

RECENT FIRE MODELLING IN ALBERTA

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The current design trend towards spaces that provide occupants with more light, visibility and openness often conflicts with the fire safety objectives of the Building Code, which generally require small compartmentalised areas that limit the spread of fire using walls that serve as fire separations. With our understanding of fire science and a library of fire engineering design tools, GHL Consultants Ltd has become one of the premier fire engineering firms that develops successful Building Code variances in Alberta to serve the growing need of demonstrating Code compliance for unique architecture.

This newsletter highlights two recent projects in Alberta where GHL has successfully developed CFD-based fire modelling analysis as part of a Building Code variance to permit open interconnected floor spaces.

ART GALLERY OF ALBERTA

Designed by Los Angeles based Randall Stout Architects Inc., the Art Gallery of Alberta in Edmonton, AB, features a large, 4 storey atrium constructed of sculpted steel and angular glazing, which defines the inward and outward appearance of the building. In order to create a sense of openness, the interior floors are interconnected, with only key areas separated by tempered glazing assemblies. In addition, one of the two exit stairs is also enclosed by tempered glazing assemblies.

Although the use of glazing assemblies as fire separations is permitted in Alberta through the application of Standata 06-BCV-010, the criteria in the documentation proved to be restrictive and created significant limitations that would compromise the architecture.



*Interior photograph of the Art Gallery of Alberta in Edmonton, AB
(photo credit - Randall Stout Architects Inc)*

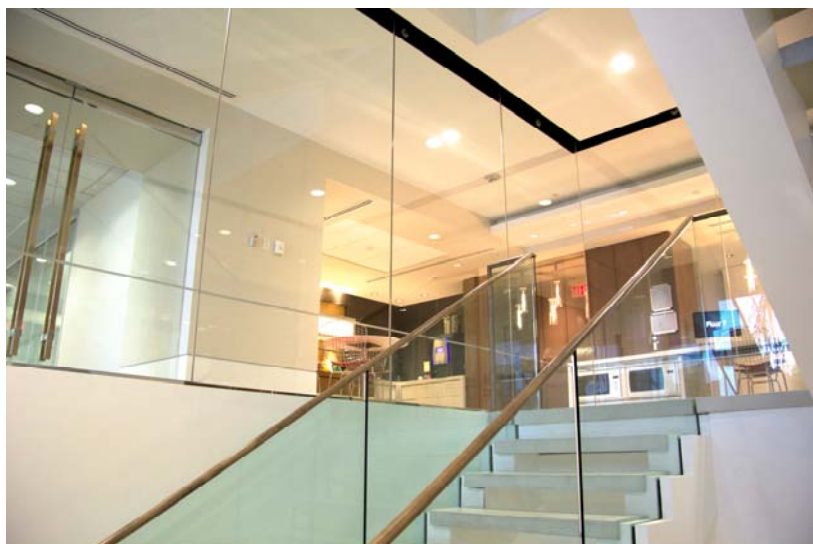
In order to demonstrate to the City of Edmonton that the interconnected floor space satisfied the fire safety objectives of the Alberta Building Code, extensive fire modelling analysis was undertaken by GHL to assess the potential fire hazards in the facility. Starting from an account of the fire loading in the atrium, to the definition of probable-worst-case design fire scenarios, a computational fluid dynamics (CFD) based fire modelling analysis was performed to study the movement of heat and smoke in the atrium, as well as the exposure to the exit stair fire separations. From our analysis, it was shown that additional quick-response pendent sprinklers protecting glazing assemblies in the atrium and Tyco WS window sprinklers protecting glazing assemblies at the exit stair formed an acceptable solution. In both instances, it was also substantiated that the glazing assemblies can be full-height, without the need for a 3ft high pony wall as mandated by the Standata.



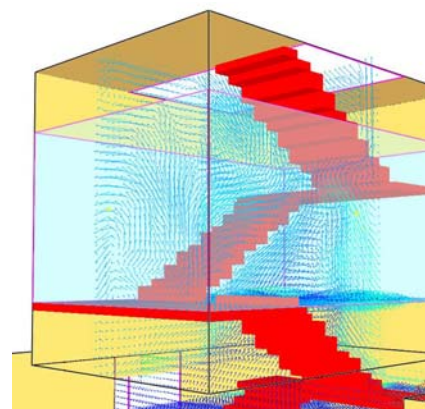
ARC RESOURCES

When office space availability in Calgary limits businesses to grow horizontally - they grow vertically. Fueled by the vast number of operations and staff in this prime natural resource company in Canada, Arc Resources Inc. required an office space of 9 floor levels in downtown Calgary to serve as its world headquarters. As a means of connecting different departments, an interior stairway was required to allow convenience access to all 9 levels of the facility. This type of stairway creates an interconnected floor space of 9 storeys in an office tower for which Alberta Building Code has restrictive requirements.

Instead of making a compromise with the design of the stairway, GHL was engaged to provide an engineered solution that balanced safety and functionality. In order to meet the objective of preventing the spread of fire and smoke between different floor levels, the stairway was enclosed by full-height glazing assemblies at all 9 floor levels, and protected by Tyco WS window sprinklers, following Standata 06-BCV-010. However, to maintain the openness in this modern office space, the 3ft pony wall requirement in the Standata was not desired. In order to address this, a CFD-based computer fire model was prepared to demonstrate the effectiveness of the Tyco sprinklers to protect the glazing system under various fire scenarios. Through fire modelling, an estimation of sprinkler activation times and corresponding glazing temperatures was established. From this, an analysis of the thermal stress and assessment of possible failure of the glass was determined. By analysing and comparing the results, it was demonstrated to the City of Calgary that the Code objective of maintaining floor-to-floor fire separation would be achieved by full-height glazing assemblies without the pony wall.



Stairway enclosure in the Arc Resources office features full-height glazing assemblies.



Model showing Glazed 9 Storey Atrium Stairwell with Sprinkler Protection

ABOUT THE AUTHORS



Andrew Harmsworth (M Eng, P Eng, PE, CP) is an accomplished fire engineer and Building Code consultant, bringing over 20 years of experience in fire safety design, Code consulting and construction practice to a project. Having obtained his Master's Degree in Fire Protection Engineering at UBC, and continuing to enhance his education, Andrew is familiar with recent developments, techniques and tools of Fire Science and Engineering which has assisted in the development and successful negotiation of numerous equivalent approaches to Building Code compliance and successful resolution of several legal disputes.



K. M. Gary Chen (MAsc, P Eng) is a professional engineer registered in British Columbia and Alberta with specialized expertise in fire science, thermal fluid mechanics and structural design for fire. As a PhD candidate, he has completed a Master's Degree in Mechanical Engineering from University of Waterloo, specializing in fire engineering, and a Bachelor's Degree in Chemical Engineering from UBC.

ABOUT GHL CONSULTANTS LTD

Led by Principals David Graham, Andrew Harmsworth, and Teddy Lai, and Associate Principals Khash Vorell and Adam Nadem, GHL is a team of fire protection engineers and technologists who have extensive experience and advanced training in fire safety codes and fire engineering. With expert knowledge in fire safety and established working relationships with many authorities having jurisdiction, we are capable of solving a wide variety of fire engineering challenges that arise from the prescriptive codes. Our fire science background provides us with a strong capability in fire modelling and evacuation/egress modelling. With a dedicated team of fire modelling engineers, GHL can advise clients when fire modelling adds value to a project and when fire modelling analysis is required. For further information, visit our website at www.ghl.ca