



EXECUTION RISK MANAGEMENT IN DESIGN-BUILD INFRASTRUCTURE PROJECTS BY JACK DIGNUM, PATRICIA GALLOWAY AND KRIS NIELSEN

1 INTRODUCTION

The construction industry at large has utilized the Design-Build construction delivery methodology for a long time, yet until recently and for a variety of reasons, governmental agencies were limited to a design-bid-build construction delivery methodology. Over the past fifteen years, an increasing number of governmental agencies have turned to Design-Build in response to the need to control costs and streamline total project schedule, while at the same time effectively managing and controlling risk. As more and larger infrastructure projects are undertaken by government agencies, the benefits from utilizing a Design-Build construction delivery methodology will increase, but the governmental agencies must recognize and adjust to a different risk allocation and management environment than that which they have historically used.

Every party to an infrastructure construction project holds a particular and unique position relative to the risk elements for which it assumes responsibility during the execution of that project. We examined

- The Owner and Design-Build Contractor Risk Management roles during the Project Formation stage of the infrastructure project life cycle (**Section 2**);
- The Owner and Design-Build Contractor Risk Management roles during the Project Execution stage of a design-build infrastructure project (**Section 3**); and,
- Risk Management problems experienced during the execution of infrastructure design-build construction projects (**Section 4**).

Generally the construction industry recognizes two types of Risk Management:

- (1) Traditional insurance Risk Management, which is concerned with the management of the party's insurance program (i.e. builders risk insurance, hazard insurance and liability insurance).
- (2) Execution Risk Management, which is concerned with the management of specific events or conditions which may inhibit or prevent the achievement of project cost, schedule and/or quality goals (i.e. design defects and construction delays).

As regards *execution Risk Management* there are two definitions which are useful to understanding execution Risk Management for infrastructure projects:

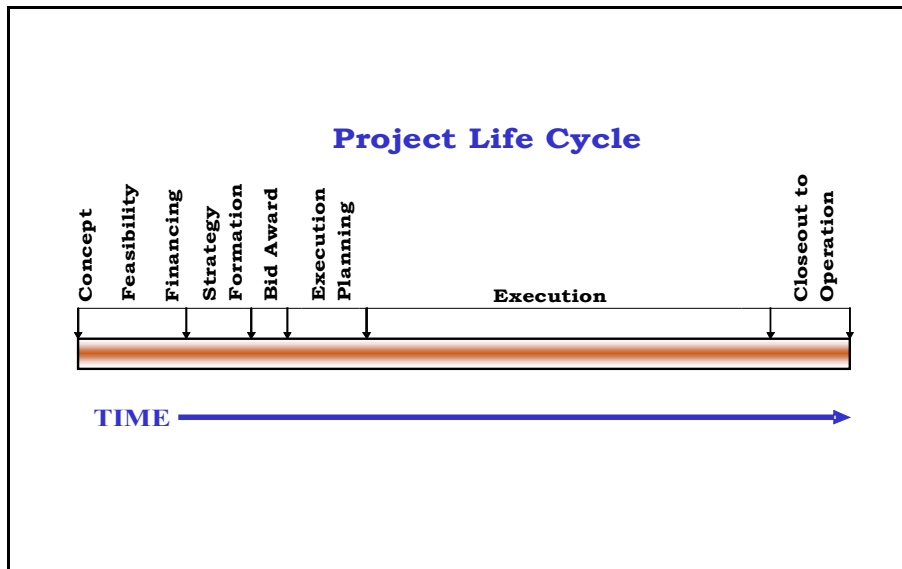
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Risk is defined as an *element* or *factor* arising during project execution which inhibits or negates the achievement of stated project cost, schedule or quality goals. Risk is both a potential condition and a specific element or event which may result in that condition.

Execution Risk Management is a systematic process by which risk elements or conditions may be identified, evaluated and avoided, mitigated or eliminated, in order to preserve the achievement of project cost schedule and quality goals.

Risk Management is the common term for a systematic program by which a party to an infrastructure project identifies, evaluates, and acts to avoid, mitigate or eliminate risk elements or factors which threaten the successful achievement of project cost, schedule and quality goals.

Every project moves through a similar Project Life Cycle, which may be summarized as shown immediately below:



The individual life cycle phases of any engineering and construction project may be roughly divided into two major stages:

- **Project Formation** – this stage includes the Concept, Feasibility, Financing, Strategy Formation and Bid Award phases of the total Project Life Cycle.
- **Project Execution** - this stage includes the Execution Planning, Execution and Close-out to Operations phase of the total Project Life Cycle.

Although every party involved in an infrastructure project has risk which it must manage and control, this paper focuses on the primary parties, the Owner and the Design-Build Contractor. There is a definitive shift in the functional, management and control focus of Risk Management passing from the Owner to the Design-Build Contractor which occurs during the Bid Award phase of the total Project Life Cycle. **Sections 2** and **3** examine the relational roles of each of the primary parties over the entire course of the Project Life Cycle. **Section 4** examines a number of the most common Risk

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Management failures for design-build infrastructure projects encountered by Pegasus-Global in recent years.

2 OWNER AND CONTRACTOR RISK MANAGEMENT ROLES DURING THE PROJECT FORMATION STAGE

As noted earlier, the Project Formation stage of the typical project life cycle consists of the following Project Life Cycle phases:

- (1) **Concept** – during this phase the Owner identifies the need for the infrastructure project and establishes the initial outer limit parameters of the project in terms of function, location, and preliminary funding and timing targets.
- (2) **Feasibility** – during this phase the Owner establishes the fundamental design and construction attributes of the concept of the infrastructure project and prepares an order of magnitude cost estimate and schedule for completion of the project based on those fundamental design and construction attributes.
- (3) **Financing** – during this phase the Owner secures financing or dedicates funding for the project based upon the order of magnitude cost and schedule estimate, the comparative need for the project (evaluation and ranking of all capital projects identified to attain a priority ranking), the total capital funds available, the feasibility of completing the project as planned and the cost to benefit ratio expected as a result of placing the completed structure of facility into its intended service.
- (4) **Strategy Formation** – during this phase the Owner finalizes the primary cost, schedule and quality goals for the project, selects the project delivery system, identifies the contractual and payment methods, drafts the contract document set, sets the basic design or performance specifications for the structure or facility, and establishes its own project management and control processes, procedures and organization.
- (5) **Bid Award** – during this phase the Owner develops and issues a Request for Proposal (RFP) against which the Design-Build Contractors will respond. During this phase the Design-Build entity will examine the RFP, develop a project execution plan, estimate the cost to complete the full scope of work delineated, prepare the preliminary (or bid) master project schedule for completion of the scope of work, and undertake all of the other activities required within the RFP.

During the Project Formation Stage, the Owner bears the sole responsibility for completing all of the Risk Management functions for the entire project until the Bid Award phase at which point the Design-Build Contractor begins to develop its own Risk Management plans in response to the RFP. Every Risk Management action taken during the Project Execution stage are based upon and flow directly from the decisions made by the Owner and winning Design-Build Contractor during the Project Formation stage.

2.1 The Owner's Risk Management Role during Project Formation

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From the Owner's perspective, a construction project is successful when the Owner's function, cost, schedule and quality goals are met. An Owner is at the top of the Risk Management structure and if the Owner does not practice sound Risk Management then it is almost a given that risks will be unidentified, misevaluated, unallocated, misallocated, and mismanaged during the execution. How an Owner manages risk, and the Risk Management that it requires of the other parties that it brings into the construction project, will determine whether or not a project is successful. In the end, every risk element which is not actively managed and controlled has the potential to preclude the achievement of the Owner's project goals.

Until the point at which an Owner takes deliberate action to involve other parties in the execution of an infrastructure project, all of the risk inherent in that infrastructure project is its sole responsibility. Once the Owner has decided to pay another party to assume specific elements of risk, it has a series of important decisions to make, such as, which risks to allocate and which to keep; which project delivery method will provide the most suitable management of the inherent risk; which contractual provisions and payment methodologies are most compatible to the project delivery method and best suited for controlling the risk elements inherent in the infrastructure project.

An Owner's decisions during the Project Formation stage not only reflect the risk inherent within that infrastructure project, those decisions always result in adding to or changing the profile of risks inherent within the infrastructure project. For that reason alone, the Owner must have the most comprehensive Risk Management program of any of the parties on an infrastructure construction project. Although Risk Management programs are varied, and there are certain elements which are common to every sound Risk Management program:

- (1) Project Risk Profile Development
- (2) Project Risk Element Allocation
- (3) Project Delivery System Selection
- (4) Project Contract Form and Provisions

Therefore, Risk Management during any infrastructure project literally begins and ends with the Owner.

2.1.1 Project Risk Profile Development

The core of every formal Risk Management program is a process by which all project risk elements are identified, evaluated and action plans prepared in advance. Pegasus-Global refers to that process as the development of the project risk profile. A project risk profile is an amalgamation of all the risk elements which are inherent in a given project. Within that project risk profile risk elements are identified and evaluated, and specific actions plans are established for addressing each of the risk elements contained within the profile. An Owner's risk profile should attempt to identify and evaluate every risk inherent within the project to be executed. Execution risks on any construction project flow from a variety of sources, which include:

- **Construction Industry Environment** - certain risk elements exist simply because of the nature of the construction industry environment as a whole (i.e. construction is a physical undertaking and is thus exposed to natural phenomena and conditions which can impact any element of the construction project).

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- **Facility or Structure Specific** - certain risk elements are inherent in the type of infrastructure facility or structure to be constructed (i.e. a large water treatment facility vs. a high speed highway interchange).
- **Legal Environment** – certain risk elements are inherent to the legal jurisdiction within which the structure or facility is to be built (i.e. legislative funding limitations or restrictions on procurement methods).
- **Decision Specific** – certain risks are built into the project by the decisions or actions (or failures to act) of the Owner and Design-Build contractor during the entire life cycle of the construction project (i.e. deciding to execute the project as Design-Build and / or employing a fast track schedule to completion).

Regardless of the source from which a particular risk element may flow, once the risk elements are in place within the body of the project they become inherent to that construction project. Regardless of which party to a project is ultimately responsible for the control, management or liability of a particular risk element, the risk element itself continues to exist as a threat to the successful execution of the project as a whole.

2.1.1.1 Risk Element Identification

Insofar as an Owner's position in managing risk on any infrastructure project is concerned it is important to remember that what you don't know **CAN** hurt you. An Owner generally has three options relative to those elements of risk which are inherent within an infrastructure construction project:

- Retain and manage risk elements
- Allocate the responsibility and liability for managing risk elements to other parties to the project
- Insure against the impact of risk elements.

A risk element must be purposely (contractually or legally) allocated or insured against by the Owner. Consequently, an Owner cannot exercise its option to either insure or allocate those risk elements which it has failed to identify. And any risk element that an Owner fails to identify and then properly allocate remains, by default, the responsibility of the Owner during the execution of the project. However, the simple act of allocating various risk elements to other parties does not eliminate those risk elements as a factor within the body of the project. What an Owner is allocating to other parties is the responsibility for managing the risk element and liability for the impact to cost, schedule or quality created if that risk element does occur during the execution of the project. While an Owner may have passed liability on to another party, the mere fact that cost, schedule and quality were impacted will have some effect on the Owner's own cost, schedule and/or quality goals.

2.1.1.2 Risk Element Evaluation

Each risk element poses a different level of threat to the attainment of project cost, schedule and quality goals. At a minimum a risk element evaluation should consider the likelihood of the risk element manifesting and the impact to cost, schedule and/or quality should that risk impact the project. A risk element evaluation can be done on a simple matrix format which categorizes a risk as having a high, medium or low probability and a high, medium or low impact on the project goals

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should it manifest. At the other end of the evaluation spectrum one can utilize sophisticated computer generated probability models such as a Monte Carlo simulation in order to actually model a risk element to attain detailed statistical analysis of probability over a range of scenarios. The evaluation method used is a matter of choice by the Owner with each method having definite advantages and disadvantages that an Owner should take into consideration as it develops its Risk Management program. However, regardless of the method used, risk elements must be evaluated simply to ensure that an Owner has focused the right amount of attention on the right risk elements as it makes the thousands of decisions which go into strategic planning.

From that evaluation process an Owner should be able to identify those risks which pose the most significant threat to the successful completion of the project and the full attainment of the project goals. Using the results of that evaluation an Owner can make informed decisions as to risk allocation among the project parties and establish the level of control or monitoring it should establish for each risk element during execution.

Decisions as to whether to retain, allocate or insure a risk element depend upon the evaluation of an individual risk, the rule of thumb being that a risk should be assigned to the party in the best position to manage or control that risk. Examining each of the three options in turn:

- An Owner should **retain** those risk elements which it is in the best position to manage or control. For example: Owner's may retain the right to initiate and approve changes to the design of an infrastructure project.
- An Owner should **allocate** those risk elements which another party to the project is in the best position to manage or control. For example: An Owner may allocate the responsibility to meet all applicable codes and regulatory requirements to the Design-Build Contractor.
- Finally, if a risk element is **beyond** any party's ability to manage or control, the Owner should consider insuring against the impact of the risk element should it manifest during execution of the project. For example: On the gulf coast an Owner may secure insurance against the possibility of a hurricane destroying the structure or facility prior to the completion of construction.

Understanding the nature of the risk, the likelihood of a risk element occurring and the possible impact to cost, schedule and quality if the risk element occurs are all factors that the Owner should consider during the Project Formation stage of the project life cycle. Decision's as to how to manage and control those risk elements which have been identified and evaluated are the some of most important that an Owner will make over the course of any construction project.

2.1.1.3 Summary – Project Risk Profile

Considering how important it is to the successful attainment of project cost, schedule and quality goals, Pegasus-Global has been surprised at how little organized, focused attention infrastructure Owners tend to pay to development of a comprehensive, detailed Risk Management profile for a specific project. To an alarming extent infrastructure Owners tend to have developed and rely on standardized lists of risk elements. Further, infrastructure Owners generally do not use even those limited risk lists as a basis for making critical project execution decisions or for making risk allocation

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decisions; rather infrastructure Owners tend to make critical risk allocation decisions on the basis of standard policies or procedures and preset boilerplate contracts primarily drafted to shield the Owner from bearing the impact of as much risk as is possible. Seeking only to protect an Owner from impacts attributable to risk elements is not proactive management of risk; it is abandonment of an Owner's project cost, schedule and quality goals to luck.

The identification and evaluation of individual risk elements are the first and most important Risk Management actions taken on every infrastructure project. Numerous legal and project structural decisions which must be made by the Owner, such as the allocation of risks, the choice of a project delivery system and the drafting of practicable contract provisions, rest upon the risk profile of a particular project. Failure to allocate a risk element to the party in the best position to manage and control that risk, or to appropriately match a risk element to the "best fit" delivery method or contractual provision could result in leaving the risk "uncovered" during execution due to a technicality (i.e. a contract provision which assigns the control of a risk element but not the liability for failure to act appropriately or a project control system which does not monitor the risk element). Just as every infrastructure project is to a certain extent unique, so every risk profile of every infrastructure project is unique. An infrastructure Owner that attempts to apply a standard one-size-fits-all contract and project execution format to those unique infrastructure risk profiles will find successful attainment of its cost, schedule and quality goals elusive at best.

2.1.2 Project Risk Element Allocation

Only the Owner gets to choose which party to an infrastructure project is allocated which risk element identified for the infrastructure project. Allocation of risk elements is one of the most important management decisions an Owner will make during the entire project life cycle. In the most recent past the theory was that an Owner should divest itself of as much risk as possible either through insurance or allocation of risk to other parties. The theory was that the more risk allocated to others the less risk faced by the Owner. In fact, one of the most touted attributes of the Design-Build project delivery system was the Owner was able to divest itself of the maximum amount of the risk using that project delivery method. Unfortunately, the concept of total risk divestiture under any project delivery system was based on the mistaken assumption that once a risk element was allocated to others it (1) ceased to be a concern to the Owner and (2) had no impact on the Owners cost, schedule or quality goals. However, those assumptions were false.

Even under a Design-Build delivery system an Owner can never successfully divest itself of every risk it faces on a project because simply allocating the risk to another party does not eliminate or remove the risk element from the project, it simply shifts the responsibility to control and manage the risk element and part of the liability or burden of the impact of that risk to another party. Even in situations where the Owner has erected seemingly impenetrable contractual barriers to the liability occasioned by the manifestation of the risk element and has gone so far as to establish penalties (e.g. liquidated damages for delay) for another parties' failure to manage a risk element, courts and arbitration panels have found reasons under which an Owner must bear some (if not all) of the cost and/or schedule impact of those risk elements. Attempts to manage risk by total allocation of all risk to another party simply have not worked as intended.

Therefore, the growing trend is to allocate risk elements on the basis of identifying the party within the project structure which is best equipped and best positioned to manage that particular risk element. For example: the parties best equipped and best positioned to handle risks associated with meeting

local, state and federal laws, regulations and codes are the Design-Build Contractors. Therefore the responsibility and liability should be allocated as appropriate to that Contractor. However, the party best equipped and positioned to manage and control changes to the project is the Owner. Therefore the responsibility and liability to manage and control change should be retained by the Owner.

Allocation of risk elements is founded in the risk profile created for the project. There are any number of factors which should go into a decision to allocate a risk element, however whatever the specific factor, the process must be formal and must be based on a subjective evaluation of who among the project parties is best able to manage that risk element so as to avoid, mitigate or eliminate the risk from the project. The contract document set is the vehicle by which risk is allocated among the project parties, thus making the contract document set the single most important collection of documents for the entire project.

Risk allocation is not simply resolved by making a choice as to which party will be paid to take responsibility and liability for a particular risk element. Risk allocation is a management decision or how and who is best to manage and control a risk for minimal impact on cost, schedule and quality goals.

2.1.3 Project Delivery System

A project delivery system is the organizational structure under which the Owner intends to execute the project. A project delivery system can be one in which the Owner self performs all of the design and construction work or it could be a system that depends upon a single contractor or multiple contractors executing a specific scope of work and working in a predetermined sequence. To a large extent the choice of a specific project delivery system depends on the relative priority of the Owner's cost, schedule and quality goals and the risk profile inherent within the project. One of the Owner's tasks during the Project Formation stage is to match the project specific goal priority and risk profile with the most compatible project delivery system.

The Design-Build project delivery system, is an option that has gained popularity with infrastructure project Owners in recent years. There are a number of reasons for that growing popularity, among them:

- Infrastructure projects tend to be time critical, making the attainment of schedule a priority goal. A fundamental attribute of the Design-Build project delivery system is the significantly lower total project duration that can be achieved under that project delivery system.
- Infrastructure projects are cost sensitive. Funding for a class of infrastructure projects (i.e. water treatment) is generally capped, forcing the Owner to choose among a myriad of needed projects; however total cost becomes secondary to schedule when the projects are ranked by most immediate need. Early knowledge of project cost is important for the infrastructure Owner so that it can both allocate the money necessary to fund the project in question and so that it can know the money remaining within the particular infrastructure fund which is available to execute other infrastructure projects awaiting execution. The Design-Build project delivery system, particularly when coupled with a Guaranteed Maximum Price or lump sum pricing structure, establishes a total project cost more quickly than most other project delivery systems.

- Since in infrastructure projects quality will always be to some extent a tertiary goal to schedule and cost goals, it is prudent to focus the responsibility for ensuring that the quality goals are met with a single party. Under the Design-Build project delivery system an Owner can set quality standards for which it then makes the Design-Build Contractor responsible. In this way quality goals become a condition of the contract and are included as part of the Design-Build Contractors price for the project. This in turn makes it easier for the Owner to oversee and enforce those quality targets set within the contract document set.
- Using a single point of delivery – the Design-Build Contractor – the administrative burden (and costs) borne by the public Owner responsible to either self perform an infrastructure project or manage and coordinate multiple contractors with different and sometimes conflicting scopes of work.

Although those are indeed powerful reasons for infrastructure Owners to be turning to the Design-Build project delivery system, there is one attribute that the Design-Build system does not have: it does not eliminate a single risk element inherent within an infrastructure project. In fact, no project delivery system currently in practice can eliminate those inherent risks. Risk under any project delivery system simply assigns the management, control and liability for the risk elements to a specific party engaged in the execution of the project, no project delivery system, including the Design-Build project delivery system, eliminates risk. There is no such thing as a legally defined or universally accepted standard allocation of project risk based upon the concept of a Design-Build delivery system. An infrastructure Owner must still allocate risk elements individually within the provisions of the Design-Build contract document set.

2.1.4 Project Contract Form and Provisions

A contract must be crafted to reflect the Owners cost, schedule and quality goals, the risk profile inherent within the infrastructure project and the strengths of the project delivery system selected by the Owner for the execution of the project. Not surprisingly, boilerplate or standard contracting forms cannot generally be simply overlaid on those goals, risks and project delivery systems successfully: standard contracts leave gaps between the goals, risks and delivery system which are often filled in during the resolution of claims and disputes.

At a minimum the contract document set must acknowledge that a liability for a risk element cannot be allocated without also allocating the authority to plan, manage and control that risk element. For example: to allocate the risk for meeting a date certain for completion of the project but to retain control of the means and methods by which the Design-Build Contractor must sequence and execute the work establishes an untenable situation for the Design-Build Contractor. In effect the Design-Build Contractor is responsible to complete the project by a given date but does not have control over the process by which it will achieve that goal. Such contractual inconsistency is often a primary basis for claims and disputes between the infrastructure Owner and the Design-Build Contractor.

In the end the three primary components of the Owner's Risk Management program – the risk profile, the project delivery method and the contract form and provisions – must align to create a coordinated, seamless process under which risk elements are identified, evaluated, allocated and enforced.

2.1.5 Summary of the Owner's Role during Project Formation

Quite simply, up to the point of bid award the infrastructure Owner is solely and totally responsible for Risk Management during the Project Formation stage of every infrastructure project. Decisions by the Owner during this stage of the infrastructure project will add to and alter the risk profile. If an Owner fails to employ a sound Risk Management program during the Project Formation stage of the project life cycle, the chances of successfully executing the infrastructure project are significantly reduced.

The Owner's last Risk Management action during the Project Formation stage is to "bundle" the results of all of its management and planning actions and decisions into a Request for Proposal (RFP) which it then submits to potential Design-Build Contractors on which they prepare their bids.

2.2 The Design-Build Contractor's Risk Management Role during Project Formation

The Design-Build Contractor has no Risk Management role in the infrastructure project until the point at which the Owner issues the RFP. However the first step that a prudent Design-Build Contractor should take will be exactly the same as that taken by the Owner:

- (1) Prepare a profile of the risk elements which have been allocated by the Owner to the Contractor. Note that from the Design-Build Contractor's point of view the risk elements include the discrete items delineated within the project scope of work (i.e. deliverables).
- (2) Develop plans for executing the scope of work (deliverables), taking into account those risk elements which will pose a threat to the completion of those deliverables.
- (3) Develop the schedule for completion of the scope of work taking into account those risk elements which will pose a threat to the completion of those deliverables as scheduled.
- (4) Prepare a bid cost estimate for the completion of the scope of work taking into account those risk elements which will pose a threat to the completion of the those deliverables as estimated.

The Design-Build Contractor works under two significant disadvantages:

- It has a very limited time within which to prepare its response to the RFP which significantly restricts the depth to which it can conduct any analysis of the risk elements inherent within the project; and,
- Its initial cost to prepare the response to the RFP is, in itself, a significant risk to the Contractor, as the Contractor must invest money which it may never recover in an attempt to win a competitively bid project award.

Executing these steps can be costly and time consuming, yet must be well done if the Contractor is to have any chance to win the infrastructure project. The Design-Build Contractor always walks a very fine and precarious line between over-investing and under-investing in the preparation of the bid and there is no simple formula which the Contractor can apply that will tell it what the "right" level of investment might be. If the Design-Build Contractor invests too little and thus fails to correctly establish the risk profile for the project it runs the risk of winning a project only to find it has underestimated the cost and time it will take to successfully execute the scope of work. If the Design-Build Contractor invests too much in preparing the response to the RFP it may accurately identify the

risk elements, but attempting to recover its “sunk cost” of bidding may result in submittal of a price which is non-competitive and thus cause it to lose the award of the project.

Once the decision has been made to tender a response to the RFP, a Design-Build Contractor has a definitive Risk Management role to play in the project, the results of which can potentially win or lose the award. Just as importantly, it will lead to the success or failure of the Owner to achieve its cost, schedule and quality goals.

2.2.1 Development of the Risk Profile

The Design-Build Contractor must rely on those documents issued by the Owner and its own infrastructure project experience in order to prepare a definitive risk profile for the infrastructure project it is bidding. The first step is a straight forward exercise: the Design-Build Contractor must abstract all of the risk elements allocated by the Owner to the Contractor via the RFP document set (including the draft contract conditions). The Contractor has a legal right to rely on the documents provided by the Owner in developing its risk profile and after repeated legal precedent has held that if a document issued by the Owner is silent on a particular issue or risk element, the Contractor has a right to apply its own interpretation to that silence.

The second step, however, is somewhat more difficult in that the Design-Build Contractor must identify those risk elements within the document set which appear to be missing, identify those risk elements which are presented with conflicting contractual provisions (e.g. allocation of the schedule risk yet Owner retention of the approval of all schedule means, methods and activity sequencing), and identifying those risk elements which from its own experience it will encounter during execution of the project (e.g. an Owner’s desire to impose late changes in the project design).

Having identified all of the risk elements, the Design-Build Contractor must conduct its own evaluation of those risk elements in much the same manner and using much the same tools as the Owner used during the earlier Project Formation stage. After that point, however, a Design-Build Contractor faces different decisions relative to how it will manage and control risk as the Contractor does not have the option of cleanly allocating risk to another party that it might bring into the project. Although a Design-Build Contractor may pass through a particular performance risk to a subcontractor, if the risk element manifests and the project suffers an impact, the Owner will not seek recovery from that subcontractor: the Owner will look no further than the Design-Build Contractor for recovery. From a practical standpoint, the Design-Build Contractor remains responsible to manage and control all of the risks which have been allocated to it by the Owner.

The Design-Build Contractor does have choices it may make concerning risk:

- (1) If the total risk load is too high or there are a few significant risk elements which the Design-Build Contractor is unable to take on it can choose not to bid the project.
- (2) If a risk element is likely to manifest during the execution of the project, the Design-Build Contractor can add money in the form of direct cost or contingency intended to cover the impact of the risk to the project. For example: it is not unusual for a Contractor facing liquidated damages to assume a limited number of delays of delay and add the cost of the expected liquidated damages for those delay days to their total bid.

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- (3) A Design-Build Contractor can impose back-to-back liability on subcontractors and vendors which, while they will not protect the Contractor from the Owner, will enable the Contractor to recover at least a portion of the impact cost generated by the risk element.
- (4) A Design-Build Contractor can propose alternatives to the Owner which may reduce or remove a risk from the Contractor in return for a lower price or shorter time to completion of the project.

However, risk elements which an Owner has allocated to the Design-Build Contractor are a fact of life in the construction industry and in the end the Contractor must price, schedule, control and manage risk if it is to be successful. Like the Owner, the critical first step is for the Design-Build Contractor to identify as much of the risk possible, evaluate that risk as accurately as possible and then establish its alternatives for managing and controlling that risk.

2.2.2 Execution Planning

A significant element of every Design-Build Contractors bid preparation will be the development of a detail execution plan which addresses the physical execution of the Owner's scope of work, the processes by which that scope of work will be managed and controlled and the general sequence in which the work will flow through the project execution. From that plan will flow labor needs, timing and loading, procurement plans and schedules, trade coordination, etc. At this phase of the project life cycle the Design-Build Contractor is not conducting detailed execution planning, however it is attempting to validate a general project flow and process and lay the foundation for the more detailed estimates and bid schedules. During the preparation of the execution plan additional risk considerations will be identified and must be added to the full project risk profile (e.g. winter weather vs. exterior construction sequence) and tentative plans for mitigating or avoiding those execution risk elements.

It is during the execution planning that the Design-Build Contractor will select its project control systems (cost and schedule) which are two of the most critical tools necessary to monitor, manage and control risk during project execution. In selecting those project control systems the Design-Build Contractor must look beyond the need to satisfy the Owner's requirements for cost and progress reporting and consider its own need to have in place systems which will enable it to identify likely points on the schedule at which various risk elements will be most likely to manifest or progress monitoring systems which will provide early trend warnings of a particular risk element conditions being manifest. Too often Design-Build Contractors under value (and thus under price) the true cost of project controls systems which are adequate to the need for those systems during project execution.

2.2.3 Project Master Bid Schedule

For a Design-Build Contractor time is always money as the Owner in part selected the Design-Build project delivery method in an effort to shorten the time to completion. Therefore the Design-Build Contractor is expected to find ways in which time can be shaved off of the total project schedule and for every day saved by the Design-Build Contractor during the planning for the project there is both a direct cost and a risk element assumed by the Contractor. Design-Build projects are expected to overlap activities such as design, procurement and construction, phasing work on each subsequent activity to start at point of progress in the predecessor activity which will support the start and continuation of that successor activity. Thus, procurement and construction activities will not await the completion of detailed design, but will be initiated at the point in time when the design elements which have been completed can support the start of those activities.

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Such phasing has a direct cost which must be estimated by the Design-Build Contractor and a risk element impact cost which must also be evaluated and estimated by the Contractor. In this instance there is the direct cost of simultaneously attempting to manage design, procurement and construction and the risk potential cost for the Design-Build Contractor to have to accelerate an activity or string of activities in order to maintain the scheduled completion date. As with the execution plan, development of the initial master project schedule will raise additional risk elements which will have to be added to the risk profile, evaluated and estimated by the Design-Build Contractor.

2.2.4 Project Bid Estimate

Estimating the cost to complete an infrastructure project is not a simple matter of quantifying materials and equipment and pricing them on the open market. Vendors generally will not give firm prices to Design-Build Contractors for bid purposes. Thus the Design-Build Contractor will have to take the prices cited and evaluate the risk that the prices will remain stable until award and placement of the purchase order. Likewise, subcontractors will not commit to firm prices for specialty work and so Design-Build Contractors must evaluate the risk that the price will increase by the time the project award is made to the Contractor and the subsequent subcontract award is made to the subcontractor. The Design-Build Contractor will evaluate that risk and, if warranted, will add to the price of materials, equipment or subcontract work in an effort to offset the risk of a price increase which may occur between bid and award.

Every line item in an estimate has an element of risk associated with it, including the risk that the Design-Build Contractor has misestimated the quantity, the unit price or the total cost of that line item. In recognition of that risk, Design-Build Contractors generally apply two levels of contingency to a bid:

- Line item contingency (above the line) which is in recognition of a particular cost line item which the Design-Build Contractor has reason to suspect will change for some reason or which may have a high element of risk associated with it. For example: the Design-Build Contractor can add a contingency amount to the estimated cost of a particular commodity such as formed steel in recognition of the current volatility of the price of steel in the open market.
- General Risk Contingency (below the line) which is in recognition of the risks associated with the project in general. For example: the Design-Build Contractor may be concerned about a vague Owner requirement for it to “meet the highest industry standards of design” and add a contingency to the total bid price in an effort to offset the possible cost of that vague standard of performance.

The cost estimate submitted by the Design-Build Contractor to the Owner literally represents the Contractor's estimate of what it will cost for it to successfully execute the project, which includes successfully managing and controlling those risk elements which have been allocated to it by the Owner. Together, the cost estimate and schedule represent the Design-Build Contractor's best opportunity to address the risks which have been allocated to it by the Owner.

2.2.5 Summary of the Design-Build Contractors Role during Project Formation

Whereas one might think of the Owner's Risk Management role during the Project Formation stage as proactive the Design-Build Contractor's role during that stage of the Project Life Cycle is much more reactive. Within a very limited amount of time a Design-Build Contractor must identify, evaluate, price and schedule all of the risk elements which have been specifically allocated by the Owner within the RFP and those risk elements which, in its experience, have the potential to impact its execution of the full scope of work.

Technically, the primary Risk Management steps are the same for both the Owner and the Design-Build Contractor. However, because the responsibility to manage and control the risks and the liability for the cost or schedule impact of those risks have been allocated to the Design-Build Contractor by the Owner, the Design-Build Contractor must evaluate risk elements not just probabilistically, but to the point of being able to actual price and schedule those risk elements. It is in the development of specific execution plans, the choice of project control systems and the setting of the cost estimate and master project schedule that Risk Management becomes more than an exercise to identify what can go wrong. At the point of bid, Risk Management must be converted into a system by which risk will be monitored, avoided, mitigated, controlled and overcome by the Design-Build Contractor.

2.3 Summary of Risk Management during Project Formation

The Owner and Design-Build Contractor begin their respective Risk Management efforts in exactly the same way during the Project Formation stage of an infrastructure project: identifying and evaluation risk inherent in the project. However, once risk has been identified and evaluated the roles change because the options open to the Owner and Design-Build Contractor change:

- An Owner has three options open to it during this stage of the project life cycle: retain, allocate or insure a risk element.
- A Design-Build Contractor must accept the risk which it has been allocated, estimate the cost and schedule necessary to overcome that risk and then develop specific plans for managing and controlling that risk.

Both of those roles are critical to the successful execution of an infrastructure project and each party has to recognize the role which the other fills if they are to initiate the execution stages of the project with a clear and consistent understanding of the risks that exist and the part that each will play in successfully managing and controlling those risks.

3 OWNER AND DESIGN-BUILD CONTRACTOR RISK MANAGEMENT ROLES DURING THE PROJECT EXECUTION STAGE

The next stage of the Project Life Cycle is Project Execution, during which

- (1) The Owner and Design-Build Contractor finalize the project execution plan;
- (2) The Owner and Design-Build Contractor execute their respective portions of the infrastructure project; and,
- (3) The infrastructure project is completed and placed into service.

Those three steps comprise the heart of every construction project: executing the work necessary to complete the structure or facility. The simple sounding steps actually involve hundreds of actions and decisions every day throughout the duration of the infrastructure project, everyone of which have the potential to add to or significantly alter the risk profile of the project.

An Owner's or Design-Build Contractor's Risk Management plan never controlled, avoided or mitigated a risk. A cost contingency cannot cover the total impact to a project if the actions upon which the contingency amount was set are never taken by the Design-Build Contractor. And unless the Owner and Design-Build Contractor actually manage risk during the execution of the infrastructure project then all of the Risk Management efforts taken during the Project Formation stage of the Project Life Cycle will have been wasted. Managing risk during the Project Execution stage should be one of the primary responsibilities for both the Owner and the Design-Build Contractor if for no other reason that risk elements pose a threat to the successful completion of the infrastructure project.

Under the Design-Build project delivery system the primary responsibility for the management and control of inherent project risk shifts to the Design-Build Contractor. However, to successfully manage risk during execution an Owner and Design-Build Contractor both have significant roles to fill if the project is to meet its cost, schedule and quality goals

3.1 The Owner's Risk Management Role during Project Execution

The Owner fills three distinct Risk Management roles during the actual execution of an infrastructure project:

- (1) Management of Retained Risk Elements
- (2) Monitoring and Contractual Enforcement of Allocated Risk Elements
- (3) Project Acceptance Procedures

3.1.1 Retained Risk Management Action Plans

An Owner's risk profile should clearly delineate those risk elements which the Owner has chosen to retain. Risk elements are generally retained by an Owner when the Owner is in the best position to manage that risk element and/or needs to maintain ultimate control over that risk element in order to ensure meeting some specific project objective or goal. For example: the Owner may have a definitive budget limit for the infrastructure project and must tightly control the introduction of any changes into the design of a facility or structure in order to control cost against that definitive budget. If the Owner, for whatever reason, decides to retain a risk element then it must be prepared to actively manage that risk element during the execution of the project.

To actively manage retained risk elements an Owner's Risk Management plan must be as complete and detailed as that which it would expect from any other project participant. That plan should include predicting when each retained risk element is most likely to manifest during the project and establish a matrix of responses from which the Owner can chose an appropriate response to the manifestation of that risk element. Risk Management action plans can be identified as either avoidance or mitigation based. Avoidance action plans are applied when the best way in which to control the risk element in question is to preclude the conditions which will result in the manifestation of the risk from every

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occurring. For example: if the Owner has retained the risk to obtain the required construction permits by a certain date within the project schedule it's Risk Management plan should focus on the steps necessary to secure the permits at a specific date well in advance of the scheduled "need dates" established for those permits. Obtaining the permits as scheduled will avoid any ripple impact delay to the Design-Build Contractor's schedule which would flow from those permits being obtained later than planned.

Mitigation action plans are predicated on the assumption that a particular risk element will, at some time during the execution of the project, manifest and rather than attempting to avoid the risk the best response is to initiate actions which are directed toward reducing (or mitigating) the impacts of that risk element on the project. For example: Owners make changes in structures and facilities as they are designed and constructed. Rather than try to ban changes, an Owner would be better served by managing a change control process which limits the number of changes, streamlined the processing of changes and closely monitored the cost and schedule impact of each change on the project as a whole.

An Owner's management actions relative to the manifestation of a risk element should be based on specific actions taken in a timely manner so that impact to the total project will be minimal, otherwise it will be the Owner which suffers from its inability to manage and control the risk. Risk elements which an Owner retains have the potential to impact the costs and schedules of the other participants, therefore any additional cost or schedule delays which result from the manifestation of those risk elements will be the Owners responsibility and applied against the Owner's account.

As noted earlier, the risk profile of an infrastructure project changes over time as a project is executed. Every decision made and event which occurs during a project has the potential to add, delete or modify the risk elements which comprise the risk profile. A part of every Owner's Risk Management plan should be to periodically audit the project risk profile to ensure that the any changes to that profile have been recognized and the risk profile has been modified to accommodate those changes.

3.1.2 Allocated Risk Monitoring and Enforcement

An Owner should never insert itself directly into the management of a risk element it has allocated to the Design-Build Contractor; to do so would defeat the purpose for having allocated the risk element in the first place. However, an Owner must ensure that the Design-Build Contractor to whom the risk has been allocated is managing and controlling those risk elements for which it is being paid. Every contract has enforcement provisions which are specifically intended to be used by the Owner in the event that the Design-Build Contractor is not managing and controlling those risk elements for which it is being paid; however, in order to use those enforcement provisions an Owner must monitor those risk elements which have been allocated to the Design-Build Contractor and then take those enforcement actions necessary and appropriate to ensure that Contractor responds as required within the contract document set.

To monitor Risk Management on a project the Owner must have cost, schedule and quality control systems in place which enable it to track the activities and progress on the project. The Owner's project control systems should be compatible with those used by the Design-Build Contractor to monitor and manage cost, schedule and quality on a project so that data flow between the two parties is as easy as possible. The monitoring of allocated risk elements is to some extent predicated on an Owner having a requirement that every party engaged in the project has and follows an acceptable,

formal Risk Management program. The total risk profile should include the processes and project control systems by which allocated risks will be monitored and enforcement actions will be taken.

3.1.3 Project Acceptance Procedures

An infrastructure project is not complete until it has been accepted into its intended service by the Owner and the Owner should not accept any project in which any execution risk elements other than extended warranty remain open. For example: if a contractor has outstanding payments due to its subcontractors, the cost risk elements of the project are not closed and the Owner should not accept the infrastructure project as complete.

Part of every Owner's project closeout and acceptance procedure should be the formal closure of each of the primary risk elements which are contained within the project risk profile.

3.1.4 Summary of the Owner's Risk Management Role during Project Execution

As noted, the Owner's role in managing risk on an infrastructure project is diminished to a certain extent by the use of the Design-Build project delivery system. The Owner must manage those risks it has chosen to retain, monitor the Risk Management actions of the Design-Build Contractor, enforce the contractual provisions which govern the Design-Build Contractor's responsibilities to manage risk and periodically audit the risk profile for the project. However, the Owner must resist the impulse to step into the Design-Build Contractor's Risk Management role during the execution of the project. This is a particularly difficult impulse to overcome in an industry sector which has a tradition of the Owner having complete control over every aspect of the infrastructure project under a strict design-bid-build delivery system. The Owner must keep in mind that stepping into the Design-Build Contractor's Risk Management role will to a large extent negate one of the primary benefits sought under the Design-Build project delivery system.

3.2 The Design-Build Contactor's Risk Management Role during Project Execution

The Owner has a right to assume that a Design-Build Contractor has priced every risk element which was allocated to it via the contract document set. The Owner has a right to assume that the Design-Build Contractor has taken the allocated risk elements into account when it established the schedule for execution of the project. The Owner has a right to assume that the Design-Build Contractor has developed a Risk Management plan which will enable it to avoid or mitigate the risk elements which were allocated to it. And, an Owner has a right to expect that if an allocated risk element manifests during the execution of the project to the extent that it impacts the cost, schedule or quality of the project the Design-Build Contractor will bear the liability for that impact.

From the Owner's point of view it paid the Design-Build Contractor to accept the responsibility to manage and control certain risk elements and bear the liability for the impact those risk elements might have on cost, schedule or quality should any of them manifest during the execution of the project. The Owner therefore expects the Design-Build Contractor to earn that payment either by successfully managing and controlling risk or by absorbing the impact of that risk should it manifest.

The Design-Build Contractor must take that same view: it has been paid to assume the responsibility to manage, control and bear the liability of those risk elements allocated by the Owner within the contract documents set. Acknowledging and accepting responsibility and liability for allocated risk is

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the first step in the preparation and execution of a sound project execution Risk Management program for the Design-Build Contractor.

During the Project Execution stage of an infrastructure project the Design-Build Contractor has only three primary functions, however all are critical to the ultimate success of the project:

- (1) Management and Control of Allocated Risk
- (2) Updating of the Risk Profile and Risk Management Plans
- (3) Project Completion

3.2.1 Management and Control of Allocated Risk

Up to the point of bid award Risk Management for the Design-Build Contractor is an exercise in identification, evaluation, pricing and scheduling those risk elements which had been allocated to it by the Owner via the RFP. From the point in time when the infrastructure project is awarded and the contract executed between the Design-Build Contractor and the Owner Risk Management becomes a functional requirement of the project. The Design-Build Contractor has been paid to manage, control and bear the liability for that allocated risk and, in effect, now “owns” the allocated risk. The Design-Build Contractor has only two options open to it relative to that risk burden:

- (1) Ignore the risk trusting to luck that the risk will not manifest, or
- (2) Actively manage the risk in order to control the manifestation or the impact of the risk.

To ignore the risk is the default choice and one which is made more often than Design-Build Contractors may like to admit. There is a misconception that the risk contingency established within a project budget and the schedule adjustments made to acknowledge possible risk impact are, in themselves, adequate Risk Management actions. That concept is false: the contingency amount was set primarily to fund those management actions that will be necessary to manage and control the risk element should it manifest, not to cover the liability of the risk element impact. Likewise, schedule adjustments were made to enable the Design-Build Contractor to overcome delays attributable the manifestation of a risk element by giving it the flexibility to re-sequence activities or work around the risk impact, not to cover the liability of the risk element schedule impact. In short, contingency and schedule adjustments made during the bid phase were established as Risk Management tools, not as liability buffers.

During the Project Execution stage of the Project Life Cycle the Design-Build Contractor must have a proactive Risk Management program which flows from the risk profile and is based on monitoring risk to the same degree that it monitors physical progress on an infrastructure project. The Design-Build Contractor should prepare a “risk schedule” which places each of the major risk elements in relation to the overall execution schedule of the project. For instance, the most likely time to encounter equipment delivery problems is after issuance of the purchase order to the vendor and before expected delivery. That risk element therefore should be “scheduled” for close monitoring and management action during that period. The risk element should come off the “risk schedule” and risk profile when the risk opportunity has passed (i.e. the equipment is delivered). The risk schedule technique keeps the Project Execution Teams focus on the present and future risk elements and keeps the risk profile current to the progress point of the project. Note that a risk schedule is not akin to a critical path schedule and, in fact, many risk elements will never be on a projects critical path unless and until they manifest on a project. In many instances risk elements should be closely

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monitored and actions taken in an effort to assure that those risk elements never become part of the project critical path.

The Design-Build Contractor should also have in place risk monitoring systems specifically intended to track those conditions which may lead to the manifestation of a particular risk element. For example: if there are dates certain by which specific equipment specifications and designs must be finalized to support phased procurement and construction, progress on those specific designs should be isolated from the more general “design progress” curve and tracked on a more frequent basis. Focused frequent tracking will highlight any trend towards delay and enable the Design-Build Contractor to take avoidance or mitigation actions well in advance of the risk element having any actual impact on the execution of the project.

The tools discussed immediately above are not used in the same way as they normally are by Design-Build Contractors; control systems are generally used as an after the fact tool for reporting to management and the Owner where the project has been and trending where the project will go. The Design-Build Contractor estimates costs and progress achieved during a month, then reports that cost and progress to the Owner with a trend line which predicts the future cost and progress. The Risk Management project control tools are designed to track cost or progress (or any other parameter) on a real time basis and immediately identify any variation from the planned execution curves. The Risk Management control tools are also focused on individual pieces of the scope of work (the individual risk element) and not a whole element (such as design) or total project progress. As risk elements are closed, the Risk Management control tools are constantly refocused on the current or upcoming risk elements.

Early detection of a risk element manifestation allows the Design-Build Contractor to take appropriate avoidance or mitigation action, using project cost and schedule contingency to effectively control the risk element and limit its impact on the project as a whole. More so than any other project execution function, Risk Management is a forward looking function that depends upon the Design-Build Contractor to implement avoidance and mitigation actions in anticipation of a risk element manifestation. If a Design-Build Contractor waits to act on a risk element until the point at which that risk element has manifest, then all that can be done is to bear the liability for the impact created by that risk element. At that point then cost and schedule contingency become penalty payments to be paid to the Owner and not Risk Management tools to be used by the Design-Build Contractor.

3.2.2 Updating of the Risk Profile and Risk Management Plans

No battle plan survives the first shot fired and no Risk Management profile survives the first decision made or problem encountered. Risk elements may increase or decrease in importance or they may disappear off the risk profile completely depending on events and decisions made during the execution of the project. Likewise new risk elements which were not contained in the original risk profile may be added as a result of events or decisions made by the Owner or Design-Build Contractor. To be of any use, the risk profile must be constantly updated and the management plans in place to monitor, manage and control those risks must be adjusted to accommodate that changing risk profile.

As noted directly above, Risk Management is entirely based on looking forward and taking anticipatory action to avoid or mitigate risk. That in turn means that the Risk Management profile and plans must also be focused on the future and not the past. When a risk element is no longer a threat to the

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successful execution of the infrastructure project it should be removed from the active Risk Management profile. And as new risk elements arise due to events or decisions made during the execution of the project they should be added to the risk profile and place on the “risk schedule”. In effect, the process by which the original risk profile was created (identification, evaluation and action plans) must be repeated in a continuing cycle throughout the execution of the project. The process need not be so complex nor involve so many individuals; however the process must be conducted if the Risk Management profile and plan is to be current and meaningful as a project management tool.

3.2.3 Project Completion

The saying goes that the last 10% of any construction project (closeout) takes 25% of the total time and cost to achieve. Yet by the time most projects arrive at the closeout stage the cost and schedule contingency have been exhausted on risks which have manifest earlier in the execution of the project. One of the goals of Risk Management is to ensure that time and money are not exhausted at the point in time when project completion and turnover are initiated.

Project completion may be thought of as a distinct risk element faced by the Design-Build Contractor in any project. However, project completion involves a series of distinct actions which should be treated as individual risk elements and so subjected to the same intense scrutiny given other risk elements during earlier phases of project execution. To the extent possible the Design-Builder and Owner should agree to a phased or system-by-system completion process which immediately reduces the risk that one late system or failed test will delay the entire closeout process. Once that agreement has been reached, each phase or system should be treated as an individual and separate risk element and treated to the same monitoring, management and control processes which were employed during the earlier phases of the Project Execution stage. A specific risk element close out schedule should be prepared and each of those elements should be individually tracked to monitor for impact conditions so that anticipatory management actions can be taken to avoid or mitigate the impact to the project closeout as a whole.

As previously addressed for the Owner, the Design-Build Contractor should use the risk profile as a checklist by which it can demonstrate to the Owner that it has executed all of the management actions necessary to close all of the risk elements allocated to it by the Owner within the contract document set.

3.3 Summary of Risk Management during Project Execution

At this point in time Owners of infrastructure projects are facing mounting pressure to “do something” to repair, upgrade or create new infrastructure systems to meet the needs of the population. With each year that passes the strain on the in place infrastructure increases and that pressure has resulted in the need for Owners to seek new methods by which to plan and execute infrastructure projects in a shorter time period, yet without totally abandoning the control of costs and quality. The adoption of the Design-Build project delivery method can address the time pressure, and if coupled with a sound Risk Management program the Owner need not abandon its cost of quality goals to achieve that time savings.

However, Risk Management is not intended to be a one time activity done during the initial stages of the Project Life Cycle; it must be a fully functional management system which if focused on proactively managing risk at every phase of a project. If an Owner or a Design-Build Contractor does not take the

step from Risk Management identification, evaluation and planning to actually managing risk, then the investment made during the Project Formation stage was essentially wasted.

4 RECURRENT PROBLEMS IN MANAGING RISK IN DESIGN-BUILD INFRASTRUCTURE PROJECTS

Pegasus-Global has undertaken numerous analyses of both Owner and Design-Build Contractor client projects in an effort to discover why after spending extensive time and money on sophisticated Risk Management programs they continue to fail to achieve the cost, schedule and quality goals set for a project. Pegasus-Global has identified five factors which appear constantly and consistently during the execution of those analyses and, without identifying the specific projects or parties, has summarized factors below.

4.1 Lack Capital Program Risk Management System

Owners of infrastructure projects are managers of extensive capital construction and improvement programs under which a constant and overlapping stream of construction projects are selected, initiated, executed, completed and placed into service. Likewise, the business of a Design-Build Contractor is to bid, win and execute an overlapping and continuous stream of capital infrastructure projects. Multiple capital project Owners and Design-Build Contractors must have in place an organized program by which the various projects, each with their unique cost, schedule and quality goals, can be selected and successfully executed. At the most senior management levels of a Design-Build Contractor or infrastructure Owner the Risk Management focus should be focused on two objectives:

- (1) Ensuring that the total capital project risk load taken on at any one time does not to exceed the capability of the Owner or Design-Build Contractor to manage and control that risk successfully. This is part of the project identification, recommendation and approval process within a corporation or government agency.
- (2) Ensuring that the capital projects in execution at any given time are being properly managed and controlled. This is particularly critical in publicly held corporations which are governed by boards of directors who in turn must operate under legal restraints such as the Sarbanes-Oxley Act in the United States, and governmental agencies that are subject to public and political oversight.

Risk Management is a factor in the senior corporate and government agency level insofar as the total capital program risk profile for a multiple project Owner or Design-Build Contractor will be the amalgamation of all of the risk profiles for all of the projects which it has underway at any given time. There is a finite limit to the amount of risk an Owner or Design-Build Contractor can take on and successfully manage at any one point in time; therefore the project mix executed over a given period should never include more aggregate risk than the party can successfully manage at a specific point in time. The risk mix may include several low risk projects and one or two medium risk projects or it may include a single high risk project with only one or two low risk projects. The exact risk mix is a factor of the Owner's or Design-Build Contractor's capability and staffing.

4.2 Lack of Meaningful Risk Management Action during Project Execution

One of the most common findings during Pegasus-Global's analysis of Risk Management processes is that Owners and Design-Build Contractors view Risk Management as a single point activity, done once during the Project Formation stage of the infrastructure project. Pegasus-Global has encountered numerous instances in which risk profiles were prepared for an infrastructure project which, once the project was awarded were never again used by either the Owner or the Design-Build Contractor. During Risk Management analyses Pegasus-Global has discovered extensive and sophisticated Risk Management profiles in bookcases of Owners and Design-Build Contractors which were never even forwarded to the Project Execution Teams for their information or action.

The reason most often given by an Owner for that situation is their belief that once the risks had been identified and allocated to the Design-Build Contractor it had no further role in managing risk on the project.

The two reasons most often given by Design-Build Contractors were:

- The risk profile was used to establish the cost and schedule contingency for the project and that contingency had been included specifically to offset the impact of that risk element on the project cost, schedule or quality goals.
- The elements contained within the risk profile were already accounted for within the normal project management and control systems and there was no need to insert an additional project management function into an already overburdened position.

The majority of the Risk Management gap analyses that Pegasus-Global has been asked to perform were done as a result of the Owner's or Design-Build Contractor's failure to consistently achieve their respective cost, schedule and quality goals on projects. The reviews of the risk profiles prepared for those projects revealed that the Owners and Design-Build Contractors had usually identified and correctly evaluated the risk elements which were ultimately responsible in part in preventing the successful attainment of project cost, schedule and quality goals. However, because the Risk Management actions appeared to end with the identification and evaluation of risk, the allocation of risk by the Owner and the establishment of cost and schedule contingency by the Design-Build Contractor, those risks were not proactively managed during the actual execution of the project.

4.3 Forcing Fitting the Risk Element Evaluation

A common factor which Pegasus-Global regularly encounters is the fact that the evaluation of risk elements was a numbers game to many Owners and Design-Build Contractors. By this Pegasus-Global means that we have encountered instances where the evaluation of risk probability and impact were manipulated to achieve a particular probabilistic rating number by those responsible for evaluating each risk. Typically this occurred more often in situations where a computerized probabilistic risk model such as a Monte Carlo simulation was used with a relatively limited number of people involved in the process.

This factor involved situations where numerical risk rating upper limits were established at which point a project might be judged too risky to be undertaken or where for each point in excess of that limit a specific cost and/or schedule penalty had to be added to the project estimate. In effect, if a project had

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too many high risk elements the cost and schedule estimates for execution of the project had to be increased by a predetermined amount. Pegasus-Global has encountered both documentary and personal narrative evidence that in situations where the risk rating numbers were “too high” those involved in inputting the critical assumptions into the probabilistic model would change the risk element conditions until they attained a “number that they could live with”. By changing the assumptions input, the risk evaluation could be lowered, thus eliminating the necessity to add to the cost or schedule estimates for the project.

Manipulation of risk evaluations has proven to be more common than Pegasus-Global would have expected, and is not generally seen as a significant issue among those responsible for Risk Management in Owner or Design-Build Contractor organizations. When asked why manipulating a model to achieve an acceptable evaluation rating was permissible, both Owner and Design-Build Contractor staff indicated that it was permissible because they intended to more actively manage the risk, which would in turn lower the probability of the risk element manifesting and lessen the impact of that risk if it did manifest.

This implies a basic misunderstanding of the why risk elements are evaluated. The idea is not to fit a particular risk element into a particular rating, it is to rank risks in a relative hierarchy so that the project planning and execution teams can devise appropriate responses to those risk elements and focus their attention on those risk elements which pose the greatest threat to the successful attainment of the project cost, schedule and quality goals. If a high risk may best be addressed by a combination of adding contingency to a line item or schedule activity then that is the action that should be implemented. Manipulation of the evaluation process in order to obtain a more acceptable answer can only impede efforts to actively manage risk.

4.4 Risk Management Actions and Contractual Provisions are Inconsistent

During Pegasus-Global’s Risk Management engagements, we have encountered a recurring disconnect between the allocation of risk elements and the contractual provisions which establish the rights and obligations of the Owner and the Design-Build Contractor. The disconnect usually involves a situation wherein an Owner has allocated a certain specific risk element to the Design-Build Contractor but has retained the contractual right to control certain elements of the process by which that risk element may be managed. One common example is an Owner that allocates the risk of completing the structure or facility by a date certain to the Design-Build contractor while dictating to the Design-Build Contractor the means and methods by which the project scope of work will be scheduled and executed. It is not uncommon for the Owner to set the execution sequence within the contract (usually by establishing specific payment milestone events) which forces the Design-Build Contractor to adhere to a definitive sequence with no right to alter that sequence to overcome delay impacts it may suffer during execution.

It is not unusual for Owner’s to impose schedule software requirements, retain the right to review and approve updates of the schedule, review and approve changes in the schedule sequences and durations and even retain the right to force a Design-Build Contractor to accelerate work if it “has reason to believe that the project will not be completed as scheduled”. Even though the Owner has essentially retained control of the Design-Build Contractors schedule means and methods, it has allocated the risk for completing the project by a date certain.

There are other examples where an Owner's allocation of a risk element is inconsistent with other provisions within the contract document set, and those inconsistencies are a primary source of the claims and disputes which arise during the execution of an infrastructure project. However, even with the experience of having suffered through claims and disputes, Owners continue to award projects with control provisions which are inconsistent with their risk element allocation decisions and Design-Build Contractors continue to accept and execute those flawed contracts.

4.5 Lack of Risk Management Project Controls

In those projects where Risk Management was practiced by the Owner or Design-Build Contractor during the Project Execution stage of the project, the Project Execution Team utilized the risk profile as a checklist against which it evaluated the project on a monthly basis. In most instances this practice enabled the Design-Build Contractor or Owner to implement management plans to address that risk element, but only after the risk element had actually manifest into a specific threat to the successful attainment of cost, schedule or quality goals. This limited the Owner's or Design-Build Contractor's management options to mitigation efforts directed towards minimizing the impact of the risk on project cost, schedule and quality goals.

The reason most often given for the lack of Risk Management project controls was that the Project Execution Team was neither familiar with the concept nor comfortable with their ability to develop, implement and manage risk utilizing Risk Management control tools.

5 SUMMARY

The Design-Build project delivery system and infrastructure projects appear to be an almost perfect match when considering the goal priorities facing infrastructure Owners today. However it would be a mistake to think that simply adopting a particular project delivery system would in any way eliminate the risks which are inherent within those infrastructure projects. Regardless of the project delivery system employed, the risks which are inherent in an infrastructure project must be actively managed throughout the Project Life Cycle if anyone is to have a chance at achieving the function, cost, schedule and quality goals established for the project.