

# HOW DOES NEW ZEALAND EMBRACE AND MAXIMISE THE BENEFITS OF PRODUCT-BASED DELIVERY?

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## ABSTRACT

Product-based delivery represents a significant shift in thinking in the delivery of Water infrastructure. Championed by the Anglian Water @one Alliance in AMP4 (2005-2010), it is emerging as a common trend throughout the UK water industry. Rather than devising bespoke solutions to individual problems, Product-Based Delivery involves using adaptable, repeatable designs that are developed in close collaboration with the client's operations staff and the supply chain, and can be used in conjunction with one another in solving a wide spectrum of issues.

This paper will present the reasons why New Zealand should be embracing the use of product-based delivery and will draw on 10 years' experience gained from working with Anglian Water, Yorkshire Water and United Utilities in developing their Product-based delivery approaches. It will discuss the role that BIM has to play in enabling this new approach and will provide lessons that have been learnt. Finally, it will discuss the enabling factors that exist within the NZ water industry to achieve and exceed quality targets through this approach- 'the pathway to excellence'.

## KEYWORDS

Collaboration, BIM, Supply chain, Integration, Standardisation

## 1 INTRODUCTION

Standardisation has become the accepted norm in many industries. Step into a Volkswagen Golf and you quickly see the resemblance with a Skoda Octavia. Likewise with the Toyota Camry and Lexus ES350. The standardization is much more than skin deep – common components and assemblies are used to make up the majority of the cars, with little more than the finishing touches being a differentiator. These are cars that have very different brands and positions in the market but share a common core.

Standardisation has become such an essential part of the car industry that manufacturers that have failed to adopt it have fallen on hard times. When Saab launched their 9-5 sedan in 2010 they had intended to essentially peel off the badge from a Vauxhall Insignia and stick on a Saab one, but the engineers couldn't help themselves. They changed the chassis, engines, interior, suspension – in fact just about everything, including redesigning the satellite navigation system (Saab 9-5 review, Daily Telegraph). As a result of the design delays the car was brought to market before it was ready and was a resounding flop, signifying a nail in the coffin of the beleaguered, yet prestigious car manufacturer (BBC top gear).

The drivers behind the adoption of standardization in the automotive industry ring true for the water industry, yet to a large extent the Water sector in New Zealand has yet to embrace it. On the face of it, every water project is unique with its own set of constraints and challenges. However, Mott MacDonald has found through experience in the UK water sector that by designing standard, modular solutions that can be integrated with one another we can derive solutions to meet a wide range of client needs at a reduced cost, with greater reliability

and with a reduced carbon footprint than would be achieved by adopting a conventional approach. Solutions that may appear as different as a sporty Golf GTI is from a Skoda family station wagon can be built from a common core of products.

This paper will present the reasons why New Zealand should be embracing the use of product-based delivery and will draw on 10 years' experience gained from working with Anglian Water, Yorkshire Water and United Utilities in developing their Product-based delivery approaches. It will discuss the role that BIM has to play in enabling this new approach and will provide lessons that have been learnt. Finally, it will discuss the enabling factors that exist within the NZ water industry to achieve and exceed quality targets through this approach- 'the pathway to excellence'.

## 2 UK EXPERIENCES WITH PRODUCT-BASED DELIVERY

Product-based delivery represents a significant shift in thinking in the delivery of Water infrastructure. Championed by the Anglian Water @one Alliance in AMP4 (Asset Management Plan period, 2005-2010), it is now emerging as a common trend throughout the UK water industry. The intentions behind product-based delivery were that it would help address a range of issues being experienced, which included:

- Wasted design effort through designing new assets from scratch, where similar assets already exist;
- Lengthy approval processes on projects being repeated every time;
- Smart ideas arriving from the supply chain after you've already paid for the design, either resulting in delays as approvals are sought again or supply chain feeling that they are too late to a project to add value;
- Operators having a wide range of assets to operate and maintain that perform the same function;
- "Belt and braces" solutions that are overly conservative (and consequently expensive); and
- Contractors needing to develop bespoke construction methodologies for each project because the design is different every time.

For their AMP4 programme Anglian Water recognised that a radically different approach was required for the company in its capital investment programme if it were to achieve the stretching targets that it had set itself. These targets, known internally as 'Big Hairy Audacious Goals', included obtaining 30% cost savings and 50% carbon savings compared to the previous AMP. The company devised a procurement strategy that involved the formation of a fully integrated team, known as the @one Alliance, to deliver its £1bn 5 year capital programme. <http://onealliance.co.uk>

@one Alliance Director Dale Evans acknowledged that the challenging targets would not be met if previous delivery methods were to be continued. "We develop products for solutions - we don't want to design. We want to assemble the solutions, we don't want to construct, and then we operate and maintain to deliver a service. This is really product lifecycle management." (BIM for assembly in Water Industry, Infrastructure Intelligence Website)

The @one Alliance's product-based delivery initiative, under the leadership of Engineering Manager Mark Enzer and more recently Lyndsay Taylor, blazed a trail for other water companies to follow. A comprehensive electronic catalogue of standard products was developed in an integrated way with designers, constructors and the supply chain as well as the client's operations staff such that it became default for all project teams to use any available products. This approach has demonstrably contributed to considerable project successes, such as the recently completed Cambridge Water Recycling Centre, which was delivered for 20% lower cost, 45% less carbon and 3 months ahead of schedule. (Project Cambridge page, onealliance website)

Central to the @one Alliance's success in implementing product-based delivery has been long-term collaboration forged through setting common incentivisation mechanisms as well as having a common purpose. Additionally, the Alliance has been at the UK's leading edge of using Building Information Modelling (BIM) as

an enabler of its Product Lifecycle Management approach. The Alliance defined a set of information requirements for all standard products, covering a range of documentation, 3D models and non-graphical information.

Buoyed by the success of the @one Alliance in pioneering the use of product-based delivery, other organisations working in the UK water industry have embarked on developing their own standard products. Design and build contractor Mott MacDonald Bentley (MMB), part of the Mott MacDonald Group, has developed a catalogue of over 80 standard products to suit its water sector clients' varying requirements. All products consist of a range of standard documentation, as shown in Figure 1. Unlike the @one Alliance, MMB embraces both offsite solutions and on-site ones, delivered through its in-house skilled labour force where this is found to be more efficient, illustrating how a one-size-fits-all strategy is not necessary.

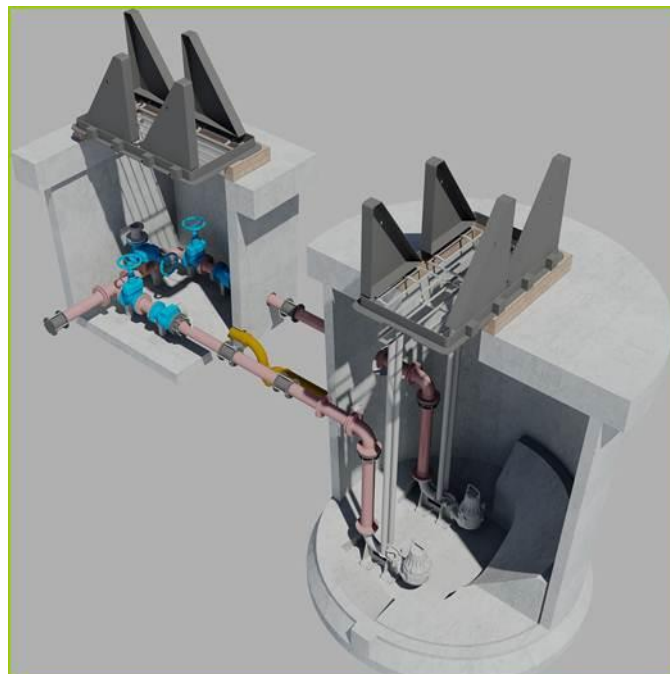


Figure 1: Product, represented by standard design and documentation

A particularly successful set of standard products developed by MMB has been its submersible pumping station (SPS) assembly consisting of wet well, valve chamber, valve kiosk, control panel kiosk, base slabs and cover slab standard products (see photograph 1). These cover a wide range of applications, from 20 properties up to 50 l/s dry weather flow.

MMB has calculated that this approach saves £24,000 (approx. NZ\$ 50,000) on a typical SPS installation and during the AMP5 period the assembly was used over 30 times.

More recently Yorkshire Water, Scottish Water and United Utilities have also embarked on their own development of standard products, all with challenging efficiency targets to achieve. Recognising the opportunity for collaboration between water companies, Buildoffsite, a UK-based organisation that promotes offsite methods of construction, has established a Standard Products working group through which water companies such as Anglian Water, Yorkshire Water and United Utilities are exploring ways in which knowledge about standard products can be more effectively shared across the industry. (Water Hub page, Buildoffsite website)



*Photograph 1: MMB Standard Pump Station Design*

The graphic below demonstrates the evolution of a chemical dosing skid over 3 Asset Management Programme (AMP) periods from the initial bespoke, robust, but costly design in AMP 3 through the intermediate, cheaper but low quality ‘compromised’ solution in AMP 4. The final result in AMP 5 is a consistent quality, pre-tested, factory assembled product with standardised design, components, commissioning plans, O+M manuals.



**AMP3 (2000-2005)**

*Dosing kit made from stainless steel and housed in a brick building (\$130k)*



**20% Efficiency Challenge**

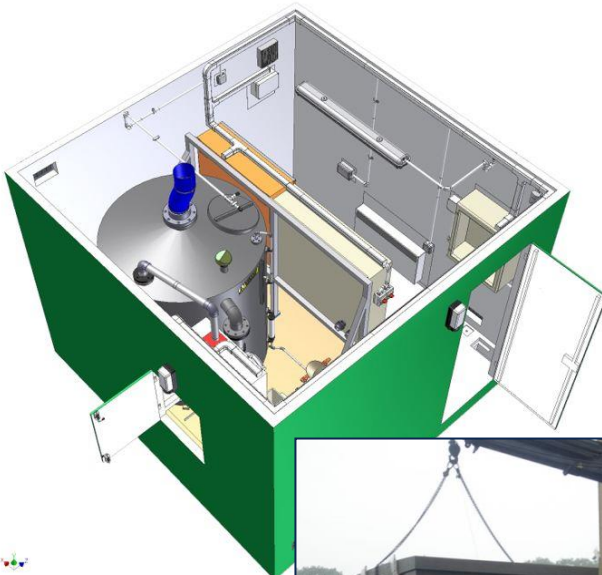


**AMP4 (2005 – 2010)**

*Cheaper but compromised solution (\$73k)*



**30% Product and Construction Efficiencies Savings**



**AMP5 (2010 – 2015)**

*Designed once, used many times, manufactured off site in 3 days, pre-tested. (\$53k)*



Figure 2 – Evolution of a dosing package (courtesy of Anglian Water)

### **3 LESSONS LEARNT**

Whilst the concept of product-based delivery is appealing to many in the UK water industry, the approach is not without significant challenges, which need to be addressed if it is to become a viable means of delivery in New Zealand. With a combination of the correct leadership and procurement strategies however these challenges have generally proven to be surmountable. In the author's experience, four factors in particular have proven to be significant challenges to the successful implementation of product-based delivery:

1. Differing client requirements;
2. Changing the culture of design;
3. Visibility of forward workload to justify the development costs; and
4. Designers not having visibility of componentry used in assembly.

#### **3.1 DIFFERING CLIENT REQUIREMENTS**

Depending on their previous experiences, client interpretations of legislation or Standard requirements can differ considerably. They may also have their own specific requirements that are unique to them. This presents a challenge with using standard products across the industry. An envelope design that meets all clients' requirements will not be efficient, so invariably standard products come with numerous different 'flavours', which adds significantly to the development cost and reduces the economies of scale that can be achieved from the supply chain.

In the UK where water companies typically cater for several million people, development of different 'flavours' of standard products is fairly easily justified. However, in New Zealand with a relatively small population and numerous water authorities, lack of agreement on standards will likely have a detrimental impact on the country's ability to exploit the potential benefits of this approach.

#### **3.2 CULTURAL CHANGE**

There is a significant cultural shift that is required to embrace product-based delivery. Engineers like to engineer. With product-based delivery we want engineers to integrate, not engineer. Skills such as the ability to manipulate and coordinate 3D models need to be acquired, whilst the ability to develop a design from first principles on a sheet of paper may be required less. Failure to embrace standardisation and the corresponding shift in skill requirements will limit the efficacy of product-based delivery.

The Anglian Water @one Alliance has demonstrated that the necessary cultural change can be achieved if the right conditions are in place. Having clear leadership that effectively communicates the direction of travel has been instrumental to their success. Given the relative size of the New Zealand water industry, it is likely that this leadership would need to come from a joined up effort between multiple water authorities if the same outcomes are to be achieved.

#### **3.3 WORKLOAD VISIBILITY**

To develop a truly flexible standard product that is usable in a range of scenarios requires considerable thought and is therefore significantly more costly and time consuming than developing a bespoke solution for a specific application. Consultants, contractors or suppliers can only commit to this increased expenditure if they can assure themselves of repeated work to get a return on their investment. Therefore, unless the client is willing to pay for the development of standard products as a separate activity, the implementation of product-based delivery is dependent on confidence of a future workload.

The use of long-term frameworks in New Zealand is less common than it is in the UK. Therefore it may prove less viable for the development of standard products to come from the supply chain at this stage. Through directly funding the development of standard products, however, water companies can ensure that they retain the benefits, though this must be done with meaningful engagement with the supply chain.

### **3.4 PROCUREMENT VISIBILITY**

The final challenge that has proven to erode the benefits of product-based delivery has been the designer's awareness of the actual componentry used in assembly. As an example of this, when MMB first designed its preformed valve chambers it was done in such a way that would allow the precast concrete chamber to be fabricated complete with core holes in one factory, after which it would travel to a second location to have the pipework fitted. Despite using British Standard sized pipework in the design, incremental differences between different manufacturers of pipes and fittings compounded to result in wall penetrations that were in the wrong place. The penetrations through the walls needed to be recut on site causing delays and introducing quality issues that should have been eliminated by using offsite methods. To address this, MMB has created a Digital Component Catalogue of all commonly used manufacturers' pipes and fittings and ensured that the design team is aware of the actual products that are being acquired by the buying department. As MMB is a design and build company this is relatively easy, but working in a traditional consultant / contractor environment, as is more conventional in the New Zealand water sector, would make this significantly more challenging to control.

## **4 ENABLERS OF PRODUCT-BASED DELIVERY IN NEW ZEALAND**

Whilst it is clear that there are significant challenges to the adoption of product-based delivery in New Zealand, there are a number of enabling factors that would serve to advantage such an initiative.

Unlike in the UK, NZ water authorities are not competitors. Cross sector collaboration is already evident and is recognised as a means for delivering best outcomes to the end customers. Since it is unlikely that any single water authority would have the necessary forward workload necessitating repeated solutions to justify the development of its own standard products, this collaboration will be a key enabler.

A facilitator of the effective use of offsite manufacture in the construction industry is coordinated 3D modelling. Intelligent, parametric 3D modelling software packages such as Autodesk Revit are already in common use in New Zealand and in fact the Australian & New Zealand Revit Standards are acknowledged as being World-leading. Such software, when implemented as part of an overall Building Information Modelling (BIM) approach, has the potential to provide significant downstream benefits to water clients through managing digital information throughout an asset's lifecycle. Several NZ water companies and authorities are already considering their approach to BIM and if this can be done in a consistent way across the industry, in accordance with international best practice, the benefits will be significant.

New Zealand has a local supply chain can be highly skilled and is quite responsive to client requirements. By encouraging more meaningful engagement between designers and suppliers through which the manufacturing process becomes a paramount design consideration, NZ water clients can help bring about substantial efficiencies and mutual benefits to its supply chain. Experience from the UK shows that the supply chain has a seemingly infinite capacity to innovate, but that innovation needs to be unlocked by the right procurement strategies.

Much of the New Zealand supply chain (equipment suppliers, contractors and design consultants) is far from isolated from the rest of the world and thus are very in tune with the advances being made globally in the water sector. Tapping into experience via our global connections is a good means of ensuring that we are not 're-inventing the wheel'. Even if standards do not fully align, but UK standards can be shown to provide an equal and acceptable alternative, then there exists an opportunity to utilise well established designs within the NZ market. In certain instances, product based design could be truly global.

## 5 CONCLUSIONS

Product-based delivery has shown to provide significant benefits in the UK, and subsequently it offers a significant opportunity to the New Zealand water sector to bring about substantial efficiencies and improved outcomes to its eventual customers through the use of repeatable, modular solutions. Central to the success of any initiative to utilise this approach will be meaningful collaboration and joined up thinking between the major water asset owners to agree on the basic principles of the strategy. New Zealand's supply chain is eager to innovate and will be critical to such an initiative.

## ACKNOWLEDGEMENTS

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