

Automating Quality Management

Using Construction Inspection Automation Software to Increase Building Project Through-Put, Project Quality and Profit Margins

White Paper

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OVERVIEW

In today's highly competitive construction industry, "product" quality, production through-put and profit margins all work hand in hand to enable construction companies to increase sales, obtain competitive advantage and ensure that they are enabling their company's growth through increased profits.

Due to the amount of labor costs associated with any construction project, "time" is literally "money".

Construction project inspection automation and sub-contractor management software applications can enable construction companies to increase profits by reducing labor costs while ensuring their customers receive the quality expected for any real estate investment.

By implementing an inspection automation and sub-contractor management solution, construction companies can expect to:

- Decrease Costs
 - Eliminated costly "re-do" errors
 - Reduce sub-contractor labor costs
 - Reduce project management time
 - Deliver projects on time to meet specific closing dates
 - Minimize project financing costs
 - Reduce warranty costs
- Increase Revenues
 - Ensure that customer defined variances are being correctly charged to the customer
 - Maintain or increase profit margins
 - Increase product production "through-put"

The purpose of this document is to present the financial benefits that can be obtained by automating the building project inspection and sub-contractor management processes within a building project.

The purpose of this summary is to:

- Present key cost components of a building project
- Present how an inspection automation and sub-contractor management application can benefit project through-put
- Present how a system can reduce project cost components while increasing project through-put

COST COMPONENTS OF A BUILDING PROJECT

There are several critical cost components associated with any building project. The general contractor (and property developers) can effectively manage these cost components in order to achieve higher profit margins for a given project. These cost components are:

Production time – project production time is critical to a general contractor. The need to deliver a building project on-time is essential to achieve customer satisfaction, minimize project financing interest costs and ensure maximum business through-put.

Project overruns and variances – to minimize project overruns and variances, the general contractor must implement the best process possible for reviewing, approving and managing project variances. When project superintendents visit the project site on a regular basis, this practice can reduce the number of sub-contractor job errors and lower the possibility of increased job error repair costs by catching errors early. To facilitate this process, job errors need to be located and resolved at the site by documenting the issues and communicating the issues to the appropriate sub-contractors for resolution. Any variances or variance requests need to be documented and submitted to the project manager so that variance purchase orders can be generated to secure funding for the customer requested added scope items.

Changes in the project plan may also impact the scheduling of the various sub-contractors within the project based on the “dependencies” between subcontractor services as they relate to the overall building process.

Sub-contractor management costs – throughout the life of a building project, general contractors absorb various costs associated with sub-contractor management. These costs would include: project planning, sub-contractor scheduling and coordination, project labor costs, quality assurance and job payment.

It is very important for project superintendents to easily and clearly communicate with each sub-contractor company in order to minimize the costs associated with sub-contractor coordination and labor. In order to ensure that sub-contractors are managed as efficiently as possible, standardized defect reporting methods should be used when documenting and presenting any issues that must be addressed throughout the project due to materials usage, installation defects or project variances.

Cost of warranty fulfillment – by ensuring that all of the sub-contractors who are involved within a project are documented as being a specific project service provider, this will allow the general contractor to ensure that the sub-contractors are held responsible for resolving any warranty issues associated with materials and/or services provided by the sub-contractor.

COST COMPONENTS OF A BUILDING PROJECT

Risk policy premiums – by reducing project building cycles and increasing the ability to meet specified dates reduces insurance claim rates and may reduce insurance policy annual premiums.

Project financing interest – most, if not all, building projects are financed through short-term project loan instruments. A key to the project's profit margins will be ensuring that the project is completed on-time, and the agreed upon customer purchase transaction closing date is met in order to ensure that project loan interest costs associated with a project fall within the budgeted amount.

Trade damage repair costs – one of the most unmanageable costs associated with a building project are costs associated with the repairs or defects caused by trades. This category of defects is often known as "trade damage". In order for a general contractor to bill the responsible party who damaged the trade work supplied by another sub-contractor or the materials that have been previously installed, these defects need to be carefully documented.

**SUB-CONTRACTOR
MANAGEMENT PRACTICES
CAN INCREASE
"THROUGH-PUT"**

In order for any general contractor to ensure profit margin targets are achieved for a given project, the general contractor must plan, schedule and manage sub-contractor labor to achieve its most efficient use.

Ideally the general contractor must define a plan and a sub-contractor labor allocation that is well coordinated with material deliveries and sub-contractor personnel availability. Dependencies between sub-contractor tasks must be scheduled in a logical fashion and be well timed. The general contractor should plan into the project schedule the time it will take for each sub-contractor to address quality and installation defects.

Since project labor can be the most costly portion of a building project, labor management inefficiencies must be eliminated through planning and management practices. In addition, general contractors must maintain a process of sub-contractor accountability to ensure the sub-contractor delivers their provided service meeting the project's quality standards.

Areas of Potential Productivity Gains

In order to increase general contractor through-put, a general contractor must recognize the areas in which productivity can be positively impacted using computer software to automate the most critical area of any building project.

The following represent key areas in which traditional "yellow-pad" management techniques can be improved using an inspection automation and sub-contractor management system:

- Inspection status and results recording
- Inspection results, statuses and defects reporting
- Communication of defect issues to sub-contractors for resolution
- Coordination of sub-contractor building and repair tasks
- Defect repair inspection "back-check" process

Automating inspection data collection, inspection results reporting, coordination of sub-contractor tasks and communications of sub-contractor tasks can reduce project management time. This reduction will lead to decreased labor and management costs associated with the project.

PROJECT VARIANCE MANAGEMENT

In any building project, project "variances" will materialize because of building code regulations, a change in customer "options", a change in materials used or architectural changes.

In order to ensure that project profit margins are not negatively impacted, it is critical to control these variances throughout the entire business and "product" delivery cycle.

Identifying and Managing Variances

A critical part of the building project is the ability to document and manage customer "selections" such as window style, paint colors, fixture types, and cabinet styles, just to name a few.

As a part of the inspection process, it is important that the project's superintendent is fully aware of all of the customer selected options. This will allow the superintendent to ensure that sub-contractors and materials suppliers are doing their part to deliver to the customer's expectations.

Variance Management Process Breakdown

Too often during the construction project, either the "end" customer will change the options they want implemented or suppliers cannot fulfill the purchase requests associated with the customer-selected options to meet the project schedule.

This situation can negatively impact superintendent and sub-contractor productivity and service cost estimates.

Superintendents must manage this process in order to ensure:

- Customer selected options are actually delivered in the final product
- Sub-contractors have the correct materials available in order to eliminate errors and material re-installations
- Customers are billed for the new materials that are to be used and the labor charges associated with any "after the installation" option change requests.

Superintendents could be faced with a large challenge, especially if they are to ensure that customer options are properly installed within each home or structure as per each individual customer's requirements.

For a 375-unit multi-family project, this could cause a superintendent to manage over 3000 customer-selected options over multiple unit locations with a suitable number of sub-contractors.

During the inspection phase, the superintendent typically views a list of customer options and must verify that each item is implemented as specified and meets quality standards. Automating this process can

**PROJECT VARIANCE
MANAGEMENT**

surely reduce the time associated with project variance requests and management while ensuring the customer is charged for these items.

**BUILDING WARRANTY
ISSUE MANAGEMENT AND
COST CONTROL**

Ensuring that sub-contractors perform quality work within a project is the key to minimizing future building warranty claims. Maintaining a high level of workmanship throughout the project combined with the use of quality materials will ensure that warranty claims are kept to a minimum.

In the case in which a customer reports a warranty claim, a general contractor must hold their materials suppliers and sub-contractor partners partially responsible for each warranty issue that arises.

It is important to maintain an accurate record of the materials used within the project and the associated points of purchase. Also, a general contractor should maintain a detailed list of the sub-contractors who performed the materials installation to ensure that any costs associated with a warranty claim are passed on to the sub-contractor responsible.

VALUE OF AUTOMATING INSPECTIONS AND SUB-CONTRACTOR COMMUNICATIONS

The value of automated quality inspections and sub-contractor management can be achieved in various steps of the inspection and management process.

The following represents several key areas in which cost savings is achieved through increased productivity, reduced paperwork and timesavings:

Inspection result collection – The use of PCs or PDAs to document field inspections eliminates the need to use a paper-based inspection process. Through this elimination of paperwork, inspectors can easily perform and organize inspection results to better manage sub-contractor partners.

Subcontractor defect tracking – Once defects are identified, automated systems can produce defect reports or “punch-lists” presenting what must be addressed by sub-contractors. Standardized reporting delivered to sub-contractors on a regular basis enables sub-contractors to better manage their resources to resolve outstanding issues. By consistently delivering reports to sub-contractors, they will be systematically aware of outstanding issues that may affect when they will receive payments for work performed.

Defect resolution tracking – As sub-contractors are resolving identified defects, inspectors should be able to review a complete history for the issue being resolved after subsequent inspections.

Sub-contractor performance reporting – Over time, an automated system archives defects per sub-contractor projects. This will allow general contractors to select sub-contractor partners who perform better than others in support of future project profitability objectives.

Trade damage reporting and accountability – Inspectors should be able to document defects caused by sub-contractor personnel from one company who negatively affect the work of another sub-contractor company or to the materials installed by another sub-contractor (i.e. paint, trim, cabinets, floor, drywall, carpets, etc.). For example, assume a sub-contractor who provides painting services damages the carpet installed by another sub-contractor by spilling paint on the carpet. The inspector should arrange for either the painting company to remove the stain or charge the painting sub-contractor a fee to have the carpeting sub-contractor replace the stained carpet. This process allows general contractors to pass trade damage costs onto the sub-contractors who caused the damage while protecting the profitability of other sub-contractor partners and the general contractor itself.

Customer selection verification – Throughout the inspection process, inspectors need to verify that materials are being installed based on the project’s architectural design and are consistent with customer selections. This verification will ensure that the “customer” is getting exactly what they specified. This process will minimize potential delays

VALUE OF AUTOMATING INSPECTIONS AND SUB-CONTRACTOR COMMUNICATIONS

in completion time minimizing the affect on when the “closing” is to take place. Also this process will eliminate “punches” that must be completed resulting in decreased “re-do” and repair costs. Automating this process will allow inspectors to operate at maximum productivity when involved with large single family, multi-family and commercial projects.

Variance identification and management – By controlling the customer selection verification process, inspectors can identify potential project variances due to customer requests, code conformance or architectural issues. Once identified, these variance issues can be reported back to the customer account manager or project manager to ensure funding and work approval is acquired from the appropriate parties.

Warranty issue management – By automating the quality control process, inspectors can prevent defects from turning into future warranty issues. Also, since all sub-contractors are associated with work items in detail throughout the project, these sub-contractors can be called upon in the future to perform work necessary to address any warranty issues that arise.

Sub-contractor performance productivity increases – Over time, sub-contractor companies will also realize an increase in productivity. This productivity will be achieved by the fact that they will often rise up to the new level of accountability because of the automated inspection system. Also the standardized data format associated with defect reports will allow sub-contractors to more efficiently manage their personnel and better coordinate with other sub-contractor partners to resolve defects and trade damage. The result will be that the sub-contractor will do a better job to ensure that materials are installed as specified in a quality fashion in order to meet their own business goals.

Achieving Consistent Quality Throughout the Entire Project

By predefining a standardized inspection process associated with each phase of a project’s build process, general contractors can be enabled to develop a “product” that has consistent quality. This goal would enable the first unit of a multi-family project be of the same quality as the 400th unit built.

Increased Project Through-put Will be Achieved

By focusing all of the sub-contractors on performing work specified correctly the first time, the longer-term result will be the achievement of an increased project through-put. Both the sub-contractor and consequently the general contractor will achieve through-put gains during the lifetime of their business relationship.

REQUIRED COMPONENTS OF AN AUTOMATED PROJECT INSPECTION AND SUB- CONTRACTOR MANAGEMENT SOLUTION

The following is an overview of the features that should be provided within a construction inspection automation and sub-contractor management solution:

Sub-contractor company management – within each project, building, room and unit quality inspectors should be able to associate the list of sub-contractors who will be providing services to build the project.

Inspection process definition – The solution should provide a tool to enable inspectors to define inspection task lists, each with specific inspection items, associate these items with a sub-contractor and associate each inspection item with the physical area that should be inspected.

Inspection project set-up tools – The solution should have a tool that allows the inspector to define an inspection project for a commercial building structure, government building structure, any other non-residential structure, a multi-family project (i.e. buildings, units, rooms etc.) or a single family project (i.e. home and rooms)

PC or PDA based inspection data collection – The solution should provide two methods of inputting inspection data. Either via a PC operating a Windows application or via a Personal Digital Assistant such as a Palm OS device. The application should present to the inspector a list of inspection projects, allow the inspector to select a location or inspection item category, then view the inspection items in which the inspection defines the status of the inspection item, the sub-contractor trade type associated with the item, the location of the item and allow the inspector to key in notes that provide the detail associated with the status of the inspection item.

Customer selections definition and verification – The solution should enable project managers to document the customer selections (i.e. paint colors, trim types, cabinet types, etc.) within an inspection project. Then on-site inspectors should be able to view the customer selection list and verify proper materials delivered prior to installation.

Inspection results reporting – Once inspections are performed, the inspectors should be able to generate reports that present the “open” items associated with the project, the trade or sub-contractor responsible for completing or repairing the item and the location in which the item was inspected. The reports should be able to be viewed on the PC, printed to a printer for distribution, e-mailed or faxed.

Distribution of reports to sub-contractors and project personnel – The reports that are produced as a result of the inspections should be able to be sent to sub-contractors in printed form, e-mail or via fax.

Issue resolution tracking – The solution should be able to track the entire history associated with inspection item statuses that documented defects and their resolution.

**REQUIRED COMPONENTS OF AN
AUTOMATED PROJECT
INSPECTION AND SUB-
CONTRACTOR MANAGEMENT
SOLUTION**

Remote access to inspection reporting results - The solution should enable sub-contractors, project personnel, customers, etc. to be able to view the results of inspections performed from remote locations.

General Operation

When using an inspection automation and sub-contractor management solution to manage a project inspection process, the solution should include the abovementioned functionality to enable the following processes to be executed:

1. Define sub-contractor partners or construction crews' trade type and contact information.
2. Create an inspection list template for structure(s) assigning sub-contractor trade-work to be inspected and inspection location.
3. Define "customer selections" and installation locations.
4. Assign specific sub-contractor trade companies (insulation, framing, windows, HVAC, etc.) to inspection items.
5. Create an inspection project (location, structure type, etc.).
6. Perform inspections on PC or on a PDA.
7. Generate reports based on inspection results.
8. Send hard copy, fax or e-mail to notify sub-contractor companies and labor teams of outstanding work to be performed and defects to correct.
9. Perform follow-up inspections to ensure items are completed and submit inspection results to sub-contractors for resolution. (repeat steps 6-9 throughout life of the project).
10. Analyze performance of labor teams based on inspection results.

Throughout this process, superintendents, project managers and inspectors should achieve time savings through reduced sub-contractor management time, the elimination of inspection paperwork and detailed reporting of outstanding issues or defects for a particular sub-contractor.

Over time, as the solution is used on a wider scale, general contractors should realize the additional benefits of reduced project overruns, increased quality and an improvement of sub-contractor labor works execution.

The result will be increased general contractor through-put, the ability to consistently complete a project on time, reduced repair costs and the minimization of customer warranty claims. This will enable the general contractor to increase project through-put thereby increasing revenues while achieving established profit margin targets.

TOTAL BUSINESS BENEFITS

As a result of using an inspection automation and sub-contractor/labor management solution, general contractors are better able to manage labor personnel to meet building project schedules while reducing costs associated with each project.

Cost Reductions Achieved

By using the solution, general contractors can:

- Reduce inspection performance time and reporting costs by eliminating inspection paperwork and redundant data input tasks.
- Reduced sub-contractor management costs through improved communications and task management using standardized defect reporting and improved communications methods.

Costs Eliminated

By using the solution to enable more frequent inspections and back checks, general contractors can:

- Eliminate “do-over” costs associated with sub-contractor performance.
- Eliminate trade damage costs by forcing sub-contractors to cover the costs of trade damage events.
- Eliminate the need for the general contractor to absorb project variance costs by closely managing the inspection process to ensure variances are identified, approved and billed to the customer.

More Efficient Warranty Management and Warranty Cost Reduction

By making the project inspection process more efficient through the enforcement of consistent and repeatable quality inspection standards, inspectors can perform more inspections throughout the project through a phased inspection approach. More frequent inspections combined with more efficient sub-contractor management practices will result in:

- Reduced warranty issues.
- Easily identifying sub-contractors to resolve warranty issues
- Elimination of the need for the general contractor to absorb the costs for these repairs.

Increased Through-put, Product Quality and Revenues

Because of the productivity gains obtained by the general contractor and its sub-contractors throughout building projects, general contractors establish a more efficient building process and enable their sub-contractors to become more efficient. If leveraged properly, these efficiencies can translate into an increased project through-put for the general contractor allowing the general contractor to secure and perform

more projects with the same level of resources. This will increase the general contractors' project revenues and in turn company profits. In addition, general contractors can implement a standardized and repeatable quality management processes that ensures consistent quality throughout the entire project.