DOWNLOAD PDF PEDESTRIAN BRIDGE DESIGN MANUAL

Chapter 1 : Manuals, Guides and Instructional and Informational Memoranda

Pedestrian Bridges. AASHTO LRFD Bridge Design Specifications. FDOT Structures Design Office Engineering Programs. Plans Preparation Manual - English (Volume I).

This section deals with both types of construction. Half-through construction is used for smaller spans, where the depth needed is less than the clearance height for people to walk through. For large spans, or where the bridge is clad to provide a complete enclosure for the pedestrians, through construction is used. Through truss footbridge Image courtesy of Briton Fabricators Ltd. The top chords can then be braced together above head level. Stability of the top compression chord in half-through construction is provided by the U-frame action of the side members and the cross-members of the deck. In through construction, lateral bracing between the two top chords offers a more direct means of stabilising them. Types of truss and Vierendeel girder The type of truss usually employed is either a Warren truss or a modified Warren truss. Occasionally a Pratt truss may be used. The different types are illustrated in Figure 3 right. Warren trusses are the simplest form of truss, with all loads being carried principally as axial loads in the members and with the minimum of members meeting at joints. However, the loads which are carried to the bottom chords from the walkway floor can lead to significant bending in these members when the panels are large. A modified Warren truss reduces the span of these chord members, though the additional vertical members add complexity to the fabrication. Pratt trusses are used where it is preferred that some members are vertical, for example to facilitate the fixing of cladding or decorative panels. Vierendeel girders have no diagonal members and rely on a combination of axial loading and bending to carry loads. The stiffness of the girder depends crucially on the bending stiffness of vertical and horizontal members and on the stiffness of the joints between the two. As a consequence they are much heavier, for a given span, than a Warren truss. However the appearance, which only shows vertical and horizontal lines, in harmony with the normal form of parapet horizontal rails, vertical posts and infill , is often considered more pleasing. For the largest spans, the Vierendeel girder will probably be too flexible, though they have been used successfully up to 45m span. Warren truss half-through footbridges Image courtesy of Nusteel Structures Ltd. Image courtesy of Nusteel Structures Ltd. Such trusses were often used for railway bridges. With half-through construction , the minimum overall depth is determined by the parapet height; for a crossing over a highway the minimum is about 1. For spans over 50 m full through construction will probably be necessary. Then the depth is determined by internal clearance, which is usually specified as 2. To reduce the tunnel effect and to keep the top bracing away from casual abuse a depth of about 3 m is needed. The arrangement of the bracing and the line of the parapets are the dominant features which are seen by road users. They therefore require careful attention and treatment. Hog-back configuration for main span Image courtesy of Briton Fabricators Ltd. Where the depth of the Vierendeel girder is determined by parapet height, the top chord can often be used as the parapet rail, with suitable infill bars fixed between the vertical members. For longer span Vierendeel girders, where the depth is more than the parapet height, parapet panels complete with top rail can be fixed inside the rectangular panels of the girder. Where a truss is used, the parapet is usually fixed to the inner face of the diagonal members. The parapets are less conspicuous to road users than the truss members, though they are still evident in silhouette. Construction depth, from footway surface to underside of the truss or girder, is normally quite shallow, not more than the depth of the chord members. This contributes greatly to the light appearance. The top and bottom chords of a truss are usually made parallel, but for larger spans a less dominating appearance can be achieved by a hog-back configuration, with a gentle curve to the top chord reducing the depth at the ends of the span. Detail of diagonal plate through bottom chord Both circular and rectangular structural hollow sections are commonly used in trusses. The bottom chord is generally rectangular, to facilitate connection with deck and cross-members. Rolled sections or flats are sometimes used as cross-members or as stiffeners to steel floor plates. Chords and diagonals are usually arranged with centrelines intersecting where possible. Standard welding details have been developed for hollow section connections. For half-through trusses the connection with cross-members at the lower chord requires particular attention, since its stiffness and strength are fundamental to U-frame action. Where the bottom chords are of rectangular section, some designers specify plates slotted diagonally across the section at the position of the cross-members Figure 4 right to prevent the chord lozenging or distorting, thus increasing the stiffness of the joint. If a non-participating form of floor is used, cross bracing in the plane of the bottom chord, to resist lateral forces, must be considered. Through trusses, used in longer spans, give lateral stability to the top compression chord by means of bracing in the plane of the top chord. Such bracing will also share in the carrying of any lateral forces, especially where the truss is clad on its sides and thus subject to significant wind loads. At the ends of the span these lateral forces have to be carried down to bearing level through portal action or through a braced frame. Vierendeel girder half-through footbridges Image courtesy of Nusteel Structures Ltd. The vertical members therefore need to be strongest at the ends of the span. Detail of a haunched joint in a Vierendeel girder On the other hand the central portions of the chords sustain predominantly axial load, whilst the ends sustain predominantly bending load. There is less need to vary the size of the chord members, and usually only thickness is varied, if at all. The consequences are that the vertical members are often wider in the plane of the girder at the ends of the span and are sometimes closer together, variations which are clearly visible in silhouette. The strength of the joint between chord and vertical members must be adequate to transmit the fixed end moments. To do this, both should have the same width normal to the plane of the girder. Under the higher moments on the joints toward the ends of the span a simple square joint may have inadequate strength, and either triangular fillets cut from the same section as the vertical or reinforcing plates may need to be added to increase stiffness and strength see Figure 5 right. The appearance of these additions may not always be acceptable and heavier sections may be preferred. Stability of the compression chord again requires U-frame action of the cross section and this again requires adequate stiffness and strength of the cross-member to vertical connection at the bottom chord. Even with the heavier sections usually required for a Vierendeel girder, it may be necessary to insert diagonal plates, as mentioned previously. The lighter steel deck is now generally preferred. Stiffened floor plate upside down in the factory Image courtesy of Briton Fabricators Ltd. The plate, typically 6 mm or 8 mm thick, is supported on and welded to steel cross-members between the chords. These cross-members form part of the U-frames which stabilise the top chord and are themselves usually hollow sections. The plate panels between chords and cross-members are divided transversely and sometimes longitudinally by stiffeners usually flats to give added support. On top of this plate a waterproof layer is required for corrosion protection , and to give a non-slip surface for safety. This is usually achieved with a thin membrane which acts both as waterproofing and as a binder and a surface dressing of fine aggregate. The total thickness is about 4 mm. This surface is often applied in the works and does not add significantly to erection weights. When precast planks are used it is necessary to provide a shelf angle on the inner face of the chords on which the planks can sit. It is very important that the joint between concrete and steel is properly sealed or it could become a moisture and corrosion trap. Where drainage over the edges of the bridge is not permitted, arrangements must be made to carry rainwater to the ends of the bridge and then to drains or a soakaway. A vertical curve or longitudinal camber should be provided on a bridge which otherwise would be level. Where rainwater can be allowed to run off the side of the bridge for example over a river , the floor may be slightly cambered transversely to facilitate drainage. With stiffened thin steel plate decks, care also needs to be exercised that panels do not dish between stiffeners and allow ponding of water â€” the spacing of stiffeners is usually limited for this reason. Weld sizes should be kept to a minimum, to reduce distortion from welding see Guidance Note 2. Parapets are normally designed to comply with a DMRB standard. The parapet may be either a separate item or may be combined with structural members. For trusses, the parapet is provided as separate units fixed to the inside faces of the truss diagonals. The diagonals must then be designed to carry lateral loads from the parapet, and the parapet rails must be designed to span between the diagonals which support them. Parapet posts can alternatively be fixed to the footway deck, though the attachment would need to be strong enough to withstand the overturning moment arising from lateral forces on the top rail. Where Vierendeel girders are used it is convenient to fix parapet panels in the rectangular panels of the girders, effectively using the vertical members as parapet posts. This achieves an integrated appearance and produces a slightly lesser overall width of bridge than with separate parapets on the inner faces of the girder. The top chord of the girder may also function as the top parapet rail, or, if it is higher than the required parapet height, a separate rail can be provided in addition to the top chord. Fine mesh cladding Image courtesy of Briton Fabricators Ltd. Over rail tracks, the highway and rail authorities require that solid non-climbable cladding be provided on the inside face of the truss or Vierendeel girder. To prevent unauthorised access, not only must the pedestrian face of the bridge be designed to be non-climbable, it must also be impossible to climb along the outer face from the ends of the bridge â€" this usually means that trusses are clad either side of the diagonals at the ends. The top flanges, chords or parapets must be arranged so that they are impossible to walk along. Such cladding is usually achieved by profiled steel sheeting, rigidized aluminium, GRP panels or even flat sheets. Fine mesh maximum 50 mm apertures may be used over non-electrified lines. Although the cladding is only required over the tracks, a better appearance is often achieved by providing the cladding over the full length of the span. Great care needs to be exercised in detailing the cladding, to avoid the creation of small inaccessible sheltered ledges on the top of the lower chord where moss and debris can accumulate or which may be used for handholds or footholds. At abutments the point of support is normally directly below the end vertical or diagonal members and thus does not give rise to local bending of the chord section. Other supports should also preferably be arranged similarly. Where it is not convenient to do so, for instance when a top landing cantilevers a short distance beyond the support columns and the support is midway between bracing connections, the bottom chord is subjected to bending. It is then common to use a heavier chord section over the last one or two panels of the truss. A wide range of sizes of hollow sections is available from the rolling mills, but it must be remembered that the fabricator has to purchase material for each job, either from the mill or from a stockist, and his orders may be subject to minimum quantities and premiums for small quantities. The designer should therefore try as far as possible to standardise his choice of section size and material grade. Although fabrications over 27 m in length require special permission to travel on the public highway, most fabricators prefer to complete fabrication in the works wherever possible and are familiar with arrangements for the movement of long lengths. Installation of a complete span Image courtesy of Briton Fabricators Ltd. Image courtesy of Briton Fabricators Ltd.

Chapter 2 : Bridges - Pedestrian Bridge

Pedestrian Bridge Design Manual WSDOT Bridge Design Manual M Pedestrian Loads. AASHTO LFRD Guide Specifications for the Design of Pedestrian Bridges, dated.

Chapter 3 : Design of steel footbridges - blog.quintoapp.com

Pedestrian loads, as described in the AASHTO LRFD Bridge Design Specifications, shall be used to not only design the pedestrian railings on the structure, but shall also be used to design stairway railings that are adjacent to the structure and are part of the contract.

Chapter 4 : Bridge Railing Manual: Bridge Railing for Pedestrians

MANUAL OF SPECIFICATIONS, STANDARDS & DESIGN / Adopted July 16, F. AASHTO LRFD Guide Specifications for Design of Pedestrian Bridges. For retaining walls and pedestrian structures that are either located on or.