Accessibility and Social Sustainability:
Assessment tools for urban spaces and buildings

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ABSTRACT: Urban and building quality and well-being deal also with the theme of accessibility. This social feature represents one of the main key issues of Social Sustainability. Public and private aspects of accessibility have to be combined in order to create a safe network, which is usable and enjoyable also for people with disabilities.
The applied research "Pavia Accessibile" (Accessible Pavia) is developed at the University of Pavia and promoted by the Department for Equal Opportunities of the Municipality of Pavia: it focuses on the accessibility assessment of urban spaces and public buildings.
In order to investigate the accessibility, both at urban scale and at building scale, the study uses two different assessment tools consisting of factors that can be objectively detected and surveyed. Thanks to this methodological approach, the systematic application of the assessment tools can create an inclusive view about accessibility problems to allow the identification of possible design solutions according to a conscious process. In addition, involving designers, researches, students, associations and people with disabilities during these surveys, the new sense of participation can improve the cultural and social dimension of architecture, creating accessible and inclusive systems for future-oriented communities.
Keywords: Social sustainability; accessibility; assessment tool.

INTRODUCTION

Urban and building quality and well-being deal not only with energy, environmental and economic aspects, but also with the theme of accessibility. This social feature, defined as the possibility for people with disabilities to reach, to enter and to enjoy buildings and environments in conditions of safety and autonomy [1], represents one of the main key issues of Social Sustainability.

Within this panorama, Khan (1995) defines the principles of the social dimension of "Sustainability" recognizing in Equity, Empowerment, Accessibility, Participation, Cultural Identity and Institutional Stability, the main issues for a socially correct distribution of the benefits (and costs) derived from the way in which men manage the environment [2].

In addition, it's important to underline the strong relationship that exist between disabilities and environments: during recent years the concept of Handicap as a physical impairments changes into the idea of the complex bio-psycho-social approach that combines the disability with environmental and territorial contextual factors (ICF model, International Classification of Functioning, Disability and Health, World Health Organization, 2001). Together with people with disabilities, elderly people, children, there are considered all the temporary situations (such as a broken limb, the state of pregnancy and the conditions of fatigue or distraction) that can affect anyone and at any time: when the environment is not suitable on these particular conditions and needs it creates "disability". That's why the role of designers (architects, engineers, etc.), able to study, to understand, and to modify the environment according to the changing needs of users, can help to improve the chance for all people to access, to use and to enjoy it in easy and safety ways.

"Sustainability" means also to consider the "Universal Design", that is the design approach summarized into seven main principles (equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, size and space for approach and use) able to form objects, buildings and public spaces accessible and usable by the largest number of people, without the need for adaptations, modifications or subsequent special pieces (Ronald L. Mace, 1998).

Finally, we have to consider the importance of the accessibility and usability of the historical and architectural heritage as essential conditions for its preservation and enhancement [3]. This particular aspect is strongly related to the development of the tourism for all, as one of the main conditions that let to improve the quality of the Society.

In light of all these considerations, it is therefore important to know the level of accessibility both of urban spaces and of private and public buildings in order

to find architectural solutions to overcome the physical and sensorial barriers and guarantee the same conditions for all users.

THE PROJECT "PAVIA ACCESSIBILE"

The research here presented, belongs to the project "Pavia Accessibile" (Accessible Pavia), developed at the University of Pavia and promoted by the Department for Equal Opportunities of the Municipality of Pavia. It focuses on the accessibility assessment of urban spaces and public buildings in Pavia, an historical town 35 km south from Milan, with one of the most ancient Universities in Italy and Europe.

This work is based on the experiences that the researchers of the University of Pavia (DICAr, Department of Civil Engineering and Architecture) gained in the study of the accessibility and usability of urban spaces and buildings, with particular attention to the historical ones. Since 2006 Prof. Alessandro Greco coordinates researches on the accessibility and usability of urban spaces and historical buildings.

In recent years, Prof. Greco also coordinates targeted interventions for the overcoming of architectural and sensorial barriers for the buildings of the University of Pavia, with the collaboration of ADD (ex SAISD), the assistance centre of the University of Pavia for students with disabilities and DSA [4].

For the project "Pavia Accessibile" the research group, directed by Prof. Greco and composed by three engineers of the University of Pavia (Annamaria Franco, Valentina Giacometti and Matteo Locatelli) structured the work in different steps, applied both at the urban scale and at the scale of the building:

- developing the assessment tools able to investigate the accessibility both of urban spaces and of historical buildings;
- numerical and photographical surveys;
- digitization of the survey and database organization;
- identification of the most critical points;
- development of synthesis' boards to understand the assessment of the accessibility;
- proposal for architectural and technical solutions for the improvement of the accessibility.

In particular, the accessibility assessment tools, for urban spaces and for historical buildings, are based on the knowledge and the methodological approach also formed during the projects:

- "Pavia città per tutti" ("Pavia town for all"), in 2006/2008;
- "Progettare senza Barriere" (Design without Barriers), in Pavia, Vigevano and Voghera, with the important collaboration of the association UICI, the Italian association for blind and visually impaired people, in 2011/2012.
- "P.U.M.A." ("Pavia University: Map of Accessibility), in 2012.

At the urban scale the research focuses on the investigation of accessibility and usability of the "system of the three squares" in the historical center of Pavia (piazza della Vittoria, piazza Duomo and piazza Cavagneria), that means to investigate the accessibility of these three squares and of all the streets that connect them; at the scale of the building the study develops the specific investigation on eight public buildings of the Municipality of Pavia, including the main building of Palazzo Mezzabarba.

ASSESSMENT TOOL FOR URBAN SPACES

The assessment tool for urban spaces defines the accessibility level of streets and squares, divided into path's sections, pedestrian crossings and pedestrian areas. The tool works through the identification of macro-indicators structured on objective parameters.

Each area of investigation includes several elements to be carefully considered and the tool is structured to give automatically a value in relation to a "tick" or "not tick" of these elements. The sum of each value gives a number (positive or negative) which is the reference to assess the accessibility level of the path detached: for values less than or equal to zero the path' section is considered "not accessible" (identified with red colour), for values between one and four it's considered "accessible with assistance" (in yellow) and for values equal or greater than five it is considered "accessible" (in green).

The analysis of the path's sections (Fig. 1) is divided into four macro-indicators:

- general characteristics;
- paving of footpaths;
- car parks and public transport;
- urban furniture.

Each macro-indicator is divided into several parameters and the filling includes multiple choices from a list of elements, that take into consideration both motor and sensorial disabilities. For example the macro-indicator of "general characteristics" is composed of:

- type of path;
- sidewalk;
- covered path;
- path profile.

Scheda di rilevamento: Progetto PAVIA ACCESSIBILE (febbraio e marzo 2013)

Comune	Pavia		
Via o Piazza	Piazza Vittoria	Codice	
Tratto (intervallo numeri civici)	Da numero civico 8 a 12	50-51	4,0
Cognome e nome compilatore	Franco Annamaria		

Caratteristiche generali

Lunghezza (m)	80		
Tipo di percorso	X	Esclusivamente pedonale	2
		Zona a traffico limitato	
		Pedonale e veicolare	
		Presenza di pista ciclabile	
Marciapiede	X	Presente: a raso - **rialzato**	0
		Pendenza trasversale > 8%	
		Assenza di marciapiede	
		Presenza di passi carrai non a norma	
		Restringimenti tali da ridurre il passaggio ad una larghezza < 90 cm	
Percorso coperto		No	
		Sì, parzialmente (almeno 50%)	
	X	Sì, completamente	1
Profilo del percorso		Completamente piano	
	X	Pendenza media ≤ 5%	0
		Pendenza media > 5% e ≤ 8%	
		Pendenza media > 8%	
		Percorso interrotto da un gradino > 2,5 cm	
		Caratteristiche generali	**3**

Pavimentazione del percorso pedonale

Tipo		Asfalto	per m	
		Battuto di cemento	per m	
		Cubetti di porfido	per m	
	X	Lastre di materiale lapideo	per m	80
		Marciapiedi in lastre di materiale lapideo sede stradale in acciottolato	per m	
		Acciottolato	per m	
		Cotto	per m	
		Ghiaia	per m	
		Legno	per m	
		Gomma o simili	per m	
		Prato	per m	
		Terra battuta	per m	
		Autobloccanti o piastrelle per esterni	per m	
Caratteristiche		Perfettamente complanare		
	X	Sconnessioni o avvallamenti		-1
		Elementi instabili		
		Presenza diffusa di rifiuti		
		Grigliati con maglie attraversabili da una sfera di 2 cm di Ø		
		Differenziazione cromatica tra sede pedonale e sede carrabile		
		Sede pedonale protetta dalla sede carrabile		
		Rugosità accentuata (antiscivolo)		
		Pavimentazione del percorso pedonale		**0,0**

Parcheggi e mezzi di trasporto

Parcheggi riservati	X	Assenti	0
		Presenti a norma (in numero pari a ...)	
		Presenti ma senza segnaletica orizzontale e/o verticale o di dimensioni inadeguate	
		Presenti ma non complanari alle aree pedonali e senza scivoli	
		Condizioni della pavimentazione non idonee	
		Parchimetro non accessibile	
		Presenza di posti per utenze deboli (gestanti, signore, etc.)	
Altri mezzi di trasporto		Fermata linee urbane (n. ...)	
		Fermata linee extra-urbane (n. ...)	
		Taxi	
Fermate autobus		Segnalatore luminoso e acustico	
		Presenza di indicazioni tattili-plantari	
		Tabellone informativo percorso e fermate	
		Presenza di seduta o appogio ischiatico	
		Assenza di tabella oraria o non leggibilità	
		Assenza di riparo dagli agenti atmosferici	
		Parcheggi e mezzi di trasporto	**0**

Arredi

Aree di sosta	X	Assenti	0
		Presenti ma non accessibili	
		Presenti e accessibili	
		Con aree di ombra	
		Con copertura dagli agenti atmosferici	
		Con bagni pubblici accessibili	
		Con cabine telefoniche accessibili	
Arredi urbani posizionati correttamente	X	Telefoni Pubblici	1
Arredi urbani posizionati **non** correttamente (tali quindi da ridurre la sede pedonale ad una larghezza < 90 cm o da costituire intralcio a non vedenti e ipovedenti)		Cestini	
		Lampioni	
		Segnaletica stradale	
		Segnaletica e arredi privati	
		Fioriere	
		Dissuasori	
		Rastrelliere per biciclette	
		Panchine	
		Parchimetri	
		Cassette postali	
		Pensiline	
		Cabine telefoniche	
		Fontanelle	
		Bidoni per raccolte differenziate	
		Edicole	
		Altro (...)	
Elementi posizionati ad una altezza < 210 cm da terra		Tende da sole	
		Segnaletica stradale	
		Segnaletica privata	
		Alberature	
		Altro (...)	
		Arredi	**1**

PUNTEGGIO TOTALE 4,0

Figure 1: Assessment tool for path's sections of urban spaces: division into four areas of investigation. The final value that lets to identify the accessibility level is the sum of the values of each area of investigation.

The analysis of pedestrian crossings is structured with the same methodology, but with only two macro-indicators with different elements. These macro-indicators are:

- general characteristics;
- paving of crossing.

Finally, the accessibility assessment tool applied to the three squares (piazza della Vittoria, piazza Duomo and piazza Cavagneria) includes the whole pedestrian area. In this case the macro-indicators are:

- general characteristics;
- paving of footpaths;
- urban furniture.

ASSESSMENT TOOL FOR PUBLIC BUILDINGS

The assessment tool for public buildings divides spatial and functional units into architectural elements and for each component it underlines the specific problem about accessibility through the identification of seven main causes: morphology (Mo), narrowing (R), dimension (D), material (Ma), colour (C), position (P) and decay (G), (Fig. 2). This division lets to identify the main specific problem that limits the accessibility, including the problem of decay that often is not considered.

The analysis focuses on eight buildings with public function of the Municipality of Pavia, and the different units, corresponding of different tools with different elements, are:

- outside areas;
- entrances;
- horizontal connections;
- vertical connections;
- restrooms;
- offices;
- collective spaces.

Università di Pavia
Progetto PAVIA ACCESSIBILE
SCHEDA DI RILEVAMENTO EDIFICI

Gruppo di Lavoro: Annamaria Franco, Valentina Giacometti, Matteo Locatelli **Data:** aprile 2013

Anagrafica dell'edificio:

Codice Identificativo: 1
Edificio: Palazzo Mezzabarba
Sito
Indirizzo: Piazza del Municipio, 2
Funzione ☐ ... ☐ ... ☐ ... ☐ ...

Ambito: **UFFICI** **1|U. 30**

Caratteristiche Generali:

Soglia	X Alla stessa quota rispetto al C.O.	☐ A quota differente rispetto al C.O. (cm .....)
Locale	Larghezza 430 cm / Profondità 320 cm	☐ Dislivelli interni (cm .....)
Pavimentazione	X Piastrelle	☐ ..... ☐ ..... ☐ .....
Restringimenti	☐ Si	☐ No ☐ Note: .....

Elementi Architettonici	Presente		Problematiche rilevate							
	SI	NO	Mo	R	D	Ma	C	P	G	Note
Soglia	✔									
Loges		⦸								
Porta	✔									Tipo: a battente, 50 cm
Arredi fissi	◗			●						Restringimento a 40 cm e 52 cm
Arredi mobili	✔									
Attrezzature (specificare)		⦸								
Segnaletica direzionale		⦸								
Segnaletica informativa	✔									
Segnaletica a terra		⦸								
Altro										

Figure 2: Accessibility assessment tool for public buildings: division into areas of investigation and breakdown for each area in different architectural elements in order to investigate the presence, the absence and the presence with accessibility problems about morphology, narrowing, dimension, material, colour, position and decay. In this case, the chart refers to the assessment of one Office of Palazzo Mezzabarba.

This methodological approach was structured in order to investigate the accessibility of the buildings of the University of Pavia within the project "P.U.M.A." (Pavia University: Map of Accessibility, 2012). Within "P.U.M.A." there were investigated more than 50 University buildings with the aim to develop a map of the accessibility level of the University and give students a framework of the problems, of the opportunities and of the new solutions. As the previous case of the public spaces, this methodological approach puts under investigation elements not only for mobility impaired people, but also for sensorial impaired people.

RESULTS AND EXPECTED RESULTS

For the analysis of the urban spaces they are analyzed 13 streets and 3 squares, for a total of 135 charts, divided into: 77 charts for the path's sections, 48 charts for the pedestrian crossing and 10 charts for the pedestrian areas. Thanks to the identification of the accessibility level also with colors, the synthesis concerns the development of a urban map with red (not accessible), yellow (accessible with assistance) or green (accessible) sections (Fig. 3). In addition, architectural solutions are identified within the most critical points, in order to improve the accessibility for all users (Fig. 4).

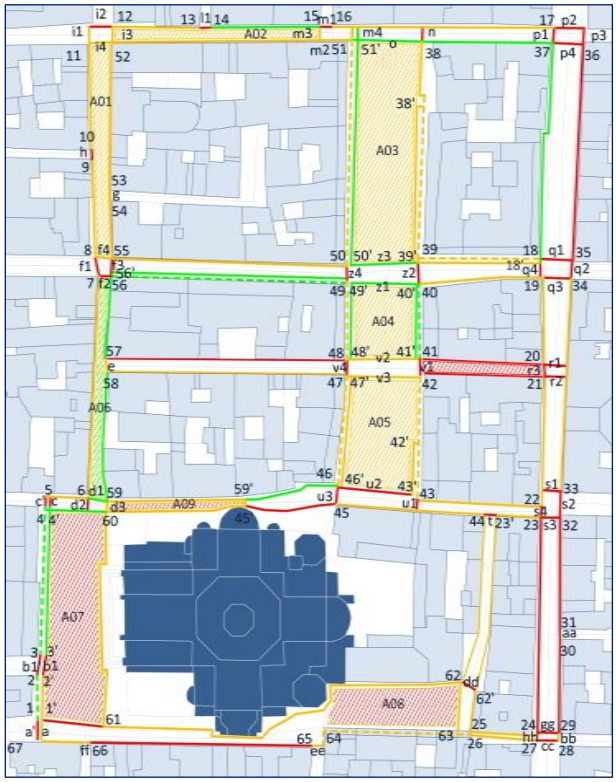

Figure 3: Synthesis of the accessibility assessment of the urban spaces of the system of the three squares, in the historical centre of Pavia (red = not accessible; yellow = accessible with assistance; green = accessible).

Figure 4: Chart for the proposal of architectural solutions for Piazza della Vittoria. The main problem identified in this case is the difference in level between the porches and the square. The solutions consist of the project of a ramp, a new paving with the same material (stone slabs) and a new urban furniture near the bus stop. These solutions are appropriate to people with mobility impairments and to people with sensory impairments.

In relation to the accessibility assessment of the public buildings of the Municipality of Pavia (eight buildings, including the main building Palazzo Mezzabarba, Palazzo Saglio, with the technical offices and social services, and the neighborhood centers) the research is still in progress. It is expected to prepare a synthesis board for each spatial and functional unit detected through the accessibility assessment tool, with the photographic and data survey of the main critical points. It is also expected to prepare a database with all the proposals of architectural solutions, able to improve the accessibility for all users and guarantee the social participation of all citizens.

CONCLUSIONS

The structure of the accessibility assessment tools and the syntheses developed into the project "Pavia Accessibile" ("Accessible Pavia"), are very easy to be

understood and to be applied not only for engineers or researchers, but for all.

The objective methodological approach and the systematic application of the assessment system on different study cases can represent an important aid for the planning of architectural interventions both at the urban scale and at the scale of the building. The exportability of the methodology can also create an inclusive view about accessibility problems to allow the identification of possible design solutions according to a conscious process.

In addition, involving designers and researches (who are aware of the complexity of the theme of accessibility within historical contexts and public buildings) also with students, associations (e.g. UICI, the Italian association for blind and visually impaired people) and people with disabilities, can help to create a new sense of participation and inclusion. The participation of all these figures can help designers and researches during the analysis, the synthesis and finally the developing of the architectural and design solutions, improving the cultural and social dimension of architecture and engineering, and creating accessible systems for future-oriented communities.

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