

## TECHNICAL NOTE 007

# Structural Steel Sub-Grades JR, J0 & J2 Does It Matter?



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### Keywords

Brittle fracture, sub-grades, JR, J0, J2

### Synopsis

After the replacement of BS 4360 by EN 10025 and EN 10113, structural steel grades and sub-grades are specified using a different system to designate different steel quality. In general engineering design works, the steel grades and sub-grades are specified by the Responsible Engineer, and all we have to do is to procure the steel grades and sub-grades specified. However, in Contractor's design, we should understand in greater detail the design implication of different steel sub-grades, noting over-specified steel sub-grades by Contractor's Designers might lead to difficulty in timely procurement.

### 1.0 Introduction

A steel of high strength and low ductility is brittle. Brittle fracture (see figures below) can occur in steel components/structures subject to tensile stresses in low temperature. In certain situations where inappropriate fabrication conditions or low toughness weld materials are used, brittle fracture can also occur at normal temperature. The problem is mitigated by specifying steel and welded joints with appropriate grades of fracture toughness (or steel quality).



Brittle fracture at steel plates



Brittle fracture at heavy welding

The following tables show the most common steel grades and sub-grades with their former grade designation in BS 4360 for reference.

EN 10025	BS 4360	EN 10025	BS 4360
S275 JR	Grade 43B	S355 JR	Grade 50B
S275 J0	Grade 43C	S355 J0	Grade 50C
S275 J2	Grade 43D	S355 J2	Grade 50D

### 2.0 Sub-Grades JR, J0, J2

Steel sub-grades indicate the Charpy impact value required to prevent brittle fracture.

JR – Longitudinal Charpy V-notch impacts 27J at Room temp

J0 – Longitudinal Charpy V-notch impacts 27J at 0°C

J2 – Longitudinal Charpy V-notch impacts 27J at -20°C

Comparing to JR, J0 & J2 quality steels are able to exhibit the same level of ductility (ie, absorbing 27J impact energy) at lower temperatures (ie, 0°C & -20°C). It means that these steels are of better quality against brittle fracture, and hence more expensive. The following tables give an indication of the percentage increase in material cost relative to S275 JR.

Steel Grade	% Extra	Steel Grade	% Extra
S275 JR	0	S355 JR	3 %
S275 J0	3.5 %	S355 J0	4 %
S275 J2	4 %	S355 J2	10 %

In very general terms, JR steel material is most readily available from stock and mill. It is also the lowest priced sub-grade and so for maximum economy and availability, JR quality material should be used whenever possible. Higher quality materials, J0 and J2, are not normally held in stock and might need ordering directly from the mill. Time allowance for this should be made in the procurement programme.

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