Smart fence for sustainable construction site in sensitive cultural and environmental heritage

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A B S T R A C T

The construction site causes significant changes to the urban landscape, especially in terms of dynamic perception by users. The appropriate use of smart fences not only aims to limit the risks arising from transformation activities, but also play an integrating and communicative role between the place of transformation, its present and future scenario and the rest of the city. In this way, the city can participate on to the changes, balancing social, cultural and environmental costs and benefits. This paper presents some final results of a research aimed to create an evaluation model applicable in sensitive cultural and environmental urban heritage. In particular, this evaluation tool was built with the aim to assess the propensity of a construction site to the installation of innovative fencing, to increase the quality level of enjoyed environment, both in relation to the context in which it is inserted and to the type of construction site itself. Choosing whether to install or not a “smart” fence, and identify which among proposed strategies it is more suited to a particular type of context and construction site, it is essential in order to improve benefits and reduce costs.

Keywords: smart fence, sustainable construction site, sensitive heritage, technological innovation

1. Introduction\textsuperscript{2}

At the urban scale, in the management of public spaces’ transformations, the need to ensure quality in this transformation emerges as significant. The ability to promote and govern processes that create urban conditions improved and sustainable social development, cultural and economic development of the settled community is recognized as a fundamental requirement.

From an analysis of the transformation interventions in progress in contemporary urban environments, it is shown that more and more often the character of transience and impermanence, that should belong to a construction site, is denied by the time of implementation of the works that go over a medium-long term.

A well-known example is represented by the construction sites of large urban transformations, like those in Rome for the Jubilee in 2000 or in Turin for the Olympics in 2006, similar to temporary architectures that characterize and transform the urban landscape.

Slender margins and impassable boundaries generate objects / envelopes / shapes that “dialogue” with the surrounding space, new, unexpected and perhaps unplanned visions, that in many cases impose themselves in contexts, where they could never be fixed, but that really determine an urban aspect metamorphosis.

Anyway, the modern need to respond the demand for goods and services always efficiently and optimally to stay afloat in the sea of intense competition in the tourism sector requires the city, on a hand, a continuous maintenance of the cultural heritage, on the other hand, the guarantee of a continuous use. We are witnessing, therefore, the evolution of the concept of usability, pushed further and further into liveability and visibility than towards visiting a place.

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The research, titled "Communicative Construction Site" (CCS Research), more directly focused on evaluating the communicative and participative potentiality of the cultural heritage's construction site, has developed a series of communication and interaction strategies in order to re-interpret it projectually as an opportunity to test action strategies useful to mend the sense of “Cittadinarietà” in the management of public space. Cittadinarietà is the citizen’s awareness to be part of a community, with which he/she evolves, for which he/she behaves “well” and in which he/she must be an active, unique, essential, but not indispensable part. The document of preparation for Habitat III: “The city we need”, indicates the need to create a sense of identity and belonging, awareness and shared responsibility, comparison and training of the social capital, on which Cittadinarietà is based and from which it takes vital sap, that should be elected as an “n dimension” of the urban sustainability (Cirafici, Melchiorre, Muzzillo, Violano, 2015).

The meaning of public space, in terms of "occasion-sharing" but also of “opportunity to increase knowledge”, has to be used with the aim of a joint growth in the sense of citizenship, through which virtuous creative pushes can be triggered.

1.1 Construction site: cost or opportunity?

The construction site, out of necessity, prevents the use of the monument or more generally of a place, but it can turn into a “knowledge and sharing tool”, as it is a protective element that usually tends to "hidden". It is possible to improve the site and facilitate design and technological ideas able to contribute to the communication of a new culture of a sustainable transformation, that cares not only for safety and environmental compatibility, but also for the quality of the transformation space, made up of smells, sounds, determining sensory stimuli, visual perceptions, emotional reactions influencing their use, spatial and functional qualities, flows, rhythms ... generally the elements of the urban landscape and its "ambiance".

Assuming that the fence represents the obstacle to its direct use in physical terms, the ambitious aim of this research is that one of determining the ways to make such devices qualifying elements of the urban landscape and elements able to attribute a value added to hidden/denied goods.

Responses were loaded in several international cases studies which have shown that creativity with which it is possible designing the fence of a construction site can give significant benefits to the urban system where this is "although temporarily" inserted.

2. Valuate the preconditions of a “smart” fence

The premises allow understanding the potential inherent in this research, for the definition of an innovative approach to the issue of the “sustainable construction site” and particularly of its fence systems.

Within the CCS Research, the study of the feasibility conditions, that make possible the implementation of "smart" fence strategies, in particularly sensitive urban environments and in areas of special historical and cultural value, is the precondition to make a SWOT analysis of the potentialities and critical aspects of the element "fence" as a technological frontier system, through which the passage of flows of material, energy, people, information, ... must take place in a controlled and monitored way.

The construction site necessarily hinders the direct use of the monument or the public space, but its traditionally protective frontier element, which delimits and hides matter and work, can and should become the technological system by which the passage of intangible flows of knowledge is guaranteed. In such a sense, the adjective "smart", contrary to what you may think, does not refer to the adoption of sophisticated technologies and systems, but it is used to identify the type of intelligent approach to be taken in order to design a construction site fence, suitable to the context and its specific needs.

Before planning “smart” fence systems, you should check the applicable conditions through a valuation tool that examines factors of livability, visibility and visiting a place connected to both the area of the construction site, directly, and its environmental surroundings, paying a great attention to the surrounding social conditions, too.

This valuation is the precondition for implementing effective design strategies. The valuation tools are offered as a support to the decision maker/designer, while pointing out that "with the valuations you do not choose, but you interact, communicate and produce ideas, values, that is culture. Valuations become an essential tool to help and find

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a priority ranking among the strategic aims [...] the valuation becomes a communication tool [...]" (Fusco Girard, 2000). Starting from a series of needs identified and verified, you can build a framework of criteria in order to valuate the problems linked and the most suitable design choices to their improvement.

So the term "quality" is transformed "into the whole of those factors, those artefacts and those features, which increase the perceptive satisfaction of a given urban space" (Franceschini, 2003).

![Figure 1. Smart strategies for the sustainable construction site](image)

Quality, in fact, is not a "pure" attribute of the urban system, that can be valuate abstractly, but it has got a ponderable component, attributable to the sphere of the individual's perception, who lives and acts in the city, and expresses a degree of environmental satisfaction according to his/her specific needs as an individual and/or a part of a community.

As well as for the urban system, even the construction site system can become a tool of valorisation of that piece of history that it contains. This is one of the main reasons that led the research team to implement a valuation tool in order to establish which strategies are feasible and under what conditions.

The aim consists in valuating the level of propensity of a construction site fence, in relationship with the context, where it is inserted, and the type of the construction site itself, to be an innovative installation object, in order to increase the level of communicability of the enjoyed environment.

It is essential choosing whether to implement a “smart” design of the fence or not, and to identify which of the proposed strategies is best suited to a particular socio-cultural context, since the practical translation of the design strategies involves economic investments and fallout on the environmental and social context that cannot be neglected.

3. **Research Methodology**

This contribution is part of a wider research work about the sustainable construction site, where the attention has been focused on two important aspects: the socio-cultural impacts, interpreted primarily as opportunities for a creative and resilient growth of the Social Capital for the urban system (Research Project: Communicative

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Construction Site - CCS - Coordinator: prof. A Violano), and environmental impacts (Research Project PRIN - Coordinator: Prof. F. Muzzillo) on soil, air and water receptors, to be mitigated and managed sustainably.

In both cases, the research methodology starts from an in depth analysis of the state of the art both on legislative developments of international guidelines and best practices developed in national and international contexts. Considering the construction site as a complex system where the processes are in conflict or in direct synergy with the urban continuum, the scientific work is aimed to define appropriate technologies in order to increase the synergies (social, cultural and economic benefits), to reduce conflicts (negative impacts) and to manage closure and openness to public space improving urban quality.

In particular, the present research contribution is articulated into three phases:

- **Best practices analysis**

  The best practices study is the starting point for the specification of some innovative fence models in order to highlight the minimum requirements and performances expected from each type of fence, and to identify the different levels of feasible strategies to create a sustainable transformation process.

  Projects and design proposals of construction site fences were selected, trying to give a reading in terms of "positive effects" by using these new generation enclosures, able to trigger active participation, integration and communication processes into the urban environment.

  The selection and classification of the different case studies led to the identification of a number of fence types, grouped into five categories: Ecological fences, interactive fences, transparent and permeable fences, luminous fences and art fences. Several international cases studies have shown that creativity with which it is possible designing the fence of a construction site can give significant benefits to the urban system where this is "although temporarily" inserted. In some cases, the fence changes its natural function of perceptive filter and becomes transparent, i.e. permeable to the visual flow. This allows making visible to the pedestrians the entire construction process that occurs in the construction site, giving rise to a sort of window on the manufacture. Another way to transform the role of the fence from barrier to tool of inclusion is to integrate multisensory and multimedia systems. Ingenious examples redesign the construction site fence using green and bioclimatic systems of rainwater collection.

  Conscious of moving into a world full of innovative ideas, projects and project proposals for construction site of fences have been selected. The CCS research has led to a critical interpretation of the "positive effects" of using these special screenings of new generation, capable of triggering processes of active participation, integration and communication in the urban environment. The study of these best practices is the basis for the specification of certain models of reference to relate to highlight the minimum requirements and the performance expected from each type of shielding, and identify different levels of workable strategies.

- **Definition of evaluation indicators**

  In the second research phase, at first the rating indicators, articulated in two different levels (Context and Construction site), have been identified. The main goal is to implement a tool that measures the propensity of a particular construction site and context for the installation of "innovative" borders. The evaluation factors concern all conditions, opportune or not, to consider into the design and installation of a "smart" fence.

- **Construction of the assessment tool: factors analysis and design strategies**

  In the last phase of the research, two test tabs were developed. In each of the two tabs, the identification of each factor involves the possibility to choose among strategies that are more feasible. These proposals strategies were identified by best practices study. The connection between each factor and the proposed strategies was the result of a subjective assessment in order to define the fences that are best suited to be implemented in a given context or construction site, because their installation is more advantageous than the other in a cost/benefit perspective.

  The score obtained in the evaluation tabs of the case study, is the results of a frequency analysis. If the largest number of conditions is verified, the score will be higher, and then the compatibility of a type of fence with the boundary conditions.

  In the next section, the eight different categories of fence, deduced from the analysis of homogeneous factors of the analyzed case studies, will be illustrated, and the grid of indicators allowing to analyze the conditions of feasibility of one or more types of identified fences.
4. Research developments

4.1 Design proposals

The integration of innovative and creative elements for construction site fences, when realized, needs to consider the urban context, the users involved and the different ways of perception of the construction site area by different types of users (direct, indirect and... potentials).

The illustration of the evaluation tool cannot avoid to firstly give an explanation about the fundamental design strategies which can be carried out for a fence, since the implemented instrument allows, at the same time to identify criticalities and potentialities of a specific transformation area and to indicate the most appropriate design strategies that can be realized.

In this research work paper, the study of the best practices has been the starting point for the specification of some reference models to consider in order to underline the minimum requirements and the expected performances of each type of fence, and to establish the different levels of feasible strategies to make the process of transformation "understandable and communicable".

In particular, the analyzed case studies have led to the identification of a set of non-traditional fence types: feasible design solutions, characterized by different complexity levels of realization. These strategies, classified in increasing order by degree complexity, have been grouped into eight different categories:

1. Design fence;
2. Permeable/Transparent fence;
3. Fence as participation tool;
4. Ecological fence;
5. Luminous fence;
6. Multimedia & not interactive fence;
7. Multimedia & interactive fence;
8. Interactive fence integrated with Augmented Reality (AR) systems.

It is provided below a concise definition of the eight fence types, to understand characteristics, advantages and communication opportunities related to their use, but also of environmental and socio-cultural compatibility.

Design fence

The design fences are all those construction site screens adopted as supports for advertising inserts, or for illustrations and artistic integrations. In this way, the fence itself becomes an artwork, which qualifies the affected area and is itself a source of attraction for the users. This category includes, even those fences that simply reproduce on the closures a graphic image detailed in the form, colors and texts, to customize the site with its own visual identity, using for example, a logo, a graphic concept, or a slogan repeatable on all the items of the construction site equipment. The benefit to install similar fences consists in the simplicity of intervention for a good communication and a strong visual distinguish-ability from environmental surrounding (Figure 2).

Figure 2. St. James Construction site_ London 2014

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**Permeable/Transparent fence**

The transparent or permeable fences consist of screens used as physical filters that allow introspection. They are used in order to make visible to the users the entire construction process, resulting in a sort of window on the construction site.

The visual permeability permitted by this type of screens can be partial or total; therefore, it allows a complete visibility of the whole processing area or a restricted visibility, only limited to some parts of the construction site, for example, through the creation of privileged observation points (Figure 3).

![Figure 3. “Grace Site Fence” by Doyle Partners (2010), USA](image)

**Fence as participation tool**

This category includes all the fences for whose implementation or modification over time, a direct intervention of the users is needed. These screens are designed as simple supports to be made available to the users, who through appropriate guidance and information, actively participate in the construction process of a "creative" fence. Consider, for example, panels made available to the street artists, or, fences that invite passers-by to fill these walls with their small contribution by displaying text or graphics, stickers, photo or various objects. In this way it implements the idea of building a fence as an opportunity for an active participation of the community. The main feature of these screens is the great engagement of users with the minimum use of resources. It must be noted, however, that this type of activity cannot always be implemented into particularly sensitive contexts (Figure 4).

![Figure 4. A picts wall for a construction sit](image)

**Ecological fence**

Ecological fences are temporary walls covered with vegetation. “The adoption of this particular type of fence provides to the surrounding environment, not only an aesthetic benefit, by improving the view of the urban landscape, but also adds all the other typical benefits of vegetation: reduction of air pollution, dust reduction, better thermal regulation, wind protection and a good sound insulation too” (Melchiorre, 2015).

The installation of this fence type, in fact, is particularly suitable and recommended for contexts characterized by considerable air and noise pollution rates (Figure 5).
Luminous fence

The luminous fences employ integrated lighting systems on the external surface whose function is both of increasing the illumination level of the area in which they are located, and aesthetic. The light, if skillfully designed and integrated on the fences, creates suggestive routes and atmospheres through shapes and colors. Therefore, the lighting design for construction sites is an important tourism development strategy, revitalizing and giving back to fruition even more hidden areas, and becoming a strong attraction element (Figure 6).

Multimedia & not interactive fence

The non-interactive multimedia fences are screens that integrate within them technological devices for the activation of a one-direction communication process. Just think of screens taken to video projections, scrolling texts, or even the playback of pictures or dynamic sounds.

The user acknowledges the message through multiple channels, but doesn't interact with the border by exchanging messages.

Their installation is recommended for significant construction sites and whose permanence times are considerable (Figure 7).
Multimedia & interactive fence

This category includes the screens equipped with technological communication devices that allow users to interact with them. The interaction can take place directly with the fence, through the installation of interactive touch screens, able to activate various kinds of sensory messages, informative, auditory, tactile or visual, or in an indirect modality. The indirect interaction occurs using smartphones, tablet, special applications, online platforms, or QR-code, with which it is possible to find information sources in every moment and for unlimited times, in order to generate customized interactive experiences.

This type of fence is highly recommended when there is the need to spread to large-scale communication of the construction site, because of its substantial significance or because it falls in a portion of the city with a high rate of users (Figure 8).

Figure 8. “The Song Board” London

Interactive fence integrated with Augmented Reality systems

This category contains the strategies relating to the adoption also for construction site fences, of the so-called "light systems" for museum heritage enhancement. The "light" definition refers to all those systems, recently experimented, linked to the enhancement of archaeological, architectural or generally historical-artistic sites; "light" in the objectivity of the support, which is basically missing or replaced by digital media.

Thus, the fence is transformed from a traditional object into a "Virtual" object. It is no longer static, but dynamic, offering direct connections to the network, virtual interactive galleries, chats, and blogs on related topics until all real virtual prints, whose main goal is the maximization of images and information, and the user's active involvement.

This type of strategy is useful and efficient especially there where the heritage enjoyment is denied, because of work in progress. In fact, you must allow the tourist to enjoy the transformation area in all conditions, and if this cannot happen in a physical way then must take place in a virtual way, using Augmented Reality systems (Figure 9).

Figure 9. A fence design with integration of AR systems
4.2 The strategic, cultural and technological conditions of a "smart" fence: the two levels of analysis.

The implementation of an assessment tool, able to evaluate the feasibility of an intervention, according to environmental and technological requirements, becomes the key to provide new opportunities in order to promote the territory, in line with the times and the needs of the modern citizen. The identified analysis factors have been divided into three investigation areas, which correspond to three levels of needs. These needs categories are the result of the processing data concerning the innovative fences examined, and they investigate the quality level of a construction site on two-dimensional scales: Context and Construction site.

Both investigation levels are scanned according to several factors, which belong to three classes of requirements:

- Living conditions (well-being), considered as life quality of places, namely balance between material and intangible resources of a system as a whole. It interprets the opportunity to live in a cozy, comfortable and clean place that meets the needs of the residents and the context of the community life.
- Visibility (image), considered as the system ability to be recognizable. A place becomes identifiable to all users for particular features. In particular, the image is connected to physical and architectural aspects.
- Visit conditions (use), considered as the possibility that offers a place to be "full" enjoyed.

### Table 1. Fattori di valutazione delle prerequisiti di propensione di un cantiere all’installazione di una “smart fence”

<table>
<thead>
<tr>
<th>Level</th>
<th>Area</th>
<th>Factor Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Level</td>
<td>CONTEXT</td>
<td>I.A.1 - Use destination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I.A.2 - Safety</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I.A.3 - Environmental quality: air pollution levels</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I.A.4 - Environmental quality: noise pollution levels</td>
</tr>
<tr>
<td></td>
<td>VISIBILITY</td>
<td>I.B.1 - Lighting equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I.B.2 - Presence of color</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I.B.3 - Presence of attractors</td>
</tr>
<tr>
<td></td>
<td>VISITING CONDITIONS</td>
<td>I.C.1 - Rest areas near the construction site</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I.C.2 - Pedestrian index</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I.C.3 - Services for citizens, tourists and city users</td>
</tr>
<tr>
<td>II Level</td>
<td>CONSTRUCTION SITE</td>
<td>I.A.1 - Construction site type</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II.A.2 - Construction site duration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II.A.3 - Air pollution levels of construction site</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II.A.4 - Noise pollution levels of construction site</td>
</tr>
<tr>
<td></td>
<td>VISIBILITY</td>
<td>II.B.1 - Construction site size</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II.B.2 - Scale of intervention</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II.B.3 - Construction site complexity</td>
</tr>
<tr>
<td></td>
<td>VISITING CONDITIONS</td>
<td>II.B.4 - Significance of the work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II.C.1 - Perceptive obstacles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II.C.2 - Opportunities to interact with the fence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II.C.3 - Accessibility to the work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II.C.4 - Events organization (the construction site as a social place)</td>
</tr>
</tbody>
</table>

The Living conditions level for the Context is evaluated according to four factors:

- I.A.1 Use destination,
- I.A.2 Safety,
- I.A.3 Environmental quality: air pollution levels,
- I.A.4 Environmental quality: noise pollution levels;

while for the Construction site it is evaluated according to:

- II.A.1 Construction site type,
- II.A.2 Construction site duration,
- II.A.3 Air pollution levels of construction site,
- II.A.4 Noise pollution levels of construction site.
The Visibility level of the Context is evaluated using the following factors:
  I.B.1 Lighting equipment,
  I.B.2 Presence of color,
  I.B.3 Presence of attractors,
  I.B.4 Distribution of equipped spaces and services;

while the Visibility of the Construction site is evaluated in relation to:
  II.B.1 Construction site size (length),
  II.B.2 Scale of intervention,
  II.B.3 Construction site complexity,
  II.B.4 Significance of the work.

The Visit conditions level for the Context is defined according four factors:
  I.C.1 Rest areas near the construction site,
  I.C.2 Pedestrian index,
  I.C.3 Services for citizens, tourists and city users,
  I.C.4 Programs and events for the community;

while the Visit conditions of the Construction site is evaluated in relation to:
  II.C.1 Perceptive obstacles,
  II.C.2 Opportunities to interact with the fence,
  II.C.3 Accessibility to the work,
  II.C.4 Events organization (the construction site as a social place).

4.3 The evaluation model

After identifying the evaluation factors of the "smart propensity", two analysis tabs of 1st and 2nd level, which reproduce in summary all criteria to be evaluated for both the Context and the Construction site were built.

Every identified factor corresponds to different strategies proposals. In the analysis of a specific transformation area, the tabs in the final section suggest the most suitable design strategy for a fence in a construction site, i.e., those that respond more frequently to the identified criteria. Both analysis tabs include:

- the thematic area to which the factor refers (living conditions, visibility, visit conditions);
- the name of the analysis factor with the relevant identifier;
- the range of alternatives, which provides three possible outputs;
- the proposed strategies corresponding to identified factor;
- the frequency analysis results, i.e. the scores reported for each of the eight design strategies.
Each of the two tabs, provides a tool easy to fill in through which you can evaluate the site propensity to the implementation of "smart" strategies for the fence, taking into account the areas in which it is necessary to intervene, and therefore, the ways of bridging the site critical points and increasing the potential of the transformation. The definition of the quality level of the context is essential to frame the starting general conditions in which the site is located, in order to identify the proposed interventions, which are most suitable as they offer both problem solutions and identified deficiencies (Table 2).

The evaluation of the second level of investigation is aimed to verify the existence of specific features of the site that allows the implementation of strategies.

The compilation of this data allows to identify, in an immediate way, the type, the duration, the environmental quality of the site itself, the object of the work to determine the significance and complexity of the construction site and the identification of feasible type of interaction with the fence too (Table 3).
5. Conclusion

This research does not intend to offer a model to be reproduced regardless of the location x and the time t when the transformation happens, but it is rather a meta-design experiment that provides a range of appropriate solutions and suggestions to the socio-cultural and technical-environmental context. Identifying case-by-case functions, needs and technological systems that you want/can take, the designer can transform the border of the site into a tool for the management of synergies and conflicts between the transformation area and the urban system.

In conclusion, the research proposes the spread of a smarter design approach of the bounding facilities of the site, an element where to convey ideas, resources and technologies.

The research is mainly aimed at professionals (architects, engineers, designers, planners ...) with a supporting instrument to the stage of the meta-design of the “site”, completely recognized as a temporary architecture of public urban space today.

The developed tool can become a decision support system for planners and administrators who care about the destiny of the territories in which they operate. The public administrations more and more often include, in the public notices for works contracts, requirements aimed at the sustainable management of the construction site.

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### Table 3. Second-level analysis: The Construction site

<table>
<thead>
<tr>
<th>Factor</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Type</td>
<td>Movements</td>
<td>Permanent</td>
<td>1; 2; 3</td>
</tr>
<tr>
<td>Site Duration</td>
<td>Short Term &lt; 3 months</td>
<td>1; 2; 3</td>
<td></td>
</tr>
<tr>
<td>Air Pollution Levels of Site</td>
<td>Low Level of Pollution</td>
<td>1; 2; 3; 4; 5; 6; 7; 8</td>
<td></td>
</tr>
<tr>
<td>Noise Pollution Levels of Site</td>
<td>Low Noise Level</td>
<td>1; 2; 3; 4; 5; 6; 7; 8</td>
<td></td>
</tr>
<tr>
<td>Site Size (Length)</td>
<td>Small &lt; 10 meters</td>
<td>1; 2; 3; 4; 5; 6; 7</td>
<td></td>
</tr>
<tr>
<td>Scale of Intervention</td>
<td>Punctual</td>
<td>1; 2; 3; 4; 5; 6; 7</td>
<td></td>
</tr>
<tr>
<td>Site Complexity</td>
<td>Individual Construction Site</td>
<td>1; 2; 3; 4; 5; 6; 7; 8</td>
<td></td>
</tr>
<tr>
<td>Significance of the Work</td>
<td>Low</td>
<td>1; 2; 3; 4; 5</td>
<td></td>
</tr>
<tr>
<td>Perceptive Obstacles</td>
<td>No Obstacle</td>
<td>1; 2; 3; 4; 5; 6; 7; 8</td>
<td></td>
</tr>
<tr>
<td>Opportunities to Interact with the Fence</td>
<td>Physical Interaction (Direct)</td>
<td>1; 2; 3; 4; 7; 8</td>
<td></td>
</tr>
<tr>
<td>Accessibility to the Work</td>
<td>Total</td>
<td>1; 2; 3; 4; 5; 6; 7; 8</td>
<td></td>
</tr>
<tr>
<td>Events Organization</td>
<td>Less than 5 months</td>
<td>1; 2; 3; 4; 5; 6; 7; 8</td>
<td></td>
</tr>
<tr>
<td>Score</td>
<td>7/12</td>
<td>5 Luminous Fence</td>
<td>7/12</td>
</tr>
<tr>
<td>Score</td>
<td>7/12</td>
<td>6 Multimedia &amp; Not Interactive Fence</td>
<td>7/12</td>
</tr>
<tr>
<td>Score</td>
<td>7/12</td>
<td>7 Multimedia &amp; Interactive Fence</td>
<td>7/12</td>
</tr>
<tr>
<td>Score</td>
<td>7/12</td>
<td>8 Interactive Fence Integrated with Air Systems</td>
<td>7/12</td>
</tr>
</tbody>
</table>

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6 Written by Antonella Violano
Therefore, designers are called to improve their environmental and social sensitivity when they propose a redevelopment project in an urban context, giving appropriate attention to the construction phase. For this reasons, it is hoped that they can benefit from the research results, in order to increase the effectiveness of regulatory instruments adopted for the urban quality government.

REFERENCES


