
# Whitepaper

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# iTWO costX® by RIB:
# The 21st Century Estimating Solution for BIM

**The CAD revolution in building design has already passed. Designers have now moved on to BIM - virtual Building Information Modelling - based on digital information exchange.**

**With so much design information available in digital form, and its capacity to change the way the industry works, the benefits of BIM to Cost Engineers and Managers are impossible to ignore. iTWO costX® from RIB supports BIM by using digital design data to accurately estimate quantities and costs, within a live electronic environment.**

**The next logical step – Integrated Project Delivery (IPD) via an integrated BIM platform – will enable estimators using iTWO costX® to play a central role in a new industry paradigm, characterized by better industry productivity and improved building design, efficiency, performance and whole of life cost.**

The introduction of 2D CAD into the construction industry saw immediate productivity benefits that are now well established. With the move to 3D, CAD developed beyond being a drafting tool to become a medium for creating and optimizing designs. With advances in technology, BIM is now becoming the new platform for an integrated approach to building design, procurement and ownership.

The concept is simple: have one, and only one, centrally accessible, database driven, virtual representation of all aspects of a building. The central database enables the design team, contractor, subcontractors, facility managers and owners to track all changes within the single model and gain real-time access to volumes of data far more effectively than current methodologies allow. The result? Real gains in industry productivity, building life cycle cost and sustainability.

The concept is now becoming a reality. In the past, limitations on software capability and file interoperability have been a constraining factor – but this is rapidly changing. Already, design teams routinely collaborate on shared software platforms, contributing towards an irresistible industry movement to BIM driven by a common desire to implement its benefits. Make no mistake – BIM is here to stay.

The power of BIM lies in its expansive range of applications for users. At its basic level, BIM represents an evolution from traditional 2D design to object based 3D modelling. However, because the model is built around a parametric database, the more data that users add to it, the wider the range of analyses such as building performance, schedules and costs that can be leveraged from it.

Currently, 3D design modelling is the most popular use of BIM in construction, with architects leading the way. However, the situation is rapidly changing as advances in software technology allow other users to find selective ways to model elements in BIM, and interrogate the model database to suit their needs. These differing types of usage of BIM have given rise to a series of categorizations which provide convenient labels for developmental stages, but will become largely redundant as technology improves and an increasingly holistic approach to BIM becomes established.

- 3D BIM refers to a design model made up of intelligent parametric objects, as distinct from 3D graphics which simply refers to geometric dimensions of points or lines in terms of x, y and z axes.

- 4D is the commonly accepted term for combining time sequencing into the 3D model. The model may be enhanced with logistics objects such as hoists or cranes and construction activities can be modeled to optimize scheduling.

- 5D is used to describe the process and applications of costing in BIM.

- 6D is emerging as a BIM term in which the model may incorporate energy modelling tools and facilitate sustainability analysis.

- nD modelling, still largely at conceptual stage, develops the application of BIM to incorporate any number of variables into a holistic model, which would enable users to portray and visually project the building design over its complete lifecycle. Thus, in addition to design information, the model database may also contain information about the building's construction, management, operations and maintenance to expand the modelling capabilities into such areas as accessibility, crime deterrence, legislative compliance, and the like.

Whatever the label, the underlying philosophy remains the same; that BIM provides a means to achieve a knowledge based, integrated approach to building design, procurement and ownership. The ability to combine and share data which was traditionally spread across multiple disciplines engenders greater collaboration which in turn produces better design solutions.

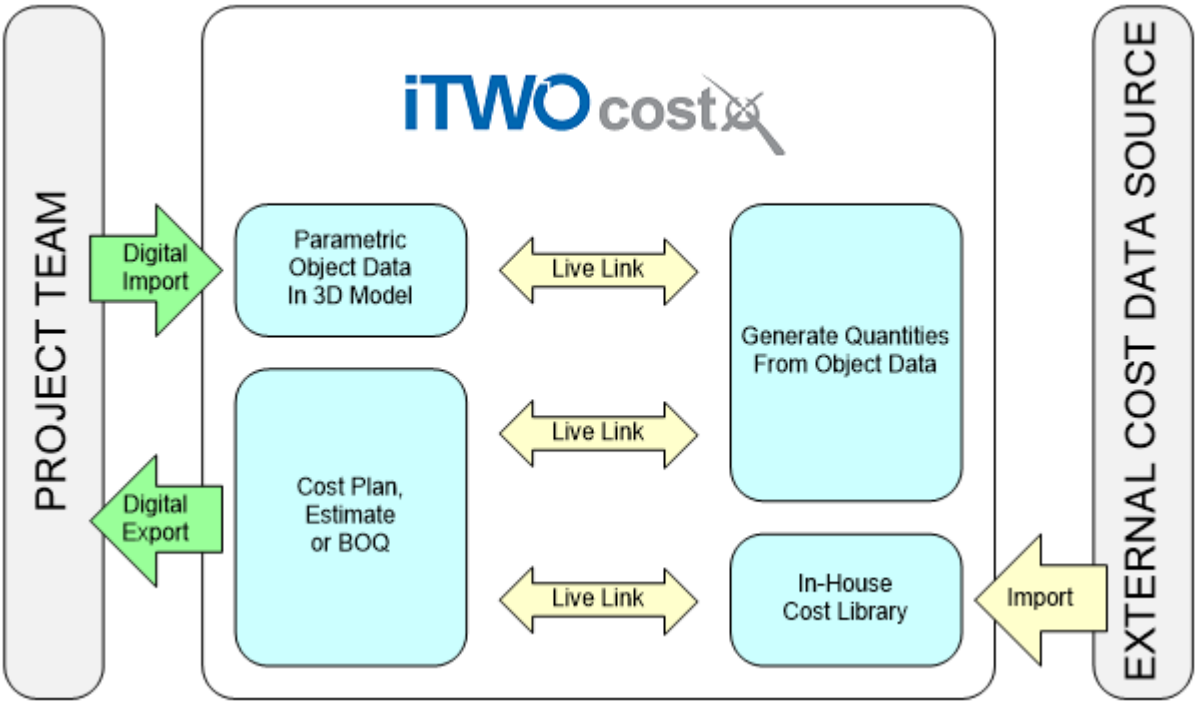
The leveraging effect of collaboration is embodied in an approach to building procurement called Integrated Project Delivery which is defined by the American Institute of Architects as follows:

"**IPD** is a project delivery method that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction."

So where does this leave Quantity Surveyors and Estimators? Experience to date would suggest that the custodians of the Fifth Dimension have been slow to come to the digital party. Designers have been exchanging data digitally for years, yet the bulk of quantities measurement remains paper-based. As the design professions continue to collaboratively develop their CAD and BIM capabilities to ever higher levels of sophistication, this gap will continue to widen.

What's been missing is an interoperable software tool which allows the seamless transfer of digital information between designers and estimators. Lack of such a tool in the past has meant that CAD automation of the design process and the development of collaborative BIM processes has yet to be harnessed and exploited in the Fifth Dimension.

Finally the software exists to short-cut the traditional approach and break down industry barriers. RIB provides iTWO costX® as part of a range of powerful CAD and BIM enabled estimating tools. Based on fast and extremely simple extraction of cost geometry and building dimensions from CAD files by non-CAD users, with optional linkage to rate libraries, iTWO costX® allows users to provide instant itemized budgets or valuations for proposed buildings at any stage of the design process and, crucially, allow the user to easily identify changes and re-calculate when revisions are made.



Rather than working in isolation to produce their quantities and costings for the project, by participating in the data interchange Cost Managers effectively get to play on the team instead of watching from the sidelines. Automated quantities generation provides a faster, more accurate tool to analyze data and provide better advice. This enables real-time options modelling and facilitates scenario testing to explore ways to improve building design, efficiency, performance and cost. Using iTWO costX® enables clients, designers and cost planners to collaborate and explore opportunities with the aim of eliminating risk, reducing costs and producing better buildings.

iTWO costX® supports and promotes cost management as an integral part of the BIM process because ultimately, professional advice will always be needed to analyze and interpret cost data in preference to the raw output from any software program, no matter how sophisticated. The sequential nature of design will always mean that early models will lack detail and definition. These “design intent” models provide opportunities for collaboration and analysis, testing and validation but are insufficient for construction and cannot form the basis of a comprehensive costing exercise. Hence, as with traditional costing procedures, the skill and experience of the estimator will be required to fill in the gaps.

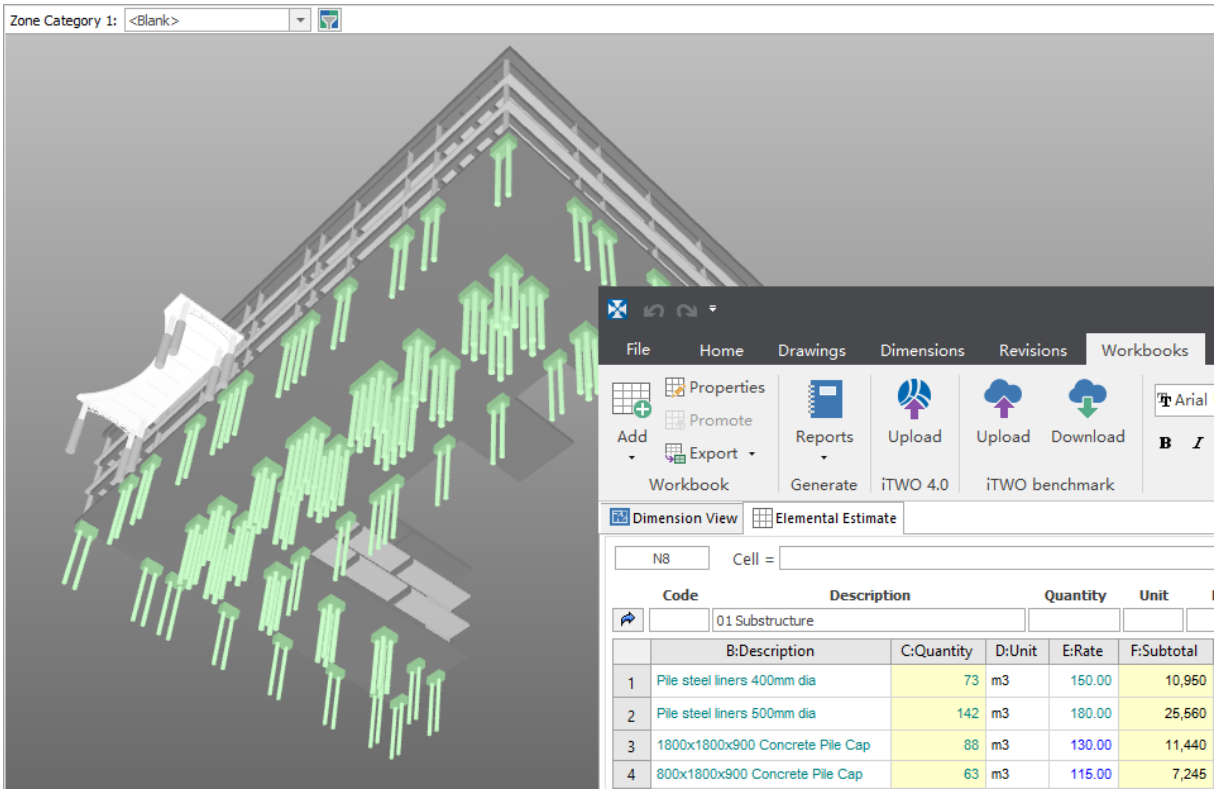
BIM is also not the death of 2D drawings, which will remain a universal language of construction.

In order to deal with the many types of design media currently in use, iTWO costX® has universal application ranging from hand-drawn sketches, through PDFs and CAD files, up to full 3D BIM capability. A bi-directional graphical link to scanned images or standard industry drawing formats (PDF, DWG, DXF, and many others) captures dimensions and quantities using intelligent measurement tools. No CAD software or experience is required. All measurements can be live-linked into spreadsheet based hierarchical workbooks, or extracted to Microsoft® Excel®.

The BIM capability arises from the capacity to read parametric design models to automatically extract object properties and their associated quantities. Rather than drafting plans and elevations using lines, 3-D virtual models recognise objects (walls, doors, windows, etc) and their inter-relationship. The properties (parameters) of each object are held in a database which can contain highly detailed information, and the parametric coding of the objects within the database is read by iTWO costX® to automatically generate the quantities.

Whichever file format is used, having live links between drawing files and workbooks means that changes to dimensions are automatically updated in the workbook, and enables the software to identify drawing revisions and update quantities. The automation of the process can dramatically improve productivity with users anecdotally reporting that work that would typically take days to complete can now be done in hours.

Clearly, the 21st Century is already seeing a paradigm shift in the way that buildings are designed, built and operated. Advancements in software capability and interoperability are giving greater traction to BIM and transforming how its users approach their work. As BIM continues to gain ground, its impact will become even more profound and will redefine the way the industry works. iTWO costX® makes traditional inefficiencies become a thing of the past, and many processes obsolete. Its success is being driven by companies and individuals who see its potential and devote their energies to being at the forefront of their industry and the best at what they do.



# iTWO costX® Product Features

iTWO costX® is a powerful project costing tool with broad application across the construction and property industries.

Overview:

- Provides automatic quantities generation from 3D BIM models and a simple interface for the extraction of dimensions and geometry from 2D CAD files.
- Interactive hierarchical spreadsheet estimating program.
- Can be tied to a costing library to provide instant cost information and re-calculation when changes are made.
- Paperless estimating solution – no prints, savings in document handling, storage and retrieval.

CAD Interface:

- An easy to use 3D viewing navigation system, including a view cube for rotating and aligning the drawing and the ability to move through a building (even through walls) to see the 3D model from any position or angle.
- Individual BIM objects can be shown and hidden (e.g. hide the roof to access the interior of the building) and the whole building can be shown in shaded, transparent or wireframe mode.
- Measurements are extracted from CAD drawings without opening the drawing file or interfering with the integrity of the design.
- With iTWO costX®, no prior experience with CAD software is necessary. In fact, estimators have no need to have CAD software loaded on their computer.
- Visual on screen checking for completeness; measured items are highlighted, color coded and labeled and can be ‘switched on/off on screen’ letting you see that all items are measured and priced.
- CAD layers can be easily switched on/off to remove unwanted clutter to allow clearer focus on the items to be measured.
- Drawing revisions automatically identified and highlighted.

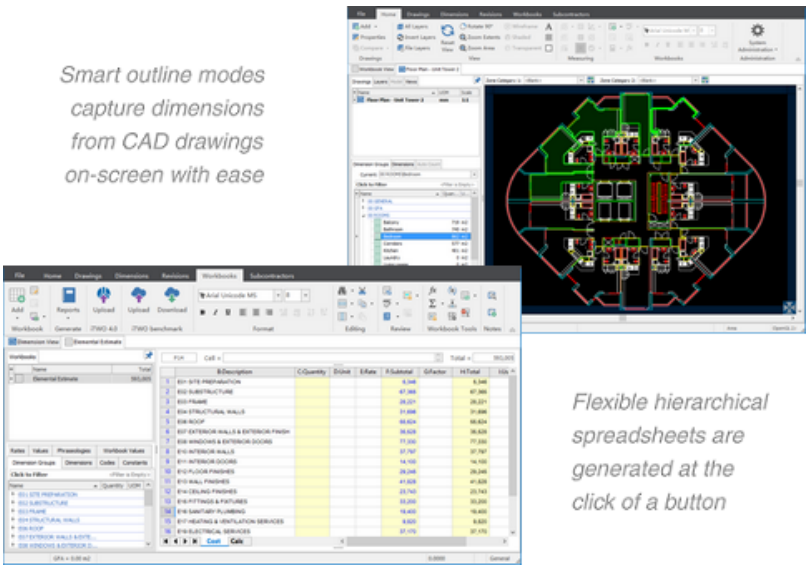
Dimensioning:

- Able to automatically extract BIM Object properties and quantities from 3D Model drawing files or multi-sheet 3D and 2D files, with several measurement options available to optimize data extraction.
- User friendly and flexible electronic cost planning and estimating system – estimate and drawings available on PC for use in office, on site or on the move.
- Ability to add measurements manually during session.
- Option to extract measurements to Microsoft® Excel®.
- Measurements taken directly from CAD avoiding data input errors.

Costing:

- Automatic cost plan generation from dimension information.
- Full data import capability from third party systems.
- Ability to manipulate cost plan elements, rates, quantities etc.
- Free form hierarchical spreadsheet capability.
- Costing libraries can be manually entered or imported.
- Standard reports can be created for cost plans.
- Export of costing information to Microsoft® Excel®.

*Smart outline modes capture dimensions from CAD drawings on-screen with ease*



*Flexible hierarchical spreadsheets are generated at the click of a button*

# iTWO costX® Product Benefits

iTWO costX® is truly new generation software. It provides immediate and tangible benefits, yet its full potential is still to be fully explored and developed.

At user level, its benefits include:

- Dramatically reduced measurement time
- Elimination of errors and improved accuracy
- Reduced report output time
- Reduction in project cost overruns
- Greater certainty of outcome
- Definition of scope and cost is transparent to all project stakeholders
- Reduced price risks
- Continuous real-time updating of costs with design
- More creative use of design resources
- Savings in program time for design, client approvals, package lettings
- Transparency of scope and cost decisions
- Greater accountability in management of projects
- No drawing printing, paper handling and storage costs
- Mobility – estimators not office bound as full estimate and drawings together on PC in office, on site, on the move

At a broader level, it is the first software to enable true integration across design disciplines. The implications of this are profound. The following paper examines the effect of iTWO costX® in the areas of:

- Benefits to the Design Process through greater interoperability
- Benefits in Scope Management
- Other considerations – Document management
  – Workflow and Productivity Benefits

# Benefits of iTWO costX® to the Design Process through greater interoperability

The performance and cost parameters of a building throughout its construction and life cycle are largely determined at schematic design stage. It is therefore critical that the schematic design, which establishes the scope parameters for the building, contains no in-built inefficiencies which may ultimately impact on:

- Construction cost
- Maintenance cost
- Operational cost
- User comfort and productivity
- Economic performance

Now, using iTWO costX®, not only can the computer provide a visual simulation of the design, it can simulate the performance of the building with respect to its construction cost. This kind of simulation enables the architect to create “what if” scenarios early in the design process, to explore ways to improve the performance of the design.

This enables fast and accurate comparative evaluation of early scheme options and facilitates active cost modelling, which can be readily manipulated to examine permutations of any or all cost factors and provides a common basis for comparisons for any number of scheme options and sub-options such as façade and structure, environmental services and ESD.

This innovative approach allows a speedy/real-time response to design options, allowing the design to flow to an affordable cost, and provides comprehensive and reliable cost data upon which informed development decisions can be based. The process provides significant time savings over traditional methods and the direct link to CAD also provides a dynamic tool for managing scope and design creep.

# Benefits of iTWO costX® in Scope Management

Scope 'creep' – a progressive growth of project quantum and quality over that provided in the project cost budget – is a major cause of cost-overruns and client dissatisfaction with project outcomes. The project cost directly correlates to the building function, quantum and quality. Changes to these parameters, which occur regularly throughout the design process, have a direct impact on the project cost budget.

To effectively control the project budget, scope must be clearly defined at the outset and managed throughout the design and delivery stages. Whilst major changes or design revisions are usually easy to identify, the more insidious form of scope creep arises from the myriad of small and minor changes which occur throughout progressive design iterations – none of major consequence within themselves, but with a cumulative effect that if undetected can lead to major cost implications.

iTWO costX® technology which directly links cost to the CAD design offers the best opportunity for improvement and re-engineering of costing processes and techniques to support scope management.

For a particular building type there are inherent relationships in the geometry of its design that directly impact on its cost – its "cost geometry". These relationships are defined at the earliest design stages and are the framework upon which the project scope is built.

Using iTWO costX®, the cost geometry can be extracted from the earliest CAD designs and quickly applied to generate a project specific cost model for the building which defines project scope at an elemental level and establishes a realistic and achievable budget.

The live links to the CAD drawing or model enable iTWO costX® to readily identify and highlight all changes that are then made in progressive drawing issues. The associated quantities are updated and the cost automatically recalculated, with all changes recorded as an audit trail.

Following this iterative process, scope is effectively managed and nasty surprises arising from scope creep become a thing of the past.

In commercial terms, this means time and money is saved because the traditional problems of redesign, excessive tendering costs, costly resolution of variations and frequent contract disputes over matters of fact or interpretation are avoided.

# Other Considerations - Document Management

Manual methods of handling, storing and maintaining paper based information are difficult, time-consuming and costly. Some of the most obvious problems include:

- Paper drawings are susceptible to aging and damage over time.
- Manual-based revisions are costly, particularly with drawings requiring frequent updates.
- Paper is slow to distribute. It takes longer to copy and distribute a single piece of paper than it takes to distribute or reproduce several documents electronically.
- Not all participants or stakeholders are CAD enabled so many transactions between companies have to be inefficiently conducted with manual archives, even when the originals are CAD files.
- Paper is cumbersome. It is often hard to find specific information in specific documents. Electronic searching is more efficient and faster.
- Paper is restrictive in format. It is limited to graphics and text, while electronic documents can contain other data and attributes.
- Paper is static. It can be out of date even before it is distributed because of lengthy release cycles. The added concern of who has the most recent revision intensifies this problem.
- Facility costs for the storage and maintenance of paper archives can be substantial.

Electronic document management allows the iTWO costX® advantage to be applied completely. The electronic estimate files, complete with embedded drawings, can be easily stored and quickly retrieved in a fraction of the time it takes to find paper records.

Benefits include:

- Faster, more effective communication flows.
- Reduced retrieval times for documents.
- Improved QA information flow with workflow and email tools.
- Improved QA conformance by instituting better document control procedures.
- Fewer lost, damaged and misfiled documents.
- Immediate availability of accurate information.
- Streamlining of the change process.

# Other Considerations - Workflow and Productivity Benefits

iTWO costX® provides a powerful tool to re-engineer workflow protocols because the entire estimating process is electronic. Drawings can be received by email, the estimate generated, and reports issued back by email. The entire transaction is paperless. Cost benefits of such workflow improvements are far greater than those provided by document management tools alone. Company-wide electronic workflow process enables work to be carried out in any location – across continents, on the building site, on a laptop in a car, anywhere that an internet connection can be established.

Freed from tedious process, it puts skilled professionals in a far better position to use their skills to evaluate the data provided and focus on improving the quality of the information provided.

The ability to generate cost data and communicate it in a visual form by connection to the CAD drawings has several benefits. One is the value added through interaction. Rather than a static hard copy document, an understandable and interactive cost model will be available for all stakeholders to use in pursuing their particular contribution to the building process.

Secondly, as the value of this model becomes more evident to the stakeholders, more attention will be given at the design stages to ensure that the model is comprehensive as this will result in savings further on in the process because the information can be constantly re-used.

Thirdly it provides an extremely useful building management tool, an electronic database of building cost information connected to CAD drawings which allows consideration of issues such as maintenance management, facilities management and, with further development of the software, interaction with other programs that the client can use for the ongoing life of the building.

In commercial terms there is probably a larger demand for service in this field than there is in new projects, not just in construction but applied to capital expenditure generally, for example engineering and petrochemicals, major resource areas, plant building, ship building and so on.

Thus, there is a huge potential to harness the software to develop services to better serve the needs of the property industry at large and the quality of the built environment on a worldwide basis, which, with Internet technology and communication, could be made available anytime, anywhere.