

**Scheme name: A47 Blofield, A47 Thickthorn, A47 Tuddenham, A47 Wansford**

**Category:** Design

**Scheme context:**

The development of four major highway improvement schemes on the A47 corridor through PCF Stages 3 to 5, carried out as part of the Regional Delivery Partnership (RDP), Lot 7 – East.

**Case Study details:**

This case study has been written to summarise the work done to date by Galliford Try in relation to their Tender Commitment 45. This commitment stated:

*We will investigate how other sectors have generated productivity gains such as Design for Manufacturing (DfMA) and 'plug and play'. Taking this proactive stance, we will review commonly used standard specifications and propose changes to Highways England (SES) to increase productivity through off-site production, precast and plug and play solutions {C6.03}.*

As part of the A47 scheme design development carried out in PCF Stages 3 to 5, Galliford Try and their Design Partner Sweco have investigated and implemented opportunities to incorporate off-site production, precast and 'plug and play' solutions within each scheme's preliminary and detailed designs. [Table 1 on page 2](#) summarises the work done to date in this area. The implementation of such solutions was carried out on a case-by-case basis, and took into account the constraints on each scheme, including the Preferred Route Announcement, Client Open for Traffic and Start of Works dates, site access constraints and scheme budget.

Please note that the term 'plug and play' applies primarily to Highways Communications infrastructure ('Comms'), and stems from the Smart Motorway sector. Following design development work, the final scope of Comms work on the A47 RDP schemes was extremely small, and therefore gave little opportunity for similar implementation. As an alternative to this specific category, this case study also includes examples where:

1. Standardisation of design detailing has been adopted across the A47 RDP schemes during PCF Stages 3 to 5.
2. 'Offline' construction of structure sub elements, i.e. in site areas away from live traffic lanes, has been investigated and implemented.

**What are the benefits?**

Please refer to [Table 1 on page 2](#) for details of the benefits and efficiencies associated with each example.

Impact on the quality of delivery will be assessed upon completion of PCF Stage 6 (Construction) for each scheme, e.g. as part of associated Lessons Learnt reviews.

**How can others apply your learning?**

- i. PCF Stage 3 is the key stage of design development for confirming preferred solutions associated with structures and highways elements. It is important to ensure that all parties involved in the construction process are 'bought in' to the decisions made at this stage, and in order to avoid any design re-work and/or delays in later PCF Stages. This is not always possible due to changes in project personnel and/or organisational approaches during the lifecycle of a project.
- ii. When inheriting design solutions and/or construction methodologies from others in PCF Stage 2, it is important that any fundamental scheme buildability problems are identified and resolved as part of the contract award due diligence process, and not as part of the PCF Stages 3 to 5 design development process. This also applies to any fundamental changes of proposed solution (and noting that the two can be intrinsically interlinked). This issue can affect any subsequent decision to adopt offsite / offline production, design standardisation and/or precast techniques.
- iii. The nature of the RDP schemes is such that scheme budget constraints take ultimate priority over the National Highways Imperatives of Customer, Safety and Delivery. In some cases, this can preclude the use of precast solutions and/or offline or offsite construction techniques, and their associated benefits in relation to the Imperatives.
- iv. The Preferred Route Announcement for each scheme, and associated scheme specific constraints, can restrict the ability to adopt wider standardisation across a series of schemes awarded to one Main Contractor. For example, standard bridge designs. Larger programmes of work, e.g. HS2, LTC, may offer greater scope for implementing such approaches.
- v. The use of helical piles as foundations to bridge structures with 120-year design life is not acceptable to National Highways SES. This is despite their widespread use on gantries and cantilever signs on Smart Motorways (60-year design life), potential mitigations involving additional sacrificial corrosion allowance (for durability purposes), and their use on Network Rail footbridges.

**Further information:**

For structures, refer to the Stage 3 Structures Options Report (SOR) for each scheme. – see [example on page 3](#).

**Contact for more details:**

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**Table 1: Examples of offsite / offline production, design standardisation and precast solutions investigated and implemented on the A47 RDP Schemes**

Scheme(s) <sup>(1)</sup>	Example of offsite / offline production, design standardisation and precast solutions	Specific Examples <sup>(2)</sup>	Status <sup>(3)</sup>	Reference Material	Summary of Benefits and Efficiencies
All schemes	Use of fully precast drainage chambers and/or chamber bases	e.g. Easi-Base by FP McCann	Investigated and remains under consideration for implementation in PCF Stage 6	Supplier presentation from FP McCann <a href="https://fpmccann.co.uk/uk/drainage/">https://fpmccann.co.uk/uk/drainage/</a>	Increased speed of installation. Reduction in confined space working, e.g. as associated with insitu benching.
All schemes	Use of precast foundations for Road Restraint Systems	e.g. Arbus Smartraft		Supplier presentation from Arbus <a href="https://arbus.co.uk/products-services/smartraft/">https://arbus.co.uk/products-services/smartraft/</a>	Increased speed of installation. Elimination of driven post requirement, and associated service strike risk.
TTN	Use of precast coping units above reinforced earth retaining walls	Structure S41 and S42	Implemented	HE551492-GTY-SBR-S41-DR-CB-50017 HE551492-GTY-SBR-S42-DR-CB-50016	Elimination of temporary works associated with insitu construction of copings. Reduction in amount of work at height.
BLO, TUD, TTN	Precast parapet stringcourse units on new build bridges	TTN: S41, S42 TUD: S05, S03, S17 BLO: S01	Investigated	A14C2H scheme bridge examples.	
BLO	Parapet stringcourse cast onto the edge beams during the fabrication process, and delivered to site as a combined unit	BLO: S03	Implemented	HE551490-GTY-SBR-S03-DR-CB-50110	Elimination of parapet falsework requirement and associated work at height. Improved quality. Reduction in overall bridge construction duration.
TTN	(1) Use of helical piles (pre-fabricated steel pile sections) as the foundations for a footbridge instead of insitu reinforced concrete bored piles. (2) Use of prefabricated steel grillages instead of insitu reinforced concrete pile caps.	Structure S45	Investigated	HE551492-GTY-SBR-S45-RP-CB-50001	Improved construction safety compared to traditional bored piles, including elimination of piling platforms and large piling rigs adjacent to live traffic. Reduced construction cost. Shorter installation duration. Carbon reduction benefit.
TTN	Standardisation of construction methodology for the two major underpasses on the scheme	Structures S02 and S04	Implemented	<ul style="list-style-type: none"> <li>Thickthorn Structures Buildability Review, 1st March 2023 presentation to National Highways.</li> <li>HE551492-GTY-SBR-000-RP-CB-50001</li> </ul>	Ability to share design and construction resources across both structures.
TTN	Use of precast shell units for bridge abutment construction	TTN: <ul style="list-style-type: none"> <li>S41 and S42 Bridge Abutments</li> <li>S02 and S04 Underpass Structures</li> </ul>	Investigated	Supplier presentation from Expanded <a href="https://www.laingorourke.com/thinking/technology-and-innovation-spotlight-building-bridges/">https://www.laingorourke.com/thinking/technology-and-innovation-spotlight-building-bridges/</a>	
TTN	Use of offline construction for major structural elements and installation using 'heavy lift' methods during short duration full road closures	TTN: <ul style="list-style-type: none"> <li>S41 Bridge deck and use of self-propelled modular transporters (SPMTs)</li> <li>S45 Footbridge truss and use of self-propelled modular transporters (SPMTs)</li> <li>S02 and S04 Underpass portal structures and use of box push method and guide tunnels</li> </ul>	Implemented	<ul style="list-style-type: none"> <li>Structure S41: HE551492-GTY-SBR-S41-DR-CB-50015, 50016, 50017</li> <li>Structure S45: HE551492-GTY-SBR-S45-RP-CB-50002</li> <li>Underpasses S02 &amp; S04: <ul style="list-style-type: none"> <li>A47 Thickthorn_Underpass Design Development Timeline_V1.1</li> <li>HE551492-GTY-SBR-000-RP-CB-50001</li> <li>HE551492-GTY-SBR-S02-RP-CB-50201</li> <li>HE551492-GTY-SBR-S04-RP-CB-50401</li> <li>Thickthorn Structures Buildability Review, 1<sup>st</sup> March 2023 presentation to National Highways.</li> </ul> </li> </ul>	Reduced interface with live traffic. Reduced customer disruption. Improved construction safety. Ability to meet Client key dates for the scheme.
BLO, TUD, WAN	Standardisation of design solutions for typical highways elements associated with new build dual carriageways, including: <ul style="list-style-type: none"> <li>Edge of carriageway drainage detail</li> <li>Central reserve road restraint type</li> <li>Central reserve paving / finishing detail</li> </ul>	BLO, TUD, WAN	Implemented	<ul style="list-style-type: none"> <li>HE551489-GTY-HGN-000-RP-CD-30003</li> <li>HE551489-GTY-HGN-000-RP-CD-30004</li> <li>HE551489-GTY-HGN-000-RP-CH-30007</li> </ul>	Standardisation of design and construction approach across the A47 schemes. Design to budget, while meeting minimum design / technical requirements. Early agreement of key design details with National Highways SES and Ops Teams.
WAN, TUD, TTN, BLO	Use of the same proprietary reinforced earth system on all structures where reinforced earth construction was proposed	<ul style="list-style-type: none"> <li>BLO: S01, S03</li> <li>TTN: S41, S42</li> <li>TUD: S03, S04, S16, S17</li> <li>WAN: S02, S05</li> </ul>	Implemented	Refer to the Stage 5 structures design drawings for each scheme.	Same design organisation / points of contact for all reinforced earth walls. Standardisation of design and construction approach across the A47 schemes. Supplier design incorporated into scheme detailed design during PCF Stage 5, and certified accordingly (best practice approach).
WAN, TUD, TTN, BLO	Use of both standardised and bespoke precast concrete components for the construction of new structures	<ul style="list-style-type: none"> <li>Standard box culvert and wingwall units: WAN: S04; TTN: S46; TUD: S01, S18</li> <li>Standard 'catalogue' bridge beams: TTN: S41, S42; TUD: S03, S07; BLO: S01, S03</li> <li>Bespoke precast deck units: <ul style="list-style-type: none"> <li>WAN: S08</li> <li>TTN: S02 and S04</li> </ul> </li> <li>Precast 'u and n' units to form box structures: <ul style="list-style-type: none"> <li>WAN: S02, S05</li> <li>TUD: S04, S16</li> </ul> </li> </ul>	Implemented Implemented Implemented Investigated Implemented Investigated	Refer to: <ol style="list-style-type: none"> <li>The Stage 5 structures design drawings for each scheme</li> <li>The Stage 3 Structures Options Reports for each scheme</li> </ol>	Reduced site installation duration. Improved quality. FRC (formwork, reinforcement and concrete) resource demand on each scheme reduced by using precast instead of insitu reinforced concrete construction.

**Notes:**

(1) BLO = Blofield, TUD = Tuddenham, TTN = Thickthorn, WAN = Wansford.

(2) 'S' numbers refer to specific new structures on each scheme. Refer to the PCF Stage 5 general arrangement drawings for each scheme for further details.

(3) 'Implemented' = measure incorporated into the PCF Stage 5 detailed design for the scheme. In the case of the Thickthorn scheme, this applies up to the point of contact handover to National Highways in July 2023.

'Investigated' = measure reviewed in detail as part of the design development, but ultimately not taken forward into the PCF Stage 5 detailed design for the scheme.

**A47 RDP Schemes:**

**Schedule of Stage 3 Structures Options Reports (SORs)**

Version 1, 18.01.2024

Scheme	Document Number	Viewpoint Location or Link	Title
Tuddenham	<a href="https://download.4projects.com?LinkID=20b4094d-a24d-4532-97ff-391455673446">HE551489-GTY-SGN-000-RP-CB-30002</a>	<a href="https://download.4projects.com?LinkID=20b4094d-a24d-4532-97ff-391455673446">https://download.4projects.com?LinkID=20b4094d-a24d-4532-97ff-391455673446</a>	SOR Volume 1 - Introduction
	<a href="https://download.4projects.com?LinkID=31e9acc3-0ea3-4007-9867-391455661906">HE551489-GTY-SGN-000-RP-CB-30003</a>	<a href="https://download.4projects.com?LinkID=31e9acc3-0ea3-4007-9867-391455661906">https://download.4projects.com?LinkID=31e9acc3-0ea3-4007-9867-391455661906</a>	SOR Volume 2 - S03 and S07
	<a href="https://download.4projects.com?LinkID=3e46075e-e7dd-4492-9505-391455658090">HE551489-GTY-SGN-000-RP-CB-30004</a>	<a href="https://download.4projects.com?LinkID=3e46075e-e7dd-4492-9505-391455658090">https://download.4projects.com?LinkID=3e46075e-e7dd-4492-9505-391455658090</a>	SOR Volume 3 - River Tud Crossing
	<a href="https://download.4projects.com?LinkID=7c07d21d-837a-4203-b7b3-391455664351">HE551489-GTY-SGN-000-RP-CB-30005</a>	<a href="https://download.4projects.com?LinkID=7c07d21d-837a-4203-b7b3-391455664351">https://download.4projects.com?LinkID=7c07d21d-837a-4203-b7b3-391455664351</a>	SOR Volume 4 - S04 and S16
	<a href="https://download.4projects.com?LinkID=e9fbe56f-9d8f-46be-bb3f-391455665165">HE551489-GTY-SGN-000-RP-CB-30006</a>	<a href="https://download.4projects.com?LinkID=e9fbe56f-9d8f-46be-bb3f-391455665165">https://download.4projects.com?LinkID=e9fbe56f-9d8f-46be-bb3f-391455665165</a>	SOR Volume 5 - Easton Footbridge
	<a href="https://download.4projects.com?LinkID=ae88a673-190e-4b0d-88b5-391455665986">HE551489-GTY-SGN-000-RP-CB-30007</a>	<a href="https://download.4projects.com?LinkID=ae88a673-190e-4b0d-88b5-391455665986">https://download.4projects.com?LinkID=ae88a673-190e-4b0d-88b5-391455665986</a>	SOR Volume 6 - S18
Blofield	<a href="#">HE551490-GTY-SBR-S01-RP-CB-30001</a>	18.01.24: Query raised with GT DC on location of these documents on Viewpoint – not found on a search.	SOR - STRUCTURE OPTIONS REPORT S01
	<a href="#">HE551490-GTY-SBR-S03-RP-CB-30001</a>		SOR - STRUCTURE OPTIONS REPORT S03
Wansford	<a href="#">HE551494-GTY-SBR-S02-RP-CB-50001</a>	> <a href="#">GT INFRA Div</a> > <a href="#">OU5012 - HIGHWAYS</a> > <a href="#">National Highways</a> > <a href="#">FWK-HE18005-East</a> > <a href="#">CON-HE022-A47WAN</a> > <a href="#">10. Drgs, Sch and Specs</a> > <a href="#">02 Design Deliverables</a> > <a href="#">02 Highways</a> > <a href="#">1700</a>	S02 Wansford NMU Underpass Technical Note SOR
	<a href="#">HE551494-GTY-SMN-S04-RP-CB-00002</a>		SOR - S04 Sluice Extension
	<a href="#">HE551494-GTY-SGN-S05-RP-CB-00001</a>		SOR - S05
	<a href="#">HE551494-GTY-SMN-S08-RP-CB-50002</a>		S08 Structures Options Report
Thickthorn	<a href="https://download.4projects.com?LinkID=93f9a329-2833-4f9a-83fd-391456052125">HE551492-GTY-SGN-000-RP-CB-30001</a>	<a href="https://download.4projects.com?LinkID=93f9a329-2833-4f9a-83fd-391456052125">https://download.4projects.com?LinkID=93f9a329-2833-4f9a-83fd-391456052125</a>	Structure Options Report (Vol 1) - Scheme wide Information
	<a href="https://download.4projects.com?LinkID=2c48584f-e39f-4b0f-a65c-387837133716">HE551492-GTY-SGN-000-RP-CB-30002</a>	<a href="https://download.4projects.com?LinkID=2c48584f-e39f-4b0f-a65c-387837133716">https://download.4projects.com?LinkID=2c48584f-e39f-4b0f-a65c-387837133716</a>	Structures Options Report (Vol 2) - Underpasses
	<a href="https://download.4projects.com?LinkID=56891314-9231-47ac-b9d9-391455997312">HE551492-GTY-SBR-000-RP-CB-50001</a>	<a href="https://download.4projects.com?LinkID=56891314-9231-47ac-b9d9-391455997312">https://download.4projects.com?LinkID=56891314-9231-47ac-b9d9-391455997312</a>	SOR Volume 2 Addendum
	<a href="https://download.4projects.com?LinkID=903d1228-fb20-4b92-9727-391456053923">HE551492-GTY-SGN-000-RP-CB-30004</a>	<a href="https://download.4projects.com?LinkID=903d1228-fb20-4b92-9727-391456053923">https://download.4projects.com?LinkID=903d1228-fb20-4b92-9727-391456053923</a>	Structure Options Report (Vol 4) - Overbridges
	<a href="https://download.4projects.com?LinkID=1ecc1121-f3c3-4e63-926e-391456133348">HE551492-GTY-SGN-000-RP-CB-30005</a>	<a href="https://download.4projects.com?LinkID=1ecc1121-f3c3-4e63-926e-391456133348">https://download.4projects.com?LinkID=1ecc1121-f3c3-4e63-926e-391456133348</a>	Structures Options Report (Vol 5) - Footbridges
	<a href="https://download.4projects.com?LinkID=7a355952-afb8-4da7-a845-391456000101">HE551492-GTY-SBR-S45-RP-CB-50001</a>	<a href="https://download.4projects.com?LinkID=7a355952-afb8-4da7-a845-391456000101">https://download.4projects.com?LinkID=7a355952-afb8-4da7-a845-391456000101</a>	SOR Volume 5 Addendum S45
	<a href="https://download.4projects.com?LinkID=54d9f598-7d26-4638-abe8-391456054892">HE551492-GTY-SMN-S46-RP-CB-50002</a>	<a href="https://download.4projects.com?LinkID=54d9f598-7d26-4638-abe8-391456054892">https://download.4projects.com?LinkID=54d9f598-7d26-4638-abe8-391456054892</a>	Structures Options Technical Note - S46 Cantley Lane South Culvert

**Yellow highlighted items:** GT DC / IM to make document available via Public Link.