# Providing the Best Value for Your Budget Case Study: Zoetis

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**CO5430-P** One of the biggest challenges that the architecture, engineering, and construction industry faces is conveying the design intent in a manner that reduces constructability and rework complications at all handover stages of a project's lifecycle. This presentation will discuss how early contractor involvement and an integrated design and construction process can help to achieve design optimization through the use of virtual design and construction (VDC) tools like Building Information Modeling (BIM). On the Zoetis project the Construction Team was involved in the earliest stages of the project-performing task, including quantity analysis and cost trending, discipline constructability, and coordination review. Because the reviews happened by the time construction documentation was issued, the firm avoided the majority of the problems that normally occur during construction. Additionally, the Construction Team has seen a reduction of 50% of the normal schedule time for the coordination of the project. This has enabled the team to provide the client, Zoetis, with value for its budget.

## Learning Objectives

At the end of this class, you will be able to:

- Learn about key project-planning tools
- Realize the benefits of model-based quantity takeoff
- Understand integrated design build approach
- Learn how to identify client advantages on schedule and cost

## About the Speaker

**John Grady**
**Virtual Construction Director, CRB Builders**
**Speaker Bio**

With over 18 years of experience across a wide variety of fields, John Grady's career started with the United States Navy Seabees as a tradesman. This position led to a position as an estimator with W. G. Yates and Sons Construction Company and then as a Building Information Modeling (BIM) manager with McCarthy Building Companies, Inc. John is now the director of Virtual Construction for CRB Construction, where his primary goal is to proactively lead and develop the utilization and implementation of virtual design and construction (VDC)-related technologies and processes that all team members can implement. CRB's processes are designed to enhance CRB's integration with project partners to provide clients with top value for their budgets. John also serves as CRB's representative on many national BIM committees. Through interfacing with the various national standards committees, John helps CRB to employ the latest and most effective VDC processes on the company's projects.

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**John Loethen**
**Project Director, CRB Builders**
**Speaker Bio**

John has over eight years of diversified construction experience, five of which have been specific to biotech & pharmaceutical manufacturing facilities. He has been working side by side with client project management and engineering teams for over the last five years, acting in multiple roles depending on the job requirements. He works particularly well in overall construction management and client relationship management. He is a hybrid manager that balances the responsibilities of field supervision and the office duties associated with project management.

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**Todd Williams**
**Technology Director, CRB Engineers**
**Speaker Bio**

As Technology Director for CRB Todd's primary function is to strategically drive technology across the firm in a consistent, uniform manner using tested and developed workflows and methods that help to streamline CRB's project delivery process. Todd's focus is on technology and tool change management and oversees the hardware, software and support structure to ensure that projects are delivered in a consistent fashion across the enterprise. Todd started his career as a cad draftsman and now with over 18 years of industry experience brings a unique perspective from end user to executive.

## Zoetis - Our Findings

CRB completed all phases of Architectural and Engineering design for the expansion. In addition CRB is the Construction Manager on-site. 3D design provided several critical benefits to the project, including ability to implement an aggressive schedule and expediting of routing and shop-drawing review.

### How Did They Do It?

CRB completed the conceptual and detailed design effort with responsibility for all architectural and engineering design, construction documentation and construction support. The entire design is modeled using Revit for construction drawings generated from the design model.

Through the use of design in Revit and 3D Coordination during the design phase, the construction team was able to confidently implement an aggressive schedule. Construction began prior to completion of design. The construction team provided constructability reviews during the coordination process, effectively reducing problems in the construction phase. The equipment was purchased prior to completion of design and equipment shop drawing information was incorporated into model.
Regular feedback from Zoetis and the design team allowed the construction team to operate without unnecessarily taxing the Client or Designer's resources. The design team brought specialized expertise of the design intent into the construction coordination phase earlier than 2D design methodology.
The routing and shop-drawing review process was expedited with the use of the 3D models. With the design team integrated into the project during the construction phase; changes were able to quickly be made.

The RFI count peaked early; those normally expected during construction were developed during model coordination. The design team was able to quickly review identified issues and make informed decisions. Earlier RFI resolution reduced construction impact by reducing change orders.

## Learn about key project-planning tools

Revit® and Navisworks® are the main focus of our discussions with Assemble providing a good supporting role. Revit® was used for the design starting with the conceptual design phase all the way through detailed design and construction administration. We were using Navisworks® just to review visually any clashes. Midway through the project, later than we would have liked, we started using Navisworks® in its true clash detective functionality. We were using the Navisworks® QTO functionality but made the adjustment to using Assemble to trend the project quantities that made the biggest cost impacts.

### Tools Needed for Planning

Almost everyone in the AEC Industry knows the importance of knowing which tool to use for the job and how important it is to be able to use that tool effectively. There are many different trades and disciplines on a project and they use different sets of tools to accomplish a task. BIM software can be regarded in the same manner. Not every piece of software is suitable for every task, and not every piece of software will be commonly used by every member of the project.

The first tool that we feel is the most important is not even a piece of software! That tool is the BIM Use Execution Plans. If you don't have a plan all of the other tools lose their effectiveness. Since this was a

design build job we used Revit® for conceptual and detailed design. We used Navisworks® for design and construction coordination, also for some quantity verification. And we also used Assemble for quantity trending on the project. The three software tools used can be broken down into five different BIM Use tools.

1. Conceptual Design Authoring Tools
2. Design Intent Authoring Tools (Detailed Design)
3. Design Analysis Tools
4. Construction Analysis Tools
5. Fabrication Tools

The design tools help all project participants understand what is to be built, while construction software tools help the construction teams understand how it should be built. For example, design intent software is used by the Structural Engineer to design a concrete wall with a window opening for a building. Construction software tools are used by the construction team to model the components needed to produce the finished wall, including formwork, rebar, blockout material, and any other items that might be buried in the wall.

BIM Tools and software allow information from the model to be retrieved quickly and efficiently in the field. These tools allow data from the field to be incorporated into the BIM. These types of tools also include hardware in addition to the software. For example, robotic total stations are used for layout in the field based on information from the BIM.

***The most important tool is a plan once you have that everything starts to fall into place.***

## Realize the benefits of model-based quantity takeoff

**The project team used Model-Base Quantity Trend to ensure the project stayed on budget during design. This effort provided the following key benefits :**

- Ability to compare cost plans to the original project budget at any point in time.
- Ability for Stakeholders to easily identify what has changed and decide if/when to adjust scope as necessary.
- Ability to understand and focus on design decisions that have the largest impact on the project cost.

***BIM modeling allows for ACCURATE QUANTITY DATA to be extracted from the model and tracked/trended in relative ease.***

Model-Based Quantity Take Off and Trending uses the estimating ability in the model so any change in the design is reflected in the budget quickly. Model-Based Quantity Take Off and Trending enables architects, engineers, and contractors to estimate in real time, which ensures that cost calculations can be changed whenever any modification is made in the design of the project. This provides higher accuracy in the estimating process and allows for design options to be quickly analyzed for cost implications to the project. Quantity takeoffs from a BIM model enable project teams to quickly generate cost estimates to assist in decision-making and provide cost information about alternatives to owners early in the design phase and throughout the project lifecycle.

## Understand integrated design build approach

### Your SINGLE SOURCE from PLANNING to START-UP.

Whether you refer to it as EPC (engineer-procure-construct) or design-build or integrated project delivery, CRB's ONEsolution™ integrates our in-house planning, design, construction, and commissioning and qualification into a structured, measurable, and efficient approach to achieve project objectives. As a single, accountable and collaborative entity, CRB's multi-disciplinary teams partner with a client to execute architecture, engineering, procurement, construction, safety, quality, regulatory inspection, commissioning, and management of our clients project. From concept to completion, our integrated, multi-disciplinary process allows for innovation and efficiency in achieving success for projects.
Integrated Design Build Benefits

### Single Team, Common Goals

A single source of responsibility, communication and streamlined coordination are some of the initial benefits of an integrated design build team. From start to finish, planning, design, construction, commissioning and qualification professionals are aligned with the project's vision and driven to collectively pursue and achieve client goals for success.

### Early Reliable Cost, Reduced Risk

Today's traditional Architect/Engineering/Construction Management delivery model can be a challenge to manage because it often ends with unpredictable results . . . and financial risk. Rather than budgeting to your design, design build, design and construction team gains a deep understanding of your facility requirements, and then design to your budget and needs. Your risk is minimized with an early cost projection and predictable results.

### Schedule Optimization

The early collaboration of  planning, design and construction teams allows for complete awareness of project goals and utilization of expertise across all disciplines. Resources are maximized, schedules are optimized, and redundancies are eliminated, allowing your project to move forward with streamlined consistency. Compared to industry averages, our RFI and shop drawing turnaround time is 15% faster, and the total cost of rework is significantly less. Many projects have reduced project delivery time by more than one-third compared to industry norms.

### Single Source Accountability

Design Build provides seamless collaboration between client, design, construction and C & Q professionals. By removing the traditional trade boundaries and layers of responsibility, sound judgments can be made that transform your vision into reality. There are no "hand-offs," priorities lost in translation or finger pointing, removing inefficiencies and the stress of your decision making.

### Development & Adherence to Project Quality Plan

From the start of your project, integrated teams collaboratively work to meet performance needs, not just minimum requirements, providing innovative solutions that can often deliver a better facility than initially imagined. design and construction professionals work hand in hand to develop the design while projecting costs through the conceptual, design development and construction phases.

## Learn how to identify client advantages on schedule and cost

### Schedule Advantages

Many presentations extoll the schedule advantages where they saved one or two months on the project because of BIM. I can't tell you we did save anytime off of the very aggressive schedule we had. Yet I can say if we did not utilize the BIM tools discussed in the presentation we would not have met our schedule. By planning early we were able to start fabricating our MEP systems two months prior to the installation of those systems. The shop drawing review process was streamline with the use of shop model reviews and the design team participating in the construction 3D coordination.

### Cost Advantages

This is one of the hardest and also one of the easiest items to find a return on investment with BIM. Some might ask why it is hard. The fact is a lot of the items we find early and resolve before boots are on the ground or before and item is installed are hard to know the true cost. We all make educated guesses but at the end of the day through avoidance of the issue we are left only with the ability to guess the cost impact. The reason why it is also one of the easiest is that we can use our historical cost data and look at the interference or problem and put together a fairly accurate cost impact estimate. One of the things we have done at CRB is assigning the subcontractors with the task of identifying a rough order of magnitude cost for the issues they resolved. We also identify each change that is resultant to design deficiencies and owner directed changes. One of the best owner changes was the addition of a sink in the process area after everything was coordinated. We looked at several different scenarios and we able to come up with one that only added the cost of the new materials and labor and was able to exclude and rework added cost.