

Tim Broyd's Presidential Address (1st November 2016)

'Engineering a Digital Future'

Good evening ladies and gentlemen, colleagues and friends of the Institution.

As in previous years we are currently live streaming, so a warm and very special welcome to everyone who is watching in the Godfrey Mitchell Theatre and around the world.

Thank you John for such kind words, likewise it is an honour to build upon the excellent progress you have made during your year in office.

Before I begin, I would like to recognise the huge contribution over the last three years of Keith Clark, Adrian Coy and Steve Fox – our outgoing Vice Presidents. We all owe them a great debt of thanks.

And I'd also like to welcome four *new* Vice Presidents - Kyle Clough, Ed McCann, Rachel Skinner and Andrew Wolstenholme.

Along with the rest of the Presidential team, I look forward to working with them over the next year and would like to give my personal thanks for making this commitment to the Institution and the profession.

As you can see from the title of my Address, tonight I would like to talk about how *together*; we can engineer a digital future.

Six months ago when I was first asked on what I wished to base my Presidential Address, there was no hesitation.

Innovation and technological advances have been at the heart of the ICE for years, and they are the themes on which my career has been based.

This address allows me to set out *my* thoughts on a subject about which I am passionate; the key challenges and opportunities that face society; how our industry, supported by the ICE, must change if we are to be up to task of tackling them.

Tonight I will set out how digital engineering can transform people's lives, how this agenda can help us to deliver, on time, at reduced cost, and with a quality and precision that changes the way we operate and manage truly *smart* infrastructure.

So what do I mean when I say the word 'digital'? And what do I mean when I am using it in the context of the future of our infrastructure and our industry?

It is a term that can mean different things to different people.

I am talking about a world where we, the industry, can provide our customers with the same level and reliability of service from our infrastructure that we have come to expect from Amazon, Google or Uber.

A world where infrastructure brings economic prosperity, improves living standards and provides a *better quality of life* to the billions of people for whom reliable, clean drinking water is still an aspiration.

A world where society will be able to demand and receive a level of *service* and will be absolutely confident they will receive that service.

A world where technology will enable us to understand in *real time* how our assets are performing and we will be able to *intervene* to maximise value for money.

A world in which our industry *leads* the way in innovative thinking and our firms find new ways of adding *value*.

So when I say we must engineer a digital future, I mean much more than just using existing technologies to keep doing what we are already doing, but faster and cheaper.

I mean we must engineer for ourselves a complete transformation in the way we think about our infrastructure and our professional practices.

This transformation must address the issues the public care about, and we must explain to them, in plain language, how we will meet their personal needs and concerns.

It sounds like a very big ask, I know.

So it should be. As an industry, we *are* ambitious. We *do* aim high.

But we must also recognise that we have entered a new industrial revolution and, if we are to be what we claim to be, we must get ahead and move beyond simply responding to events.

We must forecast what society needs and then provide it.

But how do we get there? What is already happening that we can build on? And of course, what is the role of this great Institution in making it a reality?

We have many positives to build on.

We have already started on this digital journey.

The rise of artificial intelligence and vast pools of data are leading to better decision-making.

Advances in technology, computing power and just the sheer volume of data at our fingertips, are transforming how infrastructure is operated and what it can do for the public.

The advent of smart highways, smart meters, and the 'Internet of Things' is changing our expectations of what our physical infrastructure can, and should, do for us.

Autonomous vehicles are becoming a reality and look set to shape the future of mobility and mass transit, and potentially even the fabric of our cities and towns.

Looking at ourselves, the industry is *already* committed to radical improvements in time and quality of projects – a commitment driven by one of my Presidential predecessors, Peter Hansford, during his time as the UK government’s Chief Construction Advisor.

By adopting BIM, in conjunction with lean and agile technologies, we are *already* going some way to reducing the capital cost of a project, approximately twenty per cent according to the government

The mandate for BIM shows what can be achieved when government and industry work together.

But as ever, there is further to go.

Currently, BIM is mainly used for *central* government procurement, so the next step must be to ensure that more Local Authorities and private clients insist on its use.

BIM is a useful case study of how technology can support collaboration, save time and improve our ability to deliver.

It is an example of *innovation*, however, not of *invention*. There is an important difference.

We don’t *always* need to invent new technologies or business models; but we do *always* need to be innovative in how we deploy existing knowledge.

These changes are global.

Look at maglevs, the grace and elegance of the links between Hong Kong and Macau, and the new delivery models unlocked by Australia and New Zealand's approach to long term planning.

Here in London with Crossrail, the adoption of new technologies and use of data has enabled a whole new railway line to be built under the middle of the city, with minimal disruption to, but close integration with, other railway services.

In turn, it will add 10 per cent extra capacity to London's overcrowded rail network and unlock billions of pounds of economic growth.

The same expansive thinking is going on across the country.

BIM was used in the design and construction of the new Alder Hey Children's Hospital in Liverpool – the recent recipient of the Prime Minister's Better Building Award at this year's British Construction Industry Awards.

It allowed greater integration of the building as a whole entity, across the whole supply chain, and streamlined co-ordination between design and engineering teams.

As a result, we have one of the fastest built hospitals to date in the UK, making a *real* difference to the lives of the children and families who depend on it.

Despite successes such as these, so far BIM has only really been used to help capital delivery.

If we can move its use into the operational phase, we have a real opportunity to radically improve performance over the whole life of an asset.

For me, understanding and improving how our infrastructure is *performing* is what is really important, and what will make the biggest difference.

I was honoured to be asked by the UK government to pull together a strategy for the *next* generation of BIM.

We want to extend BIM into operational stages, by using increasingly large volumes of data to measure the performance of our infrastructure.

A recent report by KPMG demonstrated that construction companies and project owners, who invest in disruptive, digital technologies, should enjoy a step change in performance.

But unfortunately when it came to technological innovation, just 8 percent of global construction companies were considered to be “visionary”.

Sixty nine percent were “behind the curve.”

I do believe, however, that we can achieve the goal of gathering real time information on how we are performing and feed that back to asset managers - or even to customers directly – opening up the prospect of delivering a *service* to a specified level of performance.

That is where the true value lies for society.

In plain English, it will mean making our trains run faster, cheaper, more frequently and more reliably.

It will mean making sure the lights never go out and that people can afford their energy bills.

When I chaired the ICE BIM conference two weeks ago, it was heartening to see such agreement for this shared vision.

The UK BIM Alliance, led by ICE Fellow Anne Kemp, will provide the necessary leadership for industry on this very important issue, and will help us to realise the full benefits of the technology.

I am hopeful that this Alliance will be signed into being, in this building, within the next few weeks.

But what else do we need to do? How can we build upon this progress? What is the next step?

Frankly speaking, we need to take a long, hard and honest look at ourselves.

Last month the Construction Leadership Council, co-chaired by ICE Vice President Andrew Wolstenholme, published the *Farmer Review*, or to use it's more provocative title, "Modernise or Die".

It painted a picture of an industry, parts of which are locked into what it called a *survivalist* mode, rooted in short termism, afflicted by low productivity, low profitability and low innovation.

Now, I don't agree with everything in the report. There is much to be optimistic about in our industry.

But Farmer is right when he says we, as leaders of the profession, need to commit, and I mean really commit, to a radical transformation of how our industry goes about its business.

He is also right that technology and innovation are key to delivering these changes.

McKinsey's recent report on infrastructure productivity said that contractors should be encouraged to use advanced techniques from manufacturing, such as prefabrication and modularization.

While we all know that a lot of progress has been made in these areas in recent years, there is still much more that we can do, and to a good end.

The prize is huge.

McKinsey argue that these measures, among many others, could globally help save one trillion dollars a year and help head off delays and overruns in projects.

There is much we can learn from other sectors, such as aerospace and manufacturing.

Just look at how materials used in airframe construction have changed; how aviation engineers' business models have been changed to meet customer, not industry needs; look at how logistical engineering has transformed manufacturing.

But while we do need to borrow innovations from other sectors, we must *also* remember that we are not the same as these sectors in every way.

Developing a faster jet or more efficient car *is* different from protecting homes from flooding or keeping the traffic moving.

But, other industries do seem to find it easier to take risks and try out new technologies.

Why?

Perhaps because there isn't an entire system failure at risk in doing so; one that could affect whole cities, tax payers' money or a politician's chances of being re-elected.

We are perceived as a risk averse industry and in one respect, this is understandable. We can't put the public at risk by cutting corners.

But even though this is all valid, the questions should then be; how can we take *more* risks *given* these constraints? Why don't we take *more* risks in supporting research and development? Why don't we get *better* at exploiting the results of research that is already carried out?

There is some excellent work in UKCRIC, a government-funded programme that is delivering a *new generation* of infrastructure capital research facilities in leading UK universities.

But we still need to find ways to test new business models and new technologies in a safe environment.

We need to look more closely at vertical integration.

While I am not suggesting monoliths in the industry, we do need to think seriously about some of the benefits these changes could bring for clients and end users.

We must find new ways of exploiting and sharing knowledge.

Engineers must find new ways to inspire trust.

We need to create more opportunities to drive the innovation agenda and to do so harder and faster than we have done to date.

As many of you will already know, I have spent the majority of *my* career in this field, having been concerned significantly with innovation, sustainability and knowledge management in the infrastructure sector.

Over the years I have worked extensively on the development of digital engineering techniques, and on advanced, holistic techniques for assessing the long term sustainability of infrastructure assets.

The thread linking virtually all of my work has been trying to understand the appropriate *use* of digital technology and digital techniques.

How we integrate technology into infrastructure systems to give the public, our customer, the best possible outcome.

Early in my career as Research and Innovation Director at Atkins I was invited to step into a totally new role. R&D was then a poorly understood area in the industry.

So I started with a blank sheet of paper for a job spec. Filling it in required a great deal of trust and collaboration – a culture change in the firm.

The same was true when I became the first CEO of CIRIA and later as Halcrow's R&D Director.

In all these organisations we realised that we must change ourselves, because it would be good for us, good for the people who work for us and, ultimately, good for the whole of society.

As an industry we'd become too used to being provoked into change at short notice by being prodded with a long, pointy stick by government.

R&D – which has innovation at its core - is about removing the need for the stick.

It is about managing the future, by inventing your own future.

I never did fill the piece of paper. And that's how I think it should be. The very essence of innovation is that it continually evolves to meet the changing needs of each firm and the industry as a whole.

But thankfully we have come a long way since the 1970s when we used slide rules and seven figure logarithms.

But changes to date are far less radical than they could be.

We need an even greater cultural shift than I was part of, as well as advances in technology.

We can't continue to constrain thinking or to encumber our profession with outdated process and procedure.

There is now little place in our industry for the intellectually lazy or the unenquiring mind.

Key to effecting this change in our culture, I believe, is putting the customer first in all that we do.

Our commitment to innovation must be wedded to a commitment to the public. The two go hand in hand.

We, the older generation, must make an even greater commitment to the *next* generation.

The great civil engineers of the past were successful because they had in mind a vision for how life for the public could be better.

Whether it was Bazalgette sewers, designed to relieve London of its debilitating health problems, or Stephenson's first ever steam railway line between Liverpool and Manchester, built to achieve cheaper and quicker transport of goods and passengers.

The Liverpool-Manchester line was often described as the "Grand British Experimental Railway", its success or failure was key to plans for all future railways.

Imagine if they decided it was too risky to build?

The project did face opposition from the landowners over whose land it was proposed to pass. It seems like some things never change!

In both cases, and in many others, engineers had an acute sense and understanding of what they could deliver for the public. That was true then and it is true now.

We can see that in the great civil engineers of *our* time.

They have in mind an understanding of what they are trying to achieve, what the problem is they are trying to solve and most importantly, what benefit this would bring to the public.

We know from recent research that the public are more supportive of the need for better infrastructure than we sometimes assume.

But rightfully they want to understand *what* it means to them, *how* it relates to them and *how* their lives will be better.

Will I have more employment opportunities? Can I visit places my family have never been to before? Will my children be safer? Can I afford to buy a home?

These are the questions for which we must show we have answers.

Our digital transformation will help us to meet these challenges.

Fundamentally, its goal is to make people's lives better.

So, we need to shift our thinking to what people *want* and what our society *needs* to thrive.

And we need to create the space where we can innovate in order to meet these needs.

What gives me reason to be optimistic is that I believe we are already living in a *golden age* of infrastructure delivery.

We are getting much better at delivering infrastructure, on time and on budget.

The UK is now seen as a country where projects are managed properly – a real step change from thirty years ago – and each project is getting better than the last.

Clients from all nations look to the UK for best practice on delivering large scale programmes.

Students from around the world are coming to the UK for specialist education on how to deliver major projects.

UCL's Masters Programme covering project and programme management is now substantially over-subscribed, with a significant majority of applications coming from overseas.

This is a key strength – a marketable and exportable commodity. We must not talk it down!

Clients have never before adopted such a collaborative approach.

They have never before shared so much knowledge and experience among themselves, and perhaps more importantly, with the outside world.

ICE has helped drive this change.

Our suite of NEC contracts has been instrumental in facilitating greater collaboration and breaking down the barriers created by more traditional, transactional approaches.

The Infrastructure Client Group - supported by ICE – and the Infrastructure and Projects Authority work tirelessly to improve the efficiency of the construction sector and help deliver major cost savings.

Consequently, this has had a demonstrable, positive impact on the service we offer the public.

It won't surprise you that I believe that the use of digital technology is making a big contribution to this golden age.

While there is no silver bullet that guarantees projects are delivered better, the application of digital tools, techniques and technologies – and just a digital mind-set - will take our industry to the next level.

It will help make sure this golden age lasts long into the 21st Century.

I asked right at the start of my speech what the role of ICE – by which I mean you, its members – must play in *delivering* this vision for a digital future.

The profession, *all of us*, must embrace the rise and importance of new technologies and the profound changes they will bring.

As the voice of infrastructure and as part of our Royal Charter, we will drive and support this vision for a digital future.

The next flagship policy report in our State of the Nation series, due to be launched in the Spring, will focus on digital engineering.

The report will look at the implications of digital on civil engineering and all infrastructure sectors, and therefore for society.

It will examine the potential for radically improved services and outcomes and the interventions from both government and industry that are needed to get us there.

This report will build upon findings that have come through our Industry Transformation Thought Leadership Programme – emerging thinking from around the world on how to deliver and operate high performing infrastructure.

Some of this work is being showcased this evening in the Great Hall, and I want to thank all who have contributed their insights and expertise.

I have argued that digital is not just solely about technology. It is also about having a modern mind-set.

This leads me on to two other issues which I believe are critical to our future success.

We at ICE have always prided ourselves on being a broad church.

We want to be a home and voice for everyone contributing to the engineering, construction, built environment and infrastructure sectors.

Increasingly this includes professionals in firms that we wouldn't normally assume are part of the infrastructure debate – engineers at companies like Google, IBM or Siemens, as well as colleagues in other professions at firms like KPMG and Pinsent Masons, who work alongside us to deliver more for the public.

We join with these professionals to include their ideas and expertise in our work.

The National Needs Assessment, presented to the Chief Secretary to the Treasury just two weeks ago, is an excellent example of our broad church approach to solving some of our big national challenges.

The NNA also showed how important digital engineering will be for the future of our networks.

Each industrial revolution has been based around a transformation of infrastructure. And an infrastructure revolution is under way now, which is enabling smarter delivery and better use of services.

The NNA showed that the future will not always be about building more things, but it will be about applying technology to use our infrastructure more efficiently.

ICE has also used a broad church approach when making the case for infrastructure at a time of great change – as the Government negotiates our withdrawal from the European Union.

It is still unclear what Brexit will mean for the construction sector, and this is not just a concern for those of us in the UK. It was an issue that came through strongly during my recent visits to Malaysia and the Middle East.

ICE's pan-industry "Brexit Infrastructure Group" and our support for the Royal Academy of Engineering's parallel work across all engineering disciplines, has gathered wide-ranging expertise with the aim of better informing the UK's negotiations.

Politicians and officials must be equipped with the facts on the challenges and opportunities for the sector.

Contrary to what Michael Gove has said, people *do* want to hear from the experts!

We have a responsibility as professionals to offer support and advice. I was inspired by the way the industry has come together to work for the common good.

And as part of this debate we should be very clear: fundamentally, we are a global industry with global supply chains. Therefore we *must* remain globally competitive

The UK should not walk away from practices which create a common framework for trade, and help us to do business - not only across Europe, but all over the world.

ICE has been supporting the development of infrastructure around the world for over two hundred years. There is no reason why this should change.

Our record on transparency and fair procurement processes signifies the strength of the UK market. I see no reason why this will not continue.

Our professional qualifications are globally recognised. This will not change.

While we recognise that we have a capacity challenge now, we also need to be confident that we can attract the right skills in the future.

The economic benefits of our industry and that of effective infrastructure are well established.

It boosts economic growth, rebalances the economy, creates jobs, regenerates communities, connects people and places and underpins environmental sustainability.

So now, more than ever, the case for infrastructure must continue to be made.

And that case has, and will, be made by ICE and its members.

Another way we can benefit society is by communicating the *value* of civil engineering and changing the *perception* of what a civil engineer does.

As part of the refurbishment of this building over the summer, ICE has created an “Infrastructure Learning Hub” - a new exhibition space to showcase our work to the public.

This has been made possible by generous donations from many and, on behalf of ICE, I would like to offer our sincerest thanks and gratitude.

You will see that the first exhibition, on bridges, tells the story of civil engineering through some of our most iconic creations.

This will be the first of many different types of stories we will tell about the contribution that civil engineers make to society.

Oh, and we’ve also built the world’s longest Lego bridge!

This is with the aim of inspiring the *next* generation of civil engineers.

We have already had 1500 people through our doors to see it, and over 10,000 views online.

If *you* haven’t had a chance to see it yet, I hope you will enjoy the exhibition – including the bridge - during the drinks reception later this evening.

But please, don't remove any souvenir pieces of Lego!

One other area of the ICE that not many people know about is the Benevolent Fund, a charitable arm that supports civil engineers from all walks of life, who find themselves in times of hardship and distress.

It is our way of giving back to those who help to shape the world around us.

Programmes such as these are just a few of the ways the ICE pools its resources to support civil engineers, and promote all the benefits we bring.

We also need to change the perception of *who* a civil engineer is.

Women represent twelve per cent of ICE's total membership. Female applications are rising slowly, with twenty one per cent of UK students and new graduates being women.

This year, thirteen members and fellows of the ICE featured in the Telegraph's top fifty women in engineering poll.

The recent James Rennie Award, which recognises the best Chartered Professional Review candidate of the year, this year, saw an all-female final.

This is the first time in the medal's history that three women finalists have been selected from over a thousand candidates as being the best in the industry.

Sonja, Victoria and Olivia between them have made some remarkable achievements, working on inspirational projects across the world.

They symbolise how the face of our industry is changing.

I hope it also shows that one day we can aspire to close down any remaining awards or schemes that are specifically for women, because there won't be any need for them!

One day, hopefully soon, women will automatically be reflected in all areas of the industry.

At the moment, however, the UK still has the lowest percentage of female engineers in Europe - less than ten per cent across all disciplines.

Latvia, Bulgaria and Cyprus have nearly 30%.

We all recognise that any organisation will be *stronger* if it can draw from a wealth of different experiences, and will better serve society if it reflects the diversity of our communities.

We all believe that engineering *solutions* are best delivered by multi-disciplinary teams of men and women, from different ethnic backgrounds and sexual orientations, all working creatively together.

I am proud that ICE is leading by example.

We are developing internship programmes for engineers returning to work after raising children.

We are working with employers and schools to make sure the industry attracts talented people from all backgrounds.

We are pushing on with our ambitions to increase our international membership by ten per cent, year on year.

In fact, two of my own president's apprentices this year are from outside the UK - based in Malaysia and the United Arab Emirates.

And 50 per cent of my apprentices are women!

And they are not all from London and the South East!

We will continue to adopt ICE Fellow, Dawn Bonfield's philosophy; to be inclusive and think: I am not different *from* you. I am different *like* you.

There are many people around the world who work day in, day out to deliver the infrastructure their communities need. And only some of them are civil engineers.

I want ICE to play the greatest possible role in driving the transformation I have been describing.

This means embracing all the professionals involved in our industry – colleagues from law, finance, environmental science, computer science – the list is endless.

This year our Council agreed to create a new Associate Membership to give *all* these colleagues a home at ICE.

So a personal message from me.

For those of you who want to be part of the Institution, but are not a practising civil engineer, you are most welcome to join us.

Especially as we undertake this new *digital* journey.

I'd like to conclude by stealing a phrase from someone who really did lead the way in innovative thinking.

Steve Jobs said that if you want to *be* the future, you have to *invent* the future.

To engineer a digital future, it means *we* have to invent our *own* future.

Now I recognise the cliché in using Apple as an example, but I do so because there is *truth* in it and it is perhaps the *best* example of what we should be trying to achieve.

Apple didn't just create a phone which used the latest technology.

They created a new *platform* for innovation, with all the economic and social opportunities that have followed.

They were quite comfortable that even *they* did not understand its full potential.

When we build an infrastructure asset we should be equally open to the idea that we don't know with any certainty how it will be used in twenty-five, fifty or a hundred years' time.

This should give us an even *bigger* incentive to be inventive.

If we want to develop smart, agile infrastructure that adapts to our changing needs, then we need to think smart.

We cannot transform our built environment, without being transformative in our thinking.

We cannot foster innovation in our industry, without adopting innovative techniques.

We won't be able to meet society's changing expectations, without using modern technology.

The industry has a fundamental opportunity – a fundamental *responsibility* – to help address this issue in order to help society thrive.

The Institution stands for shaping a better world – that is what we are about and that is why we are here.

It is our job to push our industry to take on and deliver the difficult challenges.

There is no agenda more difficult, or none that will define our industry for generations to come, than this one.

It will be hard. It will be disruptive change. And it will certainly last longer than just my one year in office!

It will be up to many of you listening tonight to pick up that baton.

We need to commit wholeheartedly to making a digital future *our* priority.

That is what I, and the Institution of Civil Engineers, plan to do over the next year.

Come with us.

Thank you.