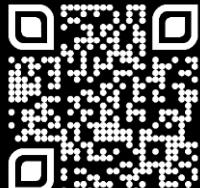


# Toolkit for effective Inspections by Field Officers

Dr. Aditya Dahiya, IAS



# Topics Covered

1. Complete Process of a civil work
2. Common Types of Civil Works & their inspection
3. Estimates – what should you check?
4. Practical aspects of Inspection by officers

1

**Complete Process in any  
Civil Work**

# Steps in any Civil Work - 1

1. Preliminary investigation is done and a rough cost estimate is prepared

**2. Administrative approval** of the department

3A. Detailed survey, *in cases of big infrastructure projects / highways*

3B. Designs, drawings, plans, elevations, sections etc. are prepared

# Steps in any Civil Work - 2

3C. Detailed Estimate (Abstract of Qty. & Cost, specifications) prepared

4. Preparation of DNIT; Technical Sanction

**5. Allotment / Release of funds**

(some departments do this after step 2)

6. Tender for works are invited – *Executive Engineer*

7. Tender Opening, Negotiation, **Rate Approval** & Contract Agreement

# Steps in any Civil Work - 3

8. Work Execution; Entry in Measurement Book by J.E. (or, A.E. / S.D.E.)

9. Preparation of Running Bill; *Running Bill Payment after Pre-Audit*

10. Work Completion; Inspection – 3<sup>rd</sup> Party / In-House sampling

11. JE prepares Final Bill ; Pay order by Ex. Eng. **Payment of Final Bill.**

12. Repayment of Security Amount after 12-24 months

# The Critical Steps

1. Preliminary investigation is done and a rough estimate is prepared
2. **Administrative approval** of the department
3. Detailed Estimate (Abstract of Qty. & Abstract of Cost, **detailed specifications esp. of N.S. Items**); DNIT Preparation
4. **Technical sanction of D.N.I.T (Eligibility Criteria)**
5. **Allotment of funds**
6. Tender for works are invited – *Executive Engineer*
7. Tender Opening, Negotiation, **Rate Approval** & Contract Agreement
8. Work Execution; **Entry in Measurement Book by J.E.** (or, A.E./S.D.E.)
9. Preparation of Running Bill; *Running Bill Payment after Pre-Audit*
10. Work Completion; **Inspection – 3<sup>rd</sup> Party / In-House sampling**
11. JE prepares Final Bill ; **Pay order by XEN, payment released.**
12. Repayment of Security Amount (as per terms. Eg: 50% on completion of work; 50 % after 1 year; different from Performance Security)

## Poll 1: Rate Approval in Developmental Works

Suppose it's February 2024, you have just finished your Phase II, and joined your state cadre. You are posted as Sub-Divisional Magistrate and have an additional charge of Administrator of the local Municipality. The Lok Sabha elections are due in April-May, and the Model Code of Conduct is about to be announced by E.C.I.

A lot of genuine developmental works are pending in your area, for want of administrative approval from Urban Local Bodies Department at state capital. Your DC / DM and the local MLA wants you to clear the many pending files, subject to ex-post facto grant of administrative approval from the State Government Department. They argue this will avoid the delay in long-drawn procedures due to M.C.C. over the next 2 months.

**Which is one type of file you should definitely never sign? (i.e., of the options below, which one is strictly illegal? Though, others may be ill-advised & unethical too!)**

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- A. Administrative approval, to be sent to State Govt.
- B. Floating of tenders.
- C. Open technical bids.
- D. Negotiation of previously opened financial bids.
- E. Work orders.
- F. All files



2

# Common Types of Civil Works & their inspection

2.1

Roads

# Types of Roads

## Based on Materials of Construction

1. Earthen roads
2. Gravel roads
3. Water Bound Macadam (WBM) roads
4. Bituminous or Black-topped roads
5. Interlocking Paver Block (IPB) Tiles' roads
6. Concrete Roads
  - C.C. / R.C.C.
  - R.M.C.

# Earthen Road



# Gravel Road



# W.B.M. Road



# Bituminous Road



15 3'03

# Cement Concrete Road



# Cross-section of a Typical Road



# Embankment

- **Entirely earthwork:**
  - constitutes about 40% of the total cost of a new road !
  - Should be ~ 0.6m to 1 m above the **highest flood** level.
- **Compacting** should be done with a power roller or light roller so that the density of compaction is **at least 95%** of the maximum dry density.
- Indian Road Congress (IRC) has approved the use of **fly ash** for embankments.



The diagram shows a cross-section of an embankment. It consists of a trapezoidal base representing the ground level, and a triangular top representing the embankment. The word 'Embankment' is written in bold black text at the top of the triangle, and '(Compacted earth)' is written below it in parentheses.

**Embankment**  
(Compacted earth)

# Preparation of Embankment

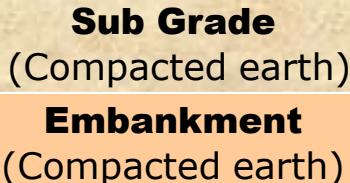


# Compaction of Embankment



# Sub-Grade

- It is the top layer of the embankment which is to receive the hard crust.
- Dense Compacting - Density of compaction is 97% to 100% of the maximum dry density.
- The embankment and sub-grade material is spread in layers of uniform thickness (after compaction) **not exceeding 20 cm at a time.**
- **Poor quality of embankment and sub-grade is responsible for the failure of most roads.**



# Preparation of Sub-Grade



# Inspection of Sub-Grade (1)



# Pavement (Road Crust)



- **Pavement thickness** is based on 2 factors:
  1. **Traffic Index** (TI), and
  2. **Sub-grade strength** as measured by **California Bearing Ratio** (CBR). – CBR a penetration test to evaluate mechanical strength of any surface – ground or subgrades.
- There is a graph from which you can read off pavement thickness required for given values of T.I and C.B.R.

# Sub-Base

Usually 7.5 cm to 15cm thick.

Composed of

- gravel (or)
- sand-gravel mix (or)
- soil-soft aggregates mix  
(brick bats, canker, laterite, etc).

# Sub-Base – Gravel Spreading



# Base

- Usually 15 - 20 cm thick.
- Composed of Water-Bound Macadam (WBM) layer(s).
- In WBM roads, crushed or broken stone (*commonly called 'road metal'*) is kept bonded by the action of rolling and the voids filled with filler material (e.g. gravel, *mhoorum* etc.) with the help of water.

## Base – WBM Layer: Metal Collection



# Base – WBM Layer: Spreading of Metal



# Base – WBM Layer: Binding with Gravel



# Base – WBM Layer: Watering



# Base – WBM Layer: Consolidation



# Base – WBM Layer Completion



# Inspection of WBM Layer: Sieve Analysis



- The following procedure will be adopted for Gradation of metal used for road construction.
- 75mm metal is to be tested to pass 100 % through 90 mm sieve & 100 % retain on 65 mm sieve.
- 65 mm metal is to be tested to pass 100 % through 80 mm sieve & 100 % retain on 50 mm sieve.
- 40 mm metal is to be tested to pass 100 % through 50 mm sieve & 100 % retain on 25 mm sieve.

| Sieve Analysis of Grade III Metal |                            |                        |                         |                                |                                    |                                     |                                       |
|-----------------------------------|----------------------------|------------------------|-------------------------|--------------------------------|------------------------------------|-------------------------------------|---------------------------------------|
| Name of the work:                 |                            |                        |                         |                                |                                    |                                     |                                       |
| Weight of sample                  | :                          | kgs                    |                         |                                |                                    |                                     |                                       |
| Location                          | :                          |                        |                         |                                |                                    |                                     |                                       |
| Thickness                         | :                          |                        |                         |                                |                                    |                                     | mm                                    |
| S.No                              | IS sieve designation on mm | Wt. of sample retained | Cumulative Wt. retained | % of Wt. of the metal retained | % of Wt. of metal passing observed | % of Wt. of metal passing specified | % of Wt. of metal oversize/ undersize |
| 1                                 | 2                          | 3                      | 4                       | 5                              | 6                                  | 7                                   | 8                                     |
| 1                                 | 63                         |                        |                         |                                |                                    | 100                                 |                                       |
| 2                                 | 53                         |                        |                         |                                |                                    | 95-100                              |                                       |
| 3                                 | 45                         |                        |                         |                                |                                    | 65-90                               |                                       |
| 4                                 | 22.4                       |                        |                         |                                |                                    | 0-10                                |                                       |
| 5                                 | 11.2                       |                        |                         |                                |                                    | 0-5                                 |                                       |

# Field Inspections up-to WBM Layer



RD 0.220 LMS

## Field Inspections up-to WBM Layer



# Wearing Course

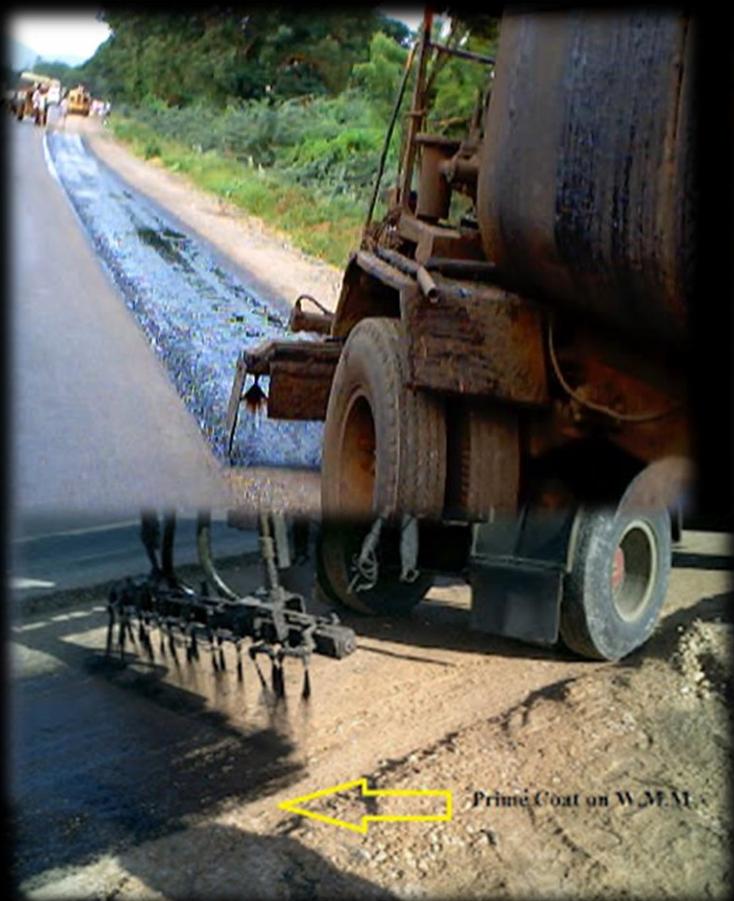
- **Bituminous (BT) / black-topped / asphalt road** – usually about 20 mm thick;
- Consists of 4 sub-layers over the Sub-Base (i.e. WBM layer):
  - i. **Prime Coat**
  - ii. **Tack Coat**
  - iii. **Premix Carpet**
  - iv. **Seal Coat.**



# Prime coat

- The **purpose of the prime coat** is to **protect the WBM layer from rain and light traffic** when the blacktopping work is likely to be delayed. And, **to plug capillary voids** in the base course surface prevent migration of moisture.
- A single coat of low viscosity bituminous material (Slow setting emulsion – SS1) is applied over the WBM layer (which should be clean, dry and free from dust).
- Rate of application: 0.6 – 0.9 kg / sq.m.
- **No heating** of emulsion.

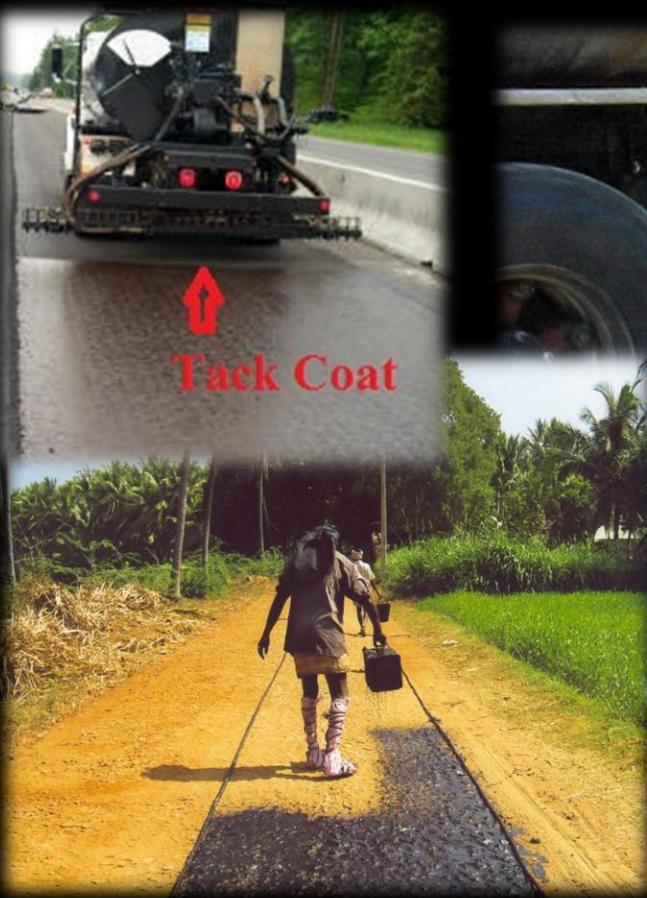
# Prime Coat over WBM



# Tack Coat

- Tack coat is an **adhesive** for gluing two layers together.
- A **single coat** of low viscosity bituminous material (**Rapid setting emulsion – RS 1**) is applied without heating.
- **Tack coat should be allowed sufficient time to set – usually 1 to 2 hours - before applying the next layer (Premix Carpet).**
- Rate of application: 0.25 – 0.3 kg / sq. m.
- **No traffic should be allowed.**

# Application of Tack Coat



# Premix Carpet with Seal Coat

- **Premix Carpet (PC)** : Hot bitumen premixed with 13.2mm -11.2mm graded metal and laid over the Tack coat.
- **Seal Coat** (6.7 mm metal) and is applied 4 to 6 hours after the laying of Premix Carpet to seal the voids.

# Laying of Premix Carpet



# Laying of Seal Coat



# Completion of Bituminous Road



# Pop Quiz

In ongoing works of bituminous road, suddenly, the payments have been stopped by Finance Department due to budget shortage. Funds are likely to come in few months. At which layer do you recommend the contractor to pause and wait (*if this is inevitable*) ?

(*i.e. since there are only bad options, which one is the least harmful amongst these?*)

- 1. Compacted Embankment**
- 2. Densely compacted Sub-Grade**
- 3. Prime Coat**
- 4. Tack Coat**

# Camber

The slight convexity provided to the road surface to drain off the rainwater.

It depends upon the type of road & the amount of rainfall.

e.g., 3.5% for B.T roads in high rainfall areas (> 1000 mm).



# Inspection of Camber - 1



# Inspection of Camber - 2



## Important things in Bituminous Roads - 2

# Storm Water Drains

Include as part of road estimates esp. Bituminous roads

Levels to be checked

Open vs. Closed Drains



## Poll 2: Taking action on allegations in civil works

Its June 2024, and you are now well settled in your role as S.D.M. Owing to your reputation for honesty, some villagers meet you and complain about a “tar-coal” road (BM / PC) which has sagged / “caved in” at a few places near the village pond. They allege collusion of contractor and local leaders in using poor quality material. They request you to visit the site and take samples.

You call the site engineer. He accepts the shortcomings, and requests you to instead release the contractor’s long-pending payments (*due to which he has allegedly stopped the repair work*). The engineer assures that he will get all rectifications done in 3 days, if payments are released now.

Next day, villagers and the MLA reach your office with site photos which clearly show the caved-in road demanding that you order a FIR to be lodged in written. What do you do?

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Next day, villagers and the MLA reach your office with site photos which clearly show the caved-in road demanding that you order a FIR to be lodged in written. What do you do?

- A. Register FIR.
- B. Wait for a week!
- C. Take samples of the bitumen and road metal.
- D. Measure the thickness & compaction of embankment, sub-grade and sub-base.
- Committee of engineers from another department for sampling as per rules.
- E. Get slump test and sieve analysis conducted, along with collection of bitumen samples.



Issue written order...

Ask MLA and village...

You visit the site an...

You visit the site a...

You visit the site, a...

# Cement Concrete Roads



# Cement Concrete Roads

## Advantages

- No potholes. **Maintenance free. Water-logging doesn't harm.**
- **Less fuel consumption** by vehicles (less by 14 – 20%).
- Especially suited for areas where there is oil/chemical spill and heavy traffic - airport tarmacs, ports, **bus stands**, bus depots, lorry depots, etc.

## Disadvantages

- Digging up C.C pavement to repair utilities can pose a problem if the utility ducts are not under unpaved surface on the side.
- High Compressive Strength; but so-so in tensile strength / shearing stress. (Solution: RCC)

# Cement Concrete Roads

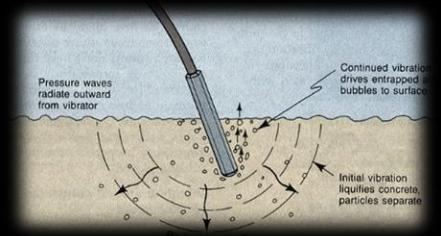
- High initial cost but 'Total Life Cycle cost' less than that of B.T roads.
- A typical C.C pavement:



# Plain Cement Concrete (PCC)

- A mixture of **cement**, **sand** ('fine aggregate'), **crushed rock** ('coarse aggregate') and **water** in a definite proportion, which when allowed to cure becomes hard as stone.
  - E.g, **1:2:4 concrete** (1 part of cement, 2 parts of sand, 4 parts of crushed rock with about 30 liters of water per bag of cement) is often used in building works.
- PCC has to be **consolidated (using a concrete-vibrator)** to reduce voids and increase its density.
  - Presence of 5% voids can cause 30% loss of strength.

# Consolidation (Concrete Vibration)



# Example of poor quality concrete (not vibrated properly)



# Plain Cement Concrete (PCC)

- PCC has to be **cured** by pouring water for about 28 days.
  - If water in the concrete is allowed to evaporate, the cement will not set properly and there will be loss in strength of the concrete.
- Strength of the concrete reaches 40% in 3 days, 65% in 7 days and 100% in 28 days.
- Concrete comes in **Grades: M10, M15, M20, M25....M70, M75, M80.**
  - The figure after **M** indicates the compressive strength in Newtons / sq. mm of a 150 mm cube of concrete after 28 days. **Higher the figure, stronger the concrete.**
- Grades M10 to M20 – **Ordinary Concrete**;
- M25 to M50 – **Standard Concrete**;
- M60 to M80 – **High Strength Concrete**.

# Curing of Concrete Road



# **Reinforced Cement Concrete (RCC)**

- PCC has high compressive strength but is weak in tension.
- Steel reinforcement is placed in PCC at suitable places to take up the tensile stresses.
- Reinforcement in the form of round bars of MS/TMT steel.

# Reinforced Cement Concrete Roads



# Ready Mix Concrete Roads

- **Preparation of Sub grade** – *brick bats / rodi-pathar*
- **Plain Cement Concrete**: M-10 (PCC)
- **Laying of Plastic Sheet** 125 micron
- **Provision of Dowel bars** for construction joints.
- **Laying of RMC** as per requirement: M-20, M-35 & M-40
- Making rough surface



# Inspection During Laying of CC Road

1. If aggregates are segregated or **large lumps** or balls of dry concrete are present in the concrete mix, then the concrete is not homogeneous.
2. Confirm that the concrete is **vibrated immediately** after placing in its final location.
3. No **delays or interruptions** are allowed while pouring the concrete as interruption or delay would result in weak or porous planes or weak joints.
4. Confirm that there are **no early shrinkage cracks** of concrete indicating signs of rapid dehydration of fresh concrete.

# Quality Inspection During Laying of CC Road

- **Concrete slump test** is an empirical test that measures workability of fresh concrete.
  - performed to check consistency of freshly made concrete.
  - indicates degree of wetness.



# Quality Inspection of a CC Road

1. After one day casting, the concrete should be in such a state as to allow a **man to walk over it** without making any undulation.
2. After one day of casting, if it is struck by a **light hammer**, the indentation should not be significant.
3. The concrete after casting should not allow **water to pass through** it.

# Interlocking Paver Block Street

1. Preparation of Sub grade
2. Plain / Lean Cement Concrete Bed
3. Laying of 30mm thick fine sand
4. 60/80/100 mm thick Interlocking paver block, M-35 etc. grade



# Inspection of Paver-Block Tiles



DIGITAL BLOCK TESTING M/C 500 KN



## **Poll 3: Choosing the right type of civil work**

Its August 2024, and you are well settled in your role as S.D.M. Impressed by your work, your Collector / DC / DM asks you to handle files relating to all other municipalities coming to his Office.

The Municipality of Town Y in your district sends a proposal to construct 10 local streets (each approx. 10 ft wide) in the interior of a newly carved colony for BPL families under a Govt. scheme. The Govt. has given a target of 6 months so that the streets are ready well in time before the handing over of vacant plots to the BPL families in a state level function. The Municipality Engineer has proposed CC streets, as they are long lasting and in-demand by local political leaders.

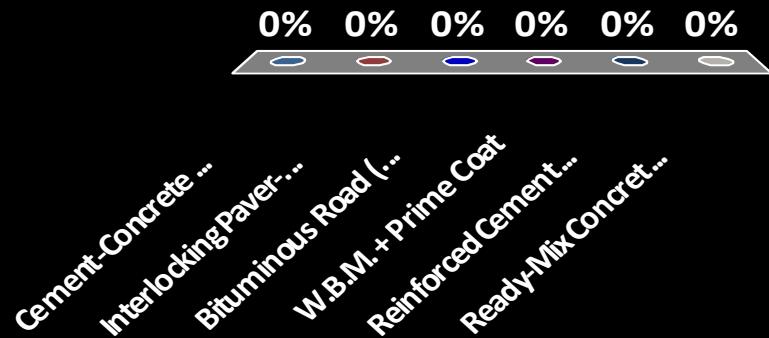
Your clerk brings file to you with request to put up to DC/DM for approval with recommendation. Which one would you recommend?

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Your clerk brings file to you with request to put up to DC/DM for approval with recommendation. Which one would you recommend?

- A. Cement-  
Concrete Road
- B. Interlocking  
Paver-Block Tiles  
Road
- C. Bituminous Road  
(Black-Top)
- D. W.B.M. + Prime  
Coat
- E. Reinforced  
Cement  
Concrete Road
- F. Ready-Mix  
Concrete Road



2.2

# Buildings

# Stages in Construction - Earthwork



6 10 2008

## Stages in Construction – Foundation Concrete



## Stages in Construction – Basement level



# Plinth Beam



# Stages in Construction – Sill level



## Stages in Construction – Laying of Lintel



# Lintel Level

- **Lintel:** horizontal member (wood, steel, but mostly RCC) placed across an opening like a door or a window to support the portion of the structure above it.



# Stages in Construction – Roof level



## Stages in Construction – Laying of Roof



# Stages in Construction – Roof laid



# Stages in Construction – Plastering completed



## Stages in Construction – Colour washing completed



## Stages in Construction – Completed houses



# Quality of Bricks

## Crushing Strength of Bricks

Class A bricks

105 Kg/Sq.cm

Class B bricks

70 Kg/Sq.cm

Class C bricks

35 Kg/Sq.cm

Minimum compressive strength of brick should be 35 kg per Sq.cm.

A



B



C



# Practicalities of Brick Work

- Bricks **must be soaked in water** for 6 to 8 hours before commencing masonry work.
- **Joint thickness < 1 cm.** Vertical joints shouldn't be continuous but staggered.
- All bricks should be placed on their beds with the '**frogs' on top.**
- A **maximum of 1 meter wall height** should be constructed in a day.
- Masonry work must be '**cured' for 7 to 10 days** by adding water carefully.

# Laboratory Sampling of Bricks

- 50 bricks from sample of up-to 50,000 bricks
- Randomly picked; not from a particular place
- Lab Tests
  - Water Absorption Test
  - Compression Test

# Quantity of bricks

Approximate Requirement on Plinth Area Basis  
for Single Storey Load bearing Residential  
Building

- **Bricks** = 500 Nos. per sq.m. of Plinth areas
- **Cement** = 1.5 Bags per sq.m. of Plinth area
- **Steel Bars** = 12 kg per sq.m. of Plinth area

## Quantity

- Weight of one bag of cement is 50 Kgs
- 1 ton of cement equals 20 bags

3

**Estimates :**

**what should you check?**

# **Components of an Estimate**

1. Summary – Nature of Work and reasons for requirements
2. Location & Rough Drawing
3. Abstract of Quantity
4. Abstract of Cost
5. Annexures – Rate Analysis

# Estimate

## Lead and Lift

- The distance over which the material is transported (carried) for disposal is termed as **LEAD**.
  - Usually transport of materials up to a distance of 5km is included in the rates.
- **LIFT** is the depth or height over which the material is lifted.
- The measurement of lead is taken for every 50 metres and lift for every 1.5 metre.

# Centage Charges

- When the PWD or any Engineering Department takes up the work, a percentage amount of 10% to 15% of the estimated cost is charged to meet the expenses of establishment, designing, planning, as Centage Charge.

# Contractor Profit

- Included in some estimates of **Non-Scheduled Items**: In Haryana, generally 10 %
- In-built in **Scheduled Items**: 10% for material and 21.5 % for Labour

# Checking Rates in an Estimate

- **Rates**
  - Schedule or Rates prepared by the PWD
  - eg: **(HSR + CP) + NS**
    - 1988 Haryana Schedule of Rates Items + Ceiling Premium; Non-Scheduled Items
- **Market Rate** – in N.S. Items – we should always insist on Rate Analysis
  - Quotations; Newspapers

# Example of an Estimate

## C.M. Announcement made on Dated 07.06.2016 (Code No. - 10208)

Subject: - Construction of Road by providing and laying of RMC M-20 grade and interlocking tiles from H. No. 5M-104/25 to 5L-49, NH-5 in ward No.14, Faridabad.

Est. Amount: - 56.74 Lac

### Estimate

Subject: - Construction of Road by providing and laying of RMC M-20 grade and interlocking tiles from H. No. 5M-104/25 to 5L-49, NH-5 in ward No.14, Faridabad.

| Sr. No. | HSR     | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Qty.    | Unit    | Rate    | Prevalent | Amount     |
|---------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|---------|-----------|------------|
| 1.      | 56.37   | Demanding of road including soiling and wearing coat, screening and making of old serviceable surface and laying in all respects as per HSR. 5M-104/25 to 5L-49.<br>101950.02<br>101950.02<br>101950.02                                                                                                                                                                                                                                                                               | 4066.72 | 100 Sqm | 196.70  | 370%      | 58431.00   |
| 2.      | 6.1 (A) | Loading & unloading of demand road. Marks complete as per HSR.<br>Area same as per item No. 01 = 4066.72 Sqm<br>Total area = 4066.72 Sqm x 0.10m = 406.67 Cum<br>Taking 90% of 406.67 Qty. 366.00 Cum                                                                                                                                                                                                                                                                                 | 366.00  | Cum     | 241.75  | 450%      | 7782.00    |
| 3.      | 6.1 (B) | Demolition of old serviceable surface and laying of new 5m wide road as per HSR.<br>Qty. same as per item No. 02 = 366.00 Cum                                                                                                                                                                                                                                                                                                                                                         | 366.00  | Cum     | 19.00   | 450%      | 18089.00   |
| 5.      | NS      | Providing of longitudinal joint reinforcement measures 125 mm dia longitudinal glass fiber of make IPCL, Shivalik & galvanizing rate in transverse when colour over the under surface complete in all respects to the centre and outer surface. Weight per meter charge<br>As per item no. 1 = 4046.72                                                                                                                                                                                | 4046.72 | Sqm     | 12.00   | -         | 50564.00   |
| 6.      | 18.12   | Galvanized deformed (ribbed or mesh) bar for RCC works were not included in the complete rate of 5M-104/25 to 5L-49. Including cutting, bending, and placing in position complete 11mm dia bars for Joints only<br>No. of Joints for 22' wide road<br>Length = 404 m<br>404 x 4.50m = 182 Nos.<br>132 Nos x 1.5 m x 0.70m = 1792.80 Kgs<br>For longitudinal joint 22' (404-0.40)0.60 = 360.00 Kgs<br>360.00 Kgs x 1.5m = 540.00 Kgs<br>Wt. @ 0.85 kg/mtr = 6125.64 kg<br>Or 21.14 Qtr | 21.18   | Qtr     | 917.00  | 500%      | 117539.00  |
| 7.      | 18.21   | Wire mesh reinforcement for RCC works were not included in the complete rate of 5M-104/25 to 5L-49. Including cutting, bending, and placing in position complete 11mm dia wire mesh only 16mm dia wire bars<br>No. of Joints for 22' wide road<br>Length = 404 m<br>404 x 4.50m = 182 Nos.<br>132 Nos x 2.2 Nos x 0.60m = 1768.80 Kgs<br>Or 27.85 Qtr                                                                                                                                 | 27.85   | Qtr     | 566.65  | 500%      | 15537.00   |
| 8.      | NS      | P/P PVC pipe 1/4" dia 151 mm for drains bars complete in all respects<br>No. of Joints for 22' wide road<br>Length = 404 m<br>404 x 4.50m = 182 Nos.<br>132 Nos x 22 Nos x 0.60m = 1474.40 Kgs                                                                                                                                                                                                                                                                                        | 1474.40 | km      | 12.50   | -         | 18422.00   |
| 9.      | NS      | Providing of concrete in quantity required for banchet, machine mixed cement concrete vibrated ready mixed cement concrete (R.M.C.) of grade M-20 with cement content not less than 260 kg / Cum (insuring minimum 5% surcharge)                                                                                                                                                                                                                                                      | 708.18  | Cum     | 5100.00 | -         | 3611718.00 |

# Example of an Estimate of IPB Tiles Street - Abstract of Quantity

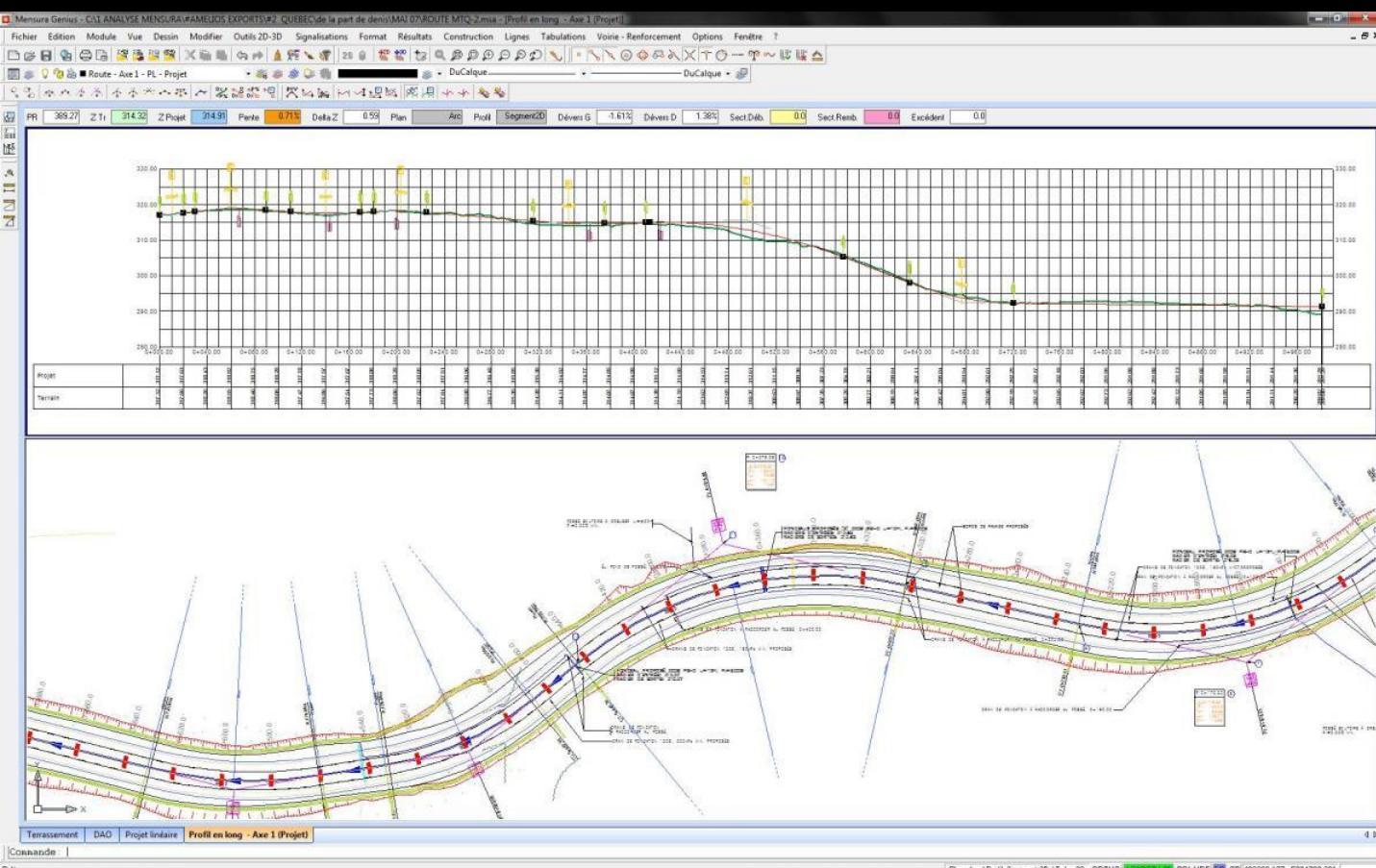
Name of work:- Providing and Fixing of 60mm and 80mm thick table vibrated Interlocking Paver Block on Berm and on Parking area from Ambedkar Chowk to N.D.R.I on Left Hand side, under Municipal Corporation Karnal.

| (Abstract of Quantities) Part - A |                                                                                                                                                                                                                                          |     |             |            |           |                                                           |       |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------|------------|-----------|-----------------------------------------------------------|-------|
| HSR                               | Description                                                                                                                                                                                                                              | No. | L           | B          | H         | Area                                                      | Unit  |
| 1<br>---<br>28.37                 | Dismantling of road and wearing coat, screening and stacking of old serviceable material complete in all respect.<br>Ii) Excavation for ramps.<br>Total length=<br>$35' + 25' + 50' + 12' + 17' + 24' + 24' + 19' + 40' + 30' = 252'-0"$ |     | 252'<br>-0" | 10'-<br>0" |           | 2520.<br>00<br>Or Sq m.<br>234.1<br>0                     | S ft. |
| 2<br>---<br>8.6d                  | Dismantling of C.C. 1:2:4 mix.                                                                                                                                                                                                           |     | 100'<br>-0" | 10'-<br>0" | 0'-<br>6" | 500.0<br>0<br>Or Cum.<br>14.15                            | Cft.  |
| 3<br>---<br>6.6                   | Earth work in excavation in foundations, trenches, etc. in all kinds of soils, not exceeding 2 meters depth including dressing of bottom and sides of trenches stacking the excavated soil, clear from the edge of excavation            |     | 35'-<br>0"  | 8'-<br>0"  |           | 280.0<br>0 S ft.<br>280.0 S ft.<br>480.0 S ft.<br>0 S ft. | S ft. |

# Example of an Estimate of IPB Tiles Street – Abstract of Cost

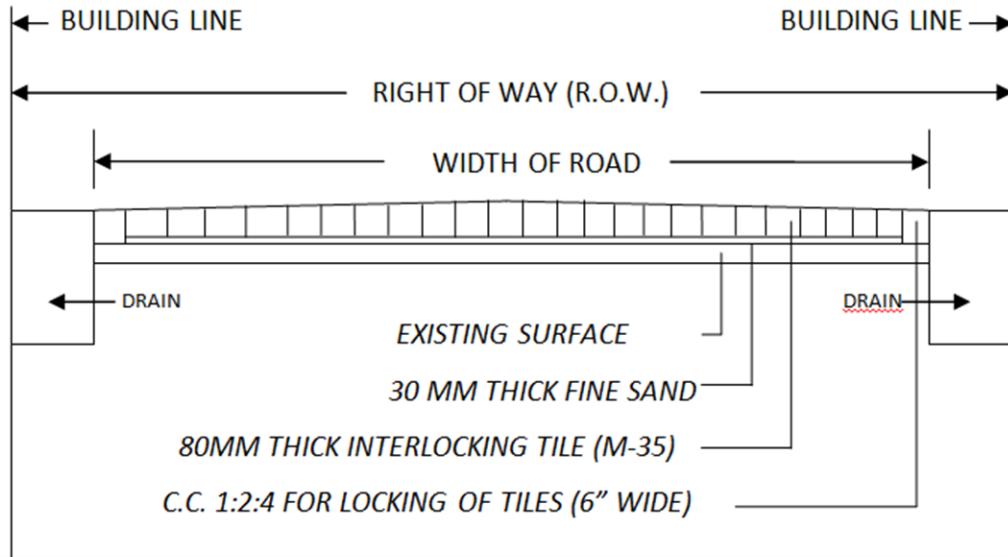
| Sr. No | HSR  | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Qty.    | Unit    | Rate        | Premi um | Amount    |
|--------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|-------------|----------|-----------|
| 1. 7   | 24.3 | Dismantling of road including soling and wearing coat, screening and stacking of old serviceable material complete in all respects as per HSR 5M-104/25 to 5L-49<br>1x1980'x22' = 43560.00 Sqft.<br>Or 4046.72 Sqm                                                                                                                                                                                                                                                            | 4046.72 | 100 Sqm | 296.70      | 370%     | 56431.00  |
| 2. (a) | 4.1  | Loading & unloading of dismantled road Malba complete as per HSR<br>Area same as per item No. 01 = 4046.72 Sqm<br>Taking dismantling 0.10m (Avg.)<br>4046.72 Sqm x 0.10m = 404.67 Cum<br>Taking 90% of 404.67 Qty. 364.20 Cum                                                                                                                                                                                                                                                 | 364.20  | Cum     | 3+1.75<br>2 | 450%     | 7762.00   |
| 3. (a) | 5.2  | Carriage of surplus dismantled road Malba up to 5 km lead as per HSR<br>Qty. same as per item No.02. = 364.20 Cum                                                                                                                                                                                                                                                                                                                                                             | 364.20  | Cum     | 19.00       | 450%     | 38059.00  |
| 5.     | NS   | Providing and laying in position separation membrane 125 micron thick impermeable plastic sheet of make IPCL Shavalik or equivalent make in transparent white colour over the under surface complete in all respects to the entire satisfaction of the Engineer-in-charge<br>As per item no.1 = 4046.72                                                                                                                                                                       | 4046.72 | Sqm     | 12.50       | -        | 50584.00  |
| 6. 2   | 18.2 | Cold twisted deformed (ribbed/for steel) bar for RCC works were not included in the complete rate of RCC including cutting, bending, binding and placing in position complete (12mm dia bars) for Joints only<br>No. of Joints for 22' wide road<br>Length = 604 m<br>604 ÷ 4.50m = 134 Nos.<br>134 Nos.x2 Nos. x 6.70m = 1795.60 Mtr.<br><br>For longitudinal joint 22'<br>(604 ÷ 0.60)x0.60 = 604.00 Mtr.<br>= 2399.60 Mtr.<br>Wt.@0.89kg/mtr = 2135.64 kg<br>Or 21.36 Qtl. | 21.36   | QtL.    | 917.05      | 500%     | 117529.00 |

# Longitudinal Section

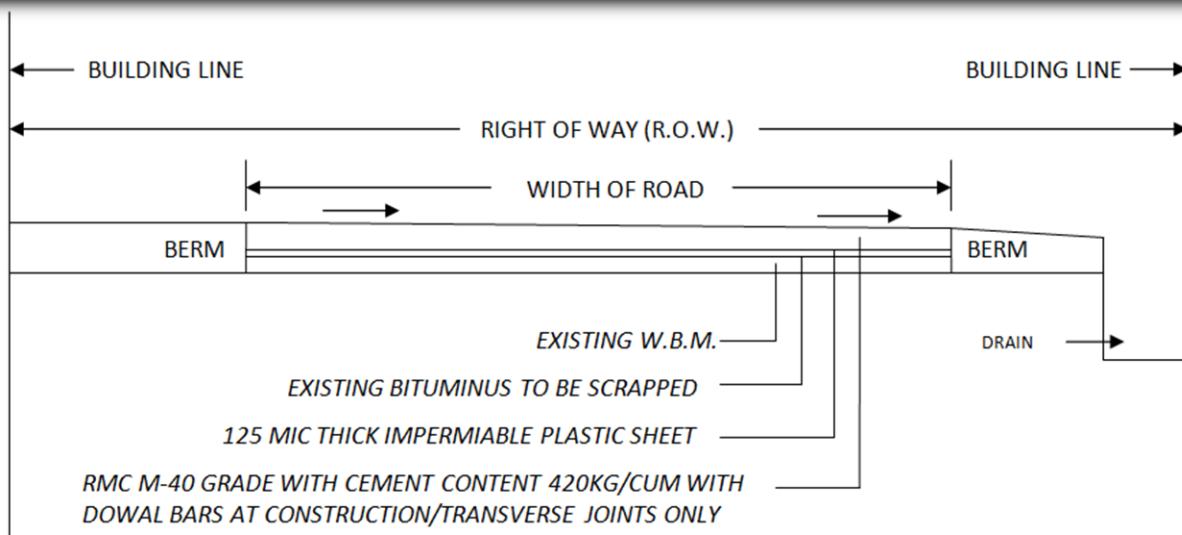


# Cross Section for Roads

## (Interlocking Paver Block Tiles)



# Cross Section for Roads (Concrete Road)



# Inspecting an Estimate - 1

| S. No.   | General Guidelines/ Documents / Annexures                                                                                                                  |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>A</b> | <b>General Documents to be submitted with estimates:</b>                                                                                                   |
| 1.       | Work is marked on <b><u>plan of the town/on Satellite view image</u></b> where the site of work and surrounding streets are clearly highlighted            |
| 2.       | <b><u>Current Photographs</u></b> of the site showing the present status of the proposed work are attached                                                 |
| 3.       | Estimates have been given <b><u>code number</u></b> (name of MC/ serial number of estimate /date) before submitting for sanction. o/o CE/SE/Head Draftsman |
| 4.       | Work is certified to be located in <b><u>approved/ authorized colonies/ public land</u></b> only. No portion of work is located in unapproved colonies.    |
| 5.       | For <b><u>Non-schedule items</u></b> , proper supporting documents are attached for justification of their rates with supporting quotation (Rate Analysis) |
| 6.       | Items taken on the basis of <b><u>HSR/Schedule of Rates bear the item number</u></b> (as per HSR) and full description of items as per HSR                 |

# Inspecting an Estimate - 2

| S. No. | In case of roads/street estimate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | <b>Certification on Roads Levels</b><br><i>(i.e. no road is proposed at higher level than the abutting streets and existing level of the road is being maintained).</i><br><i>In case it becomes necessary to raise the road from existing level then brief note of explanation be attached with estimates.</i>                                                                                                                                                                                                                                      |
| 2      | Year of Construction / <b>last repairs (if any)</b> of the road street                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 3      | Adequate <b>drainage system</b> exists/does not exist at the site. Requisite Provision has been made in the estimate.                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 4      | In case of <b>cement concrete pavements</b> , <ul style="list-style-type: none"><li>• <b>Precast CC blocks</b> have been provided at regular intervals</li><li>• <b>Interlocking tiles</b> have been provided on either side of the road to facilitate the residents who are seek public utility services</li><li>• Provision of longitudinal and transverse <b>joints</b></li><li>• No CC road is proposed to be constructed where <b>civic amenities have not yet been provided</b> and houses up to 90% have been constructed on plots.</li></ul> |
| 5      | Initial <b>Certification of the level of Ground</b> (In case earth filling proposed in the estimate)                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

# Examples of Estimates

NAME OF WORK : - CONSTRUCTION OF MASTIC ASPHALT ROAD FROM GAURI SHANKAR CONFECTIONARY TO BHAGWARIA GAS AGENCY CHOWK, GAUSHALA ROAD, IN WARD NO. 14, M.C. KARNAL

| ABSTRACT OF QUANTITY |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |                                     |       |   |          |      |
|----------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------------------------------|-------|---|----------|------|
| Sr. No.              | HSR. No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | No. | L                                   | B     | H | Qty.     | Unit |
|                      |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     | AREA IN FEET                        |       |   |          |      |
| A                    |          | Total Covered Area :-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1   | 3000.00                             | 23.00 |   | 69000.00 | Sft  |
|                      |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |                                     |       |   | OR       |      |
| 1                    | N S      | Providing and Laying TACK COAT 50KG/100M2 INCLUDING COST OF BITUMEN VG-50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     | Same area as per Total Covered Area |       |   | 6410.10  | Sqm  |
| 2                    | N S      | Providing and Laying TACK COAT 30KG/100M2 INCLUDING COST OF BITUMEN VG-30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     | Same area as per Total Covered Area |       |   | 6410.10  | Sqm  |
| 3                    | N S      | Providing and laying 25 mm thick mastic asphalt wearing course with paving grade bitumen VG-40 grade meeting the requirements given in table 500-29. prepared by using mastic cooker and laid to required level and slope after cleaning the surface.including providing antiskid surface with bitumen procoated fine grained hard stone chipping of 13.2 mm nominal size at the rate of 0.005 cum per 10 sqm and at an approximate spacing of 10 cm center to center in both direction. pressed into surfe when the temperatur if surface not les than 100° C protruding 1mm to 4 mm over mastic surface. all complete as per clause 515. (MoRT&H No. 5.14) |     | Same area as per Total Covered Area |       |   | 6410.10  | Sqm  |
|                      |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     | Same area as per Total Covered Area |       |   | 6410.10  | Sqm  |

Why - Two Tack Coats - ?  
 ✓ ✓

*John Law*  
 Sukha Singh  
 J.E. X

# Examples of Estimates

| NAME OF WORK : - CONSTRUCTION OF MASTIC ASPHALT ROAD FROM GAURI SHANKAR CONFECTIONARY TO BHAGWARIA GAS AGENCY CHOWK, GAUSHALA ROAD, IN WARD NO. 14, M.C. KARNAL |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |      |        |      |                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|------|--------|------|-------------------------------|
| ABSTRACT OF COST                                                                                                                                                |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |      |        |      |                               |
| Sr. No.                                                                                                                                                         | HSR No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Qty.    | Unit | Rate   | C.P. | Amount                        |
| 1                                                                                                                                                               | N.S     | Providing and Laying TACK COAT 30KG/100M2<br>INCLUDING COST OF BITUMEN VG-30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 6410.10 | Sqm  | 11.85  |      | 75959.69                      |
| 2                                                                                                                                                               | N.S     | Providing and laying 25 mm thick mastic asphalt wearing course with paving grade bitumen VG-40 grade meeting the requirements given in table 500-29. prepared by using mastic cooker and laid to required level and slope after cleaning the surface,including providing antiskid surface with bitumen procoated fine grained hard stone chipping of 13.2 mm nominal size at the rate of 0.005 cum per 10 sqm and at an approximate spacing of 10 cm center to center in both direction, pressed into surface when the temperatur if surface not les than 100° C protruding 1mm to 4 mm over mastic surface, all complete as per clause 515. (MoRT&H No. 5.14) | 6410.10 | Sqm  | 530.26 |      | 3399019.63                    |
|                                                                                                                                                                 |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |      |        |      | <b>TOTAL</b> 3474979.31       |
| ADD 1.50% Contigency Charges and Third Party Inspection Charges.                                                                                                |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |      |        |      | 52124.69                      |
|                                                                                                                                                                 |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |      |        |      | <b>GRAND TOTAL</b> 3527104.00 |
|                                                                                                                                                                 |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |      |        |      | <b>SAY IN RS.</b> 35.27 LACS  |

  
 Sukha Singh  
 J.E. X 104

# Examples of Estimates

### Prices of Bitumen

• Table from January 16, 2018

| Bitumen                 | Grades       |              |              |
|-------------------------|--------------|--------------|--------------|
|                         | VG-10        | VG-30        | VG-40        |
| <b>BITUMEN (BULKED)</b> |              |              |              |
| PORT BLR(Mumbai)        | 27700        | 28500        |              |
| KOCHI                   |              | 28500        |              |
| KOYALI                  | 27700        | 28500        | 29080        |
| MATHURA                 | 27100        | 28200        | 28980        |
| <b>PANIPAT</b>          | <b>27400</b> | <b>28200</b> | <b>28980</b> |
| HALDIA                  | 27000        | 27800        | 28380        |
| CHENNAI                 | 27800        | 28600        | 29380        |
| BARAUNI                 | 28030        | 28830        | 29410        |
| <b>BITUMEN (PACKED)</b> |              |              |              |
| KOCHI                   |              | 31600        |              |
| KOYALI                  | 30800        | 31600        |              |
| MATHURA                 | 30500        | 31300        |              |
| PANIPAT                 | 30500        | 31300        |              |
| HALDIA                  | 30100        | 30900        |              |
| CHENNAI                 | 30900        | 31700        |              |

**Note:**

118  
Mahender Singh  
Executive Engineer

  
L.C. RAGHAV  
Asstt. Engineer-IV

L.L. RAJUHAW  
Asstt. Engineer-IV

*Sukha Singh*  
Sukha Singh  
J.E. X

E. X

| Analysis of Rate                                                                      |                                                                            |         |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------|---------|
| Providing and Laying TACK COAT 30KG/100M2 INCLUDING COST OF BITUMEN VG-30 Rate. as on |                                                                            |         |
| <u>16.01.2018</u>                                                                     |                                                                            |         |
| Sr.No.                                                                                | Description of item                                                        | Rate    |
| 1                                                                                     | Supply of 0.03 MT Bitument VG-30 @ 36438.90 PMT                            | 1093.17 |
| 2                                                                                     | Labour Rate as per HSR 24.27 = 32.50 x 30 / 50 = 19.50+370% = 91.65/100Sqm | 91.65   |
|                                                                                       | Grand Total :-                                                             | 1184.82 |
|                                                                                       | Rate per Sqm :-                                                            | 11.85   |

Sukha Singh 30/11/18  
Sukha Singh  
J.E. X

XEN  
M. Singh  
Executive Engineer  
L.C. RAGHUVANSHI &  
Asstt. Engineer-IV

# Tender Document

# Tender Document

1. Preamble
2. Notice inviting Tenders
3. Instructions to bidders
4. Format for submission
5. Enclosures with bid
6. Agreement Format
7. Condition of Contract
8. Specifications (Technical and Financial)
9. Bill of Quantities
10. Drawings

# Example of a Tender – Public Notice

| <b>Tender Notice</b>                                      |                                                                                                                     |                        |                                     |                                         |                                                         |                             |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|------------------------|-------------------------------------|-----------------------------------------|---------------------------------------------------------|-----------------------------|
| Municipal Corporation Faridabad<br>Notice Inviting Tender |                                                                                                                     |                        |                                     |                                         |                                                         |                             |
| Sr. No                                                    | Name of Items                                                                                                       | Estimated Amount (Rs.) | EMD to be deposited by Bidder (Rs.) | Tender Document Fee & Service Fee (Rs.) | Tender Document Download and Bid Preparation/Submission |                             |
|                                                           |                                                                                                                     |                        |                                     |                                         | Start Date                                              | Expiry Date                 |
| 1                                                         | Repair of roads by patch work in Neelam Bata Road (Apposite Panel Pump and Auto Market) in Ward No.12, NIT Fundabad | 215308/-               | 4500                                | 300+1000<br>- 1300/-                    | 28/04/2016<br>Time 19.00 PM                             | 28/04/2016<br>Time 19.00 PM |

Any resident of MCF who has a stake in any of these works and wishes to be a member of the Citizen Supervisory Committee to be set up by the MCF for supervision of the execution of works on the ground, may submit their willingness giving name, address, academic qualification, professional experience and contact phone number to the undersigned by 08.05.2016.

1. Tender will be opened on 29/04/2016
2. The detail tender notice and Tender Document can be seen on website: <https://harvanseprocurement.gov.in> and downloaded online from the Portal: <https://harvanseprocurement.gov.in> by the Firms / Individual registered on the Portal.
3. Possession of Digital Signature Certificate (DSC) and registration of the contractors on the portal i.e. <http://harvanseprocurement.gov.in> is a pre-requisite for e-tendering. Kindly contact o/o Nextender (India) Pvt. Ltd., O/O Municipal Corporation Faridabad, Contact at e-mail address Chandigarh@nextenders.com
4. For any other queries, please contact Executive Engineer, Div-II, Municipal Corporation Faridabad phone no. 9711003708.  
For further details and e-tendering schedule, visit website <https://harvanseprocurement.gov.in/>
5. As the Bids are to be submitted online and are required to be encrypted and digitally signed, the Bidders are advised to obtain Digital Signature Certificate (DSC) at the earliest. For obtaining Digital Certificate, the Bidders should follow point No. 3 under "Annexure-A - Conditions of e-tendering".

Executive Engineer (Div-II)  
Municipal Corporation, Faridabad  
For-Commissioner

## IMPORTANT THINGS

1. Name of Items
2. Estimated Amount (Rs.)
3. EMD to be deposited by Bidder (Rs.)
4. Tender Document Fee & Service Fee (Rs.)
5. Tender Document Download and Bid Preparation/Submission
6. Start Date
7. Expiry Date
8. Contact Details

# Example of a Tender – D.N.I.T

## Corporation Faridabad



### E- Tender Cum community participation Notice

For Procurement of Civil/Mechanical/Electrical Works under Local Competitive Bidding Procedure.

**Name of Work: -** Providing of 4" dia (100mm) D.I. water supply pipe line (K-7) in various streets of NH -1 'B' Khokka Market, Faridabad (W - 12)

Estimated

Cost: - 215308/-

### DEATIL NOTICE INVITING TENDER

e-Tender is invited for purchase of below mentioned items in single stage two cover system i.e. Request for Pre-Qualification/Technical Bid (online Bid under PQQ/ Technical Envelope) and Request for Financial Bid (comprising of price bid Proposal under online available Commercial Envelope):-

| Sr. No | Name of Items                                                                                                                   | EMD to be deposited by Bidder (in Rs.) | Tender Document Fee & eService Fee (Rs.) | Start Date & Time of Bid Preparation & Submission | Expiry Date & Time of Bid Preparation & Submission |
|--------|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------|---------------------------------------------------|----------------------------------------------------|
| 1.     | Providing of 4" dia (100mm) D.I. water supply pipe line (K-7) in various streets of NH -1 'B' Khokka Market, Faridabad (W - 12) | 4300                                   | 300+1000 =1300                           | 20/04/2016 Time 19:01PM                           | 28/04/2016 Time 19:00 PM                           |

Under this process, the Pre-qualification/ Technical online bid Application as well as online Price Bid shall be invited at single stage under two covers i.e. PQQ/Technical & Commercial Envelope.

# Example of a Tender – Bid Format

## For Scheduled Items

| S. No | Name of Work                                                                                                                    | DNIT Amount | Rate to be quoted by the agency in Percentage (%) | Total Amount |
|-------|---------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------------------------------------|--------------|
| 1     | Providing of 4" dia (100mm) D.I. water supply pipe line (K-7) in various streets of NH -1 'B' Khokka Market, Faridabad (W - 12) | 64833       |                                                   |              |

## For N.S. Items

| Sr. No. | Description                                                                                         | Qty   | Unit | Rate to be quoted by the agency | Total Amount |
|---------|-----------------------------------------------------------------------------------------------------|-------|------|---------------------------------|--------------|
| 1       | Supply of D.I./ C.I. specials:-                                                                     |       |      |                                 |              |
|         | Socket bend 4"                                                                                      | 96    | Kg   |                                 |              |
|         | Tee 4"x4"x4"                                                                                        | 780   | Kg   |                                 |              |
|         | Tee 6"x6"x4"                                                                                        | 47    | Kg   |                                 |              |
|         | Flange socket 4"                                                                                    | 32    | Kg   |                                 |              |
|         | Collar 4"                                                                                           | 221   | Kg   |                                 |              |
|         | End cap C.I. 4"                                                                                     | 48    | Kg   |                                 |              |
|         | Tail piece 6"dia                                                                                    | 46    | Kg   |                                 |              |
|         | Tail piece 4"dia                                                                                    | 28    | Kg   |                                 |              |
| 2       | Supply of lead for caulked joints 4" & 6"dia                                                        | 279.6 | kg   |                                 |              |
| 3       | Supply of yarn for caulked Joints 4"&6"dia                                                          | 22.72 | kg   |                                 |              |
| 4       | Labour cost for making connection with existing main water supply line complete as site requirement | 1     | Job  |                                 |              |

# Administrative Issues - 1

- Competent Authority for **NEGOTIATION**
  - *Issues: Experience; Delegation; Committee !*
- Delegating powers of **RATE APPROVAL ?**

## Peculiar Financial Issue of Few Municipal Bodies

- 100% budget provision is necessary before inviting tenders if the works under the non-plan scheme are to be taken up
- Actual Practice: Checked before issuing work order

# Administrative Issues - 2

- **Revised Estimate**
  - When the original sanctioned estimate is exceeded or likely to exceed by more than 5% -10%
  - When there are material deviations from the original proposal.
  - Always Ask for **Comparative Statement** of items
- **Re-tendering: An absolute discretion ?**
  - Reasons:
    - Single Bid?; **Faulty Tender Document**; Failed Negotiation; Non-Responsive Bids (incomplete)
  - Change in the nature of an allotted but **Not-Started** work
  - Decision to re-tender: Risks
    - Whether Financial Bids already opened ?
    - Time-loss; Higher rates next time

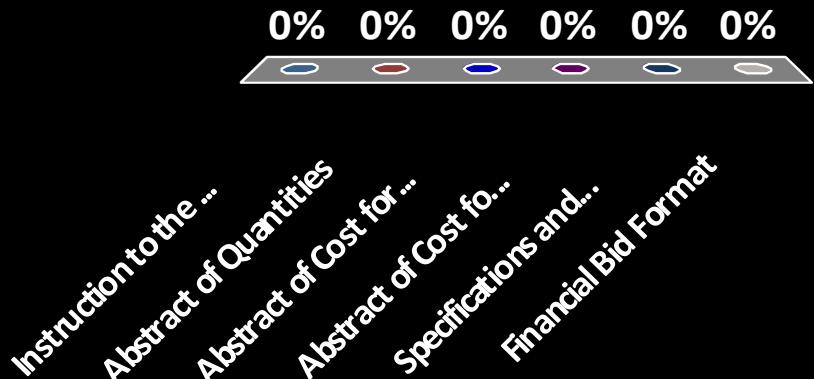
## **Poll 4: The Tender Document**

Which, according to you, should NOT be a part of the tender document to be uploaded online / published in the newspaper by your organization?

## Poll 4: The Tender Document

Which, according to you, should NOT be a part of the tender document to be uploaded online / published in the newspaper by your organization?

- A. Instruction to the bidders
- B. Abstract of Quantities
- C. Abstract of Cost for Scheduled Items
- D. Abstract of Cost for Non-Scheduled Items
- E. Specifications and Detailed Drawings
- F. Financial Bid Format



# 4

## **Practical Aspects of Inspection by officers**

# 4.1

## **Inspection & Sampling of a Road Work**

# Sampling of Bituminous Roads



# Sampling of Road Layers - 1

## APPARATUS

1. Measuring Tape / Thickness Gauge
2. A shovel
3. Suitable small canvas sheets.
4. A hand brush.
5. Suitable containers for samples such as
  1. strong canvas bags or plastic bags for unstabilized layers, and
  2. suitable tins or plastic containers with airtight lids for stabilized layers.



# Sampling of Road Layers - 2

*\*Anecdote: change of sample*

- **Videography**
- Signatures and **attendance**
- Using a pick and shovel, dig a **sqaure hole** (0.5 m X 0.5 m; or whatever size) in the layer which is to be sampled.
- The hole should be large enough to yield the required **sample size**.
- The material should be **loosened carefully** so that material from the underlying layer is not accidentally loosened and mixed in with the required material.

# Sampling of Road Layers - 3

- All the loosened material should be placed on a canvas sheet. It should then be quartered so that each container is filled with representative sample of the material.
- The loosened material must be placed in suitable containers.
  - two to three large containers
- Labelling of sample containers
  - Signatures of Contractor, JE/SDE/XEN
  - Lac seal
- Selection of Laboratory
- Advance payment to Laboratory

# Sampling of Concrete Roads

## • APPARATUS

- A **power drill** capable of drilling out cores at right angles to the surface equipped with a diamond bit 150 or 100 mm in diameter, a core barrel at least 300 mm long and a water supply under pressure to cool the bit
- A **hand-held power saw** equipped with a high-speed carborundum, diamond or similar blade approximately 300 mm in diameter.

## • Drilled out sample size:

- A minimum diameter of 100 mm is recommended
- For the **test of the compressive strength** of concrete, the standard length of the cores is twice the diameter, which, in turn, should be four times the maximum coarse aggregate size.



# Sampling of Concrete Roads



The Max Load at which  
Concrete Specimen  
collapsed is noted

# Sampling of Road Layers - 4

## REPORTING

The samples must be sent to the laboratory under cover of a properly composed report and data form

1. Name of the project.
2. Name of the sampler.
3. Date of sampling.
4. Exact Locations of Sampling
5. Depth of the layer.
6. Sample number and/or mark.
7. Number and type of container, and the numbers with which the containers are marked.
8. How sampled are being sent. (by train, bus or special transport, the information about the consignment should be given in a covering letter)

# 4.2

## Inspection of Building Works

# Practically inspecting Quality of Bricks on the site

- **Visual Test:** Good bricks should be well burnt and of uniform size and color. **Golden Red Colour.**
- **Sound Test:** Striking of two bricks together should produce a **metallic ringing sound.**
- **Scratch Test:** The brick's surface should be so hard that can't be scratched by the fingernails.
- **Drop Test:** It should **not break** if dropped from **1 m** above ground level.
- **Soak Test:** It should not absorb moisture of more than 15-20% by weight, when soaked in water. E.g., a good brick of 2 kg shouldn't weigh more than 2.3 to 2.4 kg if immersed in water for 24 hours.

# Inspection of Formwork - 1



# Inspection of Formwork - 2



# Formwork – Costly & Important

- **Forms or moulds or shutters** are the temporary casings in which concrete is placed, so that it will have the desired shape or outline when hardened.
- Once the concrete has set, the forms are removed; this is called '**stripping**'.
- Columns, floors, roofs, walls, stairs, beams, arches, etc all require suitable forms.
- Cost of formwork is about **30 to 40% of the cost** of ordinary buildings. About 50 to 60% for dams, bridges, etc.

# Inspection of Steel Quality

## Some basic Field Tests for Assessing Steel Quality

- Measuring **weight per meter** of steel bar.
- Measuring **pitch per twist**: For a twisted bar, the distance between each twist can be measured at site. The *pitch should lie between 8 to 12 times diameter* of the bar.



# 4.3 Practicalities

- **Planning the Visit**
  - Pre-schedule
  - Get complete file – AA, TS, Estimate, Work Order / Agreement etc.
- **Whom to take along?**
  - Officials – JE, SDE, .....
  - PRO ?
- **What to take along?**
  - Instrumentation – Measuring Tape, Calipers, Chisel, Hammer, Toolkit

# Practicalities

- Read documentation before inspection
- Take photography / videography along
- Inspect w.r.t. Estimate
- Prefer physical tests in starting
- Then examine the layers / composition physically



# Checking the M.B.

11/12/2016  
P.M. P-2239001

Municipal Corporation, Faridabad  
MEASUREMENT BOOK

029

| Date | Particulars                                                 | Number | Length   | Breadth | Depth | Content of area | Reference to lost measurement |
|------|-------------------------------------------------------------|--------|----------|---------|-------|-----------------|-------------------------------|
| 1    | 2                                                           | 3      | 4        | 5       | 6     | 7               | 8                             |
| 7.   | Mild Steel Reinforcement                                    |        |          |         |       |                 |                               |
|      | TMB P-24                                                    |        | 6477.30  |         |       |                 |                               |
|      | TMB P-24                                                    |        | 886.1    |         |       |                 |                               |
|      | @ Rs 266.65/- + 5% of 3768.30/-                             |        |          |         |       | Rs 316516.35    |                               |
| 8.   | SPN/PC Pipe 1479                                            |        |          |         |       |                 |                               |
|      | T.M.B P-81                                                  |        | 33.62.50 |         |       |                 |                               |
|      |                                                             |        | 1188.00  |         |       |                 |                               |
|      | @ Rs 13/-                                                   |        | 4550.50  |         |       |                 |                               |
|      |                                                             |        |          |         |       |                 | Rs 59156.50                   |
| 9.   | Slab P.M. M-35 grade cement having not less than 40% cement |        |          |         |       |                 |                               |
|      | TMB P-24                                                    |        | 2237.13  |         |       |                 |                               |
|      | TMB P-24                                                    |        | 29.20    |         |       |                 |                               |

@ Rs. 480/- m<sup>2</sup>  
Rs 13619200/-

10. Extra for making rough & faces

|          |                         |
|----------|-------------------------|
| TMB P-22 | 10372.48 m <sup>2</sup> |
| TMB P-27 | 1607.96 m <sup>2</sup>  |
|          | 12080.39 m <sup>2</sup> |

@ Rs 5/-  
Rs 60401.50  
Rs 13795040.75

Deductions

Bricklay 107. R- 1379504.  
C.Y.C. 5255. R- 724840  
T.B.A. 17. R- 137950  
F.C.C. 14. R- 137950  
A.P. faces R- 11576074 9176000  
(5365000 + 6209074) C. R- 12953718.  
Net Pay - 2239396.81  
Add Elbow  
Net Pay R- 2239396.81  
Net Pay R- 22393960.00  
Net Pay R- 22393960.00  
Net Pay R- 22393960.00  
Net Pay R- 22393960.00

Certified that works done as per Part 3/Spec. & Rate

Dated 21/12/16  
SARAVI KUMAR S.  
Assistant Engineer  
MCF

R.D. SHARMA  
Junior Engineer (MCF)

# Checking the Contractor Bill

Point 6-II

FORM DFB-25  
P.W. RUNNING BILL-C  
[See DFR-2.7]

C.B. Vr. No.....

Point No-6-IV

- Ist & Running Bill**
1. Name of Contractor / Agency: Sh. Manish Kumar Contractor.
  2. Chargeable Estimate : 42.09Lacs
  3. Name of work : Construction of 08 No. Public toilet in ward No.15 in the jurisdiction of Division no -III at various Locations and all other work Contingent there to
  4. Agreement No..... Work Order No: EE-III/MCG/2016/0035 Date: 29.02.2016
  5. Authority : Municipal Corporation Gurgaon
  6. Date of Commencement :
  7. Date of Completion:

Bill prepared & measurement made on:  
by Sh. Kirschen JE & recorded  
MB No. 1052 Page No. 011-022.

## 1. ACCOUNT OF WORK DONE :

| Restricted Amount ..... | Lacs |
|-------------------------|------|
| Rate- ....% Below       |      |
| Time Limit upto         |      |
| Extended upto .....     |      |
| Vide .....              |      |

| Sr. No. | Item No.        | Descriptions                                                                                                                                                                                                                   | Qty    | Unit     | Rate                    | Total Amount |
|---------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------|-------------------------|--------------|
| 1.      | 6.6(d)          | Earth work in excavation foundation , trenches etc in all kinds of soil , not exceeding 2 metres depth including dressing of bottom and side of trenches stacking the excavated soil clear from the excavation and as per HSR. | 102.83 | 100/ Cum | 11.08+370% (14.50)      | 5481.00      |
| 2.      | 10.28.          | Cement concrete 1:8:16 with stone aggregate 40mm nominal size in foundation and plinth                                                                                                                                         | 16.65  | Cum      | 420+450% (4698.00)      | 23667.00     |
| 3.      | 11.24           | First class brick work laid in cement stone, dust (from crusher) mortar 1:4 in foundation and plinth part etc                                                                                                                  | 35.43  | Cum      | 427.70+450% (4967.40)   | 103619.00    |
| 4.      | 10.114          | Damp proof course 40 mm thick of cement, concrete 1:2:4 with stone aggregate 20mm nominal size with 2 coats of bitumen 20/30 penetration at 1.65 Kg. Per Sqm. laid hot and sanded.                                             | 23.33  | Sqm      | 35.05+450% (49.37)      | 3836.00      |
| 5.      | 11.53           | 11.43 cm thick brick wall laid in cement stone dust (from crusher) mortar 1: 4 in super structure                                                                                                                              | 90.23  | Cum      | 57.25+600% (6222.00)    | 52222.00     |
| 6.      | 11.28           | First class brickwork laid in cement, stone dust (from crusher) mortar 1:5 in first storey upto 4 Mtrs. above plinth levels.                                                                                                   | 32.01  | Cum      | 448.70+600% (100540.00) | 100540.00    |
| 7.      | 18.22           | Cold twisted deformed (ribbed/ tor steel ) bars for RCC works where not included in the complete rates of RCC including bending and binding and placing complete fixed in position complete.                                   | 3.06   | Qty.     | 917.05+500% (16837.00)  | 16727.00     |
| 8.      | 10.81+10 .95(a) | Cement concrete 1:2:4 with aggregate 20mm nominal size for reinforced concrete work in shelves excluding steel reinforcement but including centering and shuttering laid in position complete in all respects.                 | 4.84   | Cum      | 1034.60+450% (27541.00) | 27541.00     |
| 9.      | 18.22           | Cold twisted deformed (ribbed/ tor steel ) bars for RCC works where not included in                                                                                                                                            | 6.58   | Qty.     | 917.05+500% (42260.00)  | 42260.00     |

|     |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |     |            |          |                        |           |
|-----|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|------------|----------|------------------------|-----------|
| 10. | 10.82+10.95 | the complete rates of RCC including bending and binding and placing complete fixed in position complete.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |     | 8.10       | Cum      | 1094.80+450% (5699.00) | 5699.00   |
|     |             | Cement concrete 1:2:4 with stone aggregate 20mm nominal size for reinforced concrete work in slabs with inclination not exceeding 25 degree with horizontal, excluding steel reinforcement but including centering and shuttering, laid in position, complete in all respects                                                                                                                                                                                                                                                                                                                |        |     |            |          |                        |           |
|     |             | a) Extra over item no. 10.79 to 10.94, if 11.5-3 mks is used, instead of 12.4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |     |            |          |                        |           |
| 11. | 13.13       | Terracing consisting of 22.86cm x 3.81cm laid over 87.50mm mud filling on a layer of 25mm sand plaster and an other layer of mud mortar and laying the tiles, including two coats of bitumen laid hot at 1.65 Kg Per Sqm. on top of RCC slab including grouting with cement sand mortar 1:3 and top surface to be left clean etc.                                                                                                                                                                                                                                                            | 66.92  | Sqm | 52.95+600% | 24804.00 |                        |           |
| 12. | 18.34(b)    | Pressed steel sheet framed(chowkatis), consisting of 2mm thick steel sheet of the specified section, including iron lugs(hold fasts), iron hinges, conforming to P.W.D specifications, including bolts for fixing stops, locknotch, provision for receiving towerbolts, and finished with one coats of ready mixed painted red lead non-setting primer, of approved quality, fixed in position including the cost of cement concrete 1:3:6 for filling in the frame and cement concrete 1:3:6 for lugs complete. (B) Door and window of frame size 76mm x 38mm with 35mm wide single rebate. | 148.95 | mtr | 58.60+500% | 52370.00 |                        |           |
|     |             | Total                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |     |            |          | 490885.00              | 497695.00 |
|     |             | D/d 5% Security                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |     |            |          | 24549.00               | 24884.75  |
|     |             | D/d 5.25% Sale Tax                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |     |            |          | 25771.00               | 26126.99  |
|     |             | D/d 1% income tax                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |     |            |          | 4909.00                | 4976.95   |
|     |             | D/d 1% Labour cess                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |     |            |          | 4909.00                | 4976.95   |
|     |             | Total                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |     |            |          | 430752.00              | 436727.00 |

1. Certified that work has been done as per PWD specification.

J.E.  
Rishi

A.E.  
A.E.

Executive Engineer -  
Signature

Bill Checked Re. 490885.00  
Bill to be paid Re. 430752.00  
CAG AO SO  
27/12/16

# Practicalities

- Then check raw material at site
- If needed, Sampling for Chemical analysis
- Proper follow-up of sampling
- If needed take your P.R.O / avoid crowds
- Talk to the masons for the actual truth



# Practicalities

- If ok, avoid verdict declaration on site
- If not ok, reject on file on site
- Never reject for vague quality reasons, be specific
- Avoid rejecting full work, make deductions for shortcomings



# Site Visit – Practical Tips (1)



# Site Visit – Practical Tips (2)



# Thank You

[Link to the PPT](#)

138