

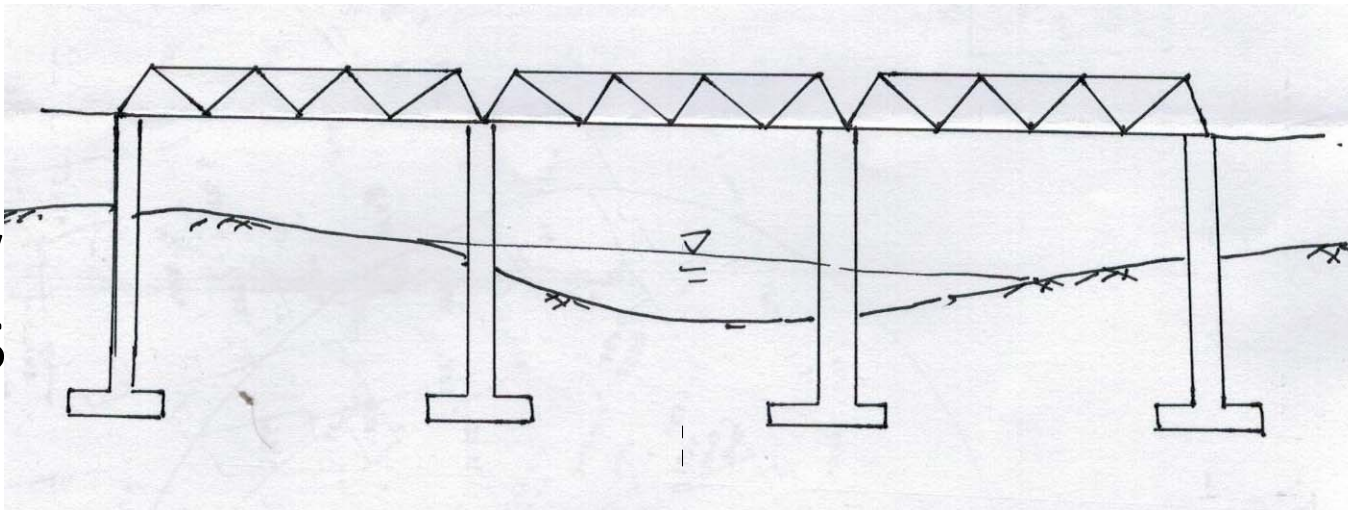
Practice of Value Engineering

Contract of Construction of Trishuli Bridge at Buhunubesi

Lambagaicha, Nuwakot

24/650/66/67 (7 Dec 2010)

he Design w
S



Number of Spans = 3 no. (steel truss)

Length of Span = 60

Foundation Depth = 4.5 m below G.L. (maximum)

the bidding was invited using the Standard Bidding Document prepared by Department of Roads.

The Bridge was contracted out to lowest bidder Himdung & Thokar Co. Ltd.

Cost Estimate:	Rs.16,96,26,776.
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Contract Amount:	14,40,39,411
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Decrease from Estimate:	2,55,87,365 (15% Saving)
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Start Date 2067/8/20

Completion time 3 years



Trishuli
Benigha



Karnail bridge, Beikhet

The following provision was made in the contract document:

“Clause K of Special Conditions of Contract:

Submission of Alternate Bridge Design: If deemed beneficial the DOR can change partly or wholly the design of the bridge through a consultant or the contractor who is willing to execute the construction of the bridge with his own design if DOR thinks that is beneficial to it.”

The Design was revised and Variation was made with the approval from Department of Roads. The Salient Features of the bridge (revised) are:

Length of bridge = 180 m

Number of Span = 1 Steel truss and 5 RCC T girder bridge

Length of span = 60 m. Steel truss and 24 m RCC T girder bridge

Foundation Depth = 6.0 m below G.L. (maximum)

Deck level = increased by one meter.

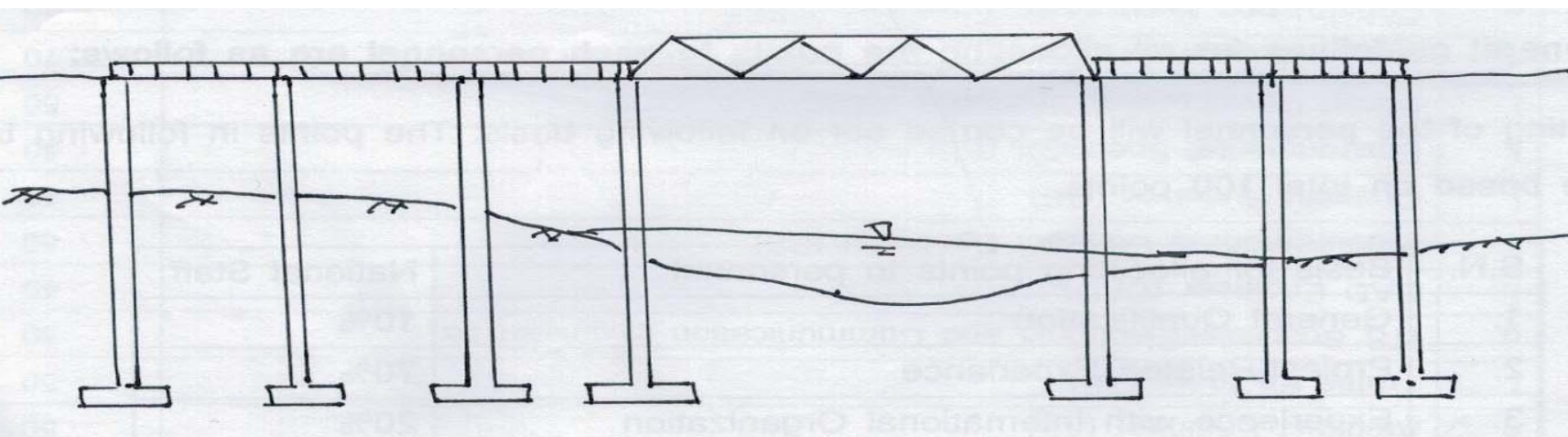
Additional 800 m Access road. (cost about 1,17,00,000)

Revised Cost estimate = 16,65,94,095

Revised contract amount = 12,34,51,132

Saving in contract amount = 2,05,88,279 (14.29%)

(Decrease from estimate = 4,31,42,964 i.e total 26% Saving)



1 Turss र RCC Bridge को Comparison

Criteria	Steel Truss	RCC
आयु (Design Life)	मर्मत संभारमा भर पर्ने । (उचित मर्मत संभार नभए ८-१० वर्षमै समस्या आउने)	आयु ५० वर्ष भन्दा बढी । Truss जस्तो Maintenance अवश्यक नपर्ने
Constructability	- निर्माणको लागि दक्ष जनशक्ति आवश्यकता । - Erection को क्रममा दुर्घटनाको संभावना । उदाहरण: दासढुंगा पुल, सुनकोशी पुल, घुर्मी दुर्घटना । - वेनीघाट पुलमा जनधनको क्षति - भोटेवडार पुल समस्याग्रस्त	नेपाली निर्माण व्यवसायी सक्षम
Bridge Site terrain	- गहिरो नदी जहाँ Support राख्न सकिदैन, तहाँ उपयुक्त (अति आवश्यक भए मात्र Truss राख्ने) ।	सकभर Rcc पुल बनाउने विभागी Best Practice तथा नीति
Construction Cost	विदेशबाट Structural Steel आयात गर्नुपर्ने भएकाले Costly.	Cost Reasonable.

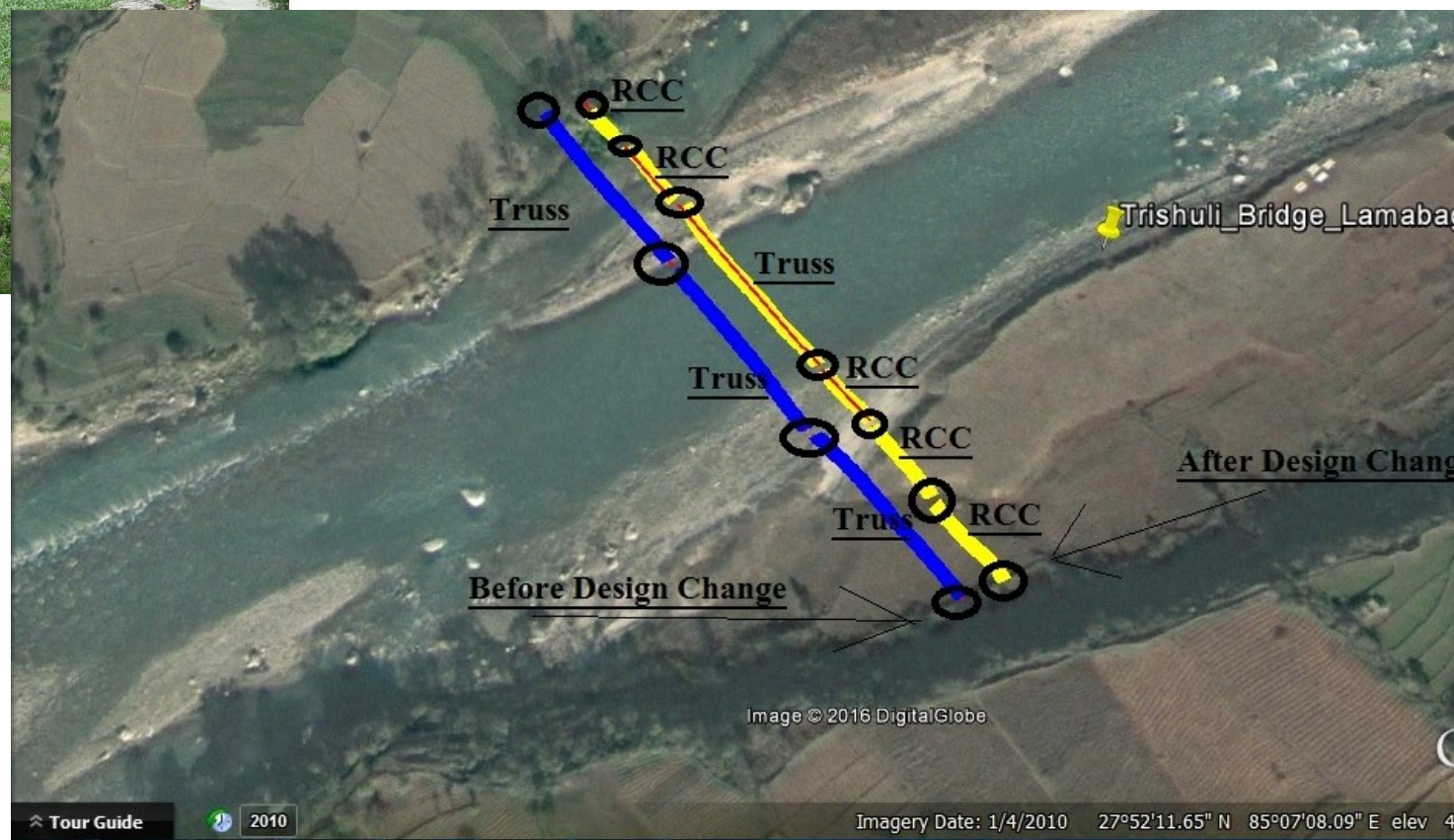
Advantages of the Revised Design:

1. Early Completion.
2. There was no access road from Devighat to bridge Site, only approach road was provided in original design. About 1 km long access road was provided in the revised design.
3. Technically strong, the foundation depth is secured (increased by 1.5 m) and the deck level is increased by 1 m. to accommodate the highest flood.
4. Life and Durability is increased.
5. Maintenance is eased, maintenance cost is reduced.
6. Contract amount saved by about 2 crore rupees.
7. Life cycle cost is also reduced.
8. Better performance in Earthquake conditions.

1. The alternate design was proposed and approved as per the provisions provided in the contract.
2. Citing the fact that the steel truss bridge construction takes considerably long time, the RCC bridges be made where water level is not deep (or none) and the Steel truss be made over deep flow.
3. The original contract period (completion time) was unaltered due to revised design / variation order.
4. The Revised Design was made based on existing items.

No new items were required except some elastomeric bearing.

Where contractor's rates are higher than the engineer's estimate, only estimate rate are given for the increased quantities. Where the contract rates are less than the estimate rate, only the contract rates are given.





Amount of Steel in original and Revised Design

	Original (3 span)	Revised (1 span)	
Cost Estimate	10,08,93,407	3,36,31,135	161 / 145 steel
Contractor quote	9,03,79,950 (9% low)	3,01,26,650	9 / 8 concrete

Decrease in cost estimate = 1.79%

Decrease in contract amount = 14.29%

Contract Award Test	Bidder 1	Bidder 2	Bidder 3	Bidder 4
Original Design	101%	85%	112%	111%
Revise Design	91%	77%	98%	111%

solving a tilted well

Jethinala Bridge,
Nepalganj Road Division

Salient Features

Length of Bridge = 25 m

Span = 1

Girder bridge , No. of Girder = 2

Well Foundation

Depth of well = 14.1 m + 1 m top plug + bottom
ump

Diameter of well = 5 m (3.5 m internal)

Total tilt + shift = 1.68 m along the traffic direction

Remdial measures

thickness of well cap = 1 m

Center shifted by 0.6 m inwards

length of bridge = 26 m.

Diameter of well is increased to 6 m.

Check the loading conditions for the superstructure

Check the well stability

- Safety against overturning
- No tension at base
- Side reactions from the steining do not exceed the passive pressure
- Maximum base pressure does exceed not bearing capacity

Well foundation at Kankai Bridge



Common problems in foundation construction:

- Ground too hard
- Ground too soft
- Artesion encountered
- Site Specific such as Tinau, Donda at Bhirawa Lumbini road, Tinau Bridge at Butwal
- Often the contractor's attitude / performance
- Inappropriate Design / Inadequate Design

Well foundations at Kaligandaki River Bridge at Chapakot

- Steel truss bridge of 60 m x 3 spans was contracted out
- **Well** foundation Designed
- Contractor finds hard ground and Redesign for open foundation purposed and approved.
- Contractor could not find rock purposes **Piles**
- What should we do ?

Well foundations at Kaligandaki Bridge at Damachaur:

- Steel truss bridge of 60 m span, 3 spans
- Well foundation was designed
- Wells constructed for P1 and P2 down to 5 m. sinking stopped
- Micro piles constructed inside the bridge
- Later on investigation rock was found below 6 m
- What should we do?
- Referred to IOE for remedial Design, Variation more than 25%

In case of **open** foundation designed, soft ground encountered remedial works is simple, change to deep foundation.

Variations?

Case of Bridge at Butwal

Case of Bijaypur Bridge at Pokhara

When **Artesion** encountered:

- Case of Rohini Bridge Well
- Case of LRBP Bridges with pile foundations



ADB funded

PMCO
PIU DOR

Three consultants involved
SMEC- GEOCE
Soil Test
ERMC Iteco Jv

Contractor:
Himsagarmath Con. Co

Pedestrian bridge over bishnumati river



Bishnumati bridge at Teku



Bishnumati bridge at Teku



trishul bridge at nagim



Bridge At Sunkoshi Bridge, Katari Okhaldhunga Road

Liquifaction cases:

$$\sigma'_v = \sigma_v - u$$
$$=0$$

- Chaumala Bridge
- Shivganga Bridge
- Jabdighat Bridge (?)