

CODE

7.12.1.2 — Where shrinkage and temperature movements are significantly restrained, the requirements of 8.2.4 and 9.2.7 shall be considered.

7.12.2 — Deformed reinforcement conforming to 3.5.3 used for shrinkage and temperature reinforcement shall be provided in accordance with the following:

7.12.2.1 — For members subjected to environmental exposure conditions or required to be liquid-tight, the area of shrinkage and temperature reinforcement shall provide at least the ratios of reinforcement area to gross concrete area shown in Table 7.12.2.1:

TABLE 7.12.2.1—MINIMUM SHRINKAGE AND TEMPERATURE REINFORCEMENT

Length between movement joints, ft	Minimum shrinkage and temperature reinforcement ratio	
	Grade 40	Grade 60
Less than 20	0.0030	0.0030
20 to less than 30	0.0040	0.0030
30 to less than 40	0.0050	0.0040
40 and greater	0.0060*	0.0050*

*Maximum shrinkage and temperature reinforcement where movement joints are not provided.

Note: When using this table, the actual joint spacing shall be multiplied by 1.5 if no more than 50% of the reinforcement passes through the joint.

Concrete sections that are at least 24 in. may have the minimum shrinkage and temperature reinforcement based on a 12 in. concrete layer at each face. The reinforcement in the bottom of base slabs supported on soil may be reduced to 50 percent of that required in Table 7.12.2.1.

7.12.2.2 — Shrinkage and temperature reinforcement shall not be spaced farther apart than 12 in. and the minimum bar size shall be No 4. No less than 1/3 of the required area of shrinkage and temperature steel shall be distributed at any one face.

COMMENTARY

R7.12.1.2 — The area of shrinkage and temperature reinforcement required by 7.12 has been satisfactory where shrinkage and temperature movements are permitted to occur. For cases where structural walls or large columns provide significant restraints to shrinkage and temperature movements, it may be necessary to increase the amount of reinforcement normal to the flexural reinforcement in 7.12.1.2 (see Reference 7.12). Top and bottom reinforcement are both effective in controlling cracks. Control strips during the construction period, which permit initial shrinkage to occur without causing an increase in stresses, are also effective in reducing cracks caused by restraints.

R7.12.2 — The amounts specified for deformed bars and welded wire fabric are empirical but have been used satisfactorily for many years. Splices and end anchorages of shrinkage and temperature reinforcement must be designed for the full specified yield strength in accordance with 12.1, 12.15, 12.18, and 12.19.

R7.12.2.1 — The required amount of shrinkage and temperature reinforcement is a function of the distance between the movement joints that will minimize cracking perpendicular to the reinforcement. In addition, the amount of shrinkage and temperature reinforcement is a function of the particular concrete mix and other properties, the amount of aggregate, the member thickness, its reinforcement, and the environmental conditions of the site. These factors have been considered in applying the analysis method developed by Vetter^{7.13} to environmental engineering concrete structures, and the recommendations contained in the remainder of this section are based on that work.^{7.14}

When shrinkage-compensating concrete is used per manufacturer's recommendations, no less than a reinforcement ratio of .003.

Where positive means are taken to substantially reduce restraint, the amount of temperature and shrinkage reinforcement and the distance between movement joints may be linearly interpolated.

Consideration may be given to reducing the amount of shrinkage and temperature reinforcement shown in Table 7.12.2.1 when details are developed in accordance with ACI 223 recommendations.

Where movement joints are not provided, shrinkage and temperature reinforcement need not exceed the values listed in Table 7.12.2.1 for greater than 40 ft joint spacing.

R7.12.2.2 — The shrinkage and temperature reinforcement is normally divided equally between both concrete faces. Where special conditions exist that significantly change the rate of drying or cooling on one face of the member, shrinkage and temperature reinforcement may be adjusted accordingly.