

UNIVERSITI TEKNOLOGI MARA

**DEVELOPMENT OF A PIPING
SYSTEM FOR A FLOW
VISUALIZATION WATER TUNNEL**

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Dissertation submitted in partial fulfillment
of the requirements for the degree of
Diploma
(Mechanical Engineering)

College of Engineering

March 2022

ABSTRACT

To measure the velocity around, and forces or pressures upon structures, the water tunnel have been created since 1947. A water tunnel is an experimental facility used for testing the hydrodynamic behavior of submerged bodies in flowing water.[5] It is very similar to a with wind tunnel but the different is use water as the working fluid, and related phenomena is investigated, such as measuring the forces on scale models of submarines or lift and drag on hydrofoils.[5] Usually water tunnel required a large space to perform the analysis.[5] The high cost needed to construct the big one with high power of pump required to produce adequate flow in the tunnel. It is expensive to buy all the components in order to build the model of water tunnel. Thus, a small of water tunnel model with low speed of flow will construct to minimize the cost. The water tunnel also important for students that want to learn about flow visualization. Due to these problem, there is a need for bulid a water tunnel to overcome this problems. In group, we should create the low cost water tunnel. So, my part is design a piping system to fabricate and develop a working prototype for a flow visualization water tunnel. The scope of the project covered the study and analysis to construct a piping system of water tunnel. Besides, pipe and pump that use for the water tunnel is available in the market and the project will be placed in UiTM. Methodology is important before make the product. In fabricate of water tunnel apparatus, methodology is important before make the product. It is should include experimental design, testing, apparatus, parameters and etc. Project methodology is a body of practices, procedures and rules used by those who work in a discipline or engage in an inquiry and a set of working methods. The expected result for this project, the water tunnel will be a beneficial things in learning laminar and turbulent behaviour. It is also will be a new valuable things in University. The cost of this water tunnel is reasonable and affordable, which is about five hundreds Ringgit Malaysia (RM). Overall, this water tunnel design and development has achieved its objective and has a capability to study the flow around small scal of fundamental structures and behavior of vortex induced vibration (VIV).[5]

ACKNOWLEDGEMENT

Firstly, I had want to express my gratitude to God for providing me with the opportunity to pursue my diploma and for successfully completing this long and difficult trip. Sir Norhisyam bin Jenal, my supervisor, deserves my gratitude and thanks.

Finally, this dissertation is dedicated to my parents for the vision and determination to educate me. This piece of victory is dedicated to both of you. Alhamdulillah.

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CHAPTER 1

INTRODUCTION

1.1 Overview / background of the Project

A water tunnel is an experimental facility used for testing the hydrodynamic behavior of submerged bodies in flowing water. It is very similar to a wind tunnel but the different is the use of water as the working fluid, and related phenomena is investigated, such as measuring the forces on scale models of submarines or lift and drag on hydrofoils.[5] Water tunnels are sometimes used in place of wind tunnels to perform measurements because techniques like particle image velocimetry (PIV) are easier to implement in water.[5] The facility also helps engineers to know about flow visualization such as understand the characteristics and effects of air flowing over and past an aircraft or an aircraft component by using water to simulate air. It is also helps students in their learning too.

However, a commercial water tunnels and proper research-purposed are too expensive and they are generally huge in size. For example, Model 1520 Water Tunnel (Hills Research Corporation) costs around hundred thousand USD and requires a large amount of lab space approximately 10 x 5 x 2 m (length x width x height).[16] Due to the high cost of commercial water tunnel, it leads to the idea of fabricating a low-cost water tunnel with acceptable quality for the educational purposes. Besides, the students also had a problem when they learn about laminar and turbulent flow. They just rely on the video or from the internet only as a reference. It is insufficient for student to learn the phenomenon. Many universities also did not have the water tunnel to show to their students because it is very expensive extensively in front of their eyes.

The solution for this problem is to develop a water tunnel with low-cost or recycle components. It is a good idea because the important parts in the water tunnel is just the flow visualization only. So, the students will be able to understand and see clearly what is a laminar and turbulent flow.