

Chapter 6 Performance Verification for Existing Structures

- (1) When retrofitting of existing structures is being studied, performance items specified as performance requirements shall be examined to verify whether or not the structure has the required performance at the time of the study.
- (2) Evaluations of the performance of existing structures at the time of the retrofitting study shall be based on load and environmental conditions, the performance of the materials in the structure, structural specifications, status of structure and the like obtained through inspections of the structure.
- (3) Performance shall be verified through selection of an appropriate performance evaluation method. Refer to **Table 6.1.1** and use the study methods for various limit states indicated in the Standard Specification (Design) and the verification methods for seismic performance indicated in the Standard Specification (Seismic Design) to calculate indices for verifying performance.

When characteristic values based on actual measurements have been determined through inspections of existing structures, safety factors for performance verifications of existing structures that are different from those in the Standard Specification may be established.

Table 6.1.1 Verification indices contained in the Standard Specification (Design) (Seismic Design)

Performance and Performance Item		Verification Indices Depicted in Existing "Standard Specification"	Corresponding Limit State, etc.
Safety	Safety with respect to rupture and collapse	Flexural load-carrying capacity of sections	Study of ultimate limit state
		Shear capacity of members	
		Torsional capacity of members	
		Various fatigue capacity values	Study of fatigue limit state
	Response displacement, ductility ratio and residual displacement of structure in the event of an earthquake	Verification of seismic performance 2 and 3	
Safety with respect to rigid stability	Resistance moment	Study of ultimate limit state	
Service-ability	Driving and walking comfort	Displacement / deformation, stress level of materials in structure, crack width	Study of serviceability limit state
	Vibration-proof performance		
	Soundproof performance		
	Appearance		
	Visual stability		
Restorability	Response displacement, restorability ductility ratio and residual displacement of structure in the event of an earthquake	Verification of seismic performance 2	
	Stress level of materials in structure	Verification of seismic performance 1	

[Commentary]

(1)(2) Performance verifications for existing structures for which retrofitting is being studied are conducted to confirm whether or not the performance requirements for that structure are being fulfilled. The values for load and environmental conditions, performance of the materials in the structure, structural specifications and status of structure used for these verifications should be actual values obtained through inspections.

(3) As a rule, performance should be verified by selecting, from among the usable performance evaluation technologies, the method that most closely matches the objective. In recent years, remarkable progress has been made in finite element analysis and other evaluation technologies that can evaluate various performance values for structures with wide-ranging applicability and high accuracy. The past achievements, reliability and scope of each method should be considered and the performance evaluation method selected at the

engineer's discretion. When the dynamic performance of structures covered in the Standard Specification has been depicted using the verification indices shown in **Table 6.1.1**, it is possible to perform verification using the various examination methods for limit state in the Standard Specification (Design) and the seismic performance verification methods in the Standard Specification (Seismic Design).

Since it is possible to determine the uncertainty and the effects of changes over time from the time the structure was designed up to the present using measurement data obtained through inspections of the existing structure, different safety factors from those in the Standard Specification may be determined for use in performance verifications for the existing structure. For example, when the characteristic values for concrete strength can be obtained from the existing structure through appropriate testing, the material factors specified in the Standard Specification which also consider the difference in material strength between the test specimens and the structure may be reduced, as noted in Section 3.2. Member factors and load factors may also be set differently from the Standard Specification when actual measurements of member size and load data have been obtained through inspections.