



Integrated 09

PROJECT DELIVERY SEMINAR SERIES

McGraw-Hill Construction Research on BIM and IPD

Steve Jones
McGraw-Hill Construction

McGraw Hill CONSTRUCTION SmartMarket Report
Design & Construction Intelligence

Building Information Modeling (BIM)

Transforming the Design and Construction Industry to Achieve Greater Industry Productivity

connecting people_projects_products

Association Collaboration Partners: AIA, ACC of America, ASCE, MCAA, COAA, etc.

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AIA California Council





McGraw-Hill Perspective on BIM

BIM is a blend of Tools and Processes

TOOLS

- Enable team members to create, analyze, share and integrate models



PROCESSES

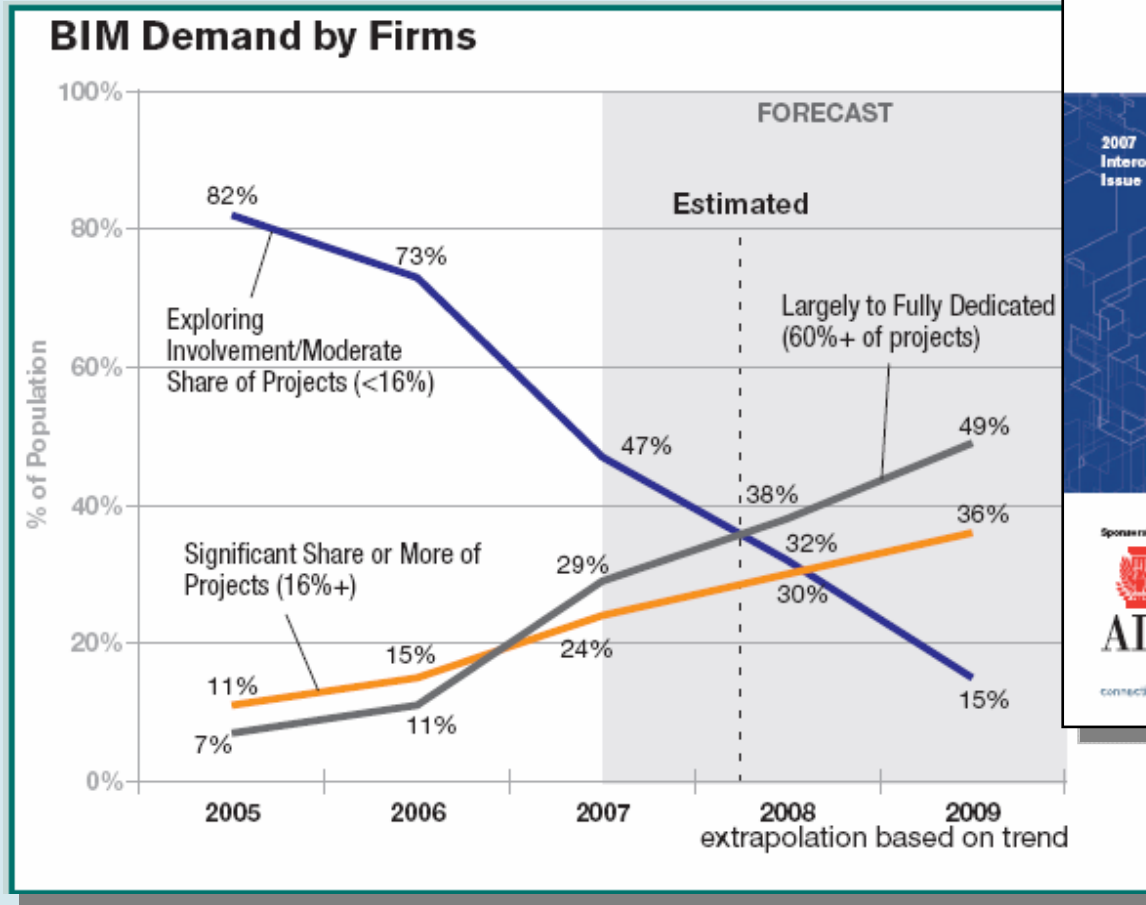
- Integrated and collaborative
- Enable teams to benefit from tools and models

“It’s not just about a model, but about the understanding which is communicated through the modeling process.”



SmartMarket Report on Interoperability

- BIM “tipping point” in AEC/O in 2008



McGraw Hill CONSTRUCTION

Interoperability
in the Construction Industry

SmartMarket Report
Design & Construction Intelligence

2007 Interoperability Issue

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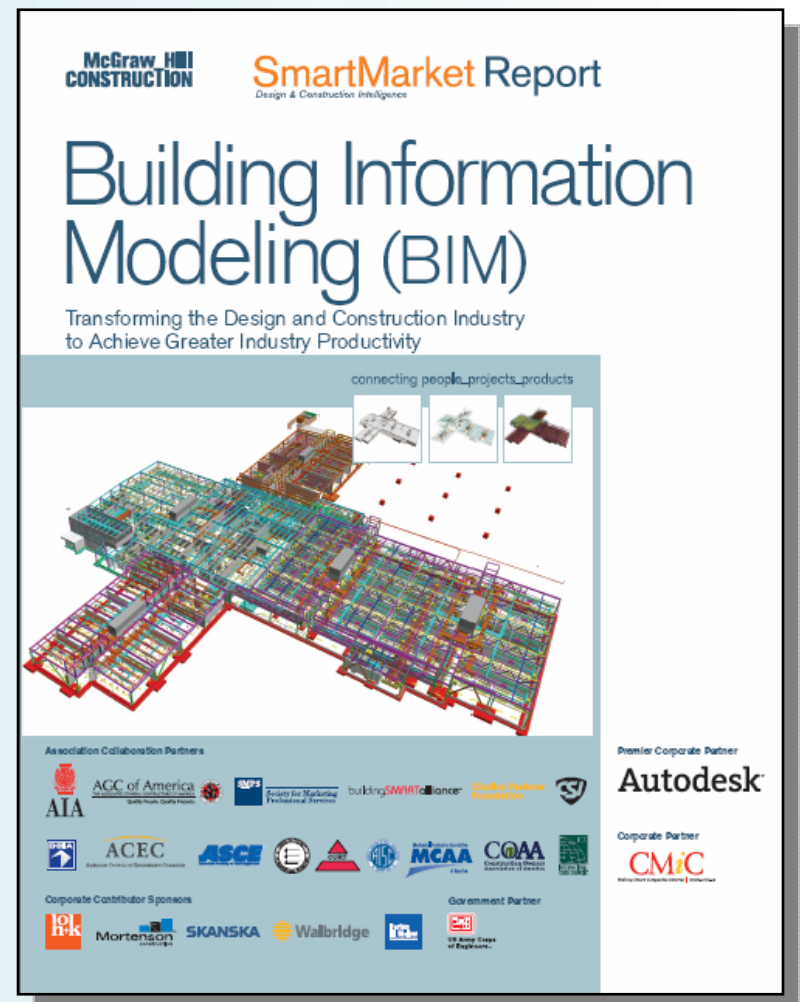
AIA, ICC, buildingSMART alliance, CMAA, COAA, ESRT, Society for Marketing Professional Services

connecting people, projects, products



SmartMarket Report on BIM

- Released 12/4/2008
- Studied only BIM users
- Track 5 major aspects:
 - Adoption
 - Implementation
 - ROI
 - Impact (internal, external)
 - Infrastructure (Standards, Content, Software, Training, Certification, Outsourcing)
- Baseline for future progress
 - Aspects that will change over time
 - Future Follow-Up Studies

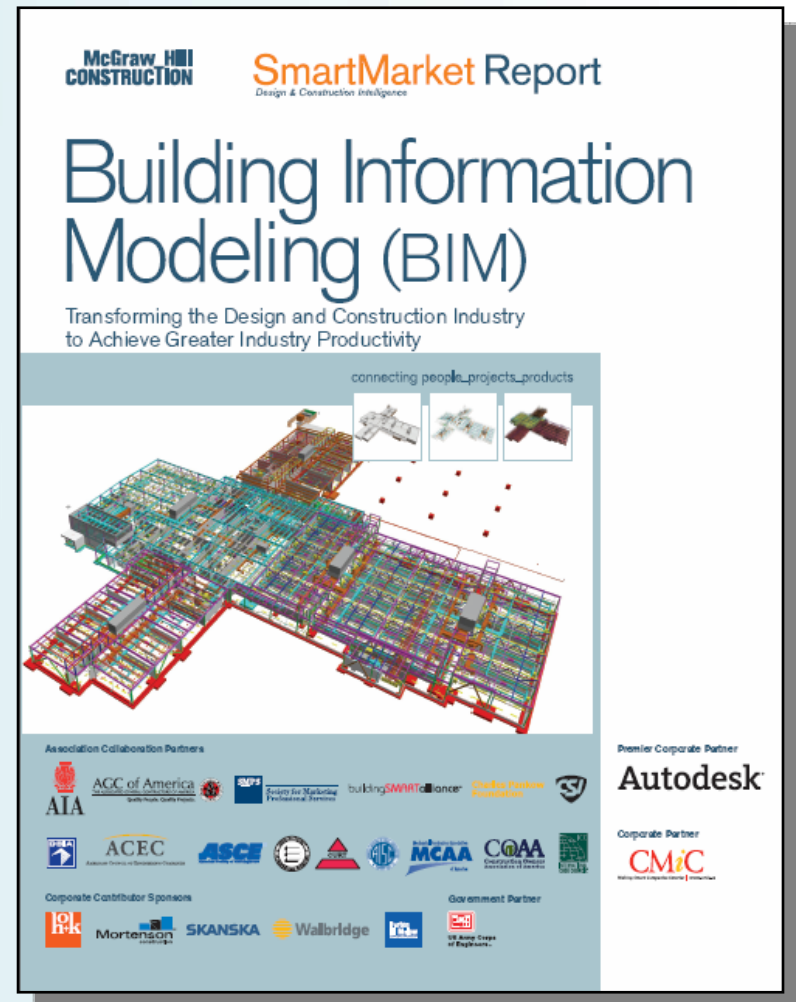




SmartMarket Report on BIM

- Survey sample
- Highlights of findings
- Aspects related to IPD

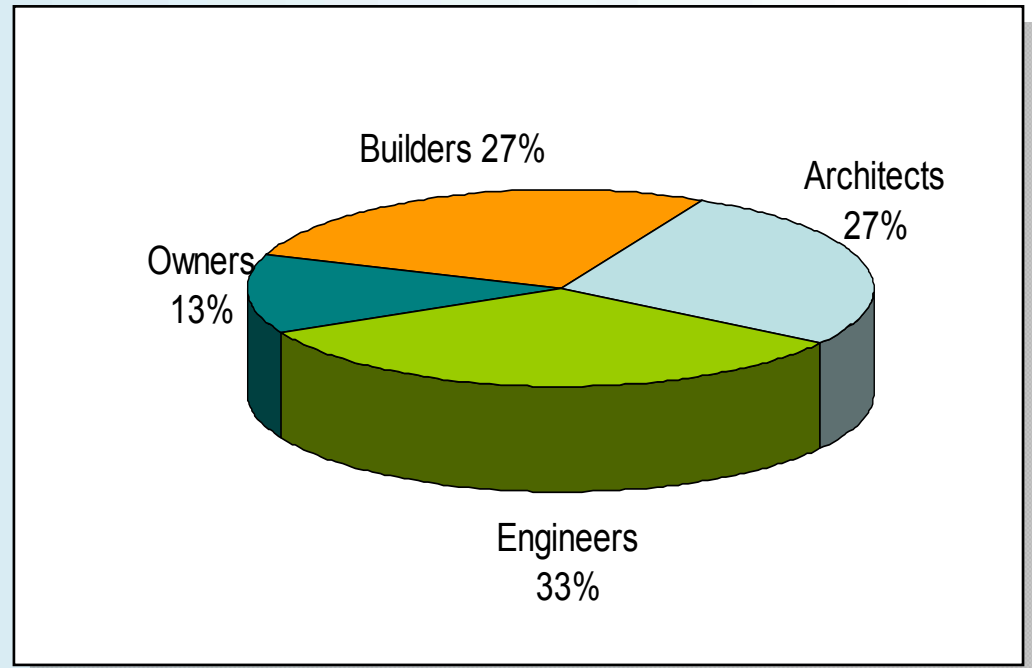
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Construction.ecnext.com





Sample by Role

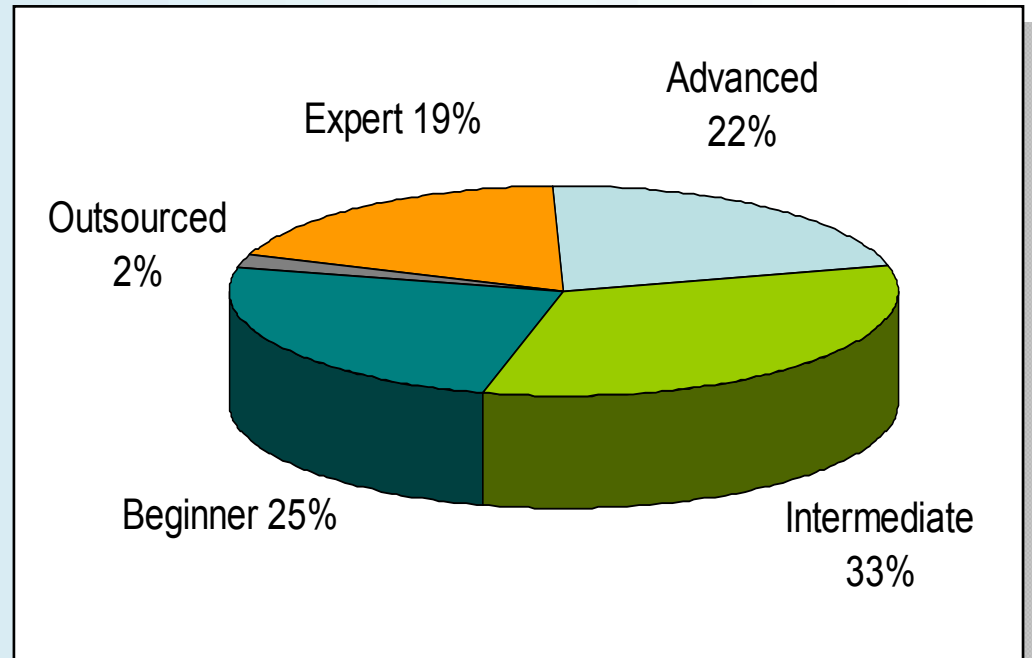
- 27% Architects
- 27% Builders
 - CM/GC 79%
 - Trade 21%
- 33% Engineers
 - MEP 39%
 - Structural 34%
 - Civil 28%
- 13% Owners





Sample by BIM “Sophistication”

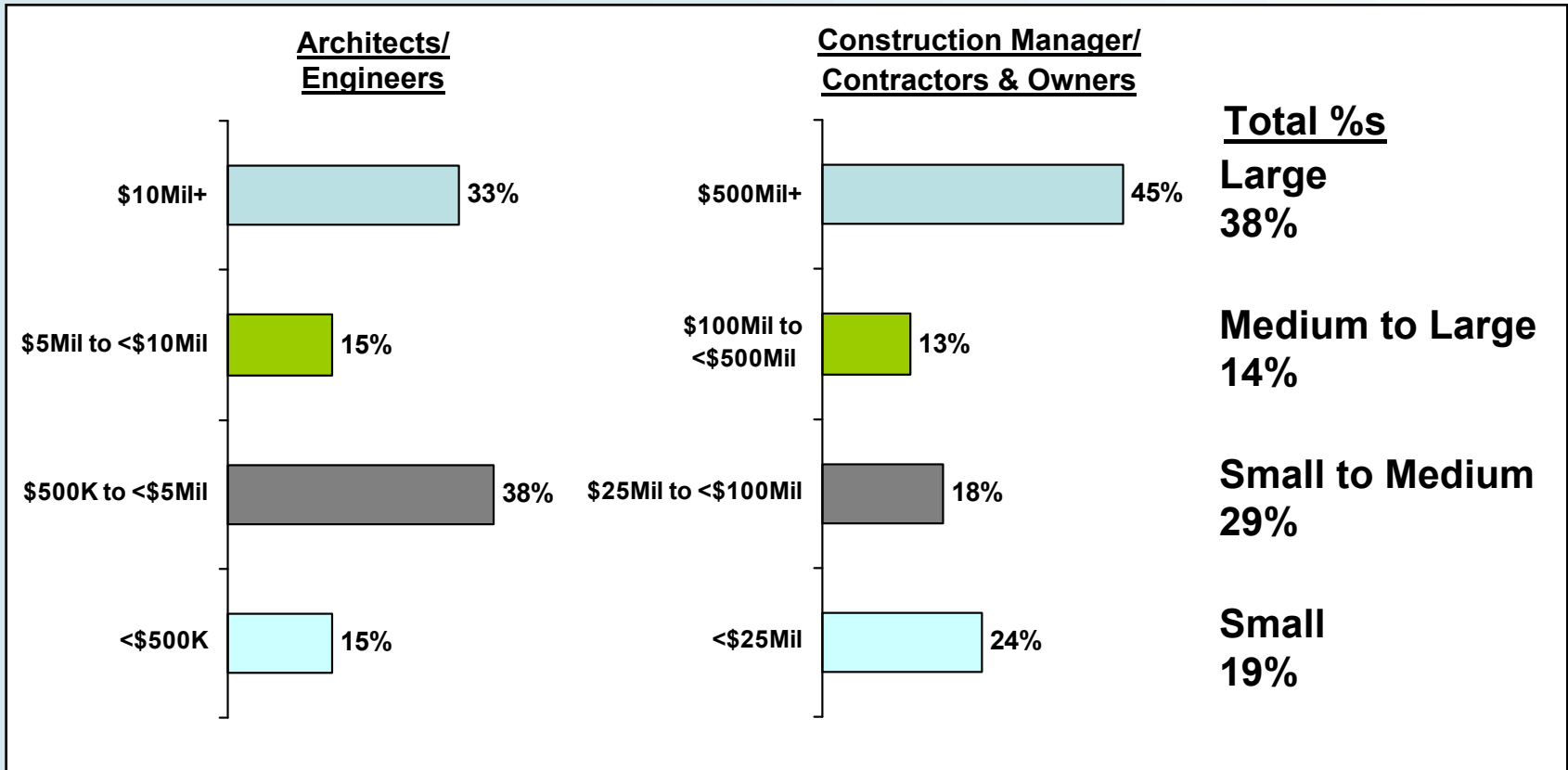
- 19% Expert
- 22% Advanced
- 33% Intermediate
- 25% Beginner
- 2% Outsourced





Sample by Company Size

- 4 tiers of company sizes (S, S-M, M-L, L)





Major Findings

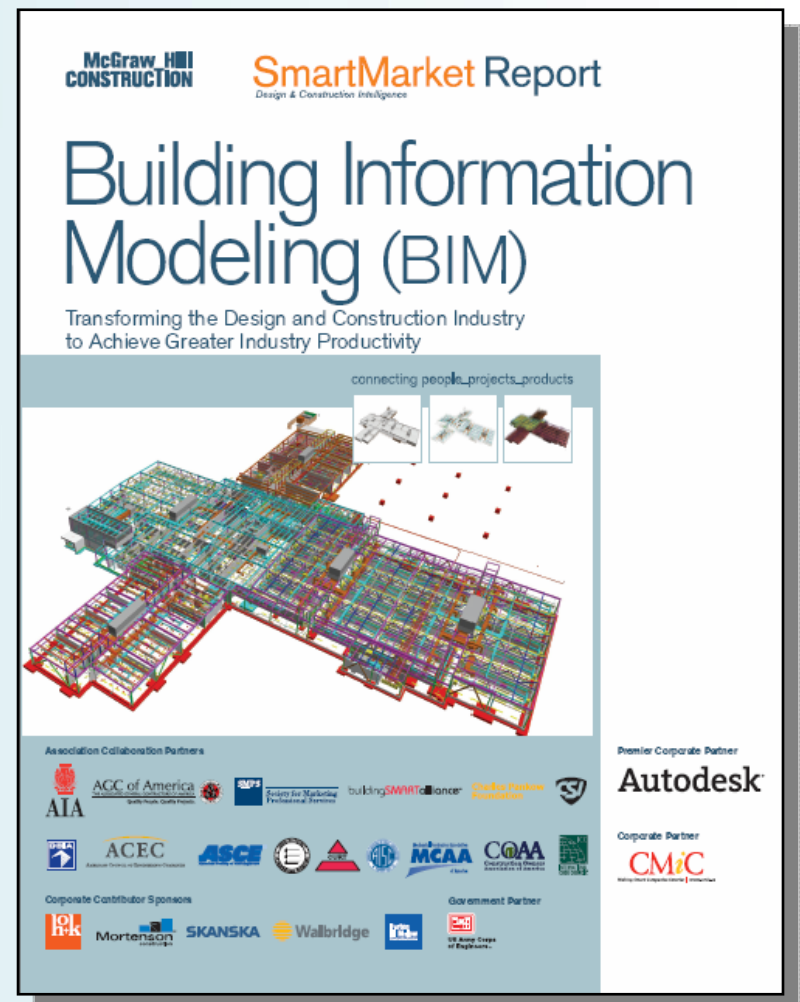
- 63% of BIM users will use it on more than 30% of their projects in 2009
- 72% of BIM users say that BIM has had an impact on their internal project processes
- 82% of Expert BIM users believe that BIM has a very positive impact on their company's productivity
- Contractors expect to see the greatest % growth of BIM use in 2009
- Users who measure it report higher ROI than the perceived ROI of those going on "gut feel"



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Internal and External Impact of BIM

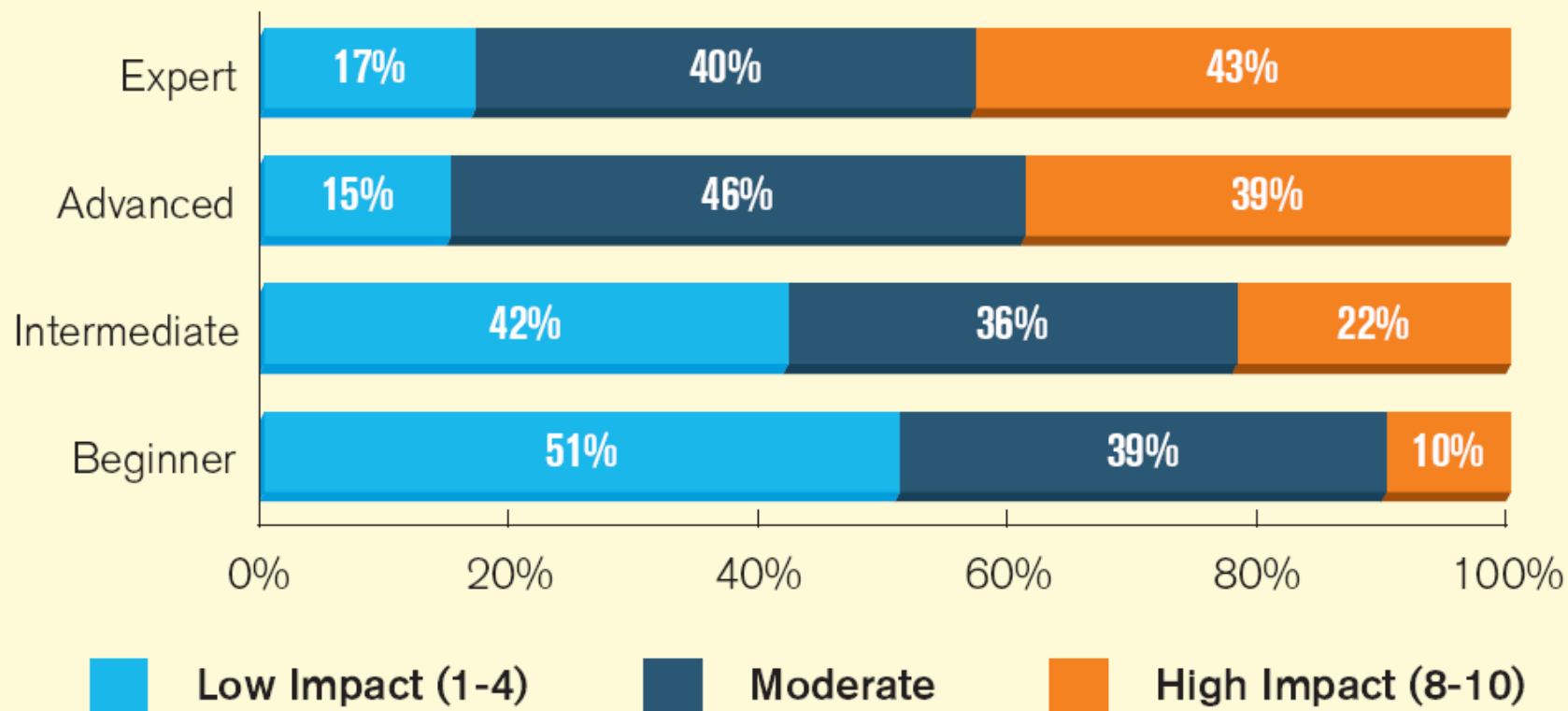
BIM is changing the way companies work internally as well as with external team members. In order to reap the greatest benefit from BIM, many users recognize a need to rethink roles and work flow. As a repository of information from multiple team members, BIM also promotes a more collaborative environment that breaks down traditional boundaries between firms and allows the sharing of project data among users.

- Seven in 10 users say that BIM has had at least a moderate impact on their internal project practices.
- Two-thirds of users say that BIM has had at least a moderate impact on their external project processes.

Top Ways BIM Changes How Users Work

- Routinely using BIM's 3D visualization capabilities to communicate with all parties.
- Using BIM on the jobsite to guide construction activities.
- More time designing, less time documenting.

Impact of BIM on External Project Processes by Experience Level



Source: McGraw-Hill Construction, 2008



Internal and External Impact of BIM

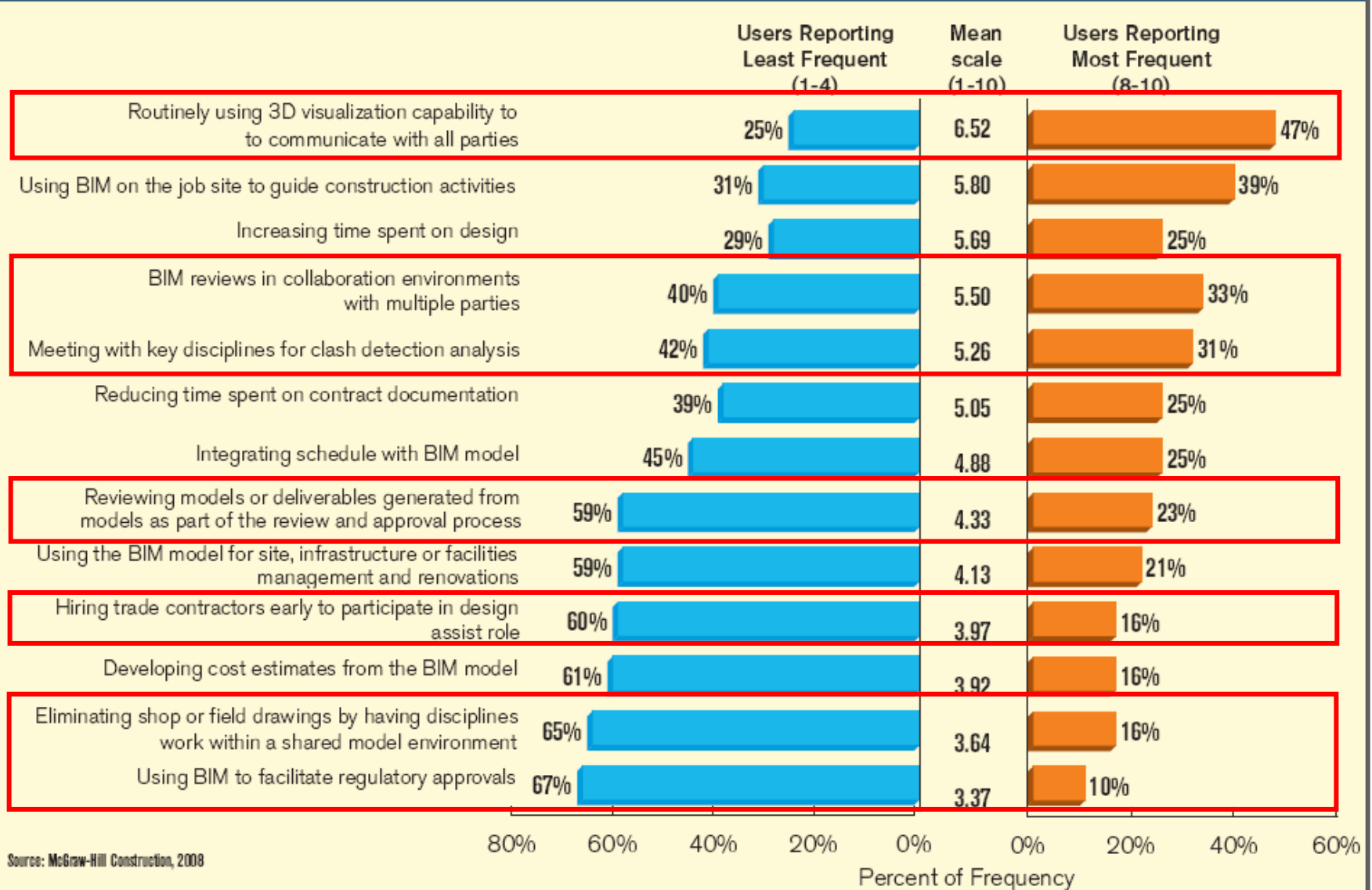
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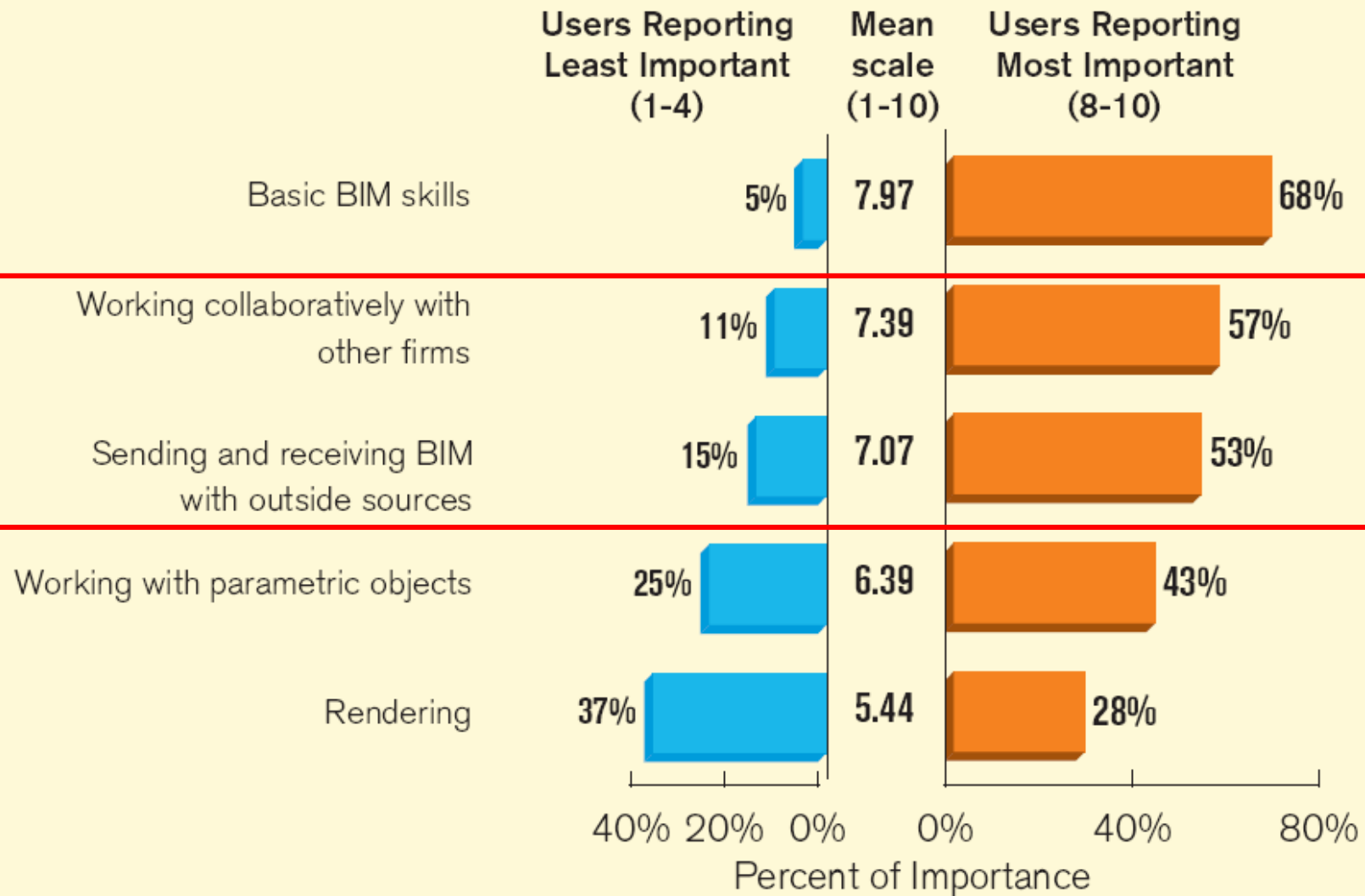
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Frequent BIM-Related Activities



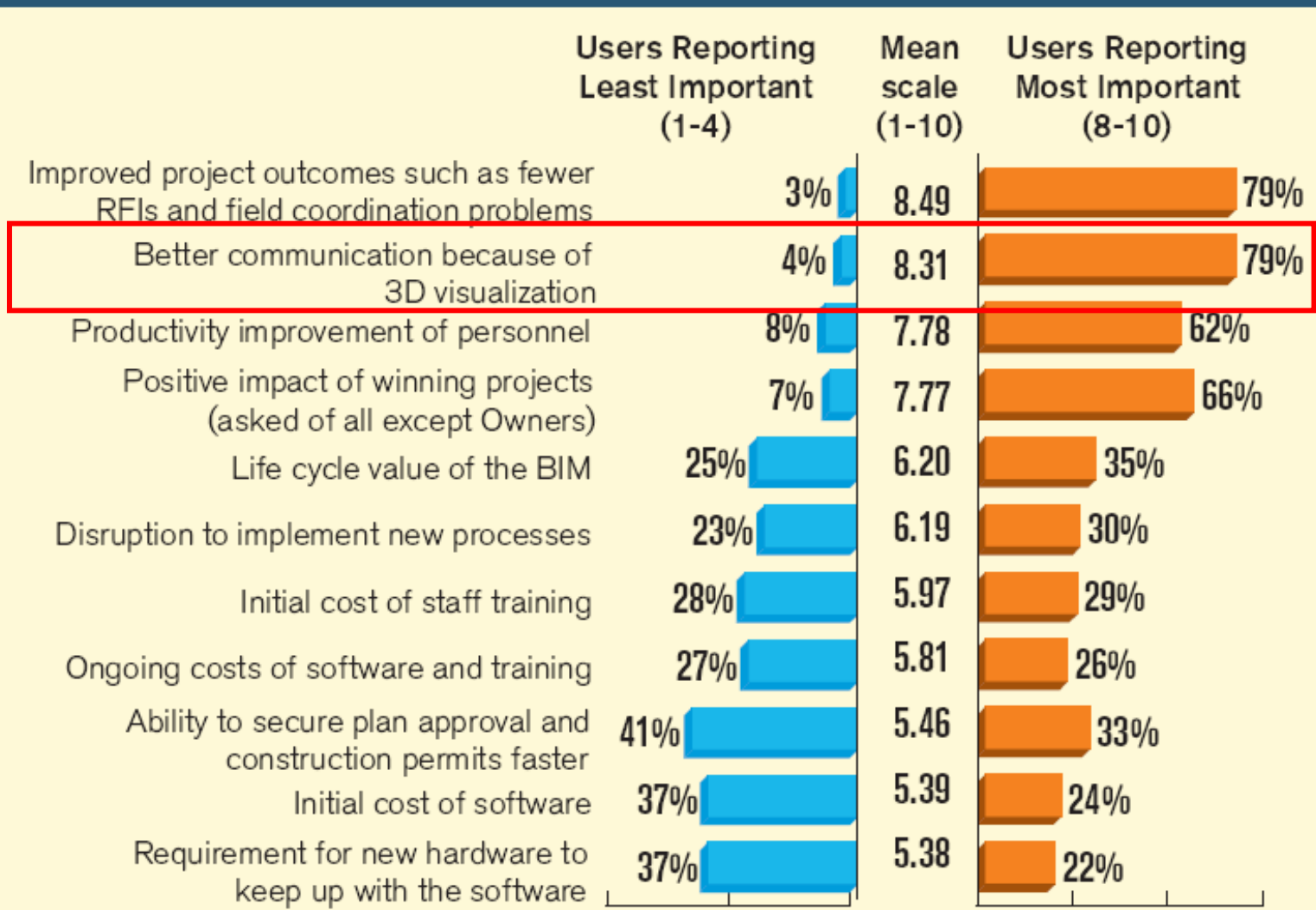
Importance of BIM Training Needs



Source: McGraw-Hill Construction, 2008



Importance of Aspects for Measuring ROI



60% 30% 0% 0% 30% 60% 90%
Percent of Importance

Source: McGraw-Hill Construction, 2008

On the campus of the University of California San Francisco, build team members are using BIM to find harmony. In constructing the university's new \$254 million 236,000-square foot Cardiovascular Research Institute laboratory, team members are adopting BIM as part of a strategy to break down traditional barriers between firms and deliver the project on time and on budget.

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Image courtesy of SmithGroup

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"The key is anticipating issues," Bade says. "The team works to anticipate issues, clear constraints and develop the information needed to build and meet goals. It uses peer pressure and rewards people for cooperating."

To help lower communication barriers, representatives of every key firm are housed in the same site trailer.

"The benefit is that people develop relationships by working in the same space," Bade adds. "You can go and ask questions on an informal basis and solve problems before they become RFI."

With completion scheduled for December 2010, Bade is confident that the strategies which have kept the project on budget and on schedule so far will keep the project on course to the finish.

"The information we have is really good so we have confidence that the building can stay on target," he says. "We'll avoid a lot of rework, avoid a lot of downtime and improve our overall productivity. It's all about information flow."



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Contractors were also brought on during design development, a move that required avoiding the traditional design-bid-build delivery method used on projects. With approval from the state legislature, UCSF experimented with a best value system.

When contractors submitted bids, they also answered questions in five detailed areas laid out by law, including questions about each firm's expertise in BIM.

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Although the bidding process took place during a time of major price escalations in the Bay Area, bids came in as projected, keeping the project on budget.

to look at things in a new way," says Luminita Ruva-Ciupitu, principal at SmithGroup.

The project, which SmithGroup was awarded in 2005, represents the San Francisco office's first large-scale foray into building information modeling. "This is one of the most efficient labs we've ever designed," Ruva-Ciupitu explains. "We were interested in doing a major BIM project and this was the right opportunity."

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In addition to using BIM for clash detection, Rudolf and Sletten did advanced 4D (schedule) simulations of the structural steel system, site logistics and the building's highly complex skin system.

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"The information we have is really good so we have confidence that the building can stay on target," he says. "We'll avoid a lot of rework, avoid a lot of downtime and improve our overall productivity. It's all about information flow."

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But those early design details paid off in other ways. Thanks to the additional project data, UCSF could bring other

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The same process was also used with awarding major subcontracts for the MEP and building envelope work.

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more cooperative way of working on public projects.

“When I came to work for the university, I saw projects run into difficulties because of the lack of cooperation and problems happening because of a lack of complete information,” Bade recalls. “Since I became responsible for UCSF’s project delivery processes in 2004, I’ve been looking for ways to use cutting edge tools and processes to improve that situation and allow projects to benefit from improved information flow and management processes.”

“The software can draw it for you,” Ruva-Cupitu says. “You have to spend the time at that point to investigate what you need, which takes more time to input.”

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“They also answered questions in the detailed areas laid out by law, including questions about each firm’s expertise in BIM.”

UCSF scored the answers and divided the score into the dollar amount of bids to get a cost per point. With the lowest cost per point bid, Rudolf and Sletten of Redwood City, California, was awarded the job.

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explains. "We were interested in doing a major BIM project and this was the right opportunity."

Thanks to the owner, that decision came easy. Michael Bade, director of capital programs in UCSF's Capital Projects and Facilities Management department, was also eager to put BIM to the test. After spending 12 years working on construction projects in Japan, Bade wanted to foster a more cooperative way of working on public projects.

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With BIM, the design and construction design phase. Once design development began in April 2007, the larger process change that BIM promotes became more obvious. Architects, structural engineers and MEP designers all fed information into the model. Many of the details that traditionally weren't expressed until later had to be addressed.

"In BIM you input elements and you have to know a lot more details so that the software can draw it for you," Ruva-Cupitu says. "You have to spend the time at that point to investigate what you need, which takes more time to input."

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contractors into the design process. The creation of bid packages from the model to get a steel order placed in the mill queue while design was at 30%.

Contractors were also brought on during design development, a move that required avoiding the traditional design-bid-build delivery method used on projects. With approval from the state legislature, UCSF experimented with a best value system. When contractors submitted bids, they also answered questions in five detailed areas laid out by law, including questions about each firm's expertise in BIM.

UCSF scored the answers and divided the score into the dollar amount of bids to get a cost per point. With the lowest cost per point bid, Rudolf and Sletten of Redwood City, California, was awarded the job.

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revised the model elements in five components of week simulations, including showing the equipment that would be used for lifts," says Michael Piotrowski, director of technical development at Rudolf and Sletten. "By doing that, you can see instantly any object or component that hasn't been included in the schedule. You quickly learn what's missing."

While BIM facilitates the frequent exchange of data between team mem-



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Conclusions

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Strategic Advantage in a Challenging Economy

As recognition of the benefits of BIM grows, the ability of design professionals, contractors, fabricators and suppliers to work effectively in this new environment will increasingly become a competitive differentiator in winning work. In challenging economic times this kind of edge can be critically important to survival. Also, owners competing for scarce capital resources will find an advantage in being able to demonstrate the ability to more accurately control costs, quality and schedule through implementation of BIM.

Owners' Lifecycle Focus Enhanced by BIM

Ultimately, as thousands of completed models are turned over to owner/sustainers along with their physical counterparts, applications will emerge to integrate their rich data with robust management systems for all aspects of networked lifecycle operations.

The current work being done to standardize property sets and data exchanges will bear fruit for decades of productive utilization of these "digital doubles." And the in-place performance data will cycle back to inform better design for the entire industry.

Expertise Breeds Positive Experience

The research clearly shows that as users become more expert with BIM they enjoy proportionately greater benefits and have an increasingly positive experience with BIM. This powerful alignment between skills and rewards augurs well for expanded implementation within firms and broader adoption across the industry.

BIM-Driven Prefabrication on the Horizon

Following the project process, it is natural to predict that fabricators will be the next group to embrace the power of BIM. As in other manufacturing industries that have integrated virtual design with automated production to reduce cost and increase quality, innovative firms in the construction industry are already finding these efficiencies. Larger and ever more complex portions of projects will be created in ideal factory conditions for assembly at sites, rather than being more wastefully and dangerously constructed from parts and materials in the outdoors. This will have a direct impact on the workforce challenges faced by the construction industry by making working conditions safer and more appealing for a new generation of industry workers.

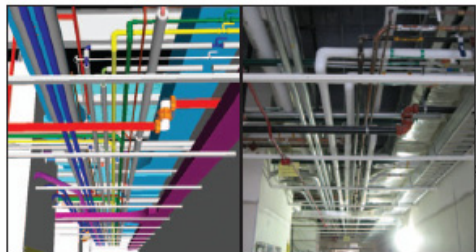


Image courtesy of Mortenson Construction

2009 Will Be the "Year of the Contractor" in BIM

Contractors are predicting an acceleration of BIM usage that significantly outstrips the other groups surveyed, and paves the way for 2009 to be "the year of the contractor" in BIM.

Most contractors using BIM are not waiting to receive BIM files from designers but are doing 2D-to-BIM conversion from whatever CAD files or paper documents they can get their hands on. The tangibility of the benefits that contractors can extract from BIM makes a compelling business case for investing.

This trend mirrors the traditional lifecycle progression of a project, where the architect is initially responsible for the format of information and shares it judiciously with a small group of consultants. Then contractors assume responsibility, using their own tools and processes to interpret, divide and distribute that information broadly for multiple purposes through to completion. BIM has now evolved from a focused tool set for design to a more comprehensive platform for design and construction integration, driving major changes in the ways all the players interact.

"There's this surge wave of interest in BIM right now. If you're not on the front end of it, you're falling far behind."

—Linda Morrissey
Senior
Preconstruction Manager
Mortenson Construction

"Leveraging BIM expertise to differentiate your firm in the crowded construction marketplace is critical."

—Leonard Toenjes,
CAE, President
AGC of St. Louis

Collaborative Silos

Increasingly, users are adopting discipline-specific BIM applications, especially to perform analyses on data extracted from design models that supports their workflow and unique project responsibilities. But this apparent fragmentation is less of a problem with BIM applications than it has been with previous discipline-specific IT tools. That is because applications that can work with multiple BIM formats to perform tasks such as clash detection are providing the benefits of interoperability even if the data structures of the core tools aren't truly interoperable. So each discipline is applying modeling to its own part of the project, and the benefits can still be leveraged across the entire team.

Steve Cook of Kristine Fallon Associates described this well in the February 2008 issue of *Midwest Construction*, saying "[BIM] seems the most efficient and effective way to get all parties around the table and make decisions about any issues that come up. We're not really creating a master model. Everyone owns their own information and does their own [model]. It's just a way to briefly bring these together, identify needed changes, and then let each party go back and make its changes until the next time we meet."

Faith-Based BIM Adoption

Most users report that although they are not yet quantitatively measuring ROI, they can definitely tell that they are working more productively and effectively with BIM and have complete faith that it is a better way of working.

This is logical because many of the benefits of BIM center on cost avoidance rather than cost reduction, and thus are more challenging to measure but are clear to experience.

This will certainly change as teams collect and share more consistently measured results.

Research efforts, such as the ongoing study of completed BIM projects by the Center for Integrated Facility Engineering (CIFE) at Stanford University, sponsored by the GSA, will continue to examine and compare results to find the meaningful trends and give shape to the appropriate expectations for value by BIM teams.

Discipline-Specific Evolution Path

The path to adoption and implementation is developing unique patterns by discipline.

As 3D visualization was the initial attraction of BIM for architects, clash detection is emerging as the gateway for contractors.

Once on board, design professionals advance into aspects of BIM that support their practice needs, such as energy modeling, and contractors move into quantity takeoff, estimating, schedule integration and construction logistics and sequencing. Each player finds their "BIM sweet spot" where the value is most tangible and relevant.

BIM Drives Integrated Project Delivery

As contractors and design professionals continue to accelerate BIM adoption, the benefits of collaboration and integration of information will become increasingly compelling.

Efficiencies achieved by firms deploying BIM solely within their own sphere will be multiplied when they begin integrating with other models.

This will shift the focus of the entire industry from technology adoption to process reinvention, and the tools will adapt to support this perspective.

Workforce Demographics

Senior management buy-in is reported as the second greatest challenge to adoption, while resistance from junior staff is last on the list of issues.

This follows a familiar pattern for technology adoption across U.S. industries. People in their twenties are ready willing and able to adopt digital technologies in the workplace.

According to a McGraw-Hill Construction white paper on workforce, the construction industry will need to hire 12 million new jobs by 2012. And an estimated 95,000 new craft workers will be needed each year for the next decade to replace those leaving the industry.

For construction, the widespread adoption and implementation of BIM has the potential to help reverse the decline of the industry's image and attract more talented young people to replace the rapidly retiring ranks of experienced workers.

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Image courtesy of McKinsey Construction

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SmartMarket Report on BIM

- Next SmartMarket Report:
 - The business impact of BIM & IPD
 - Where users are experiencing benefits
 - Qualitative/Quantitative
 - Firm/Project
 - Process/Outcome
- Launch event
 - Sept 21, 2009
 - UCSF Mission Bay

