Computer-aided design in a contracting company

Computer-Aided Design in a Contracting Company

D.K. Doran

1. Introduction

Wimpey is a large Group of Companies, mainly connected with Construction but also involved in a number of fringe activities. The spectrum of construction tasks covers the following wide field:

Housing (Public & Private Sector)
Commercial (Office Complexes)
Industrial (Warehousing & Factories)
Process Plants
Open Cast Mining
Civil Engineering
Marine Work
Offshore

This work may be in the UK or almost any country abroad.

The first known use by designers of computers was to assist in the structural design of the QE II Tattersalls grandstand at Ascot race course in 1959.

To support such complex operations it is necessary to employ specialists, many of whom are involved in the design of permanent or temporary work. The range of disciplines and sub disciplines involved include - Architects, Civil, Structural, Mechanical, Electrical, Process, Services, Chemical engineers and Surveyors. Most professional departments have departmental computer facilities: almost all have links with mainframe machines centrally housed in the Management Systems Department. Links also exist with external bureaux so that a wide variety of hardware can be marshalled at short notice.

A list of departmental systems is indicated in figure 1.

2. Computer Systems

As indicated above Wimpey deploys mainframe, mini and micro configurations. Since there is no universally agreed definition of these types, I have used the following for the purposes of this paper.

Mainframe: 32 bit word lengths
Mini: 16 bit word lengths
Micro: 8 bit word lengths

At the technical heart of the mainframe establishment there is a VAX 11/780.

A typical minicomputer such as I have in my own Civil & Structural Design Department consists essentially of a PDP 11/34 with 1 No.128K memory; 8 No. visual and graphics display terminals, printers and a drum plotter. This is soon to be upgraded to include a VAX 11/750 and an electrostatic plotter.

Additinally a considerable number of Wimpey Standard Micros are deployed throughout the Group.

The ratio of machines to engineers is not easy to define but in my own department comprising 165 engineers and technicians there are 8 No. terminals where engineers have direct access to the departmental equipment and indirect access to the facilities outlined above.

3. Typical Design Job

3.1 In-situ R C Flat Slab Block

In such a job almost all the analysis would be handled by the computer including a finite element analysis of the flat slabs. At present the general arrangement drawings would be hand draughted although we are examining the virtues (and vices) of the DOGS (Drawing Office Graphics Systems) program which would permit these drawings to be produced by machine. Using the C & C A Bard software we would then produce on a elemental basis the reinforced drawings for the flat slabs. This program also produces the bar cutting and bending schedules from the same database.

We also have available the highly interactive BCS software based on Jalut's original work more than a decade ago. This is a program which handels the whole process of analysis, design draughting, scheduling and quantities. It is, however, somewhat cumbersome to use and is only at its best on rectilinear highly repetitive structures. Although a very powerful system it depends on the setting up of an elaborate database before any tangible results can be obtained.

3.2 Timber Frame Housing

The basic structural concept for this type of housing is very simple.The promulgation of this concept is highly repetitive and involves the design and detailing of many similar elements which only differ marginally from one another. One therefore has a prime candidate for a computer based system. By putting together analysis, draughting and wordprocessing packages we have developed a system which shows clear advantages in design/detailing costs and turn round time. Given a clear run and working from completed architects drawings it is possible in a 24 hour cycle to produce high quality structural drawings for a complete house type backed up by the necessary calculations for building regulation approval.

4. Future Evolution

In Wimpey the evolution of computers has been away from the central "black box" concept towards more decentralisation where the end user comes increasingly into a "hands on" situation. With the reduction in real term hardware costs there is no reason why this trend should not continue. A colleague of mine prophesied some years ago that we would develop to the stage where each designer had a computer adjacent to his drawing board. Perhaps one question I would raise is whether the drawing board will eventually disappear in the wake of computer based graphics systems.

USER	EQUIPMENT	SYSTEM	TYPE	PRINCIPAL APPLICATION
Architects	Univac	AD380	Drawing	Production of working drawings for houses.
Architects	Hewlett Packard	SIMAP	Modelling	Analysis of building performance including heat loss/heat gain and lighting.
C&SDD	DEC	BCS	Modelling	Analysis, design and detailing of reinforced concrete column/beam/ slab buildings.
C&SDD	DEC	PAFEC/PIGS	Modelling	Analysis of large and/or complex structures.
C&SDD	DEC	BARD	Modelling	Design and detailing of reinforced concrete structures.
C&SDD	DEC	DRAGON	Drawing	Production of working drawings for timber framed houses.
Laboratories	DEC	PAFEC/PIGS	Modelling	Analysis of large and/or complex structures.
Laboratories	DEC	OFFPAF	Modelling	Analysis of large and/or complex offshore structures.
Laboratories	DEC	TASS	Modelling	Comprehensive analysis of the thermal performance of buildings.
Laboratories	DEC	SLS	Modelling	Analysis of soil structures.
ME&C	Prime	PDMS	Modelling	Overall management and control of data on process pipework projects, production of fabrication schedules and drawings via interfaces with other systems such as COMPAID.
ME&C	Prime	GW2D	Drawing	Production of piping and instrumentation diagrams, electrical schematic drawings.
ME&C	DEC	WASPS	Modelling	Analysis of stress and deflections in process pipework.
Surveyors	Data General	CALSID	Modelling	Analysis, adjustment and plotting of traverse and survey detail. Infrastructure design. Generation of setting out data and estimation of quantities.
Surveyors	Data General	SIDS	Drawing	Production of finished survey plots, standard details and estate layouts.

Figure 1: COMPUTER AIDED DESIGN IN WIMPEY