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FLAME SPREAD CLASSIFICATION METHOD FOR EXTERIOR WALL CLADDINGS

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Abstract

This paper describes a cone calorimeter fire test program and the application of a vertical flame spread model developed for internal wall linings to the flame spread on exterior wall claddings. It outlines performance criteria for the design of building facades to ensure that exterior cladding materials are unlikely to accelerate the vertical spread of fire and endanger the safety of building occupants.

1. Introduction

Classifying external wall claddings on the basis of performance in the 'combustibility' test has proved overly restrictive where some exterior wall cladding materials are concerned. In New Zealand, surface finishes of exterior wall claddings are regulated (C3/AS1 Table 2), to limit their contribution to fire spread, depending on the building occupancy, building height, and distance of the wall to the boundary. Currently the two different test methods specified, *Combustibility* (AS 1530 Part 1) and *Early Fire Hazard* (AS 1530 Part 3), are known to have shortcomings in their ability to classify fire hazard for this type of application. Some of the C3/AS1 requirements are unnecessarily restrictive eg., irrespective of the distance to another building, timber weatherboards are not permitted on a single-storey block of flats or motel units. Wade [1] identified potential hazards posed by exterior wall claddings and measured the rate of heat release behaviour for ten different cladding materials. At that time it was recognised that, in order to develop performance criteria that had a sound scientific basis, further work was required to describe the flame spread characteristics that were necessary for a cladding material to propagate flame vertically.

The intention of this study has been to apply an existing analytical vertical-flame-spread model, developed for use in room fire modelling to vertical flame spread on exterior wall claddings. The aim was to develop improved methods for determining whether combustible exterior wall claddings exposed to window fire plumes are likely to propagate flame spread on a building facade. We have used an analytical solution for concurrent flow flame spread on a vertical surface to determine whether the flame front is expected to accelerate or decelerate under external heat flux conditions representative of window fire plumes. The cone calorimeter test method was used to measure time to ignition, peak rate of heat release and total heat released for 15 types of exterior wall claddings.

Performance criteria based on heat release or 'degree of combustibility' are proposed as they seem to provide an improved classification scheme for exterior wall cladding materials. An intended future outcome of this work will be to develop a numerical model for predicting flame spread via external walls. Fire engineers will then have available a methodology for the specific design of exterior wall cladding systems that will aid in the provision of life safety.

Further research work is planned which will involve exposing a series of exterior cladding systems to a full-scale fire testing method, and the development of a computer based software model for vertical flame spread on wall claddings.

2. New Zealand Fire Regulations

In New Zealand, the building control regulatory framework (The Building Act 1991) [2] allows fire safety performance levels to be evaluated by using fire engineering solutions. Wade [1] gives a more detailed account of the New Zealand Building Code and its implications for designers of exterior claddings to resist fire spread. The New Zealand Building Code (NZBC) [3] does not specify how a building is to be designed or constructed but rather how structures should perform in service. The Building Industry Authority provides building designers with the Building Code Handbook [4] which includes the Approved Documents. The Approved Documents give options for how buildings may be designed or constructed so that they will comply with the Building Code. The Approved Documents provide only one accepted means of compliance with the Building Code and are not mandatory. However, the Approved Documents are widely regarded as the "New Zealand Fire Code".

3. Regulating the Fire Performance of Exterior Wall Claddings

The NZBC Acceptable Solution provides one approved means of complying with the code. Distances and areas of openings are controlled to limit radiation, and fire resistance requirements are also identified. A further requirement seeks to reduce the likelihood of fire propagating vertically up a combustible facade.

Clause 3.3.5 C3/AS1 of the Building Code Handbook [4] provides the following objective when designing for fire performance of external wall claddings: "*External walls and roofs shall have fire resistance to the spread of fire, appropriate to the fire load within the building and to the proximity of other household units and other property.*" Specifically, C3/AS1 seeks to reduce the likelihood of fire propagating vertically up a combustible facade, as a result of either direct flame impingement from an adjacent building on fire or from flames projecting through openings at a lower level in the same building and igniting the facade in the vicinity of the opening. The Acceptable Solution seeks to control either the ignitability or the contribution of the cladding to fire development (ie combustibility) and thereby directly influence the rate of vertical flame spread.

4. Current Fire Testing Methods for Exterior Wall Claddings

The test methods specified are: *AS 1530 Methods for Fire Tests on Building Materials, Components and Structures-Part 1: Combustibility test for materials* [5] and *Part 3: Simultaneous determination of ignitability, flame propagation, heat release and smoke release* [6]. Wade [1] gives a detailed critique of the test methods and describes how the non-combustibility test is considered to be overly restrictive towards some materials, such as fibre-cement sheets which, although combustible, do not contribute significantly to fire development.

AS 1530 Part 3 exposes a vertical specimen to a gradually increasing heat flux up to a maximum of about 30 kW/m^2 by moving the specimen closer to a radiant panel over a period of 20 minutes. The ignitability index = 0 requirement of C3/AS1 requires that no ignition occurs under these conditions. Although ignitability is an important factor influencing vertical flame spread, in this case, the heat flux level and the gradual heating conditions may be considered not severe enough to represent a window fire plume.

The combustibility test, AS 1530 Part 1 (and its equivalent around the world, BS 476 Part 4, ISO 1182, ASTM E136) is the general method for determining combustibility of building materials in New Zealand. It involves placing a small specimen into a furnace at 750°C and measuring differential temperature rises in the furnace, and on the specimen, and recording the duration of any sustained flaming. The test was also used in New Zealand prior to the NZBC for specifying fire properties of external wall claddings. The purpose of the test is stated to be "to ascertain whether a material will contribute directly to fire development". The Standard acknowledges that the exposure condition is severe, and materials having an appreciable organic content will usually prove combustible. The test is well suited to solid homogeneous materials, but it is increasingly being applied to composite materials and systems. As mentioned previously, the application of this test method to the assessment of exterior cladding materials is considered to be overly restrictive toward some materials, such as cellulose fibre-cement sheets, which do not contribute significantly to fire development but are considered combustible.

Note that these test methods only evaluate the ignitability/combustibility of a product. They do not evaluate flame spread directly or the magnitude of a cladding material's contribution to fire development.

5. Degrees of Combustibility

The concept of degrees of combustibility has also been proposed [7, 8, 9] where it is suggested that rate of heat release could be used to rank building materials according to their degree of combustibility. Test methods using a cone calorimeter to measure heat release have now been published by ASTM and ISO, and a joint Australian New Zealand Standard is also in preparation. Richardson and Brooks [8] have indicated a preferred exposure of 50 kW/m^2 for 15 minutes in the presence of an external spark igniter. Richardson and Brooks have also suggested criteria for classifying materials according to their degree of combustibility by utilising two performance parameters. The first is the peak rate of heat release and the second the total heat released after 15 minutes from commencement of the test. Thus, depending on the end use of the material and its location within the building, appropriate levels of performance in terms of peak rate of heat release and total heat release may be specified.

6. Window Fire Plumes and Vertical Fire Spread

The severity of an external wall's exposure resulting from a window fire plume will vary depending on the burning contents of the room, the size of the fire and the geometry of the window opening. The exposure will decrease with an increase in vertical distance above the window and increase with the burning rate of the cladding material. Babrauskas [10] suggests that a heat flux of 50 kW/m^2 may be a reasonable condition for many applications involving heat fluxes to the building facade from a window fire plume, and that, while higher fluxes are certainly possible, they require both very large fires and very large openings.

The study of wind-aided flame spread is well advanced, with many authors contributing to the field. James Quintiere provides a comprehensive summary in the SFPE Handbook of Fire Protection Engineering 2nd Edition [11]. A study of wind-aided flame spread on a thermally thick material (or thermally thin material with a backing board) by Saito, Quintiere and Williams [12] provided an integral equation of the Volterra type for the velocity of flame spread. Thomas and Karlsson [13] then derived an analytical solution for the integral equation for certain conditions which depended on flame length correlations, initial burner output, and the heat release rate history of the burning material. The significance of this work is that it identified limits of propagation and non-propagation for concurrent flow flame spread, as described in the following section. It is this work that provides us with a method for determining how a cladding material exposed to window fire plumes could be expected to propagate flame spread.

7. Analytical Solution for Flame Spread

Karlsson's [14,15] model for flame spread over internal wall linings has been used to observe flame acceleration and deceleration characteristics for the range of materials tested in the cone calorimeter. Karlsson provides details on the contribution of lining materials to flashover in a room fire and outlines a model for upward flame spread over solids. He also provides a lists of models and theories of varying levels of complexity for vertical upward flame spread on large surfaces [15].

It was unclear, before Karlsson's work, that any models could be used to predict flame spread over materials based on parameters derived from small scale tests. We present here a simple theory for upward flame spread that only requires results from cone calorimetry testing and that builds on the work of Parker [16] and Saito [12]. Karlsson describes the thermal theory for upward flame spread on thick solids which leads to an integral equation of the Volterra type for the velocity spread and gives a complete description of the method used in this experimental program.

Velocity of flame spread (m^2/s) can be written as:

$$V(t) = \frac{A_f - A_p}{\tau}$$

where A_f represents the flame area, A_p the pyrolysing area and τ is the time to ignition, written as

$$\tau = \left[\frac{4\dot{q}_f''^2}{\pi k \rho c \left(T_{ig} - T_0\right)^2} \right]^{-1}$$

$\dot{q}_f''$ is the heat flux from the flame to the unburnt material, $k\rho c$ is the material thermal inertia, T_{ig} is the material ignition temperature and T_0 is the surface temperature of the material ahead of the flame front.

The following assumptions allow us to solve the problem analytically, avoiding the pitfalls described by Karlsson of a numerical solution.

Assuming:

1) The method requires the heat release rate history for a material be approximated to an exponential decay function for the heat release rate, $\dot{Q}'' = \dot{Q}''_{max} e^{-\lambda t}$. Where $\dot{Q}''_{max}$ is the maximum from the cone calorimeter test, λ = is the decay coefficient of the heat release curve, as in Figure 1.

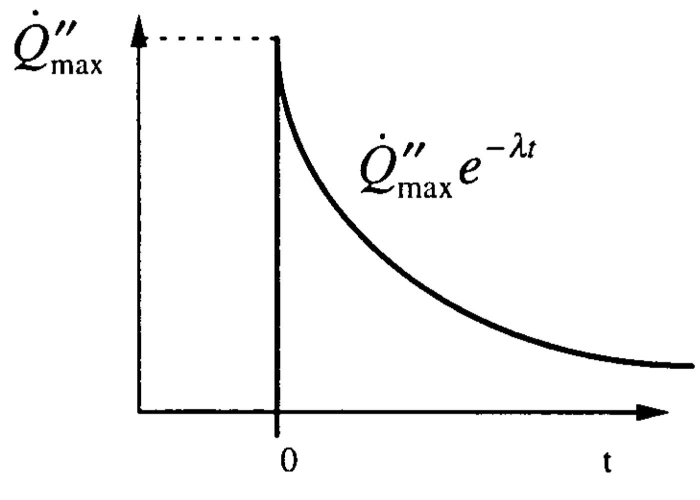

Figure 1: Mathematical representation of the material heat release rate.

2) Flame area is linearly dependent upon the total heat released and is written as $A_f = k\dot{Q}$ where k is a constant (in m^2/kW) and $\dot{Q}$ is the total heat release rate.

3) The initial pyrolysing area, A_0, depends on the strength of the ignition source and the energy released from the material directly adjacent to the ignition source.

The resulting integral equation then becomes, with $V(t) = \frac{dA_p}{dt}$ (in m²/s):

$$V(t) = \frac{1}{\tau}\left[A_0 + k\left(A_0\dot{Q}''_{max}e^{-\lambda t} + \int_0^t \dot{Q}''_{max}e^{-\lambda(t-t_p)}V(t_p)dt_p\right) - \left(A_0 + \int_0^t V(t_p)dt_p\right)\right]$$

where the first two terms on the r.h.s represent A_f and the last bracketed term represents A_p and t_p is the dummy variable of integration. The solution can be described graphically in terms of τ, λ and a (see Figure 2), with $a = k\dot{Q}''_{max}$, τ is ignition time and λ is the decay coefficient from Figure 1.

The characteristic behaviour of the solution for different parameters $a = k\dot{Q}''_{max}$ and $\lambda\tau$ are shown in Figure 2. The solutions are only valid for a positive velocity since the flame height is always considered to be positive. Figure 2 is valid for other configurations too. The value of k and the flame length or flame area coefficient change in each configuration (flame spread up a corner, on a wall or under a ceiling) and so does the initial pyrolysis area or pyrolysis length, X_p. Also, τ, the time to ignition, will be dependent on the configuration.

Karlsson [14] presents the analytical solution for the concurrent flow flame-spread equation. These rather crude engineering attempts to model a physically very complex reality show us that more detailed modelling is feasible and will improve predictive capabilities and enhance applicability under various situations. The equations can of course, be set up in somewhat more complex terms and solved numerically and this is proposed to be done in the next stage of this research work. The advantages of a numerical solution are that material heat release rates are available directly from the cone calorimeter test results.

8. Cone Calorimeter Test Program

In order to examine the concept of rate of heat release for evaluating fire performance of external wall claddings it was decided to test a range of exterior cladding materials and products (available within New Zealand) using the cone calorimeter method of ISO 5660 [17]. Each 100 mm x 100 mm sample of the cladding product was tested, at least twice, at 50 kW/m² in the cone calorimeter for at least 15 minutes. Heat Release Rates (kW/m²) were recorded, along with other test data from the start of the test until 15 minutes had passed. The time to ignition (sec), total heat release (MJ/m²) and the peak heat release rate (kW/m²) were measured.

A series of 10 products were tested at WorkCover in Australia and completed in 1995 as described by Wade [1]. Due to the lack of numerical results from these tests and the different test conditions at that time it was decided that, in order to have a coherent set of test results, we needed to redo a number of the WorkCover tests.

A further 5 products were selected for testing at the much higher irradiance of 75 kW/m². The results for these 5 products are presented in Table 2.

Test preparations:

The following procedures of the standard test method were followed.

1) All samples were conditioned to moisture equilibrium in the constant climate room at 23°C and 50% r.h. prior to testing.
2) The unexposed sides of all samples were wrapped with aluminium foil.
3) Samples were protected by the retainer frame (and when necessary the wire grid).
4) Tests were conducted at 50 kW/m² irradiance for 15 minutes from the start of the test.
5) The spark igniter was used until continuous flaming (ignition) was noted.
6) At least two replicate samples of each cladding system were tested.

Measured parameters for analytical test method:

The analytical method described in section 7 requires the following parameters from the cone calorimeter test;

1) Time to ignition , τ, (secs).
2) Peak heat release rate, $\dot{Q}''_{max}$, (kW/m^2).
3) Estimate of the decay coefficient, λ, (s^{-1}).
4) Total heat released, $\dot{Q}_{tot}$, (MJ/m^2).

Results for the products tested are listed in Table 1 and displayed visually in Figure 2.

BRANZ ID	Generic Description	Product	$\dot{Q}''_{max}$ (kW/m^2)	$\dot{Q}_{tot}$ (MJ/m^2)	τ (s)	λ (s^{-1})	a[1] $k\dot{Q}''_{max}$	λτ
1	EIFS	Insulclad	88	3	77	0.0562	1.314	4.293
2	Fibre-cement board	Hardiflex Brown	58	2	86	0.0078	0.870	6.676
3	Fibre-cement board	Hardiplank Brown	53	6	82	0.0770	0.794	6.290
4	Metal sheet	Nu-Wall	98	3	98	0.1300	1.465	12.700
5	Plaster	Multiplast Insulcote	51	3	130	0.0633	0.765	8.197
6	Plaster	Duraplast	76	6	84	0.0313	1.140	2.629
7	PVC	Superclad	151	46	28	0.0133	2.195	0.372
8	Timber	Pine Brown Acrylic	177	106	15	0.0190	2.648	0.277
9	Timber	Shadowclad	229	67	18	0.0139	3.428	0.230
10	Hardboard WB	Weathertex Brown	332	96	23	0.0220	4.973	0.508
11	Fibre-cement board	Hardiflex White	64	6	134	0.0735	0.953	9.853
12	Fibre-cement board	Hardiplank White	21	5	66	0.0290	0.308	3.799
13	Timber	Pine White Acrylic	273	77	15	0.0373	4.100	0.565
14	Hardboard WB	Weathertex White	419	106	65	0.0343	6.291	2.214
15	Metal sheet	Colorsteel	0	0	0	0.0000	0.000	0.000

Table 1: Summary of Test Results, at 50 kW/m^2.

[1] $a = k\dot{Q}''_{max}$ where $k = 0.015$ for external wall geometry.

BRANZ ID	Generic Description	Product	Peak HRR kW/m^2	Total HR[a] MJ/m^2	τ	λ	a	λτ
9	Timber	Shadowclad	322	79	4.5	0.0192	4.84	0.082
7	PVC	Superclad	190	44	17	0.0077	2.85	0.13
11	Hardboard WB	Weathertex Brown	389	111	13	0.0105	5.84	0.138
6	Plaster	Duraplast	110	10	37	0.0509	1.65	1.881
2	Fibre-cement board	Hardiflex Brown	80	7	33	0.0749	1.21	2.505

Table 2 Summary of Test Results, at 75 kW/m^2.

Regions of flame front acceleration and deceleration (@50kW/m^2)

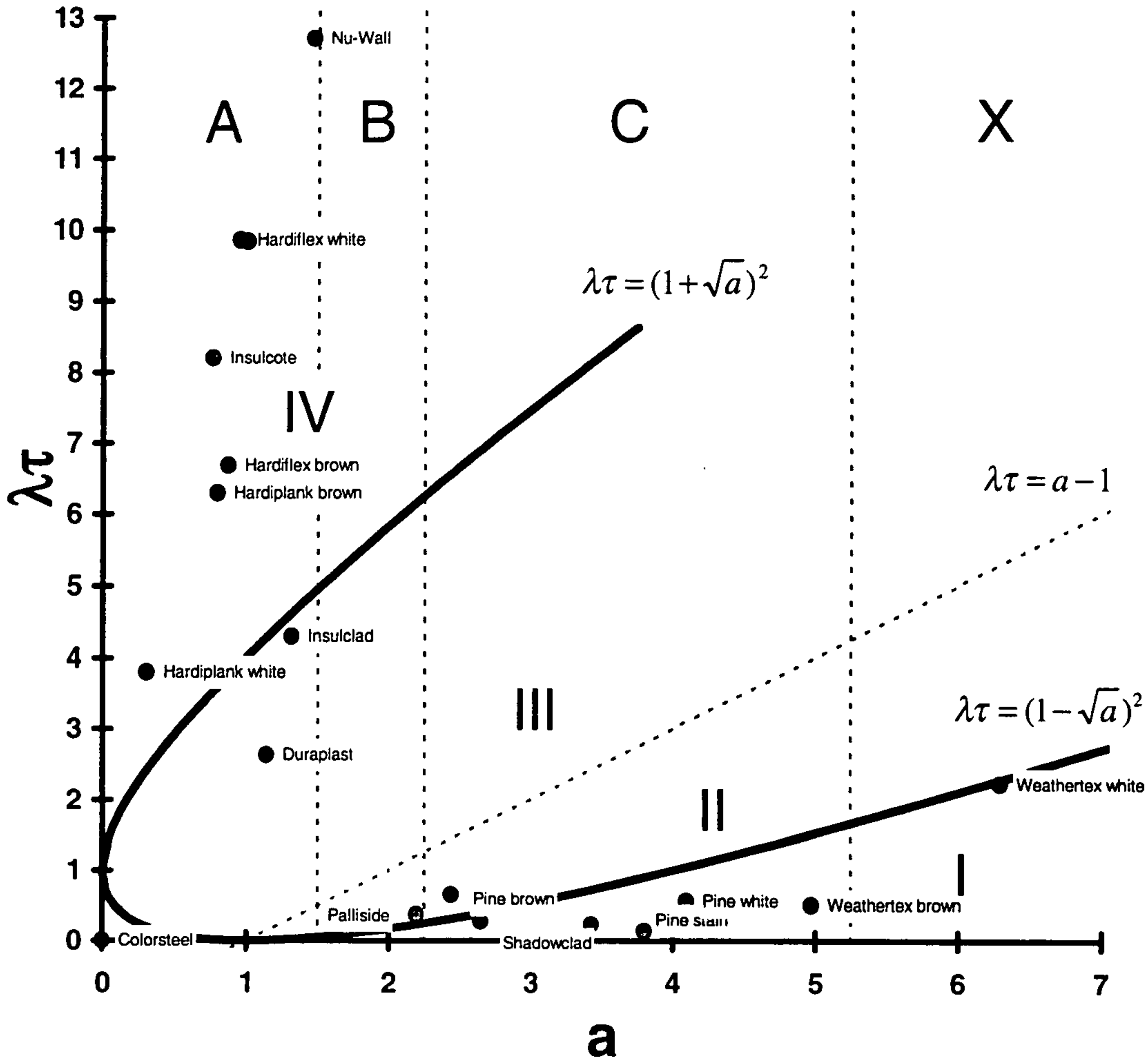

Figure 2: Regions of flame front acceleration and deceleration.

Figure 2 presents the results for each exterior wall cladding system tested as they are classified in terms of the regions of flame front acceleration.

Region I *Below the line $\lambda\tau = (1-\sqrt{a})^2$ materials will normally exhibit* ***exponentially accelerating flame spread*** *characteristics.*

In ***Region II*** *the flame exhibits* ***initial accelerating*** *but then decelerates and stops at a finite time.*

For ***Region III*** *the solution to the equation shows an* ***initial deceleration****. There is no acceleration until the velocity has been negative for some time.*

Materials in ***Region IV*** *exhibit flame spread velocities that* ***decelerate for all time****.*

The classifications based on the Flame Spread Performance Criteria, see section 9, are also illustrated as A, B, C and X.

9. Flame Spread Performance Criteria

In the context of the New Zealand Building Code, where the primary concern is the life safety of building occupants, external claddings play an important role in preventing fire spread from one building to another and between floors of the burning building. In the case of a single-storey building it is suggested that in most instances the combustibility of the external cladding has little effect on life safety within the building. However, in the case of buildings where the occupants may not be able to escape without assistance (eg. health care or prisons), highly combustible claddings are undesirable and control is considered appropriate. The NZBC Acceptable Solutions include numerous trade-offs for buildings which are sprinklered. It is suggested that a less stringent degree of combustibility on external wall claddings could also be accepted as reasonable, where the building is sprinklered.

Suggested performance criteria based on rate of heat release and total heat release and the issues of boundary distances, building height, purpose groups and sprinklers are included as Table 3.

A. Intended to apply to products which will not propagate vertical flame spread, and is indicative of regions III and IV in Figure 2.

B. Some initial flame spread, but later deceleration such as in regions II and III.

C. Vertical flame spread possible, but extremely rapid spread unlikely, such as region I and II.

Category	Peak Rate of Heat Release[1] (kW/m^2)	Total Heat Release[1] (MJ/m^2)
A	≤ 100	≤ 25
B	≤ 150	≤ 50
C	≤ 350	≤ 125

<table>
<tr><th colspan="2" rowspan="3">Building Height</th><th colspan="4">Distance to Relevant Boundary</th></tr>
<tr><th>< 1 m</th><th colspan="3">≥ 1 m</th></tr>
<tr><th>All Purpose Groups</th><th>Purpose Groups SC, SD</th><th>Purpose Groups SA, SR</th><th>All Other Purpose Groups</th></tr>
<tr><td colspan="2">Single-Storey</td><td>B</td><td>C</td><td>C</td><td>C[2]</td></tr>
<tr><td colspan="2">≤ 7 m</td><td>B</td><td>B[3]</td><td>C</td><td>C[2]</td></tr>
<tr><td colspan="2">≤ 28 m</td><td>B</td><td>B</td><td>B[3]</td><td>C</td></tr>
<tr><td rowspan="2">> 28 m</td><td>Sprinklered[4]</td><td>B</td><td>B</td><td>B</td><td>C</td></tr>
<tr><td>Unsprinklered</td><td>A</td><td>A</td><td>B</td><td>B</td></tr>
</table>

Table 3: Suggested flame spread performance criteria for exterior wall claddings.

Notes to Table 3.

1. Determined by testing to ISO 5660 at an irradiance of 50 kW/m^2 for a duration of 15 minutes.
2. External wall cladding systems in buildings with a building height not greater than 7m, and which do not contain SC, SD, SA or SR purpose groups need not comply with the above table provided the external wall is permitted to have 100% unprotected area.
3. Where the building is sprinklered in accordance with NZS 4541 or NZS 4515 (as applicable), may be reduced to a "C".
4. Sprinklered means the building is fully protected in accordance with NZS 4541.

BRANZ ID	Generic Description	Product	Peak HRR kW/m²	Total HR MJ/m²	BRANZ category	Region at 50	Region at 75
15	Metal sheet	Colorsteel	0	0	A	IV	
2	Fibre-cement board	Hardiflex Brown	58	2	A	IV	III
5	Plaster	Multiplast Insulcote	51	3	A	IV	
1	EIFS	Insulclad	88	3	A	III	III
4	Metal sheet	Nu-Wall	98	3	A	IV	
12	Fibre-cement board	Hardiplank White	21	5	A	IV	
11	Fibre-cement board	Hardiflex White	64	6	A	IV	
6	Plaster	Duraplast	76	6	A	III	III
3	Fibre-cement board	Hardiplank Brown	53	6	A	IV	
7	PVC	Superclad	182	39	C	II	I
9	Timber	Shadowclad	229	67	C	I	I
13	Timber	Pine White Acrylic	273	77	C	I	
10	Hardboard WB	Weathertex Brown	332	96	C	I	I
8	Timber	Pine Brown Acrylic	177	106	C	I	
14	Hardboard WB	Weathertex White	419	106	X	I	

Table 4: Flame spread performance of selected exterior wall claddings.

10. Discussion

It has been shown by Wade [1] that classifying exterior wall claddings on the basis of performance in the 'combustibility' test has proved overly stringent where some cladding materials are concerned.

A number of limitations are alos apparent with the proposed test method, including the performance of large sheet products in the restricted space of a small-scale test method. The classification method is not able to evaluate performance of joints/connections nor any other large-scale effects which are not apparent from small-scale tests. The same criticism can be applied to the existing test methods AS 1530 Parts 1 and 3. Large-scale tests are expensive and there is a need for simpler, cheaper, bench-scale methods such as the cone calorimeter even, if it is not a perfect solution.

Observation of the performance of an analytical solution to the concurrent flow flame spread equations developed for flame spread on internal wall configurations, in combination with material flammability parameters, indicates that the method can be used to rank combustible cladding materials according to their flame spread propensities. It is also possible to develop performance criteria based on the *peak rate of heat release* and the *total heat release* in 15 minutes from the start of the test. In general terms the A, B and C categories seem to achieve intentions of providing a better classification of external wall cladding systems than the non-combustibility criterion of AS 1530 Part 1. The relative performance of each product tested in the flame spread classification system compared with the analytical flame spread model shows good agreement, with both methods successfully ranking the flame spread characteristics of the tested materials.

11. Acknowledgments

BRANZ acknowledges the support of the Building Research Levy and the Public Good Science Fund of the Foundation for Research Science and Technology during this research project.

12. References

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13. Product Catalogue

The following table lists the products selected for assessment for this report.

1 EIFS
Insulclad, 45 mm thick.
Proprietary Exterior Insulation and Finish System (EIFS). Polystyrene foam insulation board finished with a Portland cement-based plaster, reinforced with fibreglass mesh. Finished with two coats of acrylic paint.

2 Fibre-cement board
Hardiflex Brown, 6.5 mm thick.
Proprietary cellulose fibre-cement board. Finished with two coats brown acrylic paint.

3 Fibre-cement board
Hardiplank Brown, 10 mm thick.
Proprietary compressed cellulose fibre-cement sheet. Pre-finished with primer coats and a two-part-polyurethane top coat. Colour white.

4 Metal sheet
Nu-Wall, 14 mm thick.
Aluminium cladding system. Pre-finished in white.

5 Plaster
Multiplast Harditex Insulcote, 9.7 mm thick.
Consists of a proprietary cellulose fibre-cement board, covered with a skim coat of cementitious plaster and a proprietary polymer-modified, cement-based plaster. Insulcote acrylic paint finish.

6 Plaster
Duraplast, 21 mm thick.
Plaster coatings applied to Hardibacker, fibreglass mesh finishing plaster. Two-coat acrylic paint system.

7 PVC
Superclad, 13 mm thick.
Proprietary extruded twin-wall uPVC weatherboard. Colour white.

8 Timber
Radiata Pine Brown Acrylic, 20.4 mm thick.
Radiata pine treated with copper-chrome-arsenate (CCA) to H3. Finished with three-coat acrylic paint system. Colour brown.

9 Timber
Shadowclad, 12 mm thick.
Phenol formaldehyde bonded Radiata Pine veneers, treated to H3. One coat brown decking stain on rough sawn plywood face.

10 Hardboard weatherboard
Weathertex Brown, 9.4 mm thick.
CSR Weatherex shiplap cladding. Two coat brown acrylic paint.

11 Fibre-cement board
Hardiflex White, 6.3 mm thick.
Proprietary cellulose fibre-cement board. Finished with two coats white acrylic paint.

12 Fibre-cement board
Hardiplank White, 9 mm thick. Similar to product 31.
Proprietary compressed cellulose fibre-cement sheet. Finished with primer and an acrylic top coat. Colour white.

13 Timber
Radiata Pine White Acrylic, 19 mm thick.
Radiata pine treated with copper-chrome-arsenate (CCA) to H3 Finished with three-coat acrylic paint system. Colour brown.

14 Hardboard weatherboard
Weathertex White, 9.5 mm thick.
CSR Weatherex shiplap cladding Two coat white acrylic paint.

15 Metal sheet
Colorsteel, 0.5 mm thick.
A coil-coated galvanised steel sheet. Oven-dried finishing paint coat, colour titania.

THE RESOURCE CENTRE FOR BUILDING EXCELLENCE

BRANZ MISSION

To be the leading resource for the development of the building and construction industry.

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