# Phase 1 Brief

Phase 1 is concerned with exploring engineering concepts for the Transport, Structural, and Environmental components of the Civil Engineering Design, applying engineering judgement to assess the viability of current infrastructure for reuse, and providing reasoned commentary on options available for the development of the sites into Games venues.

Your aim is to **convince** the DD, DM, PCs and SCEs that you have identified the key features, enduring assets and limitations of the transport, structural, and environmental engineering systems, and can confidently inform the client on recommended actions for further works, supported by **justification** of your reasoning.

Near the end of the Phase 1 design exercise, the DD, PCs and SCEs will discuss the various findings from the investigations undertaken by the different groups. These will be considered and reviewed with the following new information that you won't yet be aware of, and which has not yet been received by the Design Manager:

- minor amendments to the brief from the Client
- results of a geotechnical study currently being undertaken
- any revisions from the rest of the Design Team (e.g. Architect)

From this new information and Phase 1 discussion, the detailed brief for the Phase 2 design will be compiled and sent to the DD for approval. For the Phase 2 brief, ALL groups will work on detailed integrated Structural, Geotechnical and Environmental design of the same stadium concept, which will be advised to groups in Week 7.

Phase 2 will extend upon the investigative and concepting works from Phase 1 to deliver detailed preliminary design documentation for the proposed stadium development that can be used for costing but is not yet detailed enough to enable procurement or construction.

Due to the timing of the mid-semester break, work on Phase 2 will commence prior to the break and it is expected that critical information for Phase 2 will be introduced while teams are still working on producing the Report for Phase 1.

# Team Selection & Charter – Thursday 31st July (Week 1)

Students should form teams of 5-6 Engineers in Week 1 – please use the Tuesday workshop session and class MS Teams site to find team members. Once you've selected your team, please advise the DD via the MS Teams 'Group Selection' channel and they will set up a private Teams channel for group communications. Please **complete and upload the Team Charter** to your group's channel (template available on Blackboard).

# Phase 1 Report – due 4pm, Friday 12th September (Week 7)

## Overview

Phase 1 will comprise the submission of **one integrated design report per team**. This report must include the following work packages:

- (A) Transport Engineering Assessment
    - Multi-Modal Analysis of Existing Transport Network (10%)
    - Transport Design Improvements (5%)
- (B) Structural Engineering Assessment
    - Assessment of Existing Stadium (7.5%)
    - Stadium Concept Designs (5%)
- (C) Environmental Engineering Assessment (Preliminary)
    - Embodied Carbon Assessment, Stages A1-A5 (7.5%)
- (D) Field Trips
    - QSAC Stadium Field Trip & Questionnaire (2.5%)
    - Expert Interview (2.5%)

Further details and recommended completion dates for Phase 1 work packages are available below. The rubric for the Phase 1 report will made available on the course Blackboard site.

## (A) Transport Engineering Assessment (15%)

### A.1 Multi-Modal Analysis of Existing Transport Network (10%)

Each group will conduct an inventory of the existing transport infrastructure serving the Victoria Park/Barrambin Games Venue(s), including access by pedestrians, cyclists / e-bikes / e-scooters, buses, trains, and passenger cars. This would include paths to and from adjacent areas to the Park generally, parking locations and public transport stops or stations at the Park or at the edge of the Park, and resulting pedestrian paths through the Park to the specific Venue(s). This inventory should include sketches of the locations of this transport infrastructure, such as a carefully annotated map. The inventory should also consider pedestrian access paths (1) from parking locations and public transport stops/stations to the Park, (2) within the Park to and from the Venue(s), and (3) any additional accommodations necessary for pedestrian flows into and out of the Venue(s), including waiting areas and security checks upon entry.

Each group will prepare an analysis of likely major event transport needed to and from the Victoria Park/Barrambin Venue(s) during the Games. The group will need to estimate:

1. the total number of spectators that may be accommodated in each Venue;
2. the schedule of events likely to be at each Venue during the day with the greatest pedestrian traffic to the Venue(s) during the Brisbane 2032 Games; and
3. an estimate of 15-minute flows to and from Victoria Park, and to and from each Venue, during the same (busiest) day of the 2032 Games.

These flows would consider the time of arrival at Victoria Park/Barrambin by whatever travel mode, the time for spectators to walk to each Venue within thePark, the time to enter and clear a security check, and the time

within the Venue to find a seat and be seated. In reverse, the flows should consider the time for spectators to depart the Venue, navigate out of Victoria Park/Barrambin, and exit using the same mode as they arrived. It would be expected that this would take the form of tables indicating the schedule from (2) and the 15-min flows from (3).

Having estimated the 15-min flows to and from each Venue, each group should then estimate the total number of persons arriving and departing, by mode, for those same 15-min flows. The modes should include train, bus (or METRO vehicle) including park-and-ride or kiss-and-ride, passenger car, cycling, or walking. Essentially, this would involve creating tables from (3) above, split out among each of the five modes.

The submission for Task A.1 shall include a 4 **x A4 page maximum** summary of the likely multimodal capabilities for Victoria Park/Barrambin for the Brisbane 2032 Games. Submit this in tables and brief descriptive text:

- Identify the necessary capacity for trains at stations adjacent to Victoria Park
- Identify the necessary capacity for buses and/or METRO vehicles at stations and stops adjacent to Victoria Park/Barrambin
- Identify locations for park-and-ride or kiss-and-ride lots (i.e. places for persons to get onto buses or METRO vehicles) for spectators to get to the Victoria Park/Barrambin Venue(s)
- Identify the frequency and number of trains and buses / METRO vehicles to serve the site during the busiest (greatest pedestrian traffic) day of the Games, by 15 min period
- Identify the capacity (space requirements) for any passenger cars, cycling, e-bike, and e-scooter parking at each Venue
- Identify the proposed pedestrian flows to and from each Venue, from and to various Victoria Park/Barrambin entrances, by 15 min period

Also, each group should submit **1 A3 page** sketch (hand-drawn or computer-generated) of the site indicating the locations of bus stops, the location(s) of passenger car, cycle / e-bike / e-scooter parking, and the proposed pedestrian access routes to and from each Venue, from and to the Victoria Park /Barrambin entrances.

## A.2 Transport Design Improvements (5%)

Each group will also submit a **4 A4 page maximum** critique of the existing transport infrastructure serving Victoria Park /Barrambin (from A.1) for the Brisbane 2032 Games. Submit this in dot point form:

- Highlight positive and negative characteristics with respect to
    a. Train operations near Victoria Park/Barrambin, particularly from Cross River Rail and other rail lines
    b. Passenger car, bus, and METRO traffic operations on the Northern Busway and other roadways adjacent to Victoria Park/Barrambin
    c. Pedestrian and cyclist / e-bike / e-scooter safety
    d. Sustainability in the context of greenhouse gas emissions and fuel use
- Discuss opportunities where further refinement of the infrastructure or layout may add value and/or improve train, bus, and traffic operations, pedestrian and cyclist safety, and/'or sustainability
- Select the group's **preferred** improvements to the transport design on the larger Victoria Park/Barrambin site and adjacent transport infrastructure, based on the above

## Recommended Completion Dates:

- A.1 Multi-Modal Analysis of Existing Transport Network – Thursday 21st August (Week 4)
- A.2 Transport Design Improvements – Thursday 28th August (Week 5)

# (B) Structural Engineering Assessment (12.5%)

## B.1 Assessment of Existing Stadium (7.5%)

Each group will undertake design checks on the existing structure for the QSAC Main Stadium. This will comprise two distinct activities. Engineers will:

1. Refer to the original structural engineering drawings provided for the Section 01 (Unit One) stands to
    a. identify the key design parameters for the structure
    b. identify the key features of the structure system, describing the purpose of each element and reasoning as to its orientation, shape and size.
    c. indicate load paths for how gravity and lateral (e.g. wind and seismic) actions applied to the stands are resolved into the footings; and
    d. model parts of the structure in SPACE GASS/ISA for analysis.
2. Use publicly available visualisation tools (e.g. Google Maps & Streetview function, QSAC Venue Map 360° Viewer, Field Trip) to observe the form of the structure that frames the roof canopy over the top of the Eastern Stand (Sections 07 to 11; Unit Seven) and
    a. identify the key features of the roof structure, distinct from the stand structure, including a summary of what cannot be observed but can be inferred;
    b. sketch the structure including a single cantilever frame in elevation, roof plane on plan and vertical bracing elevation from the east; and
    c. use the above sketches (or otherwise) to indicate load paths for how wind actions applied to the roof are resolved into the footings.

Notes:

- The stands are constructed from both steel and aluminium components. You will not be required to address the “Comalco Ltd.” luminium products listed on the drawings including seating planks, stair treads, seats, cleats, angle cleats or beams. You will only be required to address the steel members and the aluminium truss members.
- Each “typical section” of the stands (refer drawing CG6-402) is practically identical so you will only need to examine one such frame. For consistency, this shall taken to be the frame at Grid 9. Stability structures for the whole stand will need to consider the relevant tributary areas for collection.
- Each “typical section” of the roof frame is practically identical so you will only need to examine one such frame. Stability structures for the whole roof structure will need to consider the relevant tributary areas for collection.
- The stands were designed over 40 years ago as temporary structures only and hence may not comply with modern standards and expectations for permanent structures.
- For wind loads, consider the stands to be equivalent to a mono-sloped roof. Specific wind design of the stadium will not occur until Phase 2.
- No calculations are required for B.1.

The submission for B.1 Task (1) shall include the following documentation:

1. An executive summary (**2 A4 pages** maximum) describing:

a. Design criteria such as floor loads, wind loading parameters to AS/NZS 1170.2, earthquake loading parameters to AS 1170.4, assumed grades/strength of steel/aluminium/concrete, assumed geotechnical parameters etc.

b. A description of the different types of elements observed and a commentary on their documented orientation, size and section shape.

2. 2 sketches (or SPACE GASS printouts/screengrab) of the Section 01/Unit One "Typical Section" (see drawing CG6-402) and "Lateral Structure Elevation" (see drawing CG6-404 Elevation at Grid J), drawn to an appropriate scale on **1 A3 paper** and showing:

   a. primary member sizes only, (i.e. no need to show seating components);

   b. identification of materials used in the structure (e.g. steel, aluminium, concrete);

   c. footings (this may require drawing over SPACE GASS supports from screengrab); and

   d. other structural information as required

3. A series of sketches (or SPACE GASS printouts/screengrabs) of the above showing the following annotated diagrams:

   a. Loading applied to the "Typical Section" from uniform imposed live load ONLY and loading applied to the "Lateral Structure Elevation" from a unit line load at the seating level, including reaction forces;

   b. Corresponding shear force diagrams;

   c. Corresponding bending moment diagrams;

   d. Corresponding axial force diagrams; and

   e. Corresponding deflection plots.

The submission for B.1 Task (2) shall include the following documentation:

4. An executive summary (**1 A4 page** maximum) describing:

   a. Key features of the system, including how it works and how it interacts with the stand structure; and

   b. Assumptions, exclusions and limitations of the examination.

5. 3 sketches (hand-sketch or CAD is acceptable), drawn to an appropriate scale on **1 A3 page each** and showing:

   a. Elevation drawing for a single cantilever frame;

   b. Plan drawing for the roof plane members;

   c. Elevation drawing for the vertical bracing elevation from the east;

   Note: the above sketches should show nominal span lengths and member shapes (member sizing will not be possible to capture), nominal roof cladding and footings (on relevant drawings), etc.

6. Annotated sketches to describe how wind actions are carried through the structural load path to the foundations, which may include:

   a. Relevant free body diagrams

   b. Imposed load, load path and reaction arrows

   c. Axial forces, bending moment and shear force diagrams where valuable

d. Text commentary

**B.2 Stadium Concept Design (5%)**

The stadium stands described in B.1 include aluminium profile seating planks over aluminium trusses or steel beam raking members, supported by steel columns on mass concrete pad footings. Similarly, the canopy appears to be a cantilevered and tie-stayed steel truss roof with braced back span on concrete plinths. Each stand may be functionally considered a separate structure, orthogonal on plan and arranged radially around the field.

Each team will use Australian and/or international precedents to explore two (2) distinctly different stadia, considering how these differ in form, material and function to each other and the QSAC Main Stadium:

- Stand construction
    - seating plats
    - raking beams
    - vertical supports
- Roof forms
    - Linear radial systems
    - Linear and spatial bridge systems
    - 3D spatial systems
- Independence or integration of structural systems
- Materials
    - Concrete (reinforced, post-tensioned, precast etc)
    - Steel (hot rolled, cold-formed, high-strength, tensioned etc)
    - Timber
    - Roofing materials (e.g. glass, fabric, ETFE)
    - Composites
    - Earth and other alternative materials
- Architectural features including response to form, function, orientation and geometry etc.

Notes:

- Proposed or other conceptual stadium designs may be included provided that they have a substantial basis in engineering reality, however this must be approved by the DM or DD.

The submission for B.2 Task shall include the following documentation:

7. 2 presentation posters, drawn to an appropriate scale on **1 A3 page each** and showing:
    a. Photos, pictures, diagrams or other figures that visually describe the key differing features of the stadium in question, not to take up more than 50% of the page area;
    b. Engineering commentary on the key structural engineering features of the stadium and the reasons for their adoption (if possible to ascertain); this MUST contain a description of how the load paths in the system work.

8. An executive summary (**2 A4 pages** maximum) describing:
    a. How each of the stadia differ from each other and the QSAC Main Stadium. This may be summarised in a Table for ease of presentation.
    b. Key learnings from the exploration around different architectural and structural forms, materials, methods of construction and other design choices that allow designers to meet the project objectives and performance requirements.

**Recommended Completion Dates:**

- B.1 Assessment of Existing Stadium - Thursday 28th August (Week 5)
- B.2 Stadium Concept Design - Thursday 4th September (Week 6)

## (C) Environmental Engineering Assessment - Preliminary (7.5%)

Each group will undertake a Stage A1–A5 embodied carbon assessment of the existing QSAC Main Stadium structure. This task applies principles from your previous environmental engineering courses and builds on your work analysing the existing structure.

You will quantify and compare the embodied carbon of the existing structure using material quantities derived from project drawings and calculate the total embodied carbon emissions (kg $CO_2e$) using two recognised industry tools:

- NABERS Embodied Carbon Tool (https://www.nabers.gov.au/ratings/our-ratings/nabers-embodied-carbon), and
- IStructE Structural Carbon Tool (https://www.istructe.org/resources/guidance/the-structural-carbon-tool/).

While both tools rely on Environmental Product Declarations (EPDs) for modern materials, applying them to an existing structure can still generate valuable baseline data to support future design decision-making. Your aim is to explore the embodied carbon legacy of the current stadium and assess the feasibility and usefulness of applying these tools to older infrastructure.

This assessment will also support broader sustainability reporting and inform discussions around reuse vs. redevelopment for Brisbane 2032 Olympic venues.

### C.1 Material Quantity Take-Off

Using the QSAC Main Stadium project drawings:

- Identify and quantify all major structural materials (e.g. concrete, structural steel, aluminium, and glass) relevant to the primary structure (i.e. exclude footings/foundations, internal finishes, seating, services, etc).
- Focus only on materials contributing significantly to embodied carbon in Stages A1–A5 (i.e. product stage to construction).
- Present quantities in a clearly formatted table, specifying units (kg, tonnes, or $m^3$), assumed densities, and drawing references.
- Clearly document and justify any assumptions.

### C.2 Embodied Carbon Calculation

Using your quantity data, complete an embodied carbon calculation using both the NABERS Embodied Carbon Tool and the IStructE Structural Carbon Tool.

For each tool, use material quantities from C.1 but make additional assumptions as needed to evaluate Stage A1-A5 embodied carbon emissions (particularly those related to modern product equivalence, material sourcing, and transport). Clearly document and justify any assumptions.

### C.3 Comparison and Critical Reflection

Each group must compare the outputs of the two tools and reflect on the following areas:

**Tool Comparison**

- Identify and discuss differences in embodied carbon outcomes between the NABERS and IStructE tools.
- Comment on the major contributing materials and any unexpected results, data gaps, or sensitivity to assumptions.
- Explain possible and likely reasons for variations between tools.

**Methodological Reflection**

- Critically reflect on the appropriateness and limitations of using embodied carbon assessments when evaluating the environmental performance of existing infrastructure like QSAC.
- Compare the use of embodied carbon assessment (Stages A1–A5) with a full life cycle assessment (LCA, Stages A–D) in the context of infrastructure planning, i.e. when might an embodied carbon assessment sufficient and when is a full LCA necessary or more informative.
- Discuss how the results of this assessment could influence recommendations around reuse vs. redevelopment in the Olympic infrastructure strategy.

## Part C Submission Requirements

Each group should submit the following as part of their Phase 1 design report:

- **C.1 Material Quantity Table (1 A4 page max).**
  Present a summary table of material types, quantities, source references and assumptions.
- **C.2 Embodied Carbon Summary Table (1 A4 page max)**
  Present results for both tools in a clear summary table showing emissions per material, total emissions, total intensity (kg $CO_2e/m^2$), source references and key assumptions.
- **C.3 Commentary and Reflection (500 words max)**
  Comparison of tool outcomes and a short methodological reflection addressing the points above.
- **Supporting Documentation in Appendix**
  - Include any supporting information (calculations, annotated drawings) used to calculated material quantities as a design report appendix.
  - Include the ‘Comparison’ (IStructE tool) and ‘Rating Result’ (NABERS tool) summary Excel worksheets as a design report appendix.
  - Place the Excel file for both tools in your MS Teams Group and also include a share link to these files in the design report appendix.

## Recommended Completion Dates:

- C.1 - Material Quantity Table - Thursday 28th August (Week 5)
- C.2 – Embodied Carbon Calculation - Thursday 4th September (Week 6)
- C.2 – Commentary and Reflection – Thursday 11th September (Week 7)

# (D) Field Trips (5%)

**D.1 – QSAC Field Trip (Tuesday 5th August Week 2) (2.5%)**

All students are invited to attend a special site visit to QSAC Stadium in Nathan, Brisbane during the allocated time for the Workshop on Tuesday 5th August. During this time, students will be required to undertake a questionnaire to help improve their understanding of the sports venue infrastructure and inform subsequent Phase 1 design tasks. Please refer to the **CIVL4518 QSAC Fieldtrip Instructions** on Blackboard for further details.

Students will be awarded **2.5% of total course grade** for attendance at this field trip and submission of the associated questionnaire (one submission per group is sufficient).

**D.2 – Expert Interview (Thursday 28th August Week 5 or 5th September Week 6) (2.5%)**

Students will consider a broader set of civil engineering performance considerations to assess the suitability, feasibility, and value of refurbishing the stadium site for the Brisbane 2032 Games. This consideration will be conducted as interviews with design professionals with expertise in a specialist design topic with relevance to the project.

Interviews will be conducted at eight company locations during Workshops in Week 5 and Week 6. Students must sign up and attend one company interview in one week only (Week 5 OR Week 6).

Each student within the same group must choose a different expert. Each company can only host a maximum of eight students per week.

**In Week 3, a list of available companies/topics will be released** for student sign-on.

**In Week 4, students should prepare a meeting agenda** for a ~1 hour meeting, including questions to discuss with their expert. These will be shared with the expert ahead of their meetings. One agenda/question list per meeting is sufficient.

Please email a calendar invitation for the meeting time, with attached agenda, to the Development Director (A/Prof Joe Gattas) when ready.

During the interview, each group should keep minutes of the meeting. Students will be **awarded 2.5% of total course grade** for attendance at the interview and submission of the associated questionnaire. Please email the meeting minutes (including attendance record, summary of discussion) to the Development Director (A/Prof Joe Gattas) when ready, prior to the Phase 1 submission due date.

**Recommended Completion Dates:**

- D.1 QSAC Field Trip – Tuesday 5th August (Week 2)
- D.2 Expert Interview Sign-up – Week 3
- D.2 Expert Interview Group Meeting Agenda – Week 4
- D.2 Expert Interviews – Week 5 or Week 6
- D.2 Expert Interview – Meeting Minutes – Week 7

# Phase 1 Submission Requirements

This submission must include (in the following order):

1. Title page (**1 A4 page**)
2. Group Contribution declaration (**Template on Blackboard**)
3. Use of Generative AI/ML declaration (**Template on Blackboard**)
4. Contents page or Index
5. **Transport Engineering** components, as described in Part (A) above
6. **Structural Engineering** components, as described in Part (B) above
7. **Environmental Engineering** components, as described in Part (C) above
8. QSAC Field Trip Questionnaire (available on Blackboard)

Additional submission details:

- Each group is to submit one file only in PDF format via the CIVL4518 Blackboard site.
- The title page must include the group number and each group member's name and student number.
- The contribution declaration form that outlines which student/students were responsible for each part of the submission (as a %). All group members must be included, even if their contribution was 0%. This should be signed by all students prior to submission.
- The documentation must have all pages numbered and must include a contents table/index.
- Students should complete the Phase 1 Peer Assessment (released on Blackboard) immediately after the Phase 1 submission is complete for evaluation of their Peer Assessment Factor (PAF)

# Phase 1 Additional Comments

Recommendations for all submitted material:

- Keep your own copy of all submitted group material as it is submitted. This will allow design work to proceed for Phase 2 while submissions are being reviewed. Most students will also want to take a copy of all submitted material into the Project Discussion and Presentation assessment in Week 13.
- Guidelines for drawing sketches:
    - CAD Drawings, or any drawings produced using software of any kind, are acceptable but will not attract any additional credit; you have been educated as engineers not technicians. You are not expected to know how to operate CAD software however you are expected to be competent in conveying information via sketches.
    - If drawing by hand, draw in HB (or darker) pencil or black ink on A3 or A4 blank white paper or graph paper as appropriate. Avoid using thin pencil on graph paper.
    - Write on sketches in capital letters.
    - Include an appropriate title block, incorporating at least the date, designer's name/initials, reviewer/checker's name/initials, scale(s) with critical dimensions clearly shown, north point, unique sketch number and an index to the sketches.
- All submissions should have clearly defined sub-headings and page numbers (either absolute or relative to the Part, so that the relevant information can be readily found from the Table of Contents.
- As part of the team project and workshop participation, all engineers are expected to keep their own individual workbook in which they keep their own records of, and notes on, their work. The workbook should contain both design development (drafts, calculations, sketches) and project management details (meeting minutes, Gantt charts etc). Your workbook must be available for inspection and assessment by supervising engineers at any time in Weeks 2 through 13. If there is a disagreement within your team with regard to PAFs, your workbook may be taken into consideration when applying the outcomes of the peer assessment process to determine your result for the team reports.