DETERMINATION OF SOUND TRANSMISSION CLASS (STC) FOR UTEM LECTURE ROOM

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‘I / we admit that have read this work and in my / we opinion this work satisfied the scope and quality aspect for the
Bachelor of Mechanical Engineering (Automotive) awarded’

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Date :……

Signature :……
Supervisor Name 1 :……
Date :……

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This Report is to fulfill course evaluation
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CONFESSION

"I admit this report is my own work except for the summary and passage which each of it already been explained it source"

Signature :
Name of the Writer : ZAINORDIN ZHAFRAN BIN ZULKEFLI
Date : 27/03/2008

DEDICATION

Thanks to ALLAH S.W.T because with His blessings, I manage to finish this report according to the dateline.

I dedicate this report to

my beloved family who has always supported me in my whole life.

ACKNOWLEDGEMENT

Alhamdulillah thanks to Allah, with His blessing I manage to complete this report in time.

I would like to thanks my supervisor Dr JANATUL ISLAH MOHAMMAD for her guidance and encouragement during completing this report.

I also want to thank to my parents and all my friends for their support and encouragement to finish this report. Hopefully, this report will become a reference and the guideline to other students in the future.

ABSTRAK

Tujuan projek ini adalah untuk menjalankan satu ujikaji atau proses pengukuran dengan tujuan untuk menentukan tahap-tahap tranmisi (STC) dalam bilik kuliah 3 dan bilik kuliah 4 Universiti Teknikal Malaysia Melaka (UTEM) kampus Industri.Selain itu,projek ini juga bertujuan untuk mencari kaedah-kaedah yang boleh menambahkan keselesaan suasana akustik didalam bilik kuliah atau kelas bagi meningkatkan kualiti pembelajaran dan pendidikan didalam bilik kuliah.Projek ini akan menyiasat samada bilik kuliah di UTEM memenuhi standart yang ditetapkan oleh ANSI / ASAS12.60-2002 bagi tahap-tahap akustik didalam kelas atau tidak.Ini adalah penting kerana andai standart ini tidak dicapai,maka suasana pembelajaran didalam kelas akan tergangu dan seterusnya akan merosotkan pencapaian pelajar dan interaksi antara pelajar dan guru akan terjejas.

ABSTRACT

The purpose of this project is to carry out a measurement process in order to determine the sound transmission classes (STC) in classroom 3 and 4 in UTEM Campus Industry, besides that this project aims to find a solution to improve the quality of learning and teaching in UTEM classroom based on the measurement of the acoustic level in UTEM classrooms. This project is to determine whether UTEM classroom meet the ANSI/ASAS12.60-2002 Classroom Acoustic Design Standard. This project will estimate the speech intelligibility in UTEM classroom in order to improve learning and study environment. The project is important because if the sound transmission classes did not meet the sound transmission classes' standard this will affect the learning environment and lower the activity between teacher and student.

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CHAPTER 1

INTRODUCTION

1.1 Background of the Project

The amount of airborne sound blocked from transmitting through a partition is measured in a Sound Transmission Class (STC) rating. A higher STC rating will allow sound transmission through walls and increase the background noise level in the space, degrading the ability to hear and understanding speech [1].

The purpose of this classification is to provide a single-figure rating that can be used for comparing partitions for UTEM classroom. The rating is designed to correlate with subjective impressions of the sound insulation provided against the sounds of speech, sound receiver and sound sources in a classroom.

Achieving a specific STC rating depends highly on the materials and the installation methods used. Wall and ceiling assemblies can be specified and detailed to meet a required STC rating. Background noise is a major concern in learning facilities. STC ratings will help to limit the background noise levels within a space (depending on the effect of sound transmission on the background noise level). It may be necessary to increase a required STC rating in order to meet a specified background noise level requirement.

1.2 Problem Statement

A sufficient level of acoustics quality in classroom or lecture room is important in order to provide effective learning and teaching environment. However if acoustic level in classroom does not meet the ANSI/ASAS12.60-2002 Classroom Acoustic Design Standard then this will disturb the speech intelligibility in classroom and reduce the interaction between teacher and students.

Some of the disadvantaged arise if the ANSI/ASAS12.60-2002 Classroom Acoustic Design Standard does is not met are as listed below:

a) Students do not understand what the teacher says and this will reduce the communication between students and teacher.
b) Students lose their focus in class and this will reduce the quality of studies and produce bad results during assessment.
c) Overall results among UTEM's students will badly affected because the university is failed to meet the standards for acoustic requirement.

1.3 Objectives

The objective of this project is to carry out a measurement process in order to determine the sound transmission classes in a selected number of UTEM classrooms. Besides that, this project aims to evaluate some tests made to the existing classroom to improve the quality of learning and teaching in UTEM classrooms. If the standard is not met by existing classroom, some suggestions to improve the quality of learning and teaching in UTEM classrooms will be discussed as well.

1.4 Scope

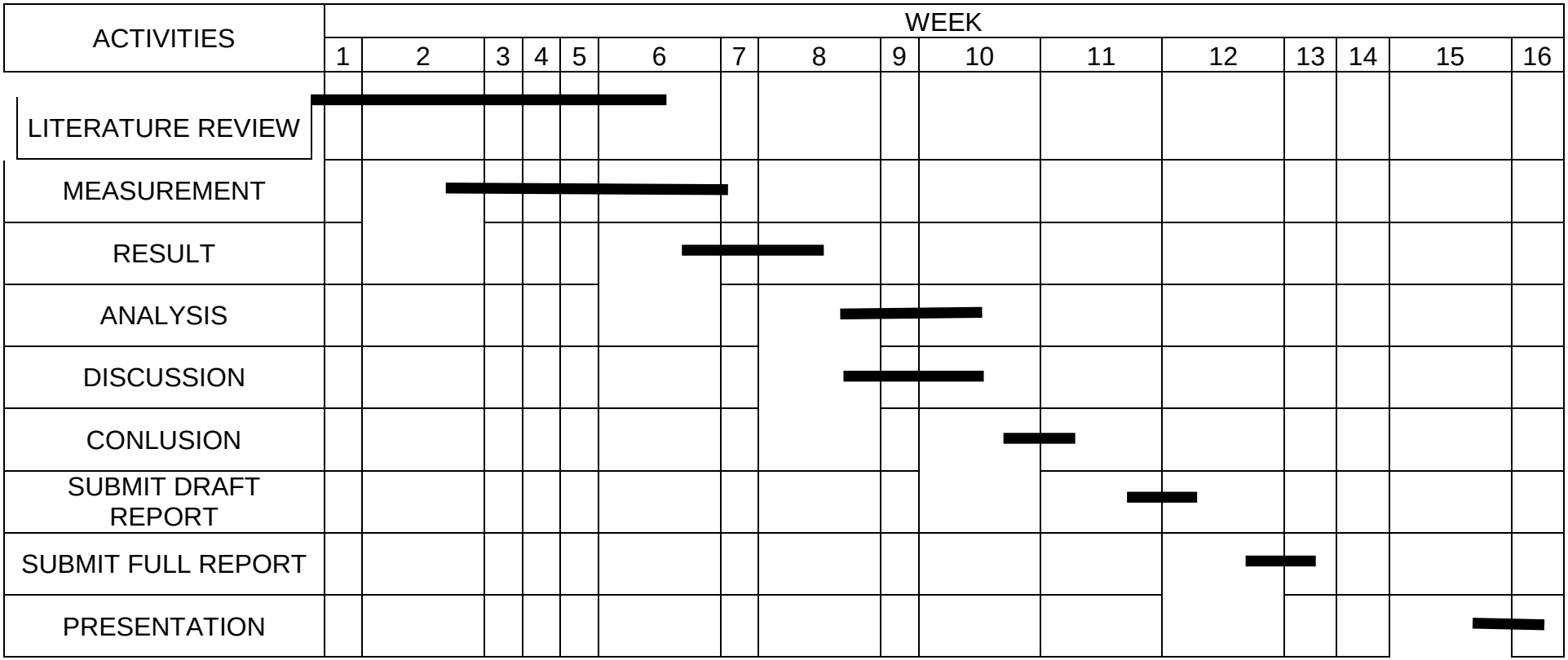
The scope for this project is to determine whether UTEM classroom meet the ANSI/ASAS12.60-2002 classroom Acoustic design Standard or not. This project involves field measurement in order to determine the acoustic data for Sound Transmission Classes (STC), as well as to estimate the speech intelligibility in UTEM classrooms.

1.5 Project Planning

Gantt Chart PSM1

ACTIVITIES	WEEK															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
TITLE CONFORMATION																
OBJECTIVE & SCOPE																
PROBLEMS STATEMENT																
LITERATURE REVIEW																
METHODOLOGY																
CONLUSION																
SUBMIT DRAFT REPORT																
SUBMIT FULL REPORT																
PRESENTATION																

Gantt chart PSM 2



1.6 Report Structure

Chapter 1 presents the introduction of the project that will include the background, problem statement, scope and overall project.

Chapter 2 discusses about the previous studies on sound transmission classes, theory on sound transmission classes, international measurement standard for sound transmission classes and basic acoustic knowledge. This chapter also discusses the implication of school design, reverberation, evaluating speech intelligibility, sound reinforcement and noise criteria rating.

Chapter 3 discuss the project implementation of determine sound transmission classes, equipment in measurement, previous measurement method and chosen method of measurement for this project.

Chapter 4 presents the result and discussion of the measurement justifies the validity of the data taken.

Chapter 5 discusses the conclusions of the project As well as lists some recommendation for further work.

CHAPTER 2

THEORY OF SOUND TRANSMISSION

2.1 Introduction

Intensity is a physical measurement of a sound wave that relates to how loud a sound is perceived to be. We can also measure the frequency of a sound wave, which we perceive as pitch. For example, on a piano, the keys to the right have a higher pitch than those to the left. If a sound has just one frequency, it is called a pure tone, but most everyday sounds like speech, music, and noise are complex sounds composed of a mix of different frequencies. The importance of frequency arises when a sound wave encounters a surface: the sound will react differently at different frequencies. The sensitivity of the human ear also varies with frequency, and we are more likely to be disturbed by medium-to high-frequency noises, especially pure tones [2].

Think of sound as a beam, like a ray of light, passing through space and encountering objects as shown in figure 2. When sound strikes a surface, a number of things can happen, including:

Transmission-- The sound passes through the surface into the space beyond it, like light passing through a window.

Absorption-- The surface absorbs the sound like a sponge absorbs water.

Reflection-- The sound strikes the surface and changes direction like a ball bouncing off a wall.

Diffusion-- The sound strikes the surface and is scattered in many directions, like pins being hit by a bowling ball.

As a result, the reflected wave will not be as loud as the initial wave. The frequency of the sound also makes a difference. Many surfaces absorb sounds with high frequencies and reflect sounds with low frequencies. The Absorption Coefficient and NRC (noise reduction coefficient) are used to specify the ability of a material to absorb sound.

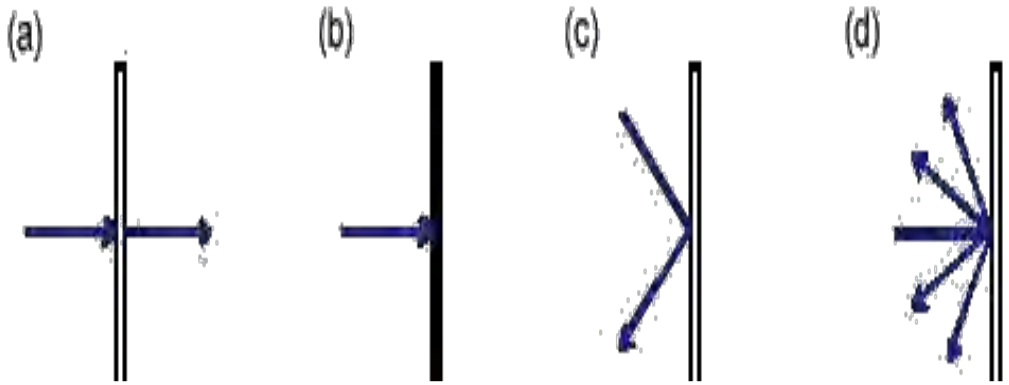


Figure 1: Sound /Surface Interaction: (a) Transmission,
(b) Absorption, (c) Reflection, (d) Diffusion
(Source: University of Kansas Architectural Engineering faculty 1998)

2.2 STC RATING

Many educators feel it is important to improve acoustics in classrooms used by students because less than acoustically optimal conditions in the classroom affect the academic performance of all students. Many experts believe that students miss up to 33 percent of the oral communication that occurs in the classroom and this will reduce the quality of learning [3]. Because of that many educator and experts in universities have has done a research to find the best solution to this problem.

The control of noise from one room to another is a major challenge in acoustics. Different materials transmit more or less sound at different frequencies. In transmission, blocking the entire speech range is important, and this factor is reflected in the STC rating (Sound Transmission Class) of a wall [3]. Critical to sound transmission issues is the background noise in the receiving room. If the background noise is higher than the amount of sound passing through (and around) the wall, then users will not hear the sound from the adjacent room. If background noise is lower than transmitted noise, then room occupants will hear sounds from the adjoining space.