

# DRAFT

## ETIHAD STADIUM NORTH STAND EXPANSION

### Addendum to Stage 3 Part 2 Construction Hoarding – crowd movement assessment

04 August 2023

# DRAFT

## METADATA



|                  |                                                                                                                                                                   |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Title            | Etihad Stadium, North Stand Expansion – Addendum to Stage 3 Part 2 Construction Hoarding – crowd movement assessment                                              |
| Abstract         | Crowd movement study to assess the impact of the proposed changes to the construction hoarding on pedestrian circulation during event days at the Etihad Stadium. |
| Client           | City Football Group Limited                                                                                                                                       |
| Filename         | 12588700 Addendum to MCFC Construction Hoarding Impact Assessment Stage 3 Part 2 Crowd Modelling_DRAFT.pptx                                                       |
| Version / Status | DRAFT                                                                                                                                                             |
| Author           | Gaila Comesaña González, Alex McCarthy                                                                                                                            |
| Reviewer         | Samuel Moutet                                                                                                                                                     |
| Date             | 04 August 2023                                                                                                                                                    |

This document has been prepared by Movement Strategies, a GHD company for the sole benefit, use and information of City Football Group Limited for the purpose agreed between Movement Strategies and City Football Group Limited set out in this report.

# DRAFT

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# EXECUTIVE SUMMARY

## Scope of works

Movement Strategies (MS) has been commissioned by City Football Group Limited (CFGL) to provide crowd movement consultancy services to inform the development of the North Stand Expansion of the Etihad Stadium.

This document is an addendum to '*Etihad Stadium North Stand Expansion, Stage 3 Part 2 Construction Hoarding – crowd movement assessment (DRAFT)*' issued on 12 April 2023.

This document assesses the impact of the changes to the hoarding layouts proposed by Sisk for Phases 1, 2 and 3 of construction of the North Stand Expansion. The study aims to determine the ability of pedestrians accessing (and egressing) the Etihad Stadium to circulate through the routes available to the west, north and east of the construction hoarding.

The MS scope of assessment extends from the points of arrival/departure (available to the public) in the wider area up to the stadium building line (turnstile and exit doors). Circulation within the building has been assessed by CFGL.

This document should be read in conjunction with:

- NS Hoarding Impact – Ingress and Egress Alterations.pptx [received on 24/03/23]
- 230320 12588700 – MCFC North Stand Expansion Stage 3 Part 2 Databook\_DRAFT-0.5.pdf
- 12588700-MCFC North Stand Expansion Stage 3 Part 2 Crowd Modelling\_DRAFT.pdf
- 12588700-230412 MCFC Construction Hoarding Impact Assessment Stage 3 Part 2 Crowd Modelling\_DRAFT.pdf.

## Main Findings

### Phase 1

- The conclusions in report '*Etihad Stadium North Stand Expansion, Stage 3 Part 2 Construction Hoarding – crowd movement assessment (DRAFT)*' for Stadium Ingress, Hard Egress and Evacuation scenarios do not change with the revised layout.
- Based on current planning assumptions, a contingency queue overflow area should be provided for the Metrolink westbound service given that the extended queue area will not be available during this phase.

### Phase 2

- The conclusions in report '*Etihad Stadium North Stand Expansion, Stage 3 Part 2 Construction Hoarding – crowd movement assessment (DRAFT)*' do not change with the revised layout.
- Scenario 5: Stadium Hard Egress and Arena Egress (Simultaneous) will still require the mitigation measures set out in that report.
- The layout and operation of the overflow queue area by the Metrolink westbound service may have to adapt to the proposed construction hoarding layout.

### Phase 3

- The conclusions for Phase 2 will also apply to Phase 3.

# DRAFT

## SCOPE



Movement Strategies (MS) has been commissioned by City Football Group Limited (CFGL) to provide crowd movement consultancy services to inform the development of the North Stand Expansion of the Etihad Stadium.

This document is an addendum to '*Etihad Stadium North Stand Expansion, Stage 3 Part 2 Construction Hoarding – crowd movement assessment (DRAFT)*' issued on 12 April 2023.

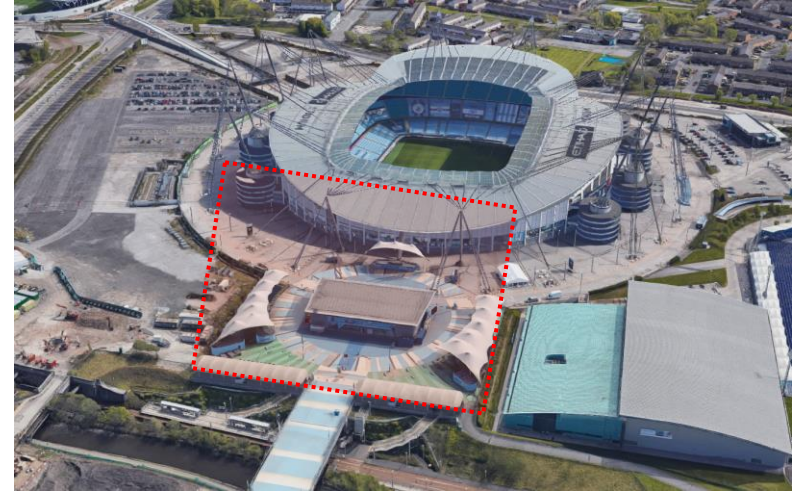
This document assess the impact of the changes to the hoarding layouts proposed by Sisk for Phases 1, 2 and 3 of construction of the North Stand Expansion. The study aims to determine the ability of pedestrians accessing/egressing the Etihad Stadium to circulate through the routes available to the west, north and east of the construction hoarding.

The MS scope of assessment extends from the points of arrival/departure (available to the public) in the wider area up to the stadium building line (turnstile and exit doors). Circulation within the building has been assessed by CFGL.

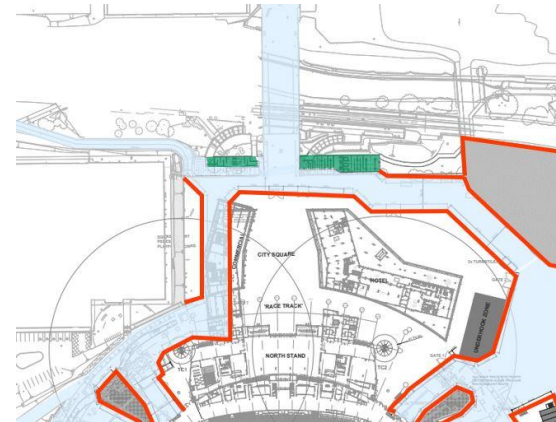
The key analysis from a crowd flow perspective is to provide evidence that supports the capacity calculations. The methods of analysis in this phase are static/spreadsheet modelling (which is the methodology needed for compliance with *The Guide to Safety at Sports Grounds*), and *SENSE* network modelling.

This document does not include:

- Detailed operational / staffing plans
- Contingency planning



Existing Etihad Stadium with project area highlighted (Source: Google Earth)



Proposed North Stand construction hoarding for Phase 1 (Source: SISK)

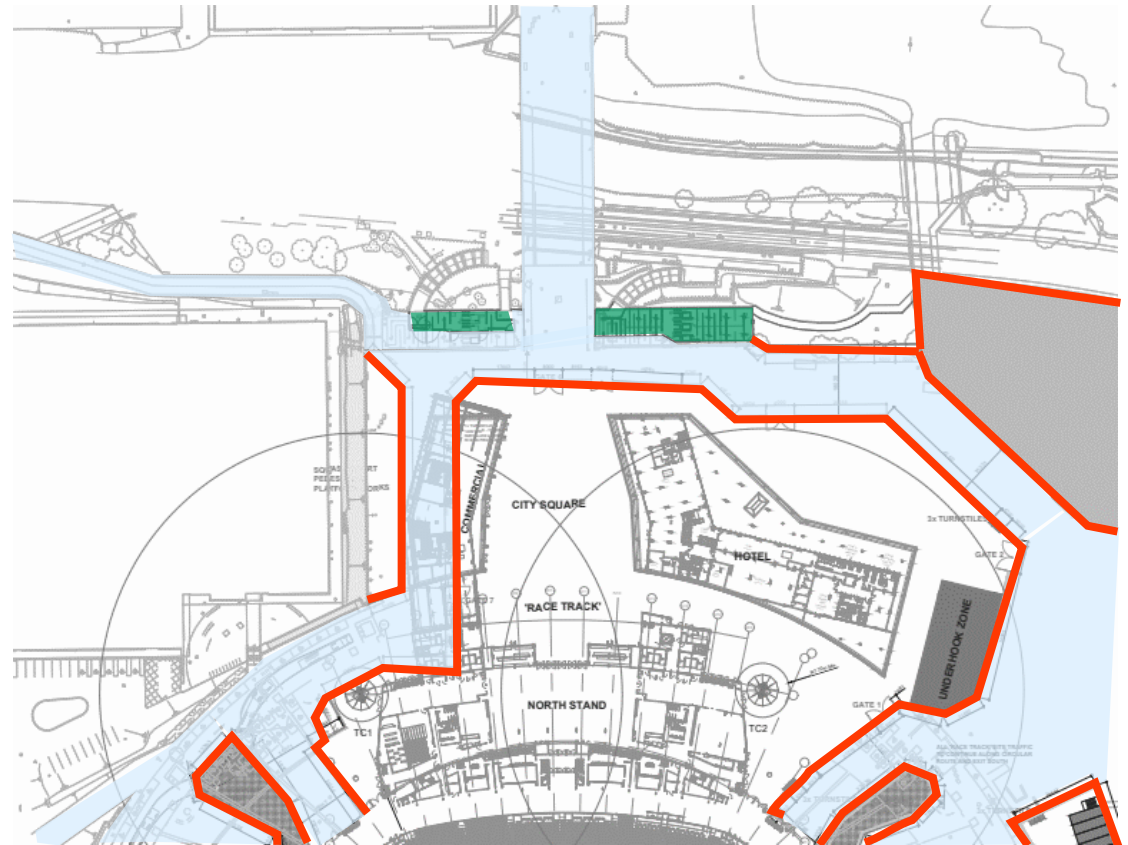
The adjacent figure shows the proposed Phase 1 construction compound for the North Stand and the pedestrian circulation space available around the compound.

This hoarding layout will be in place from the 10<sup>th</sup> August to the 20<sup>th</sup> September 2023.

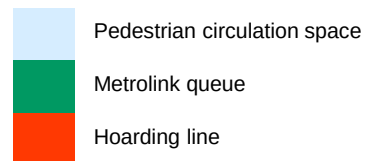
The Co-Op Live Arena will not be in operation during this phase.

The extension of the Metrolink westbound queue area will not be in place during this stage.

It is assumed that no construction works will take place on an event day and that all doors into the construction compound will be closed.



Phase 1 construction hoarding layout (Source: Sisk)



The adjacent figure shows the proposed Phase 2 construction compound for the North Stand and the available pedestrian circulation space.

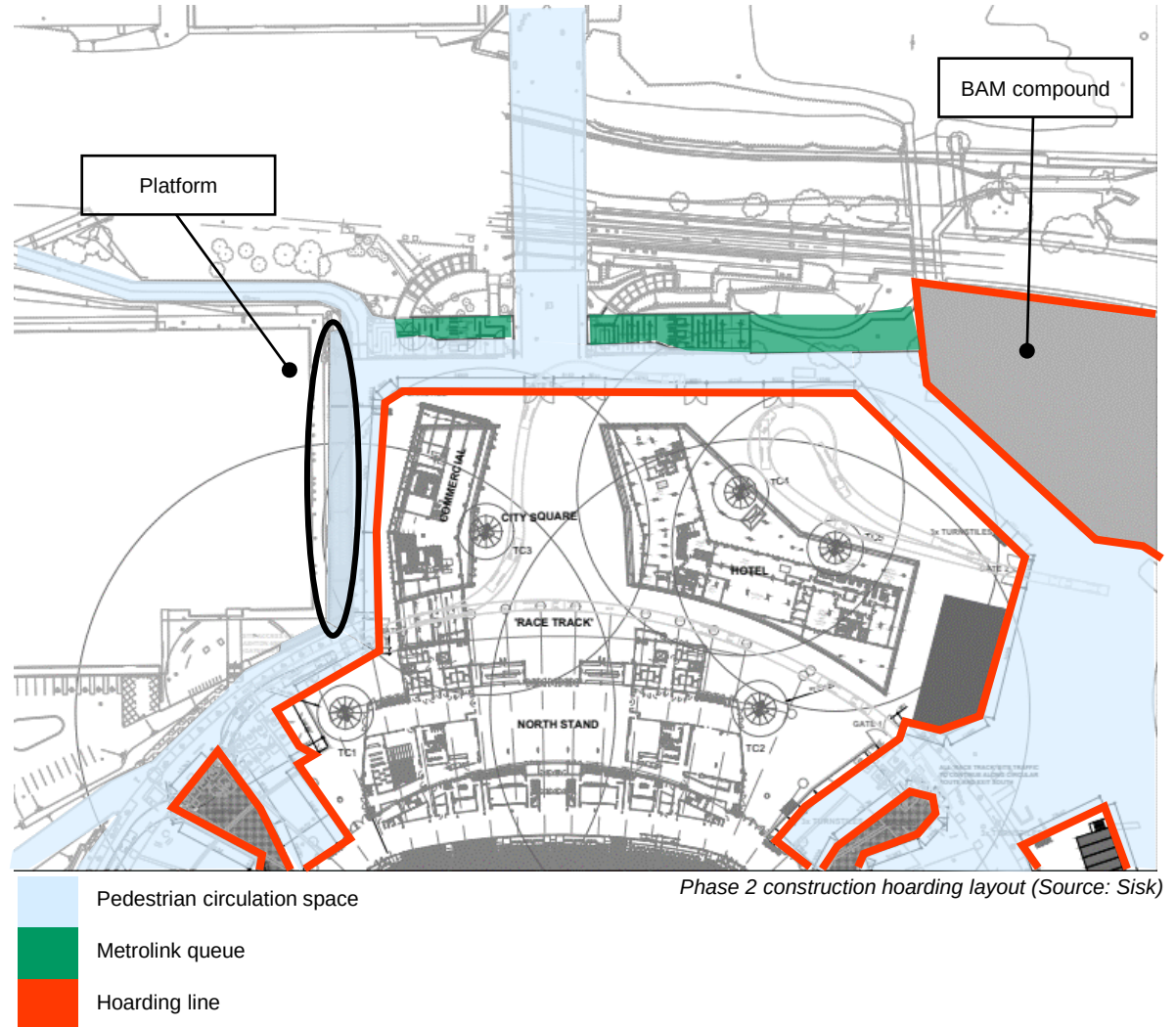
This hoarding layout will be in place from the 21<sup>st</sup> September until the 4<sup>th</sup> July 2024.

The Co-Op Live Arena will be in operation from April 2024.

A level platform will be constructed on the west side of the construction compound (by the Squash Centre) to provide extra pedestrian circulation width and reduce the pinch point created by the access ramp.

The extension of the Metrolink westbound queue area will be complete during this phase, and the BAM compound in place (with access to Forge Lane Bridge maintained).

On an event day at the Etihad Campus and/or the Co-Op Live Arena it is assumed that no construction works will take place and that all doors into the construction compound will be closed.

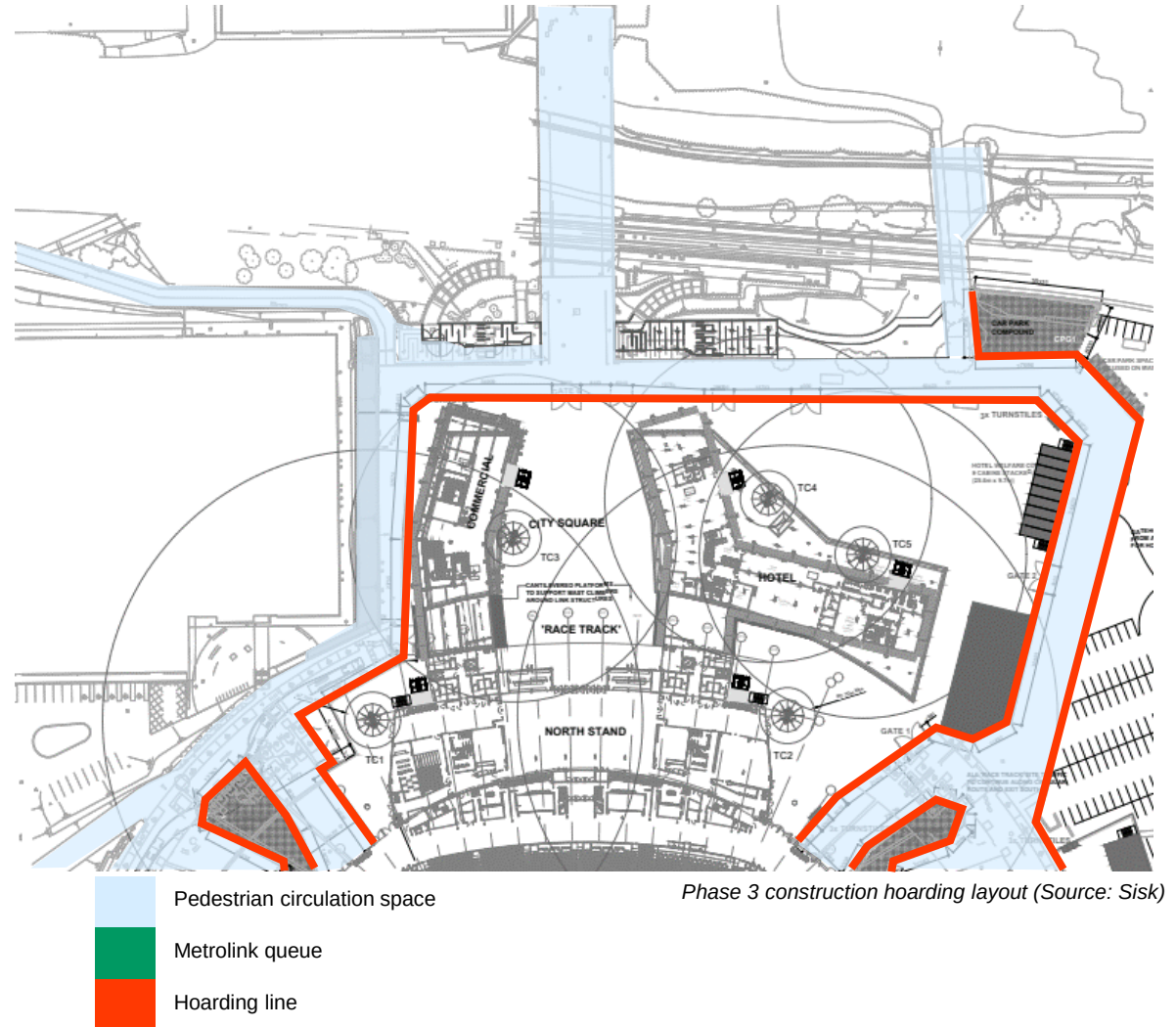


The adjacent figure shows the proposed Phase 3 construction compound for the North Stand and the pedestrian circulation space available around the compound.

This hoarding layout will be in place from the 5<sup>th</sup> July 2024 until completion.

The BAM compound will have been removed by the time Phase 3 starts, with the available space used for temporary car parking.

It is assumed that no construction works will take place on an event day and that all doors into the construction compound will be closed.



## SCOPE | DESIGN INPUTS

### DOCUMENTS REFERENCED

- NS Hording Impact – Ingress and Egress Alterations.pptx *[received on 24/03/23]*
- 230320 12588700 – MCFC North Stand Expansion Stage 3 Part 2 Databook\_DRAFT-0.5.pdf
- 12588700-MCFC North Stand Expansion Stage 3 Part 2 Crowd Modelling\_DRAFT.pdf
- 12588700-230412 MCFC Construction Hoarding Impact Assessment Stage 3 Part 2 Crowd Modelling\_DRAFT.pdf.

### DRAWINGS REFERENCED

*Hoarding compound layout [Received on 02/08/2023]*

- NSE-JSS-ZZ-ZZ-DR-J-000001\_HoardingPhase1-SquashPlatformWorks\_REVE.dwg
- NSE-JSS-ZZ-ZZ-DR-J-000002\_HoardingPhase2-SISK&BAMOnsite\_REVD.dwg
- NSE-JSS-ZZ-ZZ-DR-J-000003\_HoardingPhase3-SISKOnly\_REVD.dwg

### RELEVANT GUIDANCE DOCUMENTS

- Guide to Safety at Sports Grounds (“Green Guide”), 6th Edition, 2018 (Sports Grounds Safety Authority, UK), which provides guidance for the safe design of sports grounds;
- BS EN 13200 -1:2012, Spectator facilities, Part 1: General characteristics for spectator viewing areas;
- BS EN 13200 -7:2014, Spectator facilities, Part 7: Entry and exit elements and routes;
- Pedestrian Planning and Design (J.J. Fruin, 1971), defining a quantified scale of ‘Levels of Service’ related to crowd movement on walkways, stairs and in queuing areas.

# DRAFT



## ASSESSMENT OF CONSTRUCTION PHASES 1, 2 & 3

Key findings from the report '*12588700-230412 MCFC Construction Hoarding Impact Assessment Stage 3 Part 2 Crowd Modelling\_DRAFT.pdf*' are the minimum pedestrian circulation widths required around the construction hoarding.

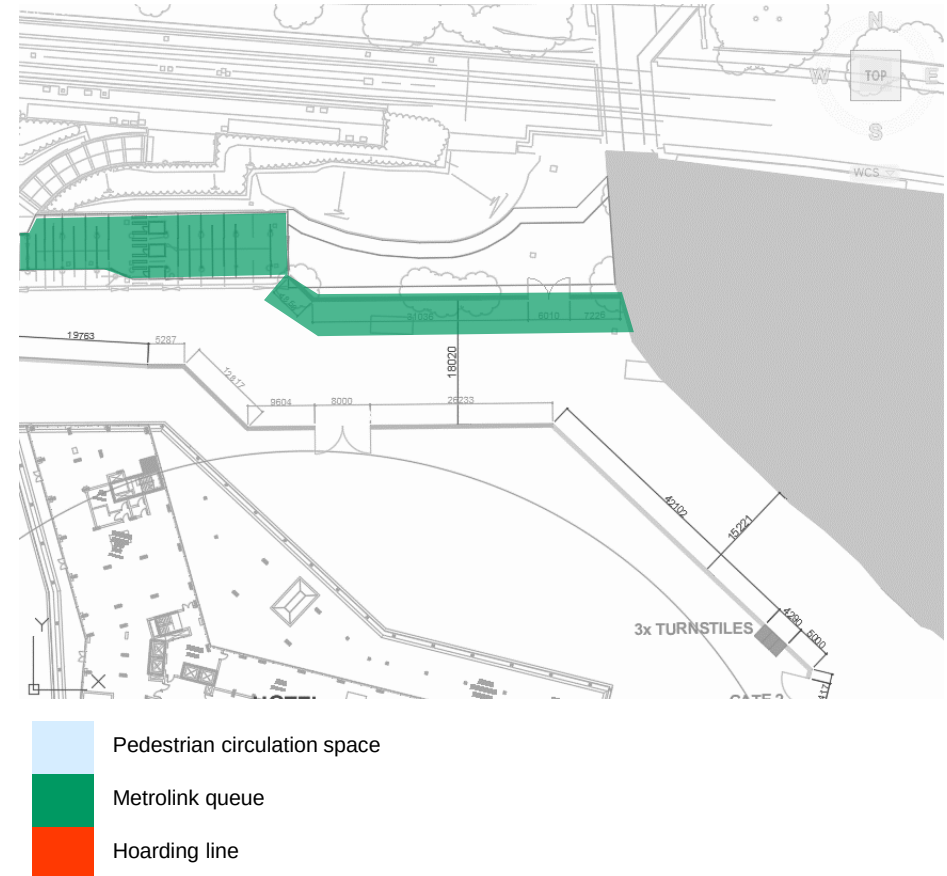
The Co-Op Live Arena will not be in operation during Phase 1, so the scenarios considered for this assessment are: Scenario 1: Stadium Ingress, Scenario 3: Stadium Hard Egress and Scenario 7: Stadium evacuation.

**The Phase 1 layout width provision does not change the conclusions presented for the previous layout.**

Given that the Metrolink westbound additional queueing area will not be available for Phase 1, a contingency overflow queue area outside the Metrolink station is recommended.

The report '*12588700-230412 MCFC Construction Hoarding Impact Assessment Stage 3 Part 2 Crowd Modelling\_DRAFT.pdf*' presents a maximum queue of 3,125 people for the Stadium Hard Egress scenario. At a density of 3 people/m<sup>2</sup> this queue would require 1,045 m<sup>2</sup> of queue space. The platform and Metrolink queue area provides approximately 800 m<sup>2</sup>, therefore a further 250 m<sup>2</sup> should be provided.

Additional overflow queue space can be provided to the east of the Metrolink westbound service queue area. The queue area and a crowd management plan could be activated if this space is required.



The Co-Op Live Arena will be in operation during this Phase, therefore the scenarios considered for this assessment include those in Phase 1 and Scenario 4: Stadium Hard Egress + Arena Egress (30 minute offset), Scenario 5: Stadium Hard Egress + Arena Egress (simultaneous) and Scenario 6: Arena only Egress.

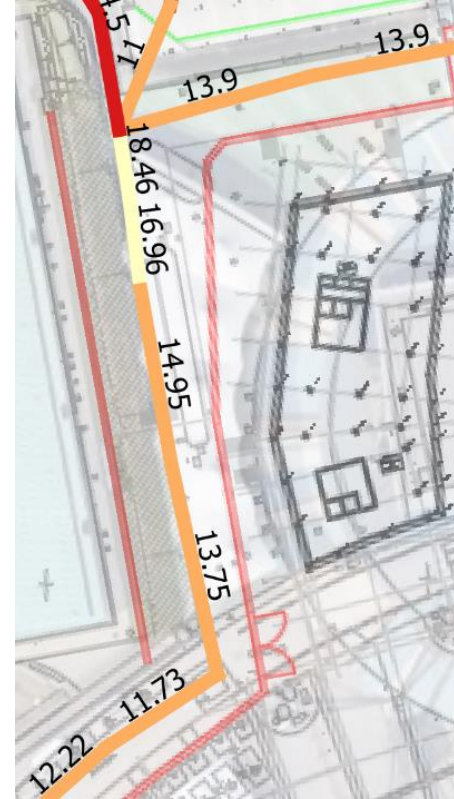
**The Phase 2 layout width provision does not change the conclusions presented for the previous layout for Scenarios 4 and 6.**

In the report '12588700-230412 MCFC Construction Hoarding Impact Assessment Stage 3 Part 2 Crowd Modelling\_DRAFT.pdf', Scenario 5: Stadium Hard Egress + Arena Egress (simultaneous) presented most of the pedestrian routes around the construction compound at, close to or exceeding the target capacity.

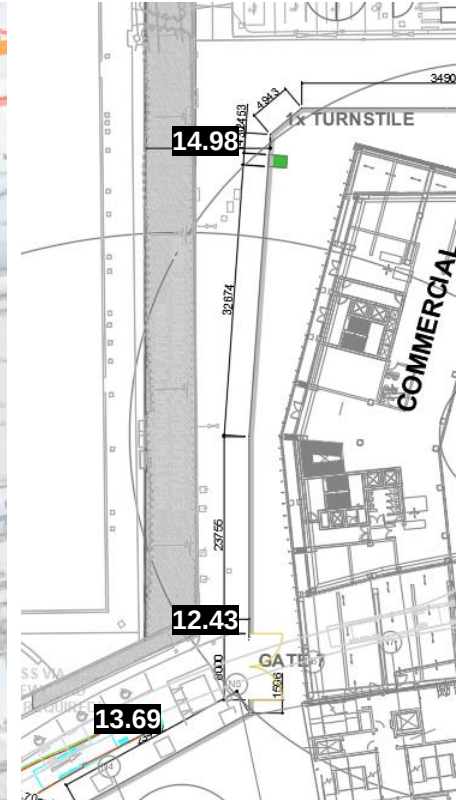
The pedestrian route to the west of the construction compound (by the Squash Court) was identified as a route where the target capacity was exceeded, and queues would form. The adjacent image shows the changed to the hoarding layout proposed by Sisk.

Given that the proposed layout reduces the pedestrian circulation width available at this location, the SENSE model for Scenario 5 has been re-run for the revised layout in order to assess the impact of the changes on pedestrian circulation.

Previous design minimum widths (m)



Proposed design minimum widths (m)



## North Stand and Arena Network Widths

The assumed widths for this model have been measured in CAD provided, or directly on Google Maps when CAD was not available.

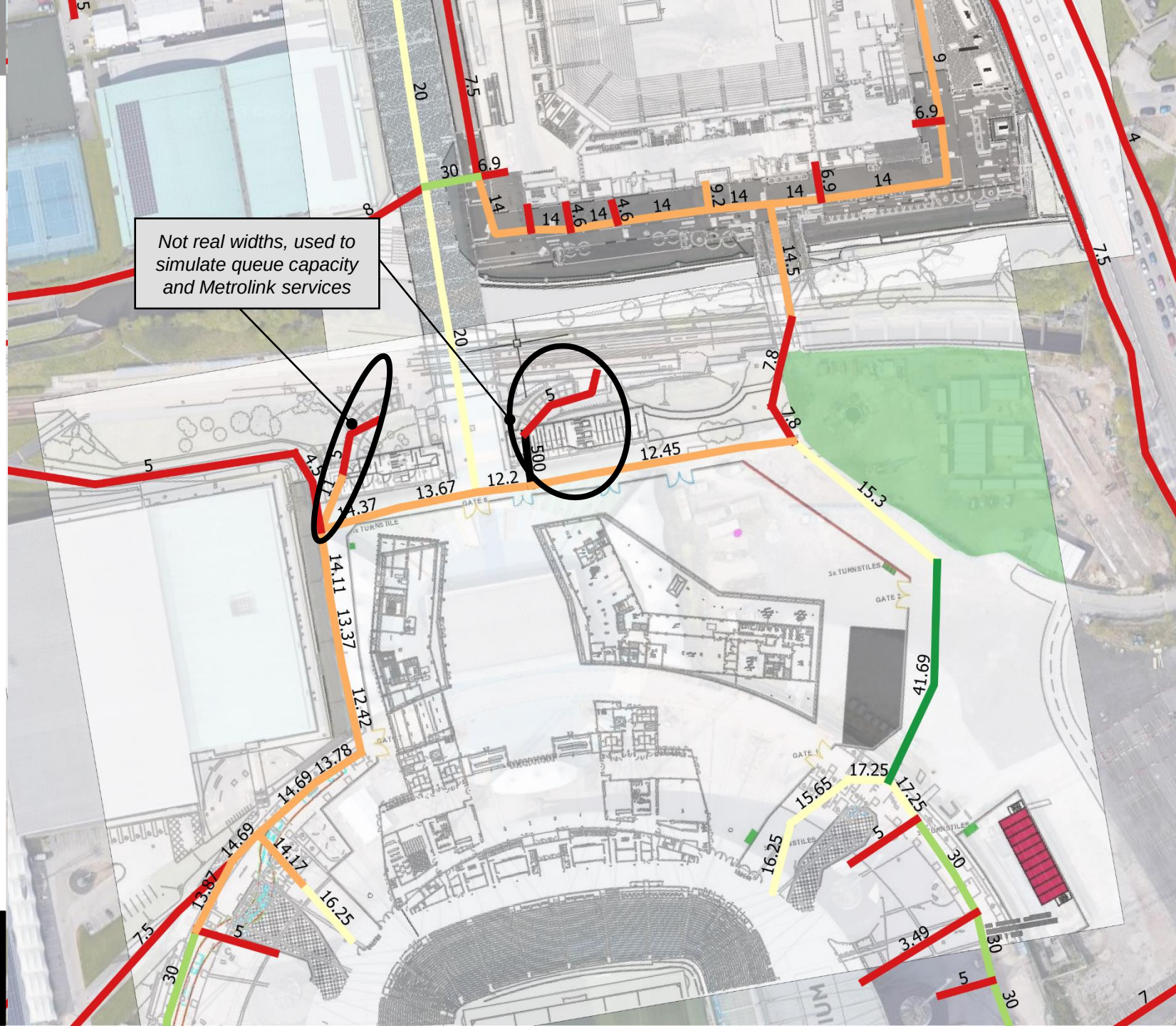
Flows out of the Stadium are constrained by the width of the exit doors.

Note that for special operations, it is assumed that 7.5m width will be provided along Alan Turing Way (from OVG Manchester, Details of the Special Measures Operating Plan, Buro Happold, 10 November 2022)

### Legend

- 1 - 8 m
- 8 - 15
- 15 - 25
- 25 - 30
- 30 - 100

Not real widths, used to simulate queue capacity and Metrolink services



## Scenario 5b

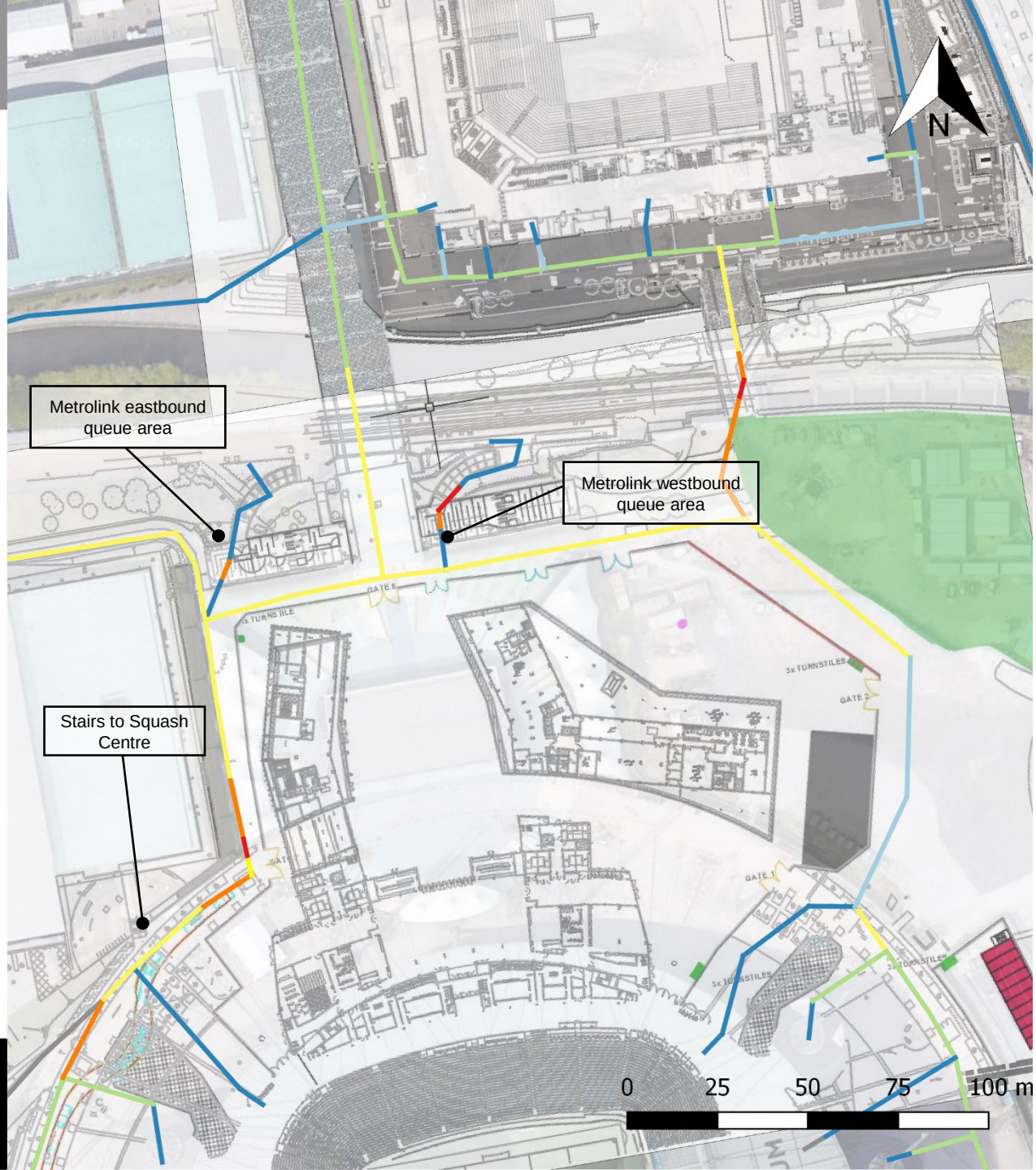
### Construction - Stadium Hard Egress + Arena Simultaneous Egress

#### North Stand and Arena Max Density by Link

- Densities of up to 1.08 persons per m<sup>2</sup> (equivalent to LoS D) are experienced around most of the construction compound.
- As for the previous layout, the pedestrian route on the west side of the construction compound (by the Squash Centre) show higher densities due to the reduction in width to 12.42 metres.
- Densities over LoS D are expected to be experienced for approximately 10 minutes at that location. This will need to be monitored and/or managed.
- High spectator densities that may require management are expected on Forge Lane Bridge as spectators depart the Arena. We understand the Arena are aware of this and are looking to have a queue management operation in place at this location.

#### Legend

- No ppl
- LoS A - < 0.31 ppl/ m<sup>2</sup>
- LoS B - 0.31 - 0.43
- LoS C - 0.43 - 0.72
- LoS D - 0.72 - 1.08
- LoS E - 1.08 - 2.17
- LoS F - 2.17 - 4



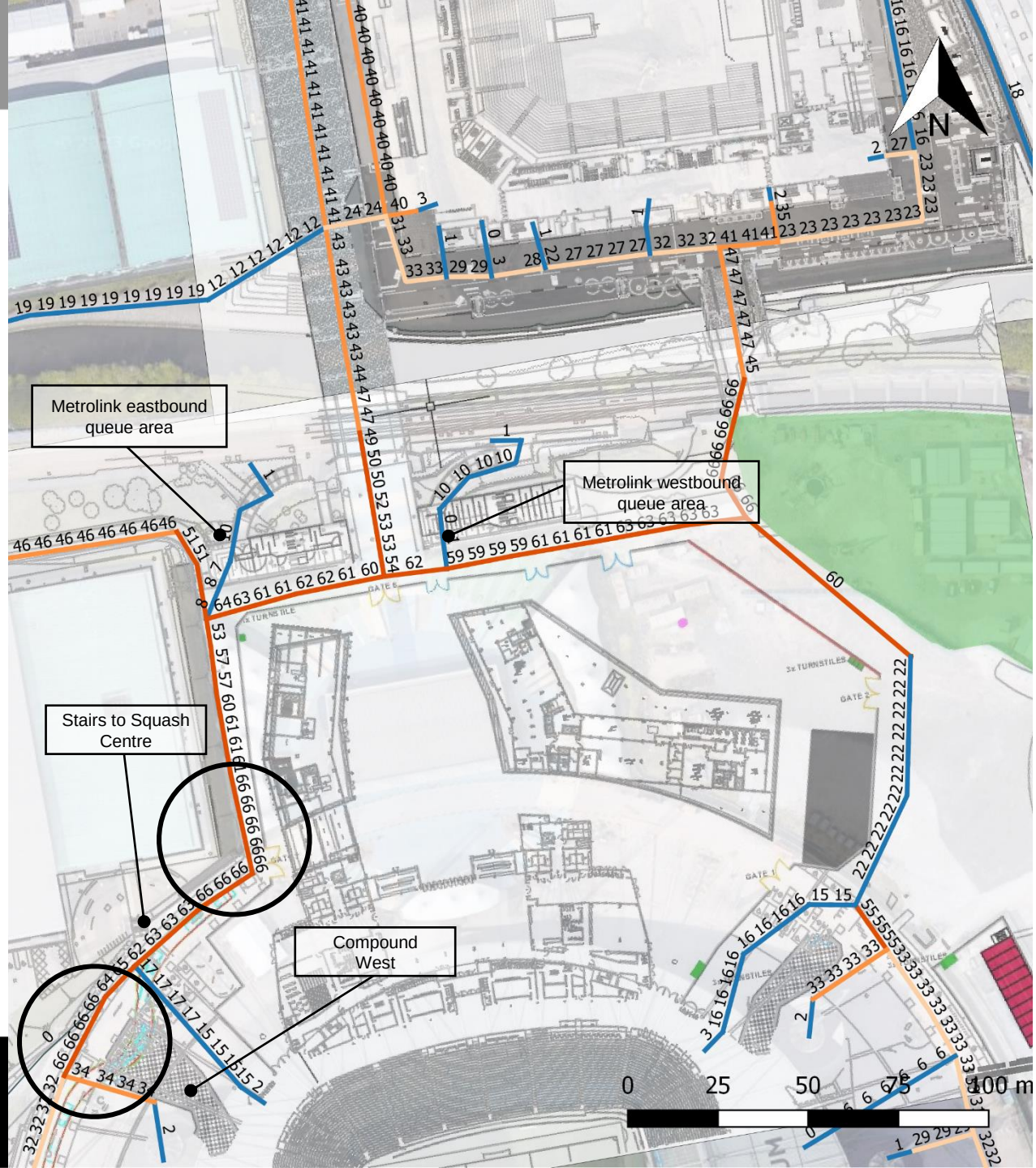
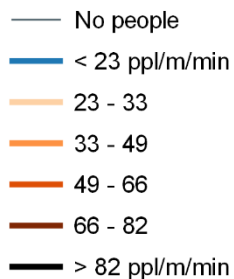
## Scenario 5b

### Construction - Stadium Hard Egress + Arena Simultaneous Egress

#### North Stand and Arena Max Flowrate by Link

- Most of the routes around the construction hoarding will be close to the target capacity.
- As for the previous layout, the pedestrian route on the west side of the construction compound (by the Squash Court) will likely experience slightly higher flow rates (highlighted in the adjacent image). This is due to the reduced width of 12.42 metres at that location.
- This circulation route is also at capacity for a period of time by Compound West due to flows from the Stadium and Arena merging.
- The SENSE model shows this will result in queueing along this route (see next slide).

#### Legend

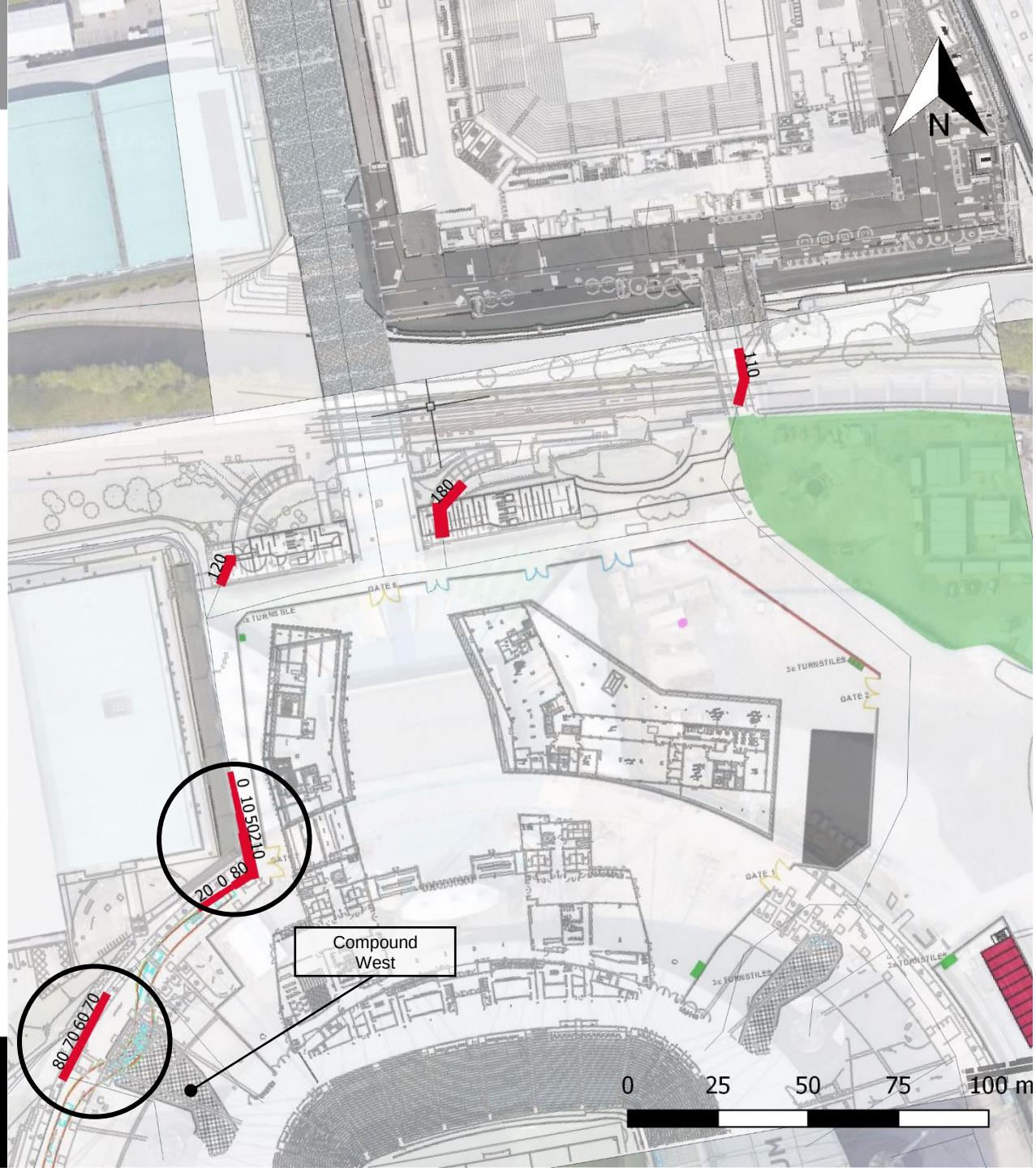


## Scenario 5b

### Construction - Stadium Hard Egress + Arena Simultaneous Egress

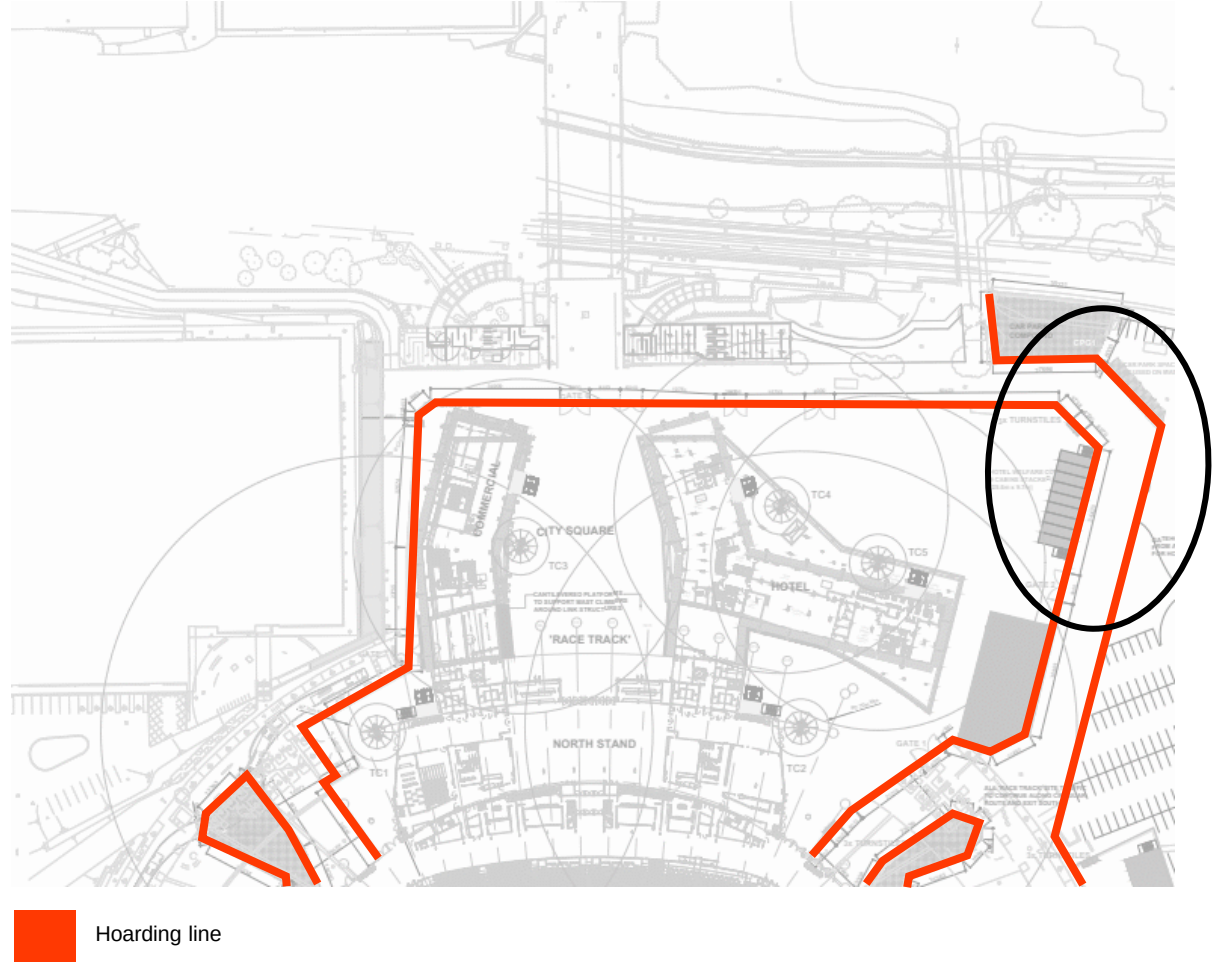
#### North Stand and Arena Max Queue by Link

- The SENSE model shows pedestrian route on the west side of the construction compound (by the Squash Court) experiencing queues for approximately 10 minutes. The maximum queues is approximately 550 persons. This is due to the width available reducing to 12.42 metres at this location.
- A maximum queue of approximately 250 persons can form due to merging flows at the location by Compound West. This queue is expected to last up to 6 minutes.
- Proposed mitigation measures have been discussed in the report '12588700-230412 MCFC Construction Hoarding Impact Assessment Stage 3 Part 2 Crowd Modelling\_DRAFT.pdf' for this scenario.



The main difference between Phase 2 and 3 is the layout on the eastern side of the construction compound.

Given that the minimum 15.0 metre width will be maintained on the eastern boundary of the construction hoarding, the same conclusions presented for Phase 2 also apply.



# DRAFT



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**Ed Dalton**

Director of Infrastructure (MCFC)  
Manchester City Football Club

11<sup>th</sup> Aug 2023

Dear Ed,

Following receipt of 12588700 Addendum to MCFC Construction Hoarding Impact Assessment Stage 3 Part 2 Crowd Modelling\_DRAFT.pdf and comments-12588700 Addendum to MCFC Construction Hoarding Impact Assessment Stage 3 Part 2 Crowd Modelling\_DRAFT.pdf please find below my comments.

I note from your email 7<sup>th</sup> August 2023, the following

*It is however incorrect to say there will not be any construction on the day of an event – for instance construction and deliveries may take place during the day with an evening event, but there is a contractual cut-off for these activities, so they are managed to avoid any crowd interfaces.*

As highlighted below, previous (Man City) and similar (other projects) the “as planned” is not necessarily “as built” for hoarding where standard lengths of hoarding/Heras fencing are used.

Page 5, states:

*The methods of analysis in this phase are static/spreadsheet modelling (which is the methodology needed for compliance with The Guide to Safety at Sports Grounds), and SENSE network modelling.*

*This document does not include:*

- Detailed operational / staffing plans
- Contingency planning

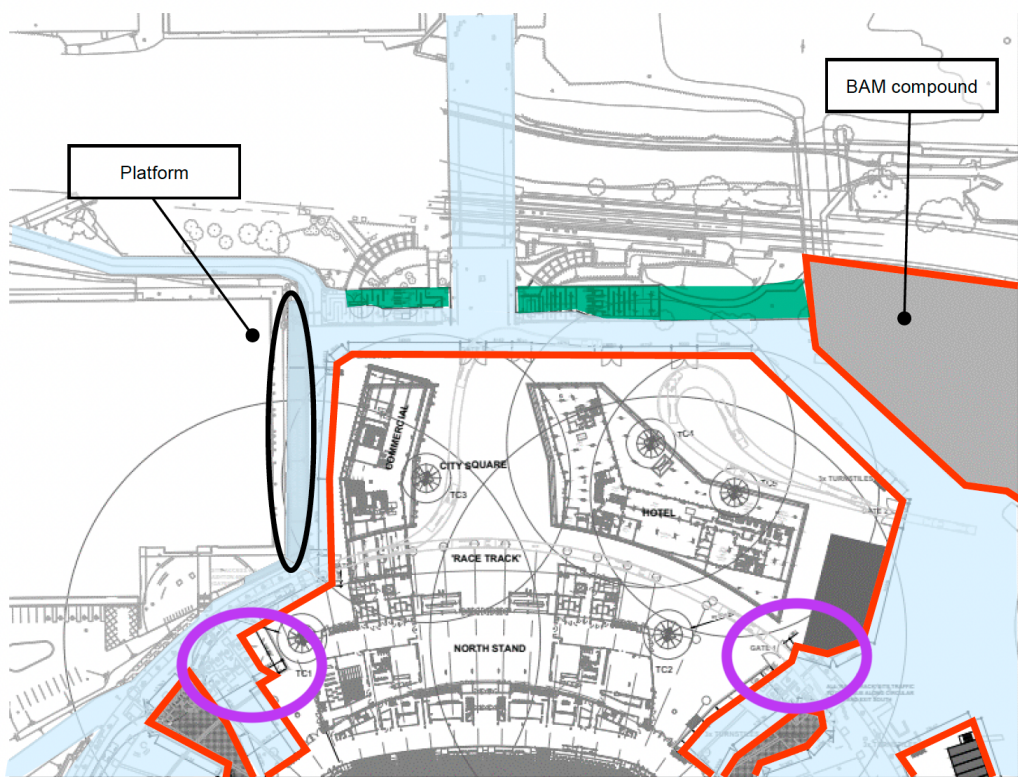
As per previous reports, compliance with guidance, is different from the building code (legislative requirement). Also, the staff planning/operations and contingency planning means that SENSE is only testing within the limits of the scenario This can, of course, determine how the operations and contingency planning parameters may evolve from any stage of the modelling scenario.

Page 6, the routes are smoother (less turbulence in crowd flow) other than the area shown below (purple oval). One caveat is that during previous projects at this site (and others) the hoarding is typically around plant/machinery, and not precision engineering. Indicative corridors (must be a minimum of X wide in this area) can be effective during construction.

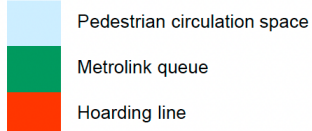


Phase 1 construction hoarding layout (Source: Sisk)

Page 7, the diagram below shows a couple of “kinks” in the hoarding. When presenting these to the construction team (for build) it may not fit the material. For example, if the hoarding is in 3-4m lengths. As above, indicative corridors” of a minimum width may be more useful for the construction phase. Similar on page 8.



Phase 2 construction hoarding layout (Source: Sisk)



Page 11, states

*The report '12588700-230412 MCFC Construction Hoarding Impact Assessment Stage 3 Part 2 Crowd Modelling\_DRAFT.pdf' presents a maximum queue of 3,125 people for the Stadium Hard Egress scenario. At a density of 3 people/m<sup>2</sup> this queue would require 1,045 m<sup>2</sup> of queue space. The platform and Metrolink queue area provides approximately 800 m<sup>2</sup>, therefore a further 250 m<sup>2</sup> should be provided.*

*Additional overflow queue space can be provided to the east of the Metrolink westbound service queue area. The queue area and a crowd management plan could be activated if this space is required.*

| Table D1 Floor space factors <sup>(1)</sup>                                                                                                                                                                                                                                                                                                               |                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| Type of accommodation <sup>(2)(3)</sup>                                                                                                                                                                                                                                                                                                                   | Floor space factor (m <sup>2</sup> /person) |
| 1. Standing spectator areas, bar areas (within 2m of serving point), similar refreshment areas                                                                                                                                                                                                                                                            | 0.3                                         |
| 2. Amusement arcade, assembly hall (including a general purpose place of assembly), bingo hall, club, crush hall, dance floor or hall, venue for pop concerts and similar events and bar areas without fixed seating                                                                                                                                      | 0.5                                         |
| 3. Concourse or queuing area <sup>(4)</sup>                                                                                                                                                                                                                                                                                                               | 0.7                                         |
| 4. Committee room, common room, conference room, dining room, licensed betting office (public area), lounge or bar (other than in (1) above), meeting room, reading room, restaurant, staff room or waiting room <sup>(5)</sup>                                                                                                                           | 1.0                                         |
| 5. Exhibition hall or studio (film, radio, television, recording)                                                                                                                                                                                                                                                                                         | 1.5                                         |
| 6. Skating rink                                                                                                                                                                                                                                                                                                                                           | 2.0                                         |
| 7. Shop sales area <sup>(6)</sup>                                                                                                                                                                                                                                                                                                                         | 2.0                                         |
| 8. Art gallery, dormitory, factory production area, museum or workshop                                                                                                                                                                                                                                                                                    | 5.0                                         |
| 9. Office                                                                                                                                                                                                                                                                                                                                                 | 6.0                                         |
| 10. Shop sales area <sup>(7)</sup>                                                                                                                                                                                                                                                                                                                        | 7.0                                         |
| 11. Kitchen or library                                                                                                                                                                                                                                                                                                                                    | 7.0                                         |
| 12. Bedroom or study-bedroom                                                                                                                                                                                                                                                                                                                              | 8.0                                         |
| 13. Bed-sitting room, billiards or snooker room or hall                                                                                                                                                                                                                                                                                                   | 10.0                                        |
| 14. Storage and warehousing                                                                                                                                                                                                                                                                                                                               | 30.0                                        |
| 15. Car park                                                                                                                                                                                                                                                                                                                                              | Two persons per parking space               |
| <b>NOTES:</b>                                                                                                                                                                                                                                                                                                                                             |                                             |
| 1. As an alternative to using the values in the table, the floor space factor may be determined by reference to actual data taken from similar premises. Where appropriate, the data should reflect the average occupant density at a peak trading time of year.                                                                                          |                                             |
| 2. Where accommodation is not directly covered by the descriptions given, a reasonable value based on a similar use may be selected.                                                                                                                                                                                                                      |                                             |
| 3. Where any part of the building is to be used for more than one type of accommodation, the most onerous factor(s) should be applied. Where the building contains different types of accommodation, the occupancy of each different area should be calculated using the relevant space factor.                                                           |                                             |
| 4. For detailed guidance on appropriate floor space factors for concourses in sports grounds refer to <i>Concourses</i> published by the Football Licensing Authority.                                                                                                                                                                                    |                                             |
| 5. Alternatively the occupant number may be taken as the number of fixed seats provided, if the occupants will normally be seated.                                                                                                                                                                                                                        |                                             |
| 6. Shops excluding those under item 10, but including: supermarkets and department stores (main sales areas), shops for personal services, such as hairdressing, and shops for the delivery or collection of goods for cleaning, repair or other treatment or for members of the public themselves carrying out such cleaning, repair or other treatment. |                                             |
| 7. Shops (excluding those in covered shopping complexes but including department stores) trading predominantly in furniture, floor coverings, cycles, prams, large domestic appliances or other bulky goods, or trading on a wholesale self-selection basis (cash and carry).                                                                             |                                             |

Note that the concourse or queueing area maximum occupancy loading is 0.7 m<sup>2</sup> per person. This is 1.42 people per square metre. To emphasis this point, the statutory instrument, the Approved Document B (Fire/Building codes) are enforceable, the Green Guide is, as it states, guidance. If an incident occurs, then the Fire/building codes may apply (specifically in/around a construction site) NOT the Green Guide. I would suggest that this is clarified with the local licensing and approved by all parties as acceptable density during construction. I would also suggest that a contingency plan for rapid response needs to be defined to further alleviate any potential risks of overcrowding.

Page 12, states:

*The pedestrian route to the west of the construction compound (by the Squash Court) was identified as a route where the target capacity was exceeded, and queues would form. The adjacent image shows the changed to the hoarding layout proposed by Sisk.*

This highlights the smoother routes (as planned) which should be emphasis as “as built” and recommended minimum widths within the bounds of construction materials, as indicated above.

Page 14, again the Approved Document B, see above, may be cited as the requirement. This needs to be clarified as outlined above.

Page 16, highlights the density and duration of the queueing patrons.

*The SENSE model shows pedestrian route on the west side of the construction compound (by the Squash Court) experiencing queues for approximately 10 minutes. The maximum queues is approximately 550 persons. This is due to the width available reducing to 12.42 metres at this location.*

- A maximum queue of approximately 250 persons can form due to merging flows at the location by Compound West. This queue is expected to last up to 6 minutes.*
- Proposed mitigation measures have been discussed in the report ‘12588700-230412 MCFC Construction Hoarding Impact Assessment Stage 3 Part 2 Crowd Modelling\_DRAFT.pdf’ for this scenario.*

Upstream hold and release could alleviate/regulate the crowd flow, but in an emergency evacuation, that option is not viable for rapid egress. I would suggest that an extreme scenario is assessed for impact/risk of crowd density. I also stress that the SENSE model (and most simulations) all assume no trips, slips, falls in these areas.

Yours sincerely,



G. Keith Still

15 August 2023

|                     |                  |                |                     |
|---------------------|------------------|----------------|---------------------|
| <b>Project Name</b> | MCFC North Stand | <b>Company</b> | Movement Strategies |
| <b>Project No.</b>  | 12588700         | <b>Role</b>    | Crowd modelling     |

**Crowd Risk Analysis Ltd (CRA) notes on 12588700 Addendum to MCFC Construction Hoarding Impact Assessment Stage 3 Part 2 Crowd Modelling\_DRAFT.pdf.**

The Addendum to the Stage 3 Part 2 Construction Hoarding – crowd movement assessment (DRAFT) was reviewed by Crowd Risk Analysis Ltd (CRA). This document sets out Movement Strategies' (MS) initial comments and suggested approach to notes set out in document '*11<sup>th</sup> Aug 2023.pdf*' received on 11 August 2023.

It should be noted that some items build on comments set out in:

- '*Man City Hoarding.pdf*' (CRA) issued on 25 April 2023
- '*23Jun08 MCFC NS\_MS\_CRA notes on Construction Hoarding\_DRAFT.docx*' (MS) issued on 8 June 2023
- '*Man City CMP.pdf*' (CRA) issued on 11 May 2023
- '*23Jun15 MCFC NS\_MS\_CRA notes on Stage 3 Part 2 Crowd Modelling\_DRAFT.docx*' (MS) issued on 15 June 2023

The table in the following pages summarises the items to be addressed, together with a short response and suggested next steps. Where a response requires additional information, further detail is provided in the sections referenced in the table.

**Key items**

- The as built construction hoarding layout may differ from that assumed in the SENSE modelling (as planned layout). The construction hoarding will need to be inspected and monitored by the Sisk / MCFC Operations Team.
- Operational and contingency plans will need to be developed by Sisk / MCFC Operations Team
- Building Control criteria for construction and licensing need to be clearly agreed.
- The SENSE (network) model shows that the 'Stadium + Arena simultaneous egress' scenario will require development of a 'reasonable' worst case scenario and an operational plan.
  - Please refer to '*23Jun08 MCFC NS\_MS\_CRA notes on Construction Hoarding\_DRAFT.docx*' Table Item 5 for more detail.

| Item | Ref (page:title) | Category              | Reviewer Comment [paraphrased]                                                                                                                           | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Proposed Action                                                                                                                                                                                                                                     | Outcome following discussion with the Reviewer | Status |
|------|------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------|
| 1    | 1: Introduction  | As built layout       | The as built layout of the construction hoarding may end up being different to the proposed design of the construction hoarding which has been modelled. | Agreed. On site conditions, materials available, etc... may result in decisions being taken during construction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Reviewer's recommendation for site inspections and minimum width measurements to be undertaken pre-event.                                                                                                                                           |                                                | Open   |
| 2    | 1: Page 5        | Modelling assumptions | Modelling is only testing the layout within the limits of the scenarios agreed.                                                                          | Agreed.<br>Robust modelling assumptions have been agreed.<br>Circulation routes which cannot meet performance targets with a 20% reduction in capacity were previously identified.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Sisk / MCFC Operations Team to identify site specific risks and operational planning response.<br><br>Sisk / MCFC Operations Team to monitor and document Event Day operations/incidences.                                                          |                                                | Open   |
| 3    | 1: Page 6        | As built layout       | Hoarding layout around plant/machinery is unlikely to be as precise as shown. Indicative corridor minimum widths would be useful for the contractor.     | <b>[See Response 01 for more detail]</b><br>Agreed. Simplified diagrams with minimum widths assumed for modelling are provided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Sisk / MCFC Operations Team to identify and inform of changes to the minimum widths provided.                                                                                                                                                       |                                                | Open   |
| 4    | 2: Page 7        | As built layout       | Hoarding layout around plant/machinery is unlikely to be as precise as shown. Indicative corridor minimum widths would be useful for the contractor.     | See response for Item 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | See response for Item 3                                                                                                                                                                                                                             |                                                | Open   |
| 5    | 3: Page 11       | Modelling assumptions | The guidance documents are not statutory instruments but building codes, occupancy loads, are legal requirements.                                        | Agreed.<br><br>Please refer to Table Item 2 in '23Jun15 MCFC NS_MS_CRA notes on Stage 3 Part 2 Crowd Modelling_DRAFT.docx'<br><br>Both Building Control and licensing requirements should be agreed as early as possible. Crowd modelling report advises occupancy as per requirements set out in the Guide to Safety at Sports Grounds, 6 <sup>th</sup> Edition.<br><br>It should be noted that the Reviewer proposes a reduced density of 1.42 persons per square meter. For the Stadium only scenarios, pedestrian circulation routes around the construction hoarding show densities below this value for arrival and departure periods.<br><br>For a Stadium only scenario, the operation at the Metrolink Westbound service should be similar to the existing operation. The modelling shows a maximum queue size based on a 'hard egress' departure profile used to test the corridor routes available. | MCFC to confirm with Building Control acceptance of planning assumptions (including Data Book) from a construction and licensing perspective.<br><br>Sisk / MCFC Operations Team to identify site specific risks and operational planning response. |                                                |        |

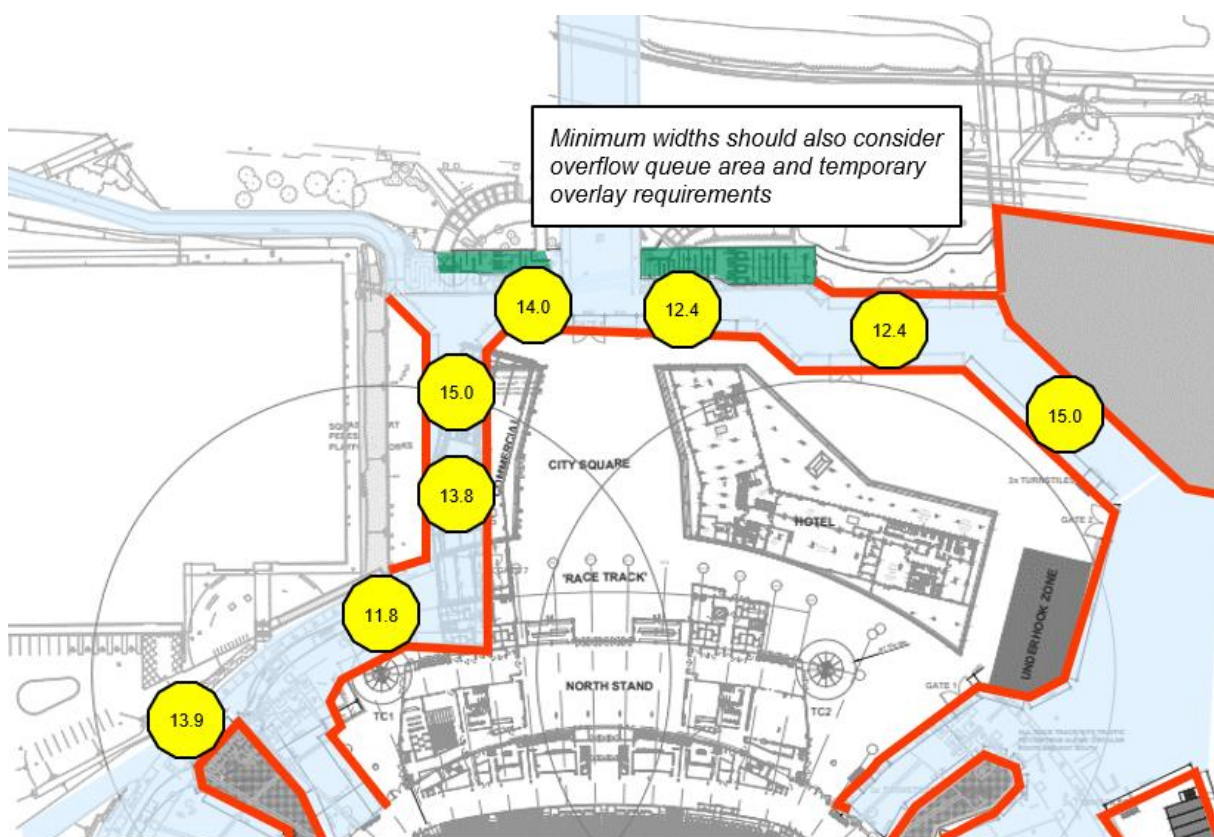
| Item | Ref (page:title) | Category              | Reviewer Comment [paraphrased]                                                                                                                       | Response                                                                                                                                                                         | Proposed Action                                                                                                                                                                                                                                                                         | Outcome following discussion with the Reviewer | Status |
|------|------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------|
| 6    | 4: Page 12       | As built layout       | Hoarding layout around plant/machinery is unlikely to be as precise as shown. Indicative corridor minimum widths would be useful for the contractor. | See response for Item 3                                                                                                                                                          | See response for Item 3                                                                                                                                                                                                                                                                 |                                                | Open   |
| 7    | 4: Page 14       | Modelling assumptions | The guidance documents are not statutory instruments but building codes, occupancy loads, are legal requirements.                                    | See response for Item 5                                                                                                                                                          | See response for Item 5                                                                                                                                                                                                                                                                 |                                                | Open   |
| 8    | 4: Page 16       | Operations            | The Stadium + Arena simultaneous egress scenario indicates management will be required on the route by Squash Centre)                                | <p>Agreed.</p> <p>Please refer to Table Item 5 in '23Jun08 MCFC NS_MS_CRA notes on Construction Hoarding_DRAFT.docx'</p> <p>Arena expected to be in operation in April 2024.</p> | <p>The 'Stadium + Arena simultaneous egress' scenario will require monitoring of potential changes to Etihad Stadium travel patterns and development of a 'reasonable worst case' scenario.</p> <p>Parameters of Reviewer's proposed new 'extreme scenario' to be discussed/agreed.</p> |                                                | Open   |

## Response 01

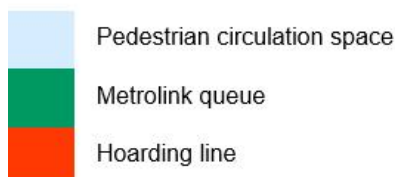
The following diagrams set out the minimum pedestrian circulation widths assumed in the SENSE modelling of the proposed construction hoarding layout.

It should be noted that:

- Outputs and conclusions presented are based on current planning assumptions
- The minimum circulation widths presented may represent a width at a specific location, rather than across a whole route (spectator direction of travel and/or merging may need to be considered at various locations along a given route).
- In general terms, the contractor should attempt to provide circulation routes more than the minimum circulation widths presented (also bearing in mind that significant differences in circulation width in localised areas, or funnelling, may not be beneficial).
- Minimum circulation widths should also consider queue overflow area and temporary overlay area requirements.
- Pedestrian circulation along the routes should be continuously monitored by Sisk and the MCFC Operations Team.

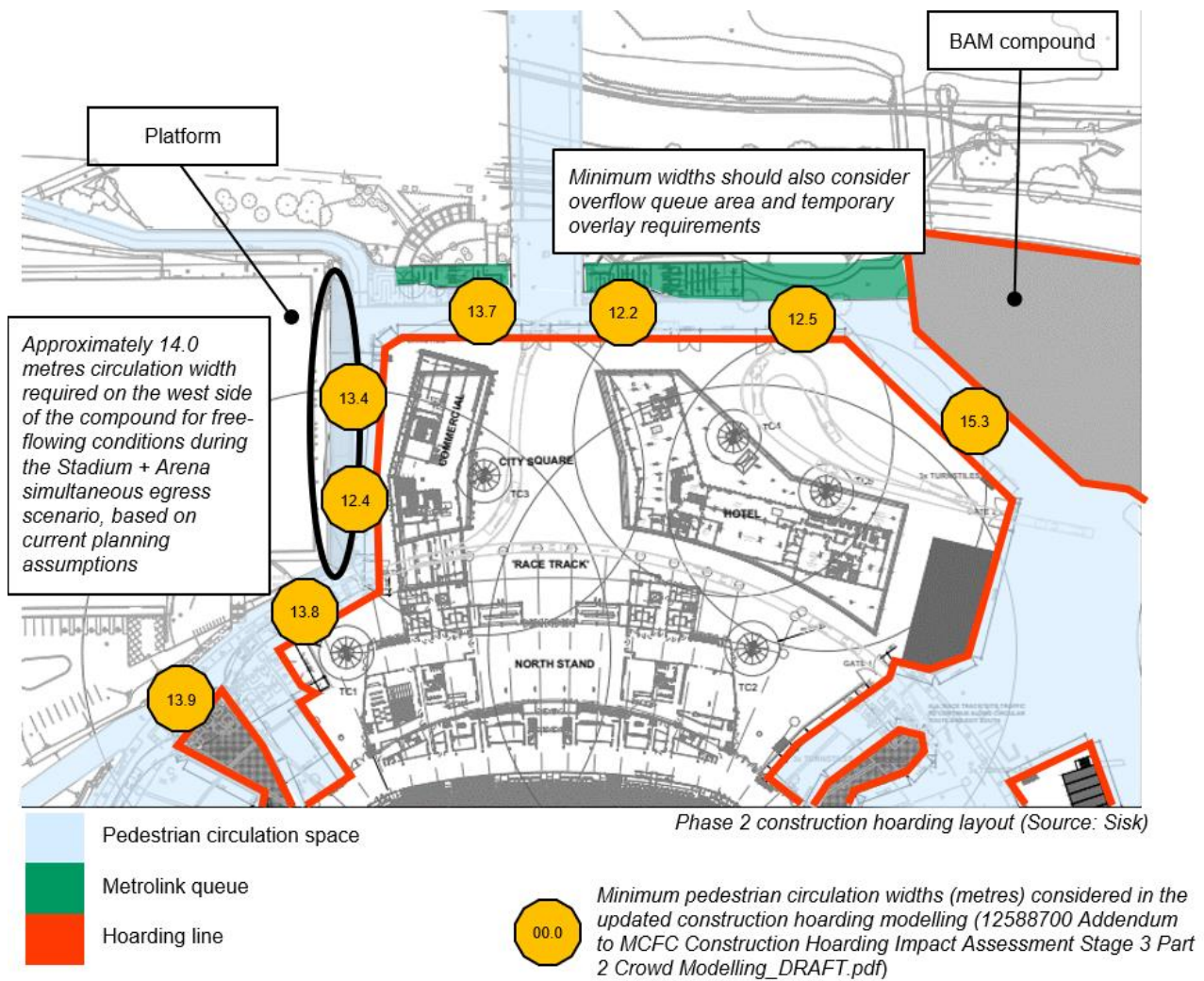


Phase 1 construction hoarding layout (Source: Sisk)

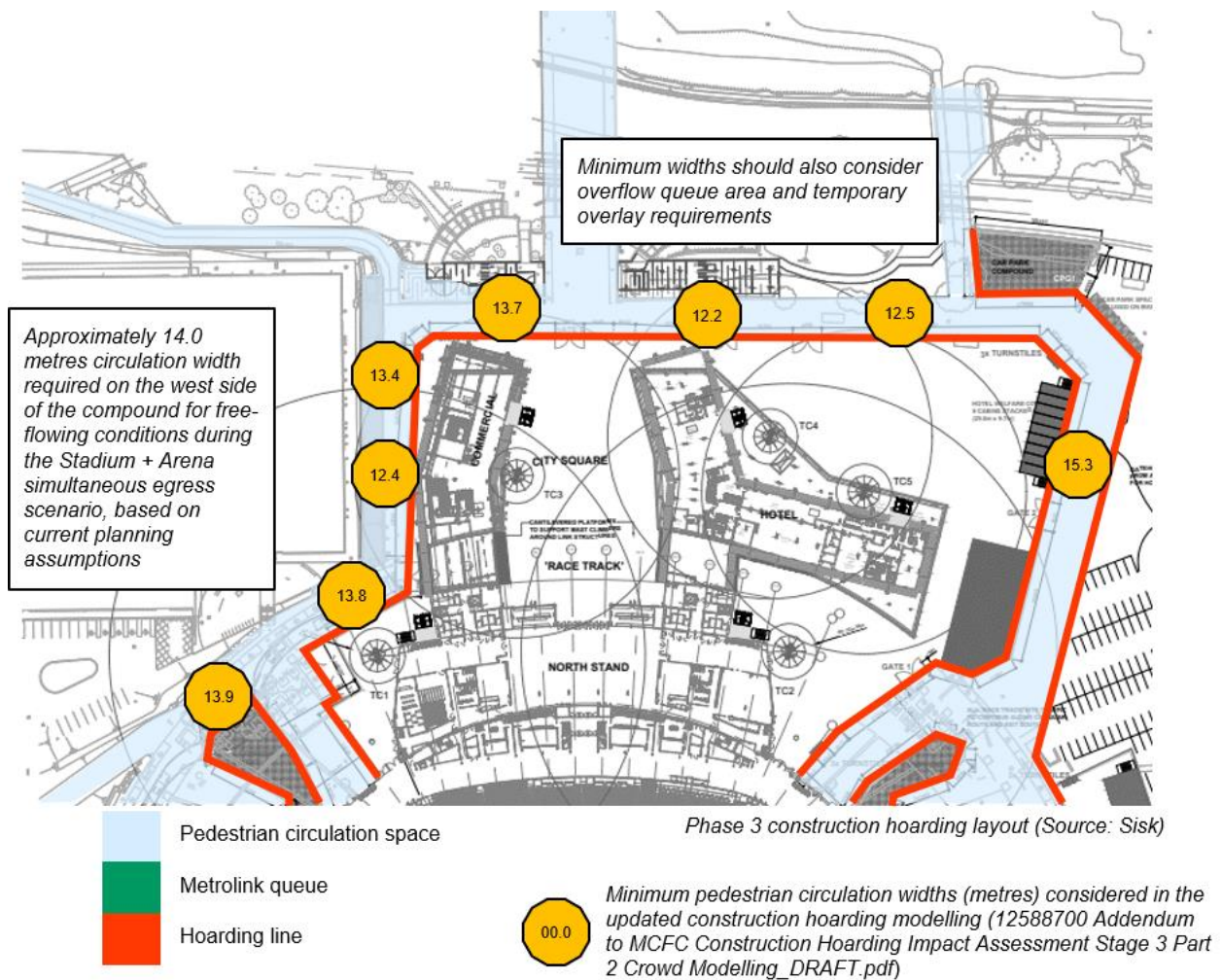


Minimum pedestrian circulation widths (metres) considered in the original construction hoarding modelling (12588700-230412 MCFC Construction Hoarding Impact Assessment Stage 3 Part 2 Crowd Modelling\_DRAFT.pdf)

**Phase 1:** August 2023 to September 2023



**Phase 2:** September 2023 to July 2024



**Phase 3:** July 2024 onwards



**Crowd Risk Analysis Ltd**

**Prof. G. Keith Still** *BSc PhD FIMA FICPEM SFIIRSM FIPM FHEA MAE*

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**Ed Dalton**

Director of Infrastructure (MCFC)  
Manchester City Football Club

17<sup>th</sup> Aug 2023

Dear Ed/Richard,

Following receipt of Crowd Risk Analysis Ltd (CRA) notes on 12588700 Addendum to MCFC Construction Hoarding Impact Assessment Stage 3 Part 2 Crowd Modelling\_DRAFT.pdf in your email of 16<sup>th</sup> August 2023, please find my comments below.

All points appear to be agreed – specific responses detailed below.

Item 1. Understood and agreed – item closed.

Item 2. Understood and agreed – during normal operations monitoring the crowd (CCTV) and a hold and release (hold the crowd back for 1-2 minutes, then release) will regulate downstream flow and alleviate congestion. – item closed.

Item 3. Understood and agreed – item closed.

Item 4. Understood and agreed – item closed.

Item 5. Understood and agreed – item closed – in addition, I'd suggest operational monitoring for density and contingency planning would place emphasis on both understanding the guidance/legislation differences and highlighting the additional layer of crowd safety considerations. This is an operational (monitor and manage crowds, hold and release) during the various construction phases and changes of operational build layout.

Item 6. Understood and agreed – item closed – see above.

Item 7. Understood and agreed – item closed – see above.

Item 8. Open – extreme and worse case to be discussed and agreed. This is an ongoing risk analysis and desktop exercise for operational review

Response 1

It should be noted that:

- Outputs and conclusions presented are based on current planning assumptions.

Agreed

- The minimum circulation widths presented may represent a width at a specific location, rather than across a whole route (spectator direction of travel and/or merging may need to be considered at various locations along a given route).

Understood and during operations monitoring the crowd with a provision for a short hold and release (stewards asking the crowd to hold for a minute, release for a minute, would facilitate any minor design issues.

- In general terms, the contractor should attempt to provide circulation routes more than the minimum circulation widths presented (also bearing in mind that significant differences in circulation width in localised areas, or funnelling, may not be beneficial).

Understood and (as above) the provision of a monitoring (CCTV) with radio to instruct hold and release would alleviate any normal egress congestion. In an emergency, the situation may become more dynamic and “hold and release” is not recommended. Normal operations only.

- Minimum circulation widths should also consider queue overflow area and temporary overlay area requirements.

Agreed

- Pedestrian circulation along the routes should be continuously monitored by Sisk and the MCFC Operations Team.

Agreed (as stated above)

Yours sincerely,



G. Keith Still