

Assessment of Footpaths Design on Renovation of City Centres

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ABSTRACT

Planning and developing the renovation and revitalization of historical city centres is a complex task, which demands integration across various fields of design and knowledge. A key concern in the renovation of city centres is the sustainability of the design solutions, and a central issue in this case regards the minimization of road traffic in these core areas. In this context, the option for soft mobility modes, such walking or cycling, is almost imperative nowadays. Thus, a walkable city centre significantly improves sustainable mobility, contributing for the reductions in air and noise pollution and greenhouse gas emissions, and also increasing the attraction as commercial, cultural and leisure destination. To achieve this purpose, the permeability of the city centre should be worked, allowing the pedestrians to move easily around the historical centre.

Promote a walkable city centre depends on how well the footpaths connections work and coexist with the other soft mobility modes and public transport, giving pedestrians the better choice in how to make their journeys. The geometrical design of the footpaths should also not be neglected, although in a historical city centre such characteristics are strongly conditioned by the existing urban morphology. For this reason, the assessment of those issues in a design phase is quite relevant for the perception of the overall quality of the proposed solution for the footpaths and the pedestrian streets [1] [2].

The main goal of this work is to present a set of indicators which can assess the footpaths design in the context of renovation of historical city centres. Four indicators were developed in order to evaluate the geometrical design and the ease of use of the footpaths, and the connection with public transport. These indicators were quantified and combined according to a combination procedure, resulting in a synthetic score for the *Assessment of Footpaths Design on Renovation of City Centres (AFD)*, which reflects the quality of the proposed design solution.

The *Width* indicator and the *Slope* indicator evaluate the width and the slope of the footpaths, in order to ensure pedestrian to move easily around the city centre. This evaluation is carried out by using two transformation functions which gives, respectively, the indicators scores S_{wd} and S_{sl} , with a value ranging on a scale of 0 to 2 and of 0 to 1, respectively, as follows [2] [3] [4] [5]:

$$\begin{aligned} S_{wd} &= 0 & \text{if } W \leq 1.5 \\ S_{wd} &= 0.4 W - 0.6 & \text{if } 1.5 < W < 4.0 \\ S_{wd} &= 1 & \text{if } W \geq 4.0 \end{aligned} \tag{1}$$

In case of pedestrian streets/car-free zones, it should be added 1 to the S_{wd} value calculated above.

where W is the width of the footpath (m).

$$\begin{aligned} S_{sl} &= 1 & \text{if } S \leq 2.0 \\ S_{sl} &= -0.125 S + 1.25 & \text{if } 2.0 < S < 10.0 \\ S_{sl} &= 0 & \text{if } S \geq 10 \end{aligned} \quad (2)$$

where S is the longitudinal slope of the footpath (%).

The *Footpaths Length Gauged by the Number of Intersections* indicator measures the frequency of occurrence of traffic roads intersections for the total length of the footpaths. This evaluation is carried out by using a transformation function which gives the indicator score S_{gi} , with a value ranging on a scale of 0 to 1, as follows [6]:

$$\begin{aligned} S_{gi} &= 0 & \text{if } W \leq 1.5 \\ S_{gi} &= (1/300) LI - 1/3 & \text{if } 1.5 < W < 2.0 \\ S_{gi} &= 1 & \text{if } W \geq 2.0 \end{aligned} \quad (3)$$

where:

$LI = LF/(NI+1)$ is the footpaths length gauged by the number of intersections; LF is the total length of the footpaths; NI is the total number of intersections with traffic roads.

The *Connection With Public Transport* indicator measures the ease of access to public transport in the city centre in terms of distance. This evaluation is also carried out by using a transformation function which gives the indicator score S_{pt} , with a value ranging on a scale of 0 to 1, as follows [7]:

$$\begin{aligned} S_{pt} &= 1 & \text{if } D \leq 150 \\ S_{pt} &= -(1/600) D + 1.25 & \text{if } 150 < D < 750 \\ S_{pt} &= 0 & \text{if } D \geq 750 \end{aligned} \quad (4)$$

where D is the maximum distance to the nearest public transport stop, measured in the less favorable point of the footpaths network (m).

Finally, the final score to the *Assessment of Footpaths Design on Renovation of City Centres*, S_{AFD} , with a value ranging on a scale of 0 to 1, is set according to the equation below:

$$S_{AFD} = \frac{S_{wd} + S_{sl} + S_{gi} + S_{pt}}{5} \quad (5)$$

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