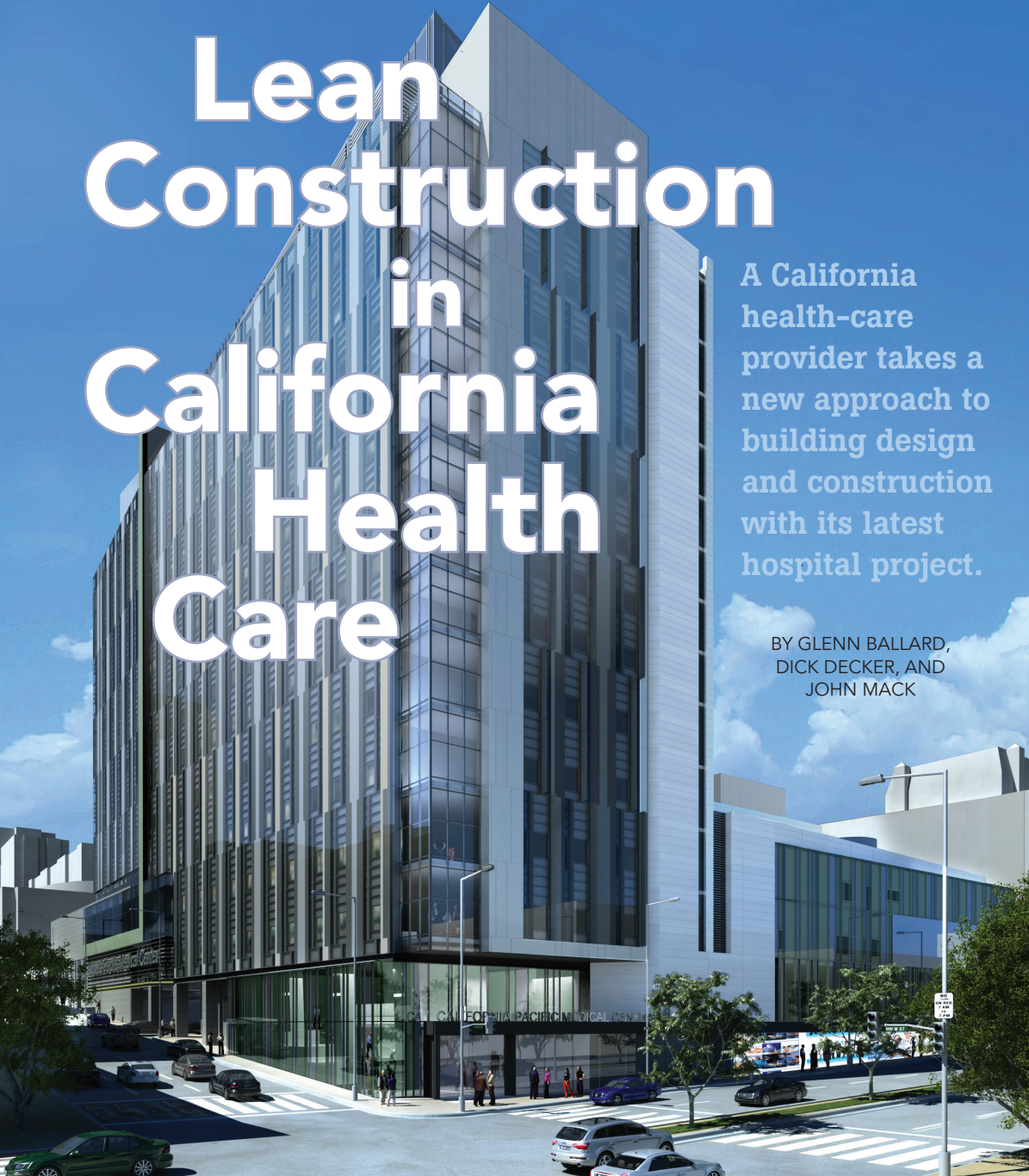


# Lean Construction in California Health Care

A California health-care provider takes a new approach to building design and construction with its latest hospital project.

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Cathedral Hill Hospital (CHH), which will take up one complete city block in downtown San Francisco, is being designed in accordance with Lean Construction methods.

## SUTTER HEALTH, ONE OF THE LARGEST HEALTH-CARE PROVIDERS

in California, has embarked on an aggressive hospital building plan to upgrade their facilities for new seismic standards. In addition to upgrading existing facilities, Sutter will add a new one, Cathedral Hill Hospital (CHH), which will take up one complete city block in downtown San Francisco.

Using Lean Construction methods from the Lean Construction Institute ([www.leanconstruction.org](http://www.leanconstruction.org)), the project team for CHH is assembling sets of tools to improve the efficiency of everyone on the project. Value Stream Mapping, Target Value Design, cluster groups,

and building information modeling (BIM) are some of the tools Sutter and the project team have chosen to use in this effort.

### A Bit on Lean

Lean Construction is a holistic project delivery approach with the objectives of maximizing value and minimizing waste. The concept is becoming increasingly popular not only in California, but also around the globe. Properly implemented, the following results are achieved:

→ The facility and its delivery process are designed together to better reveal and support customer purposes. Positive itera-

tion within the process is supported and negative iteration reduced.

→ Work is structured throughout the process to maximize value and to reduce waste at the project delivery level.

→ Efforts to manage and improve performance are aimed at improving total project performance, because it is more important than increasing the speed of any activity.

→ “Control” is redefined from “monitoring results” to “making things happen.” The performance of the planning and control systems are measured and improved.

Lean is certainly a major shift in project management philosophy. To make a suc-



Meetings, consisting of a “big room” meeting followed by smaller “cluster” meetings, are integral to the Lean Construction philosophy.

successful transition to this new way of thinking, the change needs to come from top management. On the CHH project, the owner is 100% behind the Lean delivery method and requires all project participants to attend Lean training classes. The classes are grouped into four categories: Introduction to Lean, Basic Training, Lean Project Delivery, and Lean Management.

The CHH project recently completed a round of “Introduction to Lean” classes for all participants. This three-hour class teaches the history of Lean Construction and its concepts and methods. One of the class exercises is a hands-on construction project to build airplanes out of plastic building blocks. The plane is constructed three different ways to show how Lean methods can increase efficiency with less effort. There will be future classes on Target Value Design, Last Planner System, A3 Reports, Weekly Work Plans, and Plus Delta.

Value Stream Mapping, a powerful lean tool, was employed early on in the setup of the design-assist process for CHH. Designing the relationships and dependencies between the owner, designers, and constructors was a necessary first step to produce a functional group. What information was needed and when did the designers need to supply it to the constructors for them to continue their work? What information did the constructors need to feed back to the designers to input the constructability factors, and when? Who communicates to whom and by what method? How are conflicts resolved? When do the owner and GC have to approve completed work? These are all very important questions that

Value Stream Mapping can help answer in a systematic fashion.

### Building Information Modeling

Sutter Health and HerreroBoldt are committed to reducing waste through the use of BIM models and clash-detection software. BIM is another tool to make the project more efficient. Drawing the building in a virtual environment and performing clash detection between architectural, structural, and building systems in the virtual model is more efficient than finding and correcting the issues in the field. This eliminates waste, thus meeting a core requirement of Lean Construction.

Another use of BIM that can help reduce cost and manpower is extracting production plans from the model. The production plans are used for prefabrication, assembly, delivery, and installation of items during the construction of the building. This allows assemblies to be delivered to the field, reducing the amount of people doing the installations. Using this method, efficiency of the workers also increases. Fewer and more efficient people also reduce safety-related incidents. This whole process is a chain reaction of efficiency.

In terms of BIM software, Revit Structural is being used to design CHH. The Revit model is then imported into Navisworks for clash detection and will also be imported into Tekla for detailing, fabrication, and erection planning.

### Collaborate, Really Collaborate

Target Value Design (TVD) is a value engineering technique that allows team members from the design and construction

side to work together as a group. The TVD group meets once a week for two hours to review and discuss ways to achieve a better building design at less cost. This group has at least one person from each designer and subcontractor. The group designs for what is constructable and uses detailed estimates to help guide the design, thus designing to cost rather than costing design. These methods are in opposition to the “throw it over the fence” design of each company working in its own “silo.” All decisions are made in the group environment, not in isolation. This allows for the construction team to be part of the project at a much sooner time than a traditional project, in both definition and design.

On the CHH project, the TVD meeting takes place every Tuesday at 8:30 a.m. The meeting is held in the “big room,” a management technique taken from Lean design management philosophy. After the meeting, team members move on to “cluster” team meetings to participate in their various specialties. There is a structural cluster, an architectural design cluster, an external cladding cluster, etc.

At the conclusion of every meeting at CHH, a Lean tool called “plus/delta” is used. The leader asks all the participants what they thought went well at the meeting (plus) and after all the pluses are written on a chart, the meeting leader then asks what changes could be made in the meeting to improve it for next time (delta). This tool has proven to be very powerful in that each meeting becomes part of a continual improvement process.

### The Project as a Network of Commitments

The group uses the Last Planner System to track requests made from one team member to another. It is a system of production control that tracks reliable promises made by team members. The success of the method is in tracking percentage of promises completed (PPC) versus promises made. When using Last Planner, a request is made of someone and the request is put into a weekly work plan. Each request is assigned to a person responsible for completion of the action. The weekly work plan is tracked at meeting minutes, and at the following week’s meeting all the requests are reviewed for completion.

For a request to be complete it must meet the conditions of satisfaction from

the person making the request. If a request is not met then an acceptable reason must be given to the team. The reason for non-completion is selected from predefined answers, and these reasons are also tracked to see if there are patterns to items not being complete, so that action can be taken to prevent reoccurrence.

Interestingly, the Last Planner System can become a game and bring out the competitive nature of the team members. Each week when something is assigned, the people that are responsible for completion of the task strive harder to complete the task so their name is not next to an incomplete item at the end of the promised period.

The A3 process, another lean tool, is a structured report used to solve a problem, report project status, propose a policy change, or make a purchase. The name A3 refers to A3-size paper (11.69 in. by 16.54 in.). The objective is to fit all the necessary criteria on one page of A3 paper to present to for approval. A good A3 report will have a description of the current condition, root cause analysis, target condition, implementation plan, follow-up plan and result report.

At CHH, the core team signs reviews and approves submitted A3 reports prior to anyone taking action on the A3 problem/proposal. The core team has representatives from the owner, architect, and construction management. When the A3 is approved, someone will be assigned to complete the actions describe on it. The person that presented the A3 is usually the primary person assigned to complete the action.

## Innovation

In tandem with employing Lean techniques, Sutter also wanted a structural team that could think outside the box in terms of seismic design. Degenkolb Engineering, the project's structural engineer, quickly demonstrated this ability when it recommended the use of viscous wall dampers (VWD) in the seismic load resisting system (SLRS). VWDs are a Japanese seismic invention used in other parts of the world, but this will be the technology's first United States implementation. As the structural design evolved, Degenkolb validated their prediction that the VWDs would produce a very efficient structural system with superior seismic performance, as compared to conventional seismic systems.

Another new tool applied on the CHH project is the Office of Statewide Health Planning and Development phase review process. Hospital construction in Califor-

nia is regulated, approved, and inspected by the OSHPD, and the CHH leadership and project team requested that OSHPD apply their new phased review process to the CHH project. This phased review would change the California design review process from one-step approval at the end of a three-year period to a six-step phased review process, allowing for submission of the gravity load resistance system, then the seismic load resistance system, and so on over six phases. This helped the design team spread the review and revision work load evenly over a three-year period instead of one big approval at the end of three years—a win-win for everyone on the project, including OSHPD, and also another Lean Construction technique (under the Just In Time heading).

## Now and for the Future

Participation in the CHH Lean Construction/design assist project has been a powerful experience for all project participants. The teamwork that has developed as a result of the customer, designers, and contractors truly working together will carry through to the construction phase of this project and produce unlimited future gains. Lasting friendships have been formed, professional relationships developed, and many new tools learned. This project has succeeded in producing a profound cultural change in the way health-care construction projects are designed and built. **MSC**

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### Owner

Sutter Health

### Architect

SmithGroup, San Francisco

### Structural Engineer

Degenkolb, San Francisco

### Steel Fabricator

Herrick, Stockton, Calif. (AISC Member)

### General Contractor

HerreroBoldt (a joint venture between Herrero Construction and Boldt Construction), San Francisco