MULTI-PARTICIPANT PROJECT INFORMATION MANAGEMENT SYSTEM

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Abstract
This paper examines how information technology is contributing in a significant way to the management of construction projects. The deployment of a project information management system (PIMS) was a mandatory requirement on the construction phase of 'Route 3, Tsing Yi and Kwai Chung Sections', which is an important element of Hong Kong Government's airport core programme of projects (ACP).

The paper reviews the concerns of the Client for the ACP and how the PIMS contributed to alleviating them. It includes comments, based on empirical evidence, on the implications for the change which is needed in the construction industry as it migrates from paper-based systems to computer-based information technologies. In particular the need for adherence to quality-assured site procedures within a construction process which is traditionally highly differentiated and transitory in nature.

Analysis of data and consideration of the issues, arising from the use of the PIMS in the control of costs, settlement of disputes and in the dissemination of information, provides guidance, which is relevant to a deployment of PIMS in the future.

Keywords*:* construction; project-management, information management-systems.

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INTRODUCTION

'Route 3 - Tsing Yi and Kwai Chung Sections' is one of the ten major elements of the Hong Kong Government's airport-core-programme of projects (ACP): the West Kowloon Expressway is another. They share a common background which is described in a paper presented by Boughton, Futcher and Torbet at this conference [1]. The details are not repeated here, however, the main points are re-stated.

The ACP is a complicated, multi-project programme of interrelated projects; in which the degree of interrelationship among the many participants and contracts is extreme. The cost, US$ 20.3 billion; its massive scale; and the politics of the moment, on the eve of the change of sovereignty, mean that it is essential that the Client for the ACP is directly involved in the key decisions throughout the programme life-cycle. Foremost among the Client's decisions, was the adoption of a strategy which would avoid an increase in cost, particularly uncertain costs due to litigation arising from construction disputes.

Project control requirements were imposed by the Client on the 'Employer' and his consultants, through project control procedures issued by the Client's project management advisors, the New Airport Projects Coordination Office (NAPCO) [2]. They set out the requirements for controlling: costs and the schedule-of-work; for timely reporting, including cost-trends; changes; bringing up to date progress; and a standardised format for reports to NAPCO. These procedures state what was to be provided in the way of information management *to meet the information needs of the Client*. Capped budgets were applied and, wherever possible, contracts were let on a lump-sum, fixed-price basis. A form of contract, the ACP Model Form of Contract, was drafted by the Client's legal team to set out the terms to achieve a much greater assignment of risk to the Contractor. In a departure from the Employer-Engineer-Contractor relationship incorporated in the traditional form of procurement, the ACP Form of Contract required that the Engineer obtain the Employer's agreement or direction, with regard to the key decisions on cost, time, quality and the other fundamental issues of each project. This allowed the Employer much greater control over inter-project interfaces than otherwise possible. The ACP Model Contract also set out an innovative time-limited process for the resolution of disputes.

PARAMOUNT NEED FOR INFORMATION MANAGEMENT

Notable among the Client's requirements, which were incorporated in the ACP Model Form of Contract, are those to do with 'dispute resolution and claims settlement' These provided a mechanism in which disputes would be resolved quickly, however, the process depended on two things: retention of all relevant documents and their rapid retrieval.

Lawyers writing this mechanism into the ACP Form of Contract were aware of cases of arbitration and litigation in the US, where information technology had been deployed for document discovery with considerable effect on the outcome of the case. This became a local phenomena in the late 1980's, when Parkview Development Co used information technology for the discovery of evidence during an arbitration**.** Luk and Wong [3] describe the use of database and scanning technologies when preparing for the case and its further use during the hearing. They understate its over-whelming impact, "If the opponent is not using such a computer information system they could be at a great disadvantage due to the high speed and great detail that could be achieved in accessing the relevant information by the party that is using the system".

As a result of these concerns, in 1992, the Secretary for Works requested a study leading to recommendations on how to deploy information technology to the Client's advantage on the ACP [4]. It was recommended that a project information management system (PIMS) should be used on the construction sites of the ACP to assist inter alia in the settlement of contractual disputes.

As a result of this initiative, the Client's requirements for the deployment of information technology in support of construction management was to meet two needs. One, it had to support the traditional project-management tasks of planning, monitoring, reporting and control of baselines of scope, cost, time and quality; along with trend forecasting and change-control mechanisms. Two, it should manage documents in a manner that would track issues, provide fast retrieval of relevant documents and support the time-limited process for the resolution of disputes. How this was to be done was left to the discretion of the Works Agents nominated as the 'Employer' for each element of the ACP.

THE HIGHWAYS DEPARTMENT APPROACH TO PIMS

Boughton et al [1], explain how the West Kowloon Expressway element of the ACP was assigned to the Highways Department: in a similar manner they were also assigned 'Route 3 - Tsing Yi and Kwai Chung Sections'. As Works Agent for the project, they stated a number of operational requirements and organisational arrangements for the management of the construction Contracts. English [5] provides a good description of these arrangements and their underlying purpose. Figure 1 shows the organisation structure, which is complicated by the many Contracts included within the project. The Construction Manager is a site-based project management advisor to the Employer, for the purposes of decision support, so as to aid the Employer's participation as defined in the ACP Model Form of Contract. The PIMS is supplied by the Construction Manager as part of his role as the Employer's 'eyes and ears' on the site. The traditional channels of communication remain intact - the Construction Manager taps into these to fulfill his required role.

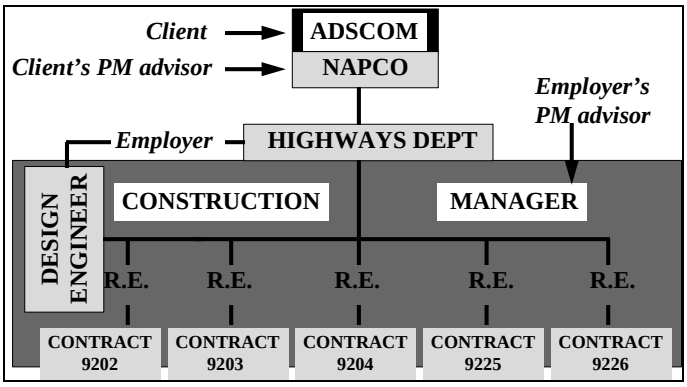

Figure 1 Organisation structure

On the subject of information technology English [5] had this to say,

> . . . A computerised . . .PIMS. . . is being developed which will encompass all parties involved in the various aspects of construction management. . .A requirement to adopt this technology *has not* [our italics] been incorporated into the construction contracts although the contractors are an integral part of the . . .information process. . . .It . . .will provide a much greater level of direct construction management of the project than has been . . .possible. Information will be available throughout the organisation the instant it is entered into the system instead of . . .days or weeks . . .as has been the case.

Features of English's model PIMS are listed in Table 1, however, in the briefing document, which appoints a consultant to the role of Construction Manager, the specification for the PIMS is made generic to suit a wider range of proposals.

Table 2 lists the revised features for the PIMS to be satisfied by the Construction Manager.

THE ROUTE 3 ACP PROJECT [6]

The 'Route 3 - Tsing Yi and Kwai Chung Sections' project, links the Lantau Link suspension bridge, which carries road and rail traffic to-and-from Lantau Island, with

Feature	*Detail*	*Provided in the R3 PIMS?*
Correspondence register	**Include matters which have a material impact on the project**, including cost, time-schedule, quality, safety, environmental impact.	**YES,** a full profile of all correspondence with 'from' 'to' trace. Optionally, full text can be held.
Documents register	**Include issued documents**, including drawings, revisions	**YES,** registers the planning, schedules, production, issue and trasmittal.
Budgets	**Include matters-of-fact about cost**, including forecasts, variations, use of provisional sums, time extensions.	**YES,** the data is integrated across budgets, contracts, payments, adjustments and forecasts
Checklists	**Actions and/or time defined procedures**, including QA for management control	**YES,** user defined with integration between schedules and actions.
Action Lists	**Include a Register of action requests/reactions** with audit trail of the resulting process.	**YES,** an 'umbrella' facility available from all the modules. Produces exception reports.
Standard Forms	**Include a Style library** and proforma for **EDI**	**YES,** user defined
Non-conformance register	Capture matters-of-fact about materials, workmanship and obligations	**YES,** user defined, applied to quality manangement. Includes a register of non-conformance.

Table 1 Original requirements for Highways Department PIMS.

Feature	*Provided in the R3 PIMS?*
"Provide readily available project information, with document control, accessible to all participants, subject to restrictions on the dissemination of confidential data;"	**YES,** with 12 levels of security and all participants linked including some of the contractors.
"assist in avoiding delay in transmitting instructions, decisions and information;"	**YES,** provides electronic dissemination of information, if and when required.
"provide an audit trail of actions and responses for all contract management purposes:"	**YES,** including an audit of changes to data which registers the data and reason.
"disciplined adherence to control procedures:"	**YES,** by provision of systematised data capture, monitoring and reporting.
"provide systematic acquisition of project management data."	**YES,** by provision of systematised data capture, monitoring and reporting.
"preparing a project cost control plan and cost management system as an integral part of the PIMS;"	**YES,** data is integrated across budgets, contracts, payments, adjustments and forecasts.

Table 2 PIMS specification given to the Route 3 Construction Manager.

the West Kowloon Expressway. It has three parts: a twin-bore tunnel 1.6 km long drilled through rock, in fact the twin three lane road tunnel will be the largest in Hong Kong; a five-span bridge 0.5 km long, carrying six lanes of traffic; and a 3 km viaduct, carrying eight lanes of traffic, and the railway, passing through the congested areas of NW Kowloon. The length of the new highway is 7 km. It will cost US$ 0.52 billion. The project is split into three civil engineering Contracts, one for each of the parts described, plus two Contracts for electrical and mechanical works to the tunnel. Each Contract is autonomous with discrete teams of engineers carrying out Supervision-in-chief on behalf of the Employer. The Construction Manager watches

Contract No.	*9202*	*9203*	*9204*	*9225*	*9226*
Name	*Cheung Ching Tunnel & Associated Roads*	*Rambler Channel Bridge & Assoc. Roads*	*Kwai Chung Viaduct*	*Cheung Ching Tunnel - Tunnel Ventlation & Central Monitoring & Control Systems*	*Cheung Ching Tunnel - Tunnel Services*
Main Contractor	*Dragages et Travaux Publics*	*Dragages-BSG-Penta Joint Venture*	*SOGEA -Campenon Bernard-Franki Joint Venture*	*Balfour Beatty Ltd.*	*GEC (HK) Ltd..*
Type of Contact	*Lump Sum*	*Lump Sum*	*Lump Sum*	*Lump Sum*	*Lump Sum*
Inherent Risk	*high*	*high*	*very high*	*low*	*low*
Start	5-Mar-93	5-Jun-93	3-May-93	1-Apr-94	1-Feb-94
Finish	28-Jan-97	3-Jun-96	30-Sep-96	28-Jan-97	28-Jan-97
Duration (Days)	1425	1094	1246	1017	1077
Contact Value (US$M)	$108.93	$80.38	$286.13	$6.30	$15.69
No. Drawings	1365	1451	17487	217	315
No. Correspondence	27420	25700	46000	3180	5084
No. (formal) Actions	6100	5625	19820	321	450
No. Variation Orders	135	225	548	9	14
No. Adjustments	1276	1285	2498	30	74
No. Claims	51	85	316	2	6
No. Disputes	5	5	24	0	0
No. Mediation Requests	2	1	14	0	0

Table 3 Comparisons between the Contracts in the Route 3 project.

over the Contractors and Supervisors-in-chief, deploying a PIMS as a means of monitoring this differentiated and sentient group of participants. The degree of differentiation and sentience can be gauged from the data given in Table 3.

PIMS CONFIGURATION

The PIMS implemented by the Construction Manager serves the participants shown in Figure 1. The PIMS has terminals in each of the Contract site offices and in the Highways Department. The system configuration is shown in Figure 2. There are 106 terminals clustered around a total of nine servers accessed by 186 users. 64 Kbytes dedicated data-lines link the servers. Terminals are 486DX/33Mhz machines, LAN servers are the same, but the PIMS servers are HP9000/800 series. Telecommunication costs are kept low and, if the dedicated lines fail, they can be switched to modems. The back-up server is low cost, but is sufficient for a daily back-up of data at a central server. PIMS software is listed in Table 4. The focus of the PIMS is the CLIENT^{TM} software, which is an information management software designed for the construction industry. Using a proprietary software on a construction project, often causes lack-of-fit problems due to the unique nature of construction. In this case, the dilemma is avoided by using features within the software which enable non-programmers to customise the database, the user interface, and the reports to suit the project. This is important. At the outset of construction, data-flow, style, format and procedures are not known. The PIMS must cater to standards and processes as they are created and as work patterns develop among the participants in the process.

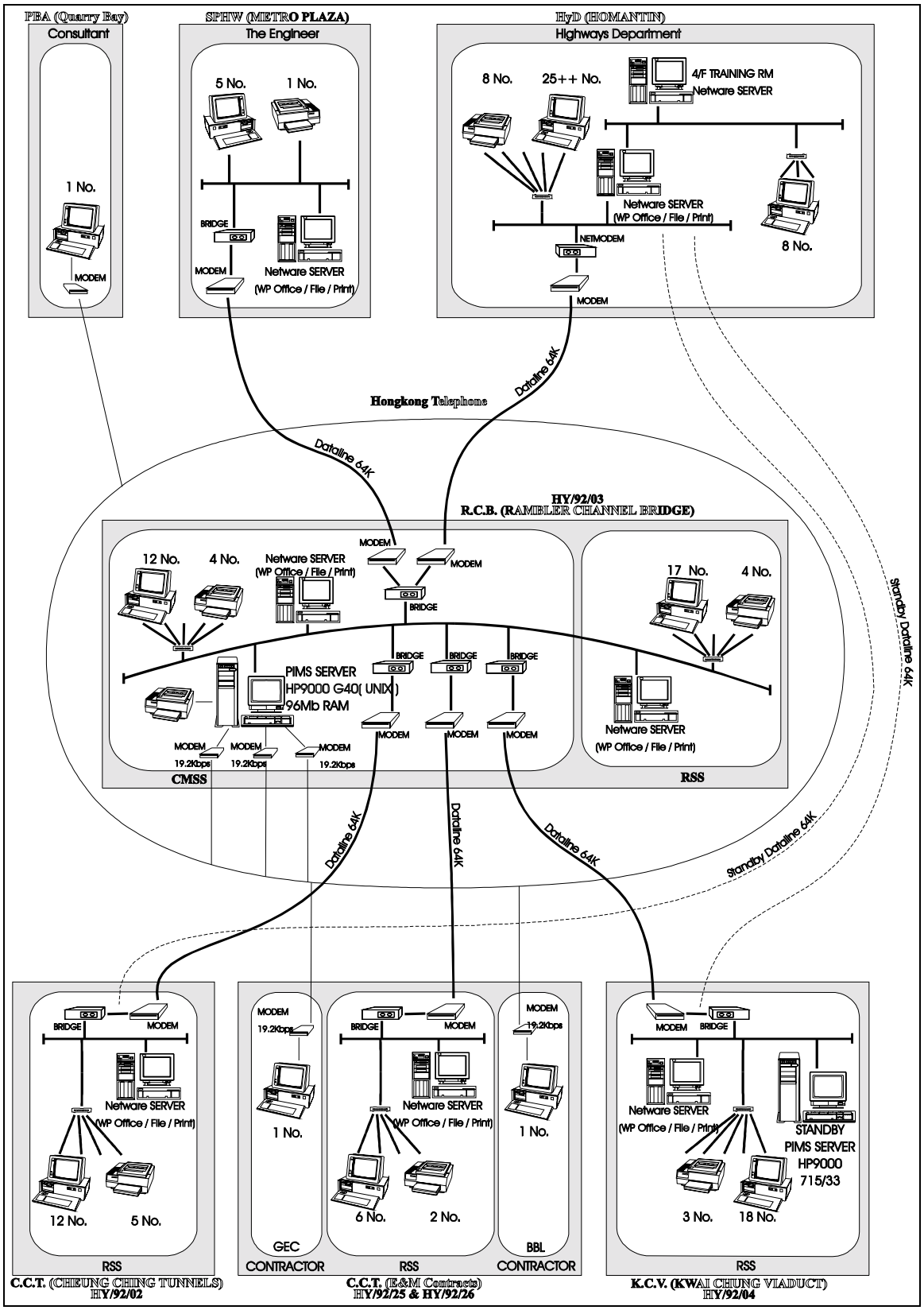

Figure 2 Configuration of the Route 3 PIMS

If not, the users are forced to conform to too rigid a system; a situation that causes dissatisfaction and resistance to acceptance of the technology.

Item	Purpose
Novell Netware™	*network communications*
LAN for Workgroups™	*terminal emulation, file transfer, network and printing support*
Microsoft Windows™ 3.1	*PC operating system*
CLIENT™	*project information management*
WordPerfect OFFICE™	*e-mail*
WordPerfect for Windows™	*wordprocessing*
LotusTM/Excel™	*spreadsheets*
Graphite™	*transfer of CLIENT™ data to a third party*
HP UNIX™	*operating system*
UNIVERSE™	*post-relational database used for CLIENT™ application development*

Table 4 Route 3 PIMS software

ROUTE 3 PIMS FUNCTIONALITY

Data is recorded in the PIMS and reports are generated from that data in terms of eight 'features'. Seven features are listed in Table 1, the eighth is a feature called 'delays and extensions of time'. This registers milestone dates and any subsequent adjustment to them. In practical terms, these features serve the forward-planning information requirements of the three principal elements of traditional project management: time, cost, and quality. They are designed to meet the planning, monitoring and reporting needs of the participants on each Contract, and the Construction Management overall, as shown in Table 5.

TIME	• Actions • Delays • Key dates • Milestones	⇒ *individual or organisational actions* ⇒ *claimed delays or merely recorded*
COST	• Budgets • Adjustments • Provisional sums • Payments • Cashflow forecasts	⇒ *for cost-centres and other items.* ⇒ *claims, variations and remeasurement* ⇒ *interim and otherwise*
QUALITY	• Correspondence • Drawings • Specifications • Standard Forms • Checklists • Safety	⇒ *letters, instructions, memos.* ⇒ *amendments* ⇒ *quality standard and conformance* ⇒ *permits, test results, authorisations* ⇒ *minutes of meetings, action lists* ⇒ *incident reports, statutory notices*

Table 5 Using PIMS data for project management purposes on Route 3.

USE OF INFORMATION TECHNOLOGY AS A MANAGEMENT TOOL

At start of construction

The three civil engineering Contracts and the Construction Manager started at much the same time. The two E&M Contracts followed on later. This concurrent start was an opportunity for the recording of project data from the outset of construction.

Within three weeks of appointment, the Construction Manager set up the PIMS software in a stand-alone PC and commenced the entry of back-data and the recording of project correspondence, as it arose. It was possible to do this, because items are recorded in terms of their "from" and "to" addressing. A third-party can act for participants not yet connected to the system. This is useful because it enables a few trained staff to take on the initial data management tasks, whilst the full system is installed and novice users are trained

In general, the project staff were novice computer users with no keyboard skills, but a few had some years experience in using information technology. They expressed frustration at the absence of a 'MSWindows' user interface and did not readily accept the use of the UNIX-based product. However, the PIMS was a proven product able to meet new requirements, as they were identified. As a result, user acceptance grew rapidly after a short period of reluctance. This is reflected in the linear growth of document registrations on all the Contracts from start of construction (Figure 3). Secretarial staff required a brief period of training and then took up the responsibility for data entry. There was no need for a high degree of skill in information technology, although it is essential for a fast-start to have someone on site who is suitably qualified to manage the system, supervise the roll-out, provide training and to 'champion the system', so as to win over reluctant users.

The question of paper-based rather than electronic documents

It was apparent at the outset, from an examination of the physical documents already produced on site, that it was not going to be practical to provide a fully electronic PIMS on the project. The various participants used a variety of technology, a range of software, or none at all. The attachments to documents were often drawings, photocopies, proforma on a range of media and format, whose capture in an electronic form would require elaborate scanning techniques. It was thought more productive to win acceptance of a standardised approach for the management of the construction data than to force change to an electronic-office approach for the management of multi-participant, multi-contract civil engineering works.

A factor which sealed the decision for a 'paper based system', was the problem of admissibility in court of electronic evidence: proving with certainty the authenticity of a wholly electronic document requires system security and a permanent audit trail of transmittal. The simplest way to remove any doubt was to "maintain the paper". This approach is in keeping with the Employer's instructions to his in-house staff.

Phased implementation of modules

The modular nature of the PIMS software permitted customisation of the software to suit specific needs as they arose; phased implementation; and selective training, which was given progressively to different groups on a need-to-know basis. Priority was given, to the capture of correspondence and then to the capture of costs. Implementation of the other modules followed-on. It is reasonable that they should have been given a lesser priority: 'quality management' arose as works progressed; 'standard forms' were developed as the need arose; and, on the other hand, the peak period for 'document management', that is multi-use documents subject to periodic revision and controlled issue, had passed with the design phase of the project.

Full participation from the users occurred, when the implementation was pervasive enough to become the norm for retrieval of data (i.e. when access was readily available to all and when recorded data had reached a critical mass) and with

the realisation of productivity benefits to the user. The benefits were due to the adoption of systematised processes for accurately capturing the data at its source, once-and-once-only, and rapid reporting using validated data, as well as the instant availability of ad hoc information from the system. The PIMS was also able to export information across a wide-area network. In this manner, claims data was routinely exported to the Client's project management advisor, which allowed them to manage the overall costs of the ACP. The consequential consistency and the timeliness of data were highly regarded by all participants. It eased tensions and helped develop an environment in which issues could be more readily addressed, because the data was not challenged.

If the PIMS is available at the conception of the project, then the data bases of documents could be used as source for the replication, dissemination and management of controlled information from the outset. Such a head-start approach, in a multi-participant project, removes the likelihood of misinformation being passed on, or decisions being made on the basis of superseded data.

The graphs of data capture in Figure 3 demonstrate that contracts, with higher value and risk, have a greater volume of data and consequent use of PIMS. 'Actions' in particular, are a reflection of the acceptance by the users of the system.

User acceptance

By the time the systems were ready for use, many management processes were well entrenched, especially the use of typewritten correspondence. The site staff were reluctant to give up their spreadsheets until it was proven beyond doubt that the PIMS results were correct. Most of the Contractors did not want to participate, therefore the Contractor's correspondence was registered on PIMS by the recipients.

This lack of participation on the part of the Contractors is a concern. Their cooperation was not required under the terms of the Contract and they could not be forced, or persuaded, to cooperate upon the implementation of PIMS: they deemed it to be too late. The E&M Contractors did, however, cooperate in the joint use of the 'correspondence' and 'document management' modules, principally because these Contracts started later and the invitation to use the system came before their management processes were firmly established.

There also was some reluctance from the other participants: the Employer's office and the Resident Engineers offices. This was quickly overcome. Participants who lacked computer skills, were given support, leadership and encouraged to "give it a go". As a result, the PIMS won broad acceptance and has been acknowledged as making information easier to find, faster to retrieve and more reliable in its content. Monthly reporting of costs, in 'real-time', has been achieved through the use of the PIMS. These same reluctant participants, new to information technology, have since expressed concern for their ability to manage effectively on the next project, should they have to revert to traditional manual methods of project management.

USE OF THE PIMS

Correspondence and action tracking

The implementation of the first modules of PIMS, 'correspondence' and 'actions', provided an on-line electronic register of the attributes of the physical correspondence sent, or received, by those offices using the system.

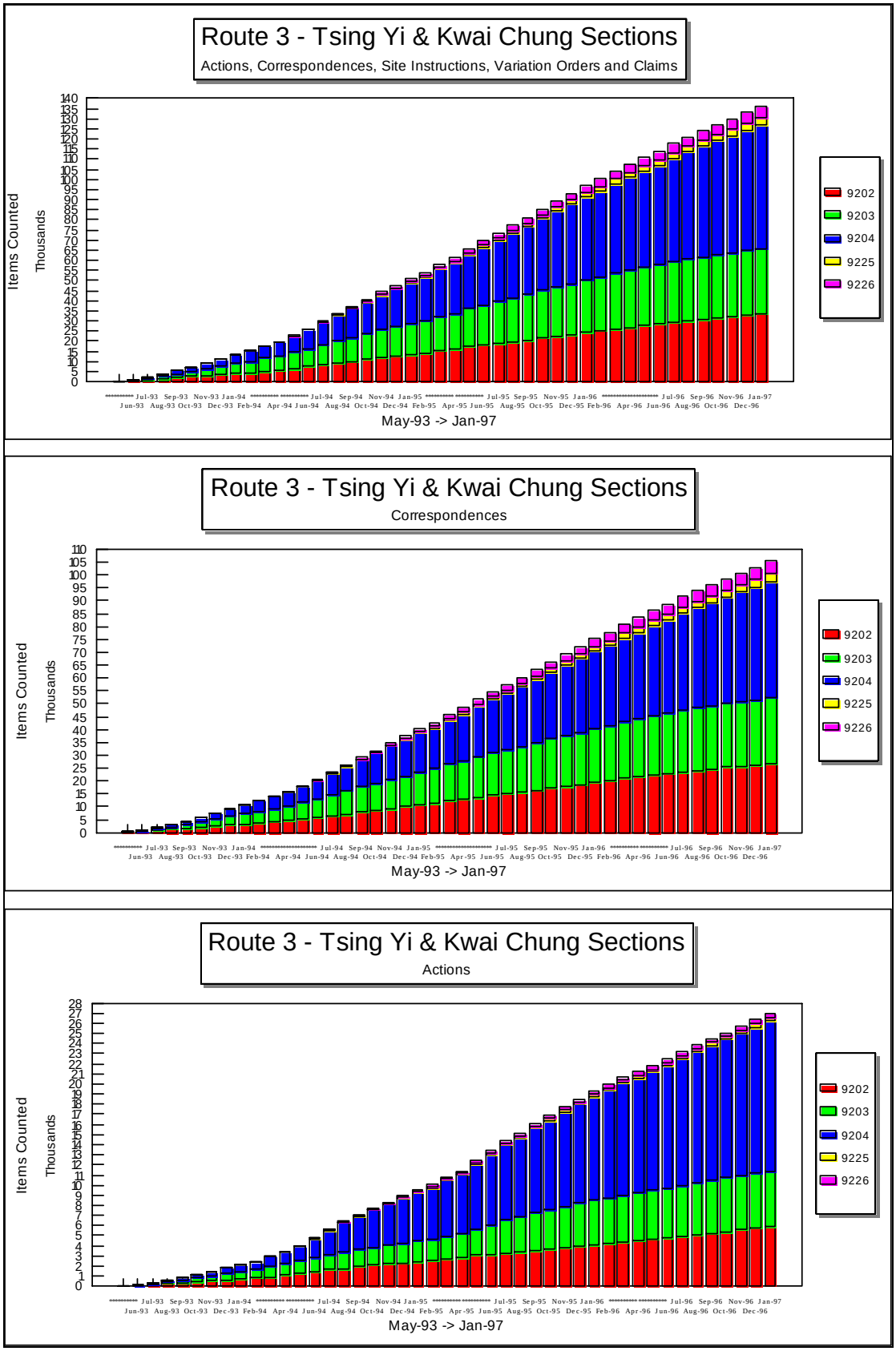

Figure 3 Cumulative registration of data on the Route 3 PIMS.

Systematised registration procedures from the outset ensured that close to 100% of all project correspondence was registered. When 'correspondence' is accompanied by the use of 'actions list', it becomes a tool for managing actions and for monitoring the prescribed response. A feedback response is defined by the

initiator, so that the response is monitored and reported, if not completed according to plan. This facility gives an assurance to management that the requested actions have been taken when specified, as well as providing an audit trail of compliance. In spite of the good intention, it was not applied by-all, for-all. Initially, across the five Contracts, the number of actions raised was twenty percentage of the correspondence items. From May 1994, the PIMS was fully implemented within the offices of the Resident Engineers and the 'actions' initiated were about forty percentage of the correspondence registered. This usage is considered low: if the feature was being used as intended, then the percentage should be one hundred or more.

Even though the full text of the correspondence was not on the system, the 'string search' function within the software did achieve rapid identification and thus retrieval of documents. The Client's technical instructions were, however, loaded onto the PIMS, so that full string search could be used for rapid retrieval of relevant technical information. A recent survey of users confirmed that they wanted the full text of all correspondence, or at least the covering document, to be on the PIMS.

Cost management

The most significant impact of PIMS on the Route 3 project is the use of the 'cost management' module. The system identifies the potential impact on the forecast final cost, the moment the cost variation is identified. Another view of the module, which is separately controlled by security and access rights, updates the data directly-relating to the Contract. Automatically, any document affected by a revision in costs is revised within PIMS - thereby capturing all potential impacts, along with an audit trail of the change, on a real-time basis. An unlimited number of documents may be defined by the user to react in this manner.

Production of payment certificates is achieved at a keystroke. This has demonstrated the advantage of a structured-database compared to the flexibility of a spreadsheet, where there is a constant need to validate each item of data. With one system and one set of programmes, any errors or miscalculation are minimised through rigorous testing and checking prior to implementation. Consensus was achieved when defining the algorithm, which was then incorporated into the system, so that all users automatically follow the agreed methodology.

In addition to the detailed fundamental cost information, the user can add supplementary information to 'cost' related documents. For example, the details of all claims by the Contractors are entered, when the claim is lodged. The Employer, or others, may add further commentary as necessary, thereby providing a history and current record of the claim without referring to the physical correspondence. A cross reference and/or file reference to the physical correspondence is also recorded to provide ready-reference to the hard copy document, should it be needed.

Time management

As this is an integrated system, claims for time extensions, or site instructions with a potential to incur a time delay, are recorded, when the Contract adjustment is first identified. The delay claims are recorded independently of the construction programme and are maintained in a similar fashion as claims for cost.

Integration of PIMS information with the critical-path-network is by manual methods. It is not recommended that extensions-of-time or delays are automatically rolled into a revised time analysis of the work-schedule, because the work deadline can often be recovered by some other action. It is important, for reasons of contract management, to keep a register of the accumulation of delays and extensions of time.

CONCLUSIONS

The PIMS cost 0.37% of the value of the Contracts managed. In terms of the Contractors' claims, which were in excess of US$ 100 million (Contractors' assessment), the cost of PIMS is less than 2% of the value it is used to defend. These costs also include the specialist staff employed on the project, to set it up and to manage the information system over the life of the project.

Whereas the cost of the PIMS to help manage project information can be measured, the effect it has had on countering claims, avoiding disputes or concluding successful mediations is a subjective assessment. Nevertheless, it is considered that the PIMS on Route 3 did achieve the objectives of the Client and the Employer. The identification and rapid retrieval of documentation has assisted the reporting to the Client and the successful planning and resolution of contractual disputes by the Employer.

This project is complicated in terms of work content, organisational arrangement and overall ambition for a rapid construction process. The project finished on time and will be within budget, to the satisfaction of the Employer and the Client for the ACP. It is a difficult, but successful, project, in which information technology has been imposed on a technology-averse audience, developed in a planned fashion to cater for procedural requirements as they arose over the life of the project. It has provided a forward-looking tool for the management of cost and time, along with a historical record of all the documented dialogues and transactions that occurred throughout the construction period. The record remains for future reference.

REFERENCES

[1] Boughton, G., Futcher, K., Torbet, E., 'Project-information-management-systems deployed in anticipation of disputes on multi-contract, non-traditional infrastructure procurement' Proceedings of CIB W78 Workshop at Cairns, July 9-11, 1997. 1997. James Cook University: Queensland.

[2] Works Branch. 1992. Airport Core Programme Project Controls. Government of Hong Kong.

[3] Luk, John and Wong, W.T. 1996 "The Efficient Management of Construction Claims in Hong Kong" Asia-Pacific Building and Construction Management Journal. Vol 2 Number 1. Hong Kong: ACMA, CIOB and HKIE

[4] Futcher, K.G. 1992 Use of computers for ACP project/contract management. Ad-hoc report Hong Kong: Works Branch of the Government Secretariat

[5] English, D 1992 "Project management approach to building Hong Kong's new airport road infrastructure" Project Management International Conference, Guangzhou Hong Kong:HKIE

[6] Siu, Duncan and Archer, George. "Application of construction management on mega scale projects - experience on the Kwai Chung and Tsing Yi Sections of Route 3". Highways into the Next Century, Paper No 061. 1996. HKIE: Hong Kong.