

# Web-based Learning in Engineering Education: A Portal for Teaching of Construction Contracts\*

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*For educators at university level, acquiring new information to prepare and design creative courses is a key to ensure the attractiveness and effectiveness of academic programmes. Nevertheless, educators are also expected to participate in value-added training such as education conferences, workshops, language and interpersonal skills seminars, and other continuing professional development-related activities. Furthermore, much time is also needed for research and administrative works. As such, less time is now available for discussion with students and out-classroom interactions. Indeed, effective learning requires active participation, peer supports and interactions. The diminishing traditional face-to-face interactions make it less contributive towards the provision of an active learning environment. This deficiency can be improved by using Web-based teaching/learning. This paper presents a Web-based learning package, called the Construction Contracts Information Service (CCIS), for the teaching of construction contracts for Construction Engineering students. The design and contents of the website was based on Mishra's on-line course framework which has been successful applied in Post-Graduate management courses. The three key elements of the on-line course framework are Active Participation, Support, and Course Content. The Web-based learning package contains four learning ingredients: Hong Kong Standard Forms of Construction Contract, Construction Cases, Common Contractual Problems, and Reference Standard Documents. The World Wide Web provides the learning platform. Active participation is achieved through e-mail and on-line discussion forum. The design and uses of the CCIS are described in the paper. Although the contents of CCIS focus mainly on the Hong Kong Construction Engineering studies, the design concept and the tools used can be applied without geographical and disciplinary barriers.*

## INTRODUCTION

THE PRIMARY OBJECTIVE of most engineering programs is to equip students with a high level of technical skill to undertake complex engineering tasks. Construction engineering is no exception and students should be well versed in structural analysis, temporary works design as well as material technology. In addition, students should have good understanding of the principles of contracts and their administration. Indeed, construction engineers spend a lot of time in administering contracts, apart from dealing with technical issues. In this respect, the study of construction contracts is an integral part of construction engineering education. The teaching of construction contracts is primarily aimed to develop the student's understanding of the underlying principles of contracts. Hence basic components of a Construction Contracts course include conditions of contract, legal interpretation and administration of contracts. With the developments in laws and regulations, more stringent environmental and building control standards, improved construction technologies, and the advent in the Internet and

the effects of globalization, construction projects are becoming more complex and the administration of such contracts are increasingly complicated [23]. As such, new contract clauses are added not only for the interests of contracting parties, but to cater for the social, commercial, political and environmental developments [11].

Some notable examples are the inclusion of environmental protection, dispute resolution, partnering, and value engineering clauses into construction contracts (C21 2000). In fact, various forms of contract have been designed to suit different project environments. In Hong Kong construction alone, there are five main forms of construction contracts commonly used. These include:

- the Standard Form of Building Contract Private Edition;
- the associated Sub-Contract for Nominated Subcontractors;
- the Hong Kong Government General Conditions of Contract for Building Works;
- the Hong Kong Government General Conditions of Contract for Design and Build;
- the Hong Kong Government General Conditions of Contract for Electrical and Mechanical Engineering Works (Environment, Transport and Work Bureau 2002).

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The use of these contracts depends on the nature and source of funding of the project. For example, the Standard Form of Building Contract Private Edition is often used for privately financed building projects procured through a traditional design-then-build method.

A successful contract course should be able to equip students with the skill to administer different forms of contract. This requires the skills to interpret contract clauses as well as deal with contractual issues arising therefrom. To successfully achieve these, construction contracts courses require constant monitoring and updating to keep up with the legal, technical and social developments. Indeed, success in acquiring new information to develop innovative services is a key not only to sustaining competitive advantage but also to business survival. The development of the above mentioned skills has been typically through interaction between the teachers and their students in lectures or tutorials. However, as teachers are now involved in many activities such as meetings, conferences, in-house training, continuing professional training, and administrative duties, less time is now available for teachers to get involved in face-to-face interaction forums [19, 30]. As such, a change in the mode of course delivery seems inevitable.

### WEB-BASED TEACHING

Web-based teaching has attained a rapid growth in line with the development in Information Technology. The advantage power of the Web-based teaching is that it not only allows teachers to publish study material on the Internet, but also helps universities provide even more accessible and flexible learning opportunities for students. Furthermore, the use of Web-based teaching can also prepare students for the information age [31]. The benefits of the web-based teaching and learning have been widely discussed. According to Flake [15], the use of the Internet to provide on-line courses by universities and other large organisations facilitates sharing of ideas and information and helps developing positive learning experiences. Yaverbaum *et al.* indicated that integrating web-based learning and multi-media technology into the traditional learning environment not only enriches the style of presentation, but provides a platform for self-taught, self-directed learning [34]. Various studies also suggest that e-learning courses (where students access the course materials through the Web and the traditional face-to-face lectures are replaced with on-line communications) have resulted in better student performance as compared with courses delivered by correspondence [8, 29, 33, 35].

With the well-planned networking system built into most of the university campuses, there is great potential for better use of the Internet to assist and complement teaching using the traditional lectures

and tutorials at tertiary level. This is especially so for universities where the whole campus is equipped with wireless-LAN technology or broadband connections facilitating full utilisation of the Internet [22]. With these perceived benefits, more and more universities have adopted Internet technology, and the amount of information available on-line increases daily. However, the benefits can only be materialised for those websites with a well-designed courseware. As stated by Duchastel, many on-line courses lack basic design consideration and the web is simply used as a medium for the delivery of instruction [13].

Detailed studies on the quality of on-line learning environments reveal that some on-line courses are in fact the electronic version of the traditional print-based lectures [12, 21]. These add little value to the learning process. Therefore, deeper thought should be accorded to clearly defining the goals and objectives, the content and format, with respect to the potential audience of the on-line course. As suggested by Berge *et al.*, on-line learning environments, generally, fall into one of the following types [5]:

- as a supplement to face-to-face instruction;
- in a mixed mode with face-to-face instruction;
- simple using web-based instruction to replace traditional face-to-face instruction.

### Framework for E-teaching

For the development of learning programmes, the theoretical model developed by Villalba and Romiszowski has been well recognised as useful point of reference [32]. In this model, three learning theories are included: behaviourism, cognitive psychology and constructivism. Under the behaviourism learning theory, behaviour is assumed to be a function of its consequences. Learning is achieved through frequent response and immediate reinforcement of appropriate behaviour. Typically, instruction is designed using a task analysis, which breaks down the behaviour into a sequence of observable actions. Cognitivism advocates that new information is built on existing structures; hence instruction is designed to promote processing activity akin to that of an expert. With constructivism, learning is understood as interpretative and emergent, and under the control of the learner. Cognition is situated and must be understood in terms of the setting, purposes, tools and tasks in which knowledge is to be learned [32]. Out of the three learning theories, constructivism has been identified as the most useful one for the design of on-line courses [18, 20]. Mishra integrates the three learning theories for the development framework of on-line course as presented in Fig. 1 [24].

The design framework in Fig. 1 provides useful ideas for the design, development and delivery of Web-based learning, and was used in the creation of the Web-based Construction Contracts Information Service (CCIS) presented in this paper. In

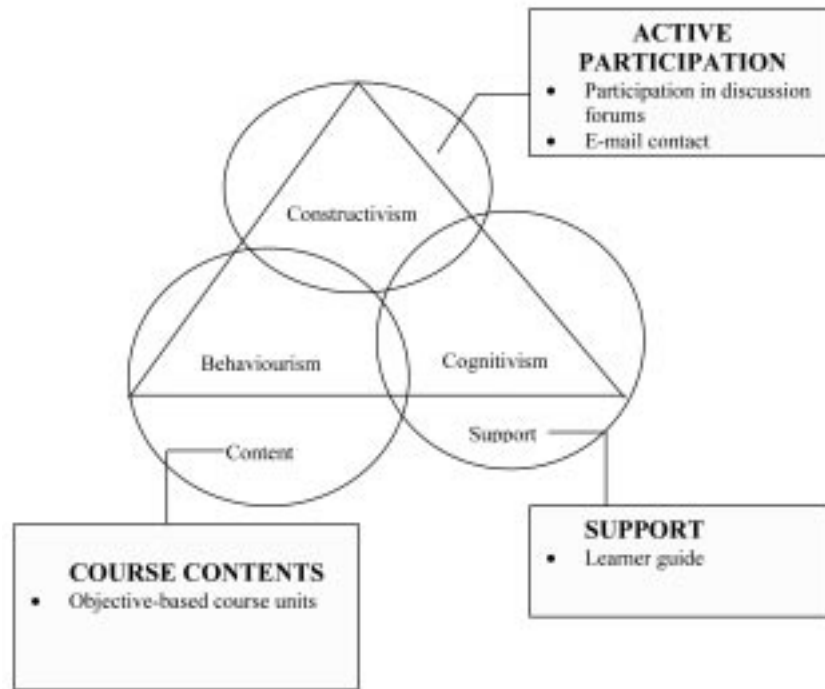


Fig. 1. Design framework for E-learning environment (adapted from Mishra [24]).

fact, this design framework has been used to develop the on-line learning facilities for post-graduate management courses by Mishra, who also recommends that this framework would also be useful in on-line delivery of other subjects [24].

### THE CONSTRUCTION CONTRACTS INFORMATION SERVICES (CCIS)

Studies of construction contracts have been well documented [16, 17]. These studies are intended to provide students and professionals with working knowledge of the various aspects of contract administration and the best practices. However, there is relatively very little work done in relation to the use of Web and Database technologies in construction contracts, in particular, the teaching and learning of construction contracts [1, 10]. For those websites that are related to construction contracts [2, 3, 6, 7], they are concerned mainly with the board construction contracts management principles or rules/regulations related to construction contracts laws. Thus, these are mainly designed for professional uses, not so relevant for the learning and teaching of construction contracts. As such, this paper presents a web-based learning program called Construction Contracts Information Service (CCIS). The program is intentionally designed and developed to assist students of construction engineering programmes to study construction contracts. The project was funded by a Quality Enhancement Fund of the City University of Hong Kong and was completed by the Construction Dispute Resolution Research Unit of the Department of

Building and Construction, City University of Hong Kong in 2002. The CCIS is organised with reference to the design framework as presented in Fig. 1, and the design concept is depicted in Fig. 2. In addition to the Mishra's on-line course framework, the following design principles were also applied:

- user-friendly screen, free and secured access;
- includes up-to-date professional information;
- supports teaching and learning of contracts administration;
- relevant to the needs of the Hong Kong contracting industry.

The central feature of the CCIS is a search engine through which students can search information by keying in key words. Figure 3 explains the learning paradigm of the CCIS.

The learning objective of the CCIS is to develop the ability of construction engineering students to perform engineering contract administration. The first step hence is to decide on the course contents. Four learning ingredients are included and discussed seriatim.

#### *Commonly used standard forms of conditions of construction contracts*

The five construction contracts as mentioned in the Introduction section are included as these are contracts that students will use when they begin their professional career. Figure 4 shows the *Standard Forms of Conditions of Contract* page (before inserting a keyword) and Fig. 5 is the resulting screen after entering a keyword (in this instance, the keywords 'extension of time' were entered. The contract clause numbers that contain

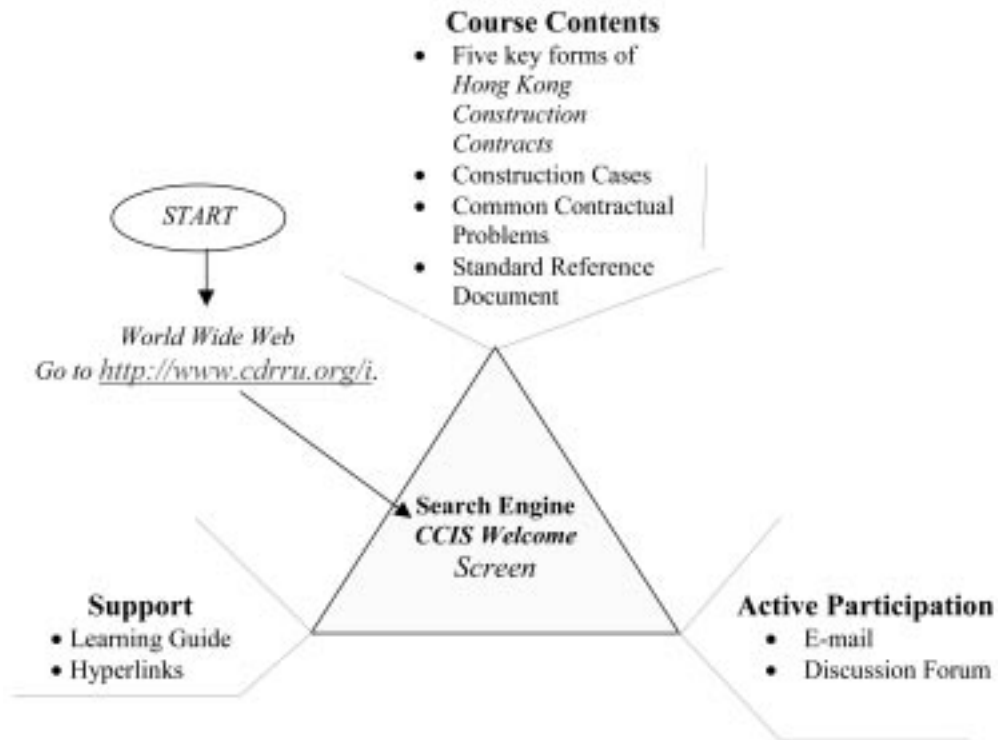


Fig. 2. Framework model of the website.

'extension of time' will be displayed. Because of the issue of intellectual property rights, it is not possible to display the full text of the contracts. Instead, agreement by the relevant authorities were obtained to link to their websites where the text contract clauses are displayed.

*Hong Kong construction cases*

Under the common law system, case law plays a central role in the interpreting contract clauses. For instance, cases like the *Arnhold v The AG* and *Philips Hong Kong Limited v The AG* are cited when Liquidated Damages (LD) are involved. The

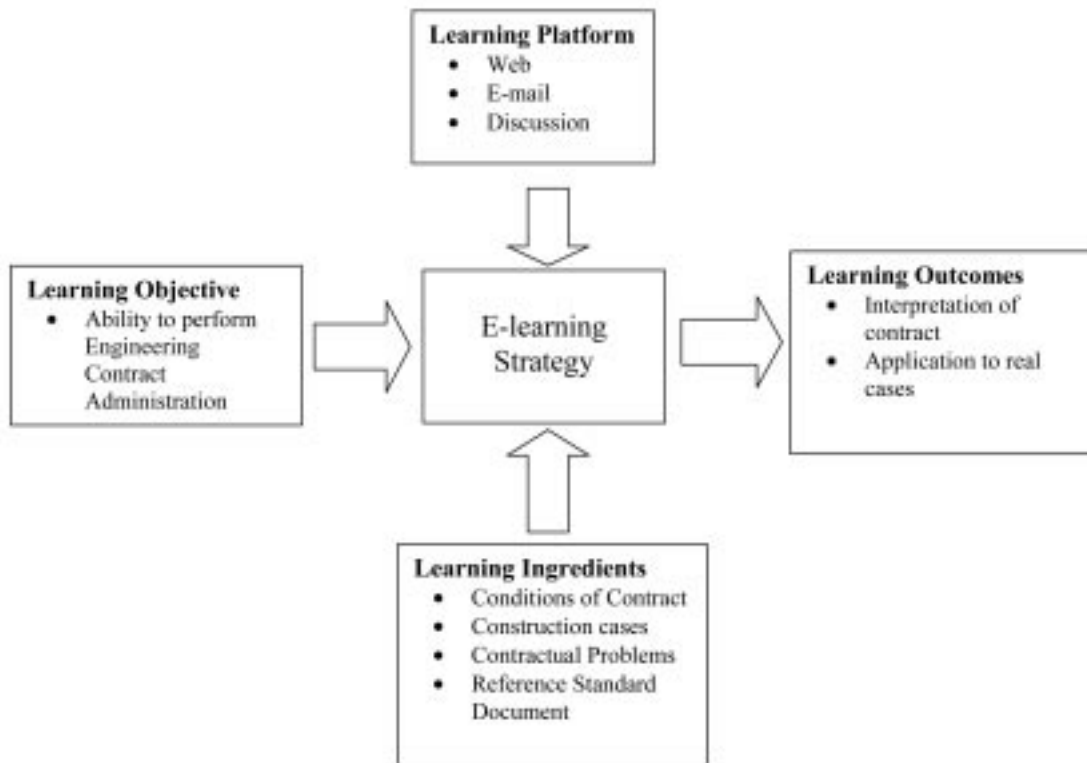


Fig. 3. Learning paradigm.

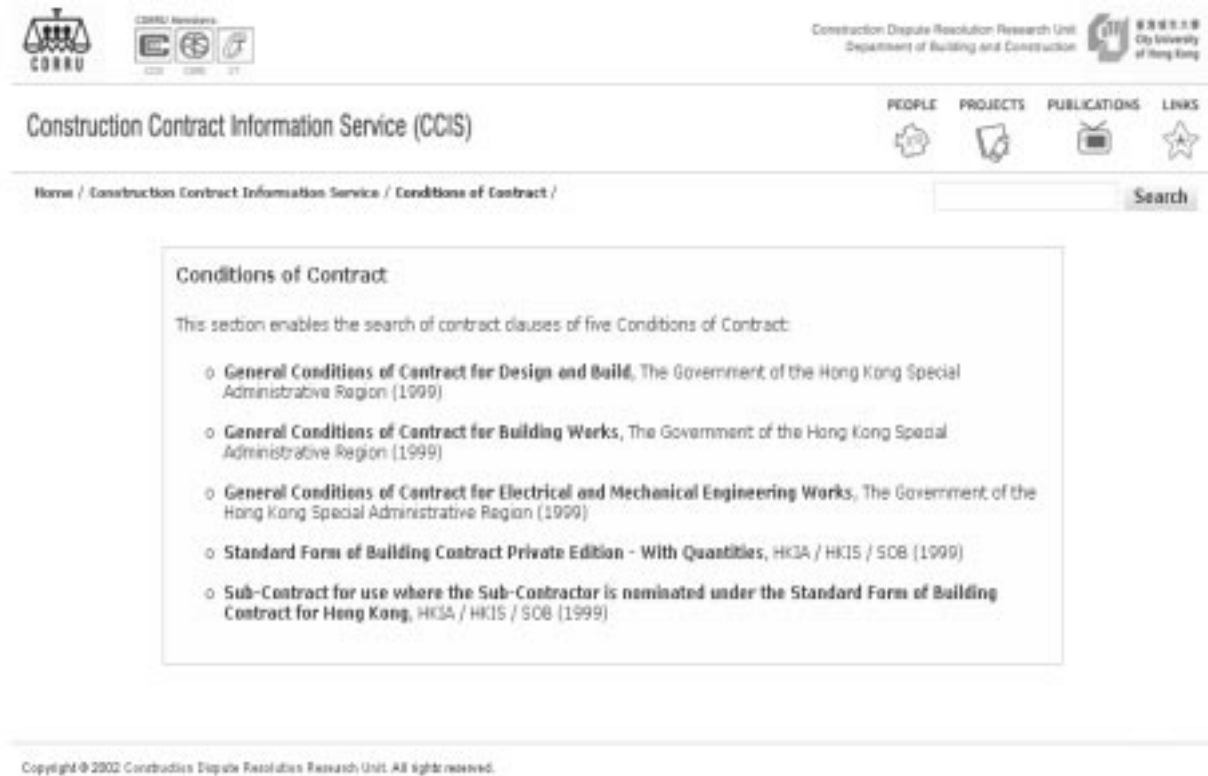


Fig. 4. Standard forms of conditions of contract page.

judgement given by the Court in this case has a profound effect on contract provision of LD set out in a sliding scale. In addition, this sets a precedent for future cases. Aamodt and Plaza suggested that systematic storage of past cases in a computer database helps to retrieve, retain and revise information, thus enhancing effective learning from previous case judgements [1]. Therefore, a systematic and well-organised record of construction contracts cases is essential for construction contracts studies.

There exists a large volume of construction cases. Therefore, only those directly related to construction contracts (contract clauses) are used to create the database. A total of 90 cases were identified as highly relevant and were grouped under nine main categories:

- Pay when Paid
- Claims
- Architects' Instructions
- Liquidated Damages
- *Quantum Meruit*
- Extension of Time
- Final Certificates
- Practical Completion
- Miscellaneous.

Such arrangements was considered to be effective as these categories are reflective of common construction contractual matters in litigations. In addition, the arrangement is relatively simple in terms of case finding, hence they save a lot of time looking up cases in law reports and journals. In

terms of presentation, instead of including all the facts of the 90 cases like 'full report' onto the Web, it was believed that students would find the 'executive report' format more useful and interesting. As such, only the key elements of a case were included: the case name, abstracts, keywords, facts, and judgement of the cases. Figure 6 shows the search results for 'claim' from the construction cases database. Figure 7 shows a screen display of a case abstract.

#### *Common contractual problems*

The third learning ingredient of CCIS is 'common contractual problems', which includes a database containing common contractual problems developed by the research team. Considerable time was spent to derive the list of problems to be included taking into account the commonality of the problems. The list of problems, like that in the construction cases, related to contract clauses such as Pay when Paid, Claims, Architects' Instructions, Liquidated Damages, *Quantum Meruit*, Extension of Time, Final Certificates, Practical Completion, etc. Indeed, the list contains a total of 48 common problems. Table 1 summarises the common contractual problems identified by the research team.

The use of scenario-type presentation helps to raise students' study interest. All problems are described in hypothetical contexts but vividly resemble real-life situations. Discussion is also provided in each problem so that students can better understand the various aspects of the

The screenshot shows the search results for 'extension of time' on the Construction Dispute Resolution Research Unit website. The page features a header with logos for CDRRU, CDRU Members (CCIS, CCIS, CCIS), and the Construction Dispute Resolution Research Unit at the Department of Building and Construction, City University of Hong Kong. Below the header, there are navigation links for PEOPLE, PROJECTS, PUBLICATIONS, and LINKS. The search results are displayed under the heading 'Search Results' and include four entries, each titled 'General Conditions of Contract for Design and Build'. Each entry lists a specific clause (49, 50(1)(a), 50(1)(b), and 50(1)(c)) and provides a brief description of the clause. At the bottom of the search results, there is a search bar with the text 'Extension of time' and a 'Search' button. Below the search bar, there are radio buttons for 'Common Contractual Problems', 'Construction Cases', and 'Conditions of Contract', with 'Conditions of Contract' selected. A footer note states: 'Copyright © 2002 Construction Dispute Resolution Research Unit. All rights reserved.'

Fig. 5. Screen display for 'extension of time' search (conditions of contract).

problem and the possible available solutions. An example of a typical contractual problem page is shown in Fig. 8.

#### Reference standard document

Contractual correspondence is an essential part of contract administration. The Reference Standard Documents database provides a useful reference guide for standard letters, forms, checklist etc. The information is grouped under a total of seven headings:

- Confirmation
- Request for information
- Submission
- Inspection and progress
- Extra and additional works

- Payment and final account
- Subcontracts.

The table of contents is shown in Fig. 9. In Fig. 10 is a typical PDF file of the standard document is given. All documents are made into PDF files for ease of download.

#### OUTCOMES/PERCEIVED BENEFITS ON TEACHING AND LEARNING

The benefits of the CCIS can be summarised as follows:

- *Proactive learning.* The Web-based Construction Contracts Information Service provides a

The screenshot shows the website interface for the Construction Dispute Resolution Research Unit (CDRRU) at the City University of Hong Kong. The page is titled "Search Results" and displays a list of search results for construction cases. The results are organized into sections, each starting with "Construction Cases Search".

At the top, there are logos for CDRRU and its members (ICC, CMC, CT), and the unit's affiliation with the Department of Building and Construction at the City University of Hong Kong. Navigation links for PEOPLE, PROJECTS, PUBLICATIONS, and LINKS are also present.

The search results include the following cases:

- Construction Cases Search**
  - Attorney General v Shimizu Corp (Formerly known as Shimizu Construction Co Ltd) (No 2) [1997] 1 HKC 453  
Global Claims – Interest & Finance Charges
- Construction Cases Search**
  - Chung Kiu Development Ltd and Another v Sung Foo Kee Ltd & Another [1995] 2 HKC 777  
Pay when paid
- Construction Cases Search**
  - Costain International Ltd & Another v Attorney General [1983] HKLR 228  
Certificate – Clear and Unambiguous
- Construction Cases Search**
  - Morison, Son & Jones (Hong Kong) Ltd v Yiu Wing Construction Co Ltd [1989] 1 HKLR 432 (CA)  
Variations – Estoppel
- Construction Cases Search**
  - North Sea A/C & Elect. Eng. Co v Collections Interior Ltd  
Claim and counterclaim
- Construction Cases Search**
  - T.S. Wong & Co Ltd v The Official Receiver & Trustee of the Property of Ng Yat Chi (a bankrupt) (Bankrupt No 242 of 1992, unreported)  
Consideration – *ex gratia* claim
- Construction Cases Search**
  - Wharf Properties Ltd & Another v Eric Cumine Associates Architects, Engineers and Surveyors (1991) 52 BLR 1 (PC)  
Global claims

At the bottom of the search results, there is a search bar with a "Search" button and radio buttons for "Common Contractual Problems", "Construction Cases" (which is selected), and "Conditions of Contract". Below the search bar, there is a note: "You can use ' + ', ' - ', ' AND ', ' OR ' and ' NOT ' in your searches."

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Fig. 6. Example of search results for construction cases.

flexible learning environment where students have unrestricted access to the vast amount of construction contracts information. It is not intended to replace the traditional face-to-face lectures and tutorials, but to supplement the course by including relevant materials which

are essential in learning construction contracts. The students can pick topics that they wish to study by making use of the search capability of the search engine.

- *Construction professionals and community.* The Centre by no means is limited to academics and

The screenshot displays the Construction Contract Information Service (CCIS) website. At the top, there are logos for CDRRU, CCIS Members (CCB, CDB, CT), and the Construction Dispute Resolution Research Unit at the Department of Building and Construction, City University of Hong Kong. The main navigation bar includes links for PEOPLE, PROJECTS, PUBLICATIONS, and LINKS. The breadcrumb trail reads: Home / Construction Contract Information Service / Construction Cases Search / Big Island Construction (HK) Ltd v Abdoolally Ebrahim & Co (HK) Ltd [1994] 2 HKLR 161. A search bar is located on the right.

**Big Island Construction (HK) Ltd v Abdoolally Ebrahim & Co (HK) Ltd [1994] 2 HKLR 161**

**Keywords**

Arbitration - application for stay - application for summary judgment

**Facts**

The Plaintiff (Big Island Construction (HK) Ltd) and the Defendant (Abdoolally Ebrahim & Co (HK) Ltd) entered into a contract for the refurbishment of the Defendant's property. The contract provided that resolution of any dispute or difference between the parties by arbitration. The architect issued a written certificate for payment of \$274,068 by the Defendant to the Plaintiff. The Defendant refused to pay and the Plaintiff issued a summons for summary judgment and the Defendant cross-summons for a stay of proceedings.

The Plaintiff argued that the Defendant had not shown any arguable defence to the Plaintiff's claim and as such that there was no dispute between the parties, either prior to or after the issue of writ. The primary issues were as follows:

1. whether the defendant had raised an arguable defence to the claim; and
2. whether these proceedings should be referred to arbitration.

**Held:** Plaintiff's summon was dismissed.

The court held that there was sufficient evidence of a dispute between the parties prior issuing of the writ by the Plaintiff to enable the matter to be resolved in arbitration. The judge noted that there was a dispute until the defendant admitted that the sum was due and payable *Ellerine Brothers (PTY.) Ltd [1982] WLR 1375 1383*. The court favored the Defendant's summons for a stay of proceedings.

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Fig. 7. Screen display of a case abstract.

students, but can be extended to serve the construction community as a whole. Such intention is reinforced by establishing Hyperlinks with key players in the field to create an on-line platform for exchange of ideas and information. In addition, on-line discussion forum is made available

to students to facilitate exchange of information and open discussion.

- *Flexibility and improved delivery of course materials.* Traditional delivery of course materials by means of hard copies has become out of place with the wide applications of the Internet



Table 1. Summary of common contractual problems

1	Written notice under a timeframe requirement for an extension of time claim	25	Too high or low rate for an item in Bill of Quantities due to an error
2	Disruption caused to works being planned to complete earlier than the contract period	26	Architect's instruction after practical completion
3	Concurrent Delay	27	Interpretation of practical completion
4	Inclement weather falling on an extended period	28	Can an architect revise an issues certificate
5	Granting an extension of time retrospectively	29	Contractor's liability to the defects after the issuance of final certificate
6	Acceleration request subsequent to delay in completion	30	Determination of nominated sub-contractor
7	Consideration of time saved in the assessing extension of time	31	Quantum meruit claims
8	Late possession	32	Defects liability of main contractor on nominated sub-contract works
9	Non-completion certificate and liquidated damages	33	Qualification made by nominated subcontractor on liquidated damages clause
10	Liquidated damages and penalties	34	Contra Proferentum Rule
11	Liquidated damages and genuine pre-estimate of loss	35	Mistake in the contract
12	Loss of Profit on omitted items	36	Can the program be a contract document
13	Use of formula for assessing overhead claim	37	Risk of commencing work based on a Letter of Intent
14	Finance charges	38	Who shall bear the loss due to unforeseen bad ground condition
15	Preparation cost of claims	39	Accepting a lesser amount than the amount certified
16	Valuation on a Quantum Meruit basis	40	The implication of final certificate
17	Global claims	41	Re-nomination
18	Pay when paid clause	42	Retention of title in sub-contract when the main contract becomes insolvent
19	MC's right to set off sums of money from sub-contractors for money due	43	Liabilities of approved drawings
20	Honouring of certificate	44	Counter-offer made during the tender stage
21	Principle of valuation of variations	45	When performance bond can be called
22	Interpretation of fair valuation of variations	46	Recovery of damages by a main contractor from an architect/engineer for negligence
23	Variations issued during culpable delay	47	Is there any remedy for the client to recover loss from a wrong assessment of a claim
24	Variations which entitle contractor to have additional time and cost	48	Information provided with tender

in all walks of life. The Web-based CCIS allows students to conduct research and learning at their own place and time. This is a great advantage to the current one-off, snap-shot presentation by the lecturer. In addition, students with learning difficulties (physically handicapped) can also take advantage of the facilities provided.

#### LESSONS LEARNT FROM THE DEVELOPMENT PROCESS

- *The requirement of both programming and computing skills and knowledge in Construction Contracts increased the complexity of the project.* The setting up of server and design of the graphics and related computing works had to be carried by a professional webmaster with experience in programming language and database design. The preparation of the CCIS contents, however, requires expertise in construction contracts. It is extremely difficult to find a researcher capable of performing both types of task. The separation of the programming and content requires detailed coordinating efforts of the research team. Furthermore, very little local reference is available on this subject, hence considerable effort had been devoted to develop a tailored reference standard document and a common contractual problems file.
- *Time consuming in developing the list of common contractual problems and the nine categories for construction cases.* Difficulties were encountered in developing the framework for the list of common contractual problems. In doing so, reference was made to the commonly used construction contracts in Hong Kong as well as previous studies in this area. Interviews with three practitioners were conducted to seek their comments on the draft list. At the end, a total of 48 problems were identified (Table 1 refers). In respect to the construction cases, due to the vast volume of construction cases reported in law reports and journals, much time was spent to shortlist the nine main categories (Pay when Paid, Claims, Architects' Instructions, Liquidated Damages, *Quantum Meruit*, Extension of Time, Final Certificates, Practical Completion, and Miscellaneous) which form the basis for the categorisation of cases concerning construction contracts. To achieve the above tasks, it required good knowledge of construction law and construction contracts. This task was completed by a senior research member with intensive practical experience.
- *Copyright issue on conditions of contract and construction cases.* The copyright of the Common

The screenshot shows the CCIS website interface. At the top, there are logos for CORRU, CCIS, and City University of Hong Kong. The main navigation bar includes 'PEOPLE', 'PROJECTS', 'PUBLICATIONS', and 'LINKS'. The breadcrumb trail reads: 'Home / Construction Contract Information Service / Common Contractual Problems / Written notice under a timeframe requirement for an extension of time claim'. A search bar is located on the right.

**Written notice under a timeframe requirement for an extension of time claim**

Client: PROFIT	Architect: NEW IDEA	Main Contractor: BUILDWELL
Conditions of Contract: The Agreement & Schedule of Conditions of Building Contract for use in the HKCSAR, July 1999 edition.		
Liquidate and Ascertained Damages: \$100,000/day		
Nominated Subcontract Conditions of Contract: The Green Form		

**Scenario**

In this contract, the clause for extension of time in the standard conditions was amended. A sub-clause was added requiring the main contractor to notify the architect in writing within 28 days upon a delay becoming apparent. During the contract period, BUILDWELL submitted an extension of time claim for the delay caused by inclement weather. However, no notice had been given to NEW IDEA for this. Application of the claim was later submitted two months after the delaying event. Would BUILDWELL be entitled to claim for an extension of time due to the inclement weather?

**Discussion**

Under the standard conditions of contract, giving notice to the architect is not a condition precedent to an extension of time claim. The architect owes duty not only to the client but also to the main contractor to assess the implication of delaying events happened. The architect has to grant an extension of time if he has the knowledge of the delay. Inclement weather is a relevant event for claiming an extension of time under contract. Should the contractor fulfil the other conditions for an extension of time claim such as the use of his best effort to prevent delay, he could submit the claim within reasonable time. However, in this case, a timeframe for giving written notice had been added to the contract condition and if this is interpreted as a condition precedent. The implication of this is that the main contractor must observe the timeframe requirement. Because BUILDWELL failed to produce a timely notice, he would lose his entitlement for the extension of time claim due to inclement weather.

**Cases**

*Bremer Handelsgesellschaft mbH v. Vanden Avenne-Izegem (1978)*  
*Stanley Hugh Leach v. London Borough of Herton (1985)*

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[Back to Common Contractual Problems](#)

Fig. 8. Screen display of a common contractual problem.

Conditions of Contract had proved to be a difficult issue to resolve. Ideally, full text of the clauses should be displayed on-screen. However, to achieve this, permission from copyright owners of these conditions of contract need to be

obtained. With regard to the Government Forms namely General Conditions of Contract for Design and Build, General Conditions for Contract for Building Works and General Conditions of Contract for Electrical and Mechanical

The screenshot displays the 'Reference Standard Documentation for Contractor' page on the CCIS website. The page features a navigation menu at the top with links for PEOPLE, PROJECTS, PUBLICATIONS, and LINKS. Below the navigation, the breadcrumb trail reads 'Home / Construction Contract Information Service / Reference Standard Documentation'. The main content area is a table listing various documents with their titles, PDF file sizes, and download icons.

Document Title	PDF File Size	Download PDF
<b>0 Table of Content</b>		
0.1 Table of Content	714B	
<b>1 Confirmation</b>		
1.1 Confirmation of instruction	704B	
<b>2 Request for Information</b>		
2.1 Request for Information	704B	
<b>3 Submission</b>		
3.1 Material Check list	67KB	
3.2 Submission of material sample	64KB	
3.3 Submission of shop drawings	1379B	
<b>4 Inspection and Progress</b>		
4.1 Daily progress report	746B	
4.2 Request for inspection	1429B	
4.2 User progress report	1444B	
4.2 Request for inspection	1429B	
4.3 Request for concrete coring/cutting form	736B	
4.4 Schedule of material to site	456B	
4.5 Steel record	366B	
<b>5 Extra and additional works</b>		
5.1 Record of additional works	896B	
5.2 Daywork sheets	62KB	
5.3 Daywork summary	65KB	
<b>6 Payment and Final account</b>		
6.1 Submission of interim payment application	75KB	
6.2 Material on site record - (precast stair)	1649B	
<b>7 Subcontracts</b>		
7.1 Notification to carry out work	609B	
7.2 Notification of contra charges	914B	
7.3 Subcontract Payment	666B	
7.4 Statement of Final Account	914B	
7.5 Acceptance of Nominated sub-contract	1089B	

Back to Construction Contract Information Service

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Fig. 9. Reference standard documents.

Engineering Works, formal agreement was received from the Works Bureau to form hyperlinks with their website so that full text of the contract clauses can be viewed. Full text of the contract is located in the Works Bureau website,

[http://www.etwb.gov.hk/publications/contract\\_doc.htm](http://www.etwb.gov.hk/publications/contract_doc.htm). The same copyright issue applies to case reports, hence the case abstracts contained in the database were prepared by the research team.



# Buildwell Construction Co. Ltd.

## REQUEST FOR INFORMATION

Project :

Ref No :

Date :

Please furnish us with the following information which is necessary to enable us to carry out and complete the works in accordance with the Conditions of Contracts. This information is required by \_\_\_\_\_.

**MATTER RELATED:**     B S Installation                       Architectural Work  
                                   Structural Work                                       Others \_\_\_\_\_

**SUBJECT:**

For and on behalf of  
Buildwell Construction Co. Ltd.

\_\_\_\_\_  
Project Manager

cc.    Structural Engineer    :                          Head Office                      :      
       Quality Surveyor        :                          Others                                :   

Fig. 10. Example of a typical standard document in PDF form.

### MAINTENANCE, COMPUTING REQUIREMENTS

The key computing requirements required for the development of this web-based portal include both Hardware and Software specifications.

### *Hardware and software specification for server*

The hardware specification required to support various portal functions depends on a number of factors, such as the size of database, the number of users' access in a specific time frame, etc. For the software specification, the teaching portal is based

Table 2. Summary of computing requirements

Computing Requirements for Set-Up of Server	
Hardware Requirements	Software Requirements
<ul style="list-style-type: none"> <li>• Intel Platinum III 1 GHz</li> <li>• 512 MB SD Ram</li> <li>• 60 GB 7200 rpm Hard Drive</li> <li>• Generic main board with on-board display card and sound card</li> <li>• Generic 10/100 PCI LAN Card connected to the Internet</li> <li>• Generic IDE CD-Rom</li> <li>• Generic Floppy Disk Drive</li> <li>• Generic CRT/LCD Monitor</li> <li>• Generic Keyboard &amp; Mouse</li> <li>• Optional Uninterrupted Power Supply (UPS) System</li> </ul>	<ul style="list-style-type: none"> <li>• Operation System Red Hat Linux 7.3 or above</li> <li>• Web Server Apache 1.3.23 or above</li> <li>• FTP Server ProFTP 1.2.6 or above</li> <li>• Secure Socket Layer OpenSSL 0.9.6b or above</li> <li>• Secure Telnet Service OpenSSH 3.1 or above</li> <li>• Programming Language PHP 4.2.2 or above</li> <li>• Database Server MySQL 3.23.52 or above</li> </ul>
Computing Requirements for End-Users	
Hardware Requirements	Software Requirements
<ul style="list-style-type: none"> <li>• Intel Celeron 1 GHz</li> <li>• 64MB SD Ram</li> <li>• 3.2GB 7200 rpm Hard Drive</li> <li>• Generic main board</li> <li>• Generic display card</li> <li>• Generic 10/100 PCI LAN Card or 56Kbps Internal/External Modem</li> <li>• Generic CRT/LCD Monitor</li> <li>• Generic Keyboard &amp; Mouse</li> </ul>	<ul style="list-style-type: none"> <li>• Microsoft Windows 95, 98, 2000, ME, XP or above</li> <li>• Microsoft Internet Explorer 5.0 or above/Netscape 4.0 or above/AOL Browser 5.0 or above</li> </ul>

on the PHP programming and the MySQL database backend. As such, the Web server is so configured to be compatible with the PHP and MySQL functions. The software package phpMyAdmin 2002 can be installed optionally as it enables effective management of the database for the teaching portal. Table 2 summarises the hardware and software requirements for the set-up.

#### *Hardware and software specifications for end-users*

There is no specific hardware requirement for end-users, a generic personal computer (PC) with Internet connection can gain access to the teaching portal. A summary of the hardware and software specification details for the end users is provided in Table 2.

#### *Maintenance and training for technical support staff*

Since the portal is built on the Linux Server, it is recommended that technical staff should have sound knowledge with the Internet, as well as skills in server administration, networking, and system security. Indeed, on-line training on the Linux System is available in the RedHat Homepage (Redhat 2002) and the Red Hat Certified Engineer Program (RHCE 2002). The administration tasks of the teaching portal are rather simple, and can be managed by people with general computing and Internet knowledge. In respect of maintenance of the teaching portal, it is suggested that the database should be backed up regularly for security purposes. In addition, technical

support staff should be prepared to answer questions or problems raised by the end-users.

## FUTURE DEVELOPMENT

### *Assessment*

Under the behaviourism learning paradigm, learning is achieved through frequent response and immediate reinforcement of appropriate behaviour. Hence timely review of performance is instrumental to effective learning. As such, it is proposed the Web page should provide the facility to assess students' understanding on topics of construction contracts through assignments, self-tests, exams, etc. In fact, previous studies suggest that on-line assessment can improve the quality of teaching as well as the quality of learning [4, 26–28].

From the students' point of view, assessment allows identification of strengths and weaknesses, hence determines what needs to be learnt, and in doing so drives the learning outcomes. From the teachers' point of view, the learning outcomes reflect the effectiveness of the teaching strategy. Hence, it would be invaluable to include the 'assessment' component in the web page such that students can learn through interactive and carefully designed questions and answers. In this connection, the assessment results can be used to establish benchmarks. With the use of a database, the assessment results are centrally stored, individual or group performance standard can be computed. The group average can be used as the

performance benchmark of a group and a student can compare his/her own performance with that group.

#### *Up-to-date information*

The web page needs to be updated regularly so as to keep up with the latest developments, i.e. updating new construction cases, adding new hyperlinks with relevant sites. With the capability of the database, the web page can be extended to include other contract-related topics, such as contracting theories and construction dispute resolution studies, making the web page more comprehensive and informative. It is recommended that future studies in the areas should focus the following aspects of development:

- Study of contracts inevitably involves claims and disputes resolution. For this reason, it is suggested that principles and relevant information of dispute resolution methods (i.e. mediation and arbitration) should be included. The website should be extended to include an on-line dispute resolution platform where claims and disputes can be resolved on-line. The study of on-line case-based negotiation is recommended.
- The Web-based teaching framework presented in this paper should equally be applicable to other areas of construction engineering. It is anticipated that construction and building management courses, including building technology, building services and construction management lectures should also be complemented by on-line teaching materials to achieve an integrated learning environment.

## CONCLUSION

A Web-based Construction Contracts Information Service for teaching construction engineering students contract administration has been described in this paper. The CCIS is primarily used by students but can certainly be extended to the construction engineering community. The website makes use of the Internet and database technology to provide an instant, on-line interactive learning environment and database search. The CCIS was developed based on the Mishra's on-line course framework [24] which has been previously adopted in management courses. Four learning ingredients are included, namely the Standard Forms of Conditions of Contract, Hong Kong Construction Cases, Common Contractual Problems, and Reference Standard Documents. Through a keyword search engine, students can assess the value of the construction contracts information relevant to their choice of study. Thus, learning construction contracts is no longer limited to lectures and books. Web-based learning is never intended to replace existing face-to-face teaching, but rather to compliment and reinforce this by focusing on the three key aspects of e-learning: course content, active participation, and support. The wide applications of IT and the well-implemented Internet networks within the campus make it possible for this portal to be applied worldwide. Learning construction contracts is now possible on-line anytime and anywhere.

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