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Theme Paper

Projection of Construction Resources

THE METHODOLOGY

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CONTENTS

EXECUTIVE SUMMARY

Through a five-year Malaysia Development Plan, the Government implements basic and social infrastructure development projects to meet the nation's development needs and fulfilling responsibilities to the people. In line with government-provided facilities, the private sector also implements projects to meet the demand from other economic sector and to spur economic growth. Major Government and private investments implemented simultaneously are often at risk of delay due to issues of supply of construction resources such as building materials and difficulty in procuring the resources. The equilibrium between demand and supply of materials; ensuring material prices stability; conformance of materials to quality standards are among the biggest challenges faced by the Malaysian construction industry pertaining to material resources.

There is a significant need for CIDB to establish a credible model in projecting the construction demand for a certain reasonable foreseeable future. This has become imperative so as to enable CIDB to undertake its statutory function under the Section 4(1), (b) and (e) of Act 520. CIDB initiated a special methodology for the projection of construction and material demand known as PROJEXIS. Projections are generated based on the estimated progress of the construction works that have been awarded according to the work progress cycle that is translated from a series of S-curves, experienced from various projects.

INTRODUCTION

Overview of the Malaysian Construction Industry

In 2017, the Malaysian economy recorded a growth of 5.9% (2016: 4.2%), with a moderate growth of 6.7% (2016: 7.4%) in the construction sector. The construction sector contributes 4.6% or about RM53.4 billion to the Malaysian GDP (2016: 4.5%; RM50.1 billion).

There are 1.3 million construction personnel or about 8.7% of Malaysia’s total workforce (14.6 billion) in 2017. This proves that the construction industry provides an extensive array of career and business opportunities to the Malaysian population. Growth is driven by the increasing demand for infrastructure projects such as MRT; LRT; and power plant with highways; sewerage; and various non-residential and residential projects.

In terms of the number and value of new construction projects awarded in 2017, the Construction Industry Development Board (CIDB) Malaysia recorded 7,981 projects worth RM181.2 billion (USD43.8 billion) (2016: 8,127 projects; RM255.9 billion, USD61.8 billion). The private sector has been the main engine of growth for construction.

Function of Construction Industry Development Board Malaysia (CIDB)

CIDB is the regulatory body for the construction industry in Malaysia. CIDB is responsible for developments and activities associated with the construction industry including establishing a credible model in projecting the construction demand and major resources for a certain reasonable foreseeable future, with a certain level of confidence based on acceptable assumptions. This has become imperative so as to enable CIDB to undertake its 14 statutory functions under the Section 4(1) of Act 520. The functions related to this report are specifically (b) and (e), of which are as follows:

(b) To advise and make recommendations to the Federal Government and the State Government on matters affecting or connected with the construction industry; and

(e) To provide consultancy and advisory services with respect to the construction industry.

Construction Resources

In project management, resources are required to carry out the project tasks. They can be land; contractors; building materials; construction personnel; machineries and equipment; facilities; investment or funding; and the like.

As for Malaysia, major Government and private investments implemented simultaneously are often at risk of delay due to issues of supply of construction resources such as building materials and construction personnel. Any deficit of any one of resource will greatly affect the project implementation. This has been experienced during the many times of various economic cycle. For instance, the steel and cement market was fully liberalised with full duty exemption to all importers in November 2018. For steel, the number of steel products liberalised expanded from 3 to 57 of the Customs Tariff Code. Out of 57, only 15 products were identified for use in the construction industry. This was due the steel price increase and high demand of steel bars and cement both domestically and globally. Domestically, the high

demand was due to many construction projects being implemented concurrently has also led to a price increase of these materials.

According to a research undertaken by CIDB in 2012, it was found that typically building construction costs are contributed by the cost of 3 major resources that are construction materials (67%), construction personnel (31%) and machineries and equipment (2%) assuming overheads and profit margin of 13%. As construction materials contribute the highest percentage of construction cost, this paper will then discuss on the methodology to project the material demand.

Definition of Construction Works and Materials

According to CIDB Act 520, Section 2(1) the definitions of construction works is stipulated as:

"construction works" means the construction, extension, installation, repair, maintenance, renewal, removal, renovation, alteration, dismantling, or demolition of—

(a) any building, erection, edifice, structure, wall, fence or chimney, whether constructed wholly or partly above or below ground level;

(b) any road, harbour works, railway, cableway, canal or aerodrome;

(c) any drainage, irrigation or river control works;

(d) any electrical, mechanical, water, gas, petrochemical or telecommunication works; or

(e) any bridge, viaduct, dam, reservoir, earthworks, pipeline, sewer, aqueduct, culvert, drive, shaft, tunnel or reclamation works,

and includes—

(A) any works which form an important and integral part of or are preparatory to or temporary for the works described in paragraphs (a) to (e), including site clearance, soil investigation and improvement, earth-moving, excavation, laying of foundation, site restoration and landscaping; or

(B) procurement of construction materials, equipment or workers, necessarily required for any work described in paragraphs (a) to (e);

While, the act also defines construction material as follows:

“construction material” means any type, size and nature of material, initial, temporary, intermediate or finished, whether manufactured locally or imported used for the purposes of construction industry.

CONSTRUCTION DEMAND

Among all major economic sectors, the importance of the construction industry is unique regardless of whether the country is underdeveloped, developing or developed. For instance, the Malaysia construction industry is subjected to annual national budget statements. The houses, offices, roads, factories, stadiums and shopping malls are all part of the outputs of the construction industry, among other capital or investment goods. Even though the construction sector contribution to the GDP in Malaysia is relatively small (2017: 4.6%), the construction sector has always played an important role in creating downstream demand through backward linkages, upstream demand through forwarding linkages and along the construction supply chain. Any investment by other economic sectors will create demand for construction works as construction is a demand-driven sector. Below are some of the construction activity advantages:

1. Strategic tool for achieving sustainable development.
2. Construction output as growth-initiating and growth dependent.
3. Contributes significantly to the economy.
4. Contributes to Gross Fixed Capital Formation (GFCF).
5. Provide outputs to most industries and utilises the outputs of many industries.
6. Contributes significantly to the informal sector.
7. Income generation and re-distribution.
8. Employment generation.

CONSTRUCTION MATERIALS

It is a matter of fact that construction materials represent a major expense in implementing construction projects. The equilibrium between demand and supply of materials; ensuring material prices and wages stability; conformance of materials to quality standards; and level of construction personnel competency engaged in construction projects are among the biggest challenges faced by the Malaysian construction industry.

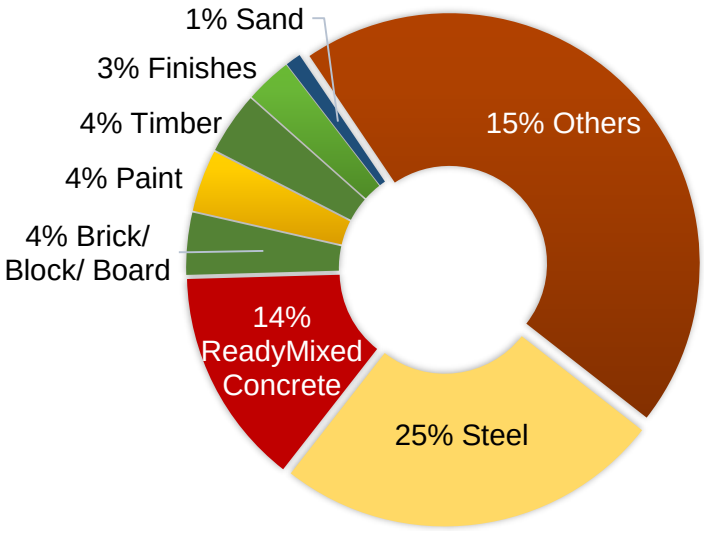
Construction Material Prices

The prices of building materials can be influenced by internal or external factors. Internal factors include Government policy; the imposition of goods and services tax; prices of petrol/ diesel and electricity tariffs due to oil subsidy rationalization; restriction on the import of specialized construction materials; long-term development plan; housing and property policies; interest rate (BLR); supply and demand in the real estate market; and economic conditions; and investor confidence. External factors include the international market forces affecting the world energy prices; and raw materials (such as coal, scrap iron, copper); global economic condition (market volatility and trade war); etc..

In many cases, sudden and unexpected increases in construction material prices can lead to a dire effect on the implementation of construction projects, particularly during the construction phase. In relation to that, CIDB had developed a cost information system called myN3C (The National Construction Cost Centre) to strengthen the role of CIDB in support of the development of government policies and the evaluation of building market scenarios through cost trends, cost analysis and cost index. The main objective of myN3C is to provide construction cost information among other things, including the building materials prices.

With reference to the research undertaken by CIDB in 2012 mention earlier, out of 67% of construction material prices, 25% contributed by steel followed by ready-mixed concrete at 14%. These two materials constitute 34% of the total building cost (material, labour and plant costs). Other material such as timber; paint; and brick/ block/ board represent at 4% each.

Chart 1 Average Cost of Building Materials in the Construction of Building



Source: CIDB Malaysia

Conformance of Construction Materials to Quality Standards

In Malaysia, construction material must comply with certain mandatory standards. The objective is to ensure compliance with Malaysian Standard (MS) and to avoid the use of non-quality products. While CIDB acknowledge, Malaysia need to ensure more building materials being comply to the MS and efforts are being made to ensure as many materials will be subjected to the MS in the future. Currently, 13 categories with 70 types of products listed under Schedule 4 of CIDB's Act are required to obtain a Standard Compliance Declaration (PPS) from CIDB.

The priority in determining a product to be listed in Schedule 4 of the CIDB Act is the substance/ product that may affect the integrity of the structure or function of a construction work which may threaten public safety and material/ products that may have a negative impact on the environment.

Some of construction material need to be import because of it is not produced in Malaysia or cheaper price. The importer required to obtain CIDB's Certificate of Approval (COA) to ensure that the materials meet the MS. These construction materials include those that are:

i. Manufactured in the country of origin and brought in for use in the country.
ii. Manufactured by local manufacturers then exported and imported back into the country.

iii. Imported materials to be manufactured by local manufacturers and products produced exported abroad.

There are two methods for importing construction products or materials. The first method via Product Certification (PC). CIDB will assess and approve the local or foreign Certification Body (CB) as proposed by the importer. If a local CB is used, the CB will conduct sampling and testing prior to the issuance of PC. If a foreign CB is used, the CB will conduct the necessary assessment, issue the PC and arrange for a one-time factory visit for CIDB. All products will be tested and verified by CIDB at each Custom's gate (port, CIQ, airport, bonded warehouse) prior to the issuance of COA.

The second method, referred to as the Full Type Test Report (FTTR) method, commences with the approval of local or foreign lab by CIDB as proposed by the importer. The Inspection Body (IB) conduct the sampling while full type testing will be done by the lab. If a local lab is used, sampling will be conducted at the country of origin followed by full type testing by the lab. The importer will then apply for the COA from CIDB. The product will be tested and verified by CIDB at each Custom's gate (port, CIQ, airport, bonded warehouse) prior to the issuance of COA.

Supply Scenario of Major Construction Materials

For the purpose of discussion, 4 major materials have been identified to be discussed.

The first being steel. In recent study conducted by Ipsos Business Consulting in 2017, 19 plants under 12 companies are involved in the manufacturing of long steel product (primary billets, bars and wire rods) in Malaysia. In 2016, these plants have a combined total production capacity of 15.6 million MT per annum. Production of steel finished products registered at 6.8 million MT. It should be noted that production capacity does not reflect the actual production. For long products, even though Malaysia has sufficient production capacity to cater to most local demand, a significant amount of the products especially wire rods was still imported. In 2016, China has become the largest source of iron and steel at 3.7 million MT. Other source countries of Malaysia's imported iron and steel products are Japan (1.7 million MT); Korea (1.0 million MT); Taiwan (1.0 million MT); and Vietnam (0.2 million MT). On the other hand, the top exported steel products are typically pipes and tubes (flat products). Top exporting destinations are Thailand (312,000 MT); Korea (307,000 MT); Indonesia (226,000 MT); Singapore (224,000 MT) and Australia (78,000 MT).

Ready-mixed concrete is produced by mixing the raw material gravel (50 – 60%); sand (30%) and cement (10 – 20%) with water. All of this materials be distributed to batching plant, mixed and process according to client's need and specification.

The ready-mixed concrete industry in Malaysia has about 150 players and approximately 1,000 ready-mixed concrete batching plants (some of which are also owned by contractors, developers and precast concrete manufacturers) in 2015. Since ready-mixed concrete is a perishable material and must be delivered to the project site within 1-2 hours, the batching plants are highly decentralized and are typically located near the project sites. Due to nature of ready-mixed concrete, there is no trading (import and export) of this material. Ready-mixed concrete production (including dry mix) stood at 12.5 million m^3 in 2015.

There were a total of 771 sand and gravel mining permit holders in 2015 (369 companies and 402 individuals). The permits in a majority of the states (8 out of 12) are predominantly owned by registered companies or enterprises. The East Coast region (Pahang, Kelantan and Terengganu) and Perak are the states with higher proportion of individual permit holders. Total sand production for 2015 and 2016 are 40 and 45 million MT respectively compared to Malaysian reserve of more than 809 million MT (study by Department of Mineral & Geoscience, Malaysia). There were minimal import and export activities of sand and gravel in Malaysia, around 11,000 MT for import and 1,500 MT for export in 2015.

Ipsos reported, as of Q2 2017, there are 8 cement manufacturers with 18 plants in Malaysia. Total estimated cement production capacity is 40.2 million MT. Out of these plants, 11 are integrated cement plants (production of both clinker and cement). Production of cement in 2016 is around 22.3 million MT. In 2016, the export volume for cement (portland, white portland, aluminous, and other types of cement) is about 1.2 million MT. Meanwhile, imported cement is small at 456,000 MT.

Table 1 Construction Material Estimated Production Capacity

Material	Number of Manufacturer/ Company	Number of Plant	Estimated Capacity	Production	Data as of
Long Steel	12	19	15.6 million MT	6.8 million MT	2016
Ready-mixed Concrete	150	1,000 (approximate)	N.A	12.5 million m^3	2015
Sand and Gravel	771 (permit holder)	N.A.	N.A.	*12.5 million MT	2015
Cement	8	18	40.2 million MT	22.3 million MT (2016)	Q2 2017

Source: Market Review of Building Materials in the Construction Industry under Competition Act 2010 Publication

*Department of Mineral & Geoscience, Malaysia study

Note: N.A. – Not Available

PROJECTION OF CONSTRUCTION AND MATERIAL DEMAND

Movement of material prices generally dictates by supply and demand. Many observations from past trends shows that insufficient supply of construction materials will result in a spike in the materials price. This will then bring about a sudden surge in demand. Therefore, it is important to be able to pre-empt materials demand through a projection exercise. Applications of this projections are important to the Malaysian Construction Industry for many reasons:

1. The foremost being that it can be used as budgetary control measure whereby industry players are able to plan ahead collectively on materials usage based on a common guideline where average prices and quantities are provided via the use of constants. Thus, indirectly encouraging uniformity in building works and cost efficiency.

2. The historical and current actual demand for construction materials and statistics set a trend line for forecasting the future path in the country's economic growth. ~~since~~. It can assist the government and its relevant agencies to better strategise the country's development during the master plan periods.

3. A periodical review of the statistics can gauge a country's development value over the analysed period. The statistics can also be used to justify the country's rate of growth in comparison to development value. It can also be used as a reference by many parties especially the construction industry players including, consultants, academicians and

students. These reviews also will lead to potential studies on construction methodology and perhaps the development of better innovations in building technology.

4. The development of a standard projection methodology for construction demand will create a database for which, current and future requirements for construction materials in relation to awarded and ongoing projects based on project timelines, can be determined. This serves as a fundamental basis for CIDB to offer consultative recommendations to the Federal and the State Governments on matters related to the construction industry. Hence, swift action can be made whenever there are abnormal deviations in any projected construction demand and construction materials trend within the review period; resulting in better management of materials, and financial resources.

Following this observation and in an effort to provide an innovative and comprehensive advisory service in the Malaysian construction industry, CIDB initiated a special methodology for the projection of construction demand known as PROJEXIS. The system collates raw data from several sources as indicated below:

1. Awarded projects information from CIDB's database;
2. New projects announcement by the government and private sector; and
3. Construction materials prices.

Statistics gathered from these sources are then incorporated into the development of a methodology, which enables the determination of a standard projection for construction demand in terms of work done and materials demand. The projection of construction demand is based on the confidence levels and other assumption.

Guidelines on Projections

Realising the importance of having a system to project construction demand, the PROJEXIS system was established, intended to reasonably foresee the demand for following elements:

1. Projection of construction demand (work done and upcoming work); and
2. Projection of materials demand.

In establishing the projection model and system, CIDB had initiated the development of the following methodologies in establishing constant of construction materials, S-curve model and integration of material constant on S-curve model.

1. Established Constants for Major Construction Materials

In order to provide a projection methodology for construction demand, it is important that a constant should be ascertained for measuring construction demand and materials demand. CIDB undertook a study in establishing standard constants of construction materials that are used in building constructions according to categories of construction projects identified. The construction categories are:

i. Residential;
ii. Hotel;
iii. Office;
iv. Commercial and industrial;
v. Education;
vi. Health;
vii. Social facilities;
viii. Safety; and
ix. Auxiliary building.

This constant is established by comparing various Bill of Quantities (BQ) in the above categories. It is noted that there are 8 major categories of materials that significantly contributed to the construction cost. From this, by using cost comparison, this study managed to establish a typical constant for the individual building material.

These constants were adopted in the creation of a model that calculates the demand for 8 major construction materials in relation to the projected construction demand. They are:

i. Steel reinforcement;
ii. Ready mixed concrete;
iii. Plywood;
iv. Bricks;
v. Paint;
vi. Sand (finishes);
vii. Glass; and

viii. Cement (finishes).

Based on the total value (Malaysian Ringgit) and quantity of projected demand for construction materials, details of projection is elaborated into annual demand. As such, occurrences of demand for major construction materials from the total progress of projected construction demand are developed.

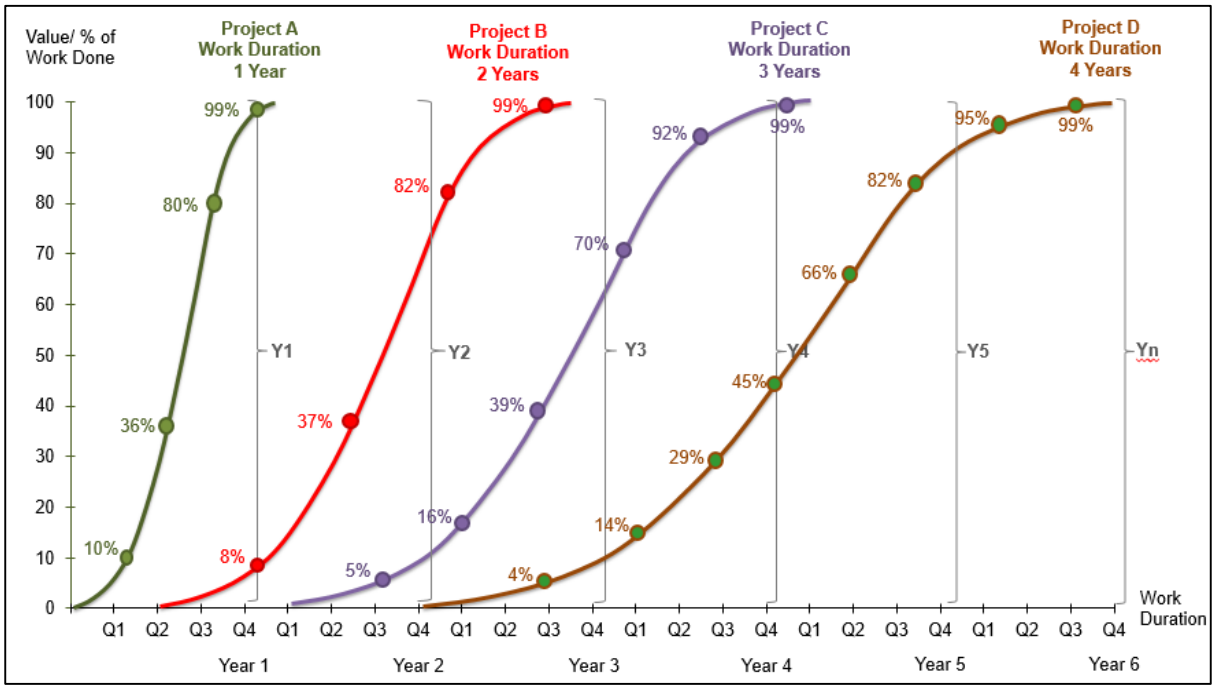
CIDB has collected historical data for this empirical study (standard constants) from 114 projects, all valued at more than RM500,000 each; with individual project commencement and completion dates. Respondents for the study are relevant public and private sectors stakeholders comprising of clients, consultants, contractors and suppliers. BQ were collected from respondents who have secured projects related to relevant construction type. For now, this study is limited only to building and civil engineering projects. Categories of building projects are as mentioned earlier, while civil engineering projects are infrastructure-related projects that cover utilities; transportation and road networks; drainage and irrigation; landscaping; and the like.

2. Development of S-Curve Model

Based on previous studies (standard constant), CIDB has establish the following work progress expenditure based on S-curve model using projects' duration. S-curve is a project management tool that tracks progress over time and allows for a quick visual to determine project status.

To establish a projection model, CIDB has initiated the development of a methodology in determining a standard S-curve construction model for each category of construction projects awarded. This study was done across 150 types of project (e.g. terrace houses, shopping complexes, office buildings, hospitals, sewerage and roads) within 4 years of construction period, divided into 23 sub-categories. The S-curves are ascertained by formula that uses historical data from similar construction projects, and are based on simple average (mean) whilst the constants were developed based on multi-completion periods (duration in years). The S-curve indicates the levels of work done on a project at progressive junctures from project's commencement to completion and hence allow for calculation of the materials at any stage of project completion as illustrated in Chart 2 below.

Chart 2 Models of Work Progress or Construction Output



Legends: A – Construction 1
B – Construction 2
C – Construction 3
D – Construction 4

3. Integration of Materials Usage on S-Curve

Constants for materials used at various stages or elements of construction were subsequently applied to the S-Curve of relevant projects. Employing the PROJEXIS system, raw input lists of projects from varying categories and completion periods were matched to produce the output of “work done” and “upcoming work”:

i. Based on the different construction stages of project implementation, the related materials used during a construction stage can be identified and calculated for every project.

ii. The sum of total material to be used for each project, can be equate as the total projected construction materials demand. Occurrences of demand for major construction materials from the total progress are developed as illustrated in Chart 3.

Chart 3 Material Used by Project Element

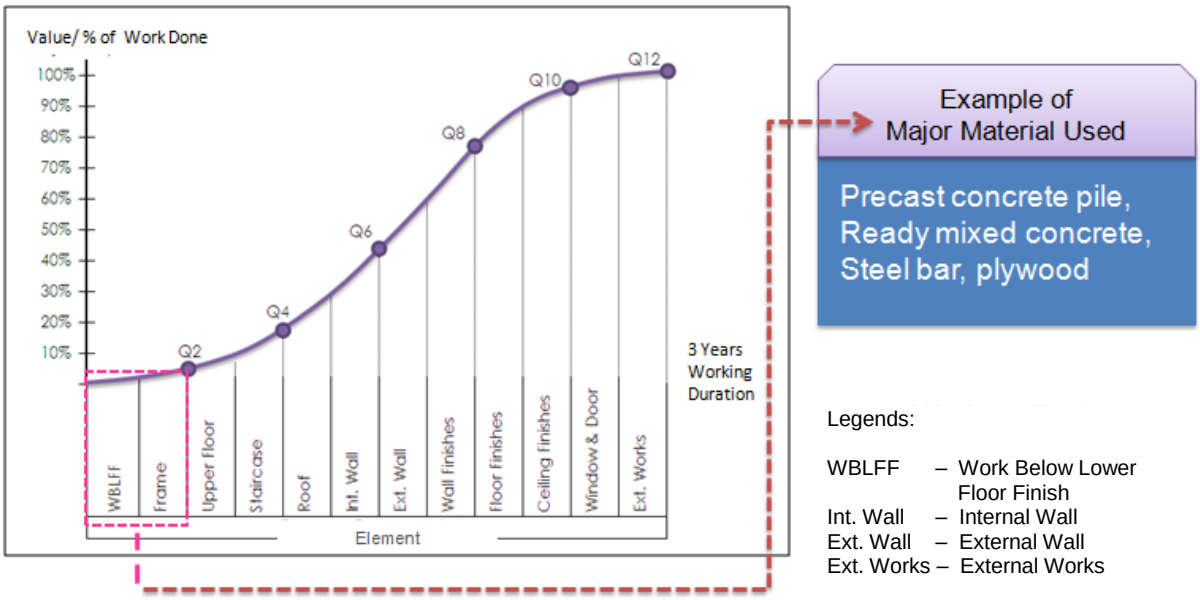


Chart 3 is an example of project elemental breakdown for certain type of throughout the 3 years of project timeline with related materials used in respective elements. Highlighted on the graphic are the element of *Work Below Lower Floor Finish* and *Frame* to be carried out with major materials used. These may include concrete piles, ready mixed concrete, steel reinforcement and plywood. Once the same type of project is keyed-in into the PROJEXIS system, it will be matched with the above constants and related materials required at every construction element can be calculated.

Assumptions of Projection Model

The following assumptions has been used as parameter for both projections of construction and materials demand:

1. The source of information on all construction projects awarded in the country is CIDB's integrated database where information on construction projects valued in excess of RM500,000 are captured. Precise estimates depend on the actual number of new construction projects that are reported by successful contractors.

2. The method of procurement of construction is based on the conventional method that refers to a design development stage that is separate from construction. Design development is generally undertaken by consultants, while constructions are by general

contractors. The sample does not consider different types of procurement arrangement and construction method.

3. Projection for construction output is based on 3 levels of confidence:
   i. Optimistic:
      Target population is based on awarded projects only;
   ii. Realistic:
      Target population is based on future projects announced by the government;
   iii. Pessimistic:
      Target population is based on future projects announced by private clients.

4. The commencement and completion date is that which is stated in the Letter of Award without consideration of extension time.

5. Methodology of construction is based on tender documentation. Alternative construction method proposed by the contractors to clients is not considered.

6. Typical percentage of 15% is used as an assumption for overhead and profit margin on any sample adopted.

7. It is assumed that the construction projects are without variation works, neither additional nor omission.

8. It is assumed that the whole allocation of Prime Cost Sum and Provisional Sum allocated (if any) in the BQ will be fully utilised.

9. The constants are equally distributed on all projects irrespective of types of project including repair, maintenance and the likes. Project of this nature normally represent an average of 10% from total projects awarded.

In addition, there are 3 other assumptions for projection of materials demand:

1. Volume of cement and sand are being extracted from plastering and finishes items only.

2. Ready mixed concrete is a stand-alone item.

3. The range, type, brand, specification, performance and constructability of construction materials are as per normal specifications.

CONCLUDING REMARKS

There is a significant need for CIDB to establish a credible model in projecting both construction demand and its resources, using different level of confidence based on acceptable assumption to achieve market equilibrium in the construction industry. This underlined the importance of CIDB to undertake its statutory function under the Act 520.

Due to the high contribution from the cost of construction materials to the overall construction cost of a building project, it is important to monitor the supply and demand of construction materials at any point of time. In promoting market equilibrium in the construction industry, the supply of construction materials should meet the materials demand. Generally, shortage or oversupply of construction materials will affect the materials price. Any volatility to the prices especially for major materials will affect the whole cost of construction. Thus, projection of demand for construction materials will serve as a guide for the producer to plan their supply and will assist the Government in preparing national policy including addressing the impact of materials' price to construction cost.

Appendix A

PROJECTION OF CONSTRUCTION AND MATERIAL DEMAND

This assumption together with other relevant data has been applied into PROJEXIS system in the effort of projecting construction and material demand for 2017 and 2018. Example of data generated by the system are explained below.

Table 1 shows the number and value of project awarded according to year from 2014 to 2018. The table also relates the numbers and estimated values of completed (work done) and prediction of upcoming work (work to be done) according to size of projects. In 2017, the total value of projects awarded are forecasted at RM170.0 billion. This projection based on targets, information and other periodic announcements on investment proposals published by several official sources such as the Ministry of Finance (MOF), Bank Negara Malaysia (BNM), Malaysia Investment Development Authority (MIDA) and National Property Information Centre (NAPIC). The demand for this project is also generated from projects announced under 11th Malaysia Plan (11MP); Federal Government's annual budget; and other private projects. Details of the projection can be referred in the Construction Industry Review and Prospect 2016/ 2017 publication.

In 2015, there were 7,544 projects awarded and commenced with a value of RM142.0 billion. It is estimated that out of this value, RM47.2 billion were completed in 2015. In 2016, out of 7,544 projects awarded in 2015, 4,900 project with a value RM58.1 billion were then completed. Subsequently another 1,600 of these projects were completed in 2017 for RM28.5 billion. What remains of the 7,544 projects awarded in 2015 are approximately 300 projects estimated to complete in 2018 for RM10.0 billion.

The estimated 7,000 projects awarded in 2016 is assumed to commenced in the same year, with a completion value of RM57.1 billion. Subsequently, an estimated 3,700 projects were completed at a value of RM138.0 billion in 2017, leaving another 1,200 projects forecasted for completion during the rest of 2018. The estimated value of total project awards for 2017 is RM 170.0 billion with an upcoming work at RM47.6 and RM102.0 billion for 2017 and 2018 respectively. An estimated total value of RM224.6 billion being targeted for execution in 2017.

Table 1 Estimated Total Projects Work Done and Upcoming Work

Year	Total Projects Award		Work Done				Upcoming Work			
			2015		2016		2017		2018	
	Number	Value (RM b)	Number	Value (RM b)	Number	Value (RM b)	Number	Value (RM b)	Number	Value (RM b)
2014	8,076	185.5	5,600	64.6	1,800	32.2	300	10.2	60	4.6
2015	7,544	142.0	7,500	47.6	5,000	58.7	1,600	28.8	300	10.1
2016	7,000[f]	230.0[f]	-	-	7,000	65.4	4,700	138.0	1,600	35.8
2017	-	170.0[f]	-	-	-	-	-	47.6	-	102.0
Total			13,100	112.2	13,800	155.7	6,600	224.6	1,560	152.5

f – forecast

Table 2 below shows the estimated utilisation of 8 major construction materials that were used in building projects and civil engineering works done in 2016 as well as forecast for future works in 2017 and 2018. It is estimated that lesser quantity and there for value in construction materials demand are expected for upcoming work in 2017 and 2018 in tandem with the volume of ongoing or newly started projects that are mostly the spill over projects from those awarded in previous years. The 2017 and 2018, figures are pure estimation that had taken into account only for project awarded until July 2017.

The demand for construction materials are directly related to the stages of construction of a project for they have specific applications throughout the entire construction timeline. The estimated material demand for 2018 is based on the overflow of projects awarded in the previous year.

Some materials utilisation estimation are reduced drastically in 2018's work-to-be-done projection since most of these materials such as steel reinforcement, ready mixed concrete and plywood were applied at the beginning stage of construction in 2017. Other materials forecasted usage such as sand, glass and paint shows a higher demand in 2018 since it is mostly used towards completion cycle. Most ongoing building projects in 2017 are in the advanced stage of construction whilst civil engineering projects do not require the same combination of construction materials as buildings. These conservatively forecasted materials demand for 2017 are also an outcome of the fact that more projects are yet to be reported and recorded in CIDB's database at the time of this report is published.

Table 2 Estimated Construction Material Demand

Construction Material	Unit	Material Demand for Total Work Done 2016			Material Demand for Total Upcoming Work 2017			Material Demand for Total Upcoming Work 2018		
		Number of Projects	Material Quantity (million)	Material Value (RM m)	Number of Projects	Material Quantity (million)	Material Value (RM m)	Number of Projects	Material Quantity (million)	Material Value (RM m)
Steel Reinforcement	tonne	9,000	7.7	18,800.0	6,000	8.2	20,000.0	2,000	1.5	3,700.0
Ready Mixed Concrete	m^3	9,000	45.5	12,000.0	6,000	56.0	14,700.0	2,000	19.1	5,000.0
Plywood	piece	9,000	66.9	3,800.0	6,000	100.0	5,700.0	2,000	49.5	2,800.0
Bricks	pallet	9,000	13.5	3,000.0	6,000	23.6	10.4	2,000	12.8	5.6
Paint	5 liter	9,000	9.7	1,300.0	6,000	13.3	1,800.0	2,000	12.7	1,700.0
Sand (finishes)	tonne	9,000	19.3	820.0	6,000	24.1	1,000.0	2,000	25.5	1,000.0
Glass	m^2	9,000	16.2	870.0	6,000	22.0	1,200.0	2,000	28.4	1,500.0
Cement (finishes)	tonne	9,000	2.5	956.0	6,000	3.3	62.9	2,000	2.6	50.7

Note: Material value is calculated based on material's average price in 2016.