

Number 9

Development of an Integrated Construction Management System for Building Estimation

Assist. Prof. Dr. Sawsan Rasheed Mohammed

Ehab Fadhil Mohammed Ali

Abstract

Project management are still depending on manual exchange of information based on paper documents. Where design drawings drafting by computer-aided design (CAD), but the data needed by project management software can not be extracted directly from CAD, and must be manually entered by the user. The process of calculation and collection of information from drawings and enter in the project management software needs effort and time with the possibility of errors in the transfer and enter of information. This research presents an integrated computer system for building projects where the extraction and import quantities, through the interpretation of AutoCAD drawing with MS Access database of unit costs and productivities for the pricing and duration of tasks, then exported to MS Project and MS Excel. The system was developed by using Visual Basic and ActiveX automation technology for combining the above software. The system, also, can calculate quantities of materials. The system includes digitizer (on-screen takeoff) calculates the lengths and areas of the drawings to which the form of an image and scanned. The integrated system has been applied to case study, a storages building for hospital 260 beds. The results proved the effectiveness of the system for the conversion of information from the graphical form dwg to numerical formulas xlcx / xlc and mpp can be handled easily pleased and software are covered.

Keywords: Construction Management, Integrated System, CAD, Estimation, Automation

الخلاصة

Introduction

In each phase of project life cycle a lot of information is exchanged among project teams. This information can be graphical (drawings) or non-graphical information (bill of quantities). These two information as independent and are not linked to each other. Current estimating is limited by the lack of integration between electronic design and construction information. Integration of design and cost information is necessary to improve the estimating and to reduce the current fragmentation. New software technologies have been developed that will help to integrate design and cost information (Staub et al, 1998).

In USA, (Elzarka, 2001) had discussed a cost-effective approach for developing computer-integrated (CIC) construction systems by integrating stand-alone CAD (AutoCAD), spreadsheet (Excel), database (MS Access) and scheduling software (MS Project) packages using Visual Basic and ActiveX technology. In India, (Arun and Appa Rao, 2005) presented a simple methodology for integrating computer aided design with construction scheduling using Visual Basic and ActiveX. It makes use of the widely used standard software application packages namely AutoCAD and MS Project along with MS Access database. The integration was achieved by developing suitable interfacing modules and also by creating the knowledge based expert system for incorporating the construction expertise to be used for achieving integration.

In Iraq, Only (Ziyad, 2007) have been developed integrated system CIS (Computer Integrated System) for water Projects, to connect three software (AutoCAD, Excel and MS Project) using Visual Basic and ActiveX data transfer technology. This integrated system can extract the graphical information from an AutoCAD drawing and transfer it to a digital form suitable for processing in the project management software MS Excel and MS Project Due to the CIS does not have a database; unit cost, production rate, precedence of the activities should be entered by user. Passing information from AutoCAD to MS Project indirect, should be presenting it in Excel first. Measure only lengths and quantities that calculate by each, without area and volume.

Research Objectives

The aim of this research is to present a simple approach for integrating CAD with estimation and planning, and to apply it for the case of building projects, as an example. It presents an approach for integrating the existing software. The integration of stand-alone AutoCAD, MS Access, MS Excel and MS Project by using Visual Basic and ActiveX automation technology was proposed as an alternative approach to developing integrated system (InCADEP).

Software Applications in Construction

Computer Aided Design

Before the 1980s, most drawings were created using paper. In 1982, Autodesk introduced AutoCAD software, bringing CAD to the PC and changing the design world forever.

Its use however has been limited to drafting for so many years that it is sometimes referred to as "Computer-Aided Drafting" (Elzarka and Dorsey, 1999). The development of IT and its application in construction industry have brought about some changes to the industry. Such as, the application of CAD grants a CAD drawing with two meanings (Wang, 2001):

• To engineers, it consists of a series of graphic symbols representing a building;

• To computer, it is a process-able data file which contains data related to the building, and this makes it possible to interpret the CAD drawing and to extract from it the data needed for construction management.

Estimating Software

The computation of construction quantities is one of those tasks which can be dealt with computer technologies. Generally, computing by hands or by evaluation computer software are two major methods for quantity calculation. There are few disadvantages with performing these two methods (Lin, 2007):

- Time consuming.
- Accumulative errors and typos produced from manually computing.
- Leaving some area out of consideration.
- Personnel's lack of graphic working experience to perform the calculation jobs.
- Original system limitations, such as format of input data, etc.

The accuracy of construction quantity is one of the most important factors for controlling building cost in construction industry (Lin, 2007).

The fundamental core of estimating is the takeoff process. Without the information obtained from a takeoff, an estimate can not be performed. While the level of detail varies, the need to know the information obtained in the takeoff process is still vital (Miller, 2001). In the takeoff phase, computer based systems have dramatically changed the available tools from pencils and papers to interactive digitizers (Elzarka and Dorsey, 1999). A simple digitizer was included in the presented system in this research.

In the pricing phase, where prices are assigned to the items selected during takeoff, computer based system have had a major impact. The database of these systems contains most of the pertinent information necessary to prepare an estimate such as unit price and production rate. Such information needs to be entered only once into the database, where it is stored for future use (Elzarka and Dorsey, 1999).

Spreadsheets

Large construction companies use estimating software that cost thousands or even tens of thousands of dollars to purchase (more money than most small-to-medium size builders can afford). However, there are inexpensive ways to do computer estimating. One way is to use computerized spreadsheets that have the power of programs costing thousands of dollars. The benefits of having computer spreadsheets are (Christofferson, 1999):

- Inexpensive
- Easy to use
- Can be customized to your style of doing business
- Very powerful.

(Christofferson, 1999) provides some helpful methods that can turn basic spreadsheets into powerful tools to accomplish estimates quickly and accurately. But main limitation, the estimating effort is centered on taking off quantities, while this research will tried avoiding this limitation.

Spreadsheets vs. Commercial Estimating Software

In 2002 a study (Information Technology Survey for the Construction Industry) in USA by CFMA shows that Microsoft Excel was the most popular estimating software even in the largest-companies group with a 33 percent. Others use specialized estimating software 26 percent use Precision Collection of Timberline. Up to 5 percent of estimating software were the result of companies' own development "Developed in house", Table (1).

In Iraq a questionnaire by (Al-Hadythy, 2006) shown that Timberline not available in the market and it is unknown to the estimators with 100 % percentage. However, the estimators concerns about software products are that they want them to integrate with project management and scheduling. They also want the ability to change the assumptions, such as work crew breakdowns and productivity rates that govern calculations (Farah, 2005).

Limitations of Current Software

Software are applications by commercial vendors and their internal data format are proprietary, which is why they can not communicate their information directly with each other unless they develop specific translators for this purpose.

An architect may use a CAD package to produce a set of drawings. A quantity surveyor/estimator will then use these drawings to produce costing information and bill of quantities. A construction planner/scheduler will also use the drawings and bill of quantities to produce a set of construction schedule. Participants use their preferred software package, maintaining their own subset of the project's information. This approach, although

well established, does have a number of disadvantages (Marir et al, 1998):

- The existence of "information lag" between participants
- occurrence of errors when re-entering data
- The difficulty in gathering an overall view of the project for management purposes
- The difficulty in integrating software packages due to the lack of a common conceptual information model.

Architect's first responsibility is to meet the client's expectations in design quality as well as in budget. Widely used by architectural firms, CAD software like AutoCAD does not support any cost data storage on their platform. In order to generate the estimate, Architect/Engineer has to rely on other software. It could vary from a MS Excel spreadsheet to Timberline (Farah, 2005). Users need to calculate quantities by hands with their imagination due to the lack of data for quantity calculation (Lin, 2007).

The CAD graphic documents often exclude information needed for effective project planning. The information that is sufficient for project designs is often insufficient to meet the requirements of project planning (Chen and Feng, 2008). The major tasks of CAD are drawing and visualization (Lin, 2007). However, these are not considered as weaknesses of AutoCAD as this software is only a general drafting tool.

Therefore, the researcher has made an effort to help the practitioners in the construction management by developing the system that presented in this research (InCADEP), which will help the practitioners in the estimating and planning.

Integration in Construction

An increase in the scale and complexity of building production requires a larger number participants and more efficient of communication among them. Because of the fragmented nature of the construction process, construction organizations have always searched for new ways to integrate both inter and intraorganisational functions (Nam and Tatum, 1992) as mentioned by (Kanoglu and Arditi, 2004). Indeed, participants in the construction activity have always encouraged researchers to focus on integration issues with



2012

the hope that such research could eliminate the consequences of the currently existing fragmentation in the construction industry. Attempts to deal with fragmentation can be carried out at three levels, namely at the (Kanoglu and Arditi, 2004):

- Organizational level: including approaches such as partnering and design/build contracting,
- Process level: including methods such as lean production, supply chain management, just-in-time delivery, and
- Virtual level: including software and hardware packages aimed at integrating the activities of the parties such as the integrated system described in this research.

Computer Integrated Construction

The concept of Computer Integrated Construction (CIC) is mainly derived from manufacturing industry such as Computer Integrated Manufacturing (CIM). CIC defines a goal to make "better use of electronic computers to integrate the management, planning, design, construction, and operation of constructed facilities". In this context "integrate" means to "combine" the individual elements to optimize the performance of whole facility (Sanvido and Medeiros, 1990). CIC describes a future target stage of the use of IT in construction. The key factor in CIC is the different integrating of the computing applications used in the life cycle of a building. Such integration will take place via automated digital data transfer between applications (Bjork, 1994).

involved in the project. Off-the-shelf standalone packages can now be integrated to develop cost-effective CIC systems that are as powerful and effective (Elzarka, 2001).

It is well known that integration of computer applications in the areas of planning, design and construction would help in saving time and cost of construction and in improving productivity (Arun and Appa Rao, 2005). CIC systems automate many of the labor- intensive tasks associated with construction management of new facilities (e.g. building). The main objective of CIC systems is to communicate data to all project participants, throughout the project's entire life cycle and across business functions (such as design, estimating and scheduling). Information processing requirements for many of these construction business functions are currently handled by computer systems that are not integrated. This creates a situation, which many refer to as "islands of automation". Through integrating individual computer systems, CIC systems improve the effectiveness of the entire management process enabling by the communication of information among all business functions through the entire project development process (Elzarka, 2001).

Many large construction companies use integrated systems that cost thousands or even tens of thousands of dollars to purchase (more money than most small-to-medium size builders can afford) (Christofferson, 1999), or have developed CIC systems in house (Elzarka, 2001).

Previous research has shown that at the heart of any effective CIC system is a 3D CAD model (Elzarka, 2001) (Arun and Appa Rao, 2005). Such a CIC system combines 3D CAD models with other project planning and management tools to integrate all parties

CAD Integration with Estimating

This automated model makes direct use of the original electronic CAD files for measurement. The benefits range from cost and time savings to improved flexibility in calculating the cost impact of different what-if scenarios (alternatives) (Staub et al, 1998). In the

Associate General Contractors (AGC) estimating text Construction Estimating and Bidding, several concerns are mentioned concerning integrating CAD with estimating (Miller, 2001) (Alder, 2006). These concerns are listed below (Miller, 2001):

- Who is responsible for quantification errors?
- What software will be universal enough for use?
- How does the architect and/or engineer preserve its copyright when it distributes its total design in a form that can be easily modified and copied by others?

Additionally, the AGC states that the technology may assist the estimator "but will always have many limitations" (Swenson et al., 1999) as mentioned by (Miller, 2001). The technology of CAD integration may in the future play a larger role in the takeoff process (Miller, 2001).

Several studies have been conducted at Stanford University to demonstrate the abilities of estimating using CAD. One study found that those who used CAD software for estimating recorded an 80% reduction in required time to complete an estimate with an accuracy margin of error of $\pm/-3\%$ (Schwegler et al, 2001) as mentioned by (Alder, 2006).

Proposed Approach

The results of design of building from CAD can be appropriately placed in the VB. The building may consist of several components. The CAD model can be used through the integrated system to extract the quantity of different components of the building. The quantity data extracted can be exported automatically to MS Excel spreadsheet. The database can also be modified interactively by the user to input the The required data. database contains This integrated system has been integrated with objects of the computer applications using

Development of an Integrated Construction Management System for Building Estimation

information for crew/team productivity rate, unit cost and other parametric. The list of construction activities, their dependencies and estimated duration of activities can be exported automatically to MS Project for generating the construction schedule.

The integration approach described above, it contributes towards automation in construction. It may be noted here that the "approach" is conceptual in nature and it is possible to use it with different levels of details and sophistication.

System Development and Implementation System Description

The Integration of Computer Aid Design with Estimation and Planning (InCADEP) was developed to facilitate the construction management of buildings projects by integrating the following off-the-shelf applications:

- AutoCAD for drafting the model. AutoCAD contains drawing and editing functions necessary to produce model of building components.
- Microsoft Access database for storing historical project information on crews, productivity and unit costs etc.
- Microsoft Project scheduling system to scheduling the project.
- Microsoft Excel spreadsheet to report the bill of quantities in a convenient spreadsheet format for subsequent manipulation and printing.

The integration of computer applications is carried out under Microsoft

Windows operating system. All components of the system are integrated by using Visual Basic and ActiveX automation technology, as illustrated in Figure (2)

VB and ActiveX automation technology. VB plays the role of "glue" that holds together



Number 9 Volume 18 September

Journal of Engineering

many objects (individual software) applications and packages. Here in this system, VB provided the capabilities to construct user interfaces and access to other software. The operation of the Flow chart as shown in figure (3).

System Requirements and Limitations

- AutoCAD scale should be (1:1).
- All building components must be drawn in one drawing, i.e. one AutoCAD drawing file (*.dwg) and different specific layers names.
- Each door and window should be drawn as a block (for example Door1 drawn as block named 24D1 1_1).
- Need four elevations for building, stairs neglected.
- The cost of the activities is estimated using activity quantities that extracted from the AutoCAD drawing and the cost information stored in database or entered by the user. Information cost should be as unit cost/unit of measure.
- The production rate for an activity is assumed to be fixed along the activity duration (production rate should be as quantity/day).
- The duration of the activities is estimated using activity quantities that extracted from the AutoCAD drawing and the productivity rate information stored in database or entered by the user.
- The precedence of the activities collected from practical constraints governing the construction only and without overlap between activities. Note here the user can enter precedence before exporting data to MS Project.

developed system is represented by the overall system

• The schedule generation is for ground floor only.

System Operation

If the user does not saved database, the user should be enter the unit cost of each item (for example 12,000 ID per square meter for plaster) and enter the production rate per day for each item (for example finishing 100 m2 per day for plaster). The one how use the system can enter the cost by Iraqi Dinar "ID" or US Dollar "\$", and the production rate consider in this case depend on the experience of the user.

If the user click on the "Import from ► AutoCAD", Figure (4), the "Open" file dialog box will appears, and the format of file type is limited to (*.dwg) to open only AutoCAD drawing. "Import from ► AutoCAD", allow for automatic extraction of quantities (length, area, volume, each/No. can be calculated) of various components of the building from the CAD model (like area of plaster, number of specific doors, etc). The user can perform the takeoff for the entire building; InCADEP will loop through all the elements contained in the model and calculate its quantities. The quantities will output in the table as shown in Figure (6). The unit cost is then retrieved from the database and the total price is calculated. In this menu "Import from ► AutoCAD", the graphical information convert to textual (non-graphical) information and the user can deal with this textual

Information in easy way more than the graphical information.

Data from this table can be exported automatically to MS Excel spreadsheets just by a click (File menu and then export to \blacktriangleright Excel), Figure (5), which can be kept as a separate file for bill of quantities. This can be used for further estimations. If user click on the "Export to \blacktriangleright Excel", the "Save As" file dialog box will appears, and the format of file type is limited to (*.xlcx \ *.xlc) to save as MS Excel spreadsheet. Then the user first enter "File name" and then click "save", the InCADEP automatically open the MS Excel and fill the cells with the required information like (description, quantity,etc).

InCADEP also contain a "Digitizer" or "On screen takeoff", which can measure (length and area) for image\scanned drawings, support (*.jpg, *.wmf and *.bmp) data format. First, the user should enter scale of drawing (by input the known distance between two points), and then can measure distance between two points and the horizontal and vertical distance for this points; or the user can measure the area and the perimeter.

The Implementation Of The System (Incadep)

The developed system was designed for reinforced concrete building projects. However, the system can be easily modified to cover all types of projects, since the main code of data exchange system is already exist. The system was designed to find: the total volume of beams. foundations, columns, and slabs concrete; Total number of doors and windows; area and volume of brick; total length of DPC; area of plaster and cement plaster and ceramic; area of roof; area of floors etc. The output of system in MS Excel is as shown in Figure(6) & (7).

Development of an Integrated Construction Management System for Building Estimation

Conclusions

The following points have been identified as the overall conclusions of the research:

- 1. Design, cost, and time integration is possible with today's off-the-shelf software products. The resulting benefits include faster estimating time, fewer takeoff errors, better documentation and reproducibility of the estimating process, and the ability to release a construction schedule electronically with the whole project prior to construction.
- 2. It is possible to prepare information of the BOQ and construction schedule for the building automatically (with least user interaction) by taking the results from the AutoCAD. A special feature of the system is the CAD modeling facilitating capability to extract quantity. A consequence of this is that project management software will be much easier to incorporate and also can have direct access to the design data from such integrated system.
- 3. The utilization of integrated systems will become more and more important as the popularity of the design/build project delivery system continues to increase. In the design/build approach, more business functions are performed by the same company and as a result, their integration to share data becomes more vital.
- 4. The integration of AutoCAD and computer based construction project management software can be utilized to reduce fragmentation and to bridge

Volume 18 September Number 9 2012

the AEC industry.

- 5. With the continuous development in BIM and improvement of programming capability (such as ActiveX automation technology), the potential application of an integrated system in construction practice can no longer be ignored. The industry is also eager to capitalize on this potential. This research provided a vision for meeting the vital, critical and urgent needs by the construction industry for integration tools that enhance the sharing of project information.
- 6. Integrating design, cost, and schedule information can help a project team to improve the efficiency of the planning and estimating processes. Design-cost integration supports the automatic calculation of quantities, thus shortening estimating time and eliminating the duplication of effort that exists in current estimating practices. In addition, it allows a project team to quickly evaluate the cost impact of different design and specification alternatives, and provides electronic validation that all the items in the CAD model have been included in the estimate. Decisions are expected to be made faster and to become more reliable.

Recommendations

1. The ability to develop integrated systems should entice the construction industry to use these systems. AutoCAD available today, with its ability to link to other software has made such development possible.

existing gaps between disciplines within 2. The IFC standards once fully developed will enhance such integration. However, it is vital to address integration within a business context which is mainly related to process, human and cultural issues

References

Abdul-Fattah. 2006. Al-Hadythy, Ahmed "Computer Applications Managing in Construction Projects" M.Sc. Thesis, University of Baghdad

Alder M. Adam, 2006, "Comparing Time and Accuracy of building Information Modeling to On-Screen Takeoff for a Quantity Takeoff of a Conceptual Estimate", M.Sc. thesis, Brigham Young University

Arun R.K., and Appa Rao T.V.S.R., 2005, "Methodology for Integrating Computer Aided Design With Construction Scheduling", Journal Structural of Engineering, Vol.31, of No.4, January.- March, pp.281–288.

B-C., 1994,"RATAS Project Björk Developing an Infrastructure for Computer-Integrated Construction", ASCE Journal of Computing in Civil Engineering, Vol. 8, No. 4, 401-419.

CFMA, 2002,"Information Technology Survey for the Construction Industry", Construction Financial Management Association, USA

Chen Yi-Jao and Feng Chung-Wei, 2008, "Streamlining the Data Transformation Process for Construction Projects via Building Information Modeling" Proceedings of the 25th International Symposium on Automation and Robotics in Construction, Vilnius, Lithuania, June 26-29, 549-558.

Christofferson Jay P., 1999,"Using Powerful Spreadsheet Application Tools to Increase the Efficiency and Effectiveness of Estimating"

ASC Proceedings of the 35th Annual Conference ,California Polytechnic State University - San Luis Obispo, California ,April 7 - 10, pp 197 – 204

Ehab Fadhil M. A .2010 " Development of an integrated Construction Management System for Building Estimation" M.Sc. thesis, University of Baghdad

Elzarka H., 2001,"Computer Integrated Construction for Small And Medium Contractors" ASC Proceedings of the 37th Annual Conference, University of Denver -Denver, Colorado, April 4 - 7, pp 255 – 262

Elzarka H. and Dorsey R., 1999, "Enhancing Value Engineering by Integrating CAD and Estimating Software" ASC Proceedings of the 35th Annual Conference, California Polytechnic State University - San Luis Obispo, California, April 7 - 10, pp 299 – 306

Farah Toni, 2005,"Review of Current Estimating Capabilities of the 3D Building Information Model Software to Support Design for Production/Construction" M.Sc. thesis, Faculty of the Worcester Polytechnic Institute

Kanoglu, A. and Arditi, D. 2004, "An integrated automation system for design/build organizations", Int. J. Computer Applications in Technology, Vol. 20, Nos. 1.3, pp. 3.14.

Lin Chen-Yang, 2007, "Automatic Construction Quantity Calculation System" M.Sc. Thesis, Development of an Integrated Construction Management System for Building Estimation

Institute of Construction Engineering, National Yunlin University of Science & Technology, Douliu, Yunlin, Taiwan, Republic of China

Marir F. Dr., Aouad, G. Dr. and Cooper G. Dr., 1998 "OSCONCAD: A model-based CAD system Integrated with Computer Applications". Information Technology in Construction (ITcon), 3:25-43.

Miller K., 2001, "Electronic Documents: Saving Contractor's Time & Money" research project was sponsored by the Building Construction Industry Advisory Council (BCIAC) under a grant from the State of Florida Department of Education

Sanvido Victor E. and Medeiros Deborah J., 1990, "Applying Computer-Integrated Manufacturing Concepts to Construction" ASCE Journal of Construction Engineering and Management, Vol. 116, No. 2, pp 365-379 June

Staub S., Fischer M. and Spradlin M, 1998, "Industrial Case Study of Electronic Design, Cost and Schedule Integration" (CIFE Working Paper #48). Stanford, CA: Stanford.

Wang, S.Q., 2001, "ESSCAD: Expert System Integrating Construction Scheduling with CAD Drawing", Construction Information Digital library.

Ziyad Jassim Fadhal, 2007, "Building an Integrated Computer System for Management of Projects (some water projects as a case study)", M.Sc. Thesis, University of Baghdad. (0, 0)

Software (vendor)	Used
Excel (Microsoft)	33%
Precision Collection (Timberline, now sage)	26%
ICE-2000 (MC2)	11%
Heavy Bid (HCSS)	6%
Other	19%
Developed in house	5%

Table (1) Estimating software used by U.S. general contractors (CFMA, 2002)

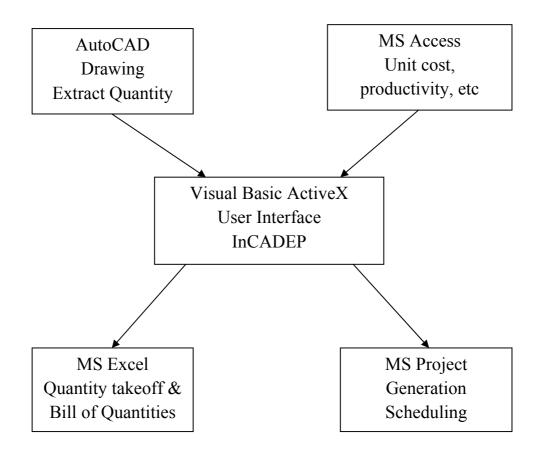


Figure (1) Architecture of Integration

Development of an Integrated Construction Management System for Building Estimation

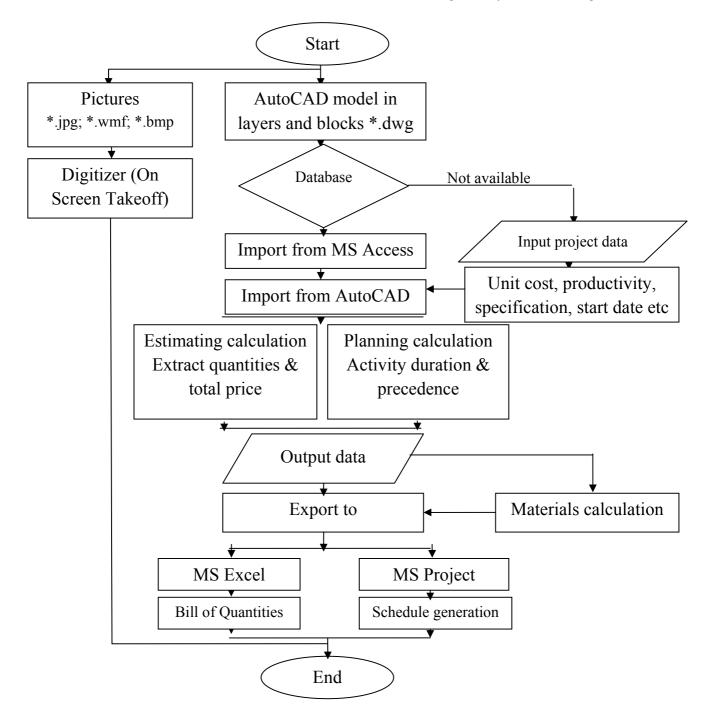
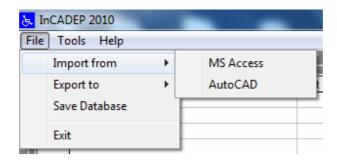
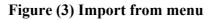


Figure (2) Overall system flow chart







📐 InCADEP 2010		
File Tools Help		
Import from	•	
Export to	•	Excel
Save Database		MS Project
Exit		

Figure (4) Export to menu

10 Tark Have, Discretion Unit Data of cardition Find of cardition	Item (. headon) Item (. he	Tak Nav, Cuendon Call Outroit Nave Nave </th <th></th> <th></th> <th></th> <th>10 InCADEP - [Building</th> <th>10 Incat</th> <th>😭 Project1 - Microsoft V</th> <th>🔓 Projecti</th> <th>t 🔁 CIS 262</th> <th>start</th>				10 InCADEP - [Building	10 Incat	😭 Project1 - Microsoft V	🔓 Projecti	t 🔁 CIS 262	start
Imak Name Drandom Ind Gambe Index (mark)	Tark Nue / December Int Outform Int Outform Predector 2 Exame: Site Control Site	Ibit Ibit <th< th=""><th></th><th></th><th>•</th><th></th><th></th><th></th><th></th><th></th><th></th></th<>			•						
Tark Mann (Nancipion) Ide Nancipion Ide Nancipion Ide Nancipion Ide Nancipion Ide Nancipion Ide Nancipion	Tark Nue Osciellon Int Outdot France Duatory France Duatory Sectory	No. Field No. Field No. Field No. Field No. Field No. Secondary No. Secondary No. Secondary No. Secondary	Π	INCAL							
	Task Nuer Veruption Unit Outer Size Vertical Productive Foundational Productive Foundational<	No. Height Unit Currentian Out Currentian Cur									
	Task Nue / Lenzinkov India Nava / Lenzinkov	Ibit Tab. Name. Chemition Indiantify Ivan Chemition Indiantify Ivan Chemition									
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Tark Nav / December Unit Unit Cut Productive Produc	Not Hery Not	_	150000 W 6							
	Table Nume / Decembra Ind Index (barry for the second sec	Ibit Table Name / Lencrition Ind Canadian Index / Lencrition Index Production / Lencrition Index Production / Lencrition Index Production / Lencrition Index Index <thindex< th=""> Index <thindex< th=""> <thindex< th=""> Index<td>_</td><td>190000 W 5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></thindex<></thindex<></thindex<>	_	190000 W 5							
Tark Name / Description Unit Canadity Predicessor	Task Nav Denetion Init Gamety Init Produces	Ibit Table Name Learning Unit Call Mark Unit Call Mark Unit Call Mark Ibit Table Mark Produces		320000 W 4							
Tark Name / Decretion Unit Unit Cast Park Duration Preducessor Preducessor Preductivity (ser Day) Corretion Foundation (ser Day)	Task Name' Description Unit Quarkany Duration Predication Duration Predication Predication <t< td=""><td>Ibit Task Name / Description Unit Quantypy First Duation Participation Control Participation Control Participation Control Participation Paritipation Participation</td><td>H of under DPC</td><td>275000 W 3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	Ibit Task Name / Description Unit Quantypy First Duation Participation Control Participation Control Participation Control Participation Paritipation Participation	H of under DPC	275000 W 3							
Tark Name / Description Unit Quarkity Productivity Productivity Productivity Foundation function Technologie Productivity Foundation function Foundatio	Tark Name, Viseruiton Ind. Causity Unit Cort Frade Frade Frade Frade Specification	Ibit Height Intel Seconda Intel Seconda <	H of Excavations	200000 W 2							
Tark Name / Decryption Unit Quarkity Unit / Cot Price Durakion Predecosors Preducinity (per Day) Cut Height / Heig	Task Name / Description Unit Quarity Unit Code Production Consistent Special Section Spec	Itole Heip Italian Italian <thitalian< th=""> <thitalian< th=""> <thitalia< td=""><td></td><td>325000 W 1</td><td></td><td>290000 1</td><td>290000</td><td></td><td>each</td><td>indow3 : 1.6 x 1.5</td><td>28 \</td></thitalia<></thitalian<></thitalian<>		325000 W 1		290000 1	290000		each	indow3 : 1.6 x 1.5	28 \
Tark Name / Decryption Unit Quarkity Unit / Cold Price Duration Predecosors Preducivity (per Day) Columns Foundation (part Day) Foundatin (part Day) Foundatin (part Day)<	Task Name / Description Unit Call analysis Unit Cast Productions Call analysis Productions Control Contro Contro Contro	Instrume Instrume Unit Unit Cat Pres Duation Predecessor 2 Leavailan n.3 5225 1000 35280 1 1 Predecessor 1 Scalar 1 1	Start Date of Proj			50000 1	50000	_	each	indow2 : 0.5 x 0.6	27 V
	Tark hane / Decrytion Int Query interferent Producesson Producesson <td>Index Task Hame / Decembion Unit Quantity Unit Cot Productive Duration Productive Productive Concerte Final According Specification Specification</td> <td></td> <td>30</td> <td></td> <td>320000 1</td> <td>160000</td> <td>2</td> <td>each</td> <td>indow1 : 1.1 x 1.2</td> <td></td>	Index Task Hame / Decembion Unit Quantity Unit Cot Productive Duration Productive Productive Concerte Final According Specification		30		320000 1	160000	2	each	indow1 : 1.1 x 1.2	
	Task Name / Description Unit Out Cost Price Duration - Prednessors	Itel Itel <th< td=""><td></td><td>linne ne my</td><td></td><td>150000 1</td><td>150000</td><td></td><td>each</td><td>oor6 : 2.1 × 0.8</td><td></td></th<>		linne ne my		150000 1	150000		each	oor6 : 2.1 × 0.8	
	Tark Name L Description Urit Quantity Init Cast Price Duration Predecessors Predecessors <t< td=""><td>Tots Heip Tots Heip Tots Name Description Unit Out Name Description Unit Cast Predecessor Predcessor Predc</td><td></td><td>40 m2</td><td></td><td>380000</td><td>190000</td><td>2</td><td>each</td><td>0075 : 2.1 x 1</td><td></td></t<>	Tots Heip Tots Heip Tots Name Description Unit Out Name Description Unit Cast Predecessor Predcessor Predc		40 m2		380000	190000	2	each	0075 : 2.1 x 1	
Task Name / Description Unit Out Cost Price Duration Predecessor Preductivity (per Day) Cast Specification	Tark Name / Description Unit Quantity Unit Cest Price Duration Predecessors Preductivity per Day - Cott Specification 4 Concrete n3 22.55 5000 110 3 33000 24.6000 5000 10 5 5000 12.1 4 12.1	Indic Height Indic Quantity Unit Cost Price Duration A section Predecessors Predecessors Predecessors Predecessors Preductivity (per Day) Car		90 m2		2/3000 1 R40000 1	000022	2-	each	bor4 : 2.4 × 1.5	
Task Name / DescriptionUnitQuantityUnit CastPriceDurationPredecessorPreductivityFor UnityFor U	Task Name \ Description Unit Quartity Unit Cost Price Dualtion Predecessors Preducessors Preducessors <t< td=""><td>Tote Heip Tote Heip Tote Name / Description Unit Quarkity Unit Cast Price Durakin Predeessors Prede</td><td></td><td>30</td><td></td><td>177000</td><td>20000</td><td>4 4</td><td>each</td><td>0072 : 2.1 X 1</td><td></td></t<>	Tote Heip Tote Heip Tote Name / Description Unit Quarkity Unit Cast Price Durakin Predeessors Prede		30		177000	20000	4 4	each	0072 : 2.1 X 1	
$ \begin{array}{ c c c c c c } \hline Task Name L Description & Unit & Quantum & Init & Quantum & Init & Duation & Predecessors & Preductivity (per Day) . Cast \\ \hline Excavations & 32.65 & 1000 & 32.55 & 5000 & 1137600 & 5 \\ \hline A reaundation Concrete & n3 & 22.65 & 40000 & 6175000 & 10 \\ \hline B casm Concrete & n3 & 15.44 & 40000 & 6175000 & 10 \\ \hline B casm Concrete & n3 & 15.44 & 40000 & 6175000 & 10 \\ \hline B casm Concrete & n3 & 15.44 & 40000 & 6175000 & 10 \\ \hline B casm Concrete & n3 & 15.44 & 40000 & 906000 & 10 \\ \hline B casm Concrete & n3 & 41.1 & 41666 & 0049657.32 & 1 \\ \hline B cash obve DPC & n2 & 628.97 & 5000 & 31348500 & 19 \\ \hline D cash of Walk & Cellings & E.M & n2 & 628.97 & 5000 & 1137600 & 2 \\ \hline 11 Roofing & n2 & 628.97 & 5000 & 31348500 & 19 \\ \hline 12 Caramic of Walk & Cellings & E.M & n2 & 723.71 & 14000 & 175330 & 2 \\ \hline 13 Caramic of Walk & Cellings & E.M & n2 & 723.71 & 14000 & 103940 & 7 \\ \hline 14 Extensi Finishing & n2 & 023.84 & 30000 & 18251400 & 7 \\ \hline 15 Foor Caramic of Walk & Cellings & E.M & n2 & 023.81 & 0000 & 18251400 & 7 \\ \hline 16 Foor Caramic of Walk & Cellings & n2 & 024.33 & 1000 & 1127200 & 10 \\ \hline 17 Foor Tate 130 x 30 & n2 & 423 & 30000 & 18251400 & 7 \\ \hline 19 Doct and Windows Works & n2 & 0.2 & 42.4 & 30000 & 127200 & 1 \\ \hline 19 Doct and Windows Works & n2 & 0.2 & 42.3 & 30000 & 127200 & 1 \\ \hline 19 Doct and Windows Works & n2 & 0.2 & 42.3 & 30000 & 127200 & 1 \\ \hline 19 Doct and Windows Works & n2 & 0.2 & 42.4 & 30000 & 127200 & 1 \\ \hline 19 Doct and Windows Works & n2 & 0.2 & 42.4 & 30000 & 127200 & 1 \\ \hline 10 Doct and Windows Works & n2 & 0.2 & 42.4 & 30000 & 127200 & 1 \\ \hline 10 Doct and Windows Works & n2 & 0.2 & 42.4 & 30000 & 127200 & 1 \\ \hline 10 Doct and Windows Works & n2 & 0.2 & 0.2 & 0.2 & 0.2 \\ \hline 10 Doct and Windows Works & 0. & 0. & 0. & 0. & 0. & 0. \\ \hline 10 Doct and Windows Works & 0. & 0. & 0. & 0. & 0. & 0. \\ \hline 10 Doct and Windows Works & 0. & 0. & 0. & 0. & 0. & 0. & 0. \\ \hline 10 Doct and Windows Works & 0. & 0. & 0. & 0. & 0. & 0. & 0. \\ \hline 10 Doct and Windows Works & 0. & 0. & 0. & 0. & 0. & 0. \\ \hline 10 Doct and Works & 0. & 0. & 0. & $	Task Name V Description Unit Quantity Unit Cost Price Duation - Freedeessore Freedeesso	Indic Heip Indic Init Quantity Init Cast Price Duration Fredecessors Predecessors Preductivity (per Day) Corr Predicion Predecessors Preductivity (per Day) Corr Predicion Predecessors Preductivity (per Day) Corr Predicion Pre	General	3		325000 1	325000		each	por1 : 2.4 × 1.5	
	Task Name / Description Unit Quantity Init Cost Price Predeessors Predeossors Predeessors <th< td=""><td>Index Head Unit Quantity Unit Cast Price Ouration Predocessos <t< td=""><td></td><td>40 m2</td><td></td><td>0</td><td></td><td></td><td></td><td>pors and Windows Works</td><td></td></t<></td></th<>	Index Head Unit Quantity Unit Cast Price Ouration Predocessos Predocessos <t< td=""><td></td><td>40 m2</td><td></td><td>0</td><td></td><td></td><td></td><td>pors and Windows Works</td><td></td></t<>		40 m2		0				pors and Windows Works	
$ \begin{array}{ $	Task Name / Description Unit Quantity Unit Cost Price Duration Predecessors Preductivity (per Day) Cost Specification 2 Excavations n3 32.65 1000 352.650 7 2 5 2 5 2 5 2 5 2 5 2 5 2 2 5 2 2 5 2 2 5 2 3 1 3 2 2 5 0 1 3 2 2 5 0 1 3 2 2 5 0 1 2 2 3 1 0 1	Indic Heip Indic Quarity Unit Cost Price Quarity Price	_	50 m2			30000	4.24	m2	por Ceramic	18 F
Task Name V DescriptionUnitQuantityInit CostPriceDurationPredecessorsPredecessorsPreductivity (per Day)CostSpecification2Excavationsn3352.651000352.650711Specification11Specification11Specification1Specification1Specification1Sp	Task Name / Description Unit Quantity Unit Cost Price Duration Predecessor Predecessor Productivity (per Day) Cost Specification 2 Excavations m3 32.25 5000 1137600 3 2 5000 1000 2 1000 352.650 7 2 5000 1137600 3 2 5000 10000 1000 1000 1	Indic Heip Indic Unit Quantity Unit Cost Price Quantity Predecessors Predecessors 2 Freewaltions m3 227.52 5000 35.6500 7 2 2 3 4 Freedacessors 1 <td>_</td> <td>[] [] [] [] [] [] [] [] [] [] [] [] [] [</td> <td></td> <td></td> <td>1000</td> <td>463.33</td> <td>m2</td> <td>oor Tile1 30 x 30</td> <td></td>	_	[] [] [] [] [] [] [] [] [] [] [] [] [] [1000	463.33	m2	oor Tile1 30 x 30	
$ \begin{array}{ c c c c c c } \hline Task Name V Description & Unit & Quantity & Init Cost & Price & Duration & Predecessors \\ \hline 2 Excavations & n3 & 352.65 & 1000 & 352.650 & 7 & 2 \\ \hline 4 Foundations(Hard Core.Blinding) & n2 & 227.52 & 5000 & 1137600 & 3 & 2 \\ \hline 4 Foundations(Incencete & n3 & 15.44 & 40000 & 6176000 & 10 & 5 \\ \hline 5 Colume Concrete & n3 & 15.44 & 40000 & 617600 & 10 & 5 \\ \hline 6 Beams Concrete & n3 & 15.44 & 40000 & 617600 & 10 & 5 \\ \hline 7 Slab Concrete & n3 & 15.44 & 40000 & 906000 & 10 & 5 \\ \hline 7 Slab Concrete & n3 & 15.44 & 40000 & 916500 & 10 & 5 \\ \hline 7 Slab Concrete & n3 & 17.43 & 11.42 & 41666 & 104967.22 & 1 & 4 \\ \hline 10 Bick above DPC & n3 & 175.93 & 1000 & 178530 & 2 & 8 \\ \hline 11 Boofing & 17 Faster of Walls & Ceilings & Ext & n2 & 562.76 & 3000 & 1251400 & 3 \\ \hline 12 Canamic of Walls & Ceilings & Ext & n2 & 608.38 & 30000 & 1251400 & 7 \\ \hline 14 Extern of Walls & Ceilings & Ext & n2 & 608.38 & 30000 & 1251400 & 7 \\ \hline 14 Extern of Walls & Ceilings & Ext & n2 & 608.38 & 30000 & 1251400 & 7 \\ \hline 14 Extern of Walls & Ceilings & Ext & n2 & 608.38 & 30000 & 1251400 & 7 \\ \hline 14 Extern of Walls & Ceilings & Ext & n2 & 608.38 & 30000 & 1251400 & 7 \\ \hline 15 Caramic of Walls & Ceilings & Ext & n2 & 338.41 & 30000 & 985230 & 6 \\ \hline 10 & 10 & PC & 100 & n1 & 1000 \\ \hline 10 & Ploster & 100 & n2 & 12000 & Floor 2 & Cert \\ \hline 10 & Ploster & 100 & n2 & 12000 & 985230 & 6 \\ \hline 10 & 10 & Ploster & 100 & n2 & 12000 & Floor 2 & Cert \\ \hline 10 & 10 & Ploster & 100 & n2 & 12000 & Floor 2 & Cert \\ \hline 10 & 10 & Ploster & 100 & n2 & 12000 & 100 & Floor 2 & Cert \\ \hline 10 & 10 & Ploster & 100 & n2 & 12000 & Floor 2 & Cert \\ \hline 10 & 10 & Ploster & 100 & n2 & 12000 & Floor 2 & Cert \\ \hline 10 & 10 & Ploster & 100 & n2 & 12000 & Floor 2 & Cert \\ \hline 10 & 10 & Ploster & 100 & n2 & 12000 & Floor 2 & Cert \\ \hline 10 & 10 & Ploster & 100 & Ploster & 100 & Ploor 2 & Cert \\ \hline 10 & 10 & Ploster & 100 & Ploor 2 & Cert & Floor 2 & Cert \\ \hline 10 & 10 & Ploster & 100 & Ploor 2 & Cert & Floor 2 & Cert & $	Task Name / Description Unit Quantity Unit Cost Frice Duration Fredeessors Fr	Totic Full Interplan Interplan Number of Sunding Specification 10 Task Name \ Description Unit Quantity Unit Cost Price Duation Predecessors Predecessors Predecessors Predecessors Predecessors Preductivity (per Day) Cost Specification 2 Excavations m3 55.60 35000 235000 137500 3 2 3 1000 320500 10 3 2 5000 137500 10 3 2 3000 235000 10 3 2 5000 137500 10 3 10 137500 10 5 10 10 15 m3 30000 12 10 10 15 m3 30000 12 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2		¥ N			20000	170.66	₽2 I	alse Ceilings	
$ \begin{array}{ c c c c c c } \hline Task Name V Description & Unit & Quantity & Int Cost & Price & Duration & Predecessor & Productivity (per Day) & Certification \\ \hline 2 Excavations & and & 352.65 & 1000 & 352.650 & 7 & 2 & 2000 \\ \hline 3 Area under Foundations(Hard Core.Blinding) & n.2 & 227.52 & 5000 & 1137600 & 3 & 2 & 2000 \\ \hline 4 Foundations(Inconcete & n.3 & 15.44 & 40000 & 6176000 & 10 & 5 & 6 & 8 \\ \hline 5 Colums Concrete & n.3 & 15.44 & 40000 & 617600 & 10 & 5 & 6 & 8 \\ \hline 6 Beams Concrete & n.3 & 15.44 & 40000 & 617600 & 10 & 5 & 6 & 8 \\ \hline 7 Slab Concrete & n.3 & 15.44 & 40000 & 617600 & 10 & 5 & 6 & 8 \\ \hline 9 DPC 24 & DPC & n.3 & 91.19 & 37500 & 3146250 & 10 & 4 & 9 & 8 \\ \hline 10 Bick kunder DPC & n.3 & 175.33 & 1000 & 175330 & 2 & 8 \\ \hline 11 Poofing & Callings & Ext & n.2 & 582.76 & 3000 & 17482800 & 6 & 10 & 80KS & 35 & n.3 & 40000 & 0 & 2 & 21 \\ \hline 12 Plaste of Walls & Ceilings & Ext & n.2 & 733.71 & 14000 & 1137940 & 9 & 10 \\ \hline 14 D Contract Fixeder & n.2 & 768.3 & 30000 & 12924400 & 7 & 10 & 0 \\ \hline 14 D Contract & n.2 & 768.3 & 30000 & 17482800 & 6 & 10 & 0 \\ \hline 14 D Contract & n.2 & 768.3 & 30000 & 17482800 & 6 & 10 & 0 \\ \hline 14 D Contract & n.2 & 768.3 & 30000 & 17482800 & 6 & 10 & 0 \\ \hline 14 D Contract & n.2 & 768.3 & 30000 & 17482800 & 6 & 10 & 0 \\ \hline 14 D Contract & n.2 & 768.3 & 30000 & 17482800 & 6 & 10 & 0 \\ \hline 14 D Contract & n.2 & 768.3 & 30000 & 17482800 & 6 & 10 & 0 \\ \hline 14 D Contract & n.2 & 768.3 & 30000 & 17482800 & 6 & 10 & 0 \\ \hline 15 D Contract & n.2 & 768.3 & 30000 & 17482800 & 6 & 10 & 0 \\ \hline 15 D Contract & n.2 & 768.3 & 30000 & 17482800 & 6 & 10 & 0 & 0 \\ \hline 15 D Contract & n.2 & 768.3 & 30000 & 17482800 & 6 & 10 & 0 & 0 \\ \hline 15 D Contract & n.2 & 768.3 & 30000 & 17482800 & 6 & 10 & 0 & 0 & 0 & 0 & 0 & 0 \\ \hline 15 D Contract & n.2 & 768.3 & 30000 & 17482800 & 6 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 &$	Task Name \ Description Unit Quantity Unit Cost Fride Duration Fredecessors Fredecessors Freductivity (per Day) Cost Specification 2 Excavations m3 32.65 1000 32.650 7 1 Fredecessors Fredecessors Freductivity (per Day) Cost Specification	Total Pice Duration Pice Duration Specification Task Name / Description Unit Quantity Unit Cost Price Duration Pice		100 m2			30000	328 41	3	aramic of Walls	
Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Productivity (per Day) Cost Specification 2 Excavations n3 352.65 10000 352.650 7 1 1 Foundations(Hard Core,Blinding) n2 227.52 5000 1137600 3 2 1000 352.65 10000 352.650 7 2 Excavations 50 n3 10000 137600 3 2 1000 10000 137600 3 3 10000 137600 3 3 1000 137600 3 3 1000 11 2 13 1000 1000 10 1 2 10 1 2 10 1 <td>Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Predecessors Preductivity (per Day) Cost Specification 2 Excavations m3 332.65 10000 352.6500 7 2 Fredecessors Productivity (per Day) Cost Specification 10000 4 Specification 10000 352.6500 7 2 Specification 10000 1137600 3 3 10000 1137600 3 3 10000 1137600 3 3 10000 1137600 3 3 10000 1137600 3 3 10000 1137600 3 3 10000 1137600 3 3 10000 1137600 10 3 3 10000 1137600 10 3 3 10000 11 2 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 <</td> <td>Tosk Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Predecessors Preductivity (per Day) · Cost Specification 2 Excavations m3 32.25 10000 3526500 7 2 Productivity (per Day) · Cost Productivity (per Day) · Cost Specification Specification 10000 3227.52 30000 2436000 5 10000 3526500 10 3 10000 10 3 10000 10 3 10000 10 3 10000 10 3 10000 10 3 10<!--</td--><td></td><td>100 m.l</td><td></td><td></td><td>2000</td><td>00 003</td><td>3 7</td><td>anan i Finishina</td><td></td></td>	Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Predecessors Preductivity (per Day) Cost Specification 2 Excavations m3 332.65 10000 352.6500 7 2 Fredecessors Productivity (per Day) Cost Specification 10000 4 Specification 10000 352.6500 7 2 Specification 10000 1137600 3 3 10000 1137600 3 3 10000 1137600 3 3 10000 1137600 3 3 10000 1137600 3 3 10000 1137600 3 3 10000 1137600 3 3 10000 1137600 10 3 3 10000 1137600 10 3 3 10000 11 2 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 <	Tosk Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Predecessors Preductivity (per Day) · Cost Specification 2 Excavations m3 32.25 10000 3526500 7 2 Productivity (per Day) · Cost Productivity (per Day) · Cost Specification Specification 10000 3227.52 30000 2436000 5 10000 3526500 10 3 10000 10 3 10000 10 3 10000 10 3 10000 10 3 10000 10 3 10 </td <td></td> <td>100 m.l</td> <td></td> <td></td> <td>2000</td> <td>00 003</td> <td>3 7</td> <td>anan i Finishina</td> <td></td>		100 m.l			2000	00 003	3 7	anan i Finishina	
Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Productivity (per Day) Cost Specification 2 Excavations n3 352.65 10000 352.650 7 2 2 3 <t< td=""><td>Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Predecessors Preductivity (per Day) Cost Specification 2 Excavations m3 332.65 10000 352.6500 7 2 Productivity (per Day) Cost Specification Specification</td><td>Tos Heip Task Name \ Description Unit Quantity Unit Cost Price Duration - Fredecessors Task Name \ Description m3 32.55 5000 3526500 7 2 - Productivity (per Day) - Cost - Specification Area under Foundations(Hard Core.Blinding) m2 227.52 5000 3526500 7 2 - Productivity (per Day) - Cost - Specification - Specification - <</td><td></td><td>33</td><td></td><td></td><td>14000</td><td>735.35</td><td>3 ₹</td><td>aster of Walls & Leilings</td><td></td></t<>	Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Predecessors Preductivity (per Day) Cost Specification 2 Excavations m3 332.65 10000 352.6500 7 2 Productivity (per Day) Cost Specification	Tos Heip Task Name \ Description Unit Quantity Unit Cost Price Duration - Fredecessors Task Name \ Description m3 32.55 5000 3526500 7 2 - Productivity (per Day) - Cost - Specification Area under Foundations(Hard Core.Blinding) m2 227.52 5000 3526500 7 2 - Productivity (per Day) - Cost - Specification - Specification - <		33			14000	735.35	3 ₹	aster of Walls & Leilings	
Task Name \ Description Unit Quantity Unit Cost Price Duration Productivity (per Day) Cost Specification <	Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Predecessors Preductivity (per Day) Cost Specification Specification <ths< td=""><td>Integration Unit Quantity Unit Cost Price Duration Predecessors Preductivity Der Datase 2 Task Name / Description n.3 325.25 5000 137600 3 3 Area under Foundations(Hard Core.Blinding) n.3 227.25 5000 137600 3 4 Foundation Concrete n.3 25.85 10000 137600 3 3 1000 9 0000 10 1 10000 10 1 2 5000 137600 3 3 1000 10000 10 1 2 1 10000 10 1 2 1 10000 10 3 3 10000 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 <td< td=""><td>21</td><td>3</td><td></td><td></td><td>30000</td><td>582.76</td><td>m2</td><td>poling</td><td>=</td></td<></td></ths<>	Integration Unit Quantity Unit Cost Price Duration Predecessors Preductivity Der Datase 2 Task Name / Description n.3 325.25 5000 137600 3 3 Area under Foundations(Hard Core.Blinding) n.3 227.25 5000 137600 3 4 Foundation Concrete n.3 25.85 10000 137600 3 3 1000 9 0000 10 1 10000 10 1 2 5000 137600 3 3 1000 10000 10 1 2 1 10000 10 1 2 1 10000 10 3 3 10000 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 <td< td=""><td>21</td><td>3</td><td></td><td></td><td>30000</td><td>582.76</td><td>m2</td><td>poling</td><td>=</td></td<>	21	3			30000	582.76	m2	poling	=
Task Name \ Description Unit Quantity Unit Cost Price Duration Productivity (per Day) Cost Specification 2 Excavations m3 352.65 10000 352.650 7 1	Task Name / Description Unit Quantity Unit Cost Price Duration Predecessors Productivity (per Day) Cost Specification 2 Excavations m3 332.65 10000 352.6500 7 Productivity (per Day) Cost Specification Specif	Index Help ID Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Predecessors Preductivity (per Day) Cost Specification 2 Excavations m3 352.65 10000 3226500 7 Predecessors Productivity (per Day) Cost Specification	_	۹ m			50000	626.97	m2	ick above DPC	10 B
Task Name \ Description Unit Quantity Unit Cost Price Duration Productivity (per Day) Cost Specification 2 Excavations m3 352.65 1000 352.650 7 2 2 3 2 3 3 3 2 5 000 352.650 7 2 2 3 4 10000 3 2 3 2 3 4 3 4 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 4 4 3 4 3 4 3 4 3 4 3 4 3 3 3 3 3 3 3 3 3 3 4 <t< td=""><td>Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Productivity (per Day) Cost Specification 2 Excavations m3 352.65 10000 352.650 7 Productivity (per Day) Cost Specification Specifi</td><td>Tod Heip Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Productivity (per Day) Cost Specification 2 Excavations m3 352.65 1000 352.650 7 Productivity (per Day) Cost Specification 4 Foundation Concrete m3 656 30000 2436000 5 3 Binding 75 m2 Specification Productivity (per Day) Cost Specification Spec</td><td> <u>-</u></td><td>2.25 m3</td><td></td><td></td><td>10000</td><td>175.93</td><td>2</td><td>PC 24</td><td>9 D</td></t<>	Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Productivity (per Day) Cost Specification 2 Excavations m3 352.65 10000 352.650 7 Productivity (per Day) Cost Specification Specifi	Tod Heip Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Productivity (per Day) Cost Specification 2 Excavations m3 352.65 1000 352.650 7 Productivity (per Day) Cost Specification 4 Foundation Concrete m3 656 30000 2436000 5 3 Binding 75 m2 Specification Productivity (per Day) Cost Specification Spec	<u>-</u>	2.25 m3			10000	175.93	2	PC 24	9 D
Task Name \ Description Unit Quantity Unit Cost Price Duration • Productivity (per Day) Cost Specification 2 Excavations m3 352.65 1000 352.650 7 2 Excavations for and the productivity (per Day) Cost Productivity (per Day) Productivity (per Day) </td <td>Task Name \ Description Unit Quantity Unit Cost Price Duration Fredecessors Productivity (per Day) Cost Specification 2 Excavations m3 352.65 10000 352.650 7 Productivity (per Day) Cost Specification Specification<td>Tools Help ID Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Preductivity (per Day) Cost Scavations Area under Foundations(Hard Core,Blinding) m3 22.55 5000 1137600 32.55 10000 1137600 32.55 10000 1137600 32.55 10000 1137600 32.55 1137600 32.55 1137600 32.54 1137600 33.000 1137600 33.000 1137600 1140000 1137600 114400000 11440000</td><td>-</td><td>1.0</td><td></td><td></td><td>416666 1</td><td>48.12</td><td>2</td><td>ick under DPC</td><td></td></td>	Task Name \ Description Unit Quantity Unit Cost Price Duration Fredecessors Productivity (per Day) Cost Specification 2 Excavations m3 352.65 10000 352.650 7 Productivity (per Day) Cost Specification Specification <td>Tools Help ID Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Preductivity (per Day) Cost Scavations Area under Foundations(Hard Core,Blinding) m3 22.55 5000 1137600 32.55 10000 1137600 32.55 10000 1137600 32.55 10000 1137600 32.55 1137600 32.55 1137600 32.54 1137600 33.000 1137600 33.000 1137600 1140000 1137600 114400000 11440000</td> <td>-</td> <td>1.0</td> <td></td> <td></td> <td>416666 1</td> <td>48.12</td> <td>2</td> <td>ick under DPC</td> <td></td>	Tools Help ID Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Preductivity (per Day) Cost Scavations Area under Foundations(Hard Core,Blinding) m3 22.55 5000 1137600 32.55 10000 1137600 32.55 10000 1137600 32.55 10000 1137600 32.55 1137600 32.55 1137600 32.54 1137600 33.000 1137600 33.000 1137600 1140000 1137600 114400000 11440000	-	1.0			416666 1	48.12	2	ick under DPC	
Task Name \ Description Unit Quantity Unit Cost Price Duration ~ Predecessors 2 Excavations m3 352.65 1000 352.6500 7	Task Name \ Description Unit Quantity Unit Cost Price Duration Fredecessors Productivity (per Day) Cost Specification 2 Excavations m3 352.65 10000 352.6500 7 Productivity (per Day) Cost Specification Height 3 Area under Foundations(Hard Core,Blinding) m2 227.52 5000 1137600 3 2 Excavations 50 m3 10000 Height 4 Foundation Concrete m3 15.44 400000 61760000 10 5 Blinding 75 m2 5000 D1 2 2 1 2 2 1 2 2 2 1 2 2 2 1 2 2 2 1 2 2 2 1 2 2 2 1 2 2 2 1 2 2 2 2 2 2 2 2 1 2 2 2 2 2 2 2 2 2 2 2 2 <td< td=""><td>Tools Help D Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Poductivity (per Day) Cost Specification 2 Excavations m3 352.65 10000 352650 7 Poductivity (per Day) Cost Specification Specification Predecessors Poductivity (per Day) Cost Specification Specification Height Specification Specification<td>3 21</td><td>- - -</td><td></td><td></td><td>375000</td><td>91.19</td><td>2</td><td>ab Concrete</td><td>2</td></td></td<>	Tools Help D Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Poductivity (per Day) Cost Specification 2 Excavations m3 352.65 10000 352650 7 Poductivity (per Day) Cost Specification Specification Predecessors Poductivity (per Day) Cost Specification Specification Height Specification Specification <td>3 21</td> <td>- - -</td> <td></td> <td></td> <td>375000</td> <td>91.19</td> <td>2</td> <td>ab Concrete</td> <td>2</td>	3 21	- - -			375000	91.19	2	ab Concrete	2
Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Productivity (per Day) Cost Specification 2 Excavations m3 352.65 10000 3526500 7 2	Task Name \ Description Unit Quantity Unit Cost Price Duration Fredecessors Productivity (per Day) Cost Specification 2 Excavations m3 352.65 1000 352.6500 7 Productivity (per Day) Cost Specification 3 Area under Foundations(Hard Core,Blinding) m2 227.52 5000 1137600 3 4 Foundation Concrete m3 152.44 40000 6136000 10	Tools Help Tools Help D Task Name \ Description Unit Quantity Unit Cost Price Duration A Predecessors Database 2 Excavations m3 352.65 10000 3325500 7 Productivity (per Day) Cost Specification 3 Area under Foundations(Hard Core.Blinding) m2 27.22 5000 1137500 3 2 Excavations 50 m3 10000 Height 4 Foundation Concrete m3 63.00 35000 23 2 Binding 75 m2 5000 10 2.4	21	15 m3			400000	22.65	2	sams Concrete	<u>6</u>
Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Productivity (per Day) Cost Specification 2 Excavations m3 352.65 10000 3526500 7 2 100000 100000 100000	Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Productivity (per Day) Cost Specification 2 Excavations m3 352.65 10000 3526500 7 Productivity (per Day) Cost Specification 3 Area under Foundations(Hard Core,Blinding) m2 227.52 5000 1376000 2 4 Excavations m3 2000 320000 320000 2	Tools Help ID Task. Name \ Description Unit Quantity Unit Cost Price Duration Predecessors Database 2 Excavations m3 325.65 1000 3325600 7 Productivity (per Day) Cost Specification 3 A cavations (Hard Core, Blinding) m2 2272 2000 312500 3 2 4 Constantion m2 2272 2000 313700 3 2 Excavations 50 m3 10000 Height 3 Constantion m2 2272 2000 313700 3 2 Excavations 50 m3 10000 Height	2	75 m2			400000	15.44	25	olumns Concrete	<u>.</u>
Task Name \ Description Unit Quantity Unit Cost Price Duration	Task Name \ Description Unit Quantity Unit Cost Price Duration Predecessors 2 Excavations m3 352.65 10000 352.650 7	Tools Help ID Task Name \ Description Unit Quantity Unit Cost Price Duation Predecessors Database 2 Excavations m3 325.65 10000 3325600 7 Predecessors Productivity (per Day) - Cost Specification 2 Excavations m3 325.65 10000 3325600 7 Predecessors Productivity (per Day) - Cost Specification	N LEG	cii UC			25000	227.52	3 2	ea under Foundations(Hard Core,Blinding)	× ω π >>
Task Name \ Description Unit Quantity Unit Cost Price Duration - Predecessors - Productivity (per Day) - Cost	Task Name \ Description Unit Quantity Unit Cost Price Duration ▶ Predecessors Productivity (per Day) Cost	Tools Help ID Task Name \ Description Unit Quantity Unit Cost Price Duration ▲ Predecessors Database Productivity [per Day] - Cost Price Duration ▲ Predecessors Productivity [per Day] - Cost Price Duration ▲ Predecessors Productivity [per Day] - Cost ■ Productivity [per Day]		3.			10000	352.65	52	cavations	2 N
			Specification	Productivity (per Day) - Cost	T				Unit	ask Name \ Description	

Figure (5) Output of InCADEP

Assist. Prof. Dr. Sawsan Rasheed Mohammed Ehab Fadhil Mohammed Ali

Development of an Integrated Construction Management System for Building Estimation

Figure
۹
MS
Excel
window

-

-	Ready		28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	00	7	6	S	4	ω	2	1			Paste	_ •		
🦖 start		1																											IJ	BOQ	A	Clipboard		Copy	Home	5
🔁 CIS 258		Sheet1 Sheet2 Sheet3 2	Window3 : 1.6 x 1.5	Window2 : 0.5 x 0.6	Window1 : 1.1 x 1.2	Door6 : 2.1 x 0.8	Door5 : 2.1 x 1	Door4 : 2.4 x 1.5	Door3 : 2.1 x 1.5	Door2 : 2.1 x 1	Door1 : 2.4 x 1.5	Doors and Windows Works	Floor Ceramic	Floor Tile1 30 x 30	False Ceilings	Ceramic of Walls	External Finishing	Cement Plaster of Walls & Ceilings & Ext	Plaster of Walls & Ceilings	Roofing	Brick above DPC	DPC 24	Brick under DPC	Slab Concrete	Beams Concrete	Columns Concrete	Foundation Concrete	Area under Foundations(Hard Core,Bling	Excavations	Description	в	d 🕞 Font	Serverat Painter	Calibri	Insert Page Layout	 < (³) <
📁 Pictures of my thesis			æ	D.	e	e	n	n	r.	o	n								_		_											S	 - A 	11 × A A	Formulas Data	
thesis			each	each	each	each	each	each	each	each	each		m2	m2	m2	m2	m2	m2	m2	m2	m2	<u>m.</u>	m3	m3	m3	m3	m3	m2		Unit Q	C				a Review	
🔊 Pro			Þ	1	2		2	2		4			4.24	463.33	170.66	328.41	628.12	723.71	736.36	582.76	660.54	175.93	48.12	91.19	22.65	15.44	69.6	227.52	352.65	luantity	D	Align		™	ew View	
😭 Project1 - Microsoft V			290000	50000	160000	150000	190000	320000	275000	200000	325000		30000	1000	20000	30000	30000	14000	12000	30000	50000	10000	416666	375000	400000	400000	350000	5000	10000	Quantity Unit Cost	m	Alignment		🛱 Wrap Text	ew	
			290000	50000	320000	150000	380000	640000	275000	800000	325000	0	127200	463330	3413200	9852300	18843600	10131940	8836320	17482800	33027000	1759300	20049968	34196250	9060000	6176000	24360000	1137600	3526500	Price	п		🚘 Merge & Center 🔹) Text		Incat
108 InCADEP - [43.dwg]																															G	Number	• • • • • • • • • • • • • • • • • • •	General		InCADEP - Microsoft Excel
🛛 🔀 Microsoft Excel - In																															_ _	Styles	Conditional Format Formatting			
inC																															×		t Cell ≥ × Styles ×			
🔁 Microsoft Project - In																															M	Cells	Insert Delete Format			
EN 🛐 🛱 🔇 🦁 10:22 AM																															и 0	Editing	4	E AutoSum *		
< 😵 10:	Q																														P		Sort & Find & Filter ▼ Select ▼	3	© 1	
22 AM	Ð		•															10)13)											•				u ×	a X

 \bigcirc

Number 9