BIM for Cold-Formed Steel Framed Projects: Benefits, Drawbacks, and How to Succeed

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Cold-Formed Steel Framing Resource Center for Building Professionals

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Table of Contents

Building Information Modeling (BIM) is a hot topic in construction, and its use is gaining ground on cold-formed steel (CFS) framed mid-rise projects. Architecture, engineering, and construction (AEC) professionals often find BIM can save them time and money in construction.

The collaborative processes of BIM foster communication among stakeholders. BIM helps resolve issues early in a project, and it can improve job site organization. And, the "greatest unmet demand" in construction modeling involves interior and building envelope contractors, according to a Dodge Data & Analytics report.[1]

However, BIM is not a silver bullet for all projects. If key project members do not have BIM expertise — or if they lack commitment to collaborate properly — then efforts to model might just be a waste of time and expense.

This eBook will help you determine if BIM is right for you and act as a practical playbook, outlining specific steps to help your firm become competent and capable in today's brave new world of BIM.

READY TO GET STARTED?

What is BIM?

The National Building Information Model Standard Project Committee defines BIM as "a digital representation of physical and functional characteristics of a facility."[2] A BIM model is a kind of building directory. The information can be used to make decisions throughout a building's lifecycle — from conception to construction to demolition. This saves building owners billions of dollars annually.[3]

USE BIM ON CFS-FRAMED PROJECTS

BIM benefits the construction of CFS structures in many ways. Project teams can model the CFS framing assemblies and make necessary changes early in the construction process. BIM can help building owners and other stakeholders review the constructability of CFS assemblies. It digitizes the workplace and can lead to workflow improvements.

In this eBook, we'll show you how to:

1. Establish a collaborative company culture for BIM modeling
2. Set up a BIM empowered team
3. Find BIM projects
4. Integrate early with the project team
5. Use BIM information successfully

Architecture, engineering, and construction (AEC) professionals often find **BIM can save them time and money in construction.**

How CFS Projects Can Benefit From BIM

1. **CFS can be framed in an infinite number of ways.** BIM can help designers visualize various aesthetic and practical possibilities.
2. **CFS systems often can be panelized.** BIM can help create these designs and produce shop drawings.
3. **BIM can resolve conflicts** between the CFS framer and other trades.
4. **BIM can often benefit CFS framers and fabricators** even if others on a project don't use models.
5. **BIM can help optimize** CFS layouts and schedules.
6. **BIM expertise is a great marketing tool** in meetings with prospective clients.

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Step 1: Establish a collaborative company culture

BIM involves using information to make decisions and bring value to the AEC process. To do that, you'll need a serious commitment to BIM, which will involve changing how you design, bid, and build structures. The key to developing BIM competence starts at the top and runs through the entire company. Successful BIM departments spring from leaders committed to the BIM process.

CONSIDER THREE WAYS YOU CAN MAKE BIM A PRIORITY

1. **Rethink your processes.** BIM is going to change your processes as they relate to design, engineering, and construction for good. In short, you must be open to change. That includes rethinking your approach to selling, designing, estimating, and for construction companies, your production methods.
2. **Don't be afraid to take risks.** BIM fits well in a company culture committed to continuous improvement. The number of decision makers and the level at which those decisions are made will change. Embrace these changes, recognizing that they will ultimately benefit your company and projects.
3. **Facilitate collaboration with others on the AEC team.** CFS framers, for example, should reach out to mechanical, electrical, and plumbing contractors. General contractors should try to see the value of bringing all trades together early for coordination meetings.

The key to developing BIM competence starts at the top and runs through the entire company. Successful BIM departments spring from leaders committed to the BIM process.

DEVELOP BIM COMPETENCE

Start training your team. Here are a few educational resources to consider:

- **Architects:** The American Institute of Architects' **BIM: The Big Picture**
- **Architects, engineers, and modelers: BIM tutorials at Lynda.com**
- **General contractors: The Building Information Modeling Education Program** at the Associated General Contractors of America
- **Framing contractors:** Association of the Wall and Ceiling Industry's (AWCI) **BIM—Doing It Right® webinar series**

Step 2: Set up your BIM department

A good BIM trial run might mean working with a third-party provider prior to launching your own BIM department. There are independent companies and CFS manufacturers that offer BIM services. Using these services is a great way to navigate the process with minimal investment.

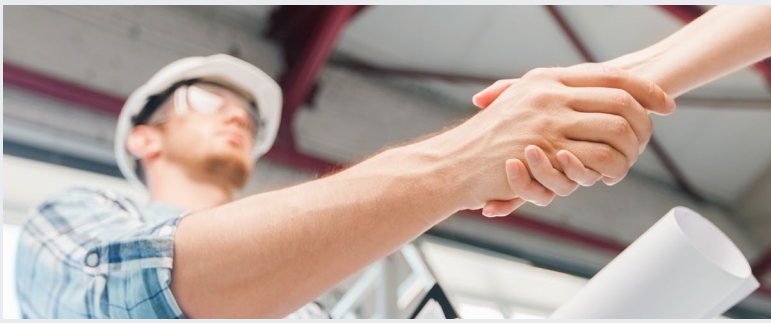
Once you understand the process and have a collaborative BIM culture in place, you can proceed with the development of in-house capabilities. Your next step is to hire BIM team members, license BIM software, and start piloting BIM on some projects.

HOW TO ASSEMBLE YOUR TEAM

Wondering where to get started? Here's what AEC professionals recommend.

1. **Define the uses of BIM for your firm.** Focus on streamlining your processes for procurement, layout, and clash detection. See if BIM can help you eliminate rework on projects.
2. **Budget $130,000.** A BIM investment of about $130,000 a year would include the salary for one on-staff modeler, software licenses, and the annual maintenance for the software.[4]
3. **Hire BIM team members who think outside of the box.** Look for candidates with schooling in commercial construction, technical design, or engineering, or with an associate's degree in drafting. The ideal candidate must offer intuitiveness and ingenuity, and be able to see problems in a different light. Candidates with field experience in addition to digital capabilities are the optimal hiring solution. People with field experience understand the constructability of CFS.

Your next step is to hire BIM team members, license BIM software, and start piloting BIM on some projects.



BIM software, add-ons, and component libraries

BIM software generally supports a BIM workflow from concept to construction. The software tends to be modular with packages slated for architectural design, MEP engineering, structural engineering, and construction. You can view models typically on many platforms, but to author BIM content, you'll need to license a package.

BIM SOFTWARE

- **Autodesk® Revit®:** Popular in the United States with a majority market share
- **Bentley MicroStation:** BIM software emphasizing infrastructure projects
- **NemetschekAllplan:** Software for architects and engineers that features a construction cost planning tool
- **NemetschekGraphisoft ARCHICAD:** Software for architects and designers
- **Trimble Tekla Structures:** Software for structural engineers and steel fabricators

ADD-ON TOOLS

- **Autodesk Navisworks®:** BIM coordination tool that works with Autodesk Revit, AutoCAD, and Bentley MicroStation, and allows users to open 3D models, combine them, navigate around them, and participate in real-time reviews using annotation tools
- **Autodesk BIM 360™:** A family of tools for AEC project teams that can coordinate robotic total stations, work plans, project documents, and more
- **StrucSoft Solutions MWF Pro Metal and Advanced Metal:** Revit software extension that automates clash detection and fabrication of CFS framing assemblies

Most add-ons include CAD viewers, annotation tools, and tools to search for objects, measure distances and areas, and print drawings to scale.

Many framing contractors and wall fabricators use Revit to author their BIMs and Navisworks to collaborate on the models from other trades.

COMPONENT LIBRARIES

- Many building product manufacturers maintain digital libraries of elements that can be incorporated into BIM models. The elements usually include performance attributes, such as fire ratings, sound tests, and material safety data sheets.
- The National Institute of Building Sciences and the buildingSMART alliance® are working on a BIM wall standard called the Wall information exchange (WALLie), which includes library elements.

Most add-ons include CAD viewers, annotation tools, and tools to search for objects, measure distances and areas, and print drawings to scale.

BIM Do's and Don'ts on CFS Projects

- **DO** define how BIM will contribute to better CFS-framed assemblies.
- **DO** use BIM to eliminate the need to rework CFS installations.
- **DON'T** try to cut corners when modeling CFS assemblies.
- **DON'T** try to model CFS assemblies late in a project cycle.

Step 3: Find BIM projects

BIM projects abound. They can be found in the repertoire of several general contractors (GCs), in certain building sectors, and by talking up your interest in BIM to others.

HOW TO IDENTIFY BIM PROJECTS

BIM involves coordinating with AEC team members and with other trades. So, find BIM projects by talking to those players.

1. **Talk to general contractors.** While many GCs may not be used to the CFS framing trades requesting model information, many are happy to share their expectations for modeling. Ask GCs for their BIM requirements for running clash detections.
2. **Ask MEP contractors for leads.** They may be building their own BIM models anyway, since sheet metal offers a lot of potential for direct fabrication using model content.
3. Talk to your sales and estimating departments. Your own sales team may be working on closing a sale, or your firm may have just won a contract, and these projects may have BIM potential.
4. **Search job lead systems.** McGraw-Hill or REED, for example, allow you to do a key word search for projects with BIM requirements.

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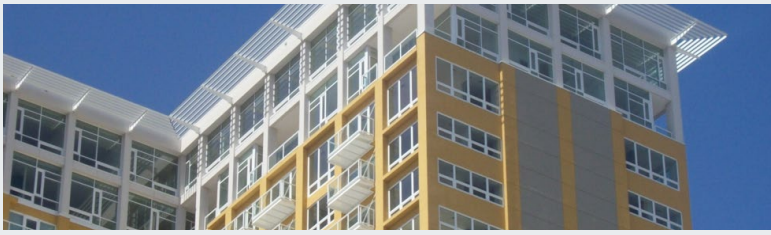
CONSTRUCTION SECTORS COMMONLY USING BIM

Wall and ceiling contractors report that BIM is especially common in the construction of the following building types:

- **Medical:** Interior CFS walls tend to include multiple penetrations and conflict resolution opportunities.
- **High rises:** CFS curtain walls can be panelized. Interior CFS wall conflict resolutions can be repeated floor after floor.
- **Design-build projects:** Modeling processes are often factored in.
- **Mid-rise load-bearing structures:** Projects include plenty of potential for conflict resolution, prefabrication, etc.



PROJECTS WHERE BIM MAY NOT BE USEFUL

BIM can be costly and counterproductive if:

- The AEC project team fails to plan and coordinate the BIM implementation process
- Software and workflow interoperability does not exist between players, impeding the exchange of information
- Team members author models that offer little productivity value or process flow advantages

Step 4: Join the project team early

BIM can be used to manage the processes associated with the design, construction, and operation of a building. Since design is the first phase of a project, try to have your internal BIM team involved at that stage, working closely with the architect, engineer, and general contractor.

MAKE YOUR CASE TO BE INVOLVED

1. **Show how modeling the CFS framing can bring value to others.** An architect may not be interested in modeling the stud detail of a CFS wall panel. But a CFS wall contractor, for example, could add that detail to the architect's BIM model to establish the value of prefabricating portions of the project.
2. **Show how modeling the CFS framing can streamline the design-to-construction process.** An architect may author a BIM model to show his design intent. But, a CFS panel fabricator could add framing details for the windows and doors, which would be helpful to the field crews.

Level of Development

The Level of Development (LOD) allows project teams to specify the content and reliability of Building Information Models (BIMs) at various stages in the design and construction process.

Using a scale of 100 to 500, LOD ***applies to each element*** included in a BIM. It does not characterize the overall project level of detail or the phase of a project. Rather, LOD establishes requirements useful in a collaborative environment. LOD provides the project team with the data they need to support design planning, clash detection, construction sequencing, and other coordinating functions associated with the element.

Here is a quick summary of LOD overview based on **2016 Level of Development Specification** by BIMForum.

LEVEL OF DEVELOPMENT	BASIC DEFINITION	COLD-FORMED STEEL (CFS) FRAMING EXAMPLES
LOD 100	Informational content related to an assembly. Assembly depth, thickness, size, and location are still flexible.	Approximate CFS framing dimensions. CFS cost per square foot.
LOD 200	Graphical content for generic assemblies with approximate quantity, size, shape, location, and orientation. May include non-graphical information.	Rough CFS quantities and member depth. Desired CFS member spacing.
LOD 300	Graphical content for specific assemblies. Precise quantity, size, shape, location, and orientation for the element can be measured from the model.	Specific CFS quantities, depth, spacing, locations, and geometries. LOD 300 is common for typical CFS framing coordination.
LOD 350	Includes LOD 300 with the parts needed to coordinate the element with other nearby or attached elements.	CFS framing assemblies modeled precisely at wall bottoms, tops, and sides. Includes bridging, strap, and other support information.
LOD 400	Requires sufficient detail and precision in order to fabricate the assembly or system component.	CFS fabrication, panelization, and installation information. CFS fabrication part numbers. All parts required to complete CFS installation. Includes CFS weld and connection information.
LOD 500	Field verifiable quantity, size, shape, location, and orientation of an assembly. LOD 500 can be considered the "as built" model. Not necessarily a higher level of element geometry.	LOD 500 is relatively rare for CFS assemblies, since CFS fabrication and installation development is provided by LOD 400. However, LOD 500 may be a contract requirement. It would provide an owner with vital CFS information for future reference.

CONTRIBUTE AS A PROJECT TEAM MEMBER

Getting on the project team early will help you 1) identify BIM uses, 2) understand everyone's roles, and 3) offer value engineering and other project improvements.

1. **Identify a project's key BIM uses.** Understand what's important to each stakeholder and demonstrate your value to the team. **Here are some BIM uses that have recognized value:**
   - The ability to visualize designs in 3D
   - Construction scheduling optimization
   - Clash detection among assemblies
   - Prefabrication to save labor
   - Analysis to help with energy-efficient design
   - Collaboration to help with LEED® certification
   - Post-construction building management and maintenance

2. **Know the role of the architect, engineer, and GC.** The importance of BIM varies with each project team member.
   - **Architect:** There may be unique architecture or certain spaces that models can help visualize. The BIM model of the Penn State Hockey Arena, for example, was used to recruit hockey players to the school.
   - **Engineer:** Engineers normally tie their structural models in with the architect's. They may share a model with framing contractors and fabricators who ask for it.
   - **General contractor:** For BIM-enabled projects, the GC normally provides a BIM modeling coordinator, who establishes the nomenclature of BIM model and sets up coordination meetings. Each trade is responsible for authoring their own models. The modeling coordinator combines the utility of each model into one master BIM model.

3. **Value engineering, quantity take-offs, and work sequencing.** BIM software and various tools offer multiple ways to crunch numbers. Here are a few uses of BIM data:
   - **Value engineering.** Several CFS wall contractors using BIM have suggested design revisions to architects that have led to thousands of dollars in savings on projects. Even if a design remains intact, resolving potential issues upfront can sometimes head off costly work in the field.
   - **Quantity take-offs.** Take-off tools make it easy to pull material quantities out of the BIM models. However, the design model may not match the construction model in the way systems will be assembled. An architect, for example, could model CFS walls to run flush with the deck, when he or she intends and notes in 2D drawings that the walls be six inches above the ceiling plane. So, even though BIM can pull material quantity estimates, proceed cautiously.
   - **Work sequencing.** A number of firms use BIM models to convey assembly processes to their workers. Tools make it easy to create schedules, material cut lists, and fully dimensioned 2D shop drawings for field crews.

Project Team Do's and Don'ts

- **DO** include the CFS framing contractor on the BIM project team.
- **DO** include CFS assemblies when authoring project BIM models.
- **DON'T** delay in sharing BIM models with project participants who ask for them.
- **DON'T** overlook BIM's ability to streamline the CFS construction process.

Step 5: Manage the flow of project information

BIM's beneficiaries include building owners, architects, engineers, general contractors, sub-contractors, fabricators, and more. To make the BIM process most successful, however, you should also stay in close contact with members of your internal team.

USE BIM TO REDUCE RFIs

If you've cultivated close relationship with a project's GC and architect, **you'll be able to take three important steps:**

1. **Clarify ambiguities early on.** Your goal is to reduce the amount of requests for information (RFIs) you send to architects. You may find you can eliminate RFIs altogether and get the architects to send supplemental instructions for areas that need clarification.
2. **Point out potential design conflicts.** Use your BIM model to present conflicts between CFS framing assemblies and various MEP runs with designers.
3. **Take your time when authoring models.** The mantra here: No shortcuts. You will pay for them time and time again.

BIM's beneficiaries include building owners, architects, engineers, general contractors, sub-contractors, fabricators, and more.

USE BIM TO AVOID CONFLICTS WITH OTHER TRADES

Research by Dodge Data & Analytics on North American AEC firms shows that BIM adoption by construction contractors exceeds that of design professionals.[5]

Thus, there's a good bet the MEP trades on a project have a BIM model underway and are willing to discuss conflict resolution upfront. **Try this:**

1. **Offer to sit down with the MEP trades.** With the GC's approval, organize a meeting in the job trailer or online. Bring in all the MEP foremen and review the placement of their equipment, conduit, and piping.
2. **Ask for the structural engineer's BIM model.** Most structural engineers have at least some capability to author BIM models. Software platforms generally make it easy to access and share structural information with the GC, the framing contractor, fabricators, and others.
3. **Be open to communication.** Be willing to coordinate your work with other trades, especially when they initiate discussions. Decide together as a project team the level of modeling detail that has value.

EMPOWER YOUR PEOPLE

Just as BIM can deliver value to AEC team players, your firm can benefit from BIM if you communicate regularly and effectively with everyone in your organization.

1. **Discuss everyone's role in the BIM process.** A true BIM environment unites everyone, from top management to those in the field.
2. **Give your construction crews information.** BIM models can help optimize field schedules. Model details can be exported to provide, for example, stud thicknesses, flange widths, and web depths.
3. **Solicit ideas.** Encourage project managers and estimators to look for ways that BIM can improve projects. Prefabricating just one element that gets repeated on a project could save money, even if it takes effort to add the details to a model.

> A true BIM environment unites everyone, **from top management to those in the field.**

Summary and conclusions

Building detailed models, loading them with information, and collaborating as the models grow, develop, and change calls for participants to believe in the BIM process.

- **Architects:** See BIM as a potential game-changer, helping you to realize your design visions.

- **Engineers:** Be interested in the collaborative workflows that BIM affords team members.

- **General contractors:** See the value of hiring subcontractors with BIM capability to drive more efficient work output.

- **Framing contractors:** Believe in BIM as a profitable planning tool.

BIM modeling can't grantee cost savings and is not practical for all projects. But, BIM can make a difference, and its use is growing. Consider the following case studies.

Case Studies

CASE STUDY 1: GENERATE SUBSTANTIAL LABOR SAVINGS

Bluebonnet Studios

Bluebonnet Studios is a 107-unit apartment building in Austin, Texas. Wall contractor F.L. Crane & Sons used BIM modeling to prefabricate CFS load-bearing walls for the three floors above the concrete podium.

"We did the stud layouts and all the components in Revit," said Justin Robbins, BIM department manager at F.L. Crane. "We pulled out all the stops on it — fully detailed panel drawings and shop drawings."

F.L. Crane's BIM team met with the MEP trades to eliminate discord on the jobsite. To avoid conflicts with some structural tube steel on the job, F.L. Crane integrated the structural model with its own model. The project involved 750 prefabricated15-foot panels. Robbins said the BIM software generated "panel tickets" — 11x17-inch printed sheets showing how to fabricate each panel and where it would be placed on the project.

The case shows how BIM modeling can be profitable for a framing contractor even when the general contractor does not push BIM coordination. The BIM process "generated pretty substantial labor savings," Robbins said.

> **"The BIM process generated pretty substantial labor savings."**
>
> – Justin Robbins
> BIM Department Manager
> F.L. Crane

> **"The client just pocketed cash."**
>
> – Megan Washnieski
> Manager of Design and Engineering
> South Valley Drywall

CASE STUDY 2: TRIM MONTHS OFF THE CONSTRUCTION SCHEDULE

Ronald McDonald House, Denver

South Valley Drywall, Inc. in Littleton, Colorado used BIM modeling to prefabricate load-bearing, CFS-framed panels for the Ronald McDonald House in Denver, Colorado. The 64,000-square-foot, 73-bedroom structure is three stories tall. The scope included sheer walls in addition to the load-bearing systems. Plumbing runs, window openings, and outside brick ties all had to be accommodated.

"We had a crazy amount of factors to line up," said Megan Washnieski, manager of design and engineering at South Valley Drywall.

South Valley Drywall used AutoCAD to create the BIM model. Washnieski authored the model from scratch and eliminated all RFIs on the project. And, the panel prefabrication cut two months off the construction schedule.

"The client just pocketed cash," Washnieski said.

CASE STUDY 3: CATCH MEP CONFLICTS EARLY

Westin Ka'anapali

Integra Steel Truss, based in Englewood, Colorado, used BIM 360 to open the GC's model and Navisworks to review potential clashes in the design of some 800 CFS trusses at the Westin Ka'anapali Ocean Resort Villas in Maui.

"The BIM process answered all of our questions that might have come up in the field," said truss designer Erik Carrasco.

The GC's weekly coordination meetings, held via online video conferencing, caught every potential conflict and problems area — MEP ducts, drains, and equipment potentially intersecting with truss studs and webs, congested corners where equipment and materials had to fit, and where and how to place an eight-foot-high, three-foot-wide catwalk to run within the truss system.

> "The BIM process **answered all of our questions** that might have come up in the field."
>
> – Erik Carrasco
> Truss Designer
> Integra Steel Truss

CASE STUDY 4: CONVERT WOOD FRAMING TO CFS

The Village at St. Mary's University

Wall contractor F.L. Crane & Sons used an internal BIM model to convert what was initially designed as a wood-framed, four-story, 90,000-square-foot residence hall at St. Mary's University, San Antonio, to a CFS project.

The general contractor had seen F.L. Crane's work at a similar mid-rise project, and asked the company for help. F.L. Crane brought in its engineer to work out the details. BIM helped convert the project from wood to CFS. Furthermore, the BIM model aided F.L. Crane in prefabricating CFS panels offsite, which helped accelerate the project timeline.

> BIM allowed the construction team to ensure that each piece fit together without error and **helped shave weeks off the installation schedule in the field.**

CASE STUDY 5: COORDINATE THE TRADES

Sibley Memorial Hospital

General contractor Turner Construction used the BIM process in constructing a new, seven-story, 460,000-square-foot building at Sibley Memorial Hospital in Washington, D.C.

Using the BIM model, the AEC team prefabricated 140-foot corridor rack systems to house the MEP elements for each floor of the hospital. The system was divided into modules, each 20 feet long and built offsite.

BIM allowed the construction team to ensure that each piece fit together without error and helped shave weeks off the installation schedule in the field.

If you have an upcoming project and have specific questions related to cold-formed steel framing, request complimentary assistance from the BuildSteel team of experts.

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Helpful BIM resources for CFS projects

1. **American Institute of Architects**
   AIA U, "BIM: The Big Picture":
   aiau.aia.org/courses/bim-big-picture

2. **Association of the Wall and Ceiling Industry**
   AWCI's BIM—Doing it Right Program:
   awci.org/education/doing-it-right/bim#bim

3. **BIM Education Program**
   AGC: agc.org/learn/education-training/building-information-modeling-education-program

4. **BIMForum**
   The U.S. Chapter of buildingSMART International:
   bimforum.org

5. **buildingSMART alliance**
   http://www.nibs.org/?page=bsa

6. **Dodge Data & Analytics SmartMarket Reports**
   "SmartMarket Brief: BIM Advancements No. 1":
   construction.com/resource-center.asp

7. **Lynda.com**
   BIM Training and Tutorials:
   lynda.com/BIM-training-tutorials/1293-0.html

8. **National Institute of Building Sciences**
   "National BIM Guide for Owners":
   nibs.org/?nbgo

9. **Penn State University**
   The BIM Project Execution Planning Guide:
   http://bim.psu.edu/Project/resources/default.aspx

10. **Penn State University**
    Computer Integrated Construction Research Program:
    http://www.pennstatecic.org/people.html

11. **Wall information exchange (WALLie)**
    nibs.org/?page=bsa_wallie

[1] Dodge Data & Analytics, SmartMarket Reports, "SmartMarket Brief: BIM Advancements No. 1." Retrieved November 21, 2016, from construction.com/resource-center.asp.
[2] FAQ, National BIM Standard—United States® (NBIMS-US™), National Institute of Building Sciences. Retrieved November 1, 2016 from nationalbimstandard.org/faqs.
[3] Interoperability among project players costs building owners $15.8B annually, according to a 2004 study by the the U.S. Department of Commerce's National Institute of Standards and Technology, NIST GCR 04-867. Retrieved November 1, 2016 from fire.nist.gov/bfrlpubs/build04/PDF/b04022.pdf.
[4] "It's BIM Buy-in Time." Ibid.
[5] Dodge Data & Analytics, Ibid.
[6] "Rethinking productivity across the construction industry: The challenge of change," *The Economist*, pp. 7-8. Retrieved November 3, 2016, from damassets.autodesk.net/content/dam/autodesk/www/solutions/bim/EIU_Autodesk_Construction_WEB.pdf

About **BuildSteel**

BuildSteel provides valuable resources, education, and complimentary project assistance related to the use of cold-formed steel framing in low and mid-rise and multi-family construction projects.

As a centralized source for information, BuildSteel offers resources to help move your next cold-formed steel framing project forward efficiently and effectively.

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