



20.32 SEISMIC DESIGN CRITERIA FOR TUNNELS

20.32.1 GENERAL

This STP provides minimum seismic design criteria for new tunnels as an addendum to the AASHTO *LRFD Road Tunnel Design and Construction Guide Specifications (Guide Specifications)*. For each tunnel project, project-specific design criteria shall be developed that satisfy the project's mandates and constraints.

20.32.2 DEFINITIONS

Tunnel — For seismic design purposes, an enclosed roadway with vehicle or pedestrian access that is restricted to portals, regardless of the type of the structure or method of construction.

20.32.3 ABBREVIATIONS

FEE = Functional Evaluation Earthquake
PSDC = Project Specific Design Criteria
SEE = Safety Evaluation Earthquake

20.32.4 DESIGN REQUIREMENTS

Extreme Event T-I in the *Guide Specifications* shall be used to combine seismic effects and permanent loads. Ground shaking and ground failure need not be applied concurrently.

The SDC shall be used as the basis for the performance of ductile components. Limiting values of ductility and strain shall be defined in the PSDC. Tunnel side walls and columns shall be classified as seismic critical members.

20.32.4.1 Seismic Hazard Evaluation Levels

Tunnels shall be designed for two seismic design hazard levels:

FEE: minimum 300-year return period

SEE: minimum 1500-year return period



20.32.4.2 Performance Criteria

Strain limits in steel and concrete shall support the performance criteria shown in Table 20.32.4.2-1. The definitions of minimal and moderate damage states shall be taken from the SDC.

Table 20.32.4.2-1 Performance Criteria

SEISMIC HAZARD EVALUATION LEVEL	ACCEPTABLE POST EARTHQUAKE DAMAGE STATE	ACCEPTABLE POST EARTHQUAKE SERVICE LEVEL
SEE	Minimal to Moderate ^a	Limited Service-weeks
FEE	Minimal	Full Service

^a The Damage State (DS) shall not exceed DS-3. Refer to the SDC for the definitions of DS-3.

20.32.5 REFERENCES

1. AASHTO (2017), “*LRFD Road Tunnel Design and Construction Guide Specifications, 1st Edition*”, American Association of State Highway and Transportation Officials, Washington D.C.