Quality Control and Designation of Specified Design Strength for Structural Steel

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1. Introduction

When using high-strength structural steel and other new materials as principal structural members of buildings, the specified design strength required for structural calculations (values forming the basis for allowable stress, etc.) needs to be designated, accompanied by ministerial approval under Article 37 (ii) of the Building Standard Law pertaining to the quality of building materials. Until now, however, there has been no unified method of designating the specified design strength of structural steel. Therefore, we studied designation methods with a view to achieving unified operation by designated performance evaluation bodies, in addition to ministerial approval. The outcome of this was that we classified structural steel into categories based on yield ratio and uniform elongation, and presented a unified method of designating the specified design strength for each category (referred to below as the "proposal for provisional treatment"). Now, designations of specified design strength for structural steel are being applied on the basis of this proposal.

2. Outline of the proposal for provisional treatment

The quality of structural steel is determined by various mechanical properties, the most important ones of which are yield strength, tensile strength, yield ratio and uniform elongation. In the proposal for provisional treatment, steel materials are divided into three categories – ductile, intermediate and elastic – taking the yield ratio and uniform elongation as scales. The proposal focuses on three steel material products – thick plate, shaped steel and steel pipes – and specifies methods of designating specified design strength for each category. Fig. 1 shows an outline of the proposal for provisional treatment. Here, the yield ratio as the vertical axis represents the yield strength of structural steel divided by the tensile strength, expressed symbolically as σy / σu. The uniform elongation as the horizontal axis represents permanent strain in relation to tensile strength. The areas marked * in the graph are those that can be given leeway, taking various factors into account.

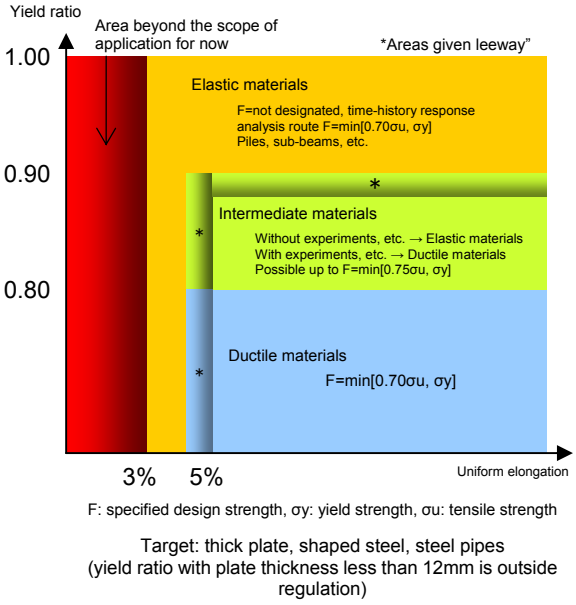

Figure 1. Schematic diagram of the outline proposal for provisional treatment

In actual practice, quality control of structural steel is not based on uniform elongation but on rupture elongation, and a conversion rule between the two will be required when applying this proposal. Therefore, NILIM and the Japan Iron and Steel Federation (JISF) carried out joint research on "Elongation performance of structural steel for determination of specified design strength", and experimentally studied the relationship between uniform elongation and rupture elongation of structural steel at varying levels of strength when the dimensions of the specimen were changed. The outcome of this research has been published in a NILIM Technical Note [1].

[References]

1) Nishiyama, Mukai, Iwata et al: Effect of dimensions of specimen on elongation of structural steel, NILIM Technical Note No. 662
http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn0662.htm