During the last 15 to 20 years I have often been confronted with the phrase, “I never seem to make money on LWSF jobs!” Why do experienced drywall/carpentry estimators miscalculate the labor factors involved in curtainwall, spandrel, and load bearing type framing?

With a working background in estimating, I decided to look into the problem in depth. During this time a good deal of my sales responsibility was shop drawing compliance inspections, job start ups and bill of material preparation. I felt I had a unique vantage point to do a labor study on all the phases of Lightweight Steel Framing (LWSF). Some general principles became quite apparent and are applicable to all types of framing.

**Drawings**

In the bidding stage, very often the architectural and structural drawings are vague in critical areas like exact gages, specific connection details, and spacing.

We are fortunate at Marino Industries to have an engineering staff complete with a CAD system to assist contractors during the bidding stage with these “missing links.” The staff reviews the drawings and issues all of the appropriate data necessary to bid the project with confidence.

The data often includes the cost of shop drawings, when required, along with appropriate engineering calculations, and all the information necessary to take the guesswork out of the bid.

**Labor Factor**

The next problem is to assess the appropriate labor factors to “dial-in” for the complexity of the work involved. Obviously there is no replacement for first hand experience. We have, however, developed data from successfully completed projects in which we have been involved.

Certain repetitive factors stand out and help bring the pieces of the puzzle together.

Basic to understanding the labor factors involved in LWSF is that every piece of stud, joist, clip, angle, bridging heads, jamb, sills, and headers must be considered as something that has to be distributed, sorted, cut, assembled and set.

This process is made more complex by the gages used in LWSF, essentially 20, 18, 16, 14 and 12 gage. So the labor involved has to be predicated on the gage. For example: The labor cost to assemble a built-up jamb or lintel unit in 18 gage will differ from a 12 gage assembly because the cutting, assembling and setting will be significantly slower. Now, consider that same thought process on a dozen or more assemblies made from various gages that may be on a project, and the need for careful analysis and precision becomes apparent.

The next factor is the height of the assembly and the gage of material.

Basic to all drywall framing is layout and track and stud installation. Using a 25 gage steel stud wall (10 feet high) as an example, how are the above factors affected when I increase the gage to 14 gage, the height to 20 feet, then change from screw attachment to welding? What about gypsum board installation? The labor factor varies with every gage and height condition

**Curtainwalls**

Let’s look at an exterior curtainwall in-fill panel as an example. Layout and installation of studs and track, as we have seen, are basically dependent on gage and height. I define these simple areas as “straights.” Starting with this basic labor factor, we then apply separate added labor factors for the window, door, louver and air conditioning sleeve areas. For each of these built-up assemblies, we must ask the questions: Which gage is required? Are they welded or screwed? What will productivity be? Is the condition repetitive or one of a kind? What type of bridging is called for? Is there an alternate detail that is easier to produce, and just as acceptable?

This is the seventh article in the Foundation’s series on lightweight steel framing systems. Future articles will discuss joists in floor, ceiling and roofing systems as well as an update on the revised AISI design manual.
The degrees of complexity are further increased when the curtainwall becomes a spandrel that is exterior to the slab or structure of the building. Spandrel framing often involves built-up lintel and jamb sections, back bracing, clip angles and strongbacks. The installation of structural brick angles may also become part of the scope of work. Jurisdictional problems can occur with other trades. Estimators should carefully review any spandrel work that requires attachment directly to structural steel. What detail is needed so the panel can be adjusted if the structural steel is out of plumb or location?

Flooring

For floors, mezzanines and loft framing, additional labor factors relating to movement and distribution of material must be considered. Floor joists range from 6 inch, 18 gage to 14 inch, 12 gage with a weight ranging from 1.5 pounds per lineal foot to slightly under 7 pounds per lineal foot.

Therefore, as construction progresses to upper floors, additional labor percentage factors for the movement and distribution of material must be included in the estimate.

Other factors to be considered include:
- Built-up lintel/header assemblies can become quite heavy and cumbersome and may require the use of a crane or a cherry picker.
- Time must be allotted for verifying heights and shimming.
- Installation of web stiffeners may be required to prevent web crippling.
- Solid and strap bridging must be installed.
- Built-up posts may have to be cut, assembled and set in crucial stress areas.
- Stairwells require built-up lintel/header sections.
- Joist or bridle hangers may have to be installed in these areas as well as attachment to structural steel.

Load Bearing Construction

With load bearing construction there are additional factors to be considered. Wind bracing, at set locations designated in the structural/shop drawings, is frequently required and anchor bolts must be placed in the concrete footings. Structural angles, along with gusset plates, may also be needed at these locations.

Very often, built-up stud members must also be placed at these crucial points. The load bearing walls must receive bridging, and the labor intensity of head, jambs, sill, and AC areas must be addressed in a manner similar to curtainwalls.
Minimizing Products

If there are multiple windows or doors, different assemblies must be cut, constructed and set. This introduces the additional factor of workers handling the variety of products involved.

Therefore, a consideration might be to minimize the number of gages and the variety of products. In this regard, shop drawings should be “value engineered” to insure that products and connections represent the most cost-effective overall method of installation.

Here’s an example of how minimizing the number of gages affects sorting and handling.

Depending on the spans, a multiple floor system might utilize 8 inch joists 18, 16, 14, and 12 gage. Would it be wise to eliminate 18 and 14 gage and construct all the spans in 16 and 12 gage? Also consider the possibility of six to 10 varieties of built-up header/lintel sections. Could this be reduced to four? If you reduce the number of different sections, you also reduce the varying labor costs for the handling, cutting, assembling and setting. And you minimize the opportunity for errors.

All manufacturers color code their products by gage. But in a short period of time material is cut up and colors are lost; I doubt if a micrometer would be desirable as a standard workers’ tool.

This may mean paying more for the heavier gage material in the beginning, but it must be weighted against 10 to 15 carpenters with a pay scale of $30 per hour or more. With this size payroll the minimizing of gages and sections can be very important and should certainly be considered.

Roofing

A phrase often used in LWSF is that the contractor “...goes to kindergarten on the first floor and gets his diploma on the top.” At the top, the contractor must frame the roof. Roof framing is probably the most labor intensive part of LWSF.

Careful attention must be paid to the utility angles, gage, weight of the rafters, composition of headers used as ridges, and the valleys. Solid and flatstock bridging must be installed. Collar tie beams and posts may have to be incorporated. The ends of the roof may have to be “dressed off” with stud and track to form fascias, soffits and gutter recesses.

If the roof is a simple gable configuration with no “breaks,” the possibility of prefabbing the trusses on or off site should be considered.

If we use this same simple gable as a labor “straight” factor of 100%, it would then be reasonable to put additional labor on all configurations.

If the estimator establishes a 100% factor for the “straight” gable configuration, he then must look at the dormers, hips, valleys and cupolas with a
Backbracing - A piece of stud kicked back diagonally to reinforce an exterior wall.
Bridging - A method used to prevent buckling and/or rotation of a stud or joist. Usual products for bridging are flat strap, V-bar, 1-1/2 inch channel, track and stud.
Built up Post - A post or column composed of stud or joist and track.
Clip Angle - A connection piece made of steel that may be made to fit a given detail. Clip angles are usually 12 inches or less in length.
Compound Cut - A cut made on a member for framing to another member (studs, joists, etc.). Where an angle is required in two directions.
Crippling - Less than full height studs. Generally above and below window/door openings.
Crippling - A form of buckling usually discussed at the bearing point of joists in which the web fails due to an overload.
Curtainwall - A wall designed to enclose the framework of a structure. Curtainwall may be either in-fill or by-pass in design.
Flange - The part of a section immediately attached and perpendicular to the web. This part determines the depth/width of the section (i.e. 1-3/8 inch, 2 inch, 2-1/2 inch).
Flat Stock - Flat metal strapping used in wind bracing and horizontal bridging.
Gage - A table of numbers that are applied to represent thicknesses of steel (i.e. 20 ga. = .0375" thick).
Gusset Plate - A flat piece of steel used to connect two or more members at Points of high stress (i.e. with trusses).
Head Framing - That portion of work at the top of a window opening.
Header - A member or members used to gather and redistribute loads around an opening that is larger than the spacing of the members of the wall or floor.
Head Sill/lamb - Those parts of an opening for a window or door that support and/or frame out the top, bottom, or side respectively.
Infill Framing - Vertical framing that is supported at the end only.
Jamb Framing - That portion of work adjacent to either side of a window opening that typically supports the head and/or sill framing.
Lintel - A header used in conjunction with exterior walls only, used primarily for the support of vertical loads.
Load Bearing Wall - Any wall designed and built to support either vertical or horizontal loads.
LWSF - Light Weight Steel Framing.
Shop Drawings - A detailed document showing how a given portion of work is intended to be constructed.
Sill Framing - That portion of work at the bottom of a window opening.
Spandrel (Fly-by) - Framing which covers the spandrel beam, attaches to it, and extends from the head of one window to the sill of the one above it.
Structures - An area in LWSF in which the framing is continuous and uninterrupted.
Strongback - A continuous horizontal member attached to the inside face of a curtainwall (infill on spandrel) used to redistribute loads.
Structural Products - Only those members made from steel that has a pre-determined and certified strength from the producer.
Web - The part of a section which determines the width/depth of the section (i.e. 3-5/8 inch, 6 inch).
Web Stiffener - A piece of stud or utility angle used to reinforce a joist at critical areas.
Wind Load - The value in pounds Per square foot (PSF) that speed of the wind exerts on a wall. This load varies depending on location of building, height of the building, shape of the structure, etc.
Utility Angle - A piece of steel bent to a 90 degree angle (usually 8 feet or longer).

About the Author: Roy Selland is Lightweight Steel Framing Specialist for Marina Industries Corp. where he has served in various lightweight steel framing positions for the past 20 years. After he received his BS in Economics from the University of Maine, Roy worked as a union carpenter, a lathing carpentry estimator, and regional manager for Inryco’s automated lathing system.

much higher labor factor. The considerations include compound cuts on rafters and built-up hips, ridges and valleys with compound cuts, and clip angles with other than 90 degree bends. The sheer weight of built-up members may require a crane or cherry picker similar to floors. Staging and scaffolding may be required, depending on the heights involved. Remember, anticipate the worst case!

Summary

Overall, my approach to LWSF must be considered a “sniper approach” since the actual estimating procedure involves a comprehensive material take off of all the pieces in a given wall, floor, or roof assembly.

If the architectural/structural drawings are insufficient, contact your supplier or manufacturer for engineering support to guide you during the bid process.

Apply a labor factor to all the pieces predicated on height, gage and degree of complexity. Labor is the overriding factor, so let it stand by itself. Material, with appropriate waste factors, must likewise stand on its own. Scaffolding, cranes, job conditions and clean-up can be amortized into the man-days required for completion.

LWSF is an engineered system which must be treated with respect for the system’s capability and limitations.

The key to success is to be thorough and thoughtful. Estimate the project by walking through the process one step at a time. The reward is a profitably completed project and a call to bid the next job.

Here are some helpful terms which are widely used in LWSF

Backbracing - A piece of stud kicked back diagonally to reinforce an exterior wall.
Bridging - A method used to prevent buckling and/or rotation of a stud or joist. Usual products for bridging are flat strap, V-bar, 1-1/2 inch channel, track and stud.
Built up Post - A post or column composed of stud or joist and track.
Clip Angle - A connection piece made of steel that may be made to fit a given detail. Clip angles are usually 12 inches or less in length.
Compound Cut - A cut made on a member for framing to another member (studs, joists, etc.). Where an angle is required in two directions.
Crippling - Less than full height studs. Generally above and below window/door openings.
Crippling - A form of buckling usually discussed at the bearing point of joists in which the web fails due to an overload.
Curtainwall - A wall designed to enclose the framework of a structure. Curtainwall may be either in-fill or by-pass in design.
Flange - The part of a section immediately attached and perpendicular to the web. This part determines the depth/width of the section (i.e. 1-3/8 inch, 2 inch, 2-1/2 inch).
Flat Stock - Flat metal strapping used in wind bracing and horizontal bridging.
Gage - A table of numbers that are applied to represent thicknesses of steel (i.e. 20 ga. = .0375" thick).
Gusset Plate - A flat piece of steel used to connect two or more members at Points of high stress (i.e. with trusses).
Head Framing - That portion of work at the top of a window opening.
Header - A member or members used to gather and redistribute loads around an opening that is larger than the spacing of the members of the wall or floor.
Head Sill/lamb - Those parts of an opening for a window or door that support and/or frame out the top, bottom, or side respectively.
Infill Framing - Vertical framing that is supported at the end only.
Jamb Framing - That portion of work adjacent to either side of a window opening that typically supports the head and/or sill framing.
Lintel - A header used in conjunction with exterior walls only, used primarily for the support of vertical loads.
Load Bearing Wall - Any wall designed and built to support either vertical or horizontal loads.
LWSF - Light Weight Steel Framing.
Shop Drawings - A detailed document showing how a given portion of work is intended to be constructed.
Sill Framing - That portion of work at the bottom of a window opening.
Spandrel (Fly-by) - Framing which covers the spandrel beam, attaches to it, and extends from the head of one window to the sill of the one above it.
Structures - An area in LWSF in which the framing is continuous and uninterrupted.
Strongback - A continuous horizontal member attached to the inside face of a curtainwall (infill on spandrel) used to redistribute loads.
Structural Products - Only those members made from steel that has a pre-determined and certified strength from the producer.
Web - The part of a section which determines the width/depth of the section (i.e. 3-5/8 inch, 6 inch).
Web Stiffener - A piece of stud or utility angle used to reinforce a joist at critical areas.
Wind Load - The value in pounds Per square foot (PSF) that speed of the wind exerts on a wall. This load varies depending on location of building, height of the building, shape of the structure, etc.
Utility Angle - A piece of steel bent to a 90 degree angle (usually 8 feet or longer).