Concrete/Steel Structures - OFGEM Justification Paper	
Name of Scheme/Programme	Concrete/Steel Structures
Primary Investment Driver	Civil works driven by condition of civil items
Scheme reference/ mechanism or category	SPNLT20100
Output references/type	NLRT2SP20100
Cost	£6.2m
Delivery Year	2021-2026
Reporting Table	Tables C0.7 and C2.2a AP and C2.2a CI
Outputs included in RIIO T1 Business Plan	No

Issue Date	**Issue No**	**Amendment Details**
July 2019	Issue 1	First issue of document
December 2019	Issue 2	Amendments to volumes, costs and references to the NIA project added.

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1 Introduction

Civil structures used to support the main electrical equipment are essential to the safe operation of the transmission system. The condition of the structures can have a bearing on the strategy for the management of the electrical assets and long term stewardship of civil assets is a key priority.

At sites where there are no major load or non-load works planned it is proposed to undertake remedial works to ensure the service life of these existing structures is maximised.

This paper supports a proposal to undertake a programme of works to refurbish existing concrete and steel structures where they are in poor condition. This programme of works will implement the findings from one of our RIIO-T1 NIA[1] projects - 'Reuse of Existing Concrete Assets'.

2 Background Information

Civil structures are classed as non-lead assets and are not within the scope of the NARM mechanism. However, SPT have an asset management system in place to ensure that these assets are inspected, recorded and managed from a risk perspective. There are two types of structures primality used with the SPT network.

2.1 Concrete Structures

There is a large asset base of concrete structures across the network. These structures were generally constructed in the 1960s and 1970s and, with minimal or no maintenance undertaken to date, have reached or are approaching the end of their service life. However it has been identified that the service life of these existing structures can potentially be extended by testing the structures, identifying the defects, and then undertaking remedial works which target these defects.

A comprehensive programme of civil inspections has been undertaken across the network and it has been identified through these inspections that at a number of sites the concrete structures are in a poor condition and without intervention will degrade to a point where they cannot be repaired and will fail.

2.2 Steel Structures

There is a large asset base of steel structures across the network. In the 1970s there was a shift from using concrete structures to steel structures. These steel structures were galvanised with a sacrificial layer of zinc which when fully corroded leaves the base steel exposed. Based on information from the galvanisers association this galvanising layer can be expected to last approximately 40 years.

The actual remaining thickness of the galvanised layer depends on the environment the structure has been exposed to since it was constructed, however as the structures have had minimal or no maintenance undertaken to date the older structures on the network are approaching point where the galvanising layer has almost corroded away.

A comprehensive programme of civil inspections has been undertaken across the network and it has been identified through these inspections that at a number of sites the steel structures are in a poor condition and without intervention will degrade to a point where they cannot be repaired and will fail.

[1] SPT NIA Project https://www.smarternetworks.org/project/nia_spt_1606

3 Optioneering

The following is a summary of the options considered for this Programme. The respective associated drawings for each of these options are available for review if required.

	Option	**Status**	**Reason for rejection**
1	**Do Nothing**	Rejected	Through our detailed Inspection process it has been determined that no intervention will lead to failure of the assets.
2	**Replace**	Rejected	Replacement of civil structures outside the normal cycle of switchgear replacement is impractical and uneconomic. Therefore this option was rejected.
3	**Refurbishment**	Proposed	-

4 Detailed analysis

4.1 Selected Option

SPT has a strategy with civil assets to visually inspect annually and intervene when asset condition requires. This has been a historical approach as concrete and steel structures have been seen as maintenance free and expected to be replaced in line with the main asset it supports. As the life of the main plant has been extended through evolution in technologies, mid-life interventions and improved maintenance regimes, the required life of the associated civil structures also requires to be examined.

As part of the RIIO-T2 submission, SPT undertook condition assessments of 90 sites constructed prior to 2000, to determine the health index of the Civil Assets and to allow the development of a programme to deliver targeted refurbishment of the civil assets either at or approaching end of life, to ensure no in-service failures.

These sites were selected as it was acknowledged that any site constructed post 2000 would use structures that would only just be approaching mid-life at present and as such should not require any interventions at this stage. SPT will continue to develop its proactive programme of civil asset management to ensure that all civil assets are planned for a whole life management. This programme of works will be the first step in a revised asset management policy to ensure life extension of civil assets.

4.2 Condition Assessment

4.2.1 Methodology Approach

SPT put in place a methodology to determine what refurbishment works are required, and that a consistent and structured approach is followed for each assessment.

This methodology was determined in our RIIO-T1 NIA project - 'Reuse of Existing Concrete Assets' and has been adapted to consider steel structures. The overall methodology considers:

- The condition of the existing concrete or steel structure. This condition assessment will include some or all of the following:
    - Visual inspection;
    - Concrete testing;
    - Structural analysis.
- The need for refurbishment for an extended service life;
- The extents of repairs and/or strengthening required;
- The whole life costs for refurbishing the concrete structure to extend its service life.

From the comprehensive programme of civil inspections a number of structures across a number of sites have been identified through visual inspection as being in poor condition and in need of refurbishment.

4.2.2 Outputs from Assessment

Through this detailed and comprehensive inspection of 90 sites SPT has been able to determine a Health Index for all of the civil assets on each site. These 90 sites, cover approximately 21,000 civil

assets, each of which has been assigned a Health Index consistent with the standard SPT range of 1 to 5. Health Index 1 is considered to be new or as new and Health Index 5 is end of life.

Through these inspections a number of structures across these substations have been identified as being in Health Index 4 or 5. This means that the assets are either at or approaching End of Life and in need of refurbishment within RIIO T2.

The table below provides a breakdown of the volumes associated with these refurbishment works.

Voltage (kV)	No of Concrete Structures	No of Steel Structures	Total
132	132	68	**200**
275	95	28	**123**
400	1	9	**10**
Total	**228**	**105**	**333**

4.3 Sustainability

The SPT sustainability approach is to prioritise reuse, then refurbish and finally replace if there is no other option. The refurbishment of the existing structures is a sustainable strategy and in the long term will lead to a significant reduction in the volumes of raw materials associated with new concrete and steelwork. It will also eliminate the need to dispose of the concrete and steelwork associated with these old structures.

4.4 Innovation

Innovation is a key component to deliver developments in all aspects of work. This programme of works will incorporate the findings from our RIIO-T1 NIA projects - 'Reuse of Existing Concrete Assets'. While the technology used in the project will be standard with a proven track record and the application adopted in line with industry standards, SPT will look to use innovate ways of project delivery and installation to deliver this programme of works.

5 Conclusion

The historical approach to civil structures as assets which are maintenance free and replaced with the associated plant at end of life is no longer a valid investment strategy. This is due to the development of mid-life refurbishments and improved maintenance of the main plant equipment. SPT have undertaken a comprehensive programme of condition inspections to identify which assets require to be refurbished. This will be the first step in a revised asset management policy to ensure life extension of our structures.

The proposed solution delivers a programme to ensure that the life and condition of the structures is in line with the plant that it is supporting.

- Forecast costs: £ 6.2m
- Timing of investment: 2021-2026
- Declared outputs: N/A

6 Future Pathways – Net Zero

6.1 Primary Economic Driver

Civil structures used to support the main electrical equipment are essential to the safe operation of the transmission system. It has been identified that some of these structures are in poor condition and the primary driver for this investment is to ensure that these structures are refurbished such that they can continue support the electrical equipment.

6.2 Payback Periods

The project is related to existing substations whose ongoing need has been confirmed.

6.3 Pathways and End Points

To extent the service life of these existing structures it is proposed to undertake this refurbishment programme. This is a sustainable strategy that will eliminate the need to dispose of these existing concrete and steel structures.

6.4 Asset Stranding Risks

The project is related to existing substations whose ongoing need has been confirmed.

6.5 Sensitivity to Carbon Prices

The project is related to existing substations whose ongoing need has been confirmed.

6.6 Future Asset Utilisation

To extent the service life of these existing structures it is proposed to undertake this refurbishment programme. This is a sustainable strategy that will eliminate the need to dispose of these existing concrete and steel structures and will ensure these structures can continue to support the electrical equipment.

6.7 Whole Systems Benefits

To extent the service life of these existing structures it is proposed to undertake this refurbishment programme. This is a sustainable strategy that will eliminate the need to dispose of these existing concrete and steel structures and will ensure these structures can continue to support the electrical equipment.

7 Outputs included in RIIO T1 Plans

None.