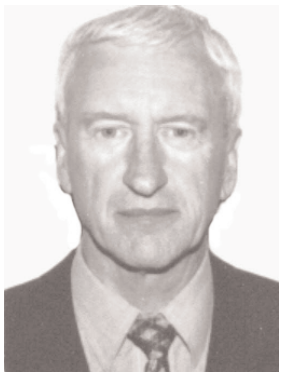
DESIGN/BUILD FOR THE STEEL FABRICATOR/ERECTOR



John Frewen-Lord

John Frewen-Lord, a Fellow of Britain's prestigious Royal Institution of Chartered Surveyors, has over 35 years' experience as a construction cost consultant/quantity surveyor and construction manager in the UK, South Africa, the US and Canada. Frewen-Lord was trained as a quantity surveyor in the UK, and emigrated to Canada in 1966, working for the branch office of a large international firm of contractors. His time with this company included two years in South Africa.

On returning to Canada in 1971, he spent the next four years with a firm of professional quantity surveyors, which included one year in Boston, MA. The company's work at this time included various construction management projects in a joint venture with a major general contractor. The experience from this was carried over when Mr Frewen-Lord joined a firm of professional construction managers responsible for a number of high profile projects in the Toronto area. During this management work, he became very experienced in the cost control, scheduling and overall management of the entire design and construction process, especially in predicting and controlling construction costs and cash flow on unusual or difficult projects. In 1980, Frewen-Lord joined the Canadian Institute of Steel Construction as Cost Analyst, and was responsible for providing steel-based cost studies and solutions to the construction professions in both Canada and the US. During this period he initiated the concept of quantifying structural steel's speed of construction advantage, and used it to win a number of major projects for the steel industry.

Frewen-Lord set up his own practice in 1987 in Ontario, Canada, and provided cost planning, cost control, construction management, codes and standards, expert witness, dispute resolution and education consulting services to the construction industry, including structural steel, both in Canada and the US. Today he is currently living in his former homeland, and, after two years as Construction Economist with the Corus Construction Centre, he is now president of BusiBuilder Software Limited, whose products are based on automating the costing, scheduling and cash flow predictions of various types of buildings.

SUMMARY

Design/Build was once thought of as a "flavor-of-the-month" phenomenon, but instead has grown until today it represents nearly 50 percent of all non-residential construction procurement, especially in large or complex commercial and institutional projects. In all types of construction contract, someone takes on risk, and someone has control, and different types of construction contract shift this risk and control between Owner and Contractor. However, an underlying precept is that he who takes on the risk must also assume control, and Design/Build permits the steel fabricator/erector to take on risk while still retaining control.

The steel fabricator/erector entering the Design/Build arena must ensure that he talks the same language as the Design/Builder, a fundamental part of which must involve being able to think conceptually, and to think beyond just the structural steel or even the entire structural frame. This may require the fabricator to acquire new skills and the software to go with them. In addition, the fabricator/erector must be able to assess how his risk changes in Design/Build, how those risks can be quantified, and then how to include those quantified risks in his bid or proposal. An example is included in assessing the increased risk, in actual dollars, compared with a traditional lump sum contract.

This paper also includes various strategies in risk management, as well as supply chain management, all of which involves assessing how the process of design and construction changes in Design/Build, and then setting down the parameters for combining the inherent risk and control in a Design/Build contract in a way that ensures that all players are aware of the expectations and goals to be achieved while reaping the rewards. Finally, some discussion is included on the concept of Partnering —what it is and how it can be used in a Design/Build contract to improve the overall outcome for everyone, whether owner, Design/Builder or steel fabricator/erector.

DESIGN/BUILD FOR THE STEEL FABRICATOR/ERECTOR

JOHN FREWEN-LORD

INTRODUCTION

In any type of business transaction or contract, there are two main criteria for both parties:

1. To maximize the profit or benefit to be realized, and
2. to minimize the costs involved.

Construction contracts are no different, and every contractor or subcontractor trying to survive in the construction industry is constantly battling both internal and external forces to realize these two goals. Get the profit or benefit to be realized too low, or the costs involved too high, and you will quickly go out of business.

What makes it even more difficult in the construction industry is that it is a brutally competitive business, with razor-thin margins, and a bidding process that essentially "takes no prisoners". Either you win a sufficient number of bids, or you die.

But the two goals above are not mutually exclusive—in fact (except in Utopia), you cannot have the first without the second (although achieving the second will not necessarily guarantee the first). But both make each party to the contract very "self-centered", looking out only for himself, and ready to distrust the other. Small wonder then that, in a highly complex process that constructs highly complex buildings and structures, simplistic contractual models have been found to be less than satisfactory over the long haul, with contract extras, claims and all too often litigation being the order of the day. Few contractors have avoided going to court, and in some countries (e.g. the UK), there are even special construction courts, using judges highly trained in the construction process. With the exception of perhaps family or traffic courts, no other industry or aspect of our lives warrants its own judicial process.

Consequently, both Owners and contractors have, in all too many instances, said: "I've had enough—there has to be a better way". One of the "better ways" is the use of a Design/Build type of contract. It CAN be better—for both parties to the contract —but it is not always the panacea that it is touted as being. Nonetheless, it has emerged relatively recently as being one of the most used types of contract in use today. So it obviously has something going for it. This paper looks at how the steel fabricator can understand what is involved in the Design/Build process, and how he can take advantage of it to achieve the two goals noted above.

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Types of Construction Contract

Over the years, many types of construction procurement procedures have been tried and developed, usually in response to some shortcoming in what was then available or usual. At the very heart of all of them are the following common factors:

- Someone takes on risk.
- Someone has control.

However, these two factors are (or should be) invariably **mutually inclusive**—i.e. **he who takes the risk will also assume the control**.

The above key terms—Risk and Control—must be defined in order to properly evaluate the various types of design/construction contracting procedures.

The first item to define is **Risk**. For the building owner, it means the risk that the final construction cost will be more than he was expecting to pay. For the contractor/subcontractor, it means that the cost of the work exceeds his price for doing it, or his profit was less than he was expecting.

The building owner's expectations can be based on a number of sources, from, say, a conceptual cost estimate prepared by an architect, engineer or cost consultant at the very earliest stages of the design process, to a fixed price stipulated sum contract submitted by a contractor bidding on completed drawings and specifications. The contractor's/subcontractor's expectations can be based on his understanding of the work involved, and the potential for costs to increase beyond his control. **Anywhere within this spectrum, opportunities abound for actual costs to exceed both the building owner's and contractor's/subcontractor's expectations**.

There is, however, another type of risk that often goes unnoticed by the building owner (until it is too late), and that is the risk that he will not get what he was expecting in terms of the project's design or performance, even if the final cost is within his budget. These two types of risk usually are at odds with each other—**the more an owner**

wants to avoid the risk of a cost overrun, the more he may have to accept some risk of a design or performance shortfall in terms of what he was expecting. It is important that the building owner understands what is being contracted for, and what he will get at the end of the day. While at first sight, this may seem a problem for the owner, not the contractor, this is not necessarily the case, as will be explained later.

The other key term is **Control**. Control can range anywhere from one small part of the construction activities—such as completing a part of the structure ahead of, and out of sequence with, the rest of the project—to managing the entire design and construction process. While a building owner obviously would like to have as much control as possible (it is after all his project), **that control can only come with the risks attached to it**. If the building owner chooses to forgo the risks noted above, then he must forfeit control accordingly.

For the contracting side of the design-construction process (and that includes the steel fabricator/erector), the key then is to ensure that risk is not assumed without the control that goes with it.

Risk and Reward According to Contract Type

In the chart below, five main types of common construction contracts are shown, ranging from Project and Construction Management, to a pure Design/Build contract, known for many years as a Turnkey type of contract. In a management type of contract, the owner is an integral part of both the design and construction process (in fact, it will fail if he is not).

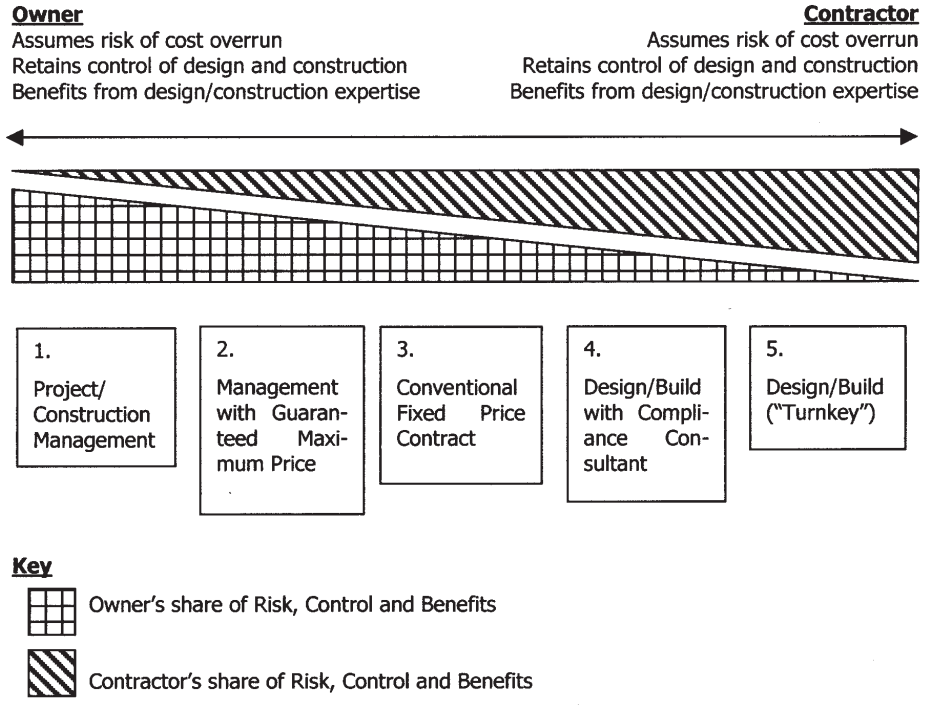
In a Turnkey contract, the owner simply walks away until the building is complete, at which point all he has to do is "turn the key" and take occupancy. Any interference by the Owner will be an avenue for large claims for extras which he will have no control over, as he has no architect or engineer acting on his behalf.

This chart shows that a Turnkey type of Design/Build contract provides the contractor and subcontractor with the maximum degree of control and benefits, albeit with the highest level of risk. But is this the best type of contract for the steel fabricator/erector? Not necessarily.

There are two disadvantages for the Design/Builder (and hence his subcontractors) in a Turnkey type of contract:

1. The owner may not get what he was expecting (as explained above);
2. The Design/Builder (and hence the steel fabricator/erector) will be making his bid or proposal with perhaps less than optimum knowledge of the owner's **real** requirements or expectations, or against less than scrupulous competitors (who will try to "bend the rules"), both of which can cause the bid or proposal to be unnecessarily lost or costs to exceed expectations.

Both of these disadvantages can lead to litigation—the very thing Design/Build is supposed to avoid. It is this author's opinion that the most suitable form of Design/Build contract is that involving the owner's own compliance consultants. For the fabricator/erector, this can be the best of all worlds, as, in the areas in which he will be supplying his expertise (i.e. structural steel design/fabrication/erection), he can still have total control over his work,



while at the same time ensuring that the playing field is truly level for everyone. Many publicly-funded projects are turning towards this type of Design/Build contract.

Defining Risk and Control—Who Calls the Shots?

To successfully make the transition from working on traditional fixed price contracts to the Design/Build process, the steel fabricator/erector must understand not only how his risk changes, but also how to measure—and provide for—that risk in a competitive business environment. It is easy to say "Consider the risk involved"—but what does this mean?

Risk can be defined as:

The probability of something going wrong times the costs if it should go wrong.

Almost every aspect of our lives is governed—consciously or unconsciously—by the rules covering risk assessment. We are however, as human beings, very inconsistent in applying them. We will take risks ourselves that we refuse to have others impose on us—how else to explain the fact that some people will drive without their seatbelts fastened, yet will refuse to fly on a plane, especially since September 11, 2001, even though the risk of death in a car accident without your seatbelt fastened is many, many times the risk of dying in a plane crash.

In a Design/Build environment, it is important, therefore, to ensure that the fabricator/erector has control over the risks he takes, and not have such control imposed on him.

How can the definition above be measured? Subjective judgement plays a major part, but it is basically down to the following:

- How well do you know your costs and cost structures?
- How well can you control your costs and cost structures?
- How capable are you in thinking ahead, and anticipating what others might want or require? Are you proactive or reactive?
- How much ingenuity and innovation can you introduce into your business? Can you "think outside the box"?
- How capable is your organization? Have you any specific strengths or weaknesses?
- How well do you control the running of your organization? How tight a ship do you run?
- How well is the entire design/construction team able and willing to work in the appropriate manner? Are you capable of fitting into that "mold"?

The following describes how the points listed above can be used to measure the risk involved in a Design/Build contract.

Firstly, the probability of something going wrong.

There are three primary routes that can introduce a problem into a steel construction contract (the ways of controlling these—called risk management—will be reviewed later):

1. The owner's requirements were not what you based your proposal or bid on.
2. Unexpected site or regulatory conditions were imposed upon you.
3. Your own design, fabrication and erection procedures and capabilities were not up to the job.

Let's look at each in turn.

The owner's requirements were not what you based your proposal or bid on:

It is important, in the first instance, to have a thorough understanding of what the owner requires. **This will require the fabricator to think conceptually**—i.e. to have a full and clear visual mental picture of what the owner intends to do with his building, and how he wants it to look and perform. Without this mental picture, it will be pure luck if his requirements or expectations have been correctly interpreted by the steel fabricator/erector. The fabricator's risk without this correct interpretation will then be much higher than otherwise—if the structure does not do what was expected of it, the buck stops at the fabricator's door, and it is no good saying "I didn't know about that!", or "It wasn't on the drawings!" In Design/Build, at the time you are submitting your bid or proposal, lack of knowledge is no excuse, and there may not be any drawings.

Unexpected site or regulatory conditions were imposed upon you:

The fabricator/erector must have full knowledge of all building codes (not just engineering design codes) to minimize these risks—without such knowledge, he is taking what may be quite large and certainly unnecessary risks. And he must understand, right at the outset, how the whole building—not just the steelwork—is going to go together, else he may find he is responsible for work that he did not anticipate was in his contract. But this can be put to the fabricator's advantage—most Design/Builders welcome subcontractors who can take the initiative and remove a few of their headaches without having to be asked.

Your own design, fabrication and erection procedures and capabilities were not up to the job:

The fabricator/erector must have a thorough knowledge of the strengths and weaknesses of his design engineers, his shop manufacturing processes and his erection procedures, as only with this knowledge can he calculate the risks involved. If any part of this total process is not up to the job—say, his design engineers have trouble thinking conceptually—then his risks will increase, perhaps quite substantially.

Secondly, the probable costs should things go wrong:

Having looked at the probability of something going wrong, the next step is to calculate its probable costs should they go wrong. This is generally easier, as it is primarily dependent on two factors:

- The complexity and type of both the steelwork involved and the project as a whole.
- The track record of the fabricator's design office and his shop, or the erector's site operations, in how well the final work completed related to the estimate or bid.

A well organized fabricator/erector should be able to determine such costs to a fairly high degree of accuracy—it is part of the total process of being in business. However, in a Design/Build situation, the fabricator now has to judge what the extra cost will be of things that can go wrong that are not even shown on the drawings (there may not even be any drawings!), as well as allowing for those things that can be more easily established at the time the bid or proposal is submitted.

The next section shows how to put values on these potential risks and allow for them in your bid or proposal.

Calculating and Controlling Risk—Risk Management

It is vital that the fabricator/erector (and of course the design/builder himself) knows how to calculate the risks, and then to include such costs as part of the bid or proposal. He must understand the drivers behind those risks, and be able to both control them, and, if possible, reduce them, as long as that reduction does not involve a corresponding loss of control.

It is easy to pass along the risks to someone else—but that is NOT risk management. Risk management involves being prepared to take on risk, understanding the risks involved, taking the necessary steps to control and contain them, and then enjoying the rewards that go along with these risks. Remember that if you pass along the risks to someone else, you will forfeit control and reduce the rewards to be earned.

Let us assume the fabricator is submitting a proposal for the steel structure on a new performing arts center. The following are some of the key **"risk points"**, which become apparent after having negotiated with the design/builder to maximize the fabricator's/erector's responsibilities and scope of work (i.e. to retain as much control and as high a contract value as possible). The approximate value of the work for the fabricator/erector is $2.5 million.

- The contract is design/build with the owner having his own compliance consultants, who will take the design through the concept stage (approximately 25 percent complete drawings and outline specification).
- The design/builder will employ his own architects, mechanical and electrical engineers, and his own structural engineers for foundations and other structural work not part of the steel frame, all of whom will take the design from the 25 percent stage through to completion.
- The fabricator/erector is responsible for the entire structural frame, including structural steel, steel deck, concrete toppings on the deck, fire protection, and interfacing with the rest of the building.
- The fabricator/erector has established with the design/builder, ahead of the bid, such key criteria as loadings, column grid layout and fire protection ratings.
- The fabricator/erector has established ahead of the bid his required access to site, equipment requirements, who provides protection and safety, and the inclusion (preferably) or exclusion of, for example, loose steel items.
- Labor conditions are favorable and material prices are stable, with no expected shortages or other difficulties.
- The expected structural duration is 6 months, including lead time.

Table 1, at the end of this paper, is a relatively simple calculation that illustrates the principles involved. (There are much more mathematically sophisticated ways of calculating these risks, but these are rarely justified in a purely economics-based risk assessment.) What this calculation shows is that the **Net Risk** for the structural work for the performing arts center is just under $100 000, or 4 percent of the $2.5 million contract. This amount is what needs to be added to the bid or proposal (over and above the fabricator's normal profit margins) to cover the risks in this design/build contract for those items the fabricator has less than total control.

If these risk items don't happen, then the fabricator is 4 percent better off. If, on the other hand, things go more wrong than the risk calculations anticipated, then the profit will be less—or even a loss incurred. This of course is simply a part of the process of being in business. But at least the fabricator will be better off—perhaps much better off—than if the risks were ignored or simply guessed at.

Having calculated the potential risks—and it must be emphasized that these are only the potential risks, the costs of which may or may not be incurred—the fabricator/erector must now undertake a formal risk management program to at the very least control them, and if possible, reduce them. The risk management program, in a design/build situation, cannot be implemented entirely in isolation, but must be done in conjunction with the design/builder, as well as any subcontractors to the steel fabricator/erector (e.g. a specialist contractor who will supply and place the concrete on the steel deck, or a fire protection applicator).

There are two main categories of risks:

1. Those that the steel fabricator/erector has total control over, and
2. Those that are partially or totally outside of his control.

Those that are entirely within the fabricator's control include such items as design expertise (both conceptual and detailed), shop efficiency and procedures, steel supply contract arrangements, etc. These risks can all be evaluated and costed before putting in a bid or proposal, and such costs included. If the actual costs exceed this amount, then the fabricator, unless he is especially unlucky, will have no-one to blame but himself.

Risk factors that are outside the fabricator's control, whether totally or partially, must be considered with a different approach. Here the fabricator/erector has to negotiate and interface with others. In terms of the design/builder, the following questions must be asked:

- How experienced is he in design/build work?
- Does he have a good track record with this type of contract?
- Is his approach to his subcontractors adversarial?
- Is he a team player, or does he work in a very autocratic manner?
- Is he flexible in considering alternative ways of achieving the end result?
- If the end result is difficult or impossible to achieve, does he take a positive approach into finding other acceptable solutions? Will he take on board your suggestions?

In terms of the steel fabricator/erector's subcontractors, there are issues here also that must be addressed:

- Are they prepared to become "part of the team"?
- Do they have the requisite design and construction expertise for the work involved?
- Are they innovators and original thinkers, or are they simply content to do what they are told to do? (This can be both good and bad, depending on the work involved, but in general being innovators is good.)
- Can they come up with alternative solutions when problems are encountered (both in design and construction)? Can they too think "outside the box"?
- Are they prepared to take on the same level of risk as you are?

Not all of the answers to these questions have to be in the affirmative, but any negative answers must be weighed against your own involvement in the process and what you are expecting from the Design/Builder as well as your subcontractors (and what they are expecting from you).

The final step in the risk management process is to see what steps can be taken to reduce the risks without reducing control or the rewards. This is especially crucial if the bid or proposal price is under pressure (which of course it will be). The place to start is with Table 1—your Risk Assessment evaluation. Look at each item, and see if you can get solid commitments from the Design/Builder on certain items you have allowed a risk factor for.

For example, in Table 1, Risk Point #1 includes a 10 percent probability that new design criteria will emerge after the bid or proposal has been submitted, and that, should they emerge, this could add 10 percent to the fabricator's cost of the work, for a total of 1 percent extra to be added to the bid or proposal. Sit down with the Design/Builder and review these numbers. He may well decide that he can impose the necessary degree of control over the building owner and his compliance consultants (and give you that commitment) to ensure that there is no chance the design criteria will change, in which case $25,000 can be deducted from the fabricator/erector's bid or proposal. In the way, the fabricator has reduced his risk without incurring any loss of control or reward. This is what risk management is about, and should be a continuous part of the process in a Design/Build contract.

Risk Starts on Day One

Much has been said above about calculating risk and including such risk in the steel fabricator's bid or proposal. There is one element of the risk in a Design/Build contract that he must be very cognizant of, and that is his competence in conceptual estimating.

Most fabricators (indeed, most contractors/subcontractors) are used to the idea that they estimate, in a detailed manner, exactly what's shown on the drawings or described in the specifications, and that is exactly what they bid on—no more (or they lose the job) and no less (or they win the job but lose money on it). Design/Build, by definition, means that the fabricator must extend his capabilities into conceptual design, and then to translate that conceptual design into working drawings and ultimately into physical construction, while still controlling the risk.

The process means that the fabricator needs additional capabilities at his disposal. The first additional capability is a good conceptual estimating department. These persons must think beyond mere structural steelwork—instead they must be able to talk the same language, right at the very beginning when submitting the bid or proposal, as the architect, the other consultants and the design/builder himself.

The second capability is some software. Design software, such as RAMSteel by RAM International, enables very quick steel designs to be made with no more than a building layout (which, at the time of submitting a bid or proposal, is probably the most you can hope for, hopefully prepared by the owner's compliance consultants). Conceptual estimating and scheduling software (for schedule can have as big an impact on costs as material and labor)

is also critical, and one such piece of software is Conedia, developed by the author of this paper. There are many other conceptual estimating packages out there (although it is believed that only Conedia can do conceptual scheduling, which can be used, for example, to add a competitive scheduling advantage for the Design/Builder by building in steel).

The third capability that the fabricator must have is his own robust internal data that shows such relationships as change orders as a percentage of total contract, what kind of steel construction he makes most money on, and so on.

With these capabilities in place, the fabricator is now equipped to enter into the Design/Build arena. When the mechanical engineer starts talking about specific items of major equipment going into specific locations, when the architect talks about using a particular type of exterior cladding system, when the elevator contractor starts talking about what kind of elevator he is going to use—**the steel fabricator must be able to assess and include the impact of these decisions right up front, before the bid or proposal is submitted**. This demands that the fabricator must be able to visualize and think through exactly how the whole building is going to go together, and then to allow for these items in his bid or proposal.

The previous section included some principles on how to calculate and include risk in the bid or proposal. These calculations must also include an honest assessment of the level of expertise in conceptual estimating and scheduling. If it is lacking, the probability of something going wrong will be that much greater, as well as the costs if it should go wrong, and that increased risk factor must then be included. If you are competing against others, this puts you at a competitive disadvantage right away.

Combining Risk and Control—Supply Chain Management

Having evaluated the risk to be taken on and the degree of control that accompanies it, the steel fabricator/erector must now undertake some "supply chain management". This sounds like a complex process, but it is really only something that is done, to a greater or lesser degree, and consciously or unconsciously, by almost anyone in business today.

Supply chain management means putting into place a formal program—or buying into one of the other player's formal program—that sets down the rules relating to how each party must be responsible to the others, and what their rights and privileges are. The steel fabricator/erector will have already set out the risks he is prepared to (even wants to) assume, and the levels of control that accompany those risks. Supply chain management ensures that all the other players in the project are aware of this, are prepared to undertake their share in the right proportions to the requisite extent, and that all parties ensure that lines of communication are open—up and down.

For this to happen, the Design/Builder must have ongoing dialogue—collectively and individually—with all the players. That means that the steel fabricator/erector must be an integral part of these discussions—initiating them if necessary—and ensure that his status in the Design/Build contract is not diminished or eroded. The discussions must encompass the following points:

- Continuing assessment of the goals to be achieved.
- A confirmation of the commitment for all parties to work to the same goals.
- Establishing where each of the major subcontractors' contract and scope of work starts and ends, including schedule and any "soft costs", such as safety or equipment.
- How problems are going to be dealt with and solved.
- Where the lines of communication start and end, and what route they take.
- Any special expectations that both the Design/Builder and the major subcontractors may have, and an honest assessment of whether those expectations can be realistically met.
- Should the unthinkable happen, and (as the Brits would say) it all goes pear-shaped, how the parties will resolve the issues, for the good of the project as a whole, but especially for the good of the building owner, who, at the end of the day, pays all the bills.

The Design/Builder should of course be taking the initiative in all of this—it is his supply chain that needs to be managed. The fabricator/erector must buy into this process, else it will fail. If the Design/Builder however has something of a less than fully robust process in place, the fabricator should take the initiative and demand it.

Partnering—How to be a Team Player

The traditional lump sum conventional bid contract is, as any contractor and subcontractor knows only too well, a very adversarial process. It is this adversarial process that has given rise to other forms of contract, ranging from a Management type of contract to Design/Build.

Management contracts are by their very nature non-adversarial. It is truly a team approach, with the owner having total control (but taking on all the risk—see chart below). The management contractor works for a fixed fee, with little or no direct financial interest in the project. Any slide towards this becoming adversarial (but with no extra profits to be made by claiming for extras, there is little reason for it to become so), and it will fail.

Design/Build can also work in this manner, and should if it is to be truly successful. The potential for an adversarial relationship between all the parties is certainly there—

which means that an extra effort to become a "team player" is critical.

Partnering has become the method of choice when establishing what is meant by a team player. It is not enough to simply say: "I want to be on the team". A commitment has to be made to work in ways that may, at first, be a little different, but will be seen to be a "win-win" for all parties to the process.

What exactly is Partnering?

Partnering is a formal, contractually-agreed-to process whereby all the parties to a construction project agree to dispense with an adversarial approach to problems that arise, and instead work in a cooperative manner towards the common goal, sharing, in proportion to their involvement, the costs and effort in rectifying such problems, **regardless of where the problems arise or who is responsible for them**. While any kind of contract can effectively embrace Partnering (and in Management type contracts it is to a certain degree inherent), Design/Build is particularly appropriate because the risks will be higher (even though they will be risk-managed), and the opportunities for things to "go off the rails" that much greater.

The key point here is that Partnering is essentially a "blame-free" process. Suppose unexpected site conditions require some redesign of the foundations, or the mechanical engineer finds that he has to resize some chillers because the final heat loads are greater than initially anticipated. Then all parties to the process share, in proportion to their involvement, the costs of rectifying these problems. If your work (i.e. the value of your contract, whether design- or construction-based) represents 7.8 percent of the total costs (including fees, etc.), then you will pay 7.8 percent of all costs of rectifying problems, regardless of how or where the problems arise. It may mean that the steel fabricator helps pay for an omission by the architect, but by the same token the architect will help pay for a miscalculation by the fabricator. (Whether you want your subcontractors to buy into a formal Partnering process is up to you—many small subs would not have the resources.)

Anything therefore that can change the way construction projects is conducted in a more positive and non-adversarial manner is to be welcomed, and Design/Build permits this to happen. It gives a degree of empowerment to each player (including the steel fabricator/erector) that they would not otherwise enjoy.

With that empowerment comes a responsibility to honor the terms of the Partnering process. Any contractor or subcontractor who falls back into a traditional adversarial approach to resolving disputes, however much he may feel he is "in the right", may be in breach of his contract. He will certainly be in breach of the spirit of the process.

Consequently, all players in a Partnering process must embrace, both contractually and philosophically, the intent behind Partnering. Even if there is no formal Partnering agreement or process, Design/Build will only work successfully if the players adopt this approach. If the Design/Builder himself does not want to embrace the concept of Partnering, either formally or informally, then the steel fabricator should be extra careful in deciding whether to "get in bed" with him.

Putting it all Together

You, the steel fabricator/erector, will have at this point taken on board all the foregoing, and are ready to undertake a Design/Build structural steel contract. It is now a case of putting it all together:

- Ensure that you really want to do Design/Build—it's not for everybody.
- Establish the risks you are prepared to take.
- Calculate those risks, and include these amounts in your bid or proposal.
- Negotiate these risk amounts with the Design/Builder, and see if he wants you to continue with them, or whether he is prepared to assume responsibility for any of them, reducing your bid or proposal accordingly.
- Ensure that, having assumed the risks, you also assume the control that accompanies them.
- Ensure that you have adequate conceptual estimating expertise, including any appropriate software or databases.
- Ensure you have a robust risk management process in place.
- Be a team player, both in your philosophical approach and in fact.
- Ensure that robust supply chain management processes are in place and all the players understand them and buy into them.
- Understand the concept of Partnering, and embrace it if possible, but ensure that all the other players also embrace it.
- Most important of all—"know thyself!" If you are more comfortable with traditional ways of doing business, or you have doubts about the depth and breadth of your expertise and capabilities in a Design/Build situation, then perhaps Design/Build is not for you.

If you are happy with all of the above, then go for it. The rewards will justify the extra effort and risk involved.

Table 1. Principles of Risk Assessment and Calculation

Risk Point	Comment	Probability of going wrong (%)	Cost if it does go wrong ($) - % of contract		Net Risk (Probability x Cost) ($)
1 The contract is design/build with the owner having his own compliance consultants, who will take the design through the concept stage (approximately 25% complete drawings and outline specification)	The compliance consultants will have set out clear design criteria before bids or proposals are submitted, leaving little doubt as to the owner's requirements or being able to introduce surprises	10%	*10%*	$250 000	$25 000
2 The design/builder will employ his own architects, mechanical and electrical engineers, and his own structural engineers for foundations and other structural work not part of the steel frame, all of whom will take the design from the 25% stage through to completion.	The steel fabricator/erector will be able to obtain all design criteria ahead of the bid/proposal, and will know that the design/builder will be fully co-operative in minimizing late changes	15%	*5%*	$125 000	$18 750
3 The fabricator/erector is responsible for the entire structural frame, including structural steel, steel deck, concrete toppings on the deck, fire protection, and interfacing with the rest of the building	This gives the fabricator complete control over all aspects of the superstructure frame, but he must understand all code requirements, must be able to co-ordinate and take responsibility for all structural work, not just the steel, and must give the design/builder any special requirements for interfacing with the rest of the building	20%	*2%*	$50 000	$10 000
4 The fabricator/erector has established with the design/builder, ahead of the bid or proposal, such key criteria as loadings, column grid layout and fire protection ratings.	These, once established, are not changeable by anyone, whether owner, his compliance consultants or the design/builder and his own consultants, except in the most urgent of circumstances	5%	*10%*	$250 000	$12 500
5 The fabricator/erector has established ahead of the bid or proposal his required access to site, equipment requirements, who provides protection and safety, and the inclusion (preferably) or exclusion of, for example, loose steel items.	Once established with the design/builder, these items cannot be changed. Including such items as loose steel with the structural contract removes one source of contention down the road, and again gives the fabricator more control and possibly higher contract value	20%	*1%*	$25 000	$5 000
6 Labor conditions are favorable and material prices are stable, with no expected shortages or other difficulties.	This is something that a fabricator/erector would be cognizant of anyway, but is something that could have an even potentially greater impact in a design/build contract if he got it wrong	2%	*15%*	$375 000	$7 500
7 The expected structural duration is 6 months, including lead time.	The fabricator/erector must spell out the criteria enabling him to work in the manner he anticipated in his bid or proposal, but at the same time must be able to think on his feet and adjust to changing circumstances in a positive and constructive manner	30%	*15% of value for one month (16% of time)*	$60 000	$18 000
				TOTAL RISK ASSESSMENT =	**$96 750**
				PERCENT OF CONTRACT =	**4%**