ANNEX B RELATIVE STRENGTH COEFFICIENT

B1 GENERAL

This Annex B describes how to calculate the relative strength coefficient as referred in clause 16.3.5 of the Code.

Unless the design is based on the properties obtained from the test, test results should be adjusted using a relative strength coefficient. This takes into account the effect of variations of the geometry or material properties of the test specimens, as compared with their nominal values. The coefficient should be used to predetermine the test load for strength tests and/or to determine the design capacity from a failure test.

B2 PREDETERMINATION OF THE TEST LOAD FOR A STRENGTH TEST

Provided that the actual cross-sectional dimensions of the components do not exceed their nominal dimensions, the relative strength coefficient Rs may be obtained from:

$$Rs = \frac{\text{Weighted mean yield strength}}{\text{Nominal yield strength}}$$

The relative strength coefficient for an assembly of structural components should be based on the weighted mean value of the actual yield strength of each component. The weighting should take into account the contribution of each component to the expected performance of the test specimen. Unless other information is available, the contribution may be based on monitoring of the preliminary proof test.

If the actual cross-sectional dimensions exceed the nominal dimensions, the relative strength coefficient Rs should be obtained by making appropriate adjustments to the weighted mean yield strength, to allow for the influence of each cross-sectional dimension of the test specimen on its expected performance.

If there have been other similar tests that provide reliable information about the expected failure mode, the relative strength coefficient Rs may be determined as for a failure test, see clause 16.4.3 of the Code.

B3 PROCESSING THE RESULTS OF A FAILURE TEST

The relative strength coefficient should be used to determine the design capacity from the results of a failure test.

If a reasonable estimate of the capacity can be made by calculation using the Code or other proven methods of calculation that take into account all stability effects, the relative strength coefficient Rs may be obtained from:

$$Rs = \frac{\text{Capacity assessed using actual yield strength and actual dimensions}}{\text{Capacity assessed using nominal yield strength and nominal dimensions}}$$

If this is not possible, the relative strength coefficient Rs should be determined according to the observed failure mode, as follows:

a) for a ductile yielding failure:

$$Rs = \frac{\text{Mean yield strength}}{\text{Nominal yield strength}} \times Rp$$

in which the mean yield strength relates to the cross-section at which failure is observed;

b) for a sudden failure due to rupture in tension or shear:

$$\text{Rs} = \frac{\text{Mean ultimate tensile strength}}{\text{Nominal yield strength}} \times \text{Rp}$$

in which the mean tensile strength relates to the cross-section at which failure is observed;

c) for a sudden failure due to buckling:

$$\text{Rs} = \frac{1.2 \times \text{mean yield strength}}{\text{Nominal yield strength}} \times \text{Rp}$$

in which the mean yield strength relates to the cross-section at which failure is observed;

d) for a ductile failure due to overall member buckling:

$$\text{Rs} = \frac{\text{Buckling strength for mean yield strength}}{\text{Buckling strength for nominal yield strength}} \times \text{Rp}$$

in which the buckling strength relates to the relevant slenderness L/r from the appropriate buckling curve and the mean yield strength relates to the cross-section at which failure is observed; alternatively, Rs may be obtained as in a) if the relevant slenderness or the appropriate buckling curve are in doubt;

e) for a ductile failure due to local buckling of a flat element:

$$\text{Rs} = \frac{\text{Actual yield strength}}{\text{Nominal yield strength}} \times \frac{\text{Actual thickness}}{\text{Nominal thickness}} \times \text{Rp}$$

$$\text{but Rs} \geq \left[\frac{\text{Actual yield strength}}{\text{Nominal yield strength}}\right]^{0.5} \times \left[\frac{\text{Actual thickness}}{\text{Nominal thickness}}\right]^{2} \times \text{Rp}$$

and $\text{Rs} \geq 1$

where

$$\text{Rp} = \frac{\text{Actual value of section property}}{\text{Nominal value of section property}} \quad \text{but Rp} \geq 1$$

in which the section property is that relevant to resisting the observed failure mode, and the values relate to the cross-section at which failure is observed.