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Analysis Of Live Load Distribution Factors For Horizontally Curved Concrete Box Girder Bridges

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Abstract*—Live load distribution factors are utilized to decide the live-load second for connect support plan when a two dimensional investigation is directed. A straightforward, examination of extension superstructures are considered to decide live-load factors that can be utilized to dissect various kinds of scaffolds. The dissemination of the live burden factors circulates the impact of burdens transversely over the width of the scaffold superstructure by proportioning the plan paths to singular supports through the conveyance factors. This examination study comprises of the assurance of Live Load Distribution Factors(LLDFs) in both inside and outside supports for on a level plane bended solid box brace connects that have focal points, with one range surpassing 34 degrees. This investigation has been done dependent on genuine geometry of extensions planned by an organization for various areas. The objective of utilizing genuine geometry is to accomplish progressively reasonable, exact, and down to earth results. Additionally, in this investigation, 3-D displaying examinations for various range lengths (80, 90, 100, 115, 120, and 140 ft) have been first led for straight extensions, and afterward the outcomes contrasted and AASHTO LRFD, 2012 conditions. The purpose of beginning with straight scaffolds investigations is to get a sign and origination about the LLDF acquired from AASHTO LRFD recipes, 2012 to those got from limited component examinations for this sort of extension (Concrete Box Girder). From that point forward, the examinations have been accomplished for bended extensions having focal edges with one range surpassing 34 degrees. Proposals investigations led for different range lengths that had just been utilized for straight extensions (80, 90, 100, 115, 120, and 140 ft) with various focal points (5º, 38º, 45º, 50º, 55º, and 60º). The consequences of displaying and examinations for straight scaffolds demonstrate that the current AASHTO LRFD equations for box-support spans give a traditionalist gauge of the structure bowing second. For bended scaffolds, it was seen from a refined examination that the circulation factor increments as the focal point increments and the current AASHTO LRFD equation is pertinent until a focal edge of 38º which is somewhat out of as far as possible.

Keywords*— *AASHTO LRFD recipes, LLDF, scaffolds

I. Introduction

A. Live Load Distribution Factors

The Live Load Distribution Factors (LLDF) depicted in the AASHTO-LFD details had been utilized for over 50 years before their update in the AASHTO-LRFD Bridge Design Specification. The recipes spoke to in AASHTO-LFD depend on the support dispersing just and are normally introduced as S/D, where S is the separating and D is a steady dependent on the scaffold type. This technique is fit to straight and non-slanted extensions as it were. While the recipes spoke to in AASHTO-LRFD are progressively helpful and exact since they consider more boundaries, for example, connect length, piece thickness, and number of cells for the case support connect typ. The change in AASHTO-LRFD conditions has created some enthusiasm for the scaffold building world and has brought up certain issues. Slanted Bridges will be picked up by utilizing AASHTO-LRFD Specification [3].

Live burden dissemination factors empower architects to investigate connect reaction by rewarding the longitudinal and transverse impacts of wheel stacks independently. These components have disentangled the plan procedure by permitting specialists to consider the brace structure second as the static second brought about by AASHTO standard truck or plan path loads, increased by the live-load dispersion factor determined through AASHTO LRFD, 4.6.2.2.2b [4]. Fig 1.1 shows the inside and outside supports that convey the truck loads. The dispersion factor diminishes when the extension shares and circulates the heap productively among neighboring supports. This prompts a low structure second for a given truck size.

Since 1931, live burden appropriation factors have been portrayed in the Standard Specification for Highway Bridges. The early qualities have been refreshed and adjusted in 1930 by Westergaard and in 1948 by Newmark as new examination results opened up. The dissemination factor introduced in AASHTO Standard Specifications was S/5.5 for an extension developed with a solid deck upheld on pre-focused on solid supports. This is appropriate for pans that convey at least two paths of traffic, where S is the support dispersing in feet. This factor is applied to the second brought about by one line of wheels. All things being equal, a few analysts, for example, Zokaie have noticed that the progressions in LLDF throughout the most recent 55 years have prompted irregularities in the heap conveyance models in the Standard Specifications these include: conflicting changes in dispersion components to reflect changes in structure path width; conflicting thought of a decrease in load power for different path stacking; and conflicting check of precision of wheel load circulation factors for different extensions [4].

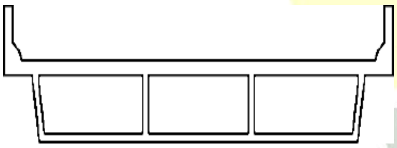
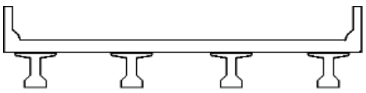
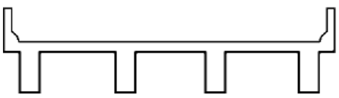
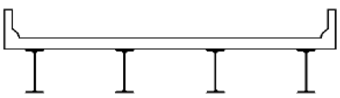
In 1994, AASHTO LRFD Specifications suggested new burden appropriation conditions as an option in contrast to the Standard Specifications. These conveyance conditions were gotten from the National Cooperative Highway Research program (venture 12-26). The recipes consider many scaffold boundaries including slant and coherence as opposed to restricted boundaries that were recently considered in AASHTO Specification. As indicated by Zokaie, the new circulation factors exist in 5 percent of the genuine dispersion factors found by breaking down the extension superstructure by utilizing the limited component model.

Despite the fact that the dissemination calculate equations AASHTO LRFD are viewed as more exact than the conveyance factors in the Standard Specifications, a few scientists like Chen and Aswad, have discovered that they are traditionalist, and they are uneconomical for spans with enormous range – to-profundity proportions. As per Chen and Aswad the conservatism of the conveyance variables can be 18 to 23 percent for inside braces and 4 to 12 percent for outside supports [4].

LRFD Article 4.6.2.2.2 presents live burden dissemination factor recipes for a few basic kinds of extension superstructures. These dissemination factors give a small amount of structure paths that ought to be utilized to an individual brace to plan it for second or shear. The variables consider cooperation among loads from different paths. Table 1.1 gives a few kinds of scaffold superstructures with conditions of live-load conveyance factors for second in inside and outside braces for various sorts of straight extensions. There are numerous different sorts of scaffold superstructures recorded in the AASHTO LRFD [1]

AASHTO LRFD gives recipes to decide live burden dissemination factors for a few normal extension superstructure types. Nonetheless, there is a limitation of utilizing these conditions for bended extensions having focal edges that surpass 34 degrees. This exploration gives an examination and displaying investigations for evenly bended solid box support connects that have a level of ebb and flow more noteworthy that 34 degree. Also, this proposition presents an examination for bended ladies that considered the impact of outward and slowing down powers.

TABLE I. LLDF EQUATIONS FOR MOMENT IN INTERIOR AND EXTERIOR GIRDERS

Type of Superstructure	LLDF equations		Range of applicability
	For Moment in Interior Girders		
Cast-in-Place Concrete Multi-cell Box 	One Design Lane Loaded $(1.75+ S/3.6) (1/L)^{0.35} (1/Nc)^{0.45}$ Two or More Lanes Loaded $(13/Nc)^{0.3} (S/5.8) (1/L)^{0.25}$		$7.0 \le S \le 13.0$ $60 \le L \le 240$ $Nc \ge 3$ If Nc > 8 use Nc = 8
	For Moment in Exterior Girders		
	One Lane Loaded g= We/14	Two or More Lanes Loaded g= We/14	$We \le S$
Precast Concrete I or Bulb-Tee Sections 	One Design Lane Loaded $0.06+(S/14)^{0.4} (S/L)^{0.3} (Kg/12\,Lt_s^3)^{0.1}$ Two or More Lanes Loaded $0.075+(S/9.5)^{0.6} (S/L)^{0.2} (Kg/12\,Lt_s^3)^{0.1}$		$3.5 \le S \le 16.0$ $4.5 \le ts \le 12.0$ $20 \le L \le 240$ $Nb \ge 4$ $10{,}000 \le Kg \le 7{,}000{,}000$
Cast-in-Place Concrete Tee Beam 	***For Moment in Exterior Girders***		
Cast-in-place concrete slab, precast concrete slab, steel 	One Lane Loaded Lever Rule	Two or More Lanes Loaded g = e ginterior e = 0.77+(de/9.1)	$1.0 \le de \le 5.5$

B. Objective of the Study

The objective of this examination is to ascertain live burden appropriation factors (LLDFs) for inside and outside braces of on a level plane bended solid box support connects that have focal edges, inside one range surpassing 34 degrees. The geometry that is utilized in this investigation dependent on genuine geometry utilized in certain extensions. The objective of utilizing genuine geometry in this examination is to acquire progressively sensible, precise, and down to earth results.

These outcomes will give factors that can be utilized by building originators to decide live burden dispersion factors on any individual required brace on a level plane bended solid box support spans. All straight and bended scaffolds that utilized in this investigation are kaleidoscopic in traverse the inside help.

C. Selection of Box-Girder Bridges

The Box-Girders connect is a typical auxiliary structure in both steel and cement. The shut segment of the crate support, Fig 1.1 makes the scaffold superstructure torsionally a lot stiffer than its open partner. This trademark makes the case support perfect for spans that have critical twist actuated by level ebb and flow coming about because of street arrangements. For instance, the case support connect is frequently utilized for firmly dispersed exchanges that require bended arrangements in view of its torsional opposition and fine tasteful characteristics [11].

The Box-Girders can be of various structures and geometry. Box support decks are thrown set up units that can be developed to follow any ideal arrangement in plan, with the goal that straight, slant and bended extensions of different shapes are normal in the roadway framework. The investigation and plan of box-support spans are mind boggling in view of its three dimensional conduct comprising of twist, mutilation and bowing in longitudinal and transverse ways. There are numerous techniques for investigation of box supports. Be that as it may, in the majority of the strategies the specific idea of bended box braces are not considered on account of the suppositions made in the investigation. The most thorough approach to investigate such an intricate framework and acquire nitty gritty outcomes is through limited component demonstrating. The limited component strategy by utilizing shell components might be utilized for the crate support connect [14].

Cast set up multi cell solid box support connect types might be planned as entire width structures. Such cross-areas will be intended for the live burden conveyance factors in AASHTO LFRD, Articles 4.6.2.2.2 and 4.6.2.2.3 for inside supports, increased by the quantity of networks. Notwithstanding the technique for investigation utilized, estimated or refined, outside braces of multi bar spans will not have less opposition than an inside bar. Entire width configuration is proper for torsionally firm cross-areas where load-sharing between supports is amazingly high and torsional loads are difficult to gauge [1].

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