

# ATI-Composites Canada Inc.

## Technology Update and Fire Test Summary

This Collection of Product Bulletins and Reports offers an Overview of the Product and the Technology and also Looks at Several Proposed Installation Scenarios.

We present this information to building code experts and potential end-users to garner feedback from industry and open a line of communication to determine where the most suitable uses will be found in the construction marketplace.

**We are particularly interested in situations where Fire Separations, Fire Walls and Incremental Fire Protection might be needed to meet the Building Code**, and get some feedback on how we might refine or improve on the proposed installations outlined herein.

The results show that the ATI-Composite Mineral Foam can provide additional fire protection well in excess of the products that we were tested:

- 1) **by 450F after 60 minutes** when compared to the 5/8 inch Fire Guard gypsum and
- 2) **by 370F after 45 minutes** when compared to the Spray Applied Cementitious Structural Steel Fire Proofing in these side-by-side tests against these specific methods and materials.

This update highlights four typical installation scenarios in three Product Bulletins and also includes a Intertek Fire Test summary of these results in table and graph form.

For further information, please call:

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## Schedule of Exhibits:

**1) Introduction and Technical Overview:** A brief overview of the technology, the market and the value proposition.

**2) New Product Bulletin: Fire Resistant Composite (FRC) Panels**

This bulletin outlines two scenarios:

- The 1<sup>st</sup> proposes the use of interlocking (tongue & groove) panels for use where an incremental 30 to 90 minutes of fire resistance is desired.
- The 2<sup>nd</sup> proposes the installation of these panels in a party wall to offer improved acoustics and superior fire ratings without the need to build two (independent) stud and gypsum board wall assemblies.

**3) Preliminary Design – the NexSys Fire Resistant Partition Systems:**

This bulletin outlines several scenarios for the pre-cast and installation of lightweight, galvanized steel stud reinforced fire resistant partition panels for use as fire separations in stairwell, elevator shafts, utility rooms, party wall and perimeter walls where 2 or more hours of fire resistance is needed.

**4) Lightweight, Insulated (2-Hour Fire Rated) Structural Wall Panels**

The detailed schematics are shown for the pre-casting and installation of lightweight, expanded polystyrene slab (EPS) & steel stud-reinforced fire resistant panels for a fire-rated perimeter wall where insulation and a 2-hour rating is needed.

**This system and assembly was tested at Intertek with three panels including seams in a wall assembly and passed a 2-hour rating including a hose stream.**

**5) Technology Update – Side-by Side Comparative Fire Tests Results;**

ASTM-E119 or Can4-S101 Fire Resistance:

This bulletin summarizes the results of running 5 different combinations of materials

- in a side-by-side orientation to demonstrate the efficacy of the ATI-Composite

Mineral Foam when compared to identical thickness of:

- 5/8” Fire Guard Gypsum Board
- 3/4” Spray Applied cementitious fire proofing (for structural steel)
- 3/8” high density fiber reinforced cement backer board (uncoated)
- 5/8” ATI-Composite Mineral Foam cast on the surface
- 5/8” ATI-Composite Mineral Foam spray applied in two coats

Graph G7 and the Conclusions on page 8 **clearly show the superior performance of the ATI-Composite Mineral Foam when compared to these other fire proofing materials in side by side tests.**

## 1) Introduction and Technical Overview:

Over the past 3 years, ATI-Composites Canada Inc., has developed a range of proprietary “Mineral Foam Composite” blends that provide several significant advantage, where productivity, reduced weight and fire protection is concerned.

These mixtures (or wet slurries) incorporate a binder and a wide range of fillers, polymers and foaming agents to produce a lightweight Mineral Foam Composite that can be precast to provide functionality in a number of building scenarios. These fillers might include organic or inorganic minerals and fibers, depending on the end-use.

In many building products the fire performance is predicated on the amount of chemically bound ‘water of hydration’, which ultimately affects the weight and fire resistance of the final assembly. Concrete, for example, offers fire protection based on its mass, though it degrades quickly under fire conditions because it typically hydrates a very small amount of water relative to its mass (less than 0.5 moles).

Fireguard Gypsum board is acknowledged as a good fire separation. Its fire performance is predicated on the fact that gypsum (calcium sulfate dihydrate = 2 moles of water) requires significant heat to dislodge (or boil away) this chemically bound water before the critical temperature will exceed the allowable limits under ASTM-E119 or ULC-Can4-S101.

The ATI-Composites Mineral Foam provides a decahydrate (10 moles of water) when fully cured. This means that ATI offers 5 times more chemically bound water than that found in gypsum board. **This important difference in chemistry accounts for the substantial improvement in the fire resistance rating of the ATI-Composite Mineral Foam, when tested and compared “head to head” with drywall and other material at identical thickness.**

**The Value Proposition:** With population increasing worldwide, we see the trend towards housing more people in less (real property) space. This crowding leads to ever more stringent fire codes. In addition, the cost of labour and materials continue to rise as energy costs and labour rates escalate.

If a designer and/or builder can find ways to meet these new fire codes and improve productivity (by reducing the job site labour using precast structural elements), the installed cost becomes more important than the cost of the individual components. For example, cinder blocks are inexpensive to purchase – but the installed cost can be 8 to 12 times higher than the unit cost per square foot of the individual blocks.

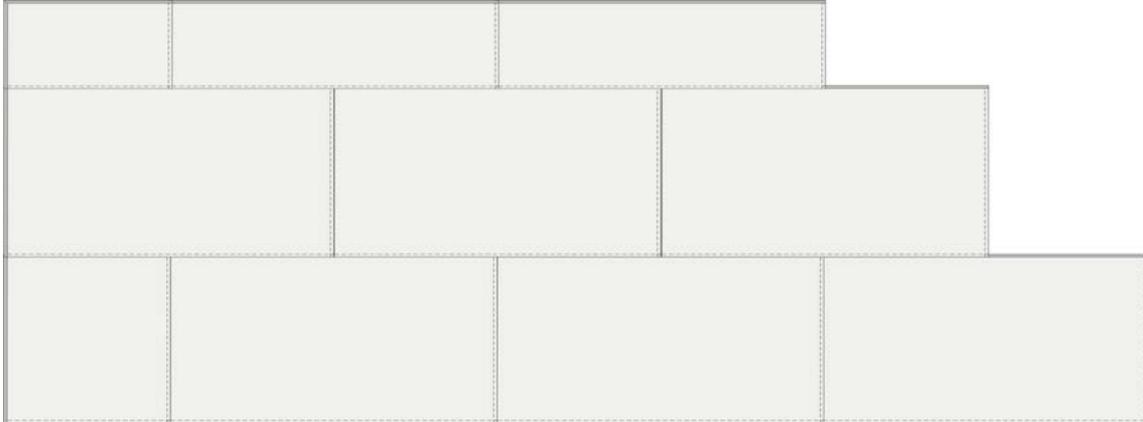
**What we provide is a cost effective alternative to these other, more labour-intensive installations or assemblies.**

The attached Product Bulletins and Technology Update show how this technology can be utilized in four typical construction scenarios. Our objective is to garner feedback from the engineering and construction community and then ‘fine tune’ these bulletins to ensure that we haven’t missed any key considerations in these assemblies.

## New Product Bulletin: “FRC-Panels” (Fire Resistant Composite Panels)

**Overview:** ATI-Composites has developed a **new, rigid Fire Resistant Composite** that provides exceptional fire resistance in a relatively lightweight, interlocking panel.

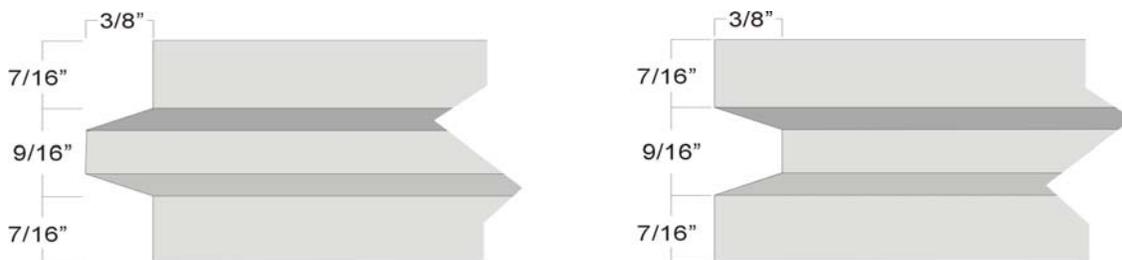
**Application:** Ideally suited for providing additional fire resistance to enhance or upgrade the fire resistance rating of a wall or ceiling assembly. Panels may be manufactured with a decorative finish, textured or inlaid with various designs or relief. These panels may also be used to provide a two-hour to four-hour rating in new construction applications.



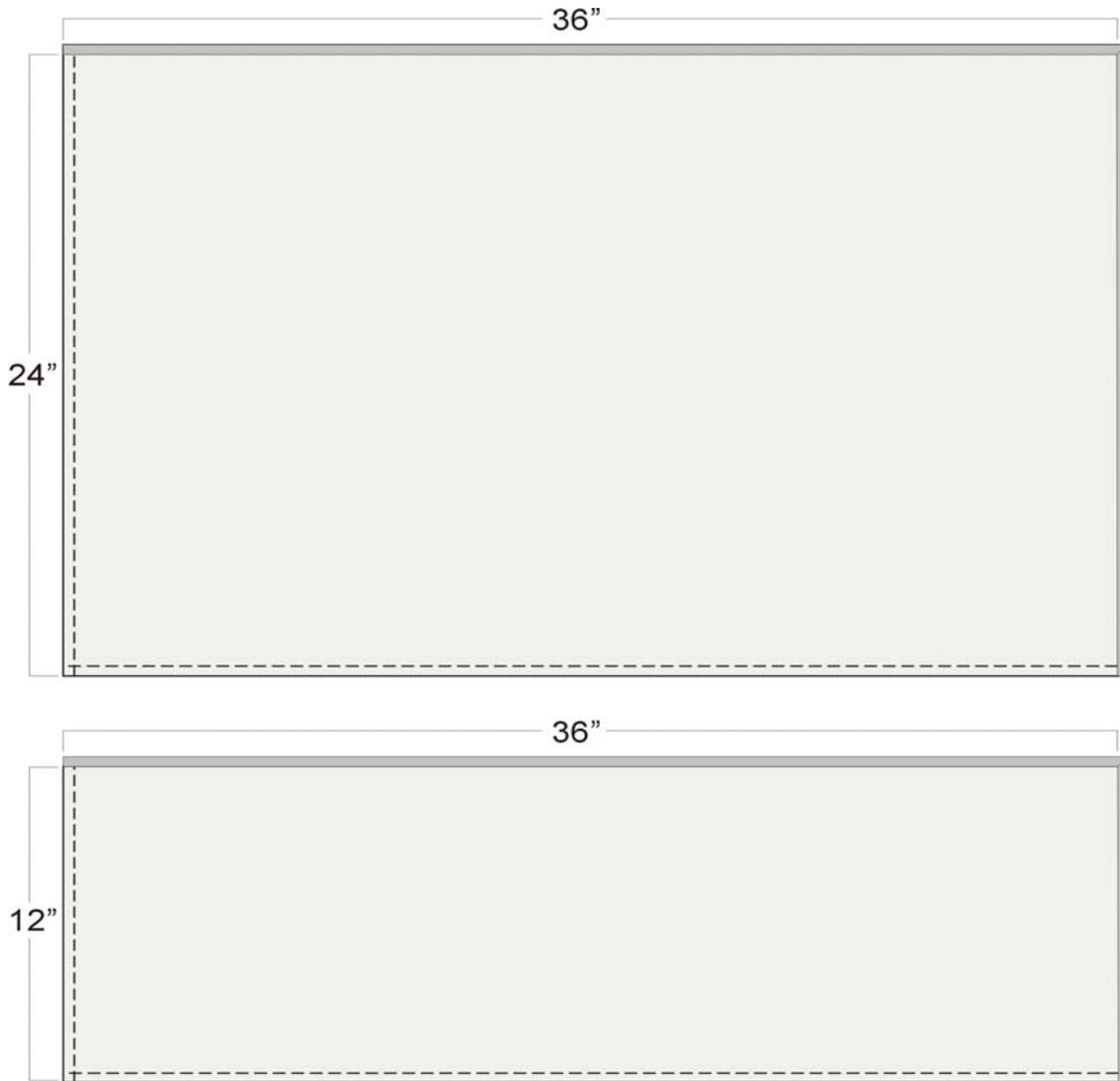
**Example 1:** The above captioned shows a typical installation of interlocking panels of two sizes 24” X 36” and the infill panels at 12” X 36”.

The finished product at 1.5” thick has an average density of 32 lb/Cu.Ft. that results in an average weight of 4 lb/Sq.Ft of surface area.

**Edge Detail:** In order to ensure that the panels are effective and tight at the interface or edges, the edge detail involves an interlocking edge detail to speed installation and reduce the risk of failure at the edges.



Tongue & groove edge detail



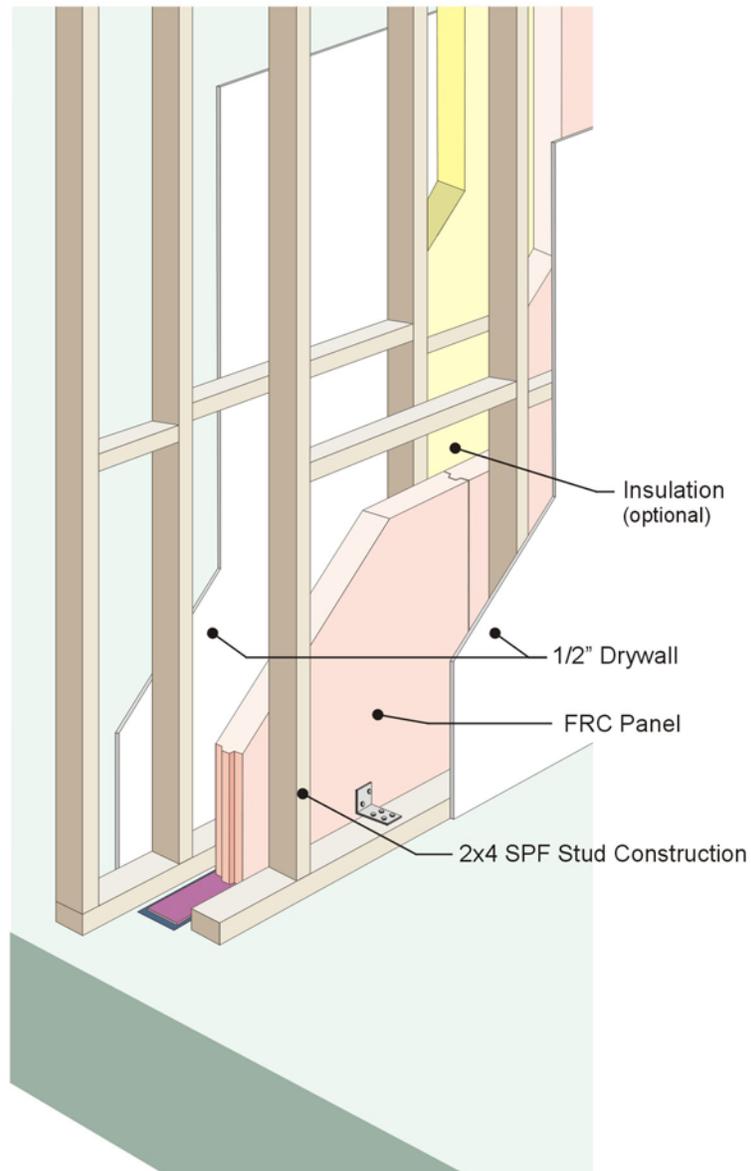
**Installation:** When upgrading an existing fire separation, the panels can be adhered to the existing surface with polymer modified thin-set cements similar to those used for tile and grout applications.

When installed as part of a fire separation, between occupancies, the installation is completed as part of the two-sided stud & gypsum board wall assembly.

**Notes on the Fire Resistance Rating:** When testing the composite under the ULC Can4-S101 (USA - ASTM E-119) - the Fire Resistant Composite demonstrated that for each 1.25 inches of thickness it achieved a 2-hour rating. While there is no absolute correlation between thickness and fire-resistance, it is reasonable to assume that a thicker panel will provide additional fire resistance. Other considerations such as the installation of mineral wool insulation and the overall thickness of the wall itself will also have a bearing since trapped air within the wall assembly will also serve to improve performance.

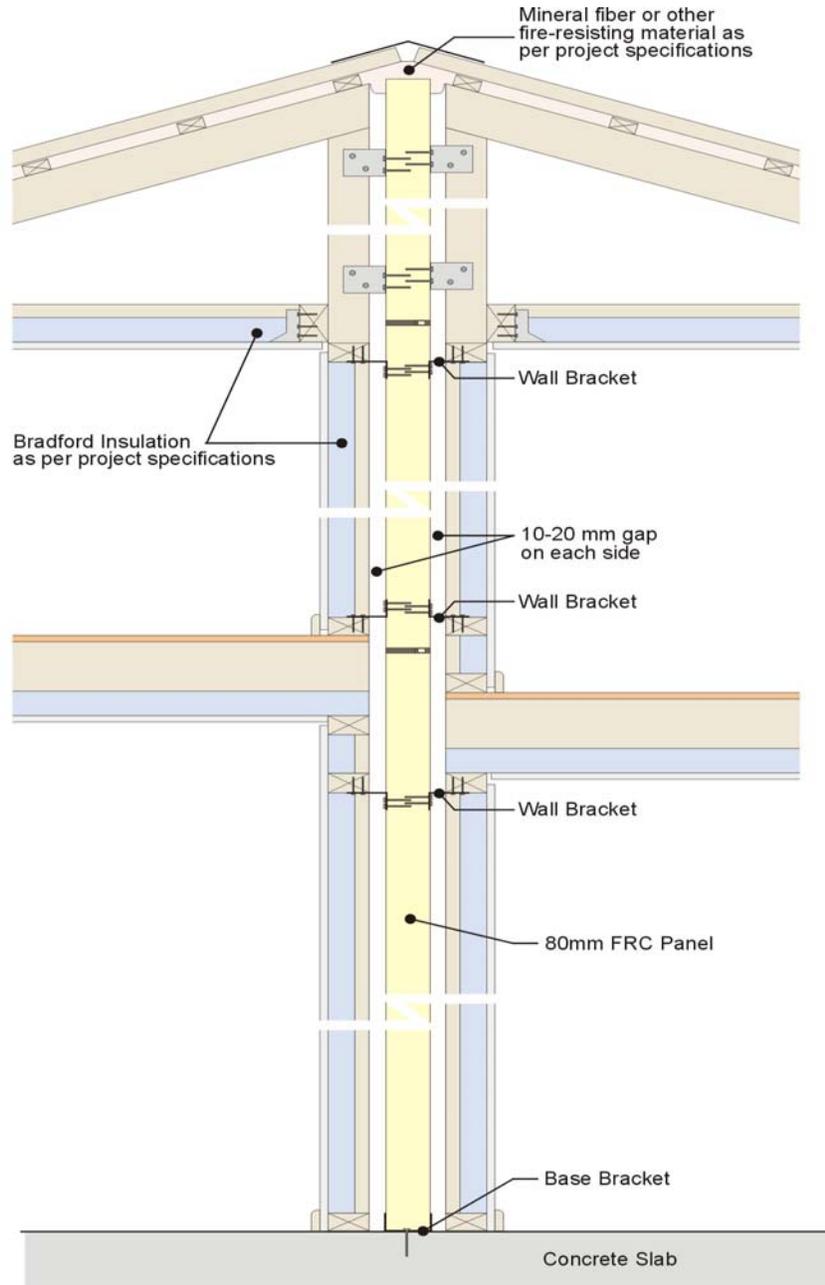
**Example No:2 Schematics:**

**CONSTRUCTION DETAIL - 50 mm FRC Panel**  
*2 Hour-Rated Fire Separation*



The schematic above might be suitable for use in a single story row home development for party or demising walls where local codes call for a fire separation between occupancies.

**Example No.3: A 2 to 3-Hour Fire-Rated demising wall between occupancies in a two-story structure.**



In the example above we see the proposed construction detail for a two-story structure. While the general description is provided for discussion purposes, specific details will change as the project engineering requirements may vary from site to site.

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## **Fire Resistant Assembly - Preliminary Design and Request for Feedback**

ATI-Composites Canada Inc. is engaged in the commercialization of a proprietary, light weight, Fire Resistant Composite (FRC) Mineral Foam technology. It will be marketed under the Trade Name “NexSys Partition Systems” for the production of precast structural and infill panels for commercial and multi-family residential construction.

Several rounds of testing under ASTM-E119 (Can-ULC-S101) Fire Resistance testing has shown that the FRC Mineral Foam technology has the potential to provide superior fire performance when compared to other materials such as Type X drywall and spray applied cementitious fire proofing. (Note 1) The testing demonstrates that the FRC Mineral Foam can provide up to 4 hours of fire separation at significant savings in weight, materials and labour when compared to other construction methods.

The FRC-Mineral Foam has the potential to offer several key advantages including:

- FRC-Mineral Foam provides the opportunity to **precast lightweight panels** which would incorporate structural elements such as L/W galvanized steel studs for wracking strength and provide ease of connectivity to other surfaces or structural elements.
- These NexSys Partition System panels can be manufactured under control conditions then shipped to the site to shorten construction or completion cycles.
- Precast NexSys Partition System panels would reduce overall weight when compared to concrete block, precast concrete and other types of construction.
- Precasting NexSys Partition System panels could substantially reduce labor & time delays associated with bringing in a specialty trade to the job site such as block layers. This could also reduce delays caused by weather, since concrete block cannot be laid in inclement weather (that may require heat and hoarding, adding to the installation costs).
- The NexSys Partition System panels could replace the labor intensive, multiple layers, and multi-component gypsum sheathing systems such as the ‘shaft-wall’ systems promoted by a number of large gypsum board producers.
- NexSys Partition System FRC panels would mean that the carpenters, drywall and other crews could tilt-up these prefabricated panels into place and cost-effectively install fire separations and stairwell enclosures without delays in the construction cycle, regardless of temperature on the site or weather conditions.

The attached “Stairwell Installation Detail” is presented for discussion purposes to garner some feedback from the industry. While the following schematic discusses an Elevator Shaft Wall or Stairwell proposal, this same detail can be used for other wall systems and partition assemblies.

For more information and to engage in the feedback discussions,

Please contact:

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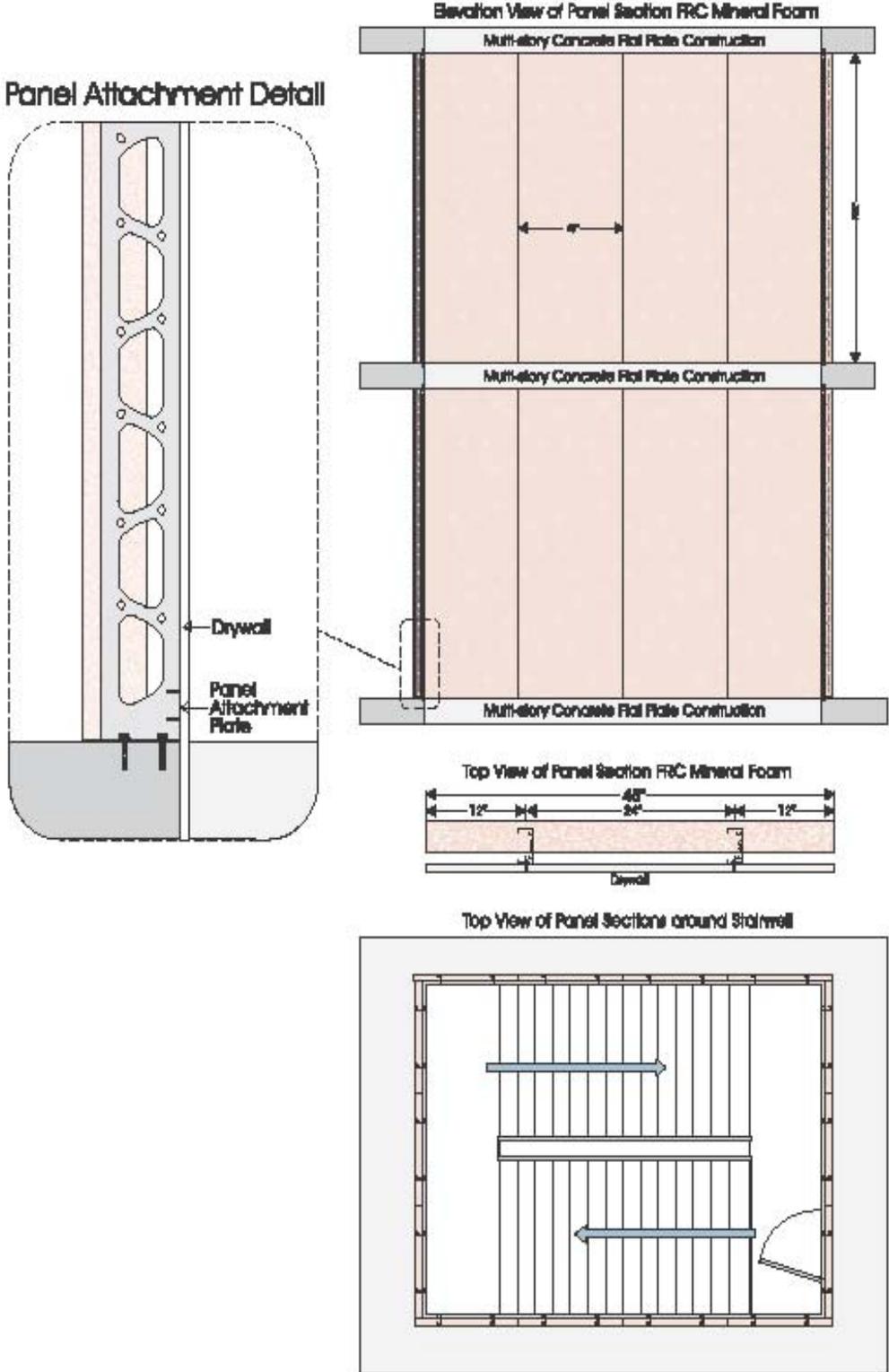
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# Proposed Stairwell Installation Detail



## New Product Bulletin:

### Lightweight, Insulated (2-Hour Fire Rated) Structural Wall Panels

In tests conducted in recent weeks, ATI-Composites Inc., and PolyCore Canada Inc., have demonstrated that by combining technologies, they can produce a ‘tilt-up’ (prefabricated) wall section that offers superior properties to a number of alternative wall systems with several key advantages:

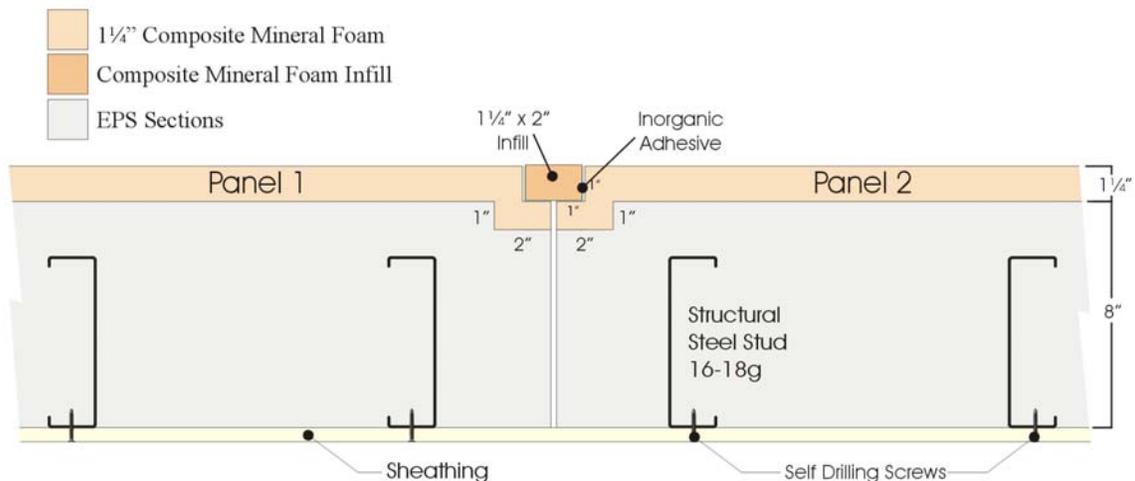
- **Insulating:** An 8-Inch thick wall provides an R-30 rating,
- **Structural:** The strategic placement of 16 to 18 gauge steel studs provides structural support, connectivity and wind-load
- **Fire Rating:** The 8-inch thick wall panel surpasses the 2-hour Fire Resistance Rating under ASTM-E119 or Can4-S101.
- **Lightweight:** Up to 90% lighter than precast concrete wall panels.

The sketches below show how the system works and how it is installed in a structure.

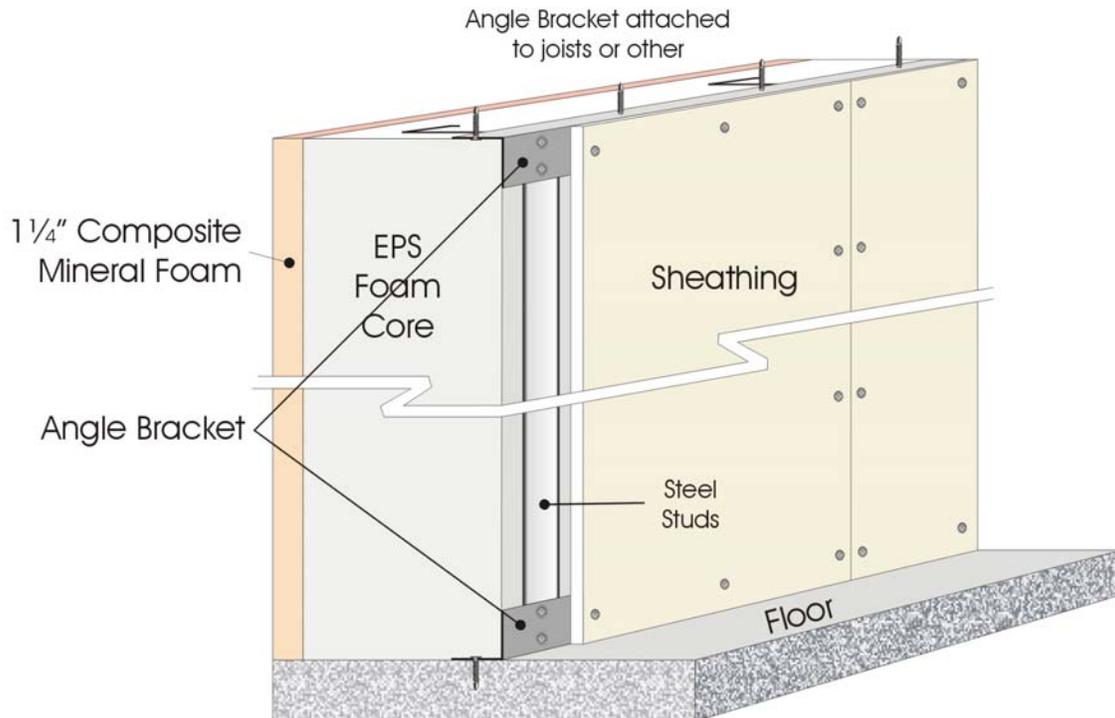
The height, width, overall finished thickness, R-Value and structural properties are completely variable. The Fire Rating is predicated entirely on the Composite Mineral Foam, which is cast into the interior exposed face of the panel.

Panels can be specified using differing gauges of steel studs, in lengths up to 20 feet to accommodate a wide variety of job-site requirements.

### Composite Panel Make-up Details:



## Assembly & Exterior Details – Cut-Away View:



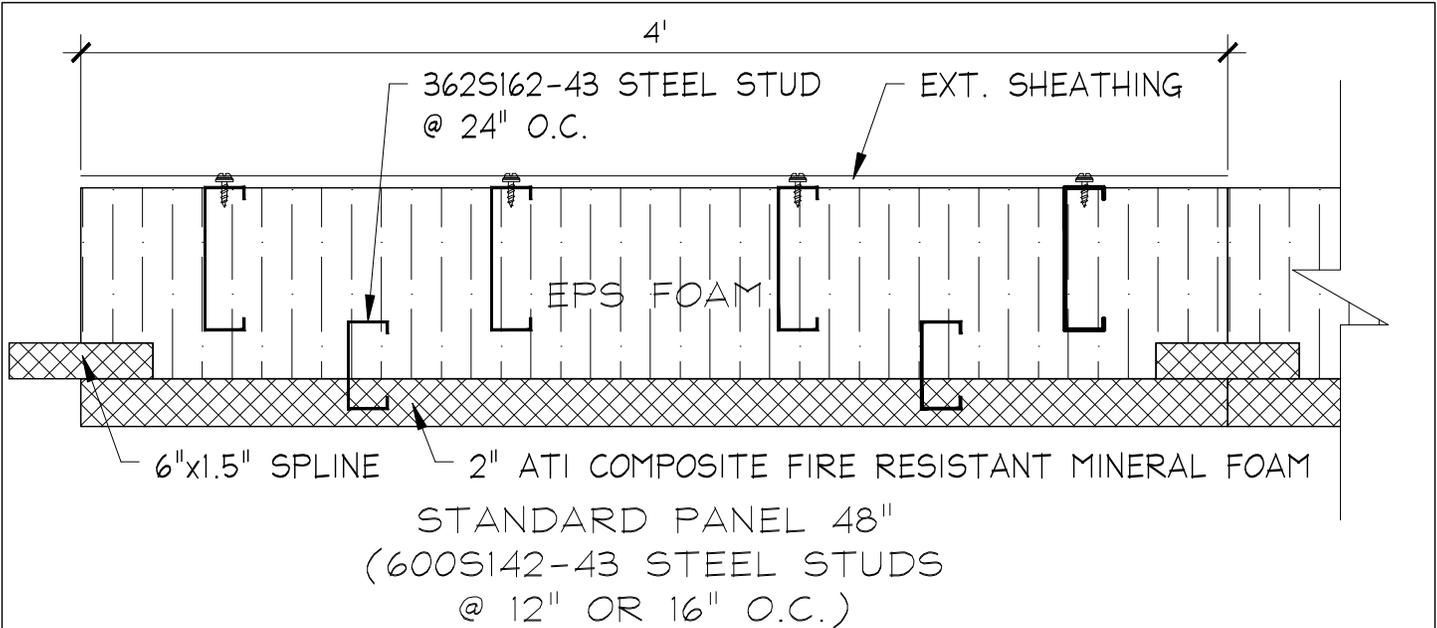
**“Rain Screen” and other finishes:** While the test panels were constructed and sheathed with 1/2” drywall on the outer face, the exterior sheathing could have been selected from a variety of products, from cement board to Oriented Strand Board (OSB) or any one of a number of other products.

The exterior finish details might include any acceptable rain screen, including vinyl siding, concrete stucco, or similar materials, selected to meet the local codes, and issues relevant to the job site and fire code requirements.

### **For further details on the building system, please contact:**

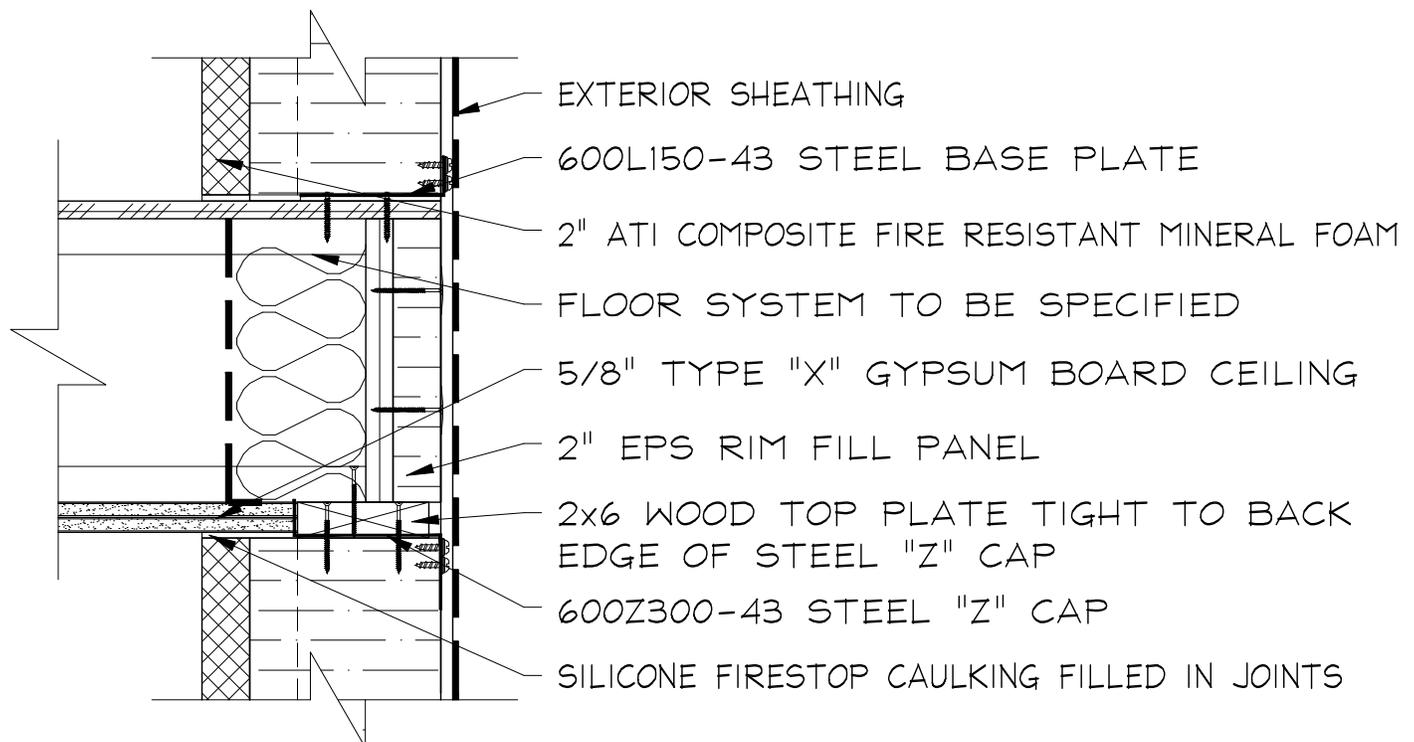
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## **STANDARD PANEL DETAIL**

SCALE: 1 1/2"=1'-0"



## **SECTION DETAIL (CEILING & FLOOR)**

SCALE: 1 1/2"=1'-0"

**POLYcore**  
 CANADA INCORPORATED  
 12112-67 St.  
 EDMONTON, AB  
 T5B 1M7  
 PH: (780)-477-2377  
 FAX: (780)-474-1317

DRAWING TITLE:

**ATI - COMPOSITE  
 FIRE RESISTANT PANEL**

DATE:

11/04/11

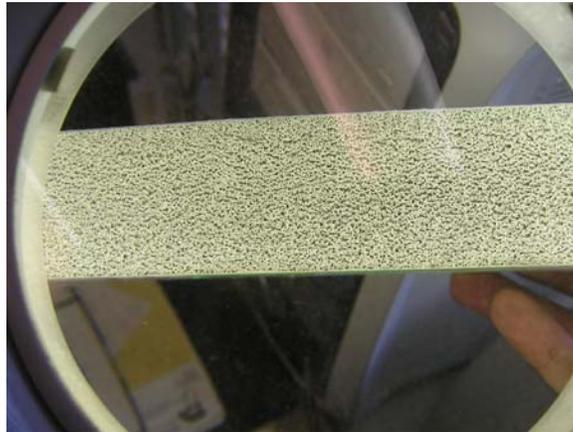
SCALE:

1 1/2" = 1'-0"

SHEET NO:

**ATI-001**

## ATI-Composites Canada Inc.



This is a cross section of the Composite Mineral Foam through a magnifying glass

## Technology Update

### Side-by-Side Comparative Fire Test Results ASTM-E119 Fire Resistance

**SUMMARY:** Over the past two years the company has run a series of fire tests at Intertek to demonstrate the fire resistant properties of the ATI-Composite Mineral Foam. This update offers a review of the 3<sup>rd</sup> round of (comparative) testing carried out at Intertek Testing Facility in British Columbia on January 25, 2011.

**Conclusions:** This testing demonstrates the ATI Fire Resistant Composite Mineral Foam:

- 1) Offers substantially better thermal performance than the materials tested as comparatives.
- 2) Offers excellent potential to provide incremental fire resistance (protection) to an existing assembly.
- 3) Performs extremely well as a Spray Applied Fire Proofing when compared to the ULC-Listed product that was installed as the benchmark test face.
- 4) Offers excellent potential to be cast in panels or sheet form to provide significantly fire protection compared to an equal thickness of CertainTeed Type X gypsum board.

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## ATI-Composites Canada Inc.,

### Technology Update:

ATI-Composites has completed a 3<sup>rd</sup> round of fire testing at Intertek (Coquitlam B.C.) and demonstrated superior fire resistance in side by side tests, when compared to other products with known thermal and/or fire resistance properties.

The objective of these comparisons was to determine how effectively the FRC Mineral Foam Composite would perform against other known Fire Resistant products. Three tests were conducted using the ASTM-E119 Time-Temperature Curve. The results are summarized below.

#### 1) Initial Test: Spray Applied Coated vs. Uncoated 3/8" Hardiboard:

Two panels constructed of 2 X 4 dimensional lumber and sheathed with 3/8" Hardiboard backer board:

- One panel was left uncoated; and
- One panel was coated with 3/4" of the ATI FRC-Mineral Foam.

These panels were subjected to the ASTM-E119 furnace test.

**Table No. 1**

<b>Side-by-Side Comparison Test</b>				
<b>Panels No. 1A - 3/8" Hardiboard with and without 3/4" ATI-FRC Foam</b>				
(1)	(2)	(3)	(4)	(5)
Time in Minutes	Furnace Temp (°F)	Average Temp Unexposed 3/8" Sample Uncoated (°F)	Average Temp Unexposed 3/8" Sample with 3/4" ATI-FRC (°F)	Net Temp. Improvement Due to ATI-FRC (°F)
5	1000	593	84	+509
10	1250	1044	152	+892
15	1400	1167	191	+976
20	1475	1238	210	+1028
25	1500	1313	227	+1086
30	1575	1401	254	+1147
35	1600	1463	300	+1163
40	1620	1491	354	+1137
45	1600	1446	434	+1012

The first test was terminated at 45 minutes because the uncoated panel was severely cracked and the furnace temperature could not be maintained due to the losses through the cracks in the face of the panel.

Observation: We found that the FRC-Mineral Foam could provide substantial incremental fire resistance protection.

The test shows the substantial impact that a spray applied coating of the FRC Mineral Foam Composite can have in improving the basic fire resistance of a thin sheet of fiber reinforced cement board as our benchmark test.

### **INTERPRETING THE DATA**

The enclosed report will summarize the Intertek test results & data in table form.

An example follows:

**Column 1:** Shows the progress/duration of the test in minutes.

Test one and two ran 45 minutes; test three ran the full one hour.

**Column 2:** Shows the temperature inside the furnace in degrees F and the temperature of the “hot side” of the panel.

**Column 3:** Shows the temperature of the unexposed or “cool side” of the panel 1A and the temperature rise through the panel (by subtracting the furnace temperature – exposed face - from the cool side or unexposed face) in degrees F.

**Column 4:** Shows the temperature of the “cool side” of the Sample 1B and the temperature rise through the panel.

**Column 5:** Shows the ‘Net Temperature Difference’ or the improvement in thermal protection provided by Sample 2B (the ATI-Composites “FRC Mineral Foam”) over 2A being the competitive and alternative covering.

## 2) Test No.2: 5/8" Fireguard Gypsum Board vs. 5/8" FRC-Mineral Foam.

When two panels constructed of 2 X 4 dimensional lumber and covered with 3/8" Hardiboard backer board:

- One panel covered with 5/8" Type X Fire Guard wall board; and
- One panel covered with 5/8" FRC-Mineral Foam (Fire Resistant Composite Mineral Foam).

We found that the FRC-Mineral Foam could provide additional fire resistance to the point where:

**Table 2**

Side-by-Side Comparison Test				
Panels No. 2A - 3/8" Hardiboard with 5/8" Type X Fireguard gypsum compared with 2B with 3/8" Hardiboard with 5/8" FRC Foam spray applied in two passes				
(1)	(2)	(3)	(4)	(5)
Time in Minutes	Furnace Temp (°F)	Average Temp (°F) Unexposed 3/8" Board + 5/8" Type X Gypsum	Average Temp (°F) Unexposed 3/8" Board + 5/8" ATI-FRC	Net Temp. Improvement Due to ATI-FRC (°F)
5	1000	128	85	+43
10	1250	168	136	+32
15	1400	184	178	+6
20	1475	195	183	+12
25	1500	214	204	+10
30	1575	307	218	+89
35	1600	427	235	+192
40	1620	576	265	+311
45	1625	725	319	+406
50	1650	837	415	+422
55	1675	941	487	+454
60	1700	973	571	+402

The test was terminated at 60 minutes because the Type X Drywall covered face had long since exceeded the maximum temperature allowance and the FRC-Mineral Foam had shown substantial improvement over the Fire Guard Type X Drywall.

Observation: The 5/8" FRC Mineral Foam was significantly more effective than the CertainTeed 5/8" Type X gypsum board.

### 3) Test No.3: 3/4" spray applied cement-fiber reinforced structural steel fire proofing compared to 3/4" FRC-Mineral Foam.

When two panels constructed of 2 X 4 dimensional lumber and covered with 3/8" Hardiboard backer board:

- One panel covered with 3/4" spray applied cement/fiber reinforced (structural steel) fire proofing; and
- One panel covered with 3/4" FRC-Mineral Foam.

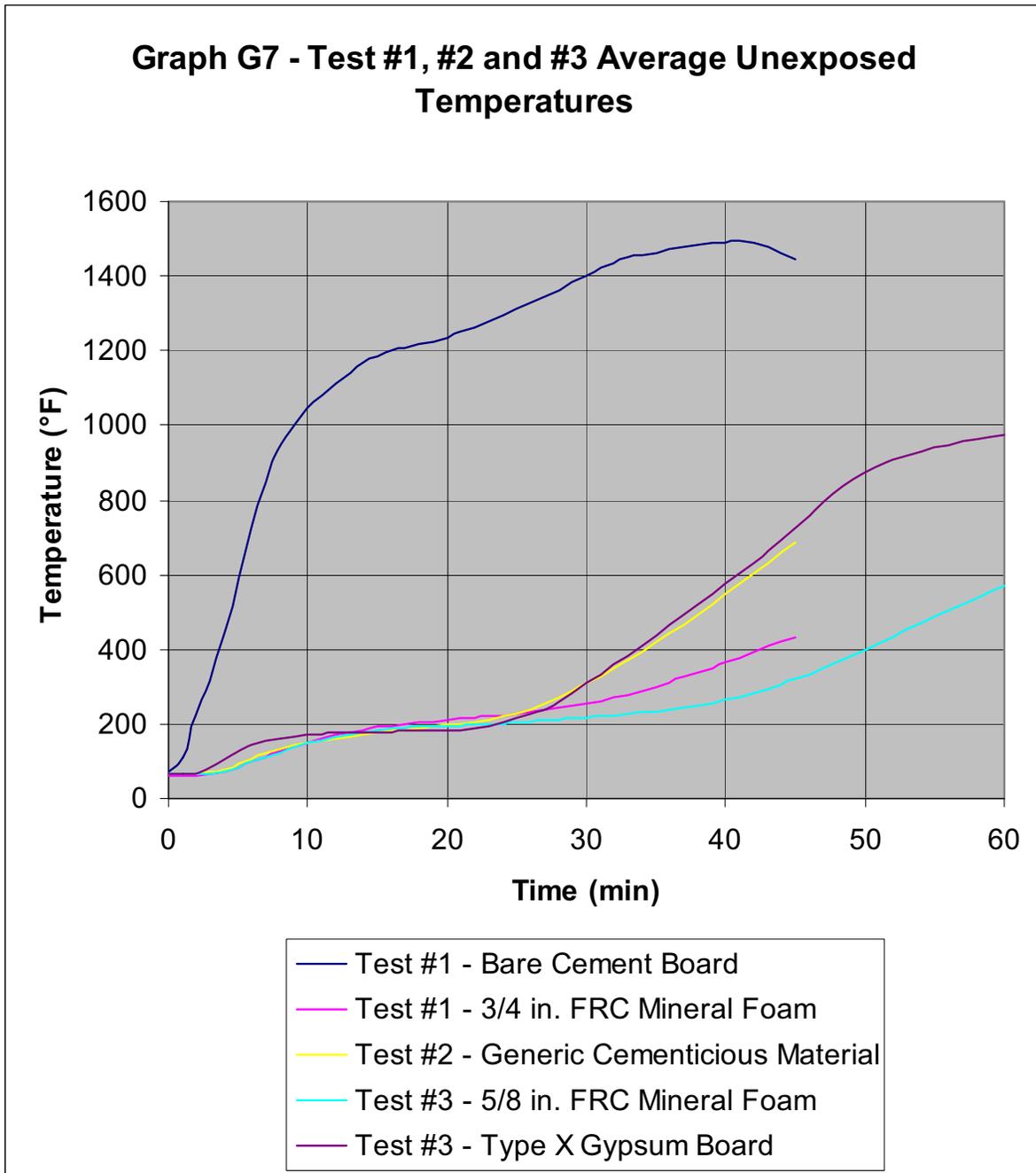
We found that the FRC-Mineral Foam could provide superior fire resistance to spray applied cement/gypsum based materials

**Table 3**

Side-by-Side Comparison Test				
Panels No. 3A - 3/8" Hardiboard with 3/4" Spray Applied Structural Steel Fire Proofing" compared with				
3B - 3/8" Hardiboard with 5/8" FRC Foam				
Time in Minutes	Furnace Temp (°F)	Average Temp (°F) Unexposed Sample 3A 3/8" Board +3/4" Fire Proof	Average Temp (°F) Unexposed Sample 3B 3/8" Board + 3/4" ATI-FRC	Net Temp. Improvement Due to ATI-FRC (°F)
5	1000	93	85	+8
10	1250	151	136	+15
15	1400	177	178	-1
20	1475	198	183	+15
25	1500	228	204	+24
30	1575	308	218	+90
35	1600	419	235	+184
40	1620	547	265	+282
45	1625	687	319	+368

Observation: When we compare the performance of the "Spray-Applied Cementitious Fire Proofing" at the same dry film thickness as the Fire Resistant Composite Mineral Foam, we see that the FRC-Mineral Foam performs at about the same level for the first 30 minutes, but the "Spray-Applied Cementitious Fire Proofing" starts to lose performance as the temperature increases and the test continues. In addition, the numbers reported are based on the average of the four thermocouples; we see some significant spikes in the readings of the 'cool side' of the Spray-Applied Cementitious Fire Proofing. These spikes would be a problem on a full scale fire test. The FRC-Mineral Foam does not show the same temperature spikes.

TIME / TEMPERATURE GRAPHS - *Continued*



## Conclusions

These tests clearly demonstrate that:

- 1) The ATI Fire Resistant Composite Mineral Foam provides better performance than the two alternative materials tested. This summary can be supported with a copy of the full Intertek Fire Test report on request.
- 2) The ATI Fire Resistant Composite Mineral Foam offer excellent potential to be installed to provide incremental fire resistance to an existing assembly to upgrade the fire resistance ratings to meet code requirement when necessary for a change of use.
- 3) The ATI Fire Resistant Composite Mineral Foam offers advantages when used as a spray applied Structural Steel Fire Proofing when compared directly to the ULC-Listed Spray-Applied fiber-cement product that was installed as our benchmark test face.
- 5) The ATI Fire Resistant Composite Mineral Foam offer excellent potential to be cast in panels or sheet form to provide superior fire protection when compared to an equal thickness of Fire Guard Type X gypsum board.