

## The Socialization of The Sound System and The Study of Acoustic in The House of Workshop (Mosque)

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**Abstract**— Mosque is the house of worship for moslem which are is used for many positive activities besides for routine worship, “shalat” five times a day. Those activities are discoursing, mentoring, reciting Al-Qur’an, marriage contract (“akad nikah”) activity, big day islam commemoration and others. To support those activities, the mosque need be supported by a great facilities and infrastructure. One of them is a good sound system. The great sound system has to meet the standards which had been applied by the instruction of General Director of Islamic Community Guidance No. Kep/D/101/1978 about Using The Sound System in Mosque, “Langgar”, Prayer Room (Mushola). In the other hand, we need to give attention to the electrical construction for sound system installation that will be used to get the great sound quality on the whole.

**Key words** - Mosque, Sound System, Quality

### 1. Introduction

#### 1.1 Background

Nowaday, the sound system is really related with the house of worship. That happened because of many positive activities which have been done in mosque besides for “shalat” five times a day. Generally, today the mosque have been had their own sound system, but sometimes there has trouble for the pilgrims or people around the mosque such as the sound is too loud and not clear, the sound where is inside the mosque not spread evenly because of the quality of acoustic is poor.

The solution has almost been taken to change or add the speaker but it would not guarantee the quality of sound if you did not notice the installation factor and placement. Therefore, the sound system application had to know about some related rules and also the operator who operates it need to get the socialization first. Because the sound system aften has become poor and broken easily because of the operator is less skilled.

The Government of Indonesian Republic had arranged some regulations which listed on the instruction of General Director of Islamic Community Guidance No. Kep/D/101/1978 about Using of The Sound System in Mosque, *Langgar*, and *Mushola*.



**Pic 1.** The Poster of Government Regulation about The Guidance of Using The Sound System

The Socialization which is related with sound system, especially for house of worship today is not good, it made impact to the quality of sound which is produced. Based on it, the study program of Electrical Engineering,

Widyatama University had intend tomake modeling with holding title of community service “Socialization of Sound System and The Study of Acoustic in The House of Worship (Mosque)”.

**1.2 The Limitation of Problem**

The target of this community service activity is for society generally and the society who administer the mosque in particular, The Mosque Security Council (DKM) around *Kp. Ciheulang, Pasir Cileutik, Kecamatan Ciparay, Kabupaten Bandung*. In expected with this socialization activity, the society would understand about a good sound system in every single side and the related rules and implementation a good soud system for room of the Mosque.

The used method was with giving socialization and a set of sound system inside the room. The step of the community service method are as follows:



**Pic 2.** Flow Chart of PkM implementation method

**2. Theoretical background**

**2.1 Room Acoustic Parameter**

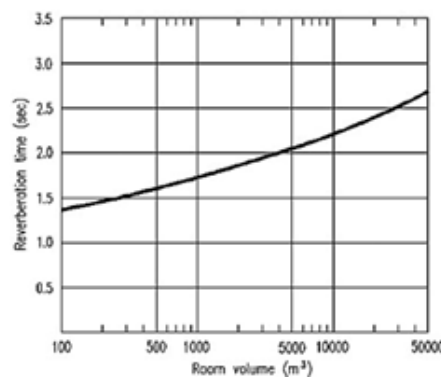
Acoustic Criteria in the room consists of several kinds, they are *Early decay time (EDT)*, reverberation time, *clarity (C)* and *Definition (D)*.

The sound system needs in mosque can be concluded into three parts, such as:

- The sound from *Imam sholat* can be heard by the *jamaah (audibility)*,
- Sermon can be recognized well, and
- Listening the Al Qur’an reciting, although sometimes used for another needs which related with music.

In this section, it is really needed a speech clarity or another sound which is usually measureable with reverberation time (RT) to give expression about speech audibility, clarity, and voice broadness.

Several parameters are requaired to know about Speech Intelligibility inside room. They are early decay time (EDT), reverberation time (RT), clarity (C<sub>50</sub>) and Definition (D<sub>50</sub>), and Articulation loss of Consonant (Alcons).



**Pic 3.** The Recommendation of Reverberation Time for Mosque

As stated in previous section that for mosque needs which wished the best speech clarity value, there are several parameters value which must be qualified.

### 2.2 The Placement of Speaker Position

The placement of speaker was becoming important to be noticed to get an equalization of sound in room. In speaker installation above roof or plafond, they were two things which need attention, there were distance between speaker (speaker spacing) and the pattern of speaker placement, square or hexagonal. While in speaker installation to the wall was important to know a speaker coverage area and the height of speaker placement.

There are several types of loudspeaker placemnr, including:

- Center, speaker position was equal to the original sound source to give a natural impression.
- Spread, this type was used for the activity which need a clarity sound compared to the direction of the sound.
- Such as an airport, the speaker is put down on the colomn evenly.
- Integrated with the chair (seat-integrated), speaker placement is behind the seat in an integrated manner.

The selection of speaker type was becoming important to get the value of clarity and to reach a good room function. An important speaker specification which needed to know was frequency response and sensitivity. A frequency response indicated a work range from a speaker to the range of human hearing frequency (20 Hz s.d 20.000 Hz). A good speaker had a flat frequency response or indicated with a small deviation ( $\pm 3\text{dB}$ ).

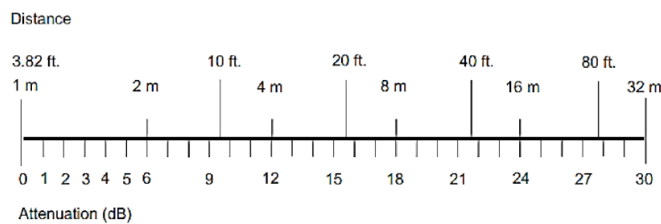
Whereas the sensitivity indicated an efficiency of speaker. Sensitivity would showed how loud the sound which generated from speaker with standard input power (1 W) and measured with range 1 meter.

Measurable sound pressure level from a sound source depends on the source input power and range of matering from source sound. The correlation between range and measurable large sound pressure can be seen on Pic 4. it can be counted mathematically with the following equation:

$$\text{SPL} = 20 \log D$$

Annotation :

- SPL : Sound Pressure Level
- D : Range from the sound source



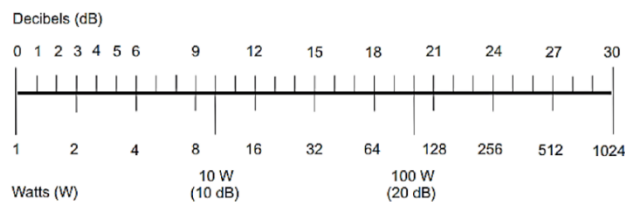
**Pic 4.** The Correlation of Sound Pressure Level with Distance

The correlation of power and substantial of sound emphasis which be taken out by speaker could be seen on Pic 5. It could be counted mathematically with the following equation.

$$\text{SPL} = 10 \log (P_1/P_0)$$

Annotation :

- SPL : Sound Pressure Level for  $P_1$
- $P_1$  : Power that delivered to speaker
- $P_0$  : Power reference (1 Watt)



**Pic 5.** The Correlation of Sound Pressure Level with power

Definition and Clarity were a ratio proportion of acoustic energy in room. D50 indicated compasion of sound energy entirety. The level of speech intelligibility got good value if  $C_{50}$  less than or equal to  $-2\text{Db}$ .

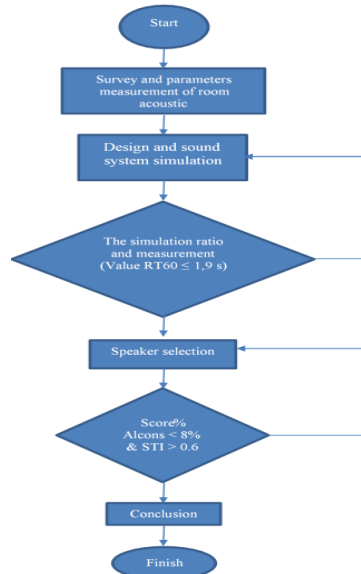
**Table 1.** The Value Category of Speech Intelligibility based on D50

D50 (%)	SI (%)	Category
0 – 20	0 – 60	Very Bad
20 – 30	60 – 80	Bad
30 – 45	80 – 90	Fair / Moderate
45 – 70	90 – 97,5	Good
70 - 80	97,5 – 100	Very Good

### 3. The implementation

#### 3.1 Research Method

The reseach flow can be seen on Pic 6.



**Pic 6.** The Research Flowchart

#### 3.2 General Rules of Speaker Installation Simulation

Speaker device had been added with variety of type and its placement to know the comparison of loudspeaker type and the result of the value of conversational clarity (Speech Speec intelligibility). The speech intelligibility parameters which used was STI (Speech Transmission Index) and % Alcons (Articulation Loss). The value of expected STI was  $> 0,6$  whereas for Alcons was  $\leq 8\%$ , Where was this value enter in category Good to Excellent (Ideal).

Loudspeaker device that used was TOA ZS-102C. This speaker selection was based on to the rated input power, and coverage angle od speaker(Govender & Govender, 2019; Barkhuizen et al., 2020; Abulela & Harwell, 2020; Burgos et al., 2020; Codina et al., 2020).

#### 3.3 The Materials and Tools Used

In this community service activity, the team from Electrical Engineering, Widyatama University besides giving socialization about a good sound system and related to the government regulation which listed on the instruction of General Director of Islamic Community Guidance No. Kep/D/101/1978 about using sound system in the mosque, *langgar*, mushola, the team had also given a set of an acoustic sound system fot the room in mosque. The materials and tools used among others are as follows:

1. The module with the topic is a good sound system in electrical side and linkages with the government regulation which valid at this time.
2. A set of sound system inside a room are as follows:
  - a. The room speaker with the specification Speaker TOA type ZS-102C – Column Speaker



**Pic 7.** TOA type ZS-102C – Column Speaker

b. Audio Cable – GA Cable



**Pic 8.** Audio Cable (GA – Cable) 2 x 30

c. Microphone

- Wireless microphone with the specification TOA type ZM – 361 – AS, to be used by *imam* while shalat.



**Pic 9.** Wireless Microphone TOA tipe ZM – 361 – AS

- Cable microphone with the specification Advance Type 888, to be used when there had events besides shalat.



**Pic 10.** Microphone Cable Advance tipe 888

### 3.4 The Result of Acoustic Parameters Measurement

The acoustic parameters measurement that had been done with using the impulse method, had generated three grade of parameters to find the condition inside mosque which known from the data processing of measurement result. The three parameters were RT60, D<sub>50</sub> and C<sub>50</sub>.

**Table 2. Measurement Result of RT<sub>60</sub>**

Measurement Position	RT <sub>60</sub> (second) in sampling to		An Average of RT 60 (detik)
	500 Hz	1000 Hz	
In the middle room	1,89	1,91	1,90
In the back room	1,89	1,91	1,90
<b>Average</b>			<b>1,90</b>

**Table 3. The Calculation Table of Grade D<sub>50</sub> and C<sub>50</sub>**

Measurement Position	An Average of RT <sub>60</sub> (detik)	D <sub>50</sub> (%)	C <sub>50</sub> (Db)
In the middle room	1,90	80	-2,4
In the back room	1,90	80	-2,2
<b>Average</b>	<b>1,90</b>	<b>80</b>	<b>-2,3</b>

### 3.5 Result of The Socialization and Discussion

An enforcement target of the community service for the program study of Electrical Engineering S1 are the general public and in particular is the society who administer the house of worship (mosque). In this community service, team had chosen the mosque where located in *Kabupaten Bandung*, because the writer thought that the mosque where were far from the city were less attention, and it was impacted to the knowledge about the existing regulations especially the regulation about the sound system in mosque. Therefore, *Kp. Pasir Cileutik* where is in Ciheulang Village, Ciparay District, Bandung Regency had been chosen as a target for community service at this time. From the result of the activities which had been done could be got conclusion as follows:

**Tabel 4.** The Result of Community Service

No	Description of Activities	Result of Activities
1.	Socialization of sound system and the regulation as an instruction of General Director of Islamic Community Guidance No. Kep/D/101/1978 about using loudspeaker in Mosque, <i>Langgar, Mushala.</i>	80% society of <i>Kp. Pasir Cileutik RT. 04 Rw. 02</i> has known a good sound system as a valid regulation.
2.	Socialization of acoustic system especially inside mosque based on electrical system	80% society of <i>Kp. Pasir Cileutik RT. 04 Rw. 02</i> has known acoustic system and how to install a good electrical system.
3.	The installation of sound system inside mosque	80% society of <i>Kp. Pasir Cileutik RT 04 RW 02</i> has know a good sound system in the mosque room.

For the sound system installation would be done after socialization event took place, and some people play role in its installation.



**Pic 11.** Speaker installation process for room acoustic system



**Pic 12.** Speaker has been installed for room acoustic system

#### 4. Conclusion

From this the community service activity, it could be concluded some of the following:

1. Some society had not understood about a good sound and acoustic system.
2. Some society had not known the government regulation about rule of sound system for house of worship (mosque).
3. Some society had not understood the concept of acoustic sound system that seen from electronic side.
4. After this activity of the community service done, the people especially in *Kp. Pasir Cileutik* where is in Ciheulang Village, Ciparay District, Bandung Regency had known well about a good sound system and linkages to the government regulation which related to the rule of sound system for house of worship (mosque).
5. The quality of acoustic of interval sound system inside mosque had been good because it had a reverberation time in accordance with the recommendation, which is equal to 1,9 second,  $C_{50}$  -2,3 dB, dan  $D_{50}$  as big as 80%.

As for advice in this community service activity should be expected going and continuing and can produce the idea, innovation or useful discovery for people, especiallu in electrical engineering field and the relationship with existing regulation.

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