

WHITE PAPER REPORT – ELECTRONIC PLAN REVIEW

I – BACKGROUND AND PURPOSE:

Quality Design Review has evolved tremendously since the construction industry began conducting formal and systematic quality reviews of drawing packages many decades ago. The *significance* of the process has grown as well, offering a way to minimize potential construction problems and scheduling delays, and more importantly, to control the costs of construction. Clients and project stakeholders are increasingly requiring quality design review processes and documentation for projects that have undergone a formal quality review.

Prepared by the **Owen Group, Inc.**, a proponent and advocate for exciting and innovative new web-based technology, this white paper will introduce the benefits and best practices of **Electronic Plan Review** (EPR) technology. Read on to see how Owen uses these smart tools to simplify the processes of owners, architects, and engineers as they work through their projects to completion.

II – PROBLEM STATEMENT – TRADITIONAL PAPER PLAN REVIEW:

Hundreds of thousands of construction projects are being designed worldwide on aggressive and ever-shrinking schedules. The growing problem of delivering a *quality* product is that it is difficult to accomplish, as review teams with outdated tools are faced with the following common shortcomings:

- The review process is extremely *cumbersome* and lacks efficiency
- It is *time intensive* - something most projects do not have
- Review information is easily lost, poorly managed and difficult to track
- There is no proper review documentation
- Back-checking is inconsistent, if it is present at all

III – EXECUTIVE SUMMARY:

As new advances in software created specifically for building design and construction management enter the marketplace, some great new tools are finding their way into the hands of designers and constructors to make their tasks easier. These allow them to better manage their projects and teams.

Electronic plan review software is one of these tools. For construction design and management teams using this technology, the benefits are vast:

- **Reviews and coordination that typically take weeks may now take only days – significantly reducing costs and improving turn-around time.**
- **The process is properly documented (review comments, design changes, etc.), especially decisions made during the review process.**
- **Documents are stored in a secure, central location, available to teams via the Internet from anywhere in the world.**
- **Reviewers can work simultaneously on the same plans in a collaborative web application - and review comments and sketches are instantly available to all.**
- **Management and outsiders-by-invitation can be allowed secured access to the project.**
- **Review teams and project stakeholders benefit from e-mail notifications.**
- **Electronic Plan Review supports *green environment* and sustainable practices by allowing for pure digital review.**

IV - WHY WE DO WHAT WE DO - AN EXPERIENCED PERSPECTIVE:

The advent of computer-aided design (CAD) and Building Information Model (BIM) as well as other electronic design tools has propelled designers, architects and engineers into being more productive on a tightened schedule. However, the design industry is experiencing an ever growing demand to deliver even faster results, with fewer resources. Unfortunately, for most firms and governmental agencies, the standard method of ensuring quality design packages has not evolved since the outmoded systems of the 1980s and 1990s.

There are a variety of reasons why AEC Industry is reluctant to make the switch to EPC software:

1. **Resistance** to letting go of the satisfaction of “old fashioned” hands-on drawing reviews. Some reviewers find it pleasant to sit down to add (red) mark-ups, highlights, and tab the sheets.
2. **It’s too hard.** Many of us are pretty fast at flipping through paper drawings to find our set, not wanting to even bother with the drawing index to help us out. *For decades this is how we have been operating - and change can be uncomfortable.*
3. **Early Attempts** to utilize these legacy tools in your firm may not have been very successful and the expected benefits were not realized.

A number of years ago, the **Owen Group** envisioned this type of *electronic plan review* when the hardcopy plans for a large review project landed in its lobby delivered by a forklift.

Since that point, we have diligently worked toward moving away from paper reviews over to the electronic plan review environment gaining valuable experience to pass on to other companies.

V – THE ELECTRONIC PLAN REVIEW SOLUTION

The optimal electronic plan review software available in today’s market is based on *cloud-based* technology. Via the Internet, these newer applications provide role-based, secure access by project teams for reviews, mark-ups,

and comments. Plans can be shared in real-time among all team members, providing a truly collaborative process.

With all of the revolutionary *new tools* and *sophisticated features* now available, conducting quality reviews electronically has never been more efficient.

New features include:

- **Built-In Management Tools** enhance the control and quality of the projects to increase productivity, accuracy and efficiency through:
 1. **Central Document Repository** - All plans which have been submitted are stored in one secure location. This provides management an ideal environment conducive to delivering a high quality project.
 2. **Databases** designed specifically to link those documents to project information, submittal history, reviewers' comments, audit logs, etc., greatly increase the ability to easily locate, manage and control vast amounts of information.
 3. **Real-Time Status Reports** in the form of *charts, graphs* and *timelines* provide busy managers an easy method to monitor overall progress and staffing resources.
 4. **Reduced Long-Term Costs** – Huge cost reductions across the board can be realized on paper, printing, staff travel, shipping and all associated expenditures. Not to mention the cost savings on staff time by reducing idle time, inconsistencies, and inaccuracies, which are sources of delays and major project delivery problems.
 5. **Review cycles** can *safely* be shortened and conducted by fewer staff. Monitoring project performance to identify potential breakdowns can be easily accomplished. Management will be able identify and act on bottlenecks before they become problems.
 6. **Reduces Project Liabilities** - Imagine a well-executed project which includes an audit trail history, a searchable project comment database and document management controls. This is really one of the main objectives for moving to an electronic plan review solution.

Benefits to Reviewers are Significant

Consider how using electronic plan review software for your next project empowers your reviewers with:

- **Faster and Easier Submission and Access** - Time spent gathering, assembling and distributing paper drawings for QA/QC reviews among your team is considerable. In this new environment, the software stores, manages, and redistributes the electronic plan submittals.
- **Shared Access** - Reviewers can work on the same drawings at the same time and all work can be instantly available to all team members.
- **Sheet Management** - Software rules that properly control plan submittals via customizable 'phases' ensure that errors made by staff working on out-dated sheets is eliminated.
- **Searchable Comments** - A database that stores and catalogs all the reviewers' comments for each project phase, provides the ability to do *keyword searches*, to sort and filter the comments by sheet number, discipline or user name is a **powerful tool** for detailed and meaningful reports.
- **Standardized Common Comments** - Stored in a central location and shared among the team, users have the ability to upload standard comments into the application.
- **Faster, More Efficient Communication** - Enhance team collaboration with *customizable e-mail notifications and milestone event* monitoring as part of any good EPR solution. Team members will have immediate, read-only access to comments created by any other reviewer.
- **Document Storage** features provide not only a central repository for all project plans, but also ensure that losses from fire or other catastrophes need not be disastrous.
- **Room on the desk** - Large layout spaces are no longer littered with extra documentation.
- **Continuity of Reviews and Reconciliations** - Electronic plan review reduces confusion as to what changes have been made and by whom. Overlay and side-by-side comparison tools make it easy to identify and mark additions and deletions to plans and back-checks are more focused and easily expedited.

Benefits to Owners, Clients and their Representatives

The previously stated benefits to reviewers and project managers flow up to the project stakeholders as well. In these newer EPR solutions, user-based roles and customizable security rules enable users to safely view project statuses and even create their own comments to communicate with the entire review team to:

- **Ensure That Projects are Properly Reviewed for Quality** – Through reviews ensure all work is properly coordinated and reviewed for quality.
- **Monitor Progress and Status** – Via the customizable security roles, these outside users have access to view the information for their *own projects*. The real-time project charts and graphics are available for them to download at will without the need to ask for help from already busy project managers.

VI - OVERCOMING BARRIERS TO IMPLEMENTATION:

There is always some reluctance to moving to new technology for any important or critical product. Here are some of the common concerns when investigating electronic plan review solutions:

1. Lack of information about *what's available* on the marketplace and what **really works**

Many solution providers offer “pilot” programs to allow users the chance to familiarize themselves with the product

2. No knowledge of the *benefits and reliable return on investment*

Economic benefits are plentiful. Ease of operation, speed of process and re-use of information are all a plus to an *efficient business model*.

Cost reduction across the board is achieved and reinvested, all resulting in increased profit and revenue.

Additionally, by eliminating paper waste, the system promotes a ‘steward of the environment’ position for any firm - empowering everyone to conserve our resources.

3. Lack of trainable staff and limited technical support.

Like any new technology, user acceptance and technical support is working to catch up to the demands of re-training and re-evaluating existing resistance in corporate mentality.

4. Fear of change.

Companies often take a “wait and see” approach to new technology, not wanting to take any risks or to be pioneers in any new ventures. However, being an early adopter can be beneficial to organizations in the long-run.

VII - WHERE TO BEGIN? BEST PRACTICES FOR MIGRATING TO E-PLAN REVIEW

The time for transition to electronic plan review technology is **now**.

With 90%+ of architects and engineers using some form of electronic drafting system for their construction documents, using electronic plan review technology is a natural progression from the traditional way of performing quality design reviews.

The growing trend of going “green” in the building design industry pushes companies that consume too much paper into heightened awareness of how to most efficiently manage natural resources.

At Owen Group, we have been instrumental in designing and developing a web-based product offered to the marketplace known as **e-PlanReview®** (EPR), via our sister company, e-Plan Inc.

Through our decades-long experience and with help from our multi-disciplinary experts, *e-PlanReview®* offers significant features and capabilities that benefit both large and smaller construction management review teams. Let’s look at some of them.

A. EPR SYSTEMS COMPARATIVE ANALYSIS:

Traditional Plan Review – Paper plans are marked up, re-printed, mailed or couriered across distances between reviewers, designers, and owners until the last review cycle is completed. This process creates paper waste.

Electronic/Digital Plan Review – Can be simply attempted using software like *Adobe Pro®* or *BlueBeam®* that provide tools to notate and mark-up PDF formatted drawings. Files are often emailed and sent back and forth between designer and reviewers, until the last review cycle is complete.

Although investing in this level of software is a move in the right direction, it is still not a fully collaborative plan review. This is the focus of our study.

For instance, these off-the-shelf software tools are often installed on a PC or laptop and currently provide no supporting for leveraging in-project management tools or the real-time sharing of information. Typically comments are stored in “note fields” that have been copied in from an external word processing document or spreadsheet that can be inherently difficult to manage on their own. Inevitably, this approach does not address or provide solutions that improve the quality of the review, project control or management needs. Consequently, they do not decrease reviewers’ time or project costs.

Cloud-Based Plan Review Applications – These higher level solutions comprise drawings that are maintained and available using the Internet via securely encrypted web sites.

Some inexpensive web-based products have been on the market for some time and although they do offer the benefit of easy access, their tools and features can be extremely limited.

Of course, quite expensive solutions are available as well; however, we have found that many of them are “modified” versions of legacy software applications that are bundled as third party add-ins to management software products.

BIM - Although Building Information Management (BIM) 3D technology is thriving in the design side of the industry, its high installation costs limit it to mostly large firms with more complex projects. The majority of the plan review community still has a “wait and see” attitude, waiting to learn from other’s experience with how cost effective these tools really are.

B. THE e-PLANREVIEW PROCESS DESCRIBED

Projects traditionally go through design quality reviews in three major submittal milestones (30%, 65% and 100%). These procedural and controlled reviews focus on code compliance, design quality, coordination with all disciplines and constructability issues.

In this process, all the documents (drawings, specifications, calculations, etc.) are uploaded into the application where they are subsequently catalogued, assigned to review teams and disciplines instantly.

During this process:

1. The workflow is identified and managed.
2. Review comments and proposed changes are automatically published and versioned in little time.
3. Reconciliation meetings are held after each review phase to allow the stakeholder parties a chance to discuss any discoveries and agree on an action towards resolution.
4. Before proceeding with the next project review phase, a back-check review will take place focusing on the comments and actions taken from the current review
5. This cycle will be repeated several more times in the next review phases as the design progresses to completion.
6. At the end of the review cycle, a record of the comments closed and those that remain open is kept.

C. SPECIAL FEATURES OF EPR:

New features that make ePR more versatile and productive consist of:

A **Custom Built Mark-up Review** Module with all of the tools necessary for conducting reviews electronically, including clouds, rectangles, circle and line tools, color pickers and digital stamps. CAD drawings saved as PDF files are wonderfully handled with the markup tools provided.

Overlay Tool – Allows users to review two drawings on top of each other to see changes, locate interferences, etc. Overlay colors can be applied at will and the layers can be swapped from top to bottom easily. It's a digital light table.

Side-by-Side Viewing – Allows users to simultaneously view two drawings that mimic zooming in and panning around as a synchronized movement. This provides an easy way to compare new and old drawing versions together.

Scaling and Measurements – Drawings uploaded into ePR can be calibrated on demand, to utilize the sheets own drawings scale. Once a calibration has been set, users can measure linear distances and calculate areas.

Common Comment Tools - Having hinted at some of the finer tools already, ePR also provides a standard comment library with the ability to assign comments to specific disciplines, keyword searching capabilities and the ability to batch upload comments from a spreadsheet for frequent reuse.

Project Comment Management – ePR has the most strongest and advanced comment management toolset on the market. Users can filter project comments by department, discipline, phase, user, date ranges, keyword searches, sheet number, et cetera. at will. Additionally, these filtered results can be picked to generate final deliverables of the electronic plans as a PDF document – all with a single button click.

Back-Check Comments and Owner Input – Comment controls exist for every comment placed by a reviewer, allowing multiple users with varying roles to view comments and respond without compromising security.

Management Tools – Resources abound for project managers and project stakeholders. Customizable dashboards, charts and graphics display status information in real-time with easily downloaded source data.

e-PlanReview's real value can be summarized as:

- **Integrate** team members effectively COLLABORATE from any location - without traveling.
- **Protect** the ENVIRONMENT by reducing your Carbon Footprint and increase potential LEED certification.
- **Reduce** your printing, traveling, physical storage costs, review cycle and delivery time.
- **Manage** CONTROL the Plan Review process online and eventually construction documents preparation.

Get a handle on quality design review.

1. Cedars-Sinai Hospital (8 Projects), Los Angeles, California:

Project Description: The scope of work for this project is to review the following on-going CSMC projects:

- 8th Floor Pathology Laboratory (Project #04-117)
- 7th Floor GI Expansion and Renovation (Project #09-264)
- 6th Floor Cath Lab, Electrophysiology, and Pulmonary (Project #09-016)
- 6th Floor OR's
- 6th, and 7th Floors PACU and CVOR (Projects 07-178,10-016,09-015)
- 5th Floor Satellite Central Sterile (Project #07-001) • 3rd Floor LDR Expansion (Package II, Project #05-048)

Client Information: Cedars-Sinai Hospital

Consultants Team: GKK Architect, Henrikson Owen and Associates

Contact Person: Steve Hooper

Brent Osborn

A. Problems which electronic plan review is trying to address:

- a. To provide a thorough and integrated review process.
- b. To determine if there are any clashes or coordination issues between projects.

- c. To suggest solutions with the appropriate project architects and OSHPD to resolve these issues.
- d. To achieve efficient use of time for every one involved.
- e. To seamlessly transfer information back and forth.

B. Advantages to the Project Team:

- a. Attributes of review comments/information are easily managed, searched, and sorted.
- b. Easy-to-understand legends make commenting and mark-ups uniform and easier for people to read.
- c. Digital tags are advanced commenting tools that can store design data, sketches, code references, etc.
- d. Reviewer comments are auto-numbered by the system. No more duplicate or lost comments.
- e. Ability to overlay digital drawings for strategic review of critical interferences.
- f. Advanced mark-up tools are available to make the review process as efficient as possible.

2. Kaiser-Permanente - Moreno Valley Medical Office Building

Project Description: Peer review for Kaiser Moreno Valley Medical Office Building (MOB) project, including Mechanical, Electrical and Plumbing (MEP) reviews, the exterior enclosure review, and a life safety code review for two (2) OSHPD-3 areas in the building - an Outpatient Procedure suite, and a Continuous Ambulatory Peritoneal Dialysis unit.

Client Information: Kaiser-Permanente

Consultants Team: HMC Architects, Henrikson Owen and Associates

Contact Person: Steve Hooper

Richard Henrikson

A. Problems electronic plan review is trying to address:

- a. To provide a thorough and integrated review process.
- b. To achieve efficient use of time for every one involved.
- c. To seamlessly transfer information back and forth.

B. Advantages to the Project Team:

- a. Drawings and design documents for multiple review phases were uploaded from the architects and managed effectively during the whole duration of the review process
- b. Attributes of review comments/information are easily managed, searched, and sorted.
- c. Easy-to-understand legends make commenting and mark-ups uniform and easier for people to read.
- d. Digital tags are advanced commenting tools that can store design data, sketches, code references, etc.
- e. Reviewer comments are auto-numbered by the system. No more duplicate or lost comments.
- f. Continuity and efficiency in reconciling reviews to ensure review comments are addressed appropriately.
- g. Advanced mark-up tools are available to make the review process as efficient as possible.

VIII - WHAT ARE YOUR NEXT STEPS?

This white paper is intended to introduce what electronic plan review can bring to the design and construction industry. Companies interested in its implementation should take the following recommended steps:

- Identify current barriers and actions that need to be resolved
- Research electronic plan review products and vendors
- Where necessary, adapt your office standard review process

Electronic plan review software is poised to be an important tool in the quality design review process for many years to come. E-PLANREVIEW® provides a proven solution that can help our industry move rapidly toward the future.

By:

Michael Chegini, PE, SE, CVE, CHW, DBIA, CCM of Owen Group

Rhodore Geronaga, RA of Owen Group

Contributors:

Steve Hooper, AIA, PE of Owen Group

Stacy Reno, BA of e-PlanSoft