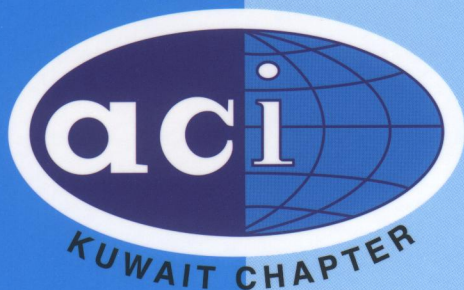
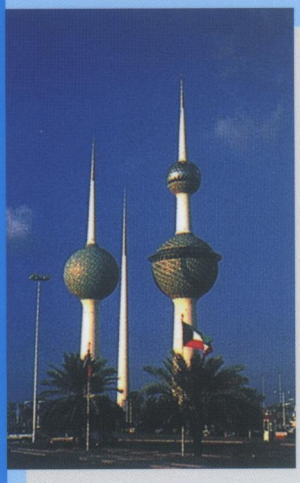


GUIDE TO PROPER CONCRETING PRACTICES PART-II PLACEMENT, COMPACTION AND FINISHING



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GUIDE TO PROPER CONCRETING PRACTICES

PART - II PLACEMENT, COMPACTION AND FINISHING

This guide provides information on the placement, compaction and finishing of the concrete under the specific conditions applicable to Kuwait.

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ACI Kuwait Chapter recommends that professionals should use their judgement in particular cases when applying the recommendations of this guide as ACI Kuwait Chapter will not be held liable in any circumstances for any consequences.

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1. GENERAL:

1.1 Scope:

Part II of the guide to Proper Concreting Practices discusses placement, compaction and finishing techniques relevant to Kuwait's unique conditions for concrete. It should be read in conjunction with the relevant ACI publications.

1.2 Objective:

The aim of the guide is to draw attention to and provide better understanding of factors peculiar to the local construction industry.

1.3 Introduction:

Concrete is more than a material, it is a complete process with changing control at different stages in the process. The stages being specification preparation, raw material production, designing mixes, mixing, transporting to the construction site, placing, compaction, finishing and curing.

Each of the stages may involve different organisations and individuals who will influence subsequent performance in the final stage by their skills and care. A lack of care in one stage can nullify all the care in each of the others.

The correct placing and compaction of concrete are probably the most important parts of the whole sequence of concreting operations from batching, mixing and transporting to the final curing. Success will not be achieved by a haphazard approach, but by careful forethought and planning.

To produce a durable, impermeable and strong concrete with the desired design life it is of paramount importance that firstly the specified COVER is maintained at all times. Secondly placing, compaction and finishing are carried out in a proper manner.

2. PLACEMENT:

2.1 General:

The main objective of placing is to deposit the concrete as close as possible to its final position so that segregation is avoided and concrete can be fully compacted. Prior to placing concrete the basic guidelines given below and checks in appendix 1 should be followed.

2.2 Placing Method:

Method of placement governs the mix proportions. Ensure that the mix is suitable for the method of placement used.

Workability of the mix must be adequate for the method of placement and nature of the structure. Pre-decide the workability requirements, based on existing nature of work and then design the mix to suite the requirement.

Concrete should be placed as quickly as possible. There is however a permitted maximum time period from the time of batching to the time of placing of between 2 and 2.5 hours, providing that water and plasticiser/retarder are added at the batching plant.

To avoid segregation, concrete should be placed in uniform layers because once

segregation has occurred, no amount of vibration can rectify the defect. Where a good finish is required on columns and walls, the forms should not be filled at a rate greater than 2m high per hour.

The height from which the concrete is discharged into the forms should be kept as low as possible related to the mix and workability. When falls of greater than 1.5m occur discharge concrete through trunking.

Avoid using a vapor barrier under slabs on grade unless the advantages outweigh the disadvantages such as aggravation of slab edge curling, drying, plastic shrinkage and cracking problems in general.

Care must be taken to maintain adequate COVER in all circumstances.

2.3 Placing Equipment

The type of equipment used for placing concrete is normally governed by site conditions and type of structure. The proper type of equipment should be used for the job in hand.

Wooden or metal chutes built for the contract application should have rounded cross sections. If long chutes are used they may have to be covered during hot weather.

Buckets with a circular cross section (conical shape) are preferred over rectangular cross-sections because they provide better concrete flow and are self cleaning upon discharge. The bucket should have steep sides. Side slopes should be at least 60 deg. from the horizontal.

The agitator in the concrete pump hopper

should be working all the time to avoid segregation.

3. COMPACTION:

3.1 General:

The process of compacting concrete consists essentially of the elimination of entrapped air and forcing the particles into closer configuration to make the concrete more dense. The following should be considered.

3.2 Compacting Method:

Workability is absolutely critical. Mixes should be designed for a predetermined target slump using plasticisers and without compromising on water/cement ratios.

Hand compaction is unlikely to produce satisfactory results. It is essential to compact concrete by mechanical vibration.

Excessive vibration could lead to segregation and bleeding. However, care must be taken to provide neither too little nor excessive vibration.

It is particularly important to ensure that concrete is thoroughly compacted around the reinforcement.

Internal vibrators (pokers) are the most commonly used on site and as they put vibration directly into the concrete, they are the most efficient. Vibrating pokers are often used inefficiently and in order to achieve good compaction the guide given in appendix 2 should be followed.

3.3 Compacting Equipment

Information on the most suitable types of vibrator is not conclusive but it is believed that vibration of high frequency and amplitude is preferable.

Satisfactory results can be obtained with immersion vibrators (pokers) operating at 8,000 or more cycles/minute (vpm).

The performance of a vibrator is affected by the dimensions of the vibrating head, its frequency and amplitude.

Small diameter vibrators have high frequencies ranging from 10,000 to 15,000 vpm and low amplitudes ranging from 0.015 and 0.03 in. As the diameter increases the frequency decreases and amplitude increases. The radius action of 1" to 1½" (in) poker ranges between 7.5 - 15cm. Whereas of 2" to 3½" (in) diameter poker ranges 17.5 - 35cm.

It is important that vibrators are checked for size, number, and their working condition prior to concrete placing.

The frequency of the vibrators should be checked using vibrometers as part of the checks carried out before casting a structure.

Figures showing the radii of action and consolidation capacities of poker vibrators can be found in appendix 3.

4. FINISHING:

4.1 General:

The purpose of finishing is to produce a good concrete surface with a desired texture and hardness.

The finish can be strictly functional or

decorative. This guide covers only a functional tooled finish.

4.2 Finishing Method:

Finishing is the part of a concreting operation where skill, knowledge and experience are absolutely essential. Proper manpower, equipment and timing is critical.

In general rich mixes are easier to finish.

Concrete should not be placed faster than it can be compacted and finished.

It is necessary first to produce a good plain finish.

Do not use a garden rake. It will cause segregation. Use a square ended shovel instead.

Never sprinkle water or cement on concrete while finishing it, as this may cause dusting or scaling.

Finishing must wait until concrete has stopped bleeding. The waiting period depends on the workability, cement content, admixture and importantly the weather. Finishing earlier may result in dusting, scaling, crazing or blisters.

Avoid excessive troweling and working up an excessive layer of mortar on the surface.

Remember finishing operations affect the quality of the concrete COVER and consequently durability of the concrete.

If plastic shrinkage cracks are seen before concrete has reached its final set, they should be closed by striking the surface on each side of the crack with a float then troweled to level finish.

5. CURING:

Curing of the concrete is of paramount importance for development of strength and eliminating shrinkage cracks. Concrete which has been properly cured, is superior in many ways to that which has not been cured.

Refer to Part I of the Guide to Proper Concreting Practices for details.

APPENDIX 1

Guideline checks prior to placing concrete.

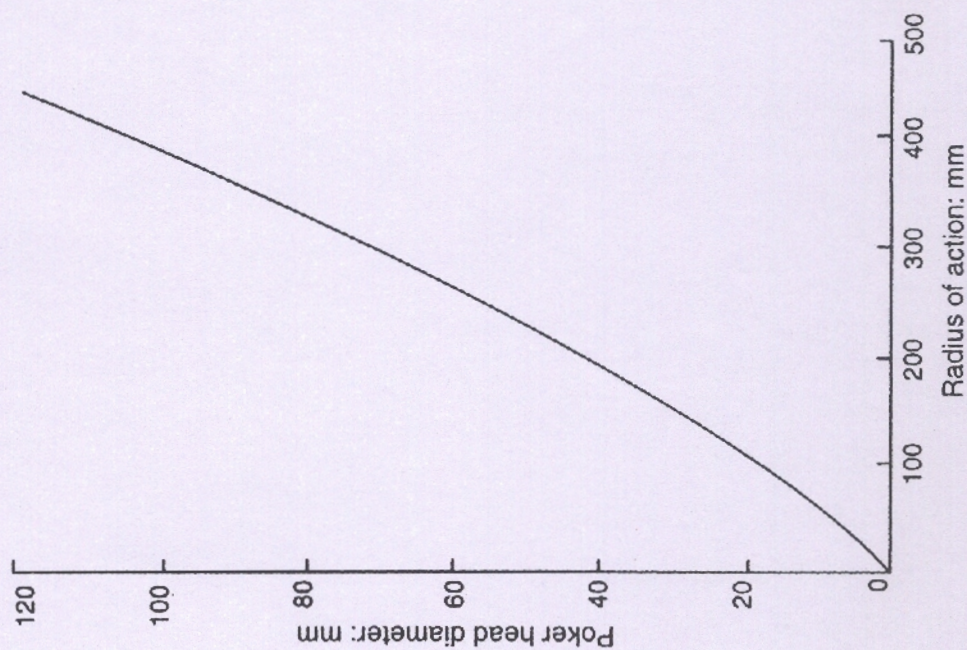
- 1) Has the formwork been checked for line and level?
- 2) Is the formwork strong enough to take the pressure of the concrete?
- 3) Are there sufficient ties, struts, props and have they been tightened?
- 4) Are all void formers and inserts in place and secured?
- 5) Is the reinforcement of the correct type, size and spacing?
- 6) Are there sufficient reinforcement spacers?
- 7) Has the placement area been cleaned?
- 8) Is the formwork grout-tight?
- 9) Are the compacting equipments ready to use and on hand?
- 10) Are the ancillary equipments (skips, dumpers etc.) ready?
- 11) Are the means of curing readily available?
- 12) Do the worker have safe access or working platform?
- 13) Has the reinforcement and formwork been well soaked with water immediately prior to concreting?

APPENDIX 2

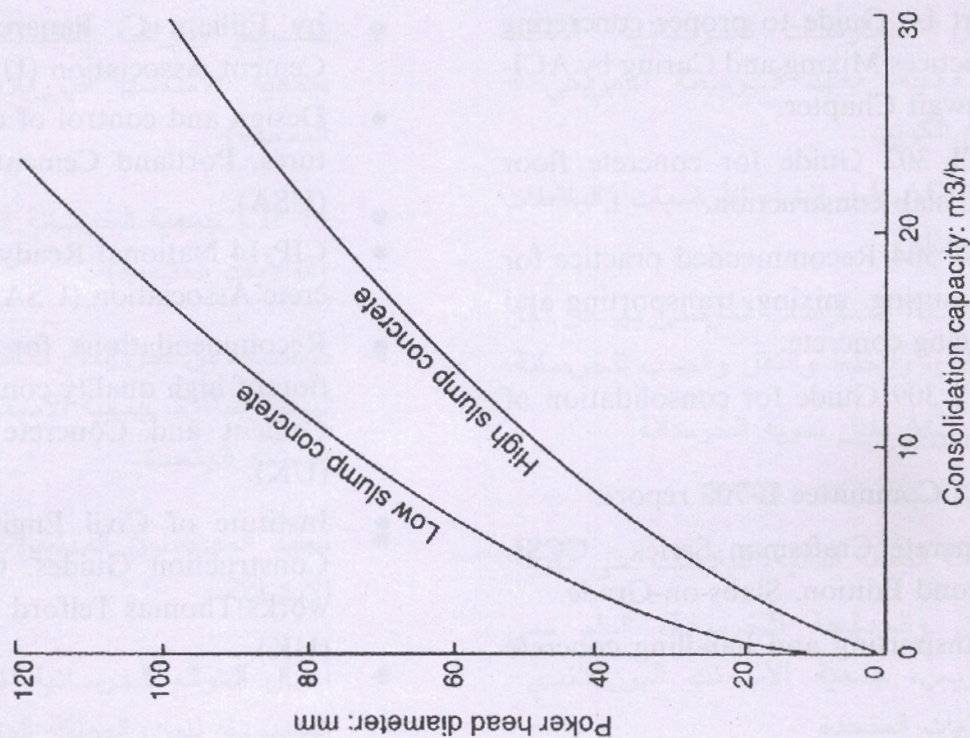
Guide to good compaction.

- 1) Make sure that you can see the concrete surface.
- 2) Put the poker in quickly allowing it to penetrate to the bottom of the layer under its own weight.
- 3) Leave the poker in the concrete for about 10 Sec.
- 4) Withdraw it slowly.
- 5) Put the poker back in not more than about 500mm away from its last position.
- 6) Avoid using the poker to make the concrete flow.
- 7) Make sure that the poker extends into any previous layer.
- 8) Put the whole head of the poker into the concrete.

APPENDIS 3-Radii of action and consolidation capacities of poker vibrators.
 (Institute of Civil Engineers Works Construction Guides)
 Concrete Site Works.



Radii of action of poker vibrators



Consolidation capacities of poker vibrators

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