

THE AFFECTS OF THE BAR DUCTILITY ON THE FAILURE MORPHOLOGY AND SAFETY OF THE STRUCTURES

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Abstract: The safety of structures does not completely depend on the force – bearing capacity. The omenless brittle failure has a great impact on the safety. The ductility of the bars is one of the key factors that determine the failure morphology. After the analysis on the failure morphology and failure condition of the concrete members, the recommendation to improve the design and to avoid the brittle failure is proposed. The main measures are: to grade the bars according to ductility and specify their applications; to use the hot – rolled bars with good ductility as the dominant reinforcement in the common concrete structures, to adopt the wires or tyre cord with high strength and low relaxation as the leading reinforcement in the prestressed concrete structures; to strictly control the quality of bars when being cold processed; not to use the cold – processed bars as prestressed ones and not to consider the plastic design; to strengthen the measures of reinforcement construction.

Key words: reinforced bars; ductility; failure morphology; structures; safety

1 General

From the statistics, among the project accidents in China, most are the problems concerning the service states such as the deformation (flexure) due to the structures too large, visible cracks, defects (inclination, vibration and leakage) that affect the service functions. The fatal accidents that practically endanger the lives and safety of the properties are few, only accounting for about 2.7%. However, since the consequence is severe, great importance has to be attached.

To control the structure safety, the strength (force – bearing capacity) was mostly focused on in the past. But the investigations of the accidents reveal that the failure morphology of the structures has more important and direct effects on the safety. In fact, the engineering sector has realized impacts

of the failure morphology (ductility and brittleness) on the safety very early and they have been reflected in the designs, for instance, to increase the allowable stress $[\sigma]$, safety factor K and reliability index β , etc. Nevertheless these still belong to the qualitative scope and have certain limitation. If the conditions leading to the brittle failure can be determined through the analysis on the failure morphology of the concrete members and the brittle failure can be avoided through calculations in the designs, it will be of great practical significance to ensure the structure safety.

2 Analysis on the Fatal Project Structural Accidents

From the statistics, among the fatal project structural accidents of all sorts, about 1/4 are the accidents of concrete structures, represented as