# Overlaying decks with LMC

*Brushing . . . . . dumping . . . . . spreading . . . . . finishing . . . . . edging ...workers must work fast and furiously to give decks a latex modified overlay. LMC requires special techniques—and special care.*

You're about to overlay a bridge deck or parking deck. Specifications call for latex modified concrete (LMC), but you've never worked with LMC before. How do you mix it, place it, finish it? For a good job, you must do five things:

PREPARE the surface thoroughly: scarify, handchip, sandblast, blow clean, and then dampen.

BATCH the LMC onsite in a mobile batcher mixer.

PLACE the concrete quickly; working time can be as short as 10 minutes.

FINISH the concrete with a self-propelled finishing machine; roller finishers are the most popular.

CURE the concrete damp for the first 24 hours, then dry cure it for 72 hours.

All five steps are crucial. They must be done quickly, in sequence, without lags. Problems start when one step in the operation stops. In more detail, here's how latex makers recommend placing LMC overlays.

**Figure 1.** You must make LMC onsite. Most contractors use a mobile batcher mixer; it holds all the raw materials for LMC on board and it can run continuously or as needed.

### Prepare the surface thoroughly

*Old decks.* Resurfacing an old deck requires much more preparation than overlaying a new deck. You must remove the top ¼ inch of concrete (because it usually contains oil and dirt) and any weak concrete below the surface. Use hydrodemolition or scarifying equipment to remove the top surface and power-driven hand tools to remove the deteriorated concrete underneath. But don't use pneumatic hammers heavier than 30 pounds; they can penetrate the entire deck. Also, wait 48 hours before scarifying or chipping concrete within 6 feet of previously placed LMC.

Splice new rebars to any reinforcing bars that have lost ¼ or more of their original diameter. Adjust the final grade to provide at least 2 inches of cover over the rebars. If the bond between the steel and concrete has been destroyed or more than half of the bar diameter is exposed, remove the concrete to at least 1 inch below the bar. But don't use pneumatic hammers heavier than 15 pounds to do this.

If you use hydrodemolition equipment to remove the top ¼ inch

**TABLE A. TYPICAL LMC MIX**

| | |
|---|---|
| Cement (pounds) | 658 |
| Sand (pounds) | 1,710 |
| Stone (pounds) | 1,140 |
| Latex (gallons) | 24.5 |
| Water (gallons) | 19 max. |
| Air-entraining agent | None |
| Water-cement ratio | 0.4 max. |
| Slump (inches) | 4-6 |
| Air content (%) | 6 ½ max. |
| Overlay thickness (inches) | 1 ¼ min. |
| Placing temperature (F) | 45-85° |

Color of LMC is slightly darker or greener than typical concrete. (To offset this, you may add small amounts of titanium dioxide.)

Styrene butadiene, the latex used to make LMC, contains about 50 percent water and has a milky white color. Store at 35° F to 85° F. Keep containers indoors or cover them with white polyethylene.

of concrete you don't need to clean the surface further. If you remove the concrete mechanically, you should sandblast or waterblast the surface within the 24 hours before concrete placement. (Air compressors on all equipment should have filters to prevent oil from entering the air supply.) Be sure to blast the edges of previously placed lanes of overpayment. This removes the trowel cut surface and promotes bond.

After sandblasting, remove all dust and chips with an air blast. Then keep the surface clean. Cover it with polyethylene until you're ready to place concrete. If it rains after sandblasting, keep the sandblasted surfaces wet until you place concrete. If these areas dry out after a rain, you must sandblast them again.

At least 1 hour before you place concrete, wet the surface. It should be damp, but not flooded. Use oil-free compressed air to blow out any water that collects in depressions or holes.

*New decks.* Prepare new decks just as you do old decks, except don't scarify or handchip. Blast cleaning alone should remove any hardened curing compound, laitance, or other contaminants.

To learn more about scarifiers, scabblers, abrasive blasters, and waterblasters, see Reference 1.

## Make the LMC onsite in a mobile batcher mixer

Because LMC should not be mixed for more than 5 minutes, you must make it onsite. You can use a drum mixer, but for bridge and parking deck overlays latex makers recommend a continuous mobile batcher mixer (Figure 1). This special concrete truck has bins and tanks on board for holding all the raw materials needed to make LMC, including the latex (see table for typical mix design). The batcher mixer can run continuously, or you can stop and start it as necessary. Most units used for LMC overlays can produce at least 6 cubic yards of concrete an hour.

The batcher mixer must proportion materials accurately. A cement meter with ticket printout helps monitor this. You also should calibrate the batcher mixer for each job. If the job requires more than 100 cubic yards of concrete, check the calibration of cement and latex at 100-cubic-yard intervals.

After every third load made by the batcher mixer, you should perform a yield test. Set the cement meter on zero, then fill a ¼-cubic-yard box with LMC. When the box is level full, the cement meter should show a discharge of 1¾ bags of cement (for a 7-bag mix). If it doesn't, you must recalibrate the batcher mixer. After each acceptable yield test, make slump, air, and compressive strength tests also. Discharge concrete for these tests on a flat, nonabsorbent surface and let it sit undisturbed for 5 minutes before making the tests.

To learn more about batcher mixers, see Reference 2.

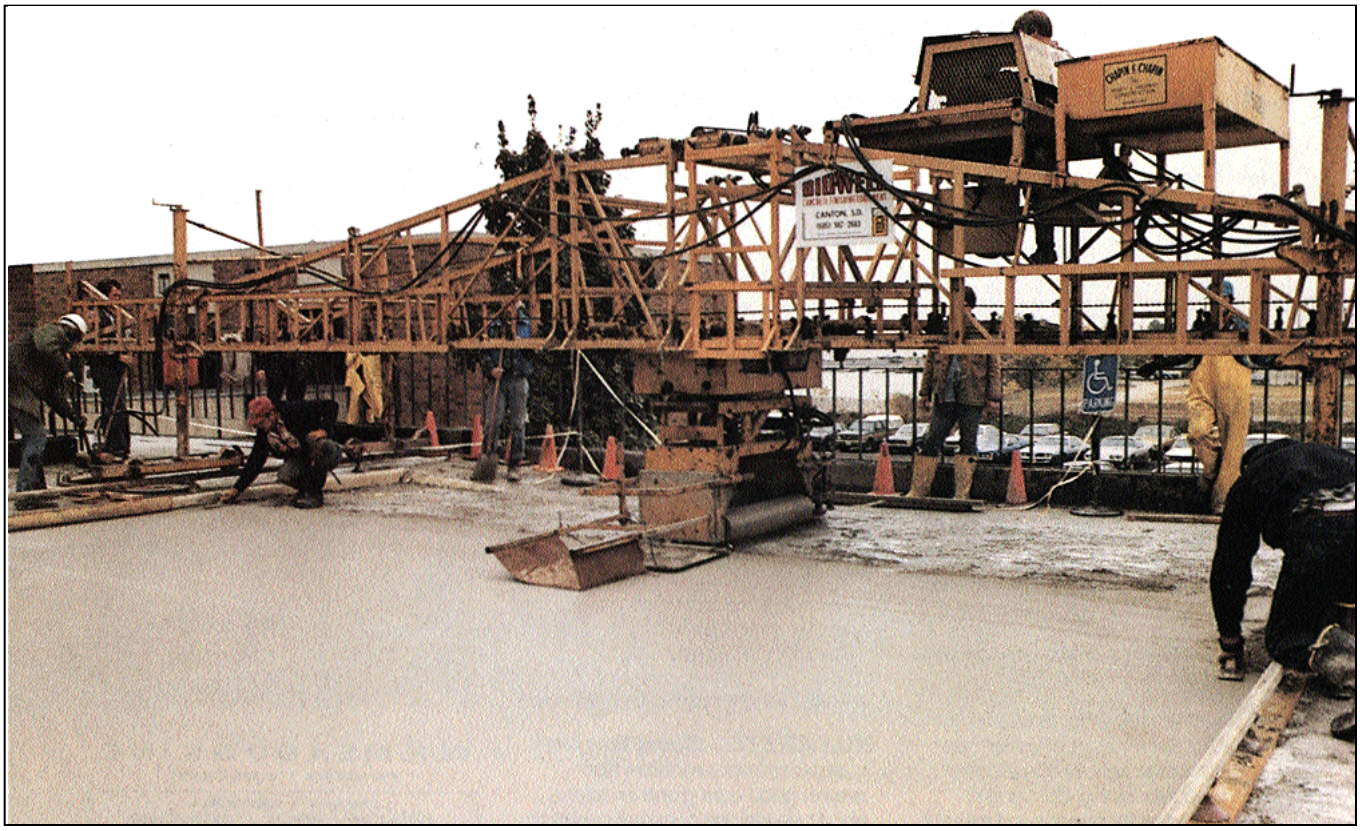

**Figure 2.** Self-propelled roller finishers are the most common way to screed and finish LMC overlays. Augers, rollers, vibratory pan, and burlap drag move back and forth across the deck to provide proper thickness and texture.

## Use a self-propelled finishing machine

For small areas or parking decks obstructed by columns, you can place LMC with a screed and spud vibrators. For bridge deck overlays, use a self-propelled finishing machine that can move forward and backward. Vibrating screeds have been used, but roller finishing machines are now more common (Figure 2). The roller machine has a carriage that travels back and forth across the paving lane. The carriage holds one or more rotating rollers, augers, and vibratory pans.

As the carriage moves across the paving lane, the machine itself moves down it. The longitudinal rails it rides on must be rigid; use 2-inch schedule 40 steel pipe or its equivalent. One contractor sets the steel pedestals for these travel rails on the 2x4-inch wood studs he uses for side forms. The studs are laid flat to produce a 1½-inch-thick overlay.

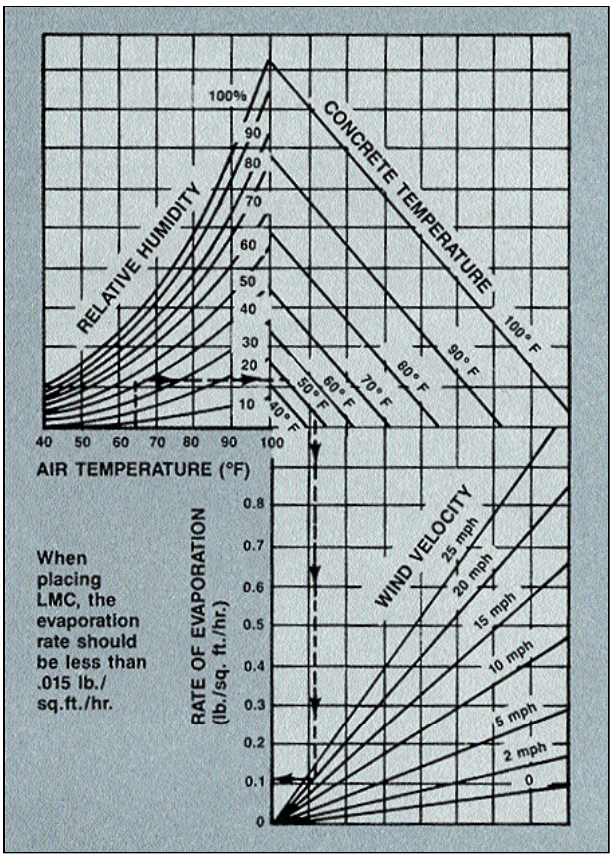


**Figure 3.** Don't place LMC if the evaporation rate exceeds 0.15 pound per square foot per hour. To determine the evaporation rate: 1) Enter this chart with air temperature, move up to relative humidity. 2) Move right to concrete temperature. 3) Move down to wind velocity. 4) Move left, read approximate rate of evaporation. (Source: ACI 308, "Standard Practice for Curing Concrete")

## Place and finish the concrete quickly

You normally have only about 10 minutes to screed and finish LMC after depositing it on the deck. This means you need several workers who must work *fast*. A typical crew may number 17 people.

First, prime the deck with latex grout. Or dump some of the LMC mix on the deck and broom it into the surface. Then shovel up the leftover aggregate and discard it. Give both vertical and horizontal surfaces a thorough, even coating. But don't get too far ahead of the finishing machine. The brushed material shouldn't dry before you apply the overlay.

Now place the LMC. Spread out the concrete in front of the finishing machine, keeping the surface at least ¼ inch above final grade. Consolidate the concrete in deep pockets, along edges, and adjacent to bulkheads with spud vibrators.

You can fill deep holes part way with conventional concrete before you place the overlay. Or you can fill them with LMC at the same time you place the LMC overlay. If you use conventional concrete, fill the holes early so that the concrete is cured when you're ready to place the overlay. Remember to sandblast the conventional concrete before you overlay.

Texture the concrete right behind the finishing machine, before the latex forms a plastic film on the surface. An attachment on the back of a roller finishing machine can produce a drag or broom finish. If specifications call for a grooved texture, stand on a workbridge immediately behind the machine and use a fluted float or wire-tined rake. Take care not to tear the surface or bring coarse aggregate to the top. Whenever the overlay tears or you add concrete behind the finishing machine, you must pass the machine over that area again. Use metal trowels for any hand finishing required at gutters and joints.

Do not treat the side forms or headers with release agents. Instead, after the concrete has stiffened a little, pass a pointing trowel along the inside face of the forms and headers to separate them from the overlay. Make this trowel cut the entire depth and length of the forms.

Also, don't forget to make joints in the overlay wherever these occur in the original deck. Use a bulkhead the same thickness as the joint. Do not cast across joints and then saw them.

## Wet cure for 24 hours, then dry cure for 72 hours

LMC forms a plastic film at the surface upon drying, usually within 25 minutes in hot, dry weather. To prevent the surface from cracking because of this, you must cover it with presaturated burlap as soon as it will support the burlap without significant deformation. Overlap the burlap a minimum of 6 inches. Cover it with a second layer of wet burlap or with 4-mil white polyethylene. Hold down the edges of the polyethylene with weights. Keep the burlap wet for the first 24 hours; if necessary sprinkle more water on it.

After 24 hours, remove the burlap and polyethylene and allow the LMC to dry cure for 72 hours before opening the deck to traffic. If rain wets the overlay for one hour or more during this dry cure period, do not count those hours as part of the dry cure.

## Clean tools immediately

If the LMC hasn't hardened, water can clean tools. If it has hardened, soften the mix with solvents such as white spirit, solvent naptha, or toluene. Sandblast the tools if the concrete has hardened too much.

## Don't place an LMC overlay ...

- less than 1 ¼ inches thick.
- next to a parallel strip of overlay that is less than 72 hours old.
- when rain is expected.
- at temperatures lower than 40° F. You may place LMC at 40° F only when the weather indicates that 8 hours of the curing period will be over 45° F. Follow American Concrete Institute 306, "Recommended Practice for Cold Weather Concreting."
- when the surface evaporation rate is more than 0.15 pound per square foot per hour. If you know the relative humidity, wind velocity, and air and concrete temperatures, you can determine the evaporation rate using Figure 3. You can lower the evaporation rate several ways: erect windbreaks, place the concrete at night, or cool the mix ingredients. Follow ACI 305, "Recommended Practice for Hot Weather Concreting."

## Stay in step

Placing a latex overlay is a continuous operation. To avoid problems, you must keep each step of the operation in step. Don't brush on latex grout far ahead of concrete placement. Don't place concrete far ahead of the finishing machine. Texture the surface right behind the machine. And cover it with wet burlap and polyethylene before the surface begins to dry.

If placement is delayed for less than 1 hour, cover the end of the placement with several layers of wet burlap. If the delay exceeds an hour, install a bulkhead.

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—by Mark Wallace


**References**

1. "Equipment for Cleaning or Preparing Concrete Surfaces for Repair," Concrete Construction, November 1986, pages 927-934.
2. "The Mobile Batcher Mixer," Concrete Construction, January 1984, pages 5-11.


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