ABSTRACT

Methodological proposal for generating a Pedestrian Crosswalk Safety Index (PCSI)

We propose a Safety Index of pedestrian crosswalks along main roads in Mexico for reducing fatalities and to improve crossing conditions. In order to identify and weight the index criterions, about 53 state of the art documents were reviewed; a non-probabilistic survey was conducted (N=1000); in situ observations were carried out and a multi-criteria analysis method was implemented. A final index was developed. It has 19 criterions arranged within 5 macro-criterions related to the infrastructure, design and operation conditions of the crosswalk. One of each criterion was weighted and assessed over a 0 to 1 range scale. The pedestrian crosswalk safety index intends to be a useful tool for public stakeholders, which allow them to easily assess crosswalk qualities as well as to identify crosswalk issues in order to be improved.

The final step is to validate the index by surveying in situ random and representative sample of crosswalks where fatalities happen, and confront them with the 2015 geocoded fatalities database.

RATIONALE & MAIN GOALS

Traffic incidents are considered as negative externalities derived from car-oriented transit policies. In Mexico, traffic fatalities are the first death causes among children between 5 to 14 years old, and the second one within youths between 15 to 29. According to the Ministry of Public Security (Secretaría de Seguridad Pública SSP), within Mexico City 61% of those fatalities happens over main streets.

The main goals of this proposal is to validate a previous developed Pedestrian Crosswalk Safety Index in order to reduce fatalities and to improve crosswalk design conditions.

Our previously developed Pedestrian Crosswalk Safety Index is focused only on signalized pedestrian crossings over main streets. Even though there are some different indexes of the same characteristics at an international level, Mexico is lacking of a validated methodology. Moreover, an standardized methodology within the new programs in Mexico City regarding “Safety Crosswalks” developed by two different Mexico City institutions (Agencia de Gestión Urbana (AGU) and the Autoridad del Espacio Público (AEP)) is missing.

In 2014, the new and recently approved Mobility Law for the Mexico City Metropolitan Area (MCMA) establishes a ‘Zero’ vision, in which the goals are to have non fatalities related to traffic incidents. In this regard, we see this zeitgeist as an invaluable opportunity to introduce a PCSI which facilitates cities’ authorities the detection of the most conflictive crosswalks in order to improve them in a hierarchic manner.
METHODOLOGY

Nowadays, there are two clear paths to develop PCSI’s: on the one hand, methods derived from direct observation, expert knowledge, and statistical regressions (i.e. Cheng et al., 2014; Bian et al., 2013; Carter et al., 2006); on the other, indexes derived from multi-criteria analysis (i.e. Basile et al., 2010; Montella et al., 2010). This team already developed a proposal for a PCSI based on Basile et al. (2010), following a five-step model: i) identification, hierarchization and criterion selection; ii) criteria rating (range of values) and criteria weighting through AHP (Analytic Hierarchic Process (Saaty 1980)); iii) Testing the instrument in field; iv) PCSI calculation; v) ‘validation’ of the PCSI against 2015 fatalities geodatabase (from the SSP).

(i) For criteria selection, we reviewed almost 53 state of the art related papers, from which 94 criterions were selected. Later, those criterions were compared against others derived from a previous field work in which 6 crosswalks were filmed and analyzed in order to identify the most problematic variables. From that analysis, an Expert Panel workshop took place, in which those experts selected a final list containing 19 criterions arranged within five macro criterions as follows: Accessibility, Visibility, Design, Horizontal Signaling, Level of Signaling (Traffic Lights).

(ii) For the criteria rating (range of values) and the criteria weighting an AHP online method was used (Saaty 1980; 2008, Malczewski, 1999). It allows to weight each criteria at different levels in order to get a final value, which at last will become the PCSI (see example below).

Source: Basile et al. (2010). Example of the AHP structure with three levels: the criteria (in white); the macro criterions (in blue), and the firs level (the Safety Index).

For weighting each criteria, it was used the the Semantic Scale of Saaty (2008) which ranges in score from 1 to 9. The panel accounted with ten experts (among them were officials of the Mobility Ministry, from the SSP and from the AGU). All of them weighted the criteria with the aid of an online AHP tool (http://bpmsg.com/ahp-online-calculator/).
(iii) The final instrument was applied within 500 crosswalks in Mexico City. At the moment of this submission, we are running several tests (linear regressions, decision trees, etc.) in order to look if there actually exist a relationship between the index and fatalities (through a geocoded database) as validation methodology.

References


