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NIA Project Registration and PEA Document

Date of Submission

Mar 2018

Project Reference Number

NIA_CAD0021

Project Registration

Project Title

Automated Pipeline BIM Modelling and Cost Estimating Tool – Stage 2

Project Reference Number

NIA_CAD0021

Project Licensee(s)

Cadent

Project Start

March 2018

Project Duration

1 year and 9 months

Nominated Project Contact(s)

Cadent Innovation Team

Project Budget

£612,657.00

Summary

The aim of this project is to build on the business requirements that were established in the “Automated Pipeline BIM Modelling and Cost Estimating Tool – Stage 1” project to develop an automated design software platform, delivering fully costed BIM models for the permanent and temporary works required for >7bar pipelines and diversions.

BIM is a collaborative structured process that is used to assist the strategic planning, design, construction, operation and maintenance of a building or infrastructure project. BIM software and technology facilitate the exchange and interoperability of the information gathered during the life of the project in a structured and intelligent manner. It also provides an opportunity to challenge the current design process and produce a design that not only meets our stringent safety requirements but also provides optimum cost and carbon efficiencies.

This project aims to develop an automated HP steel pipeline design tool, negating the need for external design consultants and dramatically reducing the time and cost required to respond to customer requests. The proposed tool will deliver 3D pipeline design models, utilising additional BIM dimensions to deliver cost, programme and carbon impact estimates in “real time”, and allowing optioneering of multiple route corridor options to ensure the optimum route is selected.

BIM is becoming increasingly ubiquitous in industry. However, historically, Cadent have had no in-house BIM expertise and this innovative project may have the added benefit of paving the way to realise the benefits that BIM technology can bring to the business and to our customers.

Nominated Contact Email Address(es)

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Problem Being Solved

Cadent Gas has to process hundreds of requests each year for pipeline diversions and demand reinforcements necessitating new pipeline infrastructure. Cadent Gas utilise established “in house” design and cost estimating software solutions for MDPE pipelines, however due to the relative complexities the existing solutions aren’t suitable for the design and cost estimation of >7bar steel pipelines.

The development of route corridor options and subsequent optioneering to determine the optimum pipeline route for >7bar pipelines is time consuming, costly and requires the engagement of external design consultants.

Method(s)

The aim of this project is to build on the business requirements that were established in the “Automated Pipeline BIM Modelling and Cost Estimating Tool – Stage 1” project to develop an automated design software platform, delivering fully costed BIM models for the permanent and temporary works required for >7bar pipelines and diversions.

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Scope

The scope of this project is to develop an automated design software system for >7bar pipelines and diversions, capable of delivering 3D “end to end” BIM models for the permanent and temporary works, Capex and Opex cost estimates (+/- 25% accuracy).

The project will comprise of the following phases;

1. The development of a software platform, capable of automating design calculations from basic user inputs and “stitching” together BIM component models to produce an “end to end” pipeline BIM model, including temporary works requirements.
2. Development of a library of BIM model components for >7 bar pipelines
3. “Proof testing” against a number of historical >7bar pipeline projects

1. Development of an automated >7bar pipeline design software application

This project aims to develop a software platform, capable of modelling pipeline routing information to deliver a fully designed “end to end” BIM model of the pipeline routing, entered through the user mapping interface. The pipeline design platform will be developed with a simple user interface, allowing engineers to route pipelines and diversions onto a mapping interface. The software will be preloaded with the >7bar pipeline design codes, standards and user specific specifications and requirements. The system will utilise default settings for extraneous variables to the pipeline, such as crossings, environmental features, ground conditions and 3rd party apparatus. The system will be designed to allow the user to edit default settings once detailed data is generated during the development stages of the project. The platform outputs will be a detailed “end to end” scope of pipeline and temporary works components. The application will select BIM models from a BIM components library and “stitch” the component BIM models together to produce an “end to end” BIM model of the pipeline. The software application will deliver Capex costs, Opex costs and carbon impact estimates, derived from metadata tagged to the individual BIM components, making up the pipeline BIM model.

2. Development of a library of BIM model components for >7 bar pipelines

The project will develop a library of BIM model for all >7bar pipeline components, building on the knowledge and expertise gained from previous NIA BIM projects undertaken by National Grid Gas Transmission. This will include every type of component utilised in the design of >7bar pipelines, including pipe, fittings, valves and connections. Each component BIM model will be parametrically modelled, allowing tailored models to be developed based on dimensional outputs from the design software platform. The library will be developed using a WBS structure accommodating interface with the design platform. Each BIM component will contain metadata to allow the cost and carbon impacts to be developed in the design software platform.

A library of temporary works models will also be developed. This will include items such as working width layout, box outs for crossings, crossing pits etc. Again, temporary works BIM models will be parametrically designed and tagged with metadata to allow cost and carbon impacts to be developed in the software platform.

3. “Proof testing” against historical >7bar pipeline projects

A detailed programme of progressive testing will be undertaken during the development of the software. It will also be tested against a number of historical projects (recently constructed >7bar pipelines) which will be defined and agreed with the project team. The “as built” pipeline route will be uploaded onto the software platform and the design outputs analysed against the “as built” design and outturn project costs.

Objective(s)

- To automate the design process for >7bar pipeline route corridor studies, allowing route corridor studies to be developed by “in house” engineers negating the requirement for external design consultants.
- Potential for positive impact on customer perception.
- Build on previous NIA projects to deliver a qualified tool capable of deployment within Cadent Gas Capital Delivery.
- Proven potential to improve levels of customer service by reducing the time required to develop an >7bar pipeline route corridor

study (currently 6 – 12 months) to <3 months.

- Develop an automated software system capable of producing cost estimates for >7bar pipeline diversion with an accuracy of +/- 25%. The usual cost estimating accuracy for a feasibility study produced by an external design house is +/- 30% of the final 'as built' cost, and this reduces to approximately +/- 25% at the conceptual design stage. The accuracy of the cost estimate produced by the software platform will be dependent on the level of site information inputted, however it will target a +/- 30% accuracy in the initial feasibility stage which could improve to +/- 15% if detailed site information is input in the conceptual design phase i.e. ground information, 3rd party crossings.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Successful testing of a software system which will deliver the following outputs for >7bar pipeline and diversions;

- Fully designed "end to end" BIM models for the permanent works
- BIM models detailing temporary works requirements
- Capex cost estimate for the pipeline route corridor (+/- 25% accuracy)
- Opex cost estimate for the pipeline (+/- 25% accuracy)
- Carbon impact information (embodied and total carbon impacts)

Project Partners and External Funding

Cadent Gas Ltd – 100% NIA Funding

- Aqua Consultants - £427,435
- Internal Allowance - £142,478
- Contingency - £42,744
- Total: £612,657

Potential for New Learning

There are currently no automated design platforms for >7 bar pipelines and diversions. Furthermore, designing pipelines and diversions using BIM instead of conventional design processes will provide a platform for digitalisation of asset management going forward. This software has the potential to revolutionise not only Cadent's cost estimating approach for pipeline diversions but it could lay the groundwork for a technology led asset risk approach going forward.

Scale of Project

A key part of this project is building and robustly testing a viable system which will build stakeholder confidence and lay the groundwork for Cadent's BIM transition.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project will be delivered from the Aqua Consultants facilities in Bradford and be operable across the Cadent networks.

Revenue Allowed for the RIIO Settlement

No revenue allowed for in the RIIO settlement.

Indicative Total NIA Project Expenditure

£612,657

Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

n/a

How the Project has potential to benefit consumer in vulnerable situations:

n/a

Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

Currently, the cost of designing pipeline diversions is passed through directly to our customers with a typical design costing c. £130k and this is expected to significantly reduce with this software. When the Cadent benefits tracking methodology was applied, this resulted in a positive business case.

Please provide a calculation of the expected benefits the Solution

Cadent Gas has 50+ >7bar pipeline diversions to construct over the next 10 years for the HS2 scheme. Furthermore we receive an average of 25 applications each year for reinforcements and diversions of the existing >7bar network. Each pipeline design costs on average C. £130k in external design costs in total. By removing the need for external design houses in the initial phases of a project, we anticipate being able to pass some of these savings onto our customers.

Cadent have just completed 3 such projects and have another 3 coming up. The average cost for a feasibility study is c. £35k with the cost for a conceptual design increasing to between c. £60k - £130k as above. Taking into account that not all projects will progress past the feasibility stage, it is assumed that this software will save Cadent an average of c. £60k per project. Assuming an average of 2 Cadent directly funded projects per year over the next 10 years, it is estimated that this software will save Cadent c. £120k annually in addition to the customer savings highlighted above.

Please provide an estimate of how replicable the Method is across GB

Applicable to all network licensees required to design >7bar pipelines and diversions as part of their operations.

Please provide an outline of the costs of rolling out the Method across GB.

Preloading BIM design platform with network shape files and user specifications, estimated at £25,000.

Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

- A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify repeating it as part of a project) equipment (including control and communications system software).
- A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)

- A specific novel operational practice directly related to the operation of the Network Licensees system
- A specific novel commercial arrangement

RIIO-2 Projects

- A specific piece of new equipment (including monitoring, control and communications systems and software)
- A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven
- A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)
- A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology
- A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution
- A specific novel commercial arrangement

Specific Requirements 4 / 2a

Please explain how the learning that will be generated could be used by the relevant Network Licensees

The automated design platform developed by this project can be adopted and utilised by all GDN's in delivering >7bar pipeline and diversion projects within their networks.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

This project supports Cadent Gas' drive to serve our customers efficiently and effectively.

- Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

Is the default IPR position being applied?

- Yes

Project Eligibility Assessment Part 2

Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

BIM has not been used to produce an automated design and costing tool for the gas industry.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

n/a

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

The project is innovative for a number of reasons, the primary one being that a design and costing tool using BIM has never been built for the gas industry before. The project was initiated when Aqua Consultants approached Cadent Gas' Capital Delivery team with the idea to develop an automated design and costing tool to assist with the initial stages of a pipeline diversion design.

Relevant Foreground IPR

n/a

Data Access Details

n/a

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

Although the potential for cost saving has been demonstrated there is still a high degree of risk associated with the project and, as such, Cadent Gas is unable to fund the project as part of it's business as usual activities.

Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project

As stated above, there is a high degree of risk associated with the project which prevents Cadent from funding it as part of its business as usual activities. Some of these key risks are: • Software and associated data may not deliver the required (and expected) level of accuracy consistently to give confidence that traditional design methods can be replaced. • Software interfaces with proprietary software applications. • Unachievable customer expectations. • Scope creep. Mitigations plans will be put in place to manage these risks as the project progresses.

This project has been approved by a senior member of staff

Yes