5 KEY BENEFITS OF BIM FOR PLANT DESIGN

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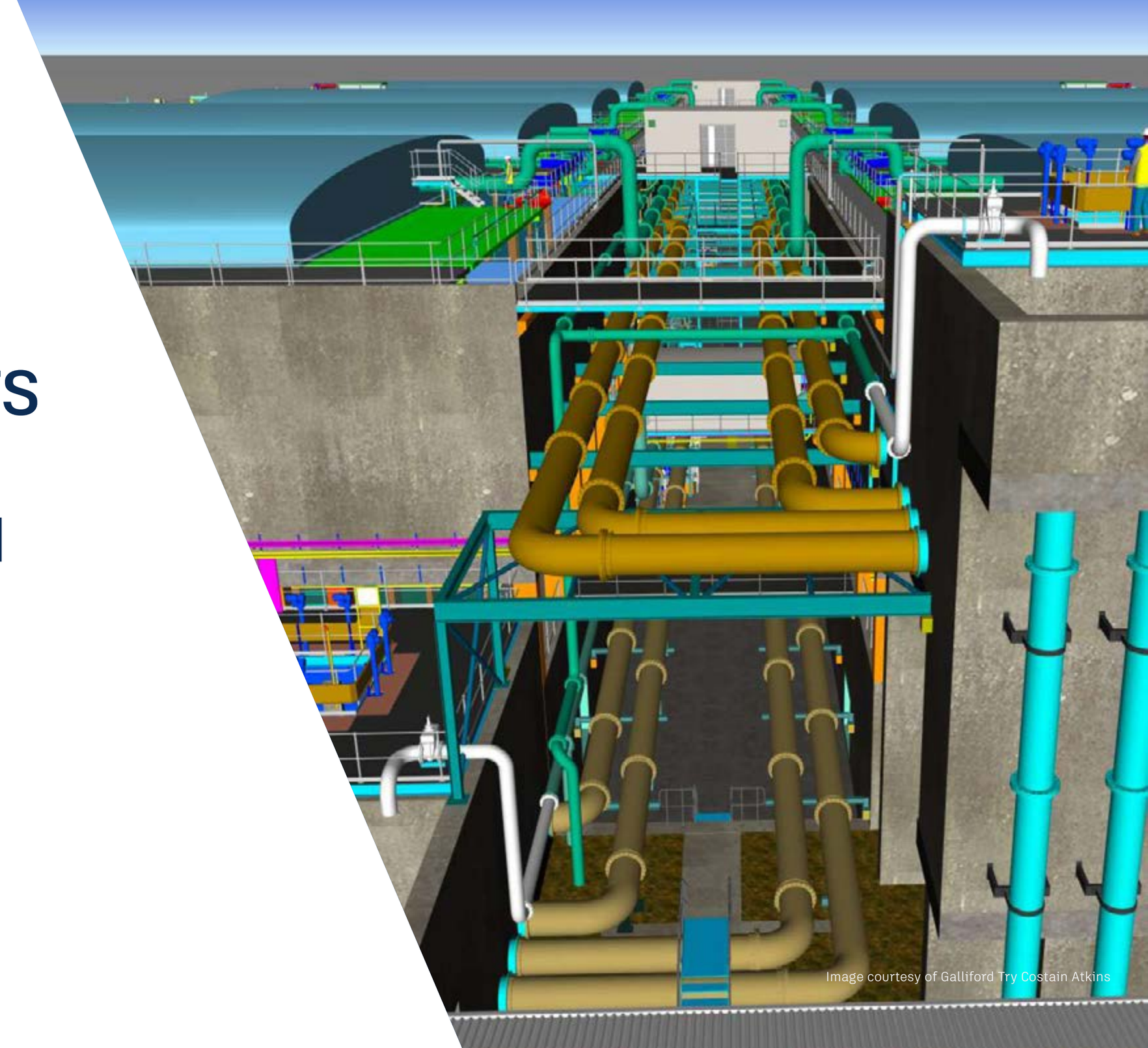


Image courtesy of Galliford Try Costain Atkins

5 Key Benefits of BIM for Plant Design

WHAT IS BIM?

Introduction

WHAT IS BIM?

For many years, the architecture, engineering, and construction industries have relied on building information modeling, or BIM, to design and engineer buildings and infrastructure projects. Because of its benefits, BIM adoption is growing rapidly for plant projects as well.

At its core, BIM is a collaboration framework that allows designers, engineers, architects, and contractors to come together around a **“single version of the truth.”**

In and of itself, BIM is not a tool or a software solution. It’s best to think of BIM as a better way of managing project information in a shared repository where the same set of plans and designs can be prepared, viewed, updated, modeled, and finalized by any and all project stakeholders simultaneously.

BIM starts with the creation of intelligent 3D models using tools like Autodesk’s AutoCAD for Plant 3D and Revit that integrate with plans and designs from many AEC and plant design disciplines and software.

These models serve as the focal point around which document management, design collaboration, and coordination come together in a single place throughout the project’s life cycle – from design through construction and operations.

From urbanization to increased regulatory pressures, plant designers are being challenged to deliver better and safer facilities on time and on budget.

This paper highlights how they can use BIM to navigate this highly complex, multi-disciplinary environment in a way that saves time and money, leading to better outcomes for everyone involved.

Let’s get started!

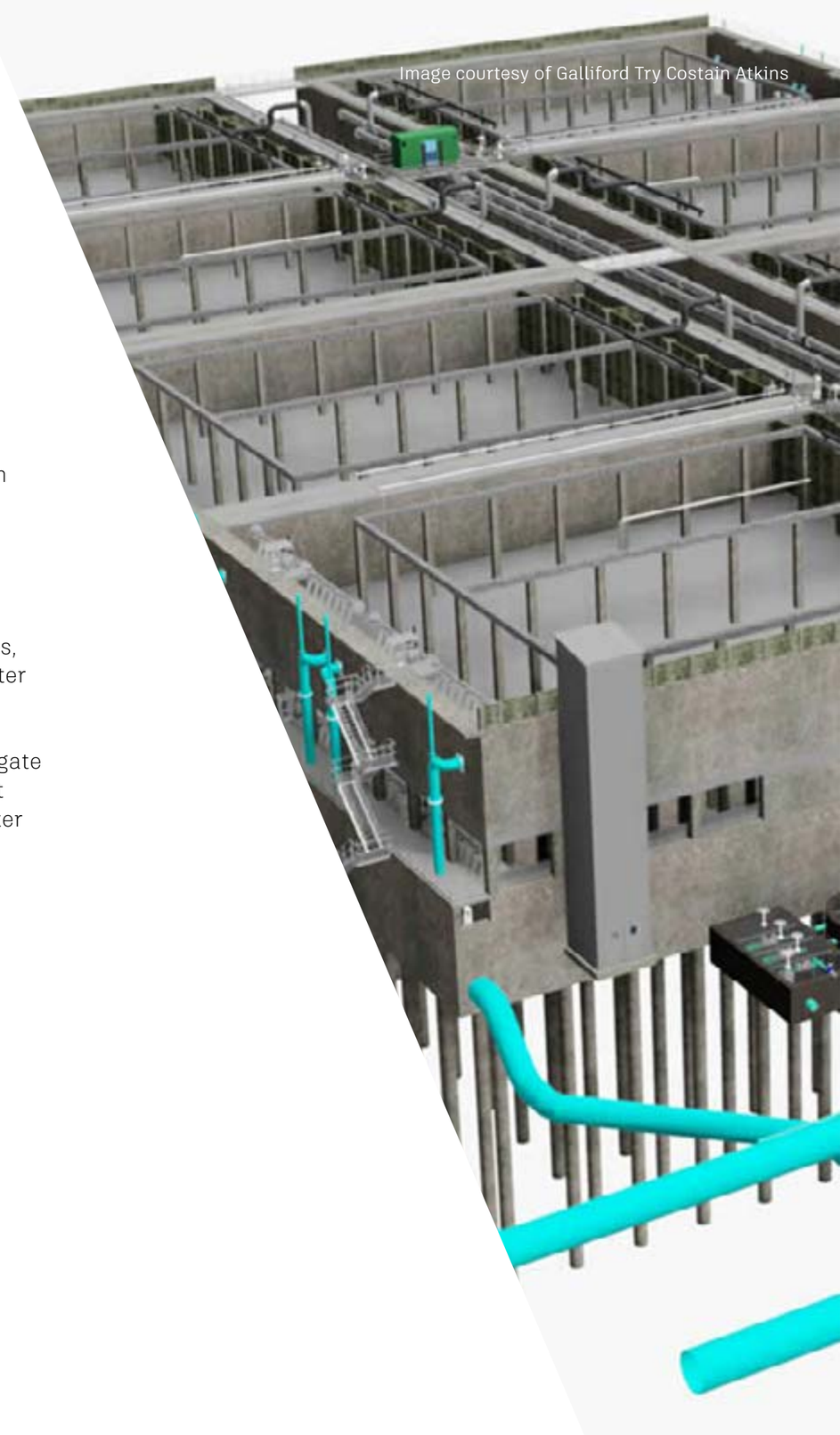


Image courtesy of Galliford Try Costain Atkins

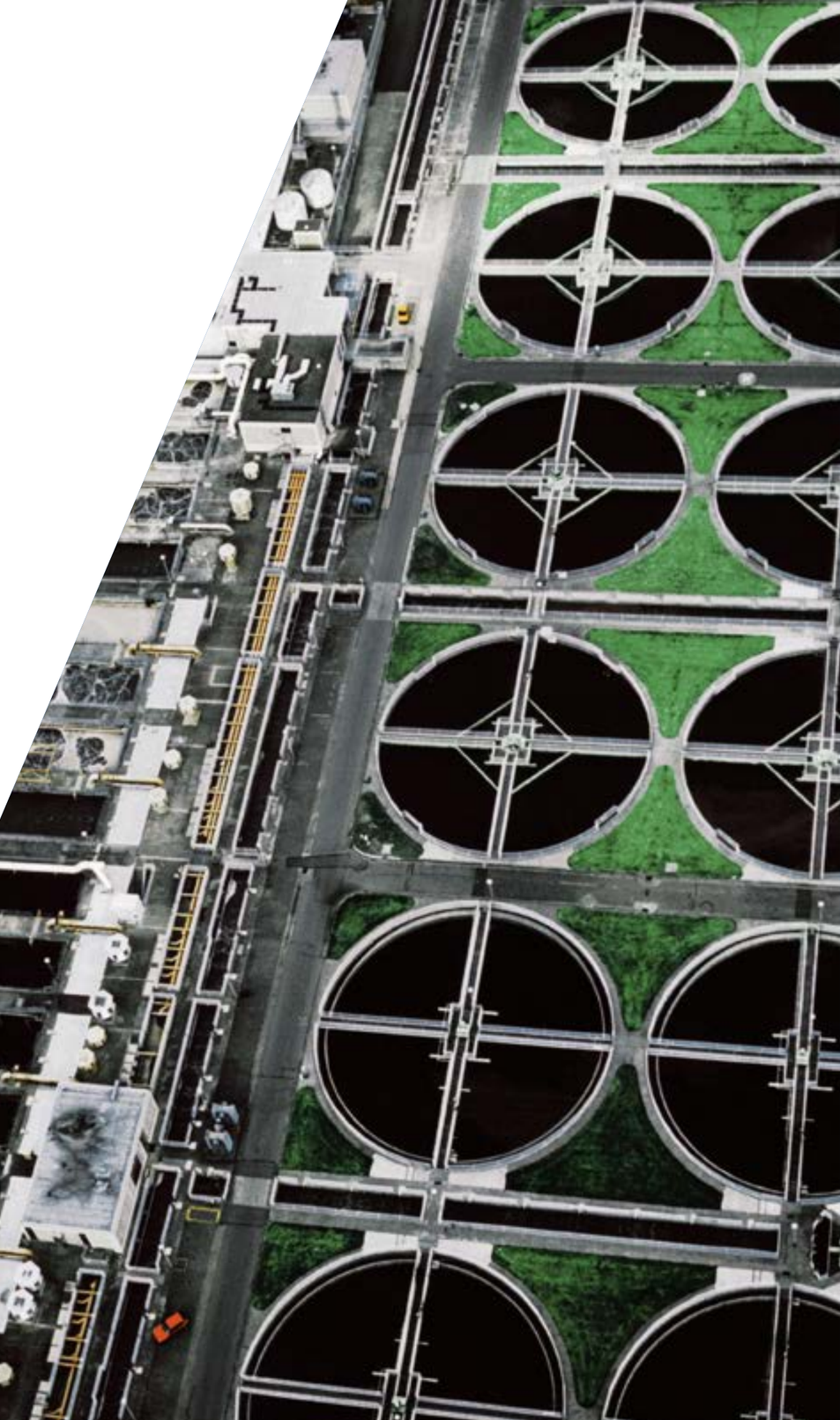
PLANT DESIGN CHALLENGES DRIVE BIM ADOPTION

Many countries around the world are introducing mandates for the use of BIM in civil engineering projects. This is driving process plant designers in the water and wastewater industries in particular to adopt it today.

According to the Dodge Data and Analytics SmartMarket Report, The Business Value of BIM for Water projects, **88 percent of companies that design and build water and wastewater facilities are already using BIM.**

THE TOP CHALLENGES DRIVING THE ADOPTION OF BIM FOR PLANT PROJECTS ARE:

- Speedy project delivery from start-up to completion
- Gain more insights earlier in the process to improve project quality
- Enhance multidisciplinary team coordination
- Minimize data loss in all project phases to minimize costs



URBANIZATION AND THE EVER-EXPANDING CITY

Today, 55 percent of the world's population live in urban areas. That is expected to increase to 68 percent by 2050, according to the United Nations. Urbanization combined with the overall growth of **the world's population could add more than 2.5 billion people to urban areas by 2050.**

As more people move into cities around the globe, urbanization is having a major impact on natural resources and aging infrastructure.

Growing populations are pushing aging water, wastewater and other plant infrastructure to the breaking point, so designers and engineers are turning to BIM to help build more capable facilities faster, more efficiently, and sustainably.

FOCUS ON REBUILDING PLANTS

Since the siting of new greenfield plants is not usually an option in densely populated cities – where people simply don't want them in their backyards – older facilities are often updated and rebuilt.

This may avoid political issues, but it also increases the complexity of these projects. Given today's high environmental standards and increasing regulatory pressures to build safer plants regardless of industry, designers must take into consideration a host of factors the original builders did not have to contend with.

This means they must also work with many disciplines from architects and building engineers to builders as they develop their plans.

Complicating matters is that each of these disciplines uses different software platforms that often do not work well together.

BIM eases this cross-discipline collaboration in ways of which yesterday's designers could only dream.

5 Key Benefits of BIM for Plant Design

TOP FIVE REASONS TO ADOPT BIM FOR PLANTS

TOP FIVE REASONS TO ADOPT BIM FOR PLANTS

There are a lot of good reasons to move to BIM and many are interrelated. Better design and collaboration, for example, begets fewer errors and omissions, which in turn reduces clashes during construction. That's why so many companies across the plant design and construction business are moving to adopt BIM.

Here are the five main reasons you should move to BIM:

1 Minimize errors and omissions

According to the Dodge wastewater study, **73 percent of respondents using BIM said that reduced errors and omissions was a top project outcome benefit.** This is consistent across disciplines.

"Analytics, both in other sectors and in the US and globally, have demonstrated that having other project team members experienced with and using BIM amplifies its benefits, and these findings demonstrate that the water sector is no exception," the report states.

Quite simply, errors occur when designers, architects, and engineers from the different disciplines and backgrounds fail to communicate effectively. When construction teams go to install pipes and there is a wall in the way, that's a problem.

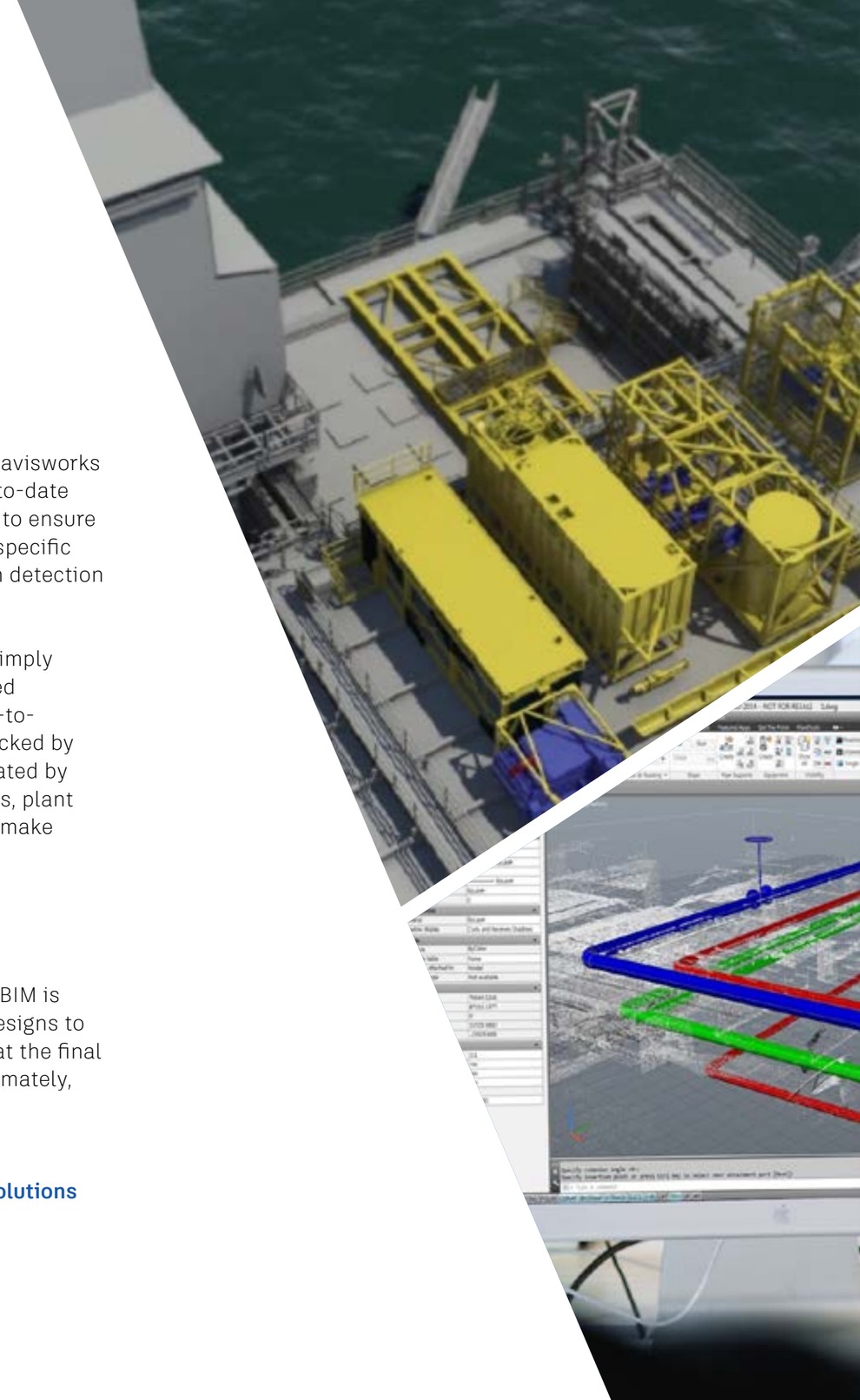
BIM tools like Revit, AutoCAD for Plant 3D, and Navisworks not only help keep designs coordinated and up-to-date with capabilities like data validation – checking to ensure designs are consistent and adhering to project-specific requirements – they also actively assist in clash detection and remediation.

Likewise, many omissions, where something is simply left out of the plant designs only to be discovered during construction, can be avoided by using up-to-date models that can be checked and cross-checked by everyone involved. In this way, as plans are updated by other disciplines like architects or civil engineers, plant designers are alerted to those changes and can make adjustments as needed.

2 Better design through visualization

One of the other big benefits of using BIM is being able to combine information, plans, and designs to create visuals that can accurately represent what the final plant will look like and to easily share them. Ultimately, this leads to better, more innovative designs.

According to the Dodge wastewater survey, **68 percent of respondents said better design solutions was another key benefit of using BIM.**



"This makes sense since these benefits cascade down through the rest of the project lifecycle," the report states. "Use of BIM tools can yield a more well-reasoned design, informed by analysis and simulation, that can more effectively achieve project goals. This can encourage more innovation on projects as well as save time and costs."

3 Improved collaboration

The main benefits of BIM begin with collaboration. It is consistently listed as the No.1 reason designers, architects, and builders adopt BIM.

According to the Dodge wastewater study,
58 percent of respondents said enhanced collaboration was the top business benefit of BIM.

This is because BIM acts as a focal point and clearinghouse for all plans, designs, build sheets, specification data, costs, and schedules.

But BIM takes collaboration a step further by allowing multidisciplinary teams of plant designers, architects, and building engineers to co-create in near real-time. This minimizes the constant back and forth that typically goes on using email. It saves time and effort, while reducing the number of friction points in the process.

4 Improved cost management

Like errors and omissions, BIM can help reduce requests for information (RFIs) by improving the ability of all stakeholders to see and work with 3D models even before construction begins.

This allows for better cost controls and even cost reductions, and it also plays a big role in improving constructability.

5 Faster project startup

While many of BIM's benefits stack up quickly once the project is underway, a more integrated design solution also enables a project to kick off faster. For example, in urban areas where space is limited and existing plants must be refurbished, a lot of the information about these facilities is either missing, wrong, or out of date.

Using reality capture technologies, designers and engineers can image the plant inside and out and then feed the BIM model with accurate 3D images to create a digital twin. The model can then be populated with up-to-date information about elevations, pipe runs, instrumentation, etc. that also includes meta-data about each.

In greenfield environments, designers can bring together land survey and GIS data, to quickly see how they will bring in pipes from the outside.

With BIM, all of these tools talk to each other. It's an integrated design that brings together structural engineers and architects working on the outside of the plant and connects them to what plant designers are doing on the inside.

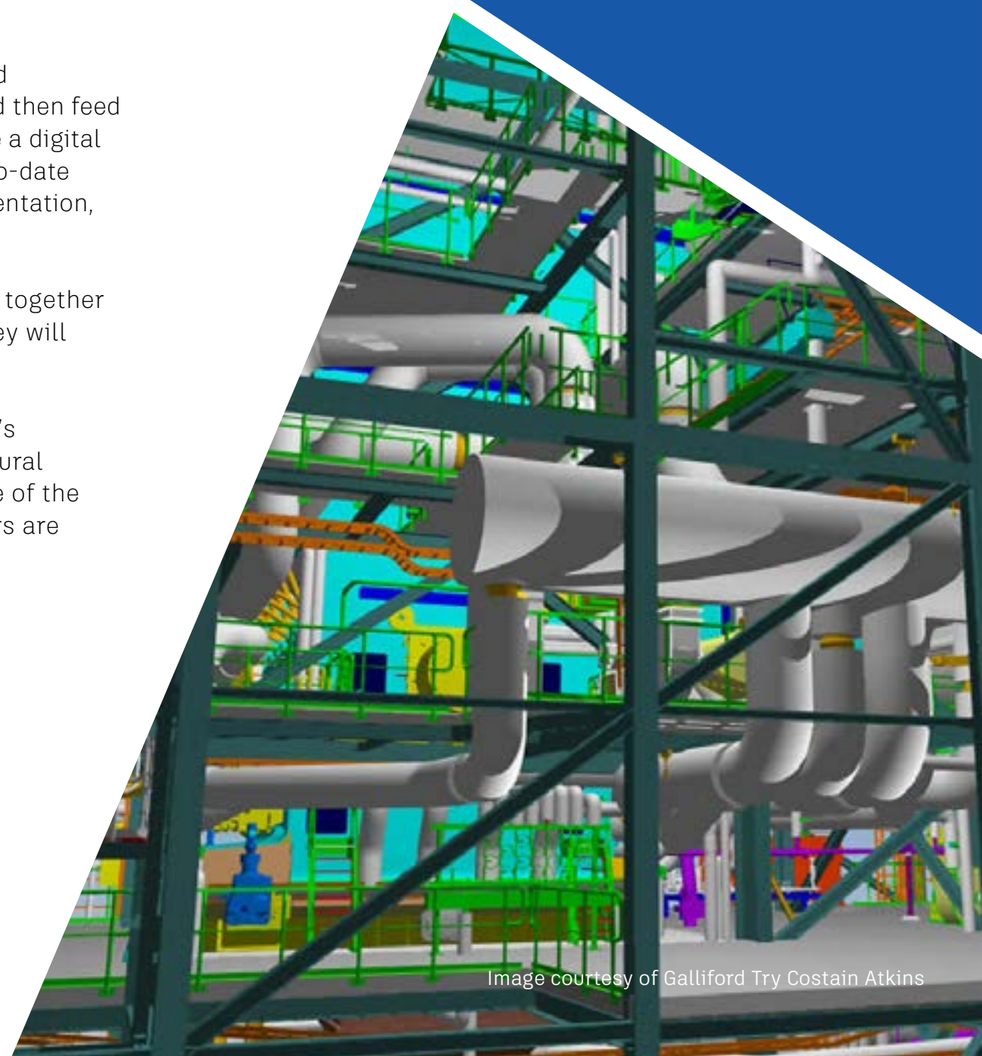


Image courtesy of Galliford Try Costain Atkins

5 Key Benefits of BIM for Plant Design

BIM IN ACTION

BIM in action

LIVERPOOL WASTEWATER TREATMENT WORKS BENEFITS FROM BETTER COLLABORATION

When the Liverpool Wastewater Treatment Works in the UK needed to be rebuilt, cross-discipline collaboration was of paramount importance. Because the plant was located in an existing operational dry dock on the River Mercy, it was subject to a preservation order as an important historical site. This meant that the design had to avoid damage to the dock's walls.

A project of this scale requires dozens of subcontractors to submit detailed models and designs. The design teams used Autodesk Navisworks to bring together more than 450 models, including civil engineering plans developed in Autodesk Civil 3D.

"Working in 3D became the norm for the team very quickly. We estimate that it has **helped to save hundreds of hours on design alone."**

Paul Heath, BIM Lead, Atkins

A good example of how BIM benefits everyone in the process was the implementation of 386 meters of large diameter pipework. The pipes were designed in the BIM model, fabricated off-site, and installed with no on-site cutting. BIM is credited with saving hundreds of hours of design work as well as cutting clashes that saved hundreds of thousands of dollars.

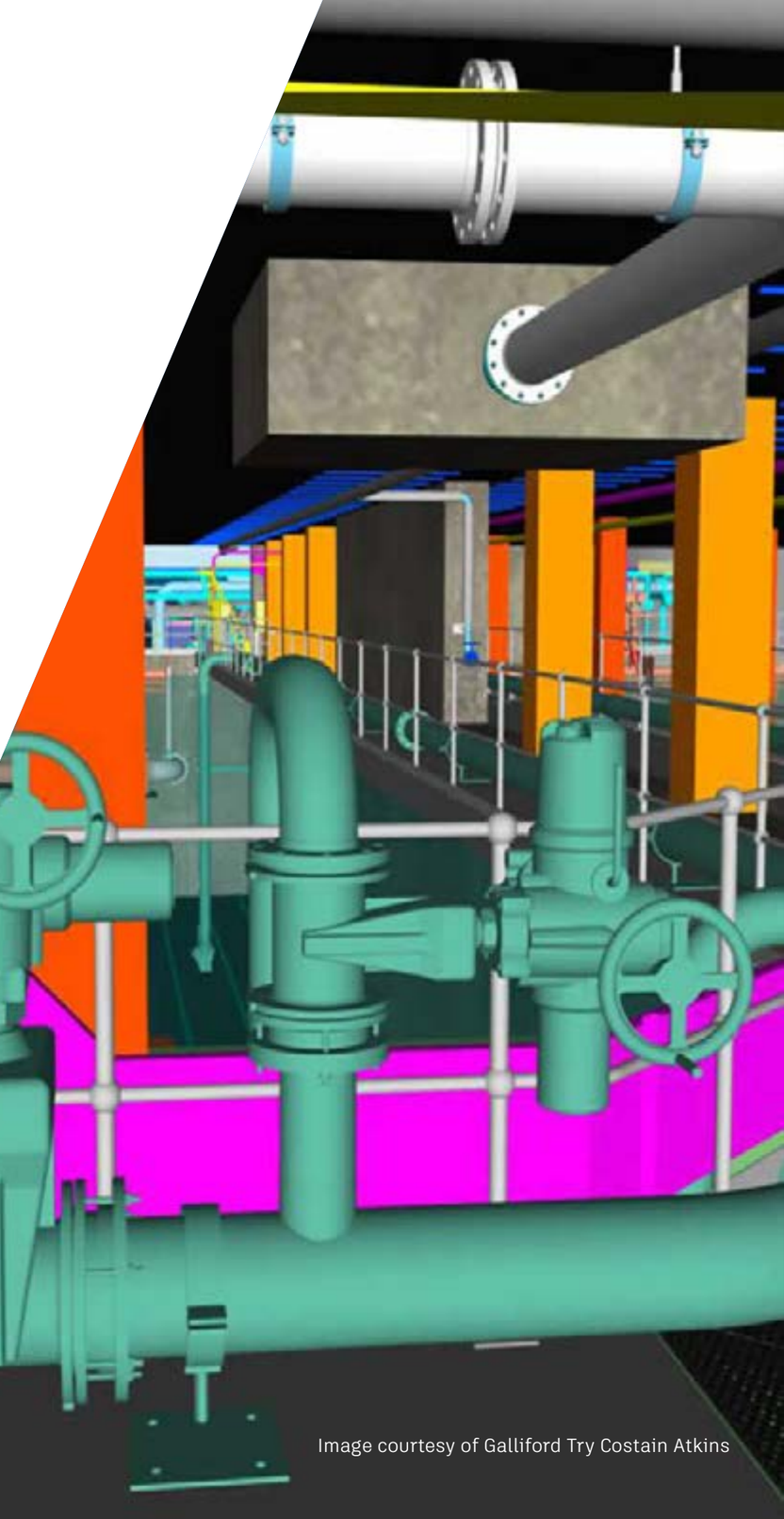


Image courtesy of Galliford Try Costain Atkins

BIM in action

HYDROCHINA KUNMING ENGINEERING SAVING TIME AND MONEY WITH BIM

As shown in the previous example, because the model allows stakeholders to communicate directly via the BIM platform, there is a single-source-of-the-truth that greatly reduces the communication and coordination problems that exist in any major process plant design project.

Because of BIM, Hydrochina Kunming Engineering in China, for example, is able to finish projects that used to take eight months in just three. On one project, the HydroBIM–Yangfanggou Hydropower station, HKE was able to reduce the amount of concrete required by 1 million cubic meters and the amount of excavation required by 1.5 million cubic meters.

To date, the adoption of BIM has resulted in project cost savings of $300 million.

It's clear from these examples and many others that when different disciplines work together, efficiency and quality improve, while errors, omissions, clashes and costs are reduced.

"Hydropower projects are complicated, requiring contributions from a range of professional disciplines. **With BIM plus cloud and mobile technology, it's easy to access the model on the job site–driving collaboration, speed, and quality in the field"**

Mr. Zhang Zongliang, General Engineer, Hydrochina Kunming Engineering

Images courtesy of Hydrochina Kunming Engineering Corporation Limited

BIM in action

TETRA TECH: DESIGN FORWARD WITH VISUALIZATION

Tetra Tech, a plant design and engineering firm in Alabama, used BIM's visualization capabilities to create an "almost seamless design-to-construction transition" for a new, **$90 million** wastewater treatment plant in Guntervilles Lake, Alabama.

Improved coordination between offices and disciplines led to **increased efficiency, saving time and money during design and construction**.

Tetra's designers credit BIM for giving them the capability to coordinate multiple workflows and design elements into a pre-built visualization that allowed them to peel back roofs, inspect structural elements, examine the plant from multiple angles, do walk throughs of the entire project – all before a single 2D blueprint was generated from the BIM models.

Implementing BIM helped improve cost management for this project. **It allowed the owner, Huntsville Utilities, to add $5 million to the project scope while spending $10 million less than originally planned.** BIM also helped to complete the project a full year ahead of schedule.

Image courtesy of Tetra Tech

GETTING STARTED WITH BIM

Improved Adopting BIM will change your current workflows and processes, and its benefits are clear.

To ensure these changes are for the better, it helps to set up regular training schedules and combine those with on-demand learning.

Placing younger staff with more skilled practitioners who have more modeling and project delivery experience, is also a good idea.

A lot of plant design firms begin their BIM transition by creating a BIM manual that includes standards for collaboration and information sharing.

But the key to success is creating a centralized project database that provides the all-important “single-version-of-the-truth” that is central to the effectiveness of BIM.

Regardless of what path you follow, the best way to reap the benefits of BIM is to just **get started.**

Image courtesy of Tetra Tech

5 Key Benefits of BIM for Plant Design

THE AEC COLLECTION

THE AUTODESK AEC COLLECTION

AutoCAD Plant 3D

AutoCAD Plant 3D is an AutoCAD specialized toolset that helps plant designers produce P₵IDs, and then integrate them into a 3D plant design model in BIM.

Revit

Revit is used by plant designers to produce consistent, coordinated, and complete model-based building designs and documentation to support BIM processes.

AutoCAD Civil 3D

Autodesk Civil 3D civil engineering design software supports BIM with integrated features to improve drafting, design, and construction documentation.

InfraWorks

InfraWorks infrastructure design software allows designers to conceptualize, optimize, and visualize infrastructure projects and supports BIM processes – all in the context of the built and natural environment.

AutoCAD

AutoCAD is one of the most widely used CAD platform in the world. This suite of AutoCAD products includes specialized toolsets with industry-specific features and intelligent objects for architecture, mechanical engineering, electrical design, and more.

Navisworks

Project review software with advanced coordination, 5D analysis, and simulation tools. Navisworks lets AEC professionals holistically review integrated models and data with stakeholders during preconstruction for better project control and outcomes.

Recap Pro

Recap Pro is a reality-capture and 3D scanning tool used to better understand existing conditions and verify as-built conditions.

3ds Max

3ds Max is used by plant designers to create stunning scenes for design visualization and engaging virtual reality experiences.

AutoCAD Map3D

AutoCAD Map3D is model-based GIS and mapping software that enriches map data by combining GIS and CAD data.

Learn more

Learn more about the Autodesk AEC Collection

Discover BIM for Plant

Contact Me

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