

CONCRETE PARKING LOTS



QUICK REFERENCE GUIDE

For Designers, Contractors, Developers & Planners

~ Based upon ACI 330 -

“Guide for the Design & Construction of Concrete Parking Lots”

Preparing the subgrade for the best performance

Proper subgrade preparation will ensure superior performance of your concrete pavement. It is important that the soil type, moisture content and density of the subgrade be uniform. Replace nonuniform 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.

In most areas of Michigan 4 inches of compacted aggregate base is recommended for constructability due to the numerous areas of the state that have clay or silty soils or as a working platform on sandy soils.

Materials and proportions

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

Air entrainment is important in providing freeze-thaw durability and it pays to test the concrete frequently for air content at the job site and make the necessary corrections as soon as possible. The air content in exterior concrete should range between 5.5% - 8.0%.

Compressive strength ($f'c$) 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 minimum design strength of 4,000 psi at 28 days and maximum water cementitious ratio (w/c) of 0.45, is adequate for Michigan.

Because Michigan pavements are subjected to freeze-thaw cycles, it is further recommended that the mix contain between 525 - 564 lb of cement per cubic yard. To densify the mix and increase workability replace 25% - 40% of the cement with fly ash or slag cements. A mixture with a slump of 3 - 4 inches is acceptable. If a water reducing admixture is specified, slumps can be higher.

Good Construction Practices

The following are recommended best practices for concrete construction:

- Make sure the pavement is sloped to provide proper drainage
- Moistened subgrade prior to placement of concrete so it does not steal water from your concrete
- Use vibration to consolidate the concrete
- Finish surface immediately with minimal passes of the bull-float to seal the surface.
 - Texture with burlap, turf or broom drag
 - Cure fresh concrete within 30 minutes of placement.
 - Liquid membrane-forming curing compound is usually recommended as the most cost effective curing agent.
- Keep automobile traffic off the slab until it reaches 2000 psi.

Jointing Guidelines

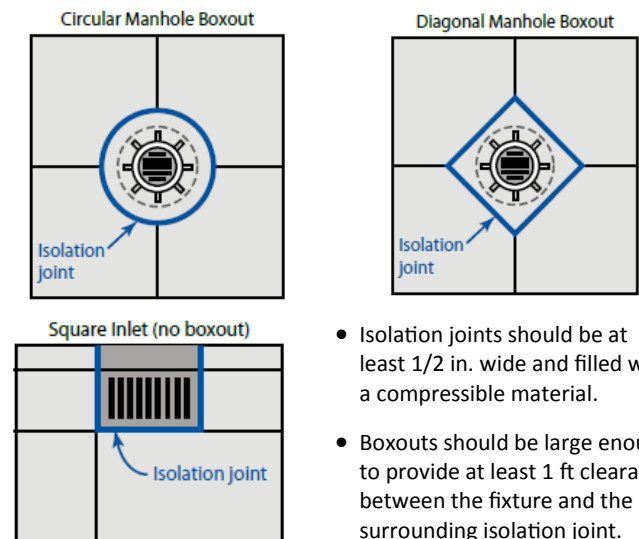
THINGS TO DO

- Match Existing Joints or cracks
- Place joints to meet structures in the pavement
- Maximum joint spacing not to exceed 1.5 times the pavement thickness in feet
Example: 4" concrete = maximum 6 foot joint spacing
- Place isolation joints to separate new pavement from existing fixed structures
- Require a jointing plan prior to concrete placement
- Make field adjustments to joint locations as necessary
- Be practical

THINGS TO AVOID

- Slabs less than 1 foot wide
- Slabs greater than 15 feet wide
- Angles less than 60 degrees (90 degrees is best)
(Do this by doglegging joints through curved radius points)
- Creating interior corners (L-shaped slabs)
- Odd Shapes (keep slabs square)

Manhole or inlet box



- Isolation joints should be at least 1/2 in. wide and filled with a compressible material.
- Boxouts should be large enough to provide at least 1 ft clearance between the fixture and the surrounding isolation joint.

Parking Area Thickness Design Worksheet

Step 1: Determine concrete compressive strength requirement. For all concrete exposed to freeze-thaw cycling and de-icers, use no less than 3500 psi. 4000 psi is recommended. (This may be specified in the plan documents)

Step 2: Determine modulus of subgrade reactivity, k. Use guidelines below.

Step 3: Determine traffic categories (car parking area, entrances, etc.)

Step 4: Determine average daily truck traffic (ADTT) on the pavement. It is safe to always assume at least one ADTT.

Step 5: Read across row that corresponds to your traffic category and ADTT to column that represents your concrete strength and k value.

Modulus of subgrade reactivity (k)

Type of subgrade Soil	k Value	CBR
Silt & Clay soils	75	2.5
	to	to
	120	3.5
Sand-Gravel soils with moderate amounts of silt & clay	130	4.5
	to	to
	170	7.5
Sandy soils	180	8.5
	to	to
	220	12

Traffic Categories

Car parking areas & access lanes (autos, pickups & panel trucks only)		A	
Truck access lanes		A-1	
Shopping center entrance & service lanes		B	
Bus parking areas, city & school buses	Parking & interior lanes	B	
	Entrance & interior lanes	C	
Truck parking areas	Single Units	Parking & interior lanes	B
		Entrance & interior lanes	C
	Multiple Units	Parking & interior lanes	C
		Entrance & interior lanes	D

20-year design thickness recommendations, inches (no dowels)

Based upon Design Guidelines in ACI 330 ~ adapted for MI applications

Traffic Category	k = 200 psi/in (CBR = 10)			k = 100 psi/in (CBR = 3)		
	f'c			f'c		
	4500	4000	3500	4500	4000	3500
Daily Truck Traffic						
A-1 (ADTT = 1)	4.0	4.5	4.5	4.5	4.5	5.0
A-1 (ADTT = 10)	5.0	5.5	5.5	5.5	6.0	6.0
B (ADTT = 25)	5.0	5.5	6.0	5.5	6.0	6.5
B (ADTT = 300)	5.5	6.0	6.5	6.0	6.5	7.0
C (ADTT = 100)	5.5	6.0	6.5	6.0	6.5	7.0
C (ADTT = 300)	6.0	6.5	7.0	6.5	7.0	7.5
C (ADTT = 700)	6.0	6.5	7.0	6.5	7.0	7.5
D (ADTT = 700)	7.0	7.0	7.0	8.0	8.0	8.0

ADTT = Average Daily Truck Traffic. Trucks are defined as vehicles with at least six wheels, excludes panel trucks, pickup trucks and other four wheel vehicles.

f'c = compressive strength (of concrete)

k value = a measure of soil strength (modulus of subgrade reactivity)

CBR (California Bearing Ratio) = a measure of subgrade resistance to deformation under load

Example 1: Car parking area truck access lane

- Soil is sandy gravel with a fair amount of clay; k value 130 therefore use k = 100
- Under area k = 100 read across row with traffic category A-1 (ADTT = 1) to column under f'c = 4000
- Traffic category A-1 (ADTT = 1)
- Specified Concrete Strength of 4000 psi
- Thickness necessary for this situation = 4.5 inches of concrete

Example 2: Single Unit Truck Parking areas

- Soil is sandy gravel minimal clay and silt; k value 170 therefore use k = 200
- Under area k = 200 read across row with traffic category C (ADTT = 100) to column under f'c = 4500
- Traffic category C (ADTT = 100)
- Specified Concrete Strength of 4500 psi
- Thickness necessary for this situation = 5.5 inches of concrete