Testing of beam cross-sections for the properties of steel in compression

The following is a proposed program for the pilot test of a whole 14×5.00 cross-section in compression to obtain the properties of the material.

The object is to find the required length that would be both practical and that won't release the residual stresses by too great an amount.

Then the whole cross-section will be tested in compression and the properties of the material obtained thus will be compared with those obtained from small coupon cut from the vicinity of the test specimen and with those obtained in previous coupon compression tests. If the results of this pilot test justify it as a program for further investigations will be worked out having as an aim, the establishment of a revised procedure for the obtaining of the compression properties of steel.

For that further investigation it is planned to study the change of the residual stresses and the physical properties of steel along a beam and to study the optimum length for other structural cross-sections such as 8×5.00, 8×15, etc., of importance would be the change of residual stresses with time.

The advantages of a new procedure would be:

1) a true stress-strain diagram that takes into account the residual stresses.
(2) Less expensive preparation of the test specimen.

Previous investigations of small sized coupons have been carried out both in tension and compression tests but these studies did not include the influence of residual stresses. However, residual stresses actually exist especially in WF steel shapes (see: Lehigh Progress Report No. 1, "Plastic Behavior of Wide Flange Beams"), and therefore it is important to know the influence of the residual stresses upon the effective stress-strain curve.
Pilot Test Program

1. Determination of the Length of 14WF30 Specimens

To get the optimum length, a sample will be cut of length 4d (d = specimen depth) and will be cut successively and the change of length will be measured over gage lengths of 10" and 2". Whitemore .0001 dial gages will be used.

<table>
<thead>
<tr>
<th>14WF30</th>
<th>Initial cut</th>
<th>1 cut</th>
<th>2 cut</th>
<th>Initial cut</th>
</tr>
</thead>
<tbody>
<tr>
<td>scale 1</td>
<td>14WF30</td>
<td>Initial cut</td>
<td>1 cut</td>
<td>2 cut</td>
</tr>
</tbody>
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Procedure:

1. Holes drilled to center line of the 56" long sample.
2. Readings taken.
4. Again readings taken.
5. Again saw cut a.s.f. until criterion in change of reading is reached. (See below)

It may be necessary to reduce the cut-off length of 7" as the process continues.

Criterion:

For an assumed residual stress of 10 ksi tension in the
middle of the flange and 20 ksi compression in the outside of the flange it is suggested that there should be no greater than 10% release of the residual stresses due to cutting of the sample. This corresponds to a change of reading of .00035" respectively .0007" for the 10" gage length and .00007" respectively .00014" for the 2" gage length.

2. Pilot Compression Test

Location of dial gages

Test has to be carried out with 800,000 ft. testing machine

(14"F30 A = 3,51, f = 350K)

Spherical bearing block will be used at the upper end of the specimen. Shims may also be used.