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PROOF OF EVIDENCE of ROY MCGOWAN of STEER DAVIES GLEAVE

APPENDIX 1

CURRICULUM VITAE ROY MCGOWAN

Roy McGowan Director & Head of Development Planning

I am the Head of Development Planning at Steer Davies Gleave for the UK and European region. I joined in 1992 after fourteen years of transport planning in the public sector and have extensive experience in regeneration, development, stadia and major events, transport interchange and master planning. My project experience includes the King's Cross Railway Lands, Merseytravel Public Transport, Victoria Transport Interchange, Canary Wharf, major commercial and leisure development, Thameslink 2000, the Royal Opera House, and the Emirates and Wembley stadia. I am currently directing Steer Davies Gleave's transport services for the London 2012 Olympic and Paralympic Games, including the Olympic Stadium, as well as directing the transport planning for the Victoria Transport Interchange which is a joint development by Land Securities and Transport for London.

Qualifications

MSc Degree in Transport Planning & Management
Uni of Westminster, 1988

Diploma in Traffic & Highway Engineering
Middlesex Poly, 1985

HNC in Civil & Traffic Engineering, Westminster College, 1980

Member of the Institute of Logistics & Transport

Fellow of the Institute of Highway Incorporated Engineers

Years of Experience
14 Client side
15 Consultancy

Background

As project manager and director for a large number of major projects Roy has considerable experience of strategic planning as well as managing and co-ordinating large technical teams. He has an in-depth knowledge of master planning, stadia design, development planning, interchange design, statutory procedures and is an experienced witness at Public Inquiries.

Relevant Skills

Stadia & Event Management Roy is directing the transport and crowd-flow services for the ODA for London 2012 which includes the Olympic Transport Plan, demand forecasting, crowd-flow modelling, surface transport and the Olympic Stadium. Roy is also providing strategic transport advice to Glasgow City Council to support the Commonwealth Games bid for 2014, and is the project director for the World Cup 2010 Stadium in Johannesburg which involves the redevelopment of Soccer City into a 100,000-person capacity venue. Roy is also the project director for the Lansdowne Road Stadium development and presented the crowd-flow and transport proposals to the Oral Hearing in Dublin in 2006. Roy was the project director for the London 2012 Olympic bid surface transport proposals and helped deliver the transport 'bid book' for the IOC in February 2005. He continues to manage the ongoing project work for the match-day impacts of the new Arsenal Emirates Football Stadium and also for Wembley National Stadium. These projects have included the development of Transport Assessments within the overall environmental strategies for the new stadia.

Major Developments Roy has worked on a large number of major development proposals, including Victoria Transport Interchange, to deliver regeneration and integrated transport proposals; One New Change which is a major mixed-used development to the east of St Paul's cathedral; the Thameslink 2000 proposals in London for which he presented evidence to the re-opened Inquiry in 2005 (approved November 2006); Canary Wharf transport strategy; the Royal Opera House, major mixed-use developments in Covent Garden for the Mercers and St Martin-in-the-Fields, Brent Cross Shopping City and the Kings Cross Railway Lands and Channel Tunnel terminal.

Projects Summary

	Project	Client	Year / Location	Role
Stadia & Event Management	London 2012 Olympic Transport Strategy	Olympic Delivery Authority	2005-2007, London, UK	Project Director
	Soccer City 2010	South Africa FA	2007-ongoing, Johannesburg, South Africa	Project Director
	Glasgow Commonwealth Games 2014	Glasgow City Council	2005-ongoing, Glasgow, Scotland	Project Director
	Lansdowne Road Stadium	LRSDC	2005-2007, Dublin, Ireland	Project Director
	London 2012 Olympic Bid	Transport for London (TfL)	2003-2005, London, UK	Project Manager
	Tottenham Regeneration Proposals	Tottenham Football Club	2003-2006, London, UK	Project Manager
	Croke Park	GAA	2000-2002, Dublin, Ireland	Project Manager
	Arsenal Emirates Stadium	Arsenal Football Club	2000-2007, London, UK	Project Manager
	Wembley National Stadium	WNSL	1999-2007, London, UK	Project Manager
	Stadium 2000	NHP Developments	1997-2000, London, UK	Project Manager
	RAF East Camp	Allies & Morris	1996-1999, UK	Project Manager
Major Development	Victoria Transport Interchange	Land Securities & TfL	2004-2007, London, UK	Project Director
	The Ritz Hotel Extension	Ellerman Investments	2005-ongoing, London, UK	Project Director
	One New Change	Land Securities	2004-2006, London, UK	Project Manager
	120 Cheapside	Land Securities	2004-2005, London, UK	Project Director
	St Martin-in-the-Field	Dean & Chapter	2003-2004, London, UK	Project Manager
	Royal Opera House	Royal Opera House	2002-2004, London, UK	Project Manager
	Bondway Office Development	Angel Developments	2002-2003, London, UK	Project Manager
	Canary Wharf	CWG	1998-2001, London, UK	Project Manager
	Mixed-use Development	Mercers Company	2000-2006, London, UK	Project Manager
Transport Planning	Crossley Park	Kidderminster for Colgate Management	1997-1998, UK	Project Manager
	Vauxhall Bridge Road Peak Period Study	City of Westminster	1997-1999, London, UK	Project Manager
	Aerodrome Park	Hendon for Allied Dunbar	1997-1999, UK	Expert Witness
	Stadium 2000	NHP Developments Ltd	1997-2000, Hackney Wick, London, UK	Expert Witness
	North West London Bus Priority	Consortium of London Boroughs	1994-1997, London, UK	Project Manager
	Detailed Review of the Harlesden Controlled Parking Scheme	Harlesden City Challenge	1996-1998, London, UK	Project Manager
	Bus Priorities for Merseyside: Detailed Study & Designs	Merseytravel	1992-1997, Merseyside, UK	Project Manager

Projects Summary

	Project	Client	Year / Location	Role
Transport Planning	Priority (Red) Route Local Plan	Westminster City Council	1993-1995, London, UK	Project Manager
	Bus Priorities for Merseyside: A Telematics Study	Merseytravel	1995, Merseyside, UK	Project Manager
	Park & Ride Study	Leicester City Council	1995, Leicester, UK	Principal Consultant
	Hospital Transport Strategy	Richmond Royal Hospital	1995, Richmond, UK	Project Manager
Event Witness/Public Inquiries	Lansdowne Road Stadium (Oral Hearing)	LRSDC	2006, Dublin	Project Director
	Thameslink 2000	National Rail	2005, London	Project Manager
	RAF East Camp	Allies & Morris	1998, London	Project Manager
	Stadium 2000	NHP	1997, London	Project Manager
	Marylebone Exchange	British Telecom	1995, London	Project Manager
	Channel Tunnel Terminal Parliamentary Inquiry	Camden Council	1990, London	Project Manager

Selected Projects

Stadia & Event Management

London 2012 Olympic Transport Strategy

Client	Olympic Delivery Authority
Year/Location	2005-ongoing, London, UK
Position Held	Project Director

Since the Games were awarded to London in July 2005, Steer Davies Gleave has assisted the Olympic Delivery Authority (ODA) and its predecessor OTA to refine the transport proposals for the London 2012 Olympic Games and Paralympic Games. Roy has been the project director throughout this period. Steer Davies Gleave has seconded several people into key roles in the ODA Transport section over the last two years. Key tasks undertaken have included:

- Forecasting of spectator and workforce travel patterns
- Project management of Olympic Route Network planning
- Forecasting of Olympic Family travel patterns
- Refinement of venue transport plans
- Olympic Park crowd movement planning
- Assisting with the writing and editing of the draft Olympic Transport Plan
- Cartography, graphic design and production of Olympic Transport Plan
- Scoping of Games-related freight and logistics activity.

Soccer City 2010

Client	South Africa FA
Year/Location	2007-ongoing, Johannesburg, South Africa
Position Held	Project Director

In 2004, South Africa was awarded the right to host the 2010 FIFA World Cup, with the Soccer City Stadium as its centrepiece. Described as the 'Jewel in the Crown' of South Africa's bid, this 94,000-seat stadium will be the venue for the opening game, the final, and six group matches. As South Africa's main football stadium and the home of the South African Football Association, it is also expected to be subject to extensive use, once the FIFA World Cup is over.

Since January 2007, Steer Davies Gleave has been carrying out Crowd Flow Modelling, to ensure that the design can cater for the numbers of spectators and the huge influx of media and VIPs expected during the biggest World Cup events, as well as allowing for a range of legacy use. In addition to football matches, the stadium is likely to attract concerts, religious festivals and other major events.

Outside the stadium, SDG's work has encompassed the capacity of the approaches, the locations of turnstiles, a colour-coded ticketing strategy to help influence the direction of approach, and the circulation areas both on and off the podium. Inside the stadium, we have carried out analysis of entry and exit routes, vertical circulation, the concourse areas, and emergency exit scenarios, to ensure that the stadium is safe to use during all phases of its operation.

Selected Projects

Stadia & Event Management

Lansdowne Road Stadium

Client	LRSDC
Year/Location	2005-ongoing, Dublin, Ireland
Position Held	Project Director

Steer Davies Gleave was commissioned by Lansdowne Road Stadium Development Company in February 2005 to provide expert advice on the planning and design of the proposed redevelopment of Lansdowne Road Stadium, the home of the Irish Rugby Football Union and the Football Association of Ireland. Steer Davies Gleave is responsible for all aspects of transportation and crowd movement advice relating to the redevelopment project.

The stadium will be used for a range of events including national and international rugby and football matches, concerts and non-matchday uses. We have provided advice on all aspects of highway and transport planning relating to stadium access and egress, including:

- Rail access;
- Car and coach parking;
- Pedestrian access to the stadium;
- Crowd flows and evacuation issues;
- The provision and marketing of public transport; and
- Environmental Impact Assessment.

We have worked with the stadium management, emergency services and stadium design team to help shape each element of the stadium so that large crowds can move in, out and around the stadium safely. An integrated transportation strategy covering all modes of transport has been developed for event days, demonstrating the ability of the local public transport facilities to cope with peak demand. Any necessary improvements to public transport services/infrastructure have been identified and planned. At the end of 2006 we supported the scheme through the Oral Hearing proceedings, submitting evidence and providing clarification to the Inspector and Third Party representatives. An Bord Pleanala approved the stadium proposals in March 2007 subject to conditions and the scheme is being reconfigured to accommodate the amended crowd-flow requirements to enable construction to commence during 2007.

Glasgow Commonwealth Games 2014

Client	Glasgow City Council
Year/Location	2005 - ongoing, Glasgow, Scotland
Position Held	Project Director

Steer Davies Gleave was commissioned in December 2005 to provide strategic support to Glasgow City Council for its preparation of the transport section of the Candidate file for its bid to hold the 2014 Commonwealth Games. Steer Davies Gleave attended key stakeholder meetings and provided strategic advice for the bid preparation and submission. The Commonwealth Games assessors will visit Glasgow in the summer of 2007 as part of the bid assessment.

Selected Projects

Stadia & Event Management

Arsenal Emirates Stadium

Client: Arsenal Football Club
Year/Location: 2000-2007, London, UK
Position Held: Project Manager

Arsenal Football Club commissioned Steer Davies Gleave in 2000 to investigate various transport aspects of the proposed development sites that included the new Emirates Stadium at Ashburton Grove, the residential redevelopment at Highbury and the mixed-use redevelopment of nearby Lough Road sites. Our commission has continued through to 2007 and now involves monitoring programmes and local community liaison and Roy has been the project manager throughout this period.

The increase in capacity and slight change in stadium position required large numbers of spectators to either modify existing habits or learn new ones in order to fully utilise available public transport capacity, minimise disruption caused at the exit/entry stations, reduce circulation on the podium surrounding the stadium and minimise disruption to local residents and businesses. A Communications Working Group was established with representatives of all the key stakeholders. Modes covered included underground, bus, national and local rail, rail/bus park& ride, walk, cycle, coaches, and car (occupancy). A pedestrian movement strategy between the new stadium, local underground/rail stations and other locations (e.g. transport interchanges) was also delivered across a wide range of media including pedestrian signing and way-finding, Arsenal.com (on-line journey planner and targeted messages through the supporter e newsletter and transport pages), leaflets to local residents, programme notices, managed information at local stations and on trains. For pedestrian signing, Steer Davies Gleave worked closely with LB Islington and Transport for London to reach agreement on final design and location. At the end of the first season at Emirates the strategy is being seen as a significant success.

Wembley National Stadium

Client: Wembley National Stadium Ltd
Year/Location: 1999-2007, London
Position Held: Project Manager

Steer Davies Gleave was commissioned in July 1999 by Wembley National Stadium Ltd to assist with the planning and design of the new national stadium. The commission deals with all aspects of the development, including sporting events, concerts and non-matchday uses.

The proposals included:

- increased spectator capacity to 90,000;
- Football Association offices;
- a Hall of Fame leisure attraction;
- four major restaurants;
- dining for up to 15,000; and
- extensive conference and banqueting facilities.

Our involvement from the commencement of the project has included the development of a Transport Impact Assessment within the overall environmental strategy for the new stadium; detailed analysis of vehicle trip generation for different types of events; parking strategies and a comprehensive event transport plan involving highway usage, signage, parking, crowd management; pedestrian flow and advice on event management and planning for sporting & non-sporting events.

We have also developed parking and public transport strategies as well as a programme to develop transport marketing proposals to support the stadium opening for the FA Cup 2007.

Selected Projects

Major Developments

Victoria Transport Interchange

Client	Land Securities & Transport for London (TfL)
Year/Location	2004-2007, London
Position Held	Project Director

Steer Davies Gleave has provided significant transport support for the Victoria Interchange Masterplan since January 2005. The development proposals are promoted by Land Securities and TfL, with interface with the City of Westminster and the GLA. The vision is to provide much needed capacity increases in public transport capacity at the interchange whilst facilitating commercial development for Land Securities.

Victoria is one of the leading international gateways to London, with 115 million people passing through the mainline station per year. The Victoria Transport Interchange proposals will deliver much needed transport infrastructure improvements, public realm improvements and commercial and residential development at Victoria, a key gateway to central London.

Steer Davies Gleave has provided the following transport services:

- design of transport infrastructure and public realm;
- bus service operations;
- pedestrian movement and environment;
- interchange matrix and analysis;
- Transport Business case in accordance with national and TFL guidance
- VISSIM, micro-simulation and modelling for the road network; and strategic presentations.

The Ritz Hotel Extension

Client	Ellerman Investments
Year/Location	2006-ongoing, London
Position Held	Project Director

The owners of the world-renowned Ritz Hotel on Piccadilly in Central London want to increase the number of rooms available to distinguished guests by demolishing an adjacent office building and constructing an extension. The intention is for the exterior of the extension to exactly match that of the existing landmark listed building. Steer Davies Gleave provided transport advice in support of the planning application for the extension. The key issue that we had to address was that Westminster City Council wanted the majority of the delivery vehicles for the hotel to be accommodated off-street rather than from the kerbside as they currently are. However, access would be very restricted due to the desire to match the existing architecture. We worked with the project team to develop a solution that enabled delivery vans that make up the majority of vehicles delivering to the Ritz, to access an off-street basement loading bay under the proposed hotel extension. The scheme has subsequently been granted planning approval. We are continuing to provide advice on construction vehicle access arrangements for what will be an extremely confined inner-city construction site immediately adjacent to the Ritz Hotel which will continue to operate throughout.

Selected Projects

Major Developments

One New Change

Client	Land Securities
Year/Location	2004-2006, London, UK
Position Held	Project Manager

Steer Davies Gleave was commissioned by Land Securities to provide transport advice regarding a proposed redevelopment of the One New Change development, a site located east of St. Paul's Cathedral. The proposals involved the redevelopment of the site in a prestigious City location to create a major mixed-use retail and office development. The close proximity to the Cathedral and the size of the development have made the project particularly complex. The transport assessment prepared in support of the planning application was required to assess the transport impact of the retail use, the office use and the development as a whole. This included an assessment of the impacts on local public transport services using a full trip generation analysis. As no parking is to be provided within the development, the local public transport services were central to the assessment. A key area was the impacts on the levels of pedestrian flows in and around the site compared to the current situation.

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APPENDIX 2

ENVIRONMENTAL STATEMENT OBJECTIVES

A2 ENVIRONMENTAL STATEMENT OBJECTIVES (TAKEN FROM THE SUPPLEMENTARY ENVIRONMENTAL STATEMENT [VSU.A31])

	Key Objectives	**Background**
Ref	A	B
1	Congestion Relief	• Demand for the northbound Victoria line is very high during AM and PM peak periods; • Station control and closures are common every weekday morning. Passengers entering the station from the National Rail station are regularly disrupted by gate-line controls and station closures; and • Up to 60% of passengers use the southern half of the train and platforms where the escalators feed onto the platforms as bunching at this point prevents many people reaching the far end of the platform.
2	Increased capacity to address future demand	By 2016 demand is forecast to rise by around 20% from current levels. Without any investment in the station: • Levels of passenger satisfaction will not be improved; and • There will be greater discomfort and frustration for the passengers. Addressing future demand: • Use of the station is forecast to grow from 70,000 during the morning peak (07.00 – 10.00) to 84,000 in 2016; • Passenger demand forecasts are based on the Transport for London strategic planning model, Railplan. Design year forecasts represent demand levels in 2016 plus an additional 20% (100,800). With this extra margin factored in it is not expected that the upgraded station will need to consider redevelopment until 2055. Taking a worst-case scenario, the forecast does not consider the potential network-wide impact of the construction of Crossrail line 1 or Thameslink Programme projects, the implementation of which would have a beneficial impact on

	Key Objectives	Background
Ref	A	B
		the volume and pattern of flows through Victoria station; and • The aim is to ensure that after the completion of the VSU scheme, the station maintains acceptable passenger flow conditions for at least a further 40 years.
3	Minimise passenger journey time	At present: • With the existing station, passengers originating from Victoria Street have to walk to the closest Victoria line entrance at Wilton Road; • There is a regular requirement for ticket hall and gateline closures to manage passenger numbers safely and prevent overcrowding; and • The existing station entrances were not designed for the current and forecast levels of passenger demand.
4	Accessibility	The Victoria line is relatively inaccessible for Persons of Reduced Mobility. The scheme will provide step-free access between Victoria line platforms and street level and step-free interchange between Victoria line and D&C line platforms.
5	Safety	• Emergency evacuation times need to improve in line with current best practice guidelines; and • There is no dedicated fire fighting access

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APPENDIX 3

VSU BUSINESS CASE: MONETARY BENEFITS

A3 SU BUSINESS CASE: MONETARY BENEFITS [VSU.B9 and VSU.XX, TABLE 20]

Ref	Benefit/ Disbenefit	Details	Jan 08 Figure £M (BCR 3.8:1)	Sep 08 Figure £M (BCR 4.4:1)
	A	B	C	D
1	Time Savings (AM (0700-1000hrs), PM (1600-1900hrs) and on street)	Assessed using PEDROUTE simulation model for 2006, 2016, 2016+5% (PM only), and 2016+10% (PM only). Shorter time on street east of Bressenden Place.	£3,790,109	£4,038,581
2	Accessibility	Step free access provided.	£146,360	£156,503
3	Ambiance	Based on Mystery Shopper scores averaged for 4 recently upgraded London stations.	£107,641	£56,403
4	Construction Disruption		£-12,895	£-28,137
5	Total Net Benefits (Current Value)		£4,031,215	£4,223,350

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APPENDIX 4

REVIEW OF THE LUL BUSINESS CASE

A4 REVIEW OF THE LUL BUSINESS CASE

A4 1.1 This Appendix provides a review of the LUL business case.

A4 1.2 Journey time benefits have been assessed by LUL using PEDROUTE modelling to compare passengers' time (weighted to take into account steps and escalators) going through the existing station with the TWAO scheme layout for both AM and PM peak periods for the 2016 reference year and expected demand for that year. For appraisal years beyond 2016, the AM peak time savings are inflated to allow for the expected growth in demand. For the PM peak, the PEDROUTE model has been used to estimate time savings at both 2016 + 5% and 2016 +10% demand levels.

A4 1.3 The journey time benefits at street level have also been quantified on the basis that passengers with origins or destinations east of Bressenden Place travelling from/to the Victoria Line (at all times of the day) would experience significant journey time savings averaging nearly seven minutes (weighted to take into account various stages of the journey). The weighting factors defined in the TfL Business Case Development Manual [VSU.B35, Table E3a] are shown overleaf.

Table E3a: WEIGHTS FOR ELEMENTS OF LUL JOURNEY TIME (1)

Journey Characteristic	Weighting
Pre-journey	
• queuing to get to a ticket office window or machine	3.4
• transaction at a ticket office window or machine	2.5
• queuing at a PASS agent	3.0
• transaction at a PASS agent	2.0
• delay at ticket gates	4.0
Riding	
• standing (or sitting) in a crowded train	1.0 + RFa
• seated in an uncrowded train	1.0
• on escalators	1.5
• in lifts	2.0
Waiting	
• for trains or lifts in acceptable uncongested conditions	2.5
• for trains on crowded platform	2.5 + CFb
Walking	
• unimpeded	2.0
• in a congested environment	2.0 + CFb
• up stairs or escalators	4.0
• down stairs unimpeded	2.5
Penalties	
• Interchange (LUL/LUL)	3.5 mins fixed
(LUL/National Rail)	5.0 mins fixed

a RF is the formula 0.09 + (2.11-1.13Y)**X** giving an overall weighting for those standing and sitting, where **X** = (train load - train seats)/(crush load - train seats) and **Y**, which relates seating capacity to standing capacity, is as follows:

Bakerloo	0.289	Metropolitan	0.405
Central	0.208	Northern	0.247
Circle	0.188	Piccadilly	0.219
District	0.248	Victoria	0.254
Jubilee	0.170		

b CF = 0.667(**P** - 0.5)², where **P** = passengers per m² and **P** is between 0.5 and 2. CF = 1.50 if **P** is greater than or equal to 2, and 0 if **P** is less than 0.5. For example, if **P** = 1.2 then CF = 0.327.

A4 1.4 As detailed in the January 2008 Business Case **[VSU.B9, paragraph S5.3]** for the 2016 reference year this equates to £9.9m annual benefits. This figure for journey time benefits at street level increases to £11.9m in the September 2008 Business Case **[VSU.B31, paragraph S5.3]** due to the increased Value of Time figure used throughout the document. The Value of time has been increased from the £6.99 per hour (at 2004) figure used in the January 2008 Business Case **[VSU.B9, paragraph S5.2]** to £8.38 (at 2007) in the September 2008 Business Case **[VSU.B31, paragraph S5.2]**. This revised Value of Time figure has been sourced from the most recent May 2008 publication of the TfL Business Case Development Manual.

A4 1.5 Ambience benefits have been quantified using LUL's in-house 'Value of Improvements Model Business Case' (VIM-BC) model which enables the expected improvements in the quality of station facilities and appearance to be quantified based on standard parameters (based on LUL's Mystery Shopper Surveys) benchmarked against other recently modernised National Rail interchange stations such as Kings Cross. For the 2016 reference year this equates to £0.49m annual benefits **[VSU.B31]** (decreased from £0.81m quoted in the January 2008 Business Case [VSU.B9] due to exclusion of D&C Line benefits). The LUL VSU Business Case **[VSU.B9 and VSU.B31, appendix 5]** provides a breakdown of current and expected MSS scores for various station ambience attributes and their respective annual benefits. Annual disbenefits experienced during construction are also quantified **[VSU.B9 and VSU.B31, appendix 6]**. The calculations to convert the expected levels of improvements into monetary benefits are performed by an in-house spreadsheet model.

A4 1.6 Benefits totalling £1.4m per annum **[VSU.B31]** (increased from £1.2m quoted in the January 2008 Business Case **[VSU.B9]**) for providing step-free access to the Victoria Line have been included in the appraisal for the 2016 reference year. No explanation is provided of how these benefits have been derived so it is assumed that these have been taken from the overall LUL step-free access Core Network Business case. A lagging factor over three years has been applied to these step-free access benefits since it is assumed that much of the benefit would come from new users.

A4 1.7 Disbenefits during implementation in the form of line closures and associated costs have been included. No reference appears to have been made to how the level of these disbenefits would differ with alternative schemes.

A4 1.8 No secondary revenue benefits appear to have been included in the appraisal. This is considered to be a conservative approach given that the new infrastructure is likely to provide some opportunities to generate secondary revenue.

A4 1.9 An appraisal period of 60 years **[VSU.B9 and VSU.B31, paragraph S5.6]** has been used on the basis that major civil engineering has a design life of 120 years.

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APPENDIX 5

TFL RESPONSE TO PPP ARBITER'S GUIDANCE

Transport for London

Transport for London responds to PPP Arbiter's Guidance on Tube Lines second period funding

09 September 2008

Transport for London (TfL) today responded to the Public Private Partnership (PPP) Arbiter's Guidance on Tube Lines second period costs, covering the funding of their maintenance and renewal works on the Jubilee, Northern and Piccadilly lines from 2010 to 2017.

The Arbiter's Guidance gives a rough estimate of the demand that Tube Lines can be expected to make for their work over the period, and this suggests a potential shortfall in funding in excess of £1bn from that currently available.

Given this extraordinary circumstance, TfL expects such a shortfall to be met by the Government, which imposed the PPP structure on the Tube and Londoners.

The PPP contract states that such additional funding may be obtained through outside financing, as was done in the first phase of the programme.

Over the next few years, we will begin to see new trains and signalling systems delivering big increases in reliability and capacity

LU Managing Director, Tim O'Toole

Investing billions

TfL requested the PPP Arbiter's Guidance due to a lack of detailed information being provided by Tube Lines, to enable TfL to fully understand their costs.

London Underground (LU) Managing Director, Tim O'Toole said: 'Billions are being invested to transform the Tube.

'Over the next few years, we will begin to see new trains and signalling systems delivering big increases in reliability and capacity.

'It is vital that these improvements are delivered for Londoners and Tube users when they were promised, especially given the record growth in ridership.

'Today's Guidance is the start of a process.

Increased capacity

'No bill has been delivered today, but the PPP requires that we issue restated contract terms later this year.

'We do not have the option of scaling back the works to offset this expected demand because the Tube will become less reliable and its capacity will shrink at a time of growing demand, and, in any event, the PPP contract produces an increase in operating charges as a result of any reduction in capital spending, thereby frustrating attempts to cut funding demands.'

'The difference in the costs budgeted for by TfL and those produced by the Arbiter are in large part in the inscrutable areas of so-called 'central costs', differential inflation and risk.

'The premiums to be paid in these areas are a result of the PPP structure.

Budgeted costs

'Any funding required above TfL's budget should be met by continuing support by Government, who imposed this PPP structure on the Tube and Londoners.

'I am frustrated that despite requesting this Guidance from the Arbiter he remains unable to provide us with the detailed information and analysis on costs and expected performance we require to make informed decisions.

'This provides a basis for the Periodic Review process, but there is a long way to go.'

The Arbiter's Guidance marks the first stage in agreeing a contract price for the second period of the Tube Lines PPP contract.

Agreeing new terms

The next stage will see LU set the scope of the contract and restated terms.

Tube Lines will then offer TfL a contract price next summer.

Should TfL and Tube Lines fail to agree on the contract price, then the PPP Arbiter will be called upon to resolve the issue, which is why this guidance is significant.

The prices must be agreed ahead of the start of the second period in the summer of 2010.

Notes to editors:

Tube Lines is responsible for the maintenance and renewal of the Jubilee, Northern and Piccadilly lines
The Arbiter's Guidance can be viewed online at www.ppparbiter.org.uk

Print

See also

Public Private Partnership

Related websites

TubeLines
PPP Arbiter

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APPENDIX 6

EXTRACT FROM DFT'S APPRAISAL GUIDANCE

Executive Summary

1. The New Approach to Appraisal (NATA) is the analytical framework used to appraise the economic, environmental and social impacts of all transport proposals that require Department for Transport funding or approval. Its introduction in 1998 represented a significant step forward in the way that transport interventions are assessed and presented to decision makers.

2. The appraisal evidence informs whether a proposal represents value for money (VfM), sitting alongside evidence on a scheme's deliverability and strategic fit. A key innovation of NATA was the use of the Appraisal Summary Table (AST) and associated worksheets to summarise all the impacts of a transport intervention in a balanced way. Interventions to which NATA is applied cover rail, road, public transport, port and airport proposals and include, for example, improvements to bus services, new road schemes and changes to rail services.

3. This consultation is based on experience from a decade of use of NATA, from the recommendations of the Eddington and Stern work, and specific issues emerging in discussions over summer 2007. Some themes can be drawn out. There is support for the overall NATA approach, with NATA being judged fit-for-purpose. While there is a need to guard against 'change for change's sake', the Eddington and Stern Reviews recommended a significant improvements to our appraisal tools and we are consulting:

   - The overall NATA framework for analysis;
   - Some specific areas we identified as needing attention; and
   - Some priority areas where we are proposing changes to be implemented in early 2008.

4. As we make specific changes, we will ensure that these are consulted on in an appropriate manner and transitional arrangements put into place for analyses in progress. We are keen to make progress on the presentational and structural areas identified in the document. These will form the basis for the 'quick wins' we envisaged would be delivered in spring 2008 when we announced this Refresh in May 2007. Early release of our proposed refinements will help you to visualise and contextualise your input into this overarching consultation. Their focus will be on:

   - *Integrating the mode-neutral perspective to stages of analysis from the strategic to intervention, recognising that better use of the existing network will be an important* *option*. Better presenting the existing guidance but also considering how to integrate the 'strategic' policy making work into intervention level analysis;

- *Progressing some specific appraisal guidance to support innovation in meeting climate change challenges*. This partly reflects the importance of the issue, but is also about ensuring NATA effectively supports delivery partners and transport professionals as they analyse innovative interventions; and
- *Progressing guidance to support innovation in meeting productivity challenges*. The Eddington study highlighted transport's role in this area. Some specific work will be advanced to support delivery partners and transport professionals more effectively in a technically challenging area.

5. The document poses some questions. These are given in the body of the document and bought together at the end. These are to get your views on some of the areas where we will progress work. During the next year we are likely to make progress in a number of areas, but the breadth of appraisal means that you can help us to order our programme of work. Your views are sought firstly on whether the areas identified are comprehensive and secondly over the priority that the Department should give them.

6. In *Chapter 2: Analytical framework*, we explain how the NATA Refresh is an opportunity to align better the analytical information needs of decision makers and the public with the latest policy priorities for transport and the Government. To inform the consultation, the Department will progress demonstration material focusing on: integrating the mode-neutral perspective to stages of analysis, recognising that better use of the existing network will be an important option and progressing some specific appraisal guidance to support innovation in meeting climate change challenges.

7. The analytical framework will underpin the Department's value-for-money assessment. As analysis widens its scope, the evaluation of schemes should also correspondingly broaden. Further, the framework should allow assessment of the impacts of regulatory or other non-infrastructure options so that it is neutral over each option.

8. *Chapter 3: Economy, accessibility and safety* then recommends that the evidence provided on how a scheme impacts on the economy should take account of the reductions in public transport crowding. The location of the health sub-objective, currently in the environment objective, should be considered.

9. The evidence base for and application of appraising the wider economic benefits (WEBs) of transport is still relatively new. This seeks to capture agglomeration impacts and the improvements to labour markets. There is a need to advance best practice and disseminate this. One of the early deliverables from this Refresh will be the development of advice on WEBs, communicating this, recognising its novelty and that innovative interventions are likely.

10. *Chapter 4: Environmental appraisal and assessing housing impacts*, recommends that the Department uses Defra's new guidance on the shadow price of carbon to ensure that carbon is properly accounted for in the appraisal of transport policy. In addition, the Department should progress some specific appraisal guidance to support innovation in meeting climate change challenges. This partly reflects the importance of the issue, but also about ensuring NATA effectively supports delivery partners and transport professionals as they analyse innovative interventions.

11. Overall, in better identifying the impact of new housing on transport schemes, appraisal tools should recognise the transport benefits and costs attributable to the residents of the new housing. Such information at a strategic and scheme level should also feed back into strategic decisions over housing. This would help in prioritising expenditure on transport schemes that are intended to support housing growth, e.g. the Community Infrastructure Fund. Further, the appraisal needs to develop analysis of the uncertainty around such development plans.

12. It is recommended that the Department should consider how to consolidate the extensive advice provided through WebTAG, Design Manual for Roads and Bridges and other products on environmental impacts. A particular aspect is to ensure that environmental information provides a consistent picture at the various stages of scheme development.

13. *Chapter 5: Assumptions and scenarios* recommends that the Department's release and update of common assumptions should be on a pre-announced, regular cycle, alongside guidance releases. For ease of use, assumptions should be stored in a single place, where possible.

14. The Department is committed to further work to provide a detailed specification of the BCR, as PSA Delivery Agreement 5 will use this ratio as an indicator of the Department's success in seeing better value for money from its investments over time. It will be important to ensure that the appraisal continues to provide the information required for the calculation of the indicator. This is covered in *Chapter 6: Evidence from appraisal*.

15. The final chapter – *Chapter 7: Building analytical capability* – highlights the need for developments to the Department's guidance to include presentational improvements as an important and on-going part of the overall approach. The Department should consider how editorial control of the various documents and 'knowledge' can be improved. In disseminating this material, the Department should consider how the use of the internet could be more effective both with regard to facilitating engagement and in being transparent with results.

OBJ3/P4/A7

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APPENDIX 7

LUL ASSESSMENT OF OPTIONS:
REVIEW OF OPTION SELECTION PROCESS

A7 LUL ASSESSMENT OF OPTIONS: REVIEW OF OPTION SELECTION PROCESS

A7 1.1 Following a review of the LUL Statement of Case and the list of documents that LUL intends to put to evidence at the Public Inquiry, LandSec requested copies of particular documents on 10th June 2008. These documents were received on 23rd June 2008 and upon review contain further detail as to the LUL option selection criteria. The comparison exercise undertaken in this note takes account of this additional information.

A7 1.2 LUL began the option review process in July 2005 with Scott Wilson as the Multi Disciplinary Design consultants. The VSU Stage B+ Option Review report was produced to assess each of the options for VSU [VSU.B5, July 2005].

A7 1.3 LUL then appointed Mott McDonald in December 2006 as their VSU MDC2 consultants and later held an Option Selection Workshop for VSU-W5D1 on 16th January 2007 in order to decide on a preferred option, using the apparent preferred Stage D option from the Scott Wilson report of 2005 as a basis for comparison. This was summarised in the Mott Macdonald W5-D1 Scheme Option Selection report [VSU.B6, May 2007, Appendix G].

A7 1.4 In particular, document [VSU.B6], Mott MacDonald (May 2007) summarises the optioneering process undertaken following the January 2007 workshop and the rationale for determining the design option to be taken forward for development of the TWAO application.

A7 1.5 The SES [VSU.A31] has also included further details of the option selection process that LUL have undertaken to arrive at the preferred scheme option. This is covered in Technical Appendix C of the SES dated and Appendices A to D of Technical Appendix C.

A7 1.6 This Technical note on the LUL Option Selection Process provides a summary of the information given in each of the Reports listed above.

Stage B+ Option Review – Scott Wilson, July 2005 – [VSU.B5]

A7 1.7 The Stage B+ Option Review [VSU.B5] evaluates 15 options through a staged acceptance process, whereby any option that fails one of the assessment criteria does not continue to the next stage.

A7 1.8 The methodology uses forecast passenger flows for 2016+35%, and the journey times have been calculated through static analysis rather than through pedestrian modelling.

A7 1.9 Passengers have been split 70% using the existing escalators, and 30% using the proposed PAL [VSU.B5, section 2.3, page 6].

A7 1.10 Table A7.1 overleaf provides a summary of the Optioneering process undergone by Scott Wilson in the Stage B+ Option Review.

Table A7.1 Stage B+ Option Review Summary – July 2005

Stage	Assessment Criteria	Options Not Meeting Criteria
1.	• Reduced Congestion • Improved access, egress & interchange times • MIP access provision • No significant line closures of either D&C or Victoria lines • Minimal impact on network rail • Minimal impact on Bus Terminus • No impact on the D&C ticket hall (part of the VTI project)	**1.** Additional Running Tunnel **2.** Low Level Exit Gallery **3.** Improved interchange over D&C platforms **4.** One Way Systems **5.** Western link over D&C lines **6.** Removal of interchange concourse **7.** New ticket hall entrance in mainline station **8.** Major remodelling **9.** Integrated within development
2.	• Buildable: o Physical constraints o Delivered as early as practicable • Cost: o <£300M – where social benefit comparable to baseline option o <£350M – where the social benefit was considered to be significantly greater than the baseline option	**10.** Platforms extended **11.** Stacked interchange concourse elevator
3.	• Station Architecture • Passenger Flow • Operations • Urban Design • Structure Design • Traffic Impact • Utility Diversion • System Engineering inc. fire • Environment & consents • Compliance • Cost • Social Benefit	• **Baseline Option** – as contained in the 'Victoria Transport Interchange – LUL Phased Implementation – Final Report - July 2004' • **Modified Baseline Option** – seeks to address limitations of the Baseline Option • **The Minimum Property Acquisition Option** – seeks to construct the ticket hall solely within the footprint of Bressenden Place Road • **Elliot House Option** – option for northern ticket hall which proposes a new surface ticket hall on the current site of Elliot House and western link between the northern ticket hall and interchange concourse.

A7 1.11 Stages 1 and 2 resulted in four schemes being taken forward into the stage 3 assessment where these final four schemes were each given a Cost Benefit Index (CBI) based on the criteria with which they were assessed. It is noted that the 'minimum property acquisition option' in the Scott Wilson report in July 2005 is similar to LandSec Option 1 in so far as the Paid Area Link (PAL) route is aligned East of the Victoria Line platforms into the North Ticket Hall (NTH).

A7 1.12 This CBI was calculated using the direct costs of the scheme elements including 'Land Assembly, On Costs and Risks.' Benefits have been given as monetised benefits compared to the do minimum scenario, and consist of generalised journey time hours calculated using the AM Peak demands and freeflow walk speeds (taking into account congested time for the interchange concourse).The four Options considered in Stage 3 of the process were given CBI's as follows:

- Baseline Option – CBI 100
- Modified Baseline Option – CBI 131
- The Minimum Property Acquisition Option – CBI 78
- Elliot House Option – CBI 74

A7 1.13 Although the 'Modified Baseline' option gave the greatest benefits in terms of journey time savings relative to the cost of the scheme, no preferred scheme was identified in this report owing to a 'number of key issues which needed to be resolved'. These 'issues' are not detailed in the report. Between July 2005 and December 2006, Mott McDonald were recruited as the new appointed VSU MDC2 Engineers.

Mott Macdonald: Victoria Station Upgrade – MDC2 Options Selection Workshop for VSU –W5D1, January to May 2007 – [VSU.B6, May 2007]

A7 1.14 A workshop was held on 16th January 2007 to review and to determine options which might better the RIBA stage D design by Scott Wilson. This is assumed to be the 'Modified Baseline' option as described above. However, this is not referenced in the Mott McDonald report, it is only stated that 'The VSU has been designed to RIBA Stage D by Scott Wilson under Multi-disciplinary Contract MDC 1.'

A7 1.15 The workshop reviewed a total of seven main options for the VSU Scheme (Options A1 to A7) first by means of a 'high level assessment.' During this 'high level assessment', a 'project management presentation' [VSU.B6, Annex C] was given in which attendees were asked to consider the following two key points:

- Ultimately, are the options cost effective including RISK?;
- Ultimately, do the options get the passengers where they want to go?

A7 1.16 Options A1, A2, A5 and A7 were dismissed following this morning session on 16th January 2007. Options A3, A4 and A6 were considered further by listing advantages and disadvantages after which option A3 was rejected and Options A4 and A6 (similar to LandSec Option 1) were taken into the next assessment stage carried out between January and May 2007.

A7 1.17 Following the workshop on 16th January, options A4 and A6 were developed and assessed with a number of new options using the criteria set out in Table A7.2 overleaf [taken from VSU.B6]. At this stage, the options were renumbered in light of their further development. Option 2A is similar to LandSec Option 1.

Table A7.2 Scheme Option Selection Summary

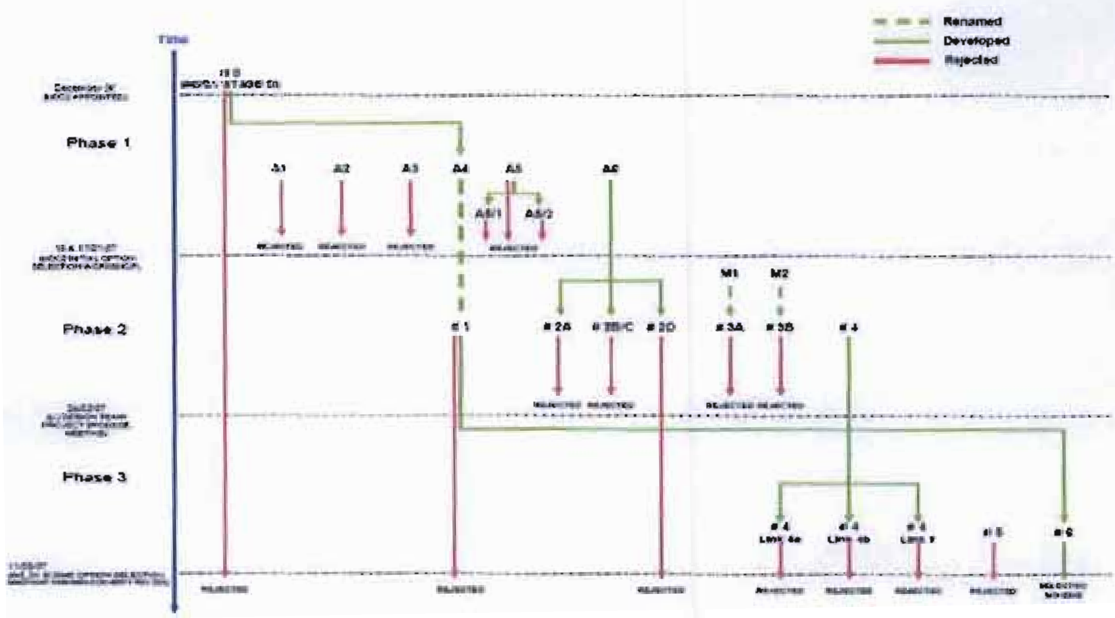
Phase	Assessment Criteria	Options Not Meeting Criteria
Phase 1. Workshop Morning Session	• Geotechnical Challenges • Space Proving o D&C underpass, LFEPA shaft/Vic, NTH escalator/Vic, STH escalator/Vic/Abford/services • Re-provisioning o Location of plant rooms, Service Routes, Proximity requirements • Passenger flow • Buildability • Programme • Risk	A1. Deep Tunnels A2. Overland A5. Increase length of eastern connection tunnel to west to enable D&C overpass to be lowered A5/1 & A5/2. Tunnels tight above Victoria Line with stairs to the Vitoria Line platforms A/7. Victoria Line overpass (VTO) – split for fire/passengers
Phase 1. Workshop Afternoon Session and LU consultation	• Advantages against SW Stage D • Disadvantages against SW Stage D	A3. New SB platform tunnel with old SB as concourse
Phase 2. W5_D1 Scheme Option Selection	A. Journey Time – 38.5% B. Programme – 8.3% C. Project Cost – 12.2% D. Buildability – 6.5% E. Operational Impacts – 21.1% F. Stakeholder Impacts – 6.0% G. Utilities – 1.5% H. Environmental Impacts – 6.0%	#0 (formerly MDC1 Stage D) – Stakeholder Impacts #1 (formerly A4) – Journey Time #2A (formerly A6 and similar to LandSec Option 1) - Journey Time #2B/C (formerly A6) - Journey Time #2D (formerly A6) - Journey Time #3A - Journey Time #3B - Journey Time #4 - Journey Time #5 - Journey Time

A7 1.18 Consequently the selected scheme which went forward to become the TWAO Scheme was Option #6 (formerly A4 in the January 2007 workshop) which involved the realignment of the PAL to the west and allowing passive provision (whereby 'passive provision comprises sizing passageways from Static Analysis for agreed future operational scenarios, where buildability constraints can be practicably resolved.' [VSU.B6, page 4-4]) for future construction of PAL to D&C eastbound connection.

LUL TWAO Supplementary Environmental Statement (SES) – Technical Appendix C, August 2008 [VSU.A31]

A7 1.19 The additional information and review of the Option Selection process submitted alongside the SES [VSU.A31, Technical Appendix C] describes a further review that was undertaken by the MDC2 design team in May 2008 which revisited all the options previously considered and compared them against the project selection criteria. It states that in considering the modified scheme proposals it was decided that where an option had been rejected because it did not meet one of the project criteria it would be tested against all of the criteria [VSU.A31, Technical Appendix C, Section 7]. Table 7.1 of this document details the results of this assessment using the Options set out in the figure below [also in VSU.A31, Technical Appendix C, Figure 4-1]. However, the Table does not detail the performance of each option against each criterion. Rather, it lists the primary and secondary reasons for rejection.

A7 1.20 Figure 4-1 [VSU.A31, Technical Appendix C] illustrates the Option Selection process as follows:



A7 1.21 Table A7.3 overleaf below summarises the primary and secondary reasons for rejection of all Options when the process was reviewed in light of the SES. The process still concludes that Option 6 was the preferred Option for the VSU scheme.

A7 1.22 Option 2A which is similar to LandSec Option 1 (and rejected on grounds of Journey Time in May 2007) was stated as being rejected due to the following primary and secondary reasons when reviewed for the SES in May 2008:

- Primary: Buildability - Increased construction risk: potential for undermining District and Circle Tunnel due to PAL alignment immediately adjacent, parallel and below footings of District and Circle line tunnel. Also increased construction risk under frontage of the Victoria Palace Theatre and and the Kings Scholars Pond Sewer.

- Secondary: Journey Time - Way finding difficult and passenger walk distance increased relative to Option 0.

- Secondary: Operational Impacts - Potential impacts on District and Circle line operations.

Table A7.3 SES Option Selection review

Option	Primary Parameter Conflicts (listed May 2008)	Secondary Parameter conflicts (listed May 2008)
A1	• Journey Time	• Buildability • Utilities
A2	• Journey Time	
A3	• Construction Cost • Buildability	• Operational Impacts • Stakeholder Impacts
A4	• Journey Time	
A5	• Journey Time	
A5/1	• Journey Time	
A5/2	• Journey Time	
A6	• Buildability	• Journey Time
#0 (formerly MDC1 Stage D)	• Stakeholder Impacts • Buildability	• Utilities • Journey Time
#2A (formerly A6 and similar to LandSec Option 1)	• Buildability	• Journey Time • Operational Impacts
#2B/C (formerly A6)	• Journey Time • Stakeholder Impacts	• Buildability
#2D (formerly A6)	• Journey Time • Buildability • Operational Impacts	
#3A	• Journey Time	• Operational Impacts
#3B	• Journey Time	• Operational Impacts
#4 4 (link 1) 4 (link 4a) 4 (link 4b)	• Journey Time	
#5 - Journey Time	• Journey Time	• Operational Impacts

Critical Review of the LUL Option Selection Process

A7 1.23 There are a number of inconsistencies throughout the Option Selection Process specifically related to the assessment of each option, which are set out in the following paragraphs.

A7 1.24 The SES [VSU.A31] states that Option 0 [VSU.A31, Technical Appendix C, Appendix B], in the case of journey time, "lacks flexibility in terms of passenger routing" [VSU.A31, Table 4-1, Page 29]. With the exception of the passive provision for future construction of the D&C link, the scheme is almost identical in terms of flexibility to the selected TWAO scheme. By the same token, Option 0 is said to require station control measures [VSU.A31, Table 4-1, Page 29], although such measures would presumably also be required in the TWAO scheme given its similarity to Option 0.

A7 1.25 Option A2 [VSU.A31, Technical Appendix C, Appendix B] is rejected; however the reasons for rejection seem unjustified, particularly given the scheme's substantial cost saving of some £50 million. One reason for rejection is the potential excessive passenger flow past Victoria Palace Theatre [VSU.A31, Table 4-1, Page 30], although this is not especially significant as the use of the Theatre is unlikely to coincide with peak passenger flows, and the likely walking route is along the south side of Victoria Street, the opposite side to the Theatre. Whilst there will be increased footfall at this location, this could be counterbalanced by the reduction in passenger flow from passengers reaching Victoria station from the east, as they would enter via the new NTH post VSU completion. One further reason for rejection is the potential for "rain causing congestion," [VSU.A31, Table 4-1, Page 30] which is a weak reason given rain occurs only occasionally, and part of the walking route would also be covered.

A7 1.26 Option A4 [VSU.A31, Technical Appendix C, Appendix B] is almost the same as the selected TWAO scheme. The journey time in Option A4 is described as being "broadly similar" [VSU.A31, Table 4-1, Page 31] to Option 0 despite the PAL measuring some 210m compared to 188m in Option 0. By describing it as broadly similar, LUL would appear to consider an additional 22m (an additional 12%) of distance as insignificant at this time. This is inconsistent with the view that at 230m (an additional 17%), Option A6 is considered excessive when measured against journey time criteria.

A7 1.27 Option A5 [VSU.A31, Technical Appendix C, Appendix B] was rejected due to "poor passenger routing" [VSU.A31, Table 4-1, Page 31], however the passenger routing appears almost identical to Option A4 which was taken forward in the option selection process.

A7 1.28 Option A5/1 and Option A5/2 [VSU.A31, Technical Appendix C, Appendix B] are the only options rejected due to the impact on properties owned by Land Securities [VSU.A31, Table 4-1, Page 32]. In fact, the impact of the scheme on Land Securities properties is no worse than the impact arising from the TWAO option.

A7 1.29 Option A6 [VSU.A31, Technical Appendix C, Appendix B] is the option that is similar in principal to LandSec Option 1. One of the reasons for rejection of this option is stated in the SES as "Way finding difficult" [VSU.A31, Table 4-1, Page 32]. It is unclear from the SES as to why this particular route will be any more unclear than other options. Another reason for rejection is the increased passenger walk distance, even though it is only 25m longer than the selected TWAO Option, which itself is 22m longer than Option 0 despite the two options being described by LUL as being of "broadly similar" length.

A7 1.30 Options 2B and 2C [VSU.A31,Technical Appendix C, Appendix B] were originally rejected only due to walking distance and wayfinding, however in the May 2008 review a number of other reasons for rejection were identified in addition to those submitted with the original November 2007 ES for the TWAO application. These additional reasons include the difficulty in tunnelling alongside the D&C line, and the fire evacuation strategy. It is not made clear exactly how the fire evacuation strategy may be affected.

A7 1.31 Looking at Phase 3 of the Option Assessment, as reported in the SES, there are further inconsistencies noted, as well as a lack of detail as to why options were rejected at this stage of the assessment process. It can only be assumed that Option 1, for example, has been rejected due to the absence of the link to the D&C line, which was previously described as "passive provision for future construction" in the original ES November 2007 [VSU.A12].

A7 1.32 An identical scheme to Option 1 was carried forward from Phase 2, and there is no detail as to why this scheme was subsequently rejected during Phase 3. Similarly, there is a lack of a detailed explanation as to why Option 2D and Option 4 [VSU.A31, Technical Appendix C, Appendix B] were also rejected in Phase 3 after being carried forward from Phase 2.

A7 1.33 Option 6 represents the selected TWAO scheme. It is considered unrealistic that no parameter conflicts are documented in Phase 3. It should, at least, be noted that the PAL length is greater than Option 0 by some 22m. Option 2A was rejected as "Passenger walk distance increased relative to Option 0". Given this, Option 6 could also be rejected on the same grounds. There is also no acknowledgement in the parameter conflicts that Option 6 has a significant impact on stakeholders (in particular Land Securities and Victoria Palace Theatre).

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APPENDIX 8

ASSESSMENT ASSUMPTIONS

A8 ASSESSMENT ASSUMPTIONS

A8 1.1 This appendix describes the assumptions used in the comparative assessment of the LandSec options against the TWAO application scheme.

Assessment Criteria

A8 1.2 Section 4.2.15 of LUL's Environmental Statement (ES) (p. 4-8, ES Main Report, Nov 2007) lists eight assessment criteria against which the TWAO application scheme and its alternative options were originally appraised by LUL, namely:

a) Journey time (operational, safety and quality)
b) Programme
c) Project Cost
d) Buildability
e) Operational impacts
f) Stakeholder impacts
g) Utilities
h) Environmental impacts

A8 1.3 The comparison of the TWAO scheme and the LandSec options presented in this report has been undertaken using these criteria.

Passenger Movements

A8 1.4 Section 19.2 of the Transport Assessment (TA) for the TWAO application states that, based on extensive station planning calculations and pedestrian simulation tests, (when the VSU scheme is complete): *Typically the split of passengers between the South Ticket Hall (STH) and Victoria Line platforms is 60:40 in terms of the existing escalator shaft and the proposed PAL* (TA, Section 19.2, p. 123). Therefore 40% of those entering and exiting via the STH to get to the Victoria Line platforms will use the PAL. This 60:40 split is also used as an assumption in 'VSU / MDC2 W5_D1 Scheme Option and Operational Scenario Summary – Appendix D' when undertaking static analysis. Therefore, a 60:40 split has been applied for pedestrians accessing the Victoria Line platforms via the existing escalators and the PAL respectively.

Peak Demand

A8 1.5 The TWAO application states that the three hour morning peak is the period 07:00-10:00 (ES, Table 2-1, Background to Key Objectives, p.2-2).

A8 1.6 TfL's Station Planning Standards and Guidelines (SPSG) (LUL, Number 1-371, December 2006) provides standards and guidance on the space requirements for public areas and staff accommodation in stations.

A8 1.7 In order to calculate pedestrian flow densities of each route option, methodology was taken from LUL's SPSG (LUL, Number 1-371, December 2006), section 3.2. The guidelines state that passenger flow calculations for station areas shall use the average flow per minute, which shall be derived from the 15 minute flow. It indicates that where the peak 15 minute data is unavailable, the factors in Table 2.2 below should be applied to the shortest peak period available (either 3 hour peak or 1 hour peak). Therefore, the AM 3-hour peak was converted to one hour peak and 15 minute inter peaks, by applying the factors in Table 3.2 below.

A8 1.8 Table 1 sets out the factors applied to the 3-hour peaks, as described in Section 3.2 of LUL's SPSG.

TABLE 1 PASSENGER FLOW DATA FACTORS

Peak	TfL station fare zone	Factor applied to peak 3-hour flow to give peak hour flow	Factor applied to peak hour flow to give peak 15 min flow
AM Peak	Zones 1,2 & 3	0.45	0.27

(Source: Station Planning Standards and Guidelines, LUL, Number 10371, p.7, Dec. 2006)

A8 1.9 Paragraphs 3.2.1 and 3.2.2 (p.7) of LUL's SPSG state:

The calculations for station areas shall use the average flow per minute which shall be derived from the peak 15 minutes flow....The average flow per minute over the peak 15 minutes = the peak 15 minute flow/15.

A8 1.10 The peak hour and interpeak assessments undertaken as part of this report follow this guidance.

Design Year

A8 1.11 The TWAO application states that the design year is 2016 + an additional 20% demand (LUL, ES, Table 2-1, p.202). The LUL Statement of Case only refers to the assessment year of 2016 (LUL, SoC, para. 8.1.1, p. 39). Therefore the design year used throughout this joint document has been taken to be the worst case which is 2016 + an additional 20% demand as referred to in the TWAO application ES.

Scenarios

A8 1.12 The following scenarios have been assessed by LUL:

a) 2016 (with existing underground infrastructure);
b) 2016 (with proposed VSU infrastructure); and
c) 2016 + 20% demand.

A8 1.13 Steer Davies Gleave has reviewed the TWAO application. On 8th January 2008 LandSec sent a letter to LUL (VSU Team) requesting a list of technical modelling information from LUL that would normally be contained within TWAO applications, which is missing.

A8 1.14 The following information was requested in that letter:

a) Plans to show the layouts of all options referred to in Table 4-3 of the ES (15th November 2007, p. 4-9 to 4-11);
b) A table comparing all the advantages and disadvantages of all VSU PAL options considered in Table 4-3 of the ES;

c) Any transport modelling used to assess pedestrian movements and capacities for the proposed tunnels and escalators;

d) Underground movement matrices;

e) Pedestrian movement modelling for Base, Do minimum and Do something (preferred Option #6 in Table 4-3 in the ES, p.4-11) scenarios in the underground tunnels.

A8 1.15 In response to LandSec's correspondence with LUL, LandSec received a CD from LUL on 20th February 2008 containing the following information:

a) 2016 passenger interchange matrix for the existing underground infrastructure;

b) 2016 passenger interchange matrix for the VSU proposed underground infrastructure; and

c) VSU option drawings.

A8 1.16 Information requested in points d) and e) of paragraph 3.20 above remains outstanding.

A8 1.17 The 2016 passenger interchange matrices for the existing underground infrastructure and with the proposed VSU infrastructure are shown in Appendix A (LUL CD, Information for LandSec, 20th Feb 2008). The two 2016 matrices show underground interchanges as well as interchanges from platform to street level and are described in Chapter 5 of this report.

A8 1.18 Applying proportions of the 2016 matrices, which are described in Chapter 5 of this report, provide estimated underground movements for the 2016 + 20% design year.

Technical Assessment

A8 1.19 The analysis of walk times for each route option is based on underground interchange matrices, tunnel capacities, Fruin levels and other factors affecting pedestrian conditions.

A8 1.20 The analysis is based on:

a) **Flows** – provided in LUL 2016 interchange matrices

b) **Capacities** – informed by PAL dimensions and widths

c) **Fruin levels** – Levels of Service (LOS) calculated from pedestrian flow densities and tunnel widths. This provides a measure of pedestrian comfort as well as congestion and it is measured in the number of pedestrians per minute.

d) **Other Factors** – other observed factors and LUL assumptions described in TWAO application documents and Statement of Case.

A8 1.21 One of the main indicators used to assess the pedestrian conditions on routes are the widely accepted Fruin Levels of Service. These rate the level of congestion based on pedestrian flow and density measures.

A8 1.22

Table 2 summarises average walk speeds under Fruin LOS and IHT guidelines.

TABLE 2 LEVEL OF SERVICE MEASUREMENT

No. of people/sqm	Level of Service (LOS)	metres/min walk speed	Source
82	Fruin LOS F	37.9	Fruin LOS
66	Fruin LOS E	60.8	Fruin LOS
49	Fruin LOS D	68.2	Fruin LOS
33	Fruin LOS C	76.2	Fruin LOS
	IHT Guidelines	80	Surface speed
	VSU / MDC2 W5_D1 Scheme Option and Operational Scenario Summary	80.4 (1.34m/s)	Appendix E

A8 1.23 However, for consistency, a walk speed of 1.34m/s (80.4 meters/min) is used throughout the report as this has been used throughout the LUL assessments and is referred to in the 'VSU / MDC2 W5_D1 Scheme Option and Operational Scenario Summary – Appendix E.'

A8 1.24 Table 3 overleaf describes the application of the Fruin LOS in further detail.

TABLE ERROR! NO TEXT OF SPECIFIED STYLE IN DOCUMENT..3 **FRUIN LEVELS OF SERVICE**

Level of Service A

>3.25 sq.m per person or <23 pedestrians per minute per metre width of footway.

Pedestrian can freely select their own walking speed, bypass slower pedestrians and avoid crossing conflicts with other pedestrians.

Level of Service B

2.32-3.25 sq.m per person or 23-33 pedestrians per minute per metre width of footway.

Pedestrians can select their own walking speed and bypass slower pedestrians in primarily one-directional flows. Where contra-flow pedestrian movements exist, minor conflicts will occur, causing average walk speeds and potential volumes to reduce slightly.

Level of Service C

1.39-2.32 sq.m per person or 33-49 pedestrians per minute per metre width of footway.

The ability of pedestrian to freely select their own walking speed and to freely bypass slower pedestrians is restricted. Where cross-flows or contra-flows exist, pedestrian flow would remain reasonably fluid, although frequent adjustment of speed and direction would be required to avoid conflicts with other pedestrians.

Level of Service D

0.93-1.39 sq.m per person or 49-66 pedestrians per minute per metre width of footway.

The majority of pedestrians will have their normal walking speed restricted due to difficulties bypassing slower moving pedestrians and avoiding conflicts. Crossing or contra-flow pedestrian movements would be severely restricted and would result in multiple conflicts.

Level of Service E

0.46-0.93 sq.m per person or 66-82 pedestrians per minute per metre width of footway

Virtually all pedestrians will have their normal walking speed restricted and insufficient space is available to bypass slower moving pedestrians. Extreme difficulties would be experienced by pedestrians attempting crossing or contra-flow movements.

Level of Service F

<0.46 sq.m per person or >82 pedestrians per minute per metre width of footway.

Pedestrian walking speeds are extremely restricted and forward progress can only be made by shuffling. There would be frequent, unavoidable conflicts with other pedestrians and crossing or contra-flow movements would be virtually impossible.

Crossrail and Passenger Demand

A8 1.25 LUL's Statement of Case and design assumptions do not take into account that the Crossrail Bill was approved to go through the Houses of Parliament to achieve Royal Assent in October 2007. The Crossrail Bill gained Royal Assent on 22nd July 2008 and this will enable the Cross London Rail Links team to prepare the first contract construction packages for the Autumn of 2008.

A8 1.26 The TWAO application (LUL, ES, Table 2-1, p.2-2) states:

Passenger demand forecasts are based on the Transport for London strategic planning model, Railplan. Design year forecasts represent demand levels in 2016 plus an additional 20% (100,800). With this extra margin factored in it is not expected that the upgraded station will need to consider redevelopment until 2055. Taking a worst-case scenario, the forecast does not consider the potential network-wide impact of the construction of Crossrail line 1 or Thameslink Programme projects, the implementation of which would have a beneficial impact on the volume and pattern of flows through Victoria station.

A8 1.27 Table 2-1 of the ES also states that *the aim is to ensure that after the completion of the VSU scheme, the station maintains acceptable passenger flow conditions for at least a further 40 years* (LUL, ES, Table 2-1, p.2-2).

A8 1.28 Paragraph 7.11.2 (p.37) of LUL's Statement of Case states:

In this context the passenger demand projections for design purposes assumed the upgrade of the Victoria line but without Crossrail, Thameslink or the Chelsea-Hackney line having being built. These last three projects would all reduce demand at Victoria and therefore the demand assumption increase of 35% is high. Due to the likelihood that the Thameslink project would be starting construction in the near future, a demand level increase of 20% has been used.

A8 1.29 The first of the above three quotes (from the ES) states that the demand forecast used in the TfL assessment has not taken into account the effects of Crossrail Line 1 or Thameslink as a 'worst case'. The Statement of Case quotation above suggests that a reduced demand level of 20% has been used to take account of likelihood of the Thameslink project starting construction in the near future.

A8 1.30 Due to the lack of clarity and apparent contradiction between the ES and Statement of Case it is unclear whether the Thameslink project has been included in the demand levels supplied in the ES, and subsequently to LandSec from LUL. However, for consistency with the LUL assessment, these demand levels have been used in the appraisal summarised in this report.

Summary of Assumptions

A8 1.31 Table 4 provides a summary of the assumptions underpinning this study and it provides the exact reference for the assumption.

TABLE 4 SUMMARY OF ASSUMPTIONS AND SOURCE DOCUMENT

Category	Assumption	LUL Document	Reference
Assessment Criteria	8 assessment criteria against which options should be appraised	LUL, ES Main Report, Nov. 2007	Section 4.2.15 of ES (p. 4-8)
Split of passengers	60:40 split of passengers between STH and Victoria Line platforms	LUL, TA, Nov. 2007	Section 19.2 of TA (p. 123)
	60% of passengers use southern half of train and platforms where escalators feed onto the platforms	LUL, ES Main Report, Nov. 2007	Table 2-1 (p.2-2)
AM peaks	AM 3-hour peak is 07:00-10:00	LUL, ES Main Report, Nov. 2007	Table 2-1 (p.2-2)
	One hour peak factor is 0.45	LUL, SPSG, Number 1-371, Dec. 2006	Sec 3.2 (p.7)
	Peak 15 min flow factor is 0.27	LUL, SPSG, Number 1-371, Dec. 2006	Sec 3.2 (p.7)
	Peak minute is derived by dividing 15 minute peak by 15.	LUL, SPSG, Number 1-371, Dec. 2006	Sec 3.2 (p.7)
Scenarios and demand assessed	Base year is 2007	LUL, TA, Nov. 2007	Section 6.2.1 (p.33)
	Design year is 2016 + 20%	LUL, ES Main Report, Nov. 2007	Table 2-1 (p.202)
	Base year underground passenger demand is 70,000	LUL, ES Main Report, Nov. 2007	Table 2-1 (p.2-2)
	2016 underground passenger demand is 81,404	LUL, CD provided to Land Securities on 20th Feb. 2008	Matrices on CD
	2016 + 20% underground passenger demand is 100,800	LUL, ES Main Report, Nov. 2007	Table 2-1 (p.2-2)
Station growth	Station growth from base to 2016 is 20% and a further 20% from 2016 to 2016 + 20% demand	LUL, ES Main Report, Nov. 2007	Table 2-1 (p.2-2)
		LUL, TA, Nov. 2007	Section 8.5 (p. 61)
Walk speed	Assumed at 1.34 meters per second	VSU.B6 VSU / MDC2 W5_D1 Scheme Option and Operational Scenario Summary MMD-VO47-1159-GEN-DOC-5011 Rev D01 (Mott MacDonald, May 2007);	Appendix E (E-1)

OBJ3/P4/A9

Transport and Works (Inquiries Procedure) Rules 2004

Proposed London Underground (Victoria Station Upgrade) Order

LAND SECURITIES PLC AND OTHERS (Objector No. 3)

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APPENDIX 9

LUL MATRICES

Victoria Underground Station - Estimated Base Matrix of Underground Passenger Movements

AM Peak (07:00-10:00) Base - Scenario: Do Something (NACHS Railplan) - Existing Station Layout

			Platforms				D&C		STH			NTH		
			District W/B	District E/B	Vic N/B	Vic S/B	Victoria St	Terminus Pl	Wilton Road	Sussex	Kent	Bressenden	Vic St North	Total
	From/to		1	2	3	4	5	6	7	8	9	10	11	
Platforms	District W/B	1	0	0	314	837	2,248	197	1,056	685	387	0	0	5,704
	District E/B	2	0	0	2,778	1,095	2,592	227	1,218	790	423	0	0	9,123
	Vic N/B	3	3,096	1,641	0	0	299	114	1,378	592	236	0	0	7,355
	Vic S/B	4	3,466	1,648	0	0	1,394	526	6,409	2,759	1,101	0	0	17,303
D&C	Victoria St	5	412	296	166	12	0	0	0	0	0	0	0	886
	Terminus Place	6	643	462	1,386	99	0	0	0	0	0	0	0	2,590
STH	Wilton Road	7	348	250	1,316	78	0	0	0	0	0	0	0	1,992
	Mainline Entry	8	4,090	2,939	8,495	507	0	0	0	0	0	0	0	16,031
	Mainline East	9	2,096	1,507	5,109	305	0	0	0	0	0	0	0	9,017
NTH	Bressenden	10	0	0	0	0	0	0	0	0	0	0	0	0
	Vic St North	11	0	0	0	0	0	0	0	0	0	0	0	0
	Total		14,151	8,742	19,563	2,933	6,533	1,064	10,060	4,827	2,127	0	0	70,000

Victoria Underground Station - 2016 Matrix of Underground Passenger Movements: Source LUL

AM Peak (07:00-10:00) 2016 - Scenario: Do Something (NACHS Railplan) - Existing Station Layout

			Platforms				D&C		STH			NTH		
			District W/B	District E/B	Vic N/B	Vic S/B	Victoria St	Terminus Pl	Wilton Road	Sussex	Kent	Bressenden	Vic St North	Total
	From/to		1	2	3	4	5	6	7	8	9	10	11	
Platforms	District W/B	1	0	0	365	973	2,614	229	1,228	797	427	0	0	6,633
	District E/B	2	0	0	3,231	1,273	3,014	264	1,416	919	492	0	0	10,609
	Vic N/B	3	3,600	1,908	0	0	348	132	1,602	689	275	0	0	8,554
	Vic S/B	4	4,031	1,917	0	0	1,621	612	7,453	3,208	1,280	0	0	20,122
D&C	Victoria St	5	479	344	193	14	0	0	0	0	0	0	0	1,030
	Terminus Place	6	748	537	1,612	115	0	0	0	0	0	0	0	3,012
STH	Wilton Road	7	405	291	1,530	91	0	0	0	0	0	0	0	2,317
	Mainline Entry	8	4,756	3,418	9,879	590	0	0	0	0	0	0	0	18,643
	Mainline East	9	2,438	1,752	5,941	355	0	0	0	0	0	0	0	10,486
NTH	Bressenden	10	0	0	0	0	0	0	0	0	0	0	0	0
	Vic St North	11	0	0	0	0	0	0	0	0	0	0	0	0
	Total		16,457	10,167	22,751	3,411	7,597	1,237	11,699	5,613	2,474	0	0	81,406

Victoria Underground Station - 2016 Matrix of Underground Passenger Movements: Source LUL

AM Peak (07:00-10:00) 2016 - Scenario: Do Something (NACHS Railplan) - VSU Scheme Design

			Platforms				D&C		STH			NTH		
			District W/B	District E/B	Vic N/B	Vic S/B	Victoria St	Terminus Pl	Wilton Road	Sussex	Kent	Bressenden	Vic St North	Total
	From/to		1	2	3	4	5	6	7	8	9	10	11	
Platforms	District W/B	1	0	0	365	973	2,614	229	1,228	797	427	0	0	6,633
	District E/B	2	0	0	3,231	1,273	3,014	264	1,416	919	492	0	0	10,609
	Vic N/B	3	3,600	1,908	0	0	348	132	148	689	275	1,351	102	8,553
	Vic S/B	4	4,031	1,917	0	0	1,621	612	691	3,208	1,280	6,289	473	20,122
D&C	Victoria St	5	479	344	193	14	0	0	0	0	0	0	0	1,030
	Terminus Place	6	252	181	542	39	0	0	0	0	0	0	0	1,014
STH	Wilton Road	7	405	291	475	28	0	0	0	0	0	0	0	1,199
	Mainline Entry	8	5,084	3,654	10,554	631	0	0	0	0	0	0	0	19,923
	Mainline East	9	2,606	1,873	6,348	379	0	0	0	0	0	0	0	11,206
NTH	Bressenden	10	0	0	980	59	0	0	0	0	0	0	0	1,039
	Vic St North	11	0	0	74	4	0	0	0	0	0	0	0	78
	Total		16,457	10,168	22,762	3,400	7,597	1,237	3,483	5,613	2,474	7,640	575	81,406

Victoria Underground Station - Estimated 2016 + 20% Matrix of Underground Passenger Movements

AM Peak (07:00-10:00) 2016 + 20% - Scenario: Do Something (NACHS Railplan) - VSU Scheme Design

			Platforms				D&C		STH			NTH		
			District W/B	District E/B	Vic N/B	Vic S/B	Victoria St	Terminus Pl	Wilton Road	Sussex	Kent	Bressenden	Vic St North	Total
	From/to		1	2	3	4	5	6	7	8	9	10	11	
Platforms	District W/B	1	0	0	452	1,205	3,237	284	1,521	987	529	0	0	8,213
	District E/B	2	0	0	4,001	1,576	3,732	327	1,753	1,138	609	0	0	13,136
	Vic N/B	3	4,458	2,363	0	0	431	163	183	853	341	1,673	126	10,591
	Vic S/B	4	4,991	2,374	0	0	2,007	758	856	3,972	1,585	7,787	586	24,916
D&C	Victoria St	5	593	426	239	17	0	0	0	0	0	0	0	1,275
	Terminus Place	6	312	224	671	48	0	0	0	0	0	0	0	1,256
STH	Wilton Road	7	501	360	588	35	0	0	0	0	0	0	0	1,485
	Mainline Entry	8	6,295	4,525	13,068	781	0	0	0	0	0	0	0	24,669
	Mainline East	9	3,227	2,319	7,860	469	0	0	0	0	0	0	0	13,876
NTH	Bressenden	10	0	0	1,213	73	0	0	0	0	0	0	0	1,287
	Vic St North	11	0	0	92	5	0	0	0	0	0	0	0	97
	Total		20,378	12,590	28,185	4,210	9,407	1,532	4,313	6,950	3,063	9,460	712	100,800

OBJ3/P4/A10

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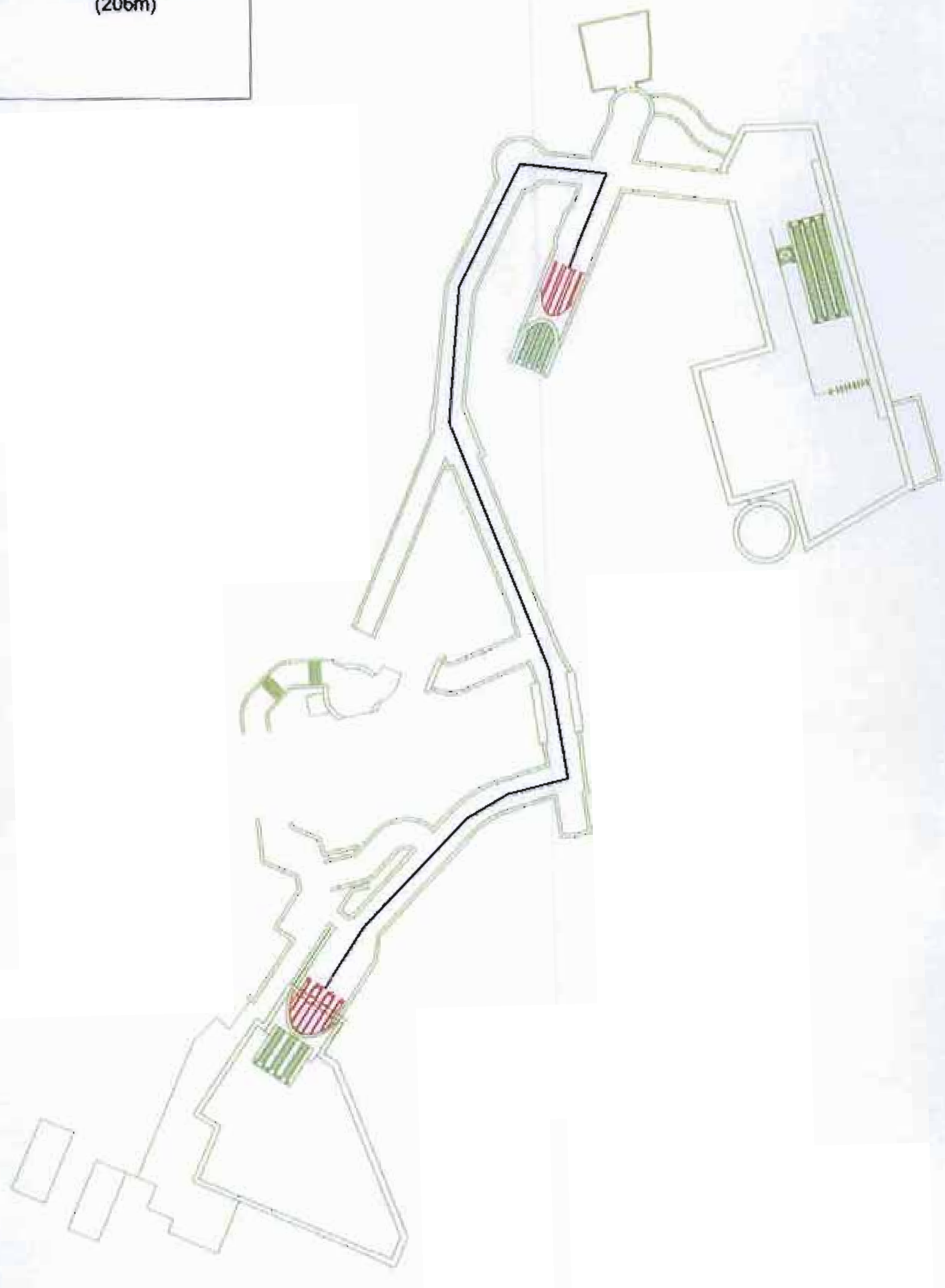
APPENDIX 10

PAL ROUTE MEASUREMENTS

KEY

Walking Distance (206m)



Victoria Station Upgrade

Transport and Works Act Order (TWAO)

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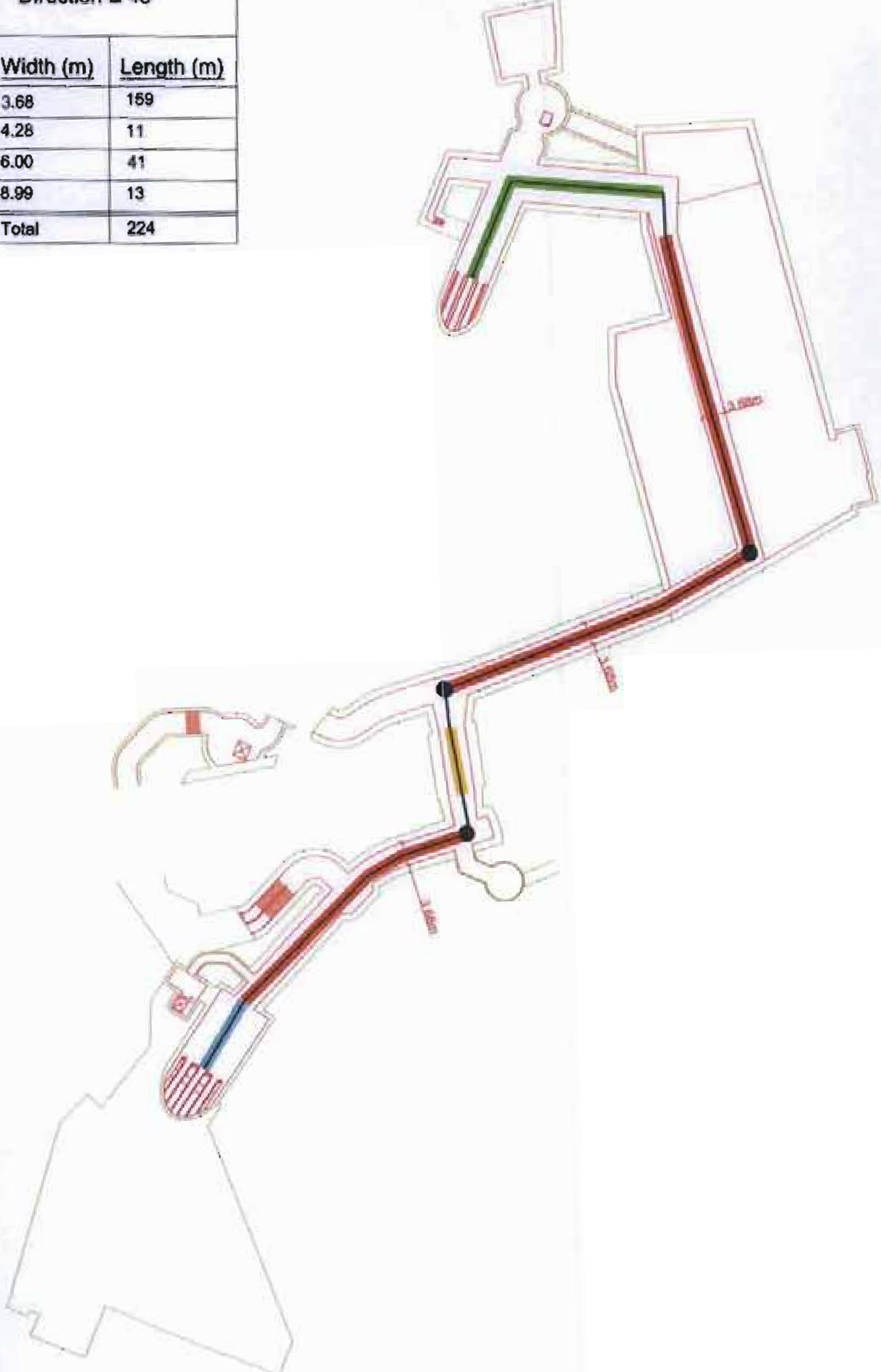
YPL	12/09/08	1:1000	SK-002

CAD REFERENCE:P:\C30\CAD\Projects\7800s\7813\7813-A\Work\Walk distances\Options 1 to 4_RevC.dwg

KEY

- Walking Distance (237m)
- ● Major Change In Direction ≥ 45°

	Width (m)	Length (m)
Red	3.68	159
Yellow	4.28	11
Green	6.00	41
Blue	8.99	13
	Total	224



Victoria Station Upgrade

Land Securities Option 1

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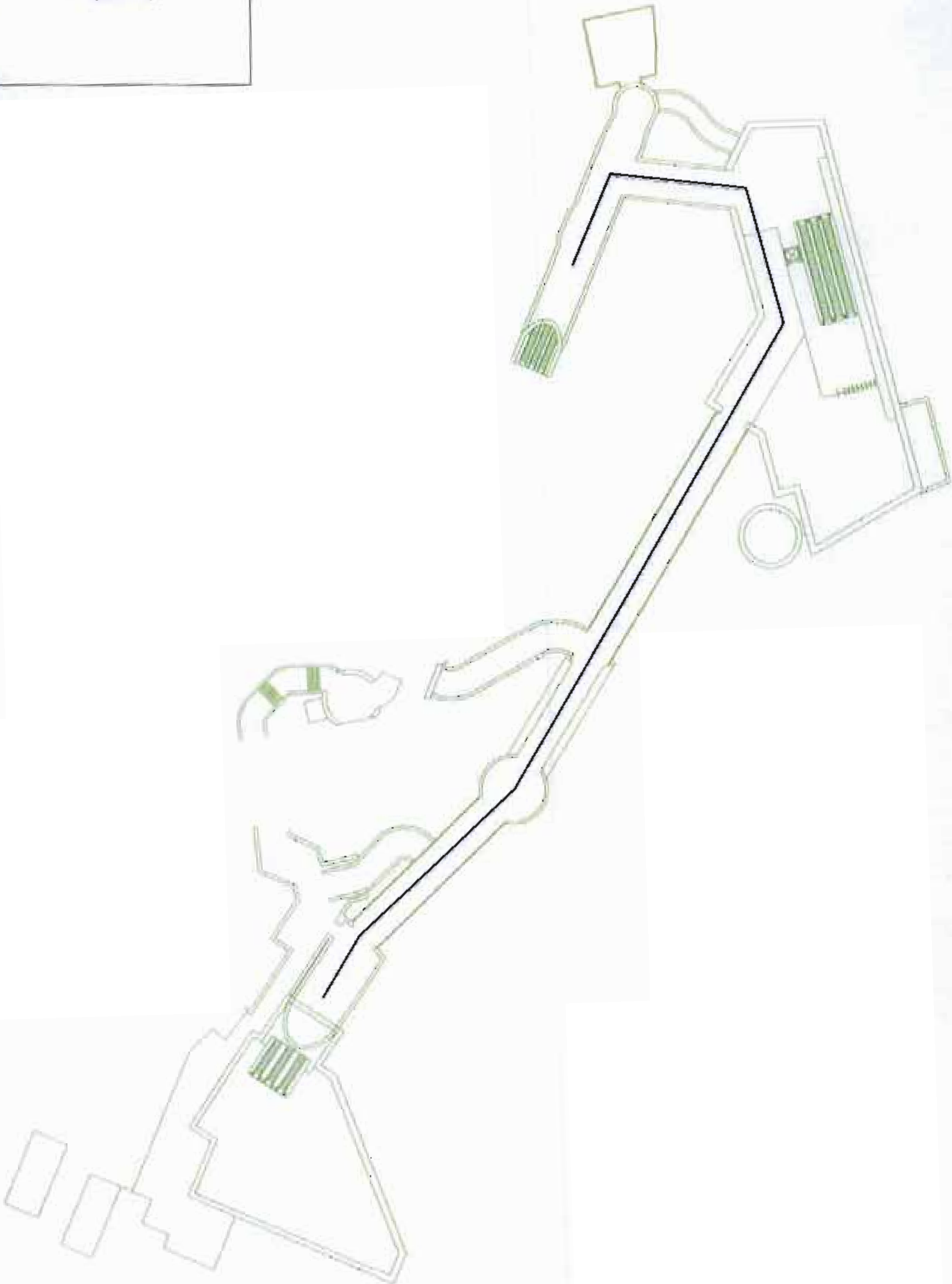
RRN	25/07/08	1:1000	SK-001

KEY

Walking Distance (227m)



Victoria Station Upgrade

Land Securities Option 1a

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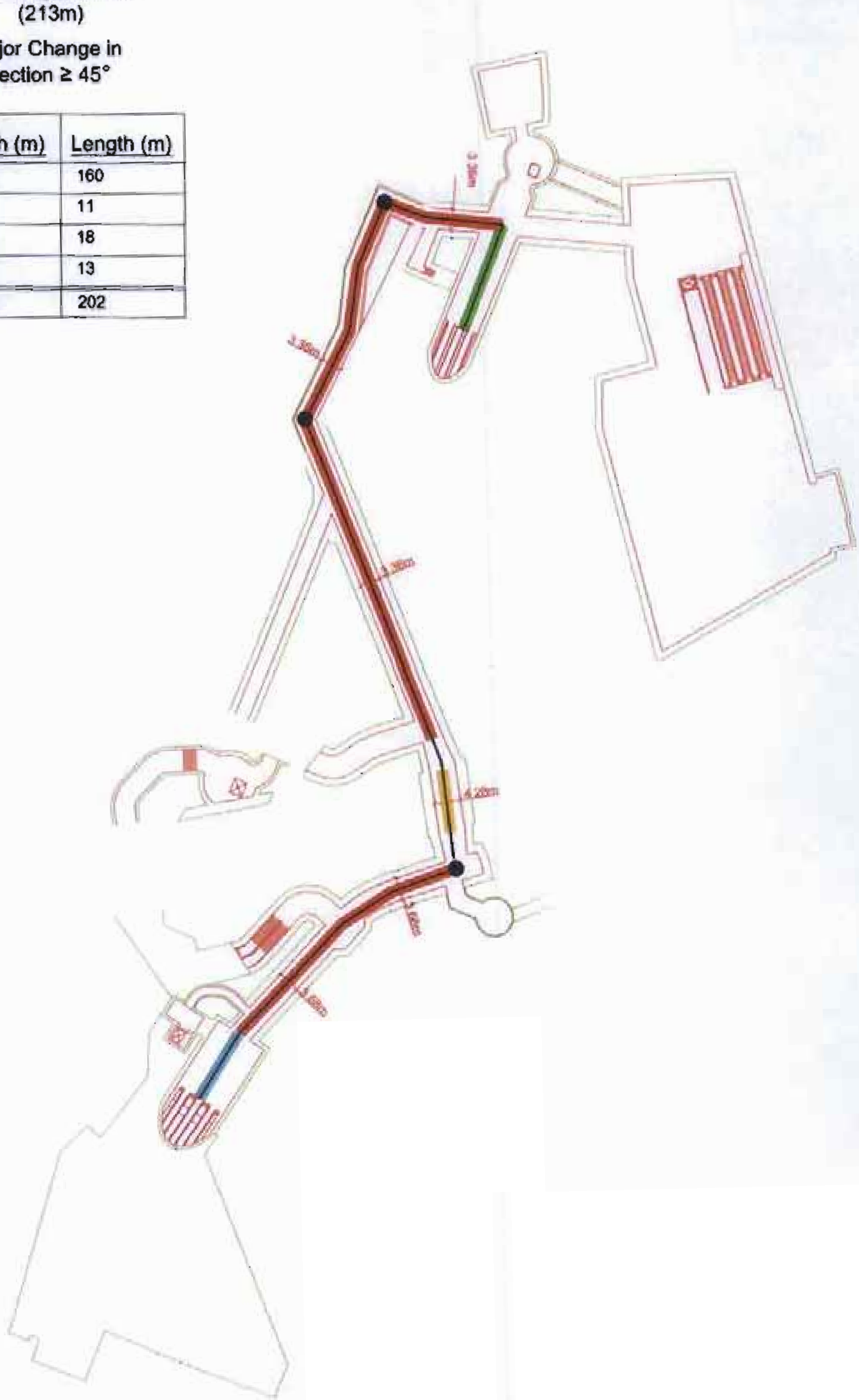
YPL	25/09/08	1:1000	SK-003a

KEY

—	Walking Distance (213m)
●	Major Change in Direction ≥ 45°

	Width (m)	Length (m)
red	3.36	160
yellow	4.28	11
green	5.97	18
blue	8.99	13
	Total	202



Victoria Station Upgrade
Land Securities Option 2

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RRN	25/07/08	1:1000	SK-004

CAD REFERENCE: P:\GGG\CAD\Projects\7800s\7813\7813-41Work\Walk distances\Options 1 to 4.dwg -- SK004

OBJ3/P4/A11

Transport and Works (Inquiries Procedure) Rules 2004

Proposed London Underground (Victoria Station Upgrade) Order

LAND SECURITIES PLC AND OTHERS (Objector No. 3)

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APPENDIX 11

EXTRACT FROM LUL STATION PLANNING GUIDELINES

2.2 This Standard supports the following LUL Policies:

Note: The identification of Policies shown below shall have no material impact upon Infraco or other Suppliers beyond the obligations already contained in this Category 1 Standard. They are provided for LU reference purposes only.

Number	Title	Version
1-01102-001	Health and Safety	A1
1-01101-003	Service Delivery - Journey Time	A1
1-01106-002	Accommodation and Facilities	A1

2.3 This Standard addresses and supports spatial planning issues of:

Passenger flow
Ticket hall
Access and Interchange facilities
Secondary income facilities
Operational staff accommodation
Station control rooms
Ticket issuing facilities
Platforms
Evacuation
Public facilities

insofar as they relate to Station planning.

2.4 This Standard shall be used to identify the station 'footprint' and to ensure that station proposals meet the requirements of HMRI Railway Safety Principles and Guidance (Part 2 section B Guidance on stations).

3 Requirements

3.1 Introduction

3.1.1 Space for normal operations in stations shall be planned to:

a) minimise congestion;
b) be resilient to surges in demand and train service disruption;
c) provide sufficient non-passenger space to enable staff to function efficiently.

3.1.2 Station size shall be determined by the space requirements of all activities, e.g. ticket purchase, retailing, vending, passage through the gateline, wayfinding, access to and from platforms, waiting for trains, boarding and alighting from trains and staff accommodation.

3.1.3 Station planning shall ensure that obvious routes with minimum travel distances, which are free from obstructions, have good lines of sight and avoid dead ends and hiding places.

3.1.4 New stations shall be designed to ensure that mobility-impaired passengers can move between street and train via step-free routes between levels, which comprise of lifts, ramps and level access between platform and trains.

3.8.6 When identifying the type and position of the place of safety, local staff, managers and Health & Safety representatives must be consulted.

3.8.7 Staff shall be made aware of the place of safety, when it should be used and how to operate all communication and other equipment.

3.8.8 Provision of the place of safety shall not exclude the use of other controls, if appropriate, to reduce the risk of potential assault.

3.8.9 Where proposals do not meet the above requirements, the alternative solution shall be referred to the Stations and Revenue Control Health and Safety Council for consideration.

3.9 Space for secondary income facilities

3.9.1 Space for secondary income facilities (see section 3.16 below) shall be in addition to the passenger space determined above.

3.9.2 Secondary income facilities, including queuing space for them, shall not be located within the run-off of gatelines, escalators and stairs.

3.9.3 The ticket hall shall be arranged so that such facilities do not hinder passenger flows through the ticket hall.

3.9.4 Location of secondary income facilities on platforms shall not interfere with passenger flows (see section 3.16 below).

3.10 Access and interchange

3.10.1 General

3.10.1.1 Passageways, intermediate concourses, escalators, passenger conveyors, lifts, stairs and ramps shall be arranged to minimise walking distances and to make the wayfinding through the station as obvious as possible.

3.10.1.2 Where stairs are located in passageways the passageway shall be the same width as the stairs.

3.10.1.3 All routes shall be free from obstructions and shall avoid recesses that could harbour litter and provide possible hiding places.

3.10.1.4 The means for providing changes in level shall be as follows:

Height of change in level	Means
Less than 0.5m	Ramp
0.5m to 3m	Staircase (min. of three risers)
3m to 5m	Staircase. Escalator if benefits are justifiable
Over 5m	Escalator or lift

3.10.1.5 New stations shall include at least one step-free access route between the street and the un-paid side of the concourse and at least one step-free route between the paid side of the concourse and the platforms.

3.10.1.6 No single escalator, passenger conveyor or lift shall provide the sole means of access or egress from any part of the station.

3.10.1.7 Where fire doors or flood doors are installed in stations they shall not interfere with passenger flows in the normal running of the station.

3.10.1.8 The flows of arriving and departing passengers, in all parts of the station, shall be separated so far as is reasonably practical.

3.10.1.9 Convex mirrors shall be installed at all stations (subject to architectural and heritage considerations) where blind corners, recesses, wide pillars and other obstructions exist to break a reasonable sightline of the passenger moving through the station.

3.10.2 Passageways

3.10.2.1 Passageway width shall be determined as follows:

$$\text{Two-way passageway width} = \left(\frac{\text{average peak minute flow}}{40} + (2 \times 0.3)\right)\text{m}$$

$$\text{One-way passageway width} = \left(\frac{\text{average peak minute flow}}{50} + (2 \times 0.3)\right)\text{m}$$

3.10.2.2 Where central barriers are provided in passageways to divide passenger flows, 0.3m shall be added to the passageway width.

3.10.2.3 The minimum width either side of the central barrier shall be 1.7m between barrier and wall finishes (i.e. the minimum passageway width shall be 3.7m [(2 x 1.7) + 0.3]m).

3.10.2.4 The minimum width for any passageway including escape and emergency access routes shall be 2m between finishes.

3.10.2.5 The width of a passageway between junctions shall be uniform along its entire length, which shall be maintained to the headroom height (with the exceptions of circular cross-section passageways detailed below).

3.10.3 Circular cross-section passageways

3.10.3.1 Circular cross-section passageways shall satisfy the following requirements;

a) The width of the floor shall be no less than the calculated passageway width, but without adding the sidewall 'edge effects'.

b) The internal diameter of the passageway (i.e. with finishes applied) shall be no less than the calculated passageway width with the sidewall 'edge effects' included. This requirement and the requirement above do not allow any local reductions to width, for example caused by advertising panels that 'square off' a circular cross-section passageway.

3.10.4 Passenger conveyors

3.10.4.1 The minimum length of a passenger conveyor shall be 50m and the maximum shall be 100m. Longer passageways shall have two or more passenger conveyors.

3.10.4.2 The following shall be taken into account when designing passenger conveyors:

a) conveyor capacity = 100 passengers per minute per metre width of treadway (based on a linear speed of 0.75m per second);

OBJ3/P4/A12

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APPENDIX 12

SCHEME CAPACITIES

A12 SCHEME CAPACITIES

Route Option		No. of Peds per minute	Min width (m)	% route that min width occurs	Peds/m/min (peds per minute divided by minimum width)	Fruin LOS	Capacity (peds/min)
Ref	A	B	C	D	E	F	G
1	TWAO	99	3.36	53%	29	B	111
2	LandSec, Option 1	99	3.68	78%	27	B	121
3	LandSec Option 1a	99	3.68	45%	27	B	121
4	LandSec Cut and Cover	99	3.36m	53%	29	B	111
5	LandSec, Option 2	99	3.36	5%	29	B	111

OBJ3/P4/A13

Transport and Works (Inquiries Procedure) Rules 2004

Proposed London Underground (Victoria Station Upgrade) Order

LAND SECURITIES PLC AND OTHERS (Objector No. 3)

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APPENDIX 13

ASSESSMENT OF PASSENGER MOVEMENT IN THE PAL

A13 ASSESSMENT OF PASSENGER MOVEMENT IN THE PAL

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		INDICATOR	TWAO OPTION		LANDSEC OPTION 1	
			Scenario 1	*Scenario 2*	*Scenario 1*	*Scenario 2*
Ref	A	B	C	D	E	F
1	North Escalators	Total Movements	34,954	25,883	17,674	23,792
2		Cross Path Movements	22,942	22,942	0	0
3		Cross Path Proportion	66%	89%	0%	0%
4		Merging Movements	14,153	14,153	0	0
5		Merging Movement Proportion	40%	55%	0%	0%
6	Central Interchange Escalators	Total Movements	17,224	25,320	31,872	25,754
7		Cross Path Movements	14,009	23,762	23,762	9,752
8		Cross Path Proportion	81%	94%	75%	38%
9		Merging Movements	8,210	16,305	12,770	8,210
10		Merging Movement Proportion	48%	64%	40%	32%
11	Combined Escalators	Total Movements	52,178	51,203	49,546	49,546
12		North / Central Split Proportion	67% / 33%	51% / 49%	36% / 64%	48% / 52%
13		Cross Path Movements	36,951	46,704	23,762	9,752
14		Cross Path Proportion	71%	91%	48%	20%
15		Merging Movements	22,363	30,458	12,770	8,210
16		Merging Movement Proportion	43%	59%	26%	17%

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INTRODUCTION

This note compares and assesses passenger movement in the Paid Area Link (PAL) of London Underground Limited's (LUL) Transport and Works Act Order TWAO scheme and the Land Securities (LandSec) alternative 'Option 1A' scheme.

The assessment is initially based on static analysis, with passengers assumed to make general routing decisions. The assessment is then developed further, with a LEGION microsimulation model constructed to reflect the potential conflicting movements along two critical interchange concourses.

Both the static modelling and the microsimulation modelling rely upon route choices that have been quantified using the 2016+20% interchange matrix for a 3 hour AM peak period, as outlined in Table 6.2 of the VSU PAL_SDG Arup Joint Report_31 July 2008. This interchange matrix is shown in Table 6 at the end of this note.

After describing the assumptions and likely route choices, this assessment then describes the different impacts at the top of the Northern Victoria Line escalator bank and the Central Interchange Concourses in terms of crossed path and merging movements between both the TWAO and LandSec Options. Assumptions are taken from Technical Appendix C 'Scheme Option Selection' of the Supplementary Environmental Statement (SES) as to likely route choice, and where certain route choices are unspecified in Technical Appendix C this note clearly outlines the assumptions made by SDG.

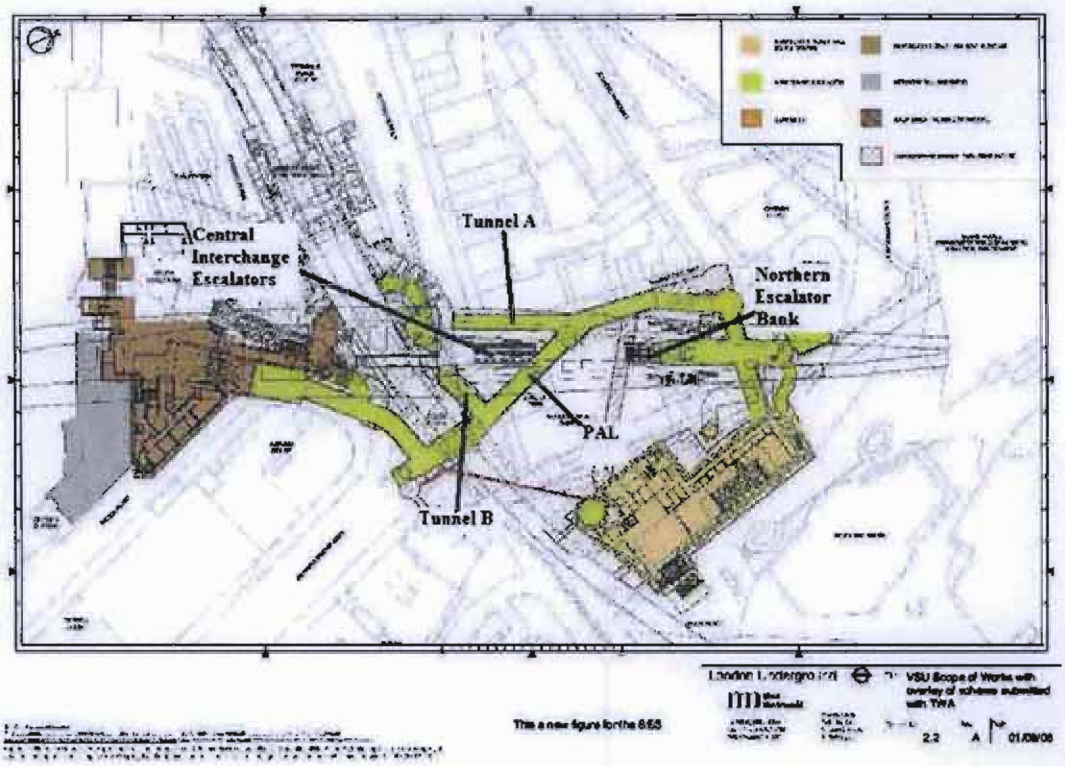
LUL TWAO PASSENGER MOVEMENT

Key Scheme Features

Appendix A (attached) shows the LUL TWAO scheme. The scheme features a PAL which follows a route to the west of the northbound Victoria Line tunnel, which lies directly underneath Allington Street. Halfway along Allington Street the PAL forks into two. The first link continues south towards Vauxhall Bridge Road. At this point, the PAL joins with infrastructure linking to the Westbound (WB) District & Circle (D&C) Line platform, and new escalators leading to the South Ticket Hall (STH) and Victoria Mainline Station (VMS). This tunnel links to the interchange concourse.

The second branch provides a dedicated link to and from the Eastbound (EB) D&C Line, referred to in the remainder of this note as 'Tunnel A'. There is also a key link between the Central Interchange Escalators and the PAL. This is referred to in this note as 'Tunnel B'. These are shown on Figure 0.

Figure 0 Key Scheme Features



Option Analysis Assumptions

For the purposes of both static and dynamic modelling in this note, there are six origin/destination points. These are D&C Line WB, D&C Line EB, D&C Ticket Hall (D&C TH), STH, Victoria Line platforms and North Ticket Hall (NTH).

The LUL TWAO scheme has been static modelled for eight different scenarios which concern the potential usage of Tunnel A and Tunnel B under normal operational conditions. Having such a high number of Scenarios ensures consistency with the assumptions outlined in Technical Appendix C of the SES, as well as exploring scenarios utilising potential operational flexibility.

The LUL TWAO scheme features six critical sections that feature a route choice for interchanging passengers. These are:

- Tunnel A - the connecting tunnel between the D&C EB and the PAL;
- North Escalator Bank – three sets between the Victoria Line platforms and the northern end of the PAL (which links to the NTH);
- Central Interchange Escalators – to/from the Victoria Line platforms;
- Tunnel B - link between the Central Interchange Escalators and the PAL;
- Southern Escalators – to/from the STH and the Victoria Line platforms; and
- PAL – the connecting tunnel between the STH and the North Escalator Bank

Details on the sections and the assumptions on which interchanging passengers will use them are outlined in Table 1 and shown in Figure 0.

SES Technical Appendix C makes the assumption that of passengers interchanging between the STH and the Victoria Line platforms (and vice-versa), 60% will use the existing southern escalators whilst 40% will be routed along the PAL. This assumption has been applied consistently across all of the scenarios in this note. Other assumptions from Technical Appendix C have also been applied in certain Scenarios, although some route choices are open to interpretation.

TABLE 1 LUL TWAO SCHEME INTERCHANGE ASSUMPTIONS (FOR ALL SCENARIOS)

Section	Assumption(s)	Interchanging Passengers
Tunnel A	A) 2 way B) One way northbound C) One way southbound D) Closed	0%-100% of EB D&C & D&C TH to Victoria Line and vice-versa depending on Scenario
North Escalators	Various	100% of Victoria Line to NTH and vice-versa; 20%-40% of STH to Victoria Line and vice-versa depending on Scenario 0%-100% of EB D&C & D&C TH to Victoria Line and vice-versa depending on Scenario
Central Interchange Escalators	Various	100% of Vic to D&C WB and vice-versa 0-20% of STH to Victoria Line and vice-versa 0%-100% of EB D&C & D&C TH to Victoria Line and vice-versa depending on Scenario
Tunnel B	A) Open B) Closed	0%-20% of STH to Victoria Line and vice-versa depending on Scenario
Southern Escalators	Consistent with Technical Appendix C of SES	60% of Vic to STH and vice-versa
PAL	Consistent with Technical Appendix C of SES	40% of Vic to STH and vice-versa

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TABLE 2 LUL TWAO SCHEME INTERCHANGE ASSUMPTIONS – LIST OF SCENARIOS ASSESSED

Scenario	Tunnel A	Tunnel B	Rationale
Scenario 1	2-way flow	Closed	Evaluates worst-case at top of northern escalators Maximises use of Tunnel A to assess value of providing this link within the scheme
Scenario 2	2-way flow	Open	Maximises use of Tunnel A to assess value of providing this link within the scheme but relieves some pressure at top of northern escalators
Scenario 3	1-way northbound only	Closed	Provides a more even split of passengers between central interchange concourse and top of northern escalators
Scenario 4	1-way northbound only	Open	Provides a more even split of passengers between central interchange concourse and top of northern escalators Consistent with assumptions outlined in Technical Appendix C
Scenario 5	1-way southbound only	Closed	Sensitivity Test for Scenario 3
Scenario 6	1-way southbound only	Open	Sensitivity Test for Scenario 4
Scenario 7	Closed	Closed	Evaluates worst-case on central interchange concourse
Scenario 8	Closed	Open	Sensitivity Test for Scenario 8

Option Layout Analysis

When assuming the route choices outlined in Table 1, there are potentially some operational benefits in implementing Tunnel A between the D&C EB and the PAL within this scheme. The link between the Central Interchange Escalators and the PAL, known as Tunnel B, is assumed in some Scenarios to be open to two-way flows, and it is assumed that 20% of the flow between the STH and the Victoria Line (and vice-versa) will use this Tunnel B. 20% of STH and Victoria Line flow is assumed to continue along the PAL to the northern escalator concourse Technical Appendix C of the SES assumes that both Tunnel B and the northern section of the PAL are available to passengers, and we have assumed the split of this to be 50/50.

LUL TWAO Scenario 1

Scenario 1 maximises the footfall along Tunnel A. Figures 1&2 show the likely movements at the northern escalators and the central interchange escalators based on the static modelling using the assumptions in Table 1. In accordance with standard London Underground practice it has been assumed in the assessment that pedestrians will keep to the left of tunnels and escalators.

Fig 1 LUL TWAO Northern Interchange Escalator Movements - Scenario 1

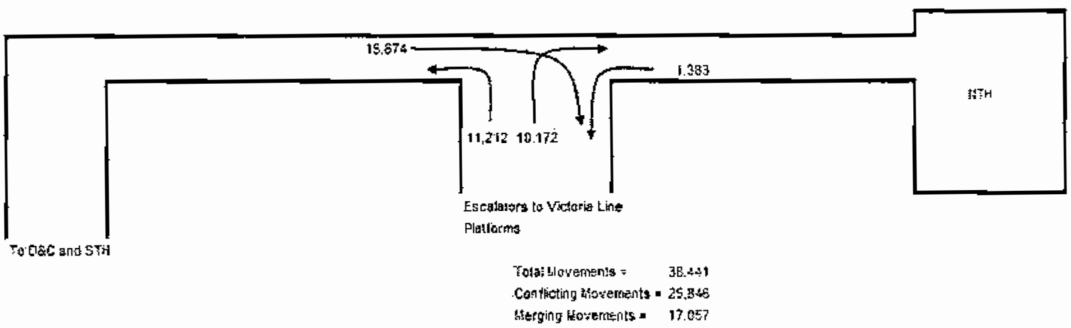
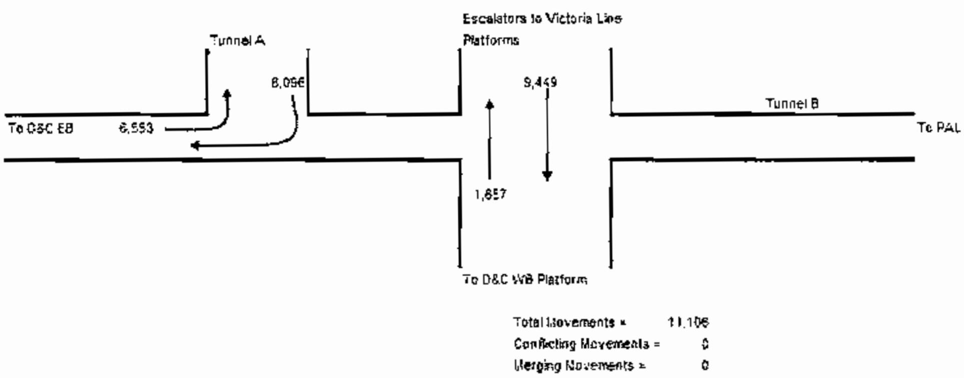


Fig 2 LUL TWAO Central Interchange Escalator Movements - Scenario 1



Maximising the movement along Tunnel A will have an impact on the Northern escalator bank. Figure 1 shows a total of 38,448 movements are likely to occur at this point. This equates to over 38% of all pedestrian movements through the station during the three hour morning peak.

By applying the 'walk on the left' assumption mentioned above, we can see that, in this scenario, the concourse at the top of northern escalators to the Victoria Line will have a total of 25,846 passengers with crossed (or conflicting) paths during the three hour morning peak. This equates for over 67% of all movements at the top of the northern escalators. Crossed path movements will cause an increase in journey times, and our dynamic modelling will help to quantify this increase.

Passenger demand flows will dictate that two escalators will need to go up and only one will go down, and there will be some 17,057 passengers using one escalator, all of which will be merging movements. Merging movements may also lengthen journey times, which will be explained in the analysis of the LEGION modelling later in the note.

By contrast, the central escalators will be far less used, with only 11,106 passengers using the three escalators. According to demand, two of the escalators should be set to travel up from the Victoria Line platforms, with one escalator heading down. By assuming that passengers will keep left, there will be no crossed path movements at this point during the three hour morning peak period. There are no merging movements at this point.

Fig 2 shows that a maximum of 8,096 passengers would walk southbound along Tunnel A, with 6,553 passengers heading northbound. The maximum total of 14,649 equates to just under 15% of all passenger movements within the station across the three hour AM peak period.

In this scenario, in total, 49,546 passengers will use either the northern escalators or the central interchange escalators. Of this total, 78% of passengers use the northern escalators, with the remaining 22% of passengers using the central interchange escalators. The distribution of interchanging passengers across the station is therefore heavily imbalanced in Scenario 1.

In Scenario 1, Tunnel A provides a bypass of the Central Escalators; however, this results in a more congested northern escalator bank, with some 25,846 crossed path movements. This is likely to have a detrimental impact on journey times through the station for interchanging passengers.

LUL TWAO Scenario 2

Scenario 2 is similar to Scenario 1 in that it maximises the footfall along Tunnel A. The difference is that Tunnel B is open in Scenario 2 which will relieve congestion on the northern escalators. This is also consistent with the assumptions in Technical Appendix C of the revised SES. Figures 3&4 show the likely movements at the northern escalators and the central interchange escalators based on the static modelling using the assumptions in Table 1. As with all Scenarios, in accordance with standard London Underground practice it has been assumed in the assessment that pedestrians will keep to the left of tunnels and escalators.

Fig 3 LUL TWAO Northern Interchange Escalator Movements - Scenario 2

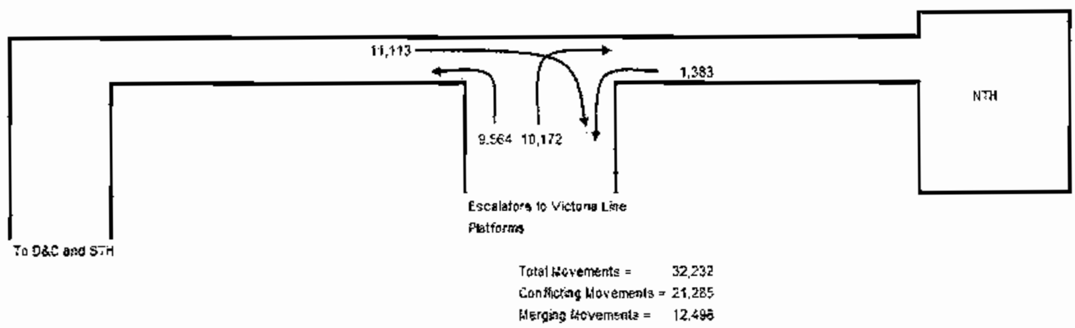
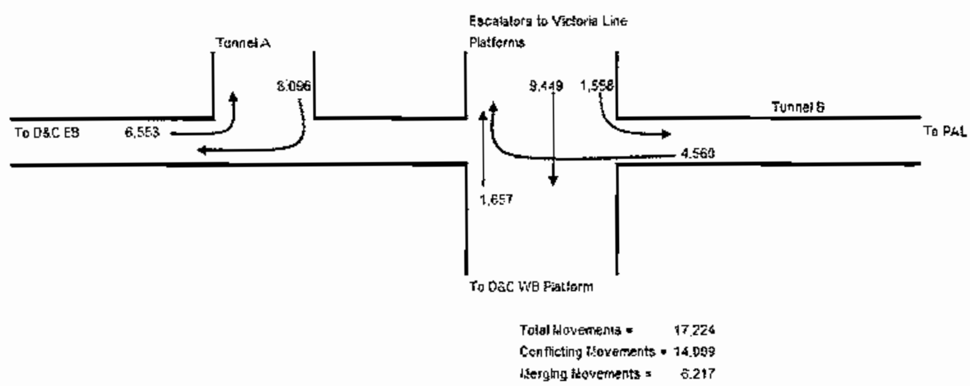


Fig 4 LUL TWAO Central Interchange Escalator Movements - Scenario 2



Maximising the movement along Tunnel A will have an impact on the Northern escalator bank, although opening Tunnel B will make this impact less than in Scenario 1. Figure 3 shows a total of 32,332 movements are likely to occur at this point. This equates to over 32% of all pedestrian movements through the station during the three hour morning peak.

By applying the 'walk on the left' assumption mentioned above, we can see that, in this scenario, the concourse at the top of northern escalators to the Victoria Line will have a total of 21,285 passengers with crossed (or conflicting) paths during the three hour morning peak. This equates for nearly 66% of all movements at the top of the northern escalators. Crossed path movements will cause an increase in journey times, and our dynamic modelling will help to quantify this increase.

Passenger demand flows will dictate that two escalators will need to go up and only one will go down, and there will be some 12,496 passengers using one escalator, all of which will be merging movements. Merging movements may also lengthen journey times, which will be explained in the analysis of the LEGION modelling later in the note.

By contrast, the central escalators will be far less used, with only 17,224 passengers using the three escalators. According to demand, two of the escalators should be set to travel up from the Victoria Line platforms, with one escalator heading down. As Tunnel B is open in Scenario 2, there will be some 14,099 crossed path movements at this point during the three hour morning peak period. 81% of all movements at the top of the central escalators will cross paths in Scenario 2. Additionally, there are 6,217 merging movements at this point, which may influence journey times.

Fig 4 shows that a maximum of 8,096 passengers would walk southbound along Tunnel A, with 6,553 passengers heading northbound. The maximum total of 14,649 equates to just under 15% of all passenger movements within the station across the three hour AM peak period.

In this scenario, in total, 49,546 passengers will use either the northern escalators or the central interchange escalators. Of this total, 65% of passengers use the northern escalators, with the remaining 35% of passengers using the central interchange escalators. The distribution of interchanging passengers across the station in Scenario 2 is therefore imbalanced, although less so than in Scenario 1.

In Scenario 2, Tunnel A again provides a bypass of the Central Escalators; resulting in a more congested northern escalator bank, with some 21,285 crossed path movements. This is likely to have a detrimental impact on journey times through the station for interchanging passengers, however less so than in Scenario 1.

LUL TWAO Scenario 3

Scenario 3 is different to Scenario 1 and Scenario 2 in that Tunnel A is made northbound only. This is consistent with the assumption in Technical Appendix C of the revised SES. Tunnel B is closed in Scenario 3 which will reduces the footfall on the Central interchange concourse. Figures 5&6 show the likely movements at the northern escalators and the central interchange escalators based on the static modelling using the assumptions in Table 1. As with all Scenarios, in accordance with standard London Underground practice it has been assumed in the assessment that pedestrians will keep to the left of tunnels and escalators.

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Fig 5 LUL TWAO Northern Interchange Escalator Movements - Scenario 3

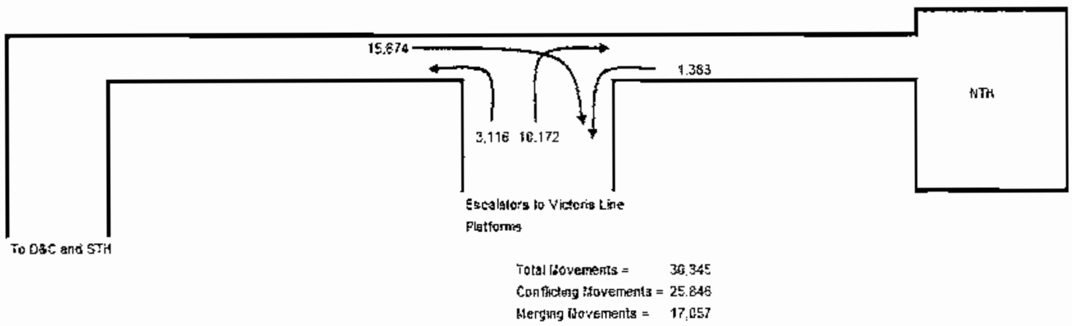
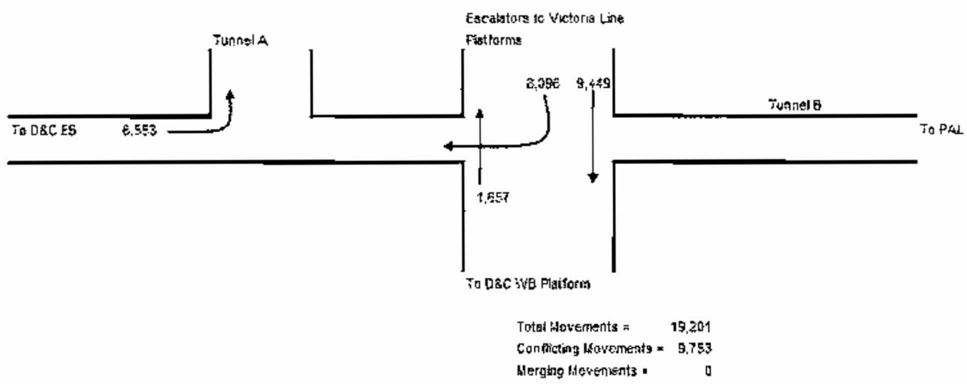


Fig 6 LUL TWAO Central Interchange Escalator Movements - Scenario 3



Permitting only northbound movement along Tunnel A will have a positive impact on the Northern escalator bank, in comparison to Scenario 1 and Scenario 2. Figure 5 shows a total of 30,345 movements are likely to occur at this point. This equates to over 30% of all pedestrian movements through the station during the three hour morning peak.

By applying the 'walk on the left' assumption mentioned above, we can see that, in this scenario, the concourse at the top of northern escalators to the Victoria Line will have a total of 25,846 passengers with crossed (or conflicting) paths during the three hour morning peak. This number is the same as in Scenario 1, however the percentage of crossed path movements at the top of the northern escalators is greater (85%) in Scenario 3 than in Scenario 1 (67%). Crossed path movements will cause an increase in journey times, and our dynamic modelling will help to quantify this increase.

Passenger demand flows will dictate that two escalators will need to go down and only one will go up, the reverse of Scenario 1 and Scenario 2. There will be some 13,228 passengers using one escalator. The 17,057 movements heading down to the Victoria Line platforms will need to merge, although merging on to two escalators is unlikely to be as detrimental in terms of journey time as merging onto one. The LEGION modelling later in this note describes the journey time variations.

The central escalators will be less used than the northern escalators, although more so than in Scenario 1 and Scenario 2. In Scenario 3, 19,201 passengers use the three escalators. According to demand, two of the escalators should be set to travel up from the Victoria Line platforms, with one escalator heading down. As Tunnel A is closed for southbound passengers, and Tunnel B closed altogether in Scenario 3, there will be some 9,753 crossed path movements at this point during the three hour morning peak period. 51% of all movements at the top of the central escalators will cross paths in Scenario 3.

Fig 6 shows that a maximum of 6,553 passengers would walk northbound along Tunnel A. This equates to under 7% of all passenger movements within the station across the three hour AM peak period.

In this scenario, in total, 49,546 passengers will use either the northern escalators or the central interchange escalators. Of this total, 61% of passengers use the northern escalators, with the remaining 39% of passengers using the central interchange escalators. The distribution of interchanging passengers across the station in Scenario 3 is therefore imbalanced, although less so than in Scenario 1 and Scenario 2.

LUL TWAO Scenario 4

Scenario 4 also models northbound flow only through Tunnel A. Tunnel B is open, which makes the option completely consistent with the assumption in Technical Appendix C of the revised SES. Figures 7&8 show the likely movements at the northern escalators and the central interchange escalators based on the static modelling using the assumptions in Table 1. As with all Scenarios, in accordance with standard London Underground practice it has been assumed in the assessment that pedestrians will keep to the left of tunnels and escalators.

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Fig 7 LUL TWAO Northern Interchange Escalator Movements - Scenario 4

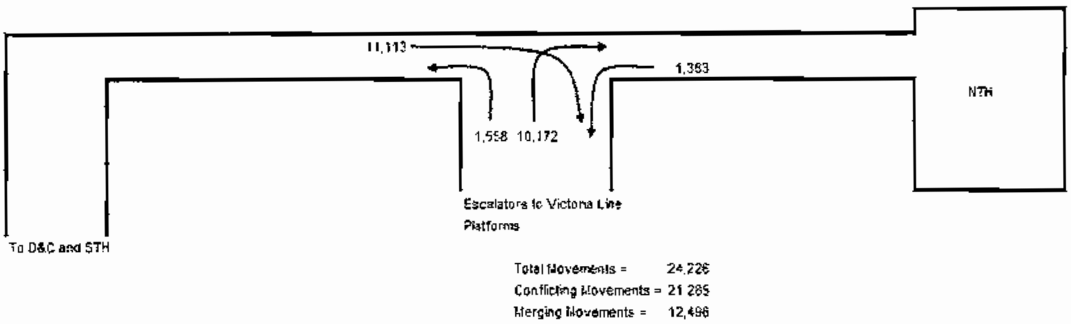
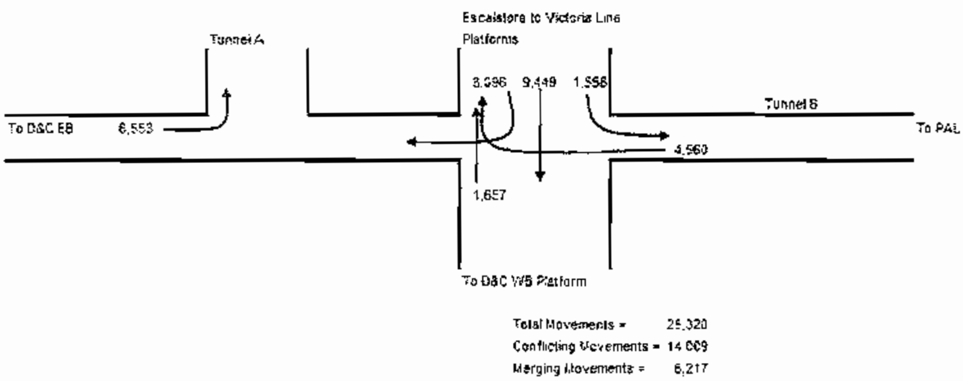


Fig 8 LUL TWAO Central Interchange Escalator Movements - Scenario 4



Permitting only northbound movement along Tunnel A will has a positive impact on the Northern escalator bank, in comparison to Scenario 1 and Scenario 2. This northern escalators are also less used as Tunnel B is open in Scenario 4. Figure 7 shows a total of 24,226 movements are likely to occur at this point. This equates to just over 24% of all pedestrian movements through the station during the three hour morning peak.

By applying the 'walk on the left' assumption mentioned above, we can see that, in this scenario, the concourse at the top of northern escalators to the Victoria Line will have a total of 21,285 passengers with crossed (or conflicting) paths during the three hour morning peak. This number is the same as in Scenario 2, however the percentage of crossed path movements at the top of the northern escalators is greater (88%) in Scenario 4 than in Scenario 2 (66%). Crossed path movements will cause an increase in journey times, and our dynamic modelling will help to quantify this increase.

Passenger demand flows will dictate that two escalators will need to go down and only one will go up, the reverse of Scenario 1 and Scenario 2. There will be some 11,730 passengers using one escalator. The 12,496 movements heading down to the Victoria Line platforms will need to merge, although merging on to two escalators is unlikely to be as detrimental in terms of journey time as merging onto one. The LEGION modelling later in this note describes the journey time variations.

The central escalators will be slightly more used than the northern escalators, which is not the case in Scenarios 1, 2 and 3. In Scenario 4, 25,320 passengers use the three escalators. According to demand, two of the escalators should be set to travel up from the Victoria Line platforms, with one escalator heading down. As Tunnel A is closed for southbound passengers, and Tunnel B open in Scenario 4, there will be some 14,009 crossed path movements at this point during the three hour morning peak period. 55% of all movements at the top of the central escalators will cross paths in Scenario 4, which is likely to have a detrimental effect on journey time.

Fig 8 shows that a maximum of 6,553 passengers would walk northbound along Tunnel A. This equates to under 7% of all passenger movements within the station across the three hour AM peak period.

In this scenario, in total, 49,546 passengers will use either the northern escalators or the central interchange escalators. Of this total, 49% of passengers use the northern escalators, with the larger 51% of passengers using the central interchange escalators. The distribution of interchanging passengers across the station in Scenario 4 is therefore balanced far more evenly than in Scenarios 1, 2 and 3.

LUL TWAO Scenario 5

Scenario 5 provides a sensitivity test to Scenario 3, with Tunnel A made southbound only. Tunnel B is closed in Scenario 5 which will reduces the footfall on the Central interchange concourse. Figures 9&10 show the likely movements at the northern escalators and the central interchange escalators based on the static modelling using the assumptions in Table 1. As with all Scenarios, in accordance with standard London Underground practice it has been assumed in the assessment that pedestrians will keep to the left of tunnels and escalators.

Fig 9 LUL TWAO Northern Interchange Escalator Movements - Scenario 5

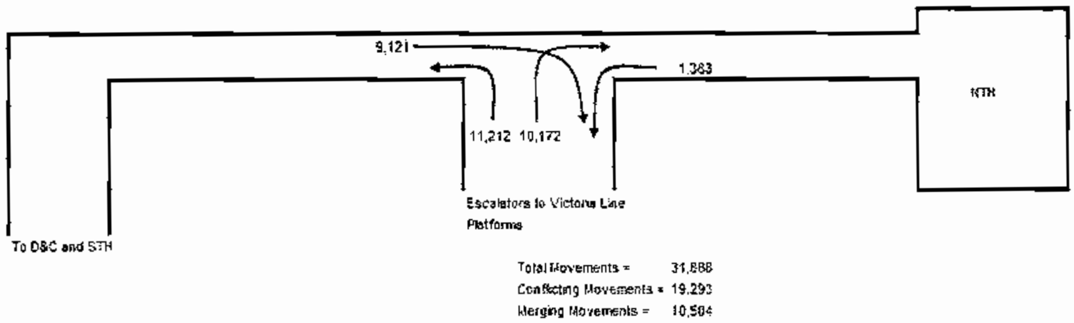
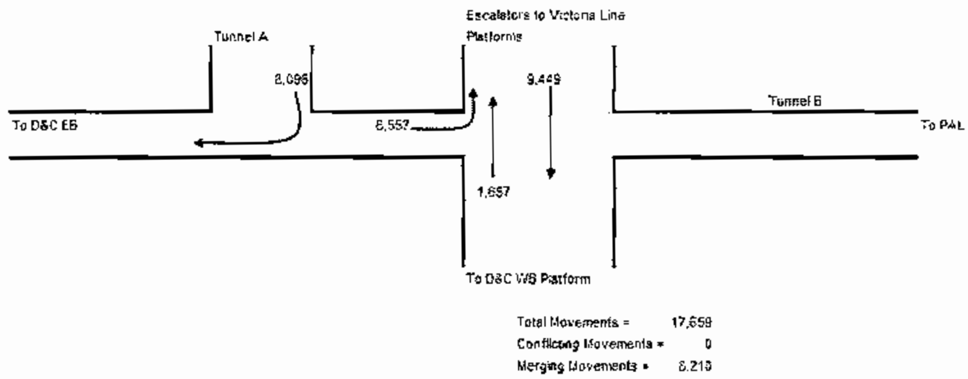


Fig 10 LUL TWAO Central Interchange Escalator Movements - Scenario 5



Permitting only southbound movement along Tunnel A will have a more negative impact on the Northern escalator bank, in comparison to Scenario 3 and Scenario 4. The number of interchanging passengers between the Victoria Line and the D&C lines (southbound) is greater than those passengers interchanging between the D&C lines and the Victoria Line (northbound). Figure 9 shows a total of 31,888 movements occurring at the top of the northern escalators. This equates to nearly 32% of all pedestrian movements through the station during the three hour morning peak.

By applying the 'walk on the left' assumption mentioned above, we can see that, in this scenario, the concourse at the top of northern escalators to the Victoria Line will have a total of 19,293 passengers with crossed (or conflicting) paths during the three hour morning peak. This equates to 61% of all movements at the top of the northern escalators.

Passenger demand flows will dictate that two escalators will need to go up and only one will go down, the reverse of Scenario 3 and Scenario 4. There will be some 10,504 passengers using one escalator. All of these movements heading down to the Victoria Line platforms will need to merge, which may be detrimental in terms of journey time. The LEGION modelling later in this note describes the journey time variations.

The central escalators will be less used than the northern escalators, although more so than in Scenario 1 and Scenario 2. In Scenario 5, 17,659 passengers use the three escalators. According to demand, two of the escalators should be set to travel up from the Victoria Line platforms, with one escalator heading down. As Tunnel A is closed for northbound passengers, and Tunnel B closed altogether in Scenario 5, there will be no crossed path movements at this point during the three hour morning peak period. There are, however, 8,210 merging movements on the one escalator heading down to the Victoria Line platforms, which may have a detrimental effect on journey time.

Fig 10 shows that a maximum of 8,096 passengers would walk southbound along Tunnel A. This equates to just over 8% of all passenger movements within the station across the three hour AM peak period.

In Scenario 5, in total, 49,546 passengers will use either the northern escalators or the central interchange escalators. Of this total, 64% of passengers use the northern escalators, with the remaining 36% of passengers using the central interchange escalators. The distribution of interchanging passengers across the station in Scenario 5 is therefore imbalanced, although less so than in Scenario 1 and Scenario 2.

LUL TWAO Scenario 6

Scenario 6 provides a sensitivity test to Scenario 4, with Tunnel A made southbound only. Tunnel B is open in Scenario 6 which will reduce the demand at the top of the northern escalators. Figures 11&12 show the likely movements at the northern escalators and the central interchange escalators based on the static modelling using the assumptions in Table 1. As with all Scenarios, in accordance with standard London Underground practice it has been assumed in the assessment that pedestrians will keep to the left of tunnels and escalators.

Fig 11 LUL TWAO Northern Interchange Escalator Movements - Scenario 6

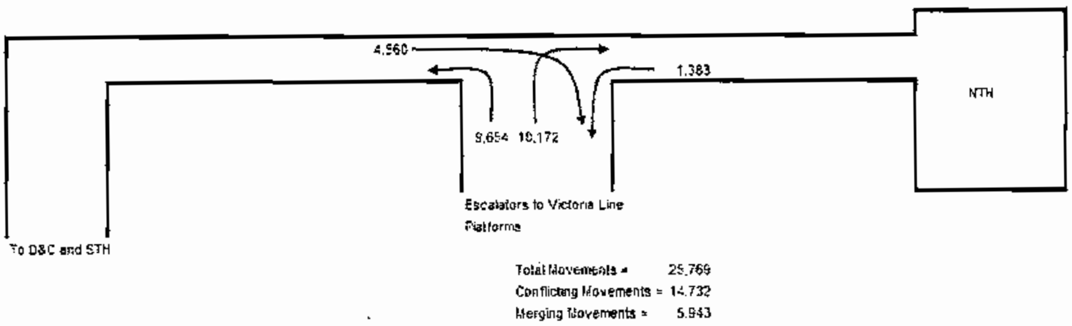
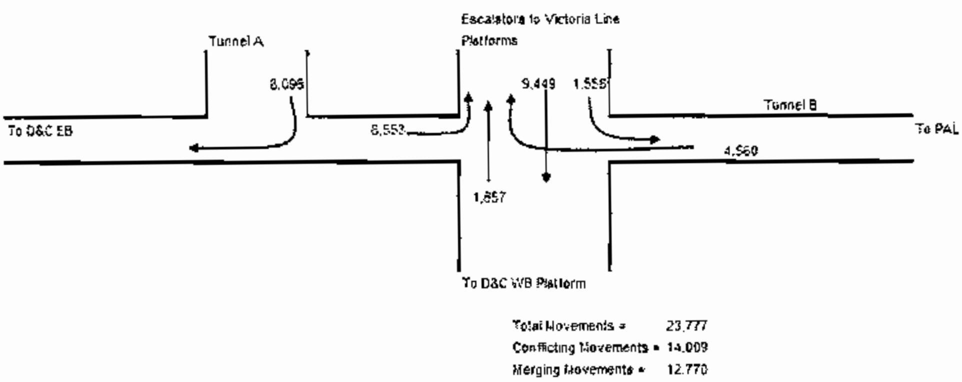


Fig 12 LUL TWAO Central Interchange Escalator Movements - Scenario 6



Permitting only southbound movement along Tunnel A will have a more negative impact on the Northern escalator bank, than is the case with Scenario 3 and Scenario 4. The number of interchanging passengers between the Victoria Line and the D&C lines (southbound) is greater than those passengers interchanging between the D&C lines and the Victoria Line (northbound). Figure 11 shows a total of 25,769 movements occurring at the top of the northern escalators. This equates to nearly 26% of all pedestrian movements through the station during the three hour morning peak.

By applying the 'walk on the left' assumption mentioned above, we can see that, in this scenario, the concourse at the top of northern escalators to the Victoria Line will have a total of 14,733 passengers with crossed (or conflicting) paths during the three hour morning peak. This equates to 57% of all movements at the top of the northern escalators. Crossed path movements will cause an increase in journey times, and our dynamic modelling will help to quantify this increase.

Passenger demand flows will dictate that two escalators will need to go up and only one will go down, the reverse of Scenario 3 and Scenario 4. Assuming an even split between the two up escalators, there is likely to be 9,913 passengers on each escalator in Scenario 6. As well as the crossed path movements, there will be some 5,944 merging passengers, which may be detrimental in terms of journey time. The LEGION modelling later in this note describes the journey time variations.

The central escalators will be used less than the northern escalators, although more so than in Scenario 1 and Scenario 2. In Scenario 6, 23,777 passengers use the three escalators. According to demand, two of the escalators should be set to travel down to the Victoria Line platforms, with one escalator coming up. This is the only Scenario where the demand down on the escalators is greater then the demand up. As Tunnel A is closed for northbound passengers, and Tunnel B open in Scenario 6, there will be 14,099 crossed path movements at this point during the three hour morning peak period. This equates to nearly 59% of all the movements at the top of the Central interchange concourse. In addition, there are 12,770 merging movements onto two escalators heading down to the Victoria Line platforms, which may have a detrimental effect on journey time.

Fig 12 shows that a maximum of 8,096 passengers would walk southbound along Tunnel A. This equates to just over 8% of all passenger movements within the station across the three hour AM peak period.

In Scenario 6, in total, 49,546 passengers will use either the northern escalators or the central interchange escalators. Of this total, 52% of passengers use the northern escalators, with the remaining 48% of passengers using the central interchange escalators. The distribution of interchanging passengers across the station in Scenario 6 is relatively evenly distributed across the station.

LUL TWAO Scenario 7

Scenario 7 provides a sensitivity test to all previous Scenarios, with Tunnel A and Tunnel B closed completely. Figures 13&14 show the likely movements at the northern escalators and the central interchange escalators based on the static modelling using the assumptions in Table 1. As with all Scenarios, in accordance with standard London Underground practice it has been assumed in the assessment that pedestrians will keep to the left of tunnels and escalators.

Fig 13 LUL TWAO Northern Interchange Escalator Movements - Scenario 7

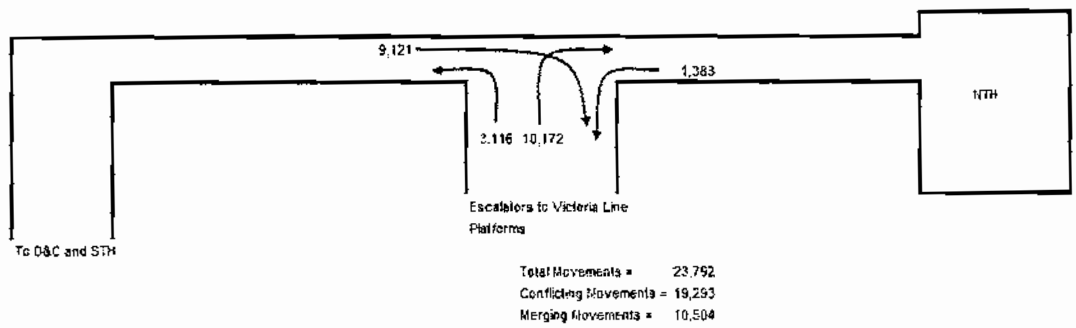
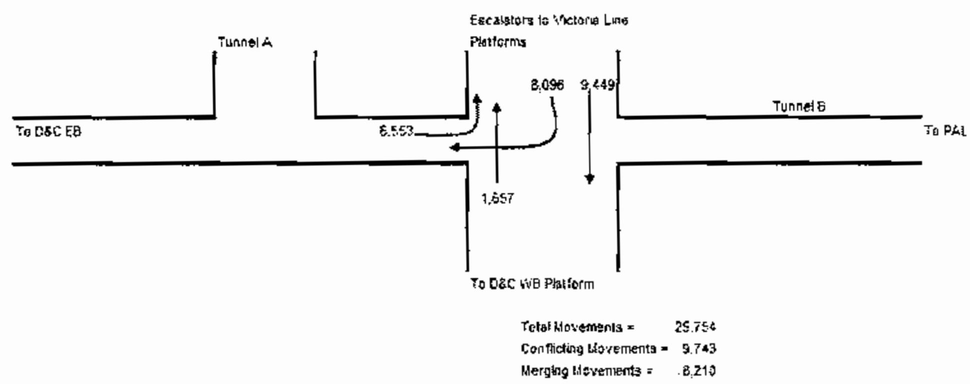


Fig 14 LUL TWAO Central Interchange Escalator Movements - Scenario 7



Closing Tunnel A and Tunnel B will relieve demand at the top of the northern escalators as all interchanging passengers from the D&C to the Victoria Line (and vice-versa) will be forced to use the central escalators, as is currently the case. Figure 13 shows a total of 23,792 movements occurring at the top of the northern escalators. This equates to under 24% of all pedestrian movements through the station during the three hour morning peak.

By applying the 'walk on the left' assumption mentioned above, we can see that, in this scenario, the concourse at the top of northern escalators to the Victoria Line will have a total of 19,293 passengers with crossed (or conflicting) paths during the three hour morning peak. This equates to 81% of all movements at the top of the northern escalators. Crossed path movements will cause an increase in journey times, and our dynamic modelling will help to quantify this increase.

Passenger demand flows will dictate that two escalators will need to go up and only one will go down, the reverse of Scenario 3 and Scenario 4. This means there will be 10,504 passengers merging onto one escalator, which may be detrimental in terms of journey time. The LEGION modelling later in this note describes the journey time variations.

The central escalators will be used more than the northern escalators, as is the case in Scenario 4. In Scenario 7, 25,754 passengers use the three escalators. According to demand, two of the escalators should be set to travel up from the Victoria Line platforms, with one escalator going down. As both

Tunnel A and Tunnel B are closed for passengers, there will be 9,753 crossed path movements at this point during the three hour morning peak period. This equates to less than 38% of all the movements at the top of the Central interchange concourse. In addition, there are 8,210 merging movements onto one escalator heading down to the Victoria Line platforms, which may have a detrimental effect on journey time.

In Scenario 7, in total, 49,546 passengers will use either the northern escalators or the central interchange escalators. Of this total, 52% of passengers use the central interchange escalators, with the remaining 48% of passengers using the northern escalators. The distribution of interchanging passengers across the station in Scenario 7 is relatively evenly distributed across the station.

LUL TWAO Scenario 8

Scenario 8 provides a sensitivity test to Scenario 7, with Tunnel A remaining closed. Tunnel B, however, is open in this Scenario. Figures 15&16 show the likely movements at the northern escalators and the central interchange escalators based on the static modelling using the assumptions in Table 1. As with all Scenarios, in accordance with standard London Underground practice it has been assumed in the assessment that pedestrians will keep to the left of tunnels and escalators.

Fig 15 LUL TWAO Northern Interchange Escalator Movements - Scenario 8

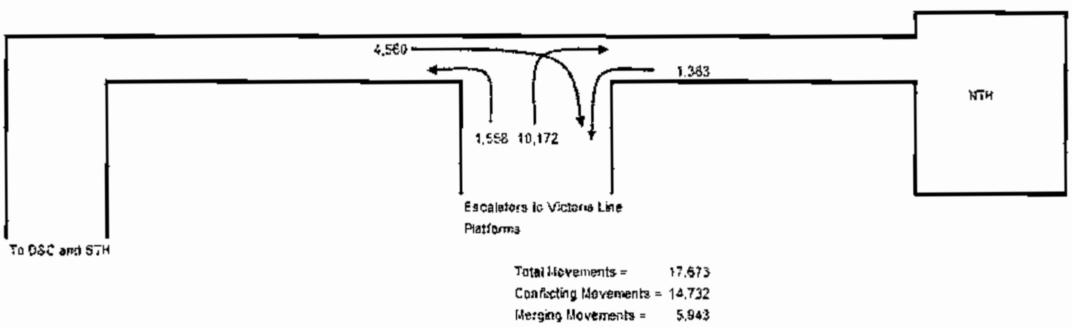
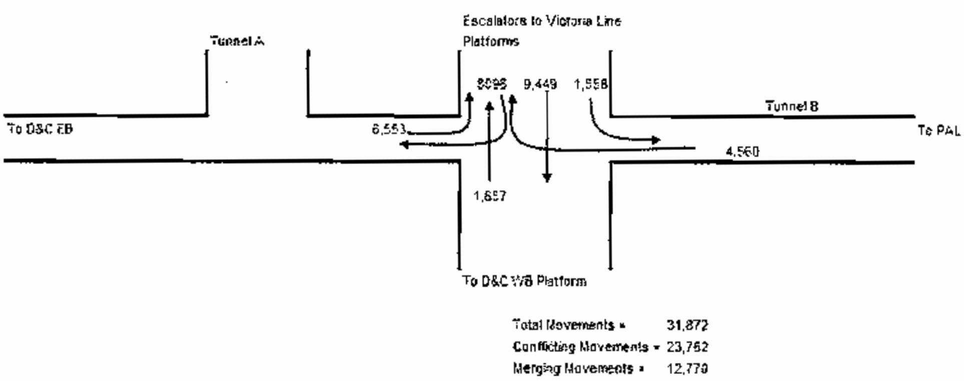


Fig 16 LUL TWAO Central Interchange Escalator Movements - Scenario 8



Closing Tunnel A but opening Tunnel B will relieve demand at the top of the northern escalators as all interchanging passengers from the D&C to the Victoria Line (and vice-versa) will be forced to use the central escalators, as is currently the case. Additionally, it is assumed that passenger interchanging between the STH and the Victoria Line platforms will be split between the north escalators and the central interchange concourse as Tunnel B is open in Scenario 8. Figure 15 shows a total of 17,674 movements occurring at the top of the northern escalators. This equates to under 18% of all pedestrian movements through the station during the three hour morning peak.

By applying the 'walk on the left' assumption mentioned above, we can see that, in this scenario, the concourse at the top of northern escalators to the Victoria Line will have a total of 14,733 passengers with crossed (or conflicting) paths during the three hour morning peak. This equates to 83% of all movements at the top of the northern escalators. Crossed path movements will cause an increase in journey times, and our dynamic LEGION modelling helps to quantify this increase.

Passenger demand flows will dictate that two escalators will need to go up and only one will go down. This means there will be 5,494 passengers merging onto one escalator, which may be detrimental in terms of journey time. However, the number of merging passengers in Scenario 8 compares favourably to all other Scenarios.

The central escalators will be used more than the northern escalators, as is the case in Scenario 4 and Scenario 7. In Scenario 8, 31,872 passengers use the three escalators. According to demand, two of the escalators should be set to travel up from the Victoria Line platforms, with one escalator going down. As Tunnel A is closed for passengers and Tunnel B is open in Scenario 8, there will be 23,762 crossed path movements at this point during the three hour morning peak period. This equates to more than 75% of all the movements at the top of the Central interchange concourse. In addition, there are 12,770 merging movements onto one escalator heading down to the Victoria Line platforms, which may have a detrimental effect on journey time.

In Scenario 8, in total, 49,546 passengers will use either the northern escalators or the central interchange escalators. Of this total, 64% of passengers use the central interchange escalators, with the remaining 36% of passengers using the northern escalators. The distribution of interchanging passengers across the station in Scenario 8 is imbalanced with high demand for the central interchange concourse. Scenario 8 is the only Scenario where the imbalance is weighted heavily in terms of demand for the central interchange concourse.

LANDSEC OPTION 1 LAYOUT

Key Scheme Features

The LandSec Option 1A scheme realigns the PAL from the north of the D&C underpass, turning fractionally east and running directly underneath Victoria Palace Theatre. The PAL then enters the basement of the Northern Ticket Hall from the western side of the Southern Ticket Hall, which ultimately links to the Northern Escalators from which the Victoria Line platforms can be accessed. Appendix B (attached) shows a plan of LandSec Option 1A.

LandSec Option 1A differs from the LUL TWAO in that there is no link between the EB D&C and the PAL (Tunnel A), and that the PAL links directly into the southern end of the NTH.

Option Analysis Assumptions

The LandSec Option 1A scheme is considered to have five sections that are crucial for interchanging passengers as they offer a route choice option.

- North Escalator Bank – three sets between the Victoria Line platforms and the northern end of the PAL (which in turn links to the NTH);
- Central Interchange Escalators – to/from the Victoria Line platforms;
- Tunnel B - link between the Central Interchange Escalators and the PAL;
- Southern Escalators – to/from the Victoria Line platforms; and
- PAL – the connecting tunnel between the STH and the northern escalator bank.

Details on the sections and the assumptions on which interchanging passengers will use them are outlined in Tables 3 and 4.

The LandSec Option 1A scheme has been static modelled for two different scenarios which concern the potential usage of Tunnel B under normal operational conditions. Scenario 1 assumes that Tunnel B is closed under normal operational circumstances, (comparable to Scenario 7 of the LUL TWAO scheme). Scenario 2 makes use of Tunnel B assuming that the tunnel will be open to two way pedestrian flows (consistent with the assumptions outlined in Technical Appendix C of the Supplementary Environmental Statement). The rationale behind Scenario 1 this is to maximise the effect of the PAL link and be consistent with one of the key objectives of the VSU project, namely to provide increase the numbers of passengers using the northern end of the Victoria Line platforms.

TABLE 3 LANDSEC OPTION 1A SCHEME ASSUMPTIONS (FOR BOTH SCENARIOS)

Section	Assumptions	Interchanging Passengers
North Escalators	Various	20-40% of Vic to STH and vice-versa; 100% of Vic to NTH and vice-versa
Central Interchange Escalators	Various	100% of D&C WB to Vic and vice-versa; 100% of D&C EB to Vic and vice-versa; 100% of D&C TH to Vic and vice-versa; 0%-20% of Vic to STH and vice-versa
Southern Escalators	Consistent with Technical Appendix C of SES	60% of Vic to STH and vice-versa;
Tunnel B	A) Open	0%-20% of Vic to STH and vice-versa

Section	Assumptions	Interchanging Passengers
	B) Closed	
PAL	Consistent with Technical Appendix C of SES	40% of Vic to STH and vice-versa

TABLE 4 LANDSEC OPTION 1A SCHEME INTERCHANGE ASSUMPTIONS – LIST OF SCENARIOS ASSESSED

Scenario	Tunnel B	Rationale
Scenario 1	Closed	Evaluates worst-case at top of northern escalators Makes greater use of the PAL and helps scheme objective of better utilisation of northern end of Victoria Line platforms
Scenario 2	Open	Evaluates worst case at top of central interchange concourse Consistent with assumptions in Appendix C of SES

Option Layout Comments

Without Tunnel A linking the PAL and the D&C EB platforms, there is likely to be increased usage of the central interchange escalators than in all of the TWAO scenarios with the exception of Scenario 7 and Scenario 8. This can be seen in Figs 17, 18, 19 and 20. Generally speaking, this impact is counterbalanced by having no crossed path movements at the top of the northern escalators.

LandSec Option 1A Scenario 1

Scenario 1 assumes that Tunnel B will be closed for pedestrian flows under normal operational circumstances. Tunnel B could be opened to allow greater operational flexibility in case of emergency, however by having the route open is unlikely to see the new northern escalators significantly used. Given that one of the key objectives for the VSU scheme is to see a greater number of passengers using the northern end of the Victoria Line platforms. Figures 17&18 show the likely movements at the northern escalators and the central interchange escalators based on the static modelling using the assumptions in Table 3 and Table 4.

Fig 17 LandSec Option 1 Northern Interchange Escalator Movements - Scenario 1

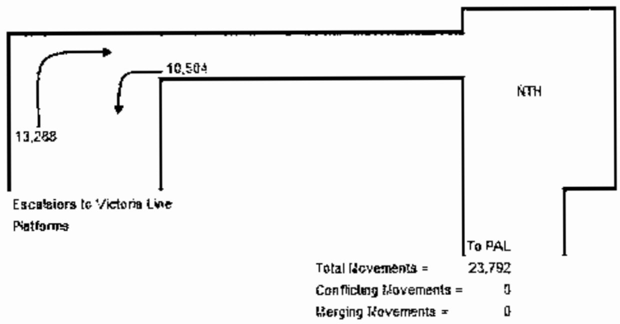


Fig 18 LandSec Option 1 Central Interchange Escalator Movements - Scenario 1

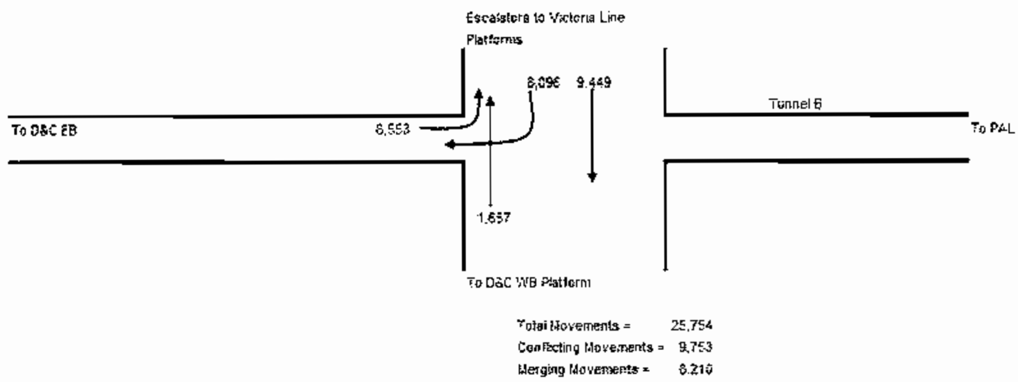


Figure 17 shows that the northern escalators are likely to see just two separate movements taking place. Neither of these movements will conflict, based on the assumption that on the London Underground passengers to walk on the left hand side of tunnels and escalators. A total of 23,792 movements are likely to occur at this point, which is just under 24% of all pedestrian movements through the station. Having no conflicts at this point is likely to have a positive effect on passenger journey times within the station. Similarly, the design of the northern escalator concourse will ensure that there are no merging movements taking place.

The escalators will be set with two heading up from the Victoria Line and one heading down. Then maximum flow on any one individual escalator will be 10,504 across the three hours of the AM peak.

Figure 18 shows the four movements occurring at the top of the Central Escalators in Scenario 1. In total, 25,754 movements are likely to take place here across the 3 hours of the AM peak. This accounts for around 26% of all movements through the station. Of these 25,754 movements, 9,753 will cross paths, if it is assumed that interchanging passengers will keep to the left of tunnels and escalators. This equates to around 38% of all movements conflicting. In addition, 8,210 movements are likely to merge from more than one direction. Both crossed path and merging movements are likely to have an effect on journey times, which is explained in greater detail later in this note using dynamic LEGION modelling.

The escalators will be set with two escalators coming up from the Victoria Line and one going down. The maximum flow on the down escalator will be 8,210 across the three hours of the AM peak.

In terms of the proportional distribution between the escalator banks, the north escalator bank takes 48% of all interchanging passengers whilst the central escalators take 52%, which represents a relatively even distribution between the two sets of escalators, and is likely to meet the scheme objective by increasing the number of people using the northern end of the Victoria Line platforms.

LandSec Option 1A Scenario 2

Scenario 2 assumes that Tunnel B will be open for two-way pedestrian flows, which is consistent with the assumption outlined in Technical Appendix C of the SES. Figures 18&19 show the likely movements at the top of the northern escalators and the central interchange escalators based on the static modelling using the assumptions in Table 3 and Table 4.

Fig 19 LandSec Option 1 Northern Interchange Escalator Movements - Scenario 2

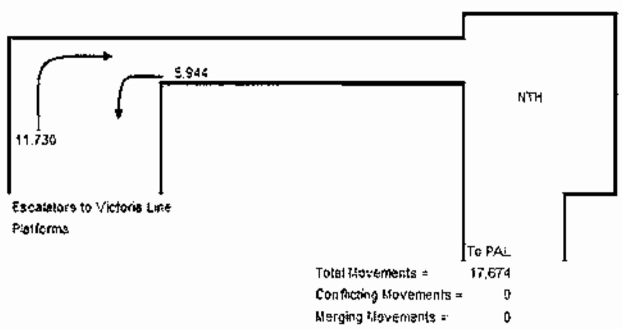


Fig 20 LandSec Option 1 Central Interchange Escalator Movements - Scenario 2

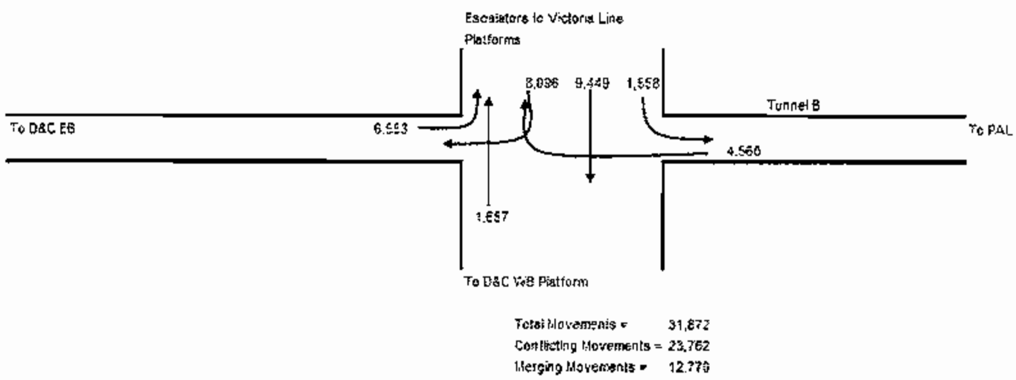


Figure 18 shows that the northern escalators are likely to see just two separate movements taking place. These movements will not conflict, based on the London Underground convention that passengers walk on the left hand side of tunnels and escalators. A total of 17,674 movements are likely to occur at this point, which is just under 18% of all pedestrian movements through the station. Having no crossed path movements at this point is likely to have a positive effect on passenger journey times within the station. As well as having no crossed path movements, there will be no passengers merging, which will, again, have a positive impact on journey times.

The escalators will be set with two heading up from the Victoria Line and one heading down. Then maximum flow on any one individual escalator will be 5,944 across the three hours of the AM peak.

Figure 19 shows the six movements occurring at the top of the Central Escalators in Scenario 2. In total, 31,872 movements are likely to take place here across the 3 hours of the AM peak. This accounts for around 32% of all movements through the station. Of these 31,872 movements, 23,762 will cross paths, if it is assumed that interchanging passengers will keep to the left of tunnels and escalators. This equates to around 75% of all movements in the central interchange concourse crossing paths with other movements. Additionally, there are likely to be some 12,770 merging movements at the central interchange concourse. These movements could have an impact on journey times.

The escalators will be set with two escalators coming up from the Victoria Line and one going down. The maximum flow on the down escalator will be 12,770 across the three hours of the AM peak.

In terms of the proportional distribution between the escalator banks, the north escalators take 36% of all interchanging passengers whilst the central escalators take 64%, which represents an uneven distribution between the two sets of escalators than in Scenario 1.

LANDSEC OPTION 2 LAYOUT

Key Scheme Features

LandSec Option 2 is very similar to the LUL TWAO option, with a slight difference to the alignment of the PAL between the Tunnel A and the northern escalators. Appendix C shows this scheme.

In terms of possible cross path and merging movements, Scenarios 1-8 also apply to the LandSec Option 2.

Conclusions

Of the LUL TWAO scheme, Scenario 4 represents the most favourable as the split between the northern escalators and the central escalator concourse is relatively even. There will be a number of conflicting movements at the top of both sets of escalators in Scenario 4, and our dynamic LEGION modelling will go into further detail on how this may impact passenger journey time.

In the LandSec Option 1A scheme, Scenario 1, which assumes Tunnel B is closed under normal operational circumstances, has an even balance between the northern and central escalators. Table 5 provides a summary of the differences in crossed path movements, merging movements and passenger distribution between the various schemes and scenarios, which shows the LandSec scheme to be the more preferable option than the TWAO scheme when measured against those criteria.

TABLE 5 SUMMARY TABLE OF CROSS PATH MOVEMENTS AND INTERCHANGE PASSENGER DISTRIBUTION BY OPTION/SCENARIO

PERFORMANCE INDICATOR		TWAO OPTION/LANDSEC OPTION 2								LANDSEC OPTION 1A	
		Scenario 1	*Scenario 2*	*Scenario 3*	*Scenario 4*	*Scenario 5*	*Scenario 6*	*Scenario 7*	*Scenario 8*	*Scenario 1*	*Scenario 2*
North Escalators	Total Movements	38,448	32,332	30,345	24,226	31,888	25,769	23,792	17,674	23,762	17,674
	Cross Path Movements	25,846	21,285	25,846	21,285	19,293	14,733	19,293	14,733	0	0
	Cross Path Proportion	67%	66%	85%	88%	61%	57%	81%	83%	0%	0%
	Merging Movements	17,057	12,496	17,057	12,496	10,504	5,944	10,504	5,944	0	0
	Merging Movement Proportion	44%	39%	56%	52%	33%	23%	44%	34%	0%	0%
Central Interchange Escalators	Total Movements	11,106	17,224	19,201	25,320	17,659	23,777	25,754	31,872	25,754	31,872
	Cross Path Movements	0	14,009	9,753	14,009	0	14,009	9,753	23,762	9,753	23,762
	Cross Path Proportion	0%	81%	51%	55%	0%	59%	38%	75%	38%	75%
	Merging Movements	0	6,217	0	6,217	8,210	12,770	8,210	12,770	8,210	12,770
	Merging Movement Proportion	0%	36%	0%	25%	46%	54%	32%	40%	32%	40%
Combined Escalators	Total Movements	49,546	49,546	49,546	49,546	49,546	49,546	49,546	49,546	49,546	49,546
	North / Central Split Proportion	78%/22%	65%/35%	61%/39%	49%/51%	64%/36%	52%/48%	48%/52%	36%/64%	48%/52%	36%/64%
	Cross Path Movements	25,846	35,294	35,599	35,294	19,293	28,742	29,046	38,495	9,753	23,762
	Cross Path Proportion	52%	71%	72%	71%	39%	58%	59%	78%	20%	48%
	Merging Movements	17,057	18,623	17,057	18,713	18,714	18,714	18,714	18,714	8,210	12,770
	Merging Movement Proportion	34%	38%	34%	38%	38%	38%	38%	38%	17%	26%

TABLE 6 2016+20% INTERCHANGE MATRIX (VSU PROPOSED UNDERGROUND INFRASTRUCTURE)

	From/To	Platforms				D&C		STH			NTH		Total
		D&C WB	D&C EB	Vic NB	Vic SB	Victoria St	Terminus Place	Wilton Rd	Mainline Entry	Mainline East	Bressenden	Vic St North	
Platforms	D&C WB	0	0	452	1,205	3,237	284	1,521	987	529	0	0	**8,213**
	D&C EB	0	0	4,001	1,576	3,732	327	1,753	1,138	609	0	0	**13,136**
	Vic NB	4,458	2,363	0	0	431	163	183	183	341	1,673	126	**10,591**
	Vic SB	4,991	2,374	0	0	2,007	758	856	856	1,585	7,787	586	**24,916**
D&C	Victoria St	593	426	239	17	0	0	0	0	0	0	0	**1,275**
	Terminus Place	312	224	671	48	0	0	0	0	0	0	0	**1,256**
STH	Wilton Road	501	360	588	35	0	0	0	0	0	0	0	**1,485**
	Mainline Entry	6,295	4,525	13,068	781	0	0	0	0	0	0	0	**24,669**
	Mainline East	3,227	2,319	7,860	469	0	0	0	0	0	0	0	**13,876**
NTH	Bressenden	0	0	1,213	73	0	0	0	0	0	0	0	**1,287**
	Vic St North	0	0	92	5	0	0	0	0	0	0	0	**97**
Total		**20,378**	**12,590**	**28,185**	**4,210**	**4,210**	**1,532**	**4,313**	**6,950**	**3,063**	**9,460**	**712**	**100,800**