# A Water Supply System to Meet The Demand in The Hostels at The Politeknik Sultan Abdul Halim Mu'adzam Shah (Polimas), Jitra, Kedah

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**Abstract**
This is a study on a water supply system in a building to meet the requirements of the occupants in the students' hostels at the Politeknik Sultan Abdul Halim Mu'adzam Shah (POLIMAS) Jitra, Kedah, Malaysia. The objective of this study is to identify the factors relating to the current inadequacy of the water supply and to suggest solutions to remedy the problem therein in the hostels in POLIMAS. The problem is the inadequacy of water supply during the peak hours of water usage by the students. The research method for the study employed involves the use of questionnaires and the analysis of data collection carried out among the hostel student population to identify the problems faced by them. From the study and analysis of the data collected, a design calculation is then used to determine the capacity that will meet the water supply requirements for the hostels. The choice of the type and size of the water supply storage tank is then determined from the calculations made to solve the water shortage problem. This is followed up with the determination of the amount of water necessary to maintain a uniformed and balanced water supply throughout the whole hostel complex. A steel panel water storage tank is proposed to overcome the problem of water shortage. This supply tank will only operate to meet any shortfall of water supply to the main storage tank during the peak periods of water demand with the help of a pumping system which will send up water to the main tank in the hostel complex to ensure adequate water supply at all times in the hostels.

**Keywords:** water supply system, water tank capacity, POLIMAS hostels

## 1.0 Introduction

The hostels are a complex of residential premises designated for the students for the duration of their studies in the campus. Ideally it is also designed in physical environment conducive for the learning process of the students, without which, there will be some unpleasant experiences faced by the students therein. An adequate water supply system is on of the many facilities that must be provided in the hostel complex to ensure a comfortable stay for the students there.

Students who have resided in the hostels or residential colleges have invariably experienced water supply cuts or at the least, experienced dripping water supply from the sinks of showers due to over demand of water. This almost always lead to crises of personal health and cleanliness management for the students, amongst others.

For this reason, a study of the adequacy of the water suppy in the hostel complex at the Politeknik Sultan Abdul Halim Mu'adzam Shah (POLIMAS), Jitra, Kedah, is highly overdue in order to identify the causes of the frequent disruption of water supply and to propose a method for the resolving of this problem.

## 1.1 Background of problem

The water supply problem in the hostel complex is not a new issue. In fact, this problem has inherently existed since the days it was first built. The water supply apparently adequate during certain hours but the intensive simultaneous demand for water has resulted in a much reduced water pressure throughout the hostel complex. Herein lies a golden opportunity for the civil engineers to put into practice their skills to employ good technological knowledge and offer practical solutions to such a problem.

The advancements in engineering have improved various physical infrastructures for the benefit of the community. Basic amenities like water supply, their channels and water pressure have also improved a great deal, in tandem with engineering advancements. Older systems over the years have suffered problems of water shortage and low water pressure when neglected and not upgraded to meet increasing demands. This has presented a challenge to the community of the water engineering and management experts to initiate a move to improve the water supply system through the practice of new and innovative technology.

## 1.2 Problem statement

The whole of the POLIMAS complex employs an indirect water supply system which is aided with a water pumping system. Water is pumped directly into a storage tank from which all appliances and users will draw water from it.

Due to this design, the water supplied to the hostel complex is found to be wanting and has always fall short of the requirements for the student population there. During the peak usage period disruptions occur and the increasing hostel population over the years has added to this problem of water shortage in the hostels.

## 2.0 Objectives

The objectives of this study is as follows:

a. To identify the problem causing the water supply shortage.
b. To suggest a solution for the improvement to the water supply system for the users in the POLIMAS student hostel complex.

## 2.1 Research scope

The scope of this study encompasses the aspect of water usage by the students in the student hostel complex of the Politeknik Sultan Abdul Halim Mu'adzam Shah (POLIMAS), Jitra, Kedah. The student hostel building complex was completed and occupied in 1987. The 4 storey building comprises the girls' hostel blocks (Blocks A, B, C and D) and the boys' hostel blocks (Blocks E and F).

Water consumption is mainly for drinking, bathing, washing and others. The study on the water usage by the hostel students in POLIMAS is dependent on two main factors, namely, time and the consumers.


**Figure 1:**Hostels complex at the Politeknik Sultan Abdul Halim Mu'adzam Shah (POLIMAS), Jitra, Kedah.

## 3.0 Research methodology

The case study involves the process of data collection which will be analysed through the use of questionnaires distributed among the respondents who reside in the hostels under study. The objective is to gather analytical data with regards to the water capacity in the POLIMAS hostels.

From the results obtained, the data collected is analysed and a calculation is made to determine the water capacity and the size of the water storage tank required to store the amount calculated. Thereafter, the selection of the suitable type of water tank is made to overcome the problem under this study.

### 3.1 Conducting interviews and questionnaires.

A set of 100 questionnaires are distributed among the respondents who reside in the hostels in the blocks mentioned above. Two relevant questions are asked in the questionnaires to derive a better understanding of the water shortage problem in the hostel blocks. The questions are related to the peak hour water flow rates, water pressures and the water storage tanks. The response to these questions will be recorded and used as a reference pursuant to the problem-solving later.

From this study, with reference to the analysis of the questionnaires, it was found that only Blocks A and E experienced a problem with the water supply whereas the problem did not suffer the same fate. The focus was therefore on providing a solution to the said problem in Blocks A and E only. The difference in the student population resident in Blocks A, E and those residing in Blocks B, C, D and F in terms of the building design and capacity has contributed to the problem under study. Blocks A and E has 126 hostel rooms compared to 110 rooms in Blocks B, C, D and F. Therefore, it would be inadequate to install water storage tanks of the same capacities for all the hostel blocks.

### 3.2 Calculations to determine the correct size for the water storage tanks

From initial estimates, it is found that only one unit of water storage tank would suffice to serve the hostel Blocks A and E based on the population of students residing there. To determine the correct water storage capacity and tank size, a set of design calculations needs to be carried out. From the calculations, the desired choice of the storage tank can be arrived at. Prior to this decision, a number of steps need to be carried out, namely:

a. A schematic sketch showing the pipework for the POLIMAS hostel blocks
b. Refer to the relevant design tables and standards.

After obtaining the size and water storage capacity, the water storage tank size can be determined using design calculations and relevant manufacturers' catalogues.

## 4.0 Result and discussion

### 4.1 Consumer-based study analysis

Below is a bar chart derived based on the response to the questions in the questionnaires from the student respondents who reside in the POLIMAS hostel blocks.

a. Peak hour water flow-rates are high for all the hostel blocks under study.

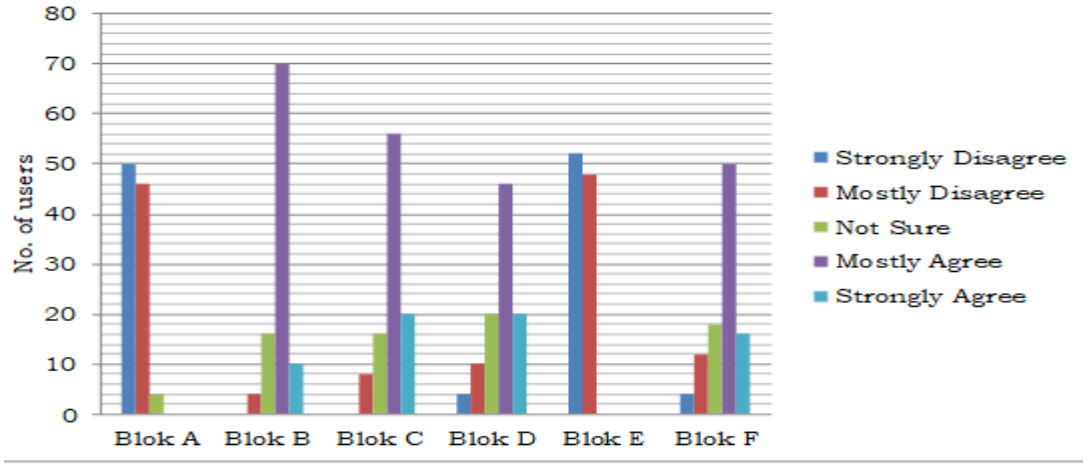


**Figure 2**: Water flow-rates during the peak hours are high

Figure 2 above shows the water flow-rates during peak hours in six of the hostel blocks in POLIMAS. 70 of the respondents in Block B agree to the suggestion that water flow-rates in the mornings are high. 56 from Block C, 50 from Block F and 50 from Block D agree to the same. However, 52 users from Block E and a further 50 from Block A expressed disagreement to the suggestion above that the water flow-rates in the mornings are high.

b. Peak hour usage resulted in low water pressures in all the hostel blocks.

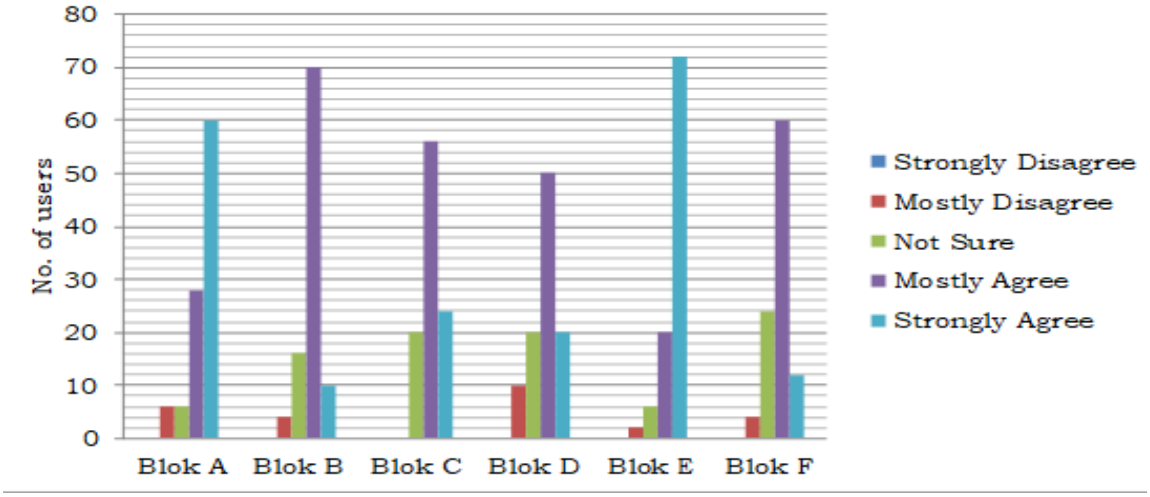


**Figure 3**: Peak hour usage resulted in low water pressures

Figure 3 shows that water usage during peak hours resulted in reduced water pressures. 72 respondents from Block E and 60 from Block A strongly agreed with the suggestion. Similarly, 70 from Block B just agreed with the suggestion put forward to them. 56 from Block C and 50 from Block D agreed.

Only 10 from Block D, 6 from Block A, 4 from Block B and finally 2 each from Blocks E and F disareed with the low water pressure suggestion.

c. Comparison of water capacity in the storage tank not adequate during peak hour usage for all the hostel blocks in POLIMAS

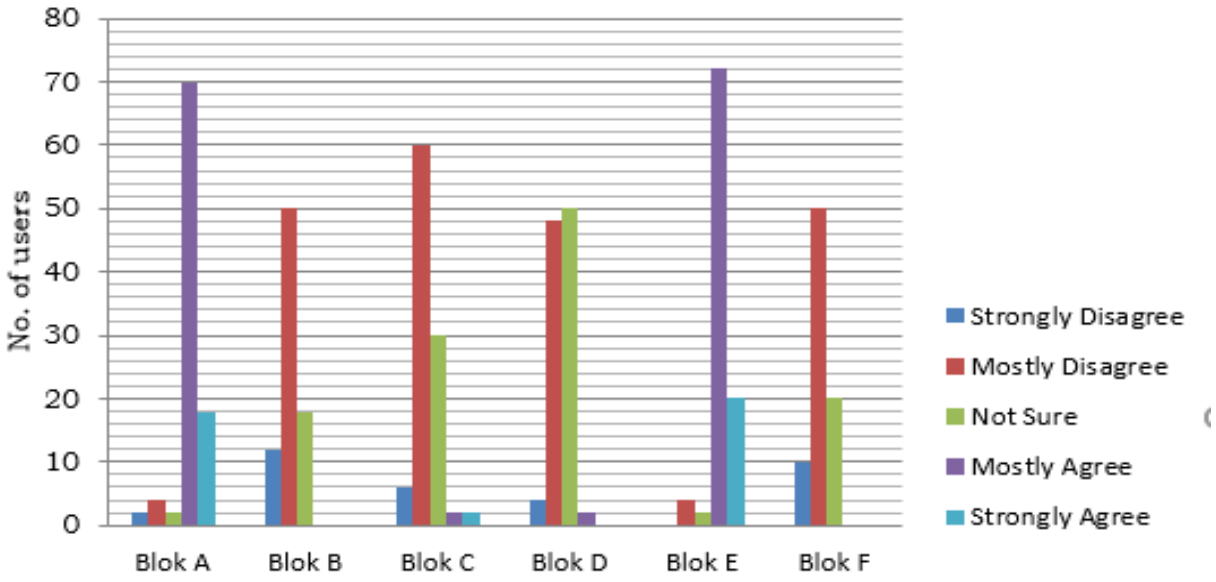


**Figure 4**: Water capacity in the storage tank not adequate during peak hour usage

Figure 4 shows a comparison between the adequacy of the water capacity in the storage tank and the comsumer demand during the peak hours in the hostel blocks in POLIMAS. From the bar chart above, a distinct disparity in response between the respondents in Blocks A and E who responded in agreement to the suggestion with 72 Block A and 70 from Block E. On the other hand, a portion of respondents from Blocks B, C, D, and F disagreed with the suggestion as shown in Figure 4.

a. Storage Tank and Pump Sizing.

b. Tank Size (Domestic Storage):

**Table 1**: Estimated Water Storage Requirements Recommended by the JKR Water Supply (2005) Standards.

| Building Type | Storage Tank Capacity |
|---|---|
| Rural Dwellings | 450 ℓ / 100 gallons |
| City Dwellings | 680 ℓ / 150 gallons |
| Flats (Storage Tanks) | 140 ℓ / 30 gallons |
| Low-cost Dwellings | 450 ℓ / 100 gallons |
| Hostels | 180 ℓ / 40 gallons per occupant |
| Day Schools | 30 ℓ / 6.5 gallons per occupant |

Total water storage volume for Blocks A and E
= Total no. of rooms x no. of students x total storage tank capacity
= 126 rooms x 2 students x 180 litres
= 45,360 litres

Total water capacity needed to be topped up is:
a. Existing capacity of tank is 3,520 gallons
= 45,360 (0.22 gallons) – 3,520 gallons (existing tank will remain)
= 9,979.2 – 3,520 gallons
= 6,459.2 gallons

Therefore the size of the supplementary water storage tank is then determined for the hostel blocks A and E, i.e,
= 12' x 24' x 4'
= 7,200 gallons
= 36 panels

a. Pump Size Calculations:
Type = HF 5AM, Centrifugal pump, 2 HP
Height = 18.5 m, Pipe size = 2 inch
Flow = 300 ℓ / min @ 66 gallons/ min

The time taken to pump water up to the storage tank is
= 7200 /66 gallons/ min
= 109.11 min @ 1 hour 49 min

## 5.0 Discussion on the results obtained

Based on the study, the main factor causing the water shortage problem in Blocks A and E was identified. It was clearly shown that the existing water storage capacity was not sufficient to meet the usage demand from the students in the blocks mentioned.

When the cause of the problem is identified, a solution is then provided in the form of the installation of a supplementary storage while retaining the existing tank in the hostel blocks A and E in POLIMAS.

It is noted that a supplementary tank with a storage capacity of 7,200 gallons each for Blocks A and E while maintain the existing tank with a capacity of 3,520 gallons.

## 6.0 Conclusion

To improve the adequacy of the water supply system for the benefit of the hostel students, the problem is solved by the installing a supplementary water supply storage tanks to meet the shortfall on the demand for each of the hostel blocks A and E, based on the calculations carried out above. Steel panel water storage tanks are chosen, and these will be filled using water pump systems to ensure there is always adequate water supply to meet the demand of the residents in the hostels especially during the peak usage periods.

In conclusion, it must always be ensured that the water supply systems are adequate to meet the demand during peak hours of usage and especially so for multi-floor buildings such as the hostel complex of POLIMAS. The consumers require a stable and adequate daily water supply at all times of the day. With the installation of the supplementary steel water storage tanks, it should be able to overcome the existing unstable water supply and the low water pressures can also be overcome with the use of pumping water systems.

Among the suggestions proposed are as follow:

a. The Maintenance Unit of POLIMAS to implement a regular maintenance schedule in order to ensure the water supply system is always in a healthy operating condition to avoid unnecessary supply disruptions.
b. Regular maintenance to identify and replace faulty appliances. Old rusty water pipes should be replaced wherever and whenever necessary to avoid water leakages and wastage, which in some instances, could result in low water pressure for certain parts of the water supply piping system.

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