Planning and management for Expeditious Construction of ROB's

S.K. Singla*
Mahabal Prasad**
Ajay Kumar***

Fast track implementation of the project is the need of time and could not be disputed. Expeditious construction is a major and key component of any project management as it causes accrual of intended benefits along with financial returns at the earliest .Fast track construction of ROB's requires special attention as it leads to safety of rail &road users, mitigate inconvenience to road users improves train operations/ uninterrupted running of train's, better maintenance of track along with many other tangible benefits like cutting down of idling fuel cost vis-a vis environmental hazards, journey time, traffic jams, in electrified section hassle free passage of ODC consignments etc.

In recent past due to fast expansion of towns& cities increase in number of trains & vehicles, increase in trains speed, laying of multiple tracks & construction of multiple lane highways/ expressways have caused huge demand for construction of grade repeaters i.e. ROB's and RUB's .

For expeditious construction we have to segregate the pre-construction activities and construction stage activities.

Major pre-construction stage activities are:-

- Preparation & approval of GAD
- Land acquisition.
- Geotechnical investigation.
- Preparation of abstract estimate.
- preparation of structural drawings
- Preparation of detail estimate
- Tendering.

Construction stageactivities are:-

- Shifting of utilities
- Construction of sub-structure
- Construction of Super-structure.

*CAO/C/SECR/BSP **DY. CE/D&D/BSP ***AXEN/C/Design/BSP

Preparation& approval of GAD should be the 1st step and process of preparation of GAD should start as soon as ***any level crossing qualifies for construction of grade separator*** .Preparation and approval of GAD's should be one of the important items of CBE's agenda for discussion during state-co-ordination meeting. Effort should be made to have approved GAD at the time of processing of ROB work in works programme. In majority of the cases preparation and approval of GAD is taken up after inclusion of work in works programme. This causes avoidable delay of 6-12 months or even more.

The major problem in deciding type of foundation (i.e. Open or Pile) is non-availability of geotechnical report. For this purpose it is suggested that ***each division should have a running contact for geotechnical investigation and survey*** on similar lines as works zonal and Geotechnical data shall be induded in GAD along with tentative foundation arrangement. As per railway board's letter No: 2014/CE-IV/ROB/250(Estt.Design) Dated: 05.09.2014, construction of pile foundation for ROBs shall be avoided.

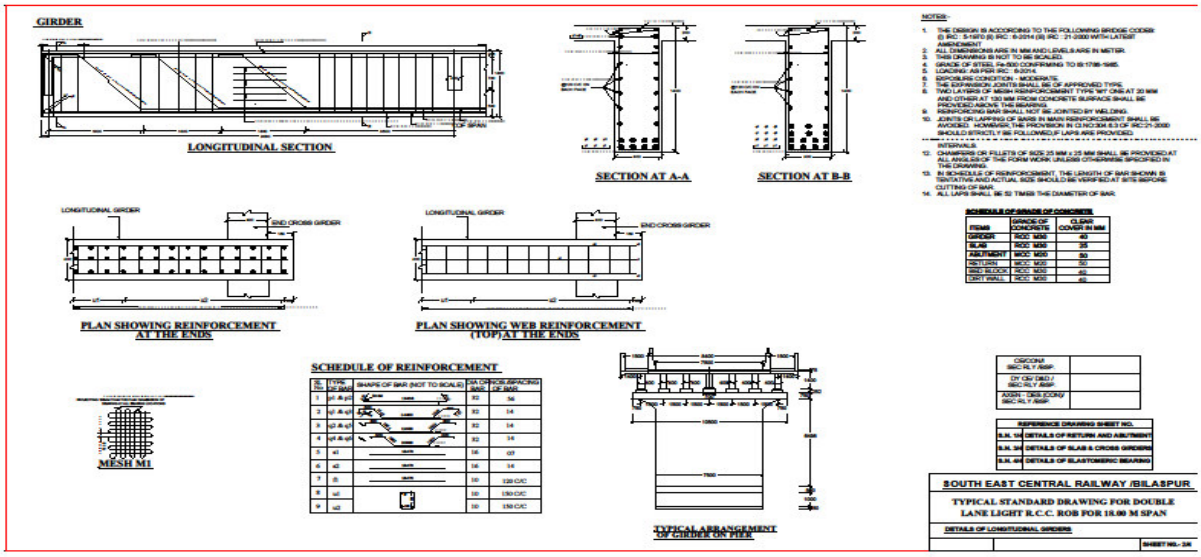
Abstract cost of the work should be as accurate as detailed estimate cost. Though it will not have as many numbers of items as in detailed estimate, yet it can be made to that accuracy provided type of foundation is known at the time of preparation of abstract estimate and railways have modular cost of major components of ROB.An accurate assessment of abstract cost will obviate the necessity of sending of detail estimate to Railway board for sanction and avoid delay of at last one working season.

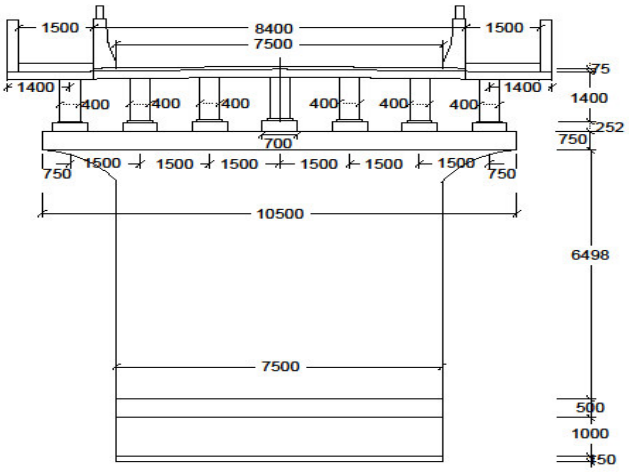
Since span,carriageway width,height above rail level arealmost fixed , railway may work out modular cost (Major cost component) for foundation , sub structure, bearings, steel Girder/RCC Girder, deck slab &bearing coat .These major cost head maybe broken down at detail estimate stage or detail estimate & tendering maybe done on major cost heads itself. This will minimizethe effort on billing stage as hardly any measurementis to be done as payment can be linked with stage of construction. Practically, stage payment leads to faster construction as contactor knows item rate payment is not possible and payment will be made only after completion of certain stage. This works as a catalyst towards faster construction.

Unit Cost for 01 ROB (03 X 18.00 M) RDSO B-11756/R				
S.No.	**Item Description**	**Nos.**	**Rate**	**Amount**
1	Up to Foundation Level	4	1702340	6809360
2	Pier	4	1321240	5284960
3	Bed Block	4	664631	2658525
4	Span (only Girders)	3	9511200	28533600
5	Bearing	3	750000	2250000
6	Superstructure	3	10073925	30221775
7	**Total**		in Rs.	**75758220**

RDSO has already standardized the drawing of super structural along with bearing. Since height above rail level is fixed and most of the ROB's are for two lanescarriageway, it shall be possible to standardize the structural drawing of sub-structure and foundation also. Authors has prepared standard drawing for RCC girders in lieu of steel girders for 18M& 24M spans.It can be seen that weight of individual RCC girders for 18 M & 24 M are 22.28 MT & 35.93 MTrespectively. These girders could be launched aseasily as steel girders but provide economy and ease of construction at site.Since steel girders are to be fabricated by RDSO approved firms, contractor has to tie-up with RDSO approved firmswhich many time leads to delay. Therefore for small spans up to 24.0M RCC girders may be preferred over steel girders. Comparative cost analysis has been doneas detailed in following table .Availability of standard sub - structure and foundation drawing will cut down time for preparation of structural drawings and tender can be invited as soon as detailed estimate in sanctioned.

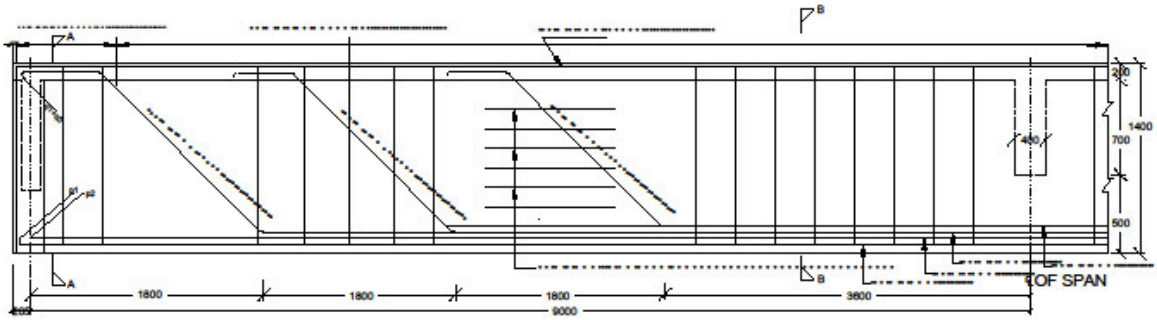
DRAWINGS OF 18.00 MSPAN ROB(RCC)



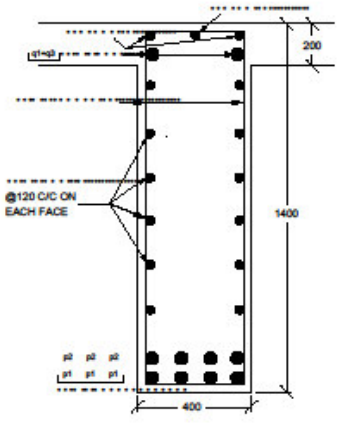


TYPICAL ARRANGEMENT OF GIRDER ON PIER

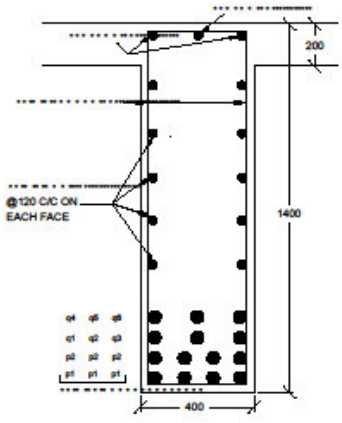
GIRDER



LONGITUDINAL SECTION

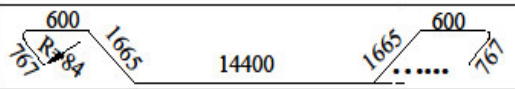
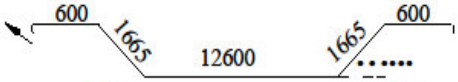
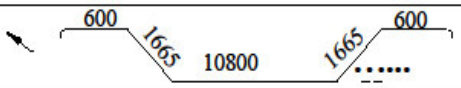
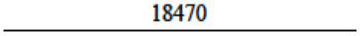
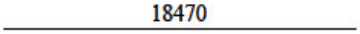
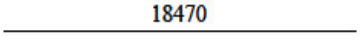
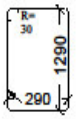


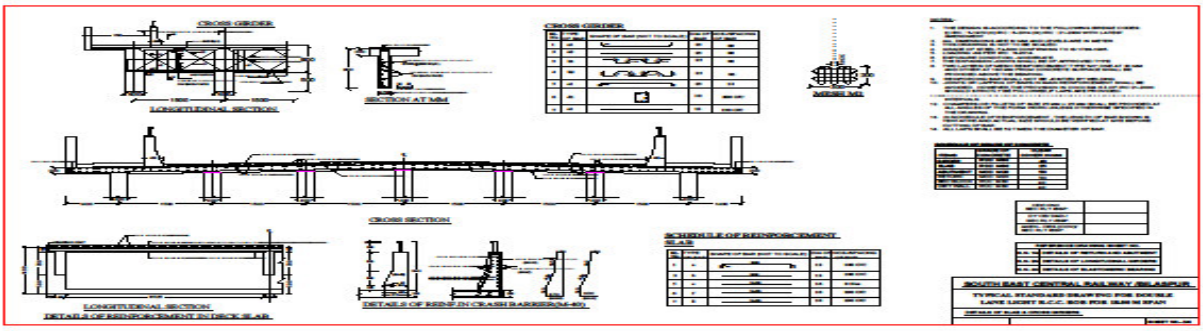
SECTION AT A-A

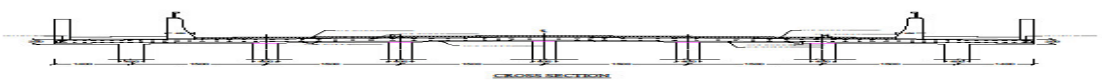


SECTION AT B-B

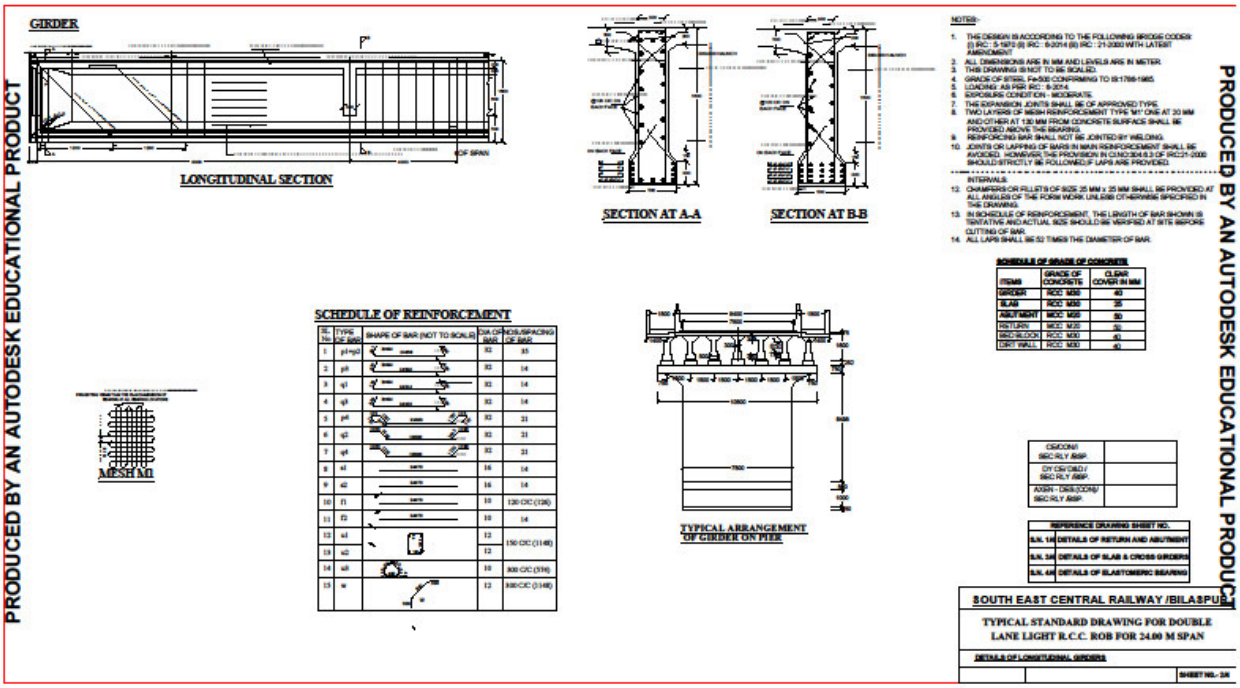
SCHEDULE OF REINFORCEMENT

SL No	TYPE OF BAR	SHAPE OF BAR (NOT TO SCALE)	DIA OF BAR	NOS./SPACING OF BAR
1	p1 & p2		32	56
2	q1 & q3		32	14
3	q2 & q5		32	14
4	q4 & q6		32	14
5	s1		16	07
6	s2		16	14
7	f1		10	120 C/C
8	u1		10	150 C/C
9	u2		10	150 C/C


CROSS GIRDER
LONGITUDINAL SECTION
SECTION AT MM
CROSS GIRDER
MODEL MC
CROSS SECTION
LONGITUDINAL SECTION
DETAILS OF REINFORCEMENT IN DECK SLAB
DETAILS OF RSPS ON CRASH BARRIER(M-40)
SCHEDULE OF REINFORCEMENT SLAB
SOUTH EAST CENTRAL RAILWAY BILASPUR
TYPICAL STANDARD DRAWING FOR DOUBLE LANE LIGHT R.C.C. BOX FOR SKEW SPAN


CROSS SECTION

DRAWINGS OF 24.00 MSPANROB(RCC)



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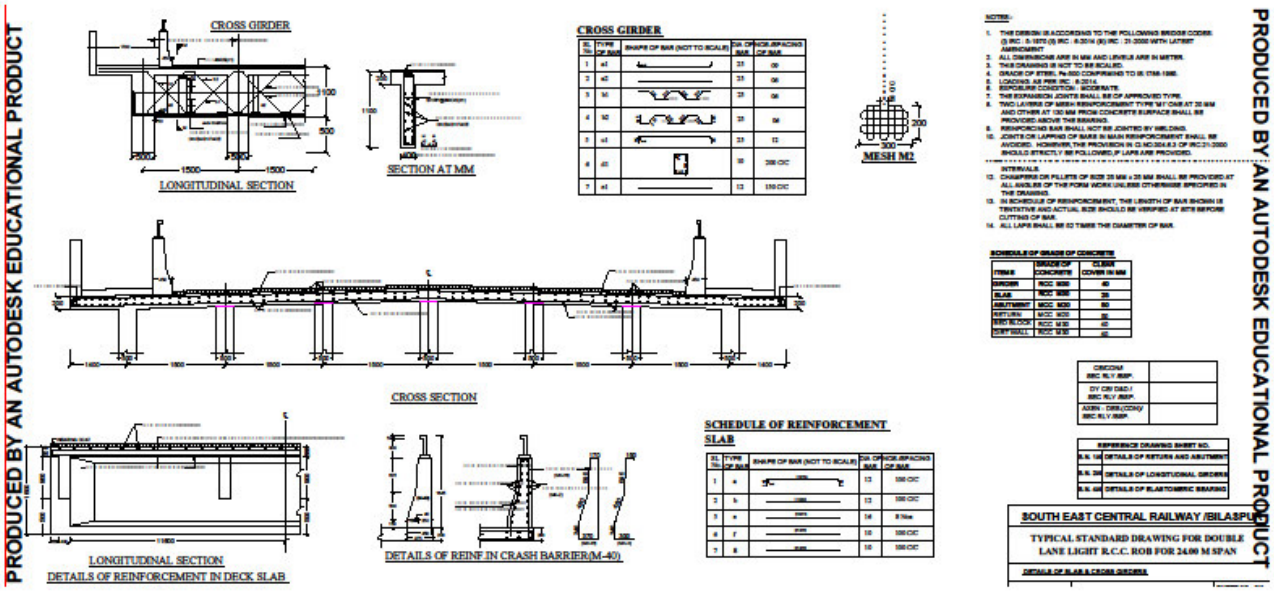

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Comparison betw een 18-M RCC Vs Steel Concrete Composite Girder		
Item description	RCC	Steel
Weight of 01 girder (in MT)	22	13
Height from girder soffit to top of deck slab (mm)	1400	1404
R/F in 01 RCC girder(in MT)	2.2744	-
Concrete cost of 01 span (07 girders)	495729.86	-
R/F cost of 01 span (07 girders)	1034852	-
Cost of Structural steel (5 Girder)	-	65000000
Launching cost of 01 span	3119760	1300000
Total cost of 01 span	4650341.8	7800000
Saving in RCC girder over Steel girder (in Rs)	3149658.2	40.38%
Saving for 03 spans ROB (in Rs)	9448974.5	

Comparison between 24-M RCC Vs Steel Concrete Composite Girder		
Item description	RCC	Steel
Weight of 01 girder (in MT)	36	20
Height from girder soffit to top of deck slab (mm)	1600	1814
R/F in 01 RCC girder(in MT)	4.4637283	-
Concrete cost of 01 span (07 girders)	799379.42	-
R/F cost of 01 span (07 girders)	2030996.4	-
Cost of Structural steel (5 Girder)	-	10000000
Launching cost of 01 span	5030707.5	2000000
Total cost of 01 span	7861083.3	12000000
Saving in RCC girder over Steel girder (in Rs)	4138916.7	34.49%
Saving for 03 spans ROB (in Rs)	12416750	

As we know tender schedule should be prepared with utmostcare. This will obviate introduction of N.S items, preparation & sanction of variation causing frequent disruption of work .However, this will depend upon accuracy and proper assessment of quantities from structural drawings. Since standarddrawings for super structure are available and as discussed earlier, drawings for foundation and sub structure can be standardized therefore, standard tender schedule with fixed items can be made. Quantity and ratesare only needs to be assessed and incorporated into tenderschedule. This will save time while tendering.

As soon as work appears in pink book joint survey with S&T, electrical and state government should be done. Utilities like S&T & electric cable, electrical mast, (electrical general &OHE), water pipe line, encroachment if any should be noted and intimated to concernedauthorities . Similarly, layout of diversion road and scheme of traffic management should be included in GAD. This will ensure availability of encumbrance free site before finalization of tender. This will help in fast and smooth execution and avoidlitigation.

For quick finalization of tender's departmental rates to be updated duly considering special site condition if any.May time finalization of tenders take long time? This is mostly due to non-updating of rates, non consideration of special site conditions in departmental rates.

Construction of sub-structure shall be planned in such a way so that sub-structure and girders are ready simultaneously. In case of pile foundation, pile foundation with large diameter piles in compassion to small diameter piles shall be preferred as time of boning & concreting for 1.0 m &1.2m diameter piles is almost same but number of piles

in case of large diameter pile gets reduced and thus time of construction of foundation is cut down.

In case of pile foundation static pile load test requires quite elaborate arranged and time taking. Therefore collection of materials equipments shall be started as soon as boring of test pile is started. Hydraulic jacks, girders, dial-gauges, loading platform shall be brought at site as soon as boring of test pile starts.

Concrete mix designshall be available with at least two approved cement brands to cater for non availability of one particular brand in market.Requirement of material &machinery should be fore-casted well in advance and their availability at site shall be ensured at last 15 days ahead of their actual date of utilization.

Wall type piers shall be preferred in comparison topier with multiple numbers of circular columns as total number of lifts in wall type pier will be less. If more than one columns are required for one pier, wall pier will cut down the time of construction of sub-structure as time for one lift is same.Not only that, construction of bed block with circular pier is more tedious and time taking but same for wall type of pier is quite simple and fast.

Launching scheme should be standardized for electrified and non-electrified territory. Based on the requirement of crane capacity, requirement of number of cranes etc shall be worked out and specified in the tender document. This will save lot of time in critical stage in arranging requisite capacity cranes. Normally launching scheme should be such so that cranes with requisite capacity are easily available. This is of paramount importance in case of electrified territory where traffic cum power block requirement is a major factor and some time we work out launching schemes with very huge capacity cranes which are locally not available and their arrangement takes months. Depending upon site conditions different launching schemesare possible. But, whatever may be the launching scheme and traffic block requirement,it shall be finalized well in advance and frozen.

Super structure is generally constructed as per standard RDSO's standard drawings. In revised RDSO drawing Bo grade of steel conforming to IS- 2062 has been specified, which was not the case in earlier RDSO's standarddrawings.InfactIRC- 24 does not specify any such grade of steel for road bridges.Normally requirement of different sections of steel for ROBs in railway portion is quite small and such small quantities of Bo grade steel is not made available by reputed manufacturers like SAIL etc. Use of A or "BR" grades steel requires approved of CAO/CBE. This cause lot of delay as it is difficult and time consuming to collect the non – availability certificate from different manufactures. Therefore it is suggested that either requirements of "Bo" steel from RDSO's standard drawingsmay be removed for time being or this is dispensed with at the stage of tendering with the approval ofCAO/PCE. Technically speaking for ROB's, Bo steel is not required as ratio of live load to dead load stresses is quite less.

Conclusion: Most of the delays can be arrested by proper planning, co-ordination with state government,accurate assessment of quantities, incorporating approved launching scheme and traffic block requirement in tender document.