



# STANDARD OPERATING PROCEDURE

for

# BANDALLING WORKS



(Ministry of Ports, Shipping & Waterways, Government of India)

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# **DRAFT**

## **Standard Operating Procedure (SOP) for Implementation of Bandalling works on National Waterways**

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## **1. Process/ Technique of Bandalling in brief**

Post monsoon, during the receding stages of an alluvial river, formation of multiple braided channels is a common phenomenon. At many locations, where slope of river bed is flatter, even the most dominant channel does not have targeted depth and width necessary for safe and efficient navigation by a cargo vessel of design dimensions (length, width and loaded draft). In such natural circumstances the main flow may shift to a different channel and process of retarded scour may start all over again. The most dominant channel carrying maximum discharge is called the 'main channel' and the other channels are called the 'secondary channels'.

Bandalling is an old indigenous technique employed in India on alluvial rivers like Ganga and Brahmaputra to increase and maintain depth in the navigation channel for safe and efficient navigation. This is done by augmenting the discharge as well as by stimulating the erosion process in the main channel and simultaneously accelerating siltation in the secondary channel(s). The technique of bandalling also makes use of the fact that major part of sediment load in a river is transported in the lower part of the depth of flow while the upper part carries cleaner water with far less sediments.

Bandals are fabricated using bamboos, bamboo mats and coir string etc which are naturally available in abundance in many States of India including Uttar Pradesh, Bihar, Jharkhand, West Bengal and Assam through which the two most important National Waterways (NWs) and their many tributaries flow through. Since this technique makes use of the natural forces of flow velocity its effect decreases with time and with decreasing slope over the shoal. At such times it becomes necessary to remove the Bandals from one location and shift/relocate them to another location.

The basics of bandalling are given in brief hereunder:

Bandals are fabricated using bamboos, bamboo mats and coir string. Length of each unit of bandal is normally 30 m or 15 m. A number of such units are erected at the site as per requirement. These units of bandals are placed at 30 to 45 degrees angle with respect to the direction of current.

For erecting a bandal unit, bamboo poles are driven firmly into the river bed at average 0.64 m center to center distance. On these vertical poles, bamboo mat screens of 1.2 m x 0.9 m size are fixed in such a way that only about 0.10 m of the screen is kept above the water level and the rest is inside the water. This level of the screens is required to be maintained by lowering/ raising them depending on the change in water level. This positioning of the screens leads to diversion of upper part of the water (carrying very little sediment load) towards

the main channel while the remaining lower part of the flow (carrying the majority of sediment load) is allowed to pass underneath the screen. This facilitates siltation in the secondary channel and at the same time, increased flow as well as erosion in the main channel, which in turn increases the depth in the main channel.



Figure-1: A photograph of a typical bandal site

After erection of bandals, these need to be maintained by raising/ lowering of mats and changing of decayed/ damaged mats and bamboos. Firmness of vertical bamboo pins is also maintained regularly by driving the loose pins into the river bed from time to time. During maintenance period, materials of bandal (e.g. bamboo, bamboo mats, coir strings).

Bandals can be of two types: Type A or Type B. In A type bandals the 0.90 m side of the mat is kept in vertical position (i.e. 0.80 m inside water and 0.10 m above the water, while in B type bandals 1.20 m side is kept in vertical position keeping 1.10 m inside water and 0.10 m above the water. Detailed drawings of typical bandals are given in Annex-1 and Annex-2.

After some time, due to siltation in the secondary channel, sand-dunes may appear behind one or more lengths of bandal. In that case, such bandal units having already served their stated purpose, would need to be removed and re-erected at other alignment/ location.

Sufficient stock of materials (bamboo, bamboo mats, coir string etc) needs to be maintained at each bandal site to ensure efficient and effective maintenance without any loss of time.

Re-erection of bandals at new nearby locations (about 5 km upstream or 10 km downstream of existing location) is done with the help of salvaged materials from the removed bandals to the extent possible and using fresh materials as required for erecting and maintaining necessary length of bandals at new locations.

Detailed technical specifications and terms & conditions for erection and maintenance of bandals given in the concerned tender document/ contract agreement needs to be followed in letter and spirit.

For being most effective, bandals should be erected during the months of November or December when water level in Indian alluvial rivers is receding. However, sometimes the shoals may also appear during the months of January, February as well necessitating erection of bandals. After initial erection, these bandals are to be maintained up to May/June as specified in the contract.

Bandals are seen to be most effective at the locations where the velocity of flow is of the order of 0.60 per second and when the bandals are erected at an angle of 30 degrees to 45 degrees with respect the direction of flow. Moreover, for best results, are achieved when the bed-material at shoals is loose sand.

As mentioned above, the technique of bandalling has been employed on Ganga and Brahmaputra since many decades before formation of IWAI as well as thereafter. Bed erosion of 0.5 m to 1.0 m has been seen on an average. With sediment load of mean grain size ( $D_{50}$ ) varying between 150 microns and 250 microns (fine sand), lean season velocity of 0.6 m per second and braided nature of the river, bandalling has time and again proved to be a highly effective method of maintenance of navigation channel (fairway) in alluvial rivers.

## **2. Standard Operating Procedure/ Steps for Executing Bandalling Projects**

There are following 11 (eleven) Standard Operating Procedure/ Important Steps in implementation of Bandalling projects of IWAI:

- (i) Preparation for Project/ Scheme (stretch wise)
- (ii) Scrutinizing and Sanction of the Project/ Scheme at Head Office
- (iii) Open E-tendering and Award of Work By concerned RO/ FO
- (iv) Constitution of Technical Teams for implementation of RC Works
- (v) Pre RC Works activities
- (vi) Execution of Bandalling by Contractor & supervision by IWAI
- (vii) SOP for Release of Payment for Initial Erection of Bandals
- (viii) Special Circumstances
- (ix) Post Bandalling Surveys
- (x) Analysis of Bandalling Work
- (xi) Engineer-in-Charge and his Representative

Each of these steps is described below for guidance and strict compliance by every official concerned.

### **2.1 Preparation for Project/ Scheme (stretch wise)**

Concerned Regional Office (RO) or Field Office (FO) of IWAI will prepare Project/ Scheme for bandalling work for the stretches under their jurisdiction. The Project/ Scheme will interalia include (but not limited to) the following:

- a) Quantity of erection and maintenance of bandals considering initial erection of 300 m of bandals at each site and 4 months' maintenance on an average. (Quantity of initial erection will be based on Thalweg survey data of minimum 3 years period, and it may vary depending upon shoal length and site conditions as per shoal analysis/ survey data);
- b) Provision of Thalweg surveys and pre and post bandal surveys;
- c) Day channel marks considering one mark in every 500 m or as per site conditions;
- d) Basis of Estimated Rates for each sub-items including rate analysis and market survey as well as awarded rates of previous year(s) with 5% escalation per annum;
- e) Detailed write-up mentioning detailed scope of work, method of execution, justification, availability/ requirement of supervision manpower, budget/ fund provision etc.

This Project/ Scheme will be submitted to Chief Engineer (Civil), Head Office Noida [with a copy to Member (Technical)] latest by end of February every year, soliciting administrative approval of the competent authority.

## **2.2 Scrutinizing and Sanction of the Project/ Scheme at Head Office**

The Project/ Scheme so received from RO/ FO will be duly examined a Head Office in the following manner:

- a) The concerned Wing/ Section/ Official(s) at Head Office will thoroughly scrutinize each aspect of the Project/ Scheme received from RO/ FO, in consultation with Hydrographic Wing and submit it through proper channel (as per prescribed channel of file submission) to Finance Wing for Financial Concurrence. In this process, time-bound clarifications can be sought from the RO/ FO whenever necessary;
- b) Finance Wing will after examining all the financial parameters of the Project/ Scheme and seeking clarifications from the Technical Wing (if required) and on getting fully satisfied from every financial angle (including availability of budget, reasonableness of rates etc) will accord Financial Concurrence to the Project/ Scheme as per prevalent delegation of Powers and forward the file back to Technical Wing for further necessary action;
- c) Technical Wing then submit the Project/ Scheme (through proper channel) to the Competent Authority (as per Delegation of Powers) seeking administrative approval.
- d) In the process of obtaining Administrative Approval, queries are sought, the same will be clarified by the concerned Wing/ Official promptly;

- e) After accord of Administrative Approval by the Competent Authority, a Sanction Order will be issued to the concerned RO/ FO by Technical Wing along with copies to all concerned.

### **2.3 Open E-tendering and Award of Work By concerned RO/ FO**

- a) Soon after receipt of the Sanction Order for the Project/ Scheme from the Head Office, the concerned RO/ FO will initiate action for open E-tendering as per prescribed procedure for Award of River Conservancy (RC) Works including Bandalling, Hydrographic Survey and Channel Marking activities as per the provisions in the sanctioned Project/ Scheme. This activity shall be completed and Work Orders issued by the respective ROs/ FOs preferably by end September or latest by end October every year to make it possible that the selected contractor may start initial erection of bandals during the months of November or December if the same is felt required by the RO/ FO.
- b) The concerned ROs/ FOs will also take all necessary actions for signing of the contract agreement by signing authority of IWAI and the Contractor as per the Terms and Conditions mentioned in the Work Order expeditiously.

### **2.4 Constitution of Technical Teams for implementation of RC Works**

- a) Before issuing the Work Order to the selected Contractor, the respective RO/ FO shall constitute sub-stretch wise teams of Technical and Survey officials for selection of shoal location, giving alignment of bandals, supervision, undertaking pre & post detail bandal surveys and monitoring of RC works as per the contract agreement. These teams should preferably be constituted before the issue of Work Order.

### **2.5 Pre RC Works activities**

Before starting initial erection of bandals and channel marks by the contractor, following pre-RC Works activities shall be carried out by Technical team(s) on the sites:

- a) To check the river morphology (channel flow, pattern, main & secondary channel) during the period of receding of flood, the latest (current) thalweg route is to be compared with previous year thalweg rout in order to find out any changes in the river flow. This will help the technical team to access possibility of new shoal or not.
- b) Tentative identification of shoal location, approximate location of bandal units and positioning of channel marks shall be based on the above analysis.
- c) Detailed pre-bandal surveys shall then be carried out at shoals covering at least 300 m on upstream & downstream and 100 m on either sides of the 'main channel' following standard hydrographic/ topographic survey methods. The length of survey area should cover deeper channels in both upstream and downstream sides. Detailed surveys shall be carried out at 50 m

line interval. At least 4 float observations shall be taken at equal distance (to cover full surveyed width) during these pre bandal surveys.

- d) All surveys are to be carried out by Automated Hydrographic Survey (AHS) System only.
- e) The identification of exact shoal location, alignment of bandal units and positioning of channel marks shall be based on the pre-bandal detail survey mentioned in b) above.

## **2.6 Execution of Bandalling by the Contractor and supervision thereof by IWAI**

Execution of Bandalling by the Contractor and supervision thereof by the technical team of IWAI shall interalia include following activities:

- a) Based on Pre RC Works mentioned above, the technical team shall give alignment of bandals for initial erection physically on the site by transferring the points from the detailed survey charts to the actual site and marking them clearly by the bamboos driven firmly into the river bed with the assistance of the team of the contractor.
- b) Date of giving the alignment of initial erection, its length, coordinates of the end points and other important notings as felt necessary, shall be recorded by the IWAI's technical team on the Site Order Book which is required to be provided and maintained by the contractor as per contract provisions.
- c) The alignment of bandal shall be given within 07 days of completion of survey or re-survey is to be carried out. If, executing agency is unable to complete the erection within 15 days from the date of alignment is given, then re-survey shall also be undertaken.
- d) One Temporary Bench Mark (TBM) is to be maintained at each bandalling site and same has to be maintained for the entire lean season period. The location of TBM should be selected well beyond the HFL Line so that it need not be shifted when water level rises.
- e) A water level gauge also established and linked with water-level to assess the improvement in channel. The gauge needs to be connected with TBM. A Water Level Register is also to be maintained at each site to record daily water levels at 0800 hours.
- f) The alignment for erection of Bandal will be given by the technical team of IWAI (whose in-charge shall also act as representative of Engineer-in-Charge) in presence representative of the Contractor.
- g) Generally, 10 days (maximum) are given to the Contractor for completing the initial erection from the date of alignment. The Contractor, however, is free to complete the initial erection prior to this period. The Contractor has to inform the Engineer in Charge in writing as soon as the initial erection is completed.
- h) A further period of 10 days is kept for ascertaining the stability of the initially erected bandals.



- i) Measurement of bandals for satisfactory initial erection shall be recorded only after completion of this 10 days stability period.
- j) This periods mentioned in (g), (h) and (i) above shall, however, be governed by the terms & conditions of the contract.
- k) One Site Order Book needs to be maintained by the Contractor at each bandal site and its safekeeping ensured. This Site Order Book should be such that orders can be recorded in triplicate so that one copy of each the site order issued by the inspecting official is carried by him to be submitted in the office of Engineer-in-Charge, one is given to the Contractor and one copy is available in the Site Order Book all the time.
- l) Detailed measurements of works are to be recorded in the Measurement Books (MBs) issued by the Engineer-in-Charge as per standard practice.
- m) It must be ensured that the Contractor provides adequate manpower/ workers for erection, maintenance and safe keeping of bandals.
- n) As and when it is felt that either the entire length or a part thereof, needs to be re-erected or removed as per site conditions, necessary instructions for the same are to be given and recorded in respective Site Order Book.
- o) It must be ensured by the technical team that the bandals are kept well maintained as per the contract conditions during entire tenancy of the Contract. Stability of bandals, positioning of the mats and quality of bamboos and bamboo mats are the most important aspects of maintenance of bandals and their effectivity. Therefore, special attention should be given to these.
- p) Periodic inspection at close interval is necessary for bandals being really effective. Hence each bandal site must be inspected at close intervals.
- q) Intermediate detailed bandalling surveys are also required be carried out on monthly basis. In addition, to justify re-erection of bandal, every re-erection of bandal should be carried out only after intermediate detail survey to the extent possible.
- r) It should be ensured that each and every technical specification and terms and conditions of the Contract entered between IWAI and the Contractor is adhered to in execution of bandalling work.

## **2.7 SOP for Release of Payment for Initial Erection of Bandals**

Following conditions/ requirements need to be met for release of payments for initial erection of bandals by the respective RO/ FO:

- a) After completion of initial erection/ re-erection of bandal at a particular site, the Contractor shall inform Engineer-in-Charge (EIC) about the same along with initial erection/ re-erection report in the prescribed format. Thereafter the inspecting officer shall verify the same at the site immediately. Measurement of the same shall however, be recorded on the Measurement Book (issued to the particular officer) only after observing the stability of the bandal for a period of

10 days. Based on this measurement only, payment of erection/ re-erection shall be considered for release of payment at the rates and other terms & conditions of per contract agreement.

b) While taking the measurement, following must be ensured/ measured:

- (i) Correctness of alignment and positioning of bandal units.
- (ii) Number and dimensions of bamboos and mats (screens) in each bandal unit.
- (iii) It may be noted that only overall/ finished dimensions of mats (screens) will be measured i.e. bandal length covered with the mats will only be measured (dimensions of individual mats will not be measured) to verify the dimensions of 15 m x 0.9 m or 15 m x 1.2m or 30 m x 0.9 m or 30 m x 1.2 m as the case may be.
- (iv) If the variation in measurement (w.r.t. standard dimensions as per contract agreement) is up to (-) 5%, the Contractor will be allowed 3 days for its rectification.
- (v) The maintenance period shall start from the following day/ date of completion of initial erection/ re-erection but claim for the maintenance charges shall be entertained only after ascertaining the stability of bandal up to 10 days or more after date of completion of erection/ re-erection.
- (vi) The contractor must maintain satisfactorily, entire length of bandal ordered and erected/ re-erected at each site during the period of the contract as per contract terms & conditions and direction of Engineer-in-Charge or his representative.
- (vii) If during any period, at any site it is found that less than 80% length of bandal is maintained, no payment for maintenance for that site shall be made for the period during which less than 80% bandal is maintained. If the length is satisfactorily maintained between 80% and 100% at a site, pro-rata payment shall be made for the actual length maintained during that month.
- (viii) Maintenance period of bandal shall be applicable from the date following the date of completion of erection/ re-erection at a particular site and the monthly maintenance charges shall be payable as per actual maintenance work i.e. part or full month as the case may be.

## **2.8 Special Circumstances**

In extra-ordinary circumstances/ urgencies (e.g. to facilitate movement of important cargo vessels etc), the alignment of bandals can also be given by the technical team mentioned above (preferably in presence of the Engineer-in-Charge) without detail survey. In such also, detail inspection of the all the channels in the shoal are should be carried out with survey vessel and a few float observations should also be made before deciding the alignment. A rough sketch of this inspection should be made and kept in records. Detail survey of this location shall however, be carried out at the earliest opportunity.

## **2.9 Post Bandalling Surveys**

- a) Soon after completion of bandalling period as per contract or when it is decided to shift/ relocate/ re-erect the whole length or a few units of bandal at/ from a particular site, post-bandal surveys should be carried out using Automatic Hydrographic Survey System and standard hydrographic/ topographic survey practices. Area of survey, float observations etc will generally be the same as in case of pre bandal surveys.

## **2.10 Analysis of Bandalling Work**

- a) Based on pre and post bandal survey charts, detailed analysis of the extent of improvement in depth and width in the main channel due to bandalling work at each site should be made.
- b) A detailed report on channel development/ improvement shall then be submitted after removal/ re-erection of bandal, duly supported with pre and post bandal chart, water level data, thalweg survey data etc by the Engineer-in-Charge to Chief Engineer (Civil) and Member (Technical).
- c) It is desirable that a few photographs of each bandal site with time & date tag are attached with this detail Analysis Report, to the extent possible. Efforts should be made in advance in this regard.

## **2.11 Engineer-in-Charge and his Representative**

Unless directed by Chief Engineer (Civil)/ Member (Technical) otherwise, Engineer-in-Charge for the bandalling work shall be the Director of concerned RO/ FO his representative shall be Assistant Director/ Assistant Hydrographic Surveyor and/or Technical Assistant/ Junior Hydrographic Surveyor as nominated by the Engineer-in-charge.

### **3.0 Roles and responsibilities of Head Quarters**

Technical Wing headed by Chief Engineer (Civil) will be responsible for monitoring of all bandalling works of various Regional Offices and Field Offices. This monitoring shall be carried out regularly by means of MIRS as well as physical inspection of sites by the teams constituted by Chief Engineer (Civil) or Member (Technical) as and when felt necessary. In general following activities related to bandalling works in field offices shall be carried out in the Head Quarters:

- a) Approval of award of work to the selected bidder based on recommendation of duly constituted TEC and officer in-charge of concerned RO/ FO as per Delegation of Powers.
- b) Approval and release of final payment based on recommendation of officer in-charge of concerned RO/ FO as per Delegation of Powers.
- c) Approval and release of Performance Bank Guarantee and Security Deposit etc as per terms & conditions of contract and Delegation of Powers.
- d) Issuing from time to time directives/ suggestions to RO/ FO based on various reports received from the field on progress of RC Works.
- e) Monitoring and cross-checking of progress of RC Works through inspection teams as deemed fit.
- f) Approval of Standard Bidding Documents for RC Works.

### **4.0 Role and responsibilities of ROs**

- a) In the capacity of being Engineer-in-Charge, the respective officer in-charges of various RO/ FO have the primary responsibility for conceptualizing, planning, project preparation, execution and monitoring of all aspects of RC Works in their respective jurisdiction as per terms & conditions of the contract and Delegation of Powers. A few important activities for which the respective RO/ FO is responsible are as follows:
  - (i) Proposing budget allocation for R C Works based on Thalweg Survey data and other ground conditions and submitting the same to the Head Quarters (HQ) for approval along with necessary justification.
  - (ii) Preparation of Project/ Scheme as per requirement and submission to Head Quarters for approval. Its follow-up for early and timely approval by the competent authority.
  - (iii) E-Tendering and award of work to the selected bidder based on recommendation of duly constituted TEC and approval of the competent authority as per Delegation of Powers.

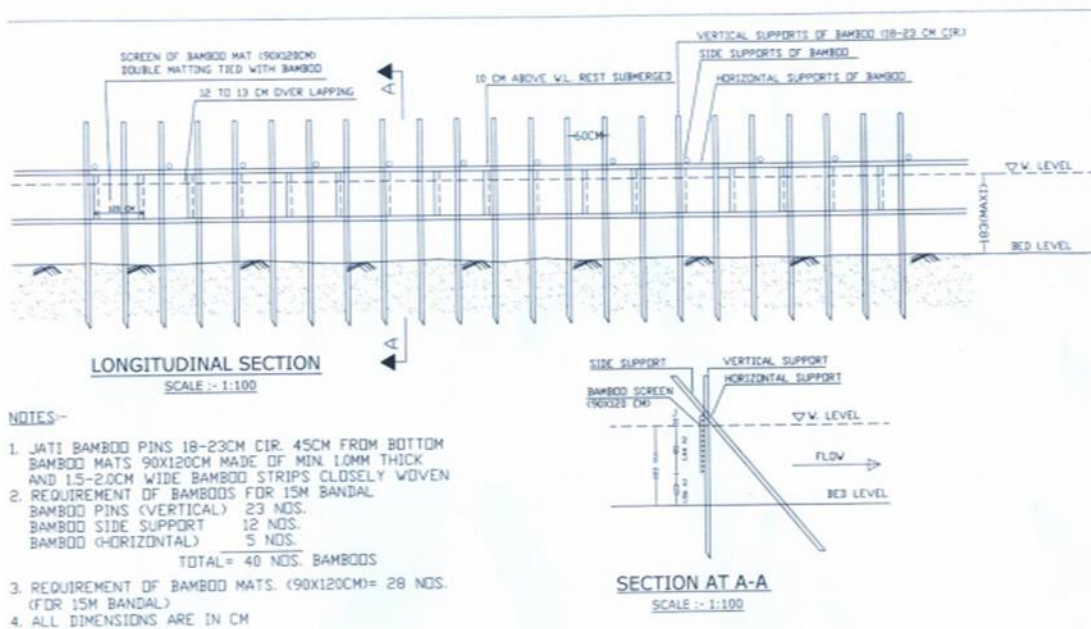
- (iv) Execution of R C Works and their monitoring.
- (v) Carrying out Thalweg and Detail Pre and Post Hydrographic and Topographic surveys at each site using Automatic Hydrographic System and as per standard practice.

## 5.0 Timelines

<b>S.N.</b>	<b>Particulars</b>	<b>Target Date</b>
1.	Scheme preparations & submission to HQ	By end February every year
2.	Sanction of Project/ Scheme by competent authority	By end March of every year
3.	Award of work after e-tendering and consent of HQ (appropriate authority)	By end May of every year
4.	Signing Agreement etc.	June of every year
5.	Formation of technical committees, nomination of representative of EIC etc. for execution of work.	As applicable
6.	Reporting frequency on work progress	10 <sup>th</sup> of every month
7.	Detailed Pre and Post bandalling surveys	As per requirement

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## ENCLOSURE - 1



GENERAL ARRANGEMENT OF BANDAL (TYPE-A)

DRG NO I/WA1/GHY/3

INLAND WATERWAYS AUTHORITY OF INDIA  
56 FLOOR PARKESHWARI BUILDING, CHATRAPATI SHIWAJI

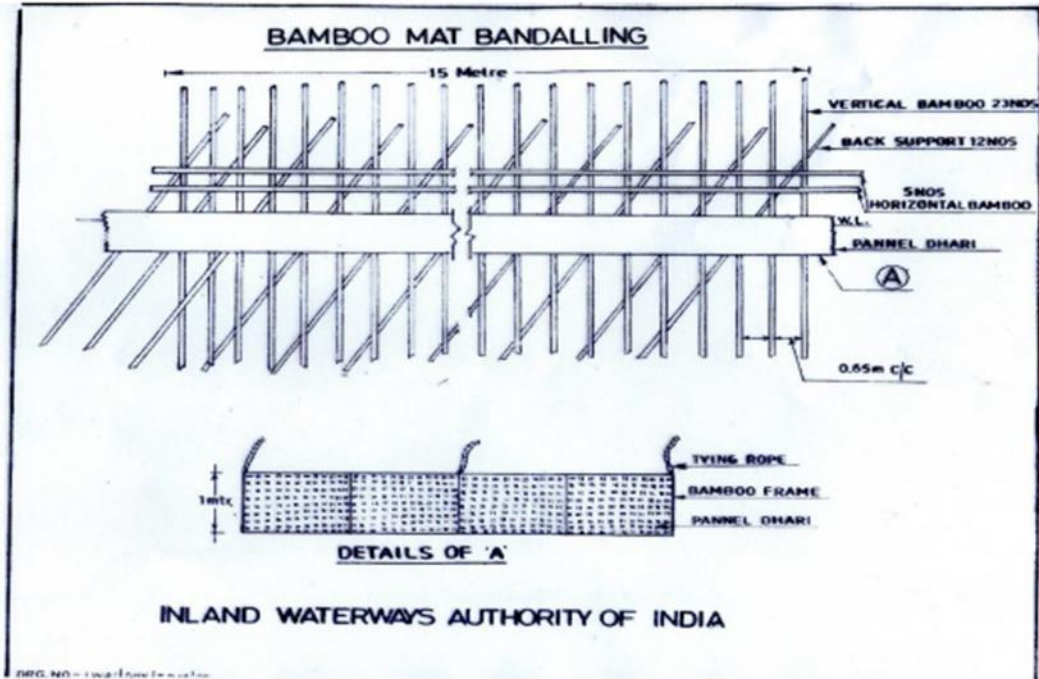
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CHECKED BY

APPROVED BY

ENCLOSURE -2

Bamboo Mat Bandalling



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Inland Waterways  
Authority of India

**CHECK LISTS**

for

**S**TANDARD **O**PERATING **P**ROCEDURE

for

**B**ANDALLING **W**ORKS





## 1. Check List for Preparation/ Vetting of a Project for Bandalling work

Note: Concerned Regional Office (RO) or Field Office (FO) will prepare a Project for bandalling work for the stretches under its jurisdiction. Following points should be kept in mind for preparing and/or vetting the projects so prepared:

<b>Sl. No.</b>	<b>Particulars</b>	<b>Checked &amp; found okay (Yes/ No/ Remarks)</b>
(a)	Whether length of initial erection of bandals has been kept about 300 m per site on an average ?	
(b)	If (a) is 'No', then whether sufficient justification for the same has been provided or not ?	
(c)	Is the proposed length of initial erection of bandals based on Thalweg survey data of minimum 3 years period ?	
(d)	Whether sufficient provision of Thalweg surveys and pre and post bandal surveys has been kept in the project ?	
(e)	Has basis of Estimated Rates for each sub-items including rate analysis and market survey as well as awarded rates of previous year(s) with 5% escalation per annum has been considered or not ?	
(f)	Is detailed write-up mentioning detailed scope of work, method of execution, justification, availability/ requirement of supervision manpower, budget/ fund provision etc included appropriately ?	
(g)	Other comments if any	

## 2. Check List for Scrutinizing and Sanction of the Project for Bandalling work at Head Office

### 2.1 Scrutiny in Technical Wing:

The Project submitted by the RO/FO to Chief Engineer (Civil), soliciting administrative approval of the competent authority will be first scrutinized by the concerned technical officer in the office of Chief Engineer (Civil). Following points should be checked in this process:

Sl. No.	Particulars	Checked & found okay (Yes/ No/ Remarks)
(a)	Has a copy of the project been endorsed to Member (Tech) ? [Note: If not, make a copy available to his office]	
(b)	Has the project been submitted by the end of February as stipulated in the SoPs ?	
(c)	Whether length of initial erection of bandals has been kept about 300 m per site on an average ?	
(d)	If (a) is 'No', then whether sufficient justification for the same has been provided or not ?	
(e)	Is the proposed length of initial erection of bandals based on Thalweg survey data of minimum 3 years period ?	
(f)	Whether sufficient provision of Thalweg surveys and pre and post bandal surveys has been kept in the project ?	
(g)	Has the basis of Estimated Rates for each sub-items including rate analysis and market survey as well as awarded rates of previous year(s) with 5% escalation per annum has been considered or not ?	
(h)	Is detailed write-up mentioning detailed scope of work, method of execution, justification, availability/ requirement of supervision manpower, budget/ fund provision etc included appropriately ?	
(i)	Other comments if any	

Note: This scrutiny will be made in consultation with Hydrographic Wing as per requirement. In this process, time-bound clarifications can be sought from the RO/ FO over phone or in writing as felt necessary. The project will then be submitted to Finance Wing for Financial Concurrence through proper channel.

## **2.2** Scrutiny in Finance Wing

The Project/ Scheme so received from the Technical Wing will be duly examined in Finance Wing. Following points should be checked in this process:

<b>Sl. No.</b>	<b>Particulars</b>	<b>Checked &amp; found okay (Yes/ No/ Remarks)</b>
(a)	Has the correct budget head/ sub-head from where the expenditure for executing this project is to be met, duly mentioned in the project ?	
(b)	Whether sufficient provision of funds exists in the budget head/ sub-head mentioned project ?	
(c)	Whether rates of various items/ sub-items considered in the project are reasonable ?	
(d)	Whether quantities of various items/ sub-items considered in the project are reasonable ?	
(e)	Have all the mathematical calculations been checked and found correct ? Note: If any mistake is noticed the same needs to be pointed out and duly corrected.	
(f)	Other comments of financial nature, if any	

Note: Finance Wing after examining all the financial parameters of the Project Scheme and seeking clarifications from the Technical Wing (if required) and on getting fully satisfied from every financial angle will accord Financial Concurrence to the Project as per prevalent Delegation of Powers and forward the file back to Technical Wing for further necessary action.

## **2.3** Further Processing:

- a) Technical Wing then submit the Project/ Scheme (through proper channel) to the Competent Authority (as per Delegation of Powers) seeking administrative approval.

- b) Queries raised by various officers in the process of obtaining Administrative Approval will be clarified by the concerned Wing/ Official promptly.
- c) After accord of Administrative Approval by the Competent Authority, a Sanction Order will be issued to the concerned RO/ FO by Technical Wing along with copies to all concerned.

**3. Guidelines for E-tendering and Award of Work By concerned RO/ FO**

- 3.1** On after receipt of the Sanction Order for the Project from the Head Office, the concerned RO/ FO will initiate E-tendering as per the prescribed procedure with the target that the Work Orders are issued by end September or latest by end October every year to make it possible that the selected contractor may start initial erection of bandals during the months of November or December if the same is felt required.
- 3.2** At the same time, the respective RO/ FO shall constitute sub-stretch wise teams of Technical and Survey officials for selection of shoal location, giving alignment of bandals, supervision, undertaking pre & post detail bandal surveys and monitoring of RC works as per the contract agreement. These teams should preferably be constituted before the issue of Work Order.
- 3.3** The concerned RO/ FO will also take necessary actions for signing of the contract agreement by the signing authority of IWAI and the Contractor as per the Terms and Conditions mentioned in the Work Order expeditiously.

**4. Check Lists for implementation, supervision, monitoring and certification of RC Works by the Technical Teams and RO/FO**

**4.1 Check List for implementation of Pre RC Works activities**

Before starting initial erection of bandals by the contractor, following points are to be ensured by the respective Technical team(s):

Sl. No.	Particulars	Checked & found okay (Yes/ No/ Remarks)
(a)	Has the river morphology (discharge, flow pattern, sediment transportation etc in main & secondary channels) during the latest (current) thalweg route been compared with previous year thalweg rout in order to find out any changes in the river flow ?	

Sl. No.	Particulars	Checked & found okay (Yes/ No/ Remarks)
	[This will help the technical team to access possibility of new shoal at vulnerable locations.]	
(b)	Based on the above analysis, has the tentative identification of shoal location, approximate location of bandal units and positioning of channel marks been assessed ?	
(c)	Has the detailed pre-bandal survey been carried out at the shoals covering at least 300 m on upstream & downstream and 100 m on either sides of the 'main channel' following standard hydrographic/topographic survey methods ?	
(d)	Does the length of survey area cover deeper channels in both upstream and downstream sides ?	
(e)	Has the detailed survey been carried out at 50 m line interval ?	
(f)	Have at least 4 float observations been taken at approximate equal distance (to cover full surveyed width) during these pre bandal surveys ?	
(g)	Has the detailed pre- bandal survey been carried out by Automated Hydrographic Survey (AHS) System only ?	
(h)	Maintenance period of bandal shall be applicable from the date following the date of completion of erection/ re-erection at a particular site and the monthly maintenance charges shall be payable as per actual maintenance work i.e. part or full month as the case may be.	
(i)	Other comments, if any.	

Note: Identification of exact shoal location, alignment of bandal units and positioning of channel marks shall be based on the pre-bandal detail survey mentioned above. Final proposed alignment of bandals should be approved by the Director or Dy Director concerned.

## 4.2 Check Lists for supervision, monitoring and certification of RC Works

For supervision, monitoring and certification of RC Works, following points must be ensured by the respective Technical teams:

Sl. No.	Particulars	Checked & found okay (Yes/ No/ Remarks)
(a)	Has the proposed alignment of bandals for initial erection is given strictly by transferring the points from the detailed survey charts (prepared as per the Pre RC Works mentioned above), to the actual site and marking them clearly by the bamboos driven firmly into the river bed ?	
(b)	Has the date of giving the alignment of initial erection of bandal, its length, coordinates of the end points and other important features as felt necessary, been recorded by the technical team on the Site Order Book (which is to be provided and maintained by the contractor) ?	
(c)	Has the alignment of bandal been given within 07 days of completion of survey or re-survey ?	
(d)	Has the alignment for erection of bandals at each site been given in presence representative of the Contractor. Note: If the contractor is unable to complete the erection within 15 days from the date of alignment, then re-survey shall also be undertaken.	
(e)	Has one Temporary Bench Mark (TBM) been established and maintained at each bandalling site for the entire lean season period ?	
(f)	Has the locations of every TBM is well beyond the HFL Line so that it need not be shifted when water level rises ?	
(g)	Has one water level gauge also been established and linked with water-level to assess the improvement in channel at each bandal site ?	
(h)	Is each of the above water level gauges are connected with the TBM ?	
(i)	Has Water Level Registers been maintained at each	

Sl. No.	Particulars	Checked & found okay (Yes/ No/ Remarks)
	site and water levels are being recorded at 0800 hours daily ?	
(j)	<p>Has the initial erection been completed within 10 days by the Contractor from the date of giving alignment at the site ?</p> <p>Note: The Contractor, however, is free to complete the initial erection prior to this period. The Contractor has to inform the EIC in writing as soon as the initial erection is completed.</p> <p>Has the measurement of initial erection/ re-erection of bandals been recorded only after completion of this 10 days stability period ?</p> <p>Note: All technical specifications and terms and conditions of the Contract need to be ascertained (and deficiencies, if any, needs to be brought out) before recording of the measurements on MBs.</p>	
(k)	<p>Has one Site Order Book is maintained at each bandal site and its safekeeping ensured by the Contractor ?</p> <p>Note: This Site Order Book should be such that orders can be recorded in triplicate so that one copy of each the site order issued by the inspecting official is carried by him to be submitted in the office of EIC, one is given to the Contractor and one copy is available in the Site Order Book all the time.</p>	
(l)	Have the detailed measurements been recorded in the Measurement Books (MBs) issued by the Engineer-in-Charge to the concerned official y name as per standard practice ?	
(m)	Has the Contractor provided adequate manpower/ workers for erection, maintenance and safe keeping of bandals ?	
(n)	Have necessary instructions given and recorded in respective Site Order Books as and when it was felt that either the entire length or a part thereof, needed to be re-erected or removed as per site conditions ?	
(o)	Have the bandals are kept well maintained as per the	

<b>Sl. No.</b>	<b>Particulars</b>	<b>Checked &amp; found okay (Yes/ No/ Remarks)</b>
	contract conditions during entire tenancy of the Contract. Note: Stability of bandals, positioning of the mats and quality of bamboos and bamboo mats are the most important aspects of maintenance of bandals and their effectivity. Therefore, special attention should be given to these.	
(p)	Give dates of the inspection made of the concerned bandal site and by whom so far during the current working season ?	
(q)	Have intermediate detailed bandalling surveys been carried out on monthly basis ? Note: If yes, give dates thereof.	
(r)	Has alignment for re-erection of bandal given only after carrying out intermediate detail surveys ? If 'Yes' give dates thereof; If 'No" give reasons for the same.	
(s)	Other comments, if any.	

#### **4.3 Check Lists for recording measurements of initial erection/re-erection/ maintenance of bandals**

Before recording the measurements on the MBs, the supervising officers must ensure the following:

<b>Sl. No.</b>	<b>Particulars</b>	<b>Checked &amp; found okay (Yes/ No/ Remarks)</b>
(a)	Have the correctness of alignment and positioning of bandal units been verified w.r.t. the detailed pre-bandal survey charts ?	
(b)	Have the number and dimensions of bamboos and bamboo mats (screens) in each bandal unit been verified w.r.t. the technical specification ? Note: Only overall/ finished dimensions of mats/ screens (i.e. bandal length covered with the mats)	



Sl. No.	Particulars	Checked & found okay (Yes/ No/ Remarks)
	will be measured to verify the dimensions of mats. Further, if the variation in measurement (w.r.t. standard dimensions as per contract agreement) is up to (-) 5%, the Contractor will be allowed 3 days for its rectification.	
(c)	Has the maintenance period been counted from the following day of completion of initial erection/ re-erection ? Note: Claim for maintenance charges shall be entertained only after ascertaining the stability of bandals up to 10 days or more after completion of erection/ re-erection of bandals.	
(d)	Has the contractor maintained satisfactorily, the entire length of bandal ordered and erected/ re-erectioned at each site during the period of the contract as per contract terms & conditions and direction of EIC or his representative. Note: If during any period, at any site it is found that less than 80% length of bandal is maintained, no payment for maintenance for that site shall be made for the period during which less than 80% bandal is maintained. If the length is satisfactorily maintained between 80% and 100% at a site, pro-rata payment shall be made for the actual length maintained during that month. Also, the monthly maintenance charges shall be payable as the per actual maintenance work i.e. part or full month as the case may be.	
(e)	Other comments, if any.	

## 5.0 Timelines

S.N.	Particulars	Target Date
1.	Scheme preparations & submission to HQ	By end February every year
2.	Sanction of Project/ Scheme by competent authority	By end March of every year

3.	Award of work after e-tendering and consent of HQ (appropriate authority)	By end May of every year
4.	Signing Agreement etc.	June of every year
5.	Formation of technical committees, nomination of representative of EIC etc. for execution of work.	As applicable
6.	Reporting frequency on work progress	10 <sup>th</sup> of every month
7.	Detailed Pre and Post bandalling surveys	As per requirement

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