BRIDGES

SUPERVISION HANDBOOK FOR CONCRETE BRIDGES

Quality System for Employer's Supervision and Contractor's Control

Activities
Formwork
Non-prestressed reinforcement
Pre-stressed reinforcement
Concrete works

August 2010

DANISH ROAD STANDARDS COMMITTEE

Vejdirektoratet

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LIST OF ANNEXES:

0. Background

This supervision handbook is part of the tender specification for concrete bridges and is to be used for formwork, pre-stressed reinforcement and concrete works on concrete bridges. The supervision handbook has been prepared by the Danish Road Directorate's departments for Road operations and Road construction as a report in preparation of road standards by an ad hoc group with the following composition:

Arne Henriksen, Danish Road Directorate
Niels Jørgensen, Gimsing & Madsen A/S
Jan Gerberg Skals, COWI A/S

1. Introduction

This supervision handbook deals with the activities which are necessary to ensure that formwork, non-pre-stressed reinforcement, pre-stressed reinforcement and concrete works are carried out correctly and optimally in accordance with the provisions of the contract.

2. Use

Scaffolding is not addressed in this supervision handbook – please refer to the separate supervision handbook for such works.

This supervision handbook may be used regardless of form of contract. In this supervision handbook, "supervision" refers to the Employer's supervision. The Employer's supervision may e.g. be employees from the Danish Road Directorate or Banedanmark and dedicated consultants, the employees of an adviser in a main contract or, in a turnkey contract, employees from a special adviser attached directly to the Employer.

Importance is attached to efficient interaction between the supervision and the Contractor's activities and the same methodologies are used as those known from the other supervision handbooks.

When used for individual bridge contracts, the activities of the supervision and Contractor shall be adapted to the relevant contract including the staff and working methods of the Contractor. The Contractor and the supervision shall therefore always consider whether the activities described are adequate.

The supervision handbook contains 4 annexes:

Annex 1 Formwork
Annex 2 Non-prestressed reinforcement
Annex 3 Pre-stressed reinforcement
Annex 4 Concrete

Each of the 4 annexes has a number of forms which serve as a common tool for the Contractor and the supervision for follow-up, documentation and control of the interaction.

Completed forms shall be referred at site meetings and shall be appended to the minutes of the site meetings as annexes. Revised forms will be assigned a new version number and appended to the next site meeting.

The supervision handbook has been prepared for use in bridge contracts for construction or repair works involving in situ casting of concrete.

The supervision handbook shall be included as part of the tender documents (typically in Terms of Reference or in the letter of invitation) and shall be referred to in the subsequent terms of reference to both the supervision and the Contractor.

Unless otherwise agreed with the Employer, all forms and reference documents cited shall be completed and be available in Danish.

The forms of the supervision handbook are available as word files for completion.

3. Organisation

For each bridge project, a person responsible for the contract will be appointed by each party. The parties hold a preparatory meeting and prepare a protocol for the preparatory meeting.

The supervision ensures that the Contractor's control is in order, including that checklists are filled in. By stating its comments on the forms, the supervision provides an assessment of whether the completed Contractor's control can be accepted.

4. Planning

Prior to any supervision and Contractor's control work, it is necessary to plan this work relative to the plans for the execution of the work.-

The basis for the planning of supervision and Contractor's control is:

* Tender material
* Contractor's working schedule (including method description, control plans, etc.)

Thorough project review is a requirement for both parties (supervision and Contractor)

Before commencement of the bridge contract, a meeting will be held between the supervision and the Contractor where the topics covered by the "Protocol for preparatory meeting", Form A are discussed and the necessary agreements are made.

Prior to commencement, the supervision shall receive and accept the Contractor's method descriptions, specifications, control and working procedures (see the guidance to Form A).

The supervision shall ensure that the Contractor submits the documentation required for the materials used in accordance with the control plans.

5. Execution, control and documentation

The work may not commence before the defects specified in the box “Action on defects before commencement” in Form A heading have been remedied and accepted by the supervision.

The supervision and the Contractor shall fill in the forms attached to annexes 1-4.

The Contractor shall regularly and immediately submit all relevant documents and documentation of controls performed to the supervision as described in the tender material and agreed at the preliminary meeting.

The supervision shall keep a record of the observations made by the supervision.

After completion of the work, the supervision shall approve the completion of the documentation material. This shall be done by the supervision stating on the checklists any comments, and by its signature, the supervision confirms that the checklist has been reviewed.

The supervision will receive and assess the above documentation; see the forms in annexes 1-4. These and any other observations after the completion of the work form the basis for the handover protocol and billing.

Annex 1: Formwork

Annex 1 for formwork contains the following forms and guidance:

Formwork shall be controlled on a daily basis by the Contractor on Form B1: "Checklist – formwork" or on similar documentation material with reference to the checklist in the boxes of the form.

Form A:

Protocol for preparatory meeting – Formwork

Guidance for completing Form A

Form B1:

Checklist - Formwork

Guidance for completing Form B1:

Protocol for preparatory meeting – Formwork Annex 1: Form A Page 1

Contract no.:	Bridge no. / Reg. no.:	Bridge name:
Main Contractor:	Employer:	Date:
Contractor's supervision:	Supervision:	

1. Drawings/ tender material General note sheet	Agreements:
2. Deviations from the tender material	
3. Scaffolding	Is a protocol available for the first site meeting (scaffolding meeting) Yes ☐ No ☐ Comments: (See supervision handbook for bridge contracts – Quality system for scaffolding supervision and Contractor's control activities for bridge contracts)
4. Formwork	Are drawings and calculations available of the formwork Yes ☐ No ☐ Comments: If no, to be agreed and stated no later than the time (date) of their submission for approval by the supervision: Date Any comments:
5. Deformations	Method and extent of measurement of settlements of scaffolding, beam deflections and horizontal deformation during construction shall be agreed and described briefly and possibly be outlined for each individual structural element. Columns: Walls: Bridge decks:

Protocol for preparatory meeting – Formwork Annex 1: Form A Page 2

6. Board form	**Are there any deviations from GWS and SWS with regard to** • **Thicknesses and widths?** **Yes** ☐ **No** ☐ **Comments:** • **Board direction?** **Yes** ☐ **No** ☐ **Comments:** • **Butt joints** **Yes** ☐ **No** ☐ **Comments:** • **Construction joints** **Yes** ☐ **No** ☐ **Comments:** • **Triangular/trapeze bar supports** **Yes** ☐ **No** ☐ **Comments:** **Any general comments:**
7. Slab form	**Are slab forms used?** **Yes** ☐ **No** ☐ **Comments:** **If yes, state the surfaces/structural elements and type of slab form used:** **Surface/structural element:** **Type:** …… …… …… …… …… …… …… …… **Are there any deviations from GWS and SWS with regard to** **free expansion** **Yes** ☐ **No** ☐ **Comments:** **tightness** **Yes** ☐ **No** ☐ **Comments:** **Any comments:**
8. Surface shuttering	**Have any necessary surface shuttering on inclined upper sides of wings, etc. been clearly described in SWS?** **Yes** ☐ **No** ☐ **Comments:** **If no, the type and size shall be agreed/specified and it shall be stated whether the form will be retained after curing or whether the surface shuttering is removed in sections for tearing off of the concrete surface:**
9. Form release agents	**Type and make of the form release agent intended to be used are: ……** **Are any data sheet/declaration available for the form release agent?** **Yes** ☐ **No** ☐ **Comments:** **Has data sheet/declaration for the form release agent been provided to the supervision?** **Yes** ☐ **No** ☐ **Comments:**

Protocol for preparatory meeting – Formwork Annex 1: Form A Page 3

10. Anchorage of side forms	**Anchoring method for single-sided side forms such as bridge deck ends shall be discussed and agreed and described/outlined in more detail:**	
11. Embeddings and grooves	**Embeddings and grooves shall be discussed and any agreements on this matter shall be stated:**	
12. Shuttering removal	**Any special conditions to be considered in addition to those listed in GWS and SWS concerning shuttering removal of the bearing form and non-bearing side forms shall be agreed and stated:**	
13. Other special conditions		
Signature	**Main Contractor's signature:**	**Supervision's signature:**

Guidance for completing Form A: Protocol for preparatory meeting - Formwork

General	To be filled in by supervision and Contractor
Header	State the name of main Contractor's foreman (Contractor's control) and name of the supervision.
1. Drawings tender material/ /general note sheet	The drawings/tender material/general note sheet regarding the formwork shall be discussed and any agreements made at the preparatory meeting shall be stated.
2. Deviations from the tender material	Any deviations from the specification in the tender material which may have consequences shall be stated here.
3. Scaffolding	State whether Protocol for the first site meeting (preliminary plan) – Scaffolding has been completed as specified in the Supervision handbook for bridge contracts, Activity areas Scaffolding.
4. Drawings and calculations	State whether drawings and calculations are available. If not, state the latest date for submitting these to the supervision for approval.
5. Deformations	State here the method and extent of deformation measurements for the individual structural elements during execution of the concreting work.
6. Board form	State whether there are special requirements for board forms for visible surfaces.
7. Slab form	State what structural elements will be cast against slab forms and the type intended to be used.
8. Upper formwork	Discuss and clarify any doubts as to the use and design of upper formwork on inclined surfaces.
9. Form release agent	State the type and make and whether any data sheet/declaration is available for the form release agent intended to be used.
10. Anchorage of side forms	State how single-sided side forms are intended to be anchored. It **shall** be avoided to make anchors to the reinforcement of the specific structural element.
11. Embeddings and grooves	State any agreement concerning embedded items and grooves.
12. Shuttering removal	State any special conditions in addition to those specified in GWS and SWS regarding shuttering removal of the individual structural elements.
13. Special conditions	Any other conditions of relevance for the formwork may be stated. May be provided in an annex.

Checklist – Formwork

Annex 2: Form B1 Page 1

Contract no.:	Bridge no. / Reg. no. / stage:	Bridge name:
Contractor's supervision:		Date:
Structural element:		

Contractor's control:

1. Drawings and calculations of form	Have the drawings and calculations been approved by the supervision?	Yes ☐	No ☐	Comments:
2. Tightness and design	Have requirements for tightness and design been met?	Yes ☐	No ☐	Comments:
3. Anchorage of side forms	Have anchors been inspected and and found to be in order?	Yes ☐	No ☐	Comments:
4. Embeddings and grooves	Have all embeddings and grooves been controlled for correct position?	Yes ☐	No ☐	Comments:
5. Cleaning and any watering	Has the form been cleaned of tying wire and other foreign matter?	Yes ☐	No ☐	Comments:
	For wooden form: Has the form been watered?	Yes ☐	No ☐	Comments:
6. Preparation of form	Has a statement of completion been made to the supervision for the formwork?	Yes ☐	No ☐	Comments
	Statement of completion made to: _____, _____			
7. Other comments				
Signature	Contractor's signature:			

Supervision's comments:

Checklist – Formwork — Guidance for completing Form B1

General	To be filled in by the Contractor The items on the checklist may be replaced by the Contractor's QA documentation by making a reference to them in the boxes of the form.
Header	State the name of the Contractor's foreman (Contractor's control). State what structural element, the control (the form) covers, e.g. *Eastern foundation in line B.*
1. Drawings and calculations of formwork	State whether drawings and calculations of the form have been approved by the supervision.
2. Tightness and design	State whether the form tightness and design meet the requirements.
3. Anchors of side forms	State whether all anchors have been controlled and found to be in order.
4. Embeddings and grooves	State whether all embeddings and grooves have been controlled and whether their positions and designs meet the requirements.
5. Cleaning	State whether the form has been completely cleaned for tying wire and other foreign matter.
6. Preparation of form	No later than 24 hours before concreting is scheduled to start, this shall be notified to the supervision.
7. Other comments	Any other conditions of relevance for the concrete work may be stated. May be provided in an annex.

SUPERVISION'S COMMENTS:

By its comments, the supervision provides an assessment of whether the Contractor's control performed gives rise to any special actions. If the supervision has no comments, state "No comments".

Annex 2: Non-prestressed reinforcement

Annex 2 for non-prestressed reinforcement contains the following forms and guidance:

Non-prestressed reinforcement shall be controlled on a daily basis by the Contractor on Form B1: "Checklist - non-prestressed reinforcement" or on similar documentation material with reference to the checklist in the boxes of the form.

Form A:

Protocol for preparatory meeting - Non-prestressed reinforcement

Guidance for completing Form A

Form B1:

Checklist – Non-prestressed reinforcement

Guidance for completing Form B1:

Protocol for preparatory meeting – Non-prestressed reinforcement

Annex 2: Form A Page 1

Contract no.:	Bridge no. / Reg. no.:	Bridge name:	
Main Contractor:	**Reinforcement supplier:**	**Employer:**	**Date:**
Contractor's supervision:		**Supervision:**	

1. Drawings/ tender material/ General note sheet	**Comments?** **Do drawings/SWS/General note sheet contain requirements for stainless steel reinforcement?** **Yes** ☐ **No** ☐ **Comments:** **Do drawings/SWS/General note sheet contain requirements for deviating cover compared to GWS?** **Yes** ☐ **No** ☐ **Comments:** **Do drawings/SWS/General note sheet contain requirements for deviating tolerances compared to GWS?** **Yes** ☐ **No** ☐ **Comments:**
2. Deviations from the tender material	
3. Product certificates for reinforcing steel in straight bars	**Are these available?** **Yes** ☐ **No** ☐ **Comments:** **Have they been approved?** **Yes** ☐ **No** ☐ **Comments:**
4. Ductility	**Does /SWS/General note sheet contain other requirements for the evenly distributed extension of the reinforcement (ductility) than those set out in GWS section 6.2.1?** **Yes** ☐ **No** ☐ **Comments** **If yes, where is the requirement stated? …** **If no, can the matter, if the Contractor so wants, be brought up for further assessment with a view to finding out whether use of non-prestressed reinforcement with a lower ductility can be accepted. In such case, it shall be stated what dimension, position and structural element this concerns.** **Structural element:** **Dimension:** **Minimum ductility:** ……. ……. ……. ……. ……. ……. ……. ……. ……. ……. ……. …….
5. Product certificates for Coils and reinforcing steel in prefab. rebend connections	**Are these available?** **Not relevant** ☐ **Yes** ☐ **No** ☐ **Comments:** **Have they been approved?** **Yes** ☐ **No** ☐ **Comments:**

Protocol for preparatory meeting – Non-prestressed reinforcement

6. Product certificates for machine-welded reinforcement units	**Are these available?**	**Not relevant** ☐	**Yes** ☐	**No** ☐	**Comments:**
	Have they been approved?		**Yes** ☐	**No** ☐	**Comments:**
7. Product certificates for manually welded reinforcement units	**Are these available?**	**Not relevant** ☐	**Yes** ☐	**No** ☐	**Comments:**
	Have they been approved?		**Yes** ☐	**No** ☐	**Comments**
8. Documentation for tying wire	**Is this available?**		**Yes** ☐	**No** ☐	**Comments:**
	Has it been approved?		**Yes** ☐	**No** ☐	**Comments:**
9. Sleeves/couplings	**Planned and designed to be used?**		**Yes** ☐	**No** ☐	**Comments:**
	Type:				
	Planned to be used?		**Yes** ☐	**No** ☐	**Comments:**
	Type:				
	Is documentation available?		**Yes** ☐	**No** ☐	**Comments:**
	Has it been approved?		**Yes** ☐	**No** ☐	**Comments:**
10. Spacer blocks	**Make and type:**				**Comments:**
	Sample provided:		**Yes** ☐	**No** ☐	**Comments:**
11. Bending schedules	**Are these available?**		**Yes** ☐	**No** ☐	**Comments:**
	If no, state a deadline for providing these:				
13. Anchors/joint irons	**Planned and designed to be used?**		**Yes** ☐	**No** ☐	**Comments:**
	Type:				
	Planned to be used?		**Yes** ☐	**No** ☐	**Comments:**
	Type:				
	Is documentation available?		**Yes** ☐	**No** ☐	**Comments:**
14. Thermal stress on reinforcement (bending or welding)	**Has this been planned?**		**Yes** ☐	**No** ☐	**Comments:**
	Has this been approved?		**Yes** ☐	**No** ☐	**Comments:**
	Are documentation available, see GWS's requirements?		**Yes** ☐	**No** ☐	**Comments:**
15. Control of cover using a cover meter after concreting	**Has a measuring programme been prepared?**		**Yes** ☐	**No** ☐	**Comments:**

Protocol for preparatory meeting – Non-prestressed reinforcement

16. Procedures for acceptance and storage	**Has a plan been prepared for procedures for acceptance and storage?**	**Yes** ☐	**No** ☐	**Comments**
	Has it been approved?	**Yes** ☐	**No** ☐	**Comments:**
17. Control logs	**Are these submitted on an ongoing basis?**	**Yes** ☐	**No** ☐	**Comments:**
18. Special conditions				
19. Action in response to defects before start-up				
Signature	**Main Contractor's signature:**		**Supervision's signature:**	

Guidance for completing Form A: Protocol for preparatory meeting – Non-prestressed reinforcement

General	To be filled in by supervision and Contractor
Header	State the name of main Contractor's foreman (Contractor's control) and name of the supervision.
1. Drawings/ tender material/ General note sheet	Discuss the details of the reinforcement work on the basis of a project plan or other drawings.
2. Deviations from the tender material	Any deviations from the specification in the tender material which may have consequences shall be stated here.
3. Product certificates for reinforcing steel in straight bars	State whether an accredited product is available in accordance with DS/EN 10080.
4. Ductility	State whether the SWS/General note sheet specify any requirements for the evenly distributed extension of the reinforcement (ductility) other than those set out in the GWS section 6.2.1. In such case, state where. If the question concerning ductility is not described in the SWS/General note sheet, the question shall be brought up for further assessment and clarification to find out what reinforcement – dimension, position and structural element – the delivery of which may be accepted with a lower ductility.
5. Product certificates for coils and reinforcing steel in prefab. rebend connections.	State whether an accredited product is available in accordance with DS/EN 10080.
6. Product certificates for machine-welded reinforcement units	State whether an accredited product is available in accordance with DS/EN 10080.
7. Product certificates for manually welded reinforcement units	State whether an accredited product is available in accordance with DS/EN 10080.
8. Documentation for tying wire	State whether documentation is available for the tying wire used.
9. Sleeves/couplings	State the type and make and documentation for the sleeves and couplings used.
10. Spacer blocks	State the type and make of spacer blocks intended to be used.
11. Bending schedules	State whether bending schedules are available. If no, state a deadline for providing these to the supervision.
12. Butt joints in continuous	State whether butt joints are made in accordance with the provisions of GWS 6.3.5 and whether a plan has been drawn up for planned butt joint.

reinforcement	The plan of the planned butt joints shall be provided to the supervision for approval before commencement of the work.
13. Anchors/ Joint irons	State whether the use of anchors and joint irons are planned and designed and what type is planned to be used and whether documentation for these are available.
14. Thermal stress on reinforcement (bending or welding)	State whether any thermal stress of reinforcement is planned to be carried out. If so, it shall be documented that the reinforcement still meets the requirements of GWS 6.3.6.
15. Control of cover using a cover meter after concreting	After concreting, the cover shall be controlled for at least 5% of the concrete surfaces.
16. Procedures for acceptance and storage	State whether a plan has been drawn up for procedures for acceptance and storage.
17. Control logs	State whether a copy of control logs shall be submitted to the supervision on an ongoing basis.
18. Special conditions	Any other conditions of relevance for the reinforcement work may be stated. May be provided in an annex.
19. Action in response to defects	State the defects identified at the preparatory meeting and the actions agreed to bring all matters up to date before starting the reinforcement work.

Checklist – Non-prestressed reinforcement Annex 2: Form B1 Page 1

Contract no.:	Bridge no. / Reg. no. / Stage.:	Bridge name:
Contractor's supervision:		Date:
Structural element:		

Contractor's control:

1. Handover inspection	Has the handover inspection been made in accordance with the procedures for acceptance and storage?	Yes ☐	No ☐	Comments:
2. Execution of reinforcement	Are the reinforcement types in accordance with the drawings?	Yes ☐	No ☐	Comments:
	Are the reinforcement dimensions in accordance with the drawings?	Yes ☐	No ☐	Comments:
	Is the position of butt joints and grip lengths in accordance with the drawings and plan of the planned butt joint?	Yes ☐	No ☐	Comments:
	Is the reinforcement free of foreign matter (rust, old concrete, oil, grease, paint and other harmful substances)?	Yes ☐	No ☐	Comments:
	Have any deviation from the design of the reinforcement shown on the drawings been approved by the supervision?	Yes ☐	No ☐	Comments
3. Joint irons and anchors mounted by bonding	Have been joint irons and/or anchors been used?	Yes ☐	No ☐	Comments:
	If yes:			
	Has chipping work been approved prior to installation of anchors:			
	What type and adhesive:			
	Result of tension tests:			
4. Metallic contact between reinforcement and embedded items		Yes	No	Comments:
	Is there any contact with stainless steel embedded parts?	☐	☐	

Checklist – Non-prestressed reinforcement Annex 2: Form B1 Page 2

5. Cover and reinforcing bar spacing	**Does the entire structure have the specified cover and within the tolerances?**	**Yes** ☐	**No** ☐	**Comments:**
	Is the reinforcement bar spacing within the tolerances specified in GWS 6.3.3?	**Yes** ☐	**No** ☐	**Comments:**
6. Control of cover after concreting	**Is an approved measuring programme available?**	**Yes** ☐	**No** ☐	**Comments:**
	Has the cover been controlled after concreting?	**Yes** ☐	**No** ☐	**Comments:**
7. Other comments				
Signature	**Contractor's signature:**			

Supervision's comments:

Guidance for completing Form B1: Checklist – Non-prestressed reinforcement

To be filled in by the Contractor

General	The items on the checklist may be replaced by the Contractor's QA documentation by making a reference to them in the boxes of the form.
Header	State the name of the Contractor's foreman (Contractor's control). State what structural element the control (the form) covers, e.g. *Foundation in line B.*
1. Handover inspection	State whether the handover inspection has been made according to the plan for procedures for acceptance and storage.
2. Reinforcement execution	The reinforcement shall be controlled before concreting.
3. Joint irons installed by bonding	State here whether any joint irons/anchors have been used and if so, what type and adhesive. Also state the results of the tension tests.
4. Metallic contact between reinforcement and embedded items	State whether there is contact with non-stainless embedded items.
5. Cover and reinforcing bar spacing	State whether all parts of the structure have the specified cover and whether reinforcing bar spacing is within the specified tolerance requirements.
6. Control of cover after concreting	State whether the cover has been controlled using a cover meter after concreting and shuttering removal.
7. Other comments	State any comments.

SUPERVISION'S COMMENTS:

By its comments, the supervision provides an assessment of whether the Contractor's control performed gives rise to any special actions. If the supervision has no comments, state "No comments".

The supervision may add its own supervision notes/forms to which reference shall then be made.

Annex 3: Pre-stressed reinforcement

Annex 3 for pre-stressed reinforcement contains the following forms and guidance:

Pre-stressed reinforcement shall be controlled on a daily basis by the Contractor on Form B1: "Checklist for execution" on Form B2: "Checklist for tensioning" and on Form B2: "Control for injection" or on similar documentation material with reference to the checklist in the boxes of the form.

Form A:
Protocol for preparatory meeting - Pre-stressed reinforcement
Guidance for completing Form A

Form B1:
Checklist for execution – Pre-stressed reinforcement
Guidance for completing Form B1

Form B2:
Checklist for tensioning - Pre-stressed reinforcement
Guidance for completing Form B2

Form B3:
Checklist for injection - Pre-stressed reinforcement
Guidance for completing Form B3:

Protocol for preparatory meeting – Pre-stressed reinforcement

Annex 3: Form A Page 1

Contract no.:	Bridge no. / Reg. no.:	Bridge name:	
Main Contractor:	Reinforcement supplier:	Employer:	Date:
Contractor's supervision:		Supervision:	

1. Pre-stressing System	**System:** ……. **Type:** ……. **Anchors:** …… **Couplings?** Yes ☐ No ☐ **Are the above as assumed in the tender material?** Yes ☐ No ☐ **Comments:** **Has an alternative pre-stressing system been offered and accepted?** Yes ☐ No ☐ **Comments:** **In such case, which?** • **System:** …….. • **Type:** …….. • **Anchors:** …… • **Couplings?** Yes ☐ No ☐ **Comments:** **Has this been approved?** Yes ☐ No ☐ **Comments:**
2. Drawings/ tender material/ General note sheet	**Comments?**
3. Deviations from the tender material	
4. Installation of pre-stressed reinforcement	**Are there any requirements for installation of pre-stressed reinforcement in the casings before concreting?** Yes ☐ No ☐ **Comments:**
5. Concrete strength on tensioning	**What minimum strength is the concrete required to have before tensioning can take place?** ---------- **MPa**

Protocol for preparatory meeting – Pre-stressed reinforcement

Annex 3: Form A

6. Documentation for materials	**Supervision declaration:**			
	Are these available?	**Yes** ☐	**No** ☐	**Comments:**
	Supervision certificate:			
	Are these available?	**Yes** ☐	**No** ☐	**Comments:**
	Random sample of test specimens:			
	Have test specimens been taken in the presence of the supervision or a third party approved by the supervision?	**Yes** ☐	**No** ☐	**Comments:**
	Are the test results for the test specimens available?	**Yes** ☐	**No** ☐	**Comments:**
	Have pre-bent bars been used?	**Yes** ☐	**No** ☐	**Comments:**
	If yes: has the usability of the bending machine been documented?	**Yes** ☐	**No** ☐	**Comments:**
	Anchors:			
	Is documentation available?	**Yes** ☐	**No** ☐	**Comments:**
	Couplings:			
	Is documentation available?	**Yes** ☐	**No** ☐	**Comments:**
	Casing and joints between these:			
	Is documentation available?	**Yes** ☐	**No** ☐	**Comments:**
	Grout:			
	Is documentation available?	**Yes** ☐	**No** ☐	**Comments:**
	Has the above been approved?	**Yes** ☐	**No** ☐	**Comments:**
7. Documentation for equipment	**Is calibration certificates available for jacks?**	**Yes** ☐	**No** ☐	**Comments**
8. Procedures for acceptance and storage	**Have procedures been prepared for acceptance, storage and transport?**	**Yes** ☐	**No** ☐	**Comments:**
9. Vents and drains of casings, anchors and coupling boxes	**Is a plan for the location of vents and drains available?**	**Yes** ☐	**No** ☐	**Comments**
10. Tensioning	**Are there any requirements for tensioning in stages (provisional tensioning)?**	**Yes** ☐	**No** ☐	**Comments:**
	Is a tensioning plan available?	**Yes** ☐	**No** ☐	**Comments:**
	Has it been approved?	**Yes** ☐	**No** ☐	**Comments:**

Protocol for preparatory meeting – Pre-stressed reinforcement

Annex 3: Form A Page 3

11. Tensioning schedules	**Are tensioning schedules available?** **Yes** ☐ **No** ☐ **Comments:** **If not, this shall be available no later than on:**	
12. Control logs	**Are copies of these provided on an ongoing basis?** **Yes** ☐ **No** ☐ **Comments:**	
13. Special conditions		
14. Action in response to defects before start-up		
Signature	**Main Contractor's signature:**	**Supervision's signature:**

Guidance for completing Form A:
Protocol for preparatory meeting – Pre-stressed reinforcement

To be filled in by supervision and Contractor

Header	State the name of main Contractor's foreman (Contractor's control) and name of the supervision.
1. Pre-stressing system	State what system and type have been prescribed and whether any alternative pre-stressing system is used.
2. Drawings/ tender material/ General note sheet	Discuss the details of the reinforcement work on the basis of a project plan or other drawings.
3. Deviations from the tender material	Any deviations from the description in the tender material which may have consequences shall be stated here.
4. Installation of pre-stressed reinforcement	State whether there are any requirements for installation of pre-stressed reinforcement in the casing before embedding.
5. Concrete strength on tensioning	State the minimum strength required for the concrete before tensioning may take place.
6. Documentation for materials	State whether the required documentation is available for the individual materials for the pre-stressed reinforcement.
7. Documentation for equipment	State whether the required calibration certificates for jacks are available.
8. Procedures for acceptance and storage	State whether the required procedures for acceptance and storage are available.
9. Vents and drains of casings and anchors and coupling boxes	State whether the required plan for location of vents and drains is available.
10. Tensioning	State whether requirements have been made for tensioning in stages.
11. Tensioning schedules	State whether tensioning schedules are available. If not, state the time for their preparation and submission.
12. Control logs	State whether a copy of control logs shall be submitted to the supervision on an ongoing basis.
13. Special conditions	Any other conditions of relevance for the reinforcement work may be stated. May be provided in an annex.
14.Action on defects before start-up	State the defects identified at the preparatory meeting and the actions agreed to bring all matters up to date before starting the pre-stressed reinforcement work.

Checklist for execution – Pre-stressed reinforcement Annex 3: Form B1 Page 1

Contract no.:	Bridge no. / Reg. no./ Stage.:	Bridge name:
Contractor's supervision:		Date:
Structural element:		

Contractor's control:

1. Handover inspection	Has the handover inspection been made in accordance with the procedures for acceptance and storage?	Yes ☐	No ☐	Comments:
2. Execution of reinforcement	Are pre-stressed reinforcement, casing, anchors and other associated items in accordance with the tender material and/or contract?	Yes ☐	No ☐	Comments:
	Is the rust grade of the pre-stressed reinforcement determined to be A or B according to DS/EN ISO 8501-1?	Yes ☐	No ☐	Comments:
	Rust grade is determined at:	A ☐	B ☐	Comments:
	Is the fixation of casing, anchors, etc. stable and safe enough to ensure that they are retained in the required position during re-concreting and vibration?	Yes ☐	No ☐	Comments:
	Is the pre-stressed reinforcement, including anchors, placed in the specified position?	Yes ☐	No ☐	Comments:
	Has a checklist with measurement results of the position of the pre-stressed reinforcement been appended as an annex?	Yes ☐	No ☐	Comments:
	Have casing and joints been safely joined and sealed?	Yes ☐	No ☐	Comments:
	Are casings and any coupling boxes intact?	Yes ☐	No ☐	Comments:
	Have the required vents and drains from casings, anchors and any coupling boxes been inserted?	Yes ☐	No ☐	Comments:
	Is a plan – insertion plan – available which clearly shows where the individual charge numbers for the pre-stressed reinforcement have been inserted?	Yes ☐	No ☐	Comments:
	Is a concreting programme available for the execution of the injection work?	Yes ☐	No ☐	Comments:
	Is a measuring programme available for control of cover after concreting?	Yes ☐	No ☐	Comments:
	Has the cover been controlled after concreting?	Yes ☐	No ☐	Comments:
	Has the above been approved?	Yes ☐	No ☐	Comments:

Checklist for execution – Pre-stressed reinforcement Annex 3: Form B1 Page 2

3. Other comments	
Signature	**Contractor's signature:**

Supervision's comments:

Guidance for completing Form B1: Checklist for execution – Pre-stressed reinforcement

To be filled in by the Contractor

General	The items on the checklist may be replaced by the Contractor's QA documentation by making a reference to them in the boxes of the form.
Header	State the name of the Contractor's foreman (Contractor's control). State what structural element the control (the form) covers, e.g. *Eastern bridge deck.*
1. Handover inspection	State whether the handover inspection has been made according to the plan for procedures for acceptance and storage.
2. Reinforcement Execution	Concreting programme – shall be approved by the supervision before casings are embedded in construction concrete - shall, as a minimum account for the following: • Completion of injection. • Division into control sections. • Injection quantities for each casing. • Measures to ensure complete filling with grout, including any post-injections at i.e. coupling boxes and trumpet-shaped anchors. • Possibilities of flushing and casings in the event of accidents during execution of the injection. • The equipment used. • Back-up equipment will be available during the execution of the injection.
3. Other comments	State any comments.

SUPERVISION'S COMMENTS:

By its comments, the supervision provides an assessment of whether the completed work and the related Contractor's control can be approved or whether it gives rise to any special actions. If the supervision has no comments, state “No comments”.

The supervision may add its own supervision notes/forms to which reference shall then be made.

Checklist for tensioning – Pre-stressed reinforcement Annex 3: Form B2 Page 1

Contract no.:	Bridge no. / Reg. no./ Stage.:	Bridge name:
Contractor's supervision:		Date:
Structural element:		

Contractor's control:

1. Tensioning schedules	Has the tensioning plan and related tensioning schedules been approved by/or prepared by the supervision?	Yes ☐	No ☐	Comments:
	Reference can be made to/correspondence from the supervision may be appended.			
2. Concrete compressive strengths	Has the concrete reached the strength required for tensioning?	Yes ☐	No ☐	Comments:
	Concrete compressive strength is determined at: 1. When compression testing of at least 3 cylinders 2. Based on the concrete maturity	…….MPa …… MPa		
3. Tensioning	Have pressure gauges for the tensioning equipment been controlled by means of control pressure gauges before and after completion of the tensioning?	Yes ☐	No ☐	Comments:
	Did the control reveal any irregularities?	Yes ☐	No ☐	Comments:
	Have any deviations occurred in connection with the tensioning in relation to the tensioning plan and tensioning schedules?	Yes ☐	No ☐	Comments:
4. Other comments				
Signature	Contractor's signature:			

Supervision's comments:

Guidance for completing Form B2: Checklist for tensioning – Pre-stressed reinforcement

To be filled in by the Contractor

General	The items on the checklist may be replaced by the Contractor's QA documentation by making a reference to them in the boxes of the form.
Header	State the name of the Contractor's foreman (Contractor's control). State what structural element the control (the form) covers, e.g. *Eastern bridge deck.*
1. Tensioning schedules	State whether a tensioning plan and related tensioning schedules have been approved or prepared by the supervision.
2. Concrete compressive strengths	In connection with the pouring of the construction concrete, at least 18 cylinders shall be concreted at the same time to be stored on the upper side of the structure against this and under the same covering. The earliest time for tensioning is when the concrete has reached the strength specified for the tensioning, which shall be based partly on a calculation of the concrete maturity and partly on compression testing of at least 3 of poured cylinders.
3. Tensioning	State whether the required controls of the tensioning equipment have been made before and after the tensioning and whether any deviations were found.
4. Other comments	State any comments.

SUPERVISION'S COMMENTS:

By its comments, the supervision provides an assessment of whether the completed work and the related Contractor's control can be approved or whether it gives rise to any special actions. If the supervision has no comments, state “No comments”.

The supervision may add its own supervision notes/forms to which reference shall then be made.

Checklist for injection – Pre-stressed reinforcement Annex 3: Form B3 Page 1

Contract no.:	Bridge no. / Reg. no./ Stage.:	Bridge name:
Contractor's supervision:		Date:
Structural element:		

Contractor's control:

1. Concreting programme	Has the concreting programme for the execution of the injection work been approved by the supervision?	Yes ☐	No ☐	Comments:
	Have the measures set out in the concreting programme been taken?	Yes ☐	No ☐	Comments:
	Have control sections been defined and approved?	Yes ☐	No ☐	Comments:
2. Injection	Has the tensioning been approved by the supervision?	Yes ☐	No ☐	Comments:
	Has the injection capacity of the casings been controlled with compressed air immediately before the grout was injected?	Yes ☐	No ☐	Comments:
	Are the temperature conditions specified in DS/EN 446 for the structure, the air and grout observed? Concrete temperature: Start: Max/min____/____°C at:_____ End: Max/min____/____°C at:_____ Air temperature: Start _____°C at:_____ End _____°C at:_____ Grout temperature: Start _____°C at:_____ End _____°C at:_____	Yes ☐	No ☐	Comments:
	Have at least the following samples been collected for each control section? 1. Fluidity measurements. 2. Expansion, water separation and water absorption measurements on grout from mixer. 3. Expansion, water separation and water absorption measurements on grout from cable trough. 4. Strength tests.	Yes ☐	No ☐	Comments:
	Has actual consumption been controlled in relation to expected consumption?	Yes ☐	No ☐	Comments:

	Have the injection nozzles been controlled and found 100% filled with grout after setting of the grout?	**Yes** ☐	**No** ☐	**Comments:**	
	Has a statement/specification of any insufficient grout filling and plan for repair been presented to and approved by the supervision.	**Yes** ☐	**No** ☐	**Not relevant** ☐	**Comments:**
	Do the concrete surfaces in the area by the anchoring to be concreted meet the requirements for rough construction joints?	**Yes** ☐	**No** ☐	**Comments:**	
3. Special conditions					
4. Other comments					
Signature	**Contractor's signature:**				

Supervision's comments:

Guidance for completing Form B3: Checklist for injection – Pre-stressed reinforcement

To be filled in by the Contractor

General	The items on the checklist may be replaced by the Contractor's QA documentation by making a reference to them in the boxes of the form.
Header	State the name of the Contractor's foreman (Contractor's control). State what structural element the control (the form) covers, e.g. *Eastern bridge deck.*
1. Concreting programme	Before embedding in the structure, the concreting programme shall be submitted to the supervision for approval, see form B1.
2. Injection	Prior to commencement of injection, the tensioning shall have been approved by the supervision. Temperature conditions. Injection may only take place at the temperatures specified in DS/EN 446. The concrete and grout temperature shall be in the range 5 to 25^{o}C and the air temperature in the range 5 to 30^{o}C. Grout filling of nozzles. If insufficient filling is discovered, a more detailed examination of the matter shall be carried out with a plan for repair. This specification and plan shall be submitted to and approved by the supervision.
3. Special conditions	State other conditions which may be of relevance for the injection work.
4. Other comments	State any comments.

SUPERVISION'S COMMENTS:

By its comments, the supervision provides an assessment of whether the completed work and the related Contractor's control can be approved or whether it gives rise to any special actions. If the supervision has no comments, state “No comments”.

The supervision may add its own supervision notes/forms to which reference shall then be made.

Annex 4: Concrete works

Annex 4 for concrete works contains the following forms and guidance:

Concrete works shall be controlled on a daily basis by the Contractor on Form B1: "Checklist – Concrete works" or on similar documentation material with reference to the checklist in the boxes of the form.

Form A:

Protocol for preparatory meeting - Concrete works

Guidance for completing Form A

Form B1:

Checklist - Concrete works

Guidance for completing Form B1

Form B2:

Checklist - Concrete works - repair

Guidance for completing Form B2

Protocol for preparatory meeting – Concrete works Annex 4: Form A Page 1

Contract no.:	Bridge no. / Reg. no.:	Bridge name:	
Main Contractor:	Concrete supplier:	Employer:	Date:
Contractor's supervision:		Supervision:	

1. Drawings/ tender material/ General note sheet	**Has the maximum permitted stone size been specified?** **Is fibre permitted or required?** **It is allowed to omit determination of production properties?** **It is allowed to omit collection of material samples?** **It is allowed to omit test concreting?** **Have requirements for the execution of repairs been specified?** **Other agreements:**
2. Deviations from the tender material	
3. Concrete manufacturer/ Supplier	**Is the manufacturer/supplier certified in accordance with DS 2426 and DS/EN 206-1?** **Yes** ☐ **No** ☐ **Comments:**
4. Supervision of concrete plant	**Made on: _____ at: _____.** **Does the supervision participate?** **Yes** ☐ **No** ☐ **Comments:** **Have the requirements of GWS been observed for** **- Delivery and storage of constituent materials?** **- Dosing equipment?** **- Mixer?** **- Dosing of constituent materials?**

Protocol for preparatory meeting – Concrete works Annex 4: Form A Page 2

5. Constituent materials	**Has the following documentation for all constituent materials (including repair materials), see GWS, been provided:** **- Origin** **- General suitability and/or CE marking** **- Results from last 12 months' production tests** **Have all constituent materials been approved?**
6. Cement	**Have any special requirements been made for the use of a particular type of cement?** **Yes** ☐ **No** ☐ **Comments:** **Type:**_____ **concrete:**_____. **Type:**_____ **concrete:**_____. **Type:**_____ **concrete:**_____.
7. Fly ash	**Have any special requirements been made for the use of fly ash?** **Yes** ☐ **No** ☐ **Comments:** **Such requirements shall be stated:**
8. Microsilica	**Have any special requirements been made for the use of microsilica?** **Yes** ☐ **No** ☐ **Comments:** **Such requirements shall be stated:**
9. Aggregate	**Have any special requirements been made for the use of natural aggregate such as crushed granite?** **Yes** ☐ **No** ☐ **Comments:** **Type:**_____ **concrete:**_____. **Type:**_____ **concrete:**_____. **Type:**_____ **concrete:**_____. **Coarse aggregate:** **Passing fraction in 0.063 mm sieve > 1%?** **If yes, has the aggregate been documented in accordance with GWS?** **Has rock distribution been stated and approved?**

Protocol for preparatory meeting – Concrete works Annex 4: Form A Page 3

10. Constituent material samples

Samples of the following shall be provided to the supervision:

	Yes	No
10 kg Cement	☐	☐
10 kg Fly ash	☐	☐
10 kg Microsilica	☐	☐
10 kg Sand	☐	☐
20 kg. Stone:	☐	☐
1 l from each vessel of recycled water:	☐	☐
10 kg of other constituent materials with the exception of drinking water:	☐	☐

Comments:

11. Concrete composition

Does the concrete composition comply with the requirements of GWS?

12. Pre-testing

Is documentation available for pre-testing of the relevant concretes or from similar concretes as the ones in question which have been pre-tested within the past 12 months? Yes ☐ No ☐

If yes, state which:	Yes	No	**Structural element:**
Concrete 25M:	☐	☐	……..
Concrete 30M:	☐	☐	……..
Concrete 35A:	☐	☐	……..
Concrete 40E:	☐	☐	……..
Concrete ?_____:	☐	☐	……..
Concrete ?_____:	☐	☐	……..

Are indicative limits available for recipe variations?

Has the maximum age for pouring of concrete been declared?

Has the concrete composition been approved for all relevant concretes?

Comments:

13. Test concreting

Does the tender material state that test concreting can be omitted? Yes ☐ No ☐ **Comments:**

If yes, state for which:	Yes	No
Concrete 25M:	☐	☐
Concrete 30M:	☐	☐
Concrete 35A:	☐	☐
Concrete 40E:	☐	☐
Concrete ?_____:	☐	☐
Concrete ?_____:	☐	☐

Have any special requirements been made for the design and sizes of test specimen? Yes ☐ No ☐ **Comments:**

If no, these shall be agreed, and their design etc. shall be described in detail:

Protocol for preparatory meeting – concrete works Annex 4: Form A Page 4

14. Concreting programme	**Can preparation of concreting programme be omitted for individual structural elements?**	**Yes** ☐	**No** ☐	**Comments:**	
	If yes, state the individual structural elements: **1.** _____ **2.** _____ **3.** _____ **4.** _____ **5.** _____				
	Comments:				
15. Recycled water	**Can production tests of recycled water be omitted?**	**Yes** ☐	**No** ☐	**Not relevant** ☐	**Comments:**
16. Tests on the site	**Is concrete to be poured using a pump?**	**Yes** ☐	**No** ☐	**Comments:**	
	If yes, can it be permitted to omit testing of concrete on the site after the pump?	**Yes** ☐	**No** ☐	**Comments:**	
	Has acceptance criteria for testing of concrete on the site been stated?	**Yes** ☐	**No** ☐	**Comments:**	
	Can measurements of air and consistency be omitted on the site?	**Yes** ☐	**No** ☐	**Comments:**	
17. Control sections:	**The Contractor states the following division into control sections:** **1.** _____ **2.** _____ **3.** _____ **4.** _____ **5.** _____ **6.** _____ **7.** _____ **8.** _____				
	Comments:				

Protocol for preparatory meeting – concrete works Annex 4: Form A Page 5

18. Concrete sealers	**Is documentation is available of the efficiency of concrete sealers?**	**Yes** ☐	**No** ☐	**Comments:**
	Have they been approved with respect to product list on the RD website?	**Yes** ☐	**No** ☐	**Comments:**
19. Poured visible surfaces	**Filling of plugholes and clamp holes:** **Are these filled as specified in GWS 8A.3.10?**	**Yes** ☐	**No** ☐	**Comments:**
	If no, state the method:_____			
20. Special conditions				
Signature	**Main Contractor's signature:**		**Supervision's signature:**	

Guidance for completing Form A: Protocol for preparatory meeting – Concrete work

To be filled in by supervision and Contractor

Header	State the name of main Contractor's foreman (Contractor's control) and name of the supervision.
1. Drawings/ tender material/ /general note sheet	The drawings/tender material/general note sheet regarding the concreting shall be discussed and any agreements made at the preparatory meeting shall be stated.
2. Deviations from the tender material	Any deviations from the specification in the tender material which may have consequences shall be stated here.
3. Concrete manufacturer/ Supplier	Production controls by concrete manufacturer shall be assessed and monitored by an approved supervisory body and then be certified by an approved certification body in accordance with DS 2426 and DS/EN 206-1, section 10.2.
4. Supervision of concrete plant	State the time of supervision of the concrete plant and whether the supervision participates. A visual inspection shall be conducted to ensure that the storage of constituent materials meets the specified requirements. The supervision shall be made in connection with the pre-test.
5. Constituent materials	The documentation required for all constituent materials, see GWS, shall be available and be approved by the supervision.
6. Cement	State whether any special requirements have been made compared to GWS for the use of a specific type of cement.
7. Fly ash	State whether any special requirements have been made compared to GWS for the use of fly ash.
8. Microsilica	State whether any special requirements have been made compared to GWS for the use of microsilica.
9. Aggregate	State whether any special requirements have been made compared to GWS for the use of a specific natural type of aggregate and in which concrete.
10. Constituent material samples	In connection with concrete deck concreting and for each commenced 1000 m^3 concrete, representative constituent material samples shall be collected and provided to the supervision for storage until handover. At the meeting, the exact extent and time (at pre-testing/test concreting, bridge deck concreting) shall be agreed and specified under comments.
11. Concrete composition	It shall be documented that the concrete composition meets the requirements added to GWS.
12. Pre-testing	For each concrete composition, pre-testing is required (GWS 8A.4.2.2). If documentation is available from similar concrete which has been pre-tested within the past 12 months, this documentation may be used.
13. Test concreting	As a general rule, test concreting (GWS 8A.4.3) shall be carried out, but the tender materials may state that test concreting may be omitted. Special requirements may have been made for the design and size of the test specimen. If no requirements have been made with respect to the design, these shall be agreed and described in detail.

14. Concreting programme	It shall be stated if the tender material specifies that concreting programme (GWS 8A. 3.3) can be omitted for individual structural elements, and for which.
15. Recycled water	It shall be stated if the tender material specifies that production tests of recycled water (GWS 8A.4.4.1) can be omitted.
16. Tests on the site	It shall be stated if the tender material specifies that tests on the site (GWS 8A.4.4.2) for measuring the fresh concrete air content and consistency can be omitted.
17. Control sections:	The Contractor shall state the control sections into which the structure is divided.
18. Concrete sealers	If the Contractor intends to use concrete sealers, their efficiency shall be documented to comply with the requirements of GWS.
19. Poured visible surfaces:	If an alternative method is used to close/finish the filling of plugholes/clamp holes specified in GWS 8A.3.10, this method shall be agreed and stated.
20. Special conditions	State any other factors of relevance for the concrete work, including any cooling/heating of the individual structural parts, addition of any additives/special additives, fibres, etc. , May be provided in an annex.

Checklist – Concrete works — Annex 4: Form B1 Page 1

Contract no.:	Bridge no. / Reg. no./ Stage.:	Bridge name:
Contractor's supervision:		Date:
Structural element:		

Contractor's control – before concreting

1. Concreting programme	Has a concreting programme been prepared?	Yes ☐	No ☐	Comments:
	Has the concreting programme been presented to the supervision?	Yes ☐	No ☐	Comments
2. Equipment	Is an overview of the Contractor's concreting equipment available?	Yes ☐	No ☐	Comments:
	Is it sufficient?	Yes ☐	No ☐	Comments:
3. Preparation of form and reinforcement	Has a statement of completion been made to the supervision for the formwork and reinforcement work?	Yes ☐	No ☐	Comments
	Statement of completion made to: _____, _____			
	Has the form and reinforcement been inspected and accepted by the supervision?	Yes ☐	No ☐	Comments:
4. Construction joints	Have requirements for purity and roughness been met?	Yes ☐	No ☐	Comments:
5. Employer's control - Material samples	Have material samples been collected as agreed at the preliminary meeting?	Yes ☐	No ☐	Comments:
	Samples have been handed over to: _____on: _____			
	Have they been approved?	Yes ☐	No ☐	Comments:
6. Concrete pre-testing and/or test concreting	Are test results available from pre-testing?	Yes ☐	No ☐	Comments:
	Have test results been presented to and approved by the supervision?	Yes ☐	No ☐	Comments:

Checklist – Concrete works — Annex 4: Form B1 Page 2

7. Protection against drying-out	**Is a procedure available for ensuring compliance with the requirement for protection against drying-out before/during/after concreting?**	**Yes** ☐	**No** ☐	**Comments:**
8. Temperature conditions and strength development in the structure	**Are calculations available which show the expected temperature development in the structural element?**	**Yes** ☐	**No** ☐	**Comments:**
	Are calculations available which show the expected maturity and strength development in the structural element?	**Yes** ☐	**No** ☐	**Comments:**
	Is a procedure available for ensuring compliance with requirements before shuttering removal of non-load-bearing/load-bearing form?	**Yes** ☐	**No** ☐	**Comments:**
	A sketch showing the number and position of temperature sensors:			
	Any special measures which are required to be established/initiated during the curing period to provide protection against harmful impacts from the surroundings, and the curing heat shall be described/stated:			
	Have calculations and procedures been commented on by the supervision?	**Yes** ☐	**No** ☐	**Comments:**
9. Pouring and vibration	**Are documentation and procedure available for the insertion distance of internal vibrators and vibration time?**	**Yes** ☐	**No** ☐	**Comments:**
	Are documentation and procedure available for the maximum length of pouring breaks	**Yes** ☐	**No** ☐	**Comments:**
10. Treatment of unhardened concrete surfaces	**Is a procedure available for the treatment of unhardened concrete surfaces**	**Yes** ☐	**No** ☐	**Comments:**
11. Other comments				

Contractor's control – before, during and after concreting

12. Handover inspection of concrete	**Has the required handover inspection of concrete on site before/after pump been performed?**	**Yes** ☐	**No** ☐	**Comments:**

Checklist – Concrete works

13. Pouring	**Has the pouring been carried out and completed in accordance with the defined pouring rate and the programme?** **Yes** ☐ **No** ☐ **Comments:** **Any deviations in relation to the above concreting programme shall be stated:** **If it has been agreed with the supervision that a concreting programme will not be prepared for the relevant structural element, a brief specification shall be made of the concreting:** **Has a log been kept (concrete form)?** **Yes** ☐ **No** ☐ **Comments:**
14. Finishing	**Has a log been kept (concrete form)?** **Yes** ☐ **No** ☐ **Comments:**
15. Evaluation of the completed finishing	**Has the completed finishing satisfied the requirements set out in GWS and SWS for finishing?** **Yes** ☐ **No** ☐ **Comments:** **If no, describe the extent of and in what areas deviations from the requirements are found:**

Checklist – Concrete works Annex 4: Form B1 Page 4

16. Hardened concrete, surfaces	**Did the shuttering removal reveal any defects in the surfaces?**	**Yes** ☐	**No** ☐	**Comments:**
	Have thorough measurements been carried out by means of levelling and using a straightedge of the bridge deck upper side?	**Yes** ☐	**No** ☐	**Comments:**
	Action in response to any defects: Has a procedure been prepared and presented to the supervision for the extent and method of the repair work?	**Yes** ☐	**No** ☐	**Comments:**
	Have cover measurements been carried out for 5% of the concrete surface?	**Yes** ☐	**No** ☐	**Comments:**
17. Compression testing of poured cylinders	**Has the supervision been notified of the time for compression testing of poured cylinders?**	**Yes** ☐	**No** ☐	**Comments:**
	Have the results been approved?	**Yes** ☐	**No** ☐	**Comments:**
	If no, has a test programme been agreed for drilled cores?	**Yes** ☐	**No** ☐	**Comments:**
18. Other comments				
Signature	**Contractor's signature:**			

Supervision's comments:

Guidance for completing Form B1: Checklist – Concrete works

To be filled in by the Contractor

General	The items on the checklist may be replaced by the Contractor's QA documentation by making a reference to them in the boxes of the form.
Header	State the name of the Contractor's foreman (Contractor's control). State what structural element, the control (the form) covers, e.g. *Eastern foundation in line B.*
1. Concreting programme	State whether a concreting programme has been prepared for the relevant structural element. The concreting programme shall as a minimum include the following: • Staffing overview • Overview of equipment/spare equipment • Overview of materials/spare materials • Measures to ensure continuity in the pouring • Specification of pouring rate • Measures regarding finishing • Planned control programme and shall be submitted to the supervision for approval no later than 10 working days before scheduled concreting.
2. Equipment	State whether the Contractor's equipment including spare equipment meet the requirements specified.
3. Preparation of form and reinforcement	No later than 24 hours before concreting is scheduled to start, this shall be notified to the supervision.
4. Construction joints	State whether the cleanliness and roughness of construction joints meet the requirements specified.
5. Employer's control Material samples	Material samples shall be taken. Necessary sampling has been agreed at the preparatory meeting (see form A: "Protocol for preparatory meeting – Concrete works). Material samples shall be taken on concreting of bridge decks and for each commenced 1000 m^3 of concrete.
6. Concrete pre-testing and/or test concreting	Test results from either pre-testing and/or test concreting, respectively, shall be available and approved by the supervision before the actual concreting starts.
7. Protection against drying-out	State whether the Contractor's protection against drying-out meet the requirements specified for the required minimum maturity.
8. Temperature conditions and strength development in the structure	Calculations shall be available of the expected development in temperature and hardening in the relevant structural element. In the form of sketches, the sensors agreed with the supervision shall be indicated in the relevant structural element for recording of temperatures during setting and hardening. May be outlined in an annex.
9. Pouring and vibration	State whether the required documentation prior to establishing the criteria for maximum length of pouring breaks and for vibration using an internal vibrator is available and has been included in the Contractor's working procedure.

10. Treatment of unhardened concrete surfaces

State whether unhardened concrete surfaces meet the requirements specified.

11. Other comments

Any other conditions of relevance for the concrete work may be stated. May be provided in an annex.

12. Handover inspection of concrete

State whether handover inspection of concrete on the site documents that the concrete complies with the requirements and the defined acceptance criteria.

13. Pouring

State whether the concreting of the relevant structure is accordance with the concreting programme.

Any deviations from the concreting programme shall be stated/ described. All deviations require prior approval by the supervision.

For small concreting jobs where it has been agreed with the supervision, that there is no need to prepare an actual concreting programme, the execution of the concreting shall be briefly described, including the planned measures concerning finishing.

A log of the concreting work processes shall be kept, including:

- Time of the commencement and completion of pouring work
- Pouring rate (amount of concrete poured per hour)
- Age for filling of each load of concrete
- Interruptions and disturbances during pouring
- Location of incorporation for the concrete of which samples have been taken
- Weather conditions during concreting (precipitation, wind, air temperature).

14. Finishing

A log of the finishing work shall be kept, including:

- Time of the commencement and completion of pouring work
- Nature and type of form material
- Weather conditions during finishing (precipitation, wind, air temperature, solar penetration and relative humidity)
- Fresh concrete temperature
- Time of shuttering removal
- Type of finishing work and duration, including time for application of concrete sealer as well as for covering of unset surfaces and for finishing of surfaces after shuttering removal.

Any adjustment/changes in the assumed (see the concreting programme) measures shall be notified to the supervision and be logged.

15. Evaluation of the completed finishing

State whether the completed finishing has met the requirements set out in GWS and SWS.
Any deviations shall be briefly described.

16. Hardened concrete surfaces

State here whether the shuttering removal reveals any defects to the concrete surfaces or in the geometry.
If defects are detected which require remediation, a procedure shall be prepared describing the extent and method of repair. Before the repair work starts, the procedure shall be presented to the supervision for comments.
After concreting, the cover shall be controlled for 5% of the concrete surface.

Concrete surfaces which form the direct base for waterproofing and surfacing shall be thoroughly measured by means of levelling and a straightedge, and puddle formation shall be determined by a hydro test.

17. Compression testing of poured cylinders	State whether the supervision has attended the compression testing and whether the result satisfies the requirements.
18. Other comments	Any other conditions of relevance for the concrete work may be stated. May be provided in an annex.

SUPERVISION'S COMMENTS:
By its comments, the supervision provides an assessment of whether the Contractor's control performed gives rise to any special actions. If the supervision has no comments, state “No comments”.

Checklist – Concrete works – repair Annex 4: Form B2 Page 1

Contract no.:	Bridge no. / Reg. no./ Stage.:	Bridge name:
Contractor's supervision:		Date:
Structural element:		

Contractor's control – before concreting

1. Concreting programme	Has a concreting programme been prepared?	Yes ☐	No ☐	Comments:
	Has the concreting programme been presented to the supervision?	Yes ☐	No ☐	Comments
	Have control parameters and the extent of controls been agreed with the supervision?	Yes ☐	No ☐	Comments
2. Equipment	Is an overview of the Contractor's concreting equipment available?	Yes ☐	No ☐	Comments:
	Is it sufficient?	Yes ☐	No ☐	Comments:
3. Preparation of form and reinforcement	Has a statement of completion been made to the supervision for the formwork and reinforcement work?	Yes ☐	No ☐	Comments
	Statement of completion made to: _____, _____			
	Have the form and reinforcement been inspected and accepted by the supervision?	Yes ☐	No ☐	Comments:
4. Construction joints	Have requirements for purity and roughness been met?	Yes ☐	No ☐	Comments:

Checklist – Concrete works – repair Annex 4: Form B2 Page 2

5. Documentation of repair products, including any pre-testing and test concreting	**Is documentation available for all repair products?**	**Yes** ☐	**No** ☐	**Comments:**
	Has the documentation been presented to the supervision?	**Yes** ☐	**No** ☐	**Comments:**
	Are test results available from pre-testing?	**Yes** ☐	**No** ☐	**Comments:**
	Have test results been presented to the supervision?	**Yes** ☐	**No** ☐	**Comments:**
	Are test results available from test concreting?	**Yes** ☐	**No** ☐	**Comments:**
	Have test results been presented to and approved by the supervision?	**yes** ☐	**No** ☐	**Comments:**
6. Protection against drying-out	**Is a procedure available for ensuring compliance with the requirement for protection against drying-out before/during/after concreting?**	**Yes** ☐	**No** ☐	**Comments:**
7. Temperature conditions and strength development in the repair	**Are calculations available which show the expected temperature development in the repair?**	**Yes** ☐	**No** ☐	**Comments:**
	Are calculations available which show the expected maturity and strength development in the repair?	**Yes** ☐	**No** ☐	**Comments:**
	Is a procedure available for ensuring compliance with requirements before shuttering removal of non-load-bearing/load-bearing form?	**Yes** ☐	**No** ☐	**Comments:**
	A sketch showing the number and position of temperature sensors:			
	Any special measures which are required to be established/initiated during the curing period to provide protection against harmful impacts from the surroundings, and the curing heat shall be described/stated:			
	Have calculations and procedures been commented on by the supervision	**Yes** ☐	**No** ☐	**Comments:**
8. Treatment of unhardened concrete surfaces	**Is a procedure available for the treatment of unhardened concrete surfaces**	**Yes** ☐	**No** ☐	**Comments:**
9. Other comments				

Checklist – Concrete works – repair Annex 4: Form B2 Page 3

Contractor's control – before, during and after concreting

10. Handover inspection of repair products including sprayed concrete	**Has the required handover inspection of concrete on the site been made?** Yes ☐ No ☐ **Comments:**
11. Pouring	**Has the pouring of the repair work been carried out and completed in accordance with the defined concreting programme** Yes ☐ No ☐ **Comments:** **Any deviations in relation to the above concreting programme shall be stated:** **If it has been agreed with the supervision that no concreting programme is to be prepared for the relevant repair, the execution of the concreting shall be briefly described:** **Has a log been kept (concrete form)?** Yes ☐ No ☐ **Comments:**
12. Finishing	**Has a log been kept (concrete form)?** Yes ☐ No ☐ **Comments:**
13. Evaluation of the completed finishing	**Does the completed finishing work satisfy the requirements set out in GWS and SWS for finishing?** Yes ☐ No ☐ **Comments:** **If no, describe the extent of and in what areas deviations from the requirements are found:**

Checklist – Concrete works – repair Annex 4: Form B2 Page 4

14. Hardened concrete, surfaces	**Did the shuttering removal reveal any defects in the surfaces?**	**Yes** ☐	**No** ☐	**Comments:**
	Have thorough measurements been carried out by means of levelling and using a straightedge of the bridge deck upper side?	**Yes** ☐	**No** ☐	**Comments:**
	Action in response to any defects: Has a procedure been prepared and presented to the supervision for the extent and method of the repair work?	**Yes** ☐	**No** ☐	**Comments:**
15. Other comments				
Signature	**Contractor's signature:**			

Supervision's comments:

Guidance for completing Form B2: Checklist – Concrete works – repair

To be filled in by the Contractor

General	The items on the checklist may be replaced by the Contractor's QA documentation by making a reference to them in the boxes of the form.
Header	State the name of the Contractor's foreman (Contractor's control). State what structural element, the control (the form) covers, e.g. *Eastern foundation in line B.*
1. Concreting programme	State whether a concreting programme has been prepared for the relevant repair/structural element. For each major repair work, the concreting programme shall at least contain the following: • Staffing overview • Overview of equipment/spare equipment • Overview of materials/spare materials • Measures to ensure continuity in the pouring • Specification of pouring rate • Measures regarding finishing • Planned control programme and shall be submitted to the supervision for approval no later than 10 working days before scheduled concreting.
2. Equipment	The Contractor shall document that he has enough equipment, including spare equipment, to carry out concreting as scheduled.
3. Preparation of form and reinforcement	No later than 24 hours before concreting is scheduled to start, this shall be notified to the supervision.
4. Construction joints	State whether the cleanliness and roughness of construction joints meet the requirements specified.
5. Documentation of repair products including any pre-testing and/or test concreting	Documentation of repair products, including test results from pre-testing and/or test concreting, shall be available and be approved by the supervision before the actual concreting starts.
6. Protection against drying-out	State whether the requirements specified for protection of the surface of repair works against drying-out have been incorporated in the Contractor's working procedure.
7. Temperature conditions and strength development in the repair	For each major repair work, calculations shall be available of the expected development in temperature and hardening in the relevant structural repair. In the form of sketches, the sensors agreed with the supervision shall be indicated in the relevant repair for recording of temperatures during setting and hardening. May be outlined in an annex.

8.Treatment of unhardened concrete surfaces	State whether it has been agreed how unhardened concrete surfaces shall be treated and whether the Contractor has prepared a working procedure.
9. Other comments	Any other conditions of relevance for the concrete work may be stated. May be provided in an annex.
10.Handover inspection of repair products	State whether handover inspection has been carried out of repair products in accordance with the agreed control programme and the agreed extent of the controls.
11. Pouring	State whether the concreting of the relevant repair is accordance with the concreting programme. Any deviations from the concreting programme shall be stated/ described. All deviations require prior approval by the supervision. For small concreting jobs where it has been agreed with the supervision, that there is no need to prepare an actual concreting programme, the execution of the concreting shall be briefly described, including the planned measures concerning finishing. A log of the concreting work processes shall be kept, including: • Time of the commencement and completion of pouring work • Pouring rate (amount of concrete poured per hour) • Interruptions and disturbances during pouring • Location of incorporation for the concrete of which samples have been taken • Weather conditions during concreting (precipitation, wind, air temperature).
12. Finishing	A log of the finishing work shall be kept, including: • Time of the commencement and completion of pouring work • Nature and type of form material • Weather conditions during finishing (precipitation, wind, air temperature, solar penetration and relative humidity) • Fresh concrete temperature • Concrete surface temperature • Time of shuttering removal • Nature and duration of finishing. Any adjustment/changes in the assumed (see the concreting programme) measures shall be notified to the supervision and be logged.
13. Evaluation of the completed finishing	State whether the completed finishing has met the requirements set out in GWS and SWS. Any deviations shall be briefly described.
14. Hardened concrete surfaces	State here whether the shuttering removal reveals any defects to the concrete surfaces or in the geometry. If defects are detected which require remediation, a procedure shall be prepared describing the extent and method of repair. Before the repair work starts, the procedure shall be presented to the supervision for comments. Concrete surfaces which form the direct base for waterproofing and surfacing shall be thoroughly measured by means of levelling and a straightedge, and puddle formation shall be determined by a hydro test.

15.	Other comments	State any other conditions of relevance for the repair, e.g. required and tested pull-off strength etc. May be provided in an annex.

SUPERVISION'S COMMENTS:

By its comments, the supervision provides an assessment of whether the Contractor's control performed gives rise to any special actions. If the supervision has no comments, state "No comments".

Colophon

Title:	Concrete bridges: Supervision Handbook for Concrete Bridges. Quality system for Employer's Supervision and Contractor's control – Activities: Formwork, Non-pre-stressed Reinforcement, Pre-stressed Reinforcement and Concrete Works.
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