গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
স্থানীয় সরকার প্রকৌশল অধিদপ্তর

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ঢাকা-১২০৭।
www.lged.gov.bd.

স্মারক নং-৪৬.০২.০০০০.৩০১.১৮.০০১.১৭- ৯৯৬৭ তারিখঃ ৯৯-০৯-২০১৮ইং

অফিস আদেশ

এতদ্বারা সংশ্লিষ্ট সকলের অবগতির জন্য জানানো যাচেছ যে, Bridge Design Standards for LGED - 2012 অনুসরণ করে উপজেলা সড়ক, ইউনিয়ন সড়ক ও গ্রামীণ সড়কে বিভিন্ন দৈর্ঘ্যের ও ধরণের ব্রীজ নির্মাণ করা হচেছ। টেকসই এবং যুগোপযোগী ব্রীজ নির্মাণের লক্ষ্যে ও AASHTO LRFD অনুসরণ করে ব্রীজের প্লানিং ডিজাইন ও বাস্তবায়নের জন্য Bridge Design Standards for LGED- 2012 হালনাগাদ করণের প্রয়োজনীয়তা দেখা দেয়। এলজিইডি এর ব্রীজ সমূহের প্লানিং ডিজাইন ও বাস্তবায়নের জন্য উপরোক্ত বিষয় সমূহ অর্ন্তভুক্ত করে Guidelines for Bridge Design of LGED- 2018 প্রস্তুত করা হয়েছে। এলজিইডি'র সকল ব্রীজ ডিজাইনের ক্ষেত্রে এখন থেকে Guidelines for Bridge Design of LGED - 2018 অনুসরণ করার জন্য নির্দেশনা প্রদান করা হলো।

সংযুক্তিঃ Guidelines for Bridge Design of LGED -2018

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জ্ঞাতার্থে ঃ
১। অতিরিক্ত প্রধান প্রকৌশলী(সকল) ....., এলজিইডি, সদর দপ্তর, ঢাকা।
২। অতিরিক্ত প্রধান প্রকৌশলী(সকল) ....., বিভাগ।
৩। তত্ত্বাবধায়ক প্রকৌশলী(সকল) ....., এলজিইডি, সদর দপ্তর, ঢাকা।
৪। তত্ত্বাবধায়ক প্রকৌশলী(সকল) ....., অঞ্চল।

কার্যার্থেঃ

১। প্রকল্প পরিচালক(সকল) ....., এলজিইডি, সদর দপ্তর, ঢাকা।
২। নির্বাহী প্রকৌশলী(সকল), এলজিইডি..... জেলা।
৩। নির্বাহী প্রকৌশলী, প্রাথমিক শিক্ষা ও প্রশিক্ষন (সকল) , এলজিইডি.....অঞ্চল।
৪। নির্বাহী প্রকৌশলী(MIS Unit),এলজিইডি'র ওয়েব সাইটে প্রচারের জন্য অনুরোধ করা হলো।

Government of the People's Republic of Bangladesh
Ministry of Local Government, Rural Developments and Cooperatives
Local Government Division
Local Government Engineering Department

Guidelines for Bridge Design
of
Local Government Engineering Department

September 2018

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Guidelines for Bridge Design of LGED, 2018

01. Design Specification

AASHTO LRFD Bridge Design Specifications, 6th Edition, 2012 with compliance to "Road Design Standards" of The Government of Bangladesh

02. Bridge Loading

- Vehicular Live Loading: AASHTO HL-93 loading. For special and longer span bridges IRC loading may be used
- Wind Loading: Wind load analysis shall be done as per AASHTO LRFD but basic wind speed will be taken from BNBC 2006. However BNBC 2017 shall be used with proper conversion to AASHTO provisions after publishing.
- Seismic Loading: Analysis of seismic force shall be done as per AASHTO LRFD but seismic zone coefficient will be taken from BNBC 2006. However BNBC 2017 shall be used with proper conversion of seismic zone coefficients after publishing.
- Other loading shall be considered as per AASHTO LRFD
- Design Life: 75 years except crash barrier, wearing surface, bearing, expansion joint etc.

03. Deck Geometry

Bridge deck geometry shall be made as follows:

- Minimum deck slab thickness shall be 200mm irrespective to spacing of girders
- Upazilla & Union Road: Carriage Way width shall be 5.50m and total width 7.30m for bridges length up to 30m. Where the length exceeds 30m, carriage Way width shall be 7.30m and total width 9.80m.
- Village Road: Carriage Way width shall be 3.70m and total width 5.50m for bridges length up to 30m. Where the length exceeds 30m, carriage Way width shall be 5.50m and total width 7.30m.
- Four Lane Bridge – Need based
- Design vehicle speed – 70km/hr
- In special cases, deck geometry shall be specified based on connectivity, traffic volume and road type

Road Type	Bridge Length ≤ 30m			Bridge Length > 30m		
	Carriage Width (m)	Walkway Width (m)	Total Width (m)	Carriage Width (m)	Walkway Width (m)	Total Width (m)
Upazilla Road	5.50	0.65	7.3	7.30	1.00	9.80
Union Road	5.50	0.65	7.3	7.30	1.00	9.80
Village Road	3.70	0.65	5.50	5.50	0.65	7.3

04. Walkway Geometry

- Clear Walkway width from front face of rail post at each side of bridge shall be 0.65m for 3.70m & 5.50m carriage way width and 1.00m for 7.30m carriage way width.
- Service duct shall be provided for all bridges nearer to District HQ, Growth centers, Industrial Area, and Densely populated urban area and longer bridges. The service duct shall preferably in open space anchored from the bottom of the deck or other suitable means.
- Curb height shall be minimum 250mm from the raw surface of deck

05. Railing

- Pedestrian Railing: Pedestrian Railing shall be used. The height of a pedestrian railing shall be 1050mm measured from the top of walkway surface. Railing geometry shall be made as follows:
    - Rail Post - 200mm x 200mm (chamfered 20mm x 20mm)
    - Rail Bar 3 Nos. - 150mm x 150mm (chamfered 20mm x 20mm)
    - C/C Distance of Post shall be ±1500mm
    - Rail bars shall be pre-cast concrete
    - Reflector shall be provided in alternate rail post
    - Painting (red & white) shall be applied in all rail posts and bars as per current LGED Road Safety guideline

06. Superstructure Type

Indicative Span range and superstructure type:

- 6-12m: RCC Slab (Need based)
- 12-24m: RCC T Girder (width 450mm)
- 20-40m: RCC Box Girder (Need based)
- 25-55m: PC T/I Girder (above 50m girder should be casting in-situ)
- 25-50m: Concrete Arch (Need based)
- 40-65m: PC Box Girder (Simple Span)
- 60-100m: PC Segmental Box Girder
- 50-150m: Steel Truss
- 30-50m: Steel Plate Girder
- 20-24m: Viaduct (RCC). In case of horizontal curve viaduct, curve portion may be provided with RCC slab/RCC box girder with appropriate span length.

For any special case, the above mentioned types and ranges may vary.

07. Girder Number

Number of girder in each span of bridge for both RCC & PC girder depending on the Carriage Way width shall be as follows:

- For 3.70m carriage way width nos. of girder shall be 2(two)
- For 5.50m carriage way width nos. of girder shall be 3(three)

- For 7.30m carriage way width nos. of girder shall be 4(four) where the total width is 9.80m including pedestrian railing.

  For special cases, 5 girder may be used. However, it should be justified by Design Unit, LGED.

08. Abutment Height

- Maximum height of abutment above existing average ground level shall be within 7m based on field condition. Preference shall be given to lower height Abutment. (preferably 4m).
- However, the bearing seat bottom level shall be at least 300mm above HFL/SHWL.

09. Materials:

a) **Concrete:**
- Minimum Concrete Strength for PC Girder: 35 MPa for span upto 32m and 40 MPa for span above 32m
- Minimum Concrete Strength for RCC Components: 30 MPa
- Minimum Concrete Strength for Pile: 25 MPa (may vary in special case)
- Minimum Concrete Strength for Pile Projected Pier and Pier system: 30 MPa

b) **Prestressing System:**
- Strand:
  - Type: 7 ply uncoated wire
  - Code: ASTM A 416M/AASHTO M203
  - Relaxation Type: Low Relaxation
  - Ultimate Tensile Strength: 1860 MPa
  - Diameter: 12.7mm and 15.24mm
  - Number: maximum 19 per cable. Higher number of strand shall only be allowed if proved efficient
- Age of PC Girder at the time of Stressing: 14 days (minimum) (in special case, it can vary with prior approval from design unit)
- Stressing work for a girder preferably be done in one stage
- Anchorage: Shall meet PTI - M50.1-98, Acceptance Standards for Post-Tensioning Multi-Strand Steel Anchorage.

c) **Sheathing Duct:**
- Galvanized corrugated metal sheet
- High-density polyethylene (HDPE) duct

d) **Steel Reinforcement:**
- Reinforcement conforming BDS ISO 6935-2:2006/2016 or ASTM A706M-16
- Grades 400, 420, 500, 550 rebars shall be used

- In Seismic zone 3 (Lalmonirhat, Rangpur, Gaibandha, Bogra, Sirajgonj, Tangail, Narsshingdi, Brahmanbaria, Khagrachari, Rangamati, Bandarban, Chittagong, Cox's Bazar) and seismic zone 4 (Kurigram, Jamalpur, Mymensingh, Netrokona, Kishoregonj, Sunamgonj, Sylhet, Moluvibazar) as per BNBC 2017, only grade 400/420 MPa shall be used for seismic force resisting elements e.g. pier and column]
- Epoxy Coated Reinforcement conforming ASTM A775/BDS ISO 14654:2013 may be used at coastal zone (Bagerhat, Borguna, Barisal, Bhola, Chittagong, Cox's Bazar, Khulna, Noakhali, Patuakhali, Pirojpour, Jhalokathi, Satkhira) as well in saline prone area. The lap length and anchorage lengths shall be increased by 25%

e) **Grouting:**

Shall meet the requirements of PTI - M55.1-12-Specification for Grouting of Post Tensioned Structures

- ASTM C938, Standard Practice for Proportioning Grout Mixtures for Preplaced-Aggregate Concrete
- ASTM C939, Standard Test Method for Flow of Grout for Preplaced Aggregate Concrete (Flow Cone Method)

10. Longitudinal Parabolic Gradient for Finished Road Surface

Maximum parabolic gradient 5% shall be provided over the full length of bridge. However, the gradient of viaduct and approach road shall be linear.

11. Deck Cross Fall

A minimum 2% cross slope shall be provided over the bridge deck. 50mm thick concrete wearing course shall be provided uniformly over the deck slab upto bridge length 100m. Asphalt wearing course including mastic asphalt concrete shall be used for bridge length above 100m.

12. Vertical Clearance over Roadways

At least 5.50m vertical clearance shall be provided for overpass/underpass, viaducts and flyovers over the entire width of the superstructure.

13. Vertical and Horizontal Clearance over Railway Lines

In case of railway overpass, minimum horizontal and vertical clearance shall be taken from Bangladesh Railway

14. Navigational Clearance

The navigational clearance shall be in accordance with current BIWTA requirement which is as follows,

SL No	Classification of Waterways	Minimum Vertical Clearance (m)	Minimum Horizontal Clearance (m)
1	Class - I	18.30	76.22
2	Class - II	12.20	76.22
3	Class - III	7.62	30.48
4	Class - IV	5.00	20.00

- For bridges more than 100m bridge on non-classified rivers, the navigational clearance document shall be collected from BIWTA
- For non-classified rivers, the navigational clearance should be fixed after field visit and consulting with stakeholder, LGED personnel of respective Upazilla and district.
- In addition, horizontal and vertical clearance shall be taken from BIWTA/BWDB for future dredging and movement of dredging equipment.
- However, the absolute minimum vertical clearance should be 0.60 m above Standard High Water Level/High Flood Level

15. Sub-Soil Investigation

- Sub Soil investigation shall be carried out to establish soil parameters required for detailed design in accordance with relevant provision of AASHTO LRFD
- Minimum depth of bore hole from lowest river bed level should be minimum 40m for the Cox's Bazar (Costal Side), Chittagong (Costal Side), Feni, Laxmipur, Noakhali, Chadpur, Bhola, Barisal, Patuakhali, Barguna, Jhalokathi, Pirojpur, Bagherhat, Khulna & Satkhira. For other areas, that should be minimum 30m. Hence, the minimum depth should be increased as per design requirement
- At the time of construction, one confirmatory soil test should be done in each abutment and pier location after finally setup the layout to review the design. In such case, bore-hole depth should be finalized according to design requirement
- Minimum 4 bore hole (2 in the river and 2 in bank position) should be done for bridges more than 100m length. Minimum 3 bore hole (1 in the river and 2 in bank position) should be done for bridges less than 100m length for design purpose or as instructed by Design Unit, LGED.

16. Location of Pier Pile Cap

- Pier Pile Cap should be underneath the bed level if inn dry season, the water depth is maximum 3m at pier location,
- If the water depth is more than 3m, pile cap top level shall be 0.5m below Lowest Water level.

17. Expansion Joint

Sl. No.	Expansion/Contraction Amount	Expansion Joint
1	Less than 25mm	Angle Plate Type Joint
2	25mm to 50mm	Elastomeric Single Strip Seal
3	More than 50mm but less than or equal to 125mm	Finger Type Expansion Joints with drainage seal
4	More than 125 mm	Modular Sealed Expansion Joint

18. Bearing

- Elastomeric: For simple structure up to 50m span
- POT/PTFE (Polytetrafluoroethylene): For continuous structure above 50m individual span.
- High Damping Rubber: Longer than 50m span in seismic zone 3 and 4

19. Survey Profile

- Sub-soil profile and topographical survey map with RL (PWD/SOB) shall be included in bridge drawing. All survey work shall be based on same PWD/SOB BM
- GIS information must be included for all abutment and pier locations
- Topographical survey, sub-soil investigation and information supplied in appraisal format must be carried out based on same TBM

20. Standard Drawings of Bridge

The standard drawing shall contain followings:

- General Notes for RCC Components
- General Notes for Pre-stressed Concrete
- Guide line for Cast-in-situ bored piles
- Sub-Soil Bore log
- Topographical Survey and Bridge Lay-out Plan
- General Plan and Elevation
- Bridge Deck Profile
- Pile Lay-out Plan
- Details of Bridge Deck
- Details of RC Girders (Long & Cross sections)
- Details of Pre-stressed Concrete Girders
- Details of Abutments
- Details of Abutment Piles

- Details of Pier
- Details of Pier Pile
- Details of Railing
- Details of Bearing on abutment and Pier
- Expansion Joint
- Protective Works around Abutment & Approach road
- Details of Guard Post
- Approach road cross-section & Alignment plan
- Electrical installation & circuit diagram
- Long & cross drain of Approach road
- Details of underpass (in needed)
- Drawing for assumed construction sequence
- Camber drawing

21. Design information to be provided in the drawings for PC Girder

- Minimum compressive strength of Concrete at 28 days
- Minimum UTS and type of Pre-stressing steel
- Nominal diameter and Area of Strand
- Area of cable system, Anchorage system, Duct size
- Nos. of strand in each cable
- Modulus of Elasticity of strand
- Anchorage slip length (as assumed in design)
- Design cable force
- Elongation of each individual cable
- Grip length of strand considered in elongation
- Instruction due to irregularities of elongation
- Stressing sequence of strands and ends
- Value of design variable like friction coefficient, wobble coefficient

22. Special features in Drawing

- Vertical & Horizontal Navigational Clearance
- Additional Items (Cofferdam, Permanent Steel Casing, Dewatering, Diversion, use of Vibro-Hammer, Underpass etc.) must be mentioned in drawing
- Boring equipment type must be mentioned in drawing
- Scaffolding/ formwork design must be submitted by the contractor prior starting of the work
- Ground Improvement (if required) must be mentioned in bridge approach.
- As built drawing to be submitted with the final bill for record keeping.
- Requirement of jack off/normal barge, staging, crane, bentonite, number and size of slurry tank, portable water, Hydraulic rotary/mechanical rotary/coupler.
- Use of saline free water especially for coastal belt.

23. Approach Road Design Section

- Full width black top pavement should be provided within the wing walls of abutment and gradually reduced to actual road pavement width (except in especial case).
- To minimize land acquisition in approach, Reinforced Earth (RE)/Mechanically Stabilized Earth (MSE) wall might be provided at suitable sites.

24. Test Requirement for Strand

The following tests are needed to be performed for Strand prior to use in PC girder.

- Ultimate Tensile Strength
- Yield Strength
- Unit Weight/Cross sectional area
- Modulus of Elasticity and
- % of Elongation at Rupture

25. Test Requirement for Anchorage

Anchorage efficiency test must be carried out from approved laboratory to confirm the quality and capacity of post tensioning anchorage (Bearing plate test, Wedge plate test, Strand-Wedge connection test) in accordance with PTI - M50.1-98.

26. Test requirement for Bearing

The following tests are needed to be performed for elastomeric bearing pad

- Hardness (ASTM D-2240)
- Compression set for 22hr at 100^0c (ASTM D-395)
- Ash Content
- Short Duration Compression
- Long Duration Compression
- Volcanized Bond Test (ASTM D-429) Method-B
- Shear modulus (ASTM D-4014)
- No. and thickness of Elastomer layer and Steel Plate

Recommendation of Technical Sub-Committee (TSC)

Local Government Engineering Department (LGED) is involved in the construction of bridges of various length on Village roads, Union roads & Upazilla roads of Bangladesh. Chief Engineer, LGED formed a technical sub-committee to update *Bridge Design Standards* for harmonizing bridge geometry, vehicular loading, material properties, drawings and to cope with the advancements in planning, design, construction & supervision of bridges. Members of TSC, with the participation of representative from BUET updated existing *Bridge Design Standards for LGED.* Proposals were presented in the meeting of TSC held on 24-July 2018. Accordingly, the sub-committee reviewed and finalized the proposals. After long discussion on each proposal, TSC prepared a *Guidelines for Bridge Design of LGED.* This "*Guidelines for Bridge Design of LGED"* shall be used for the design of all bridges to be constructed all over the country under LGED.

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