FINAL YEAR PROJECT REPORT

ADVANCED DIPLOMA IN CIVIL ENGINEERING,

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SHAH ALAM, SELANGOR.

THE ANALYTICAL STUDY OF TUNED MASS DAMPERS ON THE STABILITY OF K.L.C.C. SKYBRIDGE.

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ABSTRACT

The two storey skybridge walkway is proposed to span between Tower 1 and Tower 2 of the Kuala Lumpur City Centre development at the 41st and 42nd floors. The walkway is to have two pairs of cylindrical supporting legs below it which attach to the towers at the 29th floor.

Vortex shedding may occur when the wind speed is such as to bring the shedding frequency close to the natural frequency of the body. In this case, oscillation start to build up to pressure fluctuations, caused by passing vortices, being in tune with a natural frequency of a skybridge leg. Once vortex shedding is established, the leg motion locks in the shedding frequency to the leg's natural frequency even if the wind speed varies slightly from the original speed that initiated the motion.

A wind tunnel aeroelastic model test was done by RWDI to study the vortex shedding response of the legs. The vortex shedding motions of the east pair of skybridge legs were measured on a 1:70 scale aeroelastic model. Measurements were initially conducted for a wide range of wind direction at a damping ratio of 0.0015 to identify the wind directions producing the largest vortex shedding motions.

From these tests, it was determine that the vortex shedding motions increase sharply below a damping ratio of about 0.004. Therefore, it would be important for the damping ratio on the actual skybridge legs to exceed 0.004 unless aerodynamic modifications are made. The damping ratio which the skybridge legs will exhibit cannot be analytically or empirically obtained with any certainty. However, it is likely to be somewhat lower than 0.004.

Therefore, it would be important to ensure that the damping ratio on the actual skybridge legs exceeds 0.004, say 0.005 or greater.

CHAPTER ONE

INTRODUCTION

1.1 General

At about 7.40 p.m. on 9 August 1995, another milestone was achieved in the development of the Kuala Lumpur City Centre project when the centre section of the skybridge reached its final position at the 42nd levels of the Petronas Twin Towers. The Skybridge is 170 metres above street level, 58.4 metres long and weight about 750 tonnes, it links the sky lobbies of the 88 storey twin towers at the 41st and 42 nd levels. The bridge is supported by a two-hinge arch springing from supported at level 29 and rising at 63 degrees.

The design of the skybridge had to take into consideration the effect of along wind, cross-wind and of torsional wind movement of the towers under all conditions including the most severe storm. The cylindrical supporting legs will be tuned with a natural frequency caused by passing vortices. Rowan Williams Davies & Irwin Inc.,the wind consultant based in Ottawa, Canada, had design a specific equipment called Tuned Mass Dampers to assess and solve this vortex shedding problems.

The study will bring many benefits in term of technology transfer to the local skills. Opportunity has been taken with the corporation from RWDI to complete this final project on the efficient the Tuned Mass Dampers in gaining the stability of the skybridge. It has taken 10 months to study on the dampers from the process of installation until the preliminary testing.

This final project also covers about vortex shedding which will bring oscillation effect to the skybridge legs caused by passing vortices. Items which are inter-related to the Tuned Mass Dampers are also discussed in this final project.