



**DEPARTMENT OF BUILDING  
UNIVERSITI TEKNOLOGI MARA  
CAWANGAN SERI ISKANDAR,  
PERAK DARUL RIDZUAN**

**USE OF UAC CONCRETE WALL PANELS AS  
INDUSTRIALISED BUILDING SYSTEM IN SCHOOL PROJECT  
AT PUTRAJAYA**

**Prepared by:**

**SYAFIQ NAJMUDDIN BIN JAMALI**

**2016458736**

**DEPARTMENT OF BUILDING**  
**FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING**  
**UNIVERSITI TEKNOLOGI MARA**  
**(PERAK)**

**DECEMBER 2018**

It is recommended that the report of this practical training provided

**By**

**SYAFIQ NAJMUDDIN BIN JAMALI**  
**2016458736**

**Entitled**

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BUILDING SYSTEM IN SCHOOL PROJECT AT PUTRAJAYA**

accepted in partial fulfillment of requirement for obtaining the Diploma In Building.

Report Supervisor : Dr. Mohd Rofdzi ~~Abdullah~~

Practical Training Coordinator : En. Muhammad Naim Bin Mahyuddin.

Programme Coordinator : Dr. Dzulkarnaen Bin Ismail.

**DEPARTMENT OF BUILDING**  
**FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING**  
**UNIVERSITI TEKNOLOGI MARA**  
**SERI ISKANDAR, PERAK DARUL RIDZUAN**

**DECEMBER 2018**

**STUDENT'S DECLARATION**

I hereby declare that this report is my own work, except for extract and summaries for which the original references stated herein, prepared during a practical training session that I underwent at the Public Works Department (Jabatan Kerja Raya) Wilayah Persekutuan Putrajaya for the duration of three months starting from 9<sup>th</sup> September and ended 7<sup>th</sup> December 2018. It is submitted as one of the prerequisite requirements of DBG307 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

Name : SYAFIQ NAJMUDDIN BIN JAMALI

UiTM ID No : 2016458736

Date : 17 DECEMBER 2018

## ACKNOWLEDGEMENT

I would like to express my deepest appreciation to all those who have provided me the possibility to complete this report. They are a special group of people who have been so helpful towards me in my internship period. First and foremost, I would like to thank Ir. Dato' Habbali bin Ibrahim for the opportunity provided to conduct my internship in the Public Works Department of Putrajaya. His team of professionals in my assigned Project Management Sector comprises of Ir. Ibtisham bin Saleh, En. Rizalman bin Darus, Ir. Siti Norbaiti binti Mohd Yusuf, Ms. Zahidawaty binti Abdul Rahman, Mr. Rosleen bin Kassim and Mr. Nik Aman Nik Mansor has been an integral part in my learning process. They have always been happy to share their knowledge so I could learn and develop more thorough understanding of feel for real time projects and theories involved in structures, buildings and civil works analysis. This goes on too to the site personnel in both the companies of SPA Integrated Sdn. Bhd. and Silang Bina Sdn. Bhd. who have been at hand to extend their cooperation in assisting me to better apprehend construction and site administration procedures, site safety and best practices in the industry. To be a part of an amazing team with all of you has been very eye opening and an invaluable experience.

I would also like to thank all Universiti Teknologi Mara (UiTM) lecturers in UiTM Seri Iskandar, Perak that have nurtured me in becoming a better student and person. My deepest appreciation goes to the lecturers directly involved during my internship stint. To Dr. Mohd Rofdzi Abdullah as my Supervising Lecturer, Ms. Azizah Talkis as my Practical Training Coordinator and Dr. Ida Nianti binti Mohd Zin as my Programme Coordinator, I appreciate the time, effort, ideas and encouragement contributed towards the successful completion of my training, the comments on my report and the valuable knowledge shared over the last few semesters.

To close this, I also would not have made it had it not been for my friends whom have been a great support system and my family for their sacrifices over the years.

Thank you so much.

## **ABSTRACT**

Industrialized Building System (IBS) is a construction technique or methods involving placement, installation and assembly of on or off site manufactured building or structure components such as beams, staircases and columns. This report will predominantly discuss in depths about the application of IBS in the Proposed Construction of 35 Concept Classrooms using Panel Wall System for 10 schools in Putrajaya from September 2018- December 2018. This project is handled and assigned to be under the supervision of Public Works Department of Putrajaya. For this project, the Public Works Department has concluded to apply the usage of Industrialized Building System (IBS) in the erection of frame, wall and roof structures in order to accelerate construction processes in the short time given. Focus of this report is channeled to how solid wall panels are installed and erected following correct specifications of the supplier and the demands from the client. This way, the short time span allocated for the overall construction process can be shortened and fulfill the client's need. This report will look at how precast structures in a controlled environment guarantees optimum quality and to evaluate how it accelerated construction processes of 35 one story building structures that serves to afford the mass growth of student intake in Putrajaya schools.

CONTENTS			PAGE
Acknowledgements			1
Abstract			2
Table of Appendices			4
List of Tables			5
List of Figures			6
List of Abbreviations			7
CHAPTER	1.0	Introduction	8
	1.1	Objective	10
	1.2	Method of Study	10
CHAPTER	2.0	COMPANY BACKGROUND	12
	2.1	Company Profile	12
	2.2	Organization Chart	16
	2.3	List of Project	18
		2.3.1 Completed projects	
		2.3.2 Project in progress	
CHAPTER	3.0	CASE STUDY	22
	3.1	Alternatives of Solution	23
	3.2	Proposed Solution	24
	3.3	Analyze of Study	31
	3.4	Issues and Problems	37
CHAPTER	4.0	DISCUSSION	40
CHAPTER	5.0	CONCLUSION	41
CHAPTER	4.0	REFERENCES	42

## **LIST OF APPENDICES**

Appendix A: Project Layout Plan for SKPP 14(1)

Appendix B: Front Plan of Built Up Classroom

## LIST OF TABLES

Table 1.0	Machines and Materials for Solid Concrete Wall Panel	23
Table 2.0	Features Achieved UAC SolidPanel wall panels	28
Table 3.0	Detailed Project Progress for Package 2	37



## LIST OF FIGURES

Figure 1.0	Location of the Public Works Department of Putrajaya	15
Figure 2.0	Organization Chart in Public Works Department of Putrajaya	16
Figure 3.0	Organization Chart in Project Management Sub-sector	17
Figure 4.0	UCO Bhd's UAC solid concrete wall panel used in Project	26
Figure 5.0	UCO Bhd's UAC solid concrete wall panel typical Details	30
Figure 6.0	Physical S Curve Chart for Package 2	38
Figure 7.0	Financial S Curve Chart for Package 2	40
Figure 8.0	Item of solid wall panel in BQ of tender	41

## **LIST OF ABBREVIATIONS**

UBBL	Uniform Building By-Law
CIDB	Construction Industry Development Board
JKR	Jabatan Kerja Raya/ Public Works Department
KKRM	Kementerian Kerja Raya Malaysia/ Ministry of Public Works
JPM	Jabatan Pelajaran Malaysia/ Ministry of Education
IBS	Industrialised Building System
SBSB	Silang Bina Sdn. Bhd.
SPA	SPA Integrated Sdn. Bhd.

## CHAPTER 1

### 1.0 Background and Scope of Study

Industrialized Building System (IBS) or also commonly known as Prefabrication is the assembly and erection of under factory conditions prefabricated building structure, segments and components to join either complete or partially completed structures, enabling the targeted functions or designated performance of the building. (Warszawski, 1999) The various types of IBS offers varieties of ways for clients to achieve a well- designed building that is at least roughly tailored to resident's needs. (Limthongtang R., 2005) Most IBS systems have a clear common shared goal ; to downscale costs wherever possible and to reduce the time span required in an otherwise more conventional construction development routine where materials are transported, erected and completed on site.

IBS is very monumental in its importance to the intended exposure aimed at Malaysia's construction industry as demands for housing, commercial and industrial units are constantly on a hike due to constant investment interests nationwide and internationally. (Fetters T., 2002) This means that accelerated implementations of construction process is the way to go. Its usage plays an imperative part in the lesser total costs incurred all the while allowing for faster and smoother project completion. Guaranteed qualities of materials casted or provided directly from the plant or factory gives it an edge over conventional cast on site materials and structures. There are three main types of most commonly used IBS system which is the Frame, Panel and Cell systems. They are different from each other in regards of the used materials, functionality, application methods, structural configuration, popularity in the industry and its availability in the market.

Out of the three systems mentioned, this study will be focusing on the Panel wall system utilised in the proposed construction of 35 concept classrooms for 10 schools in Putrajaya project. This study will be centered around studying the application of panel wall IBS system used at all of the four construction sites under the contractor, Silang Bina Sdn. Bhd. of package 2 to reduce total costs determined and how it provides for swifter construction processes. The sites are all in the Federal Territory of Putrajaya with every site on average being distanced 1.5km away from each other. In this study, a great emphasis to focus on the benefits from the exercise of IBS wall panel usage in the time period allocated in the contract is placed, which is from the 15<sup>th</sup> of October to the 31<sup>st</sup> of December 2018, a total of 77 days or 11 weeks. The project is expected to be delivered from the contractor to the client just before the 2019 schooling session begins, so it is tailor made and ready for use for the teachers and students.

The works of preparing the site, manufacturing of wall panels, delivery and its installation in the site is taken into account to gauge its ability to assist contractors in faster executions of works due to readymade panels and lesser costs incurred otherwise observed in conventional on site brick walling work methods. This is studied by analyzing the project progress of the actual site and comparing it to the projected project progress. In addition, interim payments of the project work from the client to the contractor is observed for decrement from estimated amount totaled at the start of project. Any changes from these two comparisons is analyzed and used as a major case study.

## **1.2 Objectives**

1. To investigate the reduction of cost incurred and the amount of time saved by using the system.
2. To determine problems and issues concurred during construction stages and to come up with best solutions to solve the problems.

## **1.3. Methods of Study**

Along the period of internship training, enquiry and collection of information and data is very imperative for this study in various forms of methods.

### **1. Observation**

To properly grasp full understanding of the works involved in the manufacture, delivery and erection process of solid wall panels, detailed observation is done for the processes and procedures above. Works off the project sites such as preparation and drafting of documents relating to the works required is done. On the project sites, observation is done for the erection works such as installation of the solid wall panel itself.

## 2. Document reviews

Analyzing and reviewing documents is done as a form of qualitative research for data collection evaluation. Existing documents from the files of the project such as site plans, projection plans and material brochures and approval is reviewed for details to give a deeper and thorough understanding for the project.

## 3. Interviews

A series of structured interviews are developed and carried out to a predetermined set of respondents which is the staffs in the department and the contractors directly involved in the works of the project. This allows for an even and accurate data collection. The data gathered is processed and analyzed carefully and thoroughly.

## **CHAPTER 2: COMPANY BACKGROUND**

### **2.1 Organization Profile**

Public Works Department of Putrajaya (Jabatan Kerja Raya Wilayah Persekutuan Putrajaya, JKRWPP) is established on 2002, holding the mandate from the government of Malaysia to operate and monitor as a technical expert and advisory body for the Federal Government. The Public Works Department is responsible for the oversight and management of established developmental projects and infrastructure preservation to the boards of ministries, departments, statutory bodies and state government services such as roads, buildings structures, airports, harbors and piers.

### **2.2 Roles of the Public Works Department**

The Public Works Department nationwide, namely the Ministry of Works and the Public Works Department of Putrajaya is entrusted by the Federal Government to monitor and oversee;-

1. Planning of development and maintenance of federal road networks, structures, and buildings nationwide;
2. Coordinate implementation of the Federal government and agency projects under the Federal district;
3. Regulate privatized maintenance works of roads, structures, buildings, public and private agencies, government residential houses, public and private government servant houses;
4. Monitor constructions, operations, toll handlings and maintenance of tolled expressways;
5. Development of up and coming indigenous (Bumiputera) entrepreneurs in the construction industry; and
6. Planning and coordination of administration and development of human resources and financials of the Ministry of Works and Public Works Department.

### **2.3 Organization Objective**

To deliver projects that follows accordance of quality, time and cost incurred and given.



## **2.4. Organization Mission**

The Public Works Department aims to:

- Assist client in realizing fundamental objectives and targets and to deliver service through cooperation as a strategic partner agency.
- Standardize processes and procedures of the system to deliver a consistent satisfactory service.
- Provide effective, proactive and innovative asset and project management services.
- Strengthen and improve on available engineering competency.

## **2.5. Organization Vision**

Put a stronghold as a reliable world class service provider and an excellence center for asset, project management and engineering field for an innovative, creative and proactive nationwide infrastructure development.

## 2.6. Organization Profile and Location

Organization name : Public Works Department of Putrajaya (Jabatan Kerja Raya Wilayah Persekutuan Putrajaya).

Address : Level 3, Block C7, Complex C, Centre of Federal Administration, 62582 Federal Territory of Putrajaya.

Telephone :

E-mail : [jkrwpp@gmail.com](mailto:jkrwpp@gmail.com)

### Location of Organization



**Figure 1.0: Location of the Public Works Department of Putrajaya, source: [www.maps.google.com](http://www.maps.google.com)**

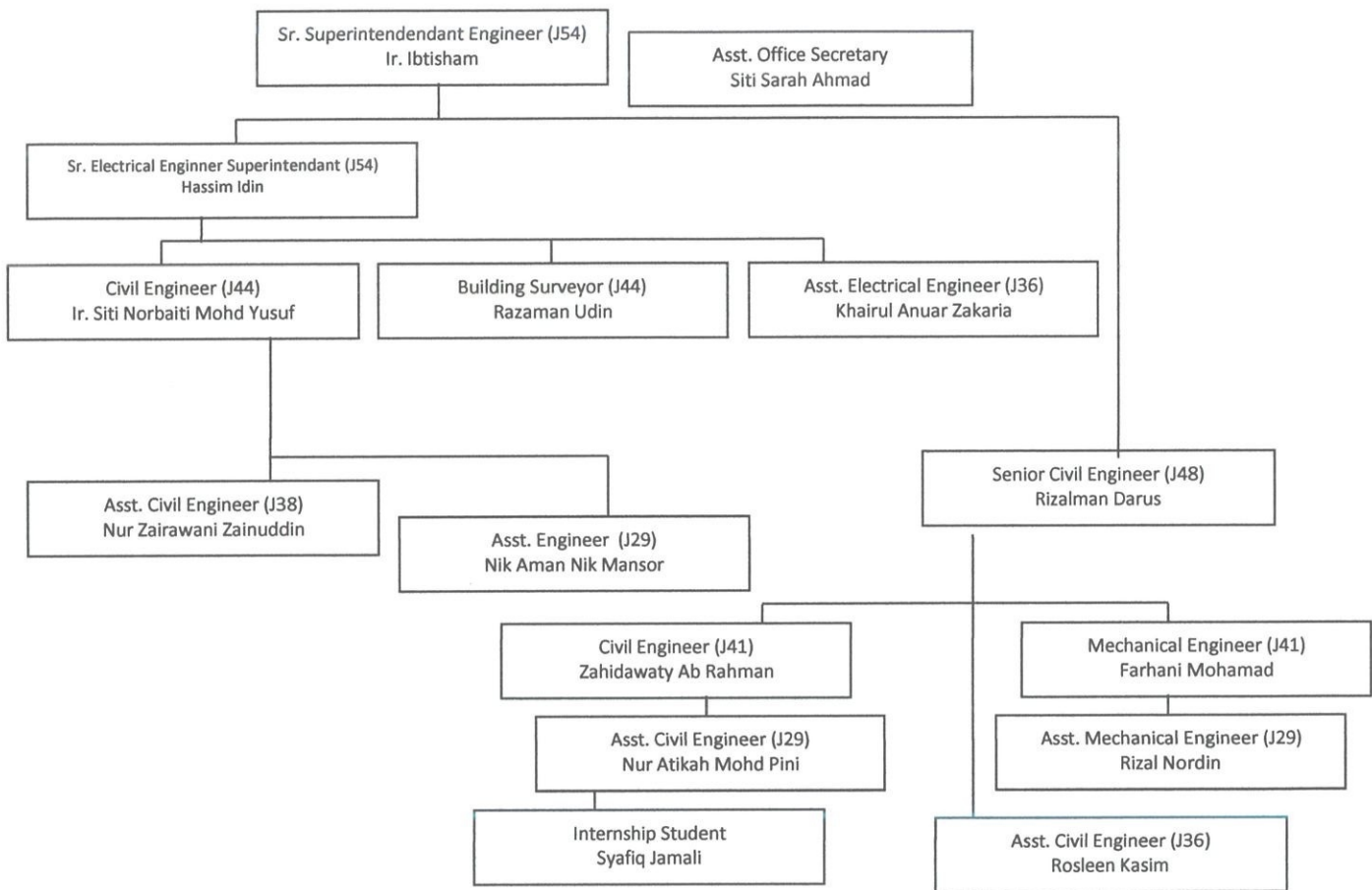
The Public Works Department of Putrajaya is situated in the C Complex of the Centre of Federal Government Administration of Putrajaya. The office is on the 2<sup>nd</sup> and 3<sup>rd</sup> level of the C7 building. Operation hours is between 8:30am to 4:30pm every weekdays.

## 2.7 The Public Works Department's Organization Chart



**Figure 2.0: Organization Chart in The Public Works Department of Putrajaya**  
**Source: Courtesy of Public Works Department of Putrajaya**

### 2.7.1 Organization Chart of the Project Management Sub- section



**Figure 3.0: Organization Chart of the Project Management Sub-sector**

**Source: Courtesy of Public Works Department of Putrajaya**

## **2.8. List of completed projects**

1. Construction of Dataran Pahlawan Square in Putra Perdana – January 2014 to June 2016
2. Management, Maintenance Operations of Civil, Electrical and Mechanical Engineering for 383 terrace unit houses, Federal Government Quarters in Precinct 9 Putrajaya- 2015 to 2018
3. Construction of 2,000 Federal District Houses (RUWAWIP) in Precinct 9 Putrajaya- February 2013 to March 2016

## **2.9. Ongoing projects**

1. Proposed Construction of 35 Concept Classrooms for 10 schools in Putrajaya- September 2018 to December 2018.
2. Proposed Upgrade of Office Space in Puspanitapuri building of the Ministry of Domestic Trades and Consumer Affairs- October 2018 to December 2018.
3. Proposed Renovation of Office Space to Kindergarten in the building of Ministry of Energy, Science, Technology, Environment and Climate Change- September 2018 to December 2018.
4. Proposed Construction of Utility Room in Masjid Sultan Zainal Abidin in Precinct 2- November 2018 to February 2019.

### CHAPTER 3: CASE STUDY

The Proposed Construction of 35 Concept Classrooms for Schools in Federal Territory of Putrajaya is a project endorsed by the Ministry of Education to address the issue of inadequate classrooms to accommodate the constant growing rate of enrolling primary school students in Putrajaya, mainly focusing on concerns to the year ahead. Since this project is addressed in the National Budget for 2019 by the Minister in August 2018, the project is expected to be delivered by the 31<sup>st</sup> of December. This result in a very short period of time allocated for the completion of the project, which is 77 days or 11 weeks. To counter this challenge, the contract requires the contractors to implement the technology of Industrialized Building System (IBS) in their works. Solid wall panels, a branch of IBS system are used in this project to assist in faster wall panel erection time. The application of solid wall panel system is expected and projected to assist in swifter, faster completion of project and to reduce or minimize costs of the works.

The total value projected for the project is RM 8,362,000.00, with the 35 classrooms to be built divided to 10 different schools under two packages. The total value is then separated to two packages, with RM 5,502,000.00 for the first and RM 2,860,000.00 for the second. The tender processes began on 27th September before official site works began on the 15th of October. The first package comprises the works of constructing classrooms for six schools, while the second package allocates for four schools. These 10 schools are situated around Putrajaya, with most of them being in a complex joined with the high schools which also acts as a niche spot for the children of the public servants around the Putrajaya government areas. This requirement for more classrooms is also reflective of the upwards growth of population in Putrajaya itself, as more and more public is attracted to the lucrative and urban lifestyle coupled with peace of serenity found in greeneries and beautiful sceneries observed in the district.

This growth of residents however, lead to increased number of students particularly in the adolescent ages of 12- 20. This trend is expected to rise, therefore the district governance and the Federal government acknowledges that the issue of limited capacity of the schools in Putrajaya must be addressed. The number of students recorded in 2017 attending 14 schools in Putrajaya is a whopping figure of 17,037 (MOE Public Archive Statistics, 2017. Retrieved from web address: <https://www.moe.gov.my/index.php/en/statistik>) This is not helped by the fact that the schools have relatively medium area in kilometer per square feet for a public urban building in a Federal government center. Traffic congestion as observed at certain schools in proximity to administration and public service buildings have been an ongoing concern too, increasing the needs for more classrooms to accommodate the ever hiking figure of student admission in the district.

### **3.1 Alternatives to solve the issue**

Some alternatives have been figured out to counter the issue, which is to encourage admissions into boarding schools and to build a new school in the district. To combat inadequate vacancies for student placements, parents can encourage their children to study in boarding schools away from Putrajaya. This allows the children to have a place to study as well as balancing the number of students in the schools. However, studying in boarding schools will incur higher costs compared to studying in proximity from their parents where costs of travel from work, home and school is considerably lower. It is easier for parents to pick up their children from school if it is closer to their workplaces. Also, not every student has enough interest to pursue studying independently away from their guardians particularly at a young age. As this is up to the guardians to figure out, it is not seen as a reasonable major solution to the issue stated.

Another alternative is to build a new school to accommodate the students inside one new school. Building a new school will help in overall structure of the new student intakes while also providing smoother transition of students into a new environment. Although this seems like a sensible solution, there is some issues to this. Construction of a new school named Sekolah Kebangsaan Putrajaya Precinct 17(3) is already underway in Precinct 17 projected to afford more students. However, the figures expected to enroll in the school is exclusive to a pre- surveyed numbers and therefore excludes the number of students requiring for placements next year. As a result of this new school construction, the Federal government has considerably ran out on budgets to allocate for new schools in Putrajaya, having the dividends set on other matters such as the district's developments and infrastructure maintenance and upgrades. Building a new school will also deplete limited land areas in the district, as more lands are being prepared for developments on a bigger scale. For the reasons stated, a new school is not a sensible solution for the time being considered from the aspects of financial and vacant land areas.

### **3.2 Proposed solution**

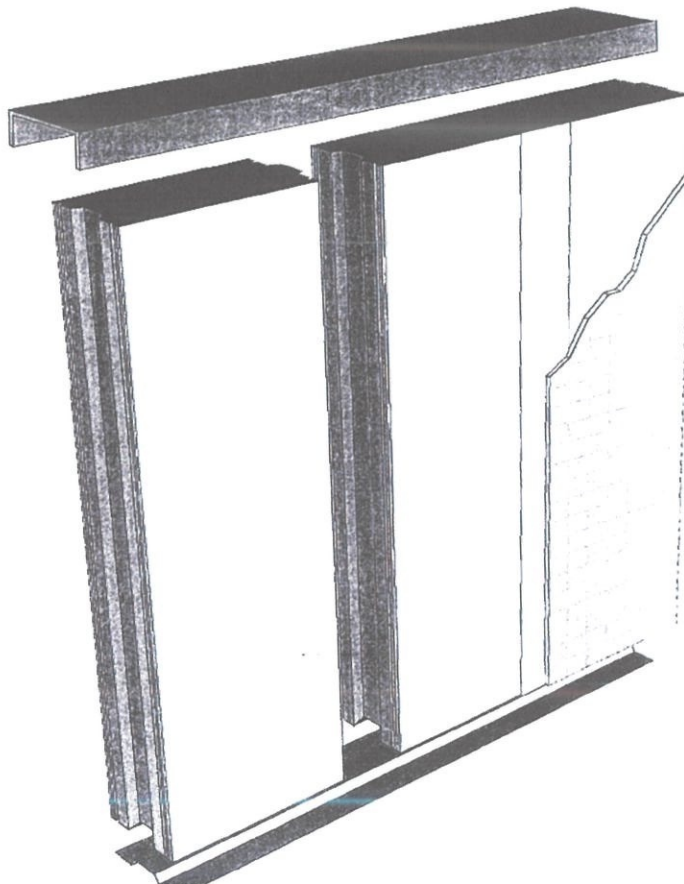
Application of IBS components in construction is very efficient. It improves the quality and affordability of the project, while reducing wastage of materials and resources (Thanoon, W.A.M, 2003) As more students aim for enrollment into primary and secondary schools, a realistic solution is to construct and add more classrooms in the schools around Putrajaya. This is very sensible from a social and financial point of view because the schools in the district have compensable land areas particularly in the football pitches available and is suitable for construction of more classrooms (See Appendix 1.0) Intended location of buildings for the classrooms is also very accessible via numerous access and egress routes. Other than that, building more classrooms will swallow only quarter of chunks from the Federal government and the client's budgets so the concerned side's budgets are not overly compromised (See Appendix 2.0) As the classrooms are one story only with no toilets, the amount of work orders such as processes and procedures observed is lesser than constructing bigger school structures or buildings. This allows for usage of the classrooms as early as January 2019.



From the as-built drawings of the classrooms, it can be observed that a classroom is comprised of only one story with basic generic classroom plan of works. As the classrooms are one story only with no toilets, the amount of work orders such as processes and procedures observed is lesser than constructing bigger school structures or buildings. This allows for usage of the classrooms as early as January 2019. Structures such as consequent floor columns and beams will not be constructed therefore allowing faster project completion and lesser costs obtained from additional works and materials. Exclusion of wet works is the biggest factor of time saving and lesser costs as there is no need for connection of services and piping, waterproofing, purchase of ceramic tiles and more.

To further accelerate construction works to keep up with the deadlines in the contract, a solid wall panel Industrialized Building System (IBS) is applied in the classrooms. UAC Limited's UCO light-weight concrete panel is chosen as the wall materials by the contractor of the second package, Silang Bina Sdn. Bhd.

### 3.2.1 UCO light- weight solid concrete wall panel



**Figure 4.0: UCO Bhd's UAC concrete solid wall panel used in project.**  
**Source: UCO Bhd's Wall Panel brochure.**

UCO light- weight solid concrete wall panels are chosen from various suppliers of wall panel systems as it provides a considerably higher advantage compared to conventional brick wall application system. As this project is a fast track construction, this wall panel system is very suitable as it is ready made in the

manufacturing factories. It is rapidly constructed under strict factory condition and quality controls, therefore there is a guaranteed delivery of performance by the product from the suppliers. The UAC SolidPanel is filled with lightweight concrete infill allowing for easier transportation, handling, finishing and jointing.

This gives confidence towards the contractors to use the product as it is very durable due to numerous achieved successful performance test that is required from enforcement and legislative bodies. Aspects of strength and quality measured and gauged in the tests are the partition stiffness, resistance to structural damages by impacts, surface damages by impacts, door slamming and application of impact from light and heavy anchorages. Passing all of these quality control tests make the solid wall panels as strong and functional as conventional brick walls are. The wall panel gives a “solid” feel, provides soundproofing and a two hour fire rating to the building occupants just like brick walls do. The specifications for the UCO solid light- weight concrete wall panels follows in the table;-

<b>Features</b>	<b>UCO SolidPanel 100T</b>
Width (mm)	600
Thickness (mm)	100
Length (mm)	2400, 2700, 3000
Weight	85 kg/ m <sup>2</sup>
Fire rating (BS 476: Part 22 :1987)	2 hours
Density	800- 900 kg/ m <sup>3</sup>
Sound insulation ( ISO 140- 3:1995 )	STC 43- 4.5mm

**Table 2.0: Features achieved by the UAC SolidPanel wall panels**

**Source: UCO Bhd's Wall Panel brochure.**

### **3.2.2 Advantages of UCO SolidPanel wall panels**

1. Guaranteed quality from a controlled manufacturing condition following to standards of installations, procedures, checklists and practice enforcements.
2. Five times lighter in weight compared to conventional brick wall.
3. Has a permanent expected lifespan.
4. Possess a good sound insulation rating.
5. Ease of construction and installation.

6. Improves site safety and cleanliness as materials are transported directly from the factory for installation
7. Cut and save cost required in installation as there is less need for use of specific additional machineries and ironmongery materials.
8. Insulates temperature very well.

### **3.2.3 Application of UCO SolidPanel wall panels**

1. Suitable for use in wet areas such as toilets and bathrooms.
2. Openings can be made without compromising functions of the wall by methods of drilling and nailing.
3. The solid panel wall is applicable for finishes where required, such as paint, wall papers and tiles.
4. Fittings such as doors and windows can be installed with less works involved.
5. Anchorages can be installed such as hanging pipes, sinks and more.

### **3.2.4. Maintenance of the UCO SolidPanel wall panels**

1. To maintain and repair cracks, simple flush jointing procedures can be done.
2. Repair of spoilt utility connection can be done without damaging the wall panel.

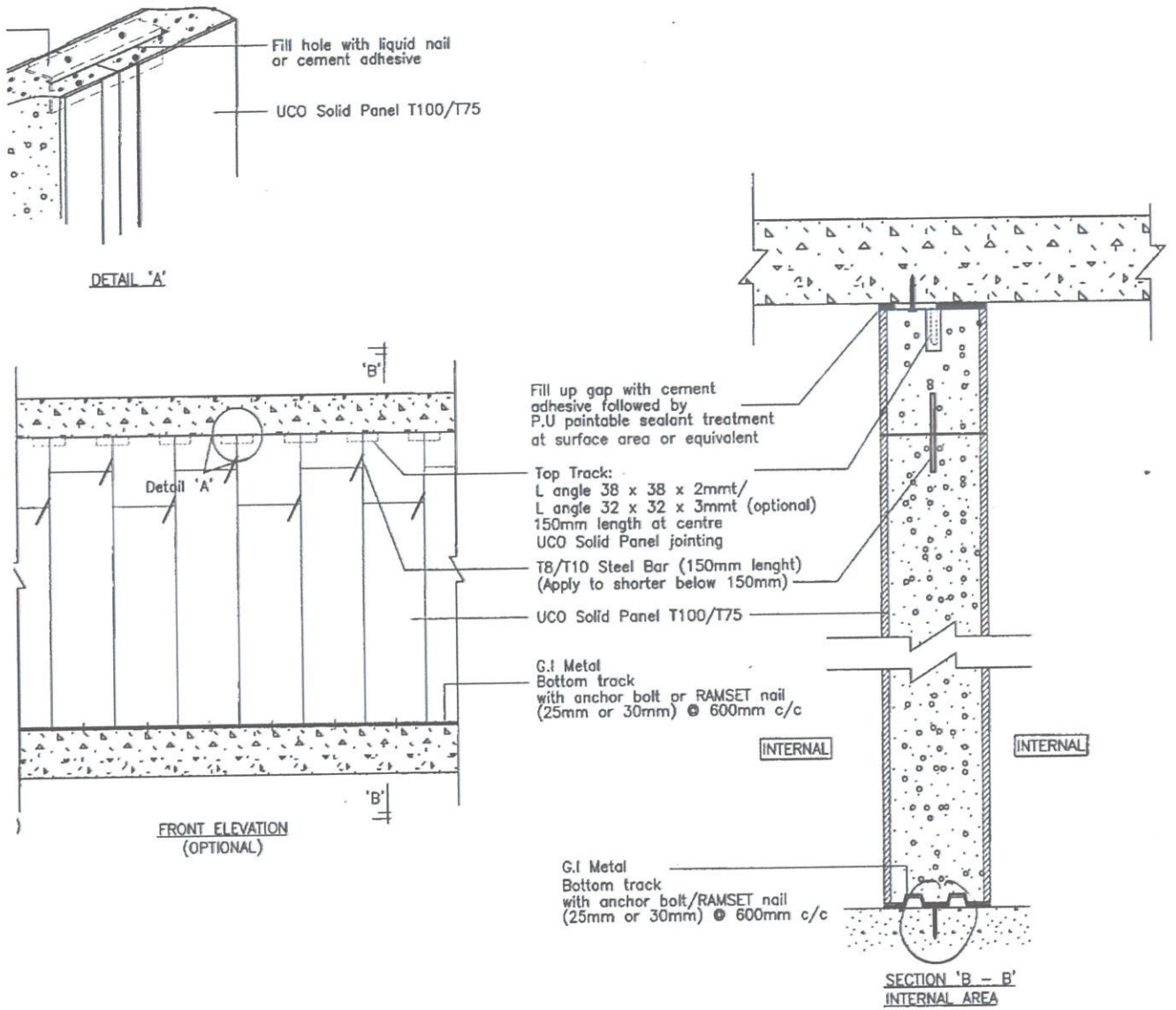


Figure 5.0 : UCO Bhd's UAC lightweight concrete solid wall panel typical detail.

Source: UCO Bhd's Wall Panel brochure

### **3.3.1. Acceleration of project works and shorter construction time**

Industrialized Building Systems (IBS) is famous for its ability to assist contractors in staying in line or exceed with the timeframe of the project. Using prefabricated materials will allow for reduction of construction time periods and save valuable time. Constructions of prefabricated components are done concurrently, giving space for works elsewhere on site (Othuman, M., Md Sani, N., Taib, M., 2014) Prefabricated IBS components can straight away be installed after concurrent works of foundation survey and earthworks are being done. This gives the contractors advancement on work by days and is very important in reducing risks of project delays. The use of readymade panel structures would be able to accelerate structural related tasks such as painting, electrical wiring and plumbing.

In this project, it is important that contractors meet the deadline in the contract scheduled at 31<sup>st</sup> December 2018. The implementation of panel wall system in the project is projected to increase the speed of works done altogether while shortening the time needed to cover specific time consuming works. As of 6<sup>th</sup> December 2018, 25 days before the deadline the contractor for Package 2 of the project has achieved remarkable project progress for the four schools taken. This progress is tabulated below:

	Physical scheduled progress (%)	Achieved physical progress (%)	Ahead of schedule advantage percentage (%)	Advantage (days)
Schools				
SK PP 14(1)	48	94	46	25
SK PP 17(1)	47	86	39	22
SK PP 18(1)	48	88	40	22
SK PP 18(2)	50	90	40	22
Overall	49	85	+36	20

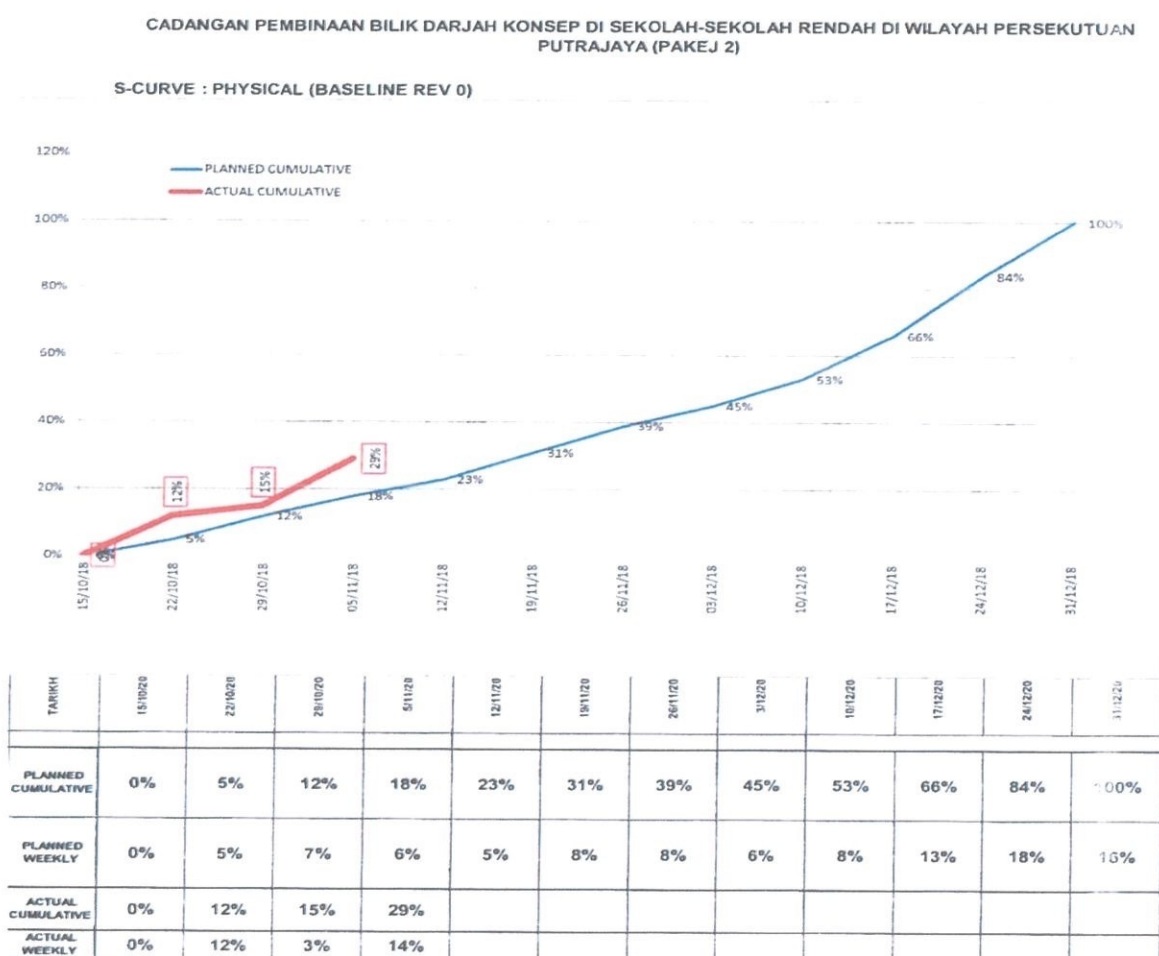
**Table 3.0: Detailed project progress for Package 2**

**Source: Silang Bina Sdn Bhd**

From the table 3.0, the contractor of Package 2, Silang Bina Sdn. Bhd. achieves a 36% overall advantage of project completion which is equivalent to being ahead 20 days earlier. All four of the project site achieved the 80% mark ahead of projected physical progresses of the 50% mark.



The progress of this project is formed into an S curve chart, as below:



**Figure 6.0: Physical S Curve chart for Package 2**

**Source: Silang Bina Sdn Bhd**

As the achieved project progression is in red, the curve is constantly on the rise with a very noticeable gap to the blue that represents projected progression. This indicates that the project is consistently progressing with little to no delays. In conventional brick wall method of constructions, there is always risk of the project works to be delayed by both natural and manmade issues, such as bad weather conditions and material delivery problems. With the application of solid lightweight concrete wall panels, the contractor is able to channel absolute workload distributions without worrying over adverse issues that could cause project delays.

### **3.3.2 Reduction of costs incurred from project**

Application of IBS components in construction is very efficient. It improves the quality and affordability of the project, while reducing wastage of materials and resources. Being able to cut costs on machineries, plants and materials by using IBS is a very desired advantage by the contractor because when the project requires lesser overall costs than the projected cost, the contractor is set to be more profitable and the client will have more freedom of budget allocations.

IBS construction methods are cheaper than traditional methods. Savings are made when IBS is applied, as the factory that produces the IBS wall panels place a standardized net price quotations for its products, contradictory to conventional methods where costs have to be allocated to the purchases of separate materials in bricks, mortars, pipework, electrical and waterproofing. A standardized, easy to install and repetitive designs of IBS wall panel is beneficial in construction of small shop lots, offices and simple residential houses. When minimalistic designs are used frequently, usage of costly temporary supports such as scaffolding is reduced. Cutting down on costs is also possible when fewer workers are employed as costs are reduced in wage payments.

In this project, costs projected to be paid to the contractor by the client is presented in the Financial S curve chart below.

CADANGAN PEMBINAAN BILIK DARJAH KONSEP DI SEKOLAH-SEKOLAH RENDAH DI WILAYAH PERSEKUTUAN PUTRAJAYA (PAKEJ 2)

S-CURVE : FINANCIAL (BASELINE REV 0)

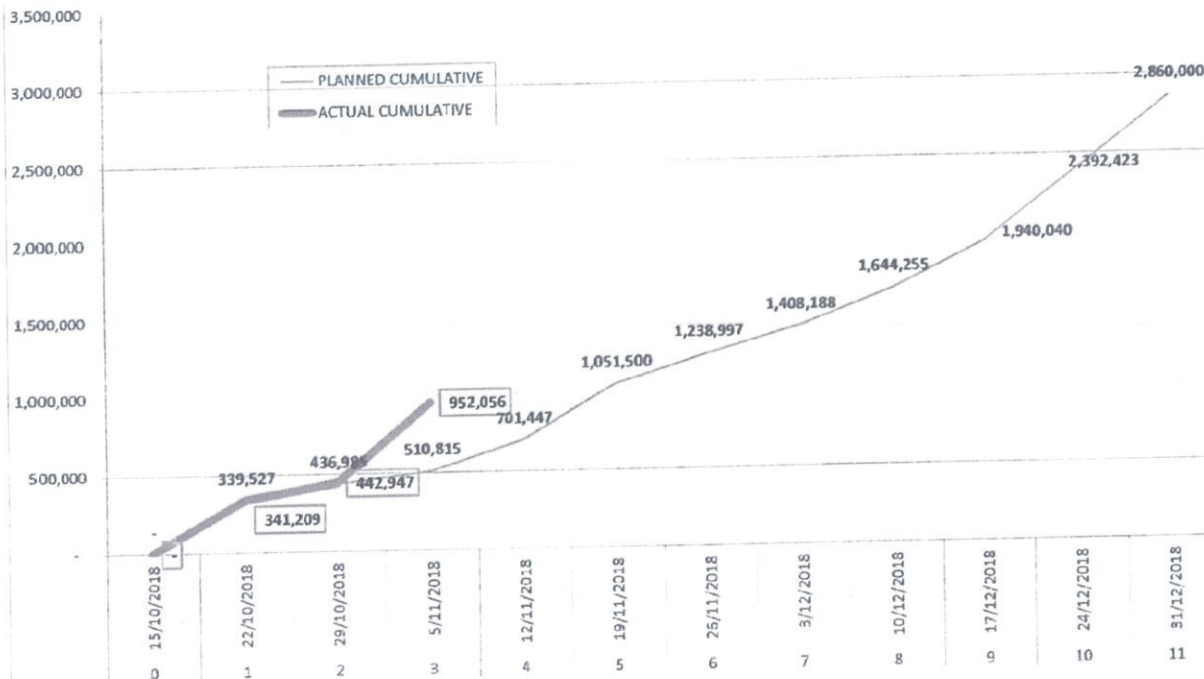


Figure 7.0: Financial S curve chart shows projected payments to be made

Source: Silang Bina Sdn Bhd

A faster and swifter construction process goes a long way to aid in a project's successful delivery to client. To ensure works are done with little disturbance and fuss, contractors will require interim payments to be made on a scheduled time. The client also needs to have the confidence in the progress made by the contractor to provide adequate financial flow. As evidenced in the chart above, as the contractor is consistently performing well, the client is inclined to inject adequate scheduled payments to encourage the contractor. The use of easy to install, quality controlled solid concrete wall panels not only ensure no added cost is observed, it also guarantees reduction of costs otherwise observed in traditional brick walling systems due to lesser itemized materials.

Traditional brick walling systems consists the built up rate of materials such as bricks, concrete and specialist services are itemized separately causing multiple price quotations can cause increment of incurred project costs. From the BQ of the project's tender document, the solid concrete wall panels are itemized as one item. This makes price quotations for the item easier and more convenient and avoids risks of any additional required cost supply.

SEKOLAH KEBANGSAAN PRESINT 5(1) - BLOK 2

BILL NO. 3 - BUILDING WORKS (THREE CLASSROOMS) (Cont'd)											
ELEMENT NO.4 - WALLS											
WALLS											
Supply and fix drywall cellulose fibre cement wall system comprising of aluminium frame, infilled with 16kg/m3 glasswool soundproof insulation and covered bothside with 9mm thick cement fibre board panel and finished with fibre glass beading at ceiling and floor including all fixing accessories. All as per manufacturer recommendation and S.O Approval											
A	100mm Thick (internally and externally)	M2	222	200.00	44,400.00	100%	44,400.00	30%	13,320.00	70%	31,080.00
				To Collection RM	44,400.00		44,400.00		13,320.00		31,080.00

**Figure 8.0: Item of solid concrete wall panels in project tender document.**

**Source: Public Works Department, Putrajaya**

As the wall panels are manufactured off site, lesser materials are built up and rated. For UAC's UCO solid concrete wall panels, all fixings required for enabling the walls to properly function is included altogether at a standardized price, such as insulation foams, beadings and accessories. As opposed to conventional brick wall systems, there is no cost observed for the appointment of specialist, which is a bricklayer. Wages can be channeled into other parts of the work orders, and thus lead to reduction of incurred costs of the project.

### **3.4. Issues and problems encountered during Transportation, Installation and Erection of UCO SolidPanel wall panels and Solutions to them.**

Along the process of applying the use of solid wall panels as a walling feature for the classrooms, there are some issues and problems encountered that requires thorough discussion for solution. These issues are tabled in technical meetings throughout the project and adjustments to solve the issues were adjusted accordingly. The issues encountered were as follows:

#### **1. Issue: Adverse weather conditions**

Since the project site is in an area of open field, the process of installation and erection of the wall panels can be halted by heavy downpour of rain for long periods. Attempt at doing the work in rainy conditions were in vain as the surface of the concrete floor beam must be dry of moisture and debris.

**Solution:** Set and schedule a fixed time period to install the wall panels in dry conditions.

Installation and erection of the wall panels could take up to a week for a single classroom block to be completed, so a suitable time period to do the works has to be determined. These works are scheduled and fit into four days to a week's time period with all works executed on clear sunny days. The wall panels were managed to be installed and erected with little to no minimum fuss by the weather conditions.

## **2. Issue:** Problem of joints between components

Malaysia is a country with an equatorial climate and heavy production of precipitation in the form of rain is expected. On cloudy and windy days, the humidity level in the atmosphere rises. As the project begins at a monsoon season in September, rainfall and windy weather alternates causing high moisture content in the air. This leads to issue of leakage in the joints of the wall panel components, as the moisture penetrates the skim coating under continuous exposure to the monsoon weather. As leakage point manifests, other complications such as dampness by marks on the wall, corrosion and cracks on finished surfaces were observed. This is a common major issue faced by buildings constructed using IBS applications.

**Solution:** Apply more layers of skim coating and jointing compound on joints affected and use waterproof finishing paint

When the wall panels show signs of damage from the leakages, the wall is scraped off of any cracks caused by corrosion to prepare a smooth and even surface. The surface of the affected area is then applied with additional jointing compound and skim coating to ensure continuous or better proofing against moisture. As the layers have been left to dry, waterproof finishing paint in oil and alkyl based paint is used. This will help repel water droplets and moisture away from the joints of the wall panel components thus protect the wall panels accordingly. These works must be done by a specialist in patching up jointing compounds with a supervising project manager.

**3. Issue:** Inadequate storage space for batch of wall panels

As the wall panels are transported directly from the factory to the construction site, the wall panels must be kept in a proper storage space neatly so that minimum fuss and mess is caused. On some construction sites, storage space for batch of wall panels were inadequate. The wall panels had to be left in the open and sometimes vulnerable to rainwater downpour.

**Solution:** Batches of all wall panels are stored in a cabin container next to the project's site office

The batches of wall panels were transported from the factory straight to the cabin container in SKPP14(1). The wall panels were arranged neatly to prevent any damages and exposure to the atmosphere.

## CHAPTER 4.0: DISCUSSION

Referring to sub- chapter 3.3.1 which is the main research point in the study, there is adequate amount of evidences to show for the second objective. IBS systems have long been a peripheral part of the constantly growing construction development in Malaysia, providing advancements in various construction aspects, namely accelerating the speed of works ahead of a predetermined schedule and reduce the overall amount of costs incurred from the application of wall panel system. Shorter time needed to erect a certain IBS structure will help cope with the intensive demands of standard building structures around the country. With a standardized design, costs are also cut down as there is lesser works required to assemble or install a structure compared to conventional construction work methods.

The findings observed in sub- chapter 3.4 encompasses around the in- depth investigation into the issues and problems encountered in the application of the IBS wall panel. These issues and problems are discusses in technical meetings with the attendance of engineers and the project manager to come up with the best solution to solve the issue. Solving this issue meant there is lesser to no delays in the project timeline, therefore allowing the project to be delivered ahead or on schedule.



## **CHAPTER 5.0: CONCLUSION**

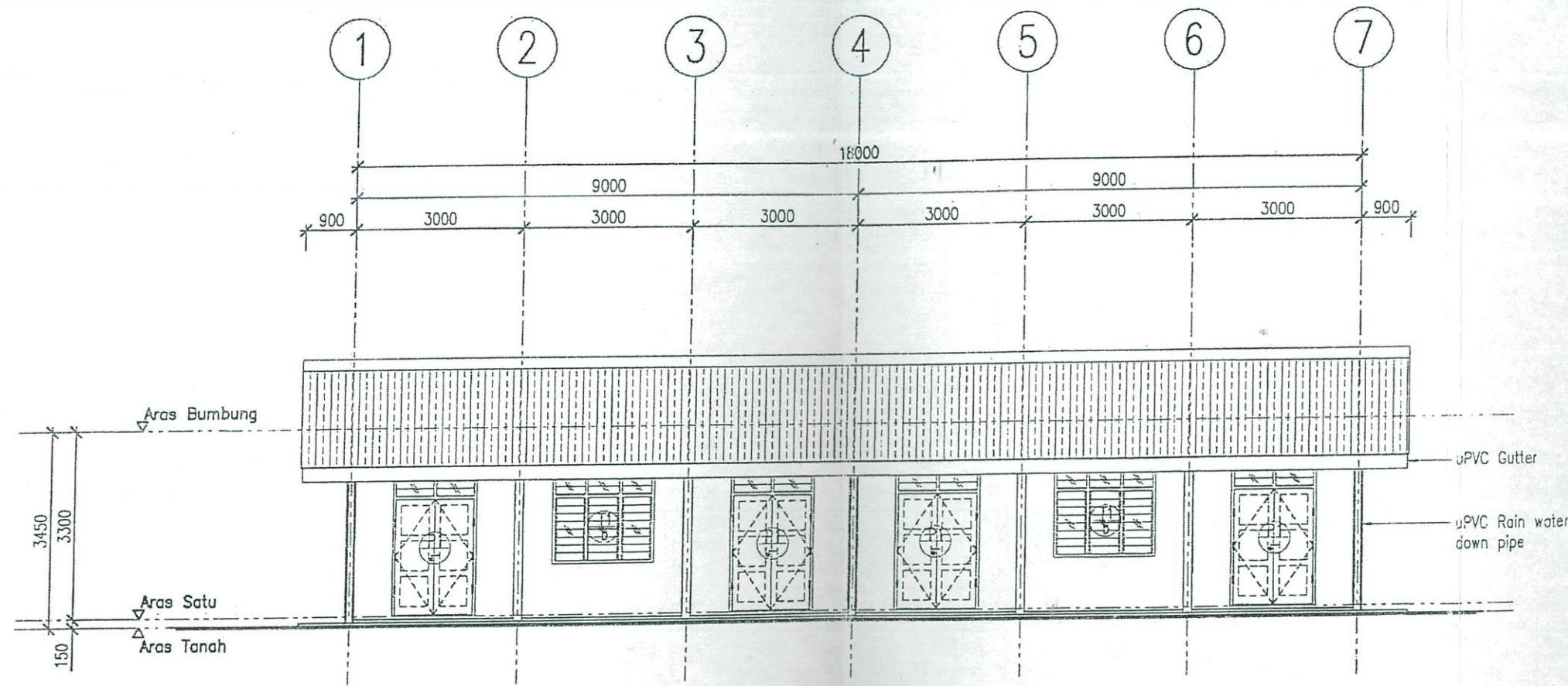
The aims of this study was to thoroughly study the procedures involved in the transportation, installation and erection of the IBS solid wall panels in the mentioned project taking place for three months from September to December 2018 in 10 schools around Putrajaya. This information were derived by methods of detailed observation, online researches and enquiries with Public Works Department's staffs and the staffs of Silang Bina Sdn. Bhd, the contractor for the package project. Although there were some issues and problems encountered during the whole process of erecting the wall panels, coming up with a thoroughly thought-out solution by a cooperative discussion of specialists and the contractors help in putting an end to the issue. Using wall panel system helps massively in the nature of the project as a 'fast-track' project, and is very helpful for the beneficiaries to have their classrooms ready for use before the schooling session begins in January 2019.

## 6.0 References

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## **APPENDICES**

### **APPENDIX A: Project Layout Plan for SKPP 14(1)**



**TAMPAK HADAPAN**  
SKALA 1 : 100



PENGARAH KANAN CAWANGAN ARKITEK DATIN Ar. HJH. MARIANI NOOR SUHUD	PENGARAH BHG. R/B & PEMB. KEPAKARAN NIK AJNUN ZANARIAH NIK ABD RASHID	PROJEK
ARKITEK PENGUASA KANAN ROSNIDA MOHD YUSOF	ARKITEK KANAN HAESATULLAILI ISHAK	ARKITEK ZAWAID MOHD ALI

**PELAKSANAAN BILIK DARJAH KONSEP  
MENGUNAKAN KAEDAH IBS  
- 2 BILIK DARJAH**

TAJUK LUKISAN  
**TAMPAK HADAPAN**

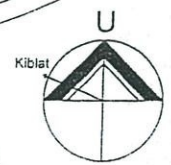
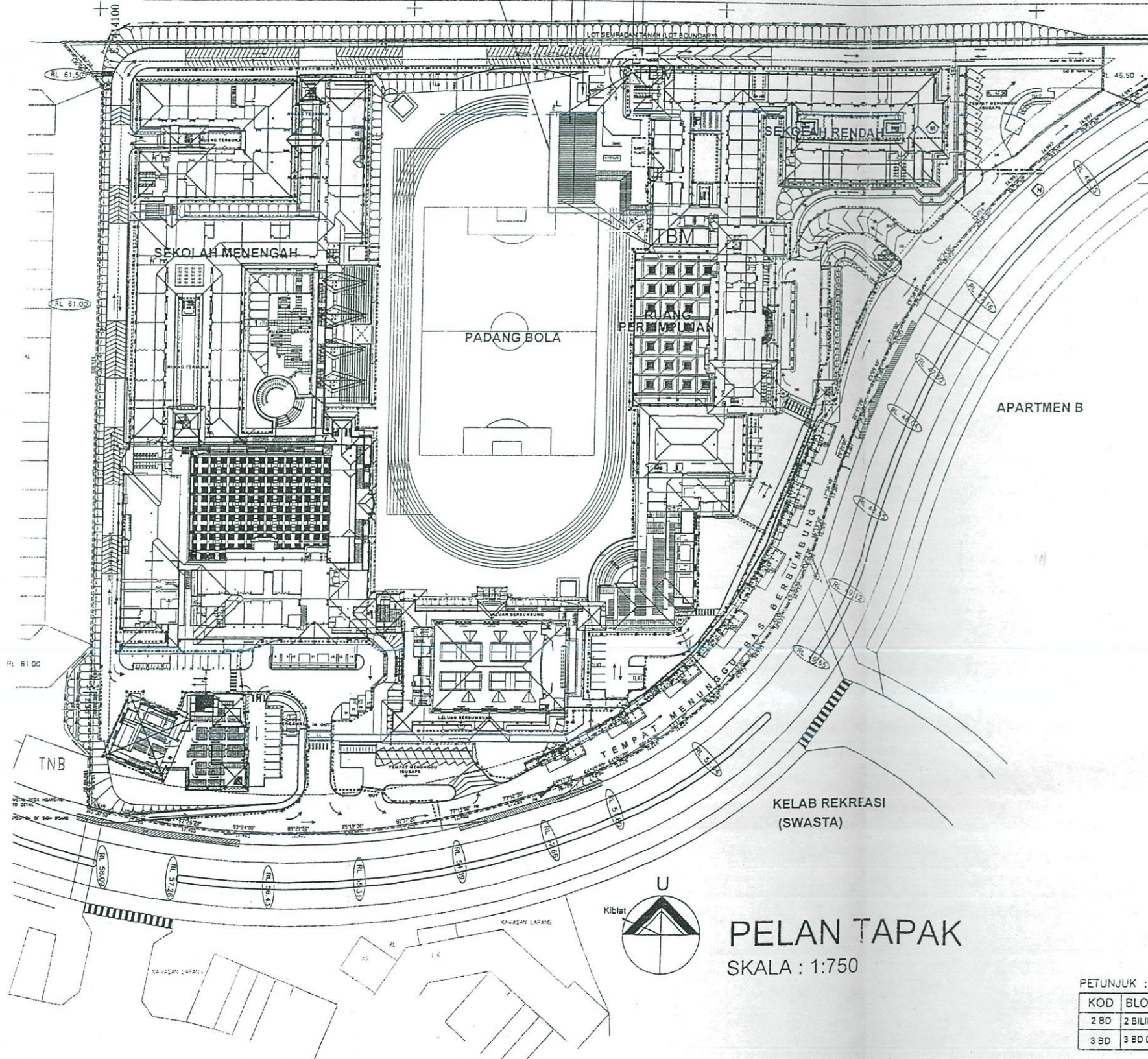
NO. LUKISAN JKR/CA/LK/02/2BD/06			
PINDAAN			
DILUKIS FAZLUN	DISEMAK YAACOB	SKALA 1 : 100	TARIKH 20/09/2018

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## **APPENDICES**

### **APPENDIX B: Front Plan of Built Up Classroom**

- CADANGAN JALAN MASUK SEMENTARA
- CADANGAN KABIN KONTRAKTOR
- CADANGAN BILIK DARJAH BARU
- CADANGAN PAGAR PENGHADANG
- CADANGAN PAGAR PENAMPAN BOLA SETINGGI 2100mm RUJUK LUKISAN BUTIRAN.

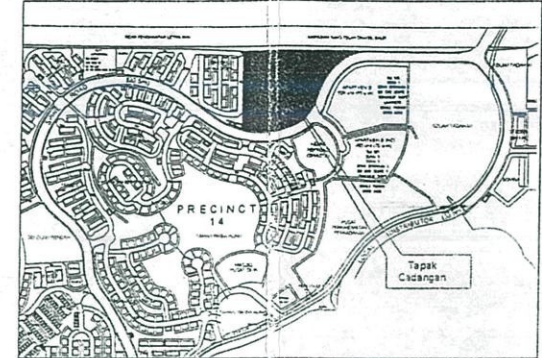


# PELAN TAPAK

SKALA : 1:750



PELAN KUNCI  
SKALA : NTS



PELAN LOKASI  
SKALA : NTS

- Nota :**  
Lukisan ini hendaklah dibaca bersama-sama dengan lukisan berikut :
- 2 BILIK DARJAH - JKR/CA/LK/02/2BD/01-03
  - 3 BILIK DARJAH - JKR/CA/LK/02/3BD/01-03
  - LALUAN BERBUMBUNG - JKR/CA/LK/02/LB/01-05
  - Dan lain-lain lukisan terlibat
- Semua dimensi, kawasan dan panjang perlu disemak dan diselaraskan di tapak oleh pihak kontraktor. Sebarang percanggahan perlu dilaporkan kepada PP dengan kadar SEGERA.
  - Kontraktor perlu menyerahkan bahan untuk kekeluasan Arkitek sebelum sebarang kerja dimulakan.
  - "Setting out point" perlu disahkan oleh PP sebelum kerja-kerja dimulakan di tapak.
  - Kontraktor bertanggungjawab untuk membaiki semua kerosakan atau ketidaksempurnaan kepada pacang, pagar, parit, laluan, pavement, landskap dan lain-lain yang terlibat serta memastikan item sedia ada yang terlibat dalam keadaan baik semasa pembinaan.
  - Jarak panjang pagar penghadang adalah 1000mm kasar sahaja. Kerja-kerja pengukuran semula hendaklah dilakukan semula oleh kontraktor.
  - Setiap binaan tanpa perlu dilengkapi susur tangan kuali dengan tinggi minima 900mm dibina dengan mengambil kira rekabentuk asal di tapak dan mendapat kelulusan PP sebelum kerja-kerja dimulakan.
  - Setiap laluan berbumbung baru yang melat laluan kenderaan hendaklah dibina 'zebra crossing' rujuk spesifikasi jurutera.
  - Semua longkang yang dibina perlu ditutup dengan penutup konkrit rujuk butiran jurutera.
  - Binaan pagar penampakan bola rujuk butiran jurutera.

**PETUNJUK : LUKISAN SENIBINA**

	ARAS YANG DI BENTUK ( 00.00 Meter )
	BLOK BANGUNAN ( BARU )
	LALUAN BERBUMBUNG JENIS A ( BUMBUNG DAN PAPAK ) ONKRIT SAHAJA
	LALUAN BERBUMBUNG JENIS B ( BUMBUNG SAHAJA )
	LALUAN BERBUMBUNG JENIS C ( BUMBUNG MERENTAS JALAN )
	PENANAMAN RUMPUT RAPAT ( BARU )
	GARISAN SEMFADAN LOT TANAH
	KERJA-KERJA MEROBOH ( GARIS PUTUS-PUTUS )
	PAPAN PENGHADANG ( BARU )
	PAPAN PENAMPAN BOLA ( BARU )

**PETUNJUK : KOD BANGUNAN**

KOD	BLOK BANGUNAN	BIL. TINGKAT	UNIT	NO. LUKISAN
2 BD	2 BILIK DARJAH	1-TIINGKAT	-	JKR/CA/LK/02/2BD/01
3 BD	3 BD DARJAH	1-TIINGKAT	1	JKR/CA/LK/02/3BD/01

NO. RUJUKAN LK  
**JKR**  
JABATAN KEAJAIBAN MALAYSIA  
JKR WILAYAH PERSEKUTUAN PUTRAJAYA  
ARAS 3 BLOK C7, PARSEL C  
PUSAT PENTADBIRAN KERAJAAN PERSEKUTUAN  
62502 PUTRAJAYA.  
TEL : FAX :

PELANGGAN  
KEMENTERIAN PENDIDIKAN MALAYSIA  
BLOK E2 KOMPLEKS E, PUSAT  
PENTADBIRAN KERAJAAN PERSEKUTUAN  
62604, PUTRAJAYA  
TEL : FAX :

PENGESAHAN PELANGGAN  
Tandatangan dan Cop  
Saya dengan ini bersetuju dengan rekabentuk yang telah direkabentuk  
Tarikh :

TAJUK PROJEK  
CADANGAN PEMBINAAN BILIK DARJAH KONSEP DI SEKOLAH - SEKOLAH RENDAH DI WILAYAH PERSEKUTUAN PUTRAJAYA - PAKEJ 2  
**SK PRESINT 14(1)**

TAJUK LUKISAN  
PELAN KUNCI  
PELAN LOKASI &  
PELAN TAPAK  
SAIZ A1 SKALA : 1 : 750

T.T PENGARAH JKR  
DATO' Ir. HASSALI BIN IBRAHIM  
PENGARAH  
JKR WILAYAH PERSEKUTUAN PUTRAJAYA  
ARAS 3 BLOK C7, PARSEL C  
62502 PUTRAJAYA.

T.T ARKITEK PENGUASA KANAN  
a) Saya memperakui bahawa perincian-perincian dalam plan-plan ini adalah menurut kehendak-kehendak Undang-Undang Kaeli Bangunan Seragam (Undang- 1986 dan saya setuju terima tanggungjawab penuh dengan sewajarnya

T.T ARKITEK KANAN  
NUR FADZILAH SINTI MO NOOR  
ARKITEK KANAN  
JKR WILAYAH PERSEKUTUAN PUTRAJAYA

T.T ARKITEK  
EMILIA AZREENA SINTI ABD GHANI  
PEN. PENGARAH (ARKITEK)  
JKR WILAYAH PERSEKUTUAN PUTRAJAYA

Tarikh : SEPT 2018 Disyork : SALLY SUMALI  
Disyork : EMILIA HUSNA  
No. Fail  
No. Lukisan  
JKR/WPP/SKP 14(1)/16/18/SP1  
PINDAAN  
Bil. Tarikh Pindaan