COMPUTER CONFERENCING FOR THE CONSTRUCTION INDUSTRY

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CMHC External Research Program – Computer Conferencing for the Construction Industry

Project Scope

This study is directed towards design and construction professionals (primarily architects and engineers and later other construction participants) that should be familiar with computer technology. Computer conferencing is seen as a bridge between municipal and design offices. Access to code experience is usually limited by the exposure and use of code concepts. In the practical business world the code official is viewed as a consultant to these professionals. Transfer of knowledge at the times when they need it most is critical to the success of any project and avoids confrontations and construction down time.

A web site and discussion group called Codeworks was developed as noted in Appendix #1 and later modified to be included as part of the City of North Vancouver's web site as noted in Appendix #2. The external research project is on going with the stucco discussion topic currently posted. A virtual community is being developed so that a wide range of construction stakeholders can participate. An expert knowledge base will be the result including definitive design details, specifications and building code development.

The primary objectives of this research is to develop information technology through a permanent web site that will:

- increase the likelihood of code uniformity between municipalities and construction stakeholders;
- develop permanent communication linkages between government agencies and construction stakeholders based on the pilot project;
- specify skills and certification requirements for the construction trades, thereby reducing the instances of poor workmanship;
- encourage construction participants to develop training programs that have net cost/benefit effects and are compatible and complimentary, thereby allowing residential construction projects to proceed expeditiously; and
- specify design and construction procedures that reduce job site confrontations, thereby reducing overhead increasing affordability.

The virtual community connected 40 design offices on-line (see Appendix #4) and chief building officials from the municipalities of Vancouver, Burnaby, Richmond, North Vancouver, and the provincial Building Standards Branch. Code professionals from municipalities served as facilitators with a curriculum developed using sections (3.1.1., 3.1.2., 3.2.1. and 3.2.2.) of Part 3 of the B.C. Building Code (Appendix #3). Most municipalities experienced difficulty with internet connections. The primary research investigator (chief building official from North Vancouver City) moderated most of the research project. The project objectives and deliverables follow:

General objectives

The interactive web site was established to discuss code issues over a commonly accessible database, using a specified curriculum as a touchstone. The site would then be permanently maintained and developed for eventual use by all construction participants,

developing features such as common design standards, issues, product updates, and discussion formats. The report contained in Appendix "#1" examines the educational research objectives encouraging a "cognitive apprenticeship" necessary for the practical application of complicated code principles not currently part of the formal university training program.

The research project delivered the code curriculum directly to professional design offices over the internet (on-the-job- training) allowing the professional to interact with the gate keepers of code interpretation and permit processes. Participation in the non-accredited course was chiefly motivated by contact with building officials and e-mail exchanges, both private and public which allowed users the chance to access many topics, including the building code. Continued development of the web site and other discussion sections will be added that will encourage participants to ask general and specific code questions that can then be compiled into the virtual community as described by Kaye and Mason, (1989).

Their research indicates that conferencing places the participant at the center of the discussion, permitting access to a larger community of interest that will, as in our case include key resources necessary for information exchange in the construction sector. Kaye and Mason also establish a "critical mass" that should not be exceeded in virtual discussion (usually about 20 – 30 individuals) but can include a larger community where information and not interaction is the primary objective. This larger community will be significantly more potent than our client/municipal exchange.

Lessening job site confrontation between building officials and designers was identified in the scope as one objective of this research. Many code issues that arise during the life of a construction project involve specific interpretations that appear to be the purview of specific municipal offices or jurisdictions. For example, one jurisdiction may accept the use of combustible piping within buildings under the provisions of 3.1.9.4.through the use of a site by site equivalency. A building code web site under the administration of a government body could identify the parameters of the equivalency through a top down explanation (deductive). The reasons for acceptance would encourage others to apply this knowledge to their particular jurisdiction or project. Because the internet allows universal access, many construction participants would then access particular training programs or problem solving scenarios to bolster their understanding of a particular code concept or construction practice. This model would mirror the formation of objectives based codes emphasizing the fact that participants must feel a sense of ownership with any conclusion that is reached. This is the key advantage in delivering a curriculum, as participation is the main ingredient of learning and change.

Curriculum development

The curriculum was developed with the assistance of the Building Officials Association of British Columbia and is contained in Appendix "#3". The material is primarily text based with GIF based graphics that assist in building code definitions. Seven code section modules were developed to keep examination and discussion topics manageable. Each module was followed by a section review that prompted networking and on-line

discussion. Participants that were given access to the curriculum could scroll through the screen or download a particular section and then submit answers either on-line or by fax.

The project and code curriculum was delivered for six weeks after which time data was gathered and collated. A primary objective of the project was to deliver the curriculum, have the group conference and then use the comments for the evolution of the curriculum. Due to time constraints feedback was not of sufficient depth to modify the original material. However, it is hoped with the continued evolution of the issues based discussion an evolving body of knowledge will develop.

Discussion forum and knowledge development

The discussion forum focussed on allowing municipalities the option of contacting each other privately or interacting with the designers publicly. Code officials could discuss issues privately without interference or bias from the public realm. Although the interaction between municipalities was not that advanced discussion did occur as various controversial code issues arose. Questionnaires probed the designer's interests in the conferencing module and begged comparisons to traditional ways of learning and communicating. Many participants felt that the traditional methods cannot be discounted and should be included as part of any virtual program development. Seminar orientation sessions were needed to ensure participants were aware of the scope and capabilities of the system.

Many felt that conferencing was going to be real time and not include asychronous delayed exchanges (see Appendix "1" – G for conferencing intinerary). This led to some frustration within the group. Orientation sessions need to include feedback from hands on computer demos of conferencing, web site display and navigation tips and enhancements. These sessions should be held once every 3 months over the life of the project to encourage development and evolution of all facets of the construction web site. The immediacy of exchange breathes life into a virtual program, which can be very static and non-productive.

A conceptual map of the program must include face-to-face meetings, virtual discussion criteria based on real time and asynchronous discussion, private e-mail options and the development of bulk e-mail dispatches so that a group can be introduced to specific questions or information that may arise.

Thus the best feature is the interactivity of the web site which spurs realization and change to effect positive growth towards code uniformity. The development of the curriculum is dynamic constantly fed by participant input. Due to the complexity and size of Part 3 of the B.C. Building Code complete course development and delivery within this project scope was not possible. The delivery of the current sections of Part 3 proved almost insurmountable, constrained by participants time frames, interface difficulties posed by the slowness of the internet, and the searchability of the curriculum. Please refer to Appendix "#3" for the hard copy of the code sections and related graphics. Each module was presented in chunks to encourage a week by week completion of sections. But notice that the text material was not searchable and half of the group that

could access the curriculum was encouraged to complete the section reviews on time to advance the project.

As noted in the research in Appendix "#1" the virtual realm is much more democratic than the traditional classroom. However, many participants, whose code knowledge was considered novice, preferred the traditional classroom delivery and the heightened immediacy of exchange. Another encumbering factor is the knowledge of the computer interface and keyboarding dexterity. The development of discussion issues and the use of the internet at work should alleviate this constraint. More study needs to focus on ways of developing mechanisms to encourage participants to develop enhanced skills at keyboarding and internet navigation. Many web sites are very user friendly and allow quicker contacts with various points of interest.

The textual environment must be searchable and more graphic. One primary research question was the degree to which the curriculum played a part in student achievement. The data indicates that conferencing and access to code officials proved as effective as having a curriculum. However, samples were small and thus definitive results cannot be claimed. Future research must examine a tailored, searchable, and graphic curriculum that encourages longer term interactivity and accredited course material. Delivery from the gate keepers of knowledge appears to provide a broader incentive to on-the-job work, but this must be further entrenched with principals of firms to ensure the effectiveness of the training is gained within the design office.

Screen examples of the current discussion issue are included as part of Appendix "#2". The discussion area is password protected to ensure data that is gathered is confined to members of the virtual construction community. Documents are displayed for viewing offering various topics for discussion and reference. The participant then enters the topics section and can discuss either a failure or permit processing issue. Discussion is threaded back to the primary issue.

The moderator may choose to cut and paste the entries for display in the related documents discussion display section, and delete redundant items. A real time chat channel may be used at the moderator's discretion once it is thought that a particular topic requires an immediate exchange of information. These meetings will be scheduled with a preseribed agenda and invitees. The moderator must ensure that the exchanges are on topic, active and generate important information. Relevant data would then be transferred to the discussion summary and frequently asked questions section of the web site.

News items

As part of the continued development of information it is important that specific topics be reported at a low interactivity level. The web site offered news articles on fire separations, fire stopping and stucco. Examples of news "departments" would be design, construction, trades, codes, products, and training. The departments would assimilate material currently in print and develop an editorial basis that would encourage discussion across the breadth of the virtual community. The web site would then point to other news

sources enhancing discussion for those that wish to dabble within other topical environments. Also important to the interface development is that an introductory abstract be provided for each textual display. Large bodies of text on the computer screen is difficult to read and hard on the eyes. The research indicates that many users preferred the ability to download the material to a hard copy rather than reading directly from the screen. Hypertext links permit better searchability and lessens frustration with the attempt to retrieve topics of primary interest.

Products, updates, specifications and design

Products were not advertised on the Codeworks Web site but manufacturers did display an interest in taking part in the discussion and describing their products. For example a fire stopping manufacturer expressed interest in enhancing participant knowledge. Specific comments and hot links would allow users to access a manufacturers information but care must be taken to ensure the material is knowledge based and not promotional. Without this feature large amounts of competitive marketing data would clutter the web site. Due to time constraints and resources the project touched on this feature but was not able to develop this to its greatest potential. Vested interests and conflict of interest potential must be closely monitored if any product is to be introduced into a government web site.

However, this segment is seen as the financial engine to keep the web site running, current and to maintain some vibrancy between code concepts and their practical application. Many code articles and interpretations beg the question: What product can I use to achieve this? Where can I get it ? How will it perform? How much does it cost? How should it be specified? For example firestopping devices are referenced in 3.1.9.1. of the Building code. An FT rating and FH rating determine the types of devices that can be used for specific applications, but what are the product and testing limitations? What about the installation requirements? This information becomes as critical as knowing the code application or concept. A mechanism needs to be developed to identify acceptable products, their limitations, specifications, and installation criteria. This practical aspect is critical to the usability of almost every code section.

Manufacturers and suppliers interact with designers on a regular basis providing standard specification and design details. The current web site provides the basis for the development of generic specifications and design details. However, as with the knowledge base this material is evolutionary and should wrap into a curriculum framework that can be accessed from the novice to the expert. Expert opinions are likely to come from the manufacturing sector which is the primary consultant to the design professional. The web site should present discussion in a problem or discussion format to encourage the development of generic details and specifications. Proprietary data could then be generated and posted. For example, large companies that supply exterior insulation finish systems (EIFS) have a proven background in product trouble shooting, industry demands, costs and comparisons to other types of products on the market. The primary objective of the moderator is to develop critical information that is not solely based on the marketability of the project but rather higher standard generic details that

can be utilized by those that will develop design drawings and specifications for permit submission and construction. Proprietary protection may interfere with this development but it is suggested that third party interests such as those currently inspecting stucco systems will be able to contribute expert material to the development of this database. This is a matter for further research, however a computer disk specification from a manufacturer of EIFS systems is enclosed for reference.

Current Web Site development

The current web site for construction discussion has been developed around an issue basis with provision for discussion summary, frequently asked questions, design details, specifications, and eventually training programs. The web site can reside on any commonly accessible source, and it is suggested that as a municipal office is the first point of contact for many participants, it should reside there. The City of North Vancouver has assisted in the development of an issues discussion segment on their web site, as a result of this CMHC sponsored project (see Appendix "#2"). The web site is very inexpensive to post. However, depending on conferencing activity requires 1-2 hours per week to moderate. Elements that need to be developed are cutting and pasting questions into the discussion summary and removing redundant material from the discussion.

The Web site needs to develop a resource for the construction community and provide a link to other web sites of interest. A resource guide is under construction and displayed on the web site. Hot links will be developed both for the current issue and construction related connections.

E-mail links and encouragement of the virtual community is critical to the database development. Many participants will continue to "lurk" and only read posted data as it appears. The moderator must be active in contacting all participants by phone, private email, bulk email or in face-to-face meetings to ensure the project matures. A virtual community will thrive on the immediacy of personal contact. As professionals signed on-line they were impressed by the ability to communicate over this medium and the potential availability of resources. However, this novelty seems to have eroded as the project developed and thus must be encouraged by other forms of communication.

Conclusions and Summary

A number of ambitious objectives were described for this project. Some will involve further research while others can be directed towards the crafting of an interactive construction web site that is current, responsive, and evolutionary. Each objective is stated followed by conclusions:

- increase the likelihood of code uniformity between municipalities and construction stakeholders: The development of a virtual community with key construction participants is now being accomplished. The research indicates that interaction of municipalities and design professionals encourages problem solving and networking that through on-line discussion can be databased, with access from national and international participants. Knowledge building will develop in a number of construction related areas.

- develop permanent communications linkages between government agencies and construction stakeholders based on the pilot project: This discussion group was implemented by the City of North Vancouver with input from the investigator. Current discussion groups are on stucco and central heating generation (engineering department). Appendix "#2" describes the address for the current web site, discussion group organization and resources. The discussion group will continue to operate and data that is generated will be summarized and formed into frequently asked questions. Curriculum material can later be developed for use by trades, designers, and other construction participants.
- specify skills and certification requirements for the construction trades, thereby reducing the instances of poor workmanship: The development of this body of knowledge has just begun and requires more research and formation before presenting a curriculum. The development of the stucco model will formulate a curriculum that is responsive to industry demands and capitalize on other skills based courses that are available. Future research needs to focus on the immediate and long term needs of the industry and ways of meeting those needs with relevant training programs both on-line and in the classroom.
- encourage construction participants to develop training programs that have net cost/benefit effects and are compatible and complimentary, thereby allowing residential construction projects to proceed expeditiously: It has been demonstrated that the internet and a virtual community can offer vast resources at interactive levels. Design professionals have easier access to hardware and time to work on the internet. Other construction participants are not as fortunate, but construction trades especially general contractors employ people with skills at completing building permitting requirements. It is expected that permit completion issues can be developed for general contractors by placing them on the internet and fashioning the core curriculum around their needs and that some of those needs will overlap with those of the design professionals. The internet remains largely untapped and like a mother lode require creativity to mine the vast array of resources into relevant current data that can be accessed, used and applied by construction designers and trades. The residential design sector remains the most under designed for the professional, and tightest bid for the contractor. More attention paid to the design and construction needs by information technology will encourage better built buildings.
- specify design and construction procedures that reduce job sit confrontations, thereby reducing overhead and increasing affordability. Construction documents that are filed with a permit office do not contain the required details that should reflect key components of buildings including building envelope, firestopping and fire separations. These construction elements need to be enhanced and standardized to reflect acceptable construction practices. The research indicates that with the development of the web site data can be gathered from a number of sources to specify adequate criteria for generic designs of many building components.

Research problem

Background

Increasingly building sustainability and project development is hindered by poor linkages between developers and professionals, especially in residential developments. Awareness of construction/design roles is limited and obscured by code misunderstanding. As a result many designers can be described as "coat-tail" professionals that are used by developers when legal issues arise (i.e. building permit, occupancy and a failed inspection). Many residentially designed projects are not tendered. The adequacy of drawing and specification preparation depend on the permit review process administered by a government jurisdiction. Therefore, it is critical to develop linkages between government and the private sector that encourage quality management systems in the residential housing sector.

Education of the construction design professional (architects and engineers) is delivered by the post secondary institution and lacks a focus on regulatory processes. The theoretical educational framework lacks a practical basis for the understanding of the major safety codes. Formalization of code programs has been initiated for practicing architects through a certified professional program currently delivered at the University of British Columbia. This voluntary program involves three months of intense code learning leading to formal certification which is currently recognized by a few lower mainland municipalities.

Integration of code principles into the university program has been attempted by several post secondary institutions throughout the country. However, criticisms of this integration arise due to the ill preparedness of the learner to synthesize complicated code principles with building designs, during their formal training (Walkington, Pemberton, Eastwell, 1994). Contact with building officials, the practical application of theory and extensive work experience are integral to this apprenticeship. Walkington et al (1994) note that it is important to translate formal training into a "cognitive apprenticeship...where students are enculturated into the culture of the engineer, for example, by participating in authentic practices, activities and social interaction." (p. 162)

Research Question

Does the computer conferencing medium improve visualization and synthesis of textual material for the adult professional at work? Two groups were created to test code knowledge gains. Both groups could conference on building code issues but only one had access to a building code curriculum. Knowledge was then tested and the groups compared.

Is the transfer of code knowledge incorporated into work practices? What are the impacts over the efficiency of the construction and regulatory processes? To explore how knowledge is formulated and retained the project examined the traits of conferencing that should encourage conferencing attributes. So the questions were reformulated as:

Will students with a greater sphere of control[1] on either the personal or the interpersonal levels be more or less likely to regularly and actively participate on-line, take another on-line course, rate the virtual classroom as easier and more effective than the traditional one, and have a positive view of the instructor or facilitator?

Will students who experience group or collaborative learning in the virtual classroom have positive[2] views of on-line course work?

Will conferencing students with good computer terminal access at either home or in the office, who spend more time on-line and view on-line courses as more convenient, report positive views of on-line courses across a number of variables[3] and will students report positive views of the on-line course across the same variables?

Research method and data sources

Research Method

The research methodology compares two groups of twenty practicing architects (each), and assess the achievement of code understanding over a two month period, using two experimental groups, and a control group with a pretest and a posttest format. The experimental design describes a pretest-posttest comparison group design:

- two experimental groups (Groups I and II) of architects will respond to a computer conferencing mediated delivery with 3 building official offices. Group I will be given building code course material and will be prompted for responses as they work through the modules. Group II will be party to the conferencing discussions but, other than code and permitting processes on the job, they will not work with any course material.
- the control group (Group III, the lecture format delivered through the CP[4] program at UBC) of designers could not be used as the number of students available for interviews and tests were 15 and only 3 students volunteered to participate.

Data Sources

[1] Hiltz (1994) describes the various spheres of control that have also been researched by Rotter (1966) and Paulhus (1983). Personal sphere of control is described as: "...a subscale of measures being a result of one's effort rather than "luck". Interpersonal control measures control over people in groups" (p.68). Measurements of these effects are contained in the images of yourself section of questionnaire 2.

[2] Positive measurements are based on correlations with on-line convenience, computer terminal access, time spent on-line, increased communication with the students, improved access to the facilitator, experienced increased motivation by reading assignments of other students and found comments and assignments by other students useful.

[3] The variables measured are computer attitudes, instructor rating, interest in the course, the ability to synthesize ideas, views on the virtual classroom, overall increased collaboration, course rating and course access and quality.

[4] The course has been running for seven years and is supported by the Architectural Institute of B.C., the Building Officials Association of B.C. and the Cities of Vancouver and Surrey. The course is delivered for three months each year to part time students. The course material covers commercial code design and permitting processes and is taught by a mixture of code experts, practicing and faculty architects. A pilot class will be run with the randomized sample.

Subjects

The design is experimental as the subjects will be randomly selected from architectural design offices (150 individuals and 40 offices were surveyed) throughout the lower mainland of B.C. A pretest was conducted to determine effective representation of the critical factors influencing the dependent variable (achievement on tests of practical and academic code knowledge and permitting processes) and elements that may confound the independent variables (computer conferencing and classroom/lecture as treatments). The subjects were selected using stratified proportional sampling methods from small, medium and large firms. Subject attrition, the early stages of the program, was accounted for by replacing students from the 150 sample pool.

The sites will be forty architectural offices (Groups I and II). The architectural offices represent a cross-section of offices throughout Canada and thus the data should be generalizable to the nation.

Data Collection

Questionnaires and surveys

Pre and posttest questions were developed using material from the Building Officials Association of B.C. Level III curriculum delivered at the British Columbia Institute of Technology (BCIT). Surveys were formulated to examine conferencing attributes that would be the most effective for various types of groups. The questions were both open and closed form addressing categorical and continuous variables such as computer accessibility (office and home), individual computer knowledge, code understanding, gender, work (office and field), experience, age, formal and informal training and internal code support mechanisms.

Interviews

Exploration of computer background, work experience and practical code understanding required interviews to ensure the data collected was reliable. These were conducted by a research assistant and the primary investigator.

Each subject of Groups I and II will have computer conferencing software. Familiarity with the software and hardware of the system is a key component of subject achievement. Research has indicated that familiarity must be incorporated as part of the curriculum. To this end feedback mechanisms will be initiated, to lead users through the software package and simultaneously expose fundamental code experience. The exercise will require each student to complete course objectives.

Results

- the internet can be a valuable tool for student access and knowledge building exercises, supporting the hypothesis that students who experience group or collaborative learning in the virtual classroom are more likely to judge the outcomes of an on-line course to be superior to the outcomes of traditional classrooms;

- that students who depend on their own effort rather than "luck" are more likely to regularly and actively participate on-line;
- those that have control over people in groups viewed the on-line experience with some trepidation indicating that they would not prefer to take another on-line course;
- the curriculum did not appear to have much effect over gains in building code knowledge between curriculum and non-curriculum groups when exposed to a computer conferencing delivery system;
- the interface continues to confound students and leads to frustration that can debilitate the learning experience; and
- on-the-job learning is constrained by time and work load demands.

ABSTRACT

Through the delivery of a building code education module over the internet, the effectiveness of on-line education in a work environment was examined. Building officials served as the expert facilitators and instructors and the students were architects and designers. Guests from an arm of the National Research Council involved in building code issues were also invited to take part. Thirty-nine selected students were placed in two groups (Group I and Group II) controlling for age, work experience, computer skill and knowledge of the building code. Two groups, each with about 20 students were selected to participate in an on-line computer conference. Group I received an on-line curriculum with posttests after each section and Group II received only posttests. Academic achievement comparisons were then made between the two groups. T-tests were used to compare achievement for the two groups of learners, one with an on-line curriculum and one without an on-line curriculum, but both given the opportunity to conference and answer specific section review or posttest questions.

Dependent variables were identified as instructor access, motivation, participation levels, comparisons to the traditional classroom, level and convenience of on-line involvement, virtual classroom overall rating, course rating, instructor rating, interest, ability to synthesize ideas, academic achievement, and group communication. The independent variables were computer attitudes, expectations about the conferencing system, interpersonal sphere of control, terminal access, and curriculum design.

Frequencies were compiled and displayed in graph form to portray variables. Comparisons were made using Pearson Correlations.

Results indicate that:

- the internet can be a valuable tool for student access and knowledge-building exercises, supporting the hypothesis that students who experience group or collaborative learning in the virtual classroom are more likely to judge the outcomes of an on-line course to be superior to the outcomes of traditional classrooms;
- students who depend on their own effort rather than "luck" are more likely to regularly and actively participate on-line;
- those with high viewed the on-line experience with some trepidation indicating that they would not prefer to take another on-line course;
- the curriculum did not affect gains in building code knowledge between curriculum and non-curriculum groups when exposed to a computer conferencing delivery system;
- the interface continues to confound students and leads to frustration that can debilitate the learning experience; and
- on-the-job learning is constrained by time and work load demands.

RÉSUMÉ

La présentation sur Internet d'un module de formation consacré au code du bâtiment a permis d'examiner l'efficacité d'un mode d'enseignement en ligne offert en milieu de travail. Les agents de bâtiment ont servi d'animateurs et de formateurs spécialistes alors que les étudiants étaient des architectes et des concepteurs. On a également invité des gens d'un organisme du Conseil national de recherches, qui traitent des enjeux du code du bâtiment, à y participer. Les trente-neuf étudiants choisis ont été classés en deux groupes (groupe I et groupe II), suivant leur âge, leurs antécédents de travail, les connaissances informatiques et leur connaissance du code du bâtiment. Les deux groupes, regroupant environ 20 étudiants chacun, ont été choisis pour participer à une conférence informatique en ligne. Le groupe I a reçu la formation en ligne de même que des tests après chacune des sections alors que le groupe II n'a eu droit qu'aux tests postérieurs. Les taux de réussite atteints dans les deux groupes ont ensuite fait l'objet d'une comparaison. Des tests ont servi à comparer le degré de réussite parmi les deux groupes d'apprentissage, l'un avec la formation en ligne et l'autre sans la formation en ligne, mais les deux ont eu l'occasion de participer à la conférence et de répondre à des questions précises en revue de section ou dans les tests postérieurs.

Des variables dépendantes ont été cernées : l'accès au formateur, la motivation, le niveau de participation, les comparaisons avec la salle de classe traditionnelle, le niveau et la commodité de la formation en ligne, la cote générale de la salle de classe virtuelle, la cote du cours, la cote des formateurs, l'intérêt, l'aptitude de faire la synthèse des idées, le taux de réussite, et la communication par groupe. Les variables indépendantes étaient l'attitude à l'égard de l'ordinateur, les attentes à l'égard du système de conférence, la sphère de contrôle interpersonnelle, l'accès au terminal et la conception du programme.

Des taux de fréquence ont été compilés et affichés sous forme graphique pour montrer les variables. Les comparaisons ont été établies à l'aide des corrélations Pearson.

Les résultats indiquent ce qui suit :

- Internet peut constituer pour les étudiants un outil précieux pour acquérir des connaissances en construction, soutenant la thèse selon laquelle les étudiants qui expérimentent l'apprentissage en groupe ou coopératif en salle de classe virtuelle sont plus susceptibles de juger les résultats d'un cours dispensé en ligne supérieure à ceux d'un cours dispensé dans une salle de classe traditionnelle;

- les étudiants qui se fient uniquement à leurs efforts plutôt qu'au «hasard» sont plus susceptibles de participer régulièrement et activement à des activités en ligne;

- le sentiment de «vive inquiétude» que les étudiants ont ressenti à l'égard de la formation en ligne révèle qu'ils ne préféreraient pas suivre un autre cours en ligne;

- la formation n'a pas influé sur l'acquis des connaissances du code du bâtiment entre les groupes soumis à la formation en ligne et non soumis à la formation en ligne lorsqu'ils étaient confrontés à un mode de présentation de conférence informatique;

- l'interface continue de confondre les étudiants et amène un sentiment de frustration risquant de nuire à l'apprentissage; et
- la formation en cours d'emploi est limitée par le temps et la charge de travail.

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Chapter One - Introduction

Overview

This chapter introduces an on-line computer conferencing project named "Codeworks" developed by municipal building officials and delivered to design architects and engineers. The described need is to make building code course material more available to design architects while they work, creating a virtual community with facilitators (municipal officials) for the dissemination and interpretation of building code knowledge. A summary of the methodology describes the need to compare:

- the effectiveness of on-line and traditional courses; and
- the effect of the curriculum on on-line learners.

Background

Communication occurs between architects and municipal building officials on a regular basis as they process building permits from design, through working drawings, permitting and occupancy phases. The building permit process is the main contact and point of "expertise exchange". It is, in many ways, a meeting of minds. This confluence occurs at the counter, over the phone, through the fax machine, in meetings and through various contacts on the job site. A needs analysis was conducted as part of this project, utilizing questionnaires and interviews to determine the key objectives in this exchange and to identify the educational mechanisms that could be brought to bear. Specifically focusing on the design profession and building officials, the gaps in knowledge and perceptions were studied.

To rid projects of major surprises such as running over-budget and failing to meet completion dates, design firms employ many mechanisms. These include contracting with fire protection design consultants, developing building code experts in each design office or encouraging a designer to study the building code. However, primary gaps occur in understanding code concepts, structure and application. Most students interviewed for the project stressed that code contradictions and divergent interpretations often lead to confusion and misapplication. Also, noted was the inability to exchange information directly with municipal building officials.

Architects and engineers who have recently graduated from university are not fully familiar with the application of the major building safety codes, yet they face an array of regulatory issues when they take on construction work. To remedy this situation in British Columbia and to assist municipalities in administering the building code, courses have been initiated for practising construction design professionals through a certified professional program[1] currently delivered at the University of British Columbia. This voluntary program uses a traditional classroom delivery format and involves three months of intensive building code training. Successful completion of the course leads to formal certification, currently recognised by a few Vancouver lower mainland permits and licenses jurisdictions.

Integration of code principles into the university architecture and engineering programs has been attempted by several post secondary institutions in Canada. However, criticisms of this integration arise due to the ill-preparedness of the learner to synthesize complicated code

[1] The course has run for sixteen years and is supported by the Architectural Institute of B.C., the Building Officials Association of B.C., the Association of Professional Engineers and the Cities of Vancouver and Surrey. The course is delivered for three months of the year to part time students who, for the most part, take time out from practicing architecture or engineering. The course material covers commercial code design requirements and is taught by code experts, professional engineers and practicing architects.

principles with building designs[2] during their formal training and to retain that knowledge over time (Walkington, Pemberton, Eastwell, 1994). Walkington et al (1994) note that it is important to translate formal training into a "cognitive apprenticeship. . .where students are enculturated into the culture of the engineer, for example, by participating in authentic practises, activities and social interaction" (p.162). Contact with building officials, the practical application of theory, extensive work experience and curriculum design tailored to student's needs is integral to this apprenticeship.

Purpose of this study

The problem is that a new delivery system is required that is convenient for people who are working that can take advantage of this "cognitive apprenticeship", is tailored to learning needs and can examine the importance of curriculum design and delivery. Information overload has been noted by Harasim (1987) as a primary failing of computer conferencing systems. By eliminating the curriculum, but retaining the interactive nature of on-line conferencing, would it be possible to achieve equal gains in knowledge, thus reducing design time and costs? Do students have positive views of the on-line experience and what do they see as critical components of the experience? The purpose of this study is to investigate some aspects of the effectiveness of on-line conferencing in teaching and learning about building codes on-the-job. Computer conferencing seems to fit the demands of a "cognitive apprenticeship" by permitting information transfer from the municipal office (where authentic practices, activities and social interaction occur) to the learner (architectural design offices) on demand, allowing self-paced learning. Nipper (1987) states that "the strength of the corporate learner (involved in electronic

[2] Listed by Walkington et al are four broad categories of practical work, including knowledge about materials, devices and techniques, safety codes and practices, specific equipment and techniques (p.164).

classrooms), educationally speaking, is the disciplined and focused way in which he/she uses the medium, by making relevant contributions to the subject-related discussions in the electronic classrooms" (p.169).

Project overview

The name "Codeworks", was chosen for the project because it portrays the delivery of building code curriculum modules based on four subsections of the 1992 B.C. Building Code (3.1.2, 3.1.3., 3.2.1, and 3.2.2.[3]) in a conferencing format over the internet. With the data links provided by Westel and Cyberstore, the project fashioned a web site located at http://www.conexus2000.com. Readily available computer hardware within design and municipal offices allowed participants to connect to the internet and then conference within the web site. The web site consisted of four sections: design news (for information only), the curriculum, a conferencing protocol section, and a password restricted conferencing section. The on-line course with computer conferencing was delivered directly into the workplace. The curriculum content was primarily text based, without hypertext capability, supplemented with graphics that elaborated key definitions. Section reviews or posttests followed each curriculum module.

Methodology overview

Key benchmark times and dates were established. On February 20, 1996, a seminar provided a project overview from Codeworks researchers, with web site presentations from the City of Vancouver and the Provincial Building Standards Branch. Ninety personnel from architectural, engineering and building official offices attended. Questionnaires 1, 2 and 3 (Appendixes F-1, 2

[3] These code sections deal with the entry level requirements for building code classification, multiple occupancy, and construction parameters.

and 3 respectively) were circulated. Based on age, code and work experience, students were selected and placed in two groups. Building officials within municipal offices acted as facilitators for both groups. Each group could then conference with each other or with the facilitators, but only one group could access the Codeworks curriculum. However, both groups were evaluated using all the instruments: pre and posttests, pre and post-interviews and questionnaires. Pre-interviews were conducted in March of 1996. In March and April, on-line curriculum development was developed with the assistance of the Building Officials Association. At the same time, 40 design offices and four municipal offices installed on-line linkages to the internet. As accredited building code courses were not available comparisons were made to perceptions of traditional classrooms experienced by the sample.

Mason (1989) discusses the development of computer conferencing and the changing roles of the technology. He notes that computer conferencing effectiveness depends upon the size of the audience and the virtual aspects of the project. According to Mason (1989) computer conferencing is a large leap from the traditional means of communication that uses only the lecture format. In the lecture format a good deal of the discussion is lost with lecture time consumed by the repetition of information (Harasim 1990). In the virtual realm each exchange can serve as a springboard for the development of easily accessible knowledge. Responses to on-line lecturing from a disbursed audience establishes recorded exchanges that everyone can work from and manipulate. Other benefits of conferencing include the potential of a support group within the office to assist with the technology and curriculum, and the ability, while learning on-line, to adjust the appearance of the text and search for cross references.

Interaction between the students and the instructor in this study was based on municipal client interaction scenarios as suggested by Harasim (1987) who said that: "...contact between instructors and students should be frequent and intense; debate and dialogue should play a greater role (than in the undergraduate courses)" (p. 119). The replacement of the classroom environment by the virtual realm has been researched by Harasim (1990); Hiltz (1994); Mason and Kaye (1989).

Various types of learning have been described by Hiltz (1994): rote learning, integrative/knowledge-building, attitudinal change, and application. Two areas of primary concern in this study are attitudinal change and integrative/critical knowledge-building skills[4] which are measured across the variables of attitudes toward computers, expectations about the system, personal and interpersonal sphere of control and the effect of the curriculum.

The four central research questions are:

Will there be significant gains in code knowledge between Groups "I" and "II" when Group "I" is exposed to a computer conferencing delivery system with a defined curriculum and "II" is exposed to a computer conferencing system without a defined curriculum?

Will students with a greater sphere of control[5] on either the personal or the interpersonal levels be more or less likely to regularly and actively participate on-line, take another on-line course, rate the virtual classroom as easier and more effective than the traditional one, and have a positive view of the instructor or facilitator?

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[4]These types of learning are described by Hiltz as: "integrative/critical knowledge-building, wherein the student is able to pull together or synthesize diverse facts, ideas, or procedures by analyzing and organising them into larger conceptual frameworks" ; and "...attitudinal change, whereby the student acquires, for instance, an 'appreciation' of literature or art, standards for ethical behaviour in their occupation, less prejudiced feelings about other racial or cultural groups or increased interest in pursuing further knowledge in a particular field." (p.76, 77).

[5] Hiltz (1994) describes the various spheres of control that have also been researched by Rotter (1966) and Paulhus (1983). Personal sphere of control is described as: "...a subscale of measures being a result of one's effort rather than "luck". Interpersonal control measures control over people in groups" (p.68). Measurements of these effects are contained in the images of yourself section of questionnaire 2.

Will students who experience group or collaborative learning in the virtual classroom have positive[6] views of on-line course work?

Will conferencing students with good computer terminal access at either home or in the office, who spend more time on-line and view on-line courses as more convenient, report positive views of on-line courses across a number of variables[7] and will students report positive views of the on-line course across the same variables?

Definitions and Glossary

The following definitions are provided to assist the reader in understanding the technical jargon used in the computer conferencing environment.

Architects - Each province in Canada regulates the educational and practice requirements of the architectural profession. This profession is chiefly responsible for all elements of building design (eg. building envelope, life safety, and esthetics) and plays a coordinating role in structural, mechanical or electrical issues. In B.C. the profession is self-regulated under the Architect's Act.

Building Code - The National Building Code is published by the National Research Council in Canada. It is a model document that is empowered and modified by provincial legislation, with the title changed to reflect the province of adoption (eg. British Columbia Building Code). The public review process for the document occurs over a 5-year cycle with the particular year of publishing assigned to the name (eg. 1995 National Building Code). Each province will then review the code through another public process, making amendments and then assigning a year to the provincial proclamation (eg. 1992 B.C. Building Code). The Building Code covers life safety, health, social, and environmental issues.

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[6] Positive measurements are based on correlations with on-line convenience, computer terminal access, time spent on-line, increased communication with the students, improved access to the facilitator, experienced increased motivation by reading assignments of other students and found comments and assignments by other students useful.

[7] The variables measured are computer attitudes, instructor rating, interest in the course, the ability to synthesize ideas, views on the virtual classroom, overall increased collaboration, course rating and course access and quality.

Computer Conferencing (CC) - The aspect of grouping a series of computers so that communication can occur on a real-time or asynchronous basis. Discussion is usually text based but can also include graphical support. Users enter comments through a keyboard with a send command and data is then posted for a response. Posted data is available for each group to view, or specific e-mails can be sent for one-to-one discussion. Data is threaded based on the time of the entry and then may be recorded for future retrieval and manipulation.

Computer Mediated Communication (CMC) - Any discussion or input/output of data that uses a computer for information transfer. Multi-media presentations using graphics, real-time video, audio or text-based communications are examples.

Distance Education (DE) - Transfer of knowledge outside of the conventional classroom including print-based correspondence courses that could be supplemented with audio, video, computer conferencing or teleconferencing

Engineers - As with architects, engineers practice under the provisions of a provincial statute requiring them to be self regulating. Engineering is subdivided into a number of disciplines including geotechnical (soil), hydrotechnical (effects of water), structural, and fire protection.

Expert Systems - A method of access to a body of knowledge that is structured so that any access will allow a systematic search and retrieval of pertinent data. For example, the University of Manitoba developed an expert system for interpreting the building code.

Face-to-Face (FtF) - Communication where the participants can see and talk to each other in person, and is contrasted to on-line communication. The exchange is characterized by body language and immediacy of exchange without a record.

Groupware - Groupware is software with computer conferencing elements that allows group communication.

On-the-job learning - A curriculum is delivered directly into a conventional work environment. Changes to the job situation are not anticipated and the elements of time constraints and peer effect are studied.

Traditional Classroom (TC) - This is the conventional learning environment involving a room, teacher and students, usually conducted face-to-face. Class size and orientation (rows, round table, small groups) will vary based on logistics, subject matter, and pedagogy.

Virtual Classroom (VC) - The use of computers or electronic media to deliver a curriculum. Computer conferencing is the main element of this delivery system and has all the appearances of attempting to simulate the best elements of the traditional classroom and face-to-face communication.

Chapter 2 - Literature Review

Traditional, Distance and Virtual Classrooms

In this chapter I will:

- discuss the advantages and disadvantages of computer conferencing in educational settings;
- compare face-to-face learning with computer conferencing; and
- discuss the formation of virtual classroom communities of learning.

Many studies cited below compare computer conferencing with traditional and distance education systems (Smith and Kelsey, 1987; Kaye and Mason, 1989; Levinson, 1990; Davie, 1988; Harasim, 1987, 1990). All of these studies found that computer conferencing displays positive results when compared to other modes of delivery. However, Hiltz (1994) notes no significant difference in mastery between virtual and traditional classrooms but cautions that other educational outcomes need to be measured to fully examine the effectiveness of virtual classrooms. She recommends that the following variables be examined: access to educational experiences, access to professor, course participation, ability to express ideas, level of interest, ability to synthesize ideas and see connectivity, and computer comfort. Only by researching the particular variables can we identify the advantages and disadvantages of virtual classrooms.

Advantages and disadvantages of computer conferencing

Computer conferencing is the grouping of a number of computers to promote real-time or asynchronous communication. Applied in an educational setting, this can be described as a "virtual classroom." This section will investigate the advantages and disadvantages of computer conferencing in educational settings.

As noted by Davie (1988), when compared to a traditional "correspondence course", the virtual classroom allows for faster information exchange. The interactive nature of computer conferencing makes students feel they have control in their studies. As a result, student confidence is boosted. More assignments are submitted and more courses are completed. Harasim (1987) speculates on some other advantages of computer conferencing, some of which are very similar to those mentioned by Davie. These are:

- increased quantity and intensity of interaction;
- access to the collective, written knowledge and support of other students;
- a more democratic and sharing environment;
- convenience of access: the 24 hour class.

A further advantage of the virtual classroom is the element of asynchronicity. Burge (1994) notes that the flexibility of the virtual classroom allows adult students to study within certain time blocks from their own desks at work.

Harasim (1987) sees asynchronicity as deleterious, owing to the lack of immediate responses from the instructor and other classmates. Further student problems are noted by Harasim (1987) and Burge (1994):

- having too much information to process, which can cause difficulty in synthesizing ideas;
- the repetition of ideas may be viewed as boring;
- the difficulty in following on-line discussion threads;
- the loss of visual cues and the immediacy of face-to-face communication;

- wrist and eye strain;
- the pressure to log on frequently, which demands time; and
- the self imposed exclusion from discussion (lurking).

Information management appears to be a key facet of computer conferencing. Harasim (1987) notes that " the first days and weeks of using a new communication medium can be stressful" (p. 129). Hiltz and Turoff (1987) indicate that the convenience of electronic access to study in the home and at work is usually thwarted by the inconvenience of interruption and also by the need to establish new study habits and time management strategies. So, although the virtual classroom provides the benefits of asynchronicity, a democratic environment, convenience of access, increased motivation and favourable attitudes towards learning, it is accompanied by the disadvantages of information overload, loss of visual cues, health concerns, the inability to follow on-line discussion threads, and interface encumbrances.

Face-to-face learning compared to computer conferencing

Hillman et al (1994) propose that fear of the computer is part of every learner's repertoire in a virtual classroom. They contend that an interface is more confounding than face-to-face communication because of the less dynamic facet of the exchange. The learner must rely on fewer contacts and less corrective feedback. Immediate tutor and peer access is lost. For this reason, to be effective, the interface must offer ease in creating and responding to messages.

Hacker (1994) concludes: "The problem of computers not increasing and maybe even decreasing productivity is attributable to the fact that computers are difficult to use for most people" (p. 3). He argues that the computer literates are not aware of this. Computer programmers often type in

excess of 60 wpm and tend to assume that keyboarding skill is not a major impediment to interface dexterity.

Thus the encumbering and confounding aspects of computer conferencing require the development of *"learn to learn"* (Eastmond, 1994) strategies. The learner interface must be incorporated into the curriculum to be valued, appreciated and used. Although computer conferencing may introduce elements of interactivity into the curriculum, concerns with the interface must be addressed for educational outcomes to be as effective as face-to-face learning.

Harasim (1990) points out that like face-to-face learning, on-line learning promotes social interaction. She states: "Historically the social affective and cognitive benefits of peer interaction and collaboration have been available only in face-to-face learning. The introduction of on-line education opens unprecedented opportunities for educational interactivity" (p.42).

However, Hiltz et al indicate that educational interactivity may suffer from the inequality of participation: "... in the virtual mode, there usually emerges a dominant person who tends to receive a disproportionate number of messages" (p.230). Commenting on this dominance, Bales and Borgatta (1955) write: "This tendency toward inequality of participation... has summative side effects on the social organization of this group. The man (sic) who gets his speech in first begins to build a reputation" (p.34). In relation to participation Hiltz (1994) concludes that: "CC tends to produce relatively more of the types of communication that support high-quality decisions, and relatively less of the types that lead to group agreement" (p.243). She also claims that: "...asking for opinions appear to help the CC groups and harm the quality of decisions in

FtF." Hiltz notes that: "...this analysis may be pushing the current data beyond their reliability limits, and should be taken only as suggestive of an intriguing line of research" (p. 244).

Some of the differences between traditional and virtual classrooms depend upon the nature of the communication. Insofar as face-to-face communication provides the participants with more information and cues, Rice (1987) hypothesizes that the virtual classroom could lead to changes in the socialization patterns and political structure within organizations. "Unlike face-to-face communication, where relationships among individuals are influenced by socioeconomic status differences, norms, physical appearance and speech behaviour, individuals using CMC are not required to use indirect paths of interpersonal connections to communicate with others, perhaps socially distant users. They can simply send a message to any person or set of persons on the system" (p. 91).

The development of virtual communities

Mason and Kaye (1989) see the development of large virtual classrooms as critical to the extension of "organizational boundaries". They indicate that this form of teaching will allow large teams of faculty, tutors, and alumni to produce a "critical mass" of users. This should build the database, expand the opportunities for curriculum development, and increase the amount and quality of human resources. The larger group lends credence to systematic problem solving ventures and information gathering and dissemination.

The paradigms developed by Kaye and Mason (1990) indicate the development of a large community of users tied into an information structure to assist in understanding the large amounts of information. Rice and Cae (1983) examined the interactive components of computer

conferencing systems with the following results. Students exchanged information (100%), followed closely by asking questions (95%), exchanging opinions (81%) and staying in touch (84%). Surprisingly, the least mentioned highly interactive components were solving disagreements (15%), getting to know someone (14.5%), and bargaining and negotiation (18%).

As noted by Eastmond (1992), computer conferencing promotes open ended discussion based on process rather than product learning. Feenberg (1989) supports this view by stating that: "...computer conferencing favors open-ended comments which invite a response, as opposed to closed and complete pronouncements" (p. 26). He goes on to say that computer conferencing has the following strengths: "computer conferencing supports both large and small group interaction; allows interaction with other individuals or the instructor, encourages rapid feedback; and provides information exchange based upon the student's own schedule" (p. 26). Thus a virtual community is developed.

Morrison and Lauzon (1992) describe a conferencing medium that counters the views of the new paradigm spoken of by Mason and Kaye (1990) and Turoff (1990). Morrison et al (1992) contend that the bulk of research has focused on "..learning and design issues, neglecting the all important area of how we can facilitate students' actual linkage with host computers so that they may, in fact, participate in on-line education" (p.6).

Hiltz (1989), when schooling students in the acceptance of the virtual community, considers three variables: subjective satisfaction, use and perceived benefits, and successful implementation or adoption. She blames the conflicting results of a number of studies on the "different indicators of acceptance, different user populations, or differences among the systems"

(p.387). She concludes that: "Evidently it is 'personal' networking that provides the contacts that may aid professionals in their careers, and those who do not feel that the medium is personal in nature will not try to use it for such activities"(p. 394). She concludes that acceptance of computer conferencing is multidimensional with moderately positive correlations between subjective satisfaction and benefits. However, computer conferencing usage, subjective satisfaction and perceived benefits may vary independently.

Summary

Computer conferencing places the student at the center of knowledge (Kaye and Mason, 1989). In the resource-based approach, which the internet may provide, the teaching can be more intimate and more cooperative. Although large communities of learning may connect people and ideas in a critical mass (Kaye and Mason, 1989) computer accessibility, user familiarity and technical difficulties remain problematic (Morrison et al, 1992).

Computer conferencing permits group exchanges, whereas traditional correspondence courses do not. Advantages over traditional distance education courses (Harasim, 1987 and Davie , 1988) were noted as the democratic environment, ease of access and asynchonicity. Disadvantages were seen as information overload and the loss of visual cues. However, the ability to download information is seen as one way of capitalizing on asynchronicity and overcoming information overload. Two other advantages are peer interaction and the ability to communicate one-to-one, one to many, or many to many (Harasim, 1990; Burge, 1994).

Content development and course design

This section discusses:

- the elements required to design an effective computer conferencing system;
- the importance of modularization;
- computer conferencing screen activities;
- difficulties with the computer interface and methods to overcome them;
- the importance of knowledge building and expert systems;
- creative and critical thinking with respect to computer conferencing; and
- the importance of the learner and facilitator.

According to Scriven it is important to modularize courses, evaluate and adapt materials and to develop student and staff support. Scriven (1991) points out that this modularization is needed as professionals "...would be more appropriately served by short modules which assist in the solution of immediate problems" (p.300). In addition the set up of the conference depends on the structure of the groupware. "Foster (1985) suggests a main conference, private conferences, public sub-conferences, document workspace, a bulletin board and an area to collect surveys" (Eastmond, p. 30). Mason (1988) divides conferences into interactive components that simulate the college functions: virtual cafes and faculty lounges, a technical conference for questions, and the main conference.

Besides the interface, several scholars propose that upper division baccalaureate and graduate seminars are a natural fit for computer conferencing because of the manageable class size, the discussion expectation and the closer professor-student relationship (Harasim, 1987; Roberts,

1988; Hiemstra, 1989). Although the professor-student relationship is important, Davie (1988) uses learning partners or peers to assist in course development and progress. In her research study, participating students reported satisfaction with the learning partner exercise. Tessmer (1988) indicates that the use of the subject specialist encourages another type of professor-student relationship, which can add expert knowledge to the computer conferencing environment. However, he supports the use of surveys, questionnaires and more testing points to overcome the proclivity of the subject specialist to dominate discussion. The use of questionnaires provides a framework for student self analysis, thus assisting in addressing learning outcomes, critical to the success of the project and important for consensus in the computer conferencing environment. These tools draw out the subject specialists' special interests and gives the students a basis for discussion.

Knowledge building

The expert system model (Frye, Olynick, and Pinkney, 1992) refers to the development of a body of knowledge that can later be accessed by user groups. Through this access, a larger and more integrated database evolves. This type of knowledge building, which involves the learner as an active participant is viewed as a critical component of effective education and integral to computer conferencing (Hiltz, 1994; Harasim, 1990).

The plethora of information on the internet is conducive to knowledge building exercises. Harasim (1990) notes that: "Active sharing and seeking of information and playing with ideas is central to on-line collaboration. The shared text-based space seems particularly conducive to stimulating brainstorming activities and group synergy, sparking ideas or identifying new associations" (p.54). She notes that: "...learning is much more an evolutionary, sense making,

experiential process of development than of simple acquisition" (p. 55). She expands upon this by stating: "From my observation, in order to facilitate sense-making and knowledge building within on-line group discussion activities, the system needs to support three educational processes: idea generating (and gathering), idea linking and idea structuring " (p. 55).

Harasim (1990) connects divergent thinking with idea generating, and convergent thinking with idea linking. Idea generating is the compilation and formulation of ideas and is expressed in computer conferencing. She contends that idea generating is not yet that advanced within the computer conferencing environment. Feenberg (1990) and Hiltz (1986) note that information vastness floods the minds of the users, leading to despair and eventual withdrawal from on-line courses, so idea linking and generating are key to program success.

Social interaction with data has been shown to accentuate interest among computer conferencing groups (Harasim, 1990), but it appears that data manipulation amongst users poses the biggest challenge to any computer conferencing learning (Levinson, 1990). Expert system development depends on the manipulation and posting of data to achieve idea structuring (Harasim, 1990). Harasim (1987) notes that: "Students 'have the floor' and control (to a considerable degree) how much they write and participate" (p. 133). For learning to take place it is imperative that a collaborative learning environment be developed with focused discussions: "...particularly within the seminar activities, to avoid 'on line brainstorming' a situation in which comments do not relate to and build upon one another" (p. 133).

The learner and the facilitator roles

Knowledge building is inextricably tied to the development of on-line relationships, both with peers and the professor. An active moderator is critical to program success, but the democratic nature of the on-line environment places more stress on task development and peer interaction (Mason, 1988; Hillman, Willis and Gunawardena, 1994; McCreary and Van Duren, 1987; Harasim, 1990).

McCreary and Van Duren (1987) outline three roles considered paramount in any conferencing architecture: "...individual participant; the "Conference moderator" and the "diffusion manager" (p.117). "The diffusion manager must entice members of the organization to engage each other via on line communication" (p. 118). The professor, instructor or diffusion manager, to be effective, must play a non-dominant facilitator role. Wilkes (1991) points out the weakness in all three roles: "From observations and interviews it was concluded that the computer conferencing system exaggerates an instructor's weaknesses. If instructors are boring in a face-to-face setting, they can reach indescribable depths of insipidity..." in the conferencing environment (p.49).

Davie (1988) "...reported that on-line courses rated better with students who were motivated and well-prepared and who took advantage of the increased chance to interact with their professors and peers" (p. 58). Harasim (1990) argues that motivation and anxiety are reduced when working with peers instead of with the instructor. She elaborates: "It may be this building of new relationships that facilitates a better grasp of the material" (p. 44).

Facilitator role

Zemke (1981) indicates that research on adult learners tends to focus on asking questions of preference: "A trainee may prefer listening to lectures but learn best by practice and application exercises" (p. 10). So, task development and peer interaction may be stronger motivating factors for the adult learner than facilitator involvement. This is borne out by Rice (1987b) who examines task and socioemotional content of a number of on-line statements that occur through a large computer conferencing environment. He measured "...socioemotional content which is defined as interactions that show solidarity, relief, agreement, and antagonism, tension and disagreement. He also measured task or dimensional content which is defined as interactions that ask for or give information or opinion" (p. 93). He uses the term "professional" to describe the task oriented nature of some computer conferencing communication and concludes that: "Even a professionally oriented CMC system, involving users who do not otherwise know each other, can support a reasonable amount of socioemotional content" (p. 101). Within his study he notes that nearly 30% of the sentences of the students in a computer conferencing course were of this socioemotional nature, which is a significant amount of affective communication for a task oriented environment.

Burge (1994) indicates that the facilitator needs to synthesize and summarize ideas to promote learning. She sees any restrictions on group focus as an impediment to group dynamics, especially if it occurs in the early stages of computer conferencing. Assisting adults in learning is seen by Galbraith (1989) as a transaction process: "...in which the facilitator interacts with learners, content, other people and material to plan and implement an educational program" (p. 10). He goes on to say that most facilitators are guides through the educational process and are expert in content but not well schooled in program delivery. Some of the ideal roles assigned to

the facilitator are counselor, content resource person, learning guide, program developer, and institutional representative. As stated by Daloz, (1989, p.11), besides accenting interpersonal skills and being adept at transmitting content, the facilitator must "...have the ability to assist adults in the process of learning how to change their perspectives...." Further, the "element of good teaching becomes the provision of care rather than use of teaching skills and transmission of knowledge" (p. 11).

The learner

Focused discussion has been identified (Mason 1988; Harasim 1990) as key to the advancement of learning and the constructive scaffolding of concepts. This would preclude brainstorming because it detracts from the information flow and fails to engender relevant comfortable ideas and feelings (Burge, 1994). This detraction from the flow is identified by Burge (1994) as an attempt to create the "volatility of conversation" (Grint, 1992) without producing prattle or what one Open University student has called "chewing gum for the eyes" (Grint 1992, p. 160). Burge (1994) sees sub-conferences as a reflective tool to promote meta-cognitive learning strategies. Burge (1994) concludes that sub-conferences should "encourage students to contribute cogent and focused messages to the appropriate sub-conference" (p. 38) and thus eliminate the 'chewing gum'.

Although impromptu creativity can result in unproductive contributions, there are strengths seen in the anonymity and ability to contemplate responses from other students (Mason, 1988). However, some learners "lurk" (refuse to interact with others) (Mason, 1988; Harasim, 1990) impeded by unfamiliarity with the technology. Similar to the concern raised by Mason et al (1989) is that of Lewis (1993) who discusses the learner's potential reluctance to face the

"interactive mirror," although group social commitment should ideally encourage the desire to learn. Taking on the responsibilities of course direction and assessment of the other student's conferencing contributions is integral to the vitality and evolution of the on-line curriculum.

According to Burge (1994) learner contributions may be encouraged by the anonymity of the system, but anonymity may be lessened by the fact that contributions are recorded. Thus, making a point known, especially within contexts that involve sensitive material, can detract from progressive and positive discussion and discourage learners from contributing. She suggests that research should be expanded to examine: "the transferability of the results and to develop our understanding of how learners behave strategically in a CC context and perceive their tasks" (p.39) and thus reduce the student's sensitivity to conferencing contributions.

Another important learning variable is student feelings about computer conferencing. Hillman et al (1994) examine and quantify learning approaches by studying students' feelings about the delivery system. They propose that the adult learner is unaware of planning learning strategies, but that certain standards arise: ". . . establishing study patterns, scheduling effective study time, working with others,... seeking specific tasks and structure, and demonstrating competence to the instructor" (p. 138). Comparing the typical distance learning and computer conferencing environments, they find that students require inordinate time and resources which detracts from learning. Thus student's affective responses must be taken into account and should be assessed in course evaluations.

Wilkes (1991) also explores the motivational orientation of various learners. His project studied 156 students enrolled in an electronic distance education course at Utah State University.

Independent variables were noted as: motivational orientation of the participants, demographic data, and course data. The dependent variables were the participant's perceptions of the learning environment in the areas of satisfaction, material environment and involvement.

Some of the conclusions reached are that :

- electronic data material is inferior to other forms of educational media but the frustrations of full time students are similar to those of part time students studying in traditional classroom settings;
- teachers have a significant bearing on student involvement;
- "motivational orientations do not appear to be a factor in the decision of individuals who dropped out of their computer conferencing classes. Time, home and work demands seem to be the major reasons why they discontinue their classes" (p. 49).

Wilkes (1991) concludes that: "There appears to be little practical relationship between motivational orientations and participant's satisfaction (p.49).

Summary

Course modularization, with increased test points is critical to on-line program success (Tessmer, 1988; Scriven, 1991). However, the large amounts of discussion data must be structured to the content and fashioned into a framework so students can compare and analyze idea development that will later support an effective body of knowledge (Harasim, 1987; Mason and Kaye, 1989; Eastmond, 1992). Expert (subject specialist) or facilitator involvement must be guided to reduce substantive conflict and the domination of discussion (Tessmer, 1988). Learners may "lurk" due to the fear of the technology, preponderance of contributors, or the inability to offer feedback on the medium or course content (sub-conferences) (Burge, 1994; Mason, 1988). Further, it was found that student motivation and satisfaction were not related (Wilkes, 1991).

Adult professionals and work

This section will discuss:

- the peculiar nature of adult learners at work; and
- the general characteristics of adult learners;

General Characteristics

Adult learners appear to be particularly well suited to the computer conferencing environment due to their proclivity to be autonomous, goal and activity oriented, and the desire to bond with others (McCreary and Houle, 1990; Johansen et al 1979). The work environment may build bridges to other forms of communication and computer resources (Johansen et al 1979) and thus support activity oriented education. Johansen et al (1979) note that on-the-job learning outcomes are affected by how, with whom, when and where people work. They noted that a good many people operated their computers from home, which is a significant variable in computer conferencing acceptance as people are more likely to favour computer conferencing learning if it fits in with their schedule.

Another general characteristic of the adult learner is his resistance to the use of computers (Lewis 1988). Other research indicates that "..those who feel that the introduction of computers preempts their judgment, offers less room for individual decision making, and limits their control over their work space, tend to be more anxious and resistant to the technology because it threatens their sense of self" (Licata and Zuboff , 1988, p. 5). They found that technology acceptance was affected by skill acquisition and not by age.

Age determinates may be further explained by Simard (1988) who describes phases of adult learning developed from a three year study conducted in 1988 and notes a number of life phases that could affect program objectives and development. Data were gathered through semi-structured interviews and two exams; one retrospective over the previous 5 years of experience and the other prospective over the following 5 years. Phases involved perceptions of learning and the degree to which each would be recognized and utilized within the training environment. The perspective of these phases provides a guideline for the interpretation of the age variable. The study notes that the age groups 28-32 require the development of occupational goals. The 38-42 year old is eager to develop avenues of learning outside of the normal institutional setting: "...for the adult of this age, the reality of continuing education is generally confined to on-the-job training; he seems to totally reject organized or institutionalized activities of adult education..." (p. 25). This age group, more than any other, prefers to concentrate energies within the work environment, but continues to learn. Consideration of these phases may be integral to program development and content delivery.

Enhancing content to make sure that it is relevant is seen as one element that can be more fulfilling for the student. However, the need for a personal sphere of control "..is considerably more complex. This complexity is why the concept of personal control is a particularly salient one in distance education theory and practice" (Garland, 1994, p. 51). Using an ethnographic study Garland (1994) found that: "...personal control means students being in control of their personal learning situation, that is, being in a position to be self-efficacious. It does not mean their being in control of the entire educational transaction" (p.47). Paramount to any conferencing program is the feeling that the student is having an impact over the material and is able to contribute to the discussion. Garland notes: "These mature distance education students

have acquired the status of adults; their difficulty is psychologically maintaining this status and power while undertaking the role of student. Their needs for respect, personal control, and fulfillment are often frustrated" (p. 48).

But interdependence is also important to the adult learner. Adult learners want "...a solid body of knowledge with links to prior understanding, practical experience and access to resources to fill in prerequisite knowledge, opportunities for interactivity, good feedback and if problems arise, empathetic counsel" (p. 55). The need to communicate and work towards autonomy is critical to the adult learner and is supported by Boud (1994) and Schlossberg (1994) who say : "...autonomy is a recognition and acceptance of interdependence" (p. 55).

Summary

Adult learners need a sense of identity and integrity and clear goals (Garland, 1994; Shaw, 1992). Greater sphere of control and cohesiveness of the adult learner is more important than the age of the learner (Simard, 1988; Wilson, 1994; Garland, 1994). However, age phases may dictate the acceptance of on-the-job learning initiatives (Simard, 1988) and older students may be more resistant to the technology than their younger counterparts (Licatta et al, 1988).

Costs

Costs will dictate system implementation ideas and project decisions. In terms of the year 1984 Rice (1987b) states a: "...survey found that half of the sampled organizations expected CMCS would be a significant portion of their 1987 telecommunications budget up from 5% in 1984. A 1985 survey reported that 71 percent of Fortune 1000 companies planned to have CMCS (computer mediated communication systems) by 1986. By the end of 1985, there were over 1

million commercial 'electronic mailboxes' sending 13.5 million messages per month, prompted by the installation of nearly 6 million personal computers with communications capabilities" (p.200, 201). The expansion of the internet and the extended resource capabilities is also considered by Santoro (1994): "...as of the end of 1993 it is estimated that thousands of individual TCP/IP networks worldwide are connected to the internet, with at least 2 million individual computers attached (Elmer-DeWitt 1993, p. 73)". Santoro (1994) states that: "..in the summer of 1993 almost 13 million U.S. workers used computer networks to "telecommute" to the office on at least a part-time basis" (p. 77). This explosion in the potential of computer conference courses leads to questions about their economic viability.

Shifts are apparent from "..major cost elements in distance education, as opposed to face-to-face education, from student-related, recurrent, teaching costs to course-related materials development and infrastructure costs" (Kaye 1987, p.154). Phelps, Wells, Ashworth and Hahn (1991) state that the literature up to 1991 concludes that distance education can be less expensive than resident instruction, depending upon student enrollment and the fixed costs of course development and delivery. The costs associated with the development of the internet has greatly reduced the charges for production. E-mail capability has allowed for the ease of two way communication. Web site set up and rental costs run in the order of $1000 and the conferencing software development at a further $1000. As a result, curriculum development charges remain the number one cost factor in development of any course (Scriven 1991). However, the resource and time constraints of facilitators do enter the equation. According to Davie (1988) the use of conferencing and the role of the facilitator are major cost factors.

Chapter Summary

This review of research illuminates some of the findings concerning virtual classrooms. These findings include:

- The virtual classroom is often compared to the traditional classroom to determine the effectiveness of the computer conferencing system. Advantages and disadvantages are elicited but it appears that key elements of comparison are asynchronicity and the convenience of access;
- Computer interface encumbrances and information overload must be considered in system design;
- The nature of the computer conferencing encourages a democratic environment among learners and facilitators leading to high quality task decisions overcoming social barriers that may be present in traditional classrooms;
- Information and resource exchange may encourage the development of virtual communities but this is tempered by computer accessibility and familiarity difficulties;
- Course design will not only depend on modularization and the ease of navigation through the system, but also the roles of the learners and facilitators;
- Knowledge building exercises have the potential of developing an evolving database;
- Adult learners are well suited to computer conferencing as they are goal oriented, cohesive, and autonomous;
- The age of the learner did not have as much effect on technology acceptance as skill acquisition;
- Personal sphere of control is a characteristic that identifies adults who should work well in on-line systems;
- Studies indicate that an effective system can be developed at reasonable costs and that curriculum costs far outweigh software costs.

The review also raised questions for future research. These include:

- Does personal sphere of control affect views of the virtual classroom?
- Will the virtual classroom increase educational efficiency?
- Are there other ways of overcoming the encumbrance of the interface?

- Does the convenience of computer access have a bearing on views of the virtual classroom?
- What other learner/facilitator concerns affect virtual classroom acceptability?
- What type of messages will be generated in on-line research and how will they compare with other face-to-face communication (Rice and Cae, 1983)?
- Is there better facilitator access in the on-line environment than in the traditional one?
- How will the development of a virtual community be affected by the computer conferencing groupware design?

Chapter 3 - Methodology

Research basis and project description

The idea was to develop an on-line computer building code course and testing knowledge gains between curriculum and non-curriculum groups, and attitudes towards the medium. Objectives were vetted through a small group of team members (Appendix I). A project timetable was established (Appendix G) with an orientation meeting as the first event. Refer to Figure 1 for the project flow chart.

Codeworks utilized various activities to ensure that participants were familiar with the technology before beginning. These included:

- project team formation was encouraged by introducing students to each other through e-mail with topical and general discussions;
- gathering of feedback and project development occurred when students expressed concerns about internet access, netscape versions, and text appearance;
- orientation meetings and demonstrations were conducted to introduce the internet capabilities, assemble questionnaire data and demonstrate conferencing objectives;
- on-line commencement with issues discussion and e-mail trial occurred when the project network was developed and could be tested with students;
- the curriculum was then delivered in sections or 'chunks' with discussion issues at the end of each section. Students were alerted (by phone and e-mail) to change modules when all section tests were received; and
- data collection and closure occurred when over ten tests from each group were received and discussion had ended in all the conferencing sections.

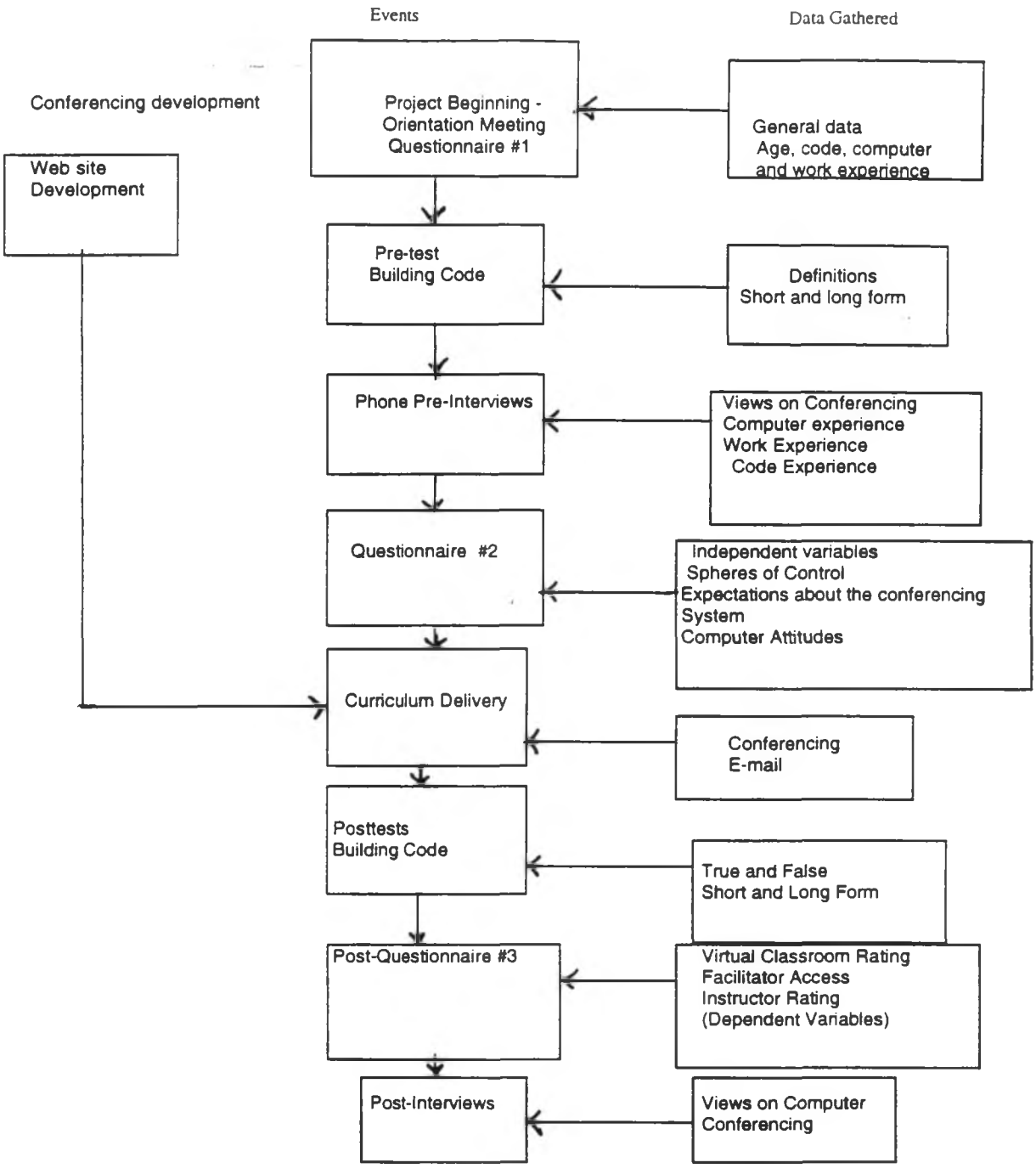

Figure 1 - Project Flow

Through on-line instructions and the pre-research seminar, each subject was informed of the delivery method, expectations and general course content (four subsections of the 1992 B.C. Building Code, 3.1.2, 3.1.3., 3.2.1, and 3.2.2.). Participants were encouraged to develop on-line internet linkages over the next several weeks. General code discussion topics were introduced initially, through which users became familiar with conferencing and the internet technology. As an incentive to participation by both groups, guests (subject specialists) from an arm of the National Research Council involved in building code issues were invited to take part. Warm up discussion on 'hot topics' led the on-line exchange. The hot topics were presented through a discussion paper, posted on-line supplemented with inserted questions. For example, examining the controversial issue of building stucco cladding prompted participants to develop their interface skills by using e-mail, web site searching and conferencing.

Two groups were then created controlling for age, work and building code experience (derived from questionnaire 1). Both groups had access to the conferencing section of the web site and the section reviews, but only Group I had access to the on-line curriculum. After the initial discussion phase on stucco, Group I participants began with modular sections of the building code. Each section was followed by a review which was primarily submitted on-line with some discussion. Pre-tests, phone interviews, and two pre-questionnaires (one and two) were conducted before the students went on-line. Curriculum modules were then posted on the web site in four stages followed by section reviews (posttests). Students could then conference on the section review topics or discuss social issues within the coffee shop section. Communication between groups was recorded on-line through the conferencing module and in the e-mail

database. Questionnaire 3 was then circulated to and completed by all the students, followed by phone post-interviews leading to project closure.

A moderator (co-investigator) was responsible for posting relevant data to the main web site, coaching discussion and answering queries. Facilitators were code professionals working within a government environment, who offered curriculum and code guidance. A conferencing protocol and facilitator guideline document assisted each group in navigating the conferencing and facilitator areas.

It was decided to restrict access to the conferencing section to participants to protect the project against outside interference. Thus passwords were assigned for each conferencing level. General public conferencing traffic would disrupt students and confound data collection. To protect the confidentiality of discussions and to structure group discussion five conferencing areas were defined:

a) General code conferencing

Participants from both groups entered this conference and discussed focused code issues on-line. Free access to this common conference was provided for all participants.

b) Facilitator conference

Facilitators were provided with the opportunity to discuss sensitive code issues within this conferencing section, thus protecting the confidential nature of some code interpretations. This level required confidentiality and therefore was restricted to facilitators. Discussion levels included policy and code interpretation.

c) Groups I and II - Student's conferences

Group I received on-line curriculum material and section reviews. Group II could access section reviews (posttests) extracted from the formal curriculum of Group I.

d) Coffee shop

This conferencing level allowed for social interaction between participants without cluttering the other main conferences. Elements of the discussions were examined for content and concept specific data and compared to the group interaction. General comments on program delivery were also accepted here and moderated as discussion proceeded. Summaries were based on the feedback and suggested comments for improvement.

Subject selection

The on-line course was developed with participants selected through a faxed request for participation sent to 120 architectural offices within Greater Vancouver. On February 20, 1996, a seminar was held to introduce the project to those able to attend. During this session, the research objectives were presented. Internet technology and its development by service providers, provincial and municipal agencies were also discussed. Thirty-nine participants completed project consent forms and questionnaire 1 (see Table A-1). They were placed in two groups using stratified sampling (Group I and Group II) controlling for variables that could confound the study including age, work experience, computer and code knowledge. Twenty subjects were placed into Group II and nineteen in Group I. Group size was restricted to keep events manageable for the computer conferencing module and to allow evaluation of subject achievement. Each design and municipal office was informed of the confidential nature of the

data and were instructed concerning the research proposal, the methods of reporting, communication, and testing.

Most of the facilitators were not able to take part in the conference as they could not develop on-line linkages and pressing workload demands restrained their participation. Three facilitators from the cities of Richmond, Burnaby and Vancouver contributed to the facilitator's conference eleven times. On-line discussion exchanges explored code concepts, discussed technical difficulties and debated the curriculum presentation. Conferencing on-line required active phone, e-mail contact and faxed data to encourage participation.

Instruments

Of the 41 subjects who started in the Codeworks project, two left after completing pre-questionnaires due to electronic access difficulties, and four because of workload demands. These six are not included in the study. Two entered the project after the pretest and their data is included in the study. The matrix in Table A-1 describes the instrument completion for the subjects and includes those that remained in the project. The pretests were completed by 17 subjects (6 for Group II and 11 for Group I). The posttests were completed by 27 subjects (15 from Group I and 12 from Group II). Questionnaire 1 was completed by 39 subjects; Questionnaire 2 by 37; and Questionnaire 3 by 24. Twenty-two subjects were pre-interviewed and 32 were post interviewed.

Subject attrition was heaviest in the pretests due to the extensive work (two to three hours) required to complete the examinations. Pre and posttests (Appendix F-4 and F-5) were formulated to test code knowledge and were based on standardized tests prepared by the Building

Officials Association of B.C. The performance on these tests formed the basic criteria to answer research question 1 and compare code knowledge gains between Groups I and II (curriculum and non-curriculum). Pre and posttest questions were short and long form requesting clarification of code definitions and code concepts. Questionnaire 1 was completed by 39 of the subjects and gathered demographic and work experience data (Appendix F-1) to assist in placing the students in each group. Questionnaire 2 and Questionnaire 3 measured variables as follows:

- computer terminal access - using a Likert scale this variable consisted of three questions, two asked in questionnaire 2, whether the student had a computer at home, or at work and one asked in questionnaire 3, is taking on-line courses more convenient and is expressed as a Pearson Correlation;

- computer attitudes, sphere of control based on the images of yourself section of questionnaire 2 and is expressed as a Pearson correlation based on the sum of the answers to the following:

    - When I get what I want, it's usually because I worked hard for it
    - I prefer games involving some luck over games requiring pure skill
    - Even when I'm feeling self confident about most things, I still seem to lack the ability to control social situations
    - I can learn almost anything if I set my mind to it
    - I have no trouble making and keeping friends
    - It's pointless to keep working on something that is too difficult for me
    - I'm not good at guiding the course of a conversation with several others
    - On any sort of exam or competition I like to know how well I do relative to everyone else
    - I can usually establish a close personal relationship with someone I find attractive
    - My major accomplishments are entirely due to my hard work and ability
    - When I make plans I am almost certain to make them work
    - When being interviewed, I can usually steer the interviewer toward the topics I want to talk about and away from those I wish to avoid
    - I usually don't set goals because I have a hard time following through on them
    - If I need help in carrying off a plan of mine, it's usually difficult to get others help
    - Competition discourages excellence
    - If there's someone I want to meet, I can usually arrange it.
    - Other people get ahead just by being lucky
    - I often find it hard to get my point of view across to others
    - In attempting to smooth over a disagreement, I usually make it worse

- interpersonal sphere of control or collaboration index.

Dependent variables are:

- achievement (pre and posttests see Appendixes F-4 and F-5)
- virtual classroom overall rating, course rating, course outcome index, interest and synthesis index and instructor rating.

Both pre and post interviews (Appendices F-6 and F-7) were conducted to support the data gathered in the questionnaires and tests. The interview questions were formulated using procedures identified by Hiltz (1994) and probed work, building code experience, computer attitudes, and conferencing expectations.

Table A-1

Instrument Matrix

SUBJECT	Q. 1	Pr.I	Pr.T.	P.T.	P.I.	Q.2	Q.3
1	x	x		x	x	x	x
2	x	x			x	x	
3	x	x	x	x	x	x	
4	x	x		x	x	x	x
5	x			x	x		x
6	x	x			x	x	
7	x	x	x	x	x	x	
8	x			x	x	x	x
9	x	x	x	x	x	x	x
10	x					x	
11	x			x	x	x	x
12	x	x		x	x	x	x
13	x	x		x	x	x	x
14	x	x		x	x	x	x
15	x	x	x	x	x	x	x
16	x		x	x	x	x	x
17	x				x	x	
18	x			x	x	x	x
19	x	x	x	x	x	x	
20	x		x			x	
21	x	x				x	
22	x	x			x	x	x
23	x	x		x	x		
24	x			x	x	x	x
25	x	x	x	x	x	x	x
26	x	x	x	x	x	x	
27	x					x	
28	x		x	x	x	x	x
29	x	x	x	x	x	x	x
30	x	x	x			x	
31	x						
32	x			x	x	x	
33	x	x	x	x	x	x	x
34	x		x			x	x
35	x	x	x	x	x	x	
36	x			x	x	x	x
37	x		x	x	x	x	x
38	x					x	
39	x		x	x	x	x	x
Totals	39	22	17	27	32	37	24

Note. Q - 1 = questionnaire 1 Q - 2 = questionnaire 2 Q - 3 = questionnaire 3

Pr. T = Pretest Group 1 = Subjects 21-39

PT = Posttest Group 2 = Subjects 1-20

Pr. I = Pre-interview PI = Post-interview

X denotes instrument completion, blank is not completed

Questions

1. Will there be significant gains in code knowledge between Groups "I" and "II" when Group "I" is exposed to a computer conferencing delivery system with a defined curriculum and "II" is exposed to a computer conferencing system without a defined curriculum?

Answering this question involves comparing achievement on pre and posttests.

The research methodolgy for the first question is developmental and quasi-experimental, studying two groups of approximately twenty architects (each), assessing achievements on standardised building code tests (pre and posttests) after exposure to a computer conferencing environment, with on-line curriculum modules delivered over the internet for a six week period with:

- a group of students (Group I) learning on-the-job responding to an on-line building code course with a defined curriculum. These students can access computer conferencing; and
- group of students (Group II) learning on-the-job, responding to an on-line building code course with summative tests, but without a defined curriculum. These students can access computer conferencing.

2. Will students with a greater sphere of control[8] on either the personal or the interpersonal levels be more or less likely to regularly and actively participate on-line, take another on-line course, rate the virtual classroom as easier and more effective than the traditional one, and have a positive view of the instructor or facilitator?

To answer this question measurements of the independent variables personal and interpersonal sphere of control were conducted using the images of yourself section of questionnaire 2. Views of the on-line educational experience were measured using the variables virtual classroom rating, course outcome, instructor rating, and views on taking another on-line course and then compared with the independent variables using a Pearson correlation.

[8] Hiltz (1994) describes the various spheres of control that have also been researched by Rotter (1966) and Paulhus (1983). Personal sphere of control is described as: "...a subscale of measures being a result of one's effort rather than "luck". Interpersonal control measures control over people in groups" (p.68). Measurements of these effects are contained in the images of yourself section of questionnaire 2.

3. Will students who experience group or collaborative learning in the virtual classroom have positive[9] views of on-line course work?

To answer this question an index measuring collaboration was compiled using questionnaire 3 measured across the variables (virtual classroom rating, collaboration index, terminal access, time on-line, and the convenience of on-line courses) that measured the effectiveness of the computer conferencing and made comparisons to the traditional classroom. Measurements of the type of conferencing exchange provide an indication of the type and complexity of interaction between participants.

4. Will conferencing students with good computer terminal access at either home or in the office, who spend more time on-line and view on-line courses as more convenient report positive views of on-line courses across a number of variables[10] and will students report positive views of the on-line course across the same variables?

To answer this question computer access was measured across the variables noted and frequencies were measured for each variable. The case study method is used in the last three questions to examine the virtual classroom mode of delivery and compare the changes in attitudes and academic achievement. It is believed that the virtual classroom will report higher subjective satisfaction than previous subject experience with the traditional classroom.

Summary

- Codeworks began with a small group of students who assisted in the development of project objectives.
- Four research questions were asked to test knowledge gains and attitudes towards the on-line system of education.

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[9] Positive measurements are based on correlations with on-line convenience, computer terminal access, time spent on-line, increased communication with the students, improved access to the facilitator, experienced increased motivation by reading assignments of other students and found comments and assignments by other students useful.

[10] The variables measured are computer attitudes, instructor rating, interest in the course, the ability to synthesize ideas, views on the virtual classroom overall increased collaboration, course rating and course access and quality.

- Students were selected from a group of lower mainland architectural offices and events were then organized to deliver the instruments to all the students. The main groups were divided into two groups to test the need and effect of the curriculum.

- The conferencing format was designed for the web site and passwords were assigned for each group and facilitators.

Validity, Reliability and Design Limitations

Computer conferencing on building code issues is a potential bridge between municipal and design offices. This research examined the effectiveness of municipal/client interaction on building code issues only and is not generalizable to other conferencing settings. The study is aimed at a profession that is generally familiar with computer technology. Generalizability to other groups (i.e. contractors and draftsmen) is limited due to computer accessibility and training backgrounds.

Chapter 4 - Results

Conferencing Traffic

Conferencing and e-mail use was monitored to answer question 2 by gauging the level and type of system involvement. The number and types of interactions were recorded with the following representations (Harasim, 1987) (type of interaction is bracketed):

- exchanging information (7)- 30% (80/265)
- staying in touch (6)- 20% (53/265)
- getting to know someone (5) - 5% (13/265)
- solving problems (4) - 5% (13/265)
- asking questions (3)- 70% (185/265)
- task oriented (2)- 17% (45/265)
- socioemotional content (1) - 83% (220/265)

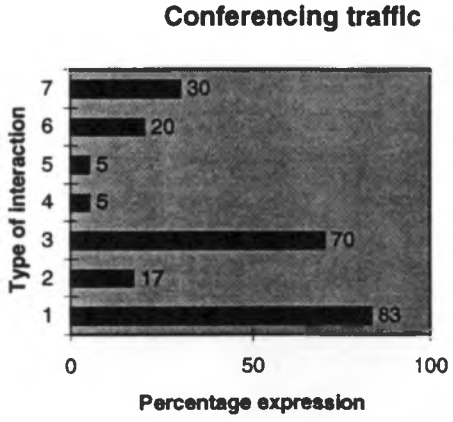

Figure 1 a). Conferencing Traffic

The conferencing exchanges were databased for future reference. The reported number of e-mails was 95 and the number of conference submissions was 170 for a total number of exchanges of 265.

Computer conferencing indexes were compiled to answer Questions 2, 3 and 4. Frequencies are reported in the following figures and tables. Pearson correlations were then developed to make comparisons

Collaborative learning

Questions 3 and 4 queries views on collaborative learning. The majority of students agreed on the following (see Table 1):

- that the assignments were useful;
- that they did not have to work as hard for on-line classes;
- that they communicated less with other students as a result of the computerized conference;
- that they communicated less using other media as a result of computer conferencing;
- that they got more out of on-line conferencing when compared to traditional classrooms; and
- that they experienced increased educational efficiency.

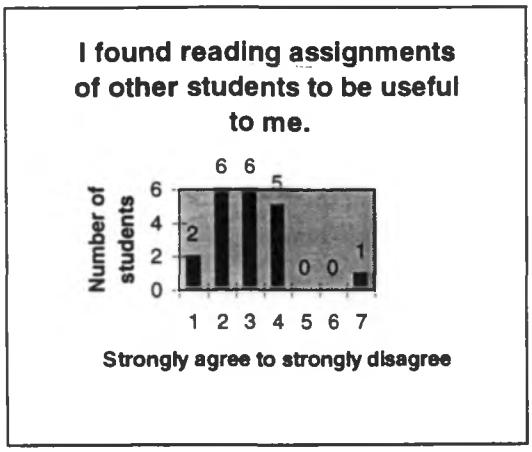

Figure 2. Found reading of assignments useful

N=20, Mean = 2.9, SD = 1.3

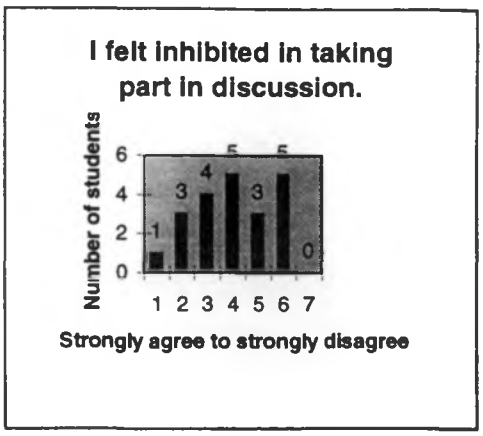

Figure 3. Felt inhibited in discussion

N=21, Mean = 4.0, SD=1.5

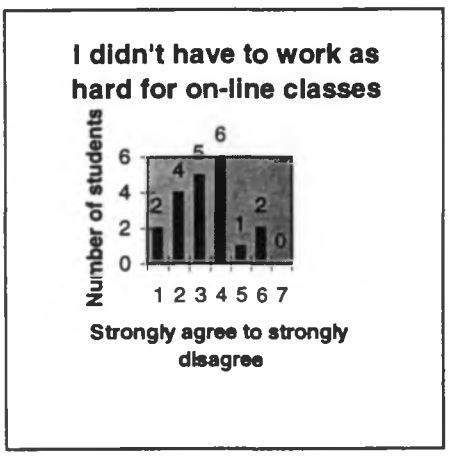

Figure 4. Did not have to work as hard for on-line classes.

N=20, Mean = 3.3, SD= 1.4

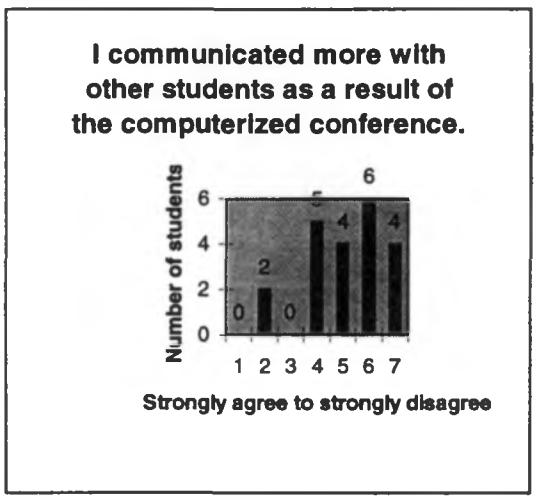

Figure 5. Communicated more with other students.

N=21, Mean = 5.1, SD=1.4

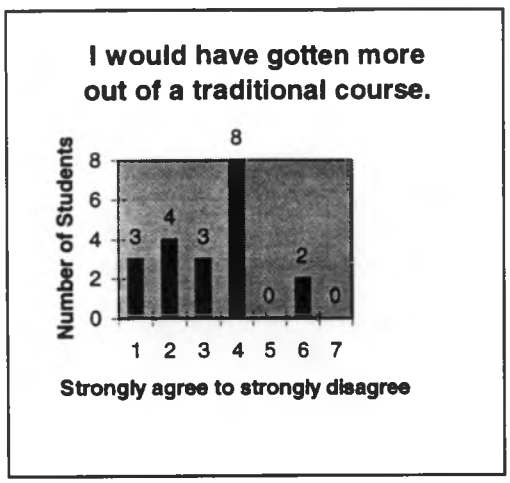

Figure 6. Got more out of traditional course
N=20, Mean=3.2, SD = 1.4

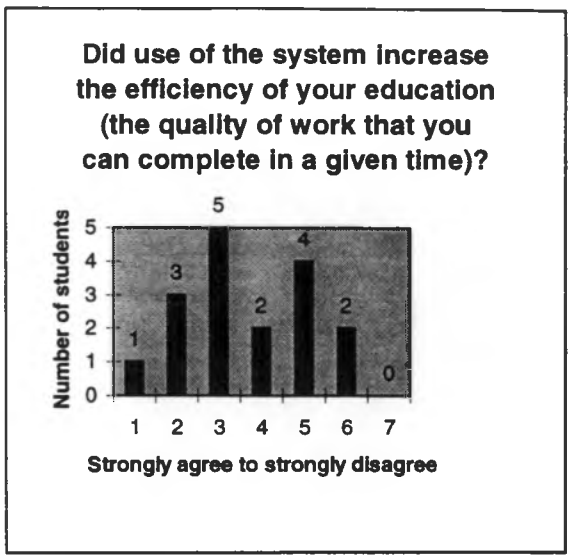

Figure 7. Increase in educational efficiency
N=17, Mean=3.6, SD=1.4

These results indicate a positive view of the collaborative aspects of computer conferencing in accessing assignments, taking part in discussion, and in educational efficiency. These results answer Question 4 positively. However, data gathered indicated support for the traditional classroom (figure 6). Interview responses expressed concerns over system time delays and the short duration of the program.

Computer attitudes

Question 4 queries the views on computer attitudes after taking the on-line course. The majority of subjects found that the use of computers (Figures 8-16 - derived from questionnaire 3) was stimulating (100%), fun (100%), easy (92%), personal (72%), helpful (58%), threatening (53%), efficient (81%), demanding (54%), and desirable (65%). Thus the majority of attitudes were positive, lending credence to support to the virtual classroom environment as expressed in question 4.

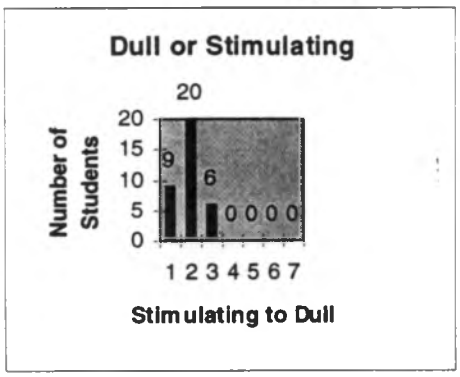

Figure 8. Dull or stimulating
N = 24, Mean = 2.03, SD=0.79

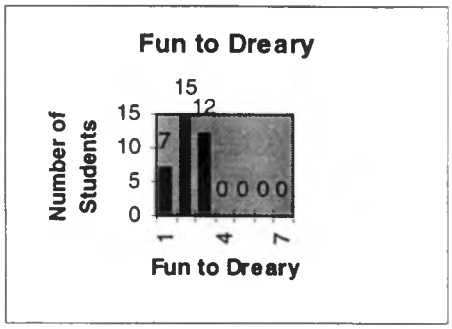

Figure 9. Fun to dreary
N=24, Mean = 2.14, SD=.0.79

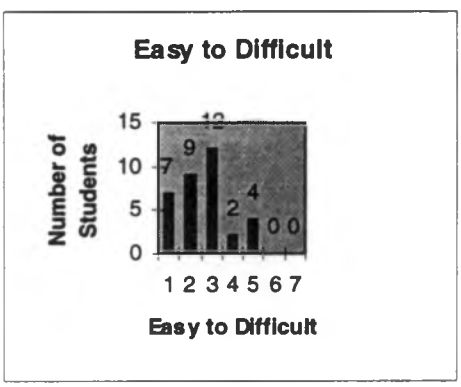

Figure 10. Easy to difficult
N=24, Mean = 2.89, SD=1.22

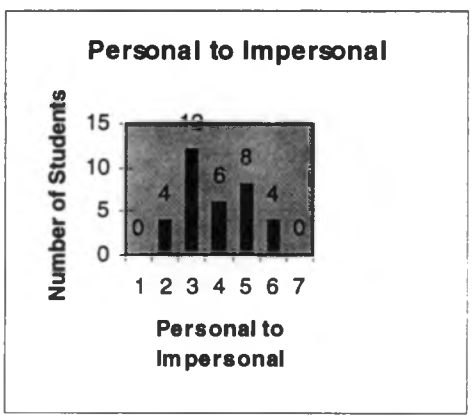

Figure 11. Personal to impersonal
N=24, Mean = 4.38, SD=1.29

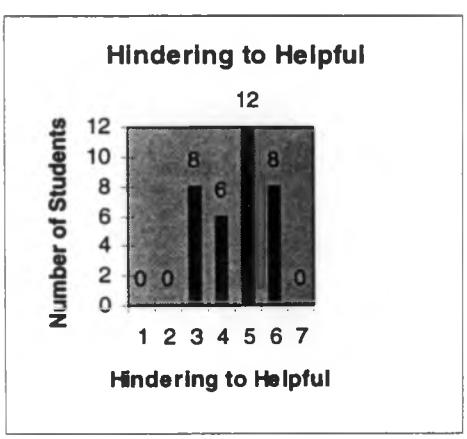

Figure 12. Hindering to helpful
N=24, Mean = 5.42, SD=1.29

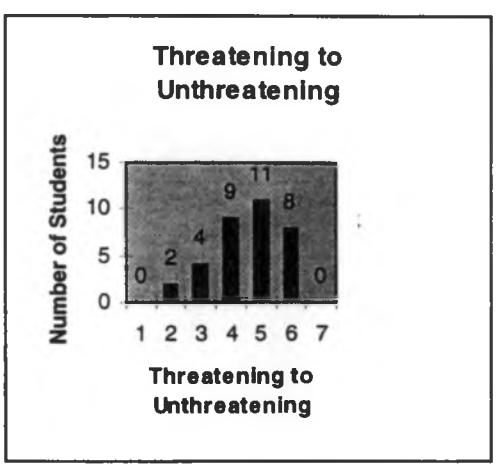

Figure 13. Threatening to unthreatening
N=24, Mean = 5.84, SD=1.55

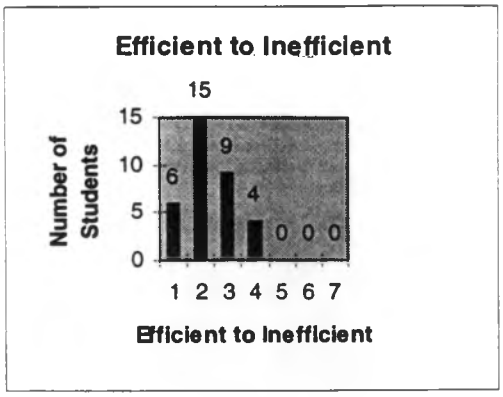

Figure 14. Efficient to inefficient
N=24, Mean = 2.68, SD=1.34

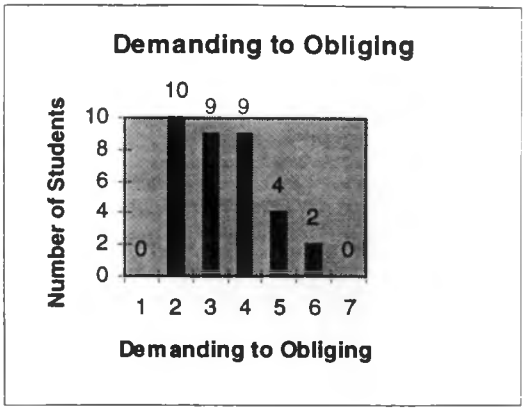

Figure 15. Demanding to obliging
N=24, Mean = 3.54, SD=1.37

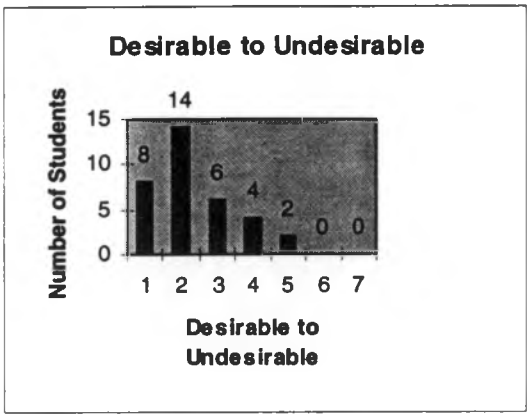

Figure 16. Desirable to undesirable
N=24, Mean = 2.09, SD=1.32

Interest and Synthesis

Question 4 asks about interest in the on-line course and the ability to synthesize ideas as noted in Figures 17-22. Students reported more interest in the subject and the ability to see relationships between important topics and ideas supporting a positive view of the on-line course.

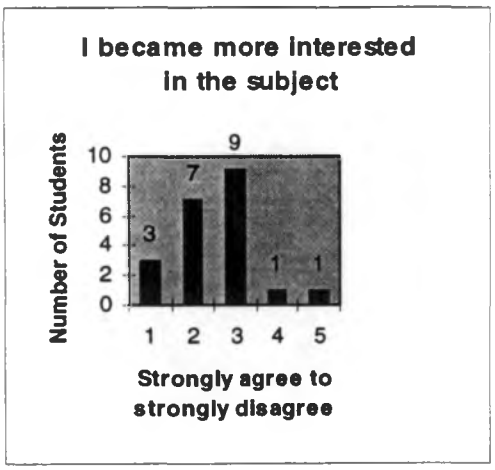

Figure 17. Became more interested in subject.

N=24, Mean = 2.53, SD=.98

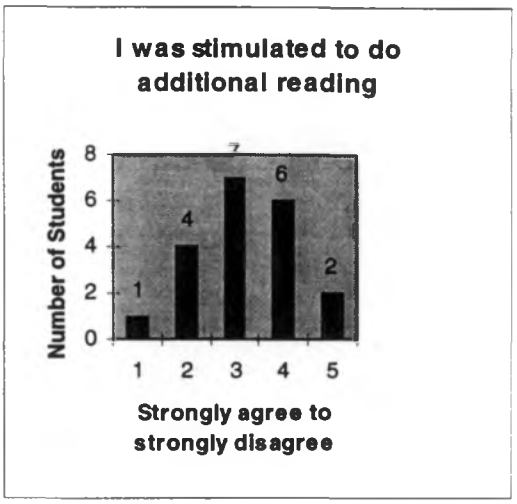

Figure 18. Stimulated to do additional reading.
N=24, Mean=3.14, SD=1.06

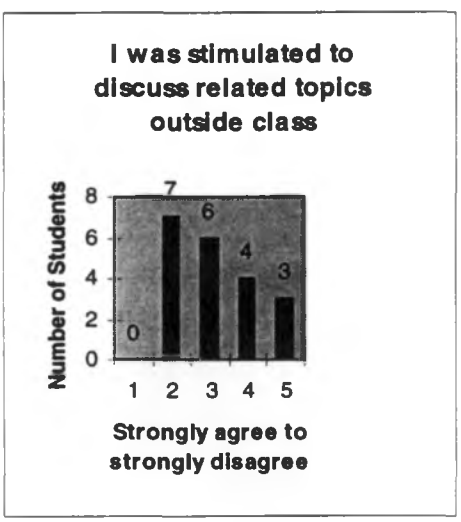

Figure 19. Stimulated to discuss related topics.

N=24, Mean = 3.19, SD=1.08

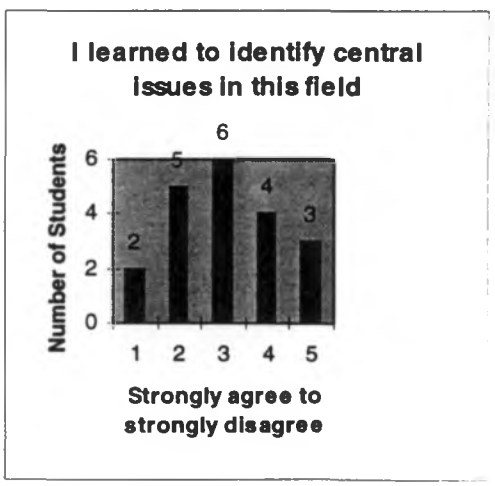

Figure 20. Learned to identify central issues.
N=24, Mean=3.05, SD=1.05

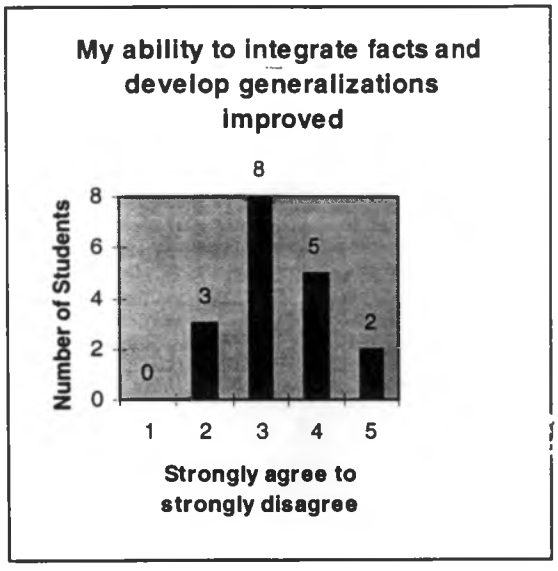

Figure 21. Ability to integrate facts and develop generalizations improved.
N=24, Mean = 3.17, SD=.79

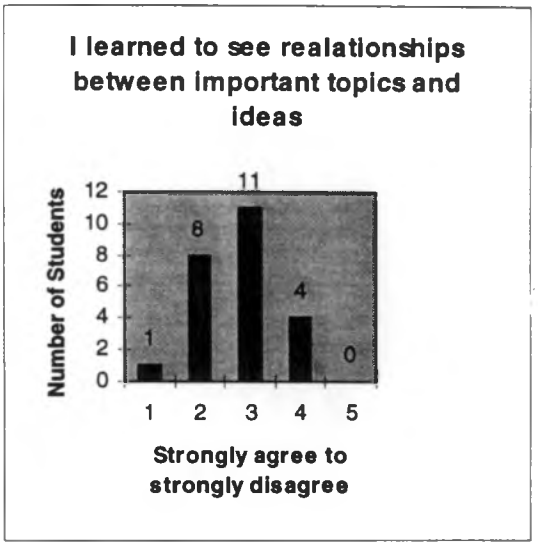

Figure 22. Learned to see relationships between important topics and ideas.
N=24, Mean=2.71, SD=.78

Collaboration Index

Question 4 asks about views on the collaborative learning experience. The ability to work together to develop ideas and seek solutions is seen as a significant contribution to an effective educational experience. The results of the collaboration index are expressed in Figures 23-28 (derived from questionnaire 3) and summaries follow:

- felt they had an individual experience (99%); and
- level of communication outside of class (62% never)

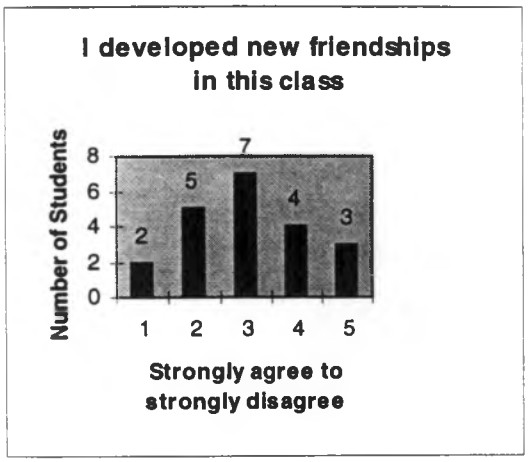

Figure 23. Develop new friendships.
N=21, Mean = 3.1, SD=1.04

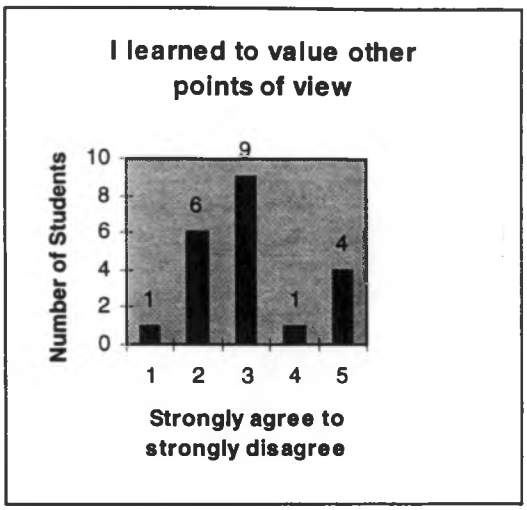

Figure 24. Value other points of view.
N=21, Mean = 2.9, SD=1.10

Individual vs. Group Learning

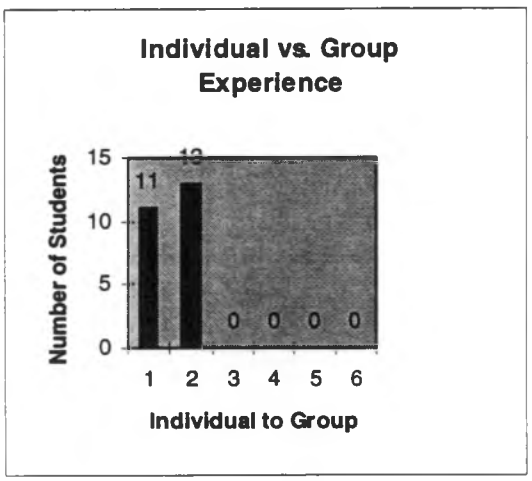

Figure 25. Individual vs. group experience.
N=24, Mean = 1.54, SD=.25

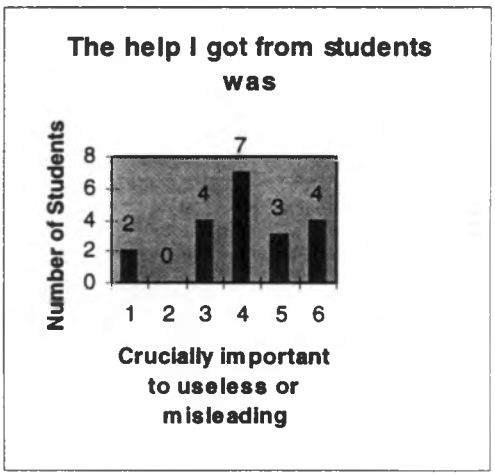

Figure 26. The help I got from students.
N=20, Mean 4.1, SD=1.29

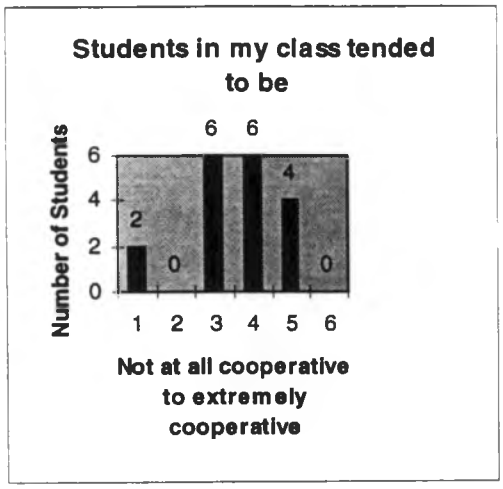

Figure 27. Students in my class.

N=18, Mean = 3.61, SD=.98

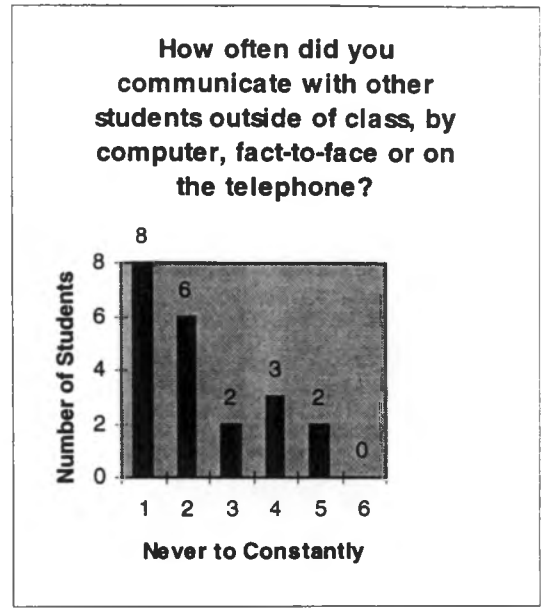

Figure 28. How often did you communicate using other media?
N= 21, Mean = 2.19, SD=1.29

The feeling of being alone seems to have pervaded the collaboration index. The active communication levels indicated that interaction was not sufficient to support a collaborative viewpoint. In part, this could be due to the limited time frame of the research and the lack of opportunity to develop liaisons. Post interview responses to the question 1.5 : "Did you feel that you were part of a group or class working together, or helpful, and to what extent did you feel this was a waste of time?" may assist in understanding this view and are recorded in Appendix A.

Instructor rating Index

Question 4 examines views on instructor access. The facilitators were to assist the subjects in understanding specific code concepts and generating discussion on various code issues. The inability to secure on-line connections and the time limitations of municipalities meant the co-

investigator fulfilled the facilitator roles. Results of the questionnaires are stated in Table 2 (derived from questionnaire 3) and some summaries follow:

Table 2 - Instructor Rating

Instructor rating used Likert scale measurements from 1-5, Strongly agree to Strongly Disagree

Issue	N	Mean	SD
Instructor organized course well	24	3.04	.88
Grading was fair and impartial	24	2.94	.24
Instructor seems to enjoy teaching	24	2.67	.91
Instructor lacks sufficient knowledge about this subject	24	3.95	.83
Students were encouraged to express ideas	24	3.80	.66
Instructor presented material clearly and summarized main points	24	3.70	2.46
Instructor discussed points of view other than his/her own	24	2.74	.81
The student was able to get personal help in the course	24	2.64	1.05
Instructor presented material in a boring manner	24	3.33	.91
Instructor critiqued my work in a constructive and helpful way	24	3.05	1.07
Overall, I would rate this teacher as:(Excellent to Poor - 5 points)	24	3.19	.93

Responses from the interviews may help clarify subject responses. Appendix B contains responses to question 1.8: "How would you describe your relationship to the facilitator on line? Do you feel MORE or LESS able to communicate and relate to your teacher?" The majority of subjects felt detached and not supported by the instructor. This will have a bearing on the support for computer conferencing asked by question 4.

Course Rating Index

Question 4 queries the views of on-line courses. The course rating measures attitudes toward the course. The overall course rating (Figures 29-35-derived from questionnaire 3) provides an indication of feelings of on-line communication concepts and central ideas. Positive views about the course are tempered by neutral feelings in a number of categories. Again the depth of conferencing activity, job constraints, and interface difficulties as displayed in the interviews, affect these results. A summary of majority opinions follow:

- course was a waste of time (disagree - 3.91 mean); and
- gained understanding of basic concepts (2.74 mean).

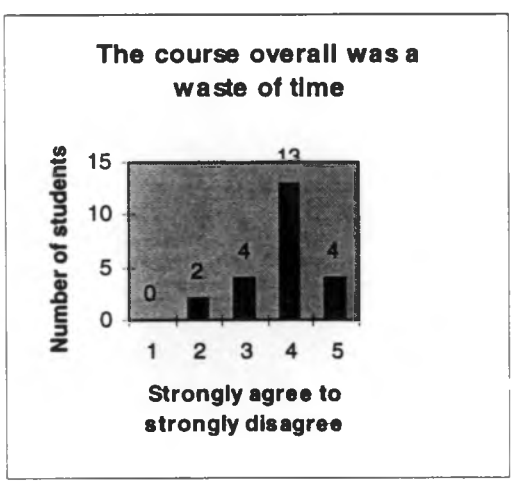

Figure 29. Course overall was a waste of time.

N=23, Mean = 3.91, SD=1.09

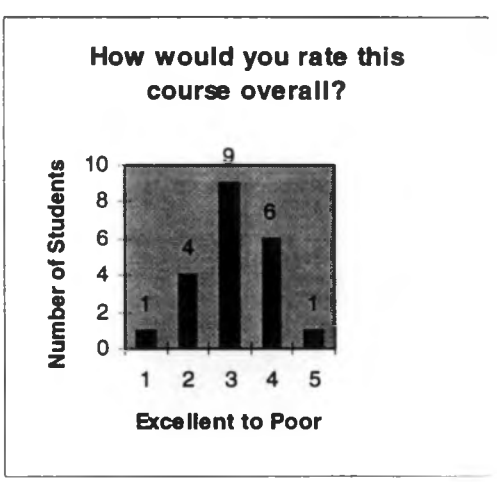

Figure 30. How would you rate this course overall?

N=21, Mean=3.19, SD=.93

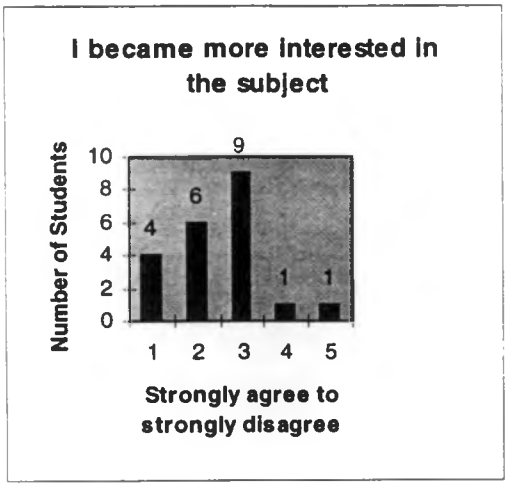

Figure 31. I became more interested in the subject.

N=21, Mean=3.17, SD=.79

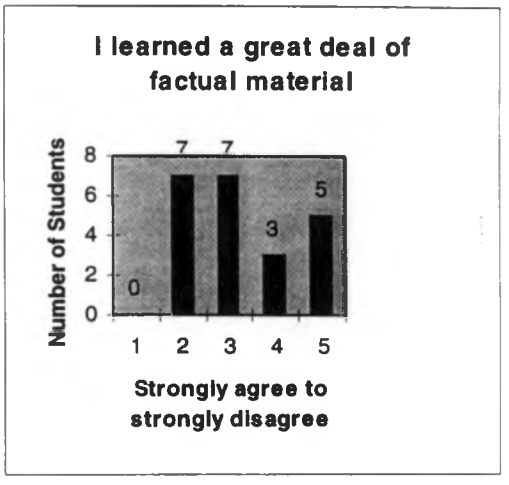

Figure 32. I learned a great deal of factual material.

N=22, Mean=3.09, SD=1.11

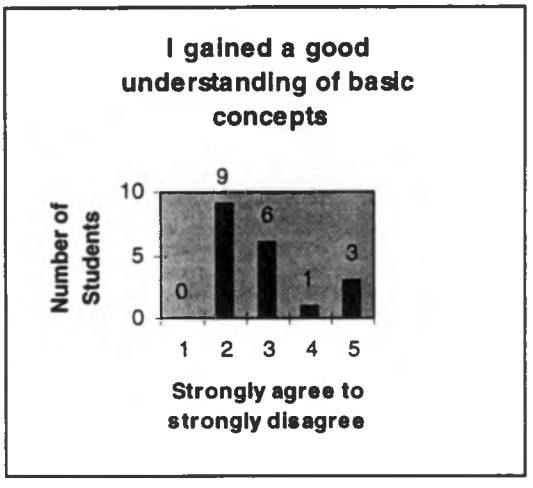

Figure 33. Gained a good understanding of concepts.

N=19, Mean=2.74, SD=.99

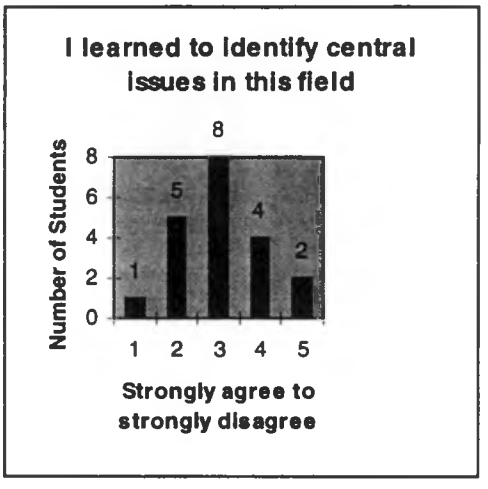

Figure 34. Learned to identify central issues.

N=20, Mean=3.05, SD=1.05

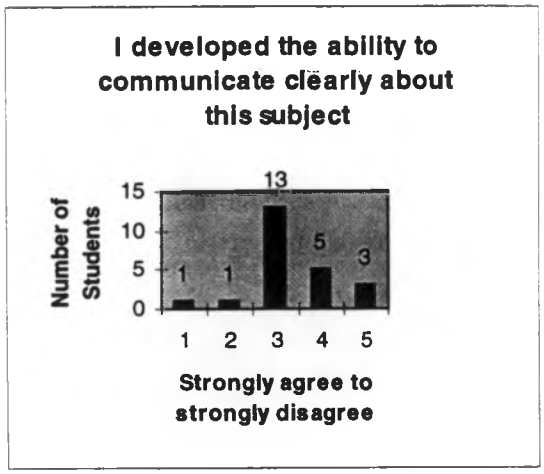

Figure 35. Developed the ability to communicate clearly about the subject.
N=23, Mean=3.33, SD=.97

Virtual Classroom overall

Question 4 queries views of the on-line experience. The virtual classroom (Figures 36-39-derived from questionnaire 3) on-line experience is summarized in this section. Measurements of educational quality are offered. Following are majority responses:

- they would choose to take another on-line course; and
- increased the quality of my education.

Interview questions also express the views concerning the on-line course. The pre-interview question 2.6 asked for a response from 1-7, strongly disagree to strongly agree, to the statement that "Computer conferencing as I know it should provide some interesting ways of understanding the code." In the post-interview, the same question was asked again, and the subject's earlier response was provided for comment and comparison. The responses are contained in Appendix C. Again time constraints, internet access, and the presentation of textual material affected subjects views of the virtual classroom, although the potential of information exchange and instructor access within the environment was recognized.

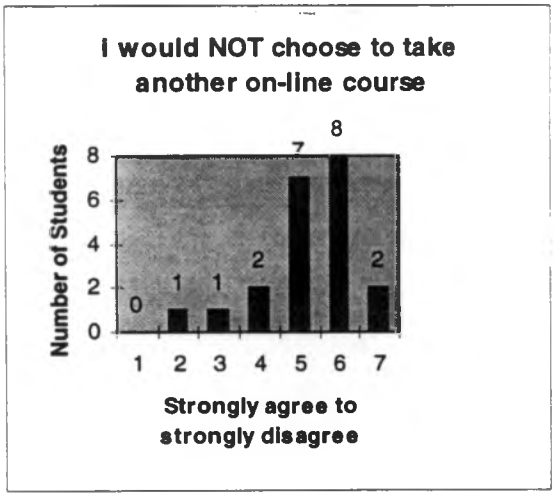

Figure 36. Not choose to take another on-line course.
N=21, Mean=4.9, SD=1.5

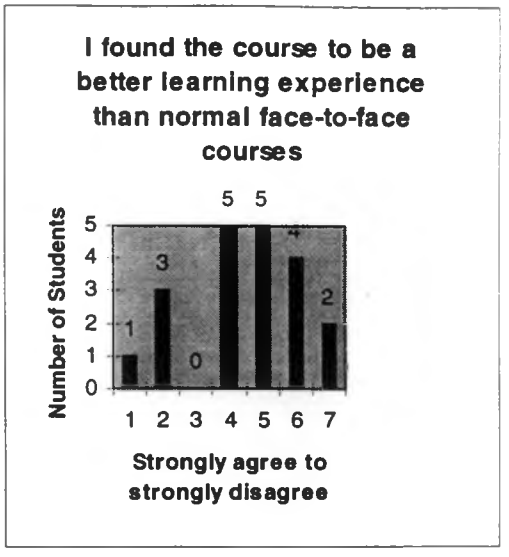

Figure 37. Better learning experience than face-to-face courses.
N=20, Mean=4.5, SD=1.7

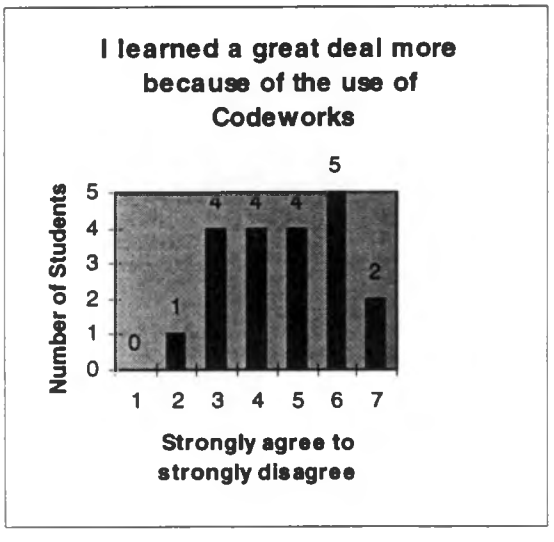

Figure 38. Learned a great deal more because of Codeworks.
N=20, Mean=4.7, SD=0.3

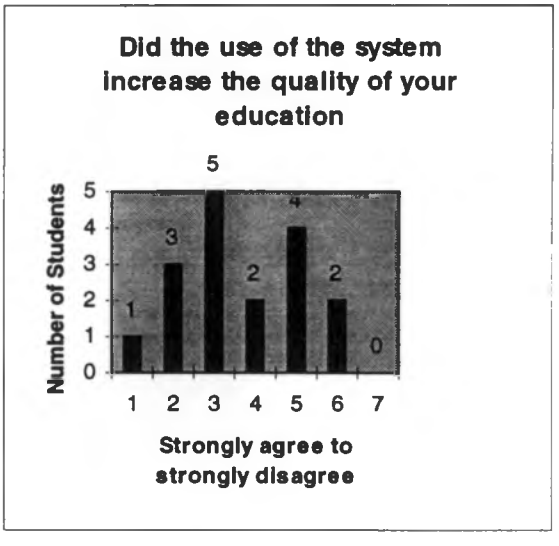

Figure 39. Did use of system increase quality of education.
N=17, Mean=3.6, SD=1.4

Access and Quality Assessments

Question 4 queries the views of computer access and the quality of the on-line course. The following opinions represent the assessment of the quality of the course and are described in Figures 40-46 which is derived from questionnaire 3:

- better access to professors;
- taking on-line courses is more convenient;
- assignments read by other students increased my motivation;
- when I became very busy I was more likely to stop participating (70% agree);
- I felt more involved and active in the course; and
- comments by others were useful.

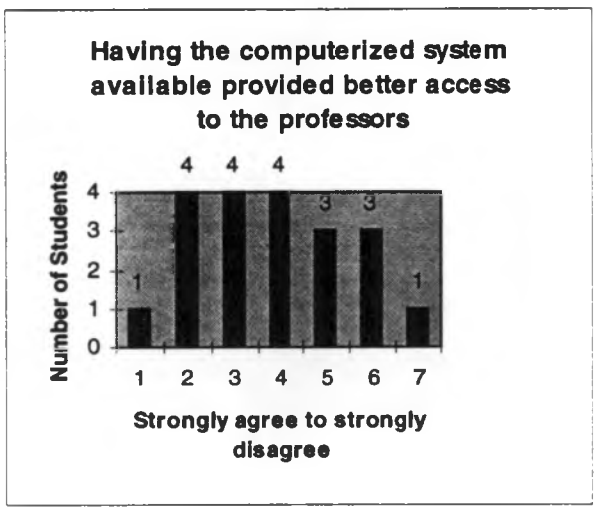

Figure 40. Computerized system provided better access to professor.
N=20, Mean=3.8, SD=1.6

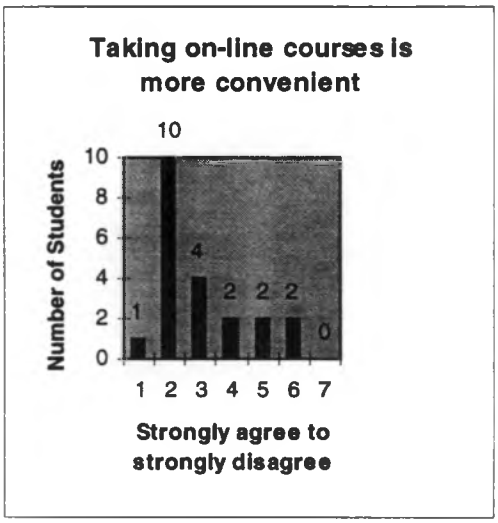

Figure 41. Taking on-line courses is more convenient.
N=21, Mean=3.0, SD=1.4

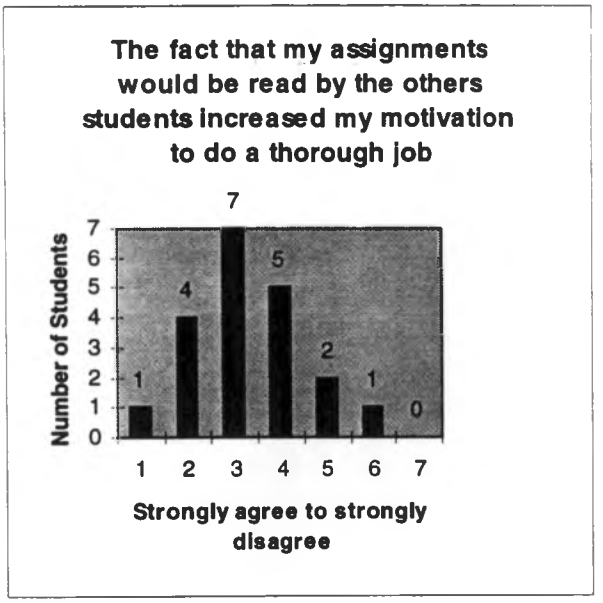

Figure 42. Students reading my assignments increased my motivation.
N=20, Mean=3.3, SD=1.2

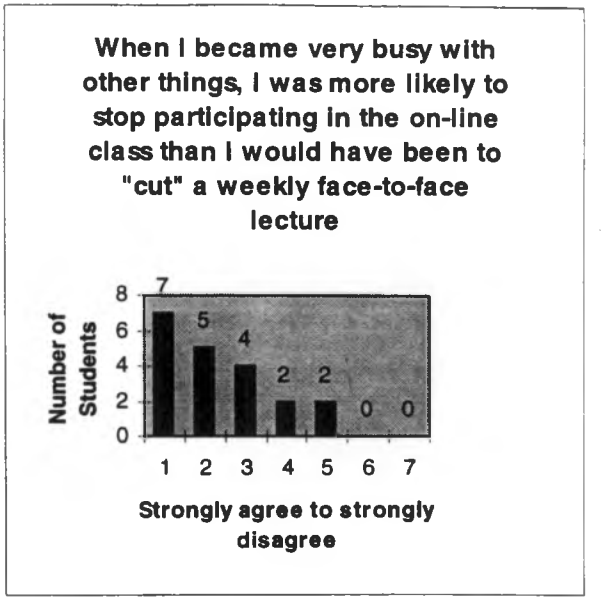

Figure 43. Became very busy I stopped participating in on-line class.
N=20, Mean=2.0, SD=1.1

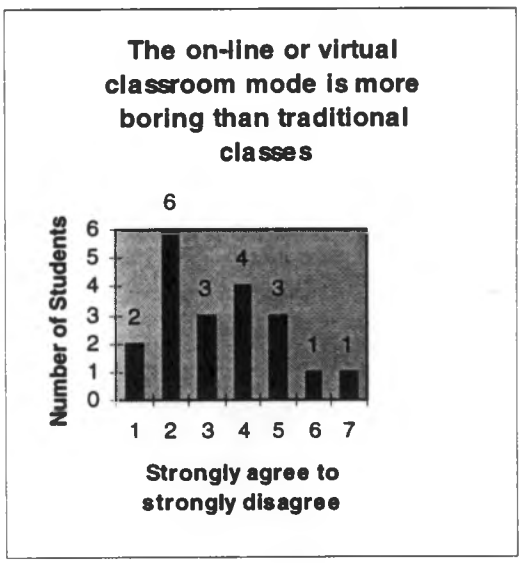

Figure 44. On-line mode more boring than traditional.
N=21, Mean=3.3, SD=1.6

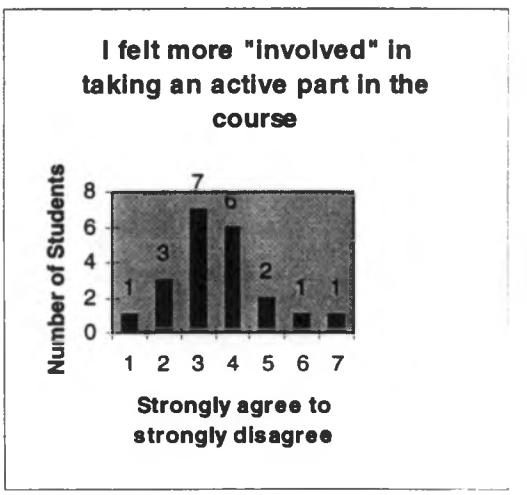

Figure 45. Felt more involved in taking part in course.
N=21, Mean=3.5, SD=1.3

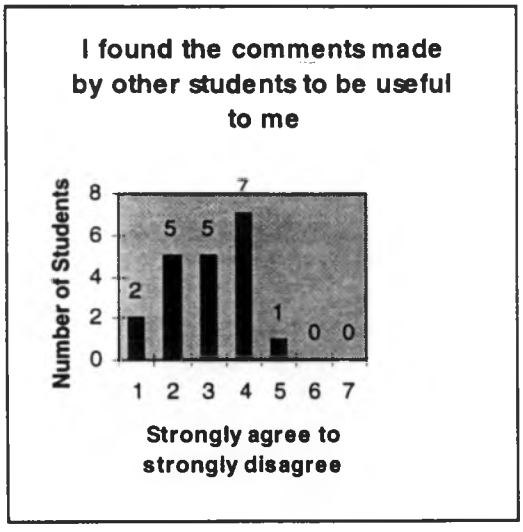

Figure 46. Found comments made by other students useful.
N=20, Mean=3.0, SD=1.1

The strength of this assessment lies in reduced participation, likely due to the constraints imposed on the subjects by their jobs (as reported in interviews). However, overall, subjects found the on-line course more convenient, they felt more involved (than in traditional classrooms), there was increased student motivation when students realized that others reading their assignments, and students reported better access to the facilitator.

Group comparisons

Independent t-tests were used to compare demographics and experience for both Groups I and II. There were no significant differences between the means across the variables of age, computer experience, work attitudes, work experience and computer experience (questionnaire 1). Group I and II comparisons to pre and posttest performance were conducted. No significant difference between the means was found across pre and posttests.

Group I and II comparisons were conducted across all the questions asked in questionnaire 2 and 3. A significant difference was found between the means across the variable of communication and is displayed in Table 3.

Table 3- Group Comparison across Questionnaire 2 and 3

How often did you communicate with other students outside of class, by computer, face-to-face or on the telephone?

Variable	Number of Cases	Mean	SD	SE of Mean
Group I	10	2.8000	1.317	.416
Group II	11	1.6364	1.027	.310

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	2.27	19	.035	.513	(.019, 2.236)
Unequal	2.24	17.02	.039	.519	(.069, 2.258)

tada10/doc

The ability of the students to use the curriculum and have access to conferencing material could have played a role in these group differences. Group I with a curriculum basis may not have needed the added media tools for task clarification.

Pearson Correlations

Questions 2, 3 and 4 compare indexes of computer conferencing activity, views and attitudes. Three matrixes were constructed (Tables 4, 5 and 6) to compare the variables. All correlations were conducted using questionnaires 2 and 3 as reported in Chapter 3, based on Likert scale measurements.

Process and Assessments of the Virtual Classroom (Table 5)

Table 5 presents correlations of variables related to research questions 3 and 4, comparing the collaboration index with important classroom experiences such as communicating with other students, access to the professor, increased motivation and usefulness by reading and responding to other students assignments and comments. Also, increased communication with other students was compared to computer attitudes, collaboration, instructor, the virtual classroom overall, course rating, synthesis and interest indexes, and the posttest results. Correlations and conclusions are explained in Chapter 5. Variables are extracted from questionnaires 2 and 3 and are explained in Chapter 3.

Table 5
Process and Assessments of the Virtual Classroom

	Communication with students	Access to Professor	Increased Motivation	Comments	Assignments Useful
Computer Attitudes	.1337	-.4596*	-.3002	-.1328	-.3026
Collaboration Index	-.5377*	.5392*	-.4977*	-.6084**	-.2001
Instructor Rating	.3579	.4459*	.2795	-.0730	-.3772
VC Overall	.6411**	.5629**	.5490*	-.3909	.3080
Course Rating	-.6176**	.6251**	.4755*	.1382	-.0605
Synthesis Index	-.4429*	-.4743	-.6312**	-.5738**	-.3455*
Interest Index	-.3799	.5438*	.5038*	-.3548	-.5506*
Posttest	.2877	.1807	.2845	.0187	-.2375
* Significant at the 0.05 level **Significant at the 0.01 level N=20					

Note:		
	Communication with students:	Communicated more with other students
	Access to Professor:	Provided better access to professor
	Assignments Useful:	Found reading Assignments of other students useful
	Comments:	Found comments made by other students useful
	Increased motive:	The fact that assignments would be read by other students increased motivation

Students Characteristics and Selected Outcomes (Table 6)

Table 6 presents the correlation affecting question 2, by examining the effects of interpersonal and personal sphere of control on the course outcome index, instructor rating index, virtual classroom overall index, that the on-line learning is easy, that students would not take another on-line course, and the total hours on-line.

The personal sphere of control is significantly correlated with the course outcome index[11]. However, the interpersonal sphere of control is significantly correlated to the view that the respective subjects would not like to take another course on-line supporting an affirmative response to question 2. From interviews it was observed that students were frustrated by the slow pace of instruction and the sophistication of the conferencing environment. Slow system reaction time, and large amounts of textual material detracted from the group experience.

Table 6
Pearson Correlation Coefficients Between Students Characteristics and Selected Outcomes

	Computer Attitudes	Virtual Class. Expect.	Personal Sphere of Control	Inter personal
Course Outcome Index	.2134	-.0847	.6679**	-.1213
Instructor Rating Index	.2239	-.0237	.3968	-.0015
VC Overall Index	-.0440	-.1152	.1496	-.3552
VC easy to learn	.1574	-.2783	.1194	-.0137
Not take another online	.2319	.2815	.0770	.6500**
Total Hours On-line	.0041	-.1494	.2332	.4044

**Significant at the 0.01 level

[11] The course outcome index is a Likert scale measurement of the questions: the course overall was a waste of time and how would you rate the course overall and is composed of figures 29-35.

Interviews

In the following questions posed in the post-interview, subjects were asked to compare the traditional and virtual classroom:

"What do you like best about the virtual classroom approach...that is, what is good about it compared to a course given in the traditional classroom?"

1) Flexibility - choose own time to work (11/32)

2) Delivered right to the office, no travel involved (3/32)

3) Support group within the office (2/32)

4) Opens the breadth and depth of communication (1/32)

"What do you currently like least?"

1) Complicated interaction with other students (9/32)

2) Too much information to process in text form (5/32)

3) Increased motivation necessary to do the work (4/32)

4) Inadequate pictures, animation, and sound (4/32)

5) Should have everyone on line simultaneously (1/32)

6) On-line help and instructions (1/32)

7) Difficult to do work when you have to set your own schedule (1/32)

8) More formalization of the instruction and people know each other (1/32)

9) Nervous about seeing their own words posted (1/32)

Interviews of two students are contained in Appendix H. Their depict specific views regarding systems improvement, including answers to the following:

What worked well?

What could be improved?

Comments on the technology.

How was your motivation affected?

What do you think about conferencing?

Initial responses gathered from the pre-interviews assist in assessing project results and are contained in Appendix D and E when subjects commented on the use of computers and the form of teaching they found best. Conferencing passwords and reading data were perceived as awkward.

Chapter 5 - Conclusions

Chapter overview

This chapter draws conclusions regarding the Codeworks research project and discusses:

- the framework for the study;
- conclusions for each research question;
- implications of research findings; and
- further research.

Summary of findings

Subjects entered the course with full assurance of confidentiality knowing that reported results would not harm their present or future academic standing. Questionnaire 1 gauged experience and expertise in the areas of work, code and computer experience. Questionnaires 2 and 3 reflected the study by Hiltz (1994) and made many of the same comparisons. Along with the interviews, these were the main data sources.

Pre and posttests were administered and t-test comparisons noted no significant difference in achievement between groups affected by the presence of the curriculum. Some interesting results were found through comparison of achievement across the variables using Pearson Correlations.

The study began with the intent of comparing the lecture-driven certified professional program offered at UBC with an on-line equivalent course. The certified professional class size was approximately 15, but only three of these students volunteered to participate. In addition a discrepancy with time allotments between the virtual classroom and the traditional classroom

would not permit a balanced comparison. The on-line course content mirrored by the certified professional program was only one to two hours in length. To allow conference participants time to conduct course work while in a busy work environment, the on-line course was offered asynchronously over a six week period.

Indexes for correlations were constructed using criteria defined by Hiltz (1994). Key measurements were sphere of control, computer attitudes, course rating, facilitator rating, motivation, comments by other students, views of reading assignments, and virtual classroom expectations. Conclusions follow:

1. Will there be significant gains in code knowledge between Groups "I" and "II" when Group "I" is exposed to a computer conferencing delivery system with a defined curriculum and "II" is exposed to a computer conferencing system without a defined curriculum?

Answering this question involved achievement on pre and posttests. The scores indicated there was no significant difference in course results, and that they were unaffected by the curriculum (see Appendix J). This has significant impact on on-line course design and implementation suggesting that it may be appropriate to rely less on curriculum design, but concentrate more on conference management. Although the samples were small and the course delivery time frames short, each group was controlled for age, work, code and computer experience. These variables ranged from novice to experienced.

The promotion of on-line participation discussion commenced with 'hot topic' issues (stucco) in a problem solving format, that could easily be adapted to an educational environment with summative and formative tests. As displayed in the interviews curriculum design elements such

as text based content detracted from discussion and project completion and could likely be deleted from a curriculum based on issues discussion.

The use of issues discussion and conferencing topics rather than a structured curricula may alleviate information overload concerns expressed by Harasim (1987) and Burge (1994). The facilitator's time could then focus on other disadvantages of the on-line experience (Hiltz and Turoff , 1987; Harasim, 1987; Burge, 1994; and Hilman et al, 1994):

- drawing out lurkers by using an active moderator;
- developing real-time discussion mechanisms encouraging the immediacy of exchange;
- setting time management priorities for students; and
- overcoming interface encumbrances by encouraging early conferencing exchanges.

2. Will students with a greater sphere of control on either the personal or the interpersonal levels be more or less likely to regularly and actively participate on-line, take another on-line course, rate the virtual classroom as easier and more effective than the traditional one, and have a positive view of the instructor or facilitator?

Answering this question involves the variables of virtual classroom rating, course outcome, instructor rating (after taking the on-line course), and views on taking another on-line course (after taking the on-line course) using questionnaires 2 and 3 applying a Pearson correlation. The personal sphere of control is positively correlated with the course outcome index supporting the view that a high degree of effort results in a positive view of the conferencing environment and therefore the view that students were more likely to actively participate on-line. The personal sphere of control prescribes a student that works hard, is goal oriented, enjoys challenges, feels in control of circumstances and seeks agreement in a debate. The course outcome index defines

two general reactions displayed in figures 29 to 35 that are worthy of comparison to this proclivity within the on-line environment. Three questions forming part of this variable are:

- Was the course was a waste of time overall?
- How would you rate this course overall?
- Did you gain a good understanding of concepts?

Most students felt strongly that the course was not a waste of time (3.91 mean on a 5 point Likert scale) and rated the course as good overall (3.19 on a 5 point Likert scale). The correlation supports the view that personal sphere of control elements are integral to the positive views of on-line courses. Control over course direction, the democratic aspects of the medium, and the convenience of access (Davie, 1988) promote this relationship.

However, the only correlation for the interpersonal sphere of control was a positive one with the view that the respective subjects would not like to take another on-line course. The interpersonal sphere of control is represented by the collaboration index which is expressed in figures 23 to 28 and is further described in research question 3. As reported in the results students felt they developed new friendships in the class, but had an individual experience, hardly ever communicated with other forms of media outside the class and did not view other students as cooperative. Interviews with students indicate that they preferred the immediacy of exchange present in the traditional classroom (Davie, 1988), but also log ons by students indicate that 60% of students entered the conference less than four times over the life of the project. Even with these interaction rates conferencing required constant vigilance by the facilitator to encourage lurkers to sign-on and enter comments (Harasim, 1987; Burge, 1994). Most students expressed frustration with the pace of instruction and the difficulty in taking time out from normal job

duties to conference. Figure 43 echoes this view with the strong majority of students stating that when they became very busy with other things, they were more likely to stop participating in the on-line course (mean 2.0 - strongly agree on a 7 point Likert scale). As most students felt that the course was an individual experience it is not surprising that positive correlations were not found with the virtual classroom experience.

The types of discussions that were generated by conferencing gives us an indication of the degree of collaboration and the focus of the discussion. Harasim (1990) stresses that a collaborative environment will be developed with focused discussions. The nature of this project displayed more social messages than task oriented or problem solving (figure 1 a)) ones and is consistent with Harasim's (1987) findings.

3. Will students who experience group or collaborative learning in the virtual classroom have positive[12] views of on-line course work?

Answering this question involves the variables virtual classroom rating, collaboration index, terminal access, time on-line, and the convenience of on-line courses using questionnaires 2 and Here comparisons were made between the collaboration index and important classroom experiences such as communicating with other students, access to the professor, increased motivation and usefulness by reading other students assignments, and whether they found comments made by other students useful.

[12] Positive measurements are based on correlations with on-line convenience, computer terminal access, time spent on-line, increased communication with the students, improved access to the facilitator, experienced increased motivation by reading assignments of other students and found comments and assignments by other students useful.

This question was posed to further explore the aspects of on-line conferencing and collaboration examining correlations with other variables. The collaborative learning index was made up of six questions (figures 23 to 28) as discussed in question 2. Correlations were found with the collaboration index as follows:

- easy access to a computer terminal had a negative impact on the collaborative nature of the students. A relatively low collaboration index is dictated by low scores in the views that students had an individual experience, did not communicate by other means outside the class, and did not view other students as cooperative. The short duration of the course and the interference of job duties likely detracted from the need to sign-on and conference.

- communicated less with other students, assignments read by other students did not increase motivation and comments made by other students were not found useful, in spite of the collaborative nature of the students. The feeling that traditional courses could offer more immediacy and interaction seemed to support the collaborative nature more than on-line conferencing (figure 6). Kaye and Mason (1989) and Hiltz (1989 and 1994) indicate that other communication media such as traditional classrooms and print mediated distance learning should supplement but not compete with the on-line experience. Personal networking is seen as critical to prompt communication and the open ended nature of computer conferencing (Feenberg, 1989). So even though students displayed a collaborative nature they demanded more ways of expressing themselves than strictly through the on-line experience.

- better access to the professor. Access to the facilitator within a democratic environment is seen as an advantage of computer conferencing and key to the development of group dynamics (Burge, 1994). However, the instructor rating (table 2) revealed scores which were mainly neutral in many categories. Significant numbers of students felt that the instructor did discuss other points of view other than his own and enjoyed teaching. Interviews of students indicated the ability to e-mail and develop new ways of communicating with instructors (in this case government officials) were seen as the positive attributes of conferencing.

4. Will conferencing students with good computer terminal access at either home or in the office, who spend more time on-line and view on-line courses as more convenient report positive views of on-line courses across a number of variables[13] and will students report positive views of the on-line course across the same variables?

Answering this question involves the variables virtual classroom rating, collaboration index, computer attitudes, interest and synthesis indexes, instructor rating index, course rating index, access and quality assessments using interviews, questionnaires and measurements of

[13] The variables measured are computer attitudes, instructor rating, interest in the course, the ability to synthesize ideas, views on the virtual classroom overall increased collaboration, course rating and course access and quality.

conferencing activity. The collaboration index has been compared to the terminal access variables in research questions 2 and 3. Frequencies displayed in the figures 2 to 46 support a number of positive views of on-line conferencing. Significant findings are that:

- the course was not a waste of time. From interviews students had a positive view of the conferencing potential identifying the medium as convenient. The course offered access to building code interpretations not readily available within their normal work environment.

- that students gained an understanding of basic concepts. As one group did not outperform the other it is suggested that the code ability (as displayed in the posttests) were as much a result of conferencing as the curriculum.

- the use of computers was stimulating (100%), fun (100%), easy (92%), personal (72%), helpful (58%), threatening (53%), efficient (81%), demanding (54%), and desirable (65%). The majority enjoyed the conferencing experience but had reservations concerning the demands of the technology and its effect over job duties.

- that students reported more interest in the subject, the ability to see relationships between important topics and ideas. They would choose to take another on-line course and on-line conferencing increased the quality of their education all of which supports a positive view of the on-line course.

The excitement of on-line conferences lies in their ability to tap into vast resources and open up a virtual world to the learner (Mason and Kaye, 1989). Even though building code discussion was confining, students enjoyed the interactive nature of the community.

Interesting correlations with computer terminal access and on-line convenience were found as follows:

- terminal access difficulties are positively correlated with computer attitudes, the collaboration index (discussed previously), the interest and the synthesis indexes and the virtual classroom overall rating. Computer attitudes measured a range of views with mainly positive results. The interest and synthesis indexes measured student views of their ability to integrate facts, discuss central issues and related topics. The virtual classroom overall gauged the effectiveness of the system. Access to a computer terminal would normally be thought of as integral to these functions but they are portrayed as negative correlations. I suggest that the positive views of the conferencing environment were because many students recognized the potential of the system to contact subject specialists and work within a virtual community.

- on-line course convenience is correlated with the course rating, synthesis index and interest index. Course rating and the interest index are positive correlations lending credence to support positive views of the computer conferencing. Interviews indicated that students enjoyed the asynchronicity advantage reported by Harasim (1987). The inability for strong interactive components and problem solving mechanisms to develop is again blamed on the short course duration, involved course tasks and interface difficulties (reference interviews Appendix H).

Summary of interview responses

Harasim (1987) indicates that the loss of visual cues was unimportant, but the need for personal 'chit chat' was critical to stimulate socialization experiences. However, the need for graphical display was supported by the students (primarily architectural designers). Some designers had difficulty with the appearance of the text and the screen; some felt that they should have been walked through the material.

The medium is seen as the impeding force in communicating (Hillman et al, 1994; Eastmond, 1994). Some of the subjects were novices with the internet and e-mail and thus needed to learn how to use the software. Although virtual access presented certain anonymous advantages, fear of the permanent record deterred some, supporting the views of Davie (1988), Harasim (1990), and Mason and Kaye (1989). Face-to-face immediacy was seen as being as important as real-time conferencing and therefore not a replacement concurring with Harasim (1990). Motivation of students was restricted by job time constraints.

Summary

The major findings of this study are that:

- on-line instructional design does not appear to have an effect on test scores in the computer conferencing environment which is likely due to the six week duration of the course, the peer effect within the offices, and the complicated textual nature of the course.

- personal sphere of control is positively correlated with the course outcome index supporting the view that a high degree of effort supports a positive view of the conferencing environment. However, the interpersonal sphere of control is positively correlated to the view that the respective subjects would not like to take another course on-line. From interviews it can be seen that students were frustrated by the pace of instruction and the sophistication of the conferencing environment. Slow system reaction time, and large amounts of textual material likely detracted from the group experience.

- collaborative attitudes supported acceptance of the conferencing environment. However, the immediacy and ease of communication within traditional classrooms were major factors supporting a negative correlation.

- communicating more with other students was positively correlated with the virtual classroom overall rating supporting the view that conferencing is integral to positive on-line course work. However, this variable was negatively correlated with the course rating and the synthesis index indicating that those with low levels of communication still supported a positive view of the course and the synthesis of ideas. Interview material supports positive perceptions and the potential of on-line communication in spite of the level of conferencing.

Further research

The virtual building code web site, through the use of the core conferencing module, could evolve into a resource base for the use of all construction participants. A knowledge base akin to an expert system would be accessible by users ranging from novice to expert. The interface utility was enhanced with building code issues discussion, orientation meetings, and one-to-one e-mail discussions. Increased interface familiarity may then develop on-line skills spurring learner motivation to participate more actively in an on-line curriculum.

Introduction to the interface would assist each participant in developing relationships, forming problem solving mechanisms, and contributing to an evolving body of knowledge. With the vast resources and accessibility of the internet, participation would eventually be expanded to include contractors, engineers, suppliers, manufacturers and other associations. Geographically and functionally diverse locations (i.e. involvement of the National Research Council in Ottawa and

requests from equipment suppliers) would develop. Expansion of subjects would demand an active moderator to summarize arguments and discussion, and distill material for future curriculum and information dissemination. For example product suppliers could be included in conferencing discussions as an educational resource to enhance product usage within building code terms. Entering the conference at this knowledge level would increase the awareness of designers, and building officials in practical applications of code concepts and assist in the interaction of key sectors of the construction community perhaps encouraging on-line education.

More research is required into:

- How can offices be connected on-line and provide adequate time to interact actively with the instructor. Achievements and attitudes would then be tested?
- How would enhanced graphics and video improve attitudes and conferencing use?
- How are on-the-job work environments affected by peers, subject specialists and time constraints, and how can this effect be measured?
- Would the use of a facilitator team, which, in this case would connect a larger number of municipalities and assist in fashioning a virtual community, encourage on-line usage?
- What innovative ways of designing discussion are available to enhance curricula design and what hypertext searching mechanisms can be employed effectively?
- How can computer conferencing programs be developed to make effective use of face-to-face instruction?
- How can the constraint of on-line communication with legal opinion be reduced?

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Appendix A - Selected Subject responses to Post-Interview Question 1.5

Did you feel that you were part of a group or class working together and to what extent did you feel this was a waste of time?

Subject 2 - "I felt part of group";

Subject 3 - "I felt more alone than part of a class. Guidelines for making postings should have been available";

Subject 4 - "I felt alone -- not as if I were part of a group. It was more like reading mail than conferencing. Like a correspondence course";

Subject 5 - "I felt as if I were on my own. The only feedback I got was from reading the comments of other participants";

Subject 7 - "I felt I was part of a discussion group";

Subject 9- "There were only two or three people who posted messages that I saw. I thought it was fine. In the coffee shop, for example, it was interesting to read how others interpreted the code";

Subject 15 - "I felt part of a class";

Subject 17 - "I felt alone. I never was aware of being in a group";

Subject 19 - "I felt somewhat part of a group. Actually, the socializing aspect came from people responding to my comments. Not from the instructor";

Subject 21 - "Yes, I did feel as though it was a class";

Subject 22 - "I think that there were enough topics on the go at one time so that I was working with my team to find answers. But the interaction wasn't happening. Maybe there weren't enough people interested in any one particular topic";

Subject 23 - "I didn't feel absolutely alone. I felt as if I were working with one or two others. But not with a class";

Subject 24 - "There was some interesting feedback from Subject 27 -- some great communication there. So that was my main contact"; and

Subject 27 - "I felt pretty much alone".

Appendix B - Selected Student responses to Post Interview Question 1.8

Students responded to Question 1.8: "How would you describe your relationship to the facilitator on-line? Do you feel MORE or LESS able to communicate and relate to your teacher?"

Subject 1 - "I felt comfortable";

Subject 4 - 'I never did communicate with my teacher. He didn't have a face or a name";

Subject 5 - "I'd prefer face to face interaction";

Subject 8 - "Yes, I felt able - not more, but adequately";

Subject 9 - "I felt comfortable with our communication. Probably more able to communicate, as I had access to email";

Subject 11 - "I didn't know who he was. I needed a course outline, I think. And an introduction to the instructor";

Subject 12 - "I had no communication with anyone like that. I felt that we needed someone to run the show. I felt that my work was going into outer space with no response";

Subject 20 - "I would feel better if I could just raise my hand and speak."

Appendix C- Selected student responses to post-interview question 2.6.

Question 2.6: "The pre-interview question 2.6 asked for a response from 1-7, strongly disagree to to strongly agree, to the statement that the computer conferencing as I know it should provide some interesting ways of understanding the code. Your reaction was ( ). What is your reaction now?"

Subject 1 (gave it a 4) - "My feelings haven't changed much, but I have great time constraints."' Subject 2 (gave it a 7) - "I have no reaction to this, because I didn't experience it as conferencing. I expected that conferencing would be direct. If someone were on line and we had a session together, that would be conferencing. But the time lag makes it into just email, nothing more."; Subject 3 (gave it a 5) - "I would lower my agreement to a 4, because it (computer conferencing) didn't live up to my expectations of a Virtual Classroom. A lot of the course work was repetitive to me.";

Subject 8 (gave it a 5) - "I'd rate it the same. People have to get used to the idea of computer conferencing before it works well.";

Subject 9 (gave it a 5) - "I would continue to rate this statement at a five. The technology is there and I see a potential for its growth.";

Subject 13 (gave it a 6) - "A 7. I like the way it (the course) has been presented. The one page of questions was good. I could easily print it out, and it wasn't too much. Now (as a result of taking the course) I'm stumping code consultants on the job.";

Subject 15 (gave it a 3) - "Slightly higher now, having gone through the process.";

Subject 17 (gave it a 5) - "I'd give the same rating. Computer conferencing has a lot of potential, but in this instance, the site needs more structure.";

Subject 20 (gave it a 6) - "I'm the same. People work well on computers. They have more time to think about what they are going to say.";

Subject 24 (gave it a 4) - "It stays the same. There are some positive things about it (computer conferencing), but there are some negative things. Reading on the screen is dissatisfying. It's hard on my eyes.";

Subject 27 (gave it a 4) - "I'd go up to a 6 now. I see the potential there--but I think there's a lot of work that has to be done to make it reach its full potential--such as the audio component and the graphics."; and

Subject 31 (gave it a 5) - "I've been working with the code for a couple of years now, and I think you have to work with it to truly learn it. So I wouldn't change my rating."

Appendix D - Selected Student responses to pre-interview comments on the use of computers

Subject 1: "The quest for speed can be intoxicating and one forgets to concentrate on accuracy."

Subject 2: "With the internet people communicate easily - people can stay current. With a code on line program people could keep in touch with changes in the code. But this doesn't allow for idiosyncratic interpretations of the code in various municipalities"

Subject 3:"There will be problems in understanding how to use the internet"

Subject 4: " I am it (the computer educational support). And I'm not an expert. I cant program. I'm self taught. I rely on friends for help."

Subject 11"Extreme. I've been using computers since '73."

Subject 24: "On-line discussions would make precedents available-they would have to somehow be monitored for accuracy, to avoid further misinterpretations."

Appendix E - Selected Student responses to pre-interview questions

What form of teaching is the best?

Subject 3:"Direct teaching lectures -- because of immediacy. You get interaction"

Subject 4: "By computer would be best, except for the problem that not everyone has access to a computer. Lectures are good, because they allow for interaction. Home study is also good, as it allows you to proceed at your own pace."

Subject 11:"Anything graphic is good-there are too few diagrams in the code."

Subject 14: "Visuals. Computer conferencing access."

Subject 16:"Seminars are best, as they bring you face-to-face with the experts - code upgrading seminars are the most useful. However, I can see how computer assisted learning would be useful in conjunction."

Subject 17:"The CP course was weak, because of the varying quality of presentation of code material, the inexperienced instructors, and the inadequate testing."

Subject 24:"Computer conferencing sounds like a great idea. Magazines and newsletters are also good. CMHC used to promote innovative solutions to housing questions - that was a good program - it delivered lots of good info."

Code experience. Describe your code review process.

Subject 1:"Osmosis. The senior people in the office instruct younger workers on the code."

Subject 14:"Ask senior code expert in-house. Phone for municipal guidelines."

Who should be involved in code education programs?

Subject 1:"Plan checkers, architects, and code specialists"

Subject 12:Groups involved in the industry, and established educational channels. Every group impacted should be involved."

Appendix F-1 Questionnaire 1

1.0 PERSONAL DATA

1.1 NAME_____ 1.1.1 EMPLOYER _____ 1.1.1.1. NO. OF EMPLOYEES_____

1.2 PHONE_____ 1.3 FAX_____ 1.4 INTERNET_____1.5BIRTHDATE_____
1.6 YEAR OF GRAD._____

1.7 FROM WHICH UNIVERSITY_____ 1.8 YEAR OF ARTICLING COMPLETION_____ 1.8.1. P.ENG. ____ ARCH.____

1.9 ARE YOU A CERTIFIED PROFESSIONAL(CP) IN B.C.? Y_____ N_____

1.10 DO YOU HAVE SOME OTHER CODE CERTIFICATION? Y_____ N____ Please specify_____

1.11 LENGTH OF COURSE_____(Hours) 1.12 GENDER ____ 1.13AGE_____

1.14 OTHER FORMAL CERTIFICATION_____ 1.14.1. FROM WHICH INSTITUTION_____ 1.14.2 YEAR OF

GRADUATION_____ 1.14.3. OTHER COURSE COMPLETION OF NOTE (please state year and length) __

_____
_

2.0 COMPUTER EXPERIENCE

2.1 Do you use a computer at home? Y_____ N_____ 2.1.1 In the office Y_____ N_____

2.2 How would you describe your computer ability?

Very poor			Good		Excellent	
1	2	3	4	5	6	7

2.3 Do you personally design buildings on the computer? Y_____ N_____

2.4 What types of computer programs do you use?
2.4.1 Word processing____ 2.4.2 CAD____ 2.4.3 Spreadsheets_____ 2.4.4 Graphics_____
2.4.5 Internet____

2.5 How many hours do you spend on the computer per work day?_____(hours)

2.6 Computer conferencing as I know it should provide some interesting ways of understanding the code.

Strongly Disagree			Agree			Strongly Agree
1	2	3	4	5	6	7

2.7 Have you learned through the computer previously? Y____ N_____

2.8 Have you taken computer training programs?_____(Y/N) 2.8.1. In the following areas? 2.8.1.1. Word Processing____ 2.8.1.2. CAD_____

2.8.1.3. Spreadsheets_____ 2.8.1.4. Graphics_____ 2.8.1.5. Internet_____

3.0 CODE KNOWLEDGE

3.1 How would you describe your code knowledge?

Very poor			Good		Excellent	
1	2	3	4	5	6	7

3.2 Do you have access to others with extensive code experience in the office? Y_____ N_____

3.3 Are you THE code expert in the office? Y____ N_____

3.4 Rank from 1(low) to 7(highest) your most common sources of code knowledge.

3.4.1 Books____ 3.4.2 Office ____ 3.4.3 Post Secondary_____ 3.4.4 Municipal Building Officials_____
3.4.5 Code professionals _____ 3.4.6 Code courses_____ 3.4.7 Other_____

3.5 How often do you contact a building official's office for code information?

Not often			Often		Very Often	
1	2	3	4	5	6	7

3.6 How would you describe your government contact? (Answer as many as you choose, with 1 Strongly disagree to 7 Strongly agree)
3.6.1 Beneficial_____ 3.6.2 Supportive_____ 3.6.3 Positive_____ 3.6.4 Negative_____ 3.6.5 Time consuming_____
3.6.6 Efficient_____ 3.6.7 Often redundant_____

4.0 WORK EXPERIENCE

4.1How many municipal jurisdictions have you practised in?_____ 4.2 Years of experience in the design and construction field:_____ (Years)

4.3 How often do you accompany a building official on an inspection?

Never			Sometimes		Often	
1	2	3	4	5	6	7

4.4 Have you worked outside the design field but still in construction? Y_____ N_____

4.5 Have you worked for a government regulatory agency (municipal, federal, provincial) Y____ N_____

4.6 Have you worked for a contractor? Y____ N____ and in what capacity?
4.6.1 Project manager___ 4.6.2 Superintendant_____ 4.6.3 Trades____ 4.6.4 Mechanical____4.6.5 General____4.6.6 Electrical____ 4.6.7 Structural_____ 4.6.8 Other_____

Completion of this form and attached questionnaire indicates your willingness to participate in this research project. Your contributions and participation are voluntary and all data gathered will be held in strict confidence. If you have any questions you may contact the principal investigator, Dr. Marv Westrom at 822-5314, the co-investigator, John Guenther at 985-7761 or the head of the Center for the Study of Curriculum Studies, Dr. John Willinsky at 822-6502. You may withdraw from the project at any time. The project results or your participation will not jeopardize your current course standing or any course you may choose to take in the future.

Signed_____ Date_____
tcan-q1/dec.31/jg

Appendix F-2 Questionnaire 2

BASELINE QUESTIONNAIRE FOR ARCHITECTS
CODEWORKS RESEARCH PROJECT

NAME: _____
CODE SECTIONS: _____
FACILITATORS: _____
DATE:_____

Mode - Mode in which class was presented

(1) ____ Completely Online
(2) ____ Partially Online
(3) ____ All Offline

SOME BACKGROUND INFORMATION

If you feel that any of these items invade your privacy, you are of course free to decline to answer them.

How important are each of the following reasons for your taking this course and this particular section or mode of delivery of the course? Very Important, Somewhat Important, or Not Important?

	Very Important	Somewhat Important	Not Important
PROFESSIONAL INTEREST	____	____	____
GENERAL INTEREST	____	____	____
VIRTUAL EXPLORATION	____	____	____
CAREER DEVELOPMENT	____	____	____
FACILITATORS REPUTATION	____	____	____
CURIOUS I was curious about how the technology works	____	____	____
CONVENIENCE More convenient than traditional classes	____	____	____

EXPECTED GRADE
What grade do you expect to receive in this course?

_____A _____B _____C _____D

EXPECTED DIFFICULTY
How easy or difficult to you expect this course to be?

EASY : 1 : 2 : 3 : 4 : 5 DIFFICULT

SEX
_____Male _____ Female

AGE

17 - 18 _____
19 - 21 _____
21 - 25 _____
26 - 34 _____
35 + _____

MAJOR _____

NATIONALITY

(1) ____ Canadian
(2) ____ Other

IMAGES OF YOURSELF

Please read each of the following and indicate how much you agree or disagree
(1 = Completely DISAGREE: 7 means Completely AGREE).

When I get what I want it's usually because I worked hard for it.

DISAGREE					AGREE	
1	2	3	4	5	6	7

I find it easy to play an important part in most group situations.

DISAGREE					AGREE	
1	2	3	4	5	6	7

I prefer games involving some luck over games requiring pure skill.

DISAGREE					AGREE	
1	2	3	4	5	6	7

Even when I'm feeling self-confident about most things, I still seem to lack the ability to control social situations.

DISAGREE					AGREE	
1	2	3	4	5	6	7

I can learn almost anything if I set my mind to it.

DISAGREE					AGREE	
1	2	3	4	5	6	7

I have no trouble making and keeping friends.

DISAGREE					AGREE	
1	2	3	4	5	6	7

It's pointless to keep working on something that is too difficult for me.

DISAGREE					AGREE	
1	2	3	4	5	6	7

I'm not good at guiding the course of a conversation with several others

DISAGREE					AGREE	
1	2	3	4	5	6	7

On any sort of exam or competition I like to know how well I do relative to everyone else.

DISAGREE					AGREE	
1	2	3	4	5	6	7

I can usually establish a close personal relationship with someone I find attractive.

DISAGREE					AGREE	
1	2	3	4	5	6	7

My major accomplishments are entirely due to my hard work and ability.

DISAGREE					AGREE	
1	2	3	4	5	6	7

When I make plans I am almost certain to make them work.

DISAGREE					AGREE	
1	2	3	4	5	6	7

When being interviewed, I can usually steer the interviewer toward the topics I want to talk about and away from those I wish to avoid.

DISAGREE					AGREE	
1	2	3	4	5	6	7

I usually don't set goals because I have a hard time following through on them.

DISAGREE					AGREE	
1	2	3	4	5	6	7

If I need help in carrying off a plan of mine, it's usually difficult to get others to help.

DISAGREE					AGREE	
1	2	3	4	5	6	7

Competition discourages excellence.

DISAGREE					AGREE	
1	2	3	4	5	6	7

If there's someone I want to meet, I can usually arrange it.

DISAGREE					AGREE	
1	2	3	4	5	6	7

Other people get ahead just by being lucky.

DISAGREE					AGREE	
1	2	3	4	5	6	7

I often find it hard to get my point of view across to others.

DISAGREE					AGREE	
1	2	3	4	5	6	7

In attempting to smooth over a disagreement, I usually make it worse.

DISAGREE						AGREE
1	2	3	4	5	6	7

YOUR PREVIOUS EXPERIENCE WITH COMPUTERS

COMPUTER EXPERIENCE

Which of the following best describes your previous experience with computer systems?

(1)_____I am a NOVICE; seldom or never use computers
(2)_____ I have OCCASIONALLY used computer terminals and systems before
(3) ____ I have FREQUENTLY used computer systems
(4) ____ Use of computers is central to my PROFESSIONAL work

For each of the following pairs of words, please circle the response that is closest to your CURRENT FEELINGS ABOUT USING COMPUTERS. For instance, for the first pair of words, if you feel computer systems in general are completely "stimulating" to use and not at all "dull," circle "1"; "4" means that you are undecided or neutral or think they are equally likely to be stimulating or dull; "3" means you feel that they are slightly more stimulating than dull, etc.

Stimulating	1	2	3	4	5	6	7	Dull
Fun	1	2	3	4	5	6	7	Dreary
Easy	1	2	3	4	5	6	7	Difficult
Personal	1	2	3	4	5	6	7	Impersonal
Hindering	1	2	3	4	5	6	7	Helpful
Threatening	1	2	3	4	5	6	7	Unthreatening
Efficient	1	2	3	4	5	6	7	Inefficient
Demanding	1	2	3	4	5	6	7	Obliging
Reliable	1	2	3	4	5	6	7	Unreliable
Desirable	1	2	3	4	5	6	7	Undesirable

EXPECTATIONS ABOUT THE CONFERENCING SYSTEM

Indicate your expectations about how it will be to use this system by circling the number which best indicates where your feelings lie on the scales below.

1	:	2	:	3	:	4	:	5	:	6	:	7
Hard to learn												Easy to learn
1	:	2	:	3	:	4	:	5	:	6	:	7
Impersonal												Friendly
1	:	2	:	3	:	4	:	5	:	6	:	7
Frustrating												Not frustrating
1	:	2	:	3	:	4	:	5	:	6	:	7

Unproductive Productive

Do you expect that the use of the system will increase the efficiency of your education (the quantity of work that you can complete in a given time)?

1 : 2 : 3 : 4 : 5 : 6 : 7
Definitely yes Unsure Definitely not

Do you expect that use of the System will increase the quality of your education?

1 : 2 : 3 : 4 : 5 : 6 : 7
Definitely yes Unsure Definitely not

Overall, how useful do you expect the System to be for your work functions?

1 : 2 : 3 : 4 : 5 : 6 : 7
Very Useful Not useful at all

EXPECTED TIME

While you are part of an online course, how much time in the average week do you foresee yourself using CONFERENCING in relation to your coursework?

1. ___ Less than 30 minutes
2. ___ 30 minutes to 1 hour
3. ___ 1 - 3 hours
4. ___ 4 - 6 hours
5. ___ 7 - 9 hours
6. ___ 10 hours or more

EQUIPMENT ACCESS

Please describe your access to a computer terminal or microcomputer at your office or place of work.

WORK ACCESS

1. ___ No terminal
2. ___ Have my own terminal
3. ___ Share a terminal, located where I can see it from my desk
4. ___ Share a terminal, which takes ___ minutes to reach
5. ___ Not applicable; I do not have an office

HOME ACCESS

Do you have a micro or terminal at home (or in your dorm, wherever you live during classes)?

1. ___ No
2. ___ Yes

TERMINAL TYPE

What kind of terminal do you usually use? (Check all that apply)
___ CRT (video display)
___ Hard copy (printer terminal)
___ Both

MICRO

___ Microcomputer (Brand ____)
___ With modem
___ With hard copy
___ With disk storage

THANK YOU VERY MUCH!!!

Completion of this form and attached questionnaire indicates your willingness to participate in this research project. Your contributions and participation are voluntary and all data gathered will be held in strict confidence. If you have any questions you may contact the principal investigator, Dr. Marv Westrom at 822-5314, the co-investigator, John Guenther at 985-7761 or the head of the Center for the Study of Curriculum Studies, Dr. John Willinsky at 822-6502. You may withdraw from the project at any time. The project results or your participation will not jeopardize your current course standing or any course you may choose to take in the future.

Signed_____ Date_____

Appendix F-3 - Questionnaire 3

POST-COURSE QUESTIONNAIRE FOR ARCHITECTS
CODEWORKS PROJECT

NAME: _____
CODE SECTIONS: _____
FACILITATORS: _____

COURSE EFFECTIVENESS

There are three sets of items in this section; we would like you to try to separate them out in your thinking. The first relates to the teaching or presentation style and effectiveness of your instructor; the second, to the course content; and the third, to the outcomes of the course for you. Later in the questionnaire, those who participated in an experimental mode of delivery will make direct comparisons between this course and traditional courses.

For each of the following, please indicate the response that corresponds to the following scale:

SA = Strongly Agree
A = Agree
N = Neither agree nor disagree (neutral)
SD = Strongly Disagree

COURSE CONTENT

The course content was interesting to me:
SA A N D SD

Course content is important or valuable:
SA A N D SD

Course goals were clear to me:
SA A N D SD

Work requirements and grading system were unclear from the beginning:
SA A N D SD

The reading assignments are poor:
SA A N D SD

The lecture material is poor:
SA A N D SD

The students had to work hard:
SA A N D SD

This course was a waste of time:
SA A N D SD

Is this course taught at an appropriate level?

: 1 : 2 : 3 : 4 : 5 :
Too easy Just right Too difficult

How would you rate this course over-all?
(1)Excellent (2) Very good (3) Good (4) Fair (5) Poor

CHARACTERISTICS OF THE TEACHING

SA A N D SD

Facilitator organized the course well
SA A N D SD

Grading was fair and impartial
SA A N D SD

Facilitators seems to enjoy teaching

SA A N D SD

Facilitators lacks sufficient knowledge about the subject area
SA A N D SD

Students were encouraged to express ideas
SA A N D SD

Instructor presented material clearly and summarized points
SA A N D SD

Facilitator discussed points of view other than her/his own
SA A N D SD

The student was able to get personal help in this course
SA A N D SD

Facilitator presented material in a boring manner
SA A N D SD

Facilitator critiqued my work in a constructive and helpful way
SA A N D SD

Overall, I would rate this facilitator as: (Facilitator names_____)

(1) Excellent (2) Very good (3) Good 4) Fair (5) Poor

Comments about the facilitator or the teaching?

_____

_____

_____

_____

OUTCOMES OF THE COURSE

I became more interested in the subject
SA A N D SD

I learned a great deal of factual material
SA A N D SD

I gained a good understanding of basic concepts
SA A N D SD

I learned to identify central issues in this field
SA A N D SD

I developed the ability to communicate clearly about the subject
SA A N D SD

My skill in critical thinking was increased
SA A N D SD

I developed an understanding of ethical issues
SA A N D

My ability to integrate facts and develop generalizations improved
SA A N D

I regularly completed the required readings
SA A N D

I was stimulated to do additional reading
SA A N D

I participated actively in class discussion
SA A N D

I was stimulated to discuss related topics outside of class
SA A N D

The written assignments aided my learning
SA A N D

I regularly completed the written assignments
SA A N D

I was forced to think for myself
SA A N D

I became more confident in expressing my ideas
SA A N D

I developed new friendships in this class
SA A N D

I learned to value other points of view
SA A N D

I was motivated to do my best work

	SA	A	N	D
I gained a better understanding of myself				
	SA	A	N	D
I increased my competence with computers				
	SA	A	N	D
I learned to see relationships between important topics and ideas				
	SA	A	N	D
My ability to critically analyze written material was improved				
	SA	A	N	D

GENERAL INFORMATION

About how much TOTAL time have your spent each week on this course (including "in class" and out, reading and writing, on and offline)

1. ___ Less than one hour
2. ___ 1-2 hours
3. ___ 3-4 hours
4. ___ 5-9 hours
5. ___ Ten hours or more

How easy or difficult was this course for you?

EASY 1 2 3 4 5 DIFFICULT

What grade do you expect to receive in this course?
____ A ____ B ____ C ____ D ____ F

Individual vs. Group Learning

Some courses are essentially a very INDIVIDUAL experience; contact with other students does not play an important part in your learning. In other courses, communication with other students play a dominant role. For THIS COURSE, please circle the number below that seems to be what you experienced.

: 1 : 2 : 3 : 4 : 5 : 6
Individual experience Group experience

The help I got from other students was -
: 1 : 2 : 3 : 4 : 5 : 6
Crucially important to me Useless or misleading

Student in my class tended to be
: 1 : 2 : 3 : 4 : 5 : 6
Not at all cooperative Extremely cooperative

: 1 : 2 : 3 : 4 : 5 : 6
Not at all competitive Extremely competitive

How often did you communicate with other students outside of class, by computer, "face-to-face" or on the telephone?
: 1 : 2 : 3 : 4 : 5 : 6
Never Constantly

ATTITUDES TOWARD COMPUTERS

For each of the following pairs of words, please circle the response that represents where you fall on the scale in terms of your CURRENT FEELINGS ABOUT USING COMPUTERS.

: 1 : 2 : 3 : 4 : 5 : 6
Stimulating Dull

: 1 : 2 : 3 : 4 : 5 : 6
Fun Dreary

: 1 : 2 : 3 : 4 : 5 : 6
Easy Difficult

: 1 : 2 : 3 : 4 : 5 : 6
Personal Impersonal

: 1 : 2 : 3 : 4 : 5 : 6
Hindering Helpful

: 1 : 2 : 3 : 4 : 5 : 6
Threatening Unthreatening

: 1 : 2 : 3 : 4 : 5 : 6
Efficient Inefficient

: 1 : 2 : 3 : 4 : 5 : 6
Demanding Obliging

: 1 : 2 : 3 : 4 : 5 : 6
Reliable Unreliable

: 1 : 2 : 3 : 4 : 5 : 6
Desirable
Undesirable

ATTITUDES TOWARD MEDIA

To what extent do you agree with the following statements?

I enjoy listening to lectures
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

I like to read.
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

I have difficulty expressing my ideas in writing
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

I like to take part in class discussion
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

PARTICIPATION IN THE ONLINE COURSE

If your participated in a traditional course or a course which did not include any online work, skip the rest of the questionnaire.

Is access to a terminal or micro for the online class a problem for you?
: 1 : 2 : 3 : 4 : 5 :
Serious Problem Not a Problem

To what extent has the slow response of the EIES system been a problem or barrier for you?
: 1 : 2 : 3 : 4 : 5 :
Serious Problem Not a Problem

How much problem have you had with "busy" lines or no available ports to EIES?
: 1 : 2 : 3 : 4 : 5 :
Serious Problem Not a Problem

To what extent has the slow response of the EIES system been a problem or barrier for you?
: 1 : 2 : 3 : 4 : 5 :
Serious Problem Not a Problem

EXPERIENCES WITH EIES

Indicate your experiences with using this system by circling the number which best indicates where your feelings lie on the scales below.

: 1 : 2 : 3 : 4 : 5 : 6
Hard to learn Easy to learn
: 1 : 2 : 3 : 4 : 5 : 6
Impersonal Friendly
: 1 : 2 : 3 : 4 : 5 : 6
Frustrating Not frustrating
: 1 : 2 : 3 : 4 : 5 : 6
Unproductive Productive

Did use of the System increase the efficiency of your education (the quantity of work that you can complete in a given time)?

: 1 : 2 : 3 : 4 : 5 : 6
Definitely yes Unsure Definitely not

Did use of the System increase the quality of your education?

: 1 : 2 : 3 : 4 : 5 : 6
Definitely yes Unsure Definitely not

COMPARISON TO TRADITIONAL CLASSROOMS

Please compare online "classes" to your previous experiences with "face to face" college-level courses. To what extent to you agree with the following statements about the comparative process and value of the EIES online course or portion of a course in which you participated? (Circle a number on the scales.)

Taking online courses is more convenient.
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

I felt more "inhibited" in taking part in the discussion.
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

I didn't have to work as hard for online classes.
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

I communicated more with other students in the class as a result of the computerized conference.
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

Having the computerized conferencing system available provided better access to the professor(s).
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

The fact that my assignments would be ready by the other students increased my motivation to do a thorough job.
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

When I became very busy with other things, I was more likely to stop participating in the online class than I would have been to "cut" a weekly face-to-face lecture.
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

The online or virtual classroom mode is more boring than traditional classes.
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

I felt more "involved" in taking an active part in the course.
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

I found the comments made by other students to be useful to me.
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

I found reading the reviews or assignments of other students to be useful to me.
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

I would NOT choose to take another online course.
1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

I found the course to be a better learning experience than normal face-to-face courses.

1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

I learned a great deal more because of the use of EIES.

1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

I would have gotten more out of a traditional course.

1 : 2 : 3 : 4 : 5 : 6 : 7
Strongly Agree Strongly Disagree

OVERALL COMMENTS AND SUGGESTIONS

1. ___ Convenience
2. ___ Enjoy Computers
3. ___ Communicate easily
4. ___ Class interest
5. ___ Hard copy
6. ___ Read helpful
7. ___ Catch-up easily
8. ___ Say anything
9. ___ Self-paced
10. ___ Accomplish more

What one or two things about your virtual classroom experience were the "worst," the most in need of improvement?

1. ___ Slow EIES
2. ___ No access
3. ___ Hate computers
4. ___ No help
5. ___ Time consuming
6. ___ Need documentation
7. ___ Hate self-paced
8. ___ Too much work
9. ___ More coordination
10. ___ Too hard
11. ___ No catch-up
12. ___ Less materials
13. ___ Branch problems
14. ___ Others copied
15. ___ Time tests
16. ___ More training
17. ___ Poor graphics

Other comments or suggestions for improvements?

1. ___ Reduce work
2. ___ EIES response
3. ___ More online
4. ___ More terminals
5. ___ Helps independence
6. ___ Improves peer relationships
7. ___ Hinders independence
8. ___ Need face-to-face
9. ___ Hard copy
10. ___ Improve branch
11. ___ More documentation
12. ___ Others should read
13. ___ Improve screens
14. ___ Standardize software

THANK YOU VERY MUCH!!!

Completion of this form and attached questionnaire indicates your willingness to participate in this research project. Your contributions and participation are voluntary and all data gathered will be held in strict confidence. If you have any questions you may contact the principal investigator, Dr. Marv Westrom at 822-5314, the co-investigator, John Guenther at 985-7761 or the head of the Center for the Study of Curriculum Studies, Dr. John Willinsky at 822-6502. You may withdraw from the project at any time. The project results or your participation will not jeopardize your current course standing or any course you may choose to take in the future

Appendix F-4 - Pretest

PRETEST ON 3.1.2. , 3.1.3., 3.2.1. and 3.2.2. OF THE B.C. BUILDING CODE 1992

INSTRUCTIONS:

This is a self-administered and independently completed open book exam. Please do not take any longer than 2 hours to complete the following questions:

1.0 In your own words define: (4 marks each)

1.1.GRADE

1.2 FIRST STOREY

1.3 BUILDING AREA

1.4 MAJOR OCCUPANCY

1.5 OCCUPANCY

1.6 BUILDING HEIGHT

1.7 FLOOR AREA

1.8 STOREY

1.9 HEIGHT

1.10 FIRE RESISTANCE RATING

1.11 FIRE SEPARATION

1.12 HORIZONTAL FIRE SEPARATION

1.13 VERTICAL FIRE SEPARATION

1.14 MEZZANINE

2.0 Classify the following uses according to occupancy: (2 marks each)

2.1 PET STORE____ 2.2. BAKERY____ 2.3. FIRE HALL_____ 2.4 GROUP HOME _____ 2.5. DAY CARE____ 2.6 WELDING SHOP_____ 2.7. CONCRETE BLOCK MANUFACTURING PLANT_____ 2.8 FAST FOOD RESTAURANT WITHOUT SEATING____ 2.9 FAST FOOD RESTAURANT WITH SEATING_____ 2.10 POLICE STATION 900 SQ. M. 1 STOREY IN BUILDING HEIGHT____ 2.11 50 UNIT

CONDOMINIUM WITH A COMMUNITY CARE FACILITY IN ONE SUITE___
(classification of suite)

3.0 What are the two instances where major occupancy does not need to be the most restrictive occupancy applying to the whole building (2 marks)

4.0 What are the fire separations required between the following occupancies? (1 mark each)

4.1 D and D____ 4.2 D and E____ 4.3 E and 2 dwelling units in a 2 storey building____ 4.4. E and C____ 4.5 F-1 and B-2 ____ 4.6 Non-major occupancies of C and F-1____
4.7 Non-major occupancies of E and C____ 4.8 Between major occupancies surrounding an atrium classified as D and C____ 4.9 Non-major occupancies of E and E____

5.0 Sketch the following building and label the most restrictive major occupancy. Then classify the uses according to 3.2.2, and indicate the amount of fire resistance rating: (8 marks each)
5.1 1000 sq.m. in building area. 1st. floor - storage garage, 2nd. floor - 50% office and 50% grocery store, 3rd. floor - residential , 4th. floor - one suite non-ambulatory use with an area of 110 sq. m, and 5th. floor - mechanical room penthouse with an 80 sq. m. mezzanine, facing 2 streets, sprinklered.

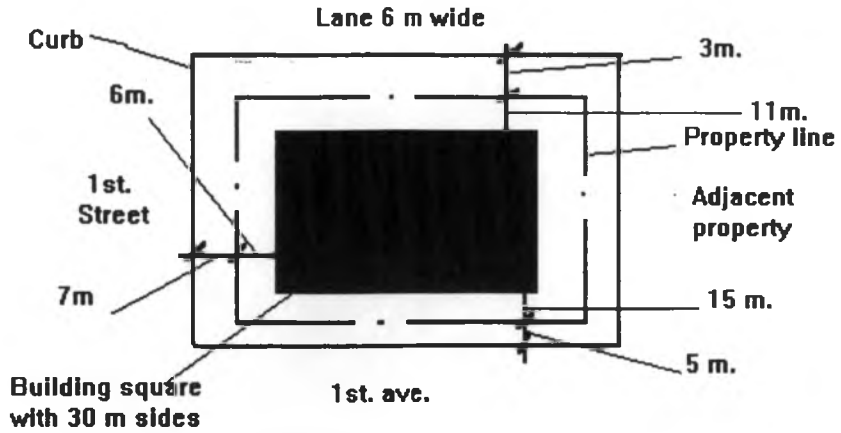
5.2 2 storeys in building height, 800 sq.m. in building area. 1st. floor - library, 2nd. floor - offices - 700 sq.m. and council chambers - 100 sq.m., facing one street, unsprinklered.

6.0 Sketch and classify the following buildings according to 3.2.2., and indicate the amount of fire resistance rating: (8 marks each)

6.13 storeys, storage garage in basement, store on 1st. floor, residential on 2 and 3rd. storeys, mezzanine on 3rd. storey less than 100 sq.m., mezzanine on 2nd. storey less than 100 sq. m. building area 1000 sq.m., facing 2 streets, sprinklered, with a tennis court on the roof.

6.2 4 storeys, building area 1000 sq. m., basement - tenant storage, 1st floor - children's custodial home 80 sq.m., store of 920 sq.m., 2nd. floor to 4th. floor residential, crawl space 2.0 m in height, sprinklered, and facing 1 street, with exterior balconies.

7.0 Determine the number of streets this building faces (5 marks)

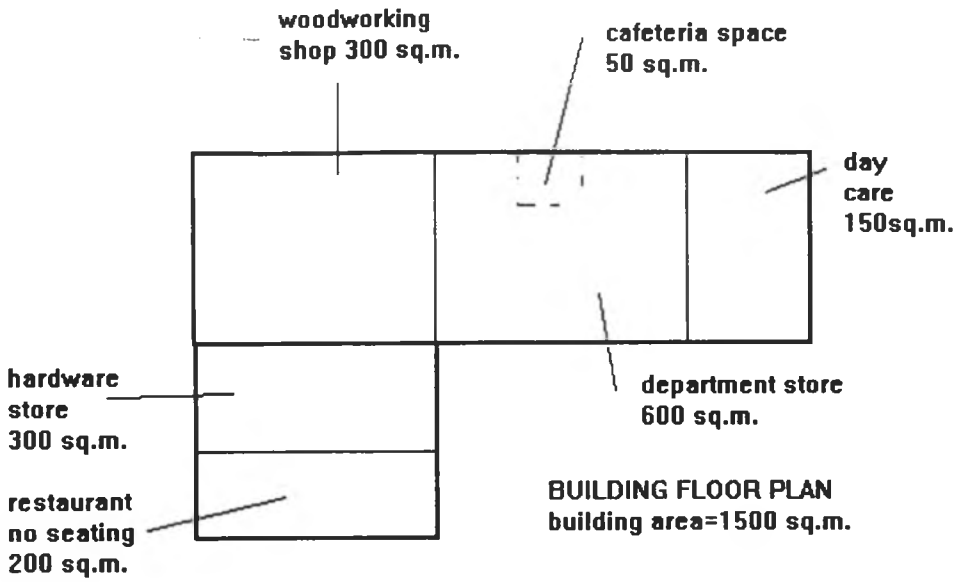


SITE PLAN – N.T.S.

Appendix F-5 - Posttests

Section Review

1. a)Classify the following uses according to occupancy:
   PET STORE____ BAKERY____ FIRE HALL_____ GROUP HOME _____ DAY CARE____ WELDING SHOP_____CONCRETE BLOCK MANUFACTURING PLANT_____FAST FOOD RESTAURANT WITHOUT SEATING____ FAST FOOD RESTAURANT WITH SEATING_____ POLICE STATION 900 SQ. M. 1 STOREY IN BUILDING HEIGHT____ 50 UNIT CONDOMINIUM WITH A COMMUNITY CARE FACILITY IN ONE SUITE___ (classification of suite)
   b) What determines the occupancy classification of a fast food restaurant?
2. If an arena was used more often than "occasionally" for trade shows how would you classify and determine construction requirements? How would you define occasional use?
3. In which instances is major occupancy the most restrictive occupancy applying to the whole building?
4. Table 3.1.3.A determines fire separations between all occupancies T__ F___
5. What are the fire separations required between the following occupancies:D and D____D and E____E and 2 dwelling units in a 2 storey building____E and C____F-1 and B-2 ____Non-major occupancies of C and F-1____Non-major occupancies of E and C____4.8 Between major occupancies surrounding an atrium classified as D and C____Non-major occupancies of E and E____
6. Contact at least one facilitator and state the reasons why an F-1 major occupancy building cannot house an A,B or C occupancy.
7. From the following sketch determine:
   a)the fire rating between each occupancy
   b)the major occupancy of the building
   c)the occupancy classifications



Section 2 Review and Comments

This section review discusses code jurisdiction and application.

1. a) Which building code is in effect in the City of Victoria? b)Which jurisdiction applies the code? c)What two documents empower the building code?
2. The National Building Code may be applied in many jurisdictions in the Province of B.C. in the absence of any other legislation.
   T____ F____
3. The public review process has no legal effect nationally.
   T____ F____
4. The municipality may alter the building code in certain key areas such as:
   a) Fire walls and fire separations T____ F____
   b) Fire protection by requiring increased sprinklerization
   T____ F____
   c) Enforcement techniques such as adopting other codes that may have more effect T____ F____
   d)Fees and legal remedies T____ F____

5. Conferencing with at least two other people *on-line* describe the code adoption process for municipal jurisdictions in the Province (excluding Vancouver). The discussion should include descriptions and relationships of the following functions: public review, national model code, time cycles, legislative authority, provincial and municipal amendments, and jurisdiction.

Appendix F-6 - Pre-Interview

INTERVIEW: I would now like to conduct a short (15 minute) regarding your views.

TELEPHONE CONTACT FORM - CANDIDATES

NAME_____ PHONE_____
DATE_____

INTERVIEWER_____

INTERVIEW QUESTIONS

1.0 COMPUTER EXPERIENCE

Computers are used in many offices to enhance work functions such as drafting, planning presentations, word processing, and internet communications. Many codes are being delivered in data based formats with integrated search mechanisms. Software has developed to the extent that user friendly navigation is enhanced and expanded. Computer conferencing software is attempting to fill the interactional gaps missing in most distance delivery programs. However, to what extent does the delivery of material in this format expand the ability of the learner to learn while working (just-in-time) while synthesizing the classroom interactions and consequently improve on classroom delivery formats?

1.1 Have you programmed a computer before? y____ n_____
1.2 What CAD program do you use? _____
1.3 What problems can you foresee with a computer delivered code program at work?
1.4 How would you describe your familiarity with the computer? 1.5 What are the advantages and disadvantages?
1.5.1.Advantages
1.5.2. Disadvantages
1.6 What is the most effective method of code official contact?
1.7 How often do you use the computer at work? Hours per day_____
Comments
1.8 Do you have computer educational support at work? y____ n_____
1.8.1 How would you describe its sufficiency?

2.0 CODE EXPERIENCE

Code understanding is mainly achieved by osmosis at work and important but rare contacts with building officials. However, it is seen as a synthesis of design and safety principles. There are significant number of confrontations over code precepts leading to costly delays and frustrations between major participants. Expanding the role of the building official and bridging the communication gaps existent between the design and safety professions is seen as another major advantage o f the conferencing delivery format.
2.1 Describe your code review process?
2.2 What reference material do you use?
2.3 Which building officials office do you contact most often?
and how often? _____

2.4 What forms of contact do you use?
2.4.1. Which is the most beneficial and why?
2.5 What ways can government interaction be improved?
2.6 What are some of the main problems with today's code?
2.7 What part of the code review process do you find most interesting?
most confusing?
2.8 Can you name the major construction codes?
2.9 How would you describe your code understanding?
2.91 What has contributed the most?
2.911 The least?
2.10 What assessments do you have of the current code application process?
The current adoption process?
2.11 Who should be involved in code education programs? (Please give priorities)

2.12 There are many types of code delivery, video, slides, basic lecture, computer assisted, computer conferencing. What is the best delivery format? and why?

3.0 WORK EXPERIENCE

3.1 What are the differences between municipal jurisdictions in code application?
3.11 What ways can they be improved?
3.2 Confrontation occurs on the job site, what is the biggest reason for that confrontation?
3.3 Your work experience includes previous construction experience. If and how has this prepared you for the design field?
3.4 What could be added to design experience to enhance effectiveness?
Thank you very much. Please contact me or the other investigators if you have any questions.

Post Interview

INSTRUCTIONS

Please familiarize yourself with the research objectives . Be sure to read the introduction to the candidate before proceeding to the following questions.

INTRODUCTION

Good day. My name is Lynn Farquhar and I am assisting in the investigation and development of the CONEXUS/CODEWORKS PROJECT that you have volunteered to participate in. We would like to follow up on the project by asking that you respond to a couple of questions. These will be gathered and reported confidentially and will assist in building the CONEXUS WEB SITE. The interview should not take any longer than 15 minutes.

Appendix F-7 - Post Interview

TELEPHONE INTERVIEW - AFTER PROGRAM DELIVERY

STUDENT NAME_____
INTERVIEWER_____

DATE_____ TIME: START_____ FINISH_____
LOCATION_____

INTERVIEW QUESTIONS

Gaining knowledge about the building code has been one of the main objectives of this course. But also it is important to consider the degree to which the technology has permitted you to access resources and knowledge. The building code tends to be viewed as very complicated and interpretive. Some pre-course interviews were conducted in which candidates described their views on a number of issues including the building code and how it should be applied and taught, your work experience and your computer knowledge.

We would now like to explore your views concerning this computer conferencing code course by having you answer the following questions:

1.1 How did you first hear about this code course? What were your initial feelings or reactions...what attracted you, what didn't sound good about this approach?

1.2 How about the initial training session...after it was over, did you feel that you would be able to sign on line and find and access the material or was there something that was not clear about what the procedure would be?

1.3 Was the computer easily accessible in the office and where did you go to use it? Were there any problems with availability? Did you have any sort of regular schedule each week when you would sign on line to participate, or how was it that you decided when to log on?

1.4 What were your initial feelings or impressions about the online class during the lead up in the first week? Can you remember what you particularly liked, or what you didn't like or found confusing? (probe....anything else?)

1.5 What were your initial reactions to reading the comments or contributions by the other participants...to what extent did you find this interesting or helpful, and to what extent did you feel this was a waste of time? Why?
Did you feel that you were part of a group or class working together, or helpful, and to what extent did you feel this was a waste of time? Why?
Did you feel that you were part of a group or class working together, or did you feel that your were pretty much alone in learning the material?
(If felt part of group). Did you or the instructor do anything in particular that helped you to be able to work and socialize with other participants in the on line class?

1.6 How about the lecture-type material presented by the instructor... did you find it easier to understand that material in writing, or do you think you would have learned it better if you had listened to it in spoken form? Why?

1.7 Did you ever look at or join any of the public conferences on the system, besides the conference within your group?
If yes, which ones, and what did you think of them?
If no...why not?
Did you ever exchange messages with anybody online that was not connected with the project?
If yes....how did this happen?
How did you feel about this experience of communicating with "strangers"?

1.8 How would you describe your relationship to the facilitator online? Do you feel MORE or LESS able to communicate and relate to your teacher? Why?

1.9 Q9 examines initial and current reactions to on-the-job learning with the computer based on the initial questionnaire.
Question 2.6 asked for a response from 1-7 strongly disagree to strongly agree, to the statement that Computer conferencing as I know it should provide some interesting ways of understanding the code. Your reaction was _____ What if your reaction now?
Have you developed any particular routines or tricks of the trade that are making computer conferencing more valuable to you than it was at first?
At this point in your online course, what do you like best about the Virtual Classroom approach... that is, what is good about it compared to a course given in the traditional classroom? (probe .... anything else?)
What do you currently like least, or feel are the greatest problems or shortcomings about this mode of course delivery?

1.10 What advice would you give a student who is thinking of signing up for an online course?
How about your instructor...what advice would you give about how they could be more effective if they try teaching this course online again?

1.11 Is there anything else you would like to tell us about your experiences... anything that was especially funny or memorable, or valuable, or unpleasant about your experience?

Appendix G- Conferencing itinerary:

1. February 20:
Session commences with seminar at PMTI in North Vancouver. Project introduction and development of conferencing networkers. Completion of consent form and surveys.

2. March 25-29:
Gathering and collating of data to identify two groups of users. Facilitator orientation instruction and testing on line. Development of user references and on line linkages for conferencing participants. Facilitator pre-course interviews and questionnaires.

3.April 16-17:
Conferencing warm up discussion with facilitators to test and run system. Discussion subject development will include current topics such as stucco application, objectives based codes and hot topic generation.

4.April 18-19:
Conferencing warm up for all participants. Discussion topics will extend from facilitator warm up. Issues identified as stucco application, objectives based codes and hot topics.

5.April 22-26:(Week 1), April 29-May 3:(Week 2), May 6-10: (break), May 13-17: (Week 3)
Conferencing on line with code course material, tests, and discussion items. Time lines will be established for contribution deadlines and project development. Code sections are 3.1.2, 3.1.3, 3.2.1, and 3.2.2.

6.May 20-24: (Week 4)
Cool down session. Debriefing, project summary, overall comments and posttest.

7.May 27-June 30
Data gathering and reporting. Project team reconfiguration and on line course redevelopment.

8.September 1 - November 30
Finalization of on line course development. Exploration and development of Web Site of linkages. Municipal coordination and facilitation.

itin1/jg/mar96

Appendix H - Selected Interviews

Subject 19 - Pre-Interview

1.0 COMPUTER EXPERIENCE

Computers are used in many offices to enhance work functions such as drafting, planning presentations, word processing, and internet communications. Many codes are being delivered in data based formats with integrated search mechanisms. Software has developed to the extent that user friendly navigation is enhanced and expanded. Computer conferencing software is attempting to fill the interactional gaps missing in most distance delivery programs. However, to what extent does the delivery of material in this format expand the ability of the learner to learn while working (just-in-time) while synthesizing the classroom interactions and consequently improve on classroom delivery formats?

1.1 Have you programmed a computer before? No
1.2 What CAD program do you use? Generic Cad

1.3 What problems can you foresee with a computer delivered code program at work?

1.3.1. None, except that people will need to be convinced that it's user friendly.

1.4 How would you describe your familiarity with the computer? Ok, but I'm not comfortable with Windows.

1.5 What are the advantages and disadvantages?

1.5.1.Advantages

1.5.1.1. There's a higher standard of presentation. More accurate documentation.

1.5.1.2.The quality [of the product] is higher.

1.5.1.3. Accuracy -- in my case, for conceptual and design planning. I can't imagine hand drafting anymore.

1.5.2. Disadvantages

1.5.2.1. It's slower.

1.6 What is the most effective method of code official contact?

Phoning John Guenther [much laughter]. The phone.

1.7 How often do you use the computer at work? Hours per day____4_____

1.8 Do you have computer educational support at work? No

1.8.1 How would you describe its sufficiency?All I use are the manuals that come with the software.

2.0 CODE EXPERIENCE
Code understanding is mainly achieved by osmosis at work and important but rare contacts with building officials. However, it is seen as a synthesis of design and safety principles. There are significant number of confrontations over code precepts leading to costly delays and frustrations between major participants. Expanding the role of the building official and bridging the communication gaps existent between the design and safety professions is seen as another major advantage o f the conferencing delivery format.

2.1 Describe your code review process? On a given project, I'll do a classification on fire ratings and stair exiting patterns, then I'll do a formal summary for the building department I'm dealing with.

2.2 What reference material do you use? ULC; CSA.

2.3 Which building officials office do you contact most often? North Van City; Port Coquitlam; Coquitlam.

and how often? Seldom -- three or four times per year.

2.4 What forms of contact do you use?I set up a meeting by written memo or by phone.

2.4.1. Which is the most beneficial and why?Phone. Then face to face is good, too. It's nice to meet on site to discuss contentious issues.

2.5 What ways can government interaction be improved?

2.5.1. By making more time available to get to know the people.

2.5.2. Open dialogue and listen to the opinions of the public.

2.6 What are some of the main problems with today's code?

2.6.1. Problems? Maybe equivalences. I like it [the code] -- it's interpretive. There are things that just can't be expressed in black and white.

2.7 What part of the code review process do you find most interesting?

2.7.1.Fire separations.

2.7.2.Exiting patterns.

2.7.3.Mezzanines and inter connective floors.

most confusing?

2.7.4. Limiting distances.

2.8 Can you name the major construction codes? BC Building code; Fire Safety code; Electrical code.

2.9 How would you describe your code understanding?Pretty good -- but I'm an open-booker.

2.91 What has contributed the most? Twenty-six years of experience.

2.911 The least? My confusion over limiting distance.

2.10 What assessments do you have of the current code application process?

2.10.1.Government offices need more manpower, especially in plan checking departments.

2.10.2. There should be more code review in government offices, by plan checkers. An incorrect height of railing should be picked up on the plans, not in the field.

The current adoption process?

2.10.4. It takes too long.

2.11 Who should be involved in code education programs? (Please give priorities) The teachers should be guys such as myself. Professionals. Also, inspectors. The students should be drafts men.

2.12 There are many types of code delivery, video, slides, basic lecture, computer assisted, computer conferencing. What is the best delivery format? and why? Reading the code out of a binder is fine by me. But on computer, too, if possible.

3.0 WORK EXPERIENCE

3.1 What are the differences between municipal jurisdictions in code application? Dramatic, because of personalities, policies and procedures.

3.11 What ways can they be improved? By legislating a uniform intent.

3.2 Confrontation occurs on the job site, what is the biggest reason for that confrontation? Someone screws up -- the inspector, the builder, or the professional . Poor documentation is a reason -- bad plans. Ass-covering is a bit reason for confrontation. When a mistake is found, an immediate defence mechanism clicks in.

3.3 Your work experience includes previous construction experience. If and how has this prepared you for the design field? It was absolutely invaluable. I know the methodology, the steps, stages, details and the interface.

3.4 What could be added to design experience to enhance effectiveness? More full service work. More old-style architectural training. They should see the project right through from tendering to completion. Perhaps designers could provide supervision on site. That would be invaluable.

Thank you very much. Please contact me or the other investigators if you have any questions.

Subject 27 - Post Interview

INTERVIEW QUESTIONS
Gaining knowledge about the building code has been one of the main objectives of this course. But also it is important to consider the degree to which the technology has permitted you to access resources and knowledge.
The building code tends to be viewed as very complicated and interpretive. Some pre-course interviews were conducted in which candidates described their views on a number of issues including the building code and how it should be applied and taught, your work experience and your computer knowledge.

We would now like to explore your views concerning this computer conferencing code course by having you answer the following questions:

1.1 How did you first hear about this code course? What were your initial feelings or reactions...what attracted you, what didn't sound good about this approach?

I guess that I heard about it through the AIBC. I thought it was a great idea. It seemed like a good chance to create some dialogue.

1.2 How about the initial training session...after it was over, did you feel that you would be able to sign on line and find and access the

material or was there something that was not clear about what the procedure would be?--

I thought that the procedure was unclear. Overall, I had no comprehension of what the objectives were. That still remains unclear.

Also, I had trouble with the passwords. I was sent a memo where the password was in capitals. This didn't work when I went to apply it. It should be been in lower case letters. Maybe a memo outlining all the possible scenarios where problems might occur would have helped alleviate a lot of my confusion.

1.3 Was the computer easily accessible in the office and where did you go to use it? Were there any problems with availability? Did you have any sort of regular schedule each week when you would sign on line to participate, or how was it that you decided when to log on?

I did it both at home and at the office. I have my own terminal at my desk. I sign on-line every morning.

1.4 What were your initial feelings or impressions about the online class during the lead up in the first week? Can you remember what you particularly liked, or what you didn't like or found confusing? (probe....anything else?)

There were notices that came out saying that something would be posted and yet nothing was posted afterward. I understand that this had nothing to do with John -- it was the server that was responsible for the delays. But I found this confusing. But, when everything was up and running, the actual web page was clear enough.

1.5 What were your initial reactions to reading the comments or contributions by the other participants...to what extent did you find this interesting or helpful, and to what extent did you feel this was a waste of time? Why?

I made some interesting contacts. I don't think it was a waste of time, but I sense that a lot of us were nervous about putting our thoughts in writing and then posting them for everyone to see.

Did you feel that you were part of a group or class working together, or helpful, and to what extent did you feel this was a waste of time? Why? Did you feel that you were part of a group or class working together, or did you feel that your were pretty much alone in learning the material?

I felt pretty much alone.

(If felt part of group). Did you or the instructor do anything in particular that helped you to be able to work and socialize with other participants in the on line class?

1.6 How about the lecture-type material presented by the instructor... did you find it easier to understand that material in writing, or do you think you would have learned it better if you had listened to it in spoken form? Why?

I would prefer a lecture. There's more immediacy when someone is speaking. I think that the web site should have had audio and lots of graphics to be as effective [as a lecture].

1.7 Did you ever look at or join any of the public conferences on the system, besides the conference within your group?

Yes.

If yes, which ones, and what did you think of them? If no...why not? Did you ever exchange messages with anybody online that was not connected with the project?

I went into the coffee shop and the a1 discussion. I think I posted one message. I didn't exchange messages with anyone not connected with the project.

If yes....how did this happen?

How did you feel about this experience of communicating with strangers?

O.K. I do that every day anyhow.

1.8 How would you describe your relationship to the facilitator online? Do you feel MORE or LESS able to communicate and relate to your teacher? Why?

I feel no different than I would if I were not online.

1.9 Q9 examines initial and current reactions to on-the-job learning with the computer based on the initial questionnaire.

Question 2.6 asked for a response from 1-7 strongly disagree to strongly agree, to the statement that Computer conferencing as I know it should provide some interesting ways of understanding the code. Your reaction was __4___ What is your reaction now?

I'd go up to a six now. I see the potential there -- but I think there's a lot of work that has to be done to make it reach its full potential -- such as the audio component and the graphics.

Have you developed any particular routines or tricks of the trade that are making computer conferencing more valuable to you than it was at first?

Yes, two things. Now I first prepare the written material before posting it. Also, I capture the material on the site and print it.

At this point in your online course, what do you like best about the Virtual Classroom approach... that is, what is good about it compared to a course given in the traditional classroom? (probe .... anything else?)

I like the flexibility I'm given in terms of accessing the information. I can do it at my own time. I like having the opportunity to review information, too. I can take my time.

What do you currently like least, or feel are the greatest problems or shortcomings about this mode of course delivery?

The on-screen design of the course material. This must be changed. There should be audio; graphics with scroll bars; compartmentalization of video and text; interactive response tools; better word processing. The form that had to be filled out is an example. It was hard to use. It took a long time. When the steps you have to go through to make something work are time-consuming and awkward, it's discouraging .

1.10 What advice would you give a student who is thinking of signing up for an online course?

I'd advise them to find a way to have a face-to-face or voice connection as well.

How about your instructor...what advice would you give about how they could be more effective if they try teaching this course online again?

An instructor -- I'd tell him to thoroughly explore the design and media aspects of the material and to make the presentation interesting as possible.

1.11 Is there anything else you would like to tell us about your experiences... anything that was especially funny or memorable, or valuable, or unpleasant about your experience?

(no answer)
1.12 What other comments do you have?

I think that there should be more linkages to outside resources in the web site. Affliliated interest groups should be linked. And the technical stuff has to be cleaned up. The technical problems when the site was starting up should be fixed for good. That was really starting off on the wrong foot.

Subject 21 - Post Interview
INTERVIEW QUESTIONS

Gaining knowledge about the building code has been one of the main objectives of this course. But also it is important to consider the degree to which the technology has permitted you to access resources and knowledge.
The building code tends to be viewed as very complicated and interpretive. Some pre-course interviews were conducted in which candidates described their views on a number of issues including the building code and how it should be applied and taught, your work experience and your computer knowledge.

We would now like to explore your views concerning this computer conferencing code course by having you answer the following questions:

1.1 How did you first hear about this code course? What were your initial feelings or reactions...what attracted you, what didn't sound good about this approach?

I know John Guenther through the Board of Variance in North Vancouver. He told me about it. My first reaction was that it was an excellent idea. I thought it would give me a chance to work more on the computer.

1.2 How about the initial training session...after it was over, did you feel that you would be able to sign on line and find and access the material or was there something that was not clear about what the procedure would be?

Yes, I felt ok.

1.3 Was the computer easily accessible in the office and where did you go to use it? Were there any problems with availability? Did you have any sort of regular schedule each week when you would sign on line to participate, or how was it that you decided when to log on?

I signed on at the office. Yes, I had a schedule. I worked on-line first thing in the morning and the last thing before I went home in the evening.

1.4 What were your initial feelings or impressions about the online class

during the lead up in the first week? Can you remember what you particularly liked, or what you didnèt like or found confusing? (probe....anything else?)

It was clear to me what was supposed to happen, but I couldn't do certain things I was supposed to be able to do. There were times when I could get the first c1 conference information, yet if I would go back into it later that day, only 50% would show up, although it said the document was full.

1.5 What were your initial reactions to reading the comments or contributions by the other participants...to what extent did you find this interesting or helpful, and to what extent did you feel this was a waste of time? Why?

It was helpful to see what other people were thinking and doing.

Did you feel that you were part of a group or class working together, or helpful, and to what extent did you feel this was a waste of time? Why? Did you feel that you were part of a group or class working together, or did you feel that your were pretty much alone in learning the material?

Yes, I did feel as though it was a class.

(If felt part of group). Did you or the instructor do anything in particular that helped you to be able to work and socialize with other participants in the on line class?

Apart from the odd prompts sent by John Guenther, I felt as if I had no instructor.

1.6 How about the lecture-type material presented by the instructor... did you find it easier to understand that material in writing, or do you think you would have learned it better if you had listened to it in spoken form? Why?

I've taken a code course already. I found that one a lot more gruelling. It was more intensive.

1.7 Did you ever look at or join any of the public conferences on the system, besides the conference within your group?

Yes.

If yes, which ones, and what did you think of them? If no...why not? Did you ever exchange messages with anybody online that was not connected with the project?

a1 and d1.
No, I don't think I exchanged messages with anyone not connected with the project.

If yes....how did this happen?

How did you feel about this experience of communicating with strangers?

It felt like quite a novelty to be able to go in there and introduce myself.

1.8 How would you describe your relationship to the facilitator online? Do you feel MORE or LESS able to communicate and relate to your teacher? Why?

Yes, I felt more able to communicate with my teacher, as I could use both E mail and the phone.

1.9 Q9 examines initial and current reactions to on-the-job learning with the computer based on the initial questionnaire.

Question 2.6 asked for a response from 1-7 strongly disagree to strongly agree, to the statement that Computer conferencing as I know it should provide some interesting ways of understanding the code. Your reaction was 7 What is your reaction now?

Seven. I haven't changed my mind.

Have you developed any particular routines or tricks of the trade that are making computer conferencing more valuable to you than it was at first?

When I was trying to E mail at the outset, I would be typing the same message at the terminal three or four times. So I started printing out everything I wrote so that I wouldn't lose it in the transfer. This way, I was able to eliminate the Codeworks background and also save some cybertime. But I still feel like a novice.

At this point in your online course, what do you like best about the Virtual Classroom approach... that is, what is good about it compared to a course given in the traditional classroom? (probe .... anything else?)

If need be, you have a support group within the office. I like that aspect. And time is a valuable commodity. It's great to be able to educate yourself at work. And there's no commuting involved.

What do you currently like least, or feel are the greatest problems or shortcomings about this mode of course delivery?

The interaction with peers is lost.

1.10 What advice would you give a student who is thinking of signing up for an online course?

I would advise a student thinking of signing up for THIS online course that it's for those who have an interest in how to deal with the code, and not to treat code understanding as a barrier to learning design.

How about your instructor...what advice would you give about how they could be more effective if they try teaching this course online again?

At the initial seminar at the Pacific Marine Institute, we should have had an initial group session to meet other conference delegates. The instructor should have then
divided us into small groups so that we could follow through the instructions all together, at the same time.

In the coffee shop and in the a1 conference, I found that people were expressing their frustration with the course.

1.11 Is there anything else you would like to tell us about your experiences... anything that was especially funny or memorable, or valuable, or unpleasant about your experience?

Not being able to get everything I needed on the screen was a problem. And I didn't like the background -- it was distracting. And I found the quality of the graphics poor.

1.12 What other comments do you have?

inter3/jg/96

Appendix I Project Development - Concerns

Introduction

Thank you for your attendance and contribution at the Codeworks session held on December 11, 1995 at the Sun Microsystems office. The key objective of the session was to garner feedback in preparation for an expanded seminar to be held in February, 1996. Your contributions were very valuable.

Summary of discussion

Discussion areas follow:

1)How will the system data that is generated be managed and manipulated into a usable form? The idea is to deliver programs that are current and relevant. The source of the program should be a team of individuals that, in the case of code information, include the key stakeholders (contractors, architects, consultants, and building officials). The opportunity to interact positively and coalesce valuable information is a key objective of the project. Maintenance and re-generation of the database, it is hoped will be part of the ongoing efforts of associations and government agencies.

2)The system should not be described as an expert one, unless it is thought of as a repository of opinions that can serve as a touchstone for further reference.

3)How is the technology different than can be currently be generated by internet email? Web technology and authenticated newsgroups allow restricted interaction to define objectives and build information that is definitive and searchable. Presently email is used for mainly one on one communication and is usually initiated by specific questions isolated from the main bodies of knowledge. Not that the information is not valuable, but rather that it is sporadic and not managed in a concerted fashion. Many of us use email within the office to discuss a number of subjects including:

a)problem solving
b)filing information and reference
c)notification and publicity

This project examines problem solving mechanisms and the retention of knowledge, through idea generation and systematic management.

4)Where would the participants find the time to utilize and access the information? How functional is information unless it can be easily accessed and processed, when it is needed most? Creating the opportunities to interact is seen as one of the keys to building relationships between construction participants. Distilling and manipulating the information so that it is beneficial is important to project success. The project will concentrate on one or two specific sections of the code and test information gains, in order to gauge the effectiveness of the opportunity to interact through the technology. Although the technology is a concern in building familiarity, it is not paramount to project success. Success, it is suggested is mainly dependent upon the willingness and desire to interact to create innovative solutions to both fundamental and functional problems. To this end it is suggested we examine pervasive problems and develop mechanisms that will achieve ongoing processes that can address solutions.

5)Some building developments tend to be site and time dependent. The final authority must continue to reside with the authority. Although many site specific problems arise, most are

loaded with performance decisions that transcend the peculiarities of each site. One example could be 4 and 5 storey wood frame buildings on sloping sites. It is suggested that information and criteria be pooled and catalogued so that decisions are reached within a broader framework and thus are of a higher and more consistent standard. There will continue to be anomalies but many will contain attributes that require attention. Reference and compilation will also assist in the code development process.

6)Many of the issues that arise are due to process type concerns, such as the types of information to be contained on drawings. What can be done to get at this? We discussed the two major areas of access to information. One is the publishing side which gives updated parameters and conditions for project submission. The interactive capability allows the publishing side to be augmented with relevant questions and current data. (eg. what is the latest zoning requirement for certain types of buildings).

Conclusions

The next event in the project is a seminar, offering a pilot session of the interactive technology. Presenters will, again be from the service provider, integrator and software sides. This will be supplemented with presentations from an architect, Building Standards and a municipality regarding the use of the technology. The session will be held in mid-February for building officials, architects and some municipal computer personnel.

The conferencing participants will be identified at this session and with the conferencing beginning in early March and concluding in early April.

The project will be seeking funding from the Industrial Research Assistance Program, in the early part of January, and hopes to deliver:

1)On-line code course on part 3 of the building code (completion November 1995)

2)Code database for use by architects. The first project will establish a mechanism for gathering and collating code issues. Building permit processing, building envelopes and performance codes will be catalogued and structured.

3)Object oriented access (icon) established through Netscape and Cyberstore to disseminate and generate pertinent information to the architectural profession in the areas of products, design, code data, and news.

Your support and continued involvement is appreciated. Please call if you have any questions or comments regarding the project.

orient3/jg/dec95

	pretest	posttest	group	change
1	.86	.77	2.00	-.09
2	.55	.72	2.00	.17
3	.76	.70	2.00	-.06
4	.76	.64	2.00	-.08
5	.76	.70	2.00	-.06
6	.75	.67	2.00	-.08
7	.77	.63	1.00	-.14
8	.40	.58	1.00	.18
9	.53	.45	1.00	-.08
10	.76	.65	1.00	-.11
11	.65	.57	1.00	-.08
12	.68	.57	1.00	-.09
13	.70	.66	1.00	-.04
14	.90	.	1.00	.
15	.75	.57	1.00	-.18
16	.68	.67	1.00	-.01
17	.78	.84	1.00	.06

t-tests for Independent Samples of GROUP

Variable	Number of Cases	Mean	SD	SE of Mean
CHANGE				
GROUP 1	10	-.0490	.105	.033
GROUP 2	6	-.0333	.100	.041

Mean Difference = -.0157

Levene's Test for Equality of Variances: F= .075 P= .788

t-test for Equality of Means Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	-.29	14	.773	.053	(-.130, .099)
Unequal	-.30	11.05	.772	.053	(-.132, .100)

CONFERENCING PARTICIPANTS

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Judy Donald	"								Y							
David Chesney	"								Y							
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Ralph Kidd	"								Y							
Elizabeth Revoczi	"								Y							
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INVITATION TO PARTICIPATE IN CITY OF NORTH VANCOUVER WEB SITE ON-LINE DISCUSSION

PROJECT AND WEB SITE

To assist designers, contractors and other building participants in developing a code knowledge base, ***an on-line stucco discussion group*** has been developed.

You are invited to participate in this code conferencing project that involves government design professionals and other construction participants. The site address is: ***http://www.cnv.org/muni/default.asp*** The entrance **password is gulfislands**. This will allow you to access on-line discussions.

The project will commence on July 16 and continue until August 15 (see attached itinerary).

Help: An on-line help feature is available to assist you in conferencing.
Discussion summaries and frequently asked questions will be posted on a weekly basis.
Real time chat channels will be scheduled as discussion proceeds.

OBJECTIVES

The objectives of the project include:

- develop an on-line virtual community of construction participants;
- summarize on-line discussion;
- formulate accurate design details;
- develop frequently asked questions;
- explore the development of permanent communication linkages between government and construction participants; and
- develop an on-line communication model for use by other participants.

If you have any questions, please contact John Guenther at: phone - 983-7373; fax - 985-0576; Internet: jguenther@city.north-van.bc.ca.

CITY OF NORTH VANCOUVER CONFERENCING WEB SITE

located at: http://www.cnv.org/muni/default.asp

Conferencing itinerary:

The virtual community will be established to discuss stucco issues with construction groups including home builders associations, contractors, municipal officials and inspectors. On-line discussion will occur within the City web site. Discussion will need to be focused and selective so the conferencing will be password protected.

1. :June 9, 1997

On-line discussion issues are posted with graphics. These are updated each day with conferencing summaries, frequently asked questions, and construction detail updates.

2. :June 16, 1997

Session commences with on-line discussion of conferencing protocol, navigating and help systems on the City web site. You may enter information on the web site or exchange email at any time during the session.

3.: June 23, 1997

Interview of participants will be conducted to probe system effectiveness and develop improvements.

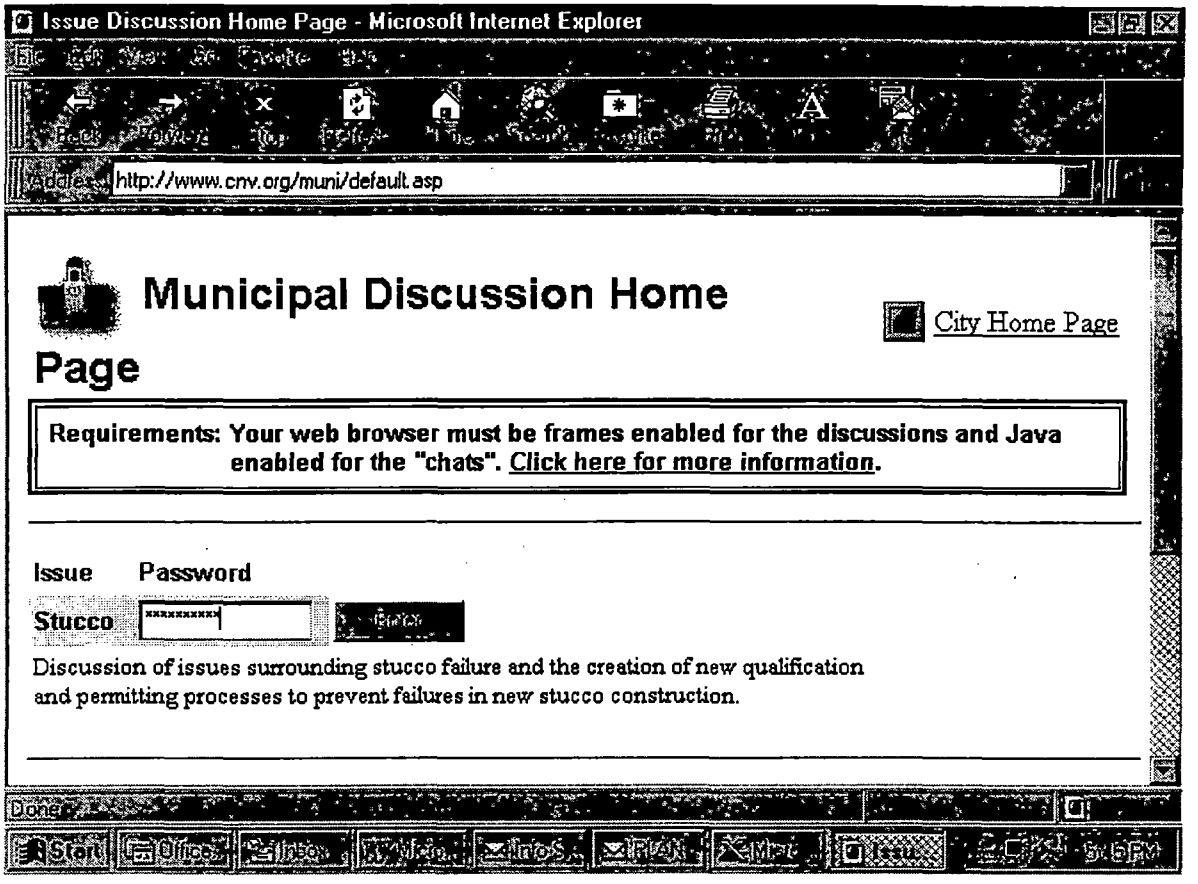
4.: July 7 and July 28:

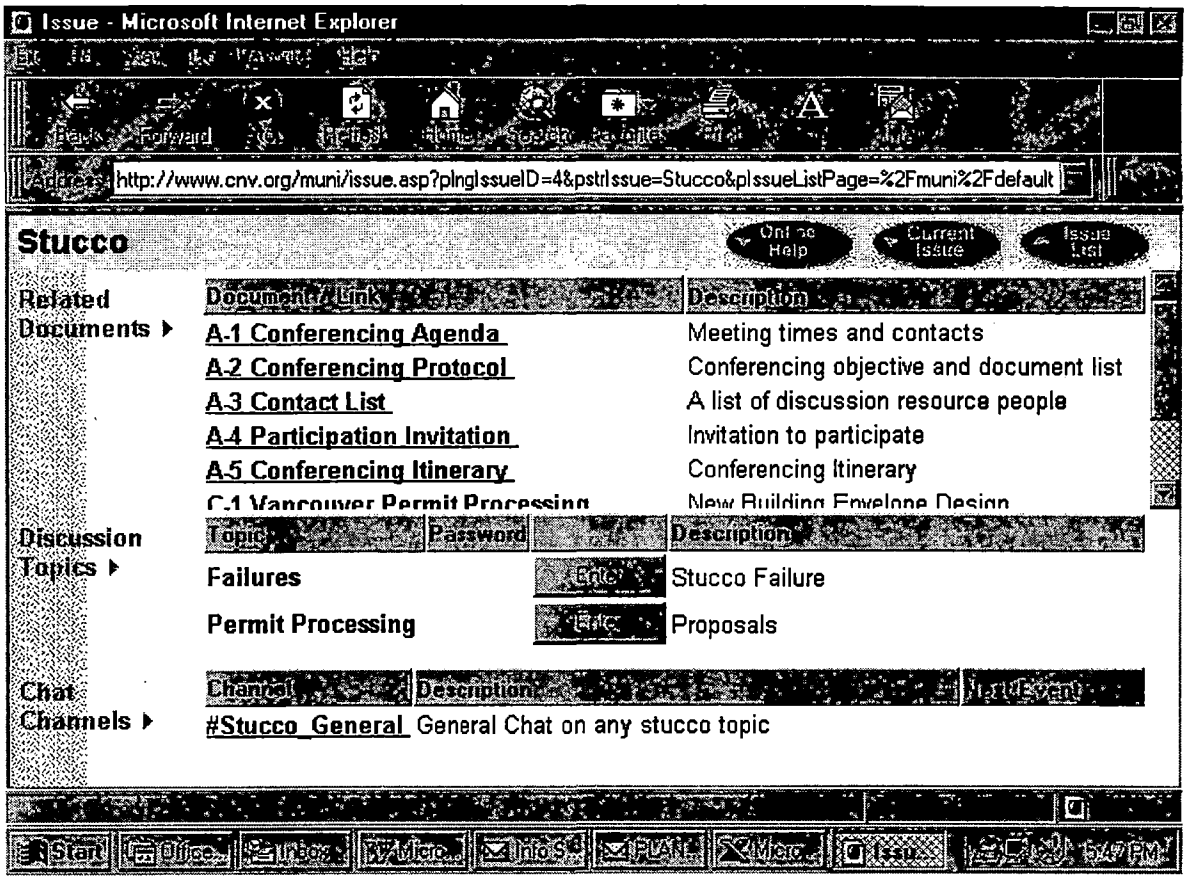
Real time meeting topics will be set once discussion begins. Agendas will be established based on discussion issues but will likely include design and permitting elements.

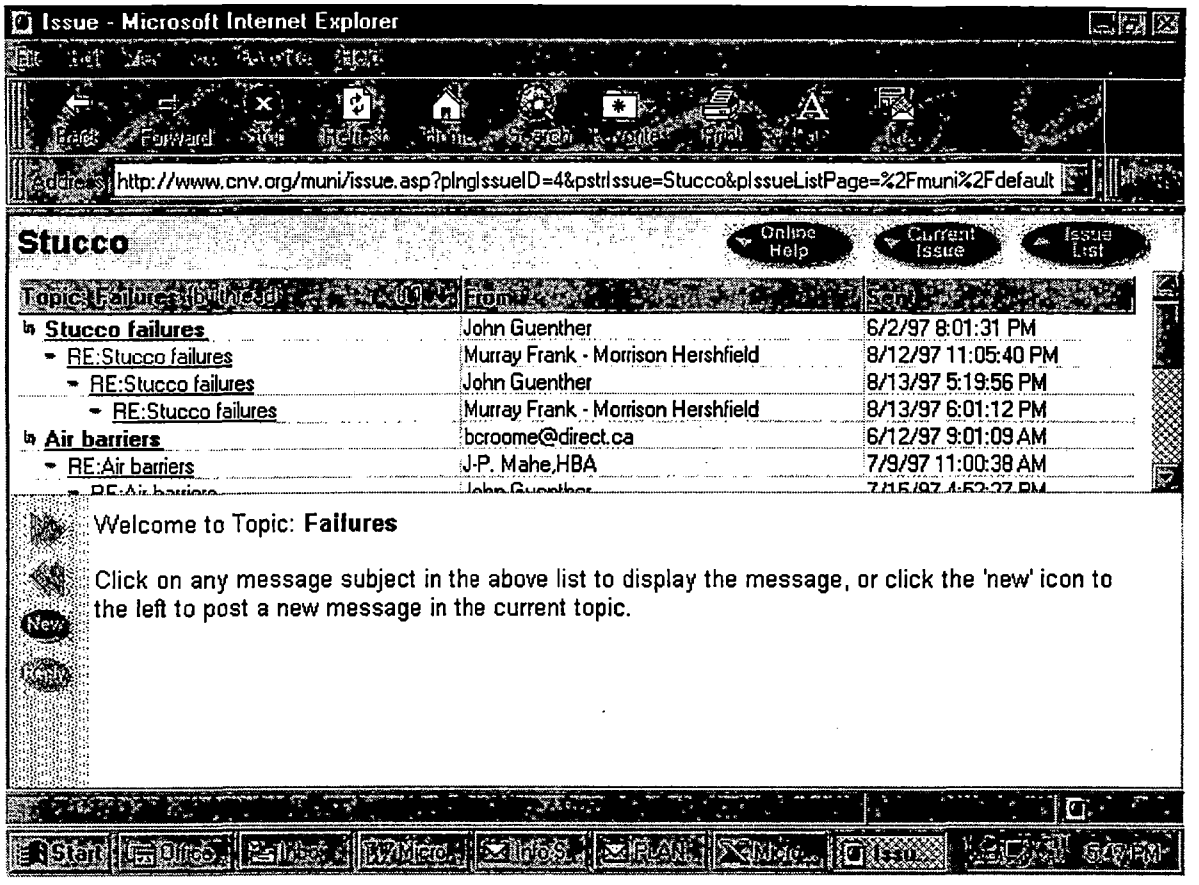
5.: Aug 15, 1997

Wrap up discussion will focus on conclusions, areas for further issue research and web site development.

cityitin/jg/mar96


Issue Discussion Home Page - Microsoft Internet Explorer
http://www.cnv.org/muni/default.asp
Municipal Discussion Home Page
City Home Page
Requirements: Your web browser must be frames enabled for the discussions and Java enabled for the "chats". Click here for more information.
Issue
Password
Stucco
Discussion of issues surrounding stucco failure and the creation of new qualification and permitting processes to prevent failures in new stucco construction.
Done
Start


Issue - Microsoft Internet Explorer
Address http://www.cnv.org/muni/issue.asp?plngIssueID=4&pstrIssue=Stucco&plssueListPage=%2Fmuni%2Fdefault
Stucco
Online Help
Current Issue
Issue List
Related Documents
Document/Link
Description
A-1 Conferencing Agenda
Meeting times and contacts
A-2 Conferencing Protocol
Conferencing objective and document list
A-3 Contact List
A list of discussion resource people
A-4 Participation Invitation
Invitation to participate
A-5 Conferencing Itinerary
Conferencing Itinerary
C-1 Vancouver Permit Processing
New Building Envelope Design
Discussion Topics
Topic
Password
Description
Failures
Enter
Stucco Failure
Permit Processing
Enter
Proposals
Chat Channels
Channel
Description
#Stucco_General
General Chat on any stucco topic
Start
5:47 PM


Issue - Microsoft Internet Explorer
Back
Forward
Stop
Refresh
Home
Search
Favorites
Print
Font
Mail
Address
http://www.cnv.org/muni/issue.asp?plngIssueID=4&pstrIssue=Stucco&pIssueListPage=%2Fmuni%2Fdefault
Stucco
Online Help
Current Issue
Issue List
Topic: Failures
From
Sent
Stucco failures
John Guenther
6/2/97 8:01:31 PM
RE:Stucco failures
Murray Frank - Morrison Hershfield
8/12/97 11:05:40 PM
RE:Stucco failures
John Guenther
8/13/97 5:19:56 PM
RE:Stucco failures
Murray Frank - Morrison Hershfield
8/13/97 6:01:12 PM
Air barriers
bcroome@direct.ca
6/12/97 9:01:09 AM
RE:Air barriers
J-P. Mahe,HBA
7/9/97 11:00:38 AM
Welcome to Topic: Failures
Click on any message subject in the above list to display the message, or click the 'new' icon to the left to post a new message in the current topic.
New
Reply
Start

Topic: **Failures** {by thread}	From	Sent
Stucco failures	John Guenther	6/2/97 8:01:31 PM
RE:Stucco failures	Murray Frank - Morrison Hershfield	8/12/97 11:05:40 PM
RE:Stucco failures	John Guenther	8/13/97 5:19:56 PM
RE:Stucco failures	Murray Frank - Morrison Hershfield	8/13/97 6:01:12 PM
Air barriers	bcroome@direct.ca	6/12/97 9:01:09 AM
RE:Air barriers	J-P. Mahe,HBA	7/9/97 11:00:38 AM
RE:Air barriers	John Guenther	7/15/97 4:52:27 PM
RE:Air barriers	bcroome@direct.ca	7/15/97 10:38:28 PM
RE:Air barriers	Adaire Chown	7/16/97 10:36:38 AM
RE:Air barriers	J-P. Mahe,HBA	7/9/97 11:01:12 AM
Stucco in general	bcroome@direct.ca	6/12/97 9:06:10 AM
RE:Stucco in general	John Guenther	8/13/97 10:08:20 PM
Flashing	krisd@ch.city.victoria.bc.ca	7/14/97 3:03:53 PM
RE:Flashing	John Guenther	7/15/97 4:46:53 PM
RE:Flashing	bcroome@direct.ca	7/15/97 10:36:38 PM
RE:Flashing	Adaire Chown	7/16/97 10:34:30 AM
(Return to top)	From	Sent

A-2 Conferencing Protocol - http://www.cnv.org

Purpose

Conferencing is meant to garner on-line opinions through primarily non-real time discussion. Real time discussion will be tried over two meeting times that will be moderated with agendas set for June 18 and July 16. It is intended that discussion will generate good usable data that can be summarized in three parts in the documents area of the conferencing section:

- **Design Details and Specifications** - This section will evolve into quality design and specification details that can viewed and downloaded on-line.
- **Discussion summary** - At the end of each week the on-line discussion questions and problems will be summarized. Problems will then be restated and reset in the conferencing setting.
- **Frequently asked questions** - These will be generated each week and posted in the issues discussion area.

Conferencing parts

The Web Site is located at http://www.cnv.org. The conferencing portion of the web site can only be activated through of passwords that will be given to specified users. The conferencing section is divided into:

- **Issues** - Password protected: the general listing of discussion issues will vary. There may be a number of issues generated by the City or other outside sources.
- **Document list - View only**: the document list contains a list of documents that can be viewed, copied or printed without passwords. Stucco documents include:
  - **C- Code Requirements**
    - Part 9 Stucco Requirements - Building Code requirements are summarized
    - Vancouver building envelope design criteria - permitting requirements
  - **R - Design details and specifications** - evolving design details and specifications
  - **R- Research literature** - listing of research documents
    - R- 1 New home warranty - Stucco clad buildings
    - R- 2 Morrison Hershfield - reference Don Hazleden CMHC - 666-8068
    - Constant documents are:
    - **T-1 Frequently asked questions**
    - **T- 2 Discussion summary**
    - **T-3 Resource guide** - lists web site and email addresses for
      - Associations
      - On-line participants
      - Government code authorities
      - Standards agencies
      - Journals and articles
      - Research agencies
    - **A-2 Conferencing protocol** - purpose and objectives of conferencing
    - **A-1 Conferencing itinerary** - schedule of events and participants

- **Topics** - Password protected: Topics are password protected and list a number of related concepts and ideas that are to be discussed. Topics that will be generated for stucco are:
  - Failures - design and construction failure discussion
  - Permit processing - Vancouver requirements

  Constant topic areas are:
  - **General building design problems** - this will be a general area for building code, design and construction discussion and may be not related to the discussion issue.
  - **Coffee shop** - This is for general chit chat not related to technical issues. You may have travel plans, hobbies or interests that help develop the social milieu.

C-1 VANCOUVER PERMIT PROCESSING
NEW BUILDING ENVELOPE DESIGN REQUIREMENTS

On September 24, 1996, City Council (City of Vancouver) passed By-law No. 7623 which adopts Part 5 of the 1995 National Building Code of Canada, with some local amendments. Although the intent of the building envelope requirements has not changed, the new wording provides a better understanding of what is required.

Significant changes include:

(1) the requirement for certification of Building Envelope Specialists at some point in the future;

(2) required verification of moisture content of framing members and sheathing prior to being enclosed, and

(3) required specialty envelope inspections to verify proper installation of flashings and detailing prior to installation of cladding materials.

This Bulletin also supplements the previous Bulletin 96-02 dated July 30, 1996 by clarifying three items:

(a) The co-ordinating registered professional is responsible for the coordination of the design of all building envelope elements and for arranging ongoing inspections of detailing (Item 5), unless the warranty program option (Item 6) is used. The co-ordinating registered professional is ultimately responsible for the complete content of the envelope design, but is not expected to coordinate building envelope subtrade work.

(b) Two layers of 30-minute building paper may not be necessary with stucco applications where certain proprietary self-furring media are applied, **or** where the building envelope incorporates a drainage system which is specifically designed by a qualified building envelope specialist to adequately drain away from the sheathing materials in an acceptable manner. The building envelope specialist must also carry out all required mandatory inspections of this design feature.

(c) The requirement for envelope inspections by an "independent" building envelope specialist means a currently qualified building envelope specialist acceptable to the City Building Inspector. In the future, this will change to a "certified" Building Envelope Specialist, a specialist that has successfully completed a certification program acceptable to the City Building Inspector.

Also, starting in January 1997, windows will be selected at random for re-testing to confirm compliance with the CAN/CSA A440-M90 Standard, specifically for water-tightness and drainage to the exterior.

C-2 Stucco requirements

The Corporation of the City of North Vancouver
Development Services Department
141 West 14th Street
North Vancouver, B.C. V7M
1H9
Telephone: 985-7761, Fax: 985-0576

Code Requirements for Stucco

The following are requirements of the 1992 B.C. Building Code and apply to part 9 buildings

GENERAL

- Sheathing required per B.C.B.C. Table 9.23.16.A, or 119mm dia galvanized wire applied horizontally to framing at vertical intervals of maximum 150mm (6"),or paper backed welded wire metal lath.

- Stucco lath is to be used to attach stucco to wood-frame construction, soft burned tile, low strength brick, or any surface that is not sound, clean, and sufficiently rough to provide a good key.

- Stucco applied over masonry chimneys to be reinforced.

- Do not apply stucco to concrete masonry units less than one month old, unless units cured in autoclave process.

Stucco is not to extend within 200mm (8") of grade, unless applied over mason

FLASHING

- Flashing material is to consist of minimum:
  1.02mm vinyl.
  0.33mm galv. steel,
  0.46mm copper,
  0.46mm zinc,
  0.48mm aluminum,
  1.73mm lead,

- except that if aluminum is used, it must be separated from stucco by impervious layer or coating.

- Flashing required at every horizontal junction between two different finishes, except where upper finish overlaps lower finish.

- Flashing required over exterior wall openings.

- Flashing to be applied so that it extends upwards a minimum of 50mm behind building paper.

CAULKING

- Caulking is to be applied to prevent entry of water into building.

- Caulking is to be applied between stucco and adjacent door/window frames.

- Caulking to be provided between vertical joints between different cladding materials

- Caulking to be applied at all penetrations.

MATERIALS

- Portland cement to conform to CAN3-A5.

- Aggregate to be clean, well graded, natural sand, or sand manufactured from crushed rock, gravel, or air-cooled blast furnace slag, and shall contain no deleterious material.

- Water to be clean and free of deleterious material.

- Aggregate to comply to B.C.B.C. Table 9.28.2.A

Table 9.28.2.A

Aggregate Grading		
Sieve Sizes, mm	Per Cent Passing	
	Maximum	Minimum
4	--	100
2	--	90
1	90	60
0.5	60	45
0.25	30	10
0.125	5	--

FASTENERS

- Fasteners to be corrosion resistant material other than aluminum.

- Nails for lath and reinforcing to be minimum 3.2mm (1/8") dia. with minimum 11.1mm (1/2") head.

  Staples to be minimum 1.98mm (1/16") dia., or thickness.
- Staples and nails to be sufficient to penetrate 25mm (1") into framing member, or the full depth of sheathing.

LATH

- Rib Lath or Expanded Metal Mesh of copper-alloy steel (coated with rust inhibitive paint after fabrication), or galvanized woven or welded wire mesh, is required.

Table 9.28.4.A

location	type	minimum diameter	max. mesh opening	minimum mass
vertical surfaces	welded or woven wire	1.19 1.35 1.60	25mm 38mm 51mm	-- -- --
	stucco mesh reinforcing	-- --	25.8cm^2	0.98
horizontal surfaces	9.5mm rib lath	--	--	1.84
	cedar lath	--	--	--

- Stucco lath to be held not less than 6mm (1/4") away from backing by means of suitable self furring devices.

- Stucco lath to be applied with the long dimension horizontal, All joints to be lapped minimum 50mm (2").

- End joints of lath to be staggered, and occur over framing members.

- External corners of stucco lath to be reinforced with a vertical strip of lath extending not less than 150mm on both sides of the corner, or reinforcing to extend around corners a minimum of 150mm (6").

MIXES

- Stucco mixes to conform to Table 9.28.5.A.

Table 9.28.5.A.

Portland Cement	Masonry Cement	Lime	Aggregate
1	--	0.25 to 1	3.25 to 4 parts per part of cementitious material
1	1	--	

- Pigments, if used, shall consist of pure mineral oxides inert to the action of the sun, lime, and cement.

- Pigments shall not exceed 6% of the Portland cement by weight.

- Materials to be thoroughly mixed before and after water is added, and applied no later than 3 hours after initial mixing.

APPLICATION

- The base for stucco shall be maintained above freezing.

- Stucco to be maintained at a temperature of not less than 10°C during application, and for not less than 48 hours afterwards.

- Stucco to be applied with not less than 2 base coats and one finish coat, providing a total thickness of not less than 15mm, measured from the face of the lath, or face of the masonry where no lath is used.

- The **first coat** to be a minimum of 6mm (1/4") measured from face of lath, fully embedding the lathfor a total depth of minimum of 12mm (1/2").

- The surface of the first coat to be scored to provide a key with the second coat.

- The **second coat** to be a minimum of 6mm thick.

- The second coat to be slightly roughened to provide a key with the finish coat, if finish coat other than stone dash.

- When the finish coat is other than stone dash, the base is to be dampened, but not saturated, before the finish coat is applied.

- The **finish coat** is to be a minimum 3mm thick.

- When stone dash is used, the stone is to be partially imbedded in the second coat before the second coat starts to stiffen or set.

INSPECTIONS

- Due to the recent flood of complaints water penetration as related to Stucco, the following Inspections will now become standared policy:

    - Paper & Lath Inspection
    - Scratch Coat Inspection
    - Finish Coat Inspection (part of Final Inspection)

R-3 New Home Warranty Stucco Failures

PROBLEM

Concerned Groups

After a year of serious stucco failures, many construction participants have endeavoured to get at the source of the problem and to find some solutions. Some failures have exceeded repair costs of $500,000. New Home Warranty, North West Wall and Ceiling Bureau, Home Builders Association, and building officials have convened meetings to generate ideas and initiatives. In January of this year the Ministry of Housing, Recreation, and Consumer Services established a task force to study the problem.

Problem clarification

Improvement has generally been stressed in the following areas: certification of installers, bylaws and enforcement, improved design details, clarification of product limits and improved manufacturer specifications, and consumer education. New Home warranty has noted the following concerns:

1.0 Stucco

1.1 Inadequate number of coats of stucco.

1.2 Thickness of stucco is too thin and does not comply with the code

1.3 Strength of the stucco is marginal and can result in excessive cracking or water absorption

1.4 Between coat applications, the stucco is not allowed to properly cure

1.5 The stucco mix is very porous, allowing water to migrate easily through the stucco

2.0 Lath

2.1 Stucco lath is improperly attached to the building, too few fasteners are used

2.2 The stucco lath is improperly attached to the building as the fasteners are installed in the wrong location and does not provide support for the lath

2.3 The lath is not properly embedded in the stucco

3.0 Flashing

3.1 The flashings are not properly installed over openings

3.2 Counter-flashings has not been provided at the junctions of horizontal and vertical surfaces

3.3 Cap flashing has not been provided or properly installed on horizontal planes of railing walls, upstanding walls, and parapets.

3.4 No through wall flashing has been provided for large expanses of stucco

3.5 The design of some "J" beads and control joints ("expansion strips") allow water to drain inward instead of shedding it to the exterior surface of the stucco

3.6 Lack of sealing of the joints in flashing and control joints
3.7 No slope to horizontal railing surfaces, allowing water to pool

4.0 Sheathing Paper

4.1 Sections of sheathing paper are missing beneath the stucco cladding
4.2 The sheathing paper has been improperly applied/lapped and does not form an effective barrier between stucco and the wall sheathing
4.3 The sheathing paper has been damaged (ripped or punctured) which allows water to infiltrate into the building
4.4 The "black" type sheathing paper may deteriorate over time, thus allowing an ever failing membrane between the stucco and the wall sheathing

5.0 Design

5.1 Elaborate architectural design with little attention or direction to how weather/water protection is to be achieved
5.2 Limited consideration to the normal shrinkage and deflection of lumber/framing and its effect on the stucco
5.3 Dissimilar building assemblies with no or limited consideration to different movements/shrinkages of the assemblies and how such affects the stucco
5.4 Indadequate or no venting of support column cavities

6.0 Other

6.1 Inadequate shrinkage gaps between wood sheathing
6.2 Windows (unsealed mitre joints) may permit water drainage behind stucco
6.3 Some wood sheathing products may excessively expand when subjected to excessive moisture, thus causing additional stucco cracking
6.4 Lack of caulking

7.0 RECOMMENDATIONS OF THE TASK FORCE

7.1 Establish a hotline to inform home owners and strata councils of the proper steps to take to address water leakage problems
7.2 Develop consumer education program and materials
7.3 Enhance the disclosure requirements for relevant documentation in real estate transactions for purchasers of both new and existing housing
7.4 Request that the ministries responsible for real estate legislation be asked to examine relevant sections of legislation for possible action to enhance consumer protection
7.5 Improve warranty protection for consumers buying new homes
7.6 Ensure that warranty programs or alternatives such as construction bonds apply to all housing built in the province, particularly with reference to owner-built housing
7.7 Recommend that warranty programs offer a minimum five-year water penetration guarantee
7.8 Ensure that problematic zoning provisions, e.g. overhang square footage calculations, are identified and revisions recommended where necessary

7.9 Require mandatory licensing of property managers

Stucco Discussion Topics:

- **Failures** are due to a number events that are design or construction related. The conferencing should generate lively debate aimed at solving some of these issues. Some of the failure points noted in research are:
  - Discussion questions (refer to **Document R-3)** are:
    - What is the best back-up system - building paper or house wrap and how should it be applied?
    - What design details are important and how can they be represented?
- **Permit processing** - Vancouver has established a qualification and permitting process for stucco clad buildings. You can read **Document C-1.**
  - Who should building envelope systems?
    - What courses are available and meet certification criteria?
  - What are some of the basic design criteria?
  - What code is in effect?
  - What inspection and verification levels are required?

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CMHC		**731-5733**	**732-9944**	
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CODEWORKS - REGULATORY RESEARCH PROJECT

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Contents of on line material

conout1/jg/apr96

96/04 Issues generation

Introduction

Each topic should generate an *issue*, the interests of the *primary vested interests*, processes that could encourage resolution, and suggested solutions. This discussion is set up to explore some problem areas that arise in administration of the bylaws. Some of these issues will require you to examine and compare current business practices with other jurisdictions and work at resolving interests of other parties.

Examples

Some of the recent issues that have been discussed and brief problem descriptions follow:

1.0 Construction Waste

Issue

The *GVRD* noted in 1994/95 that many construction companies were retaining disposal agencies and paying them to remove the material to suitable landfill sites or recycling locations. Costs and logistics involved with removal are faced by the disposal agencies. With this in mind, some have dumped drywall and other more hazardous construction materials in empty lots. Landowners of the offended property face the cost of cleanup.

Municipalities studied ways of informing and controlling the collection and removal of drywall and other construction materials. The *GVRD* developed a database for site locations and are gathering data for an information brochure. Drywall when mixed with water can create sulfide type gases that reside in the soil. Recycling of building materials is seen as making environmental sense even though the costs may not be justified.

Primary vested interests

1. Prosecuting and controlling dumper
2. Encouraging recycling to reduce landfill demands
3. Reducing construction costs

What other ways can illegal dumping be controlled? Who should be involved? What enforcement methods can be employed?

2.0 Security vs. Life safety

Issue

Many egress doors are keyed or controlled from the inside to restrict forced entry, but present exiting difficulties for occupants. Insurance companies and police agencies may insist on restricting access to reduce the risk of property

loss. In some cases the building code may be used to recognize both life safety and security issues. Electromagnetic locks may be utilized under certain code parameters. Some authorities have pointed out that these changes usually occur after occupancy as a result of other agency prompting. Also, business license inspections raise the life safety concern and hold up the license issuance, even though the restriction stays in place.

Primary vested interests

1. Life safety requirements for exiting doors must be maintained to protect building occupants
2. Poor security increases the chances of break ins and property loss
3. Reasonable insurance rates and reduced monetary risk

How do we resolve this issue of life safety? Some municipalities have utilized fixed notices at the occupancy stage.

Other issues that could be conferenced are *regional business licenses, streamlining product approvals, code uniformity development, streamlining the permit approval process, complicated code articles, and soils contamination legislation.*

Please identify the issues, the vested interests, and solutions. Tie in to the *discussion* area for viewpoints.
Please refer to the handout on demolition and construction waste in the *publications* section.

issues/jg/mar96

96/04 Hot discussion topic- Stucco

PROBLEM

Concerned Groups

After a year of serious stucco failures, many construction participants have endeavoured to get at the source of the problem and to find some solutions. Some failures have exceeded repair costs of $500,000. New Home Warranty, North West Wall and Ceiling Bureau, Home Builders Association, and building officials have convened meetings to generate ideas and initiatives. In January of this year the Ministry of Housing, Recreation, and Consumer Services established a task force to study the problem.

Problem clarification

Improvement has generally been stressed in the following areas: certification of installers, bylaws and enforcement, improved design details, clarification of product limits and improved manufacturer specifications, and consumer education. New Home warranty has noted the following concerns:

1.0 Stucco

1.1 Inadequate number of coats of stucco.
1.2 Thickness of stucco is too thin and does not comply with the code
1.3 Strength of the stucco is marginal and can result in excessive cracking or water absorption
1.4 Between coat applications, the stucco is not allowed to properly cure
1.5 The stucco mix is very porous, allowing water to migrate easily through the stucco

2.0 Lath

2.1 Stucco lath is improperly attached to the building, too few fasteners are used
2.2 The stucco lath is improperly attached to the building as the fasteners are installed in the wrong location and does not provide support for the lath
2.3 The lath is not properly embedded in the stucco

3.0 Flashing

3.1 The flashings are not properly installed over openings
3.2 Counter-flashings has not been provided at the junctions of horizontal and vertical surfaces
3.3 Cap flashing has not been provided or properly installed on horizontal planes of railing walls, upstanding walls, and parapets.
3.4 No through wall flashing has been provided for large expanses of stucco

3.5 The design of some "J" beads and control joints ("expansion strips") allow water to drain inward instead of shedding it to the exterior surface of the stucco
3.6 Lack of sealing of the joints in flashing and control joints
3.7 No slope to horizontal railing surfaces, allowing water to pool

4.0 Sheathing Paper

4.1 Sections of sheathing paper are missing beneath the stucco cladding
4.2 The sheathing paper has been improperly applied/lapped and does not form an effective barier between stucco and the wall sheathing
4.3 The sheathing paper has been damaged (ripped or punctured) which allows water to infiltrate into the building
4.4 The "black" type sheathing paper may deteriorate over time, thus allowing an ever failing membrane between the stucco and the wall sheathing

5.0 Design

5.1 Elaborate architectural design with little attention or direction to how weather/water protection is to be achieved
5.2 Limited consideration to the normal shrinkage and deflection of lumber/framing and its effect on the stucco
5.3 Dissimilar building assemblies with no or limited consideration to different movements/shrinkages of the assemblies and how such affects the stucco
5.4 Indadequate or no venting of support column cavities

6.0 Other

6.1 Inadequate shrinkage gaps between wood sheathing
6.2 Windows (unsealed mitre joints) may permit water drainage behind stucco
6.3 Some wood sheathing products may excessively expand when subjected to excessive moisture, thus causing additional stucco cracking
6.4 Lack of caulking

7.0 RECOMMENDATIONS OF THE TASK FORCE

7.1 Establish a hotline to inform home owners and strata councils of the proper steps to take to address water leakage problems
7.2 Develop consumer education program and materials
7.3 Enhance the disclosure requirements for relevant documentation in real estate transactions for purchasers of both new and existing housing
7.4 Request that the ministries responsible for real estate legislation be asked to examine relevant sections of legislation for possible action to enhance consumer protection
7.5 Improve warranty protection for consumers buying new homes
7.6 Ensure that warranty programs or alternatives such as construction bonds apply to all housing built in the province, particularly with reference to owner-built housing

7.7 Recommend that warranty programs offer a minumum five-year water penetration guarantee
7.8 Ensure that problematic zoning provisions, e.g. overhang square footage calculations, are identified and revisions recommended where necessary
7.9 Require mandatory licensing of property managers

PRIMARY OBJECTIVE

The main objective is to improve building envelope design and construction without unduly impacting costs, permit processing times and construction schedules. However, this is a tall order. Some of the discussion areas in this forum follow:

SOLUTION GENERATION

1. Analyze the problem areas and prioritize issues.
2. Decide on your best solutions in some of the function areas
3. Read the recommendation and decide if and how it gets at the problem. List the constraints and resources required for each.
4. Prioritize the recommendations from best to least choice.
5. Discuss decisions with other conferencers

Copies of handouts on stucco are included under the *publications* section.

stucco/jg/mar96

CONEXUS 2000 - CODEWORKS ON LINE CODE OUTLINE

WEEK 1 - APRIL 8-15, 1996
Introduction

1.0 SECTION 1 - Introduction, Course Development and Objectives

Haystacks:
Data, like the hay, is usually dry
And piled in stacks and measured by the bit.
But how like the needle information is: It
Always has a point and needs an eye. (Thomas F. Gilbert)

1.1 Course Development

Information mechanics and the body of knowledge

This on-line building code course will explore and develop *electronic linkages* between government and architects. As we interact and feed on ideas, concepts and opinions a body of knowledge will develop. The process may be more important than the product, so all comments are valued. Other construction and development participants from such areas as planning, engineering, and the environment will eventually be involved. With internet familiarity, information access and interaction we will all gain a unique insight into our roles and responsibilities in the safety system.

Data management - We have the tools

Our conferencing process will be stimulating and demanding. Managing the data will of course be a major task. But the project team believes that the information mechanics and the growing body of knowledge wil be a valuable commodity for the design community. Your comments and participation are critical to program success.

The building code information technology will develop throug the on line building code course and interactive mechanisms. Other web sites will be

linked in the construction and design field with particular attention to the following categories:

a) News
b) Discussion forums
c) On-line courses
d) Product updates
e) Design tips and specification updates

1.2 Overall Objectives

The first installment of this interactive development will examine Part 3 of the B.C. Building Code, and specifically subsections 3.1.2., 3.1.3, 3.2.1, and 3.2.2. The objectives of this building code course are to:

- Develop a fundamental understanding of the code article;
- Discuss knowledgeably the building code application;
- Be able to debate various interpretations and to develop a justifiable argument for the application taken;
- Know where the code reference is found and discuss the requirement in the proper context;
- Explain the purposes of the code article and the potential ramifications if the requirement is not implemented;
- Discuss how the code article will be applied by building officials and outline when the requirement is to be applied in the permitting process;
- Discuss the overall code objectives and how the building code fits in with other construction safety documents (eg. Electrical code, Gas Code);
- Be able to source proper code information within a specified period of time when challenged indicating the proper code article and its proper application;and
- Be able to discuss the legal implications of not complying with the code and define the areas of responsibility.

2.0 Section 2 - ORIGIN, EMPOWERMENT, JURISDICTION AND APPLICATION

2.1 Section Objectives

When you finish this section you should be able to:

- *Define the code in effect in the province;*
- *List other jurisdictions and the codes in effect;and*
- *Describe the framework of the empowering legislation*

2.2 Code origin and empowerment

This is the first in a series of on-line building code courses focusing on the *1992 B.C. Building Code*. This code is a child of the national model code, *The National Building Code 1990,* developed by the Institute for Research in Construction (IRC), a federal government research agency. Each of the documents is subjected to a rigorous public review process, but the provincial code remains the only enforceable code within each province as it is adopted by provincial statute.

2.3 Jurisdiction

In our case, the Municipal Act is the empowering legislation. However, within federal jurisdictions in B.C. (eg.ports and federal parks, First Nations reservations) the national code may be applied. Also, the City of Vancouver as a chartered city may adopt its own code. This document follows the national model code to some extent, with some significant modifications. The provincial code is applied in the rest of the province, except in unorganized territories which remain unregulated. In the case of the provincial building code, each municipality will adopt the code under a municipal bylaw which may also reference fee structures, penalties, and other enforcement tools.

2.4 Provincial Code application

For the most part, municipal bylaws may not add to or delete from the provincial code. One significant exception allowed in the Municipal Act is the provision for a municipality to legislate fire protection areas for building sprinklers. Examples of municipalities that have used this section are West Vancouver, Sechelt, Gibsons, Coquitlam, the Township of Langley and the City of North Vancouver. Thus, the B.C. Building Code will be the primary reference document for the design of buildings and structures.

SECTION REVIEWS Each section will be followed by a review that allows you to test your code knowledge , and to discuss principles that you find confusing and in need of clarification. You should enter your answers on-line and offer any comments concerning the material.

2.5 Section 2 Review and Comments

This section review discusses code jurisdiction and application.

1. a) Which building code is in effect in the City of Victoria? b)Which jurisdiction applies the code? c)What two documents empower the building code?

2. **The National Building Code may be applied in many jurisdictions in the Province of B.C. in the absence of any other legislation.**
   T____ F____

3. **The public review process has no legal effect nationally.**
   T____ F____

4. **The municipality may alter the building code in certain key areas such as:**
   a) Fire walls and fire separations T____ F____
   b) Fire protection by requiring increased sprinklerization
   T____ F____
   c) Enforcement techniques such as adopting other codes that may have more effect T____ F____
   d)Fees and legal remedies T____ F____

5. **Conferencing with at least two other people *on-line* describe the code adoption process for municipal jurisdictions in the Province (excluding Vancouver). The discussion should include descriptions and relationships of the following functions: public review, national model code, time cycles, legislative authority, provincial and municipal amendments, and jurisdiction.**

3.0 SECTION 3 - PART 3 INTRODUCTION AND DEFINITIONS

3.1 Section Objectives

When you finish this section you should be able to:

- ***Describe the jargon of the building code;***
- ***Discuss the use and application of various definitions;***
- ***Describe the general application of the various code sections;***
- ***Describe in your own words the intention of certain key words;***
- ***Discuss the relationship of key words to each other;***
- ***Discuss the importance of definitions in building code interpretation;and***
- ***Discuss building and life safety principles supported by code requirements.***

3.2 Building and Life Safety Principles

Construction factors such as combustible construction and sprinklers are based on both life and building safety principles and objectives. The building code defines the types of construction within the main structure. Contents are discussed obliquely in reference to general uses and other types of high hazard uses. For example, it is understood that fire loads in

mercantile (stores) and medium hazard industrial (warehouses) occupancies will have a high degree of combustible contents compared to residential or office type occupancies.

The building code controls the primary structural construction components. Uses are also limited by code definition, and changes in use will mean re-classification of the building. However, there is a wide range of building contents permitted in occupancies such as mercantile uses (eg. compare a grocery store and a hardware store). Structural components remain the chief control mechanism and are difficult to change after occupancy. Building height, building area, streets of access, and occupancy or use are factors used in assessing:

- ***Fire load orientation*** **- larger buildings will contain more structural and content fire load. Higher buildings promote fire moving vertically through each storey.**
- ***Fire fighting ability*** **- the more streets of access, the lesser the height, the smaller the building, and the lower the fire load the easier the building is to defend from fire. Fire containment within the structure is critical to rescue people and fight fires within the building. Collapse of the building structure will impede this ability.**
- ***Exiting the building*** **- occupants in dangerous situations must be able to reach a safe area outside the confines of the building. This time frame and ability will be affected by building height, size and use.**
- ***Fire spread to adjacent buildings*** **- property protection continues to be an implicit requirement within the code. Many times it is bound to other life safety principles. However, tenancy protection within fire separations (3.3.1.1.) and spatial separations (3.2.3.) are examples of principles that reflect the concern for property ownership.**

3.3 On-line course scope

The first area of development is Part 3 of the B.C. Building Code. *Part 3* is the section that deals with larger residential, business and personal service (eg. office), mercantile (eg. store), and industrial (eg. welding shop) type buildings as opposed to *Part 9,* which deals with all these types of occupancies when 600 sq.m. or less in building area and 3 storeys or less in building height. Also, *Part 9 DOES NOT* deal with assembly (eg. restaurant) or institutional (eg. hospital) occupancies.

3.4 Other code sections

Other code sections considered part of the application of Part 3 are *Part 1, and 2* (apply to all sections*), Part 4* for engineered structural design (engineering parameters exceeded in Part 9 may also refer to Part 4), *Part 5* Wind, Water and Vapour Protection, *Part 6* Heating, Ventilating and Air

Conditioning (Part 9 refers to this section in some instances) and *Part 8* Safety during Construction (applies to all sections).

3.5 Use, Occupancy, Definitions and Building Classification

We begin our course with the review of use and occupancy and specifically sections 3.1.2., 3.1.3., 3.2.1. and 3.2.2. Working through this material should give you a good in classifying the building and determining the overall construction requirements. It is the starting point for the application of Part 3.

The first area for discussion and application in this section is the definitions section. Remember that the building code like other legal documents is written in "pseudo-legal" jargon to strengthen enforcement potential. Definitions are provided to clarify the intent of the code article. Within the body of the B.C. building code these references are italicized.

To determine construction requirements key components of building classification must be known and they are building area, building height, streets of access, and major occupancy. Other primary areas having an effect on classification are combustible/non-combustible construction and sprinklers.

To discuss these components it will be necessary to understand the relevant definitions and understand their application.

3.6 Definitions

Definitions are contained within Part 1 of the building code. There are several terms that many designers would like defined such as "subsidiary use", "access routes" and "roof". *A roof becomes a wall, if it is pitched at an angle more than 60 degrees from the horizontal and adjoins a space within the building intended for an occupancy. (3.2.1.3.)* You can probably think of other examples. The code leaves the clarification of these terms up to the body of the code. For example, access routes are clarified in 3.2.5.7.

The preamble to this section in the code states that the definitions should be determined on the basis of context, common and professional trade usage. Some provinces reference an English language dictionary for further clarification.

Now, let us take a look at some code definitions.

***GRADE* (*as applying to the determination of building height*) means the lowest of the average levels of finished ground adjoining each exterior wall of a building, except that localized depressions such as for vehicle or**

pedestrian entrances need not be considered in the determination of average levels of finished ground.

Grade: **The determination of grade will define the height of the building. Building height is a major element affecting building construction. Grade is used in determining the first storey and thus the height of the remainder of the building. Remember, it is the *lowest* of the *average* of *each* exterior wall adjoining finished grade.**

(Fig1)

(Fig2)

(Fig3)

STOREY **means that portion of a building which is situated between the top of any floor and the top of the floor next above it, and if there is no floor above it, that portion between the top of such floor and the ceiling above it.**

Storey**: Storey is the determining factor for the overall height of the building. Building height is a major component and also affects building construction. Mezzanines will be discussed in section 5.2.3.. This type of intermediate storey will have a bearing on the overall building height. The higher a structure, the more difficult exterior fire fighting becomes. Increased occupant and fire loads encumber exiting.**

FIRST STOREY **means the uppermost *storey* having its floor level not more than 2m above *grade*.**

(Fig4)

BUILDING HEIGHT **(in storeys) means the number of *storeys* contained between the roof and the floor of the *first storey.***

(fig7)

BASEMENT **means a storey or storeys of a building located below the first storey.**

(fig5)

BUILDING AREA **means the greatest horizontal area of a *building* above *grade* within the outside surface of the exterior walls or within the outside surface of exterior walls and the centerline of *firewalls.***

Building Area: provides a basis for analyzing the complexity of the building, based on size. Remember, that building area includes the floor areas of all uses including exits and vertical service spaces. Also, the building area is the *greatest* horizontal area of a building. Calculations are made to the outside exterior face of the walls above grade, even though the floor of the use is below grade. An example is a parkade with a floor below grade but with walls extending above grade. The parkade will become the determining factor for building area even though storeys above the parkade may be smaller. There is an exception to this building area determination found in 3.2.1.2. (these will be discussed later)

(fig6)
(fig8)
(fig9)

FLOOR AREA means the space on any *storey* of a *building* between exterior walls and required *firewalls*, including the space occupied by interior walls and *partitions*, but not including *exits*, *vertical service spaces*, and enclosing assemblies.

(fig10)

OCCUPANCY means the use or intended use of a *building* or part thereof for the shelter or support of persons, animals or property.

Occupancy is the use of a building. The B.C.B.C. is not the only code that defines occupancy. The referenced National Fire Protection Association standards have differing occupancy references. Examples are contained in the portable fire extinguishers standard (NFPA 10; light, moderate, high) and the sprinkler standards (NFPA 13, 13R and 13D) Examples in the sprinkler standard are: light hazard (low fire load: offices, hospitals, and schools), ordinary hazard (mercantile, medium hazard industrial) and extra hazard (paint spraying, special finishing operations, hazardous lab spaces). Some of these hazards are further defined by sub-categories. Do not mistake building code occupancies for these fire load limiting uses.

Also, storage without human occupancy is considered a use, as a fire load is a component of the use, and will determine the complexity of fire fighting.

MAJOR OCCUPANCY means the principal occupancy for which a building or part thereof is used or intended to be used and shall be deemed to include the subsidiary occupancies which are an integral part of the principal occupancy.

Major occupancy is a determining factor for construction. Every building is required to be classified by major occupancy, although subsidiary occupancies may be housed within a major occupancy. For example, within a repair garage an office for use by the shop foreman is normally considered subsidiary to the use. That is to say that the use within this space is so dependent on the repair function that they are inseparable.

Some determining factors that assist in defining a subsidiary use include traffic between the two uses; dependency and complimentary functions; and the non-public aspect of the uses. Some types of uses that require judgment in determining whether they are subsidiary are between a repair garage and front office, showroom and storage garage, and paint spray operations and office functions.

General occupancy descriptions follow. Examples of types of uses are contained within the Appendix (3.1.2.A.)

A - ASSEMBLY OCCUPANCY means the occupancy or the use of a building, or part thereof, by a gathering of persons for civic, political, travel, religious, social, educational, recreational, or the like purposes, or for the consumption of food or drink.

Most assembly occupancies will have higher occupant loads than other uses and are usually public and thus unfamiliar with the building. Some borderline assembly occupancies are pool halls and take out restaurants.

B - INSTITUTIONAL OCCUPANCY means the occupancy or use of a building or part thereof by persons who require special care or treatment because of mental or physical limitations or by persons who are under restraint for correctional purposes and are incapable of self-preservation because of security measures not under their control.

Institutional occupancies impose restrictions on occupants not found with other uses and is also usually public. Borderline uses are: community care facilities, day care centers, and group homes.

C - RESIDENTIAL OCCUPANCY means the occupancy or use of a building or part thereof by persons for whom sleeping accommodation is provided but who are not harboured or detained to receive medical care or treatment or are not voluntarily detained.

Although occupants are usually familiar with the building (private), the residential occupancy's peculiarity is the sleeping function, (this may also

be prevalent in the institutional use). Sleeping occupants are more susceptible to fire and other hazards. Hence, special building code considerations such as: restricting major occupancy use combinations, and fire alarm systems are imposed.

D - BUSINESS AND PERSONAL SERVICE occupancy means the occupancy or use of a building or part thereof for the transaction of business or the rendering or receiving of professional or personal services.

Business and personal service occupancies usually contain fairly light fire loads, people who are more familiar with the building (private functions).

E - MERCANTILE OCCUPANCY means the occupancy or use of a building or part thereof for the display or selling of retail goods, wares, or merchandise.

Mercantile occupancies contain moderately high fire loads and are mainly public functions. Fire separations between other major occupancies are the most severe here and in the high hazard occupancy.

F- INDUSTRIAL OCCUPANCY means the occupancy or use of a building or part thereof for the assembling, fabricating, manufacturing, processing, repair, or storing of goods and materials.

These uses are clearly private functions (workers). However, some public functions may be present. Classification in particular sub-categories is not easy. Some shop uses contain highly ignitable functions (eg. welding and flame cutting) with apparently low fire loads (metal).

F1 - HIGH HAZARD INDUSTRIAL OCCUPANCY (Group F, Division 1) means an industrial occupancy containing sufficient quantities of highly combustible or flammable or explosive materials which, because of their inherent characteristics, constitute a fire hazard.

F2 - MEDIUM HAZARD INDUSTRIAL OCCUPANCY (Group F, Division 2) means an industrial occupancy in which the combustible content is more than 50kg/m^2 or 1200 MJ/m^2 of floor area and not classified as high hazard industrial occupancy.

F3 - LOW HAZARD INDUSTRIAL OCCUPANCY (Group F, Division 3) means an industrial occupancy in which the combustible content is not more than 50kg/m^2 or 1200 MJ/m^2 of floor area.

3.7 Section 3 - Review

1. *Explain why a non-combustible arena would require sprinklering and fire separations between storeys.*

2. *Grade is the average height of ground surrounding the building. T___ F___ Explain your response.*

3. *Explain why a roof would require a fire rating.*

4. *If building code terminology is confusing, why are there not more definitions in the code?*

5. *Working with at least 3 other people on-line, find at least three other words in the sections 3.1.2., 3.1.3., 3.2.1., and 3.2.2 that have involved code descriptions but are not defined words. Explain the criteria that defines these words.*

6. *Part 6 applies to all buildings. T___ F___*

7. *When would a roof be defined as a wall?*

8. *What are the four major components determining building construction and explain their relationship.*

9. *Building Code occupancy definitions take preeminence over other occupancy definitions found in NFPA. T___ F___ Explain your response.*

10. *List 4 primary differences between the major occupancies.*

11. *How would you classify a welding shop?*

WEEK 2 - APRIL 15-22ND, 1996

4.0 SECTION 4 - MAJOR OCCUPANCY DETERMINATION

4.1 SECTION OBJECTIVES

When you finish this section you should be able to:

- *Describe the importance of the most restrictive major occupancy;*
- *Among a list of major occupancies choose the correct one;*
- *Determine the building classification requirements in multiple major occupancy buildings;*
- *Correctly assign major occupancy fire separations;*

- *Describe subtle differences between certain major occupancies;and*
- *Given a number of occupancies, determine THE major occupancy.*

4.2 Section 4-Major occupancy determination and special classifications

All buildings are to be classified according to the major occupancies that they contain. This identifies the various uses and methods of addressing life and property safety issues such as exiting, fire spread and containment, fire fighting and property protection.

4.2.1.Borderline occupancies

Most major occupancies will be determined by selecting from the examples in the appendix. Some occupancies will be more difficult to classify. For example: where would you place a welding shop or warehouse? The differences between an F-3 and F-2 occupancy can be quite dramatic. Construction requirements that become more restrictive are contained in the following categories: non-combustible construction, fire spread from one building to the next (spatial separations in Section 3.2.3.), hose and standpipe requirements (3.2.5.9.), and exiting (3.4) .

Choosing between certain uses and reaching a decision on classification will depend on:

- **Extent of fire load. For example: a warehouse containing volumes of plastics or cardboards will likely be classified as F-2. A concrete block or steel storage warehouse will be F-3. The performance figure for determining differences between F-1, 2 and 3 is stated within each definition. A special example will be given later in the course.**
- **Extent of use. Placing flammable vapours such as paint residues, (autobody), gases or dusts (fertilizer plants, laboratories) into the air stream within the building leads to a more combustible environment. Determination of combustibility of gases or dusts may be gathered from NFPA 491 and 49. Examples of the parameters**

Occupant restrictions. The difference between institutional and other occupancies is determined on the ability of an occupant to:

1) recognize a hazard. A physical or mental restriction such as one of the senses may be blocked or not functioning.

2) ability to evacuate the building. Persons may be confined to bed or mentally incapacitated.

4.2.2. Arenas, police stations, convalescent homes, and community care facilities.

- **Arena type buildings can have multiple uses because of the open floor area. As a trade show's fire load is similar to mercantile occupancies the same sprinkler limitations that apply are 1500 sq. m. (see 3.2.2.43.,44, and 45).**

- **Police stations may house detention quarters that would normally be classified as B-1 due to the extreme restriction on occupant mobility. However, smaller police stations (not greater than 600 sq.m. in building area or 1 storey in building height) may be classified as B-2.**

- **Children's custodial homes would normally be classified as assembly occupancies, and convalescent homes would normally be classified as B occupancies, but may be classified as C occupancies provided:**

  1)not more than 10 people will have sleeping accommodation ;and

  2)the occupants are ambulatory.

- **Community care facilities (or group homes) that are licensed under the Community Care Facility Act may also be classified as C instead of B provided:**

  1) it is a single housekeeping unit in a single family dwelling with sleeping accommodation for not more than 10 persons;

  2) not more than 6 people are in care; and
  3) the dwelling unit conforms to 9.10.2.5. (i.e. smoke alarms, fire rating to garage, sprinklered, and emergency lighting)

4.3 Major occupancy classification

The key parameters in deterring building construction are:
- **Use or occupancy;**
- **Building area;**
- **Building access (# of streets);**
- **Building height (# of storeys);and**
- **Sprinklered or unsprinklered.**

4.3.1. Building classification

A building is to be classified according to one of the major occupancies. The classification according to division and group in 3.2.2 must take into consideration:

- **the building height and building area for the entire building**
- **the most restrictive major occupancy if there is more than one major occupancy.**

This leads us to a discussion concerning major occupancy . Occupancies are based on use. However, major occupancies take into account:

- ***the percentage of the building they occupy***
- ***their orientation above or below other occupancies***

Article 3.1.3.4. states that if one major occupancy is located entirely above another major occupancy the building is to be classified as if the entire building were of that major occupancy. Also, the fire separation between the floors is to be determined based on the major occupancy of the lower occupancy.

The key factor in determining major occupancies for construction is the fact that the occupancy must be *entirely* above the other one. *Common examples are mercantile uses over parkades, or residential uses over mercantile or assembly occupancies.*

Let us take a look at some examples:

Even though the F3 occupancy is located only on one floor, it must be considered as occupying the entire building. Determine from Subsection 3.2.2. the fire resistance rating of the floor assembly on the basis of the building height and building area. Apply the fire resistance rating to the floor assembly above the F3 occupancy.

(fig16)

The E occupancy is treated in the same manner as the F3 occupancy above. In this example, the E occupancy portions must be sprinklered.

(fig17)

The D occupancy is treated as described above, except that the roof assembly rating is applied to the assembly above the top storey. The roof assembly rating is determined by the major occupancy of the top storey.

(fig18)

Article 3.1.3.5. states that in a building where the aggregate area of all major occupancies in a particular Group or Division is not more than 10% of the floor area of the storey on which they are located, these major

occupancies need not be considered as major occupancies for the purposes of Subsection 3.2.2, provided they are not classified as Group F, Division 1 or 2 occupancies.

Where more than one major occupancy is contained in a storey, the occupancies need not be considered as major occupancies for the purposes of Subsection 3.2.2. provided that:

- ***The total area of all the major occupancies in a particular group or division does not exceed 10% of the floor area in the storey in which they are located, and***
- ***The occupancies are not classified as Group F Division 1, or Group F Division 2 occupancies.***

(fig20)

Example 1

The Group F-1 and the Group E occupancies are the only major occupancies. The Group A - 1 and 2 occupancies and the Group D occupancies do not constitute separate major occupancies since the total area of each of the divisions in the Group A occupancy and the total of the Group D occupancies do not exceed 10%.

(fig21)

Example 2

Only the Group A Division 2 occupancy is not considered a separate major occupancy. All of the other groups and divisions have an area greater than 10% of the floor area and each group and division must be considered as a separate major occupancy.

(fig22)

Article 3.1.3.5. does not withdraw required fire separations.(eg. between C and D, or C and E) as outlined in Table 3.1.3.A. This reference is directed to 3.2.2. classifications and permits a small area for another major occupancy, without requiring the structural frame of the building on that storey being upgraded to comply with the requirements for that major occupancy.

4.4 Major occupancy fire separations

4.4.1. Purpose

Fire separations restrict the passage of smoke and flame within the building permitting:

- **fire fighters to respond; and**
- **occupants to safely evacuate the building.**

For these reasons, major occupancies are one of the determinates in protecting building occupants. For example: paint spray applications would be hazardous to occupants of a hospital, so building compartmentation by fire separation would partially control the danger.

4.4.2. Table 3.1.3.A and anomalies

Major occupancy fire separations may be determined from the referenced table. However, there are some qualifications.

- **Fire separations between suites (separate tenancy - refer to 3.3.1.1.) still require a fire resistance rating unless D occupancies. Separate tenancy determines this need, NOT major occupancy. *For example: within the table a D and E occupancy do not require a fire separation. However, if they are suites, then a suite fire separation is required. This is normally 45 minutes to 1 hour. (refer to table note 1)***
- **In a building of Group E major occupancy, less than 3 storeys in building height and with 2 dwelling units or less the fire separation specified in the table need not be 2 hours, but rather 1 hour. *For example: many grocery stores may have dwelling units on the second storey.***
- **There are also prohibitions on major occupancies within the same building. As stated in 3.1.3.7:**

  1) F-1 major occupancies cannot be located within the same building as any occupancy of A, B, or C; and

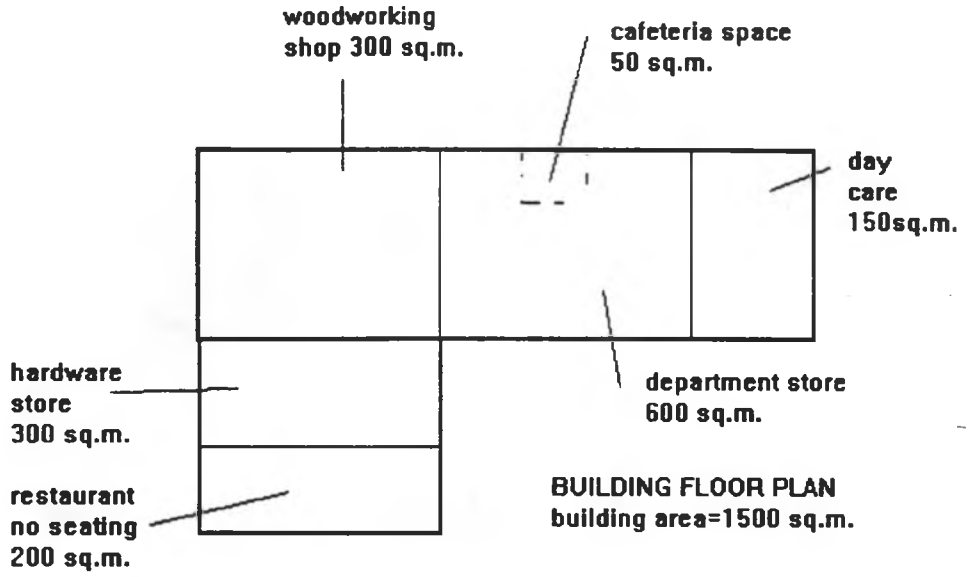
  2) Not more than one suite of C major occupancy may be contained within a building classified as F-2.

So a caretaker live-in suite may be contained within a medium hazard building, but not within a high hazard building.

- **There are certain occupancy fire separations determined strictly on the hazard. These are contained in 3.3. Safety Requirements within Floor Areas. *For example: within the industrial section, repair garages are required to be separated with construction that achieves a 2 hour fire resistance rating. Other examples are: storage garages and welding and flame cutting shops. Also, special fire suppression systems are required for mini-storage warehouses, and F-1 occupancies (3.3.5.2., and 3.3.5.10.)***

4.5 Section Review

1. *a)Classify the following uses according to occupancy:*
   PET STORE____ BAKERY____ FIRE HALL_____ GROUP HOME _____ DAY CARE____ WELDING SHOP_____CONCRETE BLOCK MANUFACTURING PLANT_____FAST FOOD RESTAURANT WITHOUT SEATING____ FAST FOOD RESTAURANT WITH SEATING_____ POLICE STATION 900 SQ. M. 1 STOREY IN BUILDING HEIGHT____ 50 UNIT CONDOMINIUM WITH A COMMUNITY CARE FACILITY IN ONE SUITE___ (classification of suite)
   b) What determines the occupancy classification of a fast food restaurant?
2. *If an arena was used more often than "occasionally" for trade shows how would you classify and determine construction requirements? How would you define occasional use?*
3. *In which instances is major occupancy the most restrictive occupancy applying to the whole building?*
4. *Table 3.1.3.A determines fire separations between all occupancies T__ F___*
5. *What are the fire separations required between the following occupancies:D and D____D and E____E and 2 dwelling units in a 2 storey building____E and C____F-1 and B-2 ____Non-major occupancies of C and F-1____Non-major occupancies of E and C____4.8 Between major occupancies surrounding an atrium classified as D and C____Non-major occupancies of E and E____*
6. *Contact at least one facilitator and state the reasons why an F-1 major occupancy building cannot house an A,B or C occupancy.*
7. *From the following sketch determine:*
   a)the fire rating between each occupancy
   b)the major occupancy of the building
   c)the occupancy classifications



WEEK 3 - APRIL 22-29, 1996

5.0 SECTION 5 - SIZE AND OCCUPANCY

5.1 SECTION OBJECTIVES

When you finish this section you should be able to:

- ***assign building height based on the requirements of roof top enclosures, mezzanines, spaces under seats and interstitial spaces***
- ***describe the instances when a storage garage may be considered a separate building***
- ***decide on the fire protection of basements***

5.2 Roof top enclosures, mezzanines, spaces under seats and intersitial spaces

5.2.1. Roof top enclosures

Article 3.2.1.1.(1)states that roof top enclosures provided for elevator machinery, stairways, and for service rooms, used for no other purpose than for service to the building, shall not be considered as a storey, in calculating the building height.

The fire separation of floor assemblies is contained in 3.2.2.10. and is not required if the roof top enclosure is under 1 storey.

Rooms and enclosures, *in spite of their area*, for elevator machinery, stairs, service rooms, and other equipment used solely for service to the building are not counted as a storey in determining building height. However, if any portion of the floor area is used for another use or occupancy, then the storey requirements would apply.

(fig23)

Example 1
Building is considered to be four storeys in building height.

(fig24)

Example 2
Where part of the top floor of a building is used for any occupancy with the remainder used as a mechanical service or equipment area, the floor is considered a storey.

Therefore, building is considered eight storeys in building height.

5.2.3. Mezzanines
Mezzanines determine building height as they may be considered as an intermediate storey and thus included in the building height calculation. Other factors affecting mezzanine design are:

- **exiting (see 3.4.2.2.)**
- **interconnected floor spaces and fire separations (see 3.2.8.1. and 3.2.8.2.)**

5.2.4. Spaces under tiers of seats
Article 3.2.1.1.(2) states that space under tiers of seats in arena type buildings shall not be considered as adding to the building height provided this space is used only for a purpose incidental to the major occupancy of the building, such as dressing rooms or concession stands.

(fig25)

Uses which are complimentary and related to an arena type building may be located in the space below tiers of seats without being considered as storeys for the purposes of calculating building height.

5.2.4. Interstitial floor spaces
Spaces within a ceiling space that permit maintenance access need not be considered as storeys in building height when various fire alarm provisions are made, emergency lighting is provided, and exiting requirements are met. These spaces are usually within hospitals and are installed to access

mechanical equipment. Maintenance offices may also be located within these spaces.

5.3 Storage Garages

Sentence 3.2.1.2.(1) states that where a basement is used primarily as a storage garage, the basement can be considered a separate building for the purposes of Subsection 3.2.2., 3.2.4., and 3.2.6. provided:

- the floor above the basement is constructed as a fire separation of masonry or concrete having a fire resistance rating of not less than 2 hrs.;
- the portion of exterior wall of the basement located within 3m on either side of any firewall immediately above the basement shall be constructed of masonry of concrete having a fire resistance rating of at least 2 hrs and have no unprotected openings; and
- except as permitted in Sentence (4), the exposed building faces above the basement shall be protected from unprotected openings in the exterior walls of the basement by a canopy conforming to Sentence (5).

(fig26)

Continuity of Firewalls

Sentence 3.1.10.3.(1) states that every firewall shall extend from the ground continuously through all storeys of a building or buildings so separated, except that where a firewall is located above a basement storage garage conforming to Article 3.2.1.2., the firewall is permitted to terminate at the floor assembly immediately above the storage garage. (see also Sentence 3.1.10.1.(3)).

(fig27)

(fig28)

(fig29)

Sentence 3.2.1.2.(5) states that canopies over unprotected openings in Clause 1(c)shall:

- be not less than 1m wide of noncombustible construction
- have a fire-resistance rating of not less than 2h with no unprotected openings
- be located at the floor level above the basement, and
- extend not less than 1m beyond both sides of basement wall openings.

(fig30)

Remember that the parkade must contain a fire alarm system where there are openings through the floor. Article 3.2.4.2. stresses the need to ensure that everyone in the building is notified concerning a fire that may circumvent the floor fire separation through stair and elevator shafts, which are common openings in parkade slabs.

5.4 Roof/Wall Determination

Article 3.2.1.3. states that for the purposes of this section any part of a roof that is pitched at an angle of 60 degrees or more to the horizontal and adjoins a space intended for occupancy within a building shall be considered as part of an external wall of the building.

(fig31)

Roof determination will have a bearing on spatial separation requirements in 3.2.3.

5.5 Basement fire protection

Basements are any floor area below the first storey. Because of access problems and restricted exterior wall exposures, it is more difficult to fight fires in basements.

Subsections 3.2.2. will contain fire separation requirements for all floors. However, in some cases floors will not have a fire-resistance rating (see 3.2.2.39 for non-combustible floor assemblies), but floors above basements are to have a minimum fire-resistance rating of 45 minutes.

Also, unsprinklered basements are to be fire compartmented into spaces less than 600 sq. m. The fire compartment rating is to equal that for the floor assembly. Due to their open nature, *open air storeys* do not require compartmentation.

5.6 Section review

1. **A roof top enclosure is the same area as the building area. The building below is 3 storeys in building height. What is the building height when considering the roof top enclosure?**

2. **Two mezzanines with floor areas of 50 sq.m. each are located within a building of 1000 sq. meters. The mezzanine is enclosed with unrated walls. Are the mezzanines considered storeys in building**

- *Outline the provisions to be met to alleviate roof fire ratings*

6.2 Special Structures

Sentence 3.2.2. divides buildings into a number of classifications based on the variables of building height, building area, streets of access, and use. However, some structures do not fit neatly into these types of classification schemes. Examples include grain elevators, water storage facilities, farm processing facilities, and dock loading equipment. NFPA gives guidelines for the protection of these types of structures. Exiting, fire suppression and fire separations will usually require special attention.

6.3 Structural fire protection

Buildings classified in 3.2.2 that require fire resistance ratings for floor and roof assemblies will need to have protection of structural support systems to ensure the assemblies do not collapse prematurely. Exceptions to these provisions are outlined within this sentence.

Sentence 3.2.2.3.(1) (g) states that fire protection is not required for loadbearing steel or concrete members wholly or partially outside of a building face in a building not more than 4 storeys in building height and classified as Group A, B, C, D, or F, Division 3 major occupancy.

This is provided:

- **such members are not less than 1m away from any unprotected opening in an exterior wall;**
- **or shielded from heat radiation in the event of a fire within a building by construction that will provide the same degree of protection that would be necessary if the member was located inside the building; and**
- **with the protection extending on either side of the member a distance equal to the projection of the member from the face of the wall. (see also Sentence 3.2.3.8.(2))**

(fig32)

6.4 Application of 3.2.2.

3.2.2. allows buildings to be classified so that construction can be determined. Classifying a buildings is the starting point to determine construction requirements. Fire separations between floors, non-combustible construction and general sprinklering requirements are the main determinates.

Article 3.2.2.4. provides the framework for classifying buildings. It notes that the least restrictive classification should be used when classifying the

building provided all the variables of building area, building height, streets of access, sprinklering, construction and sprinklering are met.

6.5 Crawl Spaces, Exterior passageways, balconies, roof top enclosures, and below ground storeys.

6.5.1. Crawl spaces

Sentence 3.2.2.5.(1) states that for the purposes of Article 3.2.1.4. and 3.2.1.5., a crawl space shall be considered as a basement when it is:

- **more than 1.8m high between the lowest part of the floor assembly and the ground or other surface below; or**
- **is used for any occupancy; or**
- **is used for the passage of flue pipes;**
- **is used as a plenum in combustible construction.**

Sentence (2) states that a floor assembly immediately above a crawl space is not required to be constructed as a fire separation and is not required to have a fire-resistance rating provided the crawl space is not considered as a basement in Sentence (1).

If a crawl space becomes a basement, this has implications for the floor fire separation and compartmentation of the space.

(fig33)

6.5.2. Exterior balconies, exterior passageways and roof top enclosures

Exterior balconies are conducive to fire spread up the exterior of the building. Roof top enclosures contain low occupant loads but also allow fire spread to be transferred to other building components. For this reason, they are treated the same as a floor assembly classification in 3.2.2. OR as required by 3.2.3. for spatial separation requirements, which is more restrictive.

In most cases, balconies and roof top enclosures will require a fire-resistance rating equal to the floor. However, most roof top enclosures will not exceed one storey, and therefore do not require a fire-resistance rating but are still required to be a fire separation.

Exterior passageways provide a means of egress, usually from motel units, but they can also serve other suites. Special fire protection measures are required in order to protect occupant egress. They will be treated with the same fire-resistance rating required for mezzanines. Also, flame spread rating requirements and exit stair termination is to be met as outlined in 3.1.13.10. and 3.2.3.13.

6.5.3.Storeys Below Ground

Storeys below ground present difficulties for fire fighting and occupant evacuation. Types of buildings that may be erected entirely below ground include civil defense buildings and shelters.

Sentence 3.2.2.11.(1) states that where a building is erected entirely below the adjoining finished ground level and does not extend more than 1 storey below such ground level, the minimum precautions against fire spread and collapse shall be the same as are required for basements under a building of 1 storey in building height having the same occupancy and building area.

(fig36)

Sentence 3.2.2.11.(2) states that where a building or portion thereof is erected entirely below the adjoining finished ground level and extends more than 1 storey below such ground level, the following minimum precautions against fire spread and collapse shall be taken:

(a) except as provided in Sentence (3), basements shall be sprinklered.

(b) floor assemblies below such ground level shall be constructed as a

- **(i) fire separation with a fire-resistance rating of not less than 3hrs where the basements are occupied by Group E or Group F, Division 1 or 2 occupancies, and**
- **(ii) fire separations with a fire resistance rating of not less than 2hrs where the basements are not occupied by Group E or Group F, Divisions 1 or 2.**

(c) all loadbearing walls, columns and arches shall have a fire-resistance rating not less than that required for the construction that they support.

OCCUPANCY	FIRE SEPARATION
A,B,C,D,F3	2hrs
E,F1,F2	3hrs

(fig37)

Sentence 3.2.2.11.(3)states that the storey immediately below the first storey need not be sprinklered as required by Clause (2)(a) where:

(a) It contains only residential occupancies, and

(b) not less than one unobstructed access opening conforming to Sentence 3.2.5.1.(2) is installed on that storey for each 15m of wall length in not less than one wall required to face a street in Subsection 3.2.2.

(fig38)

6.6.Streets of Access

Streets of access allow a fire department to approach a building and set up for fire fighting. Two key parameters for streets of access are:

- a street must be at least 3 m and no more than 15 m from the face of the building; and
- the percentage of building perimeter exposure to the street.

Remember that a building perimeter must also include firewalls even though a firewall cannot be exposed to a street.

Sentence 3.2.2.6.(1) states that every building shall face a street located in conformance with the requirements for access routes in Articles 3.2.5.5. and 3.2.5.6.

(2) For the purposes of Subsection 3.2.2. and 3.2.5. an access route conforming to Articles 3.2.5.5. and 3.2.5.6. is permitted to be considered as a street.

(3) a building is considered to face 2 streets when not less than 50 % of the building perimeter is located within 15m of a street or streets.

(4) A building is considered to face 3 streets when not less than 75% of the building perimeter is located within 15m of the street or streets.

(5) Enclosed spaces, tunnels, bridges and similar structures, even though used for vehicular or pedestrian traffic, are not considered as streets for the purpose of this Part.

(fig34)

For the purpose of this Subsection, an access route may be considered a street, provided a clear width of at least 3m is maintained between the 6m and the face of the building. The 3m may be landscaped or otherwise

finished, but not in a manner which would constitute a hindrance to the operation of fire fighting vehicles.

(fig35)

6.7 Roof Ratings

(3.2.2.12.,3.2.2.13.,3.2.2.14.) Roofs do not require a fire-resistance rating unless it is provided within a 3.2.2. requirement. If the building is fully sprinklered, the system is adequately supervised and a fire alarm signal is transmitted to the fire department, then the roof on any building does not require a fire-resistance rating.

Please note that this article does not require special sprinklering of the roof. The system must be installed to conform to NFPA 13 which, except for certain combustible blind spaces, does not require sprinklers above the ceiling below the roof.

Also, heavy timber construction (see 3.1.4.5.,6) may be applied to all building classifications up to 2 storeys in spite of the building area and construction requirements, provided the building is sprinklered. This permits this portion of the building to be combustible construction, even though the remainder of the building may need to be non-combustible construction.

Arena type buildings such as ice arenas and gynmasiums need not have a fire-resistance rating applied to the roof when the roof is over 6m above the floor. This dimension does not apply to bleacher seating inclined floors, or raised balconies for seating. The measurement, in most cases, will be taken from the activity floor.

The roof is not to be used for special loadings other than material such as ventilation, lighting and sound equipment. Examples of special loadings could be roof top activity courts.

6.8 Impeded egress zones

(3.2.2.15.) An impeded egress zone is a use that would normally be applied to people that are restrained against their will. These types of uses would usually be B-1 occupancies (eg. penal institutions). However, there are many cases where hospitals and police stations may also need security measures in certain areas.

Article 3.2.2.15. allows for this use without the entire building being classified as B-1 provided:

- the building is sprinklered;

- the occupants are not confined to a single room (contained use area);
- the building does not include sleeping accommodation (residential);
- no F-1, or E occupancies in the building;
- if the building includes an F-2 occupancy it is not more than 6400 sq.m. in building area;
- the impeded egress zone is confined to one fire compartment;and
- the occupant load of the zone is not more than 100.

6.9 Section Review

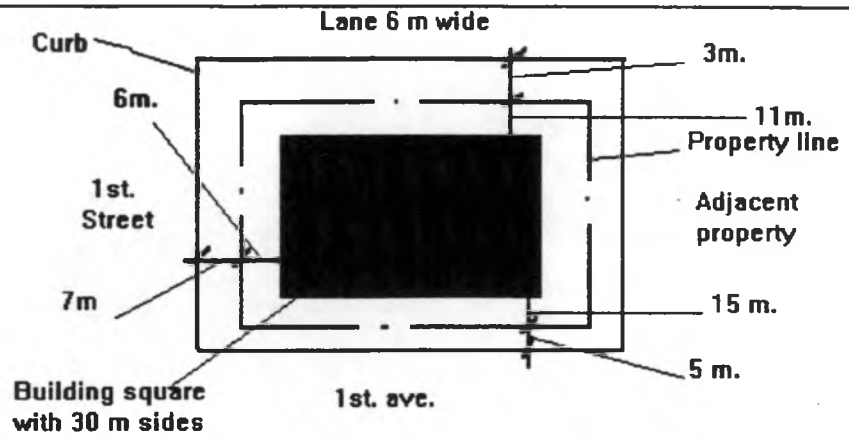
1. When would a building not be classified according to 3.2.2. and what special provisions are to be considered in these types of structures?

2. Loadbearing walls and columns must be fire rated the same as the floor and roof in order to resist premature collapse. No exceptions. T___ F___

3. Access routes may be classified as streets of access. T___ F___

4. Why is an access route permitted to be 6 m wide and a street is required to be 9 m wide?

5. Determine the streets of access for the following building:



SITE PLAN – N.T.S.

6. Why would sprinklers alleviate the fire resistance rating for a roof but not for other floors?

7. With at least 3 other conferencers determine why the distance of the roof from the floor in an arena type building would make a difference to the roof rating.

SECTION 7.0 OCCUPANCY CLASSIFICATIONS

7.1 Section Objectives

When you have finished this section you should be able to:

- ***Classify a building adequately***
- ***Determine fire resistance ratings, construction, and sprinklering when given occupancy, building area, streets of access, and building height.***
- ***Decide on the differences between building classification and other fire protection measures that may apply.***

7.2 Building Classification parameters

As we have learned, the chief variables in any building classification are building area, building height, streets of access, sprinklering and use. If one makes a mistake in classifying these variables, then the building will not be adequately classified.

Also, remember from multiple occupancy classifications that some buildings, because of use, will have multiple classifications. Examples may be residential uses over parkades, restaurants at the top of a building, and mercantile uses on the first two floors of a high rise building. The classification of the building according to 3.2.2. will have multiple expressions.

The classification in 3.2.2. proceed from the least restrictive to the most restrictive and travel through all occupancy classifications. Thus every building, unless it is a special structure, will fit in to one classification. Difficulties may arise in determining building height or streets of access.

The following two exercises will acquaint you with the use of 3.2.2.

(Lynn's exercises)

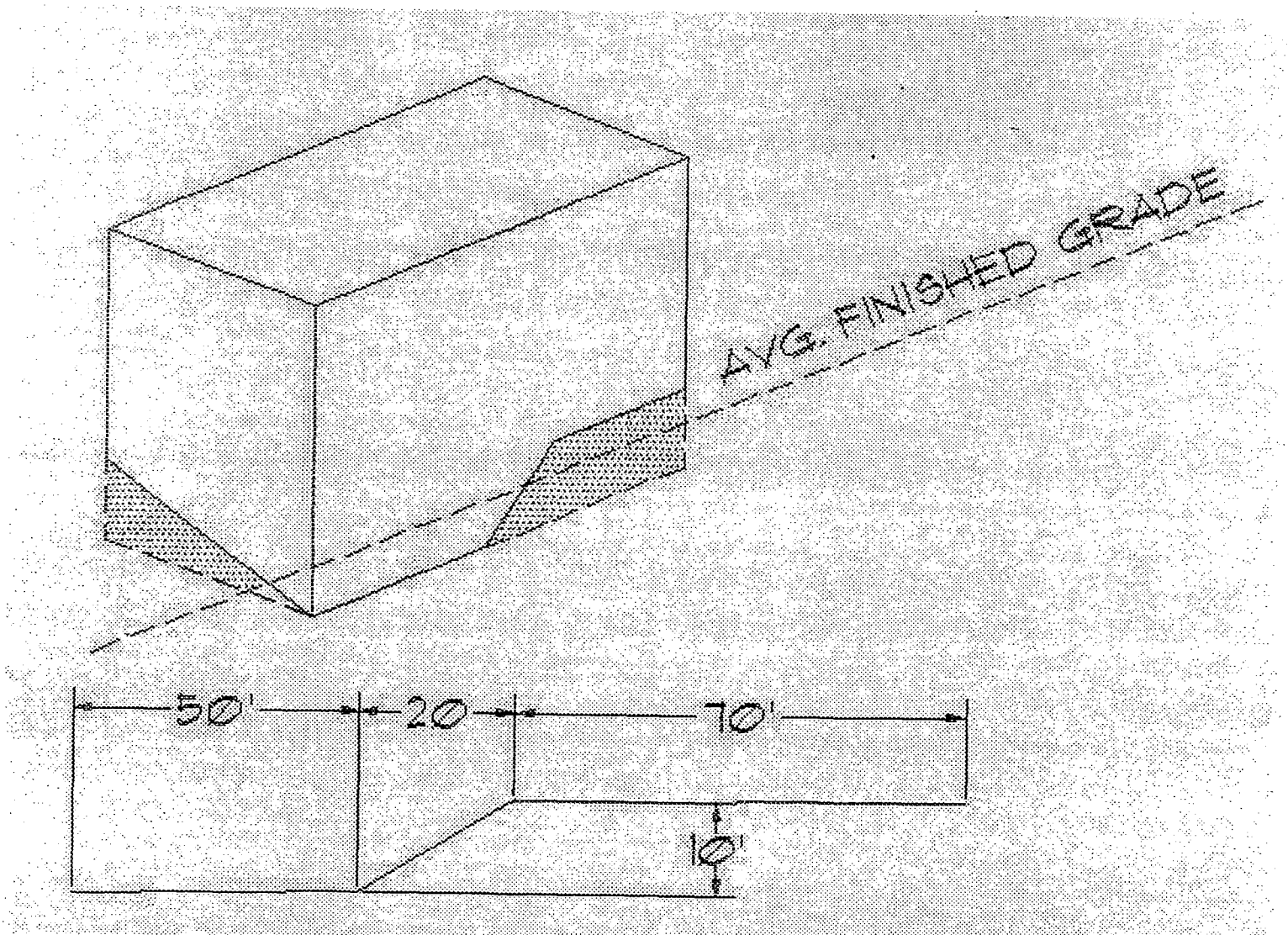


fig 1

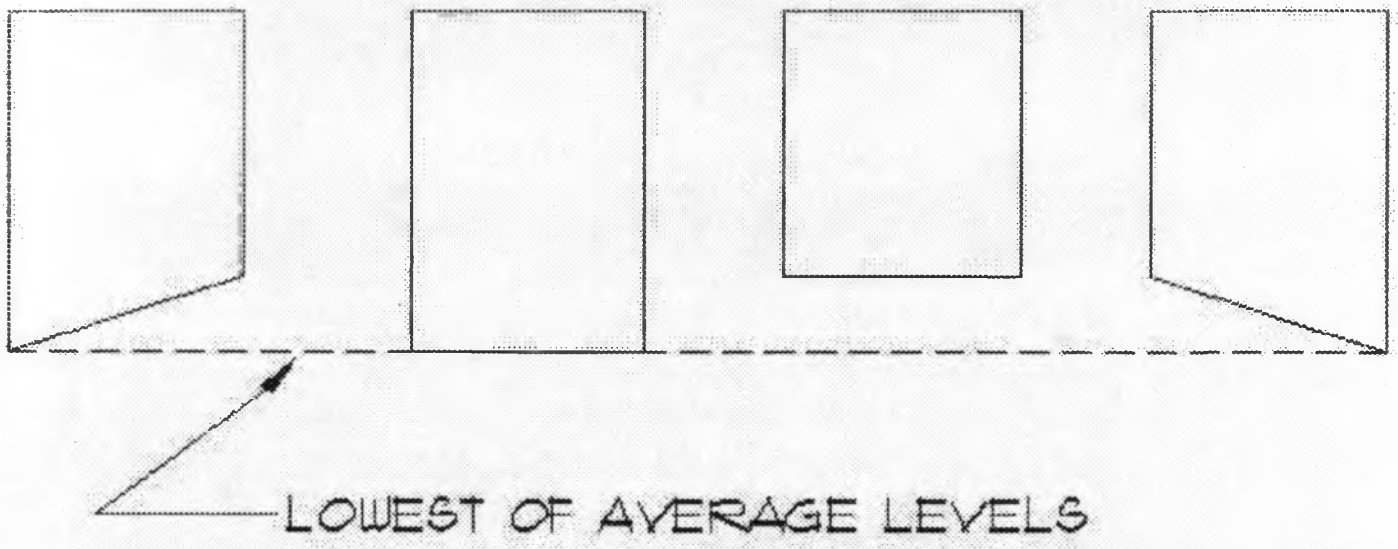
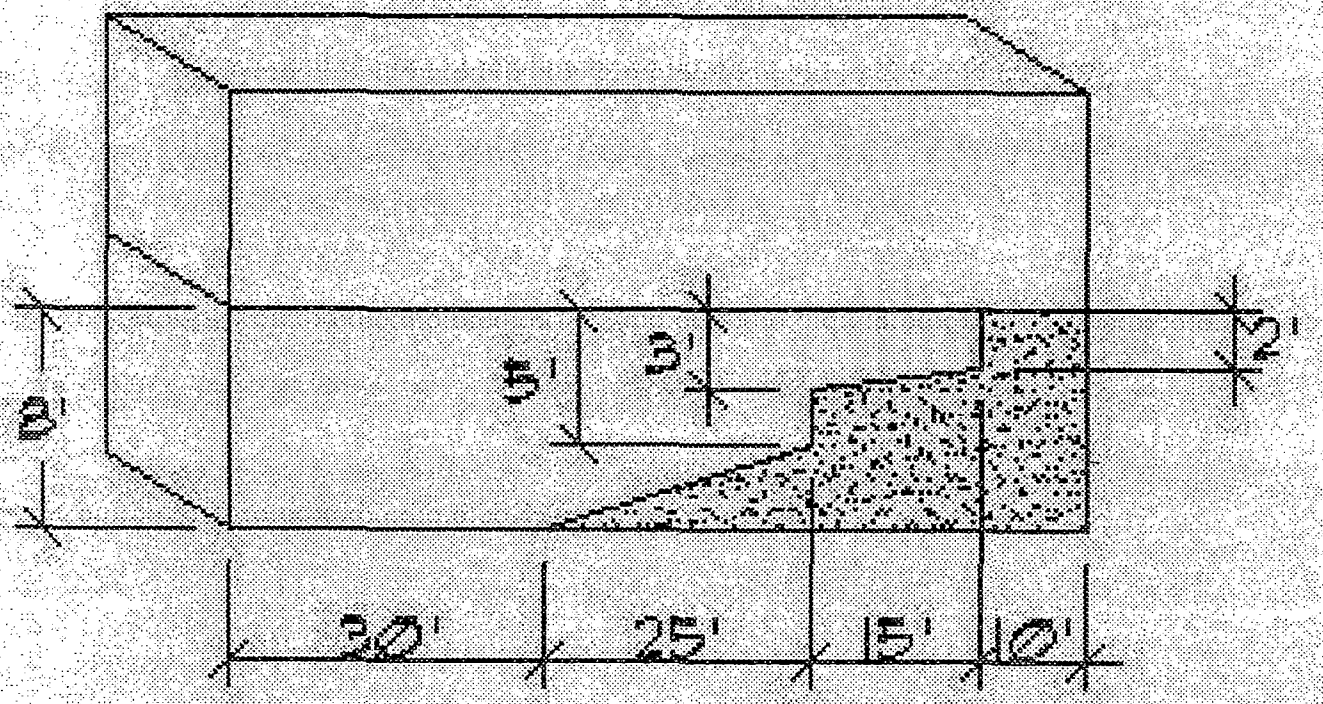


fig2



Straight Line Avg. = 8/2 = 4

Detailed Avg. =

10' x 0' = 0

+ 15 x $\frac{(2+3)}{2}$ = 15x2.5 = 37.5

+ 25x$\frac{(5+8)}{2}$ = 25x6.5 = 162.5

+ 30x8 = 240

440

AVERAGE HEIGHT OF FLOOR ABOVE FINISH GRADE = 440'/70 = 6.29'

fig 3

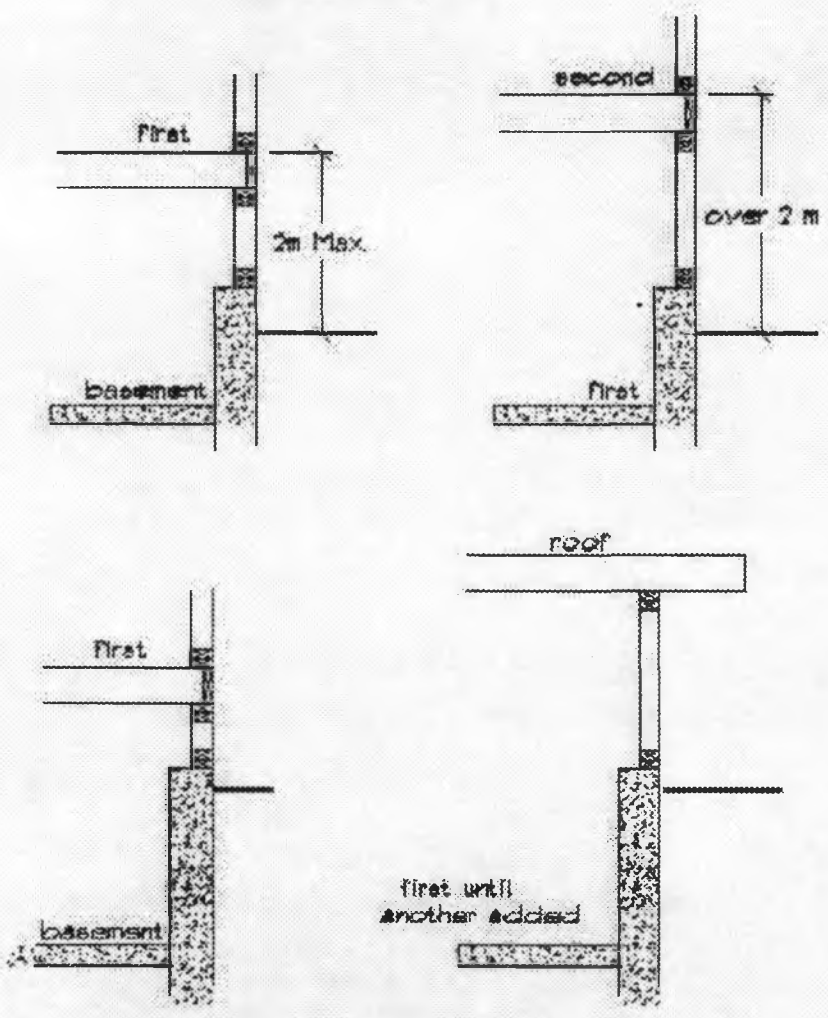
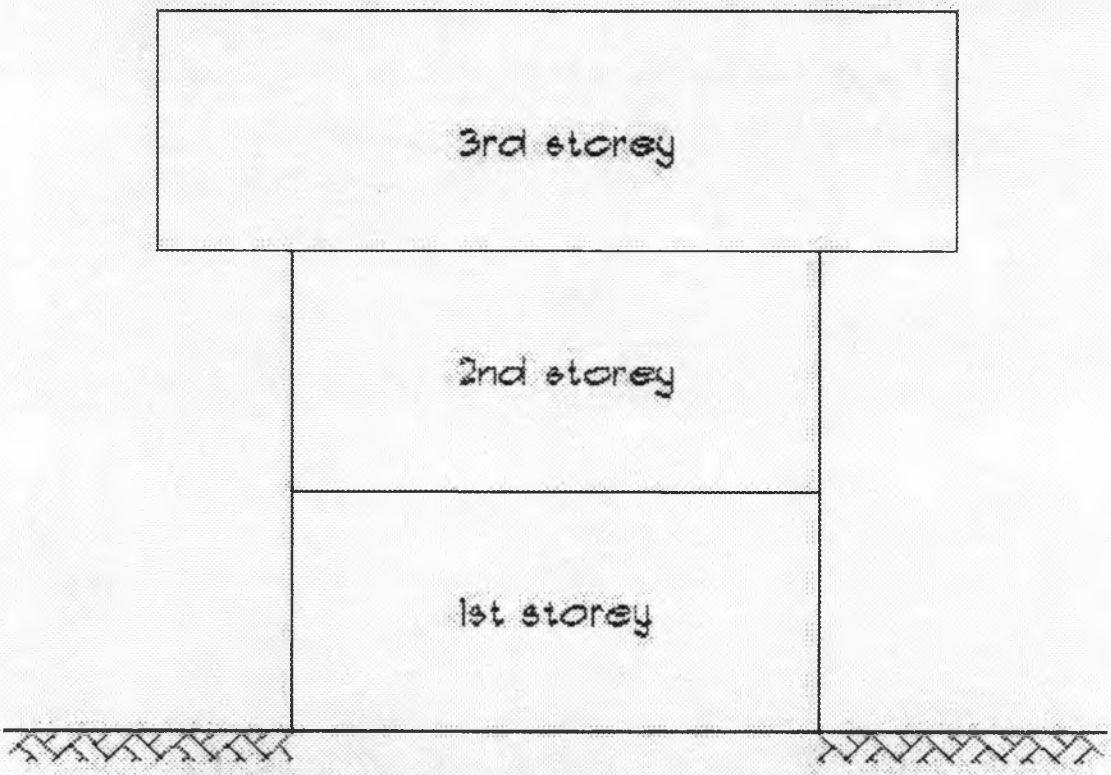

first
2m Max.
basement
second
over 2 m
first
first
basement
roof
first until
another added

fig4



Building area would be 3rd floor area.

fig6

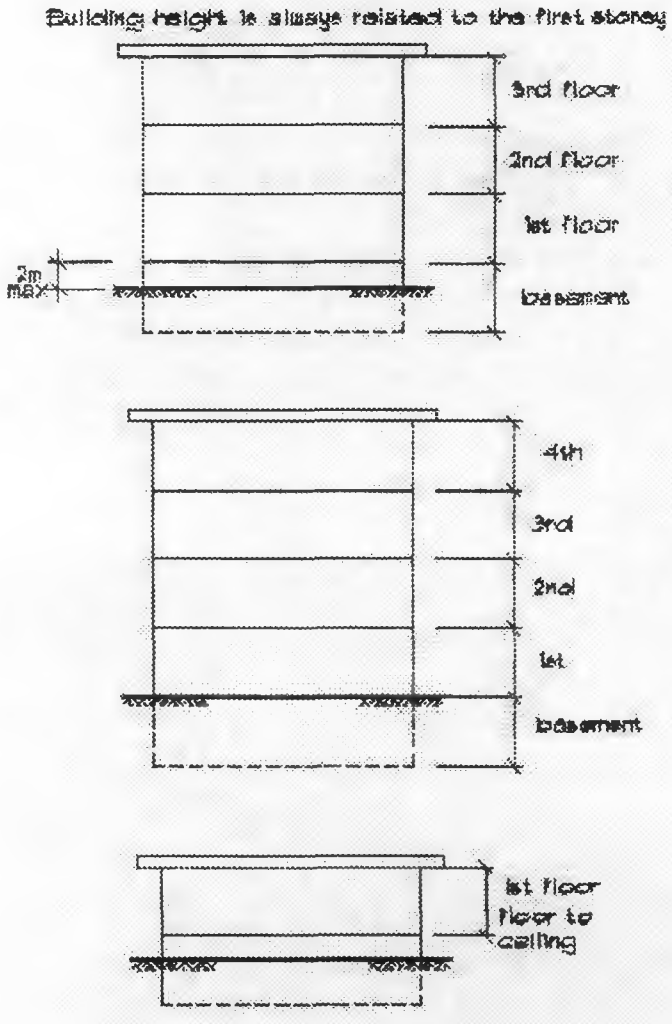

Building height is always related to the first storey
3rd floor
2nd floor
1st floor
basement
2m max
4th
3rd
2nd
1st
basement
1st floor floor to ceiling

fig 7

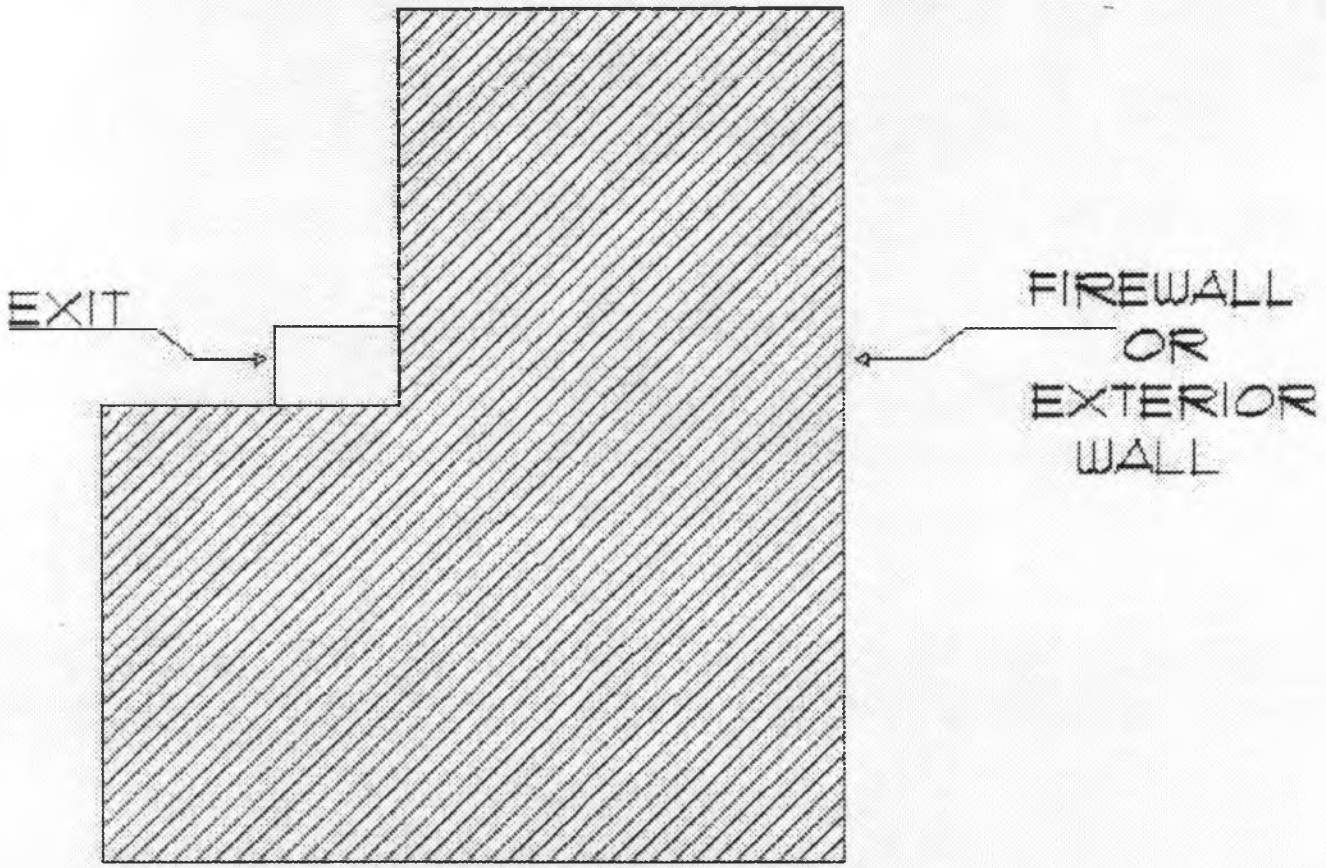


fig 8

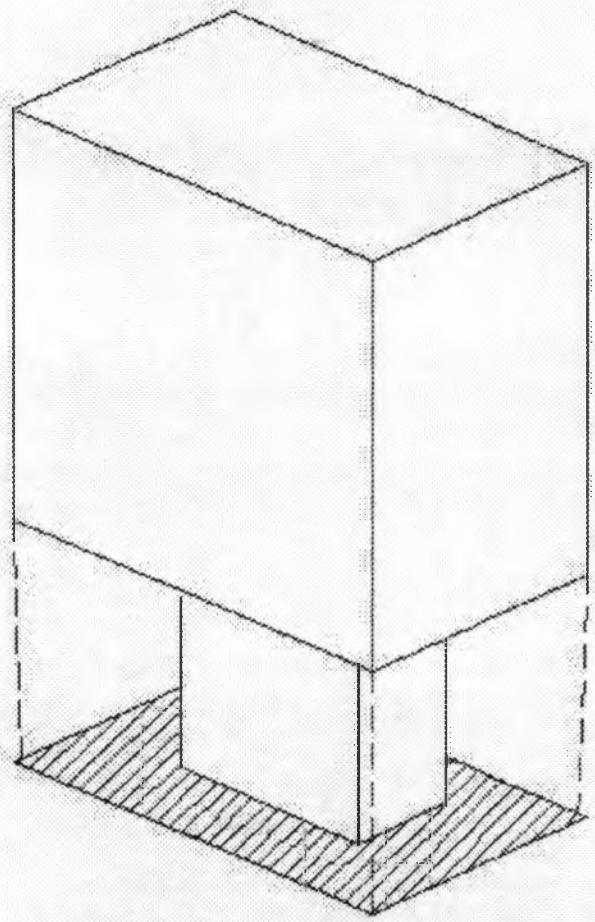


Fig 9

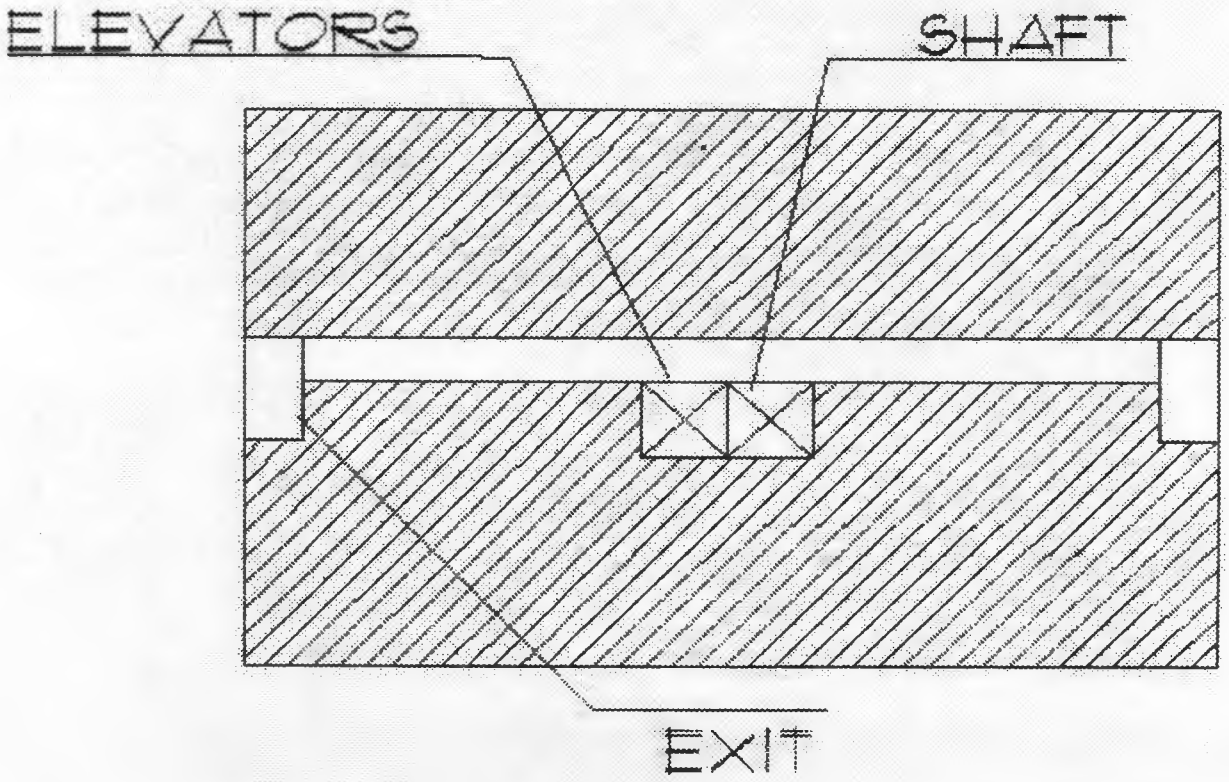


fig 10

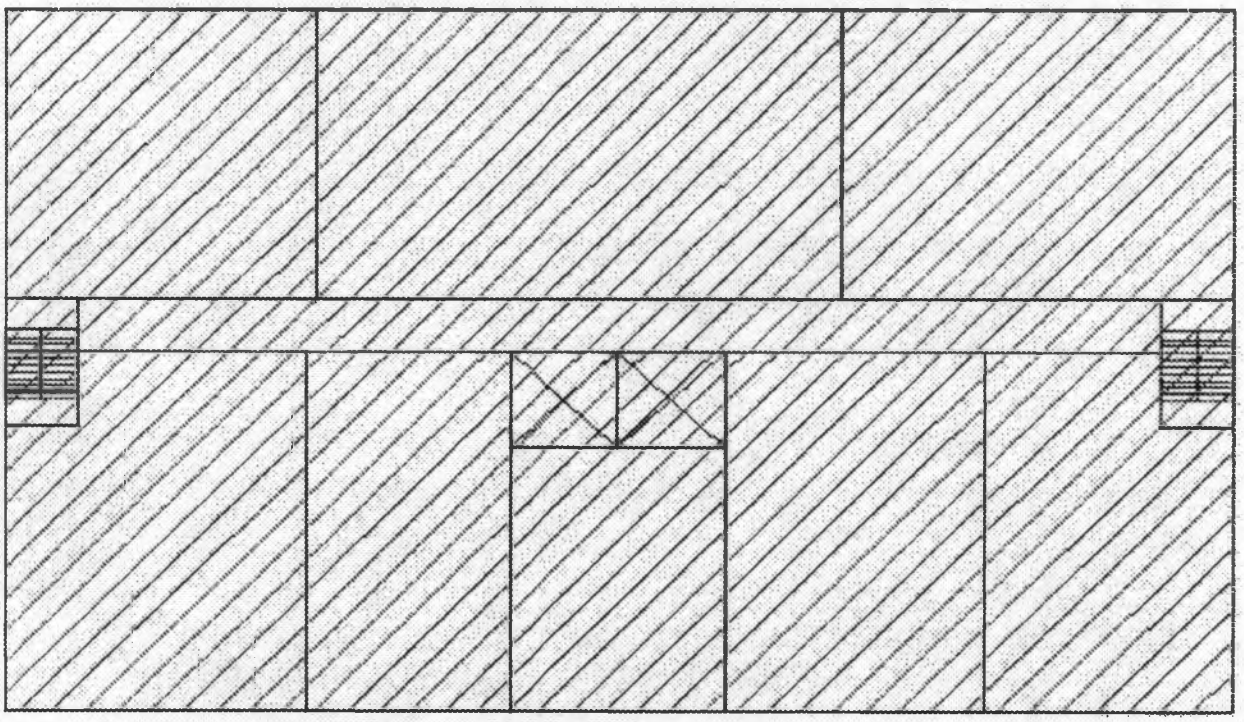


Fig 12

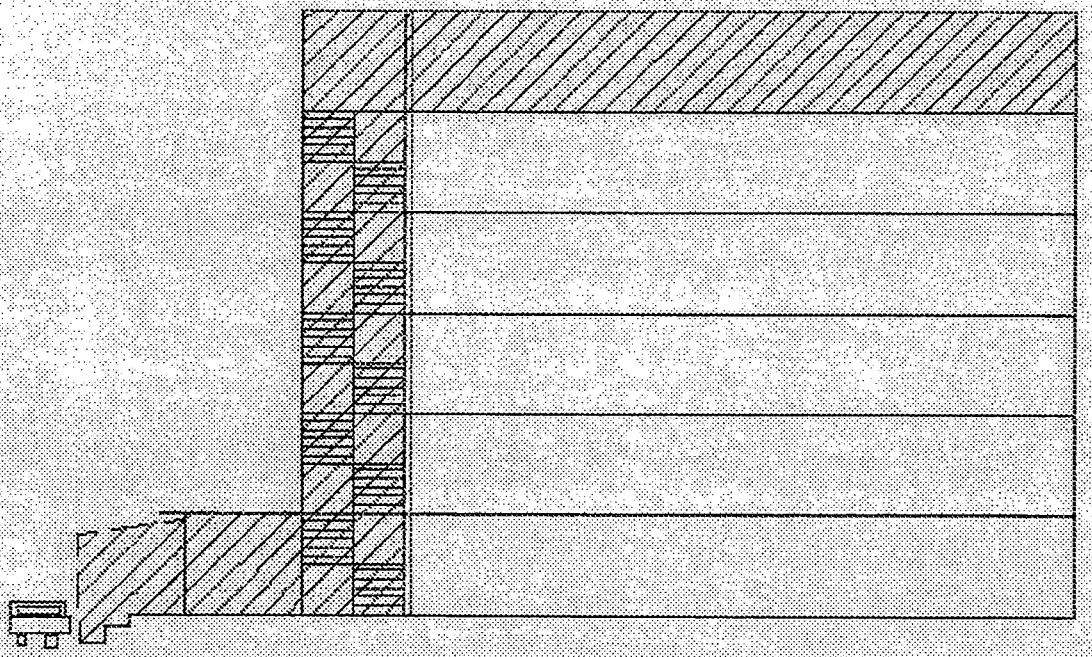


fig 12

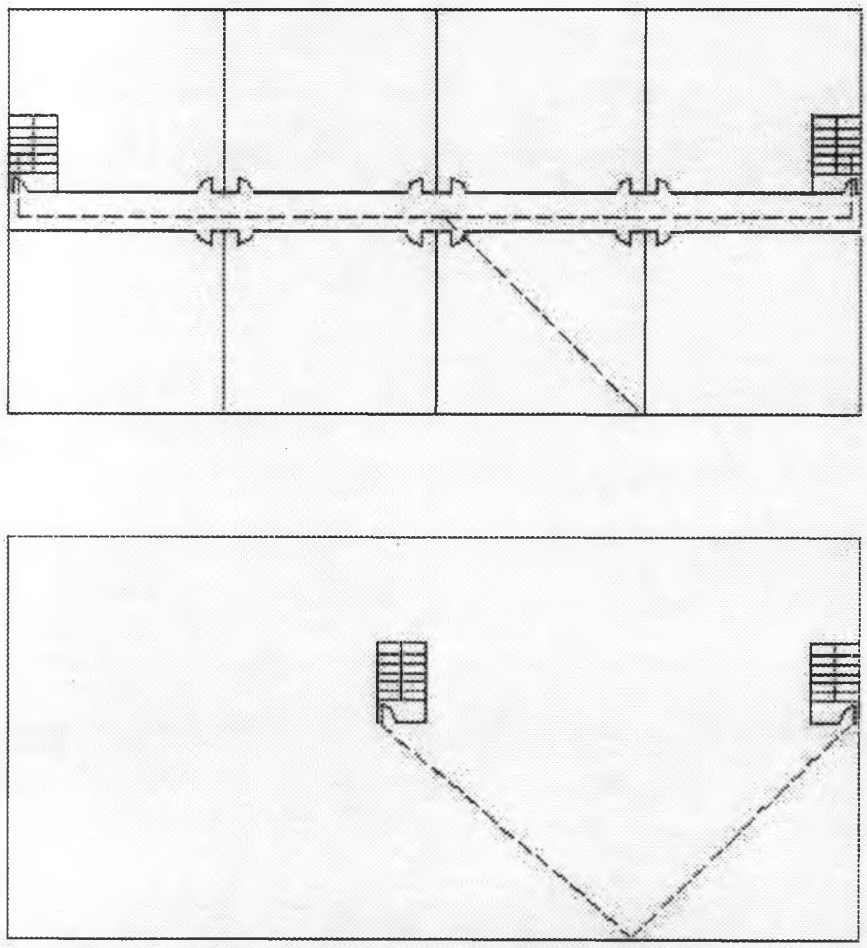
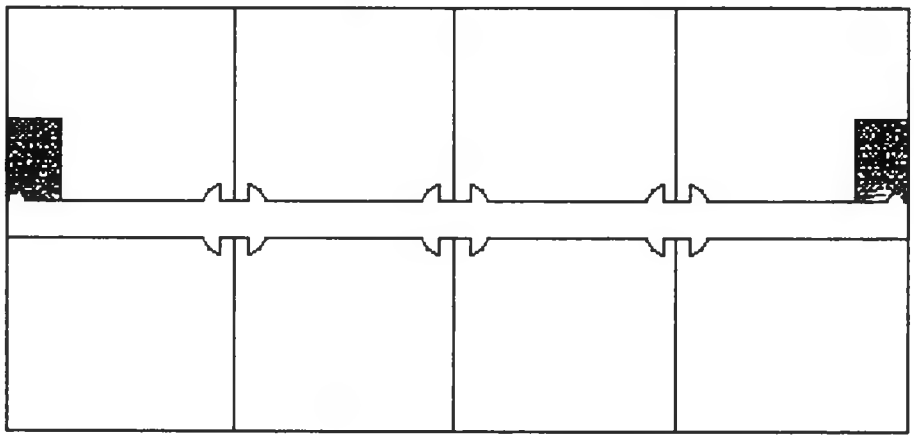


fig 1A 3

exit



An exit is a path of travel which leads from a floor area to an open public thoroughfare.

fig 4

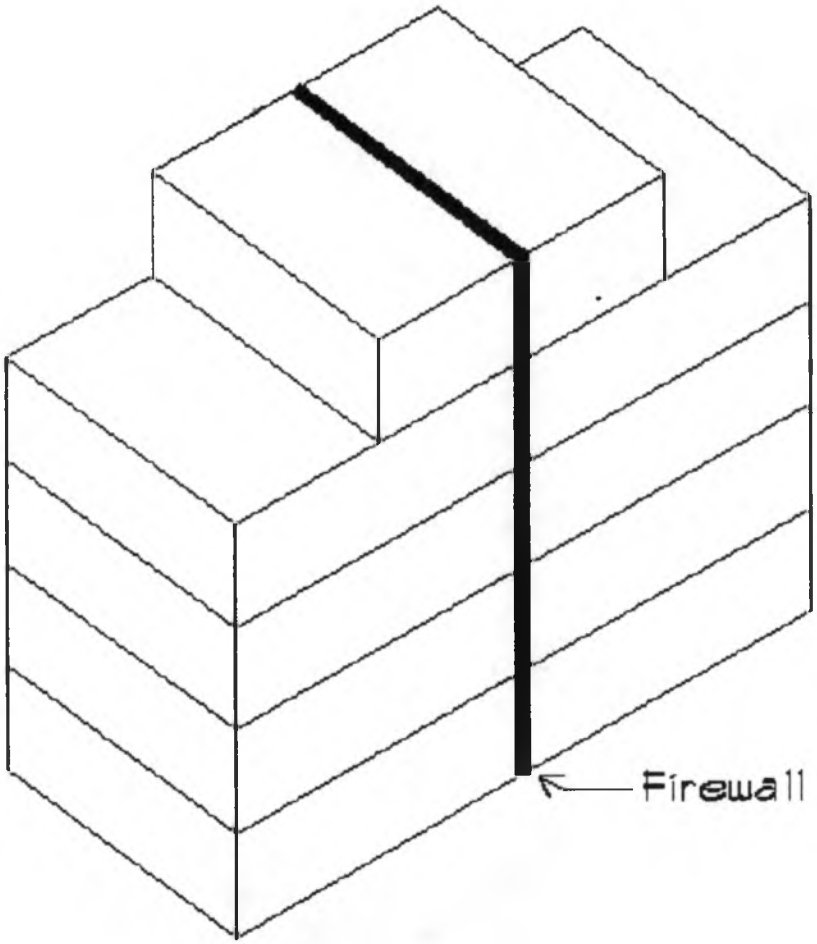


fig 15

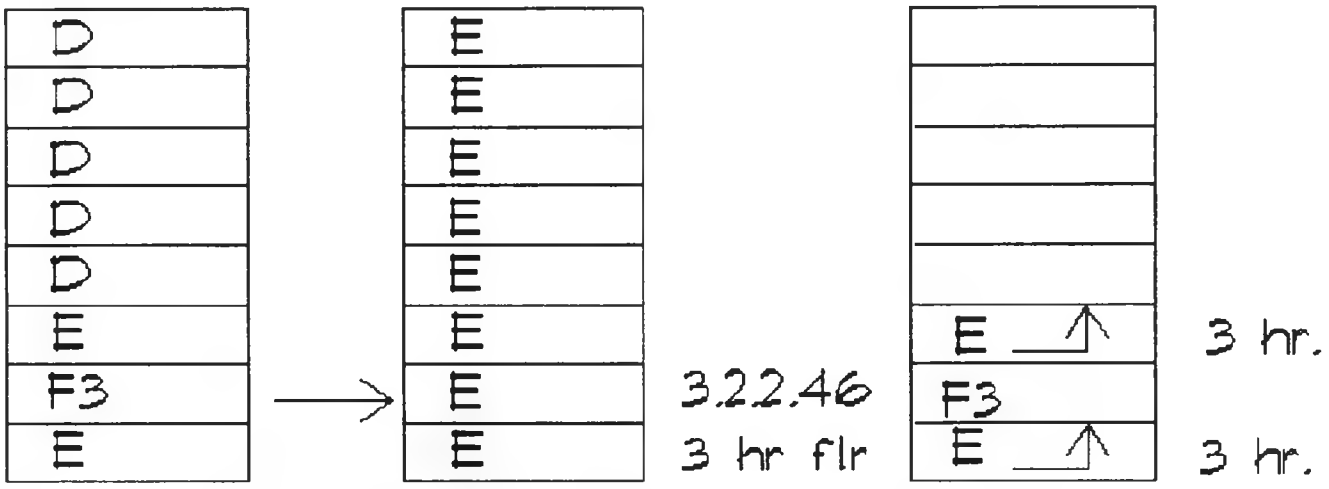


fig 16

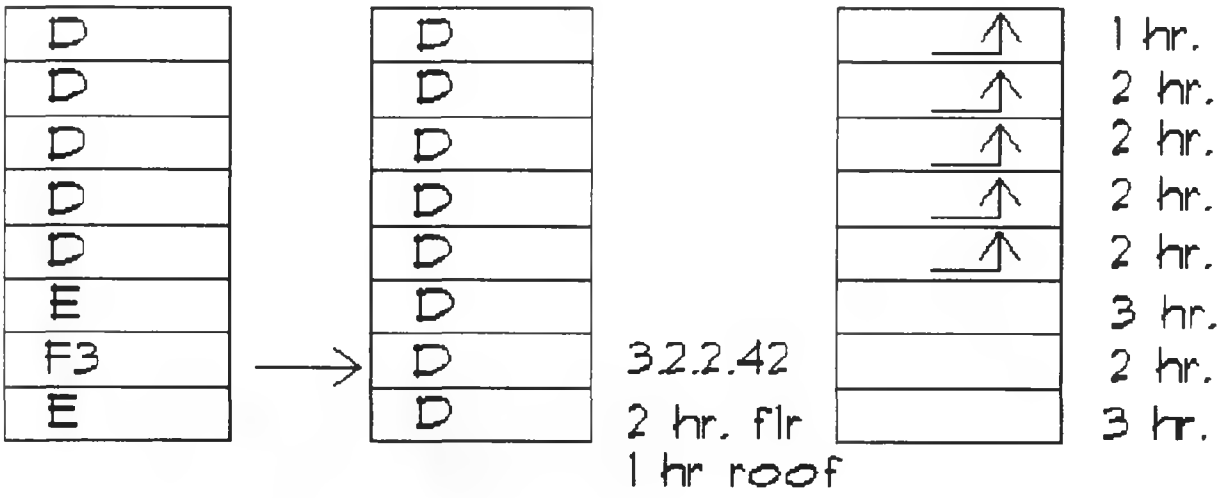

D
D
D
D
D
E
F3
E
D
D
D
D
D
D
D
D
32.2.42
2 hr. flr
1 hr roof
1 hr.
2 hr.
2 hr.
2 hr.
2 hr.
3 hr.
2 hr.
3 hr.

fig 17

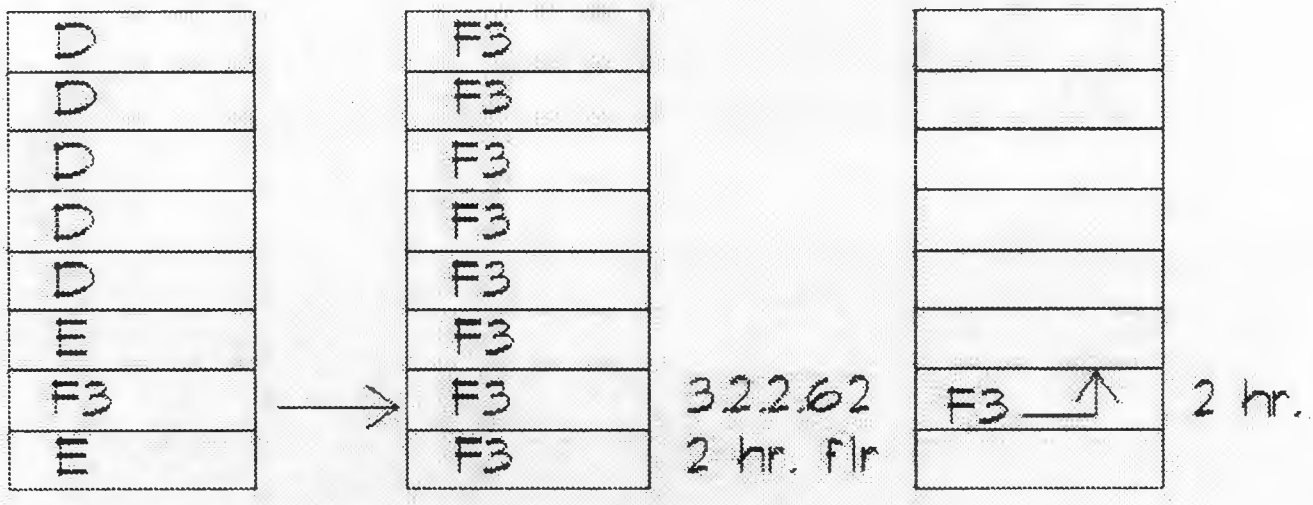


fig 18

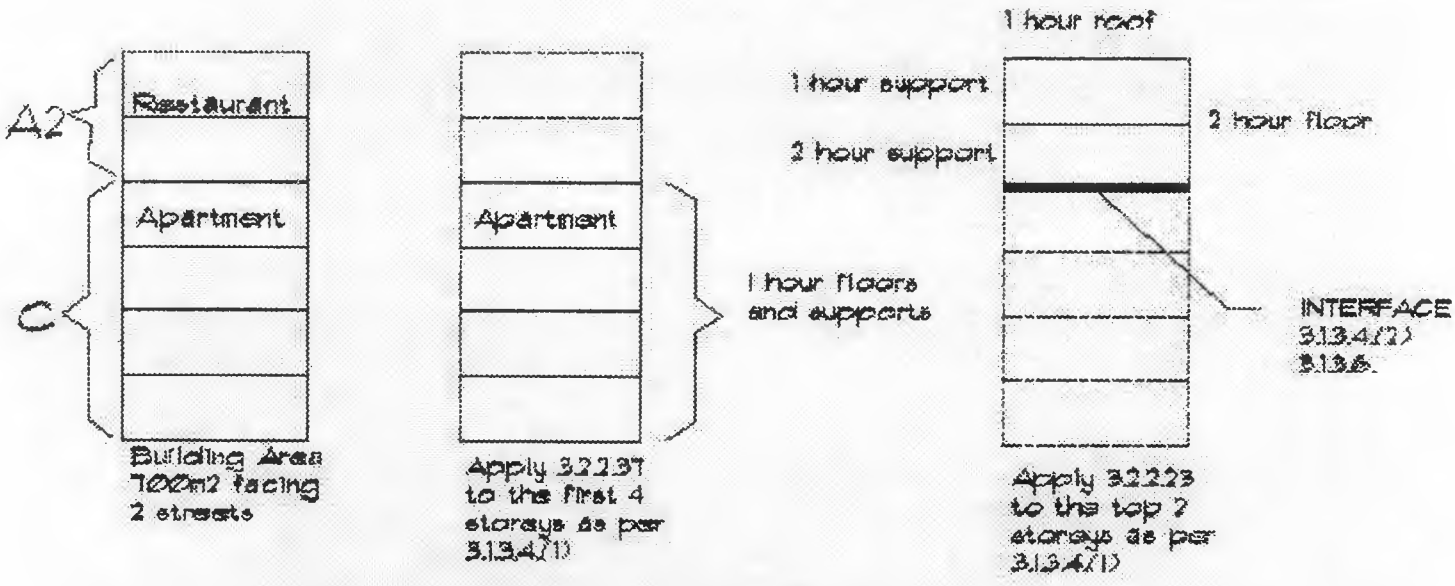

A2
C
Restaurant
Apartment
Building Area
700m2 facing
2 streets
Apartment
1 hour floors
and supports
Apply 3.2.2.3.7
to the first 4
storeys as per
3.1.3.4.(1)
1 hour roof
1 hour support
2 hour support
2 hour floor
INTERFACE
3.1.3.4.(2)
3.1.3.6.
Apply 3.2.2.23
to the top 2
storeys as per
3.1.3.4.(1)

fig 19

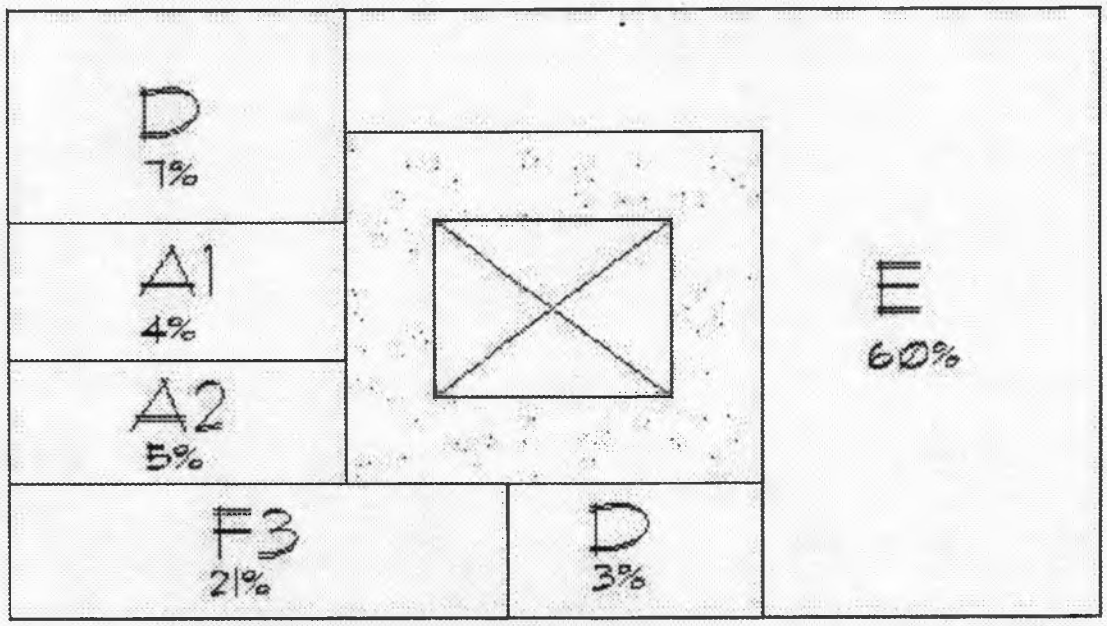


fig 20

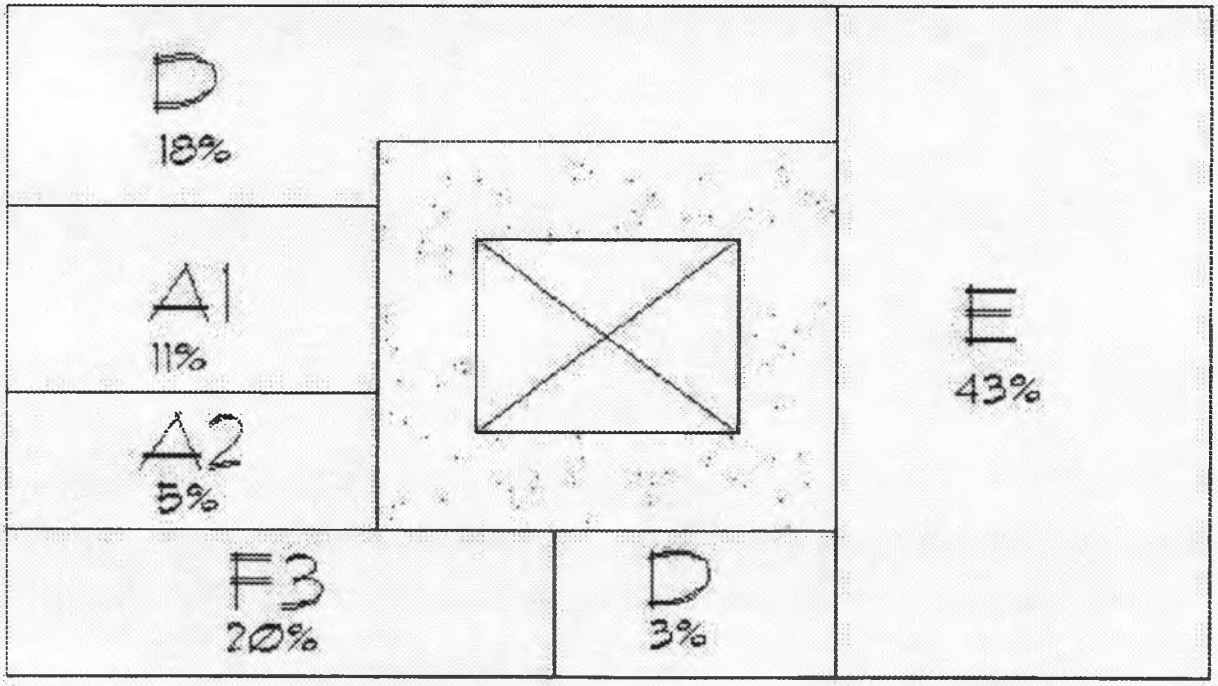
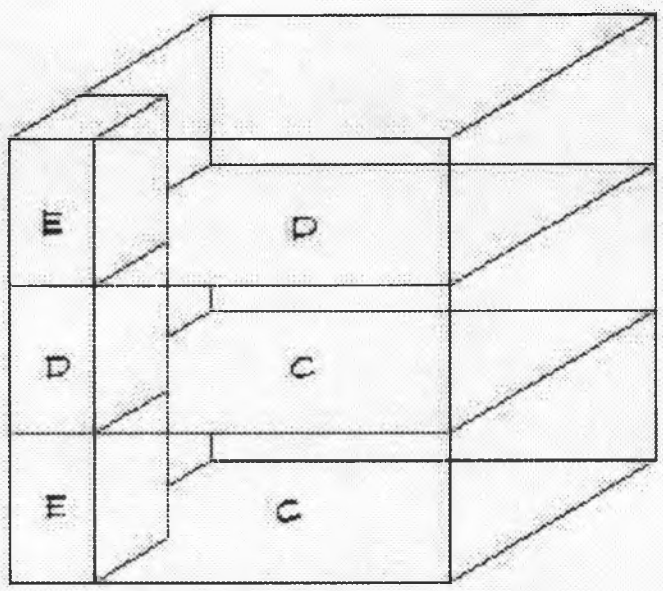


fig 21

Total Area of group or division does not exceed 10% of the storey.



This simply permits a small area for another occupancy, without requiring the structural frame of the building on that storey being upgraded to comply with the requirments for that major occupancy.

NOTE: 3.1.3.5. does not waive the required fire separations, i.e. between C and D or C and E.

fig22

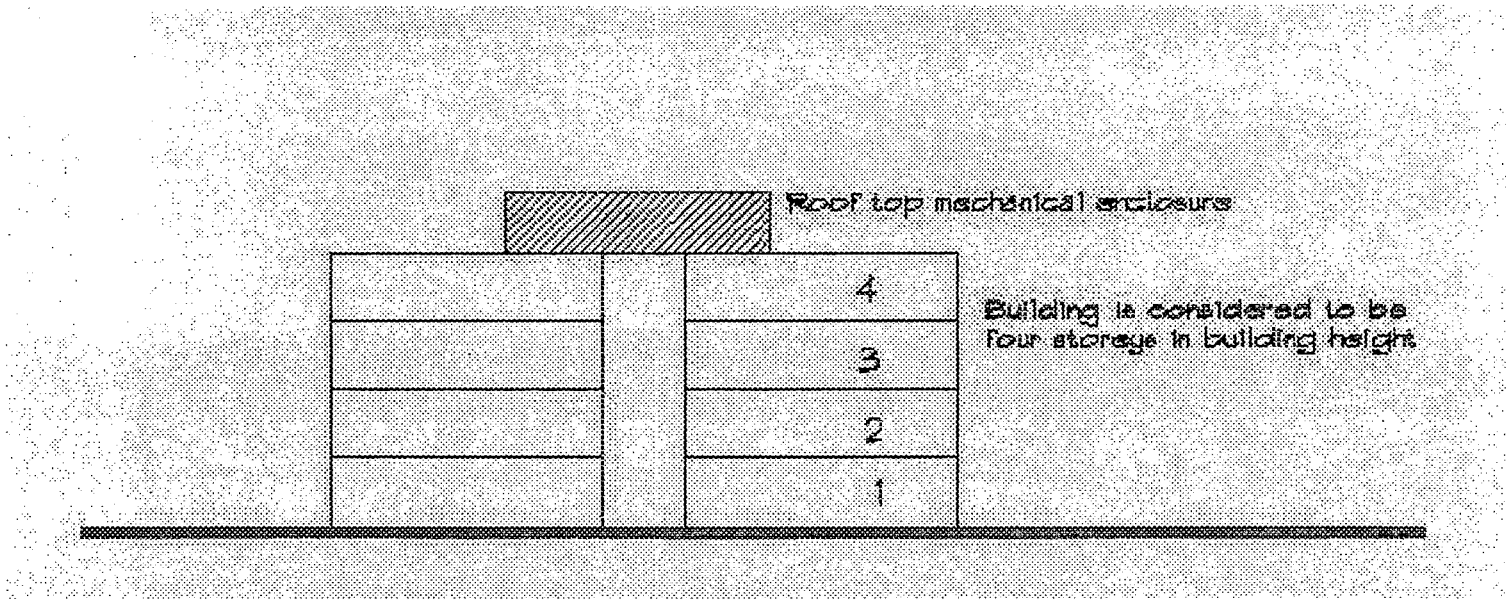

Roof top mechanical enclosure
4
3
2
1
Building is considered to be four storeys in building height

fig 23

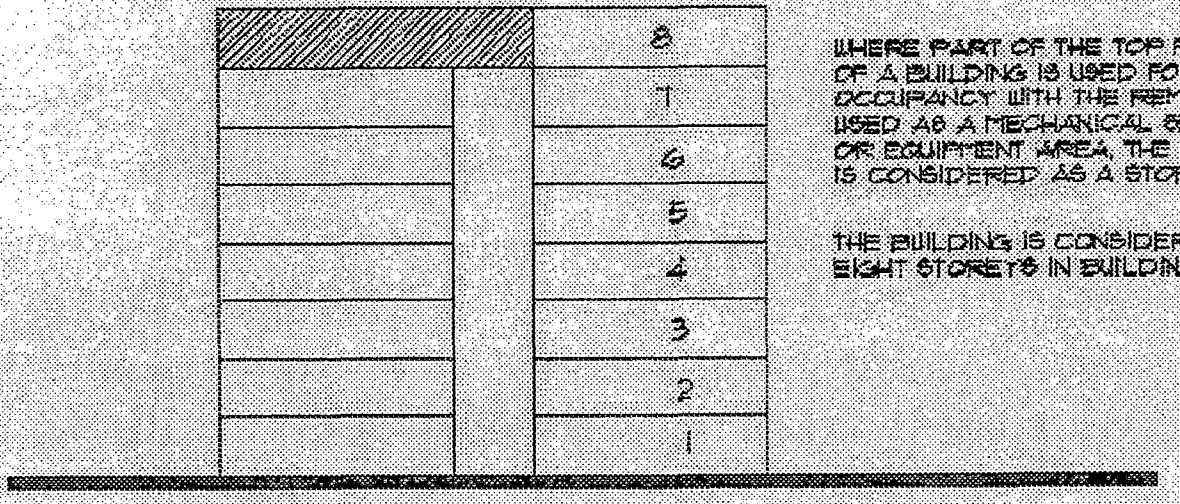

8
7
6
5
4
3
2
1
WHERE PART OF THE TOP FLOOR OF A BUILDING IS USED FOR ANY OCCUPANCY WITH THE REMAINDER USED AS A MECHANICAL SERVICE OR EQUIPMENT AREA, THE FLOOR IS CONSIDERED AS A STOREY
THE BUILDING IS CONSIDERED TO BE EIGHT STOREYS IN BUILDING HEIGHT

fig 24

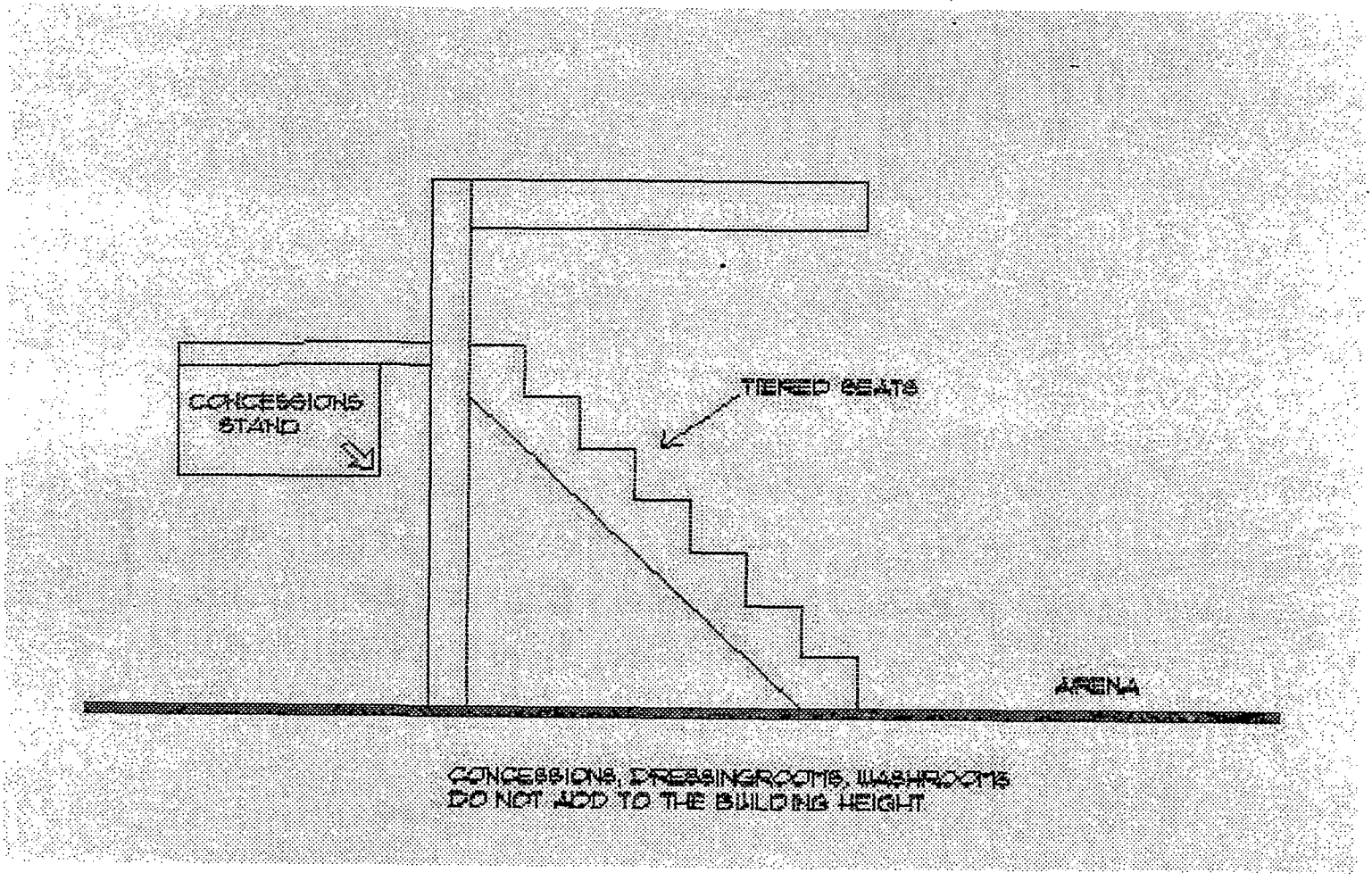

CONCESSIONS STAND
TIERED SEATS
ARENA
CONCESSIONS, DRESSINGROOMS, WASHROOMS
DO NOT ADD TO THE BUILDING HEIGHT

fig 25

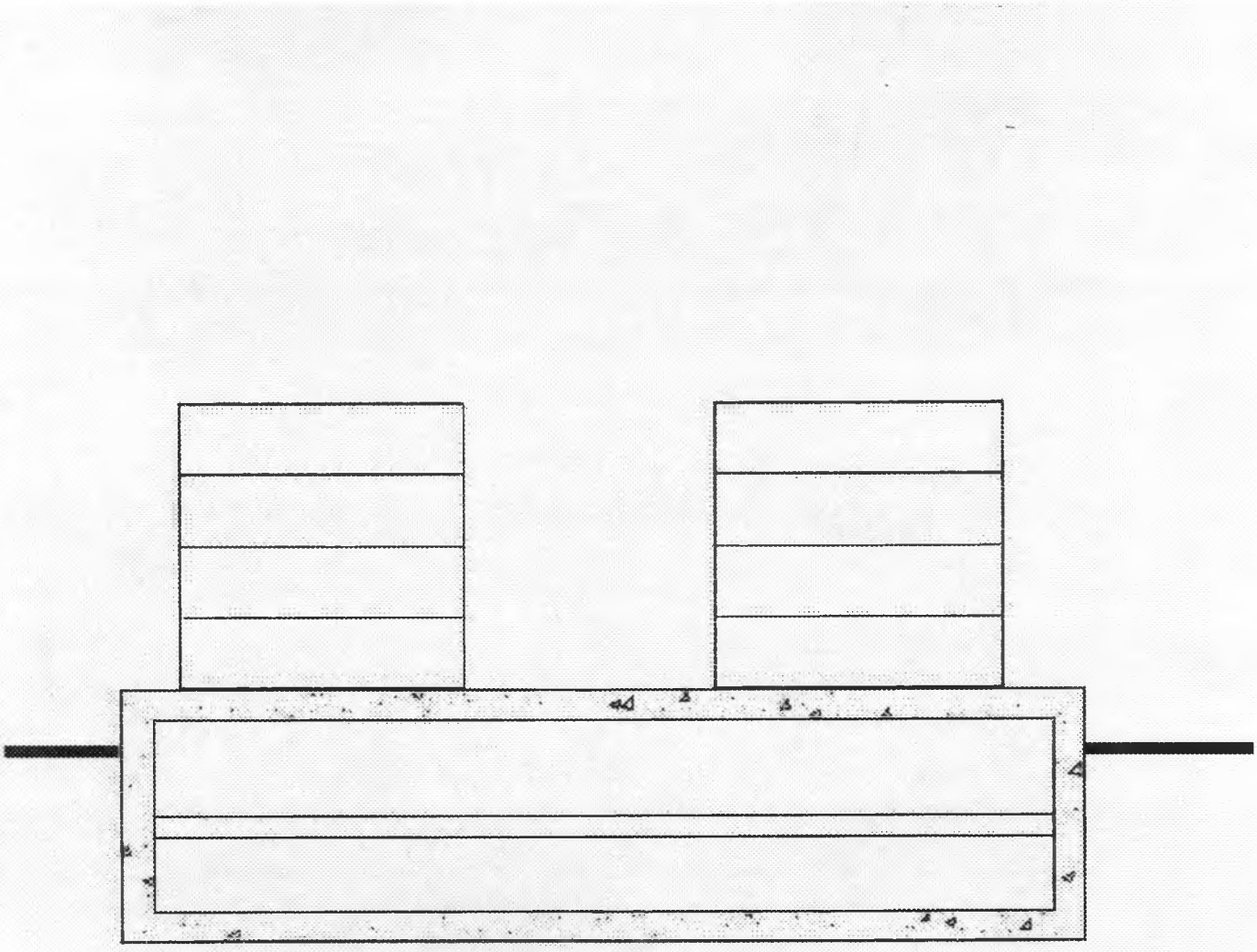


fig26

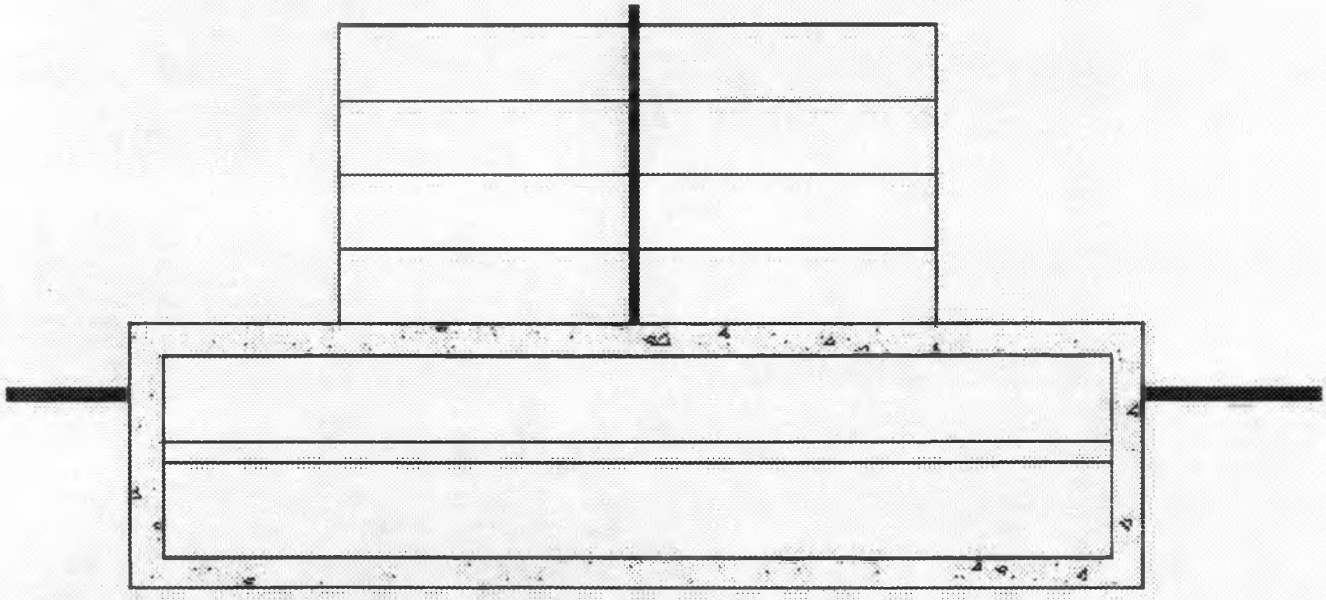
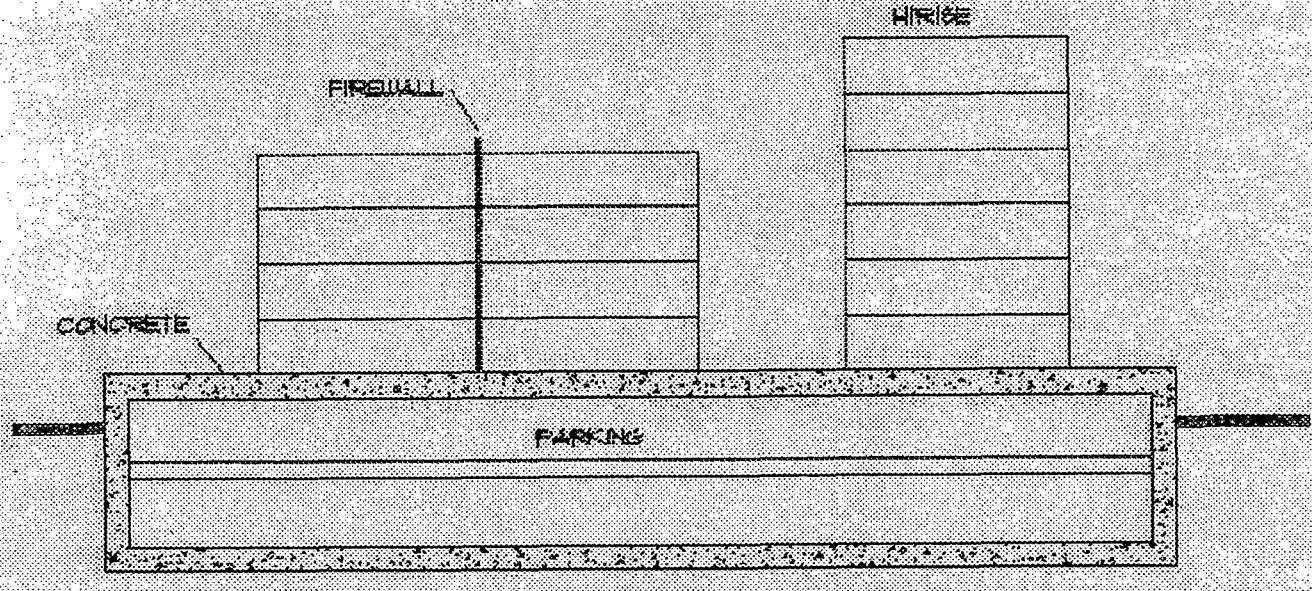
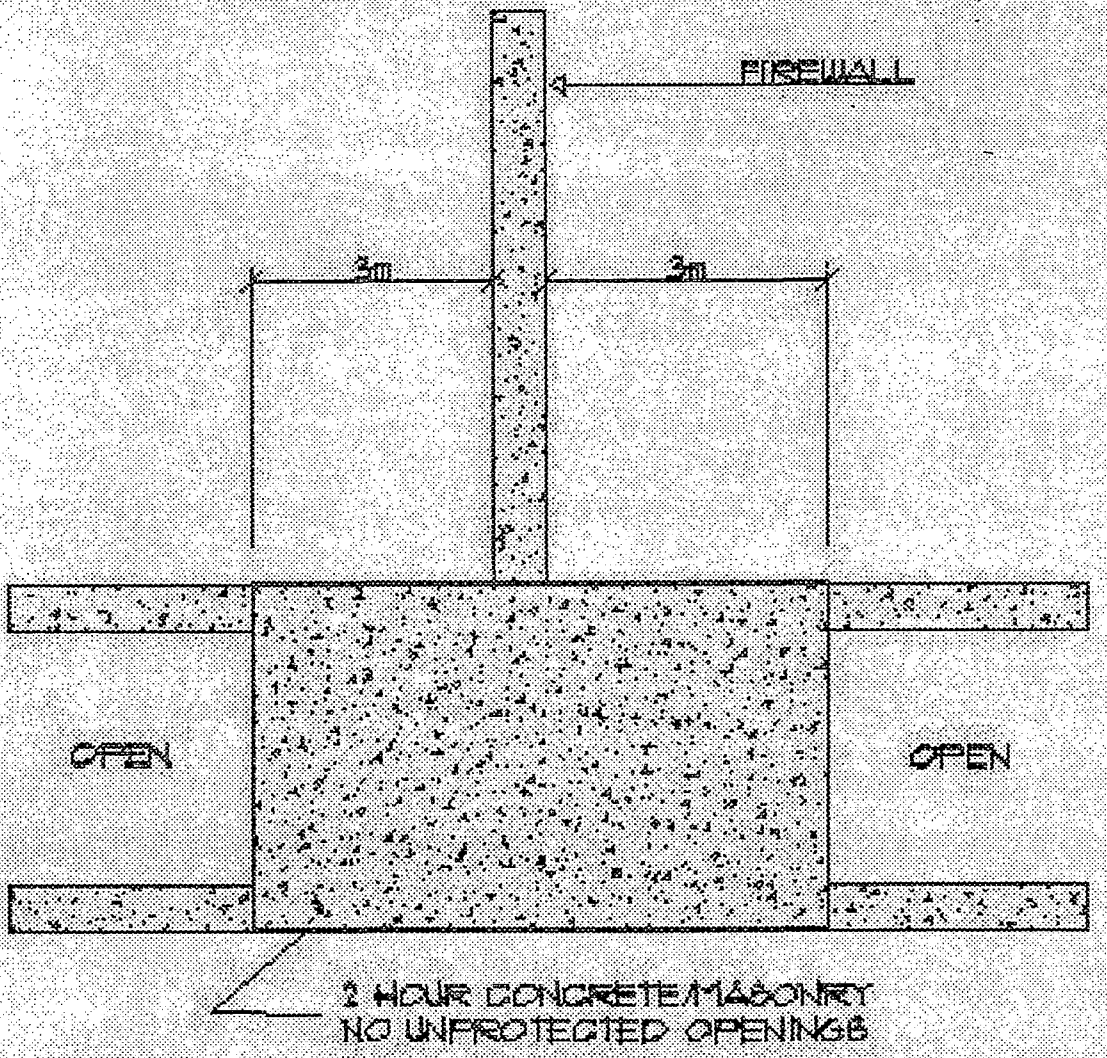


fig27



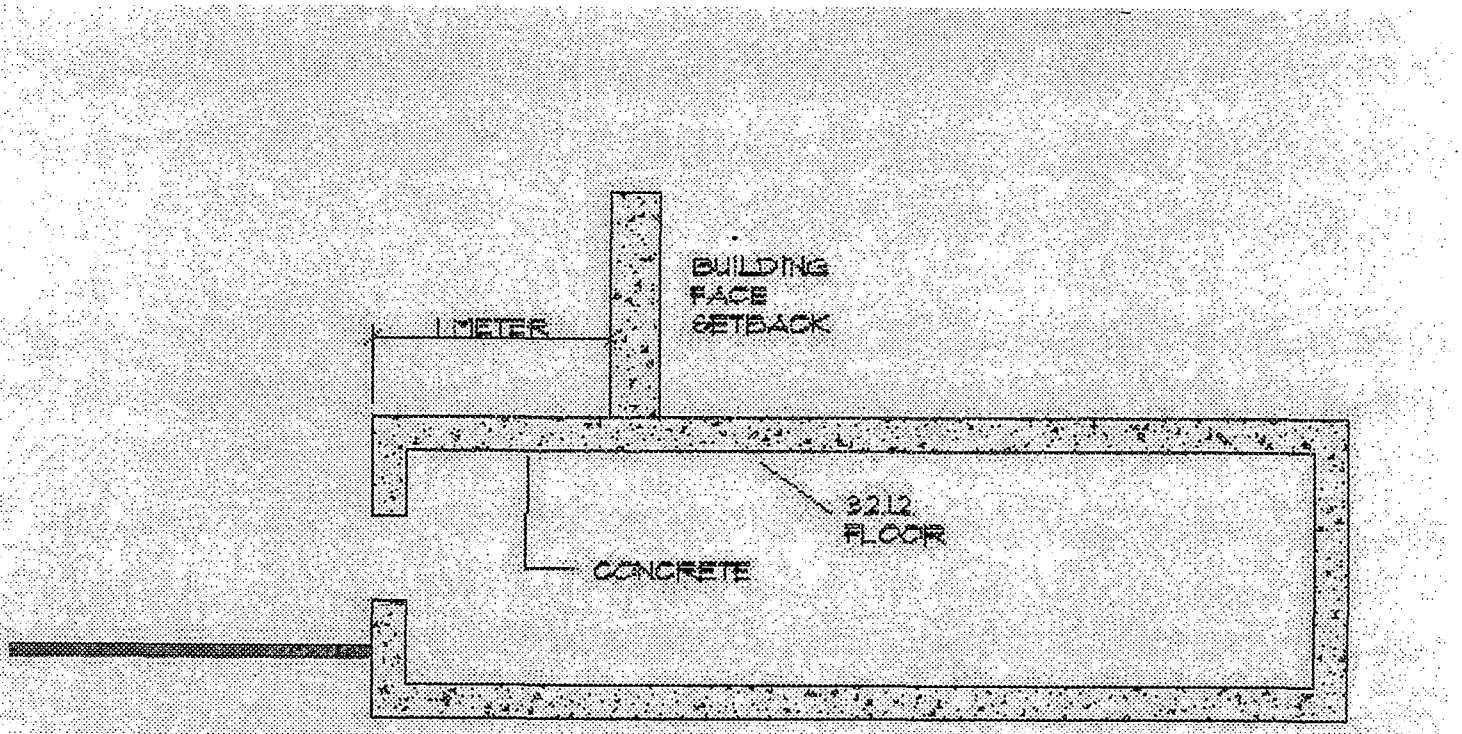
CONSIDERED AS SEPARATE BUILDINGS FOR THE PURPOSE OF:
- 322 CONSTRUCTION
- 324 FIRE ALARM
- 326 HIGH RISE

fig28



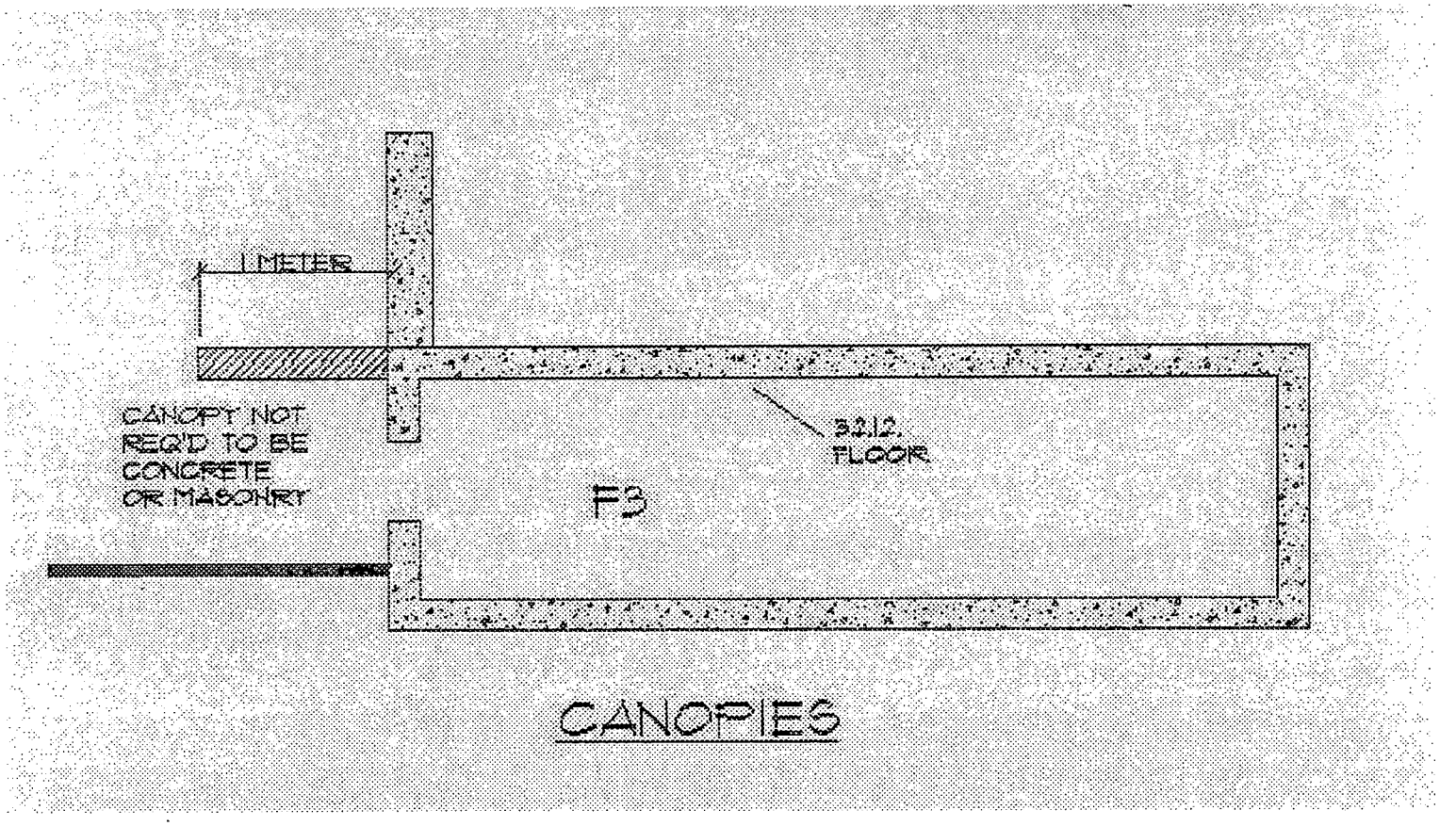
ELEVATION

Fig 29



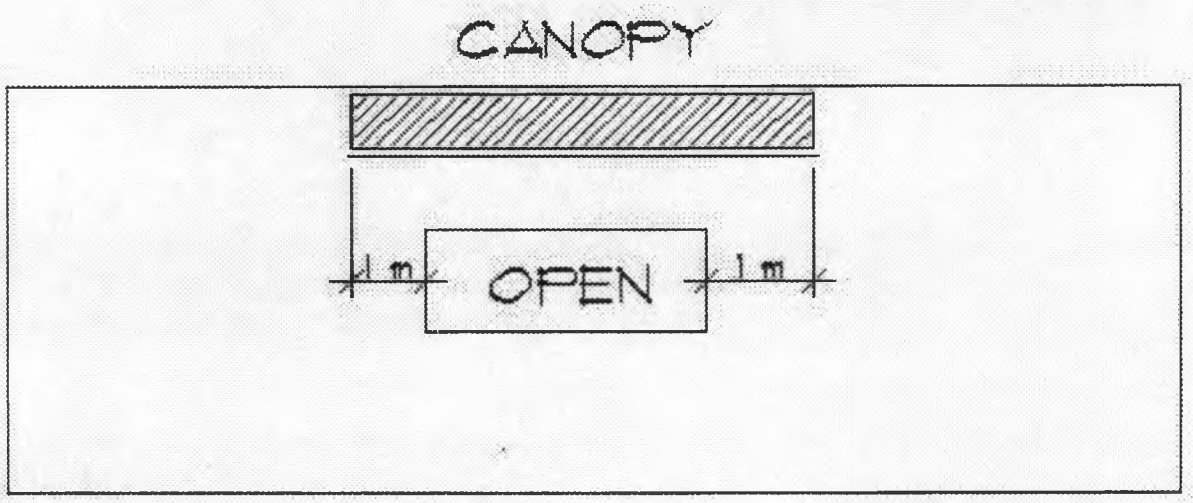
SETBACKS

fig 30a



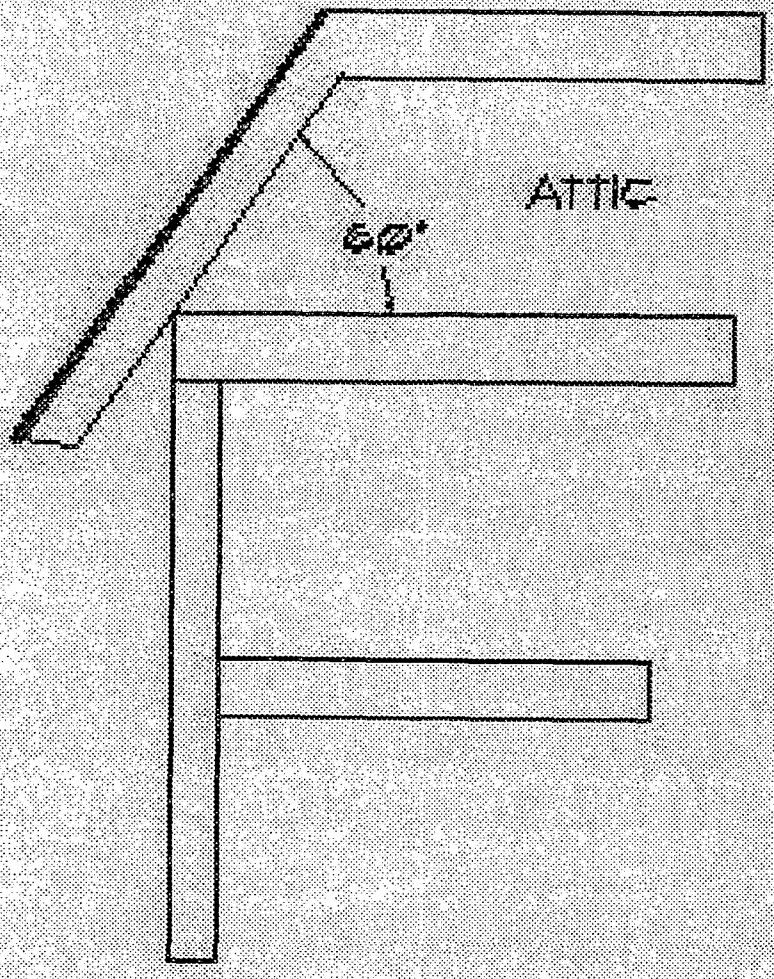
CANOPIES

fig 30b



ELEVATION

fig 30c



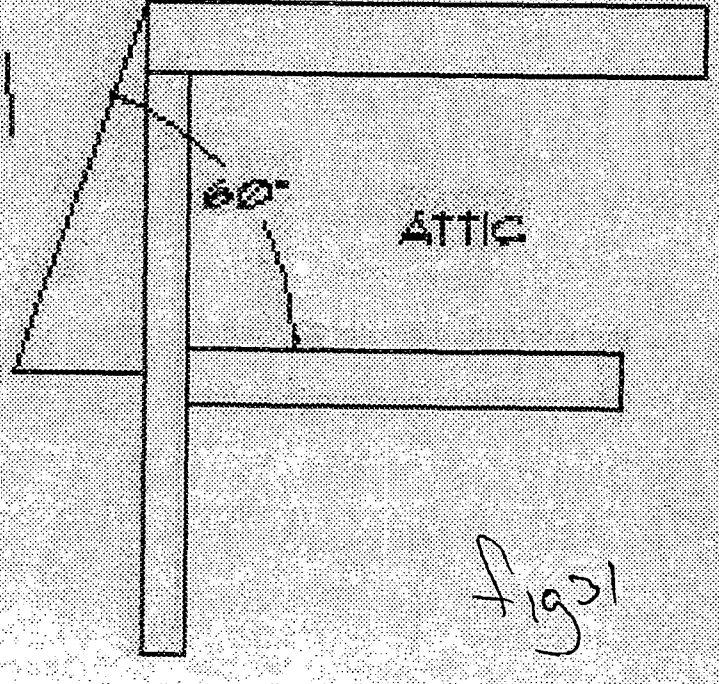


Fig 31

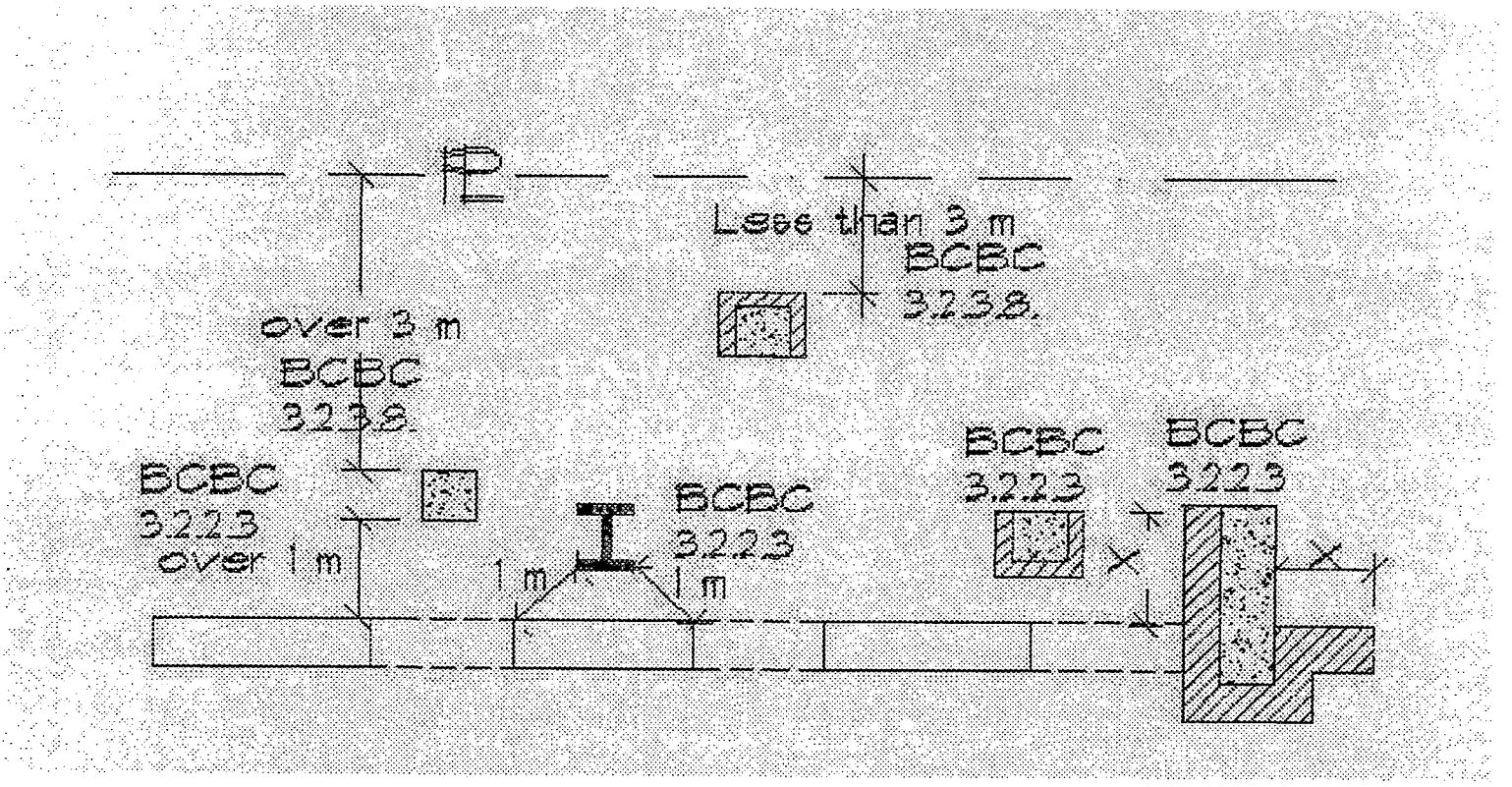
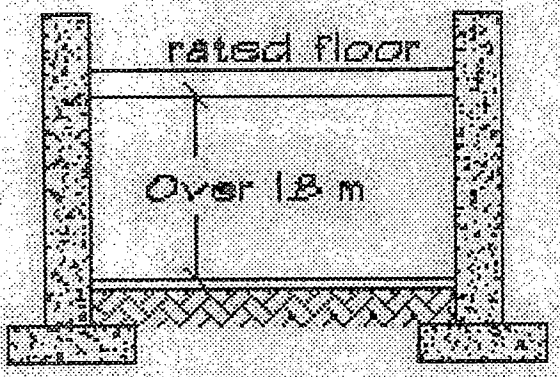
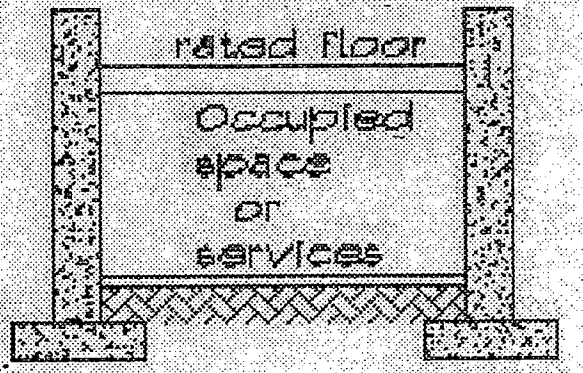

PL
over 3 m
BCBC
3238.
Less than 3 m
BCBC
3238.
BCBC
3223
over 1 m
1 m
BCBC
3223
1 m
BCBC
3223
BCBC
3223
X
X
X

fig32

A crawl space must be considered as a basement subject to the requirements of BCBC 3214. & 3215 if:





A crawl space which is not considered as a basement is not required to have the floor assembly directly above it constructed as a fire separation, or have a fire resistance rating

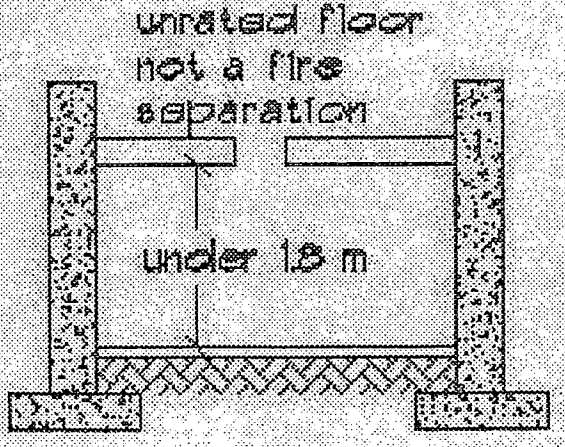


fig33

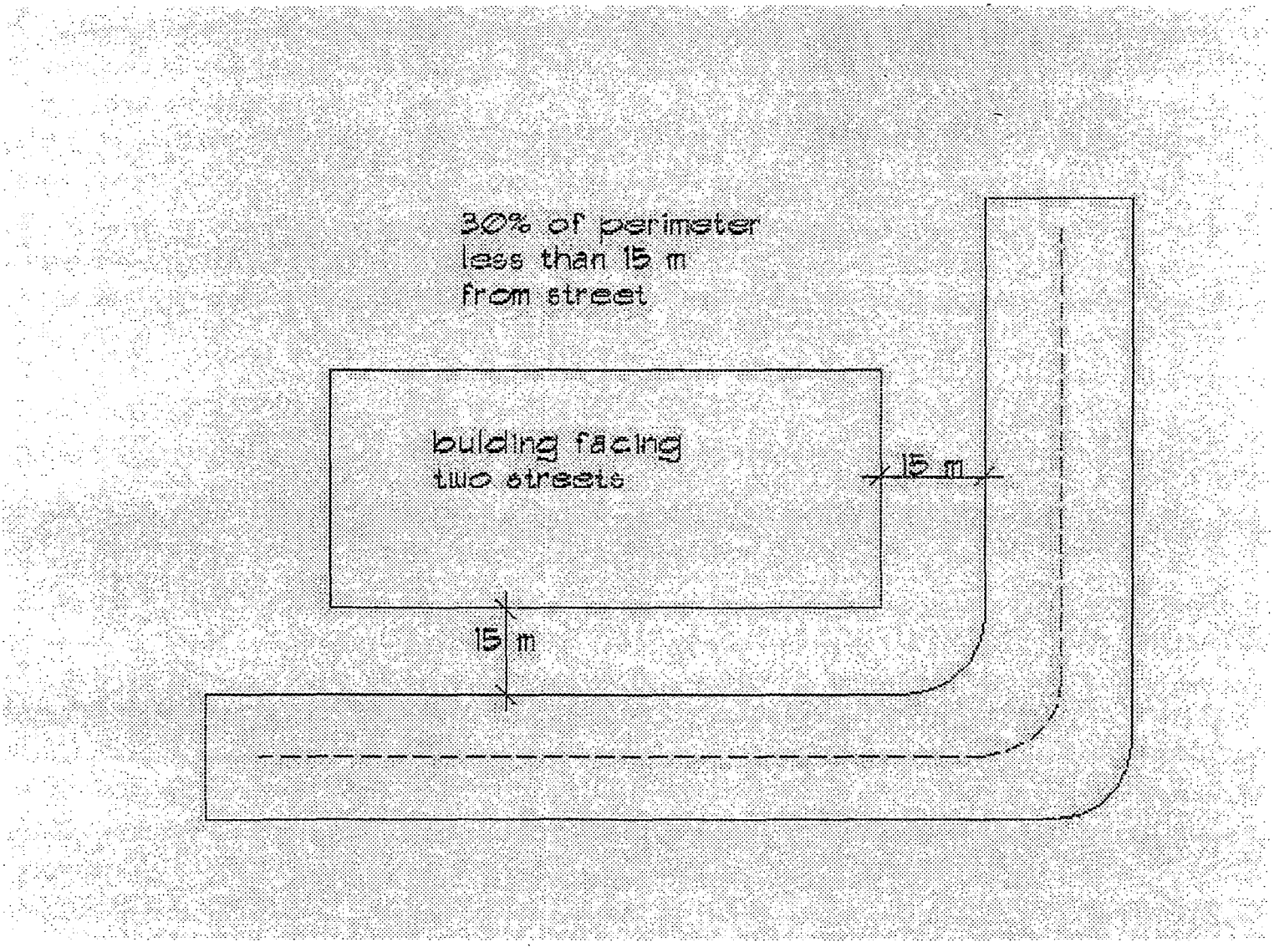

30% of perimeter
less than 15 m
from street
buiding facing
two streets
15 m
15 m

fig 34a

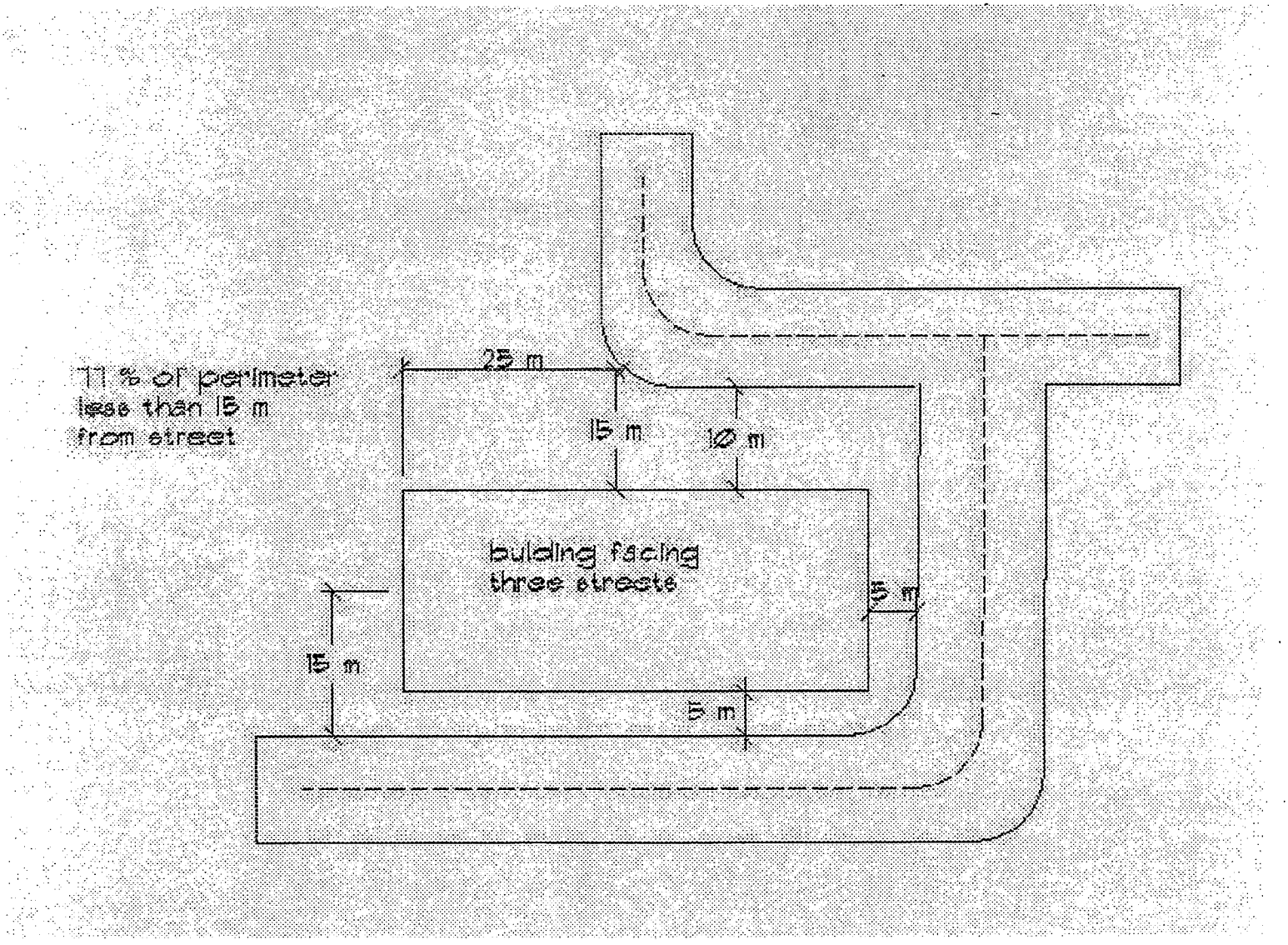
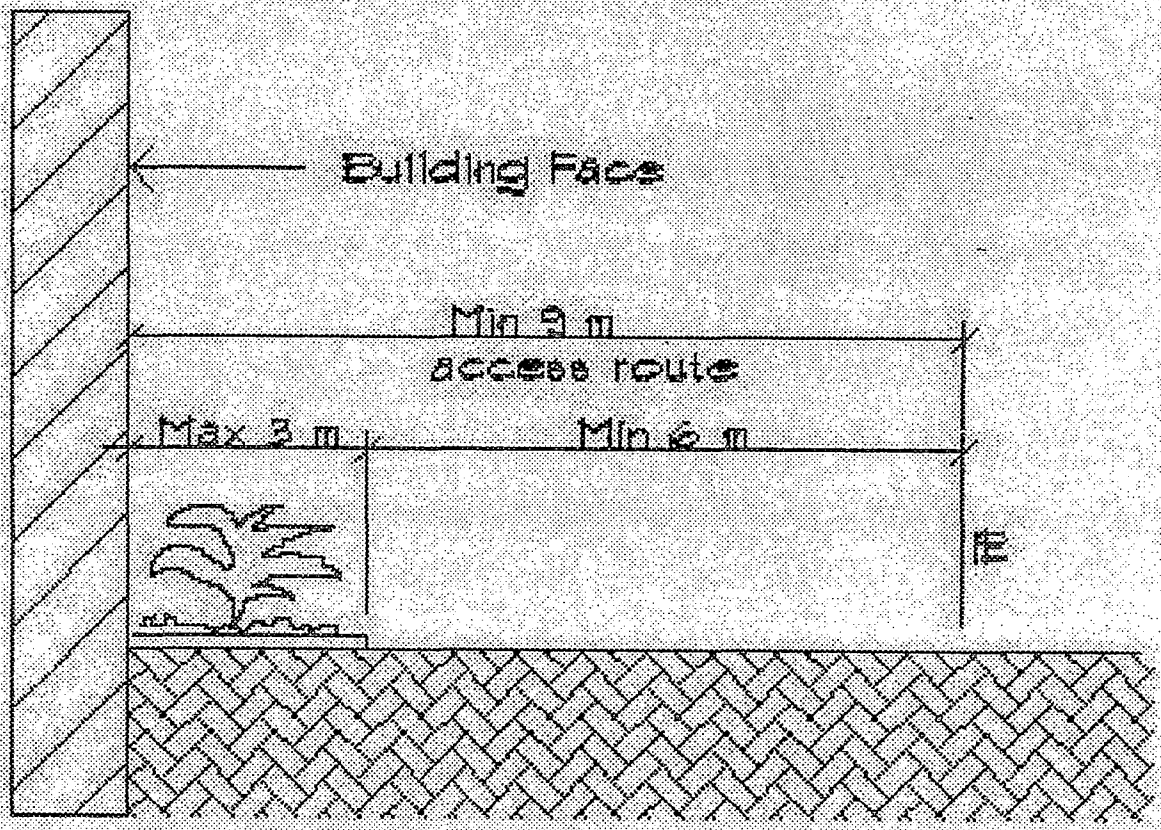

77 % of perimeter
less than 15 m
from street
25 m
15 m
10 m
bulding facing
three streets
15 m
15 m
15 m

fig 34b



For the purposes of this Subsection an access route may be considered a street, provided a clear width of at least 3 m is maintained between the 6 m and the face of the building. The 3 m may be landscaped or otherwise finished, but not in a manner which would constitute a hindrance to the operation of fire fighting vehicles.

Fig 35