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Reinforced Composite Pipelines in New Zealand - a case study of the adoption of new technology

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Context

- As a consultant and contractor, it is important you understand your customers business challenges.
- Our customers were telling us gathering pipelines were too expensive
- Our international experience told us it was feasible to use flexible pipelines, but we also knew NZ regulations wouldn't allow it.
- WorleyParsons set about solving the issue by engaging with the regulator and the major players in the NZ oil and gas industry to understand and mitigate the actual and perceived barriers for the use of this product.
- This presentation shows the process the group followed and what was achieved. It also illustrates the role of how the right consultant or contractor can lead changes in the industry that respond to the customers' business needs.

Overview

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- Reinforced composite pipelines (RCP)
- The case for deployment in NZ
- Compliance against the Australia /New Zealand pipeline standard AS2885
- Case study analysis and engineering review
- Design certification and the accrediting of specialist competencies
- Getting clever in managing regulatory risk.

Reinforced Composite Pipelines

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- Globally, reinforced composite piping RCP is a mature technology both onshore and offshore.
- There are well recognised product standards existing dating back to 1996.
- The use of RCP has been specifically written into overseas pipeline standards with supporting technical requirements and industry guidelines.

The key issue therefore is achieving code compliance and certification of these materials in the New Zealand context, and regulator / industry acceptance

Reinforced Composite Pipelines

NZ Regulatory basis for the pipeline certification encompasses jurisdiction under two NZ regulations:

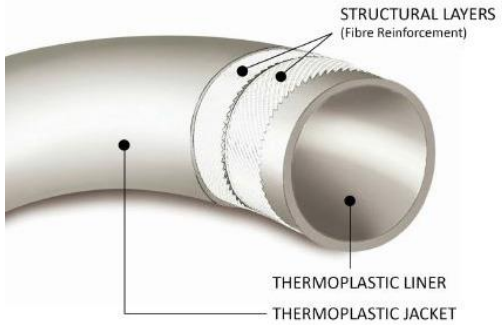
- the Health and Safety in Employment (Petroleum Exploration and Extraction) Regulations 2013.; and
- the Health and Safety in Employment (Pipelines) Regulations 1999.
  - the use of RCP is compliant with the Regulations via sub-clause 8(1) (a), where AS2885 is nominated as an applicable standard.
  - Requires appropriate requirements be established to replace the provisions related to nominated standards for materials, fracture control, stress and strain, welding etc.

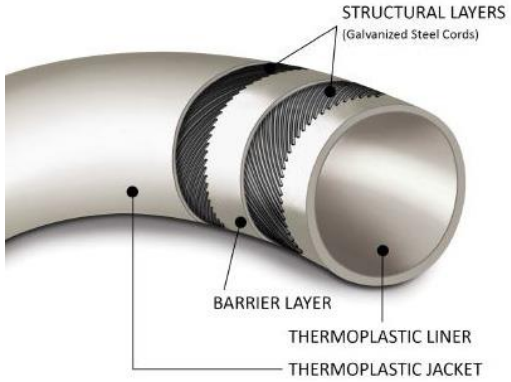
The key role is that of IANZ: - the accreditation agency responsible for Inspection Bodies and establishing accreditation requirements specific to RCP installations.

Reinforced composite pipelines

RCP is available in two types:

- spoolable composite pipe (SCP), and
- reinforced thermoplastic pipe (RTP).





The Case for Deployment in NZ

Key question - Can we do better?

Application of RCP for onshore petroleum development offers:

- Potential savings in capital and operating costs versus traditional steel pipelines. Reduced ownership costs.
- Additional benefits from being able to gather associated gas from producing oil fields, where this is otherwise sub-economic. Reduced Flaring.
- The likelihood of increased reported economic reserves by extending marginal field developments.

Both public and private benefits: win-win situation

The Case for Deployment in NZ

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Economics – hypothetical test case

An overall saving of:

- 30 percent in capital costs
- 40 percent reduction in construction time.

Extrapolating over current known proposed or future field developments suggests potential savings of up to $NZ1 million over conventional construction methods for a 10km pipeline across typical terrain and operating conditions.

The Case for Deployment in NZ

Despite being a “mature technology” not possible to obtain necessary certificate of fitness for operation under regulations due to the lack of specific regulatory recognition and due to the novel status of the materials and the absence of any “NZ experience” .

An industry study mooted to carry out:

- Initial research to finalise engineering requirements for safe and economic operation
- An AS2885 compliance study to establish possible areas of non-compliance, and other assessed threats
- Risk review and technical review of mitigation strategies to establish a model Pipeline Inspection and Test Plan ready for certification, and
- A case study for the purposes of developing a Safety Management Study and Pipeline Design Report for industry peer review and **regulator consultation.**

An industry study undertaken with support from PEPANZ and Callaghan Innovation

Compliance against the Australia /New Zealand Pipeline Standard AS/NZS 2885

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- The primary standard that pipelines in New Zealand are designed, constructed, tested and operated under is the AS/NZS 2885 set of Standards;
- Allows the use of alternative materials under Clause 1.3 provided that the appropriate requirements can be established in relation to nominated standards for materials, fracture control, stress and strain, and corrosion etc.;
- This requires detailed engineering evaluation, appraisal against relevant engineering codes or standards and detailed safety and risk reviews.

To do so is a non-trivial task and requires;

- Careful evaluation of engineering requirements for construction, operation and ongoing maintenance;
- Development of a formal Basis of Design and Pipeline Design Report suitable for certification by the appropriate inspection bodies and the regulatory authorities.

Meeting the Pipeline Standard Requirements AS/NZS 2885

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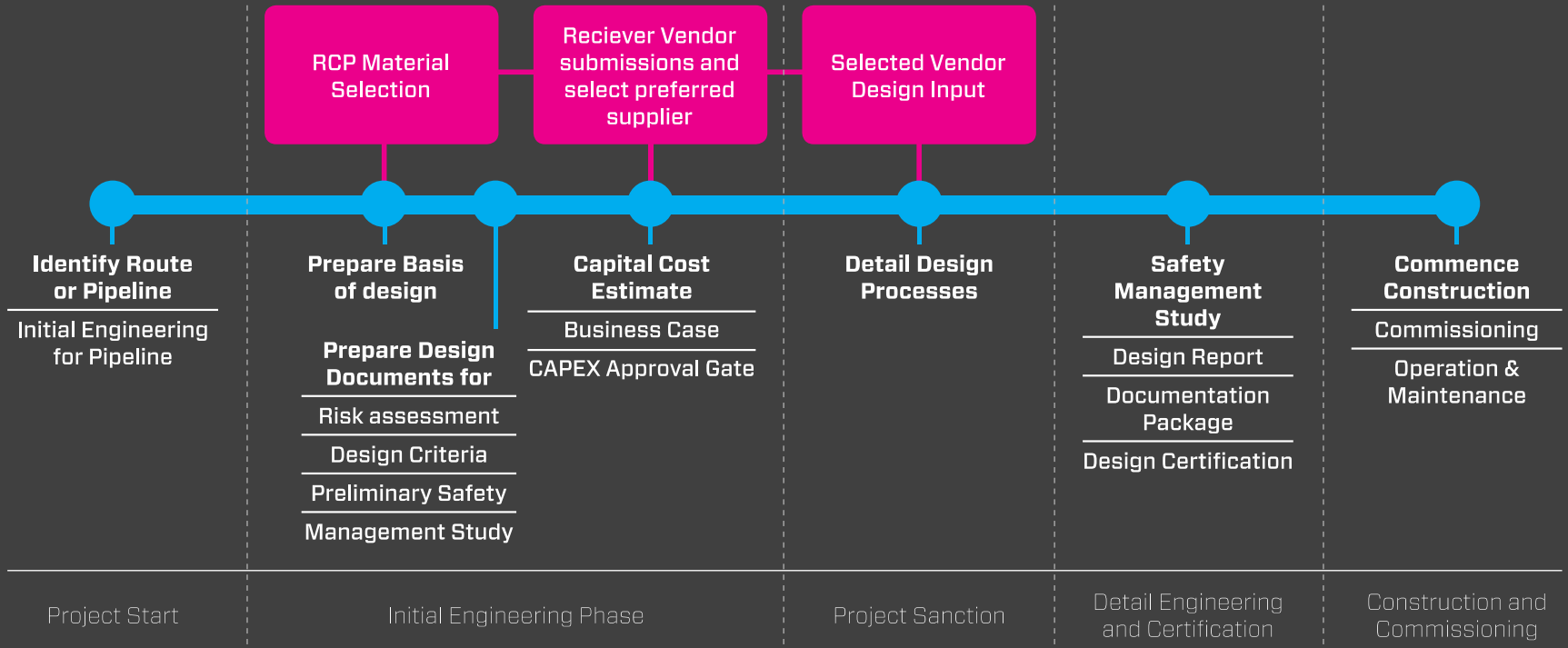
Conventional approach: • Vendor involvement • Regulator assurance



Compliance against the Australia /New Zealand Pipeline Standard AS/NZS 2885

A clause-by-clause review of AS/NZS 2885:

- Detail of this analysis is described in the Project Technical Note and the various companion reports produced during the course of the study.
- Regulator concerns were performance of both the pipeline material and jointing materials under seismic loadings, landslip and other potential seismic loss events.
- The research showed that the seismic guidelines published by the Pipeline Research Council International (PRCI) offered a suitable design resource that could be adapted for the design and seismic evaluation of RCP pipelines.
- The Guidelines provide a detailed framework easily adapted by first principles to allow a pipeline engineer to undertake the required seismic design and assessment to a standard that would fully satisfy NZ seismic loading standards.

Overall conclusion:

- RCP pipelines are compliant with the HSE (Pipeline) Regulation 1999 via sub clause 8 (1) (a) where AS2885 is the nominated applicable standard.

Case Study Analysis and Engineering Review

A hypothetical case study of a NZ RCP pipeline application:

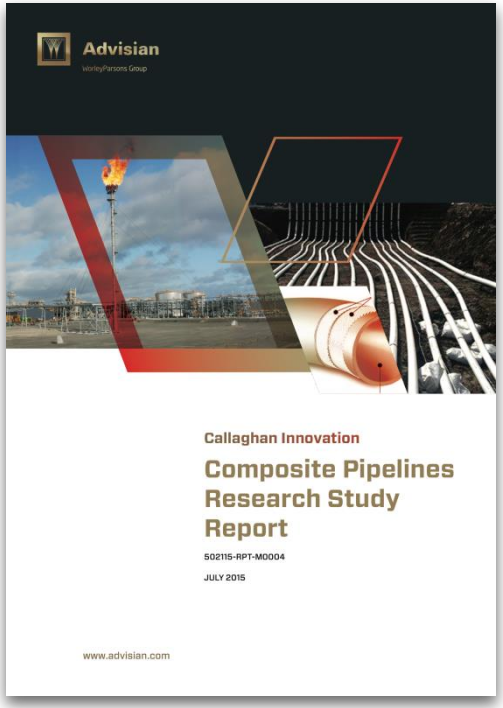
- A desk top risk assessment
- looked at ways in which the additional risks could be mitigated in line with code requirements
- risk study findings confirmed as part of the case study Safety Management Study

Safety Management Study:

- Verification that the integrity of any pipeline made from RCP could be assured over the life of the pipeline.
- Involved two work streams;
  - research into current practices in Canada and North America (undertaken by WorleyParsons Canada), and
  - an evaluation of how these methods would work in New Zealand (undertaken by Core Group)

Important component was a series of workshops with industry participants to complete development of the test case and the Safety Management Study.

Case Study Analysis and Engineering Review



- Engineering review showed that RPC pipelines could be managed in a similar way to that of a conventional steel
- The only identifiable difference in the controls proposed for RPC pipelines, when compared with steel pipelines, relate to the in-line inspection of the pipeline systems
- Proposed application limitations :
  - Maximum Operating Pressure 99 BARG
  - Maximum Operating Temperature 60C

Design Certification and the Accreditation of Specialist Competencies

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- One of the major inherent risks when introducing new technology is novelty and lack of expertise in respect of pipeline installation (construction) and ongoing maintenance and operation.
- New methods are required and standard operating procedures need to be revised to accommodate different circumstances or requirements.
- Technology transfer and knowledge diffusion to NZ practitioners is the key to deployment and regulator confidence.
- In this case our ability to demonstrate constructability and engineering controls was an important component.

PEPANZ
PETROLEUM EXPLORATION & PRODUCTION ASSOCIATION OF NEW ZEALAND

PEPANZ has an important role in facilitating the 'conversation' between parties, but – ***engineering lead***

Managing Regulatory Risk

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The study was important in:

- Identifying potential institutional barriers to the deployment of new technology
- Developing the engineering basis for regulatory review and technical accreditation
- Establishing the technical understandings and risk horizons necessary for industry acceptance of the technology.

Collaboration between operators, the service sector and government regulators is an essential attribute for successful innovation and market uptake

Future steps…

WorleyParsons is committed to :

- Continuing to work with industry players to identify deployment opportunities for composite pipeline systems
- Supporting IANZ and service providers to ensure accreditation and code compliance, and
- Liaising with RCP product manufacturers to ensure familiarisation with NZ regulatory requirements.

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Reports are publically available:

Composite Pipelines: Technical Note – Adoption of Reinforced Composite Piping In New Zealand Petroleum Field Developments, WorleyParsons New Zealand Ltd., 502115-TCN-M0001, June 2015

Source of Ideas or Information for Innovation

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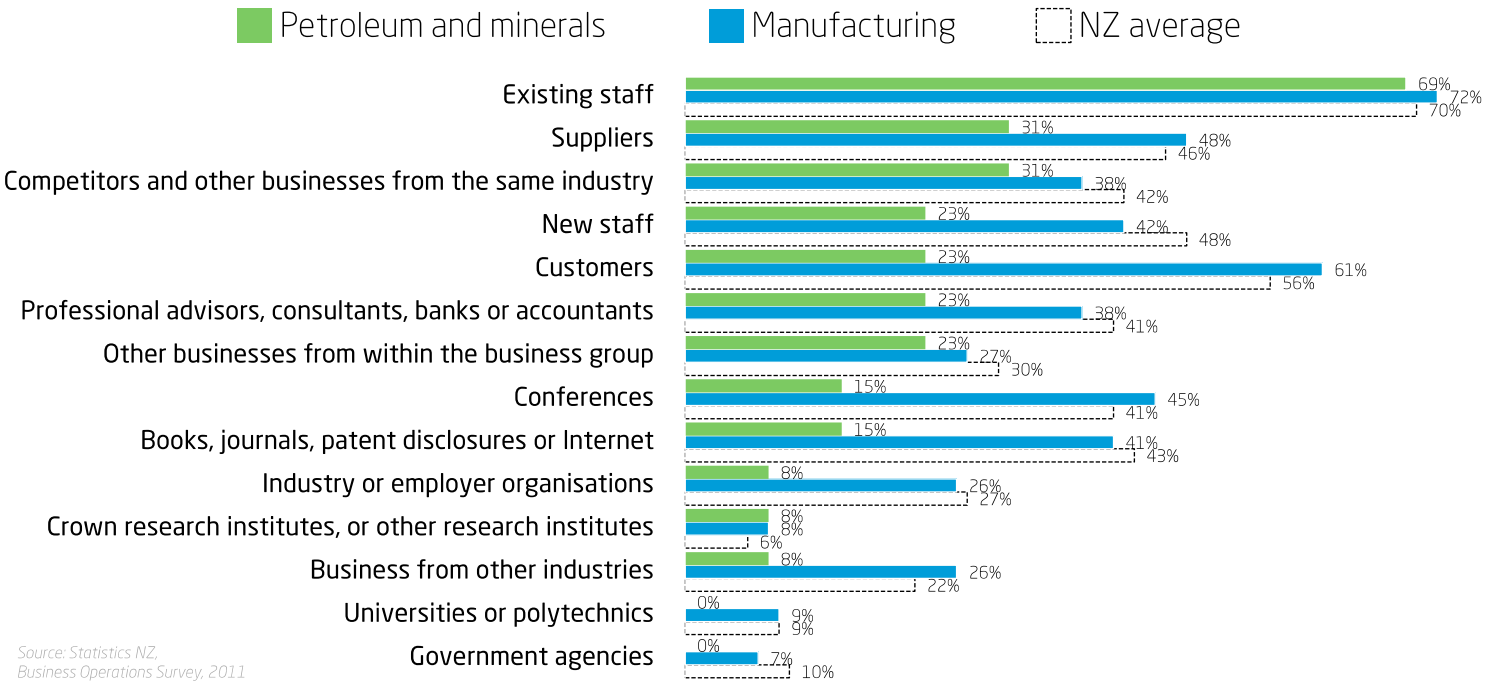
MBIE 2013 Petroleum sector report

% of firms reporting each source; 2011



Source: Statistics NZ, Business Operations Survey, 2011