



ASLI QoL2015, Annual Serial Landmark International Conferences on Quality of Life
ASEAN-Turkey ASLI QoL2015
AicQoL2015Jakarta, Indonesia. AMER International Conference on Quality of Life
The Akmani Hotel, Jakarta, Indonesia, 25-27 April 2015
“Quality of Life in the Built & Natural Environment 3”

A Method to Analyze the Living Spaces of Wheelchair Users Using IFC

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Abstract

Full physical adequacy for individuals is a temporary condition. Everyone has some limitations on the part of his life. Disabled people have some special needs. However, design for disabled are still made generic. The conventional methods are used to control the design and results are not satisfactory. BIM (Building Information Modeling) is such a good option to control the design. In this study, a method that analyzes the living spaces by using BIM model was developed. While using proposed model, it is possible to define all incompatibilities properly and use them as design feedback to create effective living spaces for wheelchair users.

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Peer-review under responsibility of AMER (Association of Malaysian Environment-Behaviour Researchers) and cE-Bs (Centre for Environment- Behaviour Studies, Faculty of Architecture, Planning & Surveying, Universiti Teknologi MARA, Malaysia).

Keywords: IFC; BIM; universal design; code checking

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1. Introduction

The United Nations Convention on the Human Rights of People with Disabilities recognizes “the importance of physical accessibility to the social, economic and cultural, health and educational buildings”. It is important to achieve physical accessibility to allow people with disabilities to enjoy all human rights and fundamental freedoms.

Full physical adequacy for individuals is a temporary condition. Everyone has some limitations on the part of his life. A child, a pregnant woman, a person with a broken leg, a mother with the pram, an elderly person can be given as examples. Very few people are healthy all his life.

Disabled people have some special needs. However, design for disabled are still made generic, and the needs of them do not identify clearly. If the built environment is not intended considering the needs of persons with disabilities, the quality of life is affected negatively. The social integration of disable people is one of the most important factors to improve the quality of life. Design decisions that are taken by considering the needs of people with disabilities should create more compatible and high-quality living space. The conventional methods are used to control the design and results are not satisfactory for compatibility checking. As a new building design and documentation method, Building Information Modeling (BIM) is such a good option to control the layout.

The usage of BIM in Architecture, Engineering and Construction (AEC) sector has been increasing rapidly. The concept of BIM contains the formation and the usage of the design, construction and management knowledge of buildings. The computational model of BIM forms an environment that serving the various disciplines of the design process to work together (Turkyilmaz, 2013).

BIM is the use of the computer-generated model to simulate the planning, design, construction and operation of a facility. It is a technology that allows users to create a visual simulation of a project with a digital prototype of a building prior to construction. The deployment of BIM in construction can make the industry more efficient, effective, flexible, and innovative (Takim et al., 2013).

Information sharing should be starting point when it comes to applying information technology to architectural design, construction and use. Information sharing requires a software environment in which computer programs can exchange data automatically regardless of software and data location. To achieve this, the IAI proposed a standard that specifies object representations for AEC projects. Today, Industry Foundation Classes (IFC) is the fundamental file type of AEC industry. IFC is an object-oriented data information model. It contains all kind of information on AEC projects. These data located in IFC data files. IFC data file creates a neutral file type to share and to change project information efficiently (Turkyilmaz, 2013).

IFC includes object specifications or classes and provides a useful structure for data sharing among applications. For instance, an IFC door is not just a simple collection of lines, and geometric primitives recognized as a door. It is an intelligent object door that has a door's attributes linked to a geometrical definition (Vanlande et al., 2008).

In this study, a method that analyzes the living spaces by using BIM model was developed. Rules for wheelchair users were generated according to the National TS9111 standards. Rules defined in Solibri Model Checker (SMC) software. The BIM model transferred to SMC as IFC (Industry Foundation Classes) files. After the compatibility analyze made with SMC, a detailed compatibility report was prepared. The results of the compatibility checking can used for design feedback.

2. Disability in Turkey

Current disability system in the world recognizes that there are various types of disabilities, and there is increasing in the number of the disabled population. About the physical environment, people with disabilities may be categorized to wheelchair-bound, sensory disabled, ambulant disabled, and temporarily disabled.

- Wheelchair-bound people, who are unable to walk, either with or without assistance and who depend on a wheelchair for mobility.
- Sensory disabled, Those who experience, partially or wholly, impaired sight or hearing.
- Ambulant disabled people, who are able, either with or without personal assistance, to walk provided that convenient facilities such as handrails be available.
- Temporarily disabled people, who are sick or victims of an accident. Pregnant women also included in this category (Kadir, Jamaludin, 2012).

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