Load tests of aluminum window meeting rails

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PREPARED FOR CGSB Committee on Specifications for Aluminum Windows

SUBJECT Load Tests of Aluminum Window Meeting Rails

Work by a committee of the Canadian Government Specifications Board, on specifications for aluminum windows, as related in Technical Note No. 301, raised some interesting questions as to the appropriate stiffness requirements to be specified for the sash rails of medium duty and heavy duty aluminum windows.

Specifications of the Aluminum Window Manufacturers Association are being used as a basis for this work, but the committee decided that the window sizes to be submitted for load tests according to the Canadian specifications should be somewhat smaller than those called for in the AWMA specifications. It remained therefore to decide on the load-deflection requirements that would be appropriate to the smaller window sizes for both medium duty and heavy duty applications.

To assist in reaching this decision a test program was undertaken to determine the stiffness properties of sash rail sections considered by Canadian window manufacturers to be appropriate for medium duty and heavy duty uses. Simple bend tests were carried out on sash rail samples submitted by five manufacturers as being the sections that they would normally supply in meeting rails for 4'0" by 6'0" vertical sliding double-hung windows for medium duty and for heavy duty applications.

Each sample rail was supported as a simple beam on a span of 20 inches and subjected to a single concentrated load at the centre, first in the vertical direction and then in the horizontal direction. The

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Each sample rail was supported as a simple beam on a span of 20 inches and subjected to a single concentrated load at the centre, first in the vertical direction and then in the horizontal direction. The

proper point of application of the load, across the width of the rail, was carefully selected, by means of the two dial gauge system illustrated in Fig. 1, to avoid any twisting of the rail during the test. The bearing ends of each rail were capped with plaster of paris. Deflections were measured at the centre of the test span by the dial gauges and recorded with the applied load.

The moment of inertia I about the neutral axis was calculated by the formula $D = \frac{Pl^3}{48EI}$

where: D = deflection

P = test load

l = test span

E = modulus of elasticity, which was taken to be 10×10^6 psi for aluminum

I = moment of inertia

The section modulus S was obtained by dividing the moment of inertia I by the distance c from the centroid of the cross-section of the rail to the outermost fibre. Centroids of the cross-sections were determined experimentally by cutting slices from each rail, pasting paper over one end of the slices and balancing them on a pinpoint.

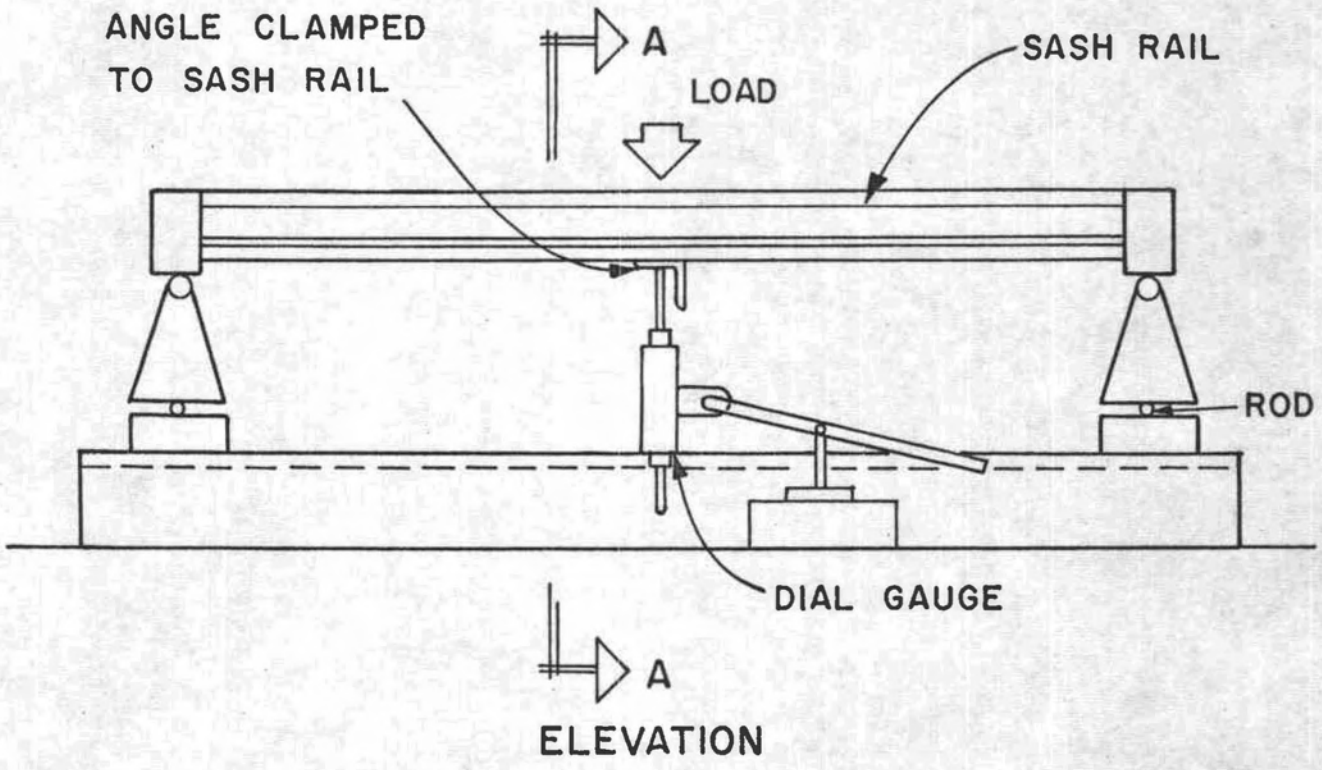
Results

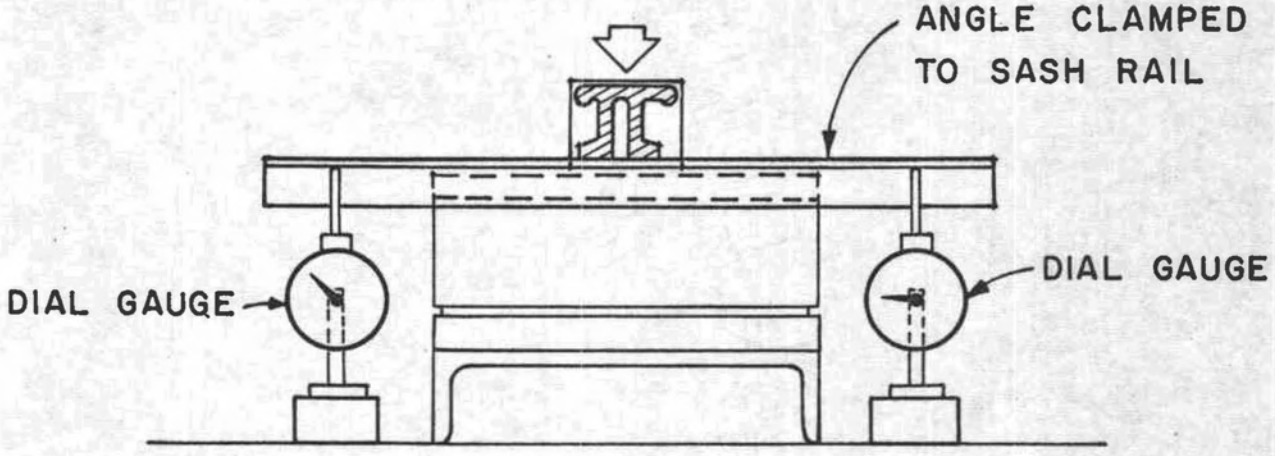
The results of the tests are given as moment of inertia I and section modulus S in Table I. Sample numbers are made up of three letters, the first being a code letter designating the manufacturer, the second identifying the section as medium duty (M) or heavy duty (H), and the third designating the inside rail (I) or outside rail (O).

TABLE I

Results of Vertical and Horizontal Load Tests on Meeting Rail Samples

Sample Number	Vertical Load		Horizontal Load	
	I ($in.^4 \times 10^{-3}$)	S ($in.^3 \times 10^{-3}$)	I ($in.^4 \times 10^{-3}$)	S ($in.^3 \times 10^{-3}$)
A-M-I	23.8	33.0	22.2	45.3
-0	24.0	34.3	22.2	43.5
B-M-I	18.4	25.6	19.2	30.0
-0	14.9	25.2	20.5	30.2
C-M-I	16.3	23.0	18.9	30.0
-0	15.8	17.0	17.8	28.2
E-M-I	19.8	28.7	6.8	14.8
-0	18.9	31.5	5.7	13.2
A-H-I	172	134	130	140
-0	161	138	113	106
B-H-I	62	70.5	69	100
-0	73.5	58.0	78.5	109
C-H-I	80.5	91.5	105	140
-0	73	86	382	490
D-H-I	156	130	203	231
-0	220	224	318	227
E-H-I	7.1	14.8	24.1	32.1
-0	6.0	15.8	25.4	33.0





SECTION A-A

FIGURE 1

BEND TEST - ALUMINUM WINDOW MEETING RAILS