

THFC New Stadium Seven Sisters Interchange Analysis

Assessment of Station Capacity

- ✍ This document contains the outcome of an assessment of capacity of Seven Sisters Station in the light of anticipated demand associated with an expanded Tottenham Hotspur Stadium.
- ✍ Two Match day scenarios are considered:
 - Midweek: 20:00 kick off, 21:50 final whistle
 - Weekend: 15:00 kick off, 16:50 final whistle
- ✍ Spectator demand forecasts have been generated by Tim Spencer & Co, using information from existing spectator surveys and analysis of THFC's database of Season Ticket Holders and those on the Waiting List.
- ✍ Assumptions used to generate the forecasts of Spectator demand at Transport Nodes are listed in a [Data Book](#)
- ✍ A spreadsheet model of demand and capacity has been constructed to assess the performance of different parts of the infrastructure.
- ✍ The following pages summarise the performance throughout the pre- and post-match period for both the Midweek and Weekend scenarios.
- ✍ Background loading on services and at the Station is included in the assessment. 8% growth has been applied to observed background figures to represent conditions in 2021.
- ✍ Spectators boarding the Victoria Line at Tottenham Hale are taken into account in the assessment of available capacity on SB services in the post-match period.

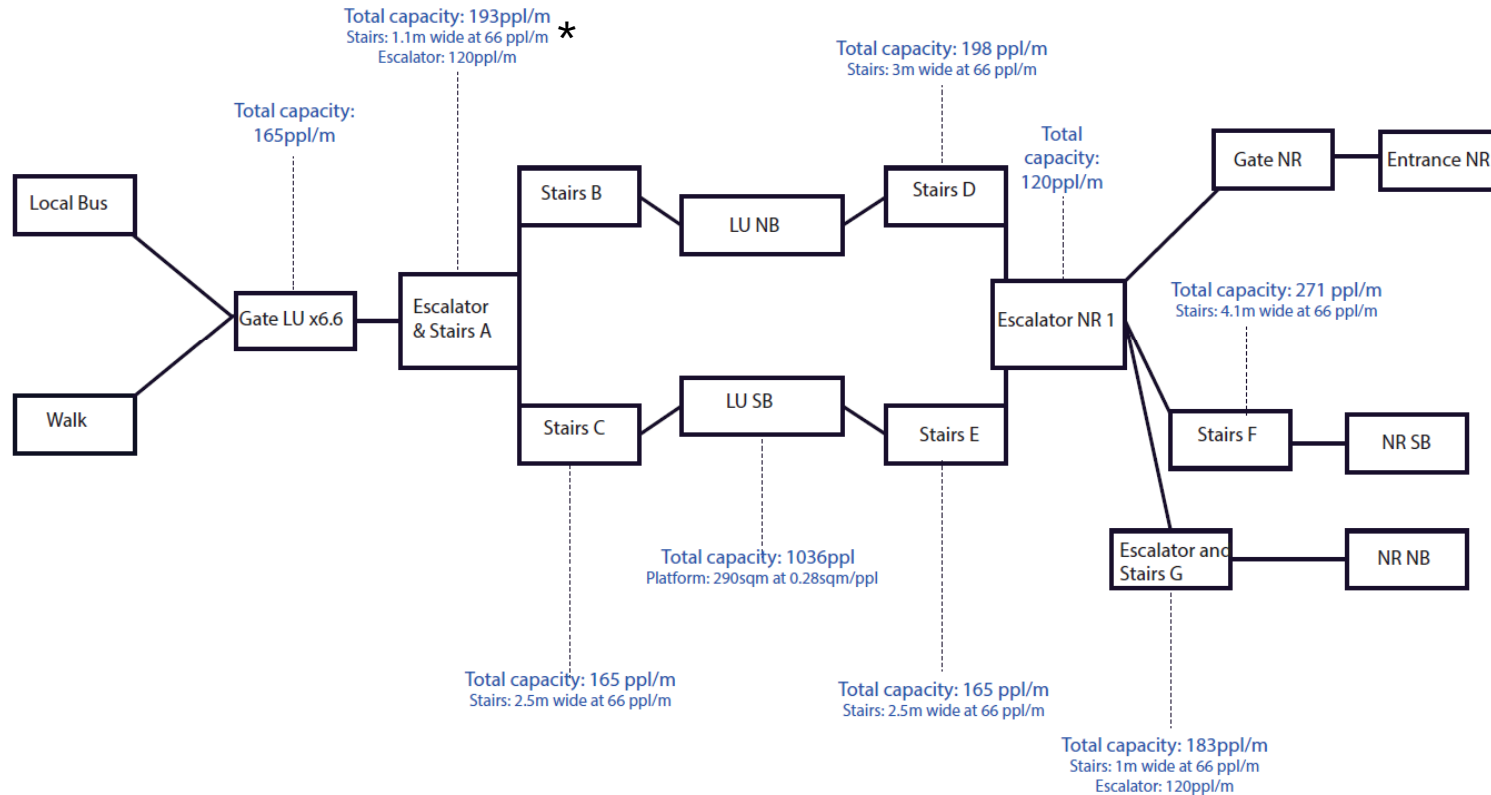
Observed Post-Match Flow Rates

Å The default position for planning the capacity of different LU station elements is to adopt the flow rates contained within SPSG Special Events guidance. However, in this instance, the choice of flow rate used within the assessment is drawn from observation of actual spectator throughputs at Seven Sisters station associated with post-match conditions at Tottenham Hotspur matches. As it is expected that that future crowd management scenario at Seven Sisters in the post-match will be an extension of the current plan (albeit in operation for a longer period), it is considered appropriate to use the observed flow rates as a proxy for what can be achieved in the future. It is believed that observations should take precedence over planning guidelines where there is a contradiction between the two.

Å A count of station entries was undertaken at Seven Sisters for the post-match period associated with the THFC home match against Portsmouth on the 23rd March 2008. The peak outcome from the count data showed that at the busiest time, 811 people entered the station via the High Road within five minutes. This equates to approximately 162 people per minute. We know from the spectator survey undertaken on the day of this match that 90% of spectators travelling via Seven Sisters would board the southbound Victoria Line. Therefore, the flow towards this platform during this peak period equates to 142 people/minute and the stairs to the southbound Victoria Line platform, at 2.43m wide have been observed to operate with a capacity of **66 p/m/min**.

Å It is this data that has been used to inform the selection of appropriate flow rates for assessing the station stair capacities in a post-match operational scenario. It should also be noted that discussions with station staff and British Transport Police suggest that this is the typical outcome on a matchday, and that they have confidence that the station can operate within these parameters when required.

Station layout and entry points (Post-Match)



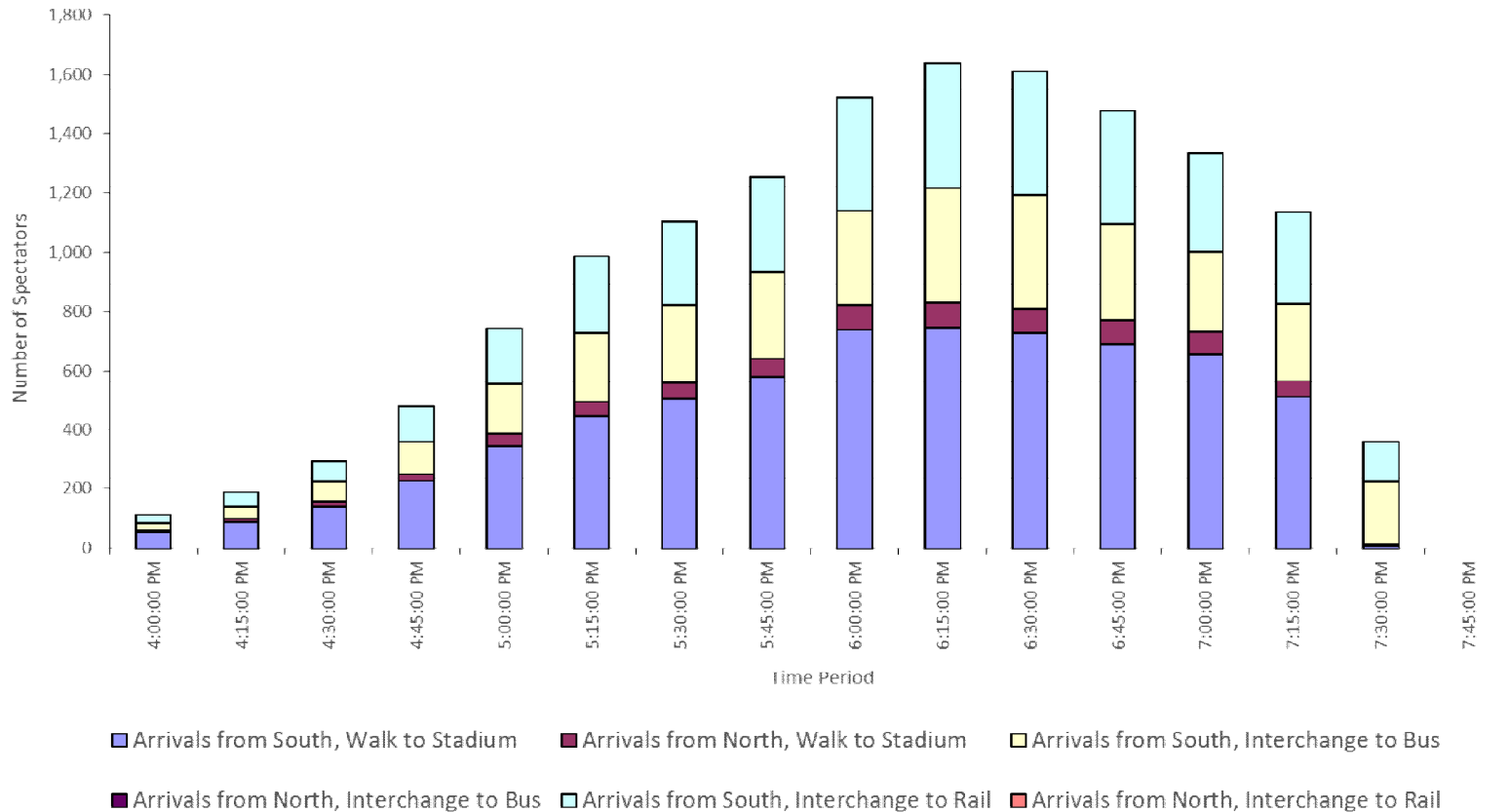
Å In the post-match management scenario, the stated capacities for Escalators & Stairs A will not be fully utilised as the flow will be regulated outside the Station to prevent queuing inside the Station (linked to capacity of Stairs C)



Midweek Matchday Scenario

Pre-match period

Spectator Arrivals at Seven Sisters during the Pre-Match Period



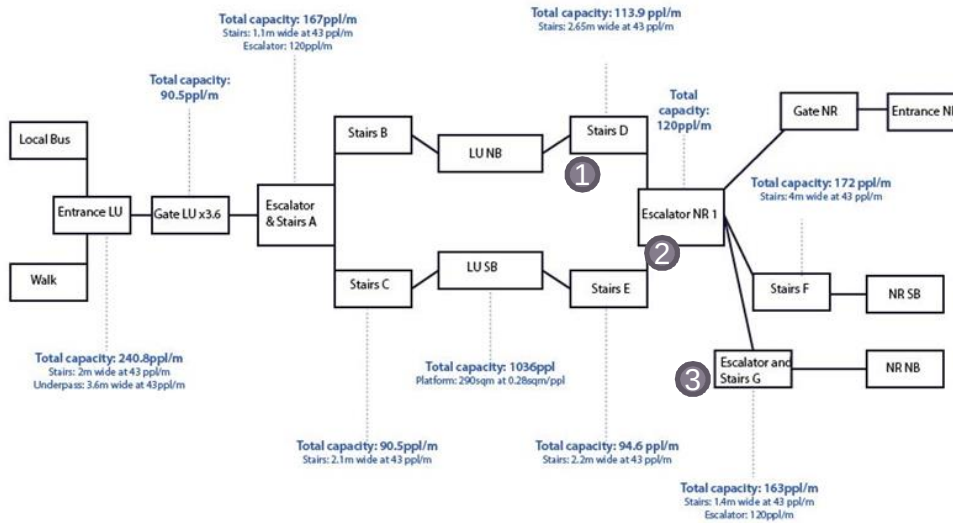
Å 14,620 spectators in total, all arriving on the Victoria Line (~24% of Spectators)

- 7,208 exit the station and Walk to the Stadium
- 3,702 interchange to NR trains to White Hart Lane
- 3,350 interchange onto Local Buses to the Stadium

Pre-match period

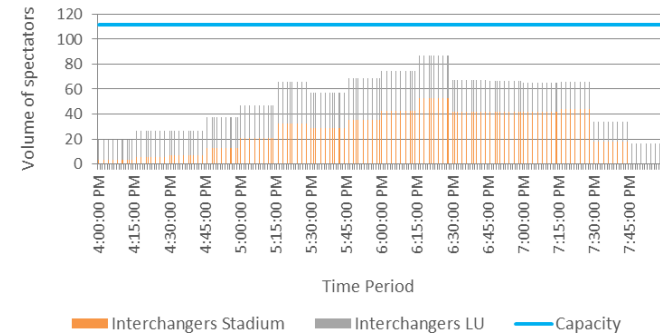
During the pre-match period, all station vertical circulation elements provide sufficient capacity to accommodate the background and spectator flows without delay.

This is also the case should passengers choose not to use the stairs where there is an option between escalators and stairs.



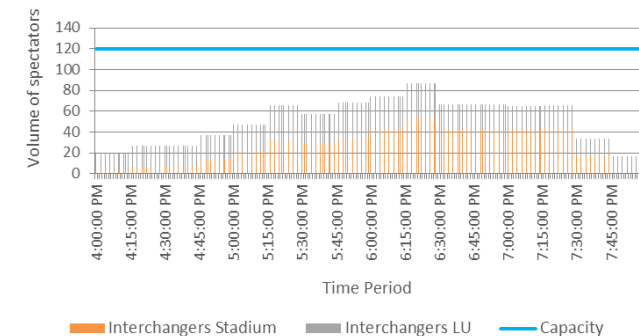
1

Demand at the bottom of Stairs from LU NB



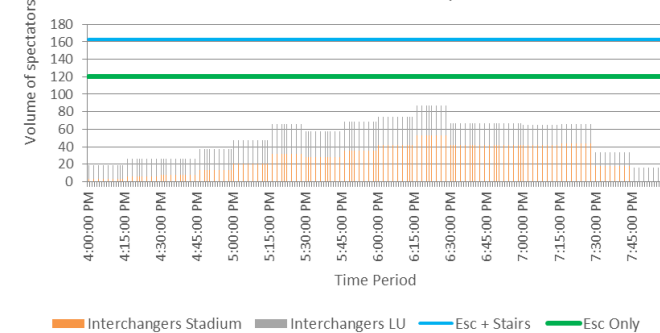
2

Demand at the bottom of Escalator from LU



3

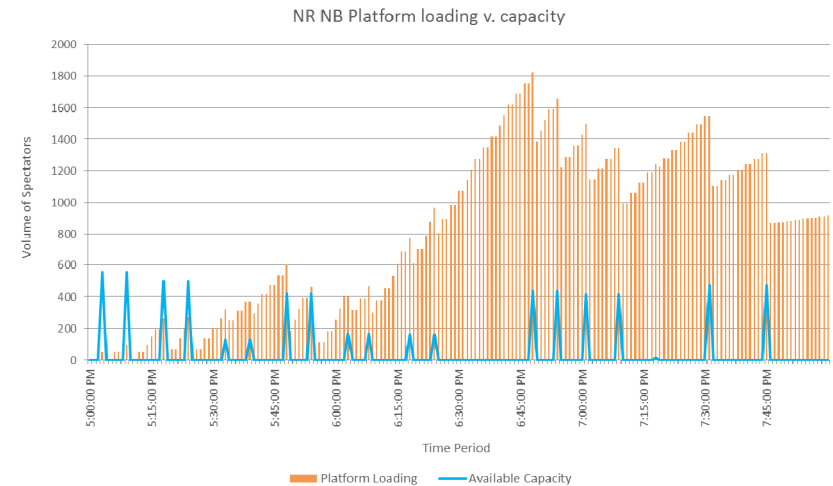
Demand at the bottom of Escalator/Stairs to NR



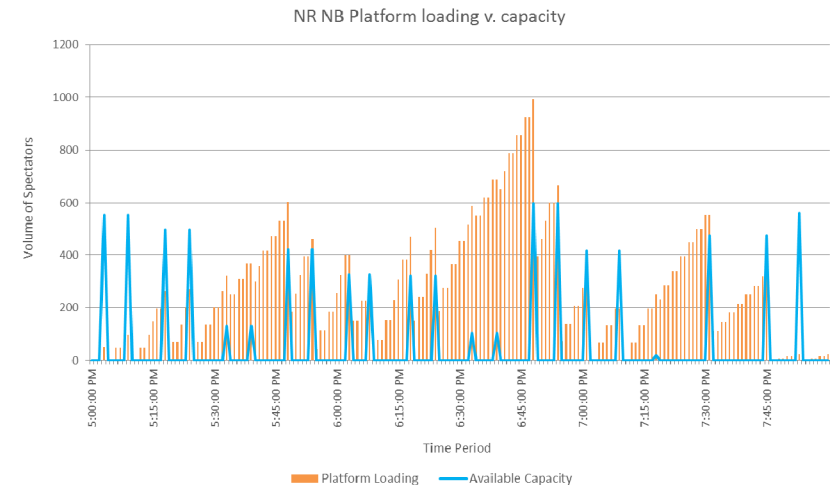
Pre-match period

- Å A potential issue for consideration is the occupancy of the NB National Rail platform during this period
- Å Trains arriving at Seven Sisters will already be partially loaded with background travellers and Spectators travelling to White Hart Lane from Central London
- Å In the first scenario, where train capacity is assumed to be limited to 859 pax/train (TfL advice that service capacity at 85% of total for events), this implies some trains will have no space for boarders at Seven Sisters. This would result in Platform loadings in excess of 1,800 people, with associated risks to safety and management.
- Å Higher loadings on these services are currently observed, and as discussed at the TfL pre-application meeting in July 2014, it is reasonable to assume that the full capacity will be available during peak times.
- Å In the second scenario, 1,020 pax/train is assumed for eight train services, which suggests that the peak loading of the platform would be between 900 and 1,000 passengers.
- Å Some passengers waiting on this platform would have to wait for two services to pass before being able to board.

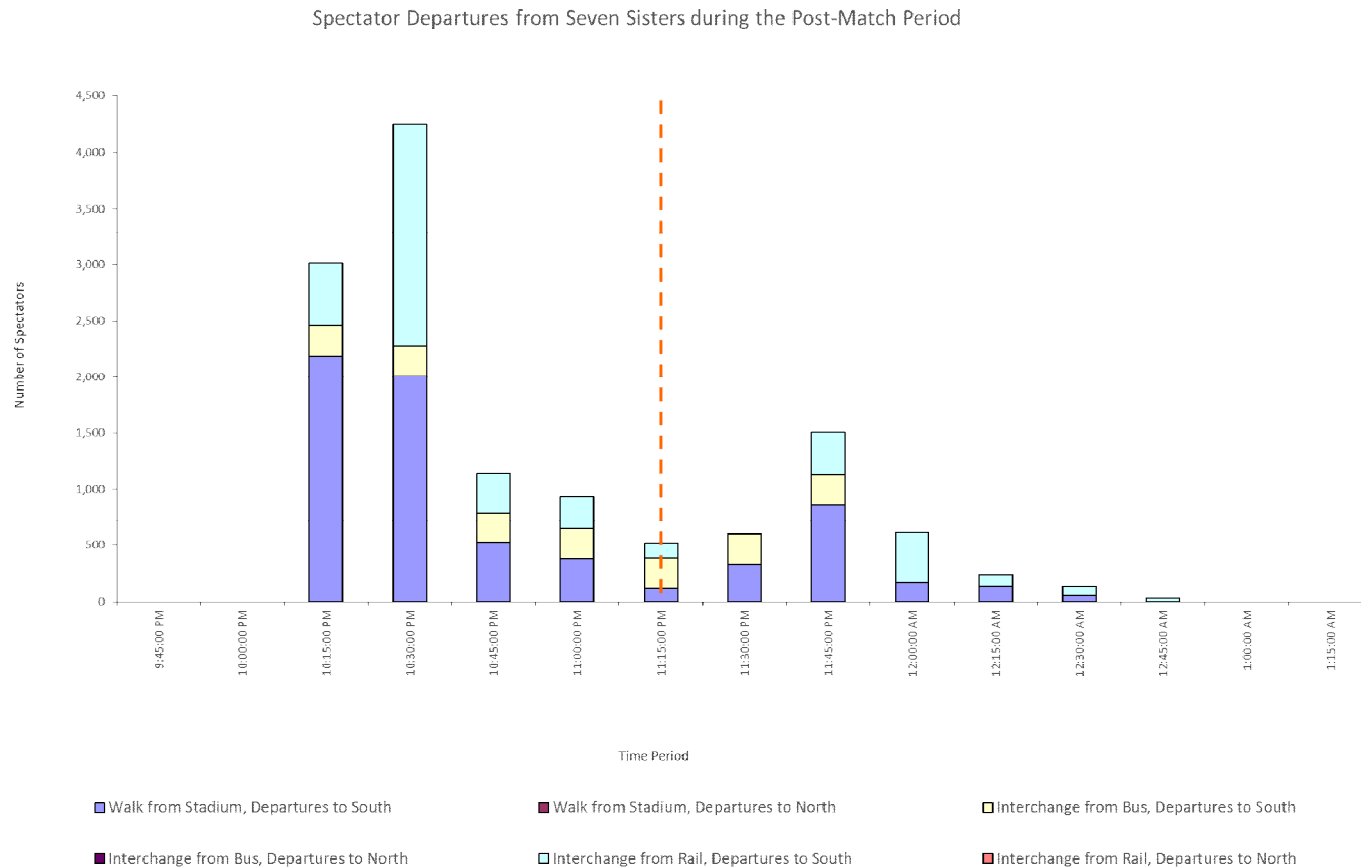
1



2



Post-match period - Arrival Profiles over time

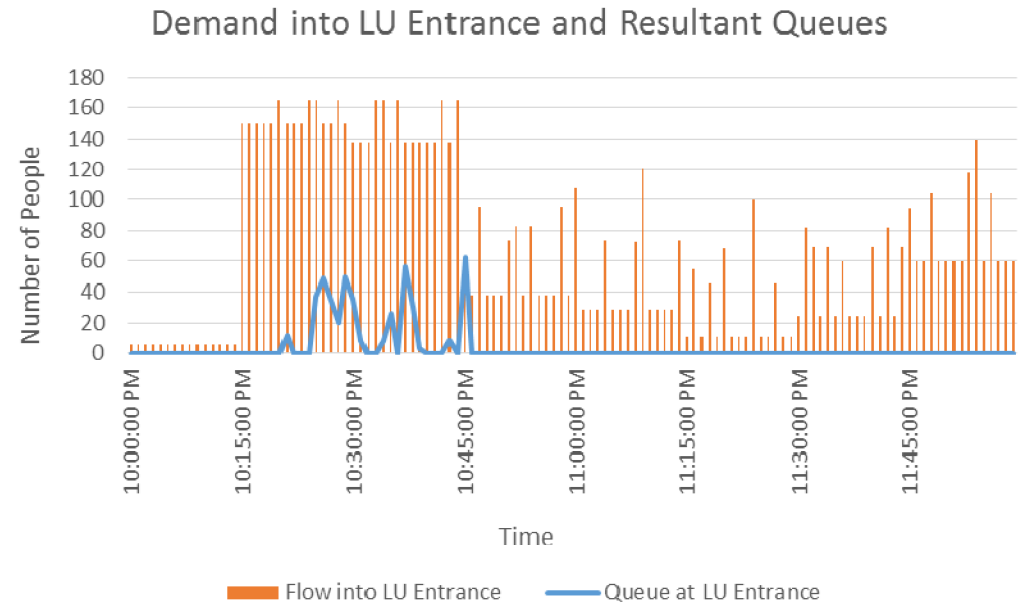


Å 12,993 spectators in total, all departing on the SB Victoria Line (~23%)

- 6,765 arrive on foot from the Stadium
- 4,338 interchanging from NR train services from White Hart Lane
- 1,890 interchanging from Buses from the Stadium

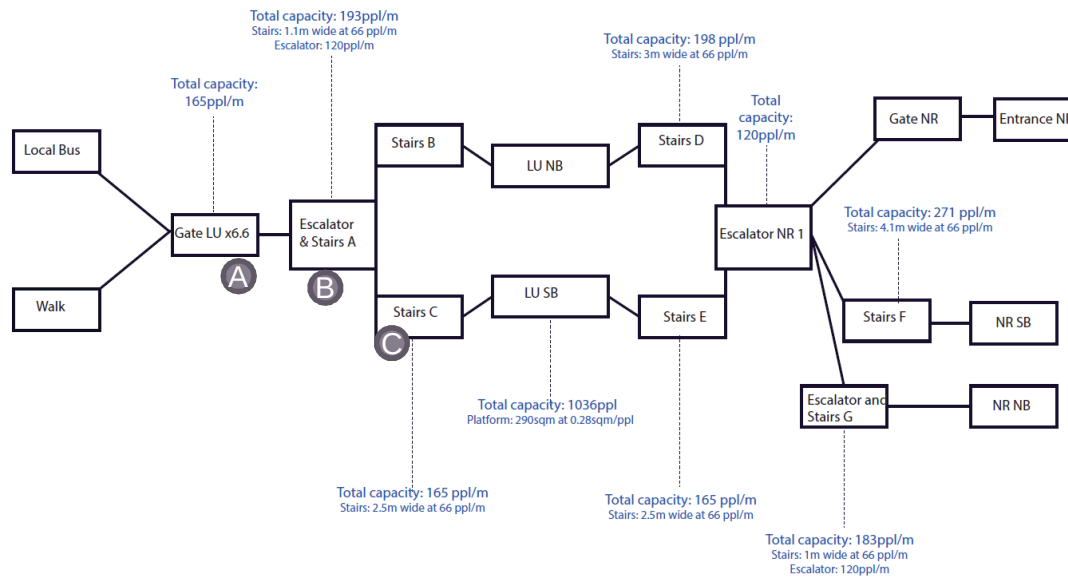
Post-match period at Main Entrance

- ⚠ To ensure that queuing and congestion does not take place inside the station, we have assumed that access to the station from the High Road is regulated.
- ⚠ Therefore, queues will form outside the station requiring a management plan to be adopted. All street level entry is assumed to be via the northernmost access point.
- ⚠ In this scenario, entry into the station would be maintained throughout, at 165 people/minute (equivalent of 6 ATG + 1 WAG gateline). However, given the rate of arrival at the station, queues would form from 22:25 onwards.
- ⚠ Maximum queue length: **62 people**
- ⚠ The requirement to accommodate some level of queuing outside the station would be for approximately half an hour.
- ⚠ The maximum delay for any individual would be less than one minute.



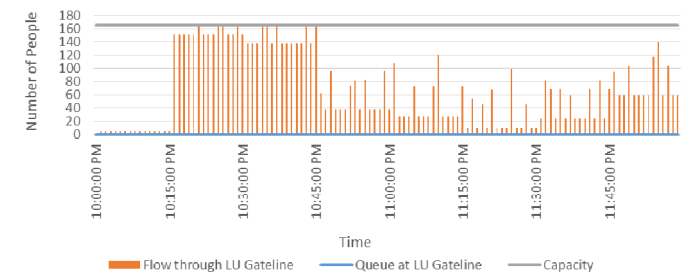
Post-match period i Other station elements

As demand is held outside the station to prevent queue formation inside, once people have entered their flow to the platform should not be impeded.



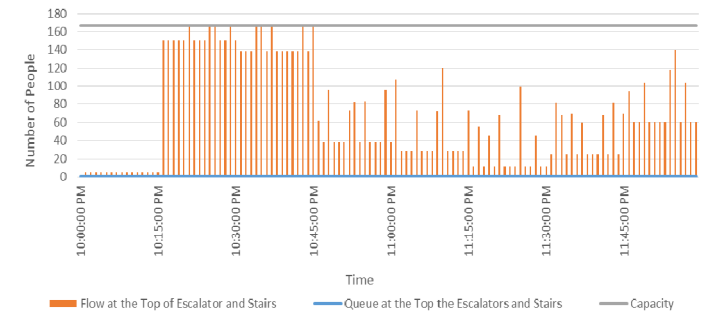
A

Demand at LU Gateline on High Road and Resultant Queues



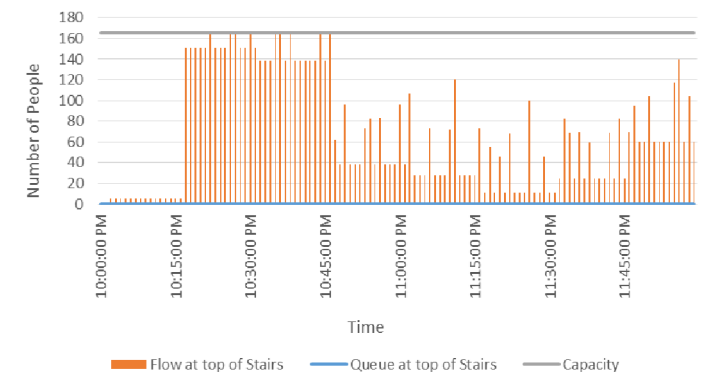
B

Demand at Top of Escalator/Stairs and Resultant Queues



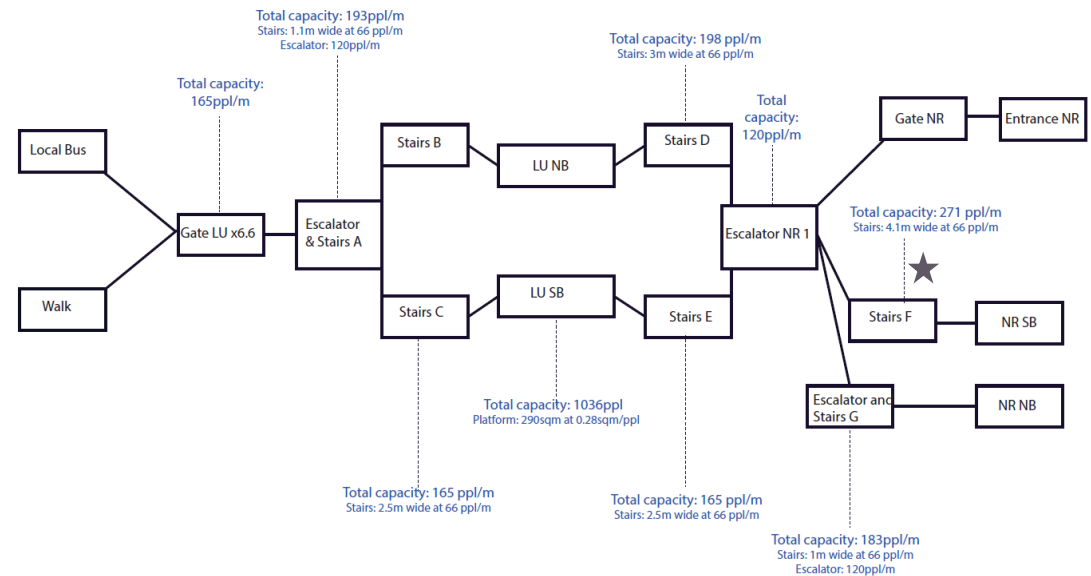
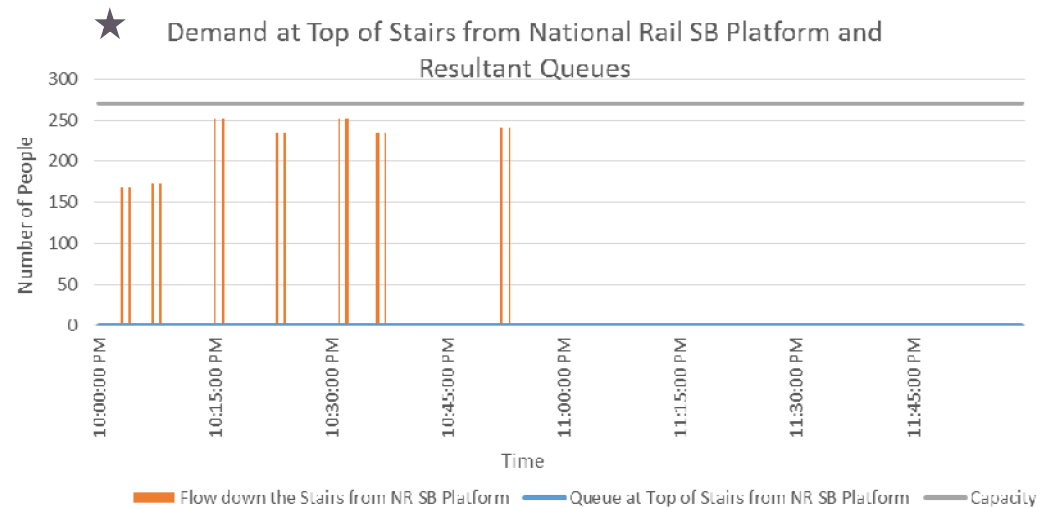
C

Demand at Top of Stairs and Resultant Queues



Post-match period i Stairs from NR Platform

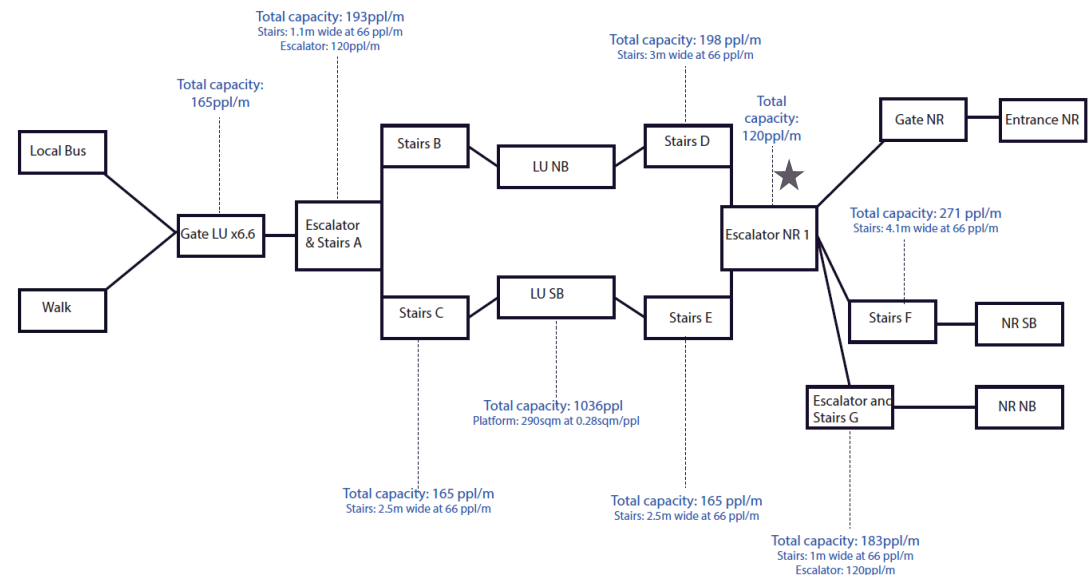
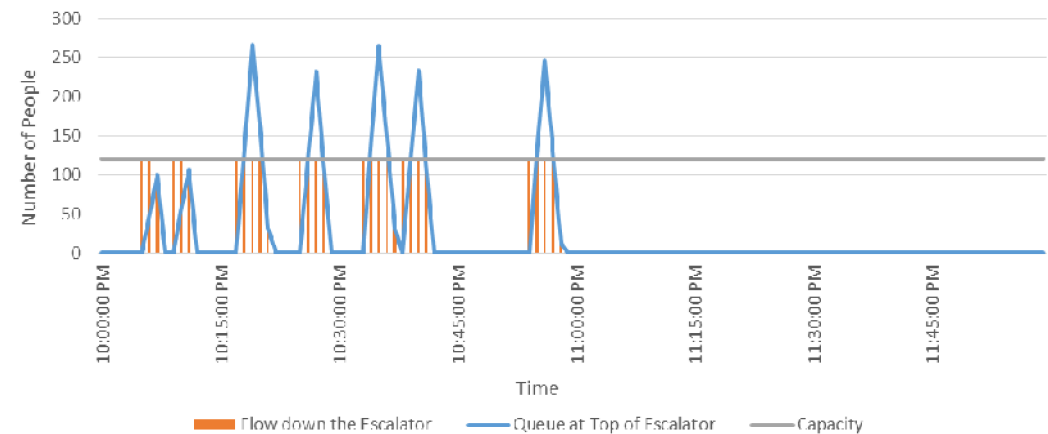
- ⚠ Spectators interchanging from National Rail SB services (having boarded at WHL) onto Victoria Line services use different parts of the station to those arriving on foot or by bus.
- ⚠ No queuing is expected.



Post-match period i Escalator from NR to LU

- ⚠ After passing from the platform through the Network Rail elements of the station, interchangers will descend an escalator to the Victoria Line.
- ⚠ As the capacity of the escalator is less than that of the Platform exit stairs, queues can be expected at times of peak interchange.
- ⚠ A maximum shuffling queue of 250 people could be expected in this location. The maximum delay would be less than 3 minutes, and would clear before the arrival of the following train.

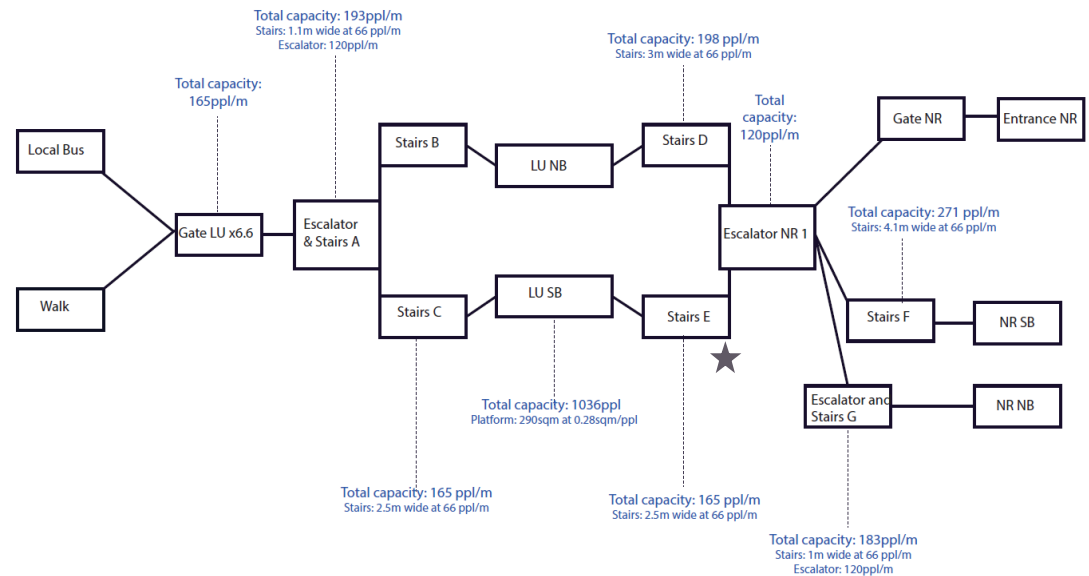
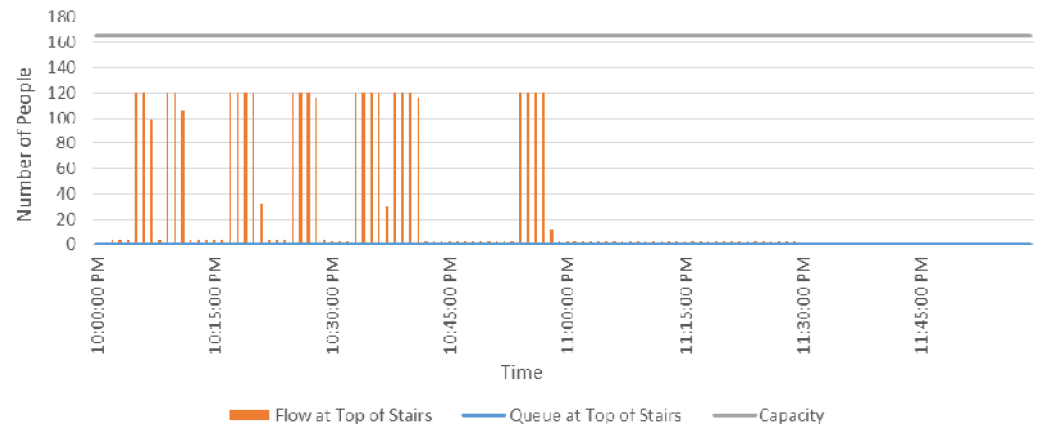
★ Demand at Top of Escalator from National Rail and Resultant Queues



Post-match period - Interchange from NR to LU SB

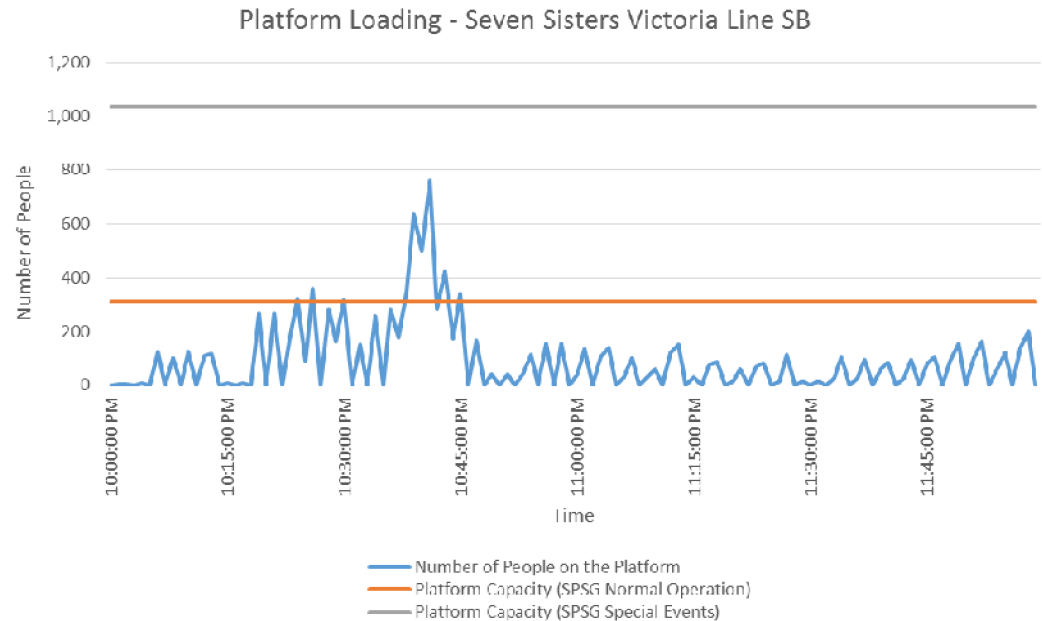
- At the base of the escalator, passengers descend further stairs to reach the Platform.
- No queuing is expected.

★ Demand at Top of Stairs and Resultant Queues



Post-match i Platform SB

- ⚠ The SB Victoria Line Platform will be fed by two entry points at either end of the Platform.
- ⚠ Under SPSG Special Events guidance, the Platform has capacity for approximately 1,000 people. As indicated in this assessment, the peak anticipated occupancy is 758 passengers.
- ⚠ Whilst this suggests that conditions on the Platform during the post-match should operate safely without management intervention, any delay in service of more than two minutes at peak times may require access to be controlled.
- The available capacity on trains takes into account background users and spectators boarding at Tottenham Hale. For all but one period, it will be possible for all passengers arriving on the platform to board the next train.

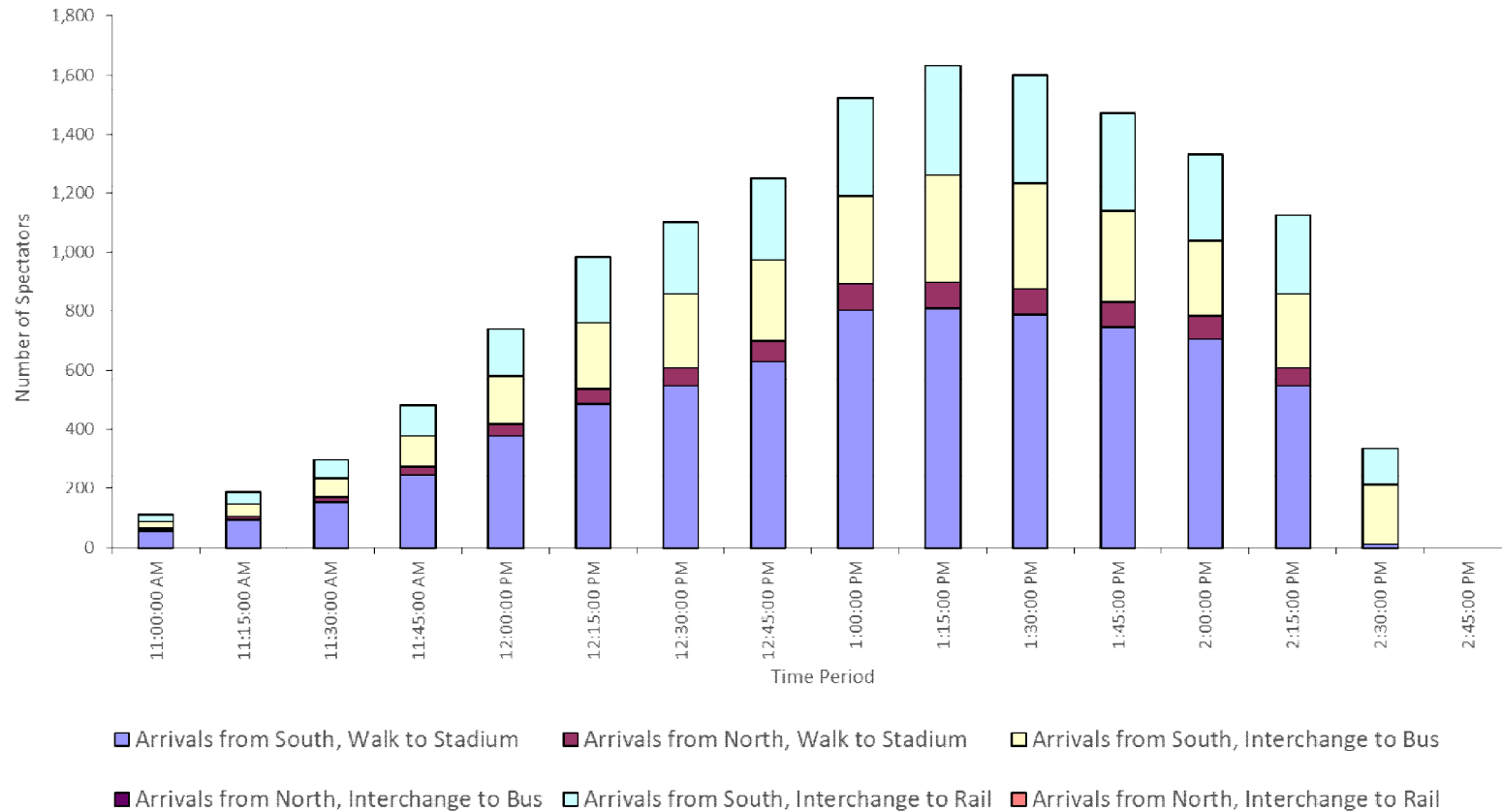




Weekend Matchday Scenario

Pre-match period

Spectator Arrivals at Seven Sisters during the Pre-Match Period



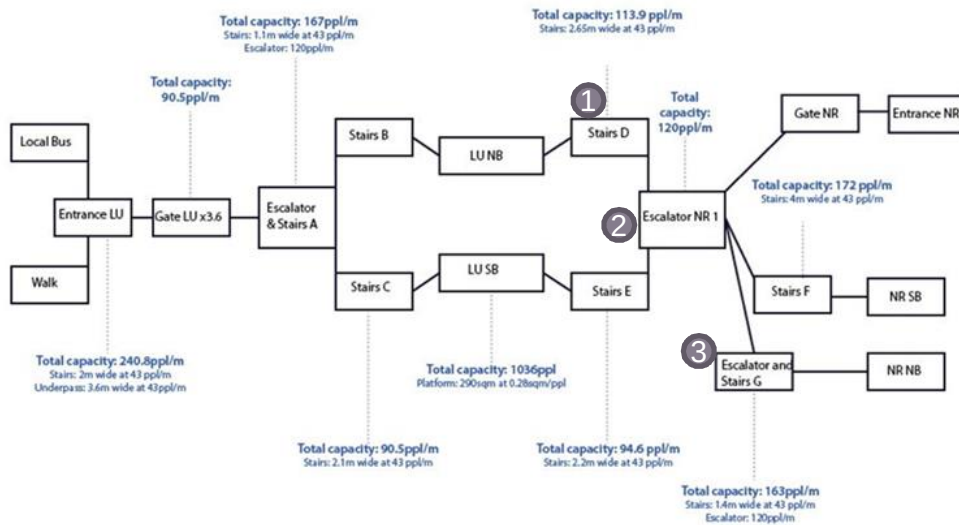
Å 14,188 spectators in total, all arriving on the Victoria Line (~23% of Spectators)

- 7,787 exit the station and Walk to the Stadium
- 3,216 interchange to NR trains to White Hart Lane
- 3,185 interchange onto Local Buses to the Stadium

Pre-match period

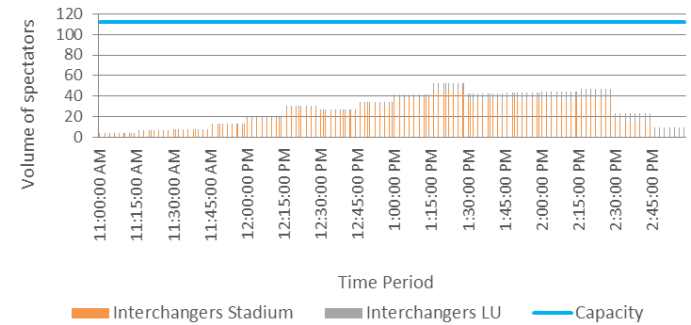
During the pre-match period, all station vertical circulation elements provide sufficient capacity to accommodate the background and spectator flows without delay.

This is also the case should passengers choose not to use the stairs where there is an option between escalators and stairs.



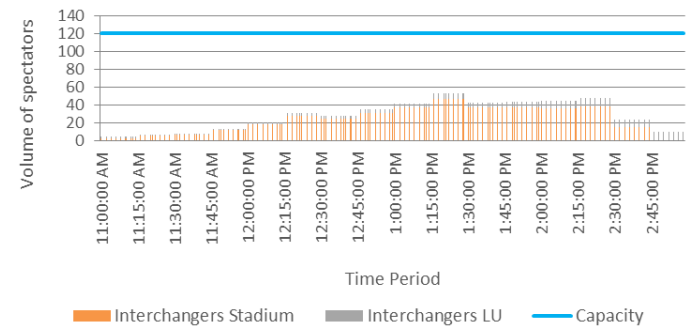
1

Demand at the bottom of Stairs from LU NB



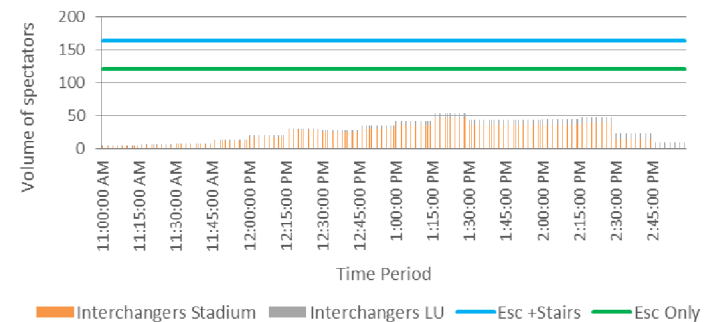
2

Demand at the bottom of Escalator from LU



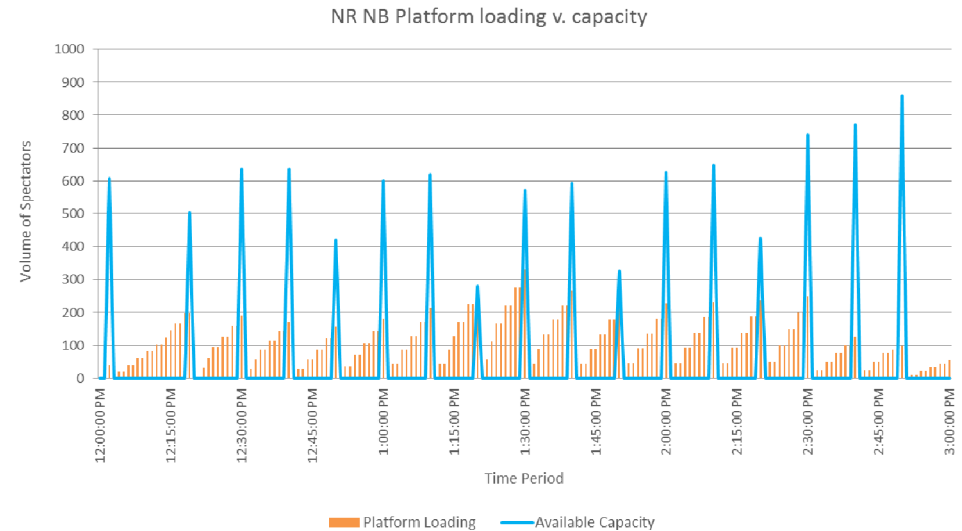
3

Demand at the bottom of Escalator/Stairs to NR

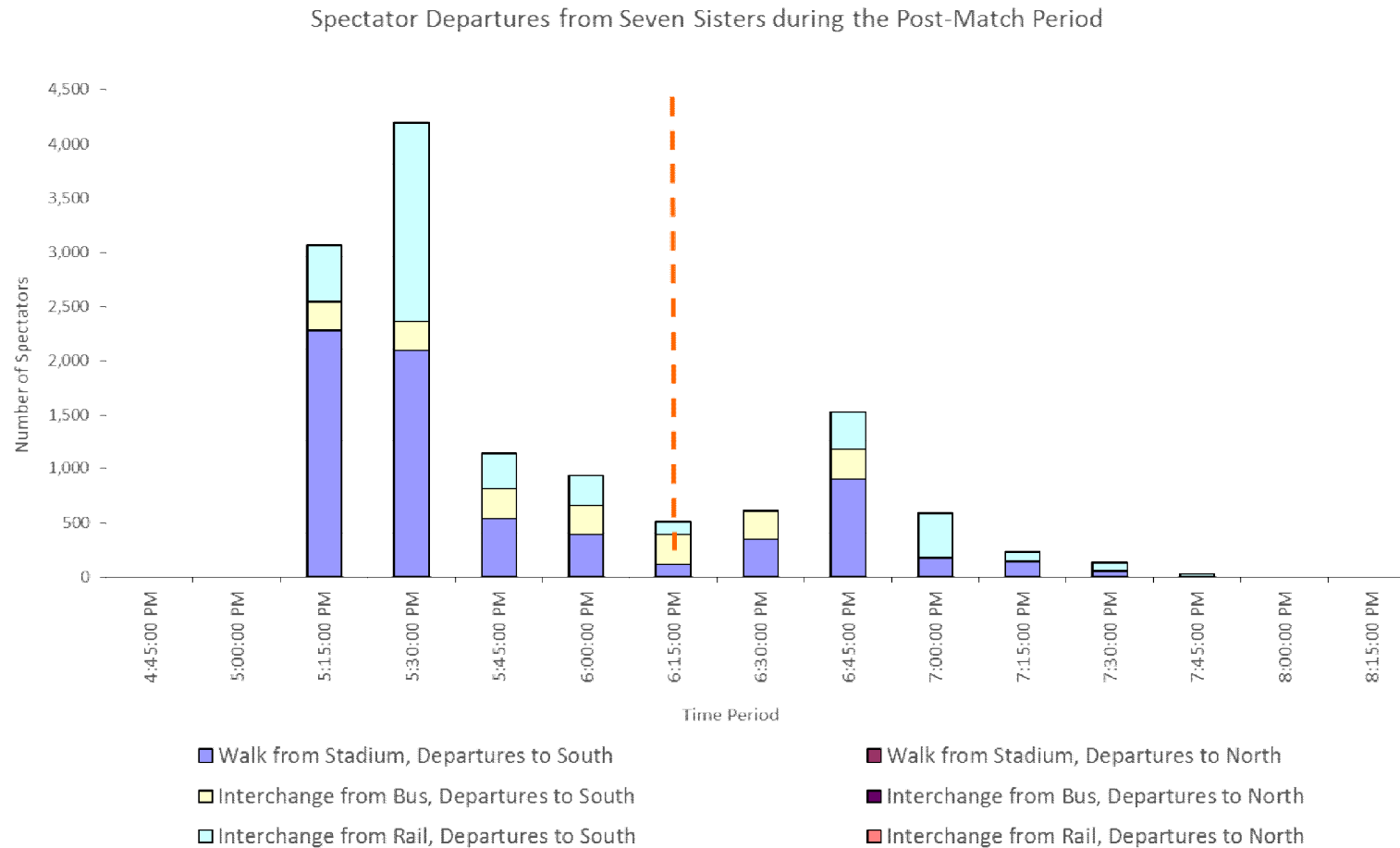


Pre-match period

- Å A potential issue for consideration is the occupancy of the NB National Rail platform during this period.
- Å Trains arriving at Seven Sisters will already be partially loaded with background travellers and Spectators travelling to White Hart Lane from Central London.
- Å However, with much lower background demand than in the midweek scenario (coincidence with commuter peak), it is anticipated that there will be adequate available train capacity for all interchangers to board the first northbound train i assuming all are in 8 car configuration.
- Å Therefore, the peak anticipated platform loading would be less than 300 passengers.
- Å The adjacent chart shows a scenario where all trains have an assumed capacity of 859 passengers.



Post match period - Arrival Profiles over time

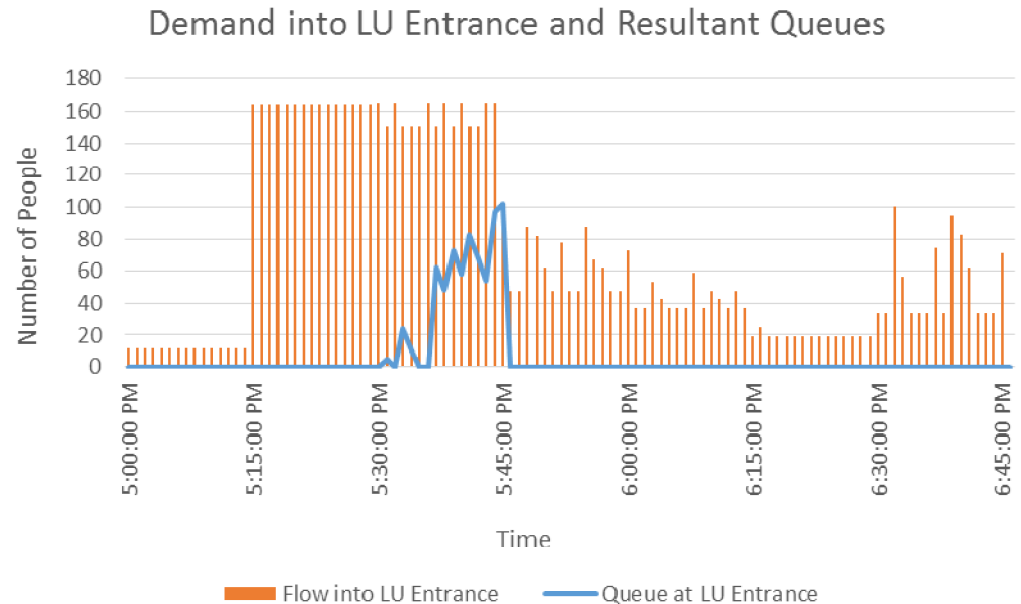


Å 12,980 spectators in total, all departing on the SB Victoria Line (~23%)

- 7,055 arrive on foot from the Stadium
- 4,035 interchanging from NR train services from White Hart Lane
- 1,890 interchanging from Buses from the Stadium

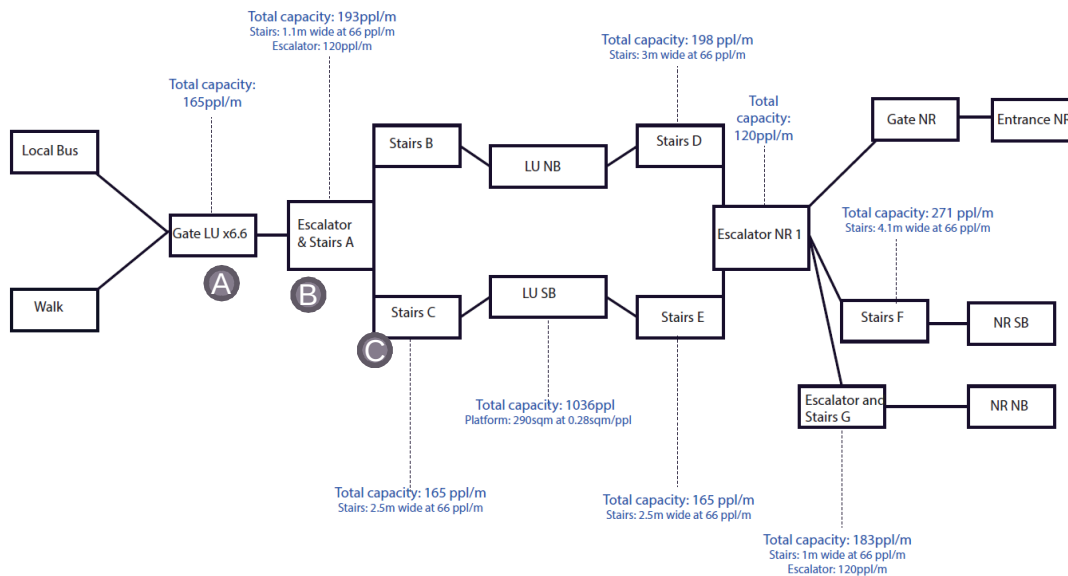
Post-match period at Main Entrance

- ⚠ To ensure that queuing and congestion does not take place inside the station, we have assumed that access to the station from the High Road is regulated.
- ⚠ Therefore, queues will form outside the station requiring a management plan to be adopted. All street level entry is assumed to be via the northernmost access point.
- ⚠ In this scenario, entry into the station would be maintained throughout, at 165 people/minute (equivalent of 6 ATG + 1 WAG gateline). However, given the rate of arrival at the station, queues would form from 17:30 onwards.
- ⚠ Maximum queue length: **102 people**
 - ⚠ NEED DRAWING SHOWING FOOTPRINT ON STREET NETWORK (TS&C)
- ⚠ The duration of queuing outside the station would be **9 mins**
- ⚠ The maximum delay for any individual outside the station would be **less than 1 minute**.



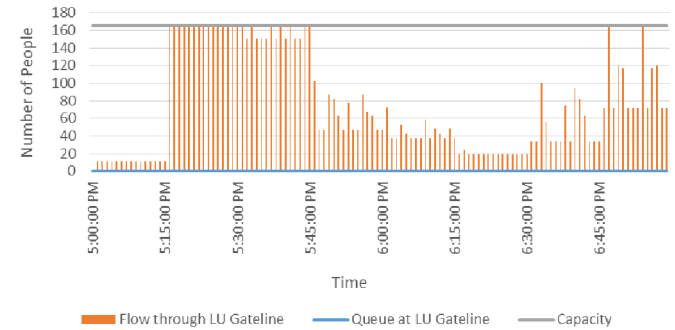
Post-match period i Other station elements

As demand is held outside the station to prevent queue formation inside, once people have entered their flow to the platform should not be impeded.



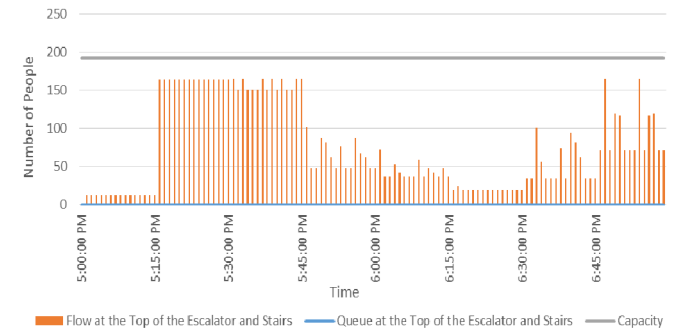
A

Demand at LU Gateline on High Road and Resultant Queues



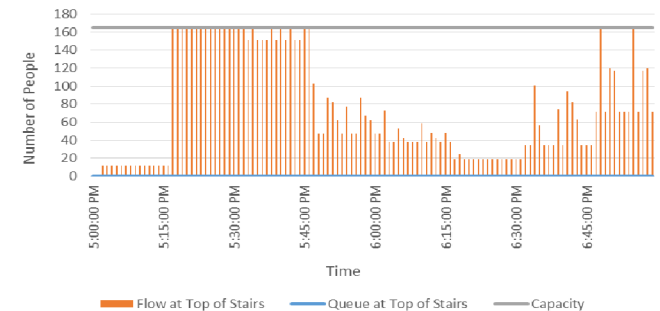
B

Demand at Top of Escalator/Stairs and Resultant Queues



C

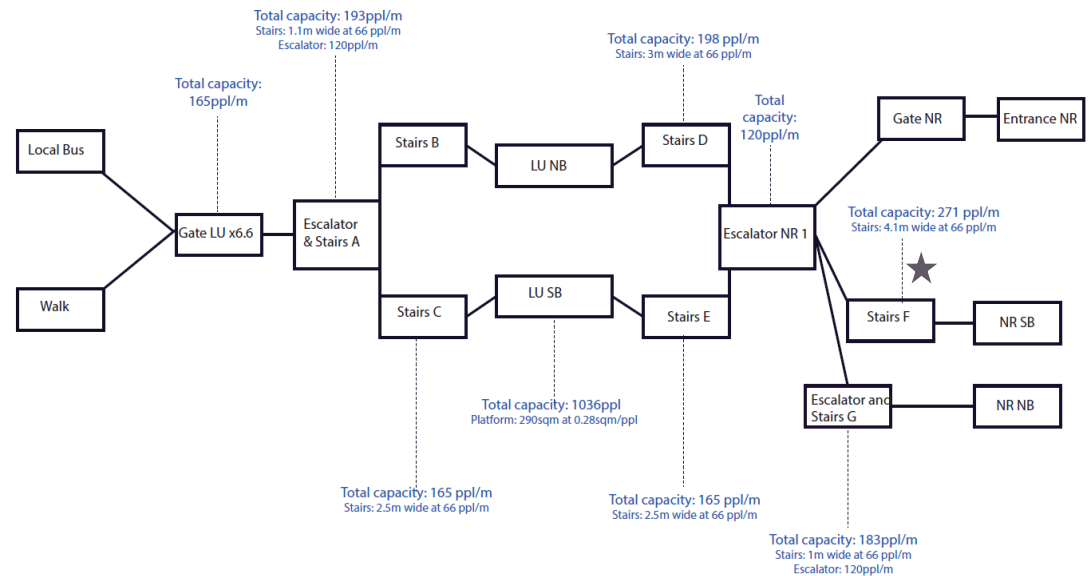
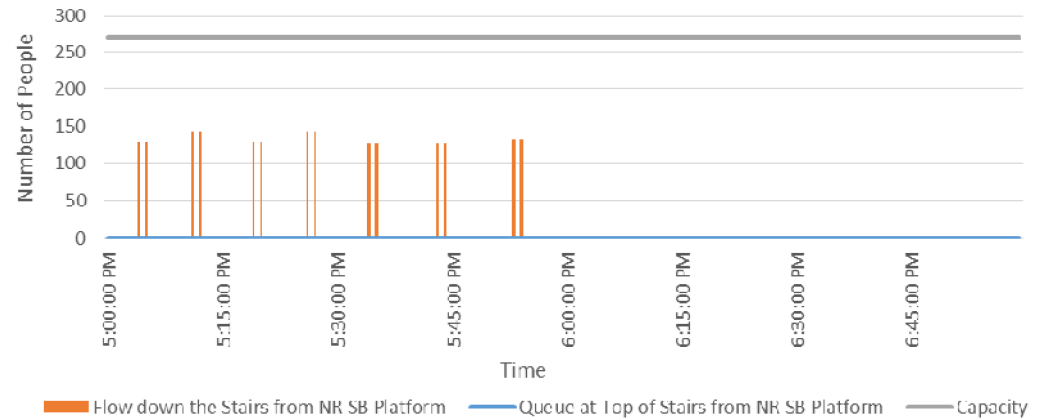
Demand at Top of Stairs and Resultant Queues



Post-match period i Stairs from NR Platform

- ⚠ Spectators interchanging from National Rail SB services (having boarded at WHL) onto Victoria Line services use different parts of the station to those arriving on foot or by bus.
- ⚠ It is anticipated that all interchangers will be able to clear the platform within 2 minutes of the train arriving.

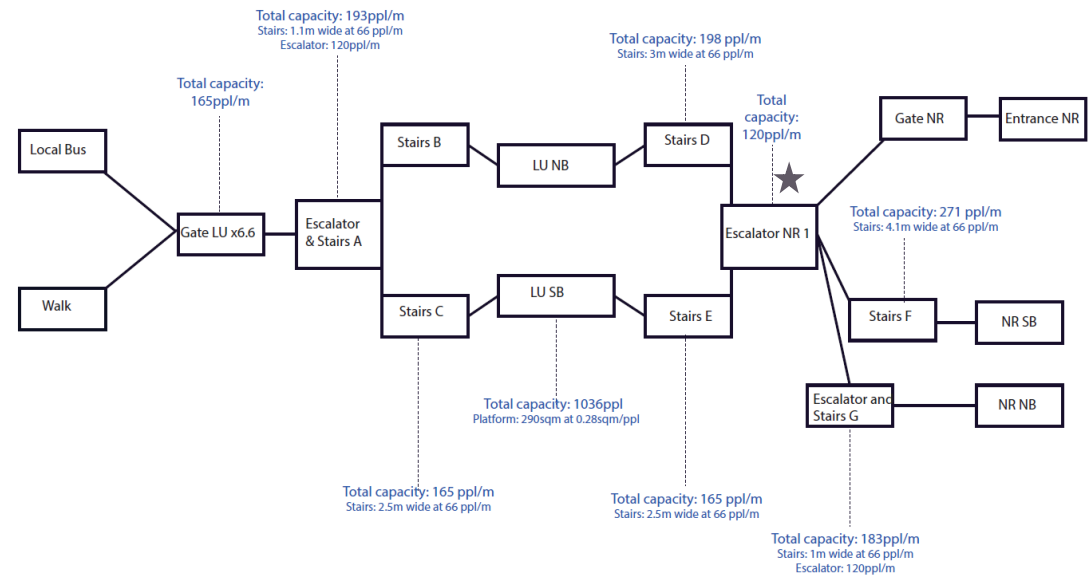
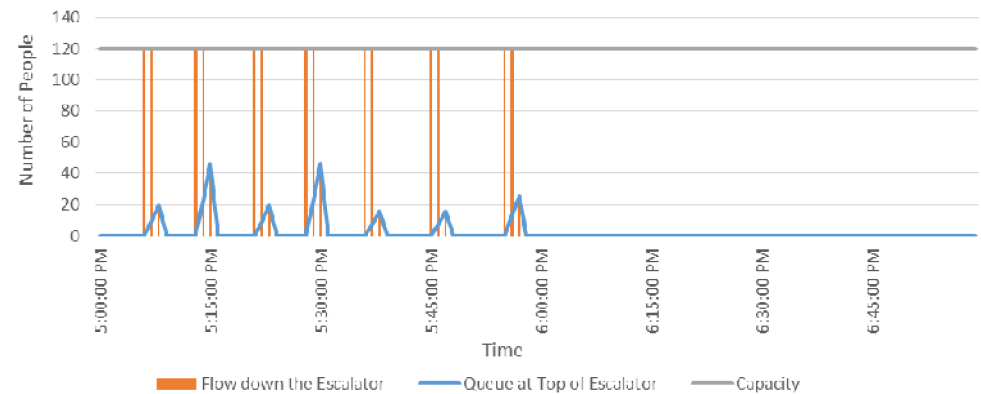
★ Demand at Top of Stairs from National Rail SB Platform and Resultant Queues



Post-match period i Escalator from NR to LU

- ⚠ After passing from the platform through the Network Rail elements of the station, interchangers will descend an escalator to the Victoria Line.
- ⚠ As the capacity of the escalator is less than that of the Platform exit stairs, queues can be expected at times of peak interchange.
- ⚠ A maximum shuffling queue of 50 people could be expected in this location. The maximum delay would be less than 2 minutes, and would clear before the arrival of the following train.

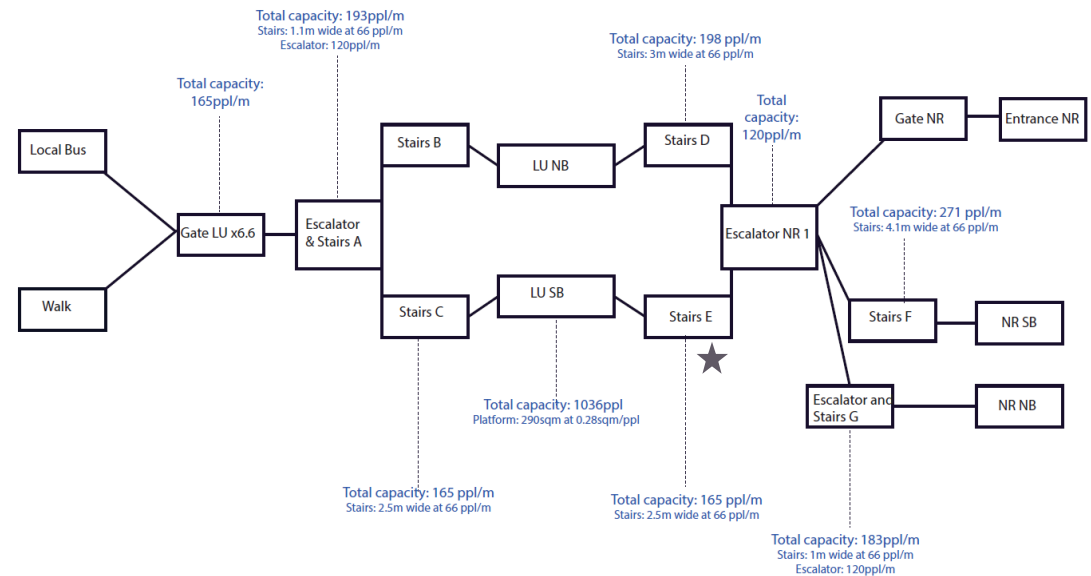
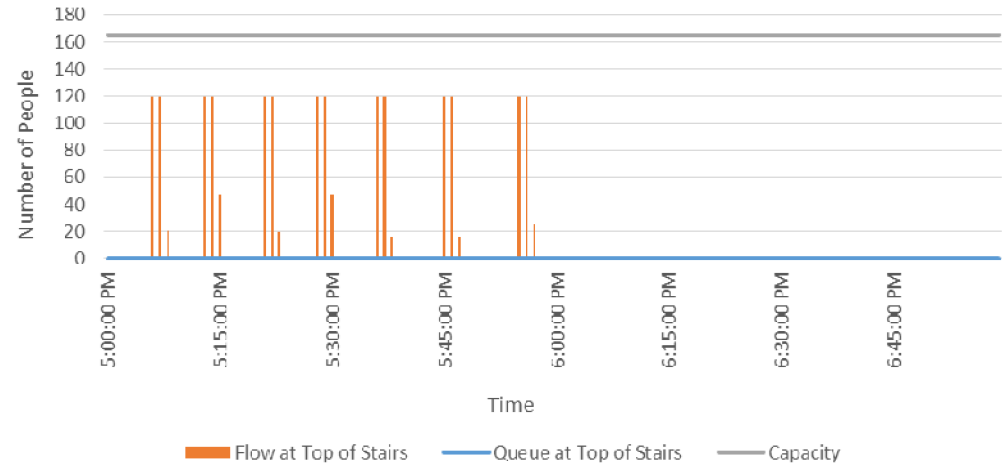
★ Demand at Top of Escalator from National Rail and Resultant Queues



Post-match period - Interchange from NR to LU SB

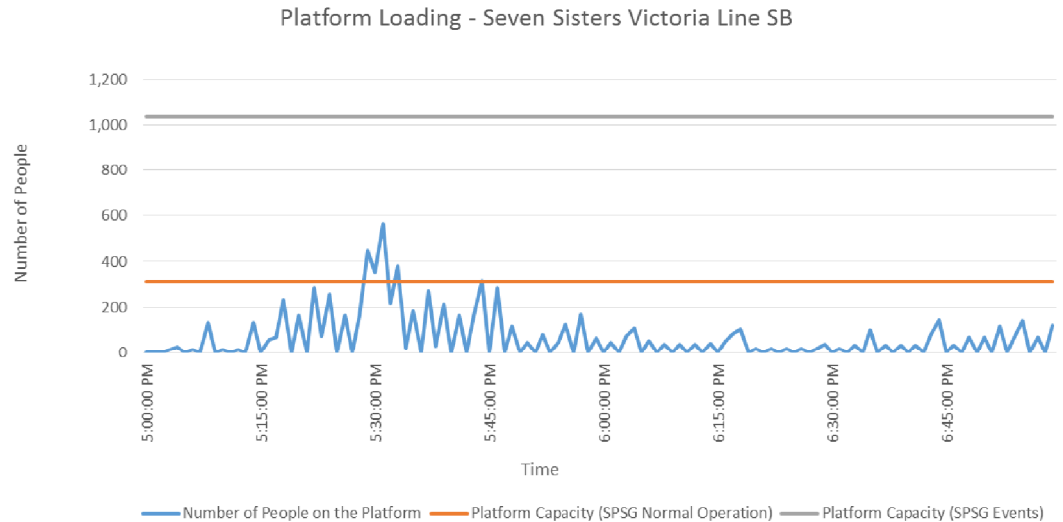
- ⚠ At the base of the escalator, passengers descend further stairs to reach the Platform.
- ⚠ No queuing is anticipated at this location.

★ Demand at Top of Stairs and Resultant Queues



Post-match i Platform SB

- ⌚ The SB Victoria Line Platform will be fed by two entry points at either end of the Platform.
- ⌚ Under SPSG Special Events guidance, the Platform has capacity for approximately 1,000 people. As indicated in this assessment, the peak anticipated occupancy is 563 passengers.
- ⌚ As this is only marginally higher than planning standards for Normal Operations, this suggests that conditions on the Platform during the post-match should operate safely without management intervention.
- ⌚ The available capacity on trains takes into account background users and spectators boarding at Tottenham Hale. It will be possible for all passengers arriving on the platform to board the next train.



Conclusions

⌘ Midweek

- ⌘ During the pre-match period, the interchange flows between LU and NR is the most challenging flow. This is principally due to the coincidence of spectator flows and the evening commuter peak on Northbound services. The assessment shows that there will be occasions where some people will be unable to board the first northbound train.
- ⌘ During the post-match, assuming that the station infrastructure continues to operate at the same level of efficiency as has been observed in existing conditions, there will be some (limited) queuing outside the station on the High Road – with entry flows managed to match the internal capacity of the route through to the Victoria Line Southbound Platforms. The analysis indicates that these queues will be small, and any delays experienced would be a matter of minutes – and should be considered acceptable, particularly in the light of conditions elsewhere.
- ⌘ Note: a capacity assessment based on SPSG Special Events flow rates is contained in the Appendix, and suggests that queuing would be more extensive, albeit with no delays of more than 14 minutes. However, in this instance, the observed conditions are considered as the base case.

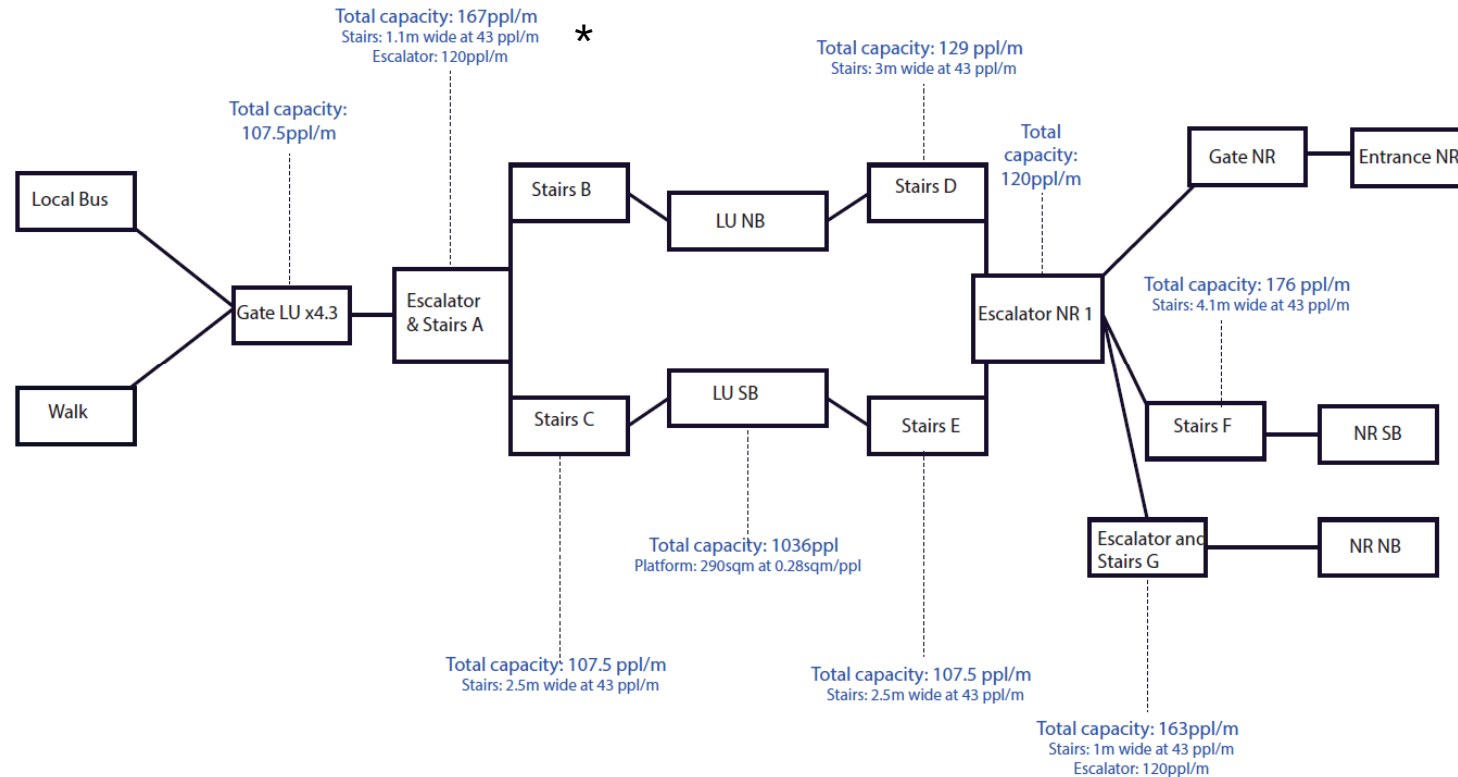
⌘ Weekend

- ⌘ During the pre-match period, there is adequate capacity to accommodate anticipated flows.
- ⌘ In the post-match, similar conditions as the midweek scenario are anticipated, although queuing is slightly higher as more spectators are forecast to arrive on foot. Nevertheless, the conditions are considered acceptable



Appendix A: Post-Match Assessment using SPSG Special Event Flow Rates

Station layout and entry points (SPSG Special Events)



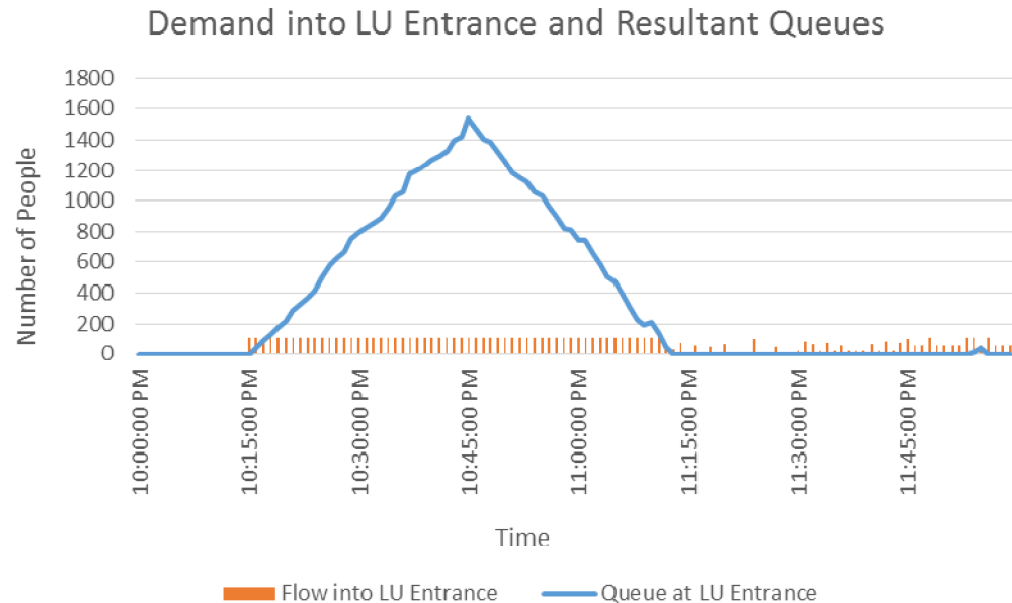
NB. Even though some elements of the station fall under Network Rail, all capacities stated are derive from SPSG Special Events guidance to ensure consistency of analysis. As highlighted in Table 3.12, all the stated capacities correspond to Fruin Level of Service E.

As stated in SPSG (p.57), *There are no 'edge effects' on stairways as all dimensions are measured between handrails (passengers walk very close to handrails as the arm and shoulder overhangs the handrail).*

Å In the post-match management scenario, the stated capacities for Escalators & Stairs A will not be fully utilised as the flow will be regulated outside the Station to prevent queuing inside the Station (linked to capacity of Stairs C)

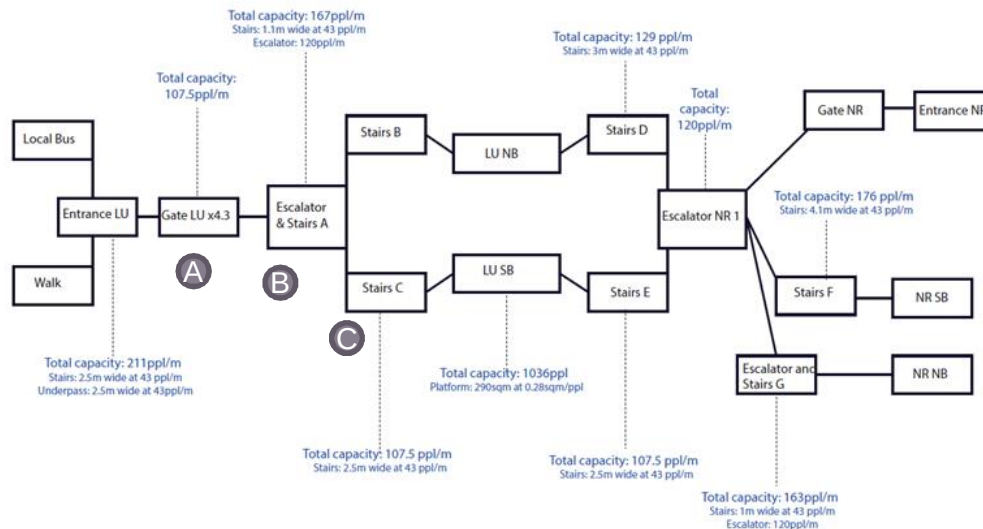
Midweek Post-match period - Main Entrance

- ⌘ To ensure that queuing and congestion does not take place inside the station, we have assumed that access to the station from the High Road is regulated.
- ⌘ Therefore, queues will form outside the station requiring a management plan to be adopted. All street level entry is assumed to be via the northernmost access point.
- ⌘ In this scenario, entry into the station would be maintained throughout, at 108 people/minute (equivalent of 4 ATG + 1 WAG gateline). However, given the rate of arrival at the station, queues would form from 22:15 onwards.
- ⌘ Maximum queue length: **1,472 people**
 - ⌘ **NEED DRAWING SHOWING FOOTPRINT ON STREET NETWORK (TS&C)**
- ⌘ The duration of queuing outside the station would be **57mins**
- ⌘ The maximum delay for any individual would be **14 mins**:
 - ⌘ 68% of spectators would be delayed for 10 mins or less
 - ⌘ 32% of spectators would be delayed for 11 - 15 mins



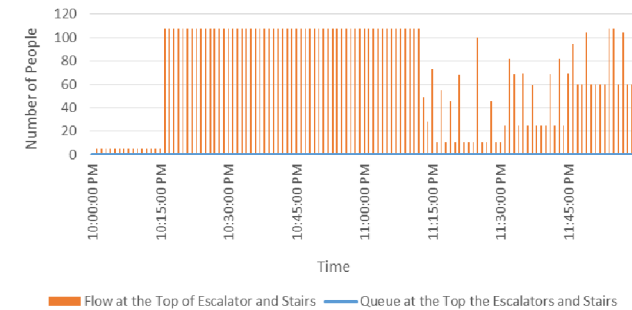
Midweek Post-match period i Other station elements

- As demand is held outside the station to prevent queue formation inside, once people have entered their flow to the platform should not be impeded.



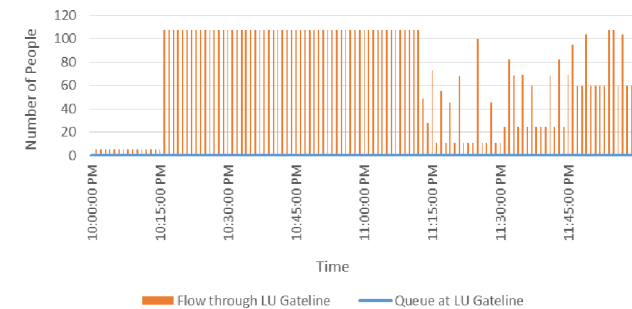
A

Demand at Top of Escalator/Stairs and Resultant Queues



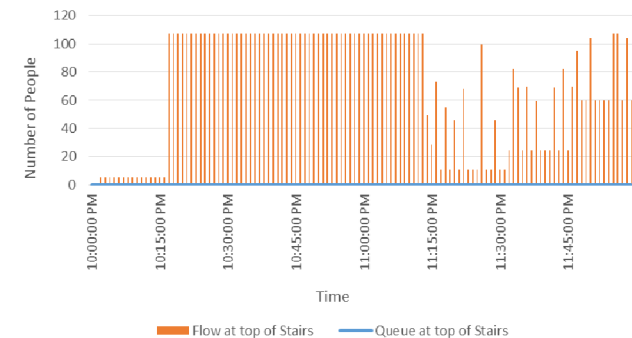
B

Demand at LU Gateline on High Road and Resultant Queues



C

Demand at Top of Stairs and Resultant Queues

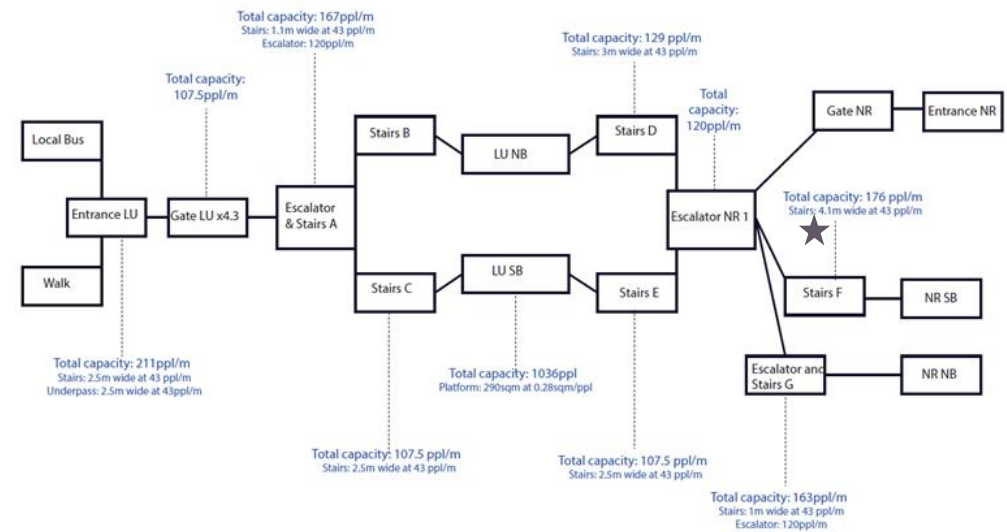
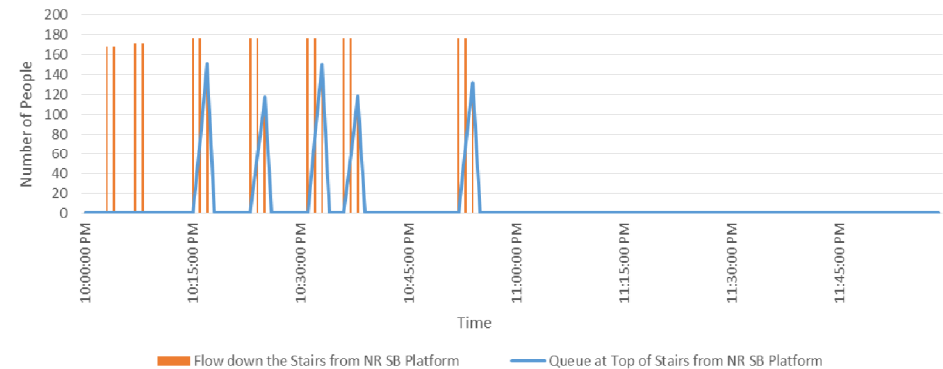


Midweek Post-match period i Stairs from NR Platform

- ⚠ Spectators interchanging from National Rail SB services (having boarded at WHL) onto Victoria Line services use different parts of the station to those arriving on foot or by bus.
- ⚠ On five occasions during the post-match period, the clearance of the SB platform will result in some queues at the head of the stairs.
- ⚠ The maximum queue duration will be 2 minutes, and is therefore always cleared before the arrival of the following train (minimum headway of 5 mins).
- ⚠ The maximum queue length at the head of these stairs is calculated to be 151 passengers, although this will be regulated to some degree by the spread of alighting across the train and the location of the stairs at one end of the platform.



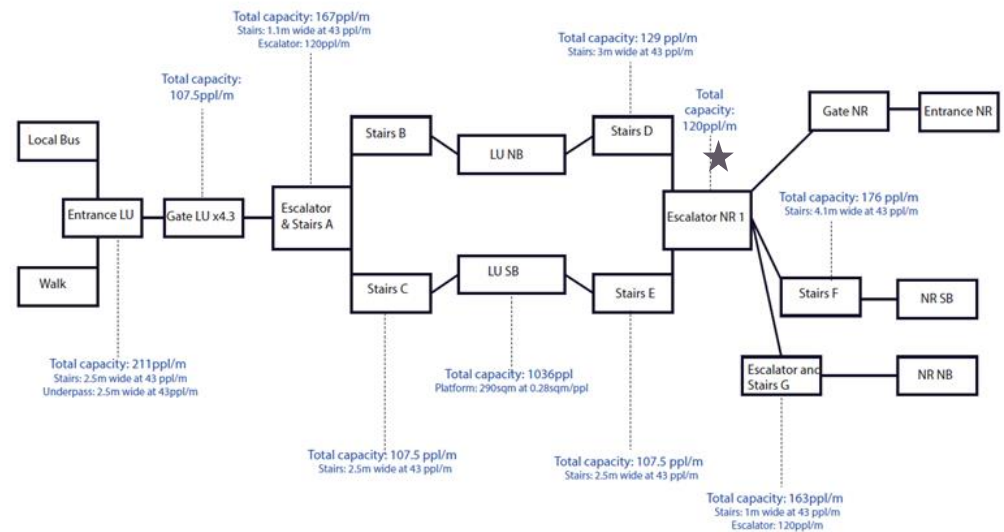
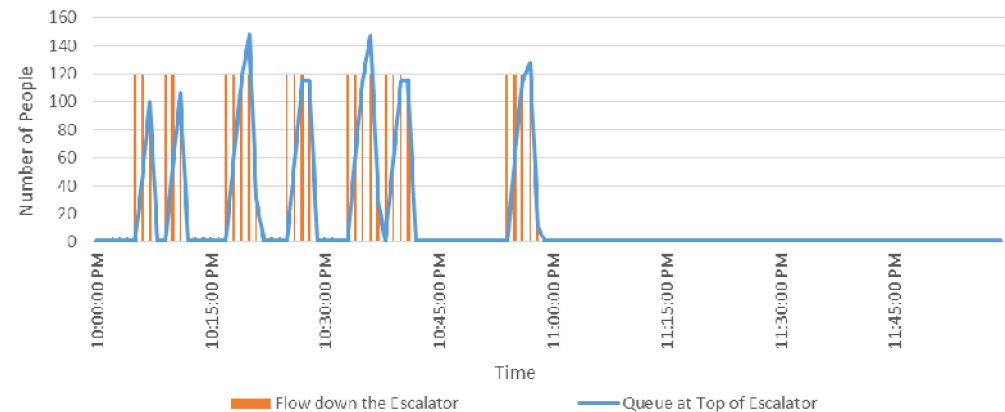
Demand at Top of Stairs from National Rail SB Platform and Resultant Queues



Midweek Post-match period i Escalator from NR to L

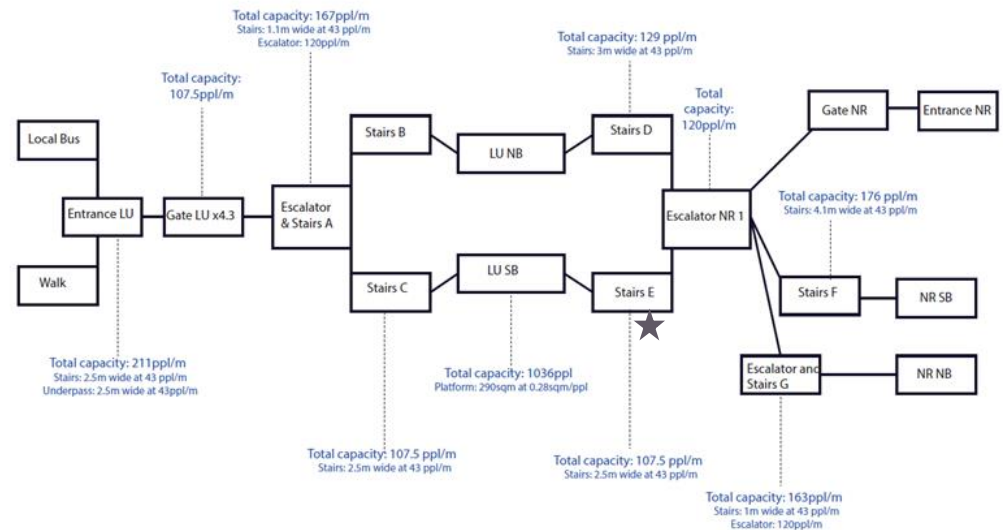
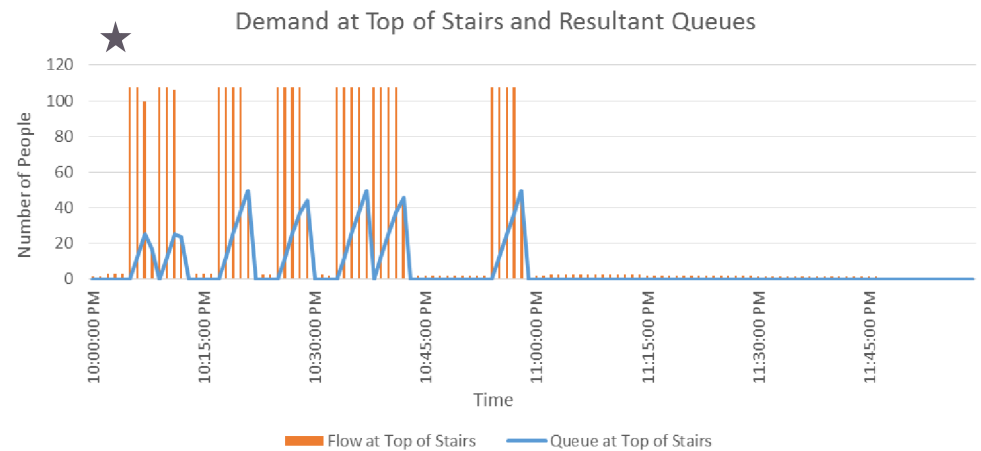
- ⚠ After passing from the platform through the Network Rail elements of the station, interchangers will descend an escalator to the Victoria Line.
- ⚠ As the capacity of the escalator is less than that of the Platform exit stairs, queues can be expected at times of peak interchange.
- ⚠ A maximum shuffling queue of 150 people could be expected in this location. The maximum delay would be less than 4 minutes, and would clear before the arrival of the following train.

★ Demand at Top of Escalator from National Rail and Resultant Queues



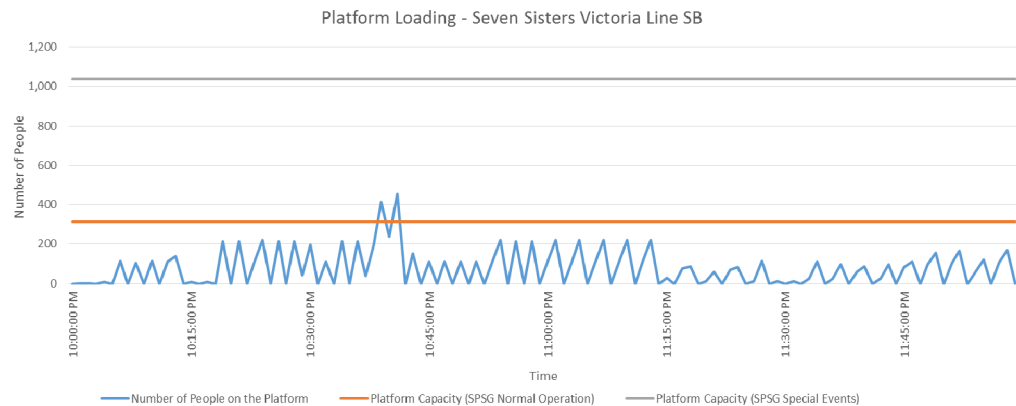
Midweek Post-match period - Interchange from NR to LU SE

- At the base of the escalator, passengers descend further stairs to reach the Platform.
- As the capacity of the final set of stairs is less than that of the escalator, small queues can be expected at times of peak interchange.
- A maximum shuffling queue of 50 people could be expected in this location. The maximum delay would be less than 4 minutes, and would clear before the arrival of demand alighting from the subsequent NR train.



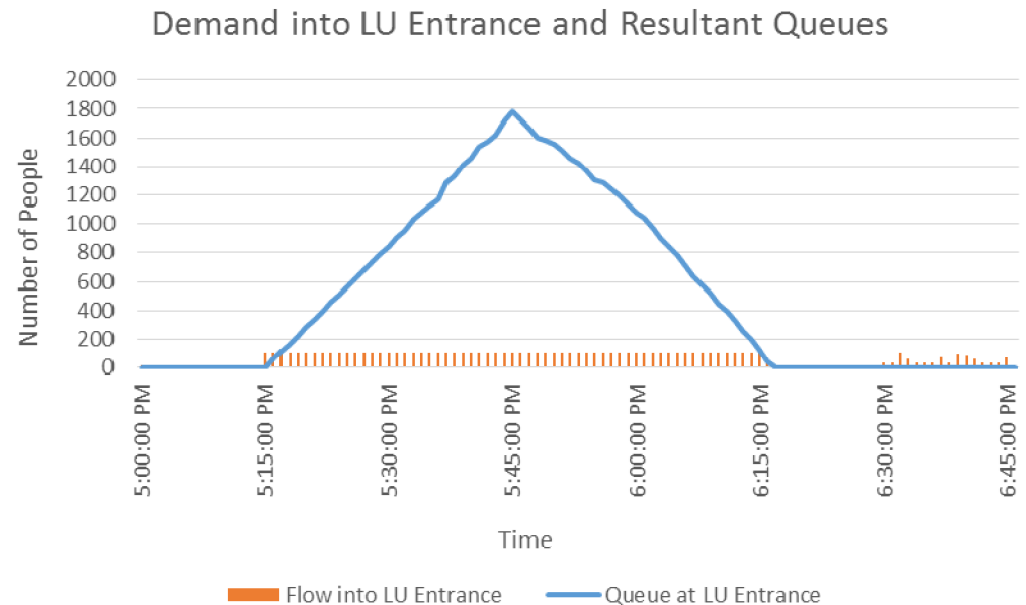
Midweek Post-match i Platform SB

- Å The SB Victoria Line Platform will be fed by two entry points at either end of the Platform.
- Å Under SPSG Special Events guidance, the Platform has capacity for approximately 1,000 people. As indicated in this assessment, the peak anticipated occupancy is 451 passengers.
- Å As this is marginally higher than planning standards for Normal Operations, this suggests that conditions on the Platform during the post-match should operate safely without management intervention.
- The available capacity on trains takes into account background users and spectators boarding at Tottenham Hale. For all but one period, it will be possible for all passengers arriving on the platform to board the next train.



Weekend Post-match period - Main Entrance

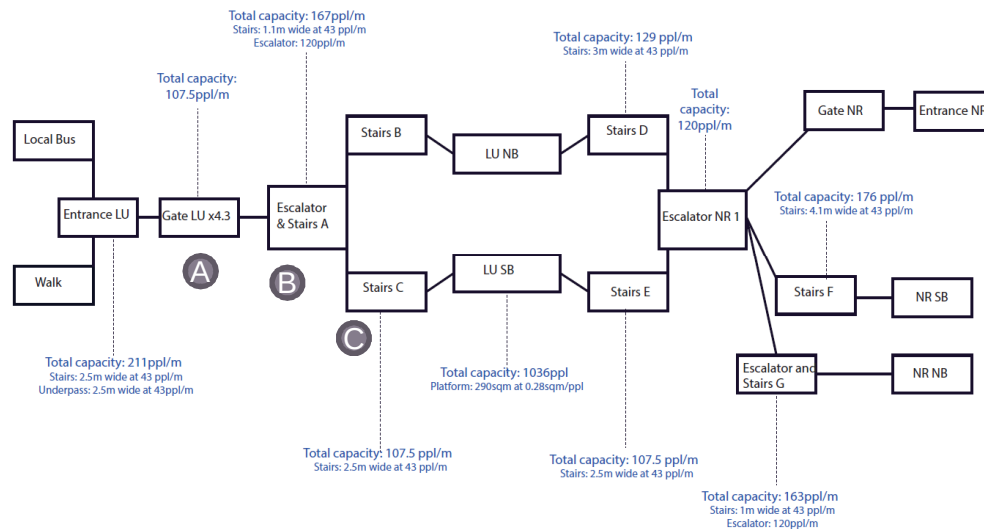
- ⌘ To ensure that queuing and congestion does not take place inside the station, we have assumed that access to the station from the High Road is regulated.
- ⌘ Therefore, queues will form outside the station - requiring a management plan to be adopted. All street level entry is assumed to be via the northernmost access point.
- ⌘ In this scenario, entry into the station would be maintained throughout, at 108 people/minute (equivalent of 4 ATG + 1 WAG gateline). However, given the rate of arrival at the station, queues would form from 17:15 onwards.



- ⌘ Maximum queue length: **1,784 people**
 - ⌘ **NEED DRAWING SHOWING FOOTPRINT ON STREET NETWORK (TS&C)**
- ⌘ The duration of queuing outside the station would be **1hour 01mins**
- ⌘ The maximum delay for any individual would be **16 mins**:
 - ⌘ 54% of spectators would be delayed for 10 mins or less
 - ⌘ 37% of spectators would be delayed for 11 - 15 mins
 - ⌘ 10% of spectators would be delayed for 16-20 mins

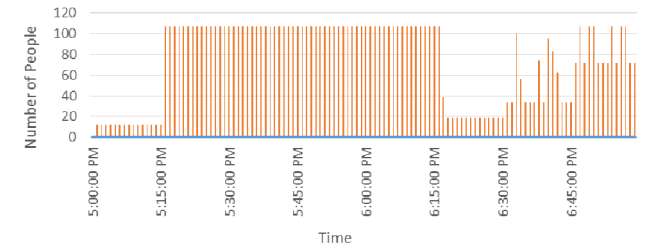
Weekend Post-match period in Other station elements

As demand is held outside the station to prevent queue formation inside, once people have entered their flow to the platform should not be impeded.



A

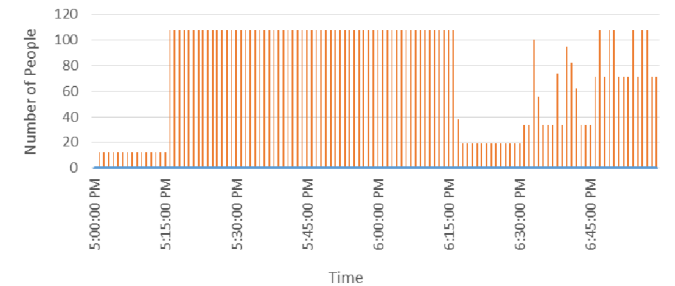
Demand at Top of Escalator/Stairs and Resultant Queues



Flow at the Top of the Escalator and Stairs Queue at the Top of the Escalator and Stairs

B

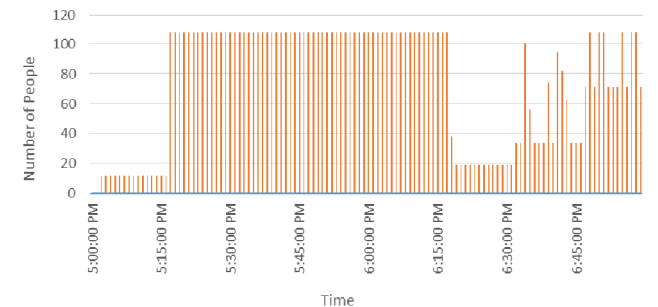
Demand at LU Gateline on High Road and Resultant Queues



Flow through LU Gateline Queue at LU Gateline

C

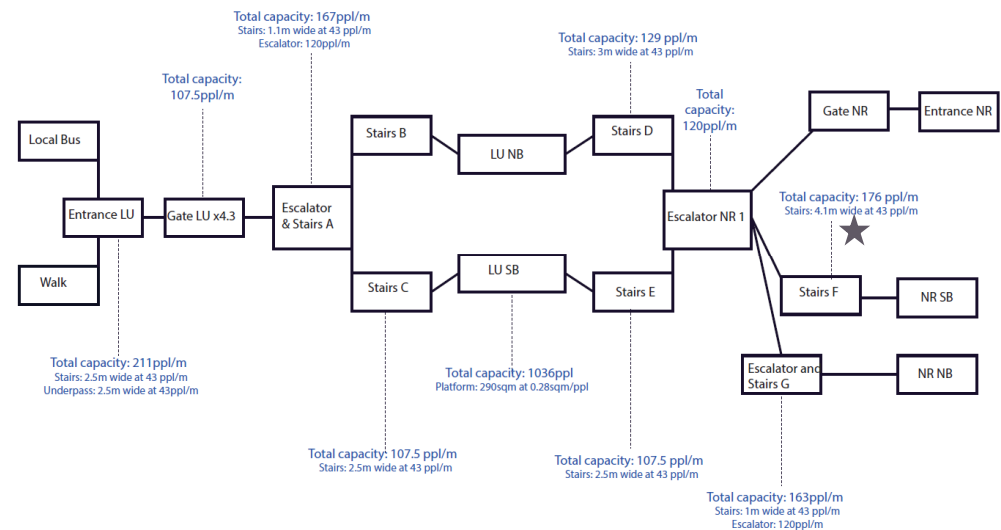
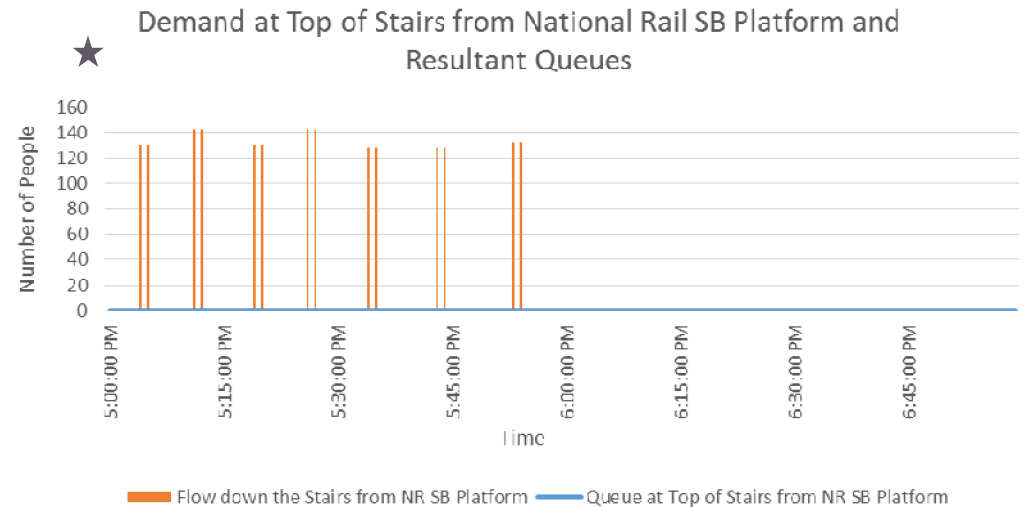
Demand at Top of Stairs and Resultant Queues



Flow at Top of Stairs Queue at Top of Stairs

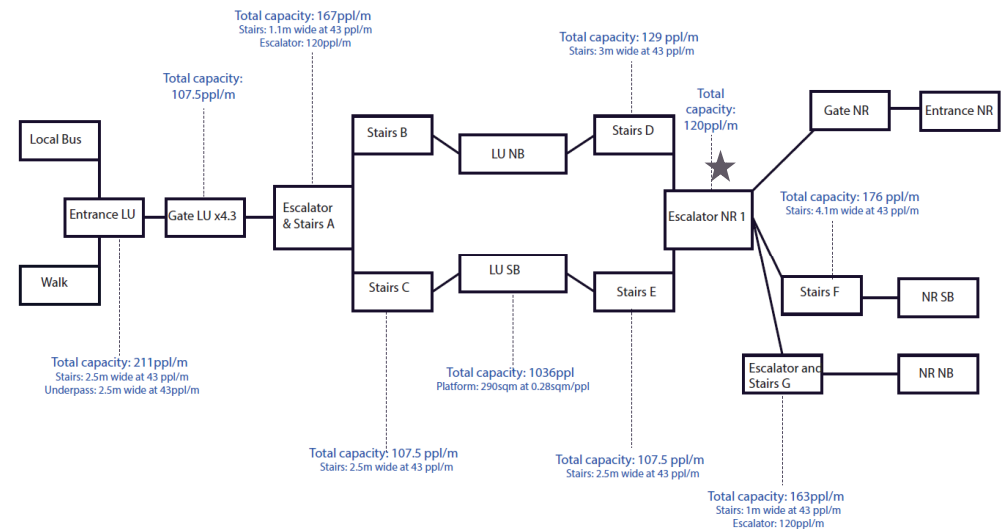
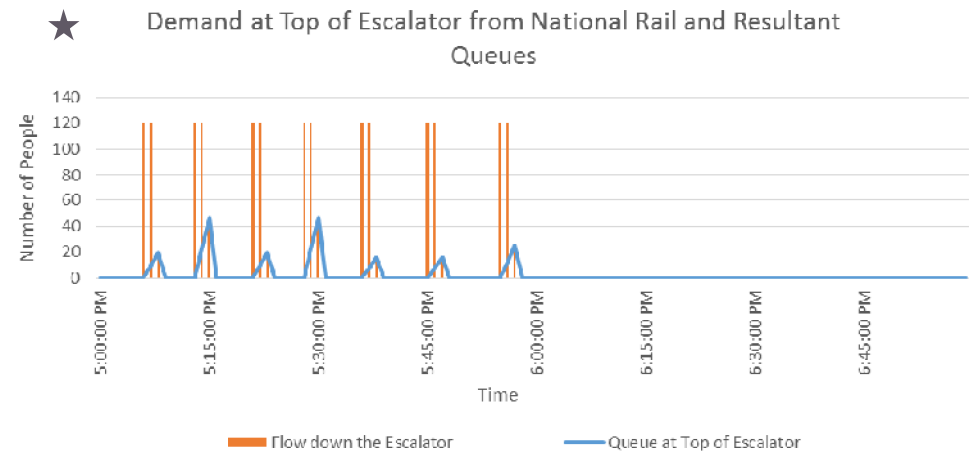
Weekend Post-match period i Stairs from NR Platform

- ⚠ Spectators interchanging from National Rail SB services (having boarded at WHL) onto Victoria Line services use different parts of the station to those arriving on foot or by bus.
- ⚠ No queuing is anticipated at this location.



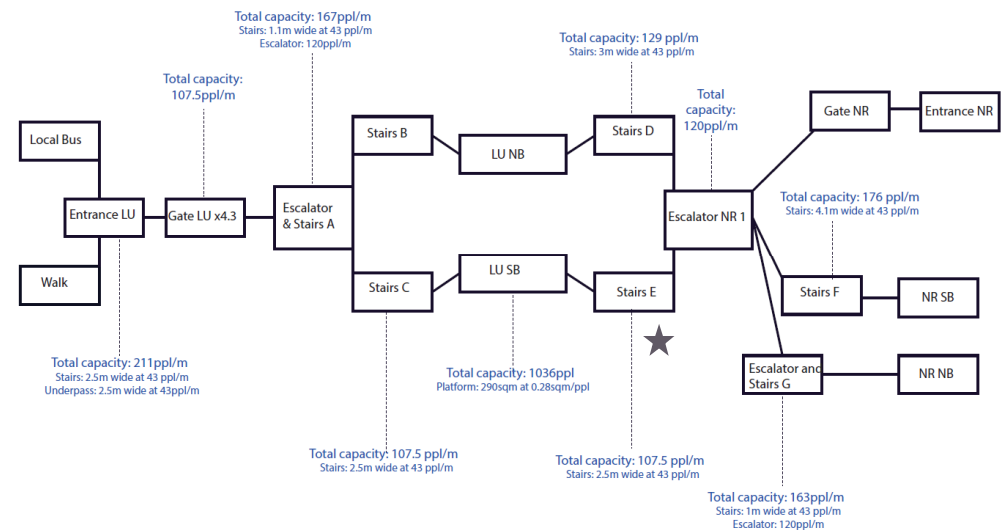
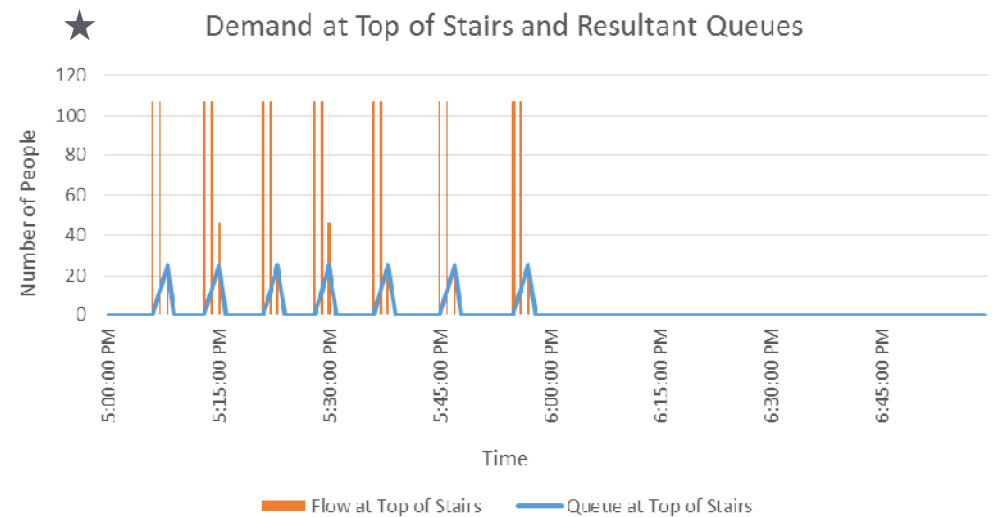
Weekend Post-match period i Escalator from NR to

- ⚠ After passing from the platform through the Network Rail elements of the station, interchangers will descend an escalator to the Victoria Line.
- ⚠ As the capacity of the escalator is less than that of the Platform exit stairs, queues can be expected at times of peak interchange.
- ⚠ A maximum shuffling queue of 46 people could be expected in this location. The maximum delay would be less than 2 minutes, and would clear before the arrival of the following train.



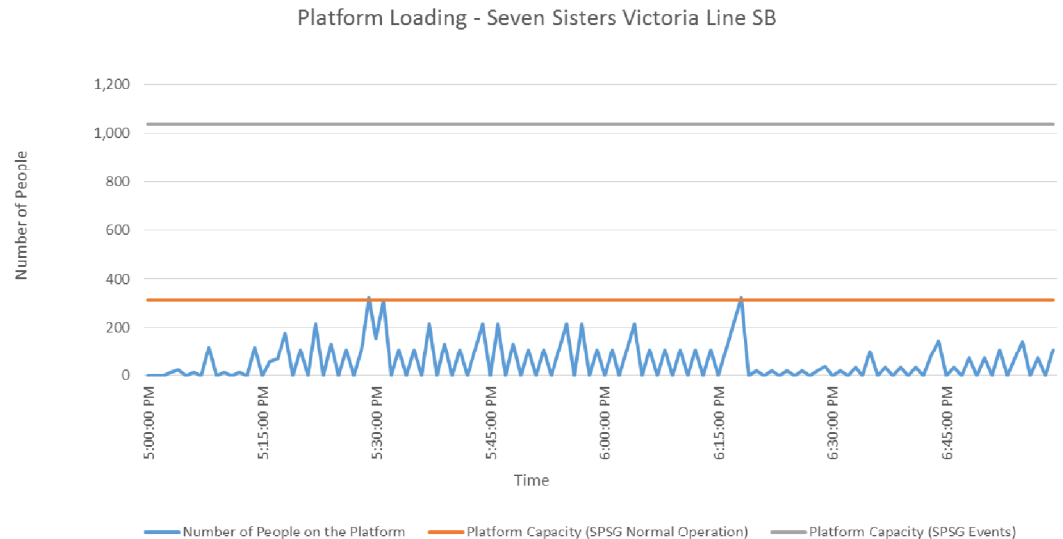
Weekend Post-match period - Interchange from NR to LU SE

- ⚠ At the base of the escalator, passengers descend further stairs to reach the Platform.
- ⚠ As the capacity of the final set of stairs is less than that of the escalator, small queues can be expected at times of peak interchange.
- ⚠ A maximum shuffling queue of 25 people could be expected in this location. The maximum delay would be less than 2 minutes, and would clear before the arrival of demand alighting from the subsequent NR train.



Weekend Post-match i Platform SB

- ⚠ The SB Victoria Line Platform will be fed by two entry points at either end of the Platform.
- ⚠ Under SPSG Special Events guidance, the Platform has capacity for approximately 1,000 people. As indicated in this assessment, the peak anticipated occupancy is 323 passengers.
- ⚠ As this is marginally higher than planning standards for Normal Operations, this suggests that conditions on the Platform during the post-match should operate safely without management intervention.
- The available capacity on trains takes into account background users and spectators boarding at Tottenham Hale. For all but one period, it will be possible for all passengers arriving on the platform to board the next train.



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