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### A punched card system for fire endurance ratings Galbreath, M.

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# NATIONAL RESEARCH COUNCIL OF CANADA

## DIVISION OF BUILDING RESEARCH

No.

367

# TECHNICAL NOTE

NOT FOR PUBLICATION

FOR INTERNAL USE

PREPARED BY M. Galbreath

CHECKED BY R. S. Ferguson APPROVED BY NBH

DATE April 1962

PREPARED FOR Record Purposes

*✓ Rgh.*

SUBJECT A PUNCHED CARD SYSTEM FOR FIRE ENDURANCE RATINGS

Standard fire tests are becoming more widely accepted as a measure of the performance of a building assembly as a barrier to fire. The National Building Code of Canada (1960) recognizes both the American ASTM E119 and the British BS 476 tests as evidence of fire endurance. Tests are being carried out to conform with both of these and with similar standards in many parts of the world. The information derived from these tests, however, is contained in a range of publications so wide that it would be impossible for the typical building industry user to gain access to more than a small fraction of the whole.

Some attempts have been made to assemble information of this kind in a convenient form. Fire Resistance Ratings, Supplement No. 2 of the National Building Code, contains approximately 550 entries in tabular form. The Underwriters' Laboratories Building Materials list contains 205 entries. Investigations on Building Fires, Part V, Fire Tests on Structural Elements, Her Majesty's Stationery Office, contains 224 reports and the Sponsored Fire-Resistance Tests on Structural Elements contains 81. This totals about 1000 fire test reports, supplemented by a large number of individual test reports published by testing authorities in the United States and Canada. There is a need for a classification system that will permit the comparison of information from these various sources and the selection of relevant data for a particular requirement.

A start on this project has been made by the coding of the more important information from each test report on a punched card system. A building assembly is described in four sections:

- 1) the core or structural material,
- 2) the finish material on the fire exposed side,
- 3) the inner material on the fire exposed side,
- 4) the finish material on the unexposed side.

The material in each situation is described in three steps:

- 1) the general description, (stone, brick, wood, etc),
- 2) the more detailed description of the material,
- 3) the form in which it is used (solid, hollow, cellular, etc).

The complete coding system is set out in Appendix A. This permits the sorting of information by fire endurance rating, by mode of failure, by type of construction and by over-all dimension. Two periods of fire endurance may be recorded making it possible to distinguish between failure by temperature rise and failure by collapse. The 8-in. by 5-in. card is large enough for the necessary description of the construction and reference data to be typed on the face. It contains 112 holes, and of these 100 are used for recording test information; 12 are spare. The 7-4-2-1 Code used allows all numbers from 1 to 9 to be selected using only four holes. The objective is to provide a simple tool that will enable all the information available to the Division of Building Research from fire test reports to be made readily accessible and to avoid the difficulties and delays that arise when filing is by published document only. The punched card system when fully operational should be a considerable value in the preparation of future revisions of Supplement No. 2, Fire Resistance Ratings, and in making the information readily available to the public.



## APPENDIX A

### Fire Resistance Ratings - Punched Card System

#### GENERAL CLASSIFICATION

	<u>HOLES</u>
1. Building Element	3
2. Fire Endurance I	4
3. Manner of Failure I	4
4. Fire Endurance II	4
5. Manner of Failure II	4
6. Core (or Structure)	12
7. Facing Material Fire Exposed Side	12
8. Inner Material Fire Exposed Side	12
9. Facing Material Non-Exposed Side	12
10. Country of Test (or Continent)	3
11. Date of Test	8

punch for

13. Non-Proprietary Material	1
14. Publishable Information	1
15. Standard Test	1
16. Restrained Sample	1
17. Spare	<u>12</u>
	102

#### BUILDING ELEMENTS

1. Wall Load Bearing
2. Wall Non-Load Bearing
3. Column
4. Floor
5. Roof
6. Ceiling and Beam Protection

#### FIRE ENDURANCE

1. Less than 20 min
2. Over 20 but less than 30 min
3. Over 30 but less than 45 min
4. Over 45 but less than 1 hr
5. Over 1 hr but less than 1½
6. Over 1½ but less than 2 hr
7. Over 2 but less than 3 hr
8. Over 3 but less than 4 hr
9. Over 4 hr

MODE OF FAILURE

1. Collapse
2. Temperature average
3. Temperature maximum
4. Flame through
5. Steel temperature
- 6.
- 7.
- 8.
9. Test Discontinued

MATERIALS

1. Natural Stone
2. Brick and Tile
3. Wood
4. Metal
5. Cement and Lime Compounds
6. Gypsum Compounds
7. Compounds having other Binder
8. Plastics
9. Miscellaneous

1 Natural Stone

1. Granite
  2. Basalt
  3. Limestone
  4. Sandstone
  5. Slate
  6. Marble
  - 7.
  - 8.
  - 9.
- 
- .01 Rubble Random
  - .02 Rubble Coursed
  - .03 Ashlar Random
  - .04 Ashlar Coursed
  - .05 Veneer
  - .06
  - .07
  - .08
  - .09

2 Brick and Tile

1. Clay
  2. Shale
  - 3.
  - 4.
  - 5.
  - 6.
  - 7.
  - 8.
  9. Other
- 
- .01 Solid Brick
  - .02 Cored Brick
  - .03 Hollow Tile Single Core
  - .04 Hollow Tile Double Core
  - .05 Hollow Tile Double-Faced
  - .06
  - .07
  - .08
  - .09 Other

3 Wood

1. Softwood
  - 2.
  - 3.
  4. Hardwood
  - 5.
  - 6.
  - 7.
  - 8.
  9. Other
- 
- .01 Joist or Stud
  - .02 Laminated or Built-Up
  - .03 Glued Laminated
  - .04 Plywood
  - .05 Plank
  - .06 Furring
  - .07
  - .08
  - .09 Other

4 Metal

1. Steel
2. Galvanized Steel
3. Aluminum
4. Zinc
5. Copper
6. Lead
- 7.
- 8.
9. Other



- .01 Joists or Studs
- .02 Hollow Units
- .03 Corrugated
- .04 Ribbed
- .05 Sheet or Pans
- .06 Metal Lath
- .07 Tee Section
- .08
- .09 Other

5 Cement

- 1. Group 1 Aggregate (Vermiculite)
- 2. Group 2 Aggregate (Expanded Slag)
- 3. Group 3 Aggregate (Limestone)
- 4. Group 4 Aggregate (Siliceous)
- 5. Fibre Inorganic
- 6. Fibre Organic
- 7. Neat
- 8.
- 9. Other

- .01 Formed in place
- .02 Formed in place reinforced
- .03 Formed in place tensioned
- .04 Precast
- .05 Precast reinforced
- .06 Precast tensioned
- .07 Cellular (foamed)
- .08 Hollow
- .09 Other

6 Gypsum

- .1 Group 1 Aggregate (Vermiculite)
- .2 Group 2 Aggregate (Expanded Slag)
- .3 Group 3 Aggregate (Limestone)
- .4 Group 4 Aggregate (Siliceous)
- .5 Fibre Inorganic
- .6 Fibre Organic
- .7 Neat
- .8
- .9 Other

- .01 Formed in place
- .02 Formed in place reinforced
- .03 Formed in place tensioned
- .04 Precast
- .05 Precast reinforced
- .06 Precast tensioned
- .07 Cellular (foamed)
- .08 Hollow
- .09 Other

7 Other Binder

- .1 Group 1 Aggregate
- .2 Group 2 Aggregate
- .3 Group 3 Aggregate
- .4 Group 4 Aggregate
- .5 Fibre Inorganic
- .6 Fibre Organic
- .7 Neat
- .8
- .9 Other
  - .01 Formed in place
  - .02 Formed in place reinforced
  - .03 Formed in place tensioned
  - .04 Precast
  - .05 Precast reinforced
  - .06 Precast tensioned
  - .07 Cellular
  - .08 Hollow
  - .09 Other

8 Plastics

- .1 Polyethylene
- .2 Polyvinyl
- .3 Polyester
- .4 Polystyrene
- .5 Phenol
- .6 Polyurethane
- .7 Acrylic
- .8 Melamine
- .9 Other
  - .01 Formed in place
  - .02 Formed in place reinforced
  - .03 Formed in place tensioned
  - .04 Precast
  - .05 Precast reinforced
  - .06 Precast tensioned
  - .07 Cellular
  - .08 Hollow
  - .09 Other

9 Miscellaneous

- .1 Glass
- .2
- .3
- .4
- .5
- .6
- .7
- .8
- .9



- .01 Formed in place
- .02 Formed in place reinforced
- .03 Formed in place tensioned
- .04 Precast
- .05 Precast reinforced
- .06 Precast tensioned
- .07 Cellular
- .08 Hollow
- .09 Other

#### GRADING OF AGGREGATES

##### Group 1

Aggregates prepared by expanding products such as perlite and vermiculite and similar lightweight cellular and granular inorganic material.

##### Group 2

Aggregates prepared by expanding calcining or sintering products such as blast furnace slag, clay, diatomite, fly ash, shale or slate. Aggregates prepared by processing natural materials such as pumice, scoria, tuff. Similar lightweight cellular or granular inorganic material.

##### Group 3

Burnt clay, blast furnace slag cinders containing not more than 25 per cent combustible material and not more than 5 per cent volatile material, limestone, calcareous gravel, trap rock, and similar dense materials containing not more than 30 per cent of quartz, chert, flint and similar materials.

##### Group 4

Granite quartzite siliceous gravel, sandstone gneiss and other dense materials containing more than 30 per cent of quartz chert flint and similar materials.

##### Country of Test

1. Canada
2. America including U.S.A.
3. Europe
4. Asia
5. Africa
6. Australia.