



भारतीय राश्ट्रीय राजमार्ग प्राधिकरण  
(सड़क परिवहन और राजमार्ग मंत्रालय)  
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**POLICY MATTER: TECHNICAL(70/2010)**

[Decision taken on Technical Division file no. NHAI/DGM(Raj.)/2010/Misc.]

**Sub: Cost Methodology for Estimation of Highway Projects under BOT.**

The MORT&H has sent a letter dated 04.11.2010 for evolving a clear guideline for framing cost estimates of all BOT projects of NHAI. The DEA has also requested for formulating a uniform Methodology for the same.

In view of above, the Competent Authority has decided the guidelines to be followed by all DPR/Feasibility Consultants and Financial Consultants, which shall be supervised by all the Technical Divisions uniformly while framing and finalizing cost estimates of the BOT projects and sending to Ministry for approval of PPPAC/SFC.

2. The Detailed Guidelines are summarized as Annexure-I.
3. This issues with approval of Competent Authority.

(M. Chandrashekhara)  
General Manager(Coord.)

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PS to Chairman,  
PS to All Members  
All CGMs/CVO  
All GMs/ DGMs  
All ROs/PIUs/CMUs/SPVs  
All Mgrs

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## **Guidelines for Costing Methodology to be adopted for framing up**

### **Cost Estimates of BOT Projects.**

#### **A. Rate Analysis**

The analysis is to be worked out on the basis of following:

- Step-1 - The basic rates for labour, material and cartage are to be taken from the available SOR for NH works (latest Schedule), if the Schedule is of previous years, an escalation of 5% is adopted for labour / material / cartage per year or for the labour minimum wages for particular State / District is considered, if available.
- Step-2 - The leads of different construction material are to be worked out based on material investigation for location of borrow area in case of borrowed earth, quarry of Stone Aggregates, Sand etc.
- Step-3 - The lead of bitumen, cement and steel is to be fixed based on location of refinery in case of bitumen, location of main city for cement, steel and hume pipe.
- Step-4 - The current rates of bitumen, cement, steel & NP pipes are to be adopted from the market / website. On the basic rate of bitumen taken from the nearest Refinery an excise duty @ 14.42% is to be undertaken on which the CST/VAT and Cartage cost is further added to arrive at the current rate of Bitumen.
- Step-5 - The format for working out rates for different items of bill of quantities is to be used from The Standard Data Book of MORT&H. If the Machinery rates are available in Schedule of Rate (SOR), the rates are taken from SOR only; however, if not available, the machinery rentals of 2001-2002 are considered from Standard Data Book and increased @ 5% per year to bring it to the current date. The same may also be compared with the market rate of hiring charges plus POL, applicable to the project location.
- Step-6 - In Granular Sub Base, Mix in place Method is used while analyzing and putting the rate for Cost Estimation.
- Step-7 - The contingency rates for different type of structures as proposed in Standard Data Book of the Ministry are to be continued presently as they are based on different site conditions and sound practical investigation done by the Ministry at the time of preparing the SDB, until they are revised.

#### **B. Cost Estimate:**

The cost estimate is worked out on the basis of following:

##### **Step 1 - Bill No. - 1 Site clearance and Dismantling**

This bill includes removing the roots of trees of girth more than 300mm, Clearing & Grubbing which is taken for full width of ROW. Also the dismantling of existing pavement and structures is considered. The

thickness of the existing pavement is taken from the details of site inventory for the existing crust.

Rebate towards the salvage value of dismantled materials is to be considered.

**Step 2 - Bill No. - 2 Earth Work**

**Bill No. -3 Granular Sub Base and Base Courses**

**Bill No. -4 (A) Bituminous Courses (Flexible Pavement), 4 (B) Rigid Pavement**

Quantities are to be estimated based on typical cross sections and the layer thickness based on pavement design as per IRC-37 for flexible pavement and IRC 58 for rigid pavement. The quantity of cut/ fill is worked out using Mx Road and the pavement quantity is worked out from detailed drawings. The length of structure is deducted while calculating the quantities of earthwork and pavement.

- a) It is assumed that approximately 50-70% of the excavated earth can be reused for embankment and 30%-50% is unsuitable for use in embankment.
- b) If hard rock is available, then 10% of the quantity out of Excavation is assumed for hard rock and the salvage value of rock is considered in bill no.1. Rest 90% of excavated stuff is considered as ordinary soil; however, this classification may vary with specific location.
- c) It is mandatory to use fly ash for Embankment construction, if fly ash is available at the nearest Thermal power plant within a radius of 100 kms. In this case an item rate needs to be analysed for embankment with use of Fly ash with appropriate lead and this, in general, works out to be more expensive than Embankment fill rate from borrow area.
- d) The quantity of fly ash (if used) and the Backfill quantity used in construction of RE Wall is finally deducted from the total quantity of embankment.
- e) The quantity for Junctions, median opening, Bus bays, Truck Parking and Rigid Pavement for Toll Plaza is considered in Bill No. 2,3 and 4.
- f) The median opening is to be considered every 5 km as per codal provision and the quantities worked out accordingly in Bill No. 2, 3 and 4.

**Step 3 - Bill No. - 5 Culverts**

Provision of additional new Culverts is based on hydrological investigation. The schedule of widening and providing new culverts are fixed up and accordingly the different types of culverts (viz pipe, slab, box) quantities are worked out from the standard drawings or from the available drawings of the particular project. A new pipe culvert of size 1200 mm dia - 1 no. each for T & Y junction and 2 No. for each X junction is considered. Further the abstract of Quantities is prepared for all the culverts and the Abstract of cost is prepared by multiplying the rates.

- Step 4 - **Bill no.- 6 Bridges**  
 Provision of additional new bridges is based on Hydrological Investigation and the quantities & cost estimate of Bridge is based on GADs. Few bridges of different foundation are worked out to assess the per sqm cost of deck area. This constant of cost is used to estimate the total estimated cost of the bridges based on the span configuration in a tabular form. This step is generally followed in the Feasibility stage. But in the DPR stage, once the design is finalized and all the detailed drawings are ready, the estimate is worked out based on them.
- Step 5 - **Bill No. -6A Repair and Repair and Rehabilitation of Existing Bridges**  
 The quantities are based on Site assessment & preparation of inventory of the structure for Repair & Rehabilitation of existing bridges.
- Step 6 - **Bill No. -7 Drainage and Protection works**  
 This Bill include types of drains, protection work such as stone pitching, crash barrier, RE wall, RCC Retaining wall, Breast wall , Drainage chutes, River Training Works etc. The Metallic crash Barrier is provided where height of Embankment is more than 3m and the drainage chutes provided where height of embankment is more than 6m. Median drain is provided in the superelevated portion.
- Step 7 - **Bill No. – 8 Junctions**  
 In this bill quantities includes only the chequered Tiles and kerb for junction and Island. Remaining items like earthwork, pavement items are already covered in Bill nos. 2,3 and 4 for Major and Minor Junctions.
- Step 8 - **Bill No. - 9 Traffic Signs, markings and Appurtenances**  
 Traffic signages are provided as given in the drawing. Gantry mounted Cantilever/ Overhead signs are provided and the numbers are based on the Start and End chainage and the location of Major Junction/ Interchanges, Toll Plaza as per provisions in the drawings. The weight of steel truss is taken as 2.5 tonne /No. for 4- Lane and 1.5 tonne / No. for cantilever truss. The lane markings, delineators, road studs, cluster of Red Reflector is considered according to the drawings and the details marked on the drawing by Traffic/Highway Engineer.
- Step 9 - **Bill No. -10 Miscellaneous**  
 Various miscellaneous items such as vehicles, mobile phones, Trauma center, Way side amenities, Traffic aid post, Administrative, Operational and Maintenance Base Camp, Vehicle rescue Post, Passenger shelter , ATMS, Toll plaza automatic Barrier including ETC , Landscaping are covered under this bill. The provision for street lighting is taken in urban sections as well as for Flyovers and structures. It is assumed that the poles are placed at 30m c/c. High mast is provided in Toll plaza and Junctions. A temporary Traffic diversion, if necessary, is considered as per requirement. Also traffic safety measures items are considered under this sub head.

The number of photographs for the project is assumed as below

@ 10 Nos per bridge and Major Structures

@ 2 Nos per culvert and underpass

@ 4 Nos per km for laying crust

Step 10 - **Bill No.- 11 Maintenance**

This bill covers Maintenance of existing road items such as pot hole and MSS for road maintenance are considered under this bill. It is also assumed that out of the whole existing road approximately 3-5% length of the road has potholes depending on the road condition. For assessing the performance of the pavement and requirement of re-laying of bituminous layers, the existing pavements are to be subjected to investigations under the Benkelman Beam Method under guidelines of IRC 81.

The **civil cost** is the addition of Bill No. 1 to Bill No. 11.

C. **Methodology for formulating TPC**

There is guideline in MCA to calculate TPC by adding 25% of Civil Construction Cost to it to account for the financing charges required by the Concessionaire to implement the BOT project. The rational method of formulating the TPC of a BOT project is to get the financial modelling done by a Financial Analyst based on uniform parameters to be applicable for all NHAI projects. The rational method of financial modelling involves the following parameters/components:

- (i) Interest on Debt Component (IDC)
- (ii) Contingencies
- (iii) Escalation during construction
- (iv) Financing charges
- (v) IC/IE cost borne by the Concessionaire

The rates of these components usually vary from project to project and for different financial consultants. A uniform parameter for deciding the rates of the above mentioned components may be taken as below:

i) **Interest on Debt Component (IDC) –**

Depending on period and phasing of expenditure during construction, and taking a uniform rate of Rs.11.75% per annum, the impact of IDC varies from 12 to 14% of TPC.

**The phasing of expenditure during the construction period may be taken as :**

Upto 180 days – 10%

400 to 650 days- 20%

400 to 650 days – 40%

650 to 910 days – 30%; **Total 100%**

ii) **Escalation of Cost during construction :**

It depends on phasing of construction period. Usually we take a figure of 5% per annum for this component. On comparing cost analysis of many projects, this component consists of 5% of TPC.

iii) Financing Cost

We may take a figure of 2% of TPC as the financing cost of the project

iv) Contingency

This may be taken as 3% of TPC

iv) IC/IE cost borne by the Concessionaire – 1% of TPC

The TPC of a BOT project should be decided by the financial modelling done by the financial consultant on the basis of the uniform parameters as proposed above. It may or may not be within the guideline of the MCA of calculating TPC by adding 25% financing cost to them.

**D. Preparation of Checklist**

Further to finalization of the cost estimate, the following check lists are to be prepared and attached along with details of cost estimate (Formats enclosed)

1	Check List	7	For Cost Estimate of Flyover	1	For Cost Estimate of Vehicular Under pass
2	Abstract of cost Estimate	8	For Cost Estimate of Major Bridge	1	For Cost Estimate of Grade Separator
3	Annexure-I to VIII	9	For Cost Estimate of Minor Bridge	1	For Cost Estimate of Service Road
4	Rate Analysis	1	For Cost Estimate of Foot Over Bridge	1	For Cost Estimate of Truck lay Bye
5	For Cost Estimate of Bypass	1	For Cost Estimate of ROB/RUB	1	For Cost Estimate of Bus lay Bye
6	For Cost Estimate of Major and Minor Junctions	1	For Cost Estimate of Pedestrian Under pass	1	For Cost Estimate Toll Plaza with ETC

: A list of all Machineries used in highway construction is also attached alongwith indicative average hire charges procured from some agencies of ongoing projects. These hire charges are subject to variation depending on age/location of the Equipment/Machinery (Annexure 'A' enclosed).

### Check List

1	Name of Project:			
2	Project Features:			
	Sr. No.	Feature	No./Particular	Justification with reference to Manual (if applicable)
	i)	Length		
	ii)	Major Bridge		
	iii)	Minor Bridge		
	iv)	Rail Over Bridge		
	v)	Grade Separator / Flyover		
	vi)	Culverts		
	vii)	Vehicular Underpass		
	viii)	Pedestrian Underpass		
	ix)	Cattle Underpass		
	x)	Bypass/realignment		
	xi)	Service Road		
	xii)	Toll Plaza		
	xiii)	Bus bays		
	xiv)	Truck lay bays		
3	Deviation from IRC Manual of Standards and Specifications, if any with justification			
4	Length of Concentric widening:			
5	Length of Eccentric widening			
6	Length of New Construction / New Alignment			
7	Traffic			
8	Estimated Cost			
	i)	Civil Cost		
	ii)	TPC		
9	Basis for Rates			
10	Civil Cost of provision other than carriageway			
	Provision	Length	Cost	
	i)	Bypasses / realignment		
	ii)	Structures**		
	iii)	Service roads		
	iv)	Special treatment, if any		
11	Cost of carriageway construction [8 (i)- 10]			



**Checklist for Cost Estimate of Bypass\***

S. No.	Description	Information to be filled as per site conditions
1	Name of the town / city to be passed	
2	Population of town	
3 a)	Length of existing road with chainage (km)	
b)	Existing ROW (m) (width)	
c)	Existing lane width (m), if divided carriageway mention specifically	
d)	Present traffic (PCU)s	
	i) Total Traffic PCUs	
	ii) Tollable traffic PCUs	
4 a)	Length of proposed bypass road (m)	
b)	Proposed ROW (m) (width)	
c)	Proposed Lane width (m)	
5	Nos of Major bridges falling in proposed bypass	
6	Length of major bridges (for three bridges e.g. 300+200+300)(m)	
7	Feasibility to acquire additional land along the existing alignment	
8	Feasibility to acquire additional land along the proposed alignment	
9	Justification for bypass	
10	Cost Estimate	
a)	Road Portion (Rs.)	
b)	Bridge Portion (Rs.)	
c)	Underpass (Rs.)	
d)	Grade Separator (Rs.)	
e)	Interchange (Rs.)	
f)	Junction Improvement (Rs.)	
	Toal Cost (Rs.)	

**\* To be designed as fully access control.**

**Checklist for Cost Estimate of Flyover**

<b>S. No.</b>	<b>Description</b>	<b>Information to be filled as per site conditions</b>
1	Location with chainage & Name of Town / city	
2	Population of town / city	
3	A) Details of Crossing road no. 1	
	a) Category of crossing road (NH/SH/MDR/ODR/VR/city road etc.) (km)	
	b) Existing ROW of cross road (m)	
	c) Existing lane width (m), if divided carriageway mention specifically	
	d) Present traffic on cross road in PCUs / hour	
	B) Details of Crossing road no. 2	
	a) Category of crossing road with chainage	
	b) Existing ROW of cross road (m)	
	c) Existing lane width (m), if divided carriageway mention specifically	
	d) Present traffic on cross road in PCUs / hour	
4	Total Traffic of the Junction in Nos of Vehicles	
5	Justification for Flyover	
6	a) Length of proposed flyover with chainage (km)	
	b) Proposed ROW (m)	
	c) Proposed lane width (m)	
7	Feasibility to acquire additional land along the existing alignment	
8	Cost Estimate	
	a) Road Portion (Rs.)	
	b) Structure (Rs.)	
	c) Misc. (Rs.)	
	Toal Cost (Rs.)	

### Checklist for Cost Estimate of Major Bridges

S. No.	Description	Information to be filled as per site conditions
1	Location of the bridge with chainage	
2	Name of river / Nallah etc.	
3	a) Length of existing bridge (e.g. 8 spans of 200m)	
	b) Existing lane width (m), if divided carriageway mention specifically	
	c) Type of Superstructure	
	d) Type of Foundation	
	e) Present Traffic (PCU)s	
4	a) Length of proposed bridges with chainage (km)	
	b) Proposed ROW (m) (width)	
	c) Proposed Lane width (m)	
	d) Type of Superstructure	
	e) Type of Foundation	
5	Length of Approaches / protection works / guide bunds etc.	
6	Cost Estimate	
	a) Road Portion (Rs.)	
	b) Structure (Rs.)	
	c) Misc. (Rs.)	
	Toal Cost (Rs.)	

**Checklist for Cost Estimate of Pedestrian Underpass (PUP)**

<b>S. No.</b>	<b>Description</b>	<b>Information to be filled as per site conditions</b>
1	Location with Chainage & name of town / city	
2	Present pedestrian traffic	
3	Distance between nearby PUP (m) / VUP	
4	Justification of Underpass	

**Note: Cost of Underpass is included in road portion of Major Road**

**Checklist for Cost Estimate of Foot over Bridges (FOBs)**

<b>S. No.</b>	<b>Description</b>	<b>Information to be filled as per site conditions</b>
1	Location with Chainage & name of town / village	
2	Present pedestrian traffic	
3	Length of FOBs	
4	Width of FOB (m)	
5	Distance between nearby FOB / PUP	
6	Justification of Foot over Bridge	
7	Cost of FOB (Rs.)	

**Note: Cost of FOB is included in Bridge portion of estimate**

**Checklist for Cost Estimate of ROB / RUB**

<b>S. No.</b>	<b>Description</b>	<b>Information to be filled as per site conditions</b>
1	Location of the ROB / RUB bridge with chainage	
2 a)	Length of Existing ROB / RUB bridge	
b)	Existing lane width (m), if divided carriageway mention specifically	
b)	Present Traffic on ROB/RUB location	
3 a)	Length of proposed ROB/RUB with chainage (km)	
b)	Proposed ROW (m)	
c)	Proposed lane width (m)	
4	Length of Approaches	
5	Feasibility to acquire additional land along the existing alignment	
6	Feasibility to acquire lang along the proposed alignment	
7	Justification for bypass	
8	Cost Estimate	
a)	Road Portion (Rs.)	
b)	Bridge Portion (Rs.)	
c)	Misc. (Rs.)	
	Toal Cost (Rs.)	

### Checklist for Cost Estimate of Service Road

S. No.	Description	Information to be filled as per site conditions
1	Location with chainage & name of town / city	
2	Population of length	
3	a) Length of existing road passing through town (km)	
	b) Existing ROW (m)	
	c) Existing lane width (m)	
	d) Present traffic (PCUs) on service road	
	i) Local traffic (PCUs)	
	ii) Through traffic (PCUs)	
4	a) Length of proposed service road with chainage (km)	
	b) Proposed ROW (m)	
	c) Proposed lane width (m)	
5	Nos of Major bridges falling in proposed service road	
6	Length of bridges (for three bridges e.g. 300+200+300) (m)	
7	Feasibility to acquire additional land if any	
8	Justification for service road	
9	Cost Estimate	
	a) Road Portion (Rs.)	
	b) Bridge Portion (Rs.)	
	c) Misc. (Rs.)	
	Total Cost (Rs.)	

**Checklist for Cost Estimate of Vehicular Underpasses**

<b>S. No.</b>	<b>Description</b>	<b>Information to be filled as per site conditions</b>
1	Location with chainage & nearby town / village	
2 a)	Category of crossing road (NH/Sh/MDR/ODR/VR)	
b)	Existing lane width of crossing road (m), if divided carriageway mention specifically	
c)	Existing ROW of crossing road (m)	
d)	Present traffic (PCUs) on crossing road	
3	Lane width of proposed underpass (m)	
4 a)	Location of nearby underpass or median opening	
b)	Lane width of nearby underpass (m)	
5	Present traffic of Major road (PCUs)	
6	Length of service road in case nearby underpass being used	
7	Justification for Vehicular Underpass	
9	Cost Estimate	
a)	Service Road if any (Rs.)	
b)	Misc. (Rs.)	
	Toal Cost (Rs.)	



**Checklist for Cost Estimate of Minor Bridge**

<b>S. No.</b>	<b>Description</b>	<b>Information to be filled as per site conditions</b>
1	Location of the minor bridge with chainage	
2	Name of river / Nallah etc.	
3	a) Length of existing bridge (e.g. 8 spans of 200m)	
	b) Existing lane width (m), if divided carriageway mention specifically	
	c) Type of Superstructure	
	d) Type of Foundation	
	e) Present Traffic (PCU)s	
4	a) Length of proposed bridges with chainage (km)	
	b) Proposed ROW (m) (width)	
	c) Proposed Lane width (m)	
	d) Type of Superstructure	
	e) Type of Foundation	
5	Length of Approaches / protection works / guide bunds etc.	
6	Cost Estimate	
	a) Road Portion (Rs.)	
	b) Structure (Rs.)	
	c) Misc. (Rs.)	
	Toal Cost (Rs.)	

**Checklist for Cost Estimate of Grade Separator**

<b>S. No.</b>	<b>Description</b>	<b>Information to be filled as per site conditions</b>
1	Location with chainage & nearby town / village	
2 a)	Category of crossing road (NH/Sh/MDR/ODR/VR)	
b)	Existing lane width of crossing road (m), if divided carriageway mention specifically	
c)	Existing ROW of crossing road (m)	
d)	Present traffic (PCUs) on crossing road	
3	Lane width of proposed grade separator	
4	Justification for Grade Separator	
5	Cost Estimate	
a)	grade separator (Rs.)	
b)	Misc. (Rs.)	
	Toal Cost (Rs.)	

**Checklist for Cost Estimate of Truck Lay Bye**

<b>S. No.</b>	<b>Description</b>	<b>Information to be filled as per site conditions</b>
1	Location with chainage & nearby town / village	
a)		
b)		
c)		
2	Justification for Truck Lay Bye	
3	Cost Estimate	
a)	Truck Lay Bye Per No. (Rs.)	
	Toal Cost (Rs.)	

**Checklist for Cost Estimate of Bus Bays / Shelter**

<b>S. No.</b>	<b>Description</b>	<b>Information to be filled as per site conditions</b>
1	Location with chainage & nearby town / village	
a)		
b)		
c)		
2	Justification for Bus Bays / Shelter	
3	Cost Estimate	
a)	Bus Bays / Shelter Per No. (Rs.)	
	Toal Cost (Rs.)	

**ABSTRACT OF COST ESTIMATE**

S. No.	Items	Unit	Quantity	Rate (lakhs)	Amount	Annexure
<b>A</b>	<b>ROAD WORKS</b>					
1	EACH INDIVIDUAL CROSS SECTION (TCS1, TCS2, ETC)	km				Annexure-I
<b>B</b>	<b>BRIDGES AND STRUCTURES</b>					
2	MAJOR BRIDGES	m				
3	MINOR BRIDGES	m				
4	ROB/RUB	m				
5	FLYOVER	m				
6	UNDERPASSES	m				
7	CULVERTS (pipe/slab/box)	m/No.				
	<b>Sub total for length</b>	<b>km*</b>				
<b>C</b>	<b>OTHER ROAD APPURTENANCE/MISCELLENEOUS ITEMS</b>					
8	JUNCTIONS					
	MAJOR	No.				Annexure-II
	MINOR	No.				Annexure-III
9	SERVICE ROAD	km				Annexure-IV
10	SLIP ROAD					Annexure-V
11	DRAIN (Type-I, Type-II etc)	km				Annexure-VI
12	CRASH BARRIER	km				
13	TOLL PLAZA	No.				
14	BUS BAYS	No.				Annexure-VII
15	TRUCK LAY BYES	No.				Annexure-VIII
16	OTHER MISCELLENEOUS ITEMS (sign boards, rest areas, medical/traffic aid post, HTMS, embulences, cranes etc to be listed out seperately)	No.				
	<b>TOTAL AMOUNT</b>					<b>Rs.</b> .....**

\* Should confirm to design length

\*\* Should confirm to civil construction cost