Parking Area Quick Reference

From American Concrete Institute Committee 330

Step 1:	Step 2:	Step 3:	Step 4:	Step 5:	Example:
Determine concrete compressive strength requirement. For all concrete exposed to freeze-thaw cycling and de-icers, use no less than 4000 psi. 4500 psi is recommended.	Determine Modulus of Subgrade Modulus of Subgrade Reaction, k. Use guidelines below.	Determine Traffic Categories (car parking area, entrances, bus routes etc.).	Determine Average Daily Truck Traffic (ADTT) on the pavement. It is safe to always assume at least one truck.	Read across row that corresponds to your Traffic Category and ADTT to the column that represents your concrete strength and k value.	» Car parking area truck access lane. » Traffic Category A, ADTT = 1. » Concrete Strength (f'c) = 4,500 psi. » Soil is sandy gravel with some clay and silt; k value is 130-170; therefore use k = 100. » Under area with k = 100, read across row with "Traffic Category A (ADTT = 1)" to column under f'c = 4500. » Thickness necessary for this situation is 4.5 in.

Modulus of Subgrade Reactivity

Type of Subgrade Soil	k Value	CBR
Fine-grained soils in which silt & clay-sized particles predominate	75 - 120	2.5 - 3.5
Sands & sand-gravel mixtures with moderate amounts of silt & clay	130 - 170	4.5 - 7.5
Sands & sand-gravel mixtures relatively free of plastic fines	180 - 220	8.5 - 12

Traffic Categories

Select Category A, B, C or D

Car Parking Areas & Access Lanes (*Autos, pick-ups, & panel trucks only*)		Category A
Shopping Center Entrance & Service Lanes		Category B
City & School Bus Parking Areas: » Parking area & interior lanes. » Entrance & exterior lanes.		Category B Category C
Truck Parking Areas:		
Parking Areas & Interior Lanes	Single-Unit Trucks*	Category B
	Multiple-Unit Trucks**	Category C
Entrance & Exterior Lanes	Single-Unit Trucks*	Category C
	Multiple-Unit Trucks**	Category D

*Single-Unit Trucks = Bobtailed Trucks
**Multiple-Unit Trucks = Tractor-trailer units with 1 or more trailers

Twenty-Year Design Thickness Recommendations in Inches (No Dowels)

Traffic Category*	k = 500 psi/in. (CBR = 50; R = 86)				k = 400 psi/in. (CBR = 38; R = 80)				k = 300 psi/in. (CBR = 26; R = 67)			
f'c	5000	4500	4000	3500	5000	4500	4000	3500	5000	4500	4000	3500
MOR, psi	650	600	550	500	650	600	550	500	650	600	550	500
A (ADTT=1)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.5
A (ADTT=10)	4.0	4.0	4.0	4.5	4.0	4.0	4.5	4.5	4.0	4.5	4.5	4.5
B (ADTT=25)	4.0	4.5	4.5	5.0	4.5	4.5	5.0	5.5	4.5	4.5	5.0	5.5
B (ADTT=300)	5.0	5.0	5.5	5.5	5.0	5.0	5.5	5.5	5.0	5.5	5.5	6.0
C (ADTT=100)	5.0	5.0	5.5	5.5	5.0	5.5	5.5	6.0	5.5	5.5	6.0	6.0
C (ADTT=300)	5.0	5.5	5.5	6.0	5.5	5.5	6.0	6.0	5.5	6.0	6.0	6.5
C (ADTT=700)	5.5	5.5	6.0	6.0	5.5	5.5	6.0	6.5	5.5	6.0	6.5	6.5
D (ADTT=700)t	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5

Traffic Category*	k = 200 psi/in. (CBR = 10; R = 48)				k = 100 psi/in. (CBR = 3; R = 18)				k = 50 psi/in. (CBR = 2; R = 5)			
f'c	5000	4500	4000	3500	5000	4500	4000	3500	5000	4500	4000	3500
MOR, psi	650	600	550	500	650	600	550	500	650	600	550	500
A (ADTT=1)	4.0	4.0	4.0	4.5	4.0	4.5	4.5	5.0	4.5	5.0	5.0	5.5
A (ADTT=10)	4.5	4.5	5.0	5.0	4.5	5.0	5.0	5.5	5.0	5.5	5.5	6.0
B (ADTT=25)	5.0	5.0	5.5	6.0	5.5	5.5	6.0	6.0	6.0	6.0	6.5	7.0
B (ADTT=300)	5.5	5.5	6.0	6.5	6.0	6.0	6.5	7.0	6.5	7.0	7.0	7.5
C (ADTT=100)	5.5	6.0	6.0	6.5	6.0	6.5	6.5	7.0	6.5	7.0	7.5	7.5
C (ADTT=300)	6.0	6.0	6.5	6.5	6.5	6.5	7.0	7.5	7.0	7.5	7.5	8.0
C (ADTT=700)	6.0	6.5	6.5	7.0	6.5	7.0	7.0	7.5	7.0	7.5	8.0	8.5
D (ADTT=700)t	7.0	7.0	7.0	7.0	8.0	8.0	8.0	8.0	9.0	9.0	9.0	9.0

*ADTT =Average Daily Truck Traffic Trucks are defined as vehicles with at least 6 wheels; excludes panel trucks, pick-up trucks & other 4-wheeled vehides. Refer to Appendix A.

k = Modulus of Subgrade Reaction; CBR =Califomia Bearing Ratio; R=Resistance value & MOR=Modulus of Rupture.

t Thickness of Category D (only) can be reduced by 1.0 in. (25 mm) if dowels are used at all transverse joints (that is joints located perpendicular to direction of traffic). Note: 1in.=25.4mm; 1psi=0.0069 MPa; & 1psi/in.=0.27 MPa/m.

Preparing the Subgrade for Best Performance

Proper subgrade preparation will ensure superior performance of your concrete pavement. While no special subbase is required, it is important that the soil type, moisture content, and density of the subgrade be uniform. Replace non-uniform subgrade areas with materials that are similar to the rest of the area.

The subgrade must also be reasonably smooth and without tire ruts so that the concrete placed over it will be uniform in thickness.

Materials & Proportions

Quality concrete starts with a well chosen mixture using consistently high quality materials.

In regions where the pavement will be subjected to freeze-thaw cycles air entrainment is essential. Air entrainment is so important in providing freeze-thaw durability that it pays to test the concrete frequently for air content at the job site and make the necessary corrections as soon as possible. See the table below for recommended air contents.

Because air entrainment also enhances workability and reduces the amount of bleed water, it is wise to consider its use even where freeze-thaw conditions do not exist.

Compressive strength is the most common and easiest property of concrete to measure, and as such, it is the property most used when specifying concrete. Concrete with a 28-day specified compressive strength of 4000 psi (27.6 MPa), is adequate for most areas of the country.

In areas subjected to freeze-thaw cycles, it is further recommended that the mix contain at least 564 lb of cement per cubic yard. In mild climates a minimum cement content of 520 lb per cubic yard is adequate. A mixture with a maximum slump of 4 inches is acceptable. If a water reducing admixture is specified, slumps can be higher.

| Recommended Air Contents for Durable Concrete		
	Total Target Air Content Percent*	
Maximum Size Aggregate	Severe Exposure	Moderate Exposure
3/8 in. (9.5 mm)	7-1/2	6
1/2 in. (12.5 mm)	7	5-1/2
3/4 in. (19.0 mm)	6	5
1 in. (25.0 mm)	6	4-1/2
1-1/2 in. (37.5 mm)	5-1/2	4-1/2
2 in. (50.0 mm)	5	4
*A reasonable tolerance for air content in field construction is -1 to +2 percentage points		

Jointing Guidelines

It is recommended that you follow these guidelines unless local experience indicates otherwise:

- Joint spacing should not exceed 24 to 30 times the pavement thickness with a maximum spacing of 15 feet.
- Lay out joints to form square panels. When this is not practical, rectangular panels can be used if the long dimension is no more than 1-1/4 times the dimension.
- Control joints should have a depth of at least one-fourth the slab thickness.

Manhole or Inlet Box
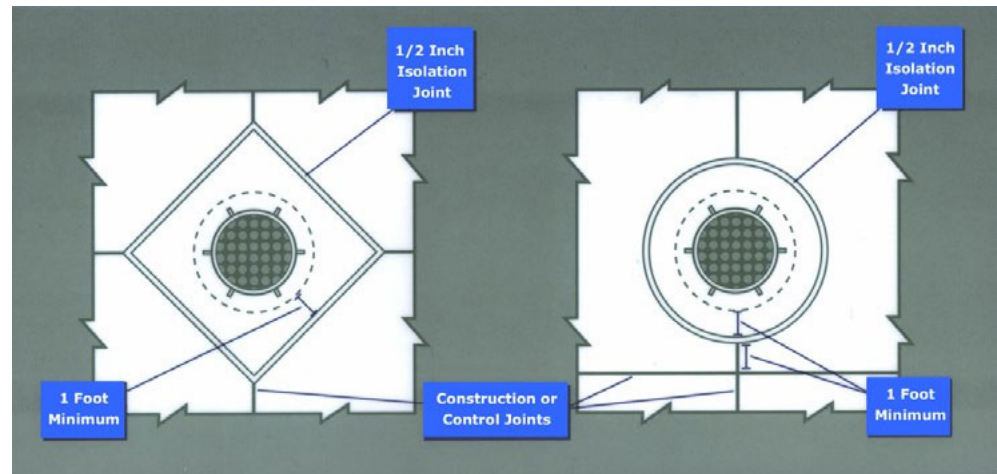
Construction Practices

Procedures that ensure a quality job are:

- Slope pavement minimum 1% or 1/8 inch per foot for surface drainage.
- Moisten subgrade just prior to placement of concrete.
- Avoid over-finishing slabs. Generally a bullfloat finish is adequate. Sometimes a burlap drag is added in the finishing process to provide a textured finish.
- Cure fresh concrete. Liquid membrane-forming curing compound is usually recommended as the most cost-effective curing agent.
- Keep automobile traffic off the slab for three days and truck traffic off the slab for seven days, unless tests are made to determine that the concrete has gained adequate strength. This is usually 3000 psi.