

# Wireless Technology in the Residential Construction Industry



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## Executive Summary

FMI recently completed a nationwide survey of US builders to find out how they are using wireless handheld devices in the field. The survey found while builders already use wireless technology in varying degrees to make their field staff more efficient, most are not taking full advantage of its capabilities. In this paper, we discuss how wireless is earning its keep on the jobsite and identify ways that builders can get more out of their investment in this technology.

We predict that, in the future, builders who want to remain competitive will need to use wireless to help their field managers do more work. The most successful wireless providers will be those who can show how their products offer a return on investment.

## Introduction

Homebuilders have always been quick to embrace new technologies that make them more efficient, but only if those technologies are easily implemented and offer a quick return on investment. Take cell phones for example. Construction is a communication-intensive business, with the need to constantly coordinate trade contractors and materials suppliers; because of this, builders embraced cell phones with push-to-talk as soon as they appeared on the market.

Now, an increasing number of builders have made the next step: they have discovered that the email and instant messaging capabilities of smart phones like the BlackBerry® and Treo® offer benefits not available from voice communication. In a recent national survey of homebuilders conducted by FMI Corporation, a full 69 percent of survey respondents said that they use smart phones for communication and exchanging data in the field.

The ability to email trade contractors and suppliers from the field is an obvious efficiency booster with a quick payoff. However, wireless devices can add much more value to the builder's operation by letting managers update the company's systems in real time.

Although other industries have been doing this for years -- for instance a UPS or FedEx package gets scanned by a wireless handheld every time it is handled, which automatically updates the system so you can find out exactly where the package is at any moment -- few builders are anywhere near as sophisticated. The reasons include a lack of understanding of wireless capabilities and a concern over the investment required to implement them. But that is starting to change, as the most difficult business climate in decades drags even the most reluctant builders into the 21st century.

## A Tough Market

The current US building market is one of falling prices and reduced business volume. The Case-Shiller National Home Price Index, a composite of single-family home price indices for the nine US Census divisions, showed a 20 percent reduction in median home prices from the end of 2006 to the end of 2008. According to Hanley Wood Market Intelligence, a firm that tracks residential construction activity nationwide, housing starts fell a full 68 percent during that same period.

Industry watchers paint a grim picture of conditions on the ground. "A lot of small and mid-sized builders have laid off their staff and closed their doors," says Paul Deffenbaugh, Editorial Director at Reed Business Information's Residential Construction Group. The survivors have made staff cuts that exceed the reduction in work volume. Two years ago, for instance, a typical project manager for a large production builder might be responsible for one community; today it is not unusual for that same manager to be handling two or three communities. "The big builders we've talked with have all cut staffing by 2/3 on average, which forces everyone to be more efficient."

These conditions have forced a lot of builders to re-think the way they do business, and have made them open to anything that will let them do more with less.

## The Opportunity

To get a better sense of how builders are using wireless devices, we interviewed a number of the FMI survey respondents. We found that while almost all managers understand the benefit of having email access in the field, younger managers are especially quick to embrace handhelds -- and they make up the bulk of builders' field staff. "Most of our field guys are 25-35 years old," said one VP of Construction for the Raleigh, North Carolina division of a National Builder. "They grew up with this technology and they expect it to be available on the job."

The BlackBerry platform is the one viewed most favorably by the survey respondents in four out of seven performance characteristics. They consider its main strengths to be email capability, security, reliability and battery life.

As mentioned above, the greatest benefits are realized by builders who integrate handhelds with their management systems, and who empower their field managers to update those systems in real time. At this point, most builders have not achieved this level of integration, but rather are using handhelds to streamline traditional, paper-based processes. The good news is that the benefits they are realizing are making them more receptive to taking the next step up the tech ladder.

Technology providers who want to help builders take this next step need to understand how builders use handheld technology, what their greatest challenges are, and what barriers stand between them and the benefits of full integration.

The study found that half of the survey respondents who use a smart phone for communication and exchanging data in the field, fall within the roles of Project Manager/Construction Manager (21%), Purchasing Manager (15%) and President/CEO/Division Leader (14%). The tasks most often completed wirelessly were scheduling, variance purchase orders, warranty requests and photographs of the job site. Scheduling was the most cited process completed wirelessly by all managers, regardless of job title. Those who were not already using wireless in their scheduling process named scheduling as the place where wireless could add the most value.

Because of these findings, we recommend that providers who want to communicate value to builder customers should start with the scheduling and VPO processes. We will focus on these two areas in the rest of this paper. We will begin by outlining how conventional, paper-based scheduling and VPO requests work, then report on how builders are using wireless to streamline those processes. Finally, we will show how those processes can be transformed by a full integration strategy.

## Then And Now

Building a home requires the scheduling and coordination of multiple materials suppliers and trade contractors: foundation companies, framers, roofers, plumbers, electricians, etc. Different builders subcontract different parts of the job; for instance, some use their own crews for framing and use trade contractors for everything else, while others are basically construction managers that sub out everything. However, the basic building and scheduling processes are the same.

### *Scheduling Before Wireless*

Scheduling on a construction project is sequential: the siding company can't start work until the framing is done, and the insulation has to wait until the plumbing, electrical, and mechanical infrastructures have been installed and inspected.

The process is time consuming and requires a lot of paper and human intervention. In a production building company, field managers are usually given a schedule sheet at the beginning of the job that tells them exactly how many days the job is expected to take, and what is supposed to happen on each of those days. They use this information to schedule the trade contractors and materials deliveries that will be needed during the upcoming two to three weeks. At the end of each week, the manager faxes a form to the office that shows the status of each home. If that office is just one division of a large national builder, the office scheduler then faxes the information to corporate headquarters, where the master schedule is updated.

When each phase of the job is complete, the trade contractor who did that phase of the work submits a paper invoice to the builder's field manager -- called a "job supervisor" or "project manager," depending on the company -- who then approves the invoice and faxes it to the office. The office then orders payment to be made.

Besides being paper- and labor-intensive, production builders' schedules leave little or no room for error. That's because the builder usually borrows money to buy the land that it builds on, and has to pay interest on the loan until the home has been completed and sold. Even in good times, most builders have relatively slim profit margins -- about nine percent according to the National Association of Homebuilders -- so when a house sits idle for any amount of time, interest charges quickly start eating into profits. As a result, schedules are built with little or no down time between trades, which puts a lot of pressure on field managers to keep the job moving toward completion, and to keep everyone on schedule.

But delays are common. If the supplier delivers the wrong roofing, or if the plumbing inspector spots a fitting that doesn't meet code (which are just two of many common glitches), then work stops until the problem gets fixed. If the fix doesn't happen immediately, the field manager has to reschedule all subsequent trades. In the conventional rescheduling process, this means making phone calls to each trade and supplier to notify them of the schedule change.

This frequent rescheduling of trades and suppliers costs time and money; in fact, it's one of the contractor's biggest pain points. That's why the survey respondents named scheduling as the number one place where handhelds could earn their keep.

### *Paper Based VPOs*

Another source of pain is the Variance Purchase Order or VPO. (Some builders call it a Field Purchase Order, but it's basically the same thing.)

The VPO is generated when there's an unexpected problem that requires extra funds to fix, such as a toilet that gets damaged after installation, and has to be replaced. The field manager writes up a VPO request then faxes it to the office. The purchasing manager reviews and approves the request, then sends it back to the field manager, who writes up a work order for the plumber to purchase and install a new toilet.

One problem with the conventional VPO process is that paperwork has to be reviewed and forwarded by people whose attention is focused elsewhere. "The guys in the field are construction guys," one field manager told us. "Asking them to keep track of paperwork only leads to problems." And if the purchasing department doesn't approve a VPO request quickly -- which our respondents say is not unusual -- it can turn into a scheduling issue.

As is true with scheduling, the VPO process can be streamlined by a paperless system that lets field managers submit requests from a wireless handheld.

### *Current Wireless Scheduling and VPO Practices*

Most of the builders interviewed for this paper were using wireless devices in two ways:

- For scheduling their personal time and workload (via an Outlook calendar, for instance).
- For streamlining conventional paper-based management processes.

Even those managers who used only the most basic wireless functions reported tangible benefits. "I can use the BlackBerry to look at my schedule in the field then email and set meeting times up without having to go to the office," notes a senior construction manager for a Midwest regional builder. "I have been doing this for two years. Before, I had to lug around a bulky day planner and notebook, which was a real pain."

For some builders, the advantages of electronic communications have led them to drop push-to-talk in favor of email or instant messaging. "We had the push-to-talk feature in the past, but didn't find it really useful," reports a small Washington state production builder, who now uses text messaging to communicate with trade contractors as well as his own field staff. "We find text messaging to be very efficient. A text comes through immediately, whereas voicemail has to be checked and listened to. The text also puts in writing what I need, which reduces mistakes."

Some big builders are also seeing the benefits of moving beyond voice communications. The Raleigh builder division mentioned above now uses email for all communications to and between field managers and trade contractors. Not only does this minimize interruptions and leave an electronic record of each communication, but it also saves money. According to one manager we interviewed: "The first year that we dropped push-to-talk we saved \$15,000 in wireless charges."

That same manager recalls that when a VPO was needed in the past, the field manager would call in the details to an office staffer, and the office staffer would generate the paperwork and fax it to purchasing for approval. Now field managers use their handhelds to email VPO requests directly to the purchasing manager. The devices have also simplified the invoice process. "Some of our vendors now send invoices as email attachments that we can approve and forward up the management chain," he says. The savings in time and effort has helped eliminate an office position, and has also made things easier for the remaining staff. "It frees up people's time because they're not constantly being interrupted."

## **Why Aren't Builders Taking The Next Step?**

The examples above are typical of builders who use wireless in the field today. While these builders have seen measurable improvements in productivity, they are not using the technology to its full potential.

Most of the builders we spoke with acknowledged this, and they understood that the ideal solution would let field managers update office systems from the field in real time. The reasons they cited for not doing so included form factor limitations, reluctance to change established processes, preconceived notions about wireless capabilities, and skepticism about return on investment.

Wireless providers need to understand these reservations and help builders see past them.

### *Corporate Resistance*

Despite a clear understanding of handheld benefits among field managers and division executives, there remains a lot of corporate-level resistance among the big national builders. Some of our respondents blamed the resistance on IT departments that have invested money and staff time in current systems that are not handheld-friendly. "The guys in the field are held hostage by IT departments that insist on writing their own scheduling applications, even though they could find something for much less money that did a better job and that integrated with the field," said one field manager.

Documentation is also a concern. With liability an ever-present worry, builders need to document everything that they do on each job, and many still don't trust electronic records. "We're in an industry that likes paper," says a Sacramento-based construction manager for a National Builder. "A paper trail seems preferred by people in the office and the field."

### *Form Factor Limitations*

Although field managers generally liked the idea of being able to update management systems from the field with a BlackBerry or Treo, most had preconceived notions about what such devices could and could not do.

The most common reservation we heard concerned screen real estate. Many builders have not considered doing anything more than email and calendar items because they use web-based management software. "Handhelds are very useful for emails and sending notices out, but our scheduling software is web-based and doesn't function well on BlackBerry's small screen," noted a division president from Norfolk, Virginia. That comment is typical: survey respondents identified Web as the weakest performance characteristic of a BlackBerry.

Some builders were also concerned about complexity. In general, builders are more willing to consider applications and devices with a simple interface, that can be easily explained to field workers, and that will be embraced by its trade contractors.

**The Solution:** Reservations about form factor and complexity represent a misunderstanding about how BlackBerry-enabled software programs work. Managers need to be shown that these programs are not accessed via a web page. Instead, simple drop-down menus are used to note schedule changes, which are then communicated wirelessly to the office computer. These menus can be specifically optimized for the BlackBerry, and customized for that builder and that project. And a field application can be built to work with most software programs.

### *Trade Contractor Resistance*

Some builders reported difficulty getting trade contractors on board. While some trade contractors are very sophisticated when it comes to technology, they tend to be the exception. Many are small companies that, while highly skilled at their particular trade, see new technology as something that will require time and money to implement. "It was long, arduous process just to get some of our subs off of fax machines and telephones," recalls the Norfolk builder mentioned above.

**The Solution:** While adoption by the trades is still relatively slow, more of them understand that they need to adapt to current market conditions. In fact, a growing number of builders are giving trade contractors no choice but to use wireless, while also explaining its benefits. "Our strategy for getting trades to use the system is pretty much that we shut down every other door and make them use it," says the purchasing manager for the Jacksonville, FL division of a national builder. "For instance, I could still print out PO's and hand them, but I just don't do it any more."

### *Skepticism Regarding ROI*

Cost was of course an issue with everyone. In fact, most of the builders we spoke with who weren't using wireless in an integrated way said that the main reason was the cost of implementing such a system.

Field managers tend to evaluate technology according to its usefulness as a management tool but big builders make technology decisions at the corporate level. The main question is how quickly the technology will recoup its investment and start saving money for the company.

**The Solution:** In the current economic climate, every company is looking for ways to use staff and resources more efficiently. Builders who have embraced full integration are reaping these benefits. "We've seen as much as a 30% reduction in cycle time with builders who are integrating BlackBerries with the rest of the enterprise," says Tom Gebes of BuilderMT, a company that makes management software for builders. The key to driving adoption will be helping builders see this type of cycle improvement, and the corresponding reduction in staffing needs.

### *An Example of Savings*

A good example of hard dollar cost savings is a builder who uses wireless technology to manage building materials.

Most builders struggle to control the delivery, handling and installation of building materials on their job sites, and the difficulty of this challenge leads to materials waste and unnecessary Field Purchase Orders. In its consulting practice with production homebuilders, FMI's team of consultants has consistently identified an average of more than \$2,000 per house in wasted material during the framing phase alone. The mistakes leading to this include incomplete deliveries and the loss of materials during construction. In most cases, the field manager, under time pressure to stay on schedule, has no choice but to approve the purchase of additional materials.

The most efficient way to correct this problem is with a handheld device linked to the company's purchasing system, as this gives field managers immediate access to information regarding the lumber order for each lot. The manager can access a drop-down menu and note whether a delivery was complete and, if not, what items are missing. This type of documentation holds everyone accountable, and tends to quickly reduce errors. For instance, FMI has found that over 60 percent of lumber deliveries don't have as much stock as noted on the invoice, but when one of its builder clients started asking its field managers to use their handhelds to photograph lumber deliveries and add a time and date stamp, delivery accuracy improved immediately.

In a company or division that builds 300 houses per year, use of the handheld materials management application can lead to \$600,000 annual savings on lumber alone. Once the system is in place, the builder can look for similar savings from other trades, such as roofing and drywall, which can increase annual savings for this scale business to over \$1,000,000. A cost reduction of \$1,000,000 in a company or division of this size, with an average selling price of \$200,000 and the median industry pre-tax profitability of 9% would result in a 19% increase in pre-tax profit.

While the handheld technology is not wholly responsible for these savings, the business process improvement that drives the savings is almost impossible to replicate efficiently across the organization without that technology.

## Real Time Solutions

Builders who want to realize savings like those in the above example will need to move beyond current wireless practice towards more integrated solutions. Wireless providers are in a good position to help their builder customers along this path. The keys to making this happen will include:

- Identifying the pain points not addressed by current wireless use.
- Helping builders see how an integrated wireless solution can alleviate the pain.
- Addressing their objections.

While current wireless use eliminates some of the paper involved in the scheduling and VPO processes and does free up field managers' time, the actual processes themselves have not changed, and the staffing needs are generally not reduced. For instance, an office person is still needed to process schedule changes, purchase orders and invoices, even if those documents come in by email rather than fax.

Some big builders have configured their in-house systems to integrate with wireless. For instance, the purchasing manager for the Jacksonville, FL division of a national builder reports that the company's scheduling system can be managed from the field using a laptop with wireless access. "We used to write out schedules two or three weeks in advance and any changes had to be made via phone call or fax. The changes didn't always get communicated correctly. Now if a builder needs to make a change to the schedule he can do it online and the subs can see the change immediately. The system also provides us with a history of every communication and transaction."

BlackBerry is also working with a number of builder software providers to wirelessly enable their solutions. At this point, the two companies who have fully integrated with BlackBerry are BuilderMT and Constellation HomeBuilder Systems. While these companies' solutions differ in some of their specifics, they both represent what we believe to be the best current use of wireless. For builders not using these two systems, BuilderMT's Business Process Management (BPM) software can cost effectively automate any business process.

The RIM website includes a number of success stories showing how builders are successfully using wireless to integrate with these solutions.

### *Scheduling*

Integrated solutions let field managers manage the scheduling process entirely from a handheld. For instance, they can access a drop-down menu on the BlackBerry and check off that the drywall is complete. This automatically sends an electronic prompt to the next set of trades.

When a job schedule gets pushed back, the field manager accesses another menu. The change is sent via the cellular network to the company's server, where the job schedule is automatically updated, including when each sub will be needed on the job, and when each material delivery will occur. Trade contractors and suppliers get an email telling them to go online and check the schedule, where they acknowledge the change.

In each case, the field manager need only make one notation. Everything else happens automatically and there is no need for someone in the office to process paperwork.

As mentioned above, updating the system does not require the field to access the Web or work with spreadsheets. Everything is done via drop down menus that have been specifically optimized for the BlackBerry, and customized for that builder and that project.

The integrated solution also eliminates the need for subcontractors to submit invoices or for the builder to process them. Instead, payments can be made on a completed purchase order. For instance, when the plumbing has been roughed in and passes inspection, the field manager simply makes a note of it on the BlackBerry. This tells the system to close out that phase and to notify accounts payable to cut a check for the plumber. With this system, trade contractors can be paid more quickly with less paperwork -- both of which go a long way toward breaking down resistance to using the system.

Being able to the schedule in real time also solves other problems. For instance, when the framing is complete, notification can automatically be routed to the sales system so that if a buyer wants to change windows, the sales staff can tell them that it's too late. With the current system, such notifications can take a few days, opening the door for expensive errors.

An example of how this works is SunCor Development in Phoenix, which used Constellation's On Location schedule information management system at their StoneRidge development in Prescott, Arizona. The company's field managers can use their BlackBerries to access detailed project information at any time, as well as to track job costs and budgets. They also receive important notifications that help them move the job forward. These include:

- Notification of when a trade contractor completes a job.
- Daily vendor reports.
- Milestone delay warnings to tell them when important milestones are not being reached.

Field managers can update the schedule from the field, and if they are behind, they have the information needed to get back on track. "We have thousands of tasks to monitor and all this information is available to our superintendents so they can manage their projects," says one of the company's job superintendents. We now have a great way to stay notified of every project detail and can plan when to send a crew, or not, and our trip charges are way down. It saves numerous phone calls and a lot of valuable time and money. The ROI is built into the improved scheduling, reduced workforce requirements, and the ability to eliminate problems before they are an issue." He adds that the menu and checklist system are designed to be quickly mastered by trade contractors and field managers. "The learning curve is very fast."

The system includes a pay hold feature. When work is not done satisfactorily and payment is held, the field manager notes the reason on his BlackBerry and the notice is sent to the trade immediately so they can fix it -- again, without the need for phone calls. SunCor says that trades have responded very positively to this feature because they know the status of each project, and there is no misunderstanding as to what needs to be done. "There is never any room for argument because everyone is working with the same information," says another SunCor manager.

### *VPO Solutions*

An integrated handheld solution can also automate much of the process of managing VPOs. One company who has used this feature is Calgary, Alberta homebuilder Morrison Homes, which builds homes ranging from 1,000 to 6,000 square feet, with costs of \$300,000 to \$2,000,000 Canadian Dollars. Most of the work was done by trade contractors and coordinated by 12 on-staff site supervisors.

Morrison built 590 homes in 2007, and had 5,300 VPOs during that time -- 8 to 10 per home -- for things ranging from extra truck loads of fill, to on-site damage and vandalism. The company's IT manager said the process of managing these changes used to be costly and time consuming. "The back office staff faxed the VPOs to the vendor and manually entered the data in the various back office systems. After the vendor came back with a price, a new PO was created and sent out. Some of our employees spent their days just standing by the fax machine sending out VPOs, a costly habit."

Using its BPM software, BuilderMT was able to make Morrison's VPO process paperless, and to automate much of what was being done by hand.

Field Managers now enter order details in an electronic VPO form on the BlackBerry, and specify a preferred trade contractor from a drop down list. The selected trade contractor then receives an email notification of the VPO with a link to Morrison's vendor-facing purchase order pricing form. When the trade contractor enters pricing, a notification is automatically sent to Morrison's purchasing department for approval. Once approved, a final purchase order is created and sent to the trade contractor as a PDF file. Closing the process, the order details are converted to a text file and entered into Morrison's accounting system without any manual entries. The new process is almost entirely automated. The only touch point required is the purchasing department's decisions to approve or deny the VPO.

Morrison's IT manager says that his staff was able to map out a new wireless-enabled VPO process in just eight to ten hours, and that the savings paid for the cost in weeks.

## Conclusion

Of course, these two companies are still exceptions. As noted above, most firms are only beginning to leverage the potential of handheld technology. As the residential construction industry becomes increasingly more complex and cost focused, mobile technology will become more important as a means to enhance the efficiency and effectiveness of a builder's organization.

The good news is that our research leads us to conclude that the industry is on the cusp of a transition from using mobile devices purely for communications (email, phone, etc.) to using them as an application platform for significant business and operational functions. That this trend is already underway is shown by the fact that our survey respondents and interview subjects recognized scheduling, processing field purchase orders and authorizing subcontractor payments as places where mobile technology can add value.

Builders who embrace this new way of using mobile technology will have a distinct competitive advantage in the future, while those who do not will likely find themselves challenged to keep up. Applications and technology platform providers who recognize the demands placed on residential builders and who can respond with new wave of solutions that can be used easily and efficiently on handheld devices, will have the best chance of becoming market leaders in the years ahead.