Activities of the Building Structures and Housing Sections of the Division of Building Research Related to Timber Structures

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SUBJECT Activities of the Building Structures and Housing Sections of the Division of Building Research Related to Timber Structures

Introduction

Since the attached report on recent activities in the field of timber structures is the first one presented to Commission W18 by the Division of Building Research, it seems appropriate to preface it by a short introduction.

The Division of Building Research is one of ten research divisions of the National Research Council of Canada which is a public body financed by the Government of Canada. The Division has a total staff of about 210.

The prime function of the Division is to provide a research service to the construction industry of Canada. The general programme of work of the Division is based on the principle of concentrating on problems that are peculiar to Canada, leaving to universities and research organizations in other countries the investigation of problems of common interest. Research into cold weather problems is a dominant part of much of its work. Structural research and work on building materials are important parts of the programme, both slanted in the direction of special Canadian problems.

In the field of timber structures close cooperation is maintained with the Ottawa Laboratory of the Forest Products Research Branch. Several projects have been carried out jointly by the two organizations.

REPORT ON RECENT ACTIVITIES FOR C. I. B. COMMISSION W18

Work of the Building Structures and Housing Sections of the Division of Building Research related to timber structures

1. Strength of Conventional and Trussed Roof Frames

Many types of conventional (rafter-and-joist) roof frames and W-trusses with nailed gussets have been load tested (individually and in full roofs) to failure to gain an over-all picture of their strength and deflection characteristics and in order to establish minimum performance criteria for the trusses. It was found that trusses designed by common engineering methods provided load factors of 3 to 5, whereas most conventional roofs were found to carry only 1-2 times the design snow load specified in the National Building Code. Failure occurred always at the joints. Nonetheless, most of the conventional roofs had a history of generally satisfactory structural performance in Canada. It was considered unjustified, therefore, to require trusses in residential structures to provide greater load carrying capacity than is found in good conventional roof frames and it was decided that trusses could be designed with a load factor of 2, as determined from a 24-hour loading test. This work was done in cooperation with the Forest Products Research Branch.

This was a very significant departure from standard engineering practice since it meant an increase in the permissible stresses and nail loads by a factor of up to 2. This raises the question whether the load factor of 2 could also be applied to other elements of house construction such as floors and walls and, more broadly speaking, whether houses can be designed with lower safety margins than larger "engineered" structures. Some of these questions are under active review at present, as well as the all-important aspect of the actual loads vs. code loads.

2. Toothed Metal Gusset Plates for Trusses

A certain amount of load testing under short-term and long-term loads of the metal gusset plate joints has been done, in view of the fact that today the majority of roof trusses used in house construction are made with joints of this type. Tests were made on joints assembled from green and dry wood, and tested at various stages. One of the purposes of the tests was also to establish a method of predicting the deflection of full-size trusses by calculation based on simple joint tests rather than full-scale load tests on trusses.

3. Prefabrication in Canadian Housing

A report (DBR Technical Paper No. 172) has been prepared based on studies of house prefabrication throughout Canada, and of some ventures in the United States where conditions are similar to anticipated conditions in Canada, to evaluate the present and future of factory house production. The factors of financing, local building codes, labour, costs, design and distribution have been assessed. The dominance of wood frame housing has been recognized in a special section on shop practice for frame house production. The potentials of innovations such as transportable section systems, stressed skin, structural sandwich and wood-plastic composite systems have been reviewed.

4. Racking Strength of Wood Frame Walls

Although no active work has been done in this project recently, a series of racking tests on 8' x 8' wood frame panels, covered with various forms of sheathing with and without diagonal bracing materials commonly used in Canada, had been carried out to evaluate the resistance of house walls to horizontal shear forces acting in the plane of the wall. This work, which was carried out jointly with the Forest Products Research Branch in Ottawa, led to the conclusion that in most frame walls interior and exterior cladding materials provide sufficient racking resistance, eliminating the need, from a structural point of view, for the traditional sheathing.