Volume

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EARNED HEIGHT MANAGEMENT: A NEW EXTENSION TO EVM FOR HIGH-RISE CONSTRUCTION

BUiD – MPM – Dissertation (Student ID# 20050098)

EHM

Earned Height Management: A New Extension to EVM for High-Rise Construction

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Abstract

The thirty-year-old Earned Value method has been playing a central role in managing projects and reporting progress. Some project managers have critically criticized it, others have trusted it, but all have used it.

For a professional project manager working in the "vertical" construction field in Dubai, applying the EVM as-presently-is in managing high-rise buildings construction is like applying a general theory to a very particular wide-spread case. Here, there's no real problem, but opportunity for further optimization.

In this research, the opportunity of creating useful tools specific for high-rise construction has been grasped.

The theory here combines the EVM principles with energy theories. The factor of "Height" added to, and stressed in, the original formula of EVM describes the progress (or earning) in the work in the form of potential energy stored in the building at high levels. Looking at it from yet another angle, the building is the "Sum" of all the work needed to complete the whole of the end deliverable. The sum of product of the forces exerted by the displacement of materials to the appropriate place (height) makes the whole of the project. This research attempts to use the height (as an element of the energy and work theories) to enhance the EVM in reporting vertical progress.

The method developed in this attempt, Earned Height Management (EHM), uses the planned and achieved heights of both the top of the building and the, here-introduced, "value center" of the building.

The research focuses on two main variables at all times: Total Height (TH) and Earned Height (EH). The first one gives indication about the progress of the skeleton (here referred to as "structure" and can be considered as the "driving activity" or "locomotive"), and the second about the entire earned value in the form of height. Monitoring these two variables gives this method irrefutable edge over the original EVM and its derivatives since EHM tells at a glance whether the structure is delayed or its subsequent activities (partitioning, plastering, finishing, glazing, etc.).

Five projects have been chosen as case studies to run the EHM method and examine its effectiveness. These projects are of heights ranging from nine floors to fifty-five floors. Project managers and planning engineers have been entrusted to apply the

EHM to the selected projects. These users (applicators) have originally been working on these projects using some other methods than EHM.

Applying the EHM to the case studies has revealed additional information about the progress of the work and the opportunities for improvement and acceleration that could not have been directly derived using any of the presently available tools.

On the other hand, HIRI-PRO, the application developed for the purpose of applying the EHM, though proved effective in calculating the indices and producing sophisticated reports, wasn't as user-friendly as the users wished. A new version of HIRI-PRO has been developed easing the data entry process and allowing easier automatic input from the available planning tools. However, the new version has been released at a later stage before the completion of entering the data used in this research.

Moreover, it was revealed that EHM application has got limitations. The accuracy of the method can be affected by the following:

- shape of the structure
- basement works
- materials delivered to site (and not fixed in place)
- pre-engineered work (work prepared and/or completed outside the project premises)
- user's assumptions (assumed heights for certain activities may need user's judgment)
- number of buildings in the project (if more than one building and progressing at different speeds)
- preparation activities

Despite the shortcomings of EHM, the case studies considered in this report proved the reliability of applying EHM on a wide spectrum of high-rise buildings.

The research recommends the incorporation of EHM indices as standard feature of planning tools available for the project managers of high-rise buildings.

Chapter

1

INTRODUCTION AND OBJECTIVES

1.1 Historic Review

The human civilization has always been thrilled by the superlative competition of building the tallest structure. The website www.tallestbuildingintheworld.com[1] expounds the history of the competition and provides update about which building holds on the title.

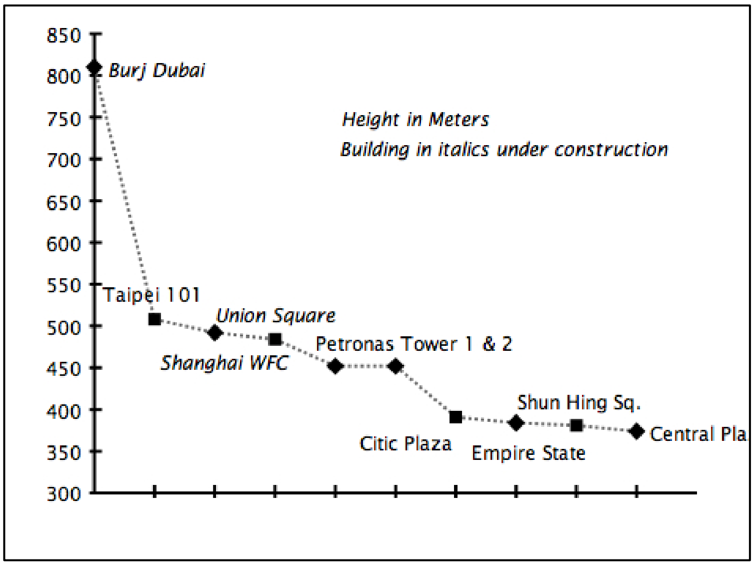


Figure 1.1 - The Tallest 10 Buildings in the World

During the first 90 years of this century, the USA dominated the race for the title of the tallest building in the world, and constructed a range of famous buildings that, sometimes only for a few months, and sometimes for many years, were widely recognized as being the 'tallest building' in the world. In 1974 Chicago's Sears Tower was completed, and generally seen as the 'tallest building' in the world. Sears held on to that title for over 20 years. But since the nineties the USA gets some stiff competition from Asia. In 1996 this resulted in the completion of the Petronas Twin Towers in Kuala Lumpur (Website: The Tallest Building in The World, 2008)[1].

Figure 1.2 - Burj Dubai

Burj Dubai is currently the tallest building in existence according to the same website. Figure 1.1 depicts the tallest ten buildings in the world as for the date of this report. Burj Dubai is a skyscraper under construction since April 2005 built in the middle of the new business area of Dubai, United Arab Emirates. Burj Dubai is planned to reach a "suggested" height of 810 meters with 160 habitable floors.

> The design of Burj Dubai is derived from the geometries of the desert flower, which is indigenous to the region, and the patterning systems embodied in Islamic architecture. The tower is composed of three elements arranged around a central core. As the tower rises from the flat desert base, setbacks occur at each element in an upward spiraling pattern, decreasing the cross section of the tower as it reaches toward the sky. At the top, the central core emerges and is sculpted to form a finishing spire. A Y-shaped floor plan maximizes views of the Persian Gulf (Website: The Tallest Building in The World, 2008)[1].

1.2 Current Construction Industry

Nowadays the trend in construction industry is to "rise high". New record breaking towers are being announced ever year or so. This is even more noticed here in Dubai where the, now, world tallest building described above is nearing completion.

This year, Nakheel has announced its one-kilometer tower in Dubai. Kuwait started building its 1,001 meters tower. Likewise, Bahrain started to compete with a planned 1,022 meters tower.

Crowning the competition, Prince Al-Walid Bin Talal of Saudi Arabia, launched the design of the one-mile tower (1,600m) in Jeddah. The project brief posted on the webpage www.skyscrapercity.com[2] describes the project as a vertical city to be built with a huge budget of SR 50b (equivalent to US$ 13.3b). The designers of such project are faced with the challenge that the tower will have to be capable of withstanding a wide range of temperatures, with its top baking in the desert sun by day but dropping to well below freezing at night[1].

Figure 1.3 - Comparison Between The Mile Tower and Existing Towers

As shown in figure 1.3, the mile tower will dwarf all the then-called skyscrapers in modern history including Burj Dubai.

In addition to the record-breaking structures being built, there seems to be a high-rise revolution in the construction industry. In new cities like Dubai, hundreds or thousands of new high-rise developments are being announced yearly.

1.3 Construction Future

Advances in engineering design and invention of high performance materials have allowed buildings to reach heights never been possible before. Fifty years ago, C40 concrete (i.e. concrete with 40 KN per square meter strength), that used to be considered high-strength, was used for the foundations and vertical elements of the buildings. Currently, it's not uncommon to come across C50, C60, and C70 concrete in the vertical elements and foundations of buildings exceeding 20 storey high.

Metha[3] explained how, in 1965, C50 concrete used in the columns of Lake Point Tower in Chicago was considered state of the art. Later, Metha[3] continues, greater strengths of concrete have been used as per the examples below.

- Water Tower Palace (Chicago):	C60 (8700psi) concrete
- Scotia Plaza (Toronto):	C90 (13000psi) concrete
- The Two Union Square Building (Seattle):	C120 (17400psi) concrete

Metha[3] argued that compressive strengths in the order of 150 and 300 MPa (C150 and C300) are obtainable with Portland cement concrete with the addition of chemicals, superplasticizers, calcium silicates, and with the control of water content. This is what Metha[3] referred to as "High-Performance Concrete" (HPC).

The more science and engineering advance, the higher buildings can be constructed. This promises an even brighter future for high-rise construction. Such developments will be challenging to the project management industry that must devise unconventional tools and techniques allowing state-of-the-art planning, monitoring, controlling, and delivery of the projects in the shortest possible time.

On the other hand, during the recently-completed development cycle of the International Code Council (ICC)[4], there have been several proposals that would threaten the economic viability of tall buildings. The council has added the requirement of additional stair for buildings over 420 feet (128 meters) in height and required low carbon emission in future buildings.

There have been other unapproved changes that would severely and negatively impact the construction of tall buildings. The proponents of these changes vowed to bring them back in the next ICC code development. Some of the unapproved changes are related to length of corridors, increase in strength of stairway walls, video monitoring requirements, complete burn-out without collapsing, and progressive collapse.

Other detractors of tall buildings have expressed their concern that no agreement has been reached yet on the lessons drawn from the tragic event of World Trade Center towers collapse[5]. They believe, however, that more stringent regulations and codes should govern the high-rise construction industry.

Despite the fears and constraints, the structures continue to be grow higher and higher. This justifies the viability of this research that focuses on better management of high-rise construction.

In this research, the tools currently available have been reviewed. This research has been limited to the tools available for monitoring and reporting of the project progress.

1.4 Objectives of the Research

The research objective is to examine the effectiveness of a new concept for monitoring, measuring, and reporting progress in high-rise building construction projects. EHM (Earned Height Management) introduced by this research is derived from the EVM method, adding the height parameter to the earned value formula, simulating the potential energy and work formulae.

Additionally, the objective of this research is to prove the soundness, usefulness, practicality, and reliability of this new EHM method.

1.5 The Research

The research methodology is a combination of the following:

- Action Research:

  The current methods used to monitor the schedule in construction buildings have been reviewed in order to introduce possible improvements. Basically the research focused on the EVM (Earned Value Management) method and its derivatives such as the ES (Earned Schedule) method. In this research, the technical construction methods haven't been examined although brought up sometimes. Rather, this research was concerned with how the progress in the project can be measured, reported, and controlled.

- Experiments Research:

  Five case studies of on-going projects have been considered. These projects are all based in Dubai and rise beyond 25 levels (except one project based in Fujeirah and doesn't exceed 9 floors in height). The projects subject of the case studies are of varying shapes, heights, specifications, number of basements, contracted procurement method, and management entities.

- Modeling:

  Software application (called HIRI-PRO) has been introduced to model the EHM method and run the input of the five case studies. The model could have been a simple spreadsheet where the input is entered and the calculations of EHM indices take place. However, HIRI-PRO has been developed to reduce the time needed for data-entry and make the mission of the volunteering users easier. It's estimated that HIRI-PRO reduced the time needed for data entry by nearly 70% according to the users.

1.6 Theory and Application

This research will explain how the theory of EHM evolved from the combination of EVM, the potential energy formula (Potential Energy = Weight x Height), and the work formula (Work = Force x Distance). The theory has been introduced by this research as a result of spotted relationship between the parameters of Earned Value (EVM) method and the "Height" parameter in high-rise construction. This is explained in depth in section 3.3 below.

1.7 Case Studies

In this research, five construction projects have been considered. In the five projects all the buildings are considered high-rise but of different natures, specifications, and dimensions. The EHM method will be applied to all the five cases based on actual data collected from the field and the teams managing the projects.

Applying the EHM to real projects should reveal information about the following:

- Soundness of this method

- Usefulness of the results

- Easiness of application

- Future of the method

1.8 Software and Technology

In order to easily apply the EHM method to the case studies and obtain useful and reliable results, a software application, has been developed. For the ease of reference (and probably for future continuation of this attempt), this software application has been given the name HIRI-PRO. This name comes as an abbreviation of the phrase "High-Rise Project".

In this dissertation, the functioning of HIRI-PRO has been explained in the form of a User's Manual in addition to including actual sample reports it produced.

Chapter

2

PROJECT MANAGEMENT OF HIGH-RISE CONSTRUCTION

2.1 Earned Value Management (EVM)

In the beginning of literature review, the EVM (Earned Value Management) methods will be discussed for being the base for most of the available methods.

In their book "Earned Value Project Management", Fleming and Koppelman (2000)[6] defined "Earned Value" as follows.

> "Earned Value" is a project management technique that is emerging as a valuable tool in the management of all projects
> In its most simple form earned value equates to fundamental project management.
>
> **(Fleming and Koppelman, 2000)[6]**

Vandervoorde and Vanhouke[7] described the Earned Value Management as a "methodology for measuring and communicating the real physical progress of a project and to integrate the three critical elements of project management (scope, time, and cost management)"

To simply describe earned value, the following definitions are necessary.

EV (also known as BCWP or Budgeted Cost of Work Performed) = Earned Value
(This can be obtained by multiplying the actual percent complete of every activity by its initial budget.)

AC (also known as ACWP or Actual Cost of Work Performed) = Actual Cost
(This can be directly obtained from the recorded expenses on each activity after making the necessary corrections to avoid considering prepaid expenses or delays in invoicing.)

PV (also known as BCWS or Budgeted Cost of Work Scheduled) = Planned Value
(This can be obtained from the baseline schedule.)

Knowing these three parameters, the cost and schedule performances in the project can be measured as follows:

$CV = EV - AC$	$SV = EV - PV$
$CPI = EV / AC$	$SV = EV / PV$

Where,

- CV is the cost variance (desirable >0 to avoid cost overruns)
- SV is the schedule variance (desirable >0 to avoid delays)
- CPI is the cost performance index (desirable >1 to avoid cost overruns)
- SPI is the schedule performance index (desirable >1 to avoid delays)

2.2 Review of Literature and Available Tools

Having reviewed the available research and literature, EVM seems to be the only widely accepted tool for measuring the time and cost performance of the project. However, Earned Schedule (ES) method, which is a derivative of EVM, is a more accurate tool in measuring the schedule performance.

According to Henderson[8], the ES concept conceived by Lipke[9] in 2002 can be explained as follows (quoting Lipke's seminal paper 2003).

> The idea of Earned Schedule is analogous to Earned Value. However, instead of using cost for measuring schedule performance, we would use time. ES is determined by comparing the cumulative BCWP earned to the performance baseline, BCWS. The time associated with BCWP, i.e. Earned Schedule, is found from the BCWS S-curve.

Henderson[8] continues that "Earned Schedule is the point in time when the current Earned Value was to be accomplished".

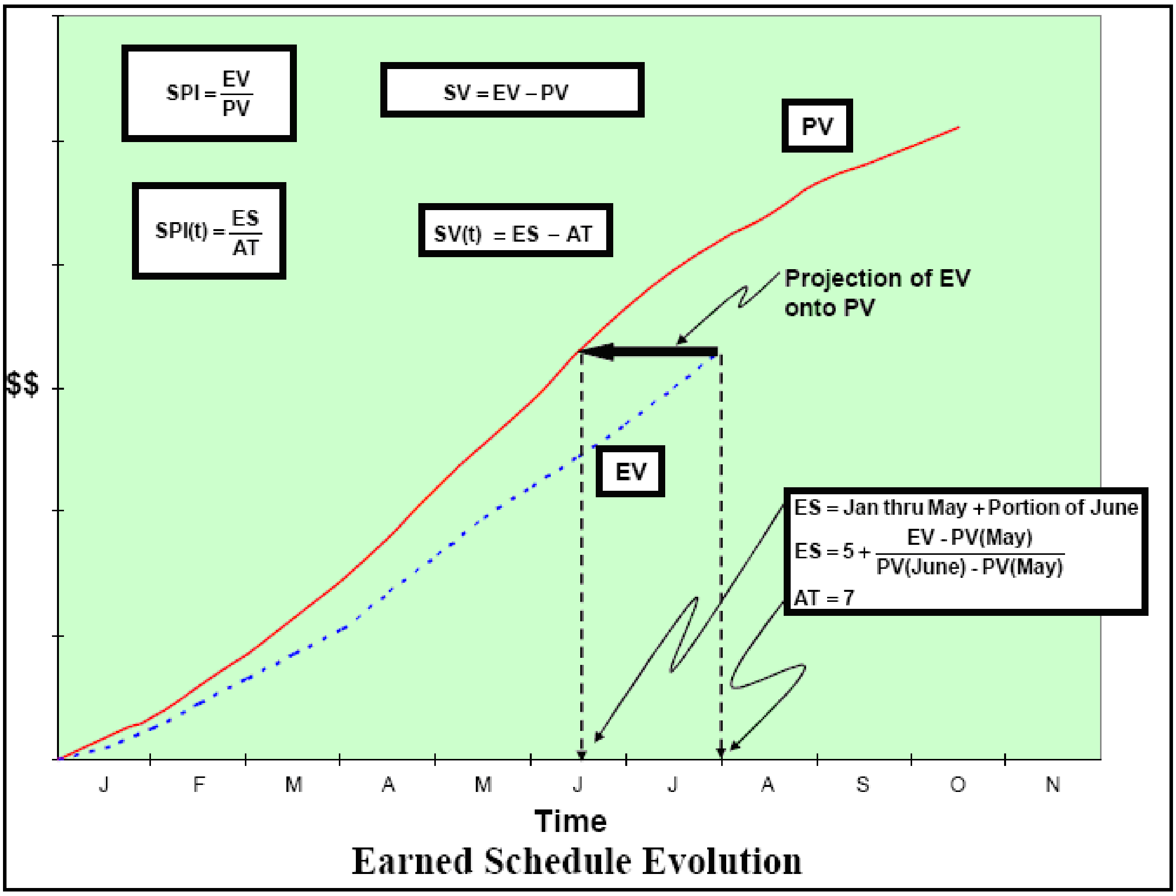


Figure 2.1 - Earned Schedule Methodology (Lipke[9])

Figure 2.1 shows how ES is obtained by projecting the EV to the PV S-curve and then, reading the corresponding time (ES) along the time axis. In the above figure, the following terms are used:

AT = Actual Time

ES = Earned Schedule which is the distance from origin till mid of June

SV(t) = Schedule Variance calculated using this method = ES – AT

SPI(t) = Schedule Performance Index calculated using this method = ES/AT

Table 2.1 below shows a comparison between the terms of EVM and ES methods.

	EVM	Earned Schedule
Status	Earned Value (EV)	Earned Schedule (ES)
	Actual Costs (AC)	Actual Time (AT)
	SV	SV(t)
	SPI	SPI(t)
Future Work	Budgeted Cost for Work Remaining (BCWR)	Planned Duration for Work Remaining (PDWR)
	Estimate to Complete (ETC)	Estimate to Complete (time) ETC(t)
Prediction	Variance at Completion (VAC)	Variance at Completion (time) VAC(t)
	Estimate at Completion (EAC) (supplier)	Estimate at Completion (time) EAC(t) (supplier)
	Independent EAC (IEAC) (customer)	Independent EAC (time) IEAC(t) (customer)
	To Complete Performance Index (TCPI)	To Complete Schedule Performance Index (TSPI)

Table 2.1 - Terminology Comparison Between ES and EVM

Other literatures that discussed topics of relation to the high-rise are discussed below.

Arditi et all[10] use the line of balance scheduling method for planning the activities in high-rise construction. The Line of Balance (LOB) method is based on the knowledge of the number of units that must be completed on any day so that the programmed delivery of units can be achieved. Arditi et all[10] find the LOB method very useful in high-rise construction due to the repetition in activities. This is not directly related to the research here under EHM theory, but a combination of EHM and LOB may be a topic to be investigated in future research.

Proverbs[11], Abeyashinghe et al[12], and Kim et al[13] propose methods for reducing the high-rise construction time without suggesting a method for management. Their work mainly focused on the construction activities, alternative construction methods, and technical aspects.

Chang at al[14] considered the physiological measures to be taken for maintaining high-rise construction safety while monitoring the schedule. They discussed the psychological and fatigue effects on the level of safety in the buildings. In their work they went through the effect of the safety on the progress of high-rise construction.

Cioffi[15] and Miyagawa[16] use the EVM at the first phase of the project to calculate the productivity for the remaining works. Their work focused on the recovery techniques. Such techniques may be useful if in the future incorporated into the EHM method.

Kog et al[17], Chan and Kumaraswamy[18], and Gong[19] discussed the causes of time overruns in EVM and the risk associated with delays. Kog et al[17] identify the project manager, the project team, and planning and control efforts as the key determinants for construction schedule performance. Chan and Kumaraswamy[18] studied construction cases in Honk Kong to determine the factors that delay the construction of projects. Gong[19] has used the float in risk analysis-based network scheduling. He used back-forward uncertainty estimation (BFUE) to analyze the time in estimating the joint impact of time uncertainty and float use of non-critical activities on the duration of the project.

De et al[20] uses EVM for cost-time trade-offs. Their work was in the form of mathematical programming not specific for high-rise construction. Their work may be used to model the decisions to be made upon reading the results of EHM reports.

Kaming et al[21] have discussed the factors influencing time and cost overruns on high-rise projects in Indonesia. Their work can be applied to any high-rise construction project around the world. They focused on the adequacy of planning, the initial estimates, the design changes, and manpower productivity.

2.3 Limitations of EVM

Vanhoucke and Vandervoorde[22] argued that the EVM, although reliable in estimating cost performance, often fails to predict the total duration of the project. They continued by listing this summary of three reasons why EVM has been heavily criticized:

1. SV measures monetary units and not time units which makes it difficult to understand.
2. SV = 0 (or SPI = 1) could mean that a task is completed, but could also mean that the task is running according to plan.
3. Towards the end of the project, the SV always converges to 0 indicating a perfect performance even if project is late.

Kim et al[23] on the other hand attributes the problems in EVM to the users, the culture, the system applied, or the implementation process.

Lipke at al[24] discussed the SPI deficiencies of EVM in contrast with the new Earned Schedule (ES) method. The ES method will be described in more details later in this report. Lipke, who's considered the father of ES, has published several papers about the usage of ES in predicting the new project durations.

Stratton[25] also advocates the ES method describing the unreliability of EVM in the last third of project duration, and its inability in predicting the estimated completion time. They argue that towards the end, the PV will converge to the total project budget irrespective of the delay in the construction time. This gives false reporting of the progress and performance.

On the other hand, Chau et al[26] and Wang et al[27] rather tried to find an alternative way of presenting the schedule and progress in a 4D model that plots the building in 3D against the 4th dimension, time. This technique delivers non-numerical results and fails to report progress in the form of indices or variances. Chau et al[28] present in their second paper a software used to perform this 4D analysis.

2.4 Why is High-Rise to be Managed so Differently?

The construction industry is characterized by the length of its projects, the large number of manpower required, the long time required in the beginning to have the "machine" started and ready to produce, the large number of stakeholders, the large number of trades involved, and the never-ending challenge to meet the time, cost, and quality objectives.

The construction of high-rises gets even more challenging by adding to the above the difficulty in reporting progress. Dubai is full of examples where the concrete structures of towers are erected at amazing speeds giving the clients illusive indication that the construction is ahead of schedule while the projects are delayed due to delay in starting other subsequent critical activities.

Thus, the focus in this report is on the reporting of progress in high-rise construction (high-rise building, or tower, is a description given to buildings not less than thirty-storey in height).

High-rise construction is characterized by the repetition of activities, the cycle, and the factor of height. This research focuses on the "Height" parameter for being the most important characteristic of the high-rise concept. Height is being linked here to the project management terminologies in the relationship referred to here as EHM.

Chapter

3

THE NEW TOOL - EHM

3.1 Why is a New Tool Needed?

EVM and ES are very universal and generic. Construction is a particular, yet large, sector within the project management environment and requires specific attention. Moreover, the recent competition for constructing superlatively high structures emphasizes the importance of managing the high-rise construction with more particularity.

Therefore, when we zoom in on the construction, and then zoom in again on the high-rise sector, we find that high-rise construction is currently being managed not differently from any small low rise villa or any other non-construction project. In other words, the high-rise is presently managed, at best, using the generic EVM method techniques. The reports produced from such method can be having certain deficiencies due to the limitations of EVM mentioned in section 2.3 above, and due to the absence of any height-related parameter in the EVM method. Thus, additional tools may be introduced to give more than just a general money-based schedule performance reporting. As discussed earlier, the project stakeholders may be misled by both a greater-than-one SPI and concrete structure erected ahead of time while in reality the project is slipping in huge delays due to major critical activities not started.

3.2 How Different This Tool is

The Earned Height Management (EHM) concept developed and introduced by the writer of this research is based on the EVM theory with the **Height** of building being reported rather than the **Value** of the project. The Earned Height (EH) refers to the real earned height of the structure as opposed to the apparent physical height (Total Height or TH) that you can see for a hollow shell of structure protruding high (figure 4.1). By knowing the EH and TH, the project manager can tell how his project is performing and if it's likely to be delayed or not.

The explanations of EHM in later chapters and the analyses of case studies show how the EHM is able to report poor project performance if the project is likely to be delayed in many cases where the EVM is reporting satisfactory results. The EHM will be examined in this research to prove its ability to be more informative and reliable than EVM for high-rise construction.

3.3 Theories Behind the Theory

The theory of EVM has been explained above. Two more theories used in this research will be explained here: Potential Energy Theory and Work Theory.

The potential energy (PE) as introduced by Serway and Jewett[29] is the energy stored in an object as a result of its presence at a certain height (from the ground or a certain datum). This theory suggests that an object placed at a certain height (H) will be pulled by its weight and has the tendency when falling to release energy proportionally to the height (H) at which it originally existed.

The formula is:

$$PE = Wt \times H \quad (\text{or } PE = m \times g \times H) \qquad (1)$$

Where

PE is the Potential Energy

Wt is the Weight of the object

H is the Height of the object from the ground

m is the Mass of the object

g is the earth Gravitational Force

The second theory discussed here is the Work theory. This theory is explained as such; when an object is displaced, work is assumed to have been done. Work exists when an object is displaced for a certain distance (d) in a certain direction under the application of a force (F) applied upon the object and is in the same direction as the displacement.

The formula of work according to Cassidy et al[30] is:

$$W = F \times d \qquad (2)$$

Where

W is the Work

F is the Force applied upon the object in the same direction of the displacement

d is the displaced Distance

It is to be noted here the similarity between Potential Energy and Work. They are both the product of a force by a distance. The Potential Energy is equal to the product of Weight (which is a force) by the Height (which is a distance). It is also to be noted that when an object is falling, it is losing potential energy and exerting work. Likewise, if work is being exerted to elevate an object by applying upon it a force equal to (or slightly greater than) its weight, this makes the object store potential energy equal to the exerted work. Therefore, there can always be tradeoffs of work for potential energy or potential energy for work. According to Cassidy et al[28], work represents an amount of energy transformed from one form to another.

Back to EHM method, let's consider the project as the sum of all the work required for the delivery of the end product, the building (or it can be the sum of the potential energy stored in the end product).

Project Scope = The sum of all the work in the project (3)

= Sum(work) (4)

= Sum(Force x distance) (5)

In construction it's assumed that the forces driving the project towards completion are the resources allocated to the project (they are the machine force).

So it's assumed here that:

Force = Project Resources (6)

The resources are:

Human Resources (or Labour Force)

Equipment Resources

Material Resources

Financial Resources

In fact, all the four forces can be expressed as Financial Resources since the latter may be used to hire the appropriate subcontractor (or entity) to do the required work. The Financial Resource allocated for the execution of the work can be referred to as Budget. This method is equally applicable to budget, cost, price, or any other financial value as long as consistency is maintained. I.e. budget for planned values must be used with budgets of earned values. If the budget of planned values is used against the contract (selling) price of earned values, the accuracy of the results will be compromised. In this research, the word Value is used instead. The user may choose what "value" should stand for as long as consistency is maintained.

On the other hand, the main displacement distance in high-rise construction is to bring the respective objects (materials or work) to the required height.

Therefore:

Distance = Height (7)

Back to the work formula, EHM method suggests the following amendment to suit the context of project management (by inserting the values of "Force" of (6) and the value of "Distance" of (7) in the equation (5)):

$$\text{Project Scope} = \text{Sum (Resources} \times \text{Height)} \tag{8}$$

$$= \text{Sum (Value} \times \text{Height)} \tag{9}$$

The product of Value by the Height is the main core entity on which the EHM relies in the representation of progressing into the construction of the project and heading toward completion.

It can be argued that this method involves lot of assumptions and the logic used above is neither fully accurate nor provable. This is moderately true, but the reader is here invited to look at the EHM as an independent, newly introduced, method of measurement. The correlation explained above serves to highlight the importance of the height in measuring the progress of the work, and to add some physical significance to the product of Value by the Height that's the very core concept of EHM.

3.4 How Height Matters

While constructing a building, it does really matter if the building is horizontal of vertical. In vertical buildings, the work is strongly constrained by the hard logic of sequential relationship between the floors. However, in horizontal buildings, work can go more in parallel and the progress is more dependent on the availability of resources than on any other constraints.

Figure 3.1 below shows a project made of four blocks A, B, C, and D. Each of the blocks is a one-level building (or floor). This is a fully horizontal project where work can take place at any or all of the buildings at virtually any time.

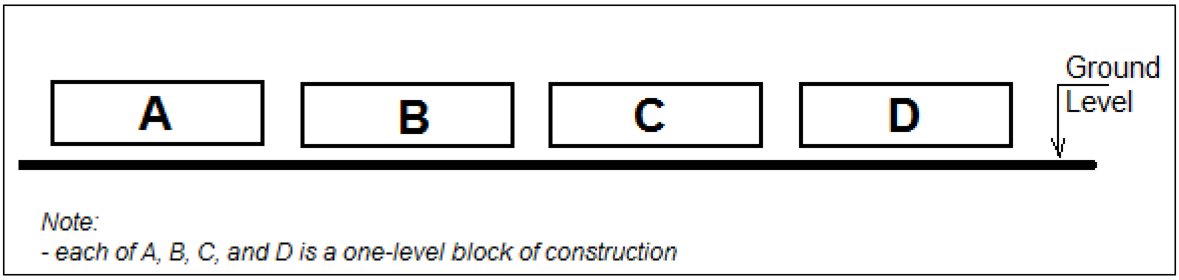


Figure 3.1 – Horizontal Project (HP)

On the other hand, Figure 3.2 shows a typical vertical project (VP) made of the same four blocks of the horizontal project (HP). The quantities of materials in these two projects are the same (except what will be needed for the foundations). However, in VP, the blocks are placed one on top of the other. This makes it impossible for block B to start before the structure of block A is in place.

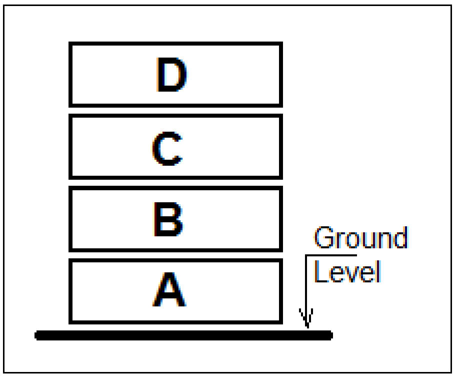


Figure 3.2 – Vertical Project (VP)

Therefore, platform 1, as shown in Figure 3.3, will be needed for block B to start, platform 2 for block C, and platform 3 for block D. This means, the work (or value) of an activity done in HP at ground level is not equal to the work (or value) of an identical activity done at a higher level in VP.

This can be attributed to the following:

- In VP, for the activity to be done, its platform and structural pre-requisites must have been completed.

- In VP, working at height is usually slower and more costly.

In other words, speeding up the opening of floors to more activities at height is similar to "flattening the structure" and turning it more into horizontal-like structure. It was explained above that flatter structure are less constrained. It's always preferred to shift from a more constrained situation to a less constrained one. Therefore, it's always desirable to complete more work-at-height.

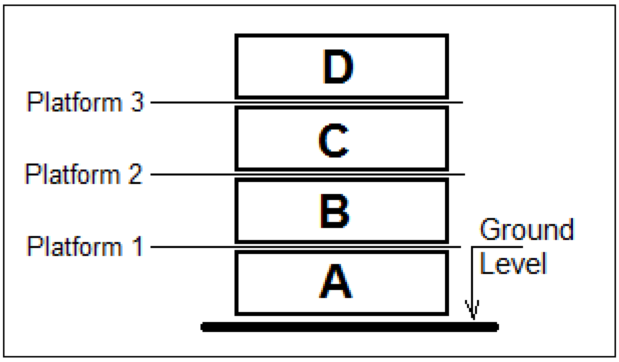


Figure 3.3 – Platforms in a vertical project

Based on the above, having the height parameter added to the equation for measurement of progress should provide more indication of the importance of work that has been done at height. In the standard equation of EVM, an activity completed at level A of VP has the same contribution to the total project progress as an identical activity completed at level C. However, in EHM method, the contribution of the activity completed at level C to the reported progress is higher than that completed at level A. As discussed above, when work is made more possible at higher levels, the project is said to be having more areas open for work and this is shifting toward flatter project.

Chapter

4

EHM EXPLAINED

4.1 The New Indicators

The following definitions have been listed to be used in the EHM method. Those that have newly been introduced by the writer of this report have been tagged as "(new)"

<u>AT START (prior to start of activities)</u>

	BTH:	Building Top Height of the Construction (this shall represent the height from ground of the highest considerable horizontal structural element, such as the roof slab of last floor)
(new)	VC:	Value Center (this represents the point where the center of the budget value of the structure is)
(new)	BVCH:	Height of VC for the complete building (this is the height in the tower where the Value Center is. This can be calculated as mentioned below) expressed in unit height meters or feet.
		BVCH = (Σ(FLBAC x FLHt))/BAC
(new)	FLBAC:	Floor Budget at Completion
(new)	FLHt:	Floor Height in meters or feet
	BAC:	Budget At Completion of the project
(new)	BHR:	Building Height Ratio
		Calculated as: BVCH / BTH
		This gives indication about the altitude of the high-budget activities in the building. A low BHR means there's lot of work of high value at the lower levels of construction (possibly there are expensive shopping outlets and restaurants in the ground floor). A high BHR is usually expected in towers where the first few floors are used for parking.

AT START – PLANNED

(new)	PTH:	Planned Top Height (this is the planned top height during the course of the project. It can be plotted as an S-curve on a graph where the abscissa is time and the ordinate is height in meters or feet)
(new)	PH:	Planned Height (this is the planned value height during the course of the project. It can be plotted as an S-curve on a graph where the abscissa is time and the ordinate is height in meters or feet)
(new)	PHR:	Planned Height Ratio Calculated as PH / PTH

DURING CONSTRUCTION- VALUES

(new)	TH:	Top Height Height from ground of the highest considerable horizontal structural element completed at the point of reporting progress.
(new)	EH:	Earned Height (Height of the value center for the current situation during the construction of the project).
(new)	EHR:	Earned Height Ratio Calculated as: EH / TH This gives indication about the magnitude of the completed activities with respect to the total height reached. A low EHR indicates that the structure is erected much faster than subsequent activities. This can also be compared to the PHR. This comparison must be read in conjunction with other indicators before a situation can be judged as favorable or bad.

DURING CONSTRUCTION - INDICATORS

(new)	THPI:	Top Height Performance Index THPI = TH / PTH
(new)	HPI:	Height Performance Index HPI = EH / PH (Note: this is somehow an SPI for the project. However, a more refined SPI shall be explained and discussed later in this report)
(new)	HRPI:	Height EHR / PHR

The above terms can be listed as per table 4.1 below for easier understanding.

	TOTAL	PLANNED	AT REPORTING TIME	INDICATORS or INDICES
Top Height	BTH	PTH	TH	THPI = TH/PTH
Value Center Height	BVCH	PH	EH	HPI = EH/PH
Height Ratio	BHR = BVCH/BTH	PHR = PH/PTH	EHR = EH/TH	HRPI = EHR/PHR

Table 4.1 - EHM Terminology

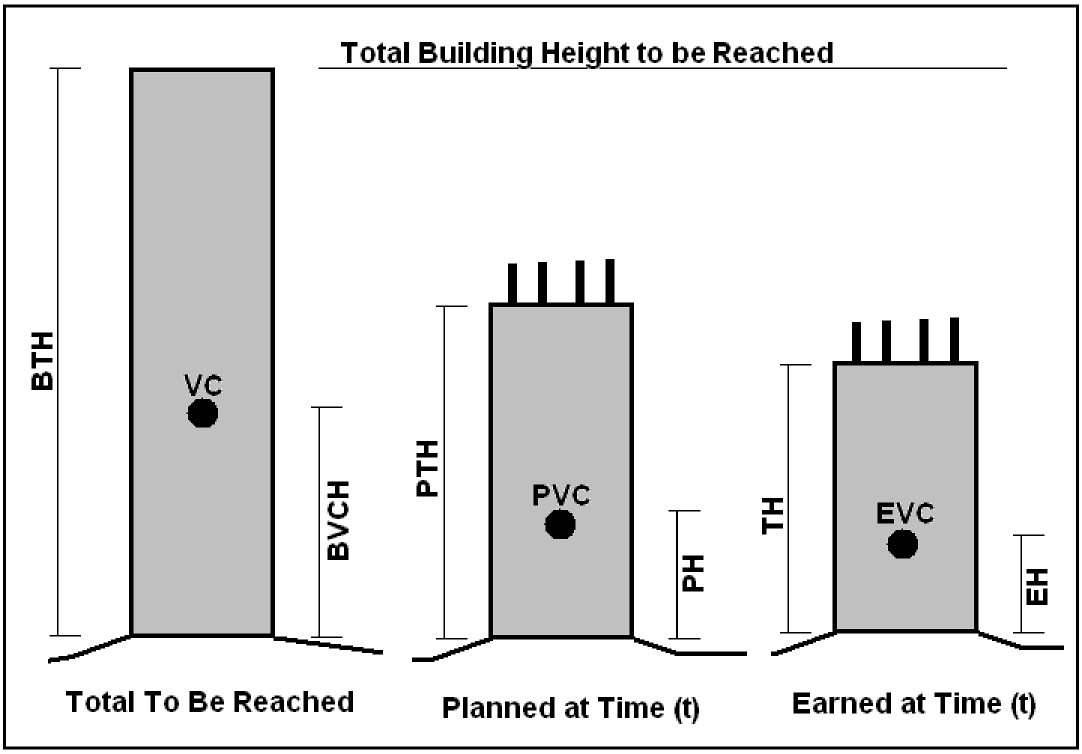


Figure 4.1 - Physical Meaning of EHM Terminology

4.2 Structure: The Driving Activity

EVM method has been applied to projects of varying natures such as IT, event management, statistics, car manufacturing, companies restructuring, and hundreds or thousands of other fields. EHM can be applied for, and only for, the construction of vertical projects. Why?

First, the element of height is somehow particular to the physical construction projects, and more to the vertical ones. You can't discuss height in a software development project.

Second, vertical construction projects are driven by the locomotive of all other activities: The Structure. In EVM, the structure is treated no differently than any other activity. Whereas in EHM, the structure is the main platform on which all other activities dwell.

The structure is the activity that opens the floor for all other activities to work. A delay in structure can very hardly be made up for by adding resources. On the other hand, delay in finishes can be compensated by adding more and more crews. Therefore, a certain float in the structure is much more precious than a float of the same duration in other subsequent activities.

To elucidate the above using EHM method, advances in structure mean more like flattening the building which means making the tall structure more like a horizontal one where more activities can be started in parallel. However, advances in subsequent activities (any activity following the structure) extend no help to the "flattening" of the structure. Because of this exclusive characteristic, the structure deserved its title as the "Driving Activity". It can also be regarded as the locomotive of the train towing all other activities.

4.3 Applicability of EHM

It stems from the very definition of the term "Project" that any project should be time-bound and cost-bound. The managers of construction projects of large scale are particularly concerned about the time and cost and are very unlikely to run the project without clear time schedule and detailed budget.

EHM can be applied in any high-rise construction project having a time schedule and a budget break-down. In this milieu, the word "value" is used. The value can represent the budget, the cost, or the contract price for the particular item.

For the EHM to be applied, the value of the project must be broken down over all the levels (floors) in the project. And within each floor, the floor value can be further broken down into packages. The number of packages depends on the desired level of control. EHM can be applied with just one package per floor and it can also be applied with tens (or more) of packages per floor. When the number of packages is reduced, the time required for applying and updating the EHM forms will be less, but also the quality and detail of information will be lower. A trade-off can always be made between time and information.

After breaking-down the value of the project, the time schedule must be available to predict the planned value of each package at every time interval. The time schedule to be used for this purpose is the baseline time schedule.

Chapter

5

HOW TO APPLY EHM

5.1 Simple Template

Although software may be used to run the EHM method as described in the following chapters, EHM can be applied by using very simple spreadsheet templates. A template similar to the one below can be used. The templates are also referred to as “tables”.

The first table to be prepared is the Value Distribution Table. In this table, the total value of the project is broken down by floor and by packages. Table 5.1 below is an example of a Value Distribution Table.

Examples of packages (just to name a few):

- Structure
- Masonry
- Finishing Works
- Metal Works
- Interior Design Works
- Electrical
- Mechanical

The project can be broken down into any number of user’s selected packages. In the example below, the project has been broken down into four packages: Concrete, Finishes, MEP (Mechanical Electrical Plumbing), and Aluminum and Glazing.

Floor	Height	Value	Value * Height	CONCRETE	FINISHES	MEP WORKS	ALUMINUM & GLAZING
Helipad	152.8	2,665	407,212	400	235	30	2,000
URoof	146.58	3,435	503,502	500	235	2,000	700
Roof	140.05	1,885	263,994	500	285	400	700
HC	135.95	1,885	256,266	500	285	400	700
30F	132.45	2,385	315,893	500	785	400	700
29F	128.95	2,385	307,546	500	785	400	700
28F	125.45	2,585	324,288	700	785	400	700
27F	121.95	2,600	317,070	700	800	400	700
26F	118.45	2,600	307,970	700	800	400	700
25F	114.95	2,600	298,870	700	800	400	700
24F	111.45	2,600	289,770	700	800	400	700
23F	107.95	2,785	300,641	900	785	400	700
22F	104.45	2,885	301,338	1,000	785	400	700
21F	100.95	2,885	291,241	1,000	785	400	700
20F	97.45	2,885	281,143	1,000	785	400	700
19F	93.95	2,885	271,046	1,000	785	400	700
18F	90.45	2,885	260,948	1,000	785	400	700
17F	86.95	2,885	250,851	1,000	785	400	700
16F	83.45	2,885	240,753	1,000	785	400	700
15F	79.7	3,285	261,815	1,000	1,185	400	700
14F	76.2	4,285	326,517	1,000	2,185	400	700
13F	72.95	2,885	210,461	1,000	785	400	700
12F	69.45	3,285	228,143	1,000	1,185	400	700
11F	65.95	3,285	216,646	1,000	1,185	400	700
10F	62.45	2,885	180,168	1,000	785	400	700
9F	58.95	2,885	170,071	1,000	785	400	700
8F	55.45	2,885	159,973	1,000	785	400	700
7F	51.95	2,885	149,876	1,000	785	400	700
6F	48.45	2,885	139,778	1,000	785	400	700
5F	44.95	2,850	128,108	1,000	750	400	700
4F	41.45	2,850	118,133	1,000	750	400	700
3F	37.95	2,850	108,158	1,000	750	400	700
2F	34.45	2,850	98,183	1,000	750	400	700
1F	30.95	2,850	88,208	1,000	750	400	700
6P	26.75	2,850	76,238	1,000	750	400	700
5P	22.6	2,850	64,410	1,000	750	400	700
4P	19.2	4,250	81,600	1,000	2,150	400	700
3P	15.8	3,250	51,350	1,000	1,150	400	700
2P	12.4	6,950	86,180	1,000	250	5,000	700
1P	9	6,950	62,550	1,000	250	5,000	700
Attic	5.6	15,250	85,400	1,000	4,150	10,000	100
GF	1.95	15,250	29,738	1,000	4,150	10,000	100
Totals:- BTH=152.8, BVCH=57.91, BHR=0.38							

Table 5.1 - Template for Value Distribution Table

If the total project value is used and broken down in the Value Distribution Table, this means the value assigned to each cell of the table becomes the value of the work package at the corresponding floor. These values should not change during the course of the project unless additional works or variation orders are introduced.

The value for each work package at each floor is calculated by estimating the percentage of work (depending on the quantity) at that particular floor of that particular work package out of the total value of that work package in the project.

The fourth column of table 5.1 calculates the product of value by the height. This product is main element used to calculate the EH (Earned Height). In the Value Distribution Table, the sum of the product (value x height) for all the floors divided by the sum of the values gives the BVCH (Building Value Center Height). This is equivalent to the ultimate Earned Height at completion of the project.

The ratio of BVCH over the BTH (Building Total Height) returns the BHR (Building Height Ratio) as described by the equation below.

$$BHR = BVCH/BTH$$

The BHR is to be used throughout as a static benchmark to which the PHR (Planned Height Ration) can be compared. The PHR, which is the baseline throughout the course of the project for the EHR (Earned Height Ratio), can be obtained at any point in time by dividing the PH (Planned Height) by the PTH (Planned Total Height) at a certain particular time.

$$PHR = PH/PTH$$

Another table (or template) as shown in table 5.2 can be used for entering the planned progress for calculating the PH at the end of every month. When a spreadsheet is used, a new table is needed for every month.

	PLANNED PROGRESS TABLE						As of:	1-Jan-09
	PTH =	22.00	m	Accomplishment (%) per Scope of Work				Total
	PH =	8.27	m					
	PHR =	0.38						
Floor	Height (FLHt)	Planned Value	Planned Value x Height	Concreting	Finishes	MEP	Aluminum & Glazing	% Accomplished
40		-	-					
39		-	-					
38		-	-					
37		-	-					
36		-	-					
35		-	-					
34		-	-					
33		-	-					
32		-	-					
31		-	-					
30		-	-					
29		-	-					
28		-	-					
27		-	-					
26		-	-					
25		-	-					
24		-	-					
23		-	-					
22		-	-					
21		-	-					
20		-	-					

19		-	-					
18		-	-					
17		-	-					
16		-	-					
15		-	-					
14		-	-					
13		-	-					
12		-	-					
11		-	-					
10		-	-					
9		-	-					
8		-	-					
7		-	-					
6		-	-					
5	22	250	5,500	25.00%	0.00%	0.00%	0.00%	5.88%
4	18	758	13,644	75.00%	0.00%	2.00%	0.00%	23.32%
3	14	1,200	16,800	100.00%	0.00%	4.00%	0.00%	17.27%
2	10	1,350	13,500	100.00%	0.00%	7.00%	0.00%	19.42%
1	6	2,135	12,807	100.00%	3.00%	10.00%	10.00%	14.00%
GF	2	2,423	4,845	100.00%	5.00%	12.00%	15.00%	15.89%
		8,115	**67,096**					**5.36%**

Table 5.2 - Planned Progress Table (Template)

A very similar table can be used to input the actual progress and calculate the EH at every month. An example of the actual progress table is shown in table 5.3.

	ACTUAL PROGRESS TABLE							
							As of:	**1-Jan-09**
	TH =	**22.00**	m	**Accomplishment (%) per Scope of Work**				**Total**
	EH =	**8.09**	m					
	EHR =	**0.37**						
Floor	**Height** (FLHt)	**Earned Value**	**Earned Value x Height**	**Concreting**	**Finishes**	**MEP**	**Aluminum & Glazing**	**% Accomplished**
40		-	-					
39		-	-					
38		-	-					
37		-	-					
36		-	-					
35		-	-					
34		-	-					
33		-	-					
32		-	-					
31								

A C T U A L   P R O G R E S S   T A B L E

As of: 1-Jan-09

TH = 22.00 m
EH = 8.09 m
EHR = 0.37

				Accomplishment (%) per Scope of Work				Total
		-	-					
30		-	-					
29		-	-					
28		-	-					
27		-	-					
26		-	-					
25		-	-					
24		-	-					
23		-	-					
22		-	-					
21		-	-					
20		-	-					
19		-	-					
18		-	-					
17		-	-					
16		-	-					
15		-	-					
14		-	-					
13		-	-					
12		-	-					
11		-	-					
10		-	-					
9		-	-					
8		-	-					
7		-	-					
6		-	-					
5	22	150	3,300	15.00%	0.00%	0.00%	0.00%	3.53%
4	18	706	12,708	70.00%	0.00%	1.50%	0.00%	21.72%

ACTUAL PROGRESS TABLE							As of:	1-Jan-09
	TH =	22.00	m	Accomplishment (%) per Scope of Work				Total
	EH =	8.09	m					
	EHR =	0.37						
3	14	1,150	16,100	100.00%	0.00%	3.00%	0.00%	16.55%
2	10	1,350	13,500	100.00%	0.00%	7.00%	0.00%	19.42%
1	6	1,908	11,448	100.00%	0.00%	9.00%	8.00%	12.51%
GF	2	2,379	4,758	100.00%	4.00%	12.00%	13.00%	15.60%
		7,643	61,814					5.04%

Table 5.3 - Actual Progress Table (Template)

5.2 Linking EHM to Time Schedules

Probably one of the most burdensome tasks in applying the EHM is to obtain the PH (Planned Height) corresponding to the end of every month (or any other selected time interval). This requires running of the project time schedule for each and every month and reading the percent complete values for all the work packages at all the floors.

While carrying out this research, the attempt to link the developed EHM software tool (described later) to Primavera (the planning software used in the case studies) has been delivering very promising results. Such link, when reliably working, reduces time by automatically querying the Primavera for the percent complete values at the end of every month and returning the results as input to the EHM tool or data-entry table.

5.3 EHM Reports

The benefit of EHM method is delivered through its summary report. An example of the report is presented in table 5.4 below. This report has been prepared using a spreadsheet template. Advanced forms of the report produced using HIRI-PRO software are presented in later chapters.

The report shall include the indices of EHM method for every elapsed month. The indices are obtained by dividing the values of TH (Total Height), EH (Earned Height), EHR (Earned Height Ratio) by PTH (Planned Total Height), PH (Panned Height), and PHR (Planned Height Ratio) respectively.

Any values of THPI and HPI less than one should be highlighted as being flagged for possible trouble. If HRPI is less than one is not necessarily an unpleasant thing; it only reflects the relative progress of the whole project with respect to the structure. An HRPI less than one means the structure is progressing faster than the entire project and, thus, faster than the other subsequent activities.

	TOTAL			PLANNED			AT PRESENT			INDICATORS			ES Calculations			
Month	BTH	BVCH	BHR	PTH	PH	PHR	TH	EH	EHR	THPI	HPI	HRPI	ES	AD	SV(t)	SPI(t)
0	164	76	0.46	0	0	0.00	0	0	0.00	1.00	1.00	1.00	0	0	0	1.00
1	164	76	0.46	5	0	0.00	4	0	0.00	0.80	1.00	1.00	1	1	0	1.00
2	164	76	0.46	10	1	0.10	15	1	0.07	1.50	1.00	0.70	2	2	0	1.00
3	164	76	0.46	22	3	0.14	22	5	0.23	1.00	1.67	1.64	4	3	1	1.17
4	164	76	0.46	40	7	0.18	30	10	0.33	0.75	1.43	1.83	6	4	2	1.38
5	164	76	0.46	60	9	0.15	60	12	0.20	1.00	1.33	1.33	7	5	2	1.30
6	164	76	0.46	81	11	0.14	81	14	0.17	1.00	1.27	1.21	7	6	1	1.13
7	164	76	0.46	100	15	0.15	95	20	0.21	0.95	1.33	1.40	9	7	2	1.24
8	164	76	0.46	120	18	0.15	120	22	0.18	1.00	1.22	1.20	9	8	1	1.17
9	164	76	0.46	134	21	0.16	130	23	0.18	0.97	1.10	1.13	10	9	1	1.07
10	164	76	0.46	140	24	0.17	135	25	0.19	0.96	1.04	1.12	10	10	0	1.03
11	164	76	0.46	153	27	0.18	150	26	0.17	0.98	0.96	0.94	11	11	-1	0.95
12	164	76	0.46	164	29	0.18	158	27	0.17	0.96	0.93	0.94	11	12	-1	0.92
13	164	76	0.46	164	31	0.19	160	29	0.18	0.98	0.94	0.95	12	13	-1	0.92
14	164	76	0.46	164	33	0.20	164	31	0.19	1.00	0.94	0.95	14	14	-1	0.96
15	164	76	0.46	164	37	0.23	164	36	0.22	1.00	0.97	0.96	15	15	0	0.98
16	164	76	0.46	164	40	0.24	164	38	0.23	1.00	0.95	0.96	15	16	-1	0.94
17	164	76	0.46	164	42	0.26	164	39	0.24	1.00	0.93	0.92	16	17	-1	0.94
18	164	76	0.46	164	45	0.27	164	40	0.24	1.00	0.89	0.89	16	18	-3	0.86
19	164	76	0.46	164	47	0.29										
20	164	76	0.46	164	50	0.30										
21	164	76	0.46	164	54	0.33										
22	164	76	0.46	164	57	0.35										
23	164	76	0.46	164	60	0.37										
24	164	76	0.46	164	62	0.38										
25	164	76	0.46	164	65	0.40										
26	164	76	0.46	164	68	0.41										
27	164	76	0.46	164	71	0.43										
28	164	76	0.46	164	74	0.45										
29	164	76	0.46	164	75	0.46										
30	164	76	0.46	164	76	0.46										

Table 5.4 – Summary Report Table

In the report in table 5.4 above, the Earned Schedule (ES) calculations have also been added for additional information and have been obtained in accordance with the formula of Lipke[10] amended by replacing the EV and PV with EH and PH respectively. SPI(t) was calculated as ES/AD and SV(t) as ES-AD. ES is the Earned Schedule value introduced by Lipke and AD is the actual duration.

Interestingly, the SPI(t), which is supposed to be the corrected SPI of Lipke, has been found to be somehow in line with our HPI (its EHM counterpart). The instances when these two indicators are not close or contradictory are mainly due to the inconsistency in progress of the structure and subsequent activities.

Below is a sample graph that can be obtained from the EVM report. In later chapters, the graph will be explained in detail.

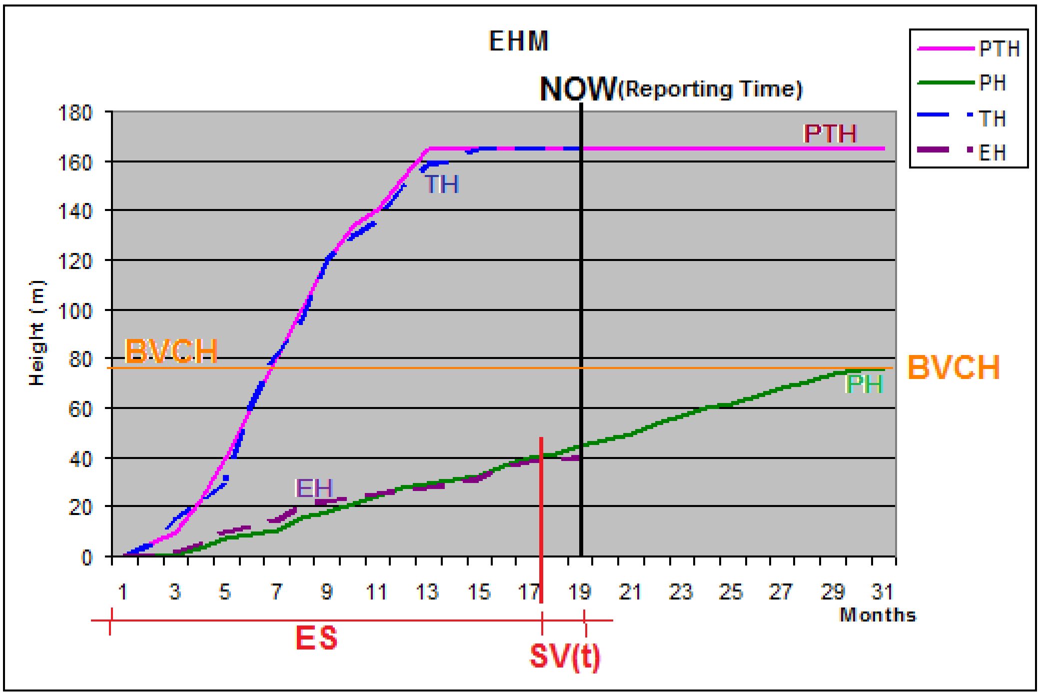


Figure 5.1 - EH graph

5.4 Usefulness of the Reports and Indicators

By having the EHM report in hand (as in table 5.4 and figure 5.1), the project manager of a high-rise building project will have access to vital information that's neither directly nor easily obtained from the currently-used project management methods for monitoring progress. The EHM allows the project manager know the status of the progress of the entire project in addition to knowing the relative progress of the "locomotive", or the structure, with respect to its subsequent activities.

PTH (Planned Total Height) is the total height the structure is supposed to reach based on the planned progress of work. This should usually refer to the planned progress in the baseline time schedule.

PH (Planned Height) is the earned height that was planned to be reached at the reporting time.

PHR (Planned Height Ratio), calculated as PH divided by PTH, tells the project manager how the PH is supposed to progress in relation to the PTH according to the baseline time schedule.

TH (Total Height) is the direct measurement of the total project height reached at the time of reporting. Usually the reporting is done at monthly interval. The comparison of

TH to PTH, reported in the form of THPI, determines how the structure is doing in comparison to the planned.

EH (Earned Height) expresses the real resultant physically-described height the project has reached according the EHM method. Unlike the TH (Total Height) that can be reached by only moving forward with one single activity (the structure), the EH accumulates progress achieved in all the open activities, and thus reflecting the real progress of the entire project.

EHR (Earned Height Ratio), which is equal to EH divided by TH at the reporting time, tracks the changes in EH with respect to TH throughout the life cycle of construction. This normally starts high in the project and decreases. It decreases very sharply after the structure is completed and the total height of the building (BTH) is reached. This will fix the denominator of the equation to a constant value while the EH continues to increase until it reaches its maximum height, which is BVCH (Building Value Center Height). For the building to be going as planned, the EHR should be very close to PHR. If EHR is higher than PHR, it doesn't necessarily mean a better achievement than planned unless when the structure is ahead of schedule.

THPI (Total Height Performance Index), calculated by dividing the TH by the PTH, advises the project manager if the structure is going as per planned. A THPI greater than one is very desirable and means the structure is going faster than planned and the project is gaining "high-quality" float in its most driving activity.

HPI (Height Performance Index), calculated as the division of EH by the PH, informs the project manager about the progress of the entire project. A HPI less than one means the project in its entirety is behind.

HRPI (Height Ratio Performance Index), calculated as the division of EHR by the PHR, provides a comparison between the current relative project-to-structure progress against the planned project-to-structure progress. An HRPI greater than one is good news only if the structure is ahead of time, i.e. if the THPI is greater than one.

Having all these gauges on his dashboard, the project manager can evaluate the current progress and spot any drifting from, or lagging behind, the schedule without having to decipher a lengthy bar chart schedule.

An experienced project manager can also use the report for several reasons, such as:

- telling if the project is in delay
- telling if the delay is coming from the structure of subsequent activities, or both
- proper re-assignment of resources
- making trade-offs between float in structure and float in subsequent activities
- knowing the structure total height at any time (useful for crane jacking, hoists raising, regulatory approvals, and materials placing and handling)
- using the historic values of BHR (Building Height Ratio) for parametric estimation of the durations of future projects

Chapter

6

SOFTWARE

6.1 HIRI-PRO Software

HIRI-PRO software has been developed by this research introduced here for the application of EHM method. The main objective was to have a user-friendly tool that can be used by the volunteered users of the EHM method in the case studies discussed later in this research.

The name HIRI-PRO stems from "High-Rise" and "Project". This software is a tool applicable for the management of high-rise projects.

HIRI-PRO is a database prepared using SQL language and MS ACCESS application. One single database file can be used to store the data of several projects at the same time. It can easily accommodate any project with any number of floors and any number of work packages. In this research, the programming of HIRI-PRO executable file and its database has been done from scratch.

This database has tables capable of storing all the costs (values) in the project distributed over the activities. The heights of floors are entered in the table and therefore each value will have a corresponding height. The database automatically performs the necessary calculations to determine the height of the building value center (BVCH).

The planned values for each work package and each floor are entered into the database and are used as baseline. The database calculates the Planned Height (PH) and Planned Total Height (PTH) for every month. The actual Earned Height (EH) and Total Height (TH) are compared to the PH and PTH by the database.

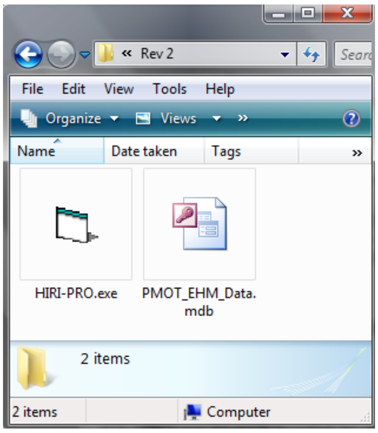


Figure 6.1 - HIRI-PRO Files

6.2 Getting Started With HIRI-PRO

The steps and explanations in this section have been basically developed to help the user of HIRI-PRO get through the software and be able to operate it. The users who have used HIRI-PRO in the five case studies, to be reported later in this dissertation, have been trained by the researcher to work according to these steps. HIRI-PRO can be easily installed by copying its two files from the installation disk. The two files needed are (as shown in figure 6.1):

- HIRI-PRO.exe (the executing file)
- PMOT_EHM_DATA.mdb (the database file)

HIRI-PRO.exe operates the database. It starts the database, queries its tables, and triggers the reports generation.

PMOT_EHM_DATA.mdb is an MS ACCESS database containing tables, forms, queries, macros, and reports. This is where the data corresponding to projects is actually stored.

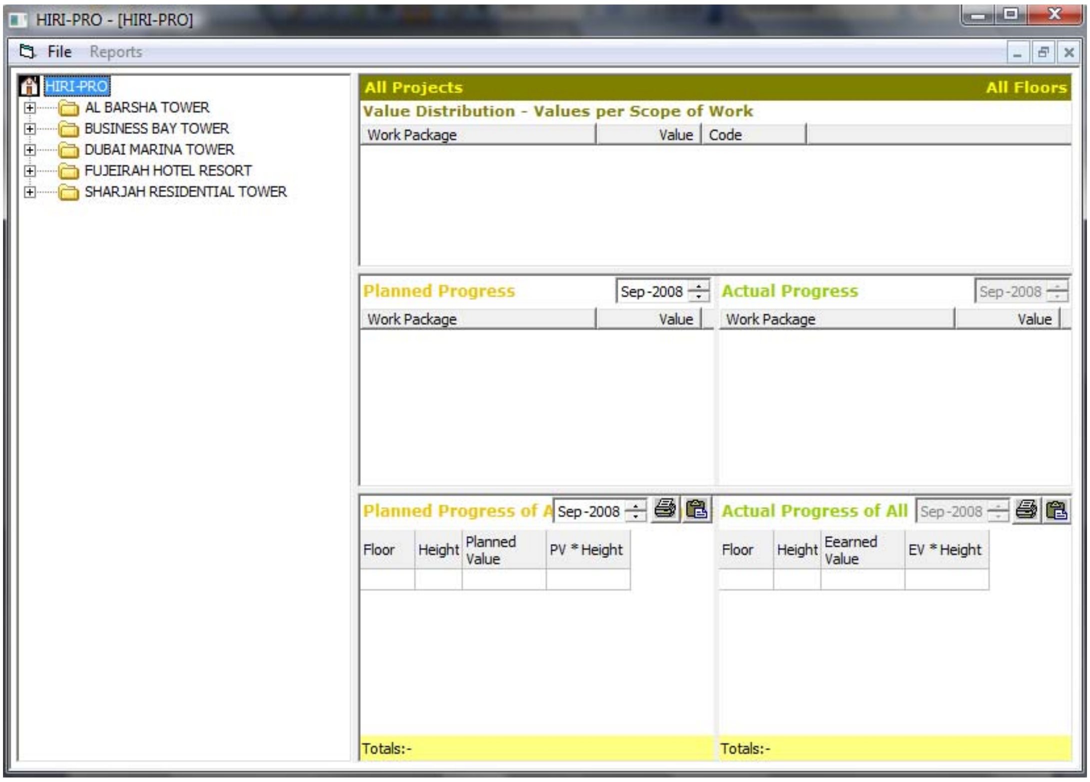


Figure 6.2 - Main Screen in HIRI-PRO

HIRI-PRO is directly run by double clicking the HIRI-PRO.exe icon. Upon start-up, the screen shown in figure 6.2 will appear. This screen here shows an already-populated database including the five projects subjects of the case studies considered later in this research.

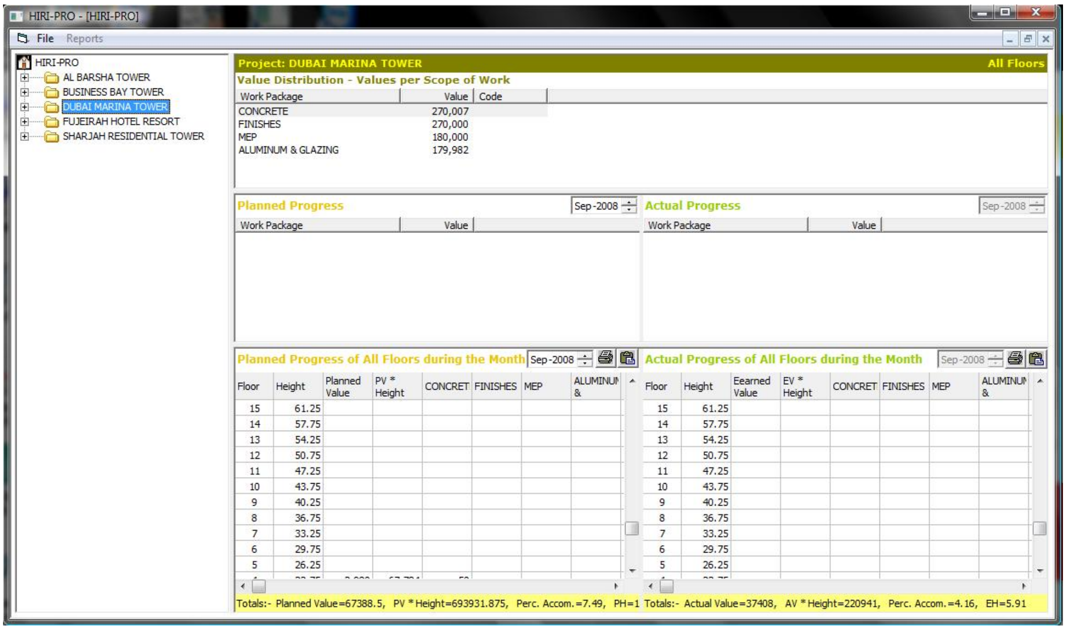


Figure 6.3 - Screen for distribution of Planned and Actual

In the screen shown in figure 6.2, when the cursor is placed on one project, the right side of the screen displays the value distribution and the planned and actual recorded progress for that particular project (as shown in figure 6.3). This is kind of quick report about the status. The more formal report will be discussed below.

To start with HIRI-PRO, a new project has to be created. A new project can be added to the database anytime by right-clicking at the HIRI-PRO root directory in the screen shown in figure 6.2. A screen such as the one shown in figure 6.4 will open where the new project can be added. The project will automatically be saved.

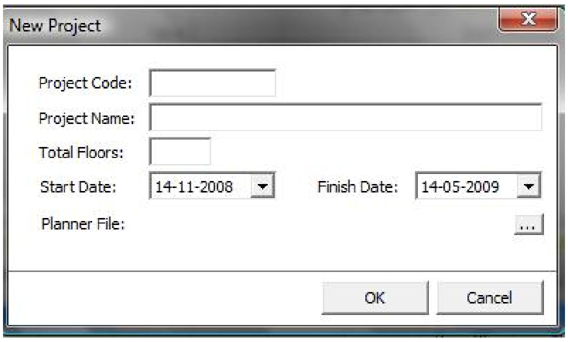


Figure 6.4 - Screen for adding a new project

A project can be easily deleted by right clicking on the project name in the screen of figure 6.2. This allows the user to delete or edit the project.

6.3 Data Collection and Input

After a project is added, the value of the project has to be broken down over the floors and the work packages to produce what we call here Value Distribution Table.

The distribution of values has to take place at each and every level. This is done by expanding the directory of the project where values are desired to be added. After expanding the project directory, all the floors in the project will be shown as per figure 6.5. Then, the value for each work package can be entered for the selected floor.

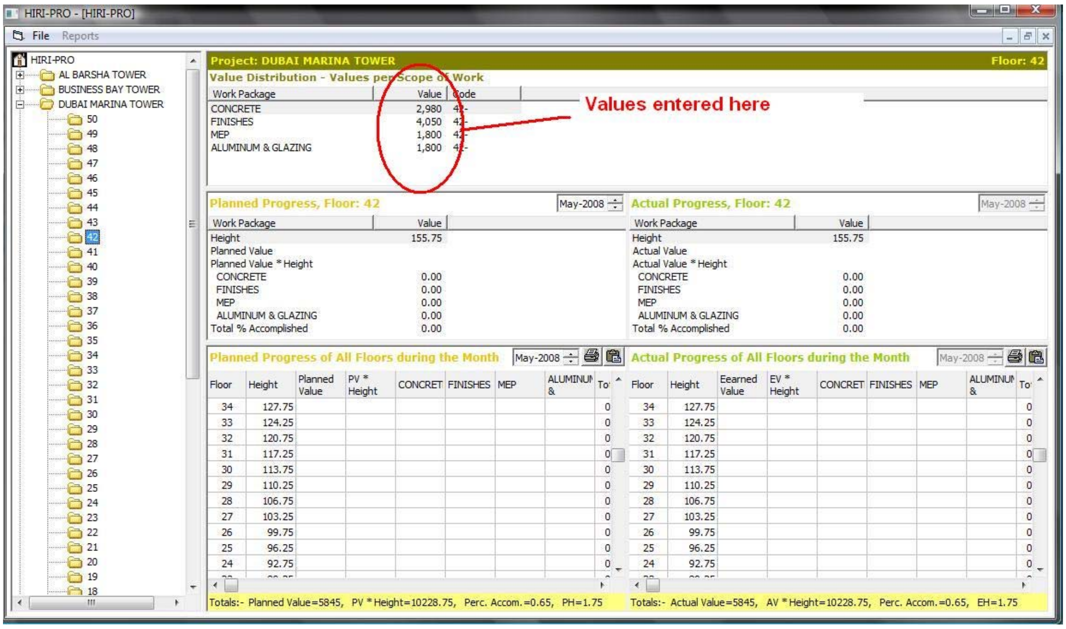
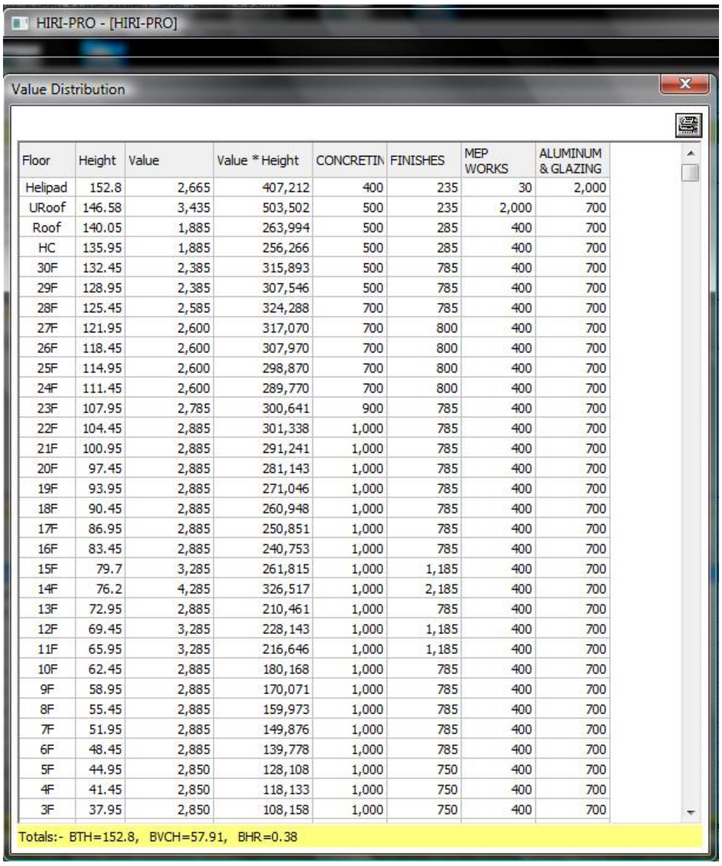


Figure 6.5 - Screen used for distributing the value over the floors and packages

By assigning the values to all the floors and respective work packages, the screen shall look like the Value Distribution Table in figure 6.5.



HIRI-PRO - [HIRI-PRO]

Value Distribution

Floor	Height	Value	Value * Height	CONCRETIN	FINISHES	MEP WORKS	ALUMINUM & GLAZING
Helipad	152.8	2,665	407,212	400	235	30	2,000
URoof	146.58	3,435	503,502	500	235	2,000	700
Roof	140.05	1,885	263,994	500	285	400	700
HC	135.95	1,885	256,266	500	285	400	700
30F	132.45	2,385	315,893	500	785	400	700
29F	128.95	2,385	307,546	500	785	400	700
28F	125.45	2,585	324,288	700	785	400	700
27F	121.95	2,600	317,070	700	800	400	700
26F	118.45	2,600	307,970	700	800	400	700
25F	114.95	2,600	298,870	700	800	400	700
24F	111.45	2,600	289,770	700	800	400	700
23F	107.95	2,785	300,641	900	785	400	700
22F	104.45	2,885	301,338	1,000	785	400	700
21F	100.95	2,885	291,241	1,000	785	400	700
20F	97.45	2,885	281,143	1,000	785	400	700
19F	93.95	2,885	271,046	1,000	785	400	700
18F	90.45	2,885	260,948	1,000	785	400	700
17F	86.95	2,885	250,851	1,000	785	400	700
16F	83.45	2,885	240,753	1,000	785	400	700
15F	79.7	3,285	261,815	1,000	1,185	400	700
14F	76.2	4,285	326,517	1,000	2,185	400	700
13F	72.95	2,885	210,461	1,000	785	400	700
12F	69.45	3,285	228,143	1,000	1,185	400	700
11F	65.95	3,285	216,646	1,000	1,185	400	700
10F	62.45	2,885	180,168	1,000	785	400	700
9F	58.95	2,885	170,071	1,000	785	400	700
8F	55.45	2,885	159,973	1,000	785	400	700
7F	51.95	2,885	149,876	1,000	785	400	700
6F	48.45	2,885	139,778	1,000	785	400	700
5F	44.95	2,850	128,108	1,000	750	400	700
4F	41.45	2,850	118,133	1,000	750	400	700
3F	37.95	2,850	108,158	1,000	750	400	700

Totals:- BTH=152.8, BVCH=57.91, BHR=0.38

Figure 6.6 Screen shot from HIRI-PRO showing the Value Distribution Table

The Value Distribution Table can be printed from HIRI-PRO and it should look like in figure 6.6 above. It can also be printed using the HIRI-PRO reporting feature and it will look like table 6.1 below.

SHARJAH RESIDENTIAL TOWER

Floors: 42

Start Date: **1-Feb-2006**   Finish Date: **30-Jul-2008**

Value Distribution

Floor	Work Package	Height	Value	Value * Height
Helipad		**152.80**	**2,665.00**	**407,212.00**
	CONCRETING		400.00	
	FINISHES		235.00	
	MEP WORKS		30.00	
	ALUMINUM & GLAZING		2,000.00	
URoof		**146.58**	**3,435.00**	**503,502.30**
	CONCRETING		500.00	
	FINISHES		235.00	
	MEP WORKS		2,000.00	
	ALUMINUM & GLAZING		700.00	
Roof		ado.WorkDesc (String)		**263,994.25**
	CONCRETING			
	FINISHES		285.00	
	MEP WORKS		400.00	
	ALUMINUM & GLAZING		700.00	
HC		**135.95**	**1,885.00**	**256,265.75**
	CONCRETING		500.00	
	FINISHES		285.00	
	MEP WORKS		400.00	
	ALUMINUM & GLAZING		700.00	
30F		**132.45**	**2,385.00**	**315,893.25**
	CONCRETING		500.00	
	FINISHES		785.00	
	MEP WORKS		400.00	
	ALUMINUM & GLAZING		700.00	
29F		**128.95**	**2,385.00**	**307,545.75**
	CONCRETING		500.00	
	FINISHES		785.00	
	MEP WORKS		400.00	
	ALUMINUM & GLAZING		700.00	
28F		**125.45**	**2,585.00**	**324,288.25**
	CONCRETING		700.00	
	FINISHES		785.00	
	MEP WORKS		400.00	
	ALUMINUM & GLAZING		700.00	
27F		**121.95**	**2,600.00**	**317,070.00**
	CONCRETING		700.00	
	FINISHES		800.00	
	MEP WORKS		400.00	
	ALUMINUM & GLAZING		700.00	
26F		**118.45**	**2,600.00**	**307,970.00**
	CONCRETING		700.00	
	FINISHES		800.00	
	MEP WORKS		400.00	
	ALUMINUM & GLAZING		700.00	

Totals:- BTH=152.8, BVCH=57.91, BHR=0.38

Table 6.1 - Value Distribution Table in printable form produced by HIRI-PRO

Back to the screen of figure 6.5, the planned values have to be entered there. All is needed is to know at every reporting time interval the percent complete for each work package at each floor. This can be done by running the planning software once for each required date.

During the course of the project, the actual percent complete has to be entered for each floor for each work package. This allows HIRI-PRO to calculate the EH. The actually reached TH (Total Height) has to be entered as input in order to have all the ratios and indices calculated.

6.4 Generating Reports Using HIRI-PRO

HIRI-PRO can quickly and automatically generate an up-to-date EHM report based on the latest information entered. The report is produced by right-clicking on the project name and the select "Summary Report". This returns a summary report as shown in table 6.2 below including all the ratios and indices of the EHM method. Additionally, the terms of the EVM and ES methods have been added for the sake of comparison.

SHARJAH RESIDENTIAL TOWER

Floors: 42

Start Date: **1-Feb-2006** Finish Date: **30-Jul-2008**

Summary Report

Month	PTH (m)	PH (m)	PHR	TH (m)	EH (m)	EHR	THPI	HPI	HRPI	PV (AED)	EV (AED)	SPI	ES (mo)	AD (mo)	SV(t) (mo)	SPI(t)	COMMENT / ANALYSIS	Rating
1	9	5	0.54	5.60	3.68	0.66	0.62	0.76	1.22	2,500	1,900	0.76	0.66	1.00	-0.34	0.66	Project behind, Structure behind, Subsequent Activities delayed less than structure	Alarming
2	16	8	0.52	15.80	7.83	0.50	1.00	0.96	0.96	4,500	4,300	0.96	1.89	2.00	-0.11	0.95	Project behind, Structure on time, Subsequent Activities behind	Alarming
3	23	12	0.51	22.60	10.72	0.47	1.00	0.93	0.92	6,500	6,000	0.92	2.76	3.00	-0.24	0.92	Project behind, Structure on time, Subsequent Activities behind	Alarming
4	31	15	0.49	30.95	14.67	0.47	1.00	0.97	0.96	8,500	8,250	0.97	3.73	4.00	-0.27	0.93	Project behind, Structure on time, Subsequent Activities behind	Alarming
5	38	17	0.45	37.95	17.76	0.47	1.00	1.05	1.04	11,845	12,345	1.04	5.91	5.00	0.91	1.18	Project ahead, Structure on time, Subsequent Activities ahead	
6	45	18	0.40	48.45	18.52	0.38	1.08	1.04	0.95	16,435	17,758	1.08	7.19	6.00	1.19	1.20	Project ahead, Structure ahead, Subsequent Activities ahead less than structure	
7	52	18	0.35	51.95	17.73	0.34	1.00	0.96	0.97	22,115	22,210	1.00	7.21	7.00	0.21	1.03	Project behind, Structure on time, Subsequent Activities behind	Alarming
8	59	15	0.26	58.95	16.07	0.27	1.00	1.06	1.04	36,625	36,005	0.98	8.80	8.00	0.80	1.10	Project ahead, Structure on time, Subsequent Activities ahead	
9	69	16	0.23	65.95	15.47	0.23	0.95	0.95	1.00	52,190	54,800	1.05	8.80	9.00	-0.20	0.98	Project behind, Structure behind, Subsequent Activities equally delayed as the structure	Alarming
10	80	19	0.24	76.20	18.05	0.24	0.96	0.96	1.00	63,130	66,320	1.05	9.73	10.00	-0.27	0.97	Project behind, Structure behind, Subsequent Activities equally delayed as the structure	Alarming
11	90	21	0.24	86.95	20.62	0.24	0.96	0.97	1.00	74,750	73,305	0.98	10.77	11.00	-0.23	0.98	Project behind, Structure behind, Subsequent Activities equally delayed as the structure	Alarming
12	101	25	0.24	97.45	23.24	0.24	0.97	0.95	1.00	81,450	79,130	0.97	11.58	12.00	-0.42	0.97	Project behind, Structure behind, Subsequent Activities equally delayed as the structure	Alarming
13	111	28	0.25	107.95	26.62	0.25	0.97	0.96	1.00	87,911	82,640	0.94	12.60	13.00	-0.40	0.97	Project behind, Structure behind, Subsequent Activities equally delayed as the structure	Alarming
14	122	30	0.25	121.95	29.06	0.24	1.00	0.95	0.96	93,742	86,985	0.93	13.47	14.00	-0.53	0.96	Project behind, Structure on time, Subsequent Activities behind	Alarming
15	132	33	0.25	128.95	31.38	0.24	0.97	0.95	0.96	99,298	94,090	0.95	14.36	15.00	-0.64	0.96	Project behind, Structure behind, Subsequent Activities delayed more than structure	Alarming
16	147	36	0.24	146.58	34.55	0.24	1.00	0.97	1.00	104,808	101,853	0.97	15.47	16.00	-0.53	0.97	Project behind, Structure on time, Subsequent Activities behind	Alarming
17	153	38	0.25	146.58	36.05	0.25	0.96	0.96	1.00	109,888	106,076	0.97	15.97	17.00	-1.03	0.94	Project behind, Structure behind, Subsequent Activities equally delayed as the structure	Alarming
18	153	39	0.26							114,518								
19	153	41	0.27							118,968								
20	153	42	0.28							122,898								
21	153	44	0.29							126,668								
22	153	45	0.30							130,443								

Legend
m = Meter; mo = Months
PTH = Planned Top Height; PH = Planned Height; PHR = Planned Height Ratio, PH/PTH
TH = Top Height; EH = Earned Height; EHR = Earned Height Ratio, EH/TH
THPI = Top Height Performance Index, TH/PTH; HPI = Height Performance Index, EH/PH; HRPI = Height Ratio Performance Index, EHR/PHR
PV = Planned Value; EV = Earned Value; SPI = Schedule Performance Index, EV/PV
ES = Earned Schedule; AD = Actual Duration
SV(t) = Schedule Variance (t); SPI(t) = Schedule Performance Index(t), ES/AD

1

Table 6.2 - Sample Summary Report produced by HIRI-PRO

In addition to the tabular report, the data contained in the report can be automatically presented in graph format as shown in figure 6.7. More details of the graphs are discussed in the case studies in later chapters and actual graphs representing the case studies have been included in appendices A through E.

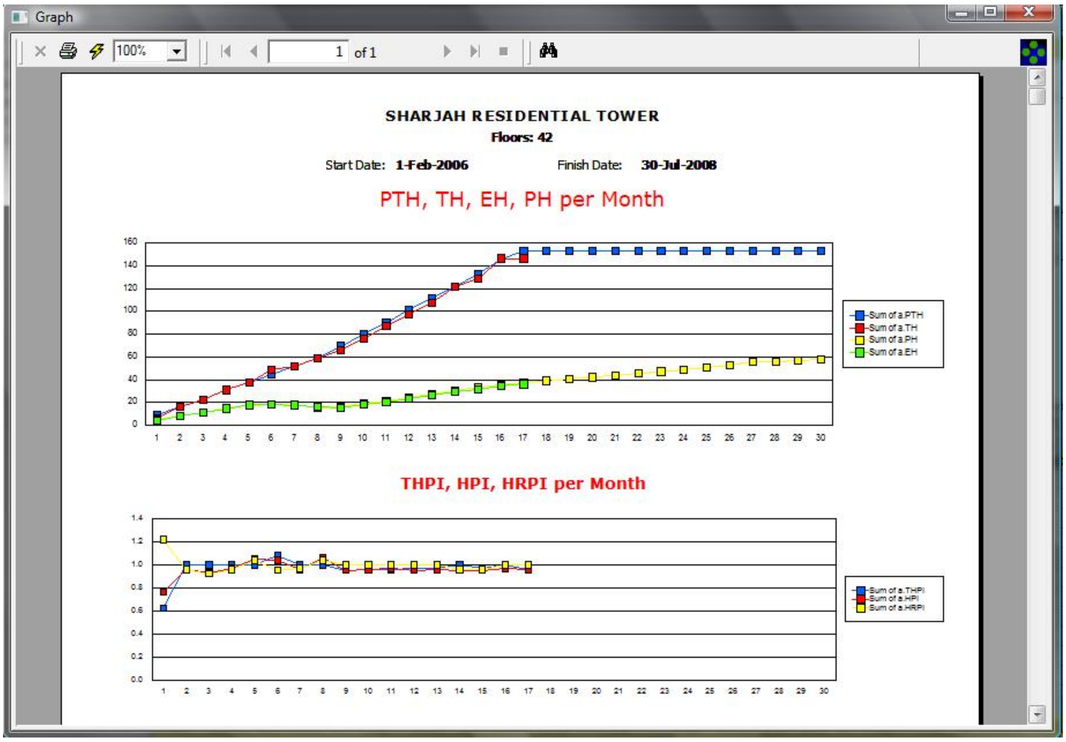


Figure 6.7 - Sample of graphs produced by HIRI-PRO

6.5 Enhancement: Smart Reports

Some artificial intelligence has been added to the EHM reports. The report has been equipped with a "Comment/Analysis" column that evaluates the situation in the project and tells the project manager what's behind and what's ahead. The report also alarms the user if anything is, or about to be, going wrong in the project.

Appendix L at the end of dissertation exhibits the decision table used for the conditions that would include an alarm in the report of HIRI-PRO.

Chapter

7

Research Methodology

7.1 Selection of Research Method

In this research, a new project management method is being introduced and discussed. This new method will be used for measuring and reporting progress in construction projects previously measured and reported using some other methods. The existence of other methods had to be investigated by means of conducting an action research as described below.

The new method has been tested in this research by applying it to five on-going construction projects. This forms the experiment part of the research. To make this experimenting part more workable, a model has been developed. This modeling part of the research is described below and has been referred to in other chapters as HIRI-PRO software.

The usage of the following applied research methods has been described in 7.2, 7.3, and 7.4 below:

- Action research

- Experiment research

- Modeling

7.2 Action Research

The current methods used to monitor the schedule in construction buildings have been reviewed in order to introduce possible improvements. There are currently several methods used for monitoring and reporting the progress in projects. However, as it can be read in this dissertation, the methods examined are neither specific for the construction nor specific for high-rise buildings. The research, thus, examined the generic methods and their pertinence to the high-rise construction projects.

Primarily, the research focused on the EVM (Earned Value Management) method and its derivatives such as the ES (Earned Schedule) method. In the research, the technical construction methods haven't been examined although brought up sometimes. Rather, this research was concerned with how the progress in the project can be measured, reported, and controlled.

7.3 Experiment Research

In the experiment part, the developed EHM method has been put into test. Extensive usage of the method has been carried out for over four months and based on actual data collected from the projects.

Five case studies of on-going projects have been considered. These projects are all based in Dubai and rise beyond 25 levels (except one project based in Fujeirah and doesn't exceed 9 floors in height). The projects subject of the case studies are of varying shapes, heights, specifications, number of basements, contracted procurement method, and management parties. Section 7.5 below describes how the projects have been chosen.

7.4 Modeling

EHM is a method consisting of theory, ratios, and indicators. For virtually any construction project where contemporary project management tools are used, the EHM ratios and indicators can be calculated. However, there is some degree of difficulty in doing so in the absence of reliable tools and techniques.

Software application (called HIRI-PRO) has been introduced to model the EHM method and run the input of the five case studies. The model could have been a simple spreadsheet where the input is entered and the calculations of EHM indices take place. However, HIRI-PRO has been developed to reduce the time needed for data-entry and make the task of the volunteering users easier. It's estimated that HIRI-PRO reduced the time needed for data entry by nearly 70% according to the users.

7.5 Choosing the Appropriate Case Studies

Choosing the case studies had to be done considering the following factors:

- The project must be undoubtedly perceived as high-rise
- The project must be under construction and progressing
- The project must be physically accessible
- Data about the project must be available and non-confidential
- A knowledgeable person to collect and feed the data must be available

- Time schedule and cost breakdown must be available

All the chosen projects fit the description except for Fujeirah project not being high enough. The chosen projects, in addition to meeting the above-listed criteria, had to be of certain variety in terms of shape, height, specifications, number of basements, type of foundation, contracted procurement method, duration, urgency, and management entities.

7.6 The Case Studies: Practical Work and Hands-On Experience

After selecting the projects, the practical part of data gathering had to be done. This would require that qualified users spend substantial time and effort collecting data and feeding the EHM templates.

The users have been qualified. The typical user was expected to:

- be having construction or planning background (EVM knowledge is preferable)
- be present on the project in one of the following capacities:
    - Project Manager
    - Project Planner
    - Project Controller
    - Project Coordinator
    - Project Administrator (with planning role)
- be able to spare adequate time to enter the data and produce reports
- be willing to learn and try the EHM method
- be available for meeting and discussing the EHM and the overall experience
- be willing to continuously provide feedback

Based on the above, meeting with the project managers of nine projects have been conducted. Four projects have been dismissed due to the lack of available person who can fit the above description and dedicate the time needed for completion of the research.

The remaining five projects have been taken on board and the EHM method application has been launched with the help of the selected users. The users are the planning engineers on these five projects, with the help and support of project managers in most of the cases.

Chapter

8

CASE STUDIES

8.1 Sharjah Project

Figure 8.1 - Sharjah Project

This residential tower project includes 180 apartments equally spread over 30 floors above a ground floor, a mezzanine, and eight parking floors. The location of this project in Al-Khan area overlooking a beautiful park made the project the first high-rise in the surrounding.

The construction of building started in February 2006 and the project had ample duration of 30 months for completion. Such duration in nowadays market seems long in comparison with similar projects in the market. The main challenge in the construction of this building was the construction of the cantilevered steel roof feature and its helipad. That element required proper engineering, detailing, fabrication, and erection.

The construction of project was procured after completion of the design as a lump sum contract awarded to one main contractor. The absence of concurrency between the design and the construction didn't allow the client to have an early start, however, it allowed having a fixed budget and more control over future changes.

Below are the details of the project.

Project Name:	Sharjah Tower
Location:	Sharjah, UAE
Building Usage:	Residential
Structure Type:	Reinforced Concrete
Type of External Cladding:	Aluminum & Curtain Wall
Type of Foundations:	Raft on piles, isolated/spread footings on piles

Water Table Level:	-3.0 m
Number of Basements:	-
Number of Floors (Ground and Above):	42
Plot Size:	3,150 sq. m.
Total Build-Up Area:	60,994 sq. m.
Total Height:	152.8 m
Average Height per Floor:	3.6 m
Deepest Level of Excavation:	-2.8 m
Project Value:	180,000,000 AED
Average Value per $m^{2:}$	2,951 AED/sq. m.
Average Value per Floor:	4,285,714 AED/floor
Planned Start Date:	1-Feb-06
Actual Start Date:	1-Feb-06
Total Planned Duration:	30 Months
Planned time per Floor:	22 Days
Application Used for Planning:	Primavera

The EHM summary report produced by HIRI-PRO software shows the project status at the end of every month of the elapsed 17 months of project duration. The user of HIRI-PRO was able to personally collect the data corresponding to last 4 month. All the data corresponding to the months before that have been obtained from the previous progress reports and project files.

The full EHM report for Sharjah Tower can be found in Appendices A and F. By looking at the row of month 17, we can have an idea about the current status of the project. As the COMMENT/ANALYSIS explains, the project is behind schedule, the structure is behind schedule, and both the structure and subsequent activities seem to be equally delayed.

HIRI-PRO has given that comment based on the following:

- THPI =0.96 (<1), this means the total height (structure) is behind.

- HPI=0.96 (<1), this means the whole project is behind.

- HRPI=1 means both the structure and the subsequent activities are performing similarly in comparison with the planned. Therefore, subsequent activities are late as well.

At the same time, the three columns PV, EV, and SPI are not part of the EHM method but rather the EVM method. These columns have been added for additional information and for the purpose of comparison between EVM and EHM results.

The same thing applies to the elements of ES concept, i.e. columns ES, AD, SV, and SPI(t). These have been added for the purpose of comparison only.

For the sake of comparison, at the end of month 7, the EHM method through its index HPI indicates project delays due to HPI of 0.96 (<1). However, EVM method says the project is on time as SPI is equal to 1.00. The ES method, for the same month, says that the project is ahead due to an SPI(t) of 1.03.

Digging into the details of the EHM results, it can be said that the THPI being equal to one has given a boost to the EV of the project, and this is why the EVM and ES show satisfactory results. However, the value of HPI was 0.96 at the end of month 7. This means the entire project is delayed, and thus the subsequent activities are delayed (since the structure is on time).

In this kind of conflict in the results (month 7), EHM proved its ability to provide information needed for decision making that the other methods (EVM and ES) were unable to accurately provide.

8.2 Business Bay Project

Business Bay project consists of 42 atypical levels of offices in an iconic geometric shape standing in prime upcoming business area in Dubai. The construction contract includes shell and core works only. “Shell and Core” in this market is referred to as delivering fully finished public and common areas, but leaving the interior of the offices barely unfinished. The tenants are supposed, later, to do the tiling, ceiling, wall rendering, internal air-conditioning, and the subsequent finishing activities.

Figure 8.2 - Business Bay Project

Due to high competition and desirability of the project, the contractor accepted to be awarded the project at a low price and for a record duration of 23 months. Meeting the duration was the main challenge to the contractor and all the parties involved in the project.

Similarly to Sharjah tower, the construction of this project was procured after completion of the design as a lump sum contract awarded to one main contractor. The absence of concurrency between the design and the construction didn’t allow the client to have an early start, however, it allowed having a fixed budget and more control over future changes.

Below are the details of the project.

Project Name:	Business Bay Project

Location:	Business Bay, Dubai, UAE
Building Usage:	Commercial, Offices, Shell & Core
Structure Type:	Reinforced Concrete with Post-Tensioned Slabs
Type of External Cladding:	Aluminum & Curtain Wall
Type of Foundations:	Raft on piles
Water Table Level:	-7.0 m
Number of Basements:	3
Number of Floors (Ground and Above):	42
Plot Size:	6,112 sq. m.
Total Build-Up Area:	84,915 sq. m.
Total Height:	159.6 m
Average Height per Floor:	3.5 m
Deepest Level of Excavation:	-12.0 m
Project Value:	197,000,000 AED
Average Value per $m^{2:}$	2,320 AED/sq. m.
Average Value per Floor:	4,377,778 AED/floor
Planned Start Date:	1-Dec-07
Actual Start Date:	1-Dec-07
Total Planned Duration:	17 Months
Planned time per Floor:	13 Days
Application Used for Planning:	Primavera

The actual progress of Business Bay project was monitored for 7 months. The full EHM report is shown in Appendices B and G. Referring to the latest project status, Month 7, the COMMENT/ANALYSIS column indicates that the project and structure are behind schedule and subsequent activities are delayed less than the structure.

This analysis of HIRI-PRO resulted in the following values:

- THPI = 0.67 (<1), this means the total height (structure) is behind.

- HPI = 0.80 (<1), this means the whole project is behind.

- HRPI = 1.21 (>1), this means that subsequent activities are late and are less delayed than the structure.

Based on the above, the project manager should improve the progress in the entire project. However, the project manager should give more attention to the structure for being in more delays that the subsequent activities. The HRPI is equal to 1.21; this means the subsequent activities have been nearly 21% faster than the structure.

Comparing EHM results to EVM, it's noted that EV is less than PV, thus resulting to a less than 1 SPI. Accordingly, the results of EVM analysis concurred with the results of EHM method (i.e. project is delayed according to the EVM as well).

The report shows that for the reported month, EVM and EHM conveyed the same overall project status but EVM analysis does not give any information about the comparison between the structure progress to subsequent activities productivity. Looking at Month 3, both EHM and EVM imply project delay, but EHM was able to indicate that subsequent activities are performing more poorly than the structure. With this in mind, the project manager could realize that he does not only need to improve on the structure but to look closely at subsequent activities' progress in order to catch up with the schedule.

8.3 Marina Project

Marina project is a large development on the prestigious touristic coast of Dubai Marina. This project consists of two towers on two common basements and common podium floors. The highest tower reaches 51 floors and it shall comprise high-quality serviced apartments. The second tower reaches 27 storey high and shall be used as a five-star hotel.


Figure 8.3 Marina Project

The project has been designed to be of high international standards. It involved international architects and several international sub-consultants specialized in such projects. The main challenge in this project was communication and coordination.

The construction of this project has been initiated using concurrent engineering and construction approach. The project has been awarded in phases to the main contractor by direct negotiation of the price. This approach made prediction of budget virtually impossible. Both the client and the contractor suffered of the absence of clear budget for the remaining packages. Besides, this created unease and conflict due to continuous prices negotiation and questioning.

The contracted construction duration had been assumed to be 36 months. This was based on the assumption that each and every package will be released, priced, and started as planned.

Project Name:	Marina Project
Location:	Dubai Marina, UAE
Building Usage:	Residential & Hotel
Structure Type:	Reinforced Concrete
Type of External Cladding:	Aluminum & Curtain Wall
Type of Foundations:	Raft on piles
Water Table Level:	-7.0 m
Number of Basements:	2
Number of Floors (Ground and Above):	51
Plot Size:	16,221 sq. m.
Total Build-Up Area:	157,384 sq. m.

Total Height:	210.0 m
Average Height per Floor:	3.5 m
Deepest Level of Excavation:	-12.0 m
Project Value:	900,000,000 AED
Average Value per $m^{2:}$	5,718 AED/sq. m.
Average Value per Floor:	16,981,132 AED/floor
Planned Start Date:	12-May-08
Actual Start Date:	12-May-08
Total Planned Duration:	36 Months
Planned time per Floor:	26 Days
Application Used for Planning:	Primavera

Dubai Marina project has been on-going for 5 months as of this writing. Appendices C and H include the full EHM report for this project. For the latest reported month which is Month 5, the COMMENT/ANALYSIS column indicates that the project and structure are behind schedule and subsequent activities are less delayed than the structure. EHM analysis seems to be most helpful in Month 2 in terms of describing project status.

Looking at Month 2, HIRI-PRO shows the following:

- THPI = 1, this means the total height (structure) is on time.
- HPI = 0.72 (<1), this means the whole project is behind.
- HRPI = 0.71 (<1), this means that subsequent activities are behind.

The project is behind though the structure is performing satisfactorily. This delay is linked to the delay in subsequent activities. EVM also implies that the project is delayed but does not cite the location of the delay; whereas the EHM does.

Glancing at the height reached by the structure, stakeholders might conclude that the project is on schedule when the whole project is actually delayed. EHM is smart to state that the cause of setback is due to the delay in subsequent activities. This analysis is effective in informing the project manager the reason behind the delay. At a glance, he can recognize the problem area and know the appropriate action to take.

From the EHM report, it can also be noticed that the EHR (Earned Height Ratio, EH/TH) decreased sharply in month 2 and then increased again in months 3 and 4, and then re-increase in month 5. Normally, the EHR starts high and decreases continuously till reaching the BHR (Building Height Ratio, BVCH / BTH) which is fixed. However, such fluctuation as the one happening in Dubai Marina project is not very uncommon, but it means the project manager should revisit the consistency of his plan.

8.4 Fujeirah Project

Fujeirah project can hardly fit under the high-rise title and doesn't satisfy the definition of high-rise made in the beginning of this document. However, this project has been added to test the possibility of applying the EHM method in middle-rise projects. This is kind of testing the boundaries of EHM indices.

Figure 8.4 - Fujeirah Project

This five-star hotel resort and spa project consists of 10 main buildings, the highest of which reaches 9 floors in height. The project complexity, international environment, and phasing of construction is identical to that of Marina project above.

The planned duration for construction is also 36 months assuming the packages will be released, priced, and started as planned.

Project Name:	Fujeirah Project
Location:	Fujeirah, UAE
Building Usage:	Hotel Resort
Structure Type:	Reinforced Concrete
Type of External Cladding:	Plastering, Paint, GRC, Stone, Glass & Aluminum
Type of Foundations:	Raft, Isolated/Spread footing on piles
Water Table Level:	-3.5 m
Number of Basements:	1
Number of Floors (Ground and Above):	9
Plot Size:	64,935 sq. m.
Total Build-Up Area:	47,099 sq. m.
Total Height:	31.43 m
Average Height per Floor:	3.2 m
Deepest Level of Excavation:	-3.0 m
Project Value:	450,000,000 AED
Average Value per $m^{2:}$	9,554 AED/sq. m.
Average Value per Floor:	45,000,000 AED/floor
Planned Start Date:	7-Feb-08
Actual Start Date:	7-Feb-08
Total Planned Duration:	36 Months
Planned time per Floor:	3.6 Months
Application Used for Planning:	Primavera

The full EHM report about Fujeirah project is included in Appendices D and I. For the past 8 months, actual progress has been reported and month-end developments show similar trend. From Month 2 to Month 8, EHM reported that the project is behind schedule, structure on time and subsequent activities are behind.

Looking at the indices during those eight months, HIRI-PRO reported the following:

- THHPI = 1, this means the total height (structure) is on time.

- HPI = <1, this means the whole project is behind.

- HRPI = <1, this means that subsequent activities are slower than structure (thus behind).

EVM also concluded that project is behind schedule. Similar to Marina Project, EVM failed to imply where the problematic area causing the entire delay is. With EHM, one can clearly reckon that improvement in subsequent activities is necessary to draw near the planned progress.

It's worthwhile noting that at the end of month 8, the three different methods show total project delay but don't agree about the magnitude of such delay. Here's the difference:

According to EHM:	HPI = 0.92	(8% delay)
According to EVM:	SPI = 0.73	(27% delay)
According to ES:	SPI(t) = 0.55	(45% delay)

This difference might be due to the following:

- The fact that the project is still in its very early stages. It's true that 8 months elapsed, but the planned progress for those 8 months is only 14% of the total project value. Considering the S-curve effect, it's inaccurate to predict the project performance based on the first 14%.

- The project is not a typical high-rise, but rather a medium rise building. This reduces the significance of the height parameter and thus, increases the inaccuracy in the EHM method.

- The planned progress to date isn't much, but the planned total height is. This means the majority of the planned activities are "structure". Therefore, the THPI is crucial and meaningful.

Having the three (conflicting) indices, the explanation shouldn't necessarily mean that two of the three are wrong while the third is correct. The explanation of high HPI is that more work is done at higher levels than it's done at lower levels. This gave a boost to the HPI while SPI and SPI(t) remained quite low.

SPI(t) may marginally differ from the SPI due to the reason that the first is strongly affected by the steepness of the slope of the progress curve, while the latter depends solely on the total earned (EV) against planned (PV) in terms of money value.

8.5 Barsha Project

Barsha project is a simple building standing high in a busy recently-populated area in Dubai. This building is intended to be either leased as residential apartments or to be sold as free-hold apartments depending on market conditions at time of completion.

Figure 8.5 - Barsha Project

The building starts below ground with four basements and it stands 87m high above ground with twenty-four semi-typical floors.

The main challenge in the construction of Barsha project is the depth of excavation in comparison with the small floor area. This coupled with the difficulty in obtaining neighbors' approval for shoring anchors forced the designer to propose strut beams to hold the shoring around the excavation in place. The presence of strut beams made the works inside the plot very difficult.

The construction of this project was procured after full completion of the design as a lump sum contract awarded to one main contractor. The absence of concurrency between the design and the construction didn't allow the client to have an early start, however, it allowed having a fixed budget and more control over future changes.

Project Name:	Barsha Project
Location:	Al Barsha, Dubai, UAE
Building Usage:	Residential
Structure Type:	Reinforced Concrete
Type of External Cladding:	Aluminum & Curtain Wall
Type of Foundations:	Raft on piles
Water Table Level:	-5.0 m
Number of Basements:	4
Number of Floors (Ground and Above):	24
Plot Size:	1,706sq. m.
Total Build-Up Area:	24,631 sq. m.
Total Height:	87.0 m
Average Height per Floor:	3.6 m
Deepest Level of Excavation:	-15.6 m
Project Value:	155,244,209 AED

Average Value per $m^{2:}$	6,303 AED/sq. m.
Average Value per Floor:	5,544,436 AED/floor
Planned Start Date:	1-Mar-08
Actual Start Date:	1-Mar-08
Total Planned Duration:	30 Months
Planned time per Floor:	15 Days
Application Used for Planning:	Primavera

Based on EHM analysis, Al Barsha project shows fluctuating progress trends for the past 7 months of reporting. Refer to Appendices E and J for the full EHM report. The structure and subsequent activities seem to take turn in leading the progress.

Month 1, 2, 4 and 7 show THPI = 1, structure being on time. HPI is less than 1, HRPI also less than 1 which accordingly means that the whole project is behind and subsequent activities are behind.

Month 3 and 5 shows that project is behind, structure behind, and subsequent activities delayed than structure. This analysis is based on the following: THPI <1, HPI <1, HRPI >1.

In Month 6, project status is in good health as shown in comment/analysis column of HIRI-PRO report. It indicates that project ahead, structure on time, subsequent activities ahead. Report analysis was based on:

- THPI = 1, this means total height (structure) is on time.

- HPI = 1.03 (>1), this means whole project is ahead.

- HRPI = 1.03 (>1), this means subsequent activities are ahead as well.

- For this month, the EVM shows SPI = 0.85, which implies that the project is behind schedule (according the EVM method and not the ES method). At this instance, EHM analysis contradicts EVM. This might be due to the error that EVM uses the money value without giving any attention to the physical characteristics of the project. This can also mean that more work of value has been carried out at heights. This boosted the indices of the EHM in comparison to those of EVM.

Chapter

9

EHM LIMITATIONS AND BARRIERS

9.1 Shape of the Structure

The EHM method works best with rectangular buildings with minimal change in floor plans from floor to floor. However, The application of the method on Business Bay Project has given acceptable results without any sign of implication of reduction in floor size as we go higher.

9.2 Basements

When EHM is applied to a building with basements, the bench mark for height must be considered as the floor of the lowest basement and not the ground floor. The height of any floor is to be measured from the lowest basement.

However, the progress in such buildings start at ground level (excavation) before it starts at lower basements. The excavation work done at ground floor level will be considered having a height greater than zero and equal to the distance from the lowest basement. This shall create a false value of Earned Height.

Such error shall last only during the excavation and shoring work and has negligible effect compared to the value of other activities.

9.3 Material on Site

EHM method gives no credit to materials delivered to and stored on site. To avoid such under-representation of progress, a subjective adjustment can be made by the user by estimating the percent of completion corresponding to the value of materials stored on site or elsewhere but being dedicated for the project.

9.4 Pre-Engineered Work

Similarly, it's not uncommon in construction that several items or packages get engineered, fabricated, and assembled outside the premises of the project site. A good example can be the steel structures on top of towers roofs that are nowadays very trendy and prolific in Dubai and in other growing cities.

In such cases, the EHM is not designed to cater for such work that may be easily dropped off of the formula or progress measurement. To avoid such under-representation of progress, a subjective adjustment can be made by the user by estimating the percent of completion corresponding to the value of the work completed off-site and adding it to the formula of EH.

9.5 User's Assumptions

EHM provides additional indicators for the management, monitoring, and reporting of the progress in high-rise projects. This process allows for the user's involvement at two main stages: input stage and results interpretation stage.

During the input stage, the user may reduce the objectiveness and accuracy of the results through the following:

- Human error in data entry

- Poor activities breakdown structure

- Inaccurate reported completion percentages received from site

- Human inclination to show a certain outcome that matches certain predisposition

- Degree of objectivity in measuring the progress equivalent to materials on site

- Degree of objectivity in measuring the progress equivalent to pre-engineered work

During the results interpretation stage, the user must carefully examine the relationship between the different indicators. The user may wrongly report results based on a single indicator.

9.6 More Than One Building in the Project

If the project includes more than one building and each of the buildings is progressing at a different level, EHM will be reporting something like the average, which will not be useful. In such case, the project must be split into more than one project, considering each building (or tower) a separate entity.

Chapter

10

APPLICABILITY OF EHM

10.1 Cost vs. Benefit

EHM can be applied by any company constructing high-rise projects. However, the benefit of EHM to the organization must outshine the cost paid to apply it. The cost can be somehow accurately calculated by estimating the number of working hours spent by the quantity surveyor and planner collecting and inputting information. Normally, for the companies already having and updating cost-loaded time schedules, EHM requires an additional work of 30 to 60 hours per month.

For a project similar to Sharjah Tower, 45 hours/month would make a total cost of:

- Man-hours spent: 30 months x 45 hrs/month = 1,350 hrs
- Assumed hourly rate: 15,000 Dhs/month ÷ 208 hours/month = 72.11 Dhs/hr
- Total Cost of Man-hours spent = 1,350 hrs x 72.11 Dhs/hr = 97,348 Dhs
- Additional cost of software and IT (assumed) = 100,000 Dhs
- The total cost will be nearly 200,000 Dhs
- Divided by the project value, the cost of applying EHM in this project is 0.11%

The management of the company or project has to decide whether this amount is worth paying. If the daily value of liquidated damages for each additional day of delay is significant (45,000 Dhs/day for Sharjah Tower), then the management should probably invest in EHM method to have clearer view of the progress and more alarms. If the EHM will help avoiding just five days of delays and liquidated damages in Sharjah project, it would be worth the cost of such investment.

The benefit delivered by the EHM method is not always that easy to calculated and rather intangible in some cases. When the case is such, the management has to decide if that additional information is needed or the project can just do fine without EHM control and reporting.

10.2 Feedback from People Who Used EHM Method

The five people who volunteered to use the EHM method have experienced a new project management environment with lot of new terms and definitions. Experienced EVM users didn't seem to have problem understanding the meaning and interpretation of EHM terms. However, others who haven't been well exposed to EVM find it uneasy to grasp the meaning of the numerous terms, ratios, and indices of EHM.

The EHM method has been put into test by asking the volunteering planning engineers to apply the HIRI-PRO software on real-life ongoing-projects in Dubai for nearly 4 months. Appendix K exhibits the questionnaire used to survey the opinions of the EHM and HIRI-PRO users after the four months of usage.

Table 10.1 shows the replies to the questionnaire received from the five respondents. It's clear that almost all the users have recognized the value of EHM and HIRI-PRO and they would recommend them to be used for high-rise construction. On the other hand, there seems to be some difficulties in dealing with the software usage and data entry.

		Users' Replies						
-	Please answer the following questions as follows: 0 for "Strongly Disagree", 1 for "Disagree", 2 for "Neither Agree nor Disagree", 3 for "Agree", and 4 for "Strongly Agree"	**Case Study No. 1**	**Case Study No. 2**	**Case Study No. 3**	**Case Study No. 4**	**Case Study No. 5**	**Average**	**Interpretation of Average**
1	Before this EHM experience, you have been on the project responsible for the planning activities.	4	4	4	4	4	**4.00**	**Strongly Agree**
2	You have experience in planning and schedules control in the construction industry.	4	3	3	3	4	**3.40**	**Agree**
3	You have been using a planning software in your project.	4	4	4	4	4	**4.00**	**Strongly Agree**
4	You have budget (or value) breakdown in your project.	4	4	3	3	4	**3.60**	**Strongly Agree**
5	Your project is considered a high-rise building.	4	4	4	1	4	**3.40**	**Agree**
6	The trend to build high-rise buildings is, in your opinion, more likely to increase.	4	3	3	4	4	**3.60**	**Strongly Agree**
7	The EHM is very useful in managing projects.	3	4	2	3	4	**3.20**	**Agree**
8	The EHM provides the user with additional tools and information not delivered by other methods previously experienced.	3	3	2	4	4	**3.20**	**Agree**
9	The EHM method provides more accurate results than the EVM method for high-rise structures.	4	4	3	3	4	**3.60**	**Strongly Agree**
10	The EHM was found easy to apply.	1	2	2	3	3	**2.20**	**Neither Agree nor Disagree**
11	The way EHM & HIRI-PRO were presented to you were easy to understand.	3	2	2	4	3	**2.80**	**Agree**

		Users' Replies						
-	Please answer the following questions as follows: 0 for "Strongly Disagree", 1 for "Disagree", 2 for "Neither Agree nor Disagree", 3 for "Agree", and 4 for "Strongly Agree"	**Case Study No. 1**	**Case Study No. 2**	**Case Study No. 3**	**Case Study No. 4**	**Case Study No. 5**	**Average**	**Interpretation of Average**
12	The Ratios of EHM are easy to understand.	2	3	3	4	2	**2.80**	**Agree**
13	In your case study, the EHM has helped the Project Manager see problems not revealed by other methods.	4	3	4	3	4	**3.60**	**Strongly Agree**
14	In your project, the Project Manager accepted the recommendations of EHM method reports.	3	2	4	2	4	**3.00**	**Agree**
15	There was no resistance in your company or project to the usage of EHM method.	3	3	4	2	4	**3.20**	**Agree**
16	You have not encountered any similar methods dealing with high-rise.	4	2	4	4	4	**3.60**	**Strongly Agree**
17	HIRI-PRO software perfectly depicts the EHM method.	4	3	4	2	4	**3.40**	**Agree**
18	HIRI-PRO is easy to use.	4	3	3	4	3	**3.40**	**Agree**
19	HIRI-PRO can function properly without any improvements.	2	2	3	2	3	**2.40**	**Neither Agree nor Disagree**
20	HIRI-PRO reporting feature was found very effective and useful.	4	4	3	4	4	**3.80**	**Strongly Agree**
21	The benefit obtained by applying the EHM method justifies the time and cost spent in applying it.	3	2	2	3	4	**2.80**	**Agree**
22	EHM is to be recommended as a method for measuring progress in high-rise buildings.	4	4	3	2	4	**3.40**	**Agree**

Table 10.1 - Questionnaire For the Users Who Used EHM and HIRI-PRO

The planning engineer of Sharjah project found the EHM method very interesting and vital. He relied in his opinion on the incident that in the 7^{th} month of the project, both EVM method and ES method reported healthy situation while the EHM method alarmed of delay in subsequent activities that's very likely to delay the project.

The planning engineer of Fujeirah project didn't feel that the EHM method is applicable to his project (as this research expected) due to the following reasons:

- Building height is low (9 floors)
- Project included more than one building (EHM reported the average, which is inaccurate)

All the users agreed that the data entry process is cumbersome and they were all pleased by the development of automatic import-from-Primavera feature that made data-entry much easier.

Chapter

11

CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusion

As a conclusion, it can be confidently stated here, that the EHM method can give the project manager of a high-rise building very useful tools for monitoring the progress. It provides gauges that can be added to the dashboard or scoreboard of the project, thus, allowing safer sailing throughout till completion.

Without the EHM, the project manager does not have enough tools to know how well the construction of his high-rise project is progressing. there might be a case when the EVM method shows an SPI greater than one indicating comfortable situation while the project is drifting away of its planned completion date due to the reason that the driving activity is delayed.

In the case studies considered, there has been more than one case where the SPI of the EVM method gave positive results (SPI above 1) while the EHM method alarmed of late structure which means future delays.

The EHM method, by its very nature, encourages "vertical thinking". It makes the project manager appreciate the importance of height and the difference between doing an activity at ground floor and doing the same activity at the 20^{th} floor.

The EHM brings in classification of float. The float in the driving activity, structure, is said to be of higher class or quality than the float in other subsequent activities. Float in structure, if lost, it can be very hard to make it up again, if ever.

By applying the EHM theory, the reported progress can be expressed in more easily understandable terms than those of the EVM. By reporting the progress in terms of height (TH and EH), the stakeholders that are not having project management background can physically relate to the meaning of the reported figures.

11.2 The Future of the Research

If EHM method becomes widely accepted, there might come a day when the indicators, THPI, HPI, and HRPI, will become a core part of construction progress report for every high-rise building.

The more people in the industry give attention to height, the more this method will have chances for success.

11.3 Other Research Areas

The indicators of the EHM method can be used for predicting the performance of future projects. When the project is still in the design phase or tendering phase, the Building Value Center Height (BVCH) of the building can be determined. Dividing the BVCH by the Building Total Height (BTH) returns the Building Height Ratio (BHR). By comparing the obtained BHR of the building with the historically recorded values of BHR for previous projects should predict the possible construction duration of the project and probably some other important information about the likely behavior of the building.

It is recommended that further research be done in the area of finding a direct relationship between the BHR and the duration of the project.

The mathematical models prepared by De et al[20] may be applied to EHM method in the same way they applied to EVM. Future research on that subject should allow EHM to include decision making alternatives to make trade-offs between cost and time.

Appendix A – *EHM Summary Report – Sharjah Project*

SHARJAH RESIDENTIAL TOWER

Floors: 42

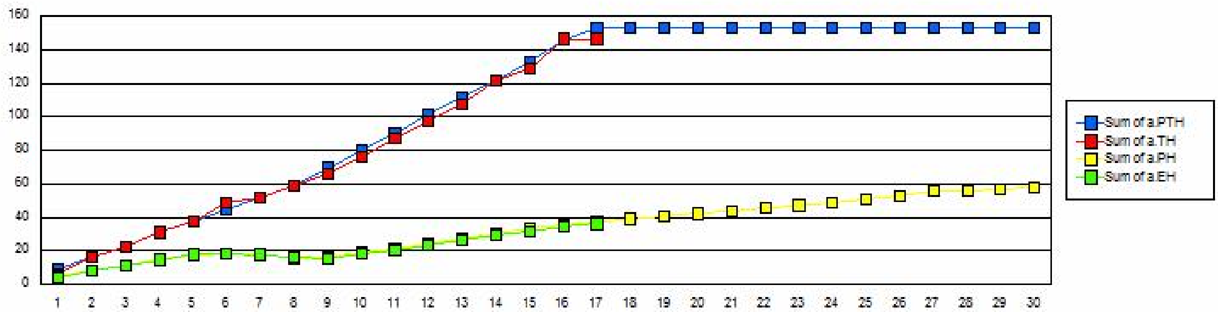
Start Date: **1-Feb-2006** Finish Date: **30-Jul-2008**

Summary Report

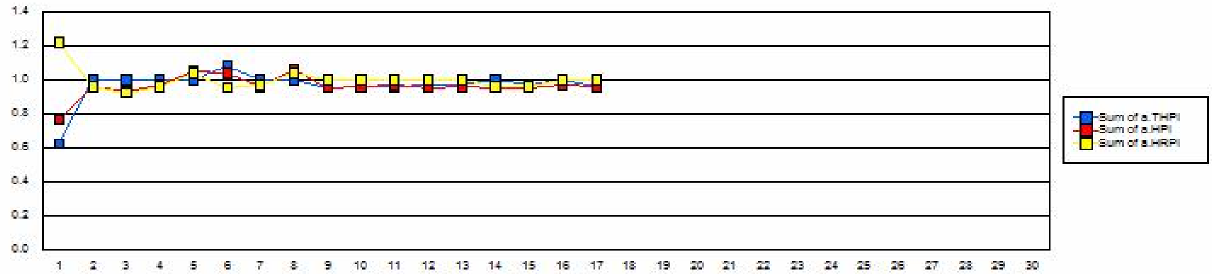
Month	PTH (m)	PH (m)	PHR	TH (m)	EH (m)	EHR	THPI	HPI	HRPI	PV (AED)	EV (AED)	SPI	ES (mo)	AD (mo)	SV(t) (mo)	SPI(t)	COMMENT / ANALYSIS	Rating
1	9	5	0.54	5.60	3.68	0.66	0.62	0.76	1.22	2,500	1,900	0.76	0.66	1.00	-0.34	0.66	Project behind, Structure behind, Subsequent Activities delayed less than structure	Alarming
2	16	8	0.52	15.80	7.83	0.50	1.00	0.96	0.96	4,500	4,300	0.96	1.89	2.00	-0.11	0.95	Project behind, Structure on time, Subsequent Activities behind	Alarming
3	23	12	0.51	22.60	10.72	0.47	1.00	0.93	0.92	6,500	6,000	0.92	2.76	3.00	-0.24	0.92	Project behind, Structure on time, Subsequent Activities behind	Alarming
4	31	15	0.49	30.95	14.67	0.47	1.00	0.97	0.96	8,500	8,250	0.97	3.73	4.00	-0.27	0.93	Project behind, Structure on time, Subsequent Activities behind	Alarming
5	38	17	0.45	37.95	17.76	0.47	1.00	1.05	1.04	11,845	12,345	1.04	5.91	5.00	0.91	1.18	Project ahead, Structure on time, Subsequent Activities ahead	
6	45	18	0.40	48.45	18.52	0.38	1.08	1.04	0.95	16,435	17,758	1.08	7.19	6.00	1.19	1.20	Project ahead, Structure ahead, Subsequent Activities ahead less than structure	
7	52	18	0.35	51.95	17.73	0.34	1.00	0.96	0.97	22,115	22,210	1.00	7.21	7.00	0.21	1.03	Project behind, Structure on time, Subsequent Activities behind	Alarming
8	59	15	0.26	58.95	16.07	0.27	1.00	1.06	1.04	36,625	36,005	0.98	8.80	8.00	0.80	1.10	Project ahead, Structure on time, Subsequent Activities ahead	
9	69	16	0.23	65.95	15.47	0.23	0.95	0.95	1.00	52,190	54,800	1.05	8.80	9.00	-0.20	0.98	Project behind, Structure behind, Subsequent Activities equally delayed as the structure	Alarming
10	80	19	0.24	76.20	18.05	0.24	0.96	0.96	1.00	63,130	66,320	1.05	9.73	10.00	-0.27	0.97	Project behind, Structure behind, Subsequent Activities equally delayed as the structure	Alarming
11	90	21	0.24	86.95	20.62	0.24	0.96	0.97	1.00	74,750	73,305	0.98	10.77	11.00	-0.23	0.98	Project behind, Structure behind, Subsequent Activities equally delayed as the structure	Alarming
12	101	25	0.24	97.45	23.24	0.24	0.97	0.95	1.00	81,450	79,130	0.97	11.58	12.00	-0.42	0.97	Project behind, Structure behind, Subsequent Activities equally delayed as the structure	Alarming
13	111	28	0.25	107.95	26.62	0.25	0.97	0.96	1.00	87,911	82,640	0.94	12.60	13.00	-0.40	0.97	Project behind, Structure behind, Subsequent Activities equally delayed as the structure	Alarming
14	122	30	0.25	121.95	29.06	0.24	1.00	0.95	0.96	93,742	86,985	0.93	13.47	14.00	-0.53	0.96	Project behind, Structure on time, Subsequent Activities behind	Alarming
15	132	33	0.25	128.95	31.38	0.24	0.97	0.95	0.96	99,298	94,090	0.95	14.36	15.00	-0.64	0.96	Project behind, Structure behind, Subsequent Activities delayed more than structure	Alarming
16	147	36	0.24	146.58	34.55	0.24	1.00	0.97	1.00	104,808	101,853	0.97	15.47	16.00	-0.53	0.97	Project behind, Structure on time, Subsequent Activities behind	Alarming
17	153	38	0.25	146.58	36.05	0.25	0.96	0.96	1.00	109,888	106,076	0.97	15.97	17.00	-1.03	0.94	Project behind, Structure behind, Subsequent Activities equally delayed as the structure	Alarming
18	153	39	0.26							114,518								
19	153	41	0.27							118,968								
20	153	42	0.28							122,898								
21	153	44	0.29							126,668								
22	153	45	0.30							130,443								

Legend
m = Meter; mo = Months
PTH = Planned Top Height; PH = Planned Height; PHR = Planned Height Ratio, PH/PTH
TH = Top Height; EH = Earned Height; EHR = Earned Height Ratio, EH/TH
THPI = Top Height Performance Index, TH/PTH; HPI = Height Performance Index, EH/PH; HRPI = Height Ratio Performance Index, EHR/PHR
PV = Planned Value; EV = Earned Value; SPI = Schedule Performance Index, EV/PV
ES = Earned Schedule; AD = Actual Duration
SV(t) = Schedule Variance (t); SPI(t) = Schedule Performance Index (t), ES/AD

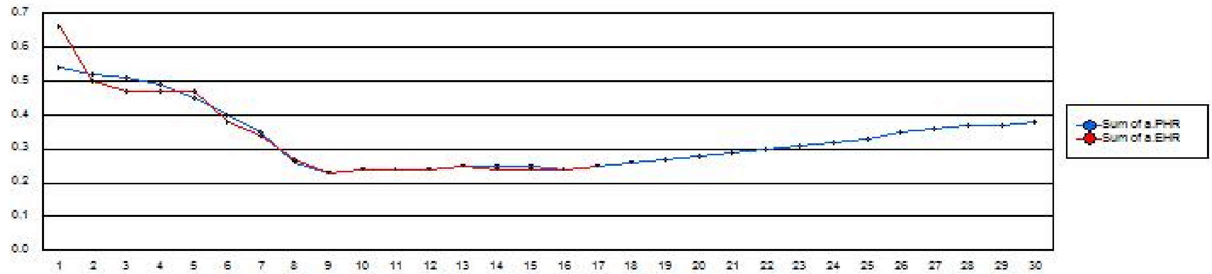
PTH, TH, EH, PH per Month



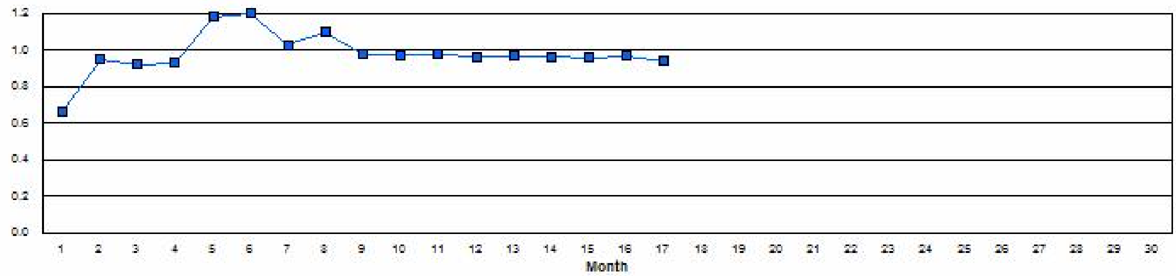
THPI, HPI, HRPI per Month



PHR, EHR per Month



SPI(t) per Month



SHARJAH RESIDENTIAL TOWER

Floors: 42

Start Date: **1-Feb-2006** Finish Date: **30-Jul-2008**

Summary Report

Month	PTH (m)	PH (m)	PHR	TH (m)	EH (m)	EHR	THPI	HPI	HRPI	PV (AED)	EV (AED)	SPI	ES (mo)	AD (mo)	SV(t) (mo)	SPI(t)	COMMENT / ANALYSIS	Rating
23	153	47	0.31							134,226								
24	153	49	0.32							138,016								
25	153	51	0.33							141,802								
26	153	53	0.35							145,278								
27	153	56	0.36							149,718								
28	153	56	0.37							150,887								
29	153	57	0.37							151,875								
30	153	58	0.38							153,905								

Legend
m – Meter
mo – Months
PTH – Planned Top Height
PH – Planned Height
PHR – Planned Height Ratio, PH/PTH
TH – Top Height
EH – Earned Height
EHR – Earned Height Ratio, EH/TH
THPI – Top Height Performance Index, TH/PTH
HPI – Height Performance Index, EH/PH
HRPI – Height Ratio Performance Index, EHR/PHR
PV – Planned Value
EV – Earned Value
SPI – Schedule Performance Index, EV/PV
ES – Earned Schedule
AD – Actual Duration
SV(t) – Schedule Variance (t)
SPI(t) – Schedule Performance Index (t), ES/AD

Appendix B *– EHM Summary Report – Business Bay Project*

BUSINESS BAY TOWER

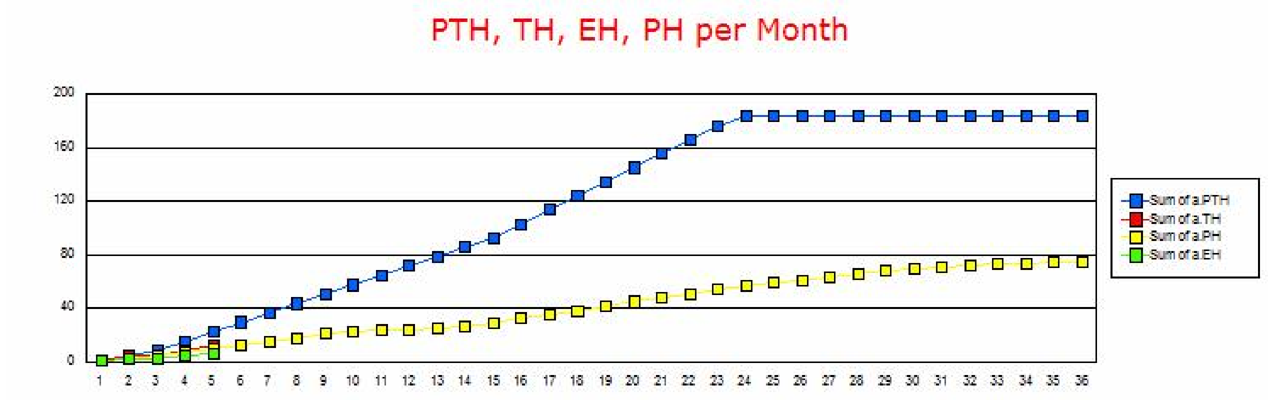
Floors: 45

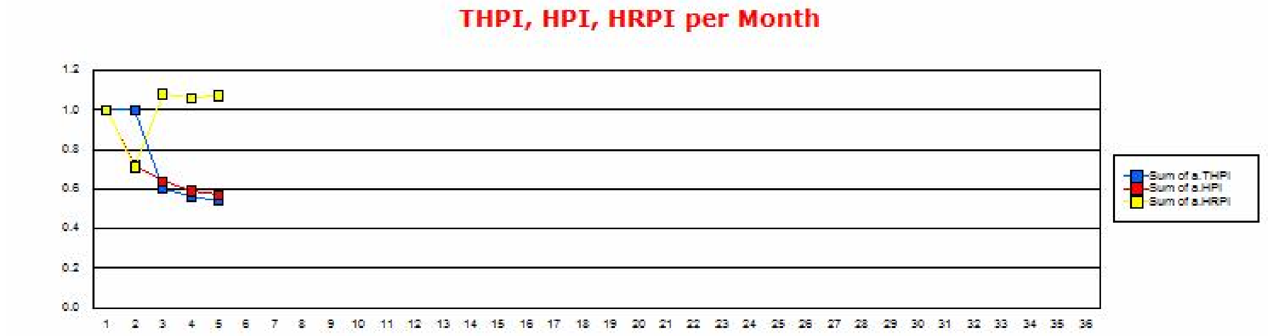
Start Date: **1-Dec-2007** Finish Date: **30-Apr-2009**

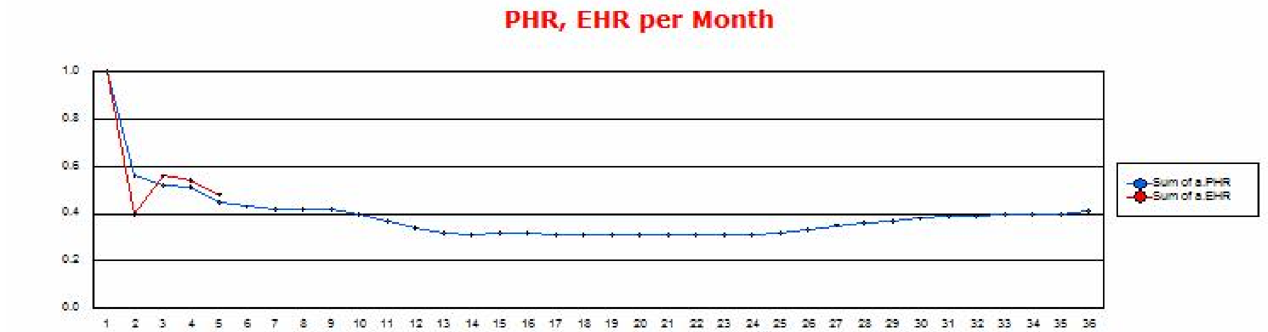
Summary Report

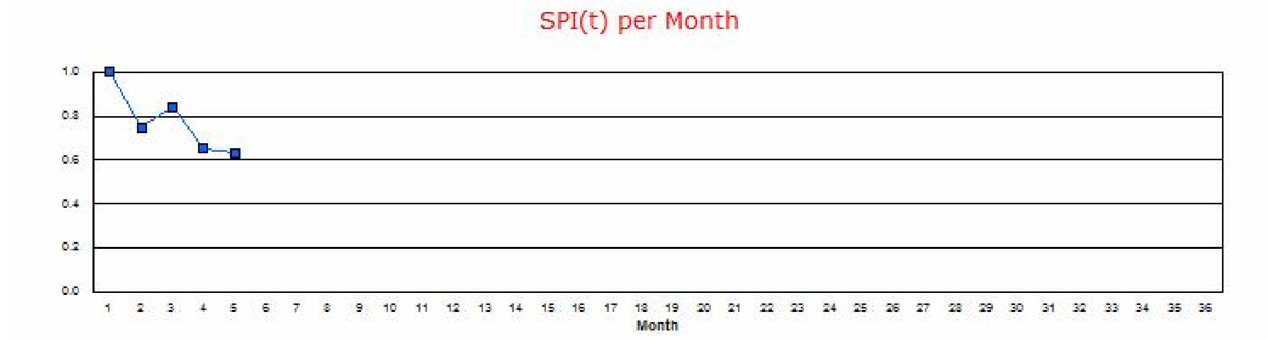
Month	PTH (m)	PH (m)	PHR	TH (m)	EH (m)	EHR	THPI	HPI	HRPI	PV (AED)	EV (AED)	SPI	ES (mo)	AD (mo)	SV(t) (mo)	SPI(t)	COMMENT / ANALYSIS	Rating
1	2	2	1.00	1.65	1.65	1.00	1.00	1.00	1.00	1,015	725	0.71	1.00	1.00	0.00	1.00	Project on time, Structure on time, Subsequent Activities on time	
2	13	5	0.40	4.97	2.54	0.51	0.39	0.49	1.27	5,043	2,718	0.54	1.40	2.00	-0.60	0.70	Project behind, Structure behind, Subsequent Activities delayed less than structure	Alarming
3	20	10	0.48	12.86	5.42	0.42	0.64	0.57	0.88	11,250	6,473	0.58	1.42	3.00	-1.58	0.47	Project behind, Structure behind, Subsequent Activities delayed more than structure	Alarming
4	32	12	0.38	12.86	5.40	0.42	0.41	0.44	1.11	15,715	7,017	0.45	2.28	4.00	-1.72	0.57	Project behind, Structure behind, Subsequent Activities delayed less than structure	Alarming
5	44	16	0.37	27.35	11.02	0.40	0.62	0.69	1.08	22,270	17,836	0.80	2.50	5.00	-2.50	0.50	Project behind, Structure behind, Subsequent Activities delayed less than structure	Alarming
6	52	18	0.35	40.02	15.68	0.39	0.77	0.87	1.11	30,081	23,627	0.79	4.80	6.00	-1.21	0.80	Project behind, Structure behind, Subsequent Activities delayed less than structure	Alarming
7	71	20	0.28	47.82	16.15	0.34	0.67	0.80	1.21	53,917	34,893	0.65	5.51	7.00	-1.49	0.79	Project behind, Structure behind, Subsequent Activities delayed less than structure	Alarming
8	87	23	0.26							72,537								
9	106	26	0.25							90,822								
10	122	31	0.25							107,431								
11	141	36	0.26							129,048								
12	161	43	0.27							150,110								
13	171	50	0.29							167,209								
14	171	55	0.32							179,321								
15																		
16	171	61	0.36							191,943								
17	171	62	0.36							194,135								

Legend
m = Meter
mo = Months
PTH = Planned Top Height
PH = Planned Height
PHR = Planned Height Ratio, PH/PTH
TH = Top Height
EH = Earned Height
EHR = Earned Height Ratio, EH/TH
THPI = Top Height Performance Index, TH/PTH
HPI = Height Performance Index, EH/PH
HRPI = Height Ratio Performance Index, EHR/PHR
PV = Planned Value
EV = Earned Value
SPI = Schedule Performance Index, EV/PV
ES = Earned Schedule
AD = Actual Duration
SV(t) = Schedule Variance (t)
SPI(t) = Schedule Performance Index (t), ES/AD


PTH, TH, EH, PH per Month
Sum of a.PTH
Sum of a.TH
Sum of a.PH
Sum of a.EH


THPI, HPI, HRPI per Month
Sum of a.THPI
Sum of a.HPI
Sum of a.HRPI


PHR, EHR per Month
Sum of a.PHR
Sum of a.EHR


SPI(t) per Month
Month

Appendix C *– EHM Summary Report – Marina Project*

DUBAI MARINA TOWER

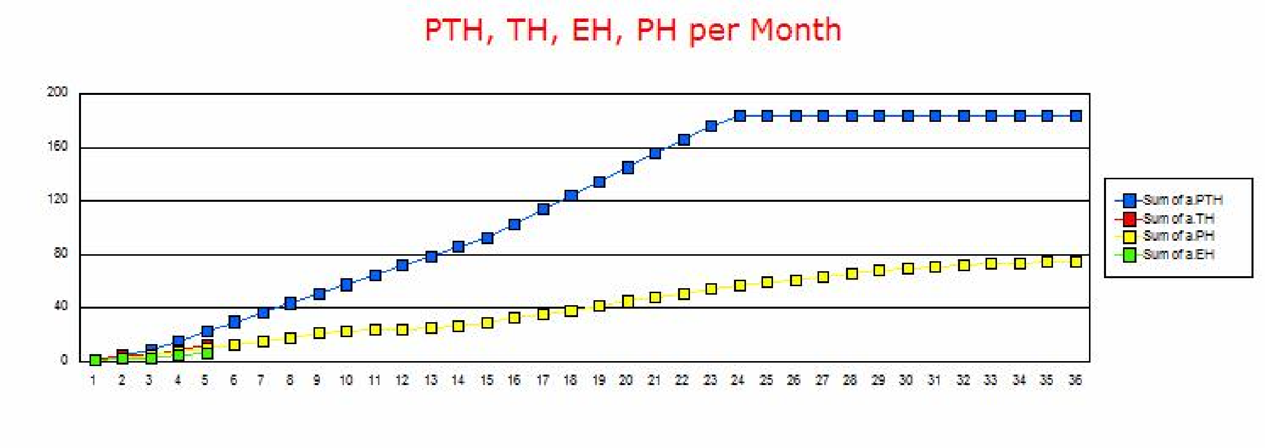
Floors: 53

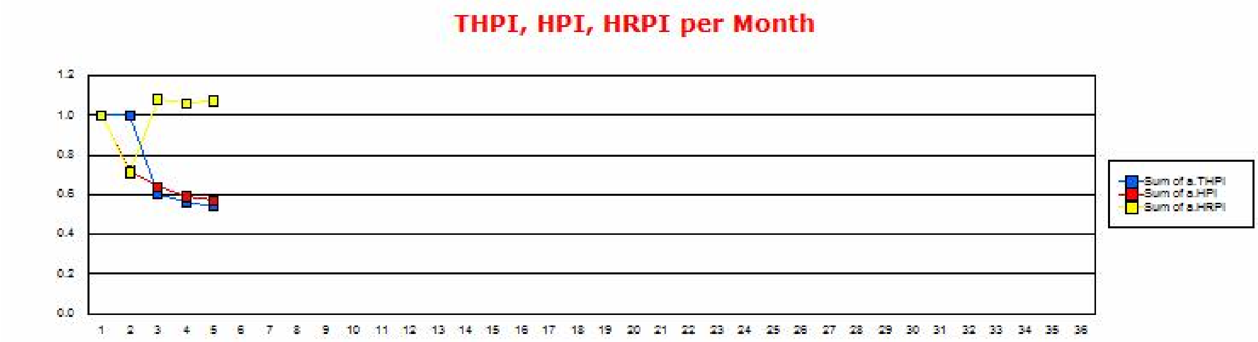
Start Date: **12-May-2008** Finish Date: **12-Apr-2011**

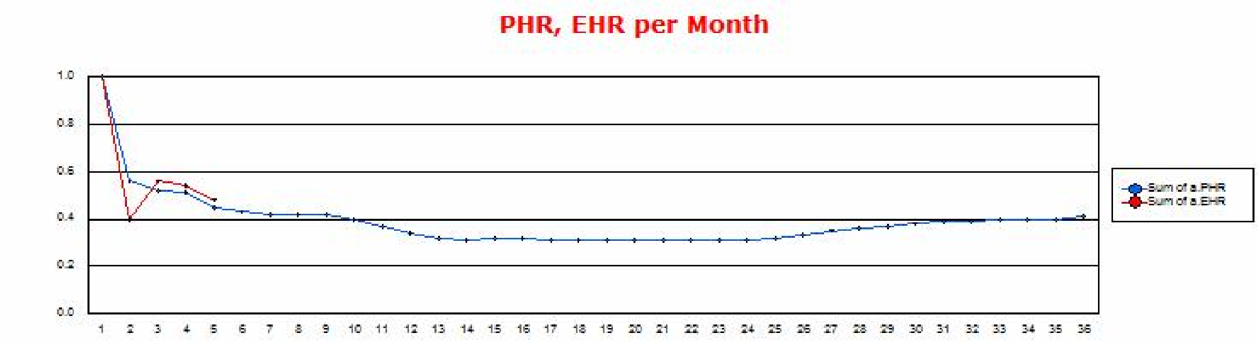
Summary Report

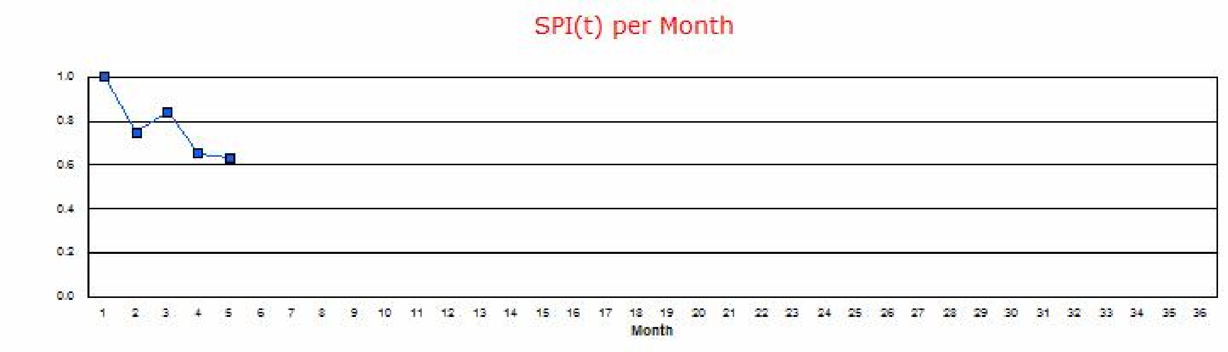
Month	PTH (m)	PH (m)	PHR	TH (m)	EH (m)	EHR	THPI	HPI	HRPI	PV (AED)	EV (AED)	SPI	ES (mo)	AD (mo)	SV(t) (mo)	SPI(t)	COMMENT / ANALYSIS	Rating
1	2	2	1.00	1.75	1.75	1.00	1.00	1.00	1.00	5,845	5,845	1.00	1.00	1.00	0.00	1.00	Project on time, Structure on time, Subsequent Activities on time	
2	5	3	0.56	5.25	2.10	0.40	1.00	0.72	0.71	17,535	11,690	0.67	1.50	2.00	-0.50	0.75	Project behind, Structure on time, Subsequent Activities behind	Alarming
3	9	5	0.52	5.25	2.92	0.56	0.60	0.64	1.08	29,225	17,535	0.60	2.52	3.00	-0.48	0.84	Project behind, Structure behind, Subsequent Activities delayed less than structure	Alarming
4	16	8	0.51	8.75	4.71	0.54	0.56	0.59	1.06	52,605	30,394	0.58	2.60	4.00	-1.40	0.65	Project behind, Structure behind, Subsequent Activities delayed less than structure	Alarming
5	23	10	0.45	12.25	5.91	0.48	0.54	0.57	1.07	67,389	37,408	0.56	3.16	5.00	-1.84	0.63	Project behind, Structure behind, Subsequent Activities delayed less than structure	Alarming
6	30	13	0.43							79,307								
7	37	15	0.42							91,225								
8	44	18	0.42							103,143								
9	51	21	0.42							115,061								
10	58	23	0.40							135,533								
11	65	24	0.37							172,548								
12	72	24	0.34							217,257								
13	79	25	0.32							267,250								
14	86	27	0.31							319,353								
15	93	30	0.32							364,751								
16	103	33	0.32							411,099								
17	114	36	0.31							452,979								
18	124	39	0.31							494,859								
19	135	42	0.31							536,739								
20	145	45	0.31							576,459								
21	156	48	0.31							612,939								
22	166	51	0.31							648,159								
23	177	54	0.31							683,109								
24	184	57	0.31							717,379								
25	184	59	0.32							744,964								
26	184	61	0.33							768,904								
27	184	64	0.35							792,574								
28	184	66	0.36							815,389								
29	184	68	0.37							837,169								
30	184	70	0.38							856,339								

Legend
m = Meter
mo = Months
PTH = Planned Top Height
PH = Planned Height
PHR = Planned Height Ratio, PH/PTH
TH = Top Height
EH = Earned Height
EHR = Earned Height Ratio, EH/TH
THPI = Top Height Performance Index, TH/PTH
HPI = Height Performance Index, EH/PH
HRPI = Height Ratio Performance Index, EHR/PHR
PV = Planned Value
EV = Earned Value
SPI = Schedule Performance Index, EV/PV
ES = Earned Schedule
AD = Actual Duration
SV(t) = Schedule Variance (t)
SPI(t) = Schedule Performance Index (t), ES/AD


PTH, TH, EH, PH per Month
Sum of a.PTH
Sum of a.TH
Sum of a.PH
Sum of a.EH


THPI, HPI, HRPI per Month
Sum of a.THPI
Sum of a.HPI
Sum of a.HRPI


PHR, EHR per Month
Sum of a.PHR
Sum of a.EHR


SPI(t) per Month
Month

DUBAI MARINA TOWER

Floors: 53

Start Date: **12-May-2008** Finish Date: **12-Apr-2011**

Summary Report

Month	PTH (m)	PH (m)	PHR	TH (m)	EH (m)	EHR	THPI	HPI	HRPI	PV (AED)	EV (AED)	SPI	ES (mo)	AD (mo)	SV(t) (mo)	SPI(t)	COMMENT / ANALYSIS	Rating
31	184	71	0.39							870,649								
32	184	72	0.39							879,289								
33	184	73	0.40							886,489								
34	184	74	0.40							892,339								
35	184	74	0.40							896,839								
36	184	75	0.41							899,989								

Legend
m = Meter
mo = Months
PTH = Planned Top Height
PH = Planned Height
PHR = Planned Height Ratio, PH/PTH
TH = Top Height
EH = Earned Height
EHR = Earned Height Ratio, EH/TH
THPI = Top Height Performance Index, TH/PTH
HPI = Height Performance Index, EH/PH
HRPI = Height Ratio Performance Index, EHR/PHR
PV = Planned Value
EV = Earned Value
SPI = Schedule Performance Index, EV/PV
ES = Earned Schedule
AD = Actual Duration
SV(t) = Schedule Variance (t)
SPI(t) = Schedule Performance Index (t), ES/AD

Appendix D – *EHM Summary Report – Fujeirah Project*

FUJEIRAH HOTEL RESORT

Floors: 10

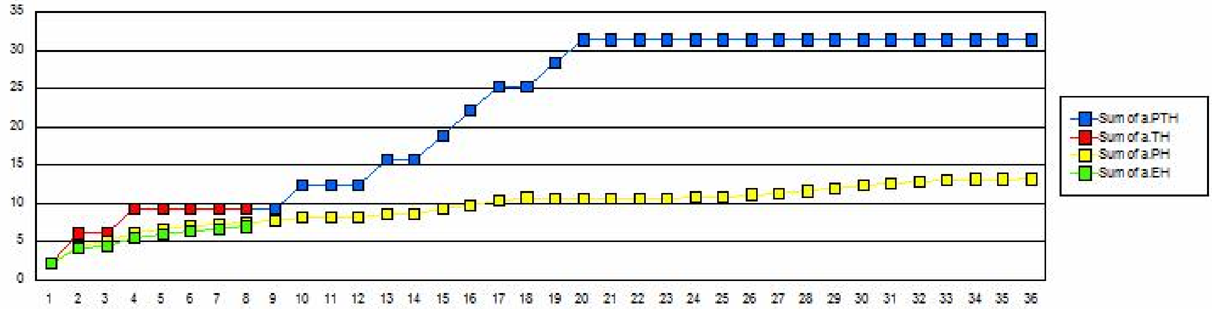
Start Date: **7-Feb-2008** Finish Date: **7-Jan-2011**

Summary Report

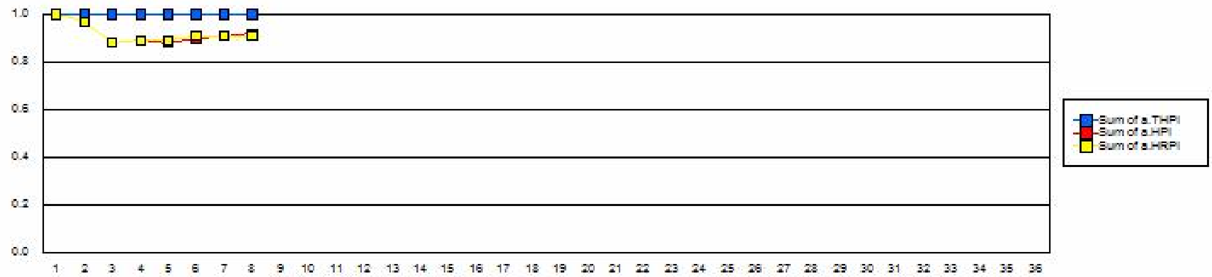
Month	PTH (m)	PH (m)	PHR	TH (m)	EH (m)	EHR	THPI	HPI	HRPI	PV (AED)	EV (AED)	SPI	ES (mo)	AD (mo)	SV(t) (mo)	SPI(t)	COMMENT / ANALYSIS	Rating
29	31	12	0.38							379,177								
30	31	12	0.39							394,451								
31	31	13	0.40							406,014								
32	31	13	0.41							415,580								
33	31	13	0.42							422,674								
34	31	13	0.42							426,841								
35	31	13	0.42							427,151								
36	31	13	0.42							427,358								

Legend
m = Meter
mo = Months
PTH = Planned Top Height
PH = Planned Height
PHR = Planned Height Ratio, PH/PTH
TH = Top Height
EH = Earned Height
EHR = Earned Height Ratio, EH/TH
THPI = Top Height Performance Index, TH/PTH
HPI = Height Performance Index, EH/PH
HRPI = Height Ratio Performance Index, EHR/PHR
PV = Planned Value
EV = Earned Value
SPI = Schedule Performance Index, EV/PV
ES = Earned Schedule
AD = Actual Duration
SV(t) = Schedule Variance (t)
SPI(t) = Schedule Performance Index (t), ES/AD

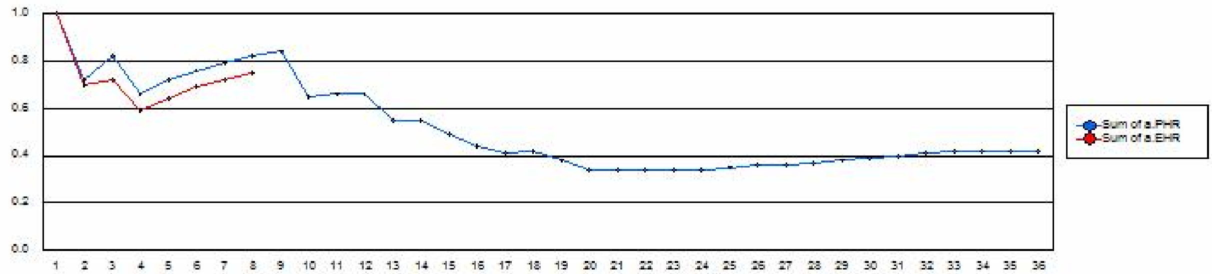
PTH, TH, EH, PH per Month



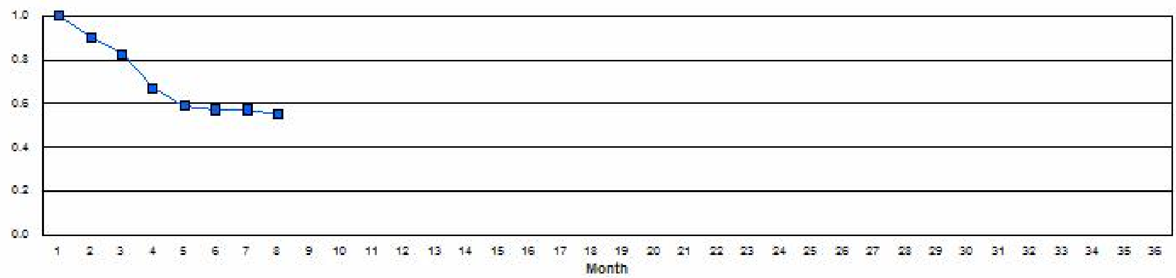
THPI, HPI, HRPI per Month



PHR, EHR per Month



SPI(t) per Month



FUJEIRAH HOTEL RESORT

Floors: 10

Start Date: **7-Feb-2008** Finish Date: **7-Jan-2011**

Summary Report

Month	PTH (m)	PH (m)	PHR	TH (m)	EH (m)	EHR	THPI	HPI	HRPI	PV (AED)	EV (AED)	SPI	ES (mo)	AD (mo)	SV(t) (mo)	SPI(t)	COMMENT / ANALYSIS	Rating
1	2	2	1.00	2.25	2.25	1.00	1.00	1.00	1.00	4,359	3,923	0.90	1.00	1.00	0.00	1.00	Project on time, Structure on time, Subsequent Activities on time	
2	6	4	0.72	6.10	4.27	0.70	1.00	0.97	0.97	9,836	8,705	0.89	1.80	2.00	-0.20	0.90	Project behind, Structure on time, Subsequent Activities behind	Alarming
3	6	5	0.82	6.10	4.39	0.72	1.00	0.88	0.88	15,313	9,836	0.64	2.48	3.00	-0.52	0.83	Project behind, Structure on time, Subsequent Activities behind	Alarming
4	9	6	0.66	9.30	5.47	0.59	1.00	0.89	0.89	28,588	22,499	0.79	2.69	4.00	-1.31	0.67	Project behind, Structure on time, Subsequent Activities behind	Alarming
5	9	7	0.72	9.30	5.94	0.64	1.00	0.88	0.89	34,561	25,684	0.74	2.95	5.00	-2.05	0.59	Project behind, Structure on time, Subsequent Activities behind	Alarming
6	9	7	0.76	9.30	6.38	0.69	1.00	0.90	0.91	40,534	30,579	0.75	3.43	6.00	-2.57	0.57	Project behind, Structure on time, Subsequent Activities behind	Alarming
7	9	7	0.79	9.30	6.72	0.72	1.00	0.91	0.91	46,507	34,561	0.74	4.00	7.00	-3.00	0.57	Project behind, Structure on time, Subsequent Activities behind	Alarming
8	9	8	0.82	9.30	6.99	0.75	1.00	0.92	0.91	52,480	38,543	0.73	4.41	8.00	-3.59	0.55	Project behind, Structure on time, Subsequent Activities behind	Alarming
9	9	8	0.84							58,453								
10	13	8	0.65							70,753								
11	13	8	0.66							81,250								
12	13	8	0.66							93,735								
13	16	9	0.55							109,627								
14	16	9	0.55							125,177								
15	19	9	0.49							153,538								
16	22	10	0.44							180,667								
17	25	10	0.41							202,396								
18	25	11	0.42							219,003								
19	29	11	0.38							230,962								
20	31	11	0.34							242,921								
21	31	11	0.34							258,294								
22	31	11	0.34							269,501								
23	31	11	0.34							293,006								
24	31	11	0.34							305,421								
25	31	11	0.35							317,817								
26	31	11	0.36							336,492								
27	31	11	0.36							351,015								
28	31	12	0.37							364,808								

Legend
m = Meter
mo = Months
PTH = Planned Top Height
PH = Planned Height
PHR = Planned Height Ratio, PH/PTH
TH = Top Height
EH = Earned Height
EHR = Earned Height Ratio, EH/TH
THPI = Top Height Performance Index, TH/PTH
HPI = Height Performance Index, EH/PH
HRPI = Height Ratio Performance Index, EHR/PHR
PV = Planned Value
EV = Earned Value
SPI = Schedule Performance Index, EV/PV
ES = Earned Schedule
AD = Actual Duration
SV(t) = Schedule Variance (t)
SPI(t) = Schedule Performance Index (t), ES/AD

Appendix E *– EHM Summary Report – Barsha Project*

AL BARSHA TOWER

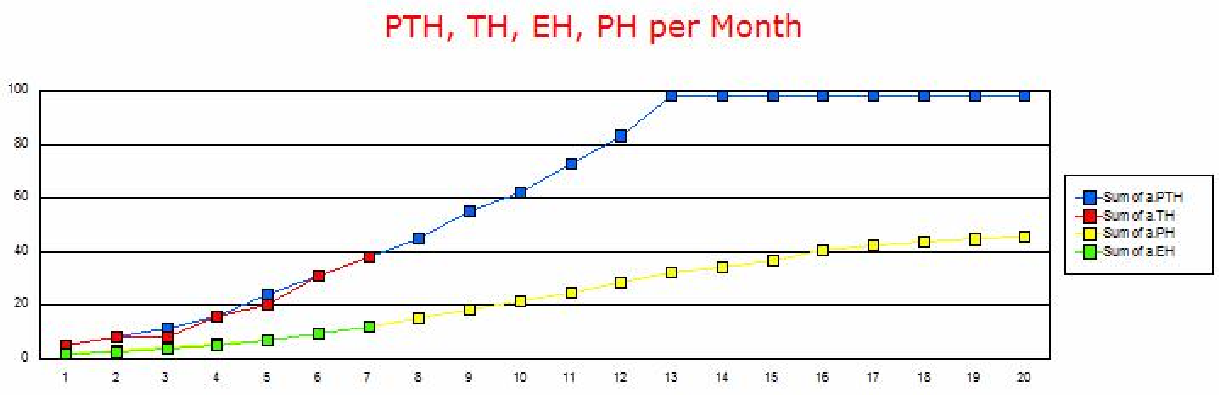
Floors: 28

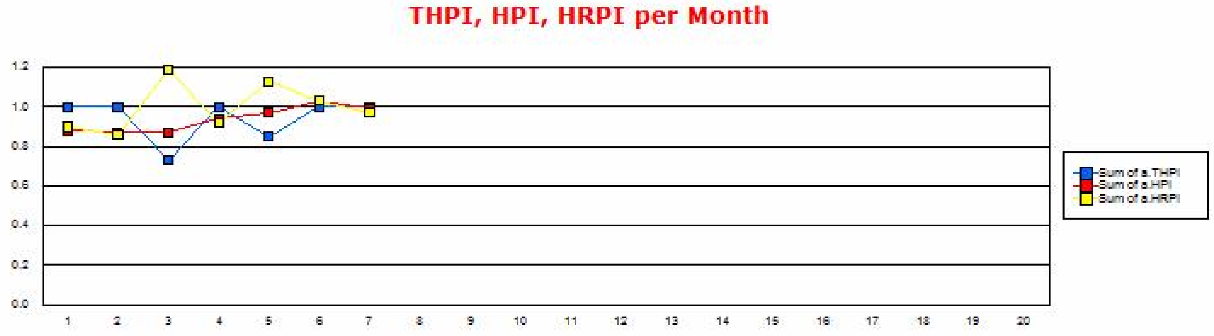
Start Date: **1-Mar-2008** Finish Date: **30-Oct-2009**

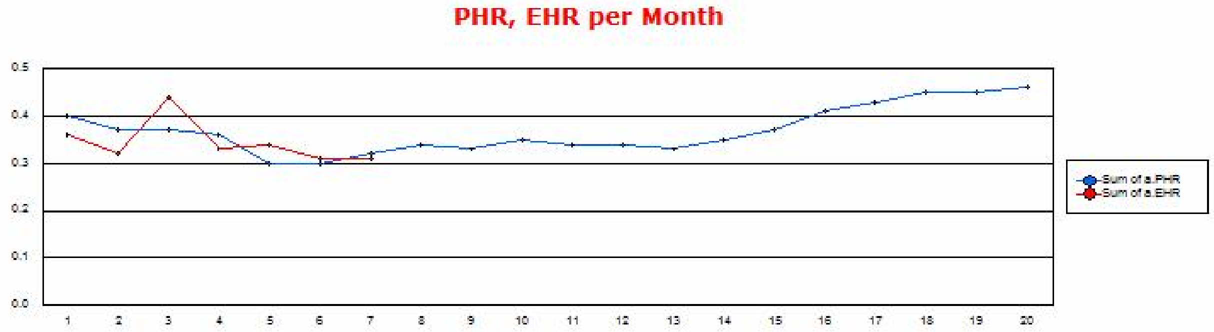
Summary Report

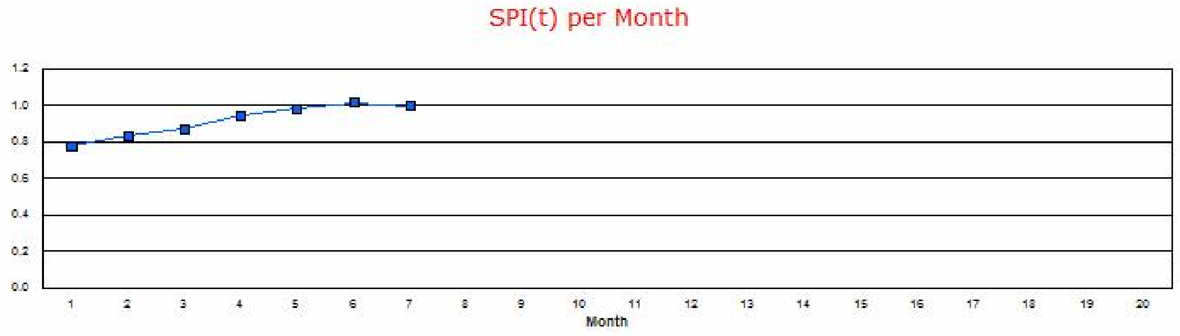
Month	PTH (m)	PH (m)	PHR	TH (m)	EH (m)	EHR	THPI	HPI	HRPI	PV (AED)	EV (AED)	SPI	ES (mo)	AD (mo)	SV(t) (mo)	SPI(t)	COMMENT / ANALYSIS	Rating
1	5	2	0.40	4.95	1.77	0.36	1.00	0.88	0.90	4,395,652	4,081,034	0.93	0.77	1.00	-0.23	0.77	Project behind, Structure on time, Subsequent Activities behind	Alarming
2	8	3	0.37	8.25	2.64	0.32	1.00	0.87	0.86	5,911,165	5,417,226	0.92	1.67	2.00	-0.33	0.83	Project behind, Structure on time, Subsequent Activities behind	Alarming
3	11	4	0.37	8.25	3.62	0.44	0.73	0.87	1.19	7,241,075	6,668,232	0.92	2.62	3.00	-0.38	0.87	Project behind, Structure behind, Subsequent Activities delayed less than structure	Alarming
4	16	6	0.36	15.70	5.25	0.33	1.00	0.94	0.92	9,442,601	8,441,076	0.89	3.78	4.00	-0.22	0.94	Project behind, Structure on time, Subsequent Activities behind	Alarming
5	24	7	0.30	20.35	6.98	0.34	0.85	0.97	1.13	12,640,914	11,354,388	0.90	4.91	5.00	-0.09	0.98	Project behind, Structure behind, Subsequent Activities delayed less than structure	Alarming
6	31	9	0.30	30.85	9.54	0.31	1.00	1.03	1.03	16,938,620	14,460,650	0.85	6.10	6.00	0.10	1.02	Project ahead, Structure on time, Subsequent Activities ahead	
7	38	12	0.32	37.85	11.92	0.31	1.00	0.99	0.97	20,607,847	15,962,181	0.77	6.98	7.00	-0.02	1.00	Project behind, Structure on time, Subsequent Activities behind	Alarming
8	45	15	0.34							24,366,850								
9	55	18	0.33							27,861,471								
10	62	22	0.35							31,121,549								
11	73	25	0.34							35,918,779								
12	83	29	0.34							41,722,344								
13	98	32	0.33							49,685,621								
14	98	34	0.35							56,416,136								
15	98	37	0.37							62,931,798								
16	98	40	0.41							70,483,460								
17	98	42	0.43							75,075,231								
18	98	44	0.45							77,754,750								
19	98	45	0.45							79,078,516								
20	98	45	0.46							80,132,506								

Legend
m – Meter
mo – Months
PTH – Planned Top Height
PH – Planned Height
PHR – Planned Height Ratio, PH/PTH
TH – Top Height
EH – Earned Height
EHR – Earned Height Ratio, EH/TH
THPI – Top Height Performance Index, TH/PTH
HPI – Height Performance Index, EH/PH
HRPI – Height Ratio Performance Index, EHR/PHR
PV – Planned Value
EV – Earned Value
SPI – Schedule Performance Index, EV/PV
ES – Earned Schedule
AD – Actual Duration
SV(t) – Schedule Variance (t)
SPI(t) – Schedule Performance Index (t), ES/AD


PTH, TH, EH, PH per Month
Sum of a.PTH
Sum of a.TH
Sum of a.PH
Sum of a.EH


THPI, HPI, HRPI per Month
Sum of a.THPI
Sum of a.HPI
Sum of a.HRPI


PHR, EHR per Month
Sum of a.PHR
Sum of a.EHR


SPI(t) per Month
Month

***Appendix F** – EHM Progress Report, June 2007 – Sharjah Project*

SHARJAH PROJECT

Floors: 42

Start Date: **1-Feb-2006** Finish Date: **30-Jul-2008**

<u>Progress Report for the Month June 2007</u>

Floor / Work	Planned Progress				Actual Progress			
	Height	Planned Value	Height Value	% Accomplished	Height	Earned Value	Height Value	% Accomplished
Floor: Helipad	**152.80**	**400.00**	**61,120.00**	**15.01%**	**152.80**	**0.00**	**0.00**	**0.00%**
CONCRETING	152.80	400.00	61,120.00	100.00%	152.80	0.00	0.00	0.00%
FINISHES	152.80	0.00	0.00	0.00%	152.80	0.00	0.00	0.00%
MEP WORKS	152.80	0.00	0.00	0.00%	152.80	0.00	0.00	0.00%
ALUMINUM & GLAZI	152.80	0.00	0.00	0.00%	152.80	0.00	0.00	0.00%
Floor: URoof	**146.58**	**500.00**	**73,290.00**	**14.56%**	**146.58**	**450.00**	**65,961.00**	**13.10%**
CONCRETING	146.58	500.00	73,290.00	100.00%	146.58	450.00	65,961.00	90.00%
FINISHES	146.58	0.00	0.00	0.00%	146.58	0.00	0.00	0.00%
MEP WORKS	146.58	0.00	0.00	0.00%	146.58	0.00	0.00	0.00%
ALUMINUM & GLAZI	146.58	0.00	0.00	0.00%	146.58	0.00	0.00	0.00%
Floor: Roof	**140.05**	**500.00**	**70,025.00**	**26.53%**	**140.05**	**500.00**	**70,025.00**	**26.53%**
CONCRETING	140.05	500.00	70,025.00	100.00%	140.05	500.00	70,025.00	100.00%
FINISHES	140.05	0.00	0.00	0.00%	140.05	0.00	0.00	0.00%
MEP WORKS	140.05	0.00	0.00	0.00%	140.05	0.00	0.00	0.00%
ALUMINUM & GLAZI	140.05	0.00	0.00	0.00%	140.05	0.00	0.00	0.00%
Floor: HC	**135.95**	**500.00**	**67,975.00**	**26.53%**	**135.95**	**500.00**	**67,975.00**	**26.53%**
CONCRETING	135.95	500.00	67,975.00	100.00%	135.95	500.00	67,975.00	100.00%
FINISHES	135.95	0.00	0.00	0.00%	135.95	0.00	0.00	0.00%
MEP WORKS	135.95	0.00	0.00	0.00%	135.95	0.00	0.00	0.00%
ALUMINUM & GLAZI	135.95	0.00	0.00	0.00%	135.95	0.00	0.00	0.00%
Floor: 30F	**132.45**	**500.00**	**66,225.00**	**20.96%**	**132.45**	**500.00**	**66,225.00**	**20.96%**
CONCRETING	132.45	500.00	66,225.00	100.00%	132.45	500.00	66,225.00	100.00%
FINISHES	132.45	0.00	0.00	0.00%	132.45	0.00	0.00	0.00%
MEP WORKS	132.45	0.00	0.00	0.00%	132.45	0.00	0.00	0.00%
ALUMINUM & GLAZI	132.45	0.00	0.00	0.00%	132.45	0.00	0.00	0.00%
Floor: 29F	**128.95**	**500.00**	**64,475.00**	**20.96%**	**128.95**	**500.00**	**64,475.00**	**20.96%**
CONCRETING	128.95	500.00	64,475.00	100.00%	128.95	500.00	64,475.00	100.00%
FINISHES	128.95	0.00	0.00	0.00%	128.95	0.00	0.00	0.00%
MEP WORKS	128.95	0.00	0.00	0.00%	128.95	0.00	0.00	0.00%
ALUMINUM & GLAZI	128.95	0.00	0.00	0.00%	128.95	0.00	0.00	0.00%
Floor: 28F	**125.45**	**700.00**	**87,815.00**	**27.08%**	**125.45**	**700.00**	**87,815.00**	**27.08%**
CONCRETING	125.45	700.00	87,815.00	100.00%	125.45	700.00	87,815.00	100.00%
FINISHES	125.45	0.00	0.00	0.00%	125.45	0.00	0.00	0.00%
MEP WORKS	125.45	0.00	0.00	0.00%	125.45	0.00	0.00	0.00%
ALUMINUM & GLAZI	125.45	0.00	0.00	0.00%	125.45	0.00	0.00	0.00%
Floor: 27F	**121.95**	**700.00**	**85,365.00**	**26.92%**	**121.95**	**700.00**	**85,365.00**	**26.92%**
CONCRETING	121.95	700.00	85,365.00	100.00%	121.95	700.00	85,365.00	100.00%

Totals:- **Planned Value=109888, PV * Height=4128881.975, Perc. Accom.=71.40, PH=37.57**
Actual Value=106076, AV * Height=3823871.95, Perc. Accom.=68.92, EH=36.05

SHARJAH PROJECT

Floors: 42

Start Date: **1-Feb-2006** Finish Date: **30-Jul-2008**

Progress Report for the Month June 2007

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
FINISHES	121.95	0.00	0.00	0.00%	121.95	0.00	0.00	0.00%
MEP WORKS	121.95	0.00	0.00	0.00%	121.95	0.00	0.00	0.00%
ALUMINUM & GLAZI	121.95	0.00	0.00	0.00%	121.95	0.00	0.00	0.00%
Floor: 26F	**118.45**	**700.00**	**82,915.00**	**26.92%**	**118.45**	**700.00**	**82,915.00**	**26.92%**
CONCRETING	118.45	700.00	82,915.00	100.00%	118.45	700.00	82,915.00	100.00%
FINISHES	118.45	0.00	0.00	0.00%	118.45	0.00	0.00	0.00%
MEP WORKS	118.45	0.00	0.00	0.00%	118.45	0.00	0.00	0.00%
ALUMINUM & GLAZI	118.45	0.00	0.00	0.00%	118.45	0.00	0.00	0.00%
Floor: 25F	**114.95**	**700.00**	**80,465.00**	**26.92%**	**114.95**	**700.00**	**80,465.00**	**26.92%**
CONCRETING	114.95	700.00	80,465.00	100.00%	114.95	700.00	80,465.00	100.00%
FINISHES	114.95	0.00	0.00	0.00%	114.95	0.00	0.00	0.00%
MEP WORKS	114.95	0.00	0.00	0.00%	114.95	0.00	0.00	0.00%
ALUMINUM & GLAZI	114.95	0.00	0.00	0.00%	114.95	0.00	0.00	0.00%
Floor: 24F	**111.45**	**700.00**	**78,015.00**	**26.92%**	**111.45**	**700.00**	**78,015.00**	**26.92%**
CONCRETING	111.45	700.00	78,015.00	100.00%	111.45	700.00	78,015.00	100.00%
FINISHES	111.45	0.00	0.00	0.00%	111.45	0.00	0.00	0.00%
MEP WORKS	111.45	0.00	0.00	0.00%	111.45	0.00	0.00	0.00%
ALUMINUM & GLAZI	111.45	0.00	0.00	0.00%	111.45	0.00	0.00	0.00%
Floor: 23F	**107.95**	**900.00**	**97,155.00**	**32.32%**	**107.95**	**900.00**	**97,155.00**	**32.32%**
CONCRETING	107.95	900.00	97,155.00	100.00%	107.95	900.00	97,155.00	100.00%
FINISHES	107.95	0.00	0.00	0.00%	107.95	0.00	0.00	0.00%
MEP WORKS	107.95	0.00	0.00	0.00%	107.95	0.00	0.00	0.00%
ALUMINUM & GLAZI	107.95	0.00	0.00	0.00%	107.95	0.00	0.00	0.00%
Floor: 22F	**104.45**	**1,000.00**	**04,450.00**	**34.66%**	**104.45**	**1,000.00**	**04,450.00**	**34.66%**
CONCRETING	104.45	1,000.00	104,450.00	100.00%	104.45	1,000.00	104,450.00	100.00%
FINISHES	104.45	0.00	0.00	0.00%	104.45	0.00	0.00	0.00%
MEP WORKS	104.45	0.00	0.00	0.00%	104.45	0.00	0.00	0.00%
ALUMINUM & GLAZI	104.45	0.00	0.00	0.00%	104.45	0.00	0.00	0.00%
Floor: 21F	**100.95**	**1,000.00**	**00,950.00**	**34.66%**	**100.95**	**1,000.00**	**00,950.00**	**34.66%**
CONCRETING	100.95	1,000.00	100,950.00	100.00%	100.95	1,000.00	100,950.00	100.00%
FINISHES	100.95	0.00	0.00	0.00%	100.95	0.00	0.00	0.00%
MEP WORKS	100.95	0.00	0.00	0.00%	100.95	0.00	0.00	0.00%
ALUMINUM & GLAZI	100.95	0.00	0.00	0.00%	100.95	0.00	0.00	0.00%
Floor: 20F	**97.45**	**1,000.00**	**97,450.00**	**34.66%**	**97.45**	**1,000.00**	**97,450.00**	**34.66%**
CONCRETING	97.45	1,000.00	97,450.00	100.00%	97.45	1,000.00	97,450.00	100.00%
FINISHES	97.45	0.00	0.00	0.00%	97.45	0.00	0.00	0.00%
MEP WORKS	97.45	0.00	0.00	0.00%	97.45	0.00	0.00	0.00%

Totals:- **Planned Value=109888, PV * Height=4128881.975, Perc. Accom.=71.40, PH=37.57**
Actual Value=106076, AV * Height=3823871.95, Perc. Accom.=68.92, EH=36.05

SHARJAH PROJECT

Floors: 42

Start Date: **1-Feb-2006** Finish Date: **30-Jul-2008**

Progress Report for the Month June 2007

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
ALUMINUM & GLAZI	97.45	0.00	0.00	0.00%	97.45	0.00	0.00	0.00%
Floor: 19F	**93.95**	**1,000.00**	**93,950.00**	**34.66%**	**93.95**	**1,000.00**	**93,950.00**	**34.66%**
CONCRETING	93.95	1,000.00	93,950.00	100.00%	93.95	1,000.00	93,950.00	100.00%
FINISHES	93.95	0.00	0.00	0.00%	93.95	0.00	0.00	0.00%
MEP WORKS	93.95	0.00	0.00	0.00%	93.95	0.00	0.00	0.00%
ALUMINUM & GLAZI	93.95	0.00	0.00	0.00%	93.95	0.00	0.00	0.00%
Floor: 18F	**90.45**	**1,000.00**	**90,450.00**	**34.66%**	**90.45**	**1,000.00**	**90,450.00**	**34.66%**
CONCRETING	90.45	1,000.00	90,450.00	100.00%	90.45	1,000.00	90,450.00	100.00%
FINISHES	90.45	0.00	0.00	0.00%	90.45	0.00	0.00	0.00%
MEP WORKS	90.45	0.00	0.00	0.00%	90.45	0.00	0.00	0.00%
ALUMINUM & GLAZI	90.45	0.00	0.00	0.00%	90.45	0.00	0.00	0.00%
Floor: 17F	**86.95**	**1,000.00**	**86,950.00**	**34.66%**	**86.95**	**1,000.00**	**86,950.00**	**34.66%**
CONCRETING	86.95	1,000.00	86,950.00	100.00%	86.95	1,000.00	86,950.00	100.00%
FINISHES	86.95	0.00	0.00	0.00%	86.95	0.00	0.00	0.00%
MEP WORKS	86.95	0.00	0.00	0.00%	86.95	0.00	0.00	0.00%
ALUMINUM & GLAZI	86.95	0.00	0.00	0.00%	86.95	0.00	0.00	0.00%
Floor: 16F	**83.45**	**1,000.00**	**83,450.00**	**34.66%**	**83.45**	**1,000.00**	**83,450.00**	**34.66%**
CONCRETING	83.45	1,000.00	83,450.00	100.00%	83.45	1,000.00	83,450.00	100.00%
FINISHES	83.45	0.00	0.00	0.00%	83.45	0.00	0.00	0.00%
MEP WORKS	83.45	0.00	0.00	0.00%	83.45	0.00	0.00	0.00%
ALUMINUM & GLAZI	83.45	0.00	0.00	0.00%	83.45	0.00	0.00	0.00%
Floor: 15F	**79.70**	**1,000.00**	**79,700.00**	**30.44%**	**79.70**	**1,000.00**	**79,700.00**	**30.44%**
CONCRETING	79.70	1,000.00	79,700.00	100.00%	79.70	1,000.00	79,700.00	100.00%
FINISHES	79.70	0.00	0.00	0.00%	79.70	0.00	0.00	0.00%
MEP WORKS	79.70	0.00	0.00	0.00%	79.70	0.00	0.00	0.00%
ALUMINUM & GLAZI	79.70	0.00	0.00	0.00%	79.70	0.00	0.00	0.00%
Floor: 14F	**76.20**	**2,355.50**	**79,489.10**	**54.97%**	**76.20**	**1,000.00**	**76,200.00**	**23.34%**
CONCRETING	76.20	1,000.00	76,200.00	100.00%	76.20	1,000.00	76,200.00	100.00%
FINISHES	76.20	655.50	49,949.10	30.00%	76.20	0.00	0.00	0.00%
MEP WORKS	76.20	0.00	0.00	0.00%	76.20	0.00	0.00	0.00%
ALUMINUM & GLAZI	76.20	700.00	53,340.00	100.00%	76.20	0.00	0.00	0.00%
Floor: 13F	**72.95**	**1,935.50**	**41,194.73**	**67.09%**	**72.95**	**1,000.00**	**72,950.00**	**34.66%**
CONCRETING	72.95	1,000.00	72,950.00	100.00%	72.95	1,000.00	72,950.00	100.00%
FINISHES	72.95	235.50	17,179.73	30.00%	72.95	0.00	0.00	0.00%
MEP WORKS	72.95	0.00	0.00	0.00%	72.95	0.00	0.00	0.00%
ALUMINUM & GLAZI	72.95	700.00	51,065.00	100.00%	72.95	0.00	0.00	0.00%

Totals:- **Planned Value=1078008, PV * Height=41200081.975, Perc. Accom.=71.40, PH=37.57**
Actual Value=1060376, AV * Height=39270071.95, Perc. Accom.=68.92, EH=36.05

SHARJAH PROJECT

Floors: 42

Start Date: **1-Feb-2006** Finish Date: **30-Jul-2008**

Progress Report for the Month June 2007

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
Floor: 12F	**69.45**	**2,411.00**	**67,443.95**	**73.39%**	**69.45**	**2,055.50**	**42,754.40**	**62.57%**
CONCRETING	69.45	1,000.00	69,450.00	100.00%	69.45	1,000.00	69,450.00	100.00%
FINISHES	69.45	711.00	49,378.95	60.00%	69.45	355.50	24,689.48	30.00%
MEP WORKS	69.45	0.00	0.00	0.00%	69.45	0.00	0.00	0.00%
ALUMINUM & GLAZI	69.45	700.00	48,615.00	100.00%	69.45	700.00	48,615.00	100.00%
Floor: 11F	**65.95**	**2,411.00**	**59,005.45**	**73.39%**	**65.95**	**2,292.50**	**51,190.38**	**69.79%**
CONCRETING	65.95	1,000.00	65,950.00	100.00%	65.95	1,000.00	65,950.00	100.00%
FINISHES	65.95	711.00	46,890.45	60.00%	65.95	592.50	39,075.38	50.00%
MEP WORKS	65.95	0.00	0.00	0.00%	65.95	0.00	0.00	0.00%
ALUMINUM & GLAZI	65.95	700.00	46,165.00	100.00%	65.95	700.00	46,165.00	100.00%
Floor: 10F	**62.45**	**2,485.00**	**55,188.25**	**86.14%**	**62.45**	**2,328.00**	**45,383.60**	**80.69%**
CONCRETING	62.45	1,000.00	62,450.00	100.00%	62.45	1,000.00	62,450.00	100.00%
FINISHES	62.45	785.00	49,023.25	100.00%	62.45	628.00	39,218.60	80.00%
MEP WORKS	62.45	0.00	0.00	0.00%	62.45	0.00	0.00	0.00%
ALUMINUM & GLAZI	62.45	700.00	43,715.00	100.00%	62.45	700.00	43,715.00	100.00%
Floor: 9F	**58.95**	**2,485.00**	**46,490.75**	**86.14%**	**58.95**	**2,605.00**	**53,564.75**	**90.29%**
CONCRETING	58.95	1,000.00	58,950.00	100.00%	58.95	1,000.00	58,950.00	100.00%
FINISHES	58.95	785.00	46,275.75	100.00%	58.95	785.00	46,275.75	100.00%
MEP WORKS	58.95	0.00	0.00	0.00%	58.95	120.00	7,074.00	30.00%
ALUMINUM & GLAZI	58.95	700.00	41,265.00	100.00%	58.95	700.00	41,265.00	100.00%
Floor: 8F	**55.45**	**2,885.00**	**59,973.25**	**100.00%**	**55.45**	**2,605.00**	**44,447.25**	**90.29%**
CONCRETING	55.45	1,000.00	55,450.00	100.00%	55.45	1,000.00	55,450.00	100.00%
FINISHES	55.45	785.00	43,528.25	100.00%	55.45	785.00	43,528.25	100.00%
MEP WORKS	55.45	400.00	22,180.00	100.00%	55.45	120.00	6,654.00	30.00%
ALUMINUM & GLAZI	55.45	700.00	38,815.00	100.00%	55.45	700.00	38,815.00	100.00%
Floor: 7F	**51.95**	**2,885.00**	**49,375.75**	**100.00%**	**51.95**	**2,685.00**	**39,485.75**	**93.07%**
CONCRETING	51.95	1,000.00	51,950.00	100.00%	51.95	1,000.00	51,950.00	100.00%
FINISHES	51.95	785.00	40,780.75	100.00%	51.95	785.00	40,780.75	100.00%
MEP WORKS	51.95	400.00	20,780.00	100.00%	51.95	200.00	10,390.00	50.00%
ALUMINUM & GLAZI	51.95	700.00	36,365.00	100.00%	51.95	700.00	36,365.00	100.00%
Floor: 6F	**48.45**	**2,885.00**	**39,778.25**	**100.00%**	**48.45**	**2,805.00**	**35,902.25**	**97.23%**
CONCRETING	48.45	1,000.00	48,450.00	100.00%	48.45	1,000.00	48,450.00	100.00%
FINISHES	48.45	785.00	38,033.25	100.00%	48.45	785.00	38,033.25	100.00%
MEP WORKS	48.45	400.00	19,380.00	100.00%	48.45	320.00	15,504.00	80.00%
ALUMINUM & GLAZI	48.45	700.00	33,915.00	100.00%	48.45	700.00	33,915.00	100.00%
Floor: 5F	**44.95**	**2,850.00**	**28,107.50**	**100.00%**	**44.95**	**2,850.00**	**28,107.50**	**100.00%**
CONCRETING	44.95	1,000.00	44,950.00	100.00%	44.95	1,000.00	44,950.00	100.00%

Totals:- **Planned Value--107808, PV * Height--4120081.975, Perc. Accom.--71.40, PH--37.57**
Actual Value--106076, AV * Height--3823871.95, Perc. Accom.--68.92, EH--36.05

SHARJAH PROJECT

Floors: 42

Start Date: **1-Feb-2006** Finish Date: **30-Jul-2008**

Progress Report for the Month June 2007

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
FINISHES	44.95	750.00	33,712.50	100.00%	44.95	750.00	33,712.50	100.00%
MEP WORKS	44.95	400.00	17,980.00	100.00%	44.95	400.00	17,980.00	100.00%
ALUMINUM & GLAZI	44.95	700.00	31,465.00	100.00%	44.95	700.00	31,465.00	100.00%
Floor: 4F	**41.45**	**2,850.00**	**18,132.50**	**100.00%**	**41.45**	**2,850.00**	**18,132.50**	**100.00%**
CONCRETING	41.45	1,000.00	41,450.00	100.00%	41.45	1,000.00	41,450.00	100.00%
FINISHES	41.45	750.00	31,087.50	100.00%	41.45	750.00	31,087.50	100.00%
MEP WORKS	41.45	400.00	16,580.00	100.00%	41.45	400.00	16,580.00	100.00%
ALUMINUM & GLAZI	41.45	700.00	29,015.00	100.00%	41.45	700.00	29,015.00	100.00%
Floor: 3F	**37.95**	**2,850.00**	**08,157.50**	**100.00%**	**37.95**	**2,850.00**	**08,157.50**	**100.00%**
CONCRETING	37.95	1,000.00	37,950.00	100.00%	37.95	1,000.00	37,950.00	100.00%
FINISHES	37.95	750.00	28,462.50	100.00%	37.95	750.00	28,462.50	100.00%
MEP WORKS	37.95	400.00	15,180.00	100.00%	37.95	400.00	15,180.00	100.00%
ALUMINUM & GLAZI	37.95	700.00	26,565.00	100.00%	37.95	700.00	26,565.00	100.00%
Floor: 2F	**34.45**	**2,850.00**	**98,182.50**	**100.00%**	**34.45**	**2,850.00**	**98,182.50**	**100.00%**
CONCRETING	34.45	1,000.00	34,450.00	100.00%	34.45	1,000.00	34,450.00	100.00%
FINISHES	34.45	750.00	25,837.50	100.00%	34.45	750.00	25,837.50	100.00%
MEP WORKS	34.45	400.00	13,780.00	100.00%	34.45	400.00	13,780.00	100.00%
ALUMINUM & GLAZI	34.45	700.00	24,115.00	100.00%	34.45	700.00	24,115.00	100.00%
Floor: 1F	**30.95**	**2,850.00**	**88,207.50**	**100.00%**	**30.95**	**2,850.00**	**88,207.50**	**100.00%**
CONCRETING	30.95	1,000.00	30,950.00	100.00%	30.95	1,000.00	30,950.00	100.00%
FINISHES	30.95	750.00	23,212.50	100.00%	30.95	750.00	23,212.50	100.00%
MEP WORKS	30.95	400.00	12,380.00	100.00%	30.95	400.00	12,380.00	100.00%
ALUMINUM & GLAZI	30.95	700.00	21,665.00	100.00%	30.95	700.00	21,665.00	100.00%
Floor: 6P	**26.75**	**2,850.00**	**76,237.50**	**100.00%**	**26.75**	**2,850.00**	**76,237.50**	**100.00%**
CONCRETING	26.75	1,000.00	26,750.00	100.00%	26.75	1,000.00	26,750.00	100.00%
FINISHES	26.75	750.00	20,062.50	100.00%	26.75	750.00	20,062.50	100.00%
MEP WORKS	26.75	400.00	10,700.00	100.00%	26.75	400.00	10,700.00	100.00%
ALUMINUM & GLAZI	26.75	700.00	18,725.00	100.00%	26.75	700.00	18,725.00	100.00%
Floor: 5P	**22.60**	**2,850.00**	**64,410.00**	**100.00%**	**22.60**	**2,850.00**	**64,410.00**	**100.00%**
CONCRETING	22.60	1,000.00	22,600.00	100.00%	22.60	1,000.00	22,600.00	100.00%
FINISHES	22.60	750.00	16,950.00	100.00%	22.60	750.00	16,950.00	100.00%
MEP WORKS	22.60	400.00	9,040.00	100.00%	22.60	400.00	9,040.00	100.00%
ALUMINUM & GLAZI	22.60	700.00	15,820.00	100.00%	22.60	700.00	15,820.00	100.00%
Floor: 4P	**19.20**	**4,250.00**	**81,600.00**	**100.00%**	**19.20**	**4,250.00**	**81,600.00**	**100.00%**
CONCRETING	19.20	1,000.00	19,200.00	100.00%	19.20	1,000.00	19,200.00	100.00%
FINISHES	19.20	2,150.00	41,280.00	100.00%	19.20	2,150.00	41,280.00	100.00%
MEP WORKS	19.20	400.00	7,680.00	100.00%	19.20	400.00	7,680.00	100.00%

Totals:- **Planned Value=109888, PV * Height=4128881.975, Perc. Accom.=71.40, PH=37.57**
Actual Value=106076, AV * Height=3823871.95, Perc. Accom.=68.92, EH=36.05

SHARJAH PROJECT

Floors: 42

Start Date: **1-Feb-2006** Finish Date: **30-Jul-2008**

Progress Report for the Month June 2007

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
ALUMINUM & GLAZI	19.20	700.00	13,440.00	100.00%	19.20	700.00	13,440.00	100.00%
Floor: 3P	**15.80**	**3,250.00**	**51,350.00**	**100.00%**	**15.80**	**3,250.00**	**51,350.00**	**100.00%**
CONCRETING	15.80	1,000.00	15,800.00	100.00%	15.80	1,000.00	15,800.00	100.00%
FINISHES	15.80	1,150.00	18,170.00	100.00%	15.80	1,150.00	18,170.00	100.00%
MEP WORKS	15.80	400.00	6,320.00	100.00%	15.80	400.00	6,320.00	100.00%
ALUMINUM & GLAZI	15.80	700.00	11,060.00	100.00%	15.80	700.00	11,060.00	100.00%
Floor: 2P	**12.40**	**6,950.00**	**86,180.00**	**100.00%**	**12.40**	**6,950.00**	**86,180.00**	**100.00%**
CONCRETING	12.40	1,000.00	12,400.00	100.00%	12.40	1,000.00	12,400.00	100.00%
FINISHES	12.40	250.00	3,100.00	100.00%	12.40	250.00	3,100.00	100.00%
MEP WORKS	12.40	5,000.00	62,000.00	100.00%	12.40	5,000.00	62,000.00	100.00%
ALUMINUM & GLAZI	12.40	700.00	8,680.00	100.00%	12.40	700.00	8,680.00	100.00%
Floor: 1P	**9.00**	**6,950.00**	**62,550.00**	**100.00%**	**9.00**	**6,950.00**	**62,550.00**	**100.00%**
CONCRETING	9.00	1,000.00	9,000.00	100.00%	9.00	1,000.00	9,000.00	100.00%
FINISHES	9.00	250.00	2,250.00	100.00%	9.00	250.00	2,250.00	100.00%
MEP WORKS	9.00	5,000.00	45,000.00	100.00%	9.00	5,000.00	45,000.00	100.00%
ALUMINUM & GLAZI	9.00	700.00	6,300.00	100.00%	9.00	700.00	6,300.00	100.00%
Floor: Attic	**5.60**	**15,250.00**	**85,400.00**	**100.00%**	**5.60**	**15,250.00**	**85,400.00**	**100.00%**
CONCRETING	5.60	1,000.00	5,600.00	100.00%	5.60	1,000.00	5,600.00	100.00%
FINISHES	5.60	4,150.00	23,240.00	100.00%	5.60	4,150.00	23,240.00	100.00%
MEP WORKS	5.60	10,000.00	56,000.00	100.00%	5.60	10,000.00	56,000.00	100.00%
ALUMINUM & GLAZI	5.60	100.00	560.00	100.00%	5.60	100.00	560.00	100.00%
Floor: GF	**1.95**	**15,250.00**	**29,737.50**	**100.00%**	**1.95**	**15,250.00**	**29,737.50**	**100.00%**
CONCRETING	1.95	1,000.00	1,950.00	100.00%	1.95	1,000.00	1,950.00	100.00%
FINISHES	1.95	4,150.00	8,092.50	100.00%	1.95	4,150.00	8,092.50	100.00%
MEP WORKS	1.95	10,000.00	19,500.00	100.00%	1.95	10,000.00	19,500.00	100.00%
ALUMINUM & GLAZI	1.95	100.00	195.00	100.00%	1.95	100.00	195.00	100.00%
Total:		**109,[illegible].00**	**[illegible]**	**71.40%**		**06,076.00**		**68.92%**

Totals:- **Planned Value=[illegible], PV * Height=[illegible]1.975, Perc. Accom.=71.40, PH=37.57**
Actual Value=106076, AV * Height=[illegible]71.95, Perc. Accom.=68.92, EH=36.05

***Appendix G** – EHM*
Progress Report, June 2008 –
Business Bay Project

BUSINESS BAY PROJECT

Floors: 45

Start Date: **1-Dec-2007** Finish Date: **30-Apr-2009**

Progress Report for the Month June 2008

Floor / Work	Planned Progress				Actual Progress			
	Height	Planned Value	Height Value	% Accomplished	Height	Earned Value	Height Value	% Accomplished
Floor: HELIPAD	**170.75**	**0.00**	**0.00**	**0.00%**	**170.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	170.75	0.00	0.00	0.00%	170.75	0.00	0.00	0.00%
FINISHES	170.75	0.00	0.00	0.00%	170.75	0.00	0.00	0.00%
MEP	170.75	0.00	0.00	0.00%	170.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	170.75	0.00	0.00	0.00%	170.75	0.00	0.00	0.00%
Floor: 3URF	**168.80**	**0.00**	**0.00**	**0.00%**	**168.80**	**0.00**	**0.00**	**0.00%**
CONCRETE	168.80	0.00	0.00	0.00%	168.80	0.00	0.00	0.00%
FINISHES	168.80	0.00	0.00	0.00%	168.80	0.00	0.00	0.00%
MEP	168.80	0.00	0.00	0.00%	168.80	0.00	0.00	0.00%
ALUMINUM & GLAZI	168.80	0.00	0.00	0.00%	168.80	0.00	0.00	0.00%
Floor: 2URF	**164.90**	**0.00**	**0.00**	**0.00%**	**164.90**	**0.00**	**0.00**	**0.00%**
CONCRETE	164.90	0.00	0.00	0.00%	164.90	0.00	0.00	0.00%
FINISHES	164.90	0.00	0.00	0.00%	164.90	0.00	0.00	0.00%
MEP	164.90	0.00	0.00	0.00%	164.90	0.00	0.00	0.00%
ALUMINUM & GLAZI	164.90	0.00	0.00	0.00%	164.90	0.00	0.00	0.00%
Floor: URF	**161.00**	**0.00**	**0.00**	**0.00%**	**161.00**	**0.00**	**0.00**	**0.00%**
CONCRETE	161.00	0.00	0.00	0.00%	161.00	0.00	0.00	0.00%
FINISHES	161.00	0.00	0.00	0.00%	161.00	0.00	0.00	0.00%
MEP	161.00	0.00	0.00	0.00%	161.00	0.00	0.00	0.00%
ALUMINUM & GLAZI	161.00	0.00	0.00	0.00%	161.00	0.00	0.00	0.00%
Floor: RF	**157.03**	**0.00**	**0.00**	**0.00%**	**157.03**	**0.00**	**0.00**	**0.00%**
CONCRETE	157.03	0.00	0.00	0.00%	157.03	0.00	0.00	0.00%
FINISHES	157.03	0.00	0.00	0.00%	157.03	0.00	0.00	0.00%
MEP	157.03	0.00	0.00	0.00%	157.03	0.00	0.00	0.00%
ALUMINUM & GLAZI	157.03	0.00	0.00	0.00%	157.03	0.00	0.00	0.00%
Floor: 35F	**153.09**	**0.00**	**0.00**	**0.00%**	**153.09**	**0.00**	**0.00**	**0.00%**
CONCRETE	153.09	0.00	0.00	0.00%	153.09	0.00	0.00	0.00%
FINISHES	153.09	0.00	0.00	0.00%	153.09	0.00	0.00	0.00%
MEP	153.09	0.00	0.00	0.00%	153.09	0.00	0.00	0.00%
ALUMINUM & GLAZI	153.09	0.00	0.00	0.00%	153.09	0.00	0.00	0.00%
Floor: 34F	**149.22**	**0.00**	**0.00**	**0.00%**	**149.22**	**0.00**	**0.00**	**0.00%**
CONCRETE	149.22	0.00	0.00	0.00%	149.22	0.00	0.00	0.00%
FINISHES	149.22	0.00	0.00	0.00%	149.22	0.00	0.00	0.00%
MEP	149.22	0.00	0.00	0.00%	149.22	0.00	0.00	0.00%
ALUMINUM & GLAZI	149.22	0.00	0.00	0.00%	149.22	0.00	0.00	0.00%
Floor: 33F	**145.32**	**0.00**	**0.00**	**0.00%**	**145.32**	**0.00**	**0.00**	**0.00%**
CONCRETE	145.32	0.00	0.00	0.00%	145.32	0.00	0.00	0.00%

Totals:- **Planned Value=53917.24, PV * Height=1082960.7963, Perc. Accom.=27.77, PH=20.09**
Actual Value=34092.95, AV * Height=5606646.006, Perc. Accom.=17.97, EH=16.15

BUSINESS BAY PROJECT

Floors: 45

Start Date: **1-Dec-2007** Finish Date: **30-Apr-2009**

Progress Report for the Month June 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
FINISHES	145.32	0.00	0.00	0.00%	145.32	0.00	0.00	0.00%
MEP	145.32	0.00	0.00	0.00%	145.32	0.00	0.00	0.00%
ALUMINUM & GLAZI	145.32	0.00	0.00	0.00%	145.32	0.00	0.00	0.00%
Floor: 32F	**141.42**	**0.00**	**0.00**	**0.00%**	**141.42**	**0.00**	**0.00**	**0.00%**
CONCRETE	141.42	0.00	0.00	0.00%	141.42	0.00	0.00	0.00%
FINISHES	141.42	0.00	0.00	0.00%	141.42	0.00	0.00	0.00%
MEP	141.42	0.00	0.00	0.00%	141.42	0.00	0.00	0.00%
ALUMINUM & GLAZI	141.42	0.00	0.00	0.00%	141.42	0.00	0.00	0.00%
Floor: 31F	**137.52**	**0.00**	**0.00**	**0.00%**	**137.52**	**0.00**	**0.00**	**0.00%**
CONCRETE	137.52	0.00	0.00	0.00%	137.52	0.00	0.00	0.00%
FINISHES	137.52	0.00	0.00	0.00%	137.52	0.00	0.00	0.00%
MEP	137.52	0.00	0.00	0.00%	137.52	0.00	0.00	0.00%
ALUMINUM & GLAZI	137.52	0.00	0.00	0.00%	137.52	0.00	0.00	0.00%
Floor: 30F	**133.62**	**0.00**	**0.00**	**0.00%**	**133.62**	**0.00**	**0.00**	**0.00%**
CONCRETE	133.62	0.00	0.00	0.00%	133.62	0.00	0.00	0.00%
FINISHES	133.62	0.00	0.00	0.00%	133.62	0.00	0.00	0.00%
MEP	133.62	0.00	0.00	0.00%	133.62	0.00	0.00	0.00%
ALUMINUM & GLAZI	133.62	0.00	0.00	0.00%	133.62	0.00	0.00	0.00%
Floor: 29F	**129.72**	**0.00**	**0.00**	**0.00%**	**129.72**	**0.00**	**0.00**	**0.00%**
CONCRETE	129.72	0.00	0.00	0.00%	129.72	0.00	0.00	0.00%
FINISHES	129.72	0.00	0.00	0.00%	129.72	0.00	0.00	0.00%
MEP	129.72	0.00	0.00	0.00%	129.72	0.00	0.00	0.00%
ALUMINUM & GLAZI	129.72	0.00	0.00	0.00%	129.72	0.00	0.00	0.00%
Floor: 28F	**125.82**	**0.00**	**0.00**	**0.00%**	**125.82**	**0.00**	**0.00**	**0.00%**
CONCRETE	125.82	0.00	0.00	0.00%	125.82	0.00	0.00	0.00%
FINISHES	125.82	0.00	0.00	0.00%	125.82	0.00	0.00	0.00%
MEP	125.82	0.00	0.00	0.00%	125.82	0.00	0.00	0.00%
ALUMINUM & GLAZI	125.82	0.00	0.00	0.00%	125.82	0.00	0.00	0.00%
Floor: 27F	**121.92**	**0.00**	**0.00**	**0.00%**	**121.92**	**0.00**	**0.00**	**0.00%**
CONCRETE	121.92	0.00	0.00	0.00%	121.92	0.00	0.00	0.00%
FINISHES	121.92	0.00	0.00	0.00%	121.92	0.00	0.00	0.00%
MEP	121.92	0.00	0.00	0.00%	121.92	0.00	0.00	0.00%
ALUMINUM & GLAZI	121.92	0.00	0.00	0.00%	121.92	0.00	0.00	0.00%
Floor: 26F	**118.02**	**0.00**	**0.00**	**0.00%**	**118.02**	**0.00**	**0.00**	**0.00%**
CONCRETE	118.02	0.00	0.00	0.00%	118.02	0.00	0.00	0.00%
FINISHES	118.02	0.00	0.00	0.00%	118.02	0.00	0.00	0.00%
MEP	118.02	0.00	0.00	0.00%	118.02	0.00	0.00	0.00%

Totals:- **Planned Value=53917.24, PV * Height=1082960.7963, Perc. Accom.=27.77, PH=20.09**
Actual Value=34892.95, AV * Height=563646.006, Perc. Accom.=17.97, EH=16.15

BUSINESS BAY PROJECT

Floors: 45

Start Date: **1-Dec-2007** Finish Date: **30-Apr-2009**

Progress Report for the Month June 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
ALUMINUM & GLAZI	118.02	0.00	0.00	0.00%	118.02	0.00	0.00	0.00%
Floor: 25F	**114.12**	**0.00**	**0.00**	**0.00%**	**114.12**	**0.00**	**0.00**	**0.00%**
CONCRETE	114.12	0.00	0.00	0.00%	114.12	0.00	0.00	0.00%
FINISHES	114.12	0.00	0.00	0.00%	114.12	0.00	0.00	0.00%
MEP	114.12	0.00	0.00	0.00%	114.12	0.00	0.00	0.00%
ALUMINUM & GLAZI	114.12	0.00	0.00	0.00%	114.12	0.00	0.00	0.00%
Floor: 24F	**110.22**	**0.00**	**0.00**	**0.00%**	**110.22**	**0.00**	**0.00**	**0.00%**
CONCRETE	110.22	0.00	0.00	0.00%	110.22	0.00	0.00	0.00%
FINISHES	110.22	0.00	0.00	0.00%	110.22	0.00	0.00	0.00%
MEP	110.22	0.00	0.00	0.00%	110.22	0.00	0.00	0.00%
ALUMINUM & GLAZI	110.22	0.00	0.00	0.00%	110.22	0.00	0.00	0.00%
Floor: 23F	**106.32**	**0.00**	**0.00**	**0.00%**	**106.32**	**0.00**	**0.00**	**0.00%**
CONCRETE	106.32	0.00	0.00	0.00%	106.32	0.00	0.00	0.00%
FINISHES	106.32	0.00	0.00	0.00%	106.32	0.00	0.00	0.00%
MEP	106.32	0.00	0.00	0.00%	106.32	0.00	0.00	0.00%
ALUMINUM & GLAZI	106.32	0.00	0.00	0.00%	106.32	0.00	0.00	0.00%
Floor: 22F	**102.42**	**0.00**	**0.00**	**0.00%**	**102.42**	**0.00**	**0.00**	**0.00%**
CONCRETE	102.42	0.00	0.00	0.00%	102.42	0.00	0.00	0.00%
FINISHES	102.42	0.00	0.00	0.00%	102.42	0.00	0.00	0.00%
MEP	102.42	0.00	0.00	0.00%	102.42	0.00	0.00	0.00%
ALUMINUM & GLAZI	102.42	0.00	0.00	0.00%	102.42	0.00	0.00	0.00%
Floor: 21F	**98.52**	**0.00**	**0.00**	**0.00%**	**98.52**	**0.00**	**0.00**	**0.00%**
CONCRETE	98.52	0.00	0.00	0.00%	98.52	0.00	0.00	0.00%
FINISHES	98.52	0.00	0.00	0.00%	98.52	0.00	0.00	0.00%
MEP	98.52	0.00	0.00	0.00%	98.52	0.00	0.00	0.00%
ALUMINUM & GLAZI	98.52	0.00	0.00	0.00%	98.52	0.00	0.00	0.00%
Floor: 20F	**94.62**	**0.00**	**0.00**	**0.00%**	**94.62**	**0.00**	**0.00**	**0.00%**
CONCRETE	94.62	0.00	0.00	0.00%	94.62	0.00	0.00	0.00%
FINISHES	94.62	0.00	0.00	0.00%	94.62	0.00	0.00	0.00%
MEP	94.62	0.00	0.00	0.00%	94.62	0.00	0.00	0.00%
ALUMINUM & GLAZI	94.62	0.00	0.00	0.00%	94.62	0.00	0.00	0.00%
Floor: 19F	**90.72**	**0.00**	**0.00**	**0.00%**	**90.72**	**0.00**	**0.00**	**0.00%**
CONCRETE	90.72	0.00	0.00	0.00%	90.72	0.00	0.00	0.00%
FINISHES	90.72	0.00	0.00	0.00%	90.72	0.00	0.00	0.00%
MEP	90.72	0.00	0.00	0.00%	90.72	0.00	0.00	0.00%
ALUMINUM & GLAZI	90.72	0.00	0.00	0.00%	90.72	0.00	0.00	0.00%

Totals:- **Planned Value=53917.24, PV * Height=1082960.7963, Perc. Accom.=27.77, PH=20.09**
Actual Value=34892.95, AV * Height=563646.006, Perc. Accom.=17.97, EH=16.15

BUSINESS BAY PROJECT

Floors: 45

Start Date: **1-Dec-2007** Finish Date: **30-Apr-2009**

Progress Report for the Month June 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
Floor: 18F	**86.82**	**0.00**	**0.00**	**0.00%**	**86.82**	**0.00**	**0.00**	**0.00%**
CONCRETE	86.82	0.00	0.00	0.00%	86.82	0.00	0.00	0.00%
FINISHES	86.82	0.00	0.00	0.00%	86.82	0.00	0.00	0.00%
MEP	86.82	0.00	0.00	0.00%	86.82	0.00	0.00	0.00%
ALUMINUM & GLAZI	86.82	0.00	0.00	0.00%	86.82	0.00	0.00	0.00%
Floor: 17F	**82.92**	**0.00**	**0.00**	**0.00%**	**82.92**	**0.00**	**0.00**	**0.00%**
CONCRETE	82.92	0.00	0.00	0.00%	82.92	0.00	0.00	0.00%
FINISHES	82.92	0.00	0.00	0.00%	82.92	0.00	0.00	0.00%
MEP	82.92	0.00	0.00	0.00%	82.92	0.00	0.00	0.00%
ALUMINUM & GLAZI	82.92	0.00	0.00	0.00%	82.92	0.00	0.00	0.00%
Floor: 16F	**79.02**	**0.00**	**0.00**	**0.00%**	**79.02**	**0.00**	**0.00**	**0.00%**
CONCRETE	79.02	0.00	0.00	0.00%	79.02	0.00	0.00	0.00%
FINISHES	79.02	0.00	0.00	0.00%	79.02	0.00	0.00	0.00%
MEP	79.02	0.00	0.00	0.00%	79.02	0.00	0.00	0.00%
ALUMINUM & GLAZI	79.02	0.00	0.00	0.00%	79.02	0.00	0.00	0.00%
Floor: 15F	**75.12**	**0.00**	**0.00**	**0.00%**	**75.12**	**0.00**	**0.00**	**0.00%**
CONCRETE	75.12	0.00	0.00	0.00%	75.12	0.00	0.00	0.00%
FINISHES	75.12	0.00	0.00	0.00%	75.12	0.00	0.00	0.00%
MEP	75.12	0.00	0.00	0.00%	75.12	0.00	0.00	0.00%
ALUMINUM & GLAZI	75.12	0.00	0.00	0.00%	75.12	0.00	0.00	0.00%
Floor: 14F	**71.22**	**451.03**	**32,122.36**	**13.48%**	**71.22**	**0.00**	**0.00**	**0.00%**
CONCRETE	71.22	451.03	32,122.36	37.00%	71.22	0.00	0.00	0.00%
FINISHES	71.22	0.00	0.00	0.00%	71.22	0.00	0.00	0.00%
MEP	71.22	0.00	0.00	0.00%	71.22	0.00	0.00	0.00%
ALUMINUM & GLAZI	71.22	0.00	0.00	0.00%	71.22	0.00	0.00	0.00%
Floor: 13F	**67.32**	**719.21**	**48,417.22**	**21.50%**	**67.32**	**0.00**	**0.00**	**0.00%**
CONCRETE	67.32	719.21	48,417.22	59.00%	67.32	0.00	0.00	0.00%
FINISHES	67.32	0.00	0.00	0.00%	67.32	0.00	0.00	0.00%
MEP	67.32	0.00	0.00	0.00%	67.32	0.00	0.00	0.00%
ALUMINUM & GLAZI	67.32	0.00	0.00	0.00%	67.32	0.00	0.00	0.00%
Floor: 12F	**63.42**	**1,119.30**	**70,986.01**	**33.23%**	**63.42**	**0.00**	**0.00**	**0.00%**
CONCRETE	63.42	1,119.30	70,986.01	91.00%	63.42	0.00	0.00	0.00%
FINISHES	63.42	0.00	0.00	0.00%	63.42	0.00	0.00	0.00%
MEP	63.42	0.00	0.00	0.00%	63.42	0.00	0.00	0.00%
ALUMINUM & GLAZI	63.42	0.00	0.00	0.00%	63.42	0.00	0.00	0.00%
Floor: 11F	**59.52**	**1,379.90**	**82,131.65**	**40.53%**	**59.52**	**0.00**	**0.00**	**0.00%**
CONCRETE	59.52	1,240.00	73,804.80	100.00%	59.52	0.00	0.00	0.00%

Totals:- **Planned Value=53917.24, PV * Height=1082960.7963, Perc. Accom.=27.77, PH=20.09**
Actual Value=34892.95, AV * Height=563646.006, Perc. Accom.=17.97, EH=16.15

BUSINESS BAY PROJECT

Floors: 45

Start Date: **1-Dec-2007** Finish Date: **30-Apr-2009**

Progress Report for the Month June 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
FINISHES	59.52	50.38	2,998.62	11.00%	59.52	0.00	0.00	0.00%
MEP	59.52	89.52	5,328.23	8.00%	59.52	0.00	0.00	0.00%
ALUMINUM & GLAZI	59.52	0.00	0.00	0.00%	59.52	0.00	0.00	0.00%
Floor: 10F	**55.62**	**1,394.33**	**77,552.63**	**40.53%**	**55.62**	**0.00**	**0.00**	**0.00%**
CONCRETE	55.62	1,253.00	69,691.86	100.00%	55.62	0.00	0.00	0.00%
FINISHES	55.62	50.93	2,832.73	11.00%	55.62	0.00	0.00	0.00%
MEP	55.62	90.40	5,028.05	8.00%	55.62	0.00	0.00	0.00%
ALUMINUM & GLAZI	55.62	0.00	0.00	0.00%	55.62	0.00	0.00	0.00%
Floor: 9F	**51.72**	**1,417.73**	**73,325.00**	**40.53%**	**51.72**	**0.00**	**0.00**	**0.00%**
CONCRETE	51.72	1,274.00	65,891.28	100.00%	51.72	0.00	0.00	0.00%
FINISHES	51.72	51.81	2,679.61	11.00%	51.72	0.00	0.00	0.00%
MEP	51.72	91.92	4,754.10	8.00%	51.72	0.00	0.00	0.00%
ALUMINUM & GLAZI	51.72	0.00	0.00	0.00%	51.72	0.00	0.00	0.00%
Floor: 8F	**47.82**	**1,439.94**	**68,857.93**	**40.54%**	**47.82**	**1,035.20**	**49,503.26**	**29.14%**
CONCRETE	47.82	1,294.00	61,879.08	100.00%	47.82	1,035.20	49,503.26	80.00%
FINISHES	47.82	52.58	2,514.38	11.00%	47.82	0.00	0.00	0.00%
MEP	47.82	93.36	4,464.48	8.00%	47.82	0.00	0.00	0.00%
ALUMINUM & GLAZI	47.82	0.00	0.00	0.00%	47.82	0.00	0.00	0.00%
Floor: 7F	**43.92**	**1,462.26**	**64,222.46**	**40.53%**	**43.92**	**1,314.00**	**57,710.88**	**36.42%**
CONCRETE	43.92	1,314.00	57,710.88	100.00%	43.92	1,314.00	57,710.88	100.00%
FINISHES	43.92	53.46	2,347.96	11.00%	43.92	0.00	0.00	0.00%
MEP	43.92	94.80	4,163.62	8.00%	43.92	0.00	0.00	0.00%
ALUMINUM & GLAZI	43.92	0.00	0.00	0.00%	43.92	0.00	0.00	0.00%
Floor: 6F	**40.02**	**1,618.03**	**64,753.56**	**40.53%**	**40.02**	**1,454.00**	**58,189.08**	**36.42%**
CONCRETE	40.02	1,454.00	58,189.08	100.00%	40.02	1,454.00	58,189.08	100.00%
FINISHES	40.02	59.07	2,363.98	11.00%	40.02	0.00	0.00	0.00%
MEP	40.02	104.96	4,200.50	8.00%	40.02	0.00	0.00	0.00%
ALUMINUM & GLAZI	40.02	0.00	0.00	0.00%	40.02	0.00	0.00	0.00%
Floor: 5F	**36.04**	**2,586.17**	**93,205.57**	**40.54%**	**36.04**	**2,324.00**	**83,756.96**	**36.43%**
CONCRETE	36.04	2,324.00	83,756.96	100.00%	36.04	2,324.00	83,756.96	100.00%
FINISHES	36.04	94.49	3,405.42	11.00%	36.04	0.00	0.00	0.00%
MEP	36.04	167.68	6,043.19	8.00%	36.04	0.00	0.00	0.00%
ALUMINUM & GLAZI	36.04	0.00	0.00	0.00%	36.04	0.00	0.00	0.00%
Floor: 4F	**31.57**	**1,031.94**	**32,578.35**	**19.67%**	**31.57**	**955.50**	**30,165.14**	**18.21%**
CONCRETE	31.57	1,031.94	32,578.35	54.00%	31.57	955.50	30,165.14	50.00%
FINISHES	31.57	0.00	0.00	0.00%	31.57	0.00	0.00	0.00%
MEP	31.57	0.00	0.00	0.00%	31.57	0.00	0.00	0.00%

Totals:- **Planned Value=53917.24, PV * Height=1082960.7963, Perc. Accom.=27.77, PH=20.09**
Actual Value=34892.95, AV * Height=563646.006, Perc. Accom.=17.97, EH=16.15

BUSINESS BAY PROJECT

Floors: 45

Start Date: **1-Dec-2007** Finish Date: **30-Apr-2009**

Progress Report for the Month June 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
ALUMINUM & GLAZI	31.57	0.00	0.00	0.00%	31.57	0.00	0.00	0.00%
Floor: 3F	**27.35**	**1,407.78**	**38,502.78**	**19.67%**	**27.35**	**1,303.50**	**35,650.73**	**18.21%**
CONCRETE	27.35	1,407.78	38,502.78	54.00%	27.35	1,303.50	35,650.73	50.00%
FINISHES	27.35	0.00	0.00	0.00%	27.35	0.00	0.00	0.00%
MEP	27.35	0.00	0.00	0.00%	27.35	0.00	0.00	0.00%
ALUMINUM & GLAZI	27.35	0.00	0.00	0.00%	27.35	0.00	0.00	0.00%
Floor: 2F	**23.78**	**1,419.66**	**33,759.51**	**19.67%**	**23.78**	**1,314.50**	**31,258.81**	**18.21%**
CONCRETE	23.78	1,419.66	33,759.51	54.00%	23.78	1,314.50	31,258.81	50.00%
FINISHES	23.78	0.00	0.00	0.00%	23.78	0.00	0.00	0.00%
MEP	23.78	0.00	0.00	0.00%	23.78	0.00	0.00	0.00%
ALUMINUM & GLAZI	23.78	0.00	0.00	0.00%	23.78	0.00	0.00	0.00%
Floor: 1F	**20.00**	**2,654.00**	**53,080.00**	**36.43%**	**20.00**	**1,327.00**	**26,540.00**	**18.21%**
CONCRETE	20.00	2,654.00	53,080.00	100.00%	20.00	1,327.00	26,540.00	50.00%
FINISHES	20.00	0.00	0.00	0.00%	20.00	0.00	0.00	0.00%
MEP	20.00	0.00	0.00	0.00%	20.00	0.00	0.00	0.00%
ALUMINUM & GLAZI	20.00	0.00	0.00	0.00%	20.00	0.00	0.00	0.00%
Floor: MZ	**16.50**	**823.20**	**13,582.80**	**40.47%**	**16.50**	**741.00**	**12,226.50**	**36.43%**
CONCRETE	16.50	741.00	12,226.50	100.00%	16.50	741.00	12,226.50	100.00%
FINISHES	16.50	82.20	1,356.30	30.00%	16.50	0.00	0.00	0.00%
MEP	16.50	0.00	0.00	0.00%	16.50	0.00	0.00	0.00%
ALUMINUM & GLAZI	16.50	0.00	0.00	0.00%	16.50	0.00	0.00	0.00%
Floor: GF	**12.86**	**9,970.16**	**28,216.26**	**42.43%**	**12.86**	**8,558.00**	**10,055.88**	**36.42%**
CONCRETE	12.86	8,558.00	110,055.88	100.00%	12.86	8,558.00	110,055.88	100.00%
FINISHES	12.86	948.90	12,202.85	30.00%	12.86	0.00	0.00	0.00%
MEP	12.86	463.26	5,957.52	6.00%	12.86	0.00	0.00	0.00%
ALUMINUM & GLAZI	12.86	0.00	0.00	0.00%	12.86	0.00	0.00	0.00%
Floor: B1	**8.66**	**6,029.21**	**52,212.96**	**60.60%**	**8.66**	**3,921.35**	**33,958.89**	**39.41%**
CONCRETE	8.66	3,624.00	31,383.84	100.00%	8.66	3,624.00	31,383.84	100.00%
FINISHES	8.66	803.40	6,957.44	60.00%	8.66	133.90	1,159.57	10.00%
MEP	8.66	1,601.81	13,871.67	49.00%	8.66	163.45	1,415.48	5.00%
ALUMINUM & GLAZI	8.66	0.00	0.00	0.00%	8.66	0.00	0.00	0.00%
Floor: B2	**4.97**	**8,257.43**	**41,039.43**	**83.00%**	**4.97**	**5,140.30**	**25,547.29**	**51.67%**
CONCRETE	4.97	3,624.00	18,011.28	100.00%	4.97	3,624.00	18,011.28	100.00%
FINISHES	4.97	856.96	4,259.09	64.00%	4.97	535.60	2,661.93	40.00%
MEP	4.97	2,059.47	10,235.57	63.00%	4.97	980.70	4,874.08	30.00%
ALUMINUM & GLAZI	4.97	1,717.00	8,533.49	100.00%	4.97	0.00	0.00	0.00%

Totals:- **Planned Value=53917.24, PV * Height= 1082960.7963, Perc. Accom.=27.77, PH=20.09**
Actual Value=34892.95, AV * Height=563646.006, Perc. Accom.=17.97, EH=16.15

BUSINESS BAY PROJECT

Floors: 45

Start Date: **1-Dec-2007** Finish Date: **30-Apr-2009**

Progress Report for the Month June 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
Floor: B3	**1.65**	**8,735.96**	**14,414.33**	**87.81%**	**1.65**	**5,504.60**	**9,082.59**	**55.33%**
CONCRETE	1.65	3,624.00	5,979.60	100.00%	1.65	3,624.00	5,979.60	100.00%
FINISHES	1.65	910.52	1,502.36	68.00%	1.65	736.45	1,215.14	55.00%
MEP	1.65	2,484.44	4,099.33	76.00%	1.65	1,144.15	1,887.85	35.00%
ALUMINUM & GLAZI	1.65	1,717.00	2,833.05	100.00%	1.65	0.00	0.00	0.00%
Total:		**53,917.24**	**82,960.80**	**27.77%**		**34,892.95**		**17.97%**

Totals:- **Planned Value=53917.24, PV * Height=1082960.7963, Perc. Accom.=27.77, PH=20.09**
Actual Value=34892.95, AV * Height=563646.006, Perc. Accom.=17.97, EH=16.15

Appendix H *– EHM Progress Report, Sept 2008 – Marina Project*

MARINA PROJECT

Floors: 53

Start Date: **12-May-2008** Finish Date: **12-Apr-2011**

Progress Report for the Month September 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
Floor: 50	**183.75**	**0.00**	**0.00**	**0.00%**	**183.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	183.75	0.00	0.00	0.00%	183.75	0.00	0.00	0.00%
FINISHES	183.75	0.00	0.00	0.00%	183.75	0.00	0.00	0.00%
MEP	183.75	0.00	0.00	0.00%	183.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	183.75	0.00	0.00	0.00%	183.75	0.00	0.00	0.00%
Floor: 49	**180.25**	**0.00**	**0.00**	**0.00%**	**180.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	180.25	0.00	0.00	0.00%	180.25	0.00	0.00	0.00%
FINISHES	180.25	0.00	0.00	0.00%	180.25	0.00	0.00	0.00%
MEP	180.25	0.00	0.00	0.00%	180.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	180.25	0.00	0.00	0.00%	180.25	0.00	0.00	0.00%
Floor: 48	**176.75**	**0.00**	**0.00**	**0.00%**	**176.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	176.75	0.00	0.00	0.00%	176.75	0.00	0.00	0.00%
FINISHES	176.75	0.00	0.00	0.00%	176.75	0.00	0.00	0.00%
MEP	176.75	0.00	0.00	0.00%	176.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	176.75	0.00	0.00	0.00%	176.75	0.00	0.00	0.00%
Floor: 47	**173.25**	**0.00**	**0.00**	**0.00%**	**173.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	173.25	0.00	0.00	0.00%	173.25	0.00	0.00	0.00%
FINISHES	173.25	0.00	0.00	0.00%	173.25	0.00	0.00	0.00%
MEP	173.25	0.00	0.00	0.00%	173.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	173.25	0.00	0.00	0.00%	173.25	0.00	0.00	0.00%
Floor: 46	**169.75**	**0.00**	**0.00**	**0.00%**	**169.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	169.75	0.00	0.00	0.00%	169.75	0.00	0.00	0.00%
FINISHES	169.75	0.00	0.00	0.00%	169.75	0.00	0.00	0.00%
MEP	169.75	0.00	0.00	0.00%	169.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	169.75	0.00	0.00	0.00%	169.75	0.00	0.00	0.00%
Floor: 45	**166.25**	**0.00**	**0.00**	**0.00%**	**166.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	166.25	0.00	0.00	0.00%	166.25	0.00	0.00	0.00%
FINISHES	166.25	0.00	0.00	0.00%	166.25	0.00	0.00	0.00%
MEP	166.25	0.00	0.00	0.00%	166.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	166.25	0.00	0.00	0.00%	166.25	0.00	0.00	0.00%
Floor: 44	**162.75**	**0.00**	**0.00**	**0.00%**	**162.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	162.75	0.00	0.00	0.00%	162.75	0.00	0.00	0.00%
FINISHES	162.75	0.00	0.00	0.00%	162.75	0.00	0.00	0.00%
MEP	162.75	0.00	0.00	0.00%	162.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	162.75	0.00	0.00	0.00%	162.75	0.00	0.00	0.00%
Floor: 43	**159.25**	**0.00**	**0.00**	**0.00%**	**159.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	159.25	0.00	0.00	0.00%	159.25	0.00	0.00	0.00%

Totals:- **Planned Value=67380.5, PV * Height=6700311.875, Perc. Accom.=7.49, PH=10.30**
Actual Value=37408, AV * Height=2229941, Perc. Accom.=4.16, EH=5.98

MARINA PROJECT

Floors: 53

Start Date: **12-May-2008** Finish Date: **12-Apr-2011**

Progress Report for the Month September 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
FINISHES	159.25	0.00	0.00	0.00%	159.25	0.00	0.00	0.00%
MEP	159.25	0.00	0.00	0.00%	159.25	0.00	0.00	0.00%
ALUMINIUM & GLAZI	159.25	0.00	0.00	0.00%	159.25	0.00	0.00	0.00%
Floor: 42	**155.75**	**0.00**	**0.00**	**0.00%**	**155.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	155.75	0.00	0.00	0.00%	155.75	0.00	0.00	0.00%
FINISHES	155.75	0.00	0.00	0.00%	155.75	0.00	0.00	0.00%
MEP	155.75	0.00	0.00	0.00%	155.75	0.00	0.00	0.00%
ALUMINIUM & GLAZI	155.75	0.00	0.00	0.00%	155.75	0.00	0.00	0.00%
Floor: 41	**152.25**	**0.00**	**0.00**	**0.00%**	**152.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	152.25	0.00	0.00	0.00%	152.25	0.00	0.00	0.00%
FINISHES	152.25	0.00	0.00	0.00%	152.25	0.00	0.00	0.00%
MEP	152.25	0.00	0.00	0.00%	152.25	0.00	0.00	0.00%
ALUMINIUM & GLAZI	152.25	0.00	0.00	0.00%	152.25	0.00	0.00	0.00%
Floor: 40	**148.75**	**0.00**	**0.00**	**0.00%**	**148.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	148.75	0.00	0.00	0.00%	148.75	0.00	0.00	0.00%
FINISHES	148.75	0.00	0.00	0.00%	148.75	0.00	0.00	0.00%
MEP	148.75	0.00	0.00	0.00%	148.75	0.00	0.00	0.00%
ALUMINIUM & GLAZI	148.75	0.00	0.00	0.00%	148.75	0.00	0.00	0.00%
Floor: 39	**145.25**	**0.00**	**0.00**	**0.00%**	**145.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	145.25	0.00	0.00	0.00%	145.25	0.00	0.00	0.00%
FINISHES	145.25	0.00	0.00	0.00%	145.25	0.00	0.00	0.00%
MEP	145.25	0.00	0.00	0.00%	145.25	0.00	0.00	0.00%
ALUMINIUM & GLAZI	145.25	0.00	0.00	0.00%	145.25	0.00	0.00	0.00%
Floor: 38	**141.75**	**0.00**	**0.00**	**0.00%**	**141.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	141.75	0.00	0.00	0.00%	141.75	0.00	0.00	0.00%
FINISHES	141.75	0.00	0.00	0.00%	141.75	0.00	0.00	0.00%
MEP	141.75	0.00	0.00	0.00%	141.75	0.00	0.00	0.00%
ALUMINIUM & GLAZI	141.75	0.00	0.00	0.00%	141.75	0.00	0.00	0.00%
Floor: 37	**138.25**	**0.00**	**0.00**	**0.00%**	**138.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	138.25	0.00	0.00	0.00%	138.25	0.00	0.00	0.00%
FINISHES	138.25	0.00	0.00	0.00%	138.25	0.00	0.00	0.00%
MEP	138.25	0.00	0.00	0.00%	138.25	0.00	0.00	0.00%
ALUMINIUM & GLAZI	138.25	0.00	0.00	0.00%	138.25	0.00	0.00	0.00%
Floor: 36	**134.75**	**0.00**	**0.00**	**0.00%**	**134.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	134.75	0.00	0.00	0.00%	134.75	0.00	0.00	0.00%
FINISHES	134.75	0.00	0.00	0.00%	134.75	0.00	0.00	0.00%
MEP	134.75	0.00	0.00	0.00%	134.75	0.00	0.00	0.00%

Totals:- **Planned Value=[illegible], PV * Height=[illegible], Perc. Accom.=7.49, PH=10.30**
Actual Value=[illegible], AV * Height=[illegible], Perc. Accom.=4.16, EH=5.98

MARINA PROJECT

Floors: 53

Start Date: **12-May-2008** Finish Date: **12-Apr-2011**

Progress Report for the Month September 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
ALUMINUM & GLAZI	134.75	0.00	0.00	0.00%	134.75	0.00	0.00	0.00%
Floor: 35	**131.25**	**0.00**	**0.00**	**0.00%**	**131.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	131.25	0.00	0.00	0.00%	131.25	0.00	0.00	0.00%
FINISHES	131.25	0.00	0.00	0.00%	131.25	0.00	0.00	0.00%
MEP	131.25	0.00	0.00	0.00%	131.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	131.25	0.00	0.00	0.00%	131.25	0.00	0.00	0.00%
Floor: 34	**127.75**	**0.00**	**0.00**	**0.00%**	**127.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	127.75	0.00	0.00	0.00%	127.75	0.00	0.00	0.00%
FINISHES	127.75	0.00	0.00	0.00%	127.75	0.00	0.00	0.00%
MEP	127.75	0.00	0.00	0.00%	127.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	127.75	0.00	0.00	0.00%	127.75	0.00	0.00	0.00%
Floor: 33	**124.25**	**0.00**	**0.00**	**0.00%**	**124.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	124.25	0.00	0.00	0.00%	124.25	0.00	0.00	0.00%
FINISHES	124.25	0.00	0.00	0.00%	124.25	0.00	0.00	0.00%
MEP	124.25	0.00	0.00	0.00%	124.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	124.25	0.00	0.00	0.00%	124.25	0.00	0.00	0.00%
Floor: 32	**120.75**	**0.00**	**0.00**	**0.00%**	**120.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	120.75	0.00	0.00	0.00%	120.75	0.00	0.00	0.00%
FINISHES	120.75	0.00	0.00	0.00%	120.75	0.00	0.00	0.00%
MEP	120.75	0.00	0.00	0.00%	120.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	120.75	0.00	0.00	0.00%	120.75	0.00	0.00	0.00%
Floor: 31	**117.25**	**0.00**	**0.00**	**0.00%**	**117.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	117.25	0.00	0.00	0.00%	117.25	0.00	0.00	0.00%
FINISHES	117.25	0.00	0.00	0.00%	117.25	0.00	0.00	0.00%
MEP	117.25	0.00	0.00	0.00%	117.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	117.25	0.00	0.00	0.00%	117.25	0.00	0.00	0.00%
Floor: 30	**113.75**	**0.00**	**0.00**	**0.00%**	**113.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	113.75	0.00	0.00	0.00%	113.75	0.00	0.00	0.00%
FINISHES	113.75	0.00	0.00	0.00%	113.75	0.00	0.00	0.00%
MEP	113.75	0.00	0.00	0.00%	113.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	113.75	0.00	0.00	0.00%	113.75	0.00	0.00	0.00%
Floor: 29	**110.25**	**0.00**	**0.00**	**0.00%**	**110.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	110.25	0.00	0.00	0.00%	110.25	0.00	0.00	0.00%
FINISHES	110.25	0.00	0.00	0.00%	110.25	0.00	0.00	0.00%
MEP	110.25	0.00	0.00	0.00%	110.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	110.25	0.00	0.00	0.00%	110.25	0.00	0.00	0.00%

Totals:- **Planned Value=67388.5, PV * Height=693931.875, Perc. Accom.=7.49, PH=10.30**
Actual Value=37408, AV * Height=220941, Perc. Accom.=4.16, EH=5.98

MARINA PROJECT

Floors: 53

Start Date: **12-May-2008** Finish Date: **12-Apr-2011**

Progress Report for the Month September 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
Floor: 28	**106.75**	**0.00**	**0.00**	**0.00%**	**106.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	106.75	0.00	0.00	0.00%	106.75	0.00	0.00	0.00%
FINISHES	106.75	0.00	0.00	0.00%	106.75	0.00	0.00	0.00%
MEP	106.75	0.00	0.00	0.00%	106.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	106.75	0.00	0.00	0.00%	106.75	0.00	0.00	0.00%
Floor: 27	**103.25**	**0.00**	**0.00**	**0.00%**	**103.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	103.25	0.00	0.00	0.00%	103.25	0.00	0.00	0.00%
FINISHES	103.25	0.00	0.00	0.00%	103.25	0.00	0.00	0.00%
MEP	103.25	0.00	0.00	0.00%	103.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	103.25	0.00	0.00	0.00%	103.25	0.00	0.00	0.00%
Floor: 26	**99.75**	**0.00**	**0.00**	**0.00%**	**99.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	99.75	0.00	0.00	0.00%	99.75	0.00	0.00	0.00%
FINISHES	99.75	0.00	0.00	0.00%	99.75	0.00	0.00	0.00%
MEP	99.75	0.00	0.00	0.00%	99.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	99.75	0.00	0.00	0.00%	99.75	0.00	0.00	0.00%
Floor: 25	**96.25**	**0.00**	**0.00**	**0.00%**	**96.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	96.25	0.00	0.00	0.00%	96.25	0.00	0.00	0.00%
FINISHES	96.25	0.00	0.00	0.00%	96.25	0.00	0.00	0.00%
MEP	96.25	0.00	0.00	0.00%	96.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	96.25	0.00	0.00	0.00%	96.25	0.00	0.00	0.00%
Floor: 24	**92.75**	**0.00**	**0.00**	**0.00%**	**92.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	92.75	0.00	0.00	0.00%	92.75	0.00	0.00	0.00%
FINISHES	92.75	0.00	0.00	0.00%	92.75	0.00	0.00	0.00%
MEP	92.75	0.00	0.00	0.00%	92.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	92.75	0.00	0.00	0.00%	92.75	0.00	0.00	0.00%
Floor: 23	**89.25**	**0.00**	**0.00**	**0.00%**	**89.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	89.25	0.00	0.00	0.00%	89.25	0.00	0.00	0.00%
FINISHES	89.25	0.00	0.00	0.00%	89.25	0.00	0.00	0.00%
MEP	89.25	0.00	0.00	0.00%	89.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	89.25	0.00	0.00	0.00%	89.25	0.00	0.00	0.00%
Floor: 22	**85.75**	**0.00**	**0.00**	**0.00%**	**85.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	85.75	0.00	0.00	0.00%	85.75	0.00	0.00	0.00%
FINISHES	85.75	0.00	0.00	0.00%	85.75	0.00	0.00	0.00%
MEP	85.75	0.00	0.00	0.00%	85.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	85.75	0.00	0.00	0.00%	85.75	0.00	0.00	0.00%
Floor: 21	**82.25**	**0.00**	**0.00**	**0.00%**	**82.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	82.25	0.00	0.00	0.00%	82.25	0.00	0.00	0.00%

Totals:- **Planned Value=67388.5, PV * Height=693831.875, Perc. Accom.=7.49, PH=10.30**
Actual Value=37408, AV * Height=220941, Perc. Accom.=4.16, EH=5.91

MARINA PROJECT

Floors: 53

Start Date: **12-May-2008** Finish Date: **12-Apr-2011**

Progress Report for the Month September 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
FINISHES	82.25	0.00	0.00	0.00%	82.25	0.00	0.00	0.00%
MEP	82.25	0.00	0.00	0.00%	82.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	82.25	0.00	0.00	0.00%	82.25	0.00	0.00	0.00%
Floor: 20	**78.75**	**0.00**	**0.00**	**0.00%**	**78.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	78.75	0.00	0.00	0.00%	78.75	0.00	0.00	0.00%
FINISHES	78.75	0.00	0.00	0.00%	78.75	0.00	0.00	0.00%
MEP	78.75	0.00	0.00	0.00%	78.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	78.75	0.00	0.00	0.00%	78.75	0.00	0.00	0.00%
Floor: 19	**75.25**	**0.00**	**0.00**	**0.00%**	**75.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	75.25	0.00	0.00	0.00%	75.25	0.00	0.00	0.00%
FINISHES	75.25	0.00	0.00	0.00%	75.25	0.00	0.00	0.00%
MEP	75.25	0.00	0.00	0.00%	75.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	75.25	0.00	0.00	0.00%	75.25	0.00	0.00	0.00%
Floor: 18	**71.75**	**0.00**	**0.00**	**0.00%**	**71.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	71.75	0.00	0.00	0.00%	71.75	0.00	0.00	0.00%
FINISHES	71.75	0.00	0.00	0.00%	71.75	0.00	0.00	0.00%
MEP	71.75	0.00	0.00	0.00%	71.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	71.75	0.00	0.00	0.00%	71.75	0.00	0.00	0.00%
Floor: 17	**68.25**	**0.00**	**0.00**	**0.00%**	**68.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	68.25	0.00	0.00	0.00%	68.25	0.00	0.00	0.00%
FINISHES	68.25	0.00	0.00	0.00%	68.25	0.00	0.00	0.00%
MEP	68.25	0.00	0.00	0.00%	68.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	68.25	0.00	0.00	0.00%	68.25	0.00	0.00	0.00%
Floor: 16	**64.75**	**0.00**	**0.00**	**0.00%**	**64.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	64.75	0.00	0.00	0.00%	64.75	0.00	0.00	0.00%
FINISHES	64.75	0.00	0.00	0.00%	64.75	0.00	0.00	0.00%
MEP	64.75	0.00	0.00	0.00%	64.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	64.75	0.00	0.00	0.00%	64.75	0.00	0.00	0.00%
Floor: 15	**61.25**	**0.00**	**0.00**	**0.00%**	**61.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	61.25	0.00	0.00	0.00%	61.25	0.00	0.00	0.00%
FINISHES	61.25	0.00	0.00	0.00%	61.25	0.00	0.00	0.00%
MEP	61.25	0.00	0.00	0.00%	61.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	61.25	0.00	0.00	0.00%	61.25	0.00	0.00	0.00%
Floor: 14	**57.75**	**0.00**	**0.00**	**0.00%**	**57.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	57.75	0.00	0.00	0.00%	57.75	0.00	0.00	0.00%
FINISHES	57.75	0.00	0.00	0.00%	57.75	0.00	0.00	0.00%
MEP	57.75	0.00	0.00	0.00%	57.75	0.00	0.00	0.00%

Totals:- **Planned Value=673881.5, PV * Height=6703811.875, Perc. Accom.=7.49, PH=10.30**
Actual Value=374088, AV * Height=2220941, Perc. Accom.=4.16, EH=5.98

MARINA PROJECT

Floors: 53

Start Date: **12-May-2008** Finish Date: **12-Apr-2011**

Progress Report for the Month September 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
ALUMINUM & GLAZI	57.75	0.00	0.00	0.00%	57.75	0.00	0.00	0.00%
Floor: 13	**54.25**	**0.00**	**0.00**	**0.00%**	**54.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	54.25	0.00	0.00	0.00%	54.25	0.00	0.00	0.00%
FINISHES	54.25	0.00	0.00	0.00%	54.25	0.00	0.00	0.00%
MEP	54.25	0.00	0.00	0.00%	54.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	54.25	0.00	0.00	0.00%	54.25	0.00	0.00	0.00%
Floor: 12	**50.75**	**0.00**	**0.00**	**0.00%**	**50.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	50.75	0.00	0.00	0.00%	50.75	0.00	0.00	0.00%
FINISHES	50.75	0.00	0.00	0.00%	50.75	0.00	0.00	0.00%
MEP	50.75	0.00	0.00	0.00%	50.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	50.75	0.00	0.00	0.00%	50.75	0.00	0.00	0.00%
Floor: 11	**47.25**	**0.00**	**0.00**	**0.00%**	**47.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	47.25	0.00	0.00	0.00%	47.25	0.00	0.00	0.00%
FINISHES	47.25	0.00	0.00	0.00%	47.25	0.00	0.00	0.00%
MEP	47.25	0.00	0.00	0.00%	47.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	47.25	0.00	0.00	0.00%	47.25	0.00	0.00	0.00%
Floor: 10	**43.75**	**0.00**	**0.00**	**0.00%**	**43.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	43.75	0.00	0.00	0.00%	43.75	0.00	0.00	0.00%
FINISHES	43.75	0.00	0.00	0.00%	43.75	0.00	0.00	0.00%
MEP	43.75	0.00	0.00	0.00%	43.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	43.75	0.00	0.00	0.00%	43.75	0.00	0.00	0.00%
Floor: 9	**40.25**	**0.00**	**0.00**	**0.00%**	**40.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	40.25	0.00	0.00	0.00%	40.25	0.00	0.00	0.00%
FINISHES	40.25	0.00	0.00	0.00%	40.25	0.00	0.00	0.00%
MEP	40.25	0.00	0.00	0.00%	40.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	40.25	0.00	0.00	0.00%	40.25	0.00	0.00	0.00%
Floor: 8	**36.75**	**0.00**	**0.00**	**0.00%**	**36.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	36.75	0.00	0.00	0.00%	36.75	0.00	0.00	0.00%
FINISHES	36.75	0.00	0.00	0.00%	36.75	0.00	0.00	0.00%
MEP	36.75	0.00	0.00	0.00%	36.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	36.75	0.00	0.00	0.00%	36.75	0.00	0.00	0.00%
Floor: 7	**33.25**	**0.00**	**0.00**	**0.00%**	**33.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	33.25	0.00	0.00	0.00%	33.25	0.00	0.00	0.00%
FINISHES	33.25	0.00	0.00	0.00%	33.25	0.00	0.00	0.00%
MEP	33.25	0.00	0.00	0.00%	33.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	33.25	0.00	0.00	0.00%	33.25	0.00	0.00	0.00%

Totals:- **Planned Value=67388.5, PV * Height=693831.875, Perc. Accom.=7.49, PH=10.30**
Actual Value=37408, AV * Height=220941, Perc. Accom.=4.16, EH=5.58

MARINA PROJECT

Floors: 53

Start Date: **12-May-2008** Finish Date: **12-Apr-2011**

Progress Report for the Month September 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
Floor: 6	**29.75**	**0.00**	**0.00**	**0.00%**	**29.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	29.75	0.00	0.00	0.00%	29.75	0.00	0.00	0.00%
FINISHES	29.75	0.00	0.00	0.00%	29.75	0.00	0.00	0.00%
MEP	29.75	0.00	0.00	0.00%	29.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	29.75	0.00	0.00	0.00%	29.75	0.00	0.00	0.00%
Floor: 5	**26.25**	**0.00**	**0.00**	**0.00%**	**26.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	26.25	0.00	0.00	0.00%	26.25	0.00	0.00	0.00%
FINISHES	26.25	0.00	0.00	0.00%	26.25	0.00	0.00	0.00%
MEP	26.25	0.00	0.00	0.00%	26.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	26.25	0.00	0.00	0.00%	26.25	0.00	0.00	0.00%
Floor: 4	**22.75**	**2,979.50**	**67,703.63**	**14.70%**	**22.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	22.75	2,979.50	67,703.63	50.00%	22.75	0.00	0.00	0.00%
FINISHES	22.75	0.00	0.00	0.00%	22.75	0.00	0.00	0.00%
MEP	22.75	0.00	0.00	0.00%	22.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	22.75	0.00	0.00	0.00%	22.75	0.00	0.00	0.00%
Floor: 3	**19.25**	**5,959.00**	**14,710.75**	**29.40%**	**19.25**	**0.00**	**0.00**	**0.00%**
CONCRETE	19.25	5,959.00	114,710.75	100.00%	19.25	0.00	0.00	0.00%
FINISHES	19.25	0.00	0.00	0.00%	19.25	0.00	0.00	0.00%
MEP	19.25	0.00	0.00	0.00%	19.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	19.25	0.00	0.00	0.00%	19.25	0.00	0.00	0.00%
Floor: 2	**15.75**	**11,690.00**	**84,117.50**	**35.73%**	**15.75**	**0.00**	**0.00**	**0.00%**
CONCRETE	15.75	11,690.00	184,117.50	100.00%	15.75	0.00	0.00	0.00%
FINISHES	15.75	0.00	0.00	0.00%	15.75	0.00	0.00	0.00%
MEP	15.75	0.00	0.00	0.00%	15.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	15.75	0.00	0.00	0.00%	15.75	0.00	0.00	0.00%
Floor: 1	**12.25**	**11,690.00**	**43,202.50**	**38.95%**	**12.25**	**4,676.00**	**57,281.00**	**15.58%**
CONCRETE	12.25	11,690.00	143,202.50	100.00%	12.25	4,676.00	57,281.00	40.00%
FINISHES	12.25	0.00	0.00	0.00%	12.25	0.00	0.00	0.00%
MEP	12.25	0.00	0.00	0.00%	12.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	12.25	0.00	0.00	0.00%	12.25	0.00	0.00	0.00%
Floor: GF	**8.75**	**11,690.00**	**02,287.50**	**36.33%**	**8.75**	**9,352.00**	**81,830.00**	**29.07%**
CONCRETE	8.75	11,690.00	102,287.50	100.00%	8.75	9,352.00	81,830.00	80.00%
FINISHES	8.75	0.00	0.00	0.00%	8.75	0.00	0.00	0.00%
MEP	8.75	0.00	0.00	0.00%	8.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	8.75	0.00	0.00	0.00%	8.75	0.00	0.00	0.00%
Floor: B1	**5.25**	**11,690.00**	**61,372.50**	**36.09%**	**5.25**	**11,690.00**	**61,372.50**	**36.09%**
CONCRETE	5.25	11,690.00	61,372.50	100.00%	5.25	11,690.00	61,372.50	100.00%

Totals:- **Planned Value=67308.5, PV * Height=693031.875, Perc. Accom.=7.49, PH=10.30**
Actual Value=37408, AV * Height=220941, Perc. Accom.=4.16, EH=5.91

MARINA PROJECT

Floors: 53

Start Date: **12-May-2008** Finish Date: **12-Apr-2011**

Progress Report for the Month September 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
FINISHES	5.25	0.00	0.00	0.00%	5.25	0.00	0.00	0.00%
MEP	5.25	0.00	0.00	0.00%	5.25	0.00	0.00	0.00%
ALUMINUM & GLAZI	5.25	0.00	0.00	0.00%	5.25	0.00	0.00	0.00%
Floor: B2	**1.75**	**11,690.00**	**20,457.50**	**36.09%**	**1.75**	**11,690.00**	**20,457.50**	**36.09%**
CONCRETE	1.75	11,690.00	20,457.50	100.00%	1.75	11,690.00	20,457.50	100.00%
FINISHES	1.75	0.00	0.00	0.00%	1.75	0.00	0.00	0.00%
MEP	1.75	0.00	0.00	0.00%	1.75	0.00	0.00	0.00%
ALUMINUM & GLAZI	1.75	0.00	0.00	0.00%	1.75	0.00	0.00	0.00%
Total:		**67,308.50**	**93,931.38**	**7.49%**		**37,408.00**		**4.16%**

Totals:- **Planned Value=67308.5, PV * Height=693031.875, Perc. Accom.=7.49, PH=10.33**
Actual Value=37408, AV * Height=220941, Perc. Accom.=4.16, EH=5.58

Appendix I *– EHM Progress Report, Sept 2008 – Fujeirah Project*

FUJEIRA PROJECT

Floors: 10

Start Date: **7-Feb-2008** Finish Date: **7-Jan-2011**

<u>Progress Report for the Month September 2008</u>

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
Floor: URF	**31.40**	**0.00**	**0.00**	**0.00%**	**31.40**	**0.00**	**0.00**	**0.00%**
CONCRETE	31.40	0.00	0.00	0.00%	31.40	0.00	0.00	0.00%
FINISHES	31.40	0.00	0.00	0.00%	31.40	0.00	0.00	0.00%
MEP	31.40	0.00	0.00	0.00%	31.40	0.00	0.00	0.00%
EXTERNAL WORKS	31.40	0.00	0.00	0.00%	31.40	0.00	0.00	0.00%
Floor: RF	**28.50**	**0.00**	**0.00**	**0.00%**	**28.50**	**0.00**	**0.00**	**0.00%**
CONCRETE	28.50	0.00	0.00	0.00%	28.50	0.00	0.00	0.00%
FINISHES	28.50	0.00	0.00	0.00%	28.50	0.00	0.00	0.00%
MEP	28.50	0.00	0.00	0.00%	28.50	0.00	0.00	0.00%
EXTERNAL WORKS	28.50	0.00	0.00	0.00%	28.50	0.00	0.00	0.00%
Floor: 6	**25.30**	**0.00**	**0.00**	**0.00%**	**25.30**	**0.00**	**0.00**	**0.00%**
CONCRETE	25.30	0.00	0.00	0.00%	25.30	0.00	0.00	0.00%
FINISHES	25.30	0.00	0.00	0.00%	25.30	0.00	0.00	0.00%
MEP	25.30	0.00	0.00	0.00%	25.30	0.00	0.00	0.00%
EXTERNAL WORKS	25.30	0.00	0.00	0.00%	25.30	0.00	0.00	0.00%
Floor: 5	**22.10**	**0.00**	**0.00**	**0.00%**	**22.10**	**0.00**	**0.00**	**0.00%**
CONCRETE	22.10	0.00	0.00	0.00%	22.10	0.00	0.00	0.00%
FINISHES	22.10	0.00	0.00	0.00%	22.10	0.00	0.00	0.00%
MEP	22.10	0.00	0.00	0.00%	22.10	0.00	0.00	0.00%
EXTERNAL WORKS	22.10	0.00	0.00	0.00%	22.10	0.00	0.00	0.00%
Floor: 4	**18.90**	**0.00**	**0.00**	**0.00%**	**18.90**	**0.00**	**0.00**	**0.00%**
CONCRETE	18.90	0.00	0.00	0.00%	18.90	0.00	0.00	0.00%
FINISHES	18.90	0.00	0.00	0.00%	18.90	0.00	0.00	0.00%
MEP	18.90	0.00	0.00	0.00%	18.90	0.00	0.00	0.00%
EXTERNAL WORKS	18.90	0.00	0.00	0.00%	18.90	0.00	0.00	0.00%
Floor: 3	**15.70**	**0.00**	**0.00**	**0.00%**	**15.70**	**0.00**	**0.00**	**0.00%**
CONCRETE	15.70	0.00	0.00	0.00%	15.70	0.00	0.00	0.00%
FINISHES	15.70	0.00	0.00	0.00%	15.70	0.00	0.00	0.00%
MEP	15.70	0.00	0.00	0.00%	15.70	0.00	0.00	0.00%
EXTERNAL WORKS	15.70	0.00	0.00	0.00%	15.70	0.00	0.00	0.00%
Floor: 2	**12.50**	**0.00**	**0.00**	**0.00%**	**12.50**	**0.00**	**0.00**	**0.00%**
CONCRETE	12.50	0.00	0.00	0.00%	12.50	0.00	0.00	0.00%
FINISHES	12.50	0.00	0.00	0.00%	12.50	0.00	0.00	0.00%
MEP	12.50	0.00	0.00	0.00%	12.50	0.00	0.00	0.00%
EXTERNAL WORKS	12.50	0.00	0.00	0.00%	12.50	0.00	0.00	0.00%
Floor: 1	**9.30**	**29,865.00**	**77,744.50**	**23.68%**	**9.30**	**15,928.00**	**48,130.40**	**12.63%**
CONCRETE	9.30	29,865.00	277,744.50	75.00%	9.30	15,928.00	148,130.40	40.00%

Totals:- **Planned Value=524800, PV * Height=2389113.85, Perc. Accom.=12.78, PH=7.60**
Actual Value=305413, AV * Height=2692299.75, Perc. Accom.=9.02, EH=6.99

FUJEIRA PROJECT

Floors: 10

Start Date: **7-Feb-2008**   Finish Date: **7-Jan-2011**

Progress Report for the Month September 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
FINISHES	9.30	0.00	0.00	0.00%	9.30	0.00	0.00	0.00%
MEP	9.30	0.00	0.00	0.00%	9.30	0.00	0.00	0.00%
EXTERNAL WORKS	9.30	0.00	0.00	0.00%	9.30	0.00	0.00	0.00%
Floor: GF	**6.10**	**18,256.00**	**11,361.60**	**31.58%**	**6.10**	**18,256.00**	**11,361.60**	**31.58%**
CONCRETE	6.10	18,256.00	111,361.60	100.00%	6.10	18,256.00	111,361.60	100.00%
FINISHES	6.10	0.00	0.00	0.00%	6.10	0.00	0.00	0.00%
MEP	6.10	0.00	0.00	0.00%	6.10	0.00	0.00	0.00%
EXTERNAL WORKS	6.10	0.00	0.00	0.00%	6.10	0.00	0.00	0.00%
Floor: B1	**2.25**	**4,359.00**	**9,807.75**	**35.30%**	**2.25**	**4,359.00**	**9,807.75**	**35.30%**
CONCRETE	2.25	4,359.00	9,807.75	100.00%	2.25	4,359.00	9,807.75	100.00%
FINISHES	2.25	0.00	0.00	0.00%	2.25	0.00	0.00	0.00%
MEP	2.25	0.00	0.00	0.00%	2.25	0.00	0.00	0.00%
EXTERNAL WORKS	2.25	0.00	0.00	0.00%	2.25	0.00	0.00	0.00%
Total:		**52,480.00**	**98,913.85**	**12.28%**		**38,543.00**		**9.02%**

Totals:- **Planned Value=52480, PV * Height=398913.85, Perc. Accom.=12.28, PH=7.60**
Actual Value=38543, AV * Height=269299.75, Perc. Accom.=9.02, EH=6.99

Appendix J *– EHM Progress Report, Sept 2008 – Barsha Project*

BARSHA PROJECT

Floors: 28

Start Date: **1-Mar-2008** Finish Date: **30-Oct-2009**

<u>Progress Report for the Month September 2008</u>

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
Floor: RF3	**98.30**	**0.00**	**0.00**	**0.00%**	**98.30**	**0.00**	**0.00**	**0.00%**
CONCRETE	98.30	0.00	0.00	0.00%	98.30	0.00	0.00	0.00%
FINISHES	98.30	0.00	0.00	0.00%	98.30	0.00	0.00	0.00%
DOORS & WINDOWS	98.30	0.00	0.00	0.00%	98.30	0.00	0.00	0.00%
GLAZING	98.30	0.00	0.00	0.00%	98.30	0.00	0.00	0.00%
MEP	98.30	0.00	0.00	0.00%	98.30	0.00	0.00	0.00%
Floor: RF2	**94.35**	**0.00**	**0.00**	**0.00%**	**94.35**	**0.00**	**0.00**	**0.00%**
CONCRETE	94.35	0.00	0.00	0.00%	94.35	0.00	0.00	0.00%
FINISHES	94.35	0.00	0.00	0.00%	94.35	0.00	0.00	0.00%
DOORS & WINDOWS	94.35	0.00	0.00	0.00%	94.35	0.00	0.00	0.00%
GLAZING	94.35	0.00	0.00	0.00%	94.35	0.00	0.00	0.00%
MEP	94.35	0.00	0.00	0.00%	94.35	0.00	0.00	0.00%
Floor: RF	**90.60**	**0.00**	**0.00**	**0.00%**	**90.60**	**0.00**	**0.00**	**0.00%**
CONCRETE	90.60	0.00	0.00	0.00%	90.60	0.00	0.00	0.00%
FINISHES	90.60	0.00	0.00	0.00%	90.60	0.00	0.00	0.00%
DOORS & WINDOWS	90.60	0.00	0.00	0.00%	90.60	0.00	0.00	0.00%
GLAZING	90.60	0.00	0.00	0.00%	90.60	0.00	0.00	0.00%
MEP	90.60	0.00	0.00	0.00%	90.60	0.00	0.00	0.00%
Floor: 20F	**86.85**	**0.00**	**0.00**	**0.00%**	**86.85**	**0.00**	**0.00**	**0.00%**
CONCRETE	86.85	0.00	0.00	0.00%	86.85	0.00	0.00	0.00%
FINISHES	86.85	0.00	0.00	0.00%	86.85	0.00	0.00	0.00%
DOORS & WINDOWS	86.85	0.00	0.00	0.00%	86.85	0.00	0.00	0.00%
GLAZING	86.85	0.00	0.00	0.00%	86.85	0.00	0.00	0.00%
MEP	86.85	0.00	0.00	0.00%	86.85	0.00	0.00	0.00%
Floor: 19F	**83.35**	**0.00**	**0.00**	**0.00%**	**83.35**	**0.00**	**0.00**	**0.00%**
CONCRETE	83.35	0.00	0.00	0.00%	83.35	0.00	0.00	0.00%
FINISHES	83.35	0.00	0.00	0.00%	83.35	0.00	0.00	0.00%
DOORS & WINDOWS	83.35	0.00	0.00	0.00%	83.35	0.00	0.00	0.00%
GLAZING	83.35	0.00	0.00	0.00%	83.35	0.00	0.00	0.00%
MEP	83.35	0.00	0.00	0.00%	83.35	0.00	0.00	0.00%
Floor: 18F	**79.85**	**0.00**	**0.00**	**0.00%**	**79.85**	**0.00**	**0.00**	**0.00%**
CONCRETE	79.85	0.00	0.00	0.00%	79.85	0.00	0.00	0.00%
FINISHES	79.85	0.00	0.00	0.00%	79.85	0.00	0.00	0.00%
DOORS & WINDOWS	79.85	0.00	0.00	0.00%	79.85	0.00	0.00	0.00%
GLAZING	79.85	0.00	0.00	0.00%	79.85	0.00	0.00	0.00%
MEP	79.85	0.00	0.00	0.00%	79.85	0.00	0.00	0.00%
Floor: 17F	**76.35**	**0.00**	**0.00**	**0.00%**	**76.35**	**0.00**	**0.00**	**0.00%**
CONCRETE	76.35	0.00	0.00	0.00%	76.35	0.00	0.00	0.00%

Totals:- **Planned Value=206078?7.4563, PV * Height=2471584?6.97357, Perc. Accom.=25.72, PH=11.59**
Actual Value=15962181.4256, AV * Height=1902509?8.293725, Perc. Accom.=19.92, EH=11.92

BARSHA PROJECT

Floors: 23

Start Date: **1-Mar-2008** Finish Date: **30-Oct-2009**

Progress Report for the Month September 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
FINISHES	76.35	0.00	0.00	0.00%	76.35	0.00	0.00	0.00%
DOORS & WINDOWS	76.35	0.00	0.00	0.00%	76.35	0.00	0.00	0.00%
GLAZING	76.35	0.00	0.00	0.00%	76.35	0.00	0.00	0.00%
MEP	76.35	0.00	0.00	0.00%	76.35	0.00	0.00	0.00%
Floor: 16F	**72.85**	**0.00**	**0.00**	**0.00%**	**72.85**	**0.00**	**0.00**	**0.00%**
CONCRETE	72.85	0.00	0.00	0.00%	72.85	0.00	0.00	0.00%
FINISHES	72.85	0.00	0.00	0.00%	72.85	0.00	0.00	0.00%
DOORS & WINDOWS	72.85	0.00	0.00	0.00%	72.85	0.00	0.00	0.00%
GLAZING	72.85	0.00	0.00	0.00%	72.85	0.00	0.00	0.00%
MEP	72.85	0.00	0.00	0.00%	72.85	0.00	0.00	0.00%
Floor: 15F	**69.35**	**0.00**	**0.00**	**0.00%**	**69.35**	**0.00**	**0.00**	**0.00%**
CONCRETE	69.35	0.00	0.00	0.00%	69.35	0.00	0.00	0.00%
FINISHES	69.35	0.00	0.00	0.00%	69.35	0.00	0.00	0.00%
DOORS & WINDOWS	69.35	0.00	0.00	0.00%	69.35	0.00	0.00	0.00%
GLAZING	69.35	0.00	0.00	0.00%	69.35	0.00	0.00	0.00%
MEP	69.35	0.00	0.00	0.00%	69.35	0.00	0.00	0.00%
Floor: 14F	**65.85**	**0.00**	**0.00**	**0.00%**	**65.85**	**0.00**	**0.00**	**0.00%**
CONCRETE	65.85	0.00	0.00	0.00%	65.85	0.00	0.00	0.00%
FINISHES	65.85	0.00	0.00	0.00%	65.85	0.00	0.00	0.00%
DOORS & WINDOWS	65.85	0.00	0.00	0.00%	65.85	0.00	0.00	0.00%
GLAZING	65.85	0.00	0.00	0.00%	65.85	0.00	0.00	0.00%
MEP	65.85	0.00	0.00	0.00%	65.85	0.00	0.00	0.00%
Floor: 13F	**62.35**	**0.00**	**0.00**	**0.00%**	**62.35**	**0.00**	**0.00**	**0.00%**
CONCRETE	62.35	0.00	0.00	0.00%	62.35	0.00	0.00	0.00%
FINISHES	62.35	0.00	0.00	0.00%	62.35	0.00	0.00	0.00%
DOORS & WINDOWS	62.35	0.00	0.00	0.00%	62.35	0.00	0.00	0.00%
GLAZING	62.35	0.00	0.00	0.00%	62.35	0.00	0.00	0.00%
MEP	62.35	0.00	0.00	0.00%	62.35	0.00	0.00	0.00%
Floor: 12F	**58.85**	**0.00**	**0.00**	**0.00%**	**58.85**	**0.00**	**0.00**	**0.00%**
CONCRETE	58.85	0.00	0.00	0.00%	58.85	0.00	0.00	0.00%
FINISHES	58.85	0.00	0.00	0.00%	58.85	0.00	0.00	0.00%
DOORS & WINDOWS	58.85	0.00	0.00	0.00%	58.85	0.00	0.00	0.00%
GLAZING	58.85	0.00	0.00	0.00%	58.85	0.00	0.00	0.00%
MEP	58.85	0.00	0.00	0.00%	58.85	0.00	0.00	0.00%
Floor: 11F	**55.35**	**0.00**	**0.00**	**0.00%**	**55.35**	**0.00**	**0.00**	**0.00%**
CONCRETE	55.35	0.00	0.00	0.00%	55.35	0.00	0.00	0.00%
FINISHES	55.35	0.00	0.00	0.00%	55.35	0.00	0.00	0.00%
DOORS & WINDOWS	55.35	0.00	0.00	0.00%	55.35	0.00	0.00	0.00%

Totals:- **Planned Value=20607897.4563, PV * Height=247158476.97357, Perc. Accom.=25.72, PH=11.99**
Actual Value=15962181.4256, AV * Height=190253918.293725, Perc. Accom.=19.92, EH=11.92

BARSHA PROJECT

Floors: 23

Start Date: **1-Mar-2008** Finish Date: **30-Oct-2009**

Progress Report for the Month September 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
GLAZING	55.35	0.00	0.00	0.00%	55.35	0.00	0.00	0.00%
MEP	55.35	0.00	0.00	0.00%	55.35	0.00	0.00	0.00%
Floor: 10F	**51.85**	**0.00**	**0.00**	**0.00%**	**51.85**	**0.00**	**0.00**	**0.00%**
CONCRETE	51.85	0.00	0.00	0.00%	51.85	0.00	0.00	0.00%
FINISHES	51.85	0.00	0.00	0.00%	51.85	0.00	0.00	0.00%
DOORS & WINDOWS	51.85	0.00	0.00	0.00%	51.85	0.00	0.00	0.00%
GLAZING	51.85	0.00	0.00	0.00%	51.85	0.00	0.00	0.00%
MEP	51.85	0.00	0.00	0.00%	51.85	0.00	0.00	0.00%
Floor: 9F	**48.35**	**0.00**	**0.00**	**0.00%**	**48.35**	**0.00**	**0.00**	**0.00%**
CONCRETE	48.35	0.00	0.00	0.00%	48.35	0.00	0.00	0.00%
FINISHES	48.35	0.00	0.00	0.00%	48.35	0.00	0.00	0.00%
DOORS & WINDOWS	48.35	0.00	0.00	0.00%	48.35	0.00	0.00	0.00%
GLAZING	48.35	0.00	0.00	0.00%	48.35	0.00	0.00	0.00%
MEP	48.35	0.00	0.00	0.00%	48.35	0.00	0.00	0.00%
Floor: 8F	**44.85**	**0.00**	**0.00**	**0.00%**	**44.85**	**0.00**	**0.00**	**0.00%**
CONCRETE	44.85	0.00	0.00	0.00%	44.85	0.00	0.00	0.00%
FINISHES	44.85	0.00	0.00	0.00%	44.85	0.00	0.00	0.00%
DOORS & WINDOWS	44.85	0.00	0.00	0.00%	44.85	0.00	0.00	0.00%
GLAZING	44.85	0.00	0.00	0.00%	44.85	0.00	0.00	0.00%
MEP	44.85	0.00	0.00	0.00%	44.85	0.00	0.00	0.00%
Floor: 7F	**41.35**	**0.00**	**0.00**	**0.00%**	**41.35**	**0.00**	**0.00**	**0.00%**
CONCRETE	41.35	0.00	0.00	0.00%	41.35	0.00	0.00	0.00%
FINISHES	41.35	0.00	0.00	0.00%	41.35	0.00	0.00	0.00%
DOORS & WINDOWS	41.35	0.00	0.00	0.00%	41.35	0.00	0.00	0.00%
GLAZING	41.35	0.00	0.00	0.00%	41.35	0.00	0.00	0.00%
MEP	41.35	0.00	0.00	0.00%	41.35	0.00	0.00	0.00%
Floor: 6F	**37.85**	**44,762.11**	**49,245.97**	**12.64%**	**37.85**	**86,829.13**	**11,482.49**	**21.52%**
CONCRETE	37.85	344,762.11	049,245.97	47.00%	37.85	586,829.13	211,482.49	80.00%
FINISHES	37.85	0.00	0.00	0.00%	37.85	0.00	0.00	0.00%
DOORS & WINDOWS	37.85	0.00	0.00	0.00%	37.85	0.00	0.00	0.00%
GLAZING	37.85	0.00	0.00	0.00%	37.85	0.00	0.00	0.00%
MEP	37.85	0.00	0.00	0.00%	37.85	0.00	0.00	0.00%
Floor: 5F	**34.35**	**36,339.43**	**93,259.42**	**26.97%**	**34.35**	**25,888.52**	**99,270.51**	**22.93%**
CONCRETE	34.35	736,339.43	293,259.42	100.00%	34.35	625,888.52	499,270.51	85.00%
FINISHES	34.35	0.00	0.00	0.00%	34.35	0.00	0.00	0.00%
DOORS & WINDOWS	34.35	0.00	0.00	0.00%	34.35	0.00	0.00	0.00%
GLAZING	34.35	0.00	0.00	0.00%	34.35	0.00	0.00	0.00%
MEP	34.35	0.00	0.00	0.00%	34.35	0.00	0.00	0.00%

Totals:- **Planned Value=20607897.4563, PV * Height=247150476.97357, Perc. Accom.=25.72, PH=11.99**
Actual Value=15962181.4256, AV * Height=190257918.293725, Perc. Accom.=19.92, EH=11.92

BARSHA PROJECT

Floors: 23

Start Date: **1-Mar-2008** Finish Date: **30-Oct-2009**

Progress Report for the Month September 2008

Floor / Work	Planned Progress				Actual Progress			
	Height	Planned Value	Height Value	% Accomplished	Height	Earned Value	Height Value	% Accomplished
Floor: 4F	**30.85**	**98,031.52**	**34,272.39**	**25.93%**	**30.85**	**28,228.37**	**30,845.15**	**23.34%**
CONCRETE	30.85	698,031.52	534,272.39	100.00%	30.85	628,228.37	380,845.15	90.00%
FINISHES	30.85	0.00	0.00	0.00%	30.85	0.00	0.00	0.00%
DOORS & WINDOWS	30.85	0.00	0.00	0.00%	30.85	0.00	0.00	0.00%
GLAZING	30.85	0.00	0.00	0.00%	30.85	0.00	0.00	0.00%
MEP	30.85	0.00	0.00	0.00%	30.85	0.00	0.00	0.00%
Floor: 3F	**27.35**	**82,611.81**	**04,432.98**	**28.41%**	**27.35**	**60,777.05**	**07,252.32**	**27.62%**
CONCRETE	27.35	760,777.05	807,252.32	100.00%	27.35	760,777.05	807,252.32	100.00%
FINISHES	27.35	21,834.76	397,180.66	5.00%	27.35	0.00	0.00	0.00%
DOORS & WINDOWS	27.35	0.00	0.00	0.00%	27.35	0.00	0.00	0.00%
GLAZING	27.35	0.00	0.00	0.00%	27.35	0.00	0.00	0.00%
MEP	27.35	0.00	0.00	0.00%	27.35	0.00	0.00	0.00%
Floor: 2F	**23.85**	**64,561.82**	**89,799.48**	**38.61%**	**23.85**	**63,734.98**	**15,079.27**	**27.70%**
CONCRETE	23.85	763,734.98	215,079.27	100.00%	23.85	763,734.98	215,079.27	100.00%
FINISHES	23.85	104,806.84	499,643.21	24.00%	23.85	0.00	0.00	0.00%
DOORS & WINDOWS	23.85	0.00	0.00	0.00%	23.85	0.00	0.00	0.00%
GLAZING	23.85	0.00	0.00	0.00%	23.85	0.00	0.00	0.00%
MEP	23.85	196,020.00	675,077.00	18.00%	23.85	0.00	0.00	0.00%
Floor: 1F	**20.35**	**65,973.92**	**32,569.33**	**51.33%**	**20.35**	**62,164.14**	**45,040.25**	**30.19%**
CONCRETE	20.35	862,164.14	545,040.25	100.00%	20.35	862,164.14	545,040.25	100.00%
FINISHES	20.35	200,879.78	087,903.58	46.00%	20.35	0.00	0.00	0.00%
DOORS & WINDOWS	20.35	0.00	0.00	0.00%	20.35	0.00	0.00	0.00%
GLAZING	20.35	0.00	0.00	0.00%	20.35	0.00	0.00	0.00%
MEP	20.35	402,930.00	199,625.50	37.00%	20.35	0.00	0.00	0.00%
Floor: GF	**15.70**	**54,272.55**	**92,079.11**	**60.61%**	**15.70**	**15,747.48**	**07,235.44**	**32.69%**
CONCRETE	15.70	215,747.48	087,235.44	100.00%	15.70	215,747.48	087,235.44	100.00%
FINISHES	15.70	149,175.07	342,048.68	59.00%	15.70	0.00	0.00	0.00%
DOORS & WINDOWS	15.70	0.00	0.00	0.00%	15.70	0.00	0.00	0.00%
GLAZING	15.70	0.00	0.00	0.00%	15.70	0.00	0.00	0.00%
MEP	15.70	889,350.00	962,795.00	49.00%	15.70	0.00	0.00	0.00%
Floor: B1	**11.35**	**99,549.16**	**74,832.97**	**81.60%**	**11.35**	**55,809.76**	**58,440.79**	**45.35%**
CONCRETE	11.35	450,649.34	464,870.01	100.00%	11.35	450,649.34	464,870.01	100.00%
FINISHES	11.35	96,549.82	095,840.46	67.00%	11.35	14,410.42	163,558.28	10.00%
DOORS & WINDOWS	11.35	0.00	0.00	0.00%	11.35	0.00	0.00	0.00%
GLAZING	11.35	0.00	0.00	0.00%	11.35	0.00	0.00	0.00%
MEP	11.35	252,350.00	214,172.50	69.00%	11.35	90,750.00	030,012.50	5.00%
Floor: B2	**8.25**	**47,670.57**	**43,232.24**	**79.15%**	**8.25**	**57,529.11**	**24,615.16**	**55.53%**
CONCRETE	8.25	376,484.87	356,000.18	100.00%	8.25	376,484.87	356,000.18	100.00%

Totals:- **Planned Value=20607897.4563, PV * Height=247158476.97357, Perc. Accom.=25.72, PH=11.99**
Actual Value=15962181.4236, AV * Height=190250918.293725, Perc. Accom.=19.92, EH=11.92

BARSHA PROJECT

Floors: 23

Start Date: **1-Mar-2008** Finish Date: **30-Oct-2009**

Progress Report for the Month September 2008

	Planned Progress				Actual Progress			
Floor / Work	**Height**	**Planned Value**	**Height Value**	**% Accomplished**	**Height**	**Earned Value**	**Height Value**	**% Accomplished**
FINISHES	8.25	91,435.70	754,344.56	67.00%	8.25	27,294.24	225,177.48	20.00%
DOORS & WINDOWS	8.25	0.00	0.00	0.00%	8.25	0.00	0.00	0.00%
GLAZING	8.25	0.00	0.00	0.00%	8.25	0.00	0.00	0.00%
MEP	8.25	179,750.00	732,937.50	65.00%	8.25	453,750.00	743,437.50	25.00%
Floor: B3	**4.95**	**51,948.51**	**27,145.12**	**78.51%**	**4.95**	**50,795.95**	**00,939.97**	**61.01%**
CONCRETE	4.95	498,178.98	415,985.95	100.00%	4.95	498,178.98	415,985.95	100.00%
FINISHES	4.95	28,469.53	140,924.17	55.00%	4.95	18,116.97	89,679.02	35.00%
DOORS & WINDOWS	4.95	0.00	0.00	0.00%	4.95	0.00	0.00	0.00%
GLAZING	4.95	0.00	0.00	0.00%	4.95	0.00	0.00	0.00%
MEP	4.95	125,300.00	570,235.00	62.00%	4.95	544,500.00	695,275.00	30.00%
Floor: B4	**1.65**	**62,126.04**	**17,507.97**	**86.74%**	**1.65**	**44,676.94**	**23,716.95**	**84.77%**
CONCRETE	1.65	931,216.14	486,506.63	100.00%	1.65	931,216.14	486,506.63	100.00%
FINISHES	1.65	105,609.90	174,256.34	55.00%	1.65	115,210.80	190,097.82	60.00%
DOORS & WINDOWS	1.65	0.00	0.00	0.00%	1.65	0.00	0.00	0.00%
GLAZING	1.65	0.00	0.00	0.00%	1.65	0.00	0.00	0.00%
MEP	1.65	125,300.00	856,745.00	62.00%	1.65	998,250.00	647,112.50	55.00%
Total:		**607,847.46**	**58,476.97**	**25.72%**		**62,181.43**		**19.92%**

Totals:- **Planned Value=206037897.4563, PV * Height=247158476.97357, Perc. Accom.=25.72, PH=11.99**
Actual Value=159621181.4256, AV * Height=190253918.2937725, Perc. Accom.=19.92, EH=11.92

***Appendix K** – Questionnaire for EHM and HIRI-PRO Users*

		Users' Replies						
-	Please answer the following questions as follows: 0 for "Strongly Disagree", 1 for "Disagree", 2 for "Neither Agree nor Disagree", 3 for "Agree", and 4 for "Strongly Agree"	**Case Study No. 1**	**Case Study No. 2**	**Case Study No. 3**	**Case Study No. 4**	**Case Study No. 5**	**Average**	**Interpretation of Average**
1	Before this EHM experience, you have been on the project responsible for the planning activities.	4	4	4	4	4	**4.00**	**Strongly Agree**
2	You have experience in planning and schedules control in the construction industry.	4	3	3	3	4	**3.40**	**Agree**
3	You have been using a planning software in your project.	4	4	4	4	4	**4.00**	**Strongly Agree**
4	You have budget (or value) breakdown in your project.	4	4	3	3	4	**3.60**	**Strongly Agree**
5	Your project is considered a high-rise building.	4	4	4	1	4	**3.40**	**Agree**
6	The trend to build high-rise buildings is, in your opinion, more likely to increase.	4	3	3	4	4	**3.60**	**Strongly Agree**
7	The EHM is very useful in managing projects.	3	4	2	3	4	**3.20**	**Agree**
8	The EHM provides the user with additional tools and information not delivered by other methods previously experienced.	3	3	2	4	4	**3.20**	**Agree**
9	The EHM method provides more accurate results than the EVM method for high-rise structures.	4	4	3	3	4	**3.60**	**Strongly Agree**
10	The EHM was found easy to apply.	1	2	2	3	3	**2.20**	**Neither Agree nor Disagree**
11	The way EHM & HIRI-PRO were presented to you were easy to understand.	3	2	2	4	3	**2.80**	**Agree**
12	The Ratios of EHM are easy to understand.	2	3	3	4	2	**2.80**	**Agree**
13	In your case study, the EHM has helped the Project Manager see problems not revealed by other methods.	4	3	4	3	4	**3.60**	**Strongly Agree**
14	In your project, the Project Manager accepted the recommendations of EHM method reports.	3	2	4	2	4	**3.00**	**Agree**
15	There was no resistance in your company or project to the usage of EHM method.	3	3	4	2	4	**3.20**	**Agree**
16	You have not encountered any similar methods dealing with high-rise.	4	2	4	4	4	**3.60**	**Strongly Agree**
17	HIRI-PRO software perfectly depicts the EHM method.	4	3	4	2	4	**3.40**	**Agree**
18	HIRI-PRO is easy to use.	4	3	3	4	3	**3.40**	**Agree**
19	HIRI-PRO can function properly without any improvements.	2	2	3	2	3	**2.40**	**Neither Agree nor Disagree**
20	HIRI-PRO reporting feature was found very effective and useful.	4	4	3	4	4	**3.80**	**Strongly Agree**
21	The benefit obtained by applying the EHM method justifies the time and cost spent in applying it.	3	2	2	3	4	**2.80**	**Agree**
22	EHM is to be recommended as a method for measuring progress in high-rise buildings.	4	4	3	2	4	**3.40**	**Agree**

Appendix L *– Decision Table for HIRI-PRO Smart Report*

THPI	HPI	HRPI	SPI(t)	Comments	Alarm
=1	=1	=1	=1	Project on time, Structure on time, Subsequent Activities on time	
=1	=1	=1	>1	Project on time, Structure on time, Subsequent Activities on time	
=1	=1	=1	<1	Project on time, Structure on time, Subsequent Activities on time	Alarming
=1	=1	>1	=1	Project on time, Structure on time, Subsequent Activities on time	
=1	=1	>1	>1	Project on time, Structure on time, Subsequent Activities on time	
=1	=1	>1	<1	Project on time, Structure on time, Subsequent Activities on time	Alarming
=1	=1	<1	=1	Project on time, Structure on time, Subsequent Activities on time	
=1	=1	<1	>1	Project on time, Structure on time, Subsequent Activities on time	
=1	=1	<1	<1	Project on time, Structure on time, Subsequent Activities on time	Alarming
=1	>1	=1	=1	Project ahead, Structure on time, Subsequent Activities ahead	
=1	>1	=1	>1	Project ahead, Structure on time, Subsequent Activities ahead	
=1	>1	=1	<1	Project ahead, Structure on time, Subsequent Activities ahead	Alarming
=1	>1	>1	=1	Project ahead, Structure on time, Subsequent Activities ahead	
=1	>1	>1	>1	Project ahead, Structure on time, Subsequent Activities ahead	
=1	>1	>1	<1	Project ahead, Structure on time, Subsequent Activities ahead	Alarming
=1	>1	<1	=1	Project ahead, Structure on time, Subsequent Activities ahead	
=1	>1	<1	>1	Project ahead, Structure on time, Subsequent Activities ahead	
=1	>1	<1	<1	Project ahead, Structure on time, Subsequent Activities ahead	Alarming
=1	<1	=1	=1	Project behind, Structure on time, Subsequent Activities behind	Alarming
=1	<1	=1	>1	Project behind, Structure on time, Subsequent Activities behind	Alarming
=1	<1	=1	<1	Project behind, Structure on time, Subsequent Activities behind	Alarming
=1	<1	>1	=1	Project behind, Structure on time, Subsequent Activities behind	Alarming
=1	<1	>1	>1	Project behind, Structure on time, Subsequent Activities behind	Alarming
=1	<1	>1	<1	Project behind, Structure on time, Subsequent Activities behind	Alarming
=1	<1	<1	=1	Project behind, Structure on time, Subsequent Activities behind	Alarming
=1	<1	<1	>1	Project behind, Structure on time, Subsequent Activities behind	Alarming
=1	<1	<1	<1	Project behind, Structure on time, Subsequent Activities behind	Alarming
>1	=1	=1	=1	Project on time, Structure ahead, Subsequent Activities behind	
>1	=1	=1	>1	Project on time, Structure ahead, Subsequent Activities behind	
>1	=1	=1	<1	Project on time, Structure ahead, Subsequent Activities behind	Alarming
>1	=1	>1	=1	Project on time, Structure ahead, Subsequent Activities behind	
>1	=1	>1	>1	Project on time, Structure ahead, Subsequent Activities behind	
>1	=1	>1	<1	Project on time, Structure ahead, Subsequent Activities behind	Alarming
>1	=1	<1	=1	Project on time, Structure ahead, Subsequent Activities behind	
>1	=1	<1	>1	Project on time, Structure ahead, Subsequent Activities behind	
>1	=1	<1	<1	Project on time, Structure ahead, Subsequent Activities behind	Alarming
>1	>1	=1	=1	Project ahead, Structure ahead, Subsequent Activities equally ahead as the structure	
>1	>1	=1	>1	Project ahead, Structure ahead, Subsequent Activities equally ahead as the structure	
>1	>1	=1	<1	Project ahead, Structure ahead, Subsequent Activities equally ahead as the structure	Alarming

THPI	HPI	HRPI	SPI(t)	Comments	Alarm
>1	>1	>1	=1	Project ahead, Structure ahead, Subsequent Activities ahead more than structure	
>1	>1	>1	>1	Project ahead, Structure ahead, Subsequent Activities ahead more than structure	
>1	>1	>1	<1	Project ahead, Structure ahead, Subsequent Activities ahead more than structure	Alarming
>1	>1	<1	=1	Project ahead, Structure ahead, Subsequent Activities ahead less than structure	
>1	>1	<1	>1	Project ahead, Structure ahead, Subsequent Activities ahead less than structure	
>1	>1	<1	<1	Project ahead, Structure ahead, Subsequent Activities ahead less than structure	Alarming
>1	<1	=1	=1	Project behind, Structure ahead, Subsequent Activities behind	Alarming
>1	<1	=1	>1	Project behind, Structure ahead, Subsequent Activities behind	Alarming
>1	<1	=1	<1	Project behind, Structure ahead, Subsequent Activities behind	Alarming
>1	<1	>1	=1	Project behind, Structure ahead, Subsequent Activities behind	Alarming
>1	<1	>1	>1	Project behind, Structure ahead, Subsequent Activities behind	Alarming
>1	<1	>1	<1	Project behind, Structure ahead, Subsequent Activities behind	Alarming
>1	<1	<1	=1	Project behind, Structure ahead, Subsequent Activities behind	Alarming
>1	<1	<1	>1	Project behind, Structure ahead, Subsequent Activities behind	Alarming
>1	<1	<1	<1	Project behind, Structure ahead, Subsequent Activities behind	Alarming
<1	=1	=1	=1	Project on time, Structure behind, Subsequent Activities ahead	Alarming
<1	=1	=1	>1	Project on time, Structure behind, Subsequent Activities ahead	Alarming
<1	=1	=1	<1	Project on time, Structure behind, Subsequent Activities ahead	Alarming
<1	=1	>1	=1	Project on time, Structure behind, Subsequent Activities ahead	Alarming
<1	=1	>1	>1	Project on time, Structure behind, Subsequent Activities ahead	Alarming
<1	=1	>1	<1	Project on time, Structure behind, Subsequent Activities ahead	Alarming
<1	=1	<1	=1	Project on time, Structure behind, Subsequent Activities ahead	Alarming
<1	=1	<1	>1	Project on time, Structure behind, Subsequent Activities ahead	Alarming
<1	=1	<1	<1	Project on time, Structure behind, Subsequent Activities ahead	Alarming
<1	>1	=1	=1	Project ahead, Structure behind, Subsequent Activities ahead	Alarming
<1	>1	=1	>1	Project ahead, Structure behind, Subsequent Activities ahead	Alarming
<1	>1	=1	<1	Project ahead, Structure behind, Subsequent Activities ahead	Alarming
<1	>1	>1	=1	Project ahead, Structure behind, Subsequent Activities ahead	Alarming
<1	>1	>1	>1	Project ahead, Structure behind, Subsequent Activities ahead	Alarming
<1	>1	>1	<1	Project ahead, Structure behind, Subsequent Activities ahead	Alarming
<1	>1	<1	=1	Project ahead, Structure behind, Subsequent Activities ahead	Alarming
<1	>1	<1	>1	Project ahead, Structure behind, Subsequent Activities ahead	Alarming
<1	>1	<1	<1	Project ahead, Structure behind, Subsequent Activities ahead	Alarming
<1	<1	=1	=1	Project behind, Structure behind, Subsequent Activities equally delayed as the structure	Alarming
<1	<1	=1	>1	Project behind, Structure behind, Subsequent Activities equally delayed as the structure	Alarming
<1	<1	=1	<1	Project behind, Structure behind, Subsequent Activities equally delayed as the structure	Alarming
<1	<1	>1	=1	Project behind, Structure behind, Subsequent Activities delayed less than structure	Alarming
<1	<1	>1	>1	Project behind, Structure behind, Subsequent Activities delayed less than structure	Alarming
<1	<1	>1	<1	Project behind, Structure behind, Subsequent Activities delayed less than structure	Alarming
<1	<1	<1	=1	Project behind, Structure behind, Subsequent Activities delayed more than structure	Alarming

THPI	HPI	HRPI	SPI(t)	Comments	Alarm
< 1	< 1	< 1	> 1	Project behind, Structure behind, Subsequent Activities delayed more than structure	Alarming
< 1	< 1	< 1	< 1	Project behind, Structure behind, Subsequent Activities delayed more than structure	Alarming

Appendix M *– List of Abbreviations*

Abbreviation	Detail
AC	Actual Cost
AT	Actual Time (ES Method)
BAC	Budget at Completion
BHR	Building Height Ratio
BTH	Building Total Height
BVCH	Building Value Center Height
CPI	Cost Performance Index
CPM	Critical Path Method
CV	Cost Variance
d	Distance
EH	Earned Height
EHM	Earned Height Method
EHR	Earned Height Ratio
ES	Earned Schedule (Method)
EV	Earned Value
EVM	Earned Value Method
F	Force
FLBAC	Floor Budget At Completion
FLHt	Floor Height
g	Earth Gravitational Force
H	Height
HIRI-PRO	High-Rise Project (Software)
HPI	Height Performance Index
HRPI	Height Ratio Performance Index
LOB	Line of Balance
m	Mass
PE	Potential Energy
PH	Planned Height
PHR	Planned Height Ratio
PTH	Planned Top Height
PV	Planned Value
SPI	Schedule Performance Index
SPI(t)	Schedule Performance Index Calculated Using ES Method
SV	Schedule Variance
SV(t)	Schedule Variance (ES Method)
t	Time
TH	Top Height
THPI	Top Height Performance Index
VC	Value Center
W	Work
Wt	Weight

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