CHAPTER 12 - SUPERSTRUCTURES

MG Latimer

12.1 SCOPE

This Chapter covers the construction of superstructures of bridges and culverts.

In the first portion of this chapter six common types of bridge decks are dealt with, each having particular features which need to be considered and monitored. Attention is drawn to these features, and additional explanatory information is provided where necessary. To assist monitoring staff in the execution of their duties, the guidance presented for each deck type is arranged under separate headings for “planning” and “construction”.

The second portion of the Chapter deals with general aspects of construction which are of particular relevance to bridge superstructures.

12.2 SOLID SLAB DECKS

12.2.1 Description and General Features

As the name suggests, solid slab decks comprise of a solid section, without beams or voids. This type of deck is commonly used in the construction of short span bridges and culverts, and is illustrated in Photo 12.1.

The construction of solid slab decks is usually straight-forward and uncomplicated, and the formwork is very simple to construct. Reinforcement layouts seldom result in congested areas, and the placement of concrete should therefore present no difficulties. Concrete volumes may be large.

Photo 12.1: Soffit of cast in-situ concrete slab deck. Note untidy construction joint line and surface blemishes.
12.2.2 Planning

The following points should be considered when planning the construction of solid slab decks:

(a) Falsework and formwork are usually subjected to heavy loading.
(b) Deflection and settlement of formwork and falsework must be contained within acceptable limits.
(c) Solid slabs often consume large volumes of concrete and may result in long concrete pours, sometimes extending into the hours of darkness. Consideration should therefore be given to the possible need for lights.
(d) The concrete supply rate, placement sequence and procedure must enable thorough compaction to be achieved and must ensure that no cold joints are formed.
(e) Standard deck items:

- The exposed surface area of the concrete deck is usually large, and rainfall during concreting can therefore present serious problems. Expected weather conditions should be checked in advance and on the day of the pour.
- Plan for the possibility of plant breakdown or delays in the supply of concrete (lights required?)
- Consider suitable positions and details for emergency construction joint in case these are required.
- The arrangements to achieve the required level control, surface finish, and curing must be planned and agreed.
- Under unfavourable weather conditions (wind, heat) some concrete mixes may be prone to plastic shrinkage cracking. Re-vibration of the concrete is recommended.
- Check that the provision of drip moulds at the edges of the deck has not been overlooked.

**NOTE**
Planning should include the control of personnel access and movement on the deck. N.B. Ensure that parapet starter bars are not disturbed or used as hand-holds during placement and finishing of the concrete (this is detrimental to anchorage and bond of the reinforcement).

12.2.3 Construction

The standard monitoring items contained in Chapter 6 Formwork, 7 Reinforcement and 8 Concrete are applicable. Monitoring staff should in addition pay particular attention to the following during construction:

(a) Thick slabs impose heavy loads on formwork, falsework and falsework supports. The construction and performance of these elements therefore deserve special attention.
(b) When pouring large volumes of concrete ensure that the supply rate is not excessive as this leads to loss of control over the placing and compaction of the concrete.
(c) Accurate setting out and alignment of parapet starter bars is of the utmost importance. These bars must not be disturbed during concrete placement and finishing.
(d) Check for signs of settlement cracks, and if noticed ensure revibration to eliminate these.
(e) Level control, surface finish, and curing.
12.3 **VOIDED SLAB DECKS**

12.3.1 **Description and General Features**

Voided slabs are characterised by the presence of voids within the slabs, their function being to reduce the volume of concrete and thereby the self-weight required to be carried by the slab. The voids are generally cylindrically shaped, and constructed using hollow thin-walled steel sections placed within the slab.

**NOTE**

It is important to note that void formers are subjected to large buoyancy forces when the concrete is cast. These forces must be resisted by straps tied to the bearers below the formwork.

*Photo 12.2: Voided slab deck under construction. Tie down straps not yet installed.*

12.3.2 **Planning**

When void formers are incorporated within concrete slab decks, both contractor and monitoring staff should ensure that they have a sound understanding of the forces acting upon the formers, straps and formwork during concreting. Major difficulties can arise when these forces are not satisfactorily provided for, sometimes requiring that the entire deck be demolished and reconstructed. It is therefore essential that the arrangement be properly designed and that the formers be sufficiently rigid, sealed and tied down before casting the concrete.

The following points should be considered when planning the construction of voided slab decks:

(a) Tie-down of formers to resist buoyancy. Ensure that tie-down devices are:

- Properly designed.
- Tied to bearers below formwork.
- Adequately distributed along the length of the formers.
• Applied in a manner which will not deform or damage the formers.
• Provided with sleeves/cones to enable the ties to be removed/cut back to ensure adequate cover to all steel. The arrangement must enable the concrete surface to be neatly repaired and finished off.

(b) The provision of drainage holes at the low points in all void formers.
(c) Concrete should be placed and compacted in layers rather than “full depth” in order to reduce buoyancy forces.
(d) The placement sequence and procedure must be planned and tightly controlled to ensure that concrete below the formers is well compacted and that no cold joints develop.
(e) Ensure adequate, but not excessive, concrete supply rate.
(f) Falsework and formwork can be subjected to heavy loading.
(g) Deflection and settlement of the formwork and falsework.
(h) Large volumes of concrete may result in long concrete pours, extending into hours of darkness. Consider the need for lights.
(i) Standard deck items (refer 12.2.2 (e)):

• Check weather conditions in advance and on the day of the pour.
• Possibility of plant breakdown or delays in concrete supply (lights required?).
• Emergency construction joint positions and details.
• Level control, surface finish, and curing.
• Control of personnel access and movement on the deck (ensure that parapet starter bars are not disturbed).
• Re-vibration of concrete to eliminate plastic shrinkage cracking.

12.3.3 Materials

Ensure that void formers:

(a) Have adequate robustness and will not deform under the action of buoyancy forces and the tie-down strapping.
(b) Will not deteriorate or soften when wet.
(c) Can resist the forces they will be subjected to.
(d) Are adequately braced to maintain their shape.
(e) Are sealed to prevent ingress of water or grout.
(f) Have adequate drainage outlets at their low points.
12.3.4 **Construction**

The standard monitoring items contained in Chapter 6 Formwork, 7 Reinforcement and 8 Concrete are applicable. Monitoring staff should in addition pay particular attention to the following during construction:

(a) Performance of tie-down devices.
(b) Movement of formers during concrete placement.
(c) Falsework and falsework supports.
(d) Accurate setting out of parapet starter bars.
(e) Concrete placement sequence and procedure.
(f) Level control, surface finish, and curing.
(g) Check for signs of settlement cracks, and if noticed ensure revibration to eliminate these.

12.4 **CAST IN-SITU BEAM & SLAB DECKS**

12.4.1 **Description and General Features**

Cast in-situ beam and slab decks comprise of deck slabs supported by cast in-situ beams. The beams provide the strength and stiffness required for the span, and enable the slab to be relatively slender and economical to construct. The number of beams utilised is dependent upon several factors, such as the width of the deck and the slenderness of the beams.

Formwork for cast in-situ beam and slab decks is more complicated than that required for solid or voided slab decks.

12.4.2 **Planning**

The following points should be considered when planning the construction of cast in-situ beam and slab decks:

(a) The design of the falsework and formwork must cater for the substantially differing load intensities of the beam and slab portions.
(b) Casting procedure and sequence.
(c) To assist compaction of concrete in beams, the leading face of the pour should not be steeply inclined.
(d) The concrete in the region of the web-slab junction should be re-vibrated to close settlement cracks which tend to form at these positions. The timing of the re-vibration is critical to the success of this exercise. Refer to Figure 12.1.
(e) Standard deck items (refer 12.2.2 (e)):
   - Check weather conditions in advance and on the day of the pour.
   - Possibility of plant breakdown or delays in concrete supply (lights required?).
   - Emergency construction joint positions and details.
   - Level control, surface finish, and curing.
   - Control of personnel access and movement on the deck (ensure that parapet starter bars are not disturbed).
• Re-vibration of concrete to eliminate the possibility of settlement cracks and plastic shrinkage cracking.

![Diagram showing crack caused by settlement of the wet concrete in the deeper web section.](image)

Figure 12.1: Section through beam showing crack at web-flange junction.

### 12.4.3 Construction

The standard monitoring items contained in Chapter 6 Formwork, 7 Reinforcement and 8 Concrete are applicable. Monitoring staff should in addition pay particular attention to the following during construction:

(a) The performance of falsework and falsework supports.
(b) Accurate setting out of parapet starter bars.
(c) Concrete placement sequence and procedure.
(d) Compaction and re-vibration to prevent settlement cracks.
(e) Level control, surface finish, and curing.

### 12.5 PRECAST BEAM & SLAB DECKS

#### 12.5.1 Description and General Features

Precast beam and slab decks are similar to cast in-situ beam and slab decks, but utilise precast beams to support the deck slabs. Refer Photo 12.3 and 12.4. During concreting of the deck slab, the formwork is usually supported by the precast beams, requiring that the precast section alone be designed to carry the combined weight of both beam and slab.
Occasionally, designs may require that the beams be temporarily propped until the slabs have been cast and have gained strength. Under these conditions the self weight of the slab only acts on the structure when the props are removed, and is therefore carried by the composite (combined) beam and slab section.

Slender precast concrete slab panels or fibre-cement boards are sometimes used as permanent slab soffit formwork.
A variation of this deck type is the contiguous beam deck, in which the beams are butted against one another to obtain a flat soffit. Refer Photo 12.5. This is commonly employed on bridges over electrified railway tracks in order to minimise work above the exposed electrification.

Photo 12.5: Soffit of Contiguous Beam Deck.

12.5.2 Planning

The following points should be considered when planning the construction of precast beam and slab decks:

(a) Note any specified propping, casting or formwork requirements.
(b) Programme for beam manufacture, erection, slab construction, formwork removal.
(c) Surface preparation required (beam top surface, diaphragm construction joint surfaces, and soffit bearing areas at the beam ends).
(d) Precamber requirements.
(e) Beam storage arrangements.
(f) Be aware of possible lateral curvature of the beam due to shrinkage and temperature (differential strains occur if only one side of the beam is exposed to the drying effects of direct sunlight or wind).
(g) Position and detail of lifting hooks/devices.
(h) Transport, erection and safety.
(i) Temporary bracing requirements to ensure beam stability during erection. This is a critical item and must be designed and signed off by the Contractor’s Competent Person (CCP).
(j) Checks on beam length, curvature, and the position and height of the protruding reinforcement prior to erection.
(k) Bedding material at bearings.

(l) If permanent slab soffit formwork panels are used:

- Ensure adequate tolerance on seating area. Note that the beam spacings may vary slightly, and that beams may not be perfectly straight. Note also that sunlight can cause lateral temperature differentials and curvature.
- Ensure that panels are secured and cannot be displaced.
- Ensure panel seating detail incorporates a grout seal.

(m) Re-vibration at diaphragms (to prevent settlement cracks at slab-diaphragm junction) – timing critical.

(n) Standard deck items (refer 12.2.2 (e)):

- Check weather conditions in advance and on the day of the pour.
- Possibility of plant breakdown or delays in concrete supply (lights required?).
- Emergency construction joint positions and details.
- Level control, surface finish, and curing.
- Control of personnel access and movement on the deck (ensure that parapet starter bars are not disturbed).
- Re-vibration of concrete to eliminate plastic shrinkage cracking.

12.5.3 Materials

When permanent formwork panels are utilised it is advisable to consult with the bridge designer to ensure that the details and materials are acceptable. Monitoring staff should ensure that the strength and stiffness of the panels are adequate, and that the necessary concrete cover is obtained.

12.5.4 Construction

The standard monitoring items contained in Chapter 6 Formwork, 7 Reinforcement and 8 Concrete are applicable. Monitoring staff should in addition pay particular attention to the following during construction:

(a) Safety aspects during beam erection.
(b) Check and confirm beam positions and levels after erecting the beams (N.B. Also check level of protruding bars at top as this can be critical in achieving the required finished level of the roadway).
(c) Accurate setting out of parapet starter bars.
(d) Cleanliness of beam reinforcement before casting slab.
(e) Seating and sealing of permanent slab formwork panels (if applicable).
(f) Check below deck during casting of the slab to identify possible leakage of fines.

WARNING
Ensure that the stability of each precast beam is assured during all stages of construction. This usually requires that secure bracing or props be provided and that the beam lifting points ensure that the beam remains stable when lifted. The adequacy of arrangements to ensure stability should be signed off by the contractor’s competent person.
(g) Compaction and re-vibration at diaphragms to prevent settlement cracks.
(h) Control of concrete slab thickness.
(i) Control of cover to reinforcement.
(j) Level control, surface finish, and curing.

12.6 CONCRETE BOX GIRDER DECKS

12.6.1 Description and General Features

Concrete box girder decks utilise a section comprised of one or more hollow boxes (usually rectangular or trapezoidal in shape). In its most common form, the deck has a single box (Photo 12.6 and 12.7) with cantilever slabs, but for wider bridges, the box is often subdivided into two or more cells.

This type of deck has high torsional stiffness, and the presence of both top and bottom slabs provides capacity for both sagging and hogging moments.

When constructing cast in-situ concrete box girder decks, the lower slab and webs are usually cast first, followed by casting of the top slab a few days later.

![Photo 12.6: End of incomplete Concrete Box Deck.](image)
12.6.2 Planning

The following points should be considered when planning the construction of concrete box girder decks:

(a) Compliance with any specified casting or formwork requirements.

(b) Compliance with any specified time limitations relating to casting, stressing and removal of formwork. Note that the specifications/drawings usually require that the top slab be cast within 7 to 10 days of casting the webs in order to limit differential shrinkage stresses. Delays in the casting of the top slab should therefore be avoided.

(c) Compliance with any specified requirements relating to the fixity of the decks (on continuous multi-span decks it is sometimes necessary to temporarily fix sliding bearings).

(d) Falsework and formwork may be subjected to heavy loading.

(e) Deflection and settlement of formwork and falsework.

(f) Precamber requirements.

(g) Concrete placement sequence and procedure must be planned and tightly controlled to ensure that concrete at the bottom slab-web junction is well compacted. A horizontal or inclined top shutter is commonly provided at the bottom of the web formwork to help retain the concrete in the web.

(h) Surface preparation required at construction joints.

(i) Some locations may be fairly congested due to prestressing and reinforcement. Ensure that thorough vibration can be achieved.

(j) Drainage holes should be provided at the low-points in each cell.

(k) Timing of falsework and formwork removal.

(l) Arrangements for removal of “internal” formwork (i.e. formwork to the top slab between webs). This may require openings in diaphragms and bottom slabs, or temporary openings in the top slab. For temporary openings, control should be exercised over the bending of reinforcement within the opening area.
Standard deck items (refer 12.2.2 (e)):

- Check weather conditions in advance and on the day of the pour.
- Possibility of plant breakdown or delays in concrete supply (lights required?).
- Emergency construction joint positions and details.
- Level control, surface finish, and curing.
- Control of personnel access and movement on the deck (ensure that parapet starter bars are not disturbed).
- Re-vibration of concrete to eliminate plastic shrinkage cracking.

12.6.3 Construction

The standard monitoring items contained in Chapter 6 Formwork, 7 Reinforcement and 8 Concrete are applicable. Monitoring staff should in addition pay particular attention to the following during construction:

(a) Congested areas: ensure sufficient space for concrete placement and compaction.
(b) Check on concrete placement and compaction at web/bottom slab junction.
(c) Check level of bars at the top of the webs and slab as this can be critical in achieving the required finished level of the roadway.
(d) Accurate setting out of parapet starter bars.
(e) Cleanliness of beam reinforcement before casting top slab.
(f) Check below deck during casting to identify possible leakage of fines.
(g) Control of concrete slab thickness.
(h) Control of cover to the reinforcement in the top slab.
(i) Compaction and re-vibration at diaphragms to prevent settlement cracks.
(j) Level control, surface finish, and curing.

12.7 TWIN SPINE BEAM DECKS

12.7.1 Description and General Features

Twin spine beam decks utilise two spine beams to carry the deck slab. Refer to Fig 12.2. The beams and slab can be constructed from either reinforced or prestressed concrete.

The spine beams commonly comprise of solid concrete sections, but often utilise void formers to reduce their cross-sectional area and increase their efficiency.
12.7.2 Planning

The following points should be considered when planning the construction of twin spine beam decks:

(a) Falsework and formwork supporting the spine beams may be subjected to heavy loading.
(b) Deflection and settlement of the falsework and falsework supports.
(c) Precamber requirements.
(d) To assist compaction of concrete in the spine beams, the leading face of the concrete pour should not be steeply inclined.
(e) Ensure that all concrete will be thoroughly compacted. Note that some locations may be difficult to compact due to high concentrations of prestressing and reinforcement.
(f) The concrete in the region of the web-slab junction should be re-vibrated to close settlement cracks which tend to form at these positions. The timing of the re-vibration is critical to the success of this exercise.
(g) Surface preparation required at construction joints.
(h) Standard deck items (refer 12.2.2 (e)):

- Check weather conditions in advance and on the day of the pour.
- Possibility of plant breakdown or delays in concrete supply (lights required?).
- Emergency construction joint positions and details.
- Level control, surface finish, and curing.
- Control of personnel access and movement on the deck (ensure that parapet starter bars are not disturbed).
- Re-vibration of concrete to eliminate plastic shrinkage cracking.
- Compaction and re-vibration at diaphragms and slab/web junctions to prevent settlement cracks.
- Surface finish and curing.

12.7.3 Construction

The standard monitoring items contained in Chapter 6 Formwork, 7 Reinforcement and 8 Concrete are applicable. Monitoring staff should in addition pay particular attention to the following during construction:

(a) Congested areas: ensure space for concrete placement and compaction.
(b) Check level of top slab bars, to ensure that the specified cover is obtained.
(c) Accurate setting out of parapet starter bars.
(d) Check below deck during casting to identify possible leakage of fines.
(e) Control of concrete slab thickness.
(f) Control of cover to reinforcement in the top slab.
(g) Level control, surface finish, and curing.

12.8 GENERAL CONSIDERATIONS FOR SUPERSTRUCTURES

12.8.1 Advance Planning

The importance of advance planning for the construction of bridge superstructures cannot be over-emphasised. Monitoring staff should ensure that they are in possession of all construction drawings and specifications, and that these are clearly understood. They are advised to actively engage with the contractor to ensure that the necessary method statements and proposals are prepared and submitted timeously.

Advance planning meetings between the monitoring staff and the designer can be very helpful, as these present an opportunity to obtain clarifications and to communicate matters of importance.

Planning should consider all aspects of the construction, including falsework and formwork, casting sequence, construction joint positions, bearings, movement joints, recesses, drainage ducts etc. Possible requirements for approvals from railway or other authorities, and advance testing or component approvals should not be overlooked.

12.8.2 Access and Safety

Refer item 2.9 in Chapter 2.

The construction of bridge superstructures almost always involves working at height, and safety aspects related to the provision of adequate safety railings, access ramps and ladders must receive the necessary attention.

Special consideration should be given to access arrangements when working over water, and to ensuring that both environmental and safety requirements are satisfied.

When working over roadways suitable protection measures must be put in place to safeguard motorists or pedestrians below.

12.8.3 Setting Out & Levels

Refer Chapter 3.

The geometry of bridge superstructures is often complex, and setting out calculations and checks may need to take account of varying crossfall, vertical and horizontal curvature, and the effects of the “tilt” of box sections and beam webs.

Formwork levels should allow for the deflection of supporting beams or girders, as well as the bedding-in and elastic shortening of falsework supports.

It is advisable that independent checks be made of critical setting out points.
12.8.4 Precamber and Casting Sequence

On all but the most elementary structures it is advisable to consult the design office to confirm and if necessary obtain approval for precamber requirements.

Reinforced concrete members usually require upward precamber to allow for downward elastic and creep deflection. Prestressed members usually require downward precamber to allow for upward elastic and creep deflection.

In instances where the superstructure being cast is carried by temporary girders which will deflect under the weight of freshly cast concrete, consideration should be given to the affect that this deflection will have on any concrete which is setting or has already set. Such concrete is prone to cracking, as it is no longer able to deform to accommodate the changing profile caused by the deflection. It follows that the ability of the concrete to tolerate this deflection without distress is dependent upon the rate and sequence of casting, as well as the time at which the concrete starts to set. An obvious further consideration is the flexibility of the supporting girders, which should be contained within acceptable limits. These aspects should be carefully considered, and guidance obtained from the design office where necessary.

12.8.5 Falsework

The contents of Chapter 6: Falsework, Formwork and Concrete Finish are applicable and should be referred to.

The following items have particular relevance to the falsework to superstructures, and should not be overlooked:

(a) Stability, wind resistance, bracing.
(b) Falsework is often required to remain in place for a long period. The bedding of falsework base pads must therefore be protected against erosion by wind and rain, and should be regularly checked.
(c) On river bridges, falsework located close to the banks must be resistant to erosion and designed to resist debris and impact.
(d) Possible vehicle impact should be considered when construction takes place above or adjacent to roadways.
(e) Timing of removal of formwork (consult design office).

12.8.6 Effect of Elastic Support on Prestressed Members

In general, when prestressing is applied to members carried by rigid supports, the members lift off the supporting formwork when the prestress loading is applied. When this occurs the weight of the concrete is immediately transferred from the formwork onto the member itself, counteracting the upward forces imposed by the applied prestressing. This behaviour enables member stresses to be contained within acceptable limits.

However, when members are cast on formwork supported by very tall scaffolding towers or flexible beams/girders, the elasticity of the support influences the above behaviour, and the weight of the concrete may be only partially transferred onto the prestressed member. Unless this behaviour is properly evaluated and accounted for, tensile stresses at the top of the member may exceed allowable values causing cracking of the member.
It is therefore essential that monitoring staff are alert to the potential for such situations and consult with their design office regarding the necessary evaluations.

12.8.7 Formwork

The contents of Chapter 6: Falsework, Formwork and Concrete Finish are applicable and should be referred to.

The following items have particular relevance to the formwork to superstructures, and should not be overlooked:

(a) Bridge superstructures are usually very visible and special attention should therefore be paid to the quality of finish, uniformity of colour and texture etc.

(b) Monitoring staff should be on the lookout for variations in the quality, texture and surface finish of timber formwork used to form visible concrete faces. Note that the surface colour and texture of concrete cast on “first-use” timber often differs from that of “second or third-use” timber. This effect can result in a very “patchy” appearance.

(c) Formwork boards or panels for visible faces should be arranged in a pleasing and regular pattern. The formwork material and panel layout should be discussed and approved well before formwork material is ordered and delivered to site.

(d) If tongue-and-grooved timber formwork is used the concrete surface should be left “as struck” (no rubbing).

(e) Formwork (particularly timber formwork) should be treated with care in order to prevent damage during handling or fixing of steel reinforcement. Reused formwork should be regularly inspected for possible defects.

(f) Note that dust, dirt and contaminants from rusting reinforcement can lead to staining of the concrete surface. The cleanliness of horizontal formwork to exposed surfaces should therefore be monitored, and the long term storage of reinforcement on formwork should be discouraged.

(g) Pay special attention to the fixing, neatness and alignment of chamfer strips in all prominent locations such as the edges of decks.

(h) Poorly constructed construction joints can be very unsightly. Pay attention to alignment, fixity of soffit formwork, provision of grout seals etc.

(i) Ensure that local overloading of formwork does not occur.

12.8.8 Concreting

The contents of Chapter 8: Concrete are applicable and should be referred to.

Attention should be paid to the following:

(a) Approvals required prior to placing concrete.

(b) Planning the movement of workmen during concreting to prevent unnecessary disturbance of reinforcement (especially parapet starter bars). Walking on the freshly placed concrete should not be permitted.

(c) Provision for and removal of adequate screening rails (limit disturbance when the rails are removed).
(d) Provision of sufficient experienced “finishers” to operate the screed rails and complete the surface finishing.

(e) Consider and plan for unfavourable weather conditions (rain, wind, cold, heat). Deck concrete should not be poured when there is a likelihood of rainfall during the casting and setting period.

(f) Planning for possible equipment failure, concrete supply problems (availability of lights?), emergency construction joints.

(g) Compaction at congested locations.

(h) Monitor possible leakage of fines at soffit, panel joints etc.

(i) Possible need for revibration of concrete to prevent plastic shrinkage cracking, especially during hot or windy conditions.

12.8.9 Deck Surface Levels

Planning and construction should consider the importance of obtaining the correct deck levels, recognising the permissible tolerances. The actual levels achieved should be checked after concreting, as deviations from the specified levels may require that remedial work be carried out and that the parapet levels be amended. Refer Item 12.8.13 below.

12.8.10 Curing

The contents of Chapter 8: Concrete are applicable and should be referred to.

Monitoring staff should pay attention to the following:

(a) The area to be cured may be extensive.

(b) Suitability of proposed curing method. Note that the top surface of bridge decks should be cured by constantly spraying the entire exposed surface with water.

(c) Application method and timing of application.

(d) Consider the affect of wind, weather etc.

12.8.11 Time of Stressing

Prior to stressing, prestressed concrete members usually have limited resistance to cracking as these members are young and often contain only small quantities of steel reinforcement. It is therefore not advisable to allow the application of prestressing to be unnecessarily delayed. The design office should be consulted for advice in situations where requirements are not specified on the drawings or in the specifications.

12.8.12 Parapets

Parapets are probably the most visible of all bridge components, and are often viewed from close range. Even minor blemishes and defects are therefore easily noticed. It follows that special attention should be paid to the quality of construction, including both alignment and finish.
Monitoring staff should pay attention to:

(a) Provision for joints, cover plates, lighting ducts and supports etc.
(b) Both horizontal and vertical alignment MUST be very good.
(c) Correct setting out of parapet starter bars is of great importance (errors can result in lack of cover).
(d) Concrete cover must be tightly controlled (lack of cover can in time lead to unsightly stains and concrete spalling - both unacceptable on parapets).
(e) Chamfers, edges, alignment etc. must be carefully checked before concreting.
(f) Monitor surface finish achieved, surface blowholes etc. and take prompt action to rectify any problems.
(g) Curing.

12.8.13 Asphalt Surfacing of Decks

Planning and construction should consider:

(a) Programme and approval of asphalt mix design.
(b) Arrangements at expansion joint recesses to permit placing of asphalt over the joint gap. Note that it is normal practise to complete the asphalt surfacing before installing expansion joints.
(c) Quality of surface finish required on deck concrete.
(d) Checking of concrete surface levels to confirm acceptability. High spots may require remedial work to lower the surface level (ensure that required concrete cover is maintained),
and low spots may require local asphalt levelling layer. In severe cases, a cementitious screed may need to be applied.

(e) Concrete surface cleaning and tack coat.

(f) Monitoring the application of the tack coat to ensure that kerb/parapet is not contaminated.

(g) Approval of compaction equipment to be used on bridge deck (the operation of vibratory compaction equipment on the deck should not be permitted, unless special circumstances require this and the designer’s approval is obtained).

(h) Monitoring the operation of compaction equipment to ensure that kerb/parapet edges are not chipped or damaged by steel wheels of rollers.

(i) Compatibility of materials where asphalt is in contact with sealants (isolation membranes may be required if the materials are not compatible).

12.8.14 Expansion Joints

Refer to Chapter 14: Ancillary Components for detailed guidance.

There are numerous important points to consider and monitor. These include:

(a) Guarantee requirements.

(b) Ensure that drainage pipes required to drain water percolating through the surfacing adjacent to the joint nosings (at low points) are not overlooked.

(c) Importance of level control to ensure good rideability etc.

(d) Normal practise is to complete asphalt surfacing before installing expansion joints. If this practice is not followed it is unlikely that good alignment will be achieved.

(e) Control the movement of construction traffic over joints which are under construction and protect the sawn edges of the asphalt surfacing.

(f) Ensure that reinforcement in joint recesses is not abused by the joint installer.

(g) Protect and cure freshly cast concrete joint nosings, and prevent traffic loading until concrete has attained acceptable age and strength. Consult with design office.
INDEX TO APPENDICES

APPENDIX 12A - SUPERSTRUCTURES CHECK LIST

NOTE
For formwork, reinforcement, concrete, prestressing, etc., the standard check-lists apply.
# Mechanoically Stabilized Earth Walls And Patented Earth Retaining Systems
## CONSTRUCTION MONITORING CHECKLIST

**PROJECT NO. / NAME:** .................................................................

**INSPECTOR’S NAME(S):** ...........................................................................

**STRUCTURE:** .......................................................... **ELEMENT:** ..........................................................

<table>
<thead>
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<th>ACTIVITY AND DETAILS</th>
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**STATUS INCLUDES**

- A Contractor's submission received
- B Engineer’s appraisal
- C Inspected / Tested
- D Compliance Verified
- E Approved / Rejected
- F Signed Off

**CCP:** Contractor’s Competent Person

**Note:** Indicate N/A under Status if not applicable