<th>pro7</th>
<th>pro8</th>
<th>total</th>
<th>diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Castleford Footbridge</td>
<td>60</td>
<td>56</td>
<td>66</td>
<td>57</td>
<td>61</td>
<td>60</td>
<td>55</td>
<td>64</td>
<td>467</td>
<td>10</td>
</tr>
<tr>
<td>La Pasarela del Voltirnariado</td>
<td>56</td>
<td>58</td>
<td>51</td>
<td>56</td>
<td>62</td>
<td>61</td>
<td>57</td>
<td>56</td>
<td>467</td>
<td>17</td>
</tr>
<tr>
<td>Limmat Footbridge and Promenade Lift</td>
<td>63</td>
<td>48</td>
<td>58</td>
<td>57</td>
<td>63</td>
<td>57</td>
<td>54</td>
<td>59</td>
<td>446</td>
<td>7</td>
</tr>
<tr>
<td>Passerelle des Trois Pays</td>
<td>61</td>
<td>56</td>
<td>55</td>
<td>61</td>
<td>50</td>
<td>31</td>
<td>57</td>
<td>56</td>
<td>443</td>
<td>9</td>
</tr>
<tr>
<td>Melkweg bridge Footbridge</td>
<td>57</td>
<td>48</td>
<td>49</td>
<td>60</td>
<td>62</td>
<td>49</td>
<td>54</td>
<td>50</td>
<td>426</td>
<td>1</td>
</tr>
<tr>
<td>Quatro Ponte sul Canale Grande</td>
<td>54</td>
<td>48</td>
<td>53</td>
<td>53</td>
<td>57</td>
<td>56</td>
<td>50</td>
<td>46</td>
<td>427</td>
<td>9</td>
</tr>
<tr>
<td>Simone de Beauvoir</td>
<td>61</td>
<td>53</td>
<td>51</td>
<td>55</td>
<td>52</td>
<td>46</td>
<td>47</td>
<td>54</td>
<td>419</td>
<td>36</td>
</tr>
<tr>
<td>Passarela del Arganzuela</td>
<td>61</td>
<td>54</td>
<td>47</td>
<td>49</td>
<td>44</td>
<td>31</td>
<td>49</td>
<td>47</td>
<td>389</td>
<td>9</td>
</tr>
<tr>
<td>Kantiya Footbridge</td>
<td>53</td>
<td>33</td>
<td>45</td>
<td>58</td>
<td>53</td>
<td>47</td>
<td>49</td>
<td>49</td>
<td>383</td>
<td>14</td>
</tr>
<tr>
<td>Gustav Heinemann Footbridge</td>
<td>49</td>
<td>44</td>
<td>44</td>
<td>44</td>
<td>40</td>
<td>48</td>
<td>46</td>
<td>45</td>
<td>395</td>
<td>1</td>
</tr>
</tbody>
</table>

In the following table number 4 there is represented the evaluation process by questions. In other way this is the performance of all examples facing each question. Here the significance of each question for the shortlisted projects are to be evaluated. The structure of the table is similar to the previous one. In the first two columns there are listed in a descending order 14 questions of the questionnaire with the respective scores by eight professionals. Besides the top scores that have been highlighted the highest scored question is the question number 2, How much important is it for its neighborhood?, with an average of 4.19 out of 5.00 score per project.

It can be easily estimated that the shortlisted projects are much successful in relation with their neighboring urban areas than other aspects questioned through the questions. The least scored question was question number 5, Is it a generator of other public events?, scoring an average of 3.16. The total average of the questions score is the same with overall average of 3.75 per project. What is interesting here is the case of question number 14, Are the structural and architectural design in accordance?, which is ranked as the second only with one point difference from the first out of 400 points in total. This is exceptional since it shows the strong relation of structural and architectural design of the footbridge. Not to be neglected is the background of each participant of the questionnaire.
Table 4. Evaluation of each question by each professional

<table>
<thead>
<tr>
<th>Question</th>
<th>pro1</th>
<th>pro2</th>
<th>pro3</th>
<th>pro4</th>
<th>pro5</th>
<th>pro6</th>
<th>pro7</th>
<th>pro8</th>
<th>Total</th>
<th>diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>How important is it for its neighborhood?</td>
<td>47</td>
<td>37</td>
<td>48</td>
<td>42</td>
<td>34</td>
<td>42</td>
<td>48</td>
<td>33</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Are the structural and architectural design in accordance?</td>
<td>44</td>
<td>36</td>
<td>49</td>
<td>43</td>
<td>34</td>
<td>42</td>
<td>43</td>
<td>33</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Is it well anchored to city pedestrian routes?</td>
<td>46</td>
<td>37</td>
<td>45</td>
<td>38</td>
<td>36</td>
<td>42</td>
<td>44</td>
<td>32</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Is this footbridge proper for human scale?</td>
<td>46</td>
<td>39</td>
<td>42</td>
<td>45</td>
<td>38</td>
<td>39</td>
<td>36</td>
<td>32</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Is it considering the principles of universal design?</td>
<td>43</td>
<td>39</td>
<td>43</td>
<td>33</td>
<td>35</td>
<td>39</td>
<td>35</td>
<td>31</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Is this footbridge a landmark for its city?</td>
<td>36</td>
<td>35</td>
<td>41</td>
<td>41</td>
<td>39</td>
<td>43</td>
<td>43</td>
<td>31</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Is this design considering the periodical floods?</td>
<td>48</td>
<td>32</td>
<td>35</td>
<td>34</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>30</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>How much architecturally aesthetical is it to you?</td>
<td>39</td>
<td>41</td>
<td>39</td>
<td>39</td>
<td>38</td>
<td>35</td>
<td>38</td>
<td>30</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Is the bridge aesthetically related with its context?</td>
<td>36</td>
<td>38</td>
<td>35</td>
<td>34</td>
<td>40</td>
<td>34</td>
<td>36</td>
<td>29</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Is the artificial lighting system appropriate for this bridge?</td>
<td>39</td>
<td>33</td>
<td>34</td>
<td>37</td>
<td>40</td>
<td>33</td>
<td>37</td>
<td>35</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Does it consume much un-renewable energy?</td>
<td>39</td>
<td>39</td>
<td>36</td>
<td>33</td>
<td>32</td>
<td>31</td>
<td>34</td>
<td>27</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Is it contributing to human-river interaction?</td>
<td>34</td>
<td>34</td>
<td>37</td>
<td>37</td>
<td>41</td>
<td>32</td>
<td>32</td>
<td>29</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Are the materials environmentally friendly?</td>
<td>36</td>
<td>37</td>
<td>33</td>
<td>38</td>
<td>36</td>
<td>32</td>
<td>31</td>
<td>26</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Is it a generator of alternative civic events?</td>
<td>33</td>
<td>36</td>
<td>36</td>
<td>38</td>
<td>34</td>
<td>35</td>
<td>31</td>
<td>26</td>
<td>17</td>
<td>17</td>
</tr>
</tbody>
</table>

In the following charts there is presented the descending graph of the overall values of each table. In the first one there are the shown the point per question option whereas in the second one the point per project case.

Figure 4. Points per question chart
Figure 5. Points per project chart

4 CONCLUSION

As a conclusion it can be highlighted that the footbridges can be studied in architectural, urban and landscape means as well. Even though their structural properties haven’t been the focal point of this study one of the questions asking the accordance among architectural and structural values of each example was ranked as the second highest point.

At the end of these study it can be claimed that there is possible to numerically evaluate some architectural and landscape projects such as pedestrian bridges.

An important missing part of the numerical analysis of the study is the table showing the points per question that each project have been evaluated. By that we would draw some important facts on evaluating these projects under special properties that have been highlighted by each question of the questionnaire.
5 ACKNOWLEDGEMENTS

This study is a revised product of my research work for the fulfillment of graduate course Pem610, taken from the Landscape Architecture department at Istanbul Technical University. In this context, I have to thank the course lecturer Selim Velioğlu. At the same time, I am grateful to other professors Ayçiçim Tüür Başkaya and Meltem Erdem, at ITU Pem for their support during the process. Furthermore, I have to thank my colleagues in the Department of Architecture at Epoka University for participating as the professionals team to respond the questionnaire. The last but not the least appreciation goes for my institution- Epoka University- and my family, for supporting by understanding my periodical trips to Istanbul as part of my PhD education.

6 APPENDIXES

Delivered Textual and visual materials to each Professional

List of Ten shortlisted Footbridge Projects

1. Pasarela del Arganzuela
2. Castleford Footbridge
3. Kurilpa Footbridge
4. La Pasarela del Voluntariado
5. Limmat Footbridge and Promenade Lift
6. Melkwegbridge Footbridge
7. Gustav Heinemann Footbridge
8. Passerelle des Trois Pays
9. Quarto Ponte sul Canal Grande
10. Simone de Beauvoir

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**Casselle du Treis Pays**

*Location:* Casselle du Treis Pays, France

**Description:**
- **Architect:** Christian de Portzamparc
- **Structural Engineer:** Zaha Hadid Architects
- **Completed:** 2009

**Key Features:**
- **Material:** Steel and concrete
- **Span:** 110m
- **Height:** 25m

**Background:**
The Casselle du Treis Pays is a footbridge that connects the Treis Pays area in France. It is known for its unique geometric design and use of high-tech materials, making it a significant example of modern bridge engineering.

**Technical Specifications:**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>110m</td>
</tr>
<tr>
<td>Height</td>
<td>25m</td>
</tr>
<tr>
<td>Material</td>
<td>Steel, concrete</td>
</tr>
</tbody>
</table>

**Design Inspiration:**
The design was inspired by the natural landscape and the surrounding environment, emphasizing the integration of architecture with nature.

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**Simone de Beauvoir**

*Location:* Paris, France

**Description:**
- **Architect:** Rafael Moneo
- **Completed:** 2009

**Key Features:**
- **Material:** Glass, steel, concrete
- **Height:** 80m
- **Span:** 170m

**Background:**
The Simone de Beauvoir Bridge is a pedestrian bridge that connects the 13th and 14th arrondissements in Paris. It is known for its innovative design and dramatic cantilevered structure.

**Technical Specifications:**

<table>
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<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Length</td>
<td>170m</td>
</tr>
<tr>
<td>Height</td>
<td>80m</td>
</tr>
<tr>
<td>Material</td>
<td>Glass, steel, concrete</td>
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</tbody>
</table>

**Design Inspiration:**
The bridge honors Simone de Beauvoir, a prominent French philosopher and feminist, and is a symbol of the city's commitment to women's rights and gender equality.
7  BIBLIOGRAPHY

