Appendix D Example 6 – Stability of Conventional Falsework in Longitudinal Direction

Refer to *Falsework Manual*, Section 6-4, *Longitudinal Stability.* This example demonstrates how to check stability of conventional falsework with horizontal forces applied in the longitudinal direction.

Given Information

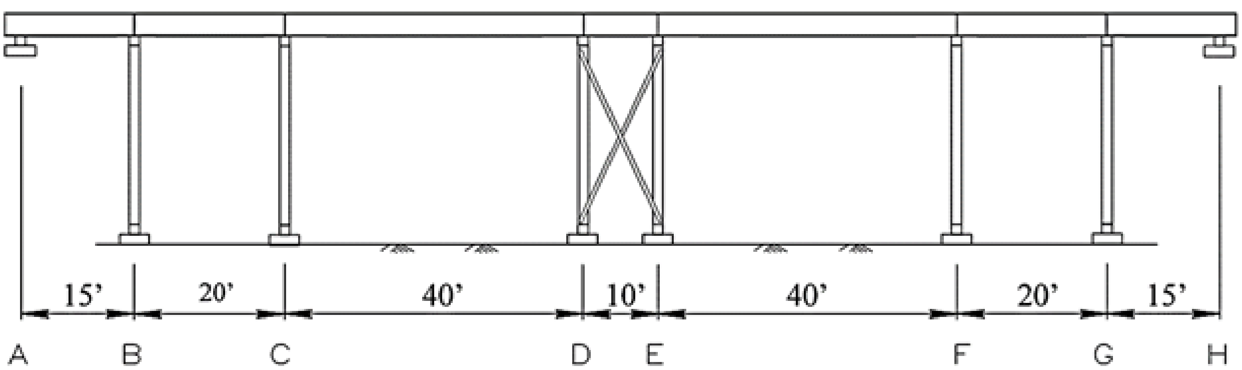

Figure D-6-1. Braced Falsework System

DL_1 = Weight of concrete per girder based on 160 pcf = 2000 plf

DL_2 = Weight of falsework stringer = 100 plf

The controlling horizontal force is 2% dead load.

Determine the Stability of the Bents

Investigate the stability of the falsework bents when the horizontal design load is applied in the longitudinal direction.

Calculate the Horizontal Design Load:

Span	Horizontal Design Load	Span	Horizontal Design Force
AB = GH	0.02 (2000 + 100) 15 = 630 lb	CD = EF	0.02(2000 + 100)40 = 1680 lb
BC = FG	0.02 (2000 + 100) 20 = 840 lb	DE	0.02(2000 + 100)10 = 420 lb

Calculate the Friction Transfer Capability (FTC)

From *Falsework (FW) Manual,* Section 6-4.03, *Friction,* FTC in the unloaded condition is the FTC that will be developed by the dead load of the falsework members plus an allowance for the weight of forms and reinforcing steel.

Weight of falsework members = 100 PLF

Weight of forms and reinforcing steel $\frac{15}{160}$ (2000 plf) = 188 plf

μ_S = 0.30 (*FW Manual*, Sect. 4-7.01)

Location			Location		
Between Bent	And Stringer	FTC (lb)	Between Bent	And Stringer	FTC (lb)
A B G H	AB BA GH HG	$0.30(100+188)\frac{15\text{ft}}{2} = 648$	C D E F	CD DC EF FE	$0.30(100+188)\frac{40\text{ft}}{2} = 1728$
B C F G	BC CB FG GF	$0.30(100+188)\frac{20\text{ft}}{2} = 864$	D E	DE ED	$0.30(100+188)\frac{10\text{ft}}{2} = 432$

As per *FW Manual*, Sect. 6-2, *Inherent Stability*:

Bents A & H are inherently stable (since post height < 3 times post width) and bracing is not required. Bents B, C, D, E, F, & G are not inherently stable (since post height > 3 times post width) and bracing, blocking, ties, etc. are required.

In the case of this example problem, bents D & E are made stable by diagonal bracing and bents B, C, F, & G will have to be made stable by strutting the horizontal forces to the stable bents.

Note: Strutting to stable bents can be forward or back and multiple load path solutions are possible. This example assumes loads will move forward.

Bent A

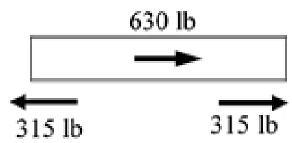

Figure D-6-2. Bent A Horizontal Forces

Half the horizontal design force for stringer AB is taken at stable bent A. Since the 315 lb is less than the FTC = 648 lb, no mechanical connection is required. The other half is strutted ahead through bent B.

Bent B

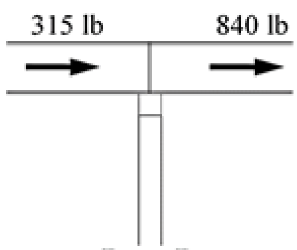

Figure D-6-3. Bent B Horizontal Forces

Since the FTC between bent B and stringer BA = 648 lb > 315 lb, and since the FTC between bent B and stringer BC = 864 lb > 315 lb, the 315 lb coming from span BA can be strutted ahead to a stable bent and no mechanical connections are required.

Bent C

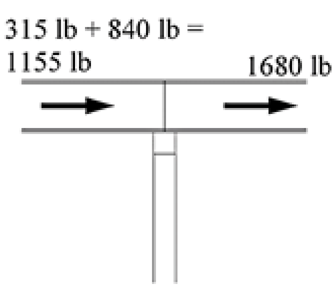

Figure D-6-4. Bent C Horizontal Forces

Since the FTC between bent C and Stringer CB = 864 lb < 1155 lb, and the FTC between bent C and stringer CD = 1728 lb >1155 lb, a mechanical connection between bent C and stringer CB will be required, but friction between bent C and stringer CD will be adequate to strut the 1155 lb coming from spans AB & BC to a stable bent.

Bent D

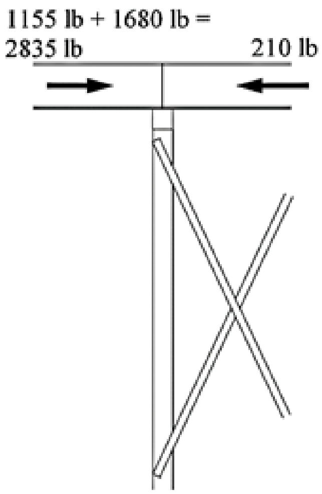

Figure D-6-5. Bent D Horizontal Forces

Since the FTC between bent D and stringer DC = 1728 lb < 2835 lb, a mechanical connection between bent D and stringer DC will be required.

The 420 lb in span DE will cause a reaction of 210 lb (at each end) which is < FTC between bent D and stringer DE = 432 lbs. Therefore, the 210 lb at bent D can be transferred to this stable bent by friction. The diagonal bracing at bent D then must take 2835 + 210 = 3045 lbs.

Bent E

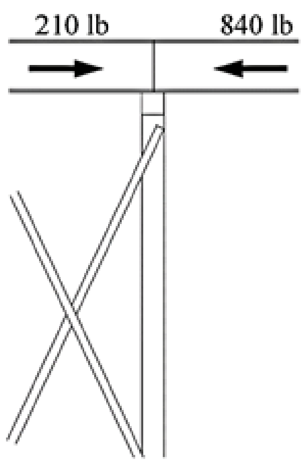

Figure D-6-6. Bent E Horizontal Forces

Since the FTC between bent E and stringer ED = 432 lb > 210lbs, the 210 lb can be taken to the stable bent E through friction. The 1680 lb in span EF will cause a reaction of 840 lb (at each end) and since the FTC between bent E and stringer EF = 1728 lb > 840lbs, the 840 lb can be taken to the stable bent E through friction and the diagonal bracing will then have to take 210 + 840 = 1050 lbs.

Bent F

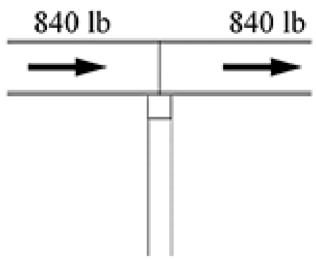

Figure D-6-7. Bent F Horizontal Forces

Since the FTC between bent F and stringer FE = 1728 lb > 840 lb, and since the FTC between bent F and stringer FG = 864 lb > 840 lb, the 840 lb coming from span FE can be strutted ahead to a stable bent and no mechanical connections are required.

Bent G

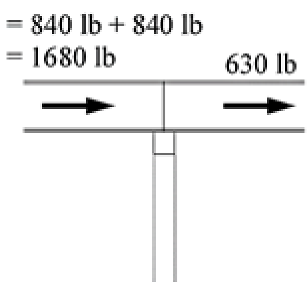

Figure D-6-8. Bent G Horizontal Forces

Since the FTC between bent G and stringer GF = 864 lb < 1680 lb, and since the FTC between bent G and stringer GH = 648 lb < 1680 lb, mechanical connections between both stringers (GF and GH) and bent G will be required to strut the forces to stable bent H.

Bent H

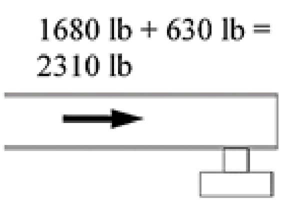

Figure D-6-9. Bent H Horizontal Forces

Since the FTC between bent H and stringer HG = 648 lb < 2310 lb, a mechanical connection is required to get the forces coming from spans EF, FG, & GH into the stable bent H.

The diagonal bracing for bents D & E must be capable of resisting a total horizontal force of 3045 lb from bent D and 1050 lb from bent E provided the bents D and E are strutted so they act together. The total force acting on the strutted bracing system is 3045+1050 = 4095 lbs.

A similar analysis is required when the horizontal design forces are applied in the opposite direction.