Diagram, engineering drawing

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**Checklists (in ‘Microsoft Word’)**

**Constructability:   
A guide to reducing temporary works**

TWf2020: 02, October 2020

**Introduction**

The aim of the guide, **Constructability: A guide to reducing temporary works** (TWf2020: 02, October 2020), is to raise awareness of the importance of constructability to clients, architects, permanent works designers, temporary works designers and contractors and how improved constructability can be achieved through a consistent systematic approach involving all parties.

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| **Editorial note**  The information provided herein is a ‘Microsoft Word’ version of the checklists contained in **Sections 8.1** to **8.4**. These are made available via the Temporary Works Forum (TWf) website ([www.twforum.org.uk](http://www.twforum.org.uk) … select … Resources/ Library Folders/ TWf Guidance).  The lists that follow here do not set out to be prescriptive and should be amended to suit individual company operations and preferences.  They may be updated from time-to-time (and the Secretary invites contributions to them ([secretary@twforum.org.uk](mailto:secretary@twforum.org.uk)). |

**Acknowledgement**

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Readers should note that the documents referenced in the TWf Guide are subject to revision from time to time and should therefore ensure that they are in possession of the latest version.

1. **Constructability Review Stages: Template Checklist**

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| **Constructability: A guide to reducing temporary works (TWf) (2020)** | | | | | | | | |
| **Constructability Review Stages: Template Checklist** | | | | | | | | |
| **Constructability at project initiation**  *Grip 1, RIBA 0, HE 0*  It is never too early to consider constructability; and as early as project initiation stage. A constructability review at this stage should be a swift process, as there will be many unknowns and many options to home in on. Such a review will enable appropriate conversations about how a proposal can be built; to test its feasibility for construction.  As early solutions are developed, the basics will then be better understood and key decisions can be made in principle, e.g. access arrangements, logistics, materials storage, cranage. This will enable key issues to be resolved, e.g. the need to buy or hire land owned by others to facilitate construction in good time.  It is important to identify early on any technical approval authorities, e.g. highways, rail. Large clients may have their own technical approval process and should be engaged. | | | | | | | | |
| **Stage** | **Constructability at option development and selection** | | **Constructability at preliminary and detailed design** | | **Constructability at pre-construction cost estimate build up (‘tender’)** | | **Constructability at pre-construction stage (‘site work’)** | |
| *Design development and options selection GRIP 1/2/3; RIBA 0/1/2; HE 0/1/2*  The brief (requirements) should be identified.  Consider the variety of options (forms) developed, e.g. location, number of spans, concrete or steel, practicalities, sequence of construction, aesthetics, etc.  The deliverability – in addition to constructability - should also be assessed. A project risk workshop may, for example, be the way to do this. This process may repeat in later stages. | | *Development phase: GRIP 4/5; RIBA 3/4; HE 3/4/5*  Consider the form to be chosen: For example, sequence of construction; bearing details (and temporary fixity/restraint); thermal movements; residual stresses; temporary support to follow on construction (e.g. temporary support to precast; precast acting as formwork resisting hydrostatic loads; precast acting as edge protection); unsupported reinforcement; correct poor buildability; eliminate unnecessary temporary works. | | *Interface between Development and Construction phases: GRIP 5/6; RIBA 4/5; HE 5/6*  Consider the form to be chosen and complete detailed design: For example: sequence of build (e.g. transport, eliminate storage and double handling); plant required; temporary works required (and plant required); improvements to buildability. | | *Construction phases: GRIP 6; RIBA 5; HE 6* | |
| **Actions to be complete before holding constructability review…..** | | **The following actions should be completed:**  • Functional requirements established  • Alternative geographical locations identified  • Stakeholders identified  • Value criteria established  • Outline solutions determined  • Options preliminary design and feasibility  • Site investigation(s) carried out  • Restrictions on timing and boundaries of site possession identified, e.g. rail interface, airport/flightpath, tidal working, nearby power transmission | | **The following actions should be completed:**  • Form of structure established  • Geographical locations established  • Stakeholders engaged  • Check that value criteria are being met  • Determine outline solutions  • Advanced the options preliminary design  • Identify interfaces between functions of works  • Identify interfaces with other contracts  • Carry out further site investigation(s)  • Draw up a schedule of site possessions | | **The following actions should be completed:**  • Design sufficiently mature to avoid major changes to form, material type and sizes  *NOTE: To achieve this it is recommended that the client and/or permanent works designer should have engaged already with contractor(s)*  • General arrangement (GA) and reinforcement detailing drawings substantially complete  • Stakeholders engaged  • Schedule of possession dates determined  • Check value criteria are being met  • Likely timing of work established  • Key dates identified for constraints and deliverables (e.g. possessions, handovers, etc.)  • Interfaces between functions of works defined  • Interfaces with other contracts defined  • Identify work content and work packages  • Establish methods and routes for delivering materials to site  • Establish preferred methods for constructing works  • Source resources for constructing the works  • Preliminary programme construction of works  • Contact and engage with specialist contractors  • Sufficient GI carried out in correct locations for temporary works assessments | | **The following actions should be completed:**  • Design complete (for the whole or part, as appropriate; the work may be staged)  • General arrangement and reinforcement detailing drawings complete  • Necessary site possessions confirmed with Stakeholders  • Budget established  • Materials for constructing the works sourced  • Resources for constructing the works engaged  • Construction team in place (including key temporary works staff)  • Divide site into work packages  • Develop programme for each work package so that each activity is identified  • Risk Assessment(s) and Method Statement(s) (RAMS) drafted for each of the work items  • Temporary works register in place for project delivery | |
| **Aim of the constructability review …..** | | **The aim of the constructability review is to determine:**  • whether the project can be built safely in the time allowed  • construction materials and methodology  • what specialist plant and contractors are required  • what geotechnical work has to be carried out  • the obstacles that must be overcome  *For example, site access and egress (e.g. timings: tides/possessions; environmental, site of special scientific interest); weather and seasonal conditions (e.g. monsoon season, school term times)*  • major items of temporary works; better still, what can be done to design them out (elimination)  • potential logistics problems  *For example: can the materials and resources be made available; where will they be coming from; does a mine, quarry or borrow-pit need to be established; do people need to be trained*  • potential transport problems  *For example: can the materials and resources be delivered to site at the correct time*  • any sources of uncertainty | | **The aim of the constructability review is to determine:**  • Method for choosing the location of construction joints  • Determine the size of pre-assembled components to be delivered to site  • Method of handling (craning) pre-assembled components.  *NOTE: If reinforcement has to be prefabricated, how will the reinforcement cage temporary structure be designed?*  • Method of connecting pre-assembled components  • Method of supporting pre-assembled components before they become incorporated into the works and are self-supporting  *NOTE: This includes reinforcement, steelwork and precast concrete*  • Method of providing strength and stability during early maturity (e.g. concrete strength for slip-forming)  • Method of providing stability during early stages of construction  *For example: additional bracing in composite bridges where the steel beams would rely on the deck to restrain the top flange; longitudinal restraint of continuous span bridges that are constructed in incremental spans*  • Assess the stability of any existing structures during the works, e.g. masonry walls upon removal of any adjacent walls, roof or floor support; the support of wet concrete on masonry walls; wind loading on previously protected walls and/or structures  • Identify parts of the permanent works that act as support for follow on construction works, e.g. precast units resisting horizontal hydrostatic loads, permanent formwork  • Construction (and access) loads that must be carried by permanent works in temporary condition  *For example, are decks strong enough for follow on work; access and egress; MEWPs, telehandlers; is extra steel required*  • Identify access routes for transporting materials and plant to site  • Identify location of foundations required for any likely temporary works or plant loadings  • Consider methods of restricting water ingress into the permanent or temporary works  • Identify gaps in information that will be required to design temporary works  *For example, is the ground investigation (GI) sufficient (and was it in the correct location); have the upper layers been sufficiently categorised*  *NOTE: GI is generally commissioned by permanent works designers, designing permanent works foundations, with little consideration for the associated temporary works. Often, there is no information on the uppermost layers in the locations where temporary works are required (e.g. cranes).*  *For example, many boreholes have no information for the top 1 to 2 m.*  • Review boundary of work package and which other packages and interfaces for possible constraints and interference  *For example: access and egress routes, cranes over-sailing, incompatible work being carried out during the same possession*  • Allow access for the implementation of surveys and the setting up of monitoring equipment | | **The aim of the constructability review is to determine:**  • Ensure the methods for constructing works are practical  • Ensure the sourcing of materials is practical  • Ensure the sequence and programme for constructing the works is practical  • Check the availability of specialist plant and contractors  • Check that all geotechnical risks have been identified  • Identify solutions to obstacles that need to be overcome  • Identify solutions to potential logistics problems  • Identify sources of uncertainty | | **The aim of the constructability review is to:**  • Review each work package in turn  • Review the boundary of work packages and those of other packages it interfaces with for possible constraints and interference (e.g. access and egress routes, cranes over-sailing)  • Define each work package site  *For example (on a bridge construction site):*   * *Define access and egress and any associated temporary works (e.g. access roads, bell-mouth, service crossing, temporary bridges)* * *Define site boundary fence, welfare, car parking and storage facilities, and any associated temporary works (e.g. fences, hoarding, cabins, foundations, drainage, outrigger foundations for cranes or HIAB)* * *Define hardstanding and laydown areas* * *Define plant movement route(s)*   • Review each step in programme from first to last activity  • Consider any provision for carrying out inspections and tests (and the access required)  • Define extent of temporary excavation (e.g. vertical supported or battered, de-watering)  • Identify affected services (e.g. diversions, service crossings)  • Define limits on plant size and materials stockpiles next to temporary excavations  • Confirm the plant required for carrying out excavation  • Define access requirements in/out of excavations, including rescue provision  • Define likely cranage requirements and possible crane locations  • Formwork for foundations  • Cranage for handling foundation reinforcement and formwork  • Support for foundation reinforcement  • Delivery of concrete  • Access for fixing wall reinforcement  • Cranage for handling wall reinforcement and formwork  • Support for wall reinforcement  • Formwork for wall  • Concrete delivery | |
| **Actions to be carried out after constructability review….** | | **The following actions should be completed:**  • best (compromise) solution chosen from options  • safety case developed  • hazard identification carried out  • risks designed out or reduced  • risk register developed | | **The following actions should be completed:**  • Design solution developed from concept to working drawings  • Develop any requirements for inspection and testing (including access)  • Safety case developed  • Hazards identified  • Risks designed out (or reduced)  • Risk register developed  • Preliminary temporary works register developed  *NOTE: Identify the implementation risk class and the design check category*  • Confirm necessary site possessions with stakeholders | | **The following actions should be completed:**  • Identify sources of materials for constructing the works  • Develop a safety case  • Develop the risk register  • Develop the temporary works register  *NOTE: Identify the implementation risk class and the design check category*  • Preliminary temporary works design carried out  • Cost the temporary works  • Schedule movement orders  • Finalise programme construction of works based on actual timings and dates considering access to site, seasonal effects, tides and possessions, etc.  • Calculate target cost for constructing the works | | **The following actions should be completed:**  • Obtain certified temporary works designs  • Finalise risk assessment(s) and method statement(s) (RAMS) for each of the work items  • Finalise the Inspection and Test Plan (ITP) and any associated check lists  • Carry out the work | |

**2.0 Constructability Review Schedule (i)**

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| **Constructability: A guide to reducing temporary works (TWf) (2020)** | | | | |
| **Constructability Review Schedule (1) - Constructability at option development and selection** | | | | |
| **Stage** | **Constructability at option development and selection**  *Design development and options selection GRIP 1/2/3; RIBA 0/1/2; HE 0/1/2*  The brief (requirements) should be identified.  Consider the variety of options (forms) developed, e.g. location, number of spans, concrete or steel, practicalities, sequence of construction, aesthetics, etc.  The deliverability – in addition to constructability - should also be assessed. A project risk workshop may, for example, be the way to do this. This process may repeat in later stages. | | | |
| **Item** | **Action / Who, what, when, where** | **Impact / Scope, programme, cost** | **Sign off** |
| **Actions to be complete before holding a constructability review….** | **The following actions should be completed:**  • Functional requirements established  • Alternative geographical locations identified  • Stakeholders identified  • Value criteria established  • Outline solutions determined  • Options preliminary design and feasibility  • Site investigation(s) carried out  • Restrictions on timing and boundaries of site possession identified, e.g. rail interface, airport/flightpath, tidal working, nearby power transmission |  |  |  |
| **Aim of the constructability review….** | **The aim of the constructability review is to determine:**  • whether the project can be built safely in the time allowed  • construction materials and methodology  • what specialist plant and contractors are required  • what geotechnical work has to be carried out  • the obstacles that must be overcome  *For example, site access and egress (e.g. timings: tides/possessions; environmental, site of special scientific interest); weather and seasonal conditions (e.g. monsoon season, school term times)*  • major items of temporary works; better still, what can be done to design them out (elimination)  • potential logistics problems  *For example: can the materials and resources be made available; where will they be coming from; does a mine, quarry or borrow-pit need to be established; do people need to be trained*  • potential transport problems  *For example: can the materials and resources be delivered to site at the correct time*  • any sources of uncertainty |  |  |  |
| **Actions to be carried out after a constructability review….** | **The following actions should be completed:**  • best (compromise) solution chosen from options  • safety case developed  • hazard identification carried out  • risks designed out or reduced  • risk register developed |  |  |  |

**3.0 Constructability Review Schedule (2)**

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| **Constructability: A guide to reducing temporary works (TWf) (2020)** | | | | |
| **Constructability Review Schedule (2) - Constructability at preliminary and detailed design** | | | | |
| **Stage** | **Constructability at preliminary and detailed design**  *Development phase: GRIP 4/5; RIBA 3/4; HE 3/4/5*  Consider the form to be chosen: For example, sequence of construction; bearing details (and temporary fixity/restraint); thermal movements; residual stresses; temporary support to follow on construction (e.g. temporary support to precast; precast acting as formwork resisting hydrostatic loads; precast acting as edge protection); unsupported reinforcement; correct poor buildability; eliminate unnecessary temporary works. | | | |
| **Item** | **Action / Who, what, when, where** | **Impact / Scope, programme, cost** | **Sign off** |
| **Actions to be complete before holding a constructability review ….** | **The following actions should be completed:**  • Form of structure established  • Geographical locations established  • Stakeholders engaged  • Check that value criteria are being met  • Determine outline solutions  • Advanced the options preliminary design  • Identify interfaces between functions of works  • Identify interfaces with other contracts  • Carry out further site investigation(s)  • Draw up a schedule of site possessions |  |  |  |
| **Aim of the constructability review ….** | **The aim of the constructability review is to determine:**  • Method for choosing the location of construction joints  • Determine the size of pre-assembled components to be delivered to site  • Method of handling (craning) pre-assembled components.  *NOTE: If reinforcement has to be prefabricated, how will the reinforcement cage temporary structure be designed?*  • Method of connecting pre-assembled components  • Method of supporting pre-assembled components before they become incorporated into the works and are self-supporting  *NOTE: This includes reinforcement, steelwork and precast concrete*  • Method of providing strength and stability during early maturity (e.g. concrete strength for slip-forming)  • Method of providing stability during early stages of construction  *For example: additional bracing in composite bridges where the steel beams would rely on the deck to restrain the top flange; longitudinal restraint of continuous span bridges that are constructed in incremental spans*  • Assess the stability of any existing structures during the works, e.g. masonry walls upon removal of any adjacent walls, roof or floor support; the support of wet concrete on masonry walls; wind loading on previously protected walls and/or structures  • Identify parts of the permanent works that act as support for follow on construction works, e.g. precast units resisting horizontal hydrostatic loads, permanent formwork  • Construction (and access) loads that must be carried by permanent works in temporary condition  *For example, are decks strong enough for follow on work; access and egress; MEWPs, telehandlers; is extra steel required*  • Identify access routes for transporting materials and plant to site  • Identify location of foundations required for any likely temporary works or plant loadings  • Consider methods of restricting water ingress into the permanent or temporary works  • Identify gaps in information that will be required to design temporary works  *For example, is the ground investigation (GI) sufficient (and was it in the correct location); have the upper layers been sufficiently categorised*  *NOTE: GI is generally commissioned by permanent works designers, designing permanent works foundations, with little consideration for the associated temporary works. Often, there is no information on the uppermost layers in the locations where temporary works are required (e.g. cranes). For example, many boreholes have no information for the top 1 to 2 m.*  • Review boundary of work package and which other packages and interfaces for possible constraints and interference  *For example: access and egress routes, cranes over-sailing, incompatible work being carried out during the same possession*  • Allow access for the implementation of surveys and the setting up of monitoring equipment |  |  |  |
| **Actions to be carried out after a constructability review….** | **The following actions should be completed:**  • Design solution developed from concept to working drawings  • Develop any requirements for inspection and testing (including access)  • Safety case developed  • Hazards identified   * Risks designed out (or reduced)   • Risk register developed   * Preliminary temporary works register developed   *NOTE: Identify the implementation risk class and the design check category*  • Confirm necessary site possessions with stakeholders |  |  |  |

**4.0 Constructability Review Schedule (3)**

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| **Constructability: A guide to reducing temporary works (TWf) (2020)** | | | | |
| **Constructability Review Schedule (3) - Constructability at pre-construction cost estimate build up (‘tender’)** | | | | |
| **Stage** | **Constructability at pre-construction cost estimate build up (‘tender’)**  *Interface between Development and Construction phases: GRIP 5/6; RIBA 4/5; HE 5/6*  Consider the form to be chosen and complete detailed design: For example: sequence of build (e.g. transport, eliminate storage and double handling); plant required; temporary works required (and plant required); improvements to buildability. | | | |
| **Item** | **Action / Who, what, when, where** | **Impact / Scope, programme, cost** | **Sign off** |
| **Actions to be complete before holding a constructability review…..** | **The following actions should be completed:**  • Design sufficiently mature to avoid major changes to form, material type and sizes  *NOTE: To achieve this it is recommended that the client and/or permanent works designer should have engaged already with contractor(s)*  • General arrangement (GA) and reinforcement detailing drawings substantially complete  • Stakeholders engaged  • Schedule of possession dates determined  • Check value criteria are being met  • Likely timing of work established  • Key dates identified for constraints and deliverables (e.g. possessions, handovers, etc.)  • Interfaces between functions of works defined  • Interfaces with other contracts defined  • Identify work content and work packages  • Establish methods and routes for delivering materials to site  • Establish preferred methods for constructing works  • Source resources for constructing the works  • Preliminary programme construction of works  • Contact and engage with specialist contractors  • Sufficient GI carried out in correct locations for temporary works assessments |  |  |  |
| **Aim of the constructability review….** | **The aim of the constructability review is to determine:**  • Ensure the methods for constructing works are practical  • Ensure the sourcing of materials is practical  • Ensure the sequence and programme for constructing the works is practical  • Check the availability of specialist plant and contractors  • Check that all geotechnical risks have been identified  • Identify solutions to obstacles that need to be overcome  • Identify solutions to potential logistics problems  • Identify sources of uncertainty |  |  |  |
| **Actions to be carried out after a constructability review…..** | **The following actions should be completed:**  • Identify sources of materials for constructing the works  • Develop a safety case  • Develop the risk register  • Develop the temporary works register  *NOTE: Identify the implementation risk class and the design check category*  • Preliminary temporary works design carried out  • Cost the temporary works  • Schedule movement orders  • Finalise programme construction of works based on actual timings and dates considering access to site, seasonal effects, tides and possessions, etc.  • Calculate target cost for constructing the works |  |  |  |

**5.0 Constructability Review Schedule (4)**

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| **Constructability: A guide to reducing temporary works (TWf) (2020)** | | | | |
| **Constructability Review Schedule (4) - Constructability at pre-construction stage (‘site work’)** | | | | |
| **Stage** | **Constructability at pre-construction stage (‘site work’)**  *Construction phases: GRIP 6; RIBA 5; HE 6* | | | |
| **Item** | **Action / Who, what, when, where** | **Impact / Scope, programme, cost** | **Sign off** |
| **Actions to be complete before holding a constructability review….** | **The following actions should be completed:**  • Design complete (for the whole or part, as appropriate; the work may be staged)  • General arrangement and reinforcement detailing drawings complete  • Necessary site possessions confirmed with stakeholders  • Budget established  • Materials for constructing the works sourced  • Resources for constructing the works engaged  • Construction team in place (including key temporary works staff)  • Divide site into work packages  • Develop programme for each work package so that each activity is identified  • Risk Assessment(s) and Method Statement(s) (RAMS) drafted for each of the work items  • Temporary works register in place for project delivery |  |  |  |
| **Aim of the constructability review ….** | **The aim of the constructability review is to:**  • Review each work package in turn  • Review the boundary of work packages and those of other packages it interfaces with for possible constraints and interference (e.g. access and egress routes, cranes over-sailing)  • Define each work package site  *For example (on a bridge construction site):*   * *Define access and egress and any associated temporary works (e.g. access roads, bell-mouth, service crossing, temporary bridges)* * *Define site boundary fence, welfare, car parking and storage facilities, and any associated temporary works (e.g. fences, hoarding, cabins, foundations, drainage, outrigger foundations for cranes or HIAB)* * *Define hardstanding and laydown areas* * *Define plant movement route(s)*   • Review each step in programme from first to last activity  • Consider any provision for carrying out inspections and tests (and the access required)  • Define extent of temporary excavation (e.g. vertical supported or battered, de-watering)  • Identify affected services (e.g. diversions, service crossings)  • Define limits on plant size and materials stockpiles next to temporary excavations  • Confirm the plant required for carrying out excavation  • Define access requirements in/out of excavations, including rescue provision  • Define likely cranage requirements and possible crane locations  • Formwork for foundations  • Cranage for handling foundation reinforcement and formwork  • Support for foundation reinforcement  • Delivery of concrete  • Access for fixing wall reinforcement  • Cranage for handling wall reinforcement and formwork  • Support for wall reinforcement   * Formwork for wall   • Concrete deliver |  |  |  |
| **Actions to be carried out after a constructability review ….** | **The following actions should be completed:**  • Obtain certified temporary works designs  • Finalise risk assessment(s) and method statement(s) (RAMS) for each of the work items  • Finalise the Inspection and Test Plan (ITP) and any associated check lists  • Carry out the work |  |  |  |