The Performance of Anidolic Daylighting System for Tall Buildings in Densely Built Cities under Overcast Sky

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This paper aims to analyze the performance of Anidolic day-lighting system in the improving of daylight performance, as well as contributing towards energy saving due to lighting usage in tall residential buildings found popular in densely built cities such as Hong Kong. Two cases i.e. Base Case and Anidolic system have been measured under real overcast sky condition in the real context. The results show that the anidolic daylighting system significantly improved the daylight factor (DF) by 26% at rear room, increased daylight uniformity by 17%, and reduced lighting energy use by 25% in comparison to the Base Case. However, further study in the real situation by mock-up method is needed to test the real daylight performance of this system. The authors believe that the actual performance of Anidolic system would be better than the simulated and the scale model ones.

Keywords: Advanced daylighting system, Anidolic system, Field measurement, Window system

1. Introduction
1.1 Background
The importance of daylighting in architectural design is well known. Daylight provides a good lighting atmosphere for architectural spaces and offers high possibility in reducing electrical lighting energy consumption. Several studies have reported the daylight contribution in improving workers’ performance at office and students’ performance at school. A 2003 study in California confirmed that workers exposed to daylight through window with views performed 10-25% better on mental functioning and memory recall test than those with no windows (Heschong-Mahone Group, 2003). The student at the classroom with most daylighting performs 20% faster on math test and 26% on reading test. The students also have 7-18% higher scores than those in the least daylighting classrooms (Heschong-Mahone Group, 1999). For residential buildings, the main reason for utilising daylight comes from the preferences of occupants. Most occupants prefer daylight because it perceived as healthier and provides greater contact with the outdoor (Wilson and Brotas, 2001). Another benefit of integrating day-lighting in residential buildings is to promote more sustainable living environments (Loveland, 2002).

Even though daylight is well appreciated by Hong Kong residences (Ng, 2003), its utilisation is very marginal due to an insensitive approach in user preference and design practice that have drifted away from a climatic-sensitive approach in the late 1960s. Apart from users’ and designers’ ignorance, the urban form of today is characterized by high-rise buildings, of forty stories and more, located in high density and close proximity situations constitute an obstacle in utilizing daylight in urban areas. Due to planning and historical reasons, Hong Kong has the world’s highest average urban densities of about 6,500 persons per km\(^2\) overall or a peak density of about 43,000 persons per km\(^2\) (CSD, 2007). Within such a density, the resultant compact urban environment is one where live, work and leisure