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No. PL-2 (1)/70

Dated the 18th January, 1971

To

All State Govts. and Administrations of UTS (Deptts dealing with Roads)

Subject : Standardisation of the procedure and data for preparation of bridge projects relating to National Highways and Other Centrally Aided Scheme

I am directed to say that the bridge projects relating to National Highways and Other Centrally Aided State Roads of inter-State or Economic importance received in this Ministry from the State Governments/ Local Administrations for obtaining Government of India's technical approval and financial sanction show considerable divergence in their preparation and presentation. In order to have uniformity of practice and to ensure that project estimates are prepared in sufficient detail, it has been considered desirable that some guidelines may be laid down for this work. This will also ensure collection of complete hydraulic and other data and also a proper and thorough study and appreciation of the project.

2. The need for carrying out detailed surveys and investigations and having a uniform procedure for their presentation had been discussed at the Chief Engineers' meetings also from time to time. At the meeting held at Kulu in October, 1969, a proforma had also been discussed. Subsequently, this proforma was circulated to all the State Chief Engineers and on the basis of the comments received from them, the proforma has now been finalised in this Ministry. Two proformae have been drawn up—one for the preparation of bridge estimates for major bridges (length 150 metres or more) and the other for medium and minor bridges. These are enclosed.

I am to request that Chief Engineers dealing with Highway in your State/Territory may kindly be asked to follow these proformae while submitting bridge project estimates relating to the National Highways and other Centrally aided State roads.

Enclosure to letter No. PL-2 (1)/70

Dated the 18.1.71

GUIDELINES FOR PREPARATION AND PRESENTATION OF BRIDGES PROJECTS
(For all Bridges-Major and Minor)

An estimate for a bridge work must contain the following items :

- (i) Report
- (ii) Specifications
- (iii) Design Data
- (iv) Design Calculations
- (v) Detailed Estimates
- (vi) Analysis of Rates
- (vii) Abstract of the Estimate
- (viii) Construction Schedule
- (ix) Drawings and Plans
- (x) Sub-estimate for the approach roads.

The above items are explained in brief in the subsequent paragraphs.

3. **REPORT**—A detailed report is a very important part of any bridge project estimate. It should be so written that after going through it a complete picture of the project can be visualised. It should, therefore, include the following information.

3.1. Reference of the authority asking for the estimate and location of the bridge *i.e.* the mileage and name of the N.H. should be mentioned.

3.2. Existing Conditions—The present arrangements for crossing, brief details of the existing bridge, if any, its roadway width, loading capacity and present condition of structure. It may also be mentioned whether the existing alignment and geometrics of the approaches would need any change and if so its details.

3.3. Necessity of the new bridge in respect of traffic needs present and future and its benefits. Reference to any cost benefit studies done. Available traffic data, and the anticipated growth over a period of 25-30 years may be given as far as possible in respect of large bridges.

3.4. Selection of site—Mention of the different alternative sites possible for the bridge, (marking them as I, II, III.....) the merits and demerits of each site. It may also be mentioned whether the final site has been inspected and approved, if so, by whom. Reference of the bench-mark which has been used for carrying out survey should be mentioned. It would be preferable to correlate the bench mark and levels with G.T.S. Bench Mark and levels as far as possible.

3.5. High Flood Level—How it has been fixed *e.g.*, from any existing flood marks, local enquiry or observation on existing structures.

3.6. Discharge—Methods for working out the design discharge and the basis for the value adopted for design.

3.7. Waterway—The waterway required. If possible, its adequacy may be discussed in comparison with the nearby bridges on the same stream. Data of railway or other bridges, if available, to be collected and furnished.

3.8. Foundation investigations—Discuss the type of soil strata and boring data.

3.9. General arrangement of the bridge—The span length adopted, the economics of adoption of the particular span length and type of foundations and superstructure.

3.10. Sub-structure—Type of foundations, piers and abutments adopted. Discuss the depth of foundations required with reference to the bearing capacity of the strata and the scour depths with reference to Lacey's silt factor and other physical characteristics of the sub-strata revealed by samples of the borings.

3.11. Superstructure—Type and brief details of the superstructure.

3.12. River Training Works—Discuss the necessity of the river training and protective works, if required. Brief details may be given. If any model studies have been done, their details should also be given.

3.13. Approaches—Length of approaches on either side which will require to be taken up along with the bridge with special features, if any.

3.14. Miscellaneous items such as diversion or temporary bridge needed during construction, site accommodation, laboratory and other buildings required and quality control methods to be used. Also discuss any special features or problems about the site or the locality here.

3.15. Rates—The basis of adopting the rates or various items with particular reference to the availability of materials and their distance from the bridge site and the modes for transporting construction materials.

3.16. Total cost of the bridge.

3.17. Construction Schedule—Construction schedule giving programme of construction and the time required for completion to be given.

3.18. Any other useful information concerning the bridge, such as the approach to the bridge site, the nearest town, nearest rail-head, the extent of working season, etc.

4. **SPECIFICATIONS**—Detailed specifications for each item of the work required to be done during the construction of the bridge for which quantities have been worked out in the estimate should be given. In case any standard specifications of the State are being followed, reference should be given of the number in the specification which will cover the item concerned.

5. **DESIGN DATA**—Complete design data for the bridge should be given. This may cover loading to be used for design, hydraulic data, soil information etc. (See Annex I and II)

6. **DESIGN CALCULATIONS**—Detailed calculations for the following must be given :—

6.1. Discharge by various methods, discussion of different values obtained and justification for adopting the design values.

6.2. Waterway to be adopted.

6.3. Depth of scour and design of foundations.

6.4. Design of piers and abutments, wing walls, return walls etc.

6.5. Design of superstructure and bearings.

6.6. Design of miscellaneous items such as railings, kerbs etc.

6.7. Design of guide bunds and other protective work.

7. **ESTIMATE OF QUANTITIES**—Detailed estimate of quantities of each item should be prepared and an abstract also given.

8. **ANALYSIS OF RATES**—Detailed analysis of rates for various items in the estimates which are not covered by the prevailing schedule of rates must be given. If the rates are as per standard sanctioned schedule of the State, full reference of the same may be given.

9. **ABSTRACT OF COST**—This will comprise two parts, one in which cost of each item has been worked out and in another an abstract giving costs under main heads *e.g.* foundations, substructure, superstructure, approaches and miscellaneous items. The charges for contingency, w.c. establishments and agency may be added in the abstract.

10. **CONSTRUCTION SCHEDULE**—The construction programme in pictorial forms may be given.

11. **DRAWINGS AND PLANS**—These will be as mentioned below :—

(a) Key map.

- (b) Index Plan
- (c) Contour survey plan.
- (d) Site Plan.
- (e) Three cross-sections
- (f) Longitudinal section
- (g) Trial boring charts
- (h) Drawings of the bridge showing general arrangement on the cross-section at site, details of foundations sub-structure and superstructure
- (i) Elevation, sections and plans of existing bridges including foundation details.

NOTE 1 —The sizes of drawing sheets (outside dimensions) may be any one of the following but all drawing sheets for one project should be of the same size.

- (i) 1000 mm×700 mm.
- (ii) 700 mm×500 mm.
- (iii) 500 mm×350 mm.

NOTE 2 —As far as possible the scales for various drawings may be as given in Annexure III.

12. SUB-ESTIMATE FOR APPROACH ROADS—Detailed estimate of the approaches prepared in accordance with the guidelines laid down by the "Roads Directorate" should invariably accompany the bridge estimate as Part B, so that there is no likelihood of the cost of approaches being missed.

ANNEXURE I

DESIGN DATA FOR MAJOR BRIDGES
(Length 150 metres or more)

A. GENERAL

1. Road and its classifications
2. Name of the Stream
3. Road chainage at centre line of the stream.
4. What arrangement exists for crossing the river at present :
 - (a) During monsoon
 - (b) During dry season.
5. Has earthquake ever occurred in the region of bridge site?
If so, what was its intensity?

B. CATCHMENT AREA & RUNOFF

6. Catchment area—
 - (a) In hilly parts
 - (b) In plains
7. Maximum recorded intensity of rainfall in catchment
8. Rainfall in centimeters per year in the region
9. Length of catchment in Kilometres
10. Width of catchment in Kilometres
11. Longitudinal slope of catchment
12. Cross slope of catchment
13. Indicate broadly the nature of catchment
14. Are there any artificial or natural storage such as lakes etc. in the catchment
15. Is the nature of catchment likely to change such as due to afforestation, deforestation?

Total _____sq.

C. NATURE OF STREAM

16. Is the stream :
 - (a) Alluvial (with erodable banks), or
 - (b) Quasi-alluvial (with more or less fixed bed but erodable banks), or
 - (c) Rigid (with inerodable banks and bed)
17. Is the stream :
 - (a) Perennial, or
 - (b) Seasonal.
18. Does the stream meander or change course?
If so, the extent or meander experienced in the past be shown on the site plan.
(in case of major bridges, the courses of the river, particularly during various years, may be shown in different colours on the large scale plan for sufficient distance upstream and downstream of the proposed bridge site).
19. Are banks at the proposed site
 - (a) Firm and steep
 - (b) Firm but gently sloping
 - (c) Erodable and Indefinite
 - (d) Does the stream confine itself within banks, or overtops banks in floods?
20. Nature of stream in the vicinity of proposed site—
 - (a) Clean bed, straight banks or rifts or deep pools
 - (b) As in (a) but with some weeds or stones
 - (c) Winding, some pools and shoals, but clean
 - (d) As in (c) but with weeds or stones

- (e) Stony section with ineffective slopes and shoals.
 - (f) Sluggish river reaches, rather weedy or with deep pools.
 - (g) With very weedy reaches.
21. (a) Low water level.
 - (b) Surface velocity at L. W. L. Metre/Second
 - (c) Water surface slope at L. W. L. Metre/km.
 - (d) Bed slope at L. W. L. Metre/km.
22. (a) Ordinary Flood Level—
 - (i) at site
 - (ii) at U/S cross-section
 - (iii) at D/S cross-section
 - (b) Surface velocity at O. F. L. Metre/Sec.
 - (c) Water-surface slope at O. F. L. Metre/km.
 - (d) Area of X-section at site at O. F. L. Sq. Metres.
 - (e) Discharge at O. F. L. Cu. M/Sec.
23. (a) High Flood Level
 - (i) at site
 - (ii) at U/S cross-section
 - (iii) at D/S cross-section
 - (b) Surface velocity at H. F. L. Metre/Sec.
 - (c) Water-surface slope at H. F. L. Metre/km.
 - (d) Area of X-section at HFL.
 - (i) at site
 - (ii) at U/S cross-section
 - (iii) at D/S cross-section
 - (e) Discharge at H. F. L. Cu.-M/Sec.
24. R. L. and location of maximum recorded scour below H.F.L.
 25. R. L. of maximum anticipated scour below H. F. L.
 26. Location on the plan of borings taken in the bed of the river at proposed bridge site available.
 27. Test results of the samples of bores, giving therein the values obtained of the soil available at the following :
 - (a) Mean diameter of the particle in mm.
 - (b) Value of Lacey's silt factor.
 - (c) Angle of internal friction (ϕ).
 - (d) Cohesion (C).
 - (e) Angle of wall friction (δ).
 28. Allowable bearing capacity of the strata at foundation level, in tonnes per sq. meter—
 - (a) calculated theoretically
 - (b) calculated by conducting standard test (if carried out)
 29. Does stream carry drifting matter in floods? If so, state its nature, such as bushes, tree branches, boulders etc.
 30. Are banks susceptible to scour? If so, indicate the extent of cutting of banks occurred in the past.
 31. Is stream navigable? If so, the clearance required?
 32. Are large scale river training works necessary? If so, give the following detailed plans :—
 - (a) Course of the stream for sufficient distance upstream and down-stream of the bridge site indicating in different colours courses adopted by the river in different years.
 - (b) Contour survey plan of the bed of the river both on the upstream and down-stream of the bridge extending to a distance beyond the location of the proposed guide bunds or other protection.
 - (c) A plan showing the maximum loop chord ratio attained by the stream in the vicinity of the bridge site.
 - (d) Any other plans considered necessary for proper appreciation of the proposal for protective works. If any model experiments have been carried out, a copy of the report to be attached.
- D. ALIGNMENT AND APPROACHES**
33. Is the proposed alignment of the bridge skew or normal to channel? If skew, give angle of skew.
 34. Will approach be straight? If not, give radii of curves on.
 - (a) Right approach
 - (b) Left approach
 35. Proposed gradients in approaches :
 - (i) Right approach
 - (ii) Left approach
 36. Will visibility of bridge be unobstructed upto 50 Metres on either side of the bridge? If not, give details.
 37. Proposed type of surface of approaches.
- E. SUPERSTRUCTURE**
38. Proposed clear roadway over the bridge.
 39. Proposed width of footpaths, if necessary.
 40. (a) Proposed formation level of the road over the bridge at the Centre.
 - (b) Gradient, if any, in the road formation along the length of the bridge.
 - (c) Camber in the road formation.

41. Is the proposed bridge to be designed to pass—
 (a) Maximum floods
 (b) Ordinary floods with dips to pass excess discharge in high floods
 (c) Only dry season discharge (Submersible bridge)
42. Number and size of spans recommended

F. FOUNDATIONS

43. What type of foundations are recommended?
 (1) Open foundations
 (2) Well foundations
 (3) R. C. Pile foundations

G. EXISTING STRUCTURES

44. Do any bridges exist on the stream? If so, have their positions been marked on Index Plan?
45. Details of each of the existing bridges :
 (a) Size and No. of spans
 (b) Type of substructure
 (c) Type of superstructure
 (d) Type and depth of foundations
 (e) X-sectional area at H. F. L. underbridges
 (f) Is the waterway found to be adequate or excessive or inadequate?
 (g) Whether the foundations have been trouble free and depth provided is adequate or inadequate.
 (h) Any other information

H. MISCELLANEOUS

46. Name of nearest town and its distance from site
47. Is accommodation available at site or in the neighbourhood for construction staff?
48. Nearest railway Station and its distance from site
49. Cost at site of the following materials—
 (Give information in respect of items of materials applicable)
 (a) Brick I Class
 (b) Masonry stone
 (c) Stone ballast
 (d) Dressed stone for arches
 (e) 3/4" grit for RCC work
 (f) Sand for masonry work
 (g) Sand for RCC work
 (h) Cement
 (i) Mild steel bars and M. S. structurals
 (j) Sal Wood
 (k) Boulders or block kankar for pitching
50. Have the following been enclosed duly completed? Plans at Serials b, c, d, e, and f to be as per provisions in Clause 101 of I. R. C. Bridge Code, Section 1
 (a) Key Map-Scale 1 cm.=50 km.
 (b) Index Plan
 (c) Contour survey plan
 (d) Site Plan
 (e) Three X-section
 (f) Longitudinal Section
 (g) Trial Boring Charts
 (h) Drawing of the bridge showing general arrangement on the cross section at site, details of foundations, substructure and superstructure
 (i) Elevation, sections and plans of existing bridges including foundation details.

NOTE : The sizes of the drawing sheets (outside dimensions) may be any one of the followings but all the drawings sheets for one project should be of the same size :

- (i) 1000 mm × 700 mm
 (ii) 700 mm × 500 mm
 (iii) 500 mm × 350 mm

Assistant Engineer

Executive Engineer

1. The proposed site for the bridge has been inspected by _____
 2. Any other remarks considered worth mentioning by the Superintending Engineer

SUPERINTENDING ENGINEER
ANNEXURE II

DESIGN DATA FOR MEDIUM AND MINOR BRIDGES
 (Less than 150 metres in length)

A. GENERAL

1. Road & its classification
 2. Name of the stream

3. Road chainage at centre
 4. What arrangement exists for crossing the river at present
 - (a) During monsoon
 - (b) During dry-season
 5. Liability of site to seismic disturbances
- B. CATCHMENT AREA & RUNOFF**
6. Catchment Area
 - (a) in hilly parts
 - (b) in plains.
 7. Rainfall during the year and maximum recorded intensity
 8. Nature of catchment
 9. Any artificial or natural storage present in catchment
- C. NATURE OF STREAM**
10. Is the stream
 - (a) Alluvial with erodable banks.
 - (b) Quasi-alluvial with fixed bed but erodable banks
 - (c) Rigid with inerodable bed & banks
 11. Is the stream
 - (a) Perennial
 - (b) Seasonal
 - (c) Navigable
 12. (a) L. W.L./average bed level
 - (b) Surface velocity at L. W. L.
 - (c) Water surface slope at L. W. L.
 - (d) Bed slope at L. W. L.
 13. (a) High Flood Level
 - (i) at site
 - (ii) at 300 m U/S Cross-section.
 - (iii) at 300 m D/S cross-section
 - (b) Surface velocity at H. F. L.
 - (c) Water surface slope at H. F. L.
 - (d) Area of X-section at H. F. L.
 - (i) at site
 - (ii) at up-stream cross-section
 - (iii) at D/S cross-section
 - (e) Discharge at H. F. L.
 14. R. L. & location of maximum scour recorded below H. F. L.
 15. R. L. of maximum anticipated scour below H. F. L.
 16. Location and plan of borings taken in the bed of the river & at other locations
 17. Test results of the samples of bores giving the following soil characteristics
 - (a) Lacey's Silt Factor
 - (b) Angle of internal friction (ϕ)
 - (c) Cohesion (C)
 - (d) Angle of wall friction (S)
 - (e) Safe bearing capacity of soil at foundation level
 18. Does the stream carry drifting matter in floods;
 19. Details of training works, if needed
- D. ALIGNMENT AND APPROACHES**
20. Whether the bridge proposed is right or skew? If skew, give the angle of skew.
 21. Will the approaches be straight? If not, give radii of curves.
 22. Proposed gradient on approaches
- E. SUPERSTRUCTURE**
23. Proposed clear roadway over the bridge
 24. Width of Footpaths, if any
 25. Formation level
 26. No. and size of spans recommended
- F. FOUNDATIONS**
27. Foundations recommended.
 - (a) Open
 - (b) Well
 - (c) Piles
- G. EXISTING STRUCTURES**
28. Details of each of the existing bridges on the same channel in the vicinity (within 5 Kms.)
 - (a) Size & No. of spans
 - (b) Type of structure
 - (c) Depth & Foundations

- (d) Whether the existing structures are trouble free
 - (e) Any other information
- H. MISCELLANEOUS
- 29. Name of town nearest to bridge site
 - 30. Nearest Railway Station and its distance from bridge site
 - 31. Cost at site of the materials required for construction
 - 32. Have the following plans been enclosed duly completed
 - (a) Key Map—Scales 1 cm=50 Km.
 - (b) Index Plan
 - (c) Contour survey Plan
 - (d) Site Plan
 - (e) Longitudinal and three cross sections of the river
 - (f) Trial boring charts
 - (g) Drawing of the bridge showing general arrangement, details of foundations, sub-structure and superstructure
 - (h) Elevation, section and plans of existing bridges including foundations details

NOTE—The sizes of the drawing sheets (outside dimensions) may be any one of the following but all drawings sheets for one project should be of the same size.

- (i) 1000 mm × 700 mm
- (ii) 700 mm × 500 mm
- (iii) 500 mm × 350 mm

ANNEXURE III

SCALES RECOMMENDED TO BE ADOPTED IN THE PREPARATION OF DRAWINGS FOR BRIDGE WORKS

1. (a) Key Plan	1/500000
(b) Index Plan	1/50000
2. Contour Survey Plan	
(a) For catchment Area less than 15 sq. Km.	1/1000
(b) For catchment Area of 15 sq. Km. or more	1/5000
3. Site Plan.	1/2500
4. Cross-section of the river	
(a) Horizontal	1/1000
(b) Vertical	1/100
5. Longitudinal section of the river	
(a) Horizontal	1/2500
(b) Vertical	1/100
6. General Arrangement Drawings	
(a) Elevation—To suit the size of the drawing sheet	
(b) Plan	1/200
(c) Section	1/100
7. Details of foundations	
(a) Curb	1/10
(b) Steining	1/50
8. Details of substructure	1/50
9. Details of Bearings	
10. Details of Superstructure	1/5
(a) Deck Slab	1/20
(b) Beams longitudinal section	1/20
(c) Beams Cross-section	1/10