

Chapter 3: Loads

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3-1 Introduction

Falsework must be designed to resist the sum of all dead and live vertical loads, plus an assumed horizontal load, as provided in the [Contract Specifications](#), Section 48-2.02B(2), *Falsework – Design Criteria – Loads*.

The vertical loads include:

- Dead load, which includes weight of concrete, reinforcing steel, forms, and falsework.
- Live load, which includes equipment, crew, and tools.
- Minimum load, which is applied to provide an acceptable strength of all falsework members.

The assumed horizontal loads include:

- A sum of equipment, construction sequence, other causes, and wind loading.
- A minimum horizontal load of 2% of the total weight of the superstructure and falsework applied during the unloaded and loaded stage of the falsework.

Loads due to differential settlement must also be considered in the design. Modified vertical design loads and traffic impact loads are applied to falsework over or adjacent to roadways and railroads.

Due to the temporary nature of falsework, earthquake loads are not considered. The probability of an earthquake occurring while the falsework is up is very low. However, there is some probability of an earthquake occurring during stage construction. Therefore, the bridge designer is directed to consider a reduced earthquake loading on partially completed structures over or adjacent to traffic as stated in *Memo to Designers (MTD)*, [Section 20-2](#), *Site Seismicity for Temporary Bridges and Stage Construction*.

3-2 Vertical Load

3-2.01 Dead Load

When calculating the dead load imposed on a falsework member (except for deflection as discussed below) the dead load imposed is the weight of the:

- Concrete
- Forms
- Reinforcing steel

- Self-weight of the member

The minimum value given in the *Contract Specifications*, Section 48-2.02B(2), *Falsework – Design Criteria – Loads*, for the weight of the concrete, forms, and reinforcing steel is:

- 160 per cubic foot (pcf) for normal concrete.
- 130 pcf for lightweight concrete.

For typical concrete bridges the weight of forms and rebar may be estimated as:

- 15 pcf

When calculating deflection as allowed by the *Contract Specifications*, Section 48-2.02B(3), *Stresses, Loadings, and Deflections*, the dead load on the member is the weight of the reinforced concrete only (see Section 4-2.01, *Maximum Allowable Deflection*). For the dead load calculation, it is customary to use:

- 150 pcf for normal concrete.
- The actual value as determined from unit-weight tests for lightweight concrete.

Falsework must be designed to support the dead load of the entire superstructure cross section, excluding the weight of the bridge railings during the unloaded and loaded stages.

There is an exception for box girder stems and soffit. Girder stems may be considered self-supporting between falsework bents if the following conditions are met:

- Distance between falsework bents does not exceed 4 times the depth of the portion of the girder stem placed in the first pour
- Deck concrete is placed more than 5 days after girder stem concrete

This exception is based on strut-and-tie modeling. The purpose of this exception is to reduce the design dead load on joists and stringers for box girder bridges in those cases where the girder stems and soffit have gained sufficient strength to carry the weight of the deck.

3-2.02 Live Load

The design live load consists of a combination of:

- 20 psf uniform load applied over the total area supported.
- The actual weight of construction equipment applied as a concentrated load at each point of contact.

- 75 pounds per lineal foot (plf) uniform load applied at the outside edge of deck overhangs.

Engineering judgment is required when investigating the effect of live loads caused by construction equipment. Some instances will occur where equipment live load and concrete dead load are not applied at the same time.

For application of the uniform 20 psf live load, the total area supported includes the area of construction walkways that extend beyond the outside edge of the deck or the deck overhang. However, the design load for all falsework supporting the walkway is the greater of the actual vertical load, or the minimum total design load of 100 psf, as discussed in the following section.

3-2.03 Minimum Total Design Load

3-2.03A Introduction

The *Contract Specifications*, Section 48-2.02B(2), *Falsework – Design Criteria – Loads*, require that the minimum total design load, dead load plus vertical live load, to be used in the design of any member must not be less than 100 psf.

The 100 psf load represents a combination of dead and live loads including miscellaneous loads such as crew, tools, equipment, and material staging. This load is in line with Cal/OSHA requirements for falsework.

3-2.03B Application

For application of this requirement, the meaning of the term “total area supported” includes any area that is subjected to dead load and/or live load during any construction sequence.

Referring to Figure 3-1, *Walkway Support Members*, the overhang joist, header, post, soffit joist, stringer, and members supporting the stringer, all see the construction walkway area as part of the “total area supported.” See also Figure 3-2, *Edge of Deck and Walkway Loading*.

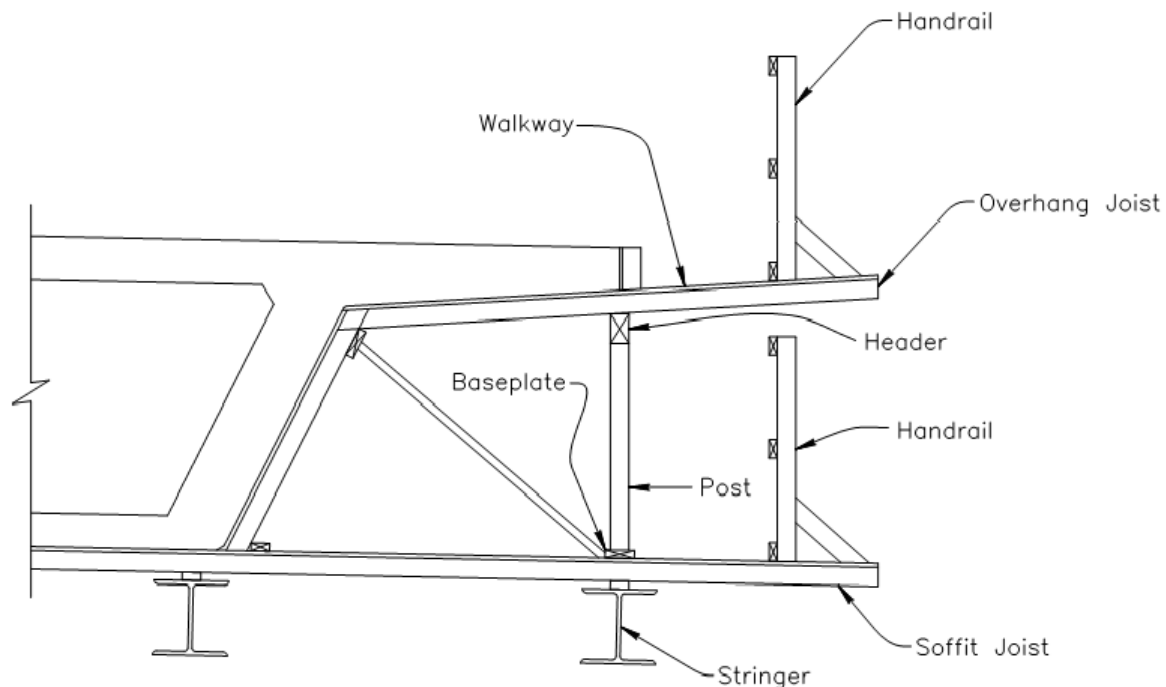


Figure 3-1. Walkway Support Members.

3-2.04 Deck Overhangs

3-2.04A Introduction

Experience has shown that concentrated live loads, such as the load from working, finishing, and curing the concrete and other miscellaneous small equipment and materials not otherwise considered, can and do occur at or near the edge of a bridge deck during the concrete placing and finishing operations. In the case of deck overhangs, these loads may significantly increase the stresses in the overhang falsework support system.

The Contractor may use a variety of equipment to construct bridges and place, finish, and, cure concrete, such as belt spreaders, concrete pavers (Bidwell), and concrete buggies. See also Section 3-2.04D, *Loaded Zone*, for miscellaneous equipment and material not otherwise considered, which are used during concrete placement and finishing operations.

3-2.04B Application

Referring to Figure 3-2, *Edge of Deck and Walkway Loading*, to account for the accumulated effect of the loads mentioned above, the *Contract Specifications*, Section 48-2.02B(2), *Falsework – Design Criteria – Loads*, include the requirement of:

- Dead load.

- 75 plf live load applied along the outside edge of all deck overhangs, applied over 20 feet, see Section 3-2.04D, *Loaded Zone*. This load represents the concrete finishing and curing operations and other miscellaneous small equipment and materials not otherwise considered.
- Concentrated equipment load from concrete bridge pavers, etc.
- 20 psf uniform live load applied over the total area supported by the falsework.
- 100 psf minimum total design load (also applied on construction walkway adjacent to the edge of the deck overhang).

The uniform load of 75 plf is only applied at the edge of deck overhangs. It is not applied along the edge of slab bridges or box girder bridges without overhangs.

Figure 3-2, *Edge of Deck and Walkway Loading*, is a schematic of the various loads and load combinations specified for design of the deck overhang falsework.

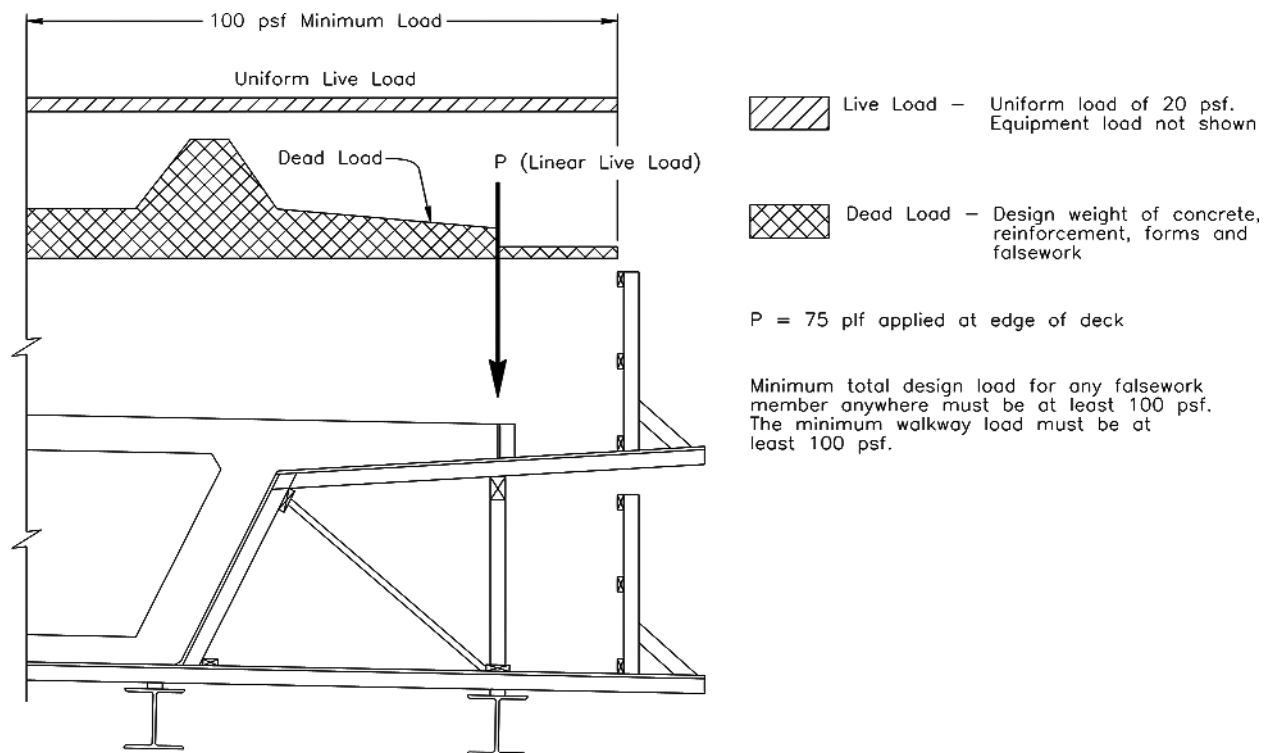


Figure 3-2. Edge of Deck and Walkway Loading.

3-2.04C Deck Overhang Brackets

For deck overhang brackets, the 75 plf and the Bidwell wheel load should not be added together but be considered separately. Use the controlling load for the design of the overhang bracket. The reasoning is that the 75 plf is more likely to occur in front of or

behind the Bidwell rather than beside it, hence the individual overhang brackets will only see one of these loads at any given time.

3-2.04D Loaded Zone

While the 75 plf load is a necessary design consideration for deck overhang falsework, its application to falsework components below the overhang support system may, in the case of long falsework spans, impose a design load that is unlikely to occur in actual practice. To prevent an unrealistic loading condition for falsework members, the distance over which this load is applied is limited to a loaded zone of 20 feet in length, measured along the edge of the overhang. The loaded zone will be viewed as a moving load positioned to produce maximum stresses in the member under consideration.

The loaded zone concept may be used when checking stresses in stringers, caps, posts, and other members of the falsework system, below the level of the bridge soffit, in all cases where the falsework spans exceed 20 feet in length.

This loaded zone concept will be applied to the following two cases:

- Application of the 75 lbs/ft live load on the edge of deck
- The minimum total design vertical load (100 psf) on a construction walkway adjacent to the edge of the deck overhang

3-2.05 Falsework Over or Adjacent to Roadways or Railroads

3-2.05A Introduction

The *Contract Specifications*, Section 48-2.02B(4), *Design Criteria – Special Locations*, include specific requirements for falsework over or adjacent to roadways and railroads. For a more detailed explanation of these requirements, see Section 4-12, *Falsework Over or Adjacent to Roadways or Railroads*.

3-2.05B Modified Design Load

The vertical design load for posts and towers, over or adjacent to roadways and railroads, must be designed for the greater of:

- 150% of the calculated post load, not including any increased or readjusted loads caused by prestressing.
- Increased or readjusted loads caused by prestressing.

The modified design load also applies to posts and towers that are adjacent to roadways and railroads, which do not support falsework members over traffic, but are

within the limits shown in Section 4-12.01, *Introduction*. For more details, see Section 4-12.05E, *Modified Design Load*.

3-3 Horizontal Load

3-3.01 Introduction

The falsework bracing system must be capable of resisting an assumed horizontal load applied in any direction. The specified horizontal design load is an assumed load. Since it is an assumed load, it will not necessarily be equal to any actual horizontal load that may occur. Nevertheless, the bracing system must be designed to resist the assumed horizontal load to ensure stability at all stages.

The minimum assumed horizontal load will generally govern the design for typical highway bridges and other structures where the falsework height is less than 30 feet. Depending on configuration, wind loads may govern when the height of falsework exceeds 30 feet and wind loads will govern most designs where height exceeds about 40 feet.

3-3.02 Application

For typical analysis, the horizontal load is applied at the top of the post (bottom of top cap).

The design horizontal load:

- Is the sum of any actual loads due to equipment, construction sequence or other causes, plus the wind load?
- The assumed horizontal load must not be less than 2% of the total dead load at the location under consideration. The total dead load includes the weight of the falsework to be supported and the total weight of the new structure to be supported.

The falsework bracing system must be designed to resist the assumed horizontal load with the falsework in both the:

- Unloaded condition.
- Loaded condition.

For concrete structures the weight of falsework, forms and rebar may be used to resist the overturning in the unloaded condition. See Section 6-5.04, *Resisting Moments*.

The falsework bracing must be designed to resist the assumed horizontal load to ensure both transverse and longitudinal stability. Falsework system stability is discussed in Chapter 6, *Stability*.

3-3.03 Wind Loads

Determining the actual force exerted by wind on bridge falsework is a highly indeterminate problem due to the number of variable factors involved. Although, it is possible to establish values for all the variables in a falsework system, it is quite cumbersome and time consuming. More complex methods of calculation are often no more accurate than a simplified method because of the subjective nature of some variables. Therefore, SC has developed *Contract Specifications*, Section 48-2.02B(2), *Falsework – Design Criteria – Loads*, which recognizes the effect of the more influential variables and assigns a coefficient to cover the others. By using this simplified method, there is statewide uniformity in calculating wind loads.

The wind pressure values were developed from the basic theory of fluid flow with a design wind velocity based on a 100-year recurrent wind prevalent in most of California. Reductions were taken to account for the temporary exposure of falsework to wind forces and increased for gusts. Variables are wind velocity, downwind width of the system, downwind distance between adjacent members, drag or shape factor for the various members, “solidity ratio” or percentage of solid-surface in a given gross frontal area, and height of the falsework above the ground.

For the wind load calculation, the specification considers two general falsework types:

- Heavy-duty metal shoring and steel pipe column falsework with a vertical load carrying capacity greater than 30 kips per tower leg or pipe column.
- All other falsework, which includes timber post, metal pipe frame, and metal shoring systems. It also includes falsework above the heavy-duty shoring or pipe columns. For some examples, see Figure 3-3, *Examples of Falsework for Wind Loading*.

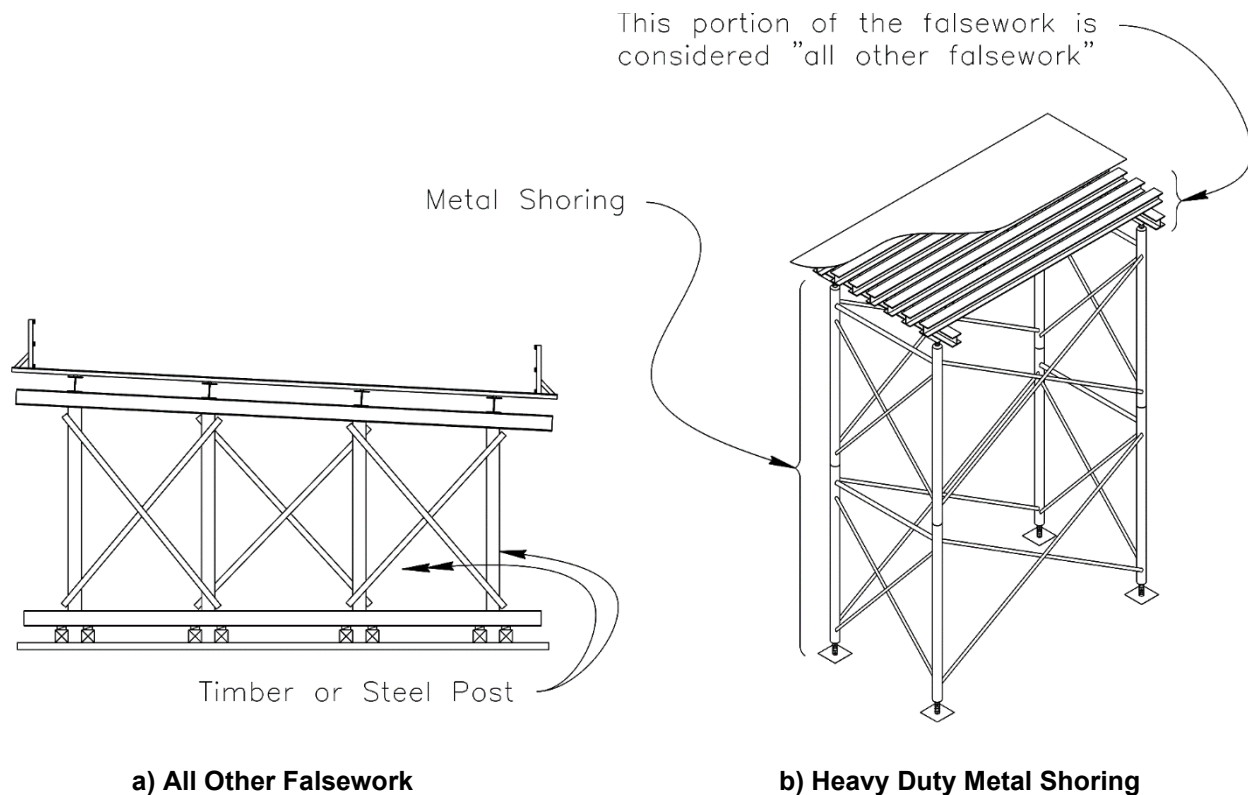


Figure 3-3. Examples of Falsework for Wind Loading.

For heavy duty shoring and pipe column falsework systems, the wind load is the product of the wind impact area, a shape factor, and an appropriate wind pressure value. The wind impact area is defined as the total projected area of all elements in a tower face or bent normal to the direction of the wind. The shape factor is included to account for the effect of wind drag forces on the members and, for heavy duty shoring, the effect of wind acting on members in the other three tower faces. See Section 3-3.03A, *Wind Load on Heavy Duty Metal Shoring*, for more details.

For all other falsework, including falsework supported by heavy duty shoring and pipe columns, the wind load is the product of the wind impact area and an appropriate wind pressure value. The wind impact area is the gross projected area of the falsework and any unrestrained portion of the permanent structure, e.g. bridge precast girder or steel girder without deck slab, excluding the area between falsework bents or towers where diagonal bracing is not used. In the specification context, the term "diagonal bracing" does not include flexible bracing systems, such as cable, reinforcing steel bars, steel rods and bars, and similar members that do not resist compression.

For all falsework types, the wind pressure value is a function of the height of the falsework. Wind pressure values, for each height zone, are tabulated in the *Contract Specifications*, Section 48-2.02B(2), *Falsework – Design Criteria – Loads*.

Wind pressure height zones are always measured from the ground up regardless of falsework configuration. Except for falsework on driven pile bents, the height to be used for the wind impact area calculation is the vertical distance between the base elevation of the component of the system, about which overturning rotation can occur, and the bridge soffit. In the case of pile bents, judgment is required to determine the lower limit of the wind impact area. If the piles are cut off and capped near the ground, the lower limit will be the plane at the pile cut-off elevation. If, however, the piles extend an appreciable distance above the ground or above the water surface for structures over water, the entire height of the falsework (measured from ground or water surface to bridge soffit) should be used.

The formwork extending above the bridge soffit should not be included in the wind impact area. This formwork is excluded from the wind impact area under the assumption that when subjected to the design wind load, the forms would be blown off the falsework. However, the Contractor should restrain their forms on top of the falsework in the event of high winds.

Example problems illustrating the procedure to be followed when calculating the wind load on various falsework systems are included in Appendix D, *Example Problems*.

3-3.03A Wind Load on Heavy Duty Metal Shoring

For wind acting on heavy-duty steel shoring with a vertical capacity of more than 30 kips per leg, the critical loading condition will occur when the wind force is applied at right angles to the tower faces. The effect of wind acting in other directions need not be considered except in the case of temporary bracing installed during erection and/or removal. See Figure 3-4, *Tower Leg Configurations*, for towers with various leg configurations.

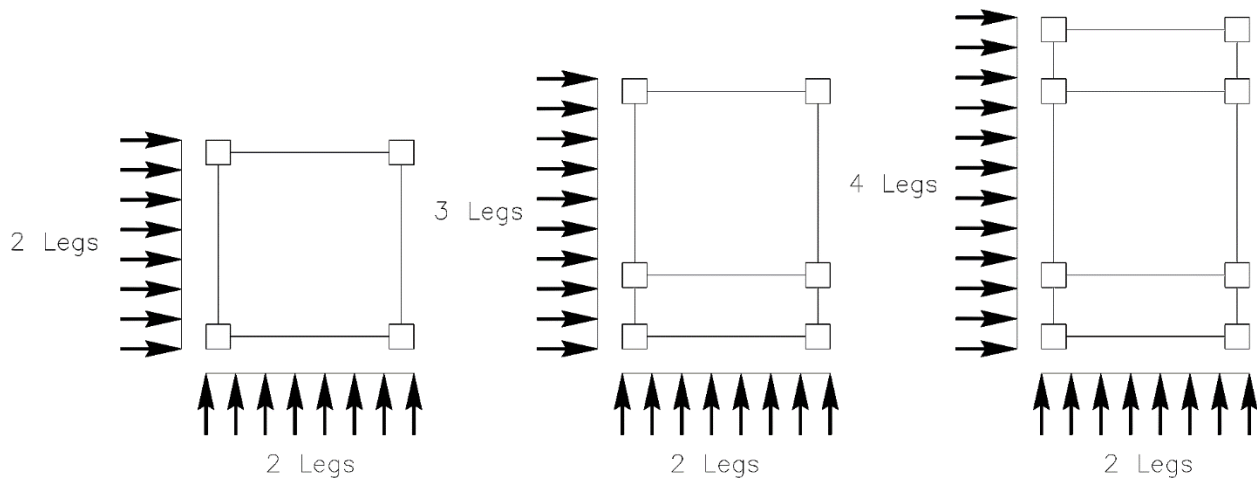


Figure 3-4. Tower Leg Configurations.

Referring to Figure 3-5, *Wind Load*, the horizontal design load produced by wind forces acting on top of the heavy-duty steel shoring is determined as follows:

1. From the table in the *Contract Specifications*, Section 48-2.02B(2), *Falsework – Design Criteria – Loads*, select the wind pressure for each height zone.
2. Multiply the selected wind pressure by the specified shape factor of 2.2 to obtain the design wind pressure.
3. Calculate the total wind force per tower, **WF**, for each height zone by multiplying the design wind pressure by the total projected area of all the elements in the tower face normal to the applied wind.
4. For each height zone, calculate the overturning moment by multiplying the wind force by the distance, **h**, from the base of the tower (top of the tower footing) to the center of pressure. Add the overturning moments for each height zone to obtain the total overturning moment.
5. Divide the total overturning moment by the vertical distance between the tower base and a horizontal plane at the top of the highest tower. The value thus obtained is the horizontal design wind load, **DWL**, acting on top of the tower.

This method calculates the wind load to be applied at top of the tower, so it can easily be compared to the assumed horizontal load, which is also applied at the top of the tower. The greater of the two loads is used for design, see also Example 5, *Horizontal Design Load on Heavy Duty Falsework*, in Appendix D, *Example Problems*.

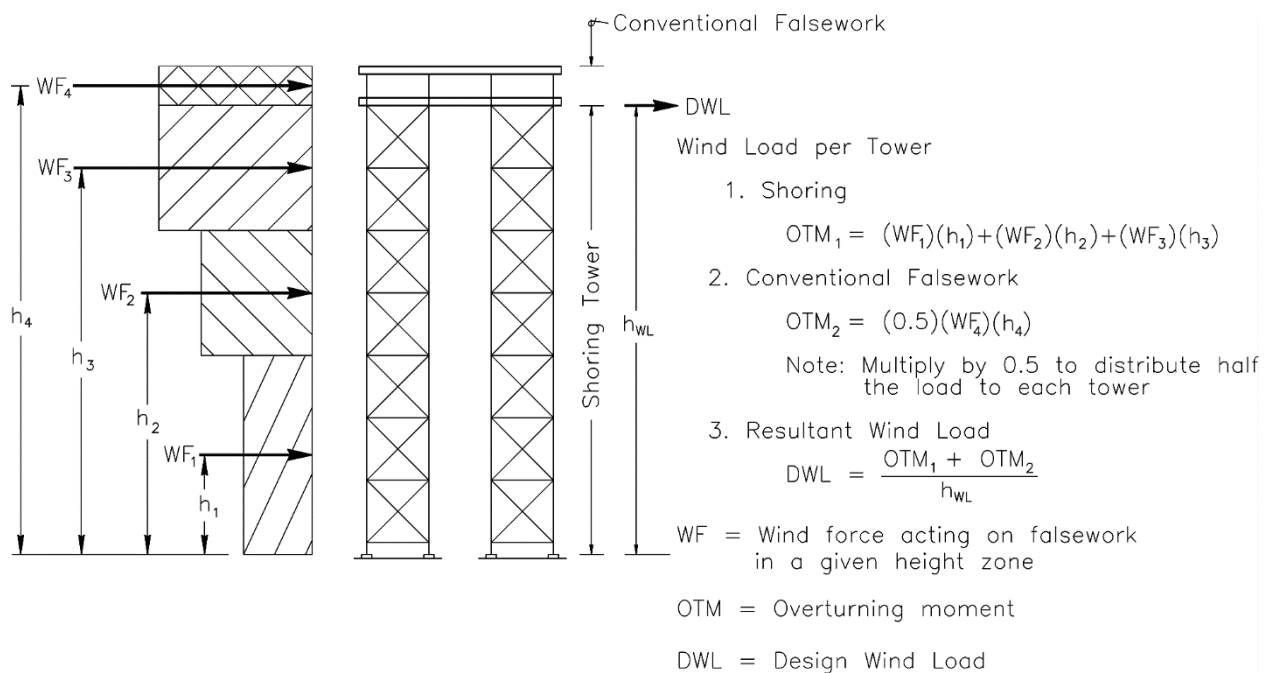


Figure 3-5. Wind Load.

3-3.03A(1) Analysis in the Transverse Direction

Except as provided in the following paragraph, adjacent towers in the same falsework bent must each resist the design wind load because the upwind tower does not shield the downwind tower to any significant degree. This premise will be considered valid regardless of the distance between the towers and will include those configurations where the space between abutting legs of adjacent towers is minimal. See Figure 3-6, *Wind Load on Independent Abutting Towers*.

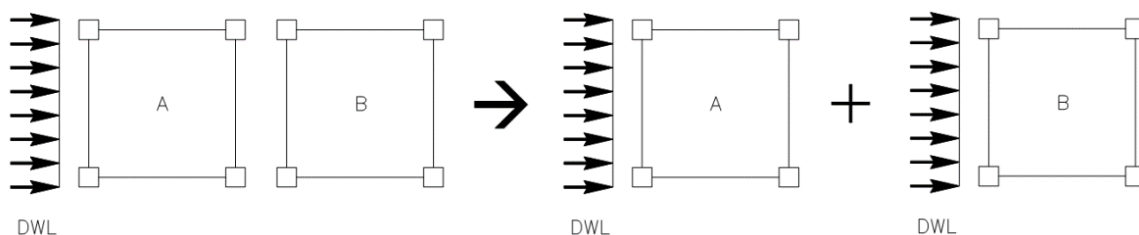


Figure 3-6. Wind Load on Independent Abutting Towers.

If the abutting legs of adjacent towers are connected, the total wind load for the two towers will be assumed as 1.5 times the design wind load acting on the upwind tower face. For analysis of the system, distribute 1/2 of the total wind load (or 75% of the design wind load) to each tower. See Figure 3-7, *Wind Load on Connected Abutting Towers*.

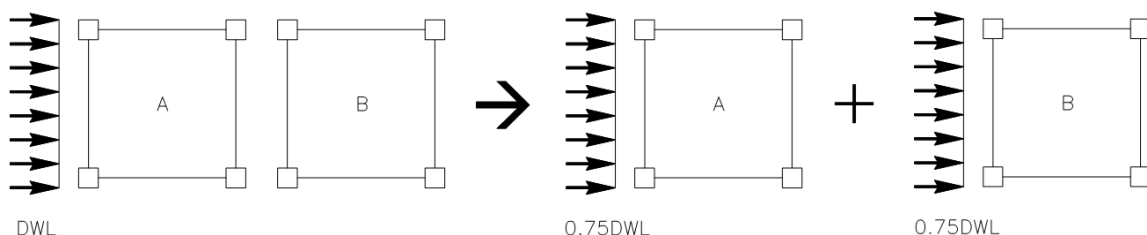


Figure 3-7. Wind Load on Connected Abutting Towers.

In addition to resisting the horizontal load produced by wind acting on the shoring towers, the bracing system must resist the additional horizontal load produced by wind acting on elements of the system supported by the shoring (caps, stringers, joists, etc.). The design wind load on supported falsework is calculated as wind load on “all other falsework”. See Section 3-3.03C, *Wind Load on All Other Falsework*.

Refer to Figure 3-8, *Wind Load on Tower from Supported Falsework*, for wind acting parallel to the falsework bent, the wind load on the supported falsework will be distributed to the individual towers in accordance with the following assumptions:

- For bents with two towers, 1/2 of the design wind load will be distributed to each tower.
- For bents with three towers or more, 1/2 of the design wind load will be distributed to the upwind tower and the remainder distributed equally to all other towers in the bent.

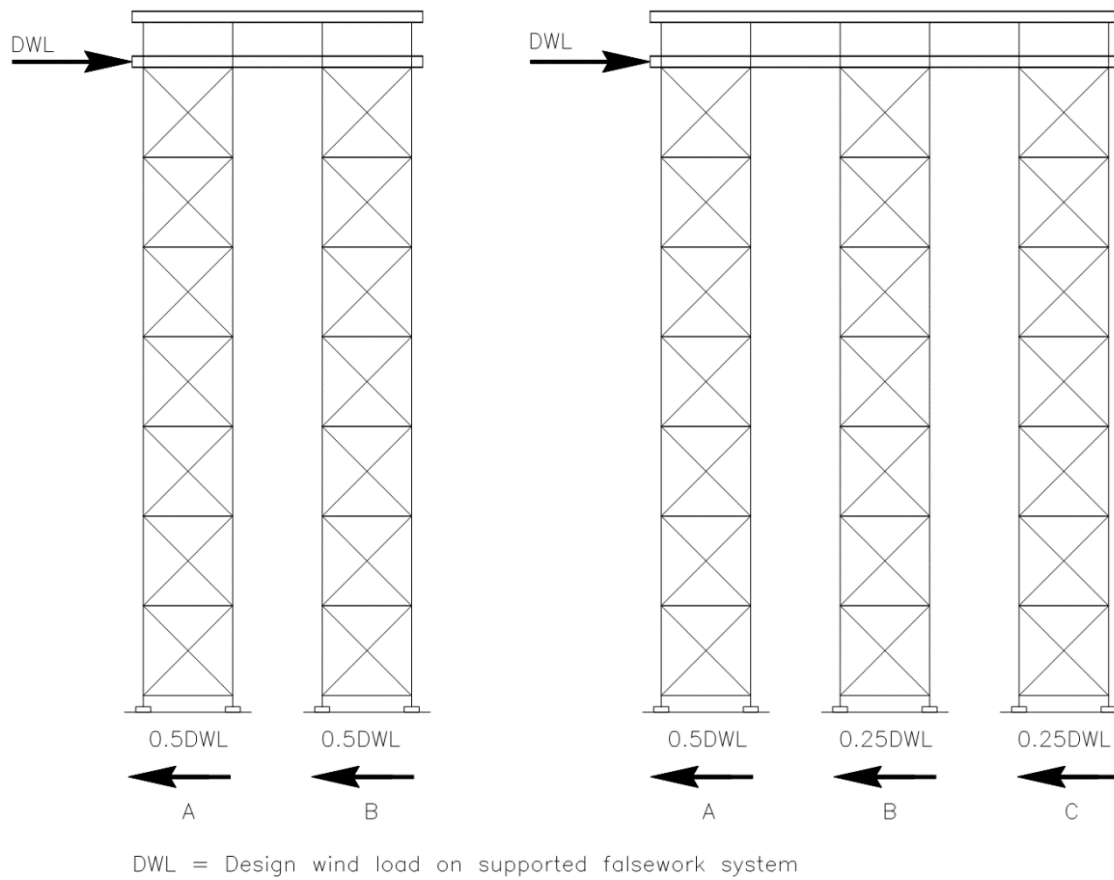


Figure 3-8. Wind Load on Tower from Supported Falsework.

3-3.03A(2) Analysis in the Longitudinal Direction

For wind acting in the longitudinal direction or normal to the bent, the overturning moment calculation (wind load per tower) will be as depicted in Figure 3-5, *Wind Load*, for wind acting on the towers. However, distribution of the load produced by wind acting on the supported falsework depends on the way the system is designed to resist longitudinal forces. The load due to wind acting on the supported falsework should be distributed to the system in accordance with the discussion in Section 6-4, *Longitudinal Stability*.

3-3.03B Wind Load on Pipe Column Falsework

For a pipe column falsework bent with a capacity greater than 30 kips per pipe column, the horizontal design load due to wind acting on the bent is the sum of the wind loads on the individual pipe columns in the bent. While this is obvious for wind acting normal to the bent, it is also the case for wind acting in the transverse direction (parallel to the bent centerline). Typically, the columns are so widely spaced that shielding will not occur.

For adjacent columns where the downwind column is within the shielded zone, the applied wind force on the downwind column will decrease. This will be offset by higher drag forces produced by increased wind turbulence. Because of this offset, ignore any theoretical decrease in wind load attributable to downwind shielding of adjacent pipe columns. See Section 3-3.03D, *Effect of Shielding on Wind Impact Area*, for a discussion of shielding of downwind falsework members.

The shape factor of 1.0 for pipe column falsework specified in the *Contract Specifications*, Section 48-2.02B(2), *Loads*, has been adjusted upward from the common shape factor of 0.8 for circular sections, to account for the effect of bracing and connections, which are ignored in the calculations. This procedure is reasonable for bents with more than 30 kips per pipe column where the bracing consists of small diameter steel rods or reinforcing steel, cable, or small structural shapes. However, in the event larger bracing elements are used, the projected area of the bracing components must be included in the total projected area of the falsework calculated in step 3. For this calculation, use a shape factor of 1.3.

The design wind load is determined as follows:

1. From the table in the *Contract Specifications*, Section 48-2.02B(2), *Falsework – Design Criteria – Loads*, select the wind pressure for each height zone.
2. For each height zone, multiply the selected wind pressure by the specified shape factor of 1.0 to obtain the design wind pressure.
3. For each height zone, calculate the total projected area of the falsework bent. The total projected area is the sum of the projected areas (height of pipe column multiplied by the diameter) of the individual pipe columns in the bent.
4. For each height zone, multiply the design wind pressure from step 2 by the total projected area to obtain the wind force.
5. For each height zone, calculate the overturning moment by multiplying the wind force by the vertical distance between the point at the base of the pipe column frame about which overturning rotation will occur and the center of wind pressure.

6. Add the overturning moments for each height zone to obtain the total overturning moment.
7. Divide the total overturning moment by the vertical distance between the point of overturning rotation at the base of the frame and the top of the highest bent component. The value thus obtained is the horizontal design load for wind acting on the bent.

Engineering judgment is required when determining the point about which overturning rotation will occur. Typically, a pipe column bent is a rigid unit consisting of top and bottom cap beams, two or more columns, and internal diagonal bracing, all supported by a foundation system. Where vertical/grade adjustment is provided at the top of the bent, the lower cap will be supported by corbels, which distribute the load to the foundation. Where vertical/grade adjustment is provided at the bottom, wedges will be located between the bottom cap and the corbels. In either of these typical cases, when overturning forces are applied, the bent will tend to rotate about a point at the bottom of the lower cap beam. For other configurations, the point of rotation should be determined as the lowest point in the system about which rotation can occur while the frame remains rigid.

In addition to resisting the horizontal load produced by wind acting on the falsework members in the bent, the bracing must resist the additional horizontal load produced by wind acting on elements of the falsework supported by the columns (caps, stringers, joists, etc.). The design wind load on supported falsework is calculated as wind load on “all other falsework”. See Section 3-3.03C, *Wind Load on All Other Falsework*.

3-3.03C Wind Load on All Other Falsework

The design wind load to be applied to all other falsework, including falsework supported by heavy duty shoring and pipe column bents, is the product of an appropriate wind pressure value and the wind impact area of the system under consideration.

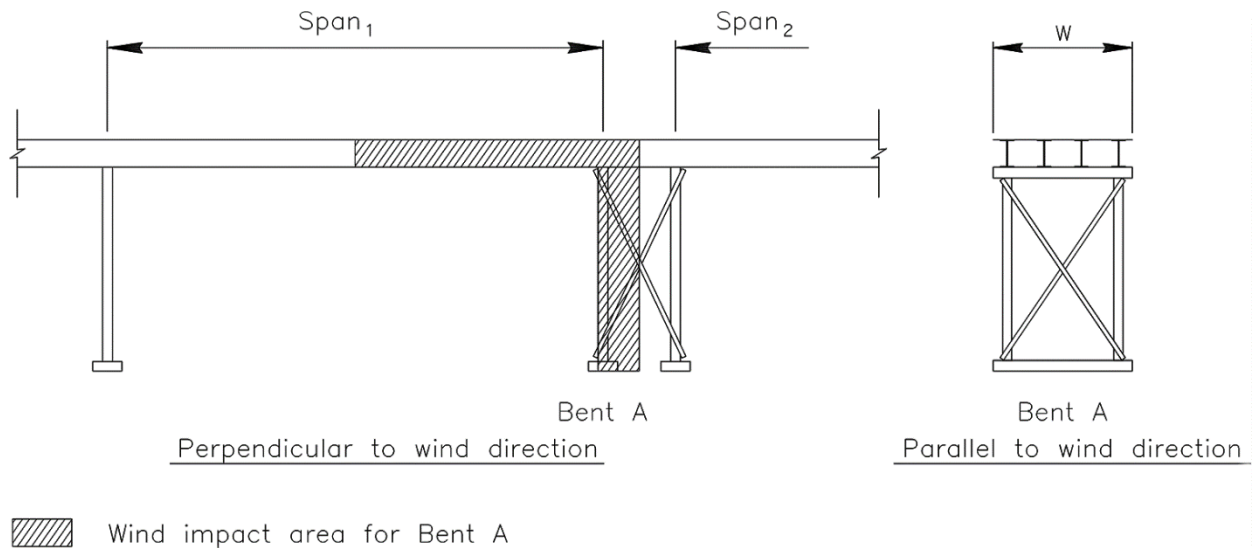


Figure 3-9. Wind Impact Area on All Other Falsework.

The design wind load is calculated as follows:

1. Determine the value for **W**, which is the downwind width of the falsework system, or that portion of the system under consideration, measured in the wind direction. For falsework supported by heavy duty shoring or pipe column bents, **W** will be the distance between the exterior beams or stringers. For all other falsework, **W** is the width of that portion of the falsework which supports a continuous cap or is connected by uninterrupted diagonal bracing.
2. Calculate the value for drag coefficient, **Q**. From the *Contract Specifications*, Section 48-2.02B(2), *Falsework – Design Criteria – Loads*:

$$Q = 1.0 + 0.2W \leq 10 \quad (3-3.03C-1)$$

where **Q** = Drag coefficient (psf)

W = Width of the falsework system as determined in step 1 (ft)

Calculate the wind pressure value for each height zone. Use the wind velocity coefficient for that height zone as listed in the table in the *Contract Specifications*, Section 48-2.02B(2), *Falsework – Design Criteria – Loads*, and the value for **Q** calculated in step 2.

3. Calculate the wind impact area, refer to Figure 3-9, *Wind Impact Area on All Other Falsework*. It is defined in the specifications as the gross projected area of the falsework and any unrestrained element of the permanent structure, excluding the area between falsework bents where diagonal bracing is not used. The term “diagonal bracing” as used in the wind impact area definition does not include flexible bracing.

4. Calculate the total wind force for each height zone by multiplying the calculated wind pressure value by the wind impact area for that height zone.
5. Calculate the overturning moment for each height zone by multiplying the wind force by its distance above the point at the base of the falsework about which overturning rotation will occur. For this calculation, the wind force will be assumed as acting at the center of pressure for the height zone under consideration.
6. Add the overturning moments for each height zone to obtain the total overturning moment.
7. Divide the total overturning moment by the distance from the point at the base of the falsework about which overturning rotation will occur to the top of the falsework post (bottom of top cap). The value thus obtained is the horizontal design load for wind acting on the system.

Overturning failure occurs when a rigid element of the system, such as a braced frame or tower, rotates about the lowest downwind point of frame or tower support. Depending on how the post or leg loads are distributed to the foundation, the point of overturning rotation might be at the top of a corbel or other load distributing member rather than at the bottom of the system as a whole.

For typical falsework, the wind force should be applied parallel to and perpendicular to the longitudinal axis of the falsework bent. The effect of wind acting in other directions typically does not need to be considered in the analysis.

For wind forces (or a wind force component) applied parallel to the axis of a falsework bent, the calculated design wind load for each width, **W**, must be resisted by bracing within that width.

For wind forces applied perpendicular to the bent, resistance to the design wind load should be evaluated in the same manner as resistance to other longitudinal forces.

3-3.03D Effect of Shielding on Wind Impact Area

When investigating the effect of wind acting perpendicular to a falsework bent, consideration may be given to the shielding provided by solid obstructions. Solid obstructions such as abutment fills and pier walls will shield downwind falsework members to some extent, and thus reduce the wind impact area. The degree of shielding provided is not easily determined. To ensure uniformity, apply the assumptions discussed in the following paragraphs.

As wind blows around the end of a solid obstruction, the area over which the wind pressure is effective will increase inward on a 2:1 ratio (downwind distance to inward

distance) as shown in Figure 3-10, *Wind Shielded Zone Limits*. Portions of falsework bents within the shielded zone will be considered as totally sheltered from wind forces.

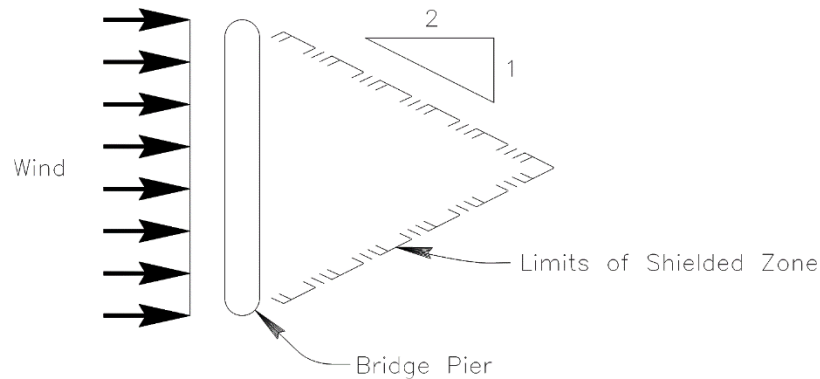


Figure 3-10. Wind Shielded Zone Limits.

Referring to Figure 3-11, *Wind Load on Continuous and Discontinuous Bents*, when bents are located immediately adjacent to solid obstructions and are almost fully shielded, the effect of wind load may be neglected, see Bents 1 and 6. When falsework bents are partially shielded, the term “gross projected area of the falsework” will be interpreted as the area of the bent that is outside the shielded zone, see Bents 2 through 5. For discontinuous bents, such as Bent 2, which is partially shielded, the wind load on Bent 2L may be distributed to the length of the Bent 2L. For continuous bents, such as Bent 5, which is partially shielded, the wind load on Bent 5 may be distributed to the entire length of Bent 5.

Wind may blow from any direction. Falsework bents that are totally shielded from wind in one direction may be fully exposed when the wind forces are applied from the opposite direction.

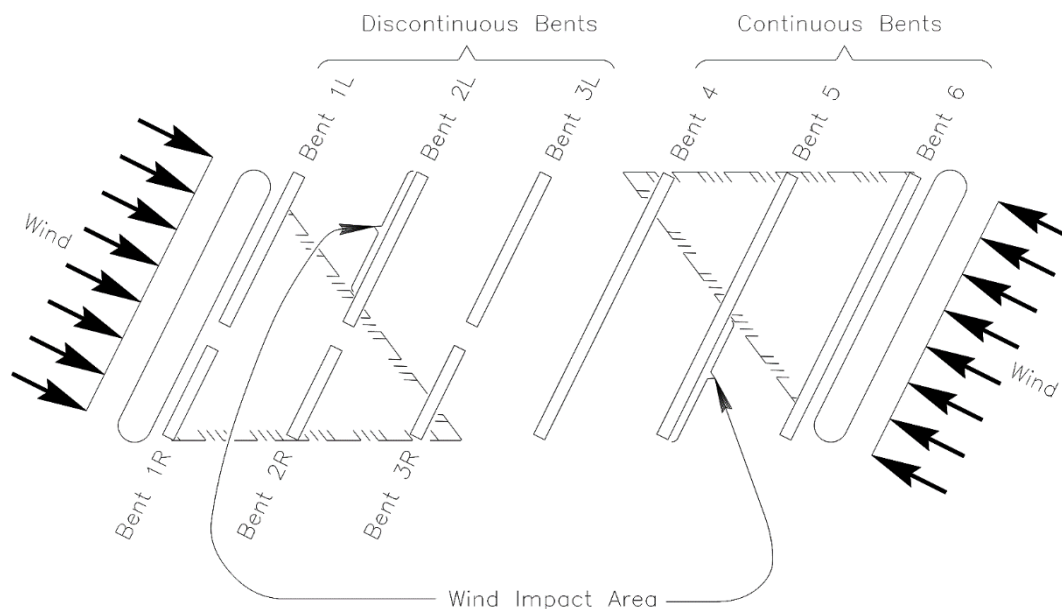


Figure 3-11. Wind Load on Continuous and Discontinuous Bents.

3-3.04 Falsework Over or Adjacent to Roadways or Railroads

The *Contract Specifications*, Section 48-2.02B(4), *Design Criteria – Special Locations*, include specific requirements for falsework over or adjacent to roadways and railroad. For a more detailed explanation of these requirements, see Section 4-12, *Falsework Over or Adjacent to Roadways or Railroads*.

Impact loads are required to be applied at various locations in falsework adjacent to or over roadways and railroads and within the limits described in Section 4-12.01, *Introduction*. For a more detailed explanation of the impact load and the required connections, see Section 4-12, *Falsework Over or Adjacent to Roadways and Railroads*, Section 4-12.05E, *Modified Design Load*, and Section 4-12.06, *Additional Requirements Over or Adjacent to Railroads*.

3-3.05 Stream Flow

When falsework supports are placed in flowing water, water pressure on the supports are determined by the following formula:

$$P_w = Kv^2 \quad (3-3.05-1)$$

P_w = pressure (psf)

v = water velocity (ft/s)

K = 1.375 for square faces

0.67 for circular piers

0.50 for angular faces