

Non - Conventional Foundations

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- Extracts

Burnt Brick Foundation

SUB- SYSTEM

Continuous strip foundation in burnt brick masonry that runs under each load bearing wall.

Masonry footings are laid over base concrete of cement or lime mix.

A damp proof course is laid on top to protect the super structure from dampness rising from the soil.

APPROPRIATE FOR

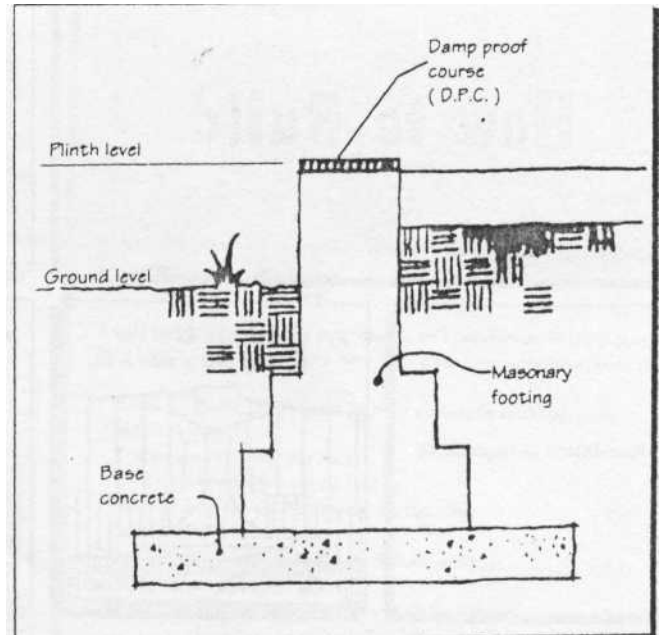
Most single and double storeyed buildings except on

- Black cotton soil
- Soils with very low bearing capacity
- On hard rock

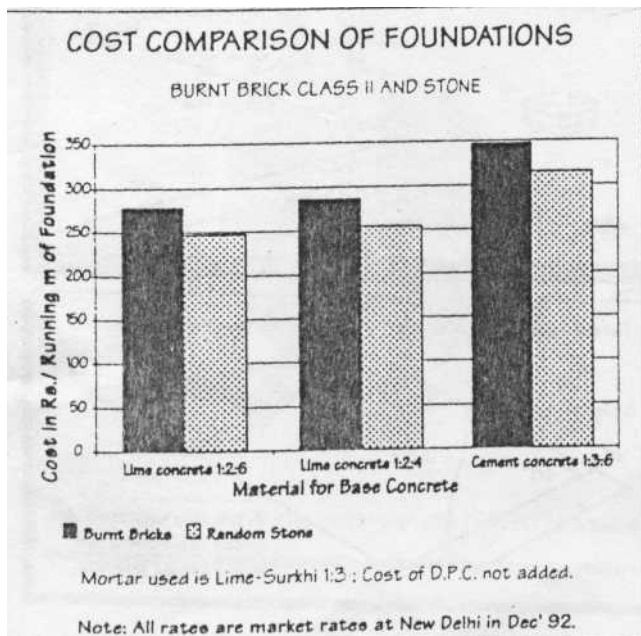
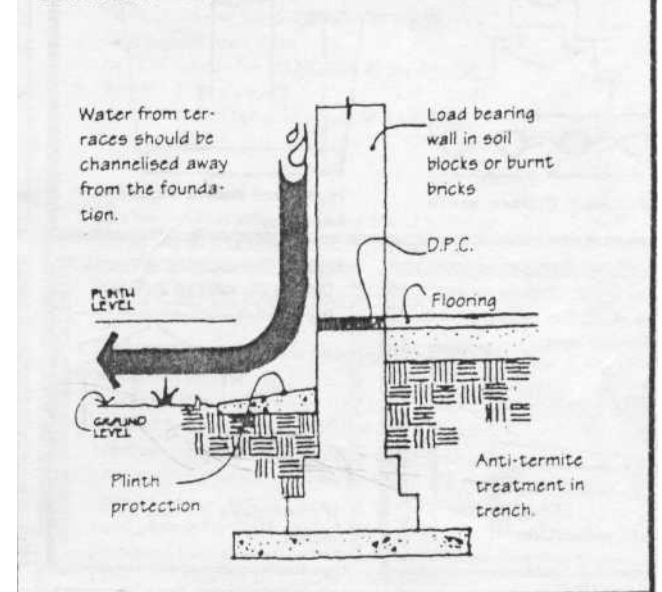
IMPROVEMENTS OVER TRADITIONAL SYSTEMS

Traditional foundations of rammed earth and stone or bricks in mud or lime mortar had depths and widths often exceeding 1m. due to thickness of walls they supported.

Using engineering design, foundation widths and depths have been optimised.



COMPATIBILITY WITH OTHER SUB-SYSTEMS



COMPARISON WITH OTHER MATERIALS

Characteristics	Burnt Brick	Random Stone
Stability	□	■
Cost Range (Rs/m)	260-320	240-350
Unskilled Labour (%)	14	18
V.E.C. (%)	21	76
Level of Skill Required	□	■
Resistance to Water/Moisture Penetration	□	■
Resistance to insects/Termites	■	■
Stage of acceptance	Widely used	Widely used
Grading:	□ Low □ Medium ■ High	

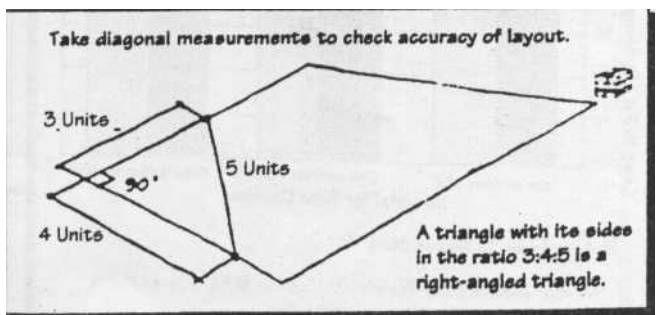
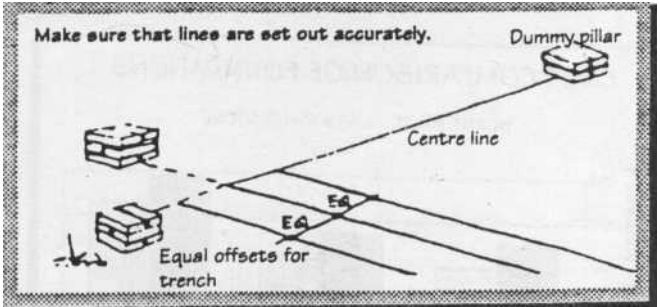
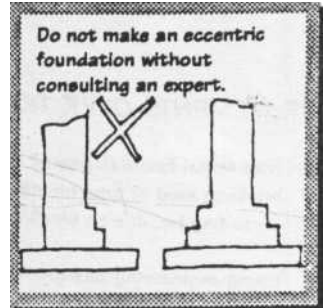
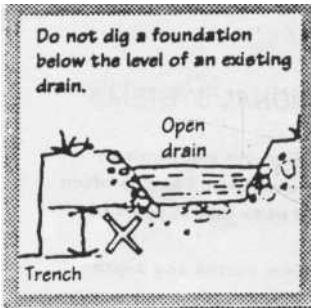
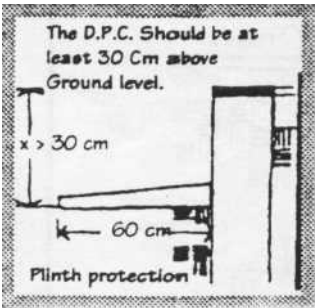
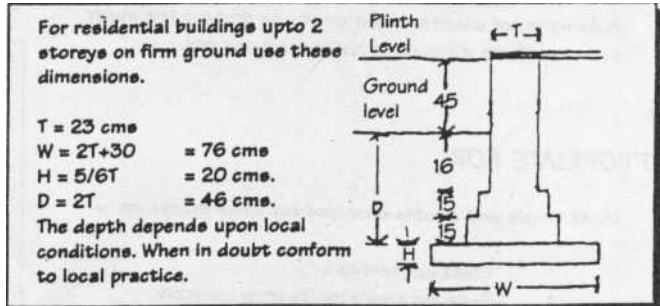
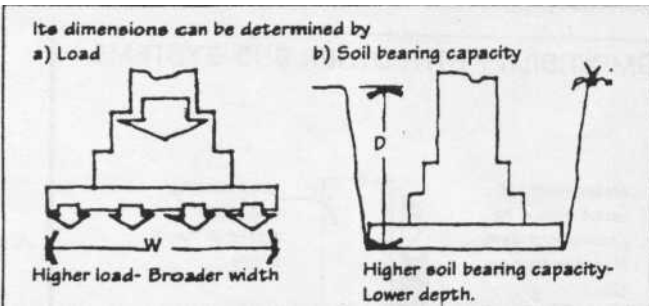
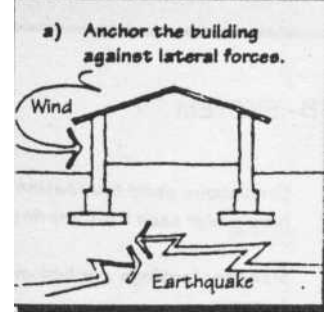
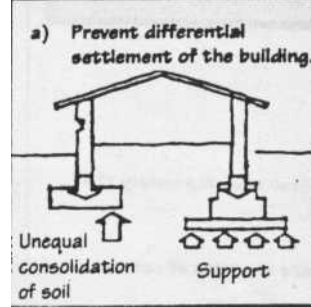
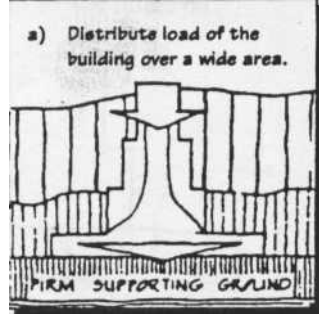
How to Build

You will need

For 1.0 running metre of foundation made with base concrete of lime concrete 1:2:6 and footings of burnt brick Class II in lime surkhi mortar 1:4.

MATERIALS	QTY	PEOPLE(Mandays)	TOOLS
Lime	26.64 kg	Mason -0.24	Masonry tools
Surkhi	0.38 cum.	Labour -0.09	Water level
Brick bats	0.9 cum.		Ramming rod
Burnt bricks class II	140 Nos.		

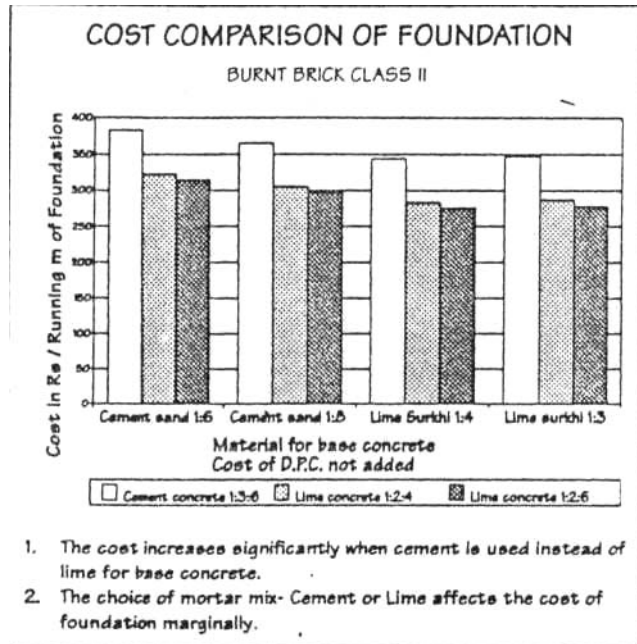
A foundation is required to



HOW MUCH WOULD IT COST

CRITICAL FACTORS

- Design of Foundation section
Choice of Materials For
- Base Concrete
 - Masonry Footings
 - D.P.C.



AN EXAMPLE

To calculate the cost of 1 running m. of foundation in fired bricks (Class) with lime - surkhi mortar (1:4) over lime concrete base (1:2:6)

a) **BASE CONCRETE:** Volume of lime concrete is 0.152 cum.

MATERIALS:
Every cum. of concrete has:

- Lime - slaked 0.16 cum or 102 kg.
Cost of lime for 0.152 cum @ Re.1.20/kg. = Re. 18
- Surkhi - 0.32 cum
Cost of Surkhi for 0.152 cum @ Re.245/cum = Re. 37
- Brick bats - 1.0 cum
Cost of brick bats for 0.152 cum @ Re.175/cum = Re. 26

LABOUR
10 cum. of concrete needs

- Mason - 1.5 man days
Cost of mason for 0.152 cum @ Re.75/day = Re. 113
- Labour - 24 man days
Cost of labour for 0.152 cum @ Re.42/day = Re. 101
- Bhisti - 2 man days
Cost of Bhisti for 0.152 cum @ Re.55/day = Re. 84

= Re. 338

MISCELLANEOUS

Let us assume that we spend 5% of total of materials and labour on tools, water etc.

Cost of miscellaneous items	= Re. 33
TOTAL COST OF BASE CONCRETE (A)	= RS. 371

b) **FOOTINGS:** Volume of masonry is 0.31 cum.

MATERIALS:

- Bricks - 1 cum of masonry has 500 bricks
Cost of bricks for 0.31 cum @ Re.0.75/brick = Re. 233
- Mortar - 1 cum of masonry has 0.36 cum of mortar.
therefore 0.31 cum of masonry has 0.112 cum of mortar.
Lime - 1 cum of mortar has 0.2 cum of lime or 120 kg.
Cost of lime for 0.112 cum @ Re.1.20/kg. = Re. 134
- Surkhi - 1 cum of mortar has 0.8 cum of surkhi
Cost of Surkhi for 0.112 cum @ Re.245/cum = Re. 274

LABOUR

- Mason - 10 cum of masonry needs 7.5 man days
Cost of mason for 0.31 cum @ Re.75/day = Re. 563
- Labour - 10 cum of masonry needs 14 man days
Cost of labour for 0.31 cum @ Re.42/day = Re. 588
- Bhisti - 10 cum of masonry needs 2 man days
cost of bhisti for 0.31 cum @ Re.55/day = Re. 171

= Re. 1322

MISCELLANEOUS

Cost @ 5% of total of materials and labour = Re. 661

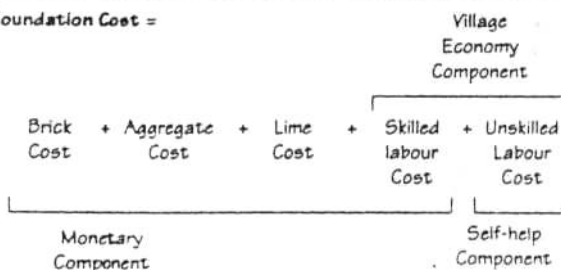
TOTAL COST OF FOOTINGS (B)	= RS. 2042
TOTAL COST OF FOUNDATION/m (A+B)	= RS. 2413

Note: All rates are Market Rates at New Delhi in Dec'92
Refer Annexure 3E.

References: Bibliography 1, 4, 5, 8.

For Costing of Comparative technique, Refer Annexure 2.

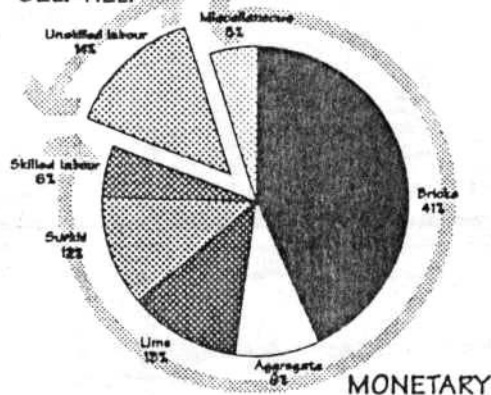
Foundation Cost =



COST BREAK-UP OF FOUNDATION

PER RUNNING m. OF 23 cms. THK. WALL

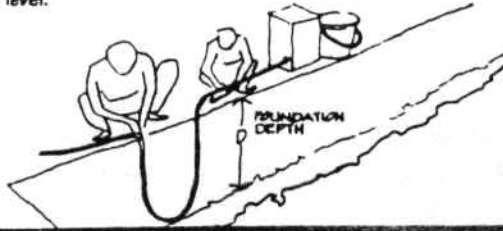
SELF-HELP



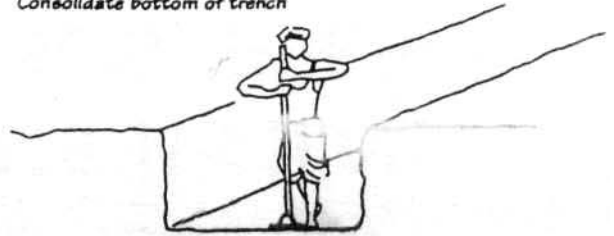
V.E.C. = 20%

Footings in 1:4 Lime Surkhi Mortar over Lime Concrete 1:2:6 base
Burnt Brick Class II.

Excavate trench.
Ensure uniform level and adequate depth by checking at every corner using a water level.

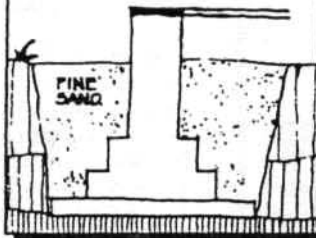


Consolidate bottom of trench



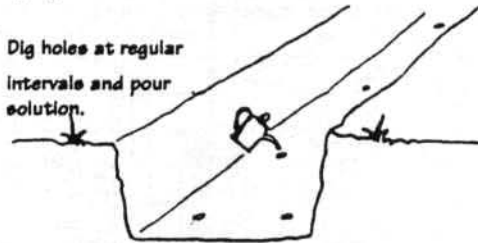
GIVE ANTI-TERMITE TREATMENT WITH EITHER

a) Fill back fine sand right next to foundation.



b) Inject anti termite solution into the trench.

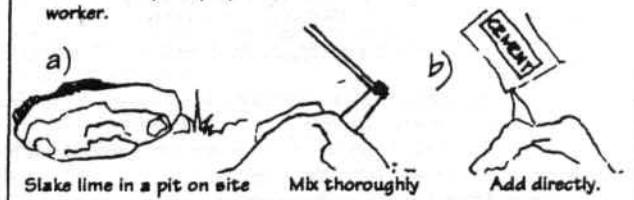
Dig holes at regular intervals and pour solution.



Pour base concrete and ram.

Use lean mixes of cement or lime for base concrete

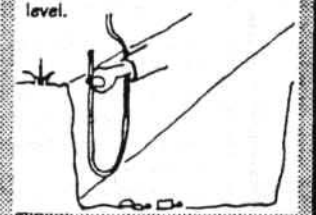
Lime needs prior preparation, more curing time and a skilled worker.



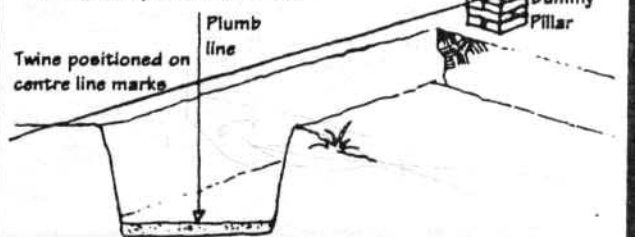
Cure base concrete by sprinkling water for 3 days.



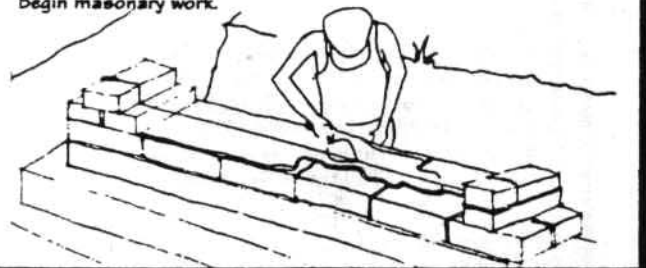
Check uniform thickness of base concrete by using water level.



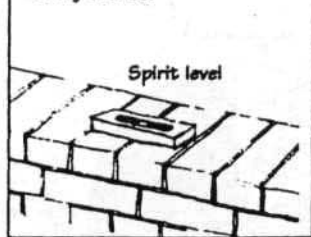
Mark centre lines on the base concrete to ensure that the footings are placed accurately.



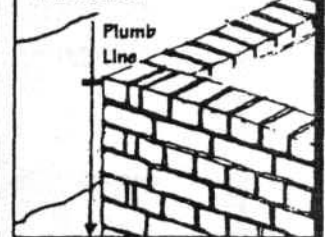
Begin masonry work.



Check horizontal level at every course.



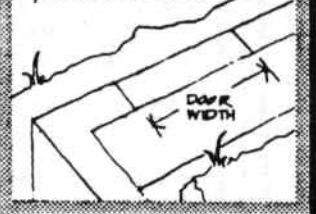
Check if in plumb at every Third course.



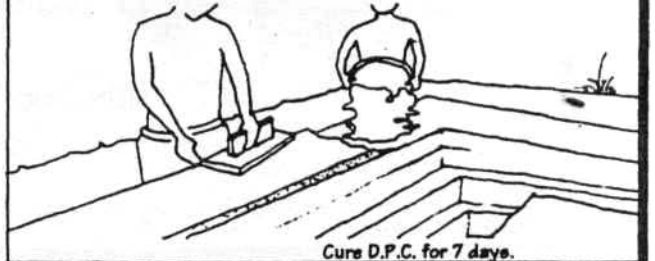
Use a Damp Proof Course of either

- a) Plain cement concrete (1:2:4), 4 cm thick with water proofing compound.
- b) Sand stone slabs grouted with cement mortar.(1:3)

Do not carry D.P.C. over door openings. Mark the positions of doors.



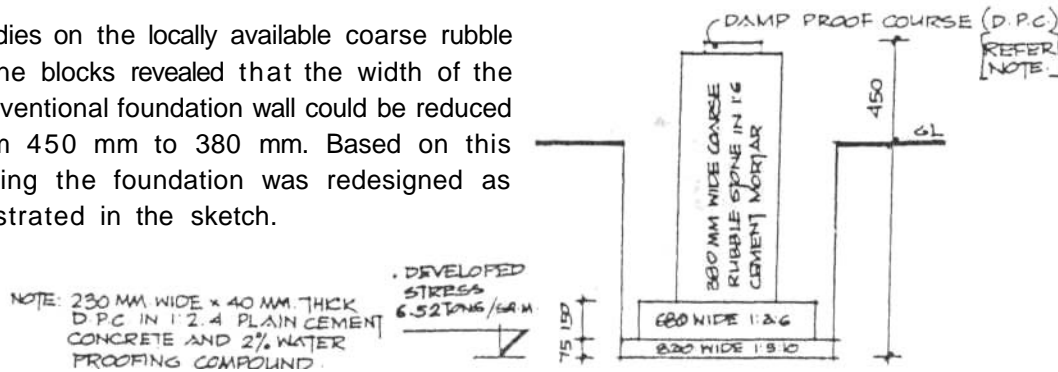
Pour D.P.C. and finish with float to uniform thickness.



WALL FOUNDATION

(1.1)

Studies on the locally available coarse rubble stone blocks revealed that the width of the conventional foundation wall could be reduced from 450 mm to 380 mm. Based on this finding the foundation was redesigned as illustrated in the sketch.



Data for 1.00 metre length of wall foundation with 330 mm wide coarse rubble stone masonry in 1:6 cement mortar

Materials

a) Cement	62.4 Kilograms
b) Sand	0.26 Cubic metres
c) 40 mm agg.	0.15 Cubic metres
d) CRS	0.43 Cubic metres
e) Shuttering	0.30 Square metres

labour

a) Skilled	0.30 Man days
b) Semi-skilled	0.70 Man days
c) Unskilled	160 Man days

INFORMATION ON THE MODIFIED FOUNDATION WITH 330 MM WIDE COARSE RUBBLE STONE MASONRY IN 1 : 6 CEMENT MORTAR.

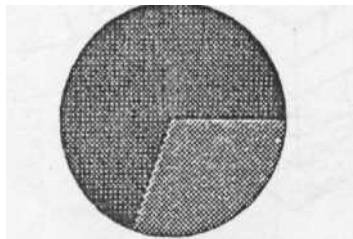
MATERIALS AND LABOUR COSTS

Total cost = Rs. 424.18 / metre

ENERGY CONSUMPTION

Total energy = 137.1 Megacal / metre

Materials
(71.61%)



Labour
(23.39%)

Non renewable
(97.33%)



Renewable
(2.67%)

ARCH FOUNDATION

(1.2)

What is an arch foundation?

In an arch foundation, the walls are supported on brick or stone masonry arches springing from a series of square cement concrete vases as in the sketch.

When to use arch foundation?

- If condition of the soil is good.
- Generally for low rise buildings.

Advantages

- Saves materials like cement, coarse rubble stone, sand etc.
- Labour intensive system.

Disadvantages

- Requires high degree of technical supervision.

Method

- Square bases of designed dimensions and positions to be excavated and then 75 mm thick plain cement concrete (1:3:6) should be laid.
- Soil between these pockets should be cut as per designed profile and 75 mm thick lean concrete (1:5:10) to be laid on it.
- Coarse rubble stone masonry arch and wall should be constructed as a monolith.

