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JOURNEY TO EXCELLENCE

IMPROVE PROFITS 2% TO 10%

BY INCREASING EFFICIENCIES AND CUTTING COSTS

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Charles C. Shinn, Jr., Phd, Often Referred To As The Profit Doctor, Created The Shinn Group Of Companies To Help Increase The Professionalism And Management Standards Of The Homebuilding Industry. Our Constant Focus Is To Help You Improve The Performance Of Your Company And Maximize Your Total Profits.

EXECUTIVE SUMMARY

For the last 40 years, I have been working with homebuilders to improve profitability through the use of integrated and accurate management and information systems. The use of integrated systems eliminates duplication and protects the integrity of the information generated throughout the process. Anyone involved in building a home or in any of the processes along the way knows the value of consistent and accurate information. However, communication has always been a challenge as multiple documents and channels are used causing confusion and creating errors and misunderstandings. Thus the final step of the integrated system has been to identify the document to be the recipient of the information which in turn could be disseminated to all required users in a standard and reliable format. It was not difficult to arrive at the conclusion the working drawings could provide such format; thus the effort to create the perfect working drawings.

What Does It Take To Get There?

It requires integration and information sharing across the entire organization. Every department needs to have access to the same data base; from sales to estimating and purchasing, to the superintendent, trades and warranty teams who build and support the home. Inaccuracies and inconsistencies create avoidable mistakes which ends-up causing deterioration of profitability and infringing on the ability of the builder to realize superior profits.

Even prior to computers, the road to superior profits has always been through the creation and disciplined implementation of integrated management systems, including the preservation and communication of reliable information throughout each department across the entire organization. How can a builder streamline processes or increase profitability if each department is working from what could be unreliable data?

We know there are scores of inefficiencies in homebuilding providing builders with the opportunity to improve profits 2% to 10% if they streamline their management systems. In doing so, the builder also increases control over its operations, and gets into a position to grow with only minor adjustments to the management systems.

Back when I started working towards seamless integration of management systems, getting to the end goal was much more of a challenge than it is today. At the time we did not have technology available, nor did we have standard classifications in accounting inside each company much less across organizations in the industry. It was difficult at best to track construction cost to each house under standard cost classifications and furthermore identify variances accurately to the right cost codes. A similar situation was prevalent with the meaningful classification of expenses. Analysis of the financial information with the objective of improving financial performance was very difficult at best. And the capability of measuring the industry performance was non-existent. Today, we see real time access to critical management information as a powerful value-added component in achieving competitive advantage and facilitating better, faster, and more strategic decision making.

We have come a long way since those early days and there have been many changes in the industry as well as with the advent of technology to bring us closer to the desired goal of integrated management systems. What years ago was a great feat has now become much easier to accomplish through developments in technology.

However, we still face resistance from the builders to standardize and allow full integration of the systems utilizing technology tools. Now more than ever, it is crucial for builders to address this challenge head on. We are facing a dramatic change in the market place we have not seen since the baby boomers entered the market. 83.4 million Millennium buyers are now poised to enter the housing market setting up to drive the future for homebuilders. The builders' product and processes must be ready for these customers who have grown up in the age of technology.

Although our vision has not changed since the early days, as technology has evolved, we continue to work with software companies to create systems that would further support our goal of integrated systems and information sharing. Today successful management information software solutions should provide the configuration for homebuilders and developers to proactively identify, document, and analyze problems or opportunities for improvement. Take the time now to investigate the opportunities new technological advances have to offer to improve your daily operations and the communication with buyers, home owners, trades, suppliers, and your own staff.



IN THE BEGINNING

My quest to get to a fully integrated management system began in 1968 when, as an economist for NAHB, I conducted an operational study of home builders to determine how the builders were organized, staffed and managed. It sounded like an easy task when I started, but when in 1969 as the Director of the Business Management Department of NAHB, I conducted the first "Cost of Doing Business Study" to analyze the builders' financial structure and performance, it became evident there were no standards for the industry. The information received from the first "Cost of Doing Business Study" was very poor and extremely difficult to evaluate. There was no consistency of reporting and it became obvious we needed to start by developing a standardized accounting system for the industry.

Creation Of A Standardized Accounting System For The Industry

In 1970 at my request, Emma Shinn, CPA, wrote "The Accounting System for All Builders" to help create a standard reporting system. Emma has been updating the publication ever since, which is in its fifth edition under the title, "Accounting and Financial Management for Residential Construction." With an accounting standard for the industry in place, we were able to collect standard financial information to produce the first "Cost of Doing Business Study." This Study was very telling and, in the analysis, it became evident the profits were

inadequate for the risk undertaken. We also found a lot of inefficiencies and redundancies across all the participating organizations. Today, we continue to track home builders financial and operational performance with results published annually in a comparative financial and operational analysis report.

During my tenure at NAHB in the early 1970's prior to the computer being generally available to the industry Emma and I, working with McBee Systems, developed a "one-write" accounting system in an attempt to streamline the manual bookkeeping process and increase the accuracy of the data and management reports. At about the same time, we began to promote management tools and procedures which were basically non-existent in the industry such as; the use of purchase orders, job cost budgets, job cost reports, variance analysis and control, financial budgeting, standard financial reports, and ratio analysis.

The First Integrated Management Software System

We remained vigilant looking for expediency tools as we developed manual tools and procedures to integrate management systems. From 1976 to 1978, we had the opportunity to work with a computer software company in Seattle to develop the first computer integrated management system designed for the housing industry which became known as the T.O.M. system. This system was nowhere near as robust as the systems in the market today, but we were instrumental in making sure the system was able to maintain a centralized database with integrated reporting across the organization.

From 1980 to 1982, Emma and I were industry consultants to develop the second computer integrated management system for home building known as F.A.S.T. which today is still one of the leading computer management systems for the industry. One of the key features developed for this system was the ability to build lot specific estimates by merging base plan, structural options, community options, and buyer selections and upgrades budgets into one job budget. The creation of the job budget would in turn allow the system to generate accurate purchase orders for each job automatically.



EMERGENCE OF CAD

The residential architecture arena began to adopt CAD in the mid 1980's. It was used primarily as an electronic drafting table, which is still prevalent today in a lot of cases. I remember working with an architect on a project I was building during those years. The architect used CAD to

draw the floor plans but went back to the traditional drawing board to do the elevations. CAD increased the efficiency and productivity of the architectural process but most of the power of the CAD system was left in the box.

In 1995 at the IBS Show, the CAD companies were presenting the ability to produce intelligent CAD drawings, or in other words the ability to produce a bill of materials. I challenged the companies to give me a demonstration so I could promote this new break through in technology. Only two systems appeared to generate meaningful bills of materials: SoftPlan with its SoftList and Argos, which is an expensive boutique system with very few trained operators. Therefore, in 1996, we researched the CAD systems and their ability to generate bills of materials, which could in turn be used to produce purchase orders. Argos generated the bill of materials but could not allocate the calculated quantities to individual PO's. After presenting our concerns, Argos made the necessary modifications.

In 1996, we held our first CAD seminar and began to conduct training classes for architects, designers, and CAD operators on imbedding intelligence into the CAD systems and developing 3D CAD working drawing. The result of the training was disappointing. Most of the attendees did not have the time or the dedication to imbed the intelligence in their CAD systems and migrated back to the 2D drawings because of work load pressures. The architects and designers did not want to be bothered with the details, and were not interested in acquiring the knowledge to draw in 3D. Their attitude was it would slow them down and the builder would not pay for the details. A number of the design professionals attending the seminars told us, the builders were only interested in a set of plans to get the building permit.

Having little to no success with the design professionals we began to train estimators with some success. The design department in one company refused to develop intelligent 3D plans. Once the working drawings were complete, a read only file was sent to the estimators who traced the unintelligent 2D plans with 3D intelligent CAD to generate the material take-offs. It was a terrible duplication of effort but the work around was successful. In another organization, the responsibility for developing working drawings was moved from the design department to the estimating department. The department hired people with construction experience and trained them in CAD. All working drawings and lot specific drawings were generated with intelligent CAD to produce the necessary bill of materials for estimating and purchasing.

In 1998, I established a research and development operation under the direction of an estimating consultant and the assistance of a CAD design engineer to improve CAD intelligence and test the

various CAD systems. The operation, imbedded item attributes, attachments, estimating formulas and waste factors in the systems, and created 3D architectural drawings. With AutoCAD Architect, we were able to generate over 95% of the information needed for a detail-material quantity take-off directly from the working drawings. Being able to make AutoCAD intelligent was important since it was and still is the standard CAD platform for the industry. To test the viability of the intelligent CAD, we created working drawings for a number of builders including a division of a national builder. The results increased the accuracy of estimates and purchase orders, validated the estimate for the superintendent and trades, produced more accurate and consistent construction results, and reduced construction costs.

Drawing in 3D CAD also allowed the detection of plan errors during the drawing process instead of having to deal with the problems during the construction phase in the field. An additional side benefit of 3D CAD drawings was the ability to create computer-generated renderings and virtual tours. These unanticipated bi-products were very beneficial for sales and marketing.

At this point in the development of computer systems, it was still very difficult to transfer data from one platform to another. We worked to develop the ability to transfer data from an AutoCAD system to one of the integrated back office systems; but it was a very difficult and time-consuming process to create the links.

EVOLUTION OF THE ESTIMATING PROCESS

In the late 70's most of the computer integrated systems did not include the ability to create job cost estimates. Material and labor estimates had to be done off-line either manually or on spreadsheets with the resulting quantities entered into the system. This process has been adequate for the production builders with standard plans. For lot specific job cost budget and the release of purchase orders, the estimator merges the base house, community options, standard structural options, and selected options and upgrades. Then the resulting material and labor estimates are priced for job cost budgeting and release of purchase orders. Problems with this procedure arise when the customers request unique changes not in the database and not estimated. Also, the costs of physically attaching structural options to the base house are typically not included in the estimate since the cost of the option is estimated independently from the base house. More problems occur when one option influences another option.

To compound the estimating problems over the years the material and labor estimating talent has waned in homebuilders' organizations as the builders moved to lump sum bidding and turnkey contracting. Several years back I developed an estimating manual entitled, "A Practical Guide to Material Estimating for Residential Construction" to provide direction to the process. Additionally, I have conducted estimating seminars over the last three decades to train estimators and improved the estimating process for builders. It surprises me every time I conduct a class how little knowledge estimators have about construction techniques, estimating procedures, and the basic math and formulas needed to create an accurate estimate. They have become more bid managers than true construction estimators.

A number of estimators have told me the material and labor estimates are the responsibility of the trade and/or supplier. They do not need the details since they competitively bid lump sum contracts. This is a very shortsighted attitude since it eliminates the ability to negotiate price with intelligence on the quantity of material and labor and to be able to bid on unit prices. Unit prices simplify the maintenance of the estimator's database and allows for quick and easy pricing of customer price requests without trade and vendor bids. As far as I am concerned, it is the builder's responsibility to create the bill of materials for each home and not leave it up to the trades and suppliers.



DEVELOPMENT OF THE INTERNET

Over the last decade the internet has come a long way, changing the relationships we have with our customers, trade contractors and suppliers. In 2001 the Executive Summit, our annual capstone program for home builders, focused on how the internet was changing the homebuilding industry. At the time, we were not able to imagine how much change was to occur. Then builders' web sites were limited to electronic brochures if the builder had any presence on the internet at all. Today, we see very dynamic websites, with model home tours, housing specs, construction schedules, etc.

During that time we also began looking at how the internet could help the builders share information with subcontractors and suppliers, even with staff members in the field. Today it is amazing to see how some builders have used this technology to improve communications.

Today the internet consumes us. We communicate by e-mail, web conferencing, and do virtual education. The internet is used to research any topic. It is the new shopping mall where consumers

can buy almost anything from groceries to cars, mortgages, and yes-even homes. Almost any electronic device can access the internet and be used to streamline and share information. The new phenomenon is social networking with LinkedIn, Twitter, Facebook, and others, which is now used by buyers to find reputable builders among other things. For builders the connectivity allows sharing of relevant parts of the centralized data base in real time with suppliers, trade contractors, buyers, and anyone else involved in the building process. Most software systems now have at least a minor component that is integrated with the internet to take advantage of the many tools and benefits available today.



THE HOUSING RECOVERY

The housing industry has experienced one of the worst housing recessions in modern history. The end of the second quarter of 2009 marks the beginning of the recovery. The recovery, however, will be slow and bumpy. This recession lasted almost four years with a reduction in housing starts of approximately 80% from peak to trough.

Builders reduced operations to skeleton staffing levels with the remaining staff having to wear multiple hats. As we emerge from the recession builders should consider out-sourcing as an alternative to re-hiring staff to help conserve cash in a very uncertain recovery period. By outsourcing, the builder maintains low fixed costs and is able to hire knowledgeable specialists on an as needed basis. Outsourcing can be very cost effective especially at a time where resources are depleted in an effort to survive and when the banks are not interested in loaning money to anyone affiliated with the housing industry.

The Emerging Markets

Every time we have had a housing cycle, the industry has had to change. I have always said, the buyer coming out of a downturn is different from the buyer going in and this is definitely the case this time. The housing product that was in demand prior to the collapse of the market is not what the new customer wants during the recovery. The longer and deeper the housing cycle is, the greater the change in customer preferences.

For the last 40 years, we have been following the baby boomers through their life cycle changes with our housing products. Coming out of this cycle, the baby boomers are moving into the downsizing stage of their lives. However, they will not return to the market in any significant number until the housing prices at least stabilize. They are over housed and can postpone the buying decision.

The next population group, the Generation X, now in the prime home buying age of 28 to 44 years old, is only two-thirds the size of the baby boomer generation. The generational gap will contribute to a significant decrease in demand of the most popular housing product prior to the recession.

With this recovery, the industry will experience a complete generational change as the millennial generation enters the housing market and becomes the new driving force for housing. This generation is different from their parents, having grown up in the digital world and are, in fact, larger than the baby boomer generation. They will control the housing market for the next 40 to 50 years.

New Market Realities And The Need To Refocus

Today the industry faces increasing challenges in every area including but not limited to sales and marketing, construction, customer satisfaction, technology, a new buyer. As the Baby Boomers begin to retire downsizing their homes, and some even exiting the market, focus needs to be directed to the Millennium buyers. The impact this generation will have on the industry will drive the builders to rethink everything.

The "Millennium buyers" will demand a different type of house to exemplify their life style which typically is informal and very active, thus requiring a low maintenance environment. In the buying process, they will use the internet and expect to see plans and 3D walkthroughs online. They will use social media to find the builder and evaluate his/her reputation. They will want to see pricing online. Builders will have to drive more data and intelligence from their CAD files than ever before to accommodate the technology savvy buyers that demand instant gratification. Furthermore, the Millennium buyer won't deal with builders who can't deliver. Are we as an industry, and the builder, ready for this?

The internet will be all-important in dealing with this buyer. Internet marketing will be a must since the Millennia's don't read newspapers or relate to the standard marketing vehicles. They want 24/7 access to information and expect to be able to get what they want, the way they want it, when they want it. They expect instant gratification. They will buy over the internet so the complete buying process needs to be available on the internet.

This buyer is used to high technology and expects it. Builders need to present an innovative image using technology in their marketing, sales presentation, selections, house plans, and back office systems. Any touch point with this generation needs to be high tech and cutting edge to get their

attention. This is going to be a big challenge for many builders. We strongly recommend builders move to transactional websites as soon as possible.



CURRENT STATUS OF THE QUEST FOR INTEGRATED MANAGEMENT AND INFORMATION SYSTEMS

Since our involvement with the early software systems, we have participated with most of the computer companies assisting in the development of software systems for the industry and we continue to work with builders to assist in selecting the most appropriate system for their company, which depends on company size, sophistication of the management systems, and anticipated growth.

Although we have made great progress on the technology side, as we help builders with the selection and implementation of software, we continually find they only use a small portion of what is available. One of our greatest challenges is how to get rid of off-line spreadsheets and have builders fully utilize the integrated solutions available to them.

Back Office Systems

In the back office, generally we find what is referred to as a “standard plan estimating system.” Under this system, the bids and/or the material takeoff (bill of materials) are entered into the database. The bidding or the creation of the bill of materials is done off-line either manually or in a spreadsheet format as it has been done for many years. The estimator creates the bill of materials using an architects’ scale to do measurements of the working drawings even though the plans say “Do NOT Scale.” Then the estimator applies the appropriate formulas and waste factors to the measurements to determine the right quantities to enter in the database. There is a major disconnect with this process and the advancement in CAD technology which facilitates the automatic calculation of the bill of materials.

Unlock The Full Potential Of CAD

Today, with all the advances in CAD technology working drawings are still in 2D format, unintelligent, probably inaccurate and missing information relevant to the estimator and the construction team. Incomplete and inaccurate working drawings leads to inaccurate bill of materials and erroneous information entered into the database used to release purchase orders as the estimator has to interpret the plans. To be able to eliminate invoices and pay vendors from purchase orders, the purchase orders need to be accurate. This implies the bill of materials needs to be correct

which in turn requires the plans to be accurate. Concurrently, if the plans have mistakes, the construction team will experience construction errors and delays for clarification, rework, and in many instances additional material.

To eliminate the construction confusion, mistakes, and rework some builders are creating lot and customer specific working drawing which incorporate the selected options and changes authorized by the customer. At the same time more permit jurisdictions require lot specific drawings to issue a building permit. While this typically does not entail a complete redraw of the plans, it is a time consuming task for the CAD department and errors can occur if the CAD operator does not go back to the original base plan. Going back to the original plan can prove challenging if the plan library is not organized properly.

Having CAD drawings in 2D instead of 3D indicates plans are not usually linked to assure floor plans and elevations will match. The design professionals either do not want to draw in 3D believing that it will slow down productivity or they do not know how to do it. I actually have had architects tell me AutoCAD cannot draw in 3D. When drawing in 2D, mistakes in the plans are not visible - the graphic data is disconnected, information is missing, and problems between the elevations, roof designs and the floor plans are not apparent.

Drawings in 2D are not able to merge pre-drawn options into the base set of working drawings which means lot specific plans need to be redrawn or an option page with the options circled needs to be included in the set of plans. It is then up to the superintendent and the trades to figure out how to merge the options.

CAD's ability to draw in 3D and to measure lengths, calculate areas, and count, has not been exploited to its full potential. In fact, it has fallen quite short of its potential. These attributes not only assist the estimator in generating bills of material by including information in the working drawings, they also supply accurate and complete information to purchasing to generate purchase orders and provide comprehensive and clear instructions to the field on how to build each house.

Sales Systems

A number of sales systems in the market today integrate with the back office but, as with all technology applications, frequently they fall short of its potential as the builders fail to implement the full system. It is not uncommon to have the sales person write an off-line paper contract and forward the contract to the office with a redlined brochure, or a set of plans marked up, or the selected structural options circled on the structural option sheet of the working drawings. The

options and upgrades come from the selections center on a separate document with the selections hand written or checked off on a form. Based on these documents, the office ratifies, enters the contract in the system and prepares the start package for the field. The information provided in the start package releasing the house to construction frequently, includes the original illegible contract, all change orders, selection sheet, and the redlined set of plans with the selected structural options circled. The plan might even be a right-hand plan for a left-handed build. This leads to construction errors, omissions of options and upgrades, confusion, and dissatisfied customers.



RECOMMENDED ACTIONS TO MAINTAIN OR ACHIEVE EXCELLENCE

As we face the challenges of the new emerging market, the new consumer, and the new developments in technology, I have identified a series of actions to facilitate the transition and preserve profitability, management control, and superior customer satisfaction.

Integrate Your Data...And Ban Off-Line Spreadsheets

The core proposition of an integrated management system relies on one central database used by all functional areas or departments. The central database eliminates the need for separate departmental data files which frequently are inaccurate and out of date.

A key tenet of the integrated management system is to provide accurate timely information to all departments and employees in the company in an attempt to eliminate miscommunications, omissions, construction errors, and erroneous information.

I once worked with a builder unable to obtain accurate information on the number of homes the company had in inventory. Each department; accounting, estimating, sales, selections, and production had a different count. Upon auditing the units in the field we found none of the information to be accurate. This problem is chronic for builders even when using an integrated system because of the practice by the departments to keep information in off-line spreadsheets. This practice sabotages the system integration and defeats the capability provided by many of today's systems to maintain accurate real time information throughout all departments.

Produce Accurate And Timely Information

A major goal of the integrated management system is to provide right, accurate, and timely management information to managers in a format that facilitates the decision making process.

Prior to the computer, managers had rudimentary information and typically made intuitive decisions. With the advent of the computer, managers have the exact opposite problem; too much information (or data) which leaves them still making intuitive decisions as important management information is buried in cluttered reports. These are data dump reports not management reports.

Utilize The Internet

Today the website is the new front door; it creates the first impression for our customers. Therefore, builders need to have a very active presence on the internet. The trend is for customers to pre-qualified builders prior to ever visiting communities and model homes. Several home buyers have told me they automatically will eliminate a builder if there is no website.

Builder websites need to transition into interactive transactional websites allowing the customer 24/7 access to information relevant to their needs and wants. Today's buyers want to access all information needed to make the purchase decision. They are more ready to buy over the internet than the builders are ready to sell over the internet. They may not actually sign the contract on-line but they are ready to go through about 95% of the buying process on-line if the information were available. This is especially true for the younger and older buyers. With accurate detailed 3D CAD plans including structural options, the buyers can actually build their custom home on line and see their new home in real time with accurate elevations, perspectives of 360 degree views and even participate in a virtual tour. Much of the decision making process can be done in the comfort of the buyer's home prior to meeting with the salesperson. This is user friendly and improves tremendously the productivity of the sales team.

To take full advantage of the website technology builders need to establish secure portals on their websites not only for customers and homebuyers, but also for the trades and suppliers to provide them with access to their specific information. The buyers want to access everything about their home before, during, and after construction. The trades and the vendors want plans, selections, purchase orders, schedules, and payment status.

In other words, websites need to integrate with the builders back office system because information needs to be accurate, and automatically transmitted to and from the website. Some builders have achieved this goal but the road has been arduous and expensive. As the industry moves forward website/back office links will provide a competitive advantage. This requires enhancements to the links to allow for the transfer of accurate information in both directions.

Adapt To The Need To Customize Plans

For the last two decades, the need to customize standard plans and personalize the home for buyers continues to expand. When this trend started, I began promoting the need to customize homes in a controlled and organized manner instead of having each customer redline the plans with unique custom changes many of which will be closely replicated from one customer to another. I labeled this approach mass customization; where customization is guided by standardized pre-planned; pre-drawn; pre-estimated; and pre-priced; structural options offered to the homebuyer. The standard structural options are then sold out of a catalog instead of dealing with customer price requests. It streamlines sales, the back office internal systems, and reduces office and field errors.

Several of the back-office computer systems today can handle the integration of standard structural options reasonably well. However, where most systems fail, is in estimating the cost of attaching the structural option to the base home and the interconnecting costs involved with the selection of an option - on an option.

On the working drawings side, the difficulty of merging the structural options with the base plan creates a challenge on how to incorporate the modifications into the final drawings. Generally the working drawings include a structural option page with the selected options circled or lot specific plans are created for each home to be built.

Improve Your New Product Development Process

The new product development process is cumbersome and time consuming. The process can take up to six months during which the original concept is modified a number of times. Because of the length of time, builders frequently jump start the sales process; they produce brochures and collateral material, open a sales trailer, and build the models while changes to the product are still being made. Consequently, the brochure, the model and the working drawings do not match. I actually had a production manager tell me his company had a 20-year standing policy to build the brochure because that is what the customer took home.

The rush to construction short circuits the builders' management systems and increases cost and expenses. Since the plans are not complete and structural options have not been developed, the sales person does not know what to sell. Hence, customer change order requests not included in the database become the norm further complicating the management systems.

Granted the new product development process is long, however, it is typically finished before it is done. Once the base plans are finished, the team still needs to develop a set of standard structural options to be offered for the product line. The structural options need to be designed, estimated, priced, and entered into the database.

Another failure of the new product development process is the lack of a complete database for the back office system. Short cuts are taken because it is time consuming and tedious work for the purchasing and estimating department. Therefore, many times, the data for the options and upgrades is not entered waiting until the sale of the option or upgrade. This creates problems down the road when the purchase orders need to be released.

Integrate Cad With The Management Systems

Historically I have looked at the estimate as the key to develop accurate information for the integrated management system. Since most of the back-office systems do not include a detail quantity take-off module as part of the system, the builder have had to rely on off-line material take-offs to generate the needed information for estimating and purchasing. Nevertheless, the accuracy of the estimate depends on the accuracy and details of the working drawing, which have been rudimentary at best with missing information, errors, and lack of detail. I have referred to residential working drawings as one step above Etch-A-Sketch. Better plans come with a bookshelf kit bought at Home Depot or Lowe's.

Thus the working drawings actually drive everything. The drawings are indeed the hub that drives the information for the integrated management system. However, because of the lack of detail and the inability to capture the bill of materials from the drawings the estimator is placed in a position where he needs, as stated previously, to interpret the plans.

Having proved that AutoCAD Architect can generate intelligent 3D working drawings, which will capture more than 95% of the bill of materials needed for an accurate estimate, CAD now becomes a significant piece of the integrated management system. This piece increases the overall accuracy of the information system by capturing data at its original source. This is even more important as the estimating talent diminishes because of the industry turning to lump sum bidding and turnkey contracting.

With the improved technology, today the base plan and structural options can be automatically merged to produce a set of lot specific plans with the appropriate bill of material allowing for better planning of the product offering, pricing and cost control.

Since we have not had much success having the architectural and design professionals embrace the 3D intelligent CAD systems, we continue to support imbedding the creation of working drawings in the purchasing and estimating department. The advancements in the internet and the advent of data ports tied into the back office data base, has also opened the option to outsource the creation of the 3D intelligent CAD working drawings and lot specific plans to professionals specializing in the production of 3D intelligent plans with bills of materials. Because of the need created by present economic conditions to cut staff, the outsourcing option becomes very attractive and could prove to be extremely efficient.

Furthermore, we recommend the integration of the 3D CAD working drawings for base plans, structural option, and selections with the website and the sales systems. This allows customers to point and click to customize their home and instantaneously see lot specific plans, and elevations. Use of a sales price calculator to build the sales price as the customer makes the selections and a mortgage calculator to calculate the monthly payments allows the customer to customize the home they can afford. Instead of giving the customer a general brochure, the system will produce a customer specific brochure on the specific home the customer designed.

By having the information on the website the customers can work on building their custom home on their own time and conduct "what if" changes to determine what they can afford. The information is then saved in their web portal where it can be accessed from the sales office to verify details, finalize and get the contract sign. Now we have eliminated another shortcoming in the integrated systems by having the sales information enter into the system right by the source: the customer.

By making CAD a piece of the integrated management system, the reality of a completely integrated system is achievable. Once the sales contract is executed including selections, options and upgrades, lot specific working drawings are automatically created. The bill of materials is generated from the final working drawings and is priced by the purchasing system. The purchasing system automatically creates and releases purchase orders, and creates the job cost budget for accounting. Finally, the construction schedule is automatically produced based on the complexity of the final working drawing.



CHALLENGES FOR THE FUTURE

We have accomplished much of the vision to create an integrated management and information system. Nonetheless, the time is here to refocus the vision and adapt to the new reality facing the

homebuilding industry; that of a technology savvy customer. It is time to challenge the software companies to develop the tools needed to succeed in the new environment. As technology continues to evolve, we continue to work closely with builders to keep them up to speed with the new developments. Because accuracy is one of my concerns, I want to get as close to the original data source as possible. For example, instead of having a sales person or assistant enter information from a prospect, I would prefer the homebuyer enter his information directly. Instead of having the estimator use his architects scale to do take-offs of material from a set of plans, I prefer to obtain the information electronically from the plans as they are created. Hence, for every input into the central data base, I want to get as close to the original source of the data as possible to increase accuracy, eliminate human error and noise in the system. Most of the integrated software systems are not reaching out to capture input from original sources neither from sales nor the working drawings. This has been due to either technical and/or human limitations.

As the internet continues to permeate our daily lives to the point where people maintain continuous open lines with these medium, builders who fail to use the internet to its fullest potential will not be competitive in the new market. This includes but is not limited to allow staff, customers, trade contractors and vendors access to accurate information on a 24/7 basis. As a consequence back office systems need to generate real-time accurate and essential information for managers, trade contractors, vendors, workers, and customers to make timely informed decisions. To make this possible, portals including two-way traffic of data and information need to be in placed. The inefficiencies of the past will not be tolerated in the new homebuilding environment.

CONCLUSION

The accuracy of the management information system and the ability to control construction costs has always relied on accurate and detail working drawings. New technology developments are changing the landscape on the role working drawings play in the integrated management and information systems. For construction, the advent of CAD and its ability to generate 3D drawing and bills of materials has opened the opportunity to integrate CAD with the back-office systems to enhance the accuracy of every piece in the system. Also, with the capabilities of merging the structural options into the base set of working drawings to automatically create lot specific working drawings, better information is generated for the field minimizing field errors and omissions. For sales, the customer can now build their customized home in real time, and once the contract is ratified the system can automatically generate working drawings, job cost budgets, purchase orders, start packages and construction schedules.

Intelligent 3D CAD integrated with the back office allows for a paperless system. It closes the loop for the management system that has been elusive during this 40 year journey to improve builders' profitability, management control and customer satisfaction. These developments will be paramount as the industry emerges from the housing recession and begin selling homes to the technology savvy millennial generation, which will lead the future of housing for the next 40 to 50 years.

