

CIVIL ENGINEERING CONSTRUCTION 3

CONSTRUCTION TECHNOLOGY 3

CONCRETE TECHNOLOGY

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COMPONENTS

Cement

Water

Aggregates

Coarse aggregates, sand

Additions

Pozzolans, natural or artificial such as Fly ash (FA, PFA), Ground granulated Blast Furnace Slag (GGBS), metakaolin, etc.

Admixtures

Set-retarding, air-entrainment, water-reducing, accelerating, shrinkage reducing, super-plastifiers, corrosion-inhibiting,



CONCRETE SPECIFICATIONS

Concrete Class. Designated concrete

GEN	General
RC	Reinforced concrete
FND	Foundation
PAV	Pavement

For structural concrete – RC f_{ck}

Strength class	20/25	25/30	28/35 ^a	30/37	32/40	35/45	40/50	45/55	50/60
Cylinder strength (MPa)	20	25	28	30	32	35	40	45	50
Cube strength (MPa)	25	30	35	37	40	45	50	55	60



PRODUCTION

Ready mix concrete

Must ensure a third party accreditation for quality assurance
(BS EN 206-1:2000)

Other concrete

The production and conformity control systems used are in accordance with BS EN 206-1:2000 and BS EN 8500-2:2006



PRODUCTION

Conditions of production

Keep materials protected from weather conditions

Cement stored in silo

Dosification in weight

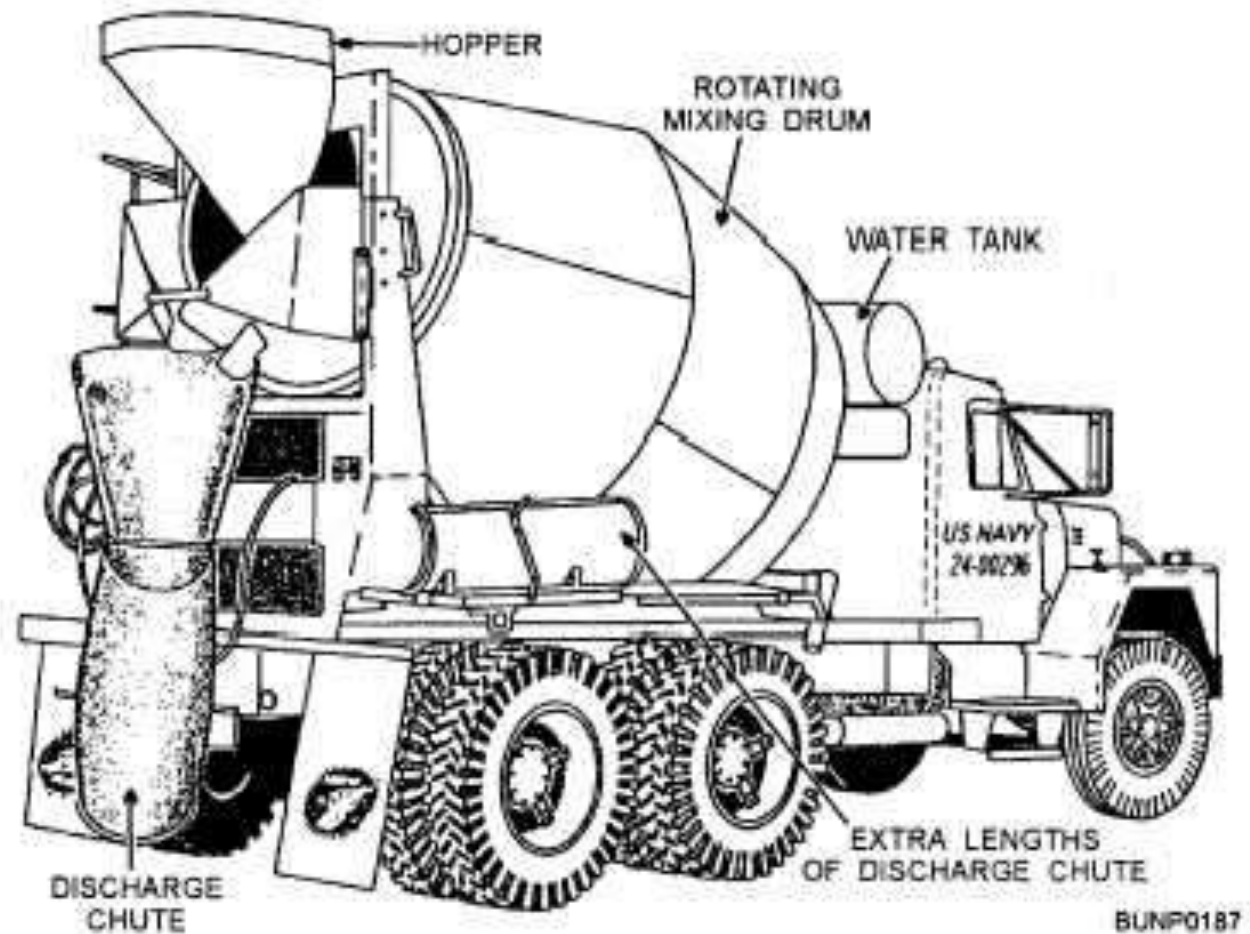
Balance the content of water in aggregates

Dosification of additives



DELIVERY

Concrete mix truck





DELIVERY

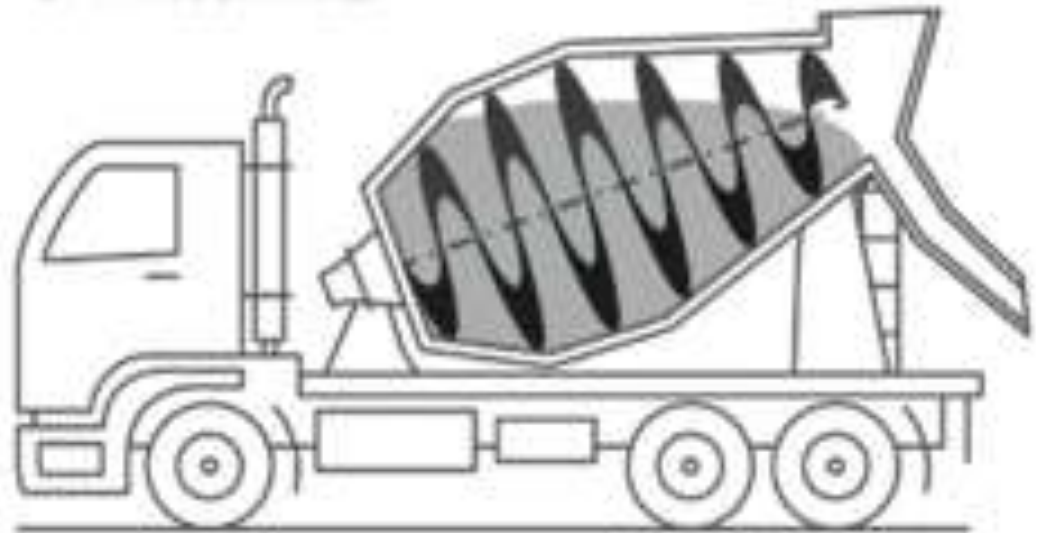
Concrete mix truck

Common load: 6m^3

The drum not completely full

Time to put on site:
90 minutes since water
enters in contact with
cement

OPERATION
OF A TRUCK MIXER





PLACEMENT ON SITE

With a chute

This chute can be manoeuvred from side to side, and vertically





PLACEMENT ON SITE

With a crane bucket







PLACEMENT ON SITE

With a concrete pump









PLACEMENT ON SITE

With a concrete pump

Conditions

Distance to cover is very important to know

Common pumps can transport concrete distances of up to 90m horizontally and 30m vertically

Delays should be avoided when pumping

The pipe diameter must be at least three times the maximum aggregate size

Consistence must be fluent enough to flow





PLACEMENT ON SITE

Concrete must be placed with due care and attention
Vibrated fully to ensure good compaction

General rules:

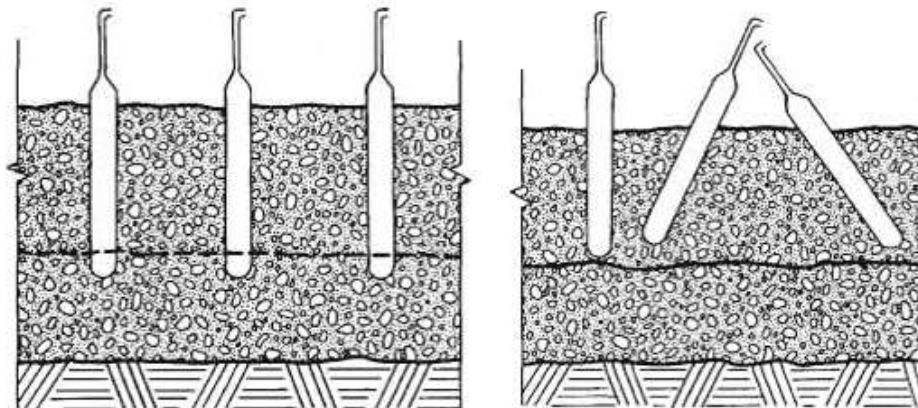
- Concrete not allowed to “free fall” more than 2 m
- Placed in uniformed layers, not greater than 500mm
- Not in large heaps or sloping layers
- Common slump class S3
- The rate of placing and compacting should be equal
- Walls and columns filled at a minimum rate of 2-3m height per hour, avoiding delays and cold joints



PLACEMENT ON SITE

General rules:

- Each layer should be fully compacted before placing the next one
- The upper layer should be placed whilst the underlying one is still plastic
- The poker vibrator should be kept vertically in the layer below and brought up slowly to avoid entrapped air
- The poker vibrator should be moved around to vibrate every 0.3 to 0.5 m and for sufficiently long period of time



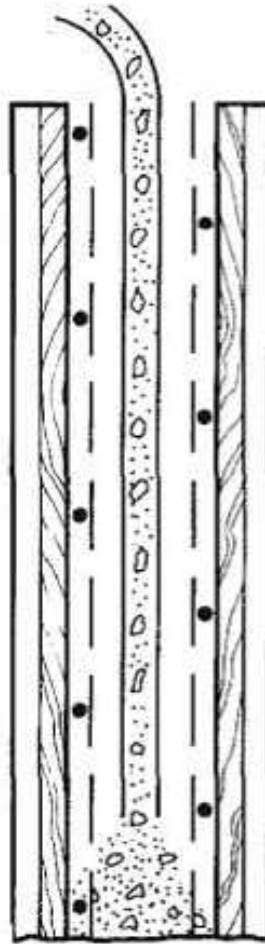
Correct

Incorrect

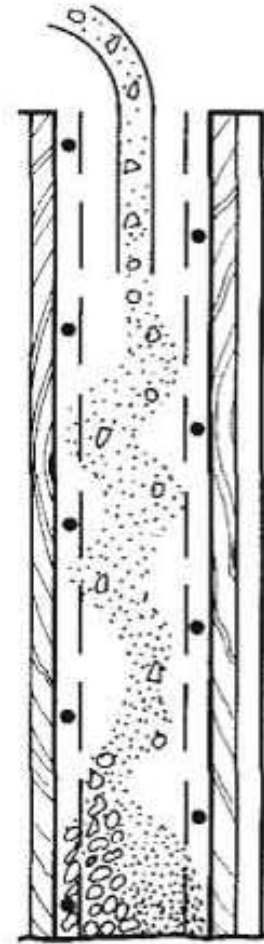


PLACEMENT ON SITE

Dropping from height



Correct

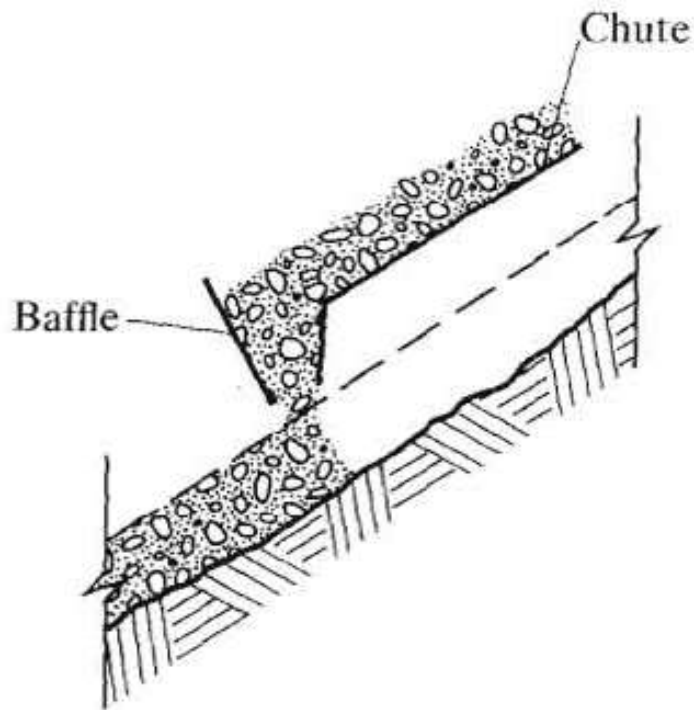


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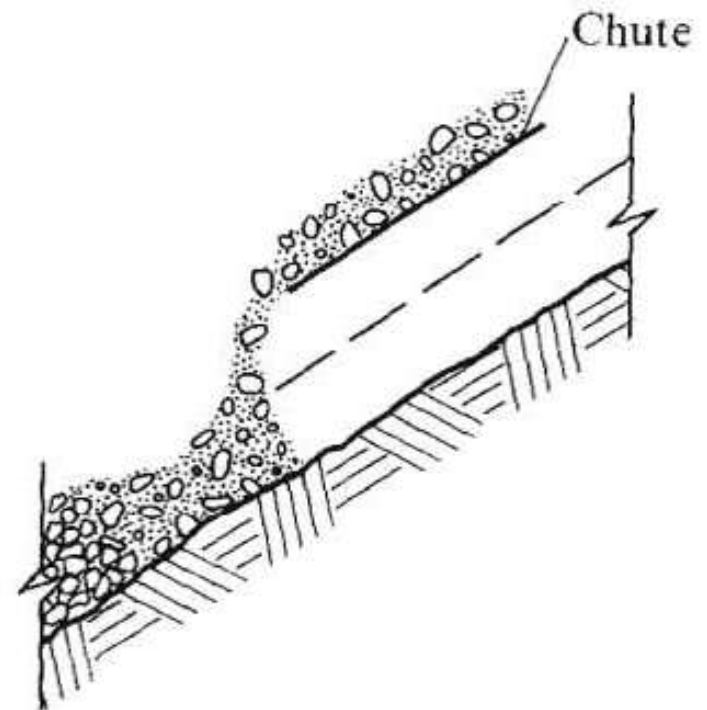


PLACEMENT ON SITE

Placement of concrete on a slope



Correct



Incorrect



FORMWORK

Must withstand the pressures exerted by the concrete during its plastic state

Release agent is applied uniformly

Striking times for formwork depend on:

- The ambient temperature
- Volume of concrete place
- Type of cement used

In cold weather, concrete hardens more slowly
Should be protected from frost











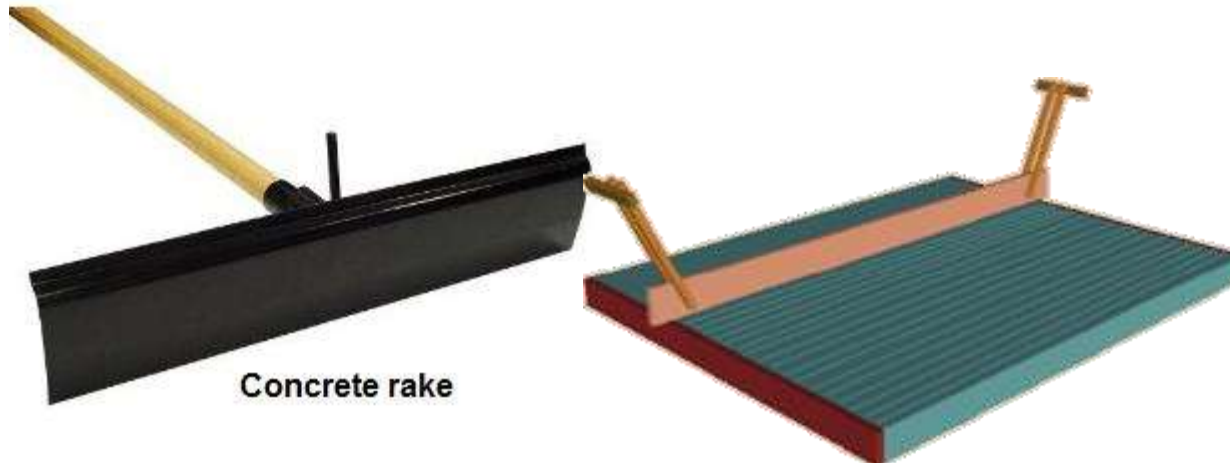
FLOATING AND FINISHING CONCRETE

There are numerous methods of vibration, floating and finishing
Ground slabs should be placed on plastic sheeting or concrete blinding to avoid rapid loss of water

Hand compaction and tamped finish

Shovel or rake. Only on surface

Tamping beam. Remove entrapped air, but not in the whole depth





FLOATING AND FINISHING CONCRETE

Vibrating beam

Provides more compaction than hand compaction

Used for deeper sections





CURING

Concrete must be protected from weather conditions while it gets hardened

There are problems that wind, rain or sun provokes

Concrete gets standard resistance at 28 days

During this time, cement is hydrating

This process can be stopped or damaged because of:

- Lost of water
- Frost
- Heat

Recommendation of using surface curing agents

Other ways (depending weather conditions):

- Sawdust
- Paper, card, plastic on the surface
- Watering
- Etc.



COLD WEATHER WORKING

Hydration of cement is slowed down even stopped

Ice breaks the crystals formed in concrete mass

If temperature falls below 5°C additional precautions must be taken

- Use of warm water
- Accelerator admixture
- Covering
- Insulation with formworks



HOT WEATHER WORKING

Temperature of concrete is increased

- Increase of evaporation of mix water
- More rapid hydration of cement
- Accelerated hardening

Precautions must be taken when temperatures approach 30°C

- Do not add water to the fresh concrete
- Order a suitable consistence/workability
- Place, compact and finish as quickly as possible
- Consider to use retarding admixture
- Improve curing