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Entitled

*DEVELOPMENT OF A COMPOSITE SUSTAINABILITY INDEX FOR INTERSECTION DESIGN ALTERNATIVES
IN THE UAE*

by

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Abstract

Many studies had been carried out to evaluate the sustainability of transportation systems, but little attention was given in these studies for the design of roadway intersections. The objective of this study was to define a framework to assess intersection sustainability and to develop a visual tool that helps decision-makers to support a more sustainable design of roadway intersections. Suitable sustainability indicators that would serve as elements in the built framework at the strategic and early planning level were extracted from the literature. The extracted indicators were utilized with relative weights to develop basic dimensional indices that would be further combined into a Composite Sustainability Index (CSI) tool. The application of the CSI tool was demonstrated in four case studies of existing intersections in Al Ain City, UAE. For each case study, the sustainability of fifteen design alternatives was evaluated for different scenarios of traffic volume and operational speed. Indices representing the individual dimensions of sustainability (economic, environmental, and social) and the overall CSI were determined for each alternative using the Multi-Criteria Decision Making method and TOPSIS technique. For each scenario, the most sustainable design alternative and its dimensional tradeoffs were determined. A sensitivity analysis was carried out to study the impact of weight assignment that reflects stakeholders' interests and priorities on the sustainability assessment of the proposed intersection designs. Results indicated that traffic volume had a significant impact on sustainability ranking between single intersection design alternatives, while the effect of operational speed was insignificant. Moreover, sensitivity analysis proved that weight assignment had an effect on determining the most sustainable design alternative. Whereas, alternatives that rank highest in the dimension of the major weight, would result in being the most sustainable. However, if an alternative performs exceedingly well in another dimension, other than the one with the heaviest weight, it may still have the highest contribution to the overall CSI. The developed methodology would assist decision-makers in other cities to assess and implement sustainable roadway intersection projects that correspond to their regional visions and goals.

Keywords: Sustainable Transport Planning, Road Intersections Design, Multi Criteria Decision Making, United Arab Emirates (UAE).