RECOMMENDED PROCEDURES FOR PROPER PREPARATION, PLACEMENT, FINISHING, CURING, AND MAINTENANCE OF RESIDENTIAL CONCRETE FLATWORK

A durable, scale resistant concrete driveway or garage pad is easily attained if the proper concrete mix is used and correct procedures are followed throughout all stages of construction. Each recommendation is made for a specific reason and each must be strictly adhered to in order to achieve quality concrete flatwork that will serve for many years.

The following procedures are for standard concrete only, and do not apply to decorative concrete such as exposed aggregate, colored and/or stamped concrete. Those finishing procedures, although similar, are different and require specific cautions on their own. Consult a professional tradesperson.

SITE PREPARATION:

All black dirt, vegetation, roots, lumps and boulders must be removed and the site leveled. The base should be uniform, preferably undisturbed, subgrade soil. All soft spots, i.e. water lines, must be repaired and the base properly compacted. A granular base of 20 mm or 25 mm material should be used to bring the site to uniform bearing and final grade. **Backfill material should be well compacted** Moisture conditioning of the sub-base material is required to achieve optimum compaction.

FORMS:

There are numerous types of forming systems. The most common forms are 50mm normal thickness lumber, and should be well anchored with 50mm x 100mm (2x4 inch) stakes, driven firmly into the ground at 1 meter intervals. Forms should be oiled before placing the concrete, to facilitate form removal.

RECOMMENDED THICKNESS:

A minimum of 100 mm is adequate for car traffic. Minimum thickness of 150 mm for trucks or recreational vehicles.

REINFORCEMENT:

Rebar should be placed every 45-60 cm in both directions and tied at every second rebar intersection. CSA A23.1 Table 17 stipulates placement of rebar with a minimum of 60 mm of concrete cover to minimize the potential for the ingress of chlorides from de-icing chemicals that could corrode the reinforcing steel. Therefore, for a typical 100 mm residential concrete slab, the rebar should be placed at a depth of approximately two thirds the slab thickness from its surface. Placing the rebar at the bottom of the slab will provide no benefit to the concrete. Welded Wire Mesh or Macro Synthetic Fibers may also be considered in place of rebar.

Polypropylene Micro Fibers may also be incorporated into flatwork mix designs to reduce the potential for plastic shrinkage crack formation and to enhance overall durability of the finished surface.

Install isolation joints using pre-molded joint material (i.e.: asphalt impregnated board strips) wherever flatwork abuts buildings, steps, walls, existing slabs, etc.

DRAINAGE:

The surface of the finished slab should slope a minimum of 10 mm per meter (1%). A slope of 20 mm per meter is preferred (2%).

CONCRETE MIX:

The Alberta Building Code (ABC), and the Canadian Standards Association (CSA) requires a C-2 exposure (plain concrete exposed to freeze thaw conditions and subjected to deicing chemicals) at a minimum compressive strength of 32 MPa, or 30 MPa where local aggregates do not achieve 32MPa, with a 0.45 water/cementing materials ratio, 5 to 8% air entrainment, and 80+/-30 mm slump.

Concrete Alberta recommends Duramix® for exterior concrete that is subject to freezing and thawing in moist conditions and / or subjected to the use of deicing products.

PLACING AND FINISHING:

Any water added to the mixer truck must be done within the first hour after the truck was initially loaded. The quantity of water added must not cause the water /cementing materials ratio of the load to exceed 0.45. **Under no circumstances should water be added to concrete in the ready mix truck to increase the slump above 110 mm.** If the slump needs to be adjusted for increased workability, it must be done by the use of a high range water reducer / super plasticizing admixture (SP) to maintain the quality of the concrete. By adding just 5 liters of water to one cubic meter of 30MPa concrete it will:

- Increase the slump by about 25 mm
- Increase shrinkage potential by 10%
- Reduce freeze thaw resistance by 20%

Any adjustments to the load of concrete, e.g. adding water, air entraining agent or super plasticizer, must be accompanied by remixing of the entire load for a minimum of 30 revolutions at full mixing speed to ensure uniform distribution throughout the load.

The concrete should be placed within 120 minutes from the time the truck was loaded. In hot weather, a shorter placement time window may be necessary in order to preserve targeted plastic characteristics like air content and slump. Even at cooler ambient temperatures, prolonged mixing time or waiting time on the job can result in a loss of air content and/or slump.

Dampen the subgrade without leaving freestanding water. Concrete should never be placed on frozen sub-grade.

Discharge concrete by pumping, or by direct discharge from the mixer truck chute, as close as possible to its final resting place. Do not dump the concrete in piles or use excessive dragging or raking. Avoid segregation of the material by minimizing handling. The concrete should be vibrated for better consolidation. Do not over vibrate as this may bring all the fines to the surface, and remove the air void structure of the surface.

Strike off the concrete to finish grade by using a straight board on edges; between the forms use a “sawing” motion. Vibratory screeds are great but again should not be over-used or used at all on exposed aggregate mixes. Smooth the surface using a magnesium or wood bullfloat. **Do not use steel trowels such as a Fresno trowel for this operation**. Use edging tools along forms (also see “hand tooled” joints below).

Following placement and leveling, **allow any bleed water that appears, to evaporate before attempting to finish.** Failure to wait will result in a scaled surface after a few seasons. **DO NOT** sprinkle cement on the surface to absorb the bleed-water. This waiting time may range from 15 minutes on hot days, to several hours on cool damp days. Take extra precaution when site relative humidity is low (see below).

Texture the garage slab or driveway with the appropriate finish (float or broom) to leave a non-slippery, slightly roughened finish.

JOINTS:

Contraction (Control) Joints: Provision for expansion and contraction movements, due to temperature and/or moisture change, should be provided with construction of contraction joints. These joints are constructed to create planes of weakness so that cracks will occur at desired locations. Contraction joints may be hand tooled or sawed. These joints MUST be a minimum of ¼ the thickness of the slab, no farther apart than 25 times the slab thickness. The length should not exceed 1.5 times the width. The thinner the slab, the closer the spacing is required. Joints should also be hand tooled at inside corners where annoying reentrant cracks have a tendency to form. If contraction joints are sawed into the hardened concrete, it should be done ASAP after final finishing providing the concrete has hardened sufficiently that it can be done cleanly without raveling along the joint. Saw cutting contraction joints 24 or more hours after the concrete is placed will do little, if anything, to control cracking.

Isolation joints should be provided whenever restriction to freedom of either vertical or horizontal movement is anticipated such as where floors meet walls, columns, or footings. These are full depth joints constructed by inserting a barrier of some type to prevent the bond between the slab and the other element.

Construction joints are joints that are placed at the end of a day's work. In slabs they may be designed to permit movement and/or to transfer load. Often in reinforced concrete a conscious effort is made to clean the joint and bond the next day's work.

CURING

EFFECTIVE CURING IS ABSOLUTELY ESSENTIAL FOR SURFACE DURABILITY. This is probably the most neglected phase of proper concrete placing, finishing, and curing practices! Curing of concrete must start immediately following the final finish and involves: Time, Temperature, and Protection from Moisture Loss.

Time:

If the ambient temperature is at or below 5°C, or when there is a probability of the temperature falling below 5°C within 24 hours of placing, all materials and equipment needed for adequate protection and curing shall be on hand and ready for use before concrete placement is started.

Temperature:

If the concrete temperature is expected to drop below 5°C within 24 hours, the Alberta Building Code specifies that the concrete must be protected for the first 72 hours with insulating materials that maintain the concrete temperature at not less than 10°C. For Class C-2 exposure; concrete flatwork subject to freeze thaw cycles and de-icer chemical exposure or application, CSA A23.1 stipulates the concrete must be cured with the concrete temperature maintained at a minimum of 10°C for 7 days or until 70% of 28 day design compressive strength is achieved. Additionally, it states that concrete must be allowed to air-dry for at least a month following the specified cure period before exposure to freeze thaw cycles and de-icing chemicals.

Protection from Moisture Loss:

Concrete hardening requires that moisture be present for cement hydration to occur. Curing methods include: curing compounds, continuous water spray, covering with wet burlap, ponding, covering with plastic sheets.

Hot weather or Severe Drying Conditions:
When the rate of surface moisture evaporation due to wind, warm ambient temperature and concrete temperature exceeds 0.50kg/m²/h, additional measures should be taken to prevent excessive loss of moisture from the surface of the concrete. It is recommended to use an evaporation reducer such as Confilm, Profilm, or approved equivalent, to protect the surface from rapid moisture loss. (Although these products may be described by their manufacturers as finishing aids, their use should be limited to that of an interim shrinkage crack prevention measure and not as a lubricant to enhance a finisher's ability to close the concrete surface).

When placing concrete after September 15th the use of curing compounds is not recommended. Proper cold-weather curing procedures should be followed. A high-quality sealer should be applied in the spring. The driveway should be kept clear of ice, snow, and freezable materials that may penetrate the surface. Do not use de-icing chemicals during the first winter. Use sand to provided skid resistance.

Placement of concrete pavements after September 30th, is not recommended unless proper **Cold Weather Concrete procedures are followed as stated above from CSA A23.1.**

Concrete finishing should be performed by, or under the direction of, a Certified Journeyman Concrete Finisher.

MAINTAINING YOUR CONCRETE SURFACE

Properly maintaining concrete can greatly extend its life and beauty. Plain concrete can look clean and bright, rather than oil stained and grimy. Decorative concrete can look the same after years of enjoyment as it did when it was new, instead of faded, oil stained, and dirty.

PROTECT YOUR INVESTMENT.

1. Concrete should be cleaned at least once per year to remove normal dirt and grime build up, and to remove rust or other stains.
2. Cracks in concrete should be repaired to maintain a structurally sound surface and to minimize water intrusion through cracks that can cause problems with the subgrade.
3. Joints should be sealed to minimize or eliminate water intrusion through the joints and to help prevent dirt from collecting in the joints where weeds may grow.
4. Sealing and periodic resealing of the concrete surface not only reduces moisture infiltration into the concrete but also helps reduce staining. **Concrete Alberta recommends PROPER SEALING of the driveway surface with a Silane penetrating sealer, following a drying period of at least one month after curing. Follow the sealer manufacturer's guidelines for concrete slab surface prep and sealer application procedures.**

CAUTION: The use of de-icing chemicals and all fertilizers may be harmful to your concrete surface.

For additional information, please contact your ready-mix supplier OR
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Concrete Thinking for a sustainable world