



## This paper will be considered in public

### 1 Summary

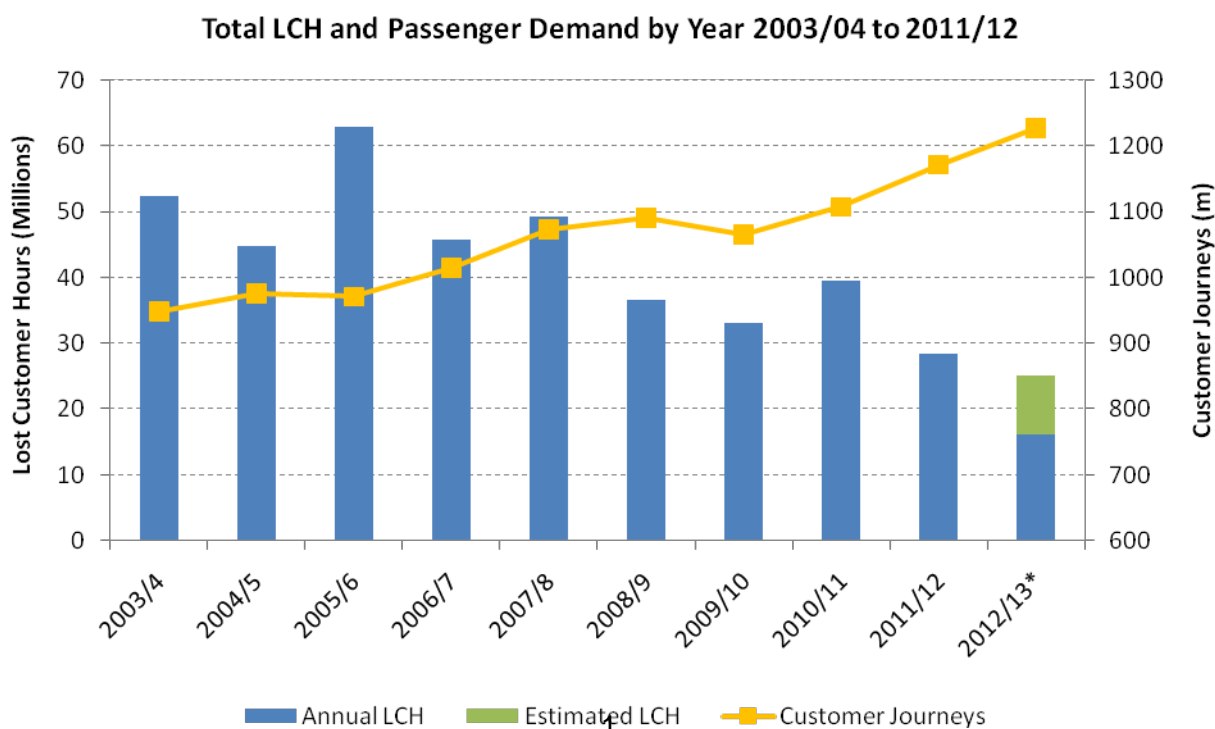
- 1.1 The purpose of this paper is to update the Board on the programme of work which has been developed by London Underground to improve reliability across the network by 30 per cent by the end of 2015 (compared to 2011).
- 1.2 On 15 November 2012, the Rail and Underground Panel considered a similar paper and acknowledged the approach being undertaken. This paper sets out at a high level the activities which will be delivered to achieve the 30 per cent target within the agreed time scales.

### 2 Recommendation

- 2.1 **The Board is asked to note the paper and approve the approach being taken.**

### 3 Background

- 3.1 Since 2003, London Underground's (LU) reliability has improved significantly while carrying ever increasing numbers of customers. In 2011/12 the network delivered its best ever levels of reliability of 28.4 million Lost Customer Hours (LCH) whilst delivering 1,171 million customer journeys, a record number. For reliability, this represents an improvement of more than 40 per cent when



\* Figures for 12/13 are based on P1-9 actuals and P11-13 estimates

compared to 2007/08.

- 3.2 In early 2012, the Mayor made a commitment to improve reliability by a further 30 per cent by the end of 2015, when compared to 2011. In 2011, reliability across the network, as measured by LCH, was 28.97 million. A 30 per cent improvement target means reducing LCH by a further 8.7 million by the end of 2015.
- 3.3 This programme of activities will be coordinated through the Reliability, Availability, Maintainability and Safety (RAMS) Programme, which was set up in 2011 by LU to focus on a systematic way of improving performance.

## 4 Current Activity

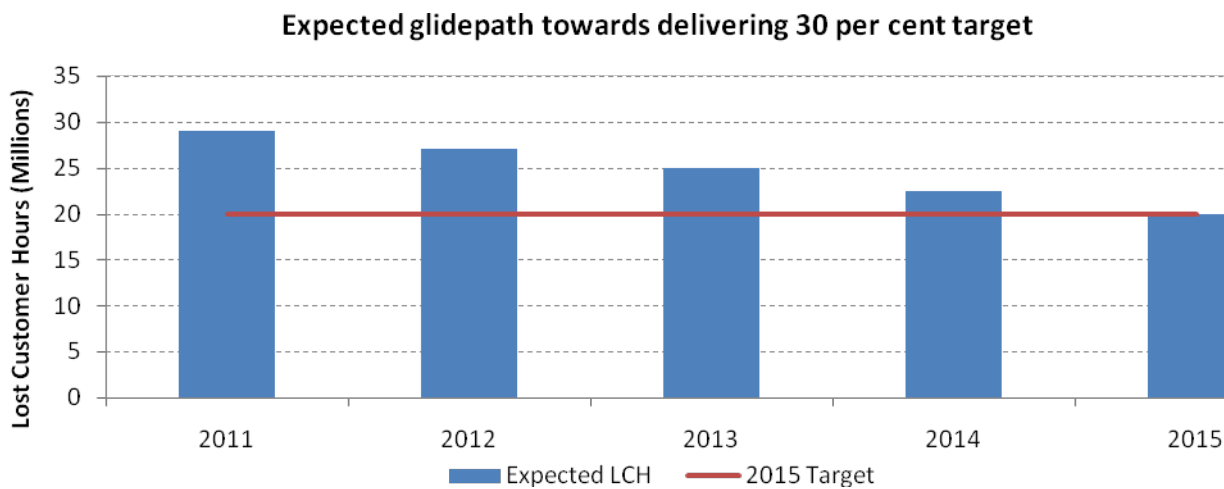
- 4.1 The approach taken to deliver improved reliability covers two core areas:
- (a) where specific focus is applied: 'Response and Recovery', 'Predict and Prevent' failures, and improved methods for bringing 'New Assets' into service; this approach is supported by people development and lessons learnt from others; and
  - (b) by detailed analysis of each line and a network wide approach to determine focus areas for reliability improvements.
- 4.2 Much of the work leading up to the London 2012 Games was on 'Response and Recovery', to provide additional resilience. Some of the headline initiatives within RAMS were:
- (a) **Line Reliability Meetings:** These meetings bring together all of the key functions of the organisation responsible for delivering improvements in reliability and keep a constant focus on day-to-day performance and longer term plans to ensure they are being delivered effectively across each line;
  - (b) **Emergency Response Unit (ERU) Blue Light initiative:** Working with the British Transport Police (BTP) in order to respond quickly to incidents, the BTP has provided officers on a 24/7 basis to help get ERU swiftly to where incidents are taking place under blue light conditions. The trial has reduced the average time travelling to site to 3.2 minutes per mile compared to pre-trial times of 6.5, resulting in an approximate 40,000 LCH reduction in delays during the trial. This initiative will become permanent once the trial concludes on 14 February 2013;
  - (c) **ERU Motorcycle to support spares delivery:** Alongside the Blue Light trial, members of the ERU provided motorcycle coverage to accelerate delivery to site of signalling spares. The trial concluded on 1 February 2013 and the recommendation is that the motorcycle capability be retained for urgent signalling spare deliveries.
  - (d) **BTP Medic Response:** To provide an enhanced response capability where medically trained BTP officers facilitate the appropriate treatment for people who become ill during their journey whilst taking into account other factors, such as large numbers of people stuck on trains in tunnels behind the

incident. To date, this one year trial has reduced delays by approximately 40,000 LCH, and will become a permanent part of how LU operates.

- (e) **Cable Theft Mitigation:** LU and the BTP created a task force to provide a visible deterrent and to ensure the return to normality as quickly as possible in the event of a cable theft by having crime scenes cleared. The task force has recovered over 214 exhibits, which has led to eight criminal convictions. Aerial support is deployed to support the task force as required.
  - (f) **Remote Condition Monitoring of Points:** LU has been rolling out remote monitoring equipment across 33 sites where M63 point machines operate on the network. This rollout will conclude by 29 March 2013. To date, approximately 150,000 LCH has been saved by using this technology to predict when point machines are developing a fault.
  - (g) **Further development of the LU Command and Control Centre,** which provides a point of accountability, ownership and clarity of protocols to minimise customer disruption and return the service to normal as soon as possible. The centre is on target to go live in Summer 2013.
  - (h) **Fitting covers to Passenger Emergency Alarms (PEAs)** on the Victoria, Jubilee, Northern and Piccadilly line fleets, to prevent accidental or malicious operation by customers have been completed. LCH due to inappropriate PEA operation has improved by an average of 90 per cent on all lines.
- 4.3 Across the whole organisation, the combined impact of detailed planning and preparation prior to the Games resulted in customers experiencing strong levels of performance – the best ever recorded. LU also witnessed a record number of passenger journeys across the network over the same period.
- 4.4 However, to build on all of the significant work to date and deliver the sustainable change in reliability required to meet the 30 per cent line improvements LU is focussed on how to better 'Predict and Prevent' failures from impacting on the service across assets, staff and customer areas.

## 5 Expected Forecast to 2015

- 5.1 The current LU plans, part of the Business Plan, are forecast to deliver around a 15 per cent LCH improvement by 2015, around 4.5 million LCH. The most substantial part of this reduction will come from improvements to signals, fleet and track assets but also from further staff and customer engagement.
- 5.2 To develop a programme built on the existing plans and to achieve the overall 30 per cent target, the approach has been to take a data driven systematic analysis approach into the principal causes of LCH at both a network and line level.
- 5.3 The figure below sets out expected forecast of LCH reduction leading up to 2015, which will deliver the required 30 per cent improvement in reliability. It should be noted that this forecast is based on current understanding of the proposed reliability projects, some of which are more mature in their development.



## 6 Planned Projects to Meet the Target

6.1 In terms of examining what can be done to reduce further LCH, at a network level and for each line, it is appropriate to group the lines into three different stages of asset maturity and where they are in their life cycle:

- (a) **Upgraded lines:** The Victoria and Jubilee lines: For these lines, emphasis is placed on seeking to extract the maximum possible performance benefits from both the new asset capability and capacity. To further enhance the performance, LU will also seek to positively influence customer behaviour particularly during peak periods. Close work with the supply chain will also be critical and many steps have been taken recently to ensure that suppliers have reliability at the heart of decision-making processes at all key stages including design, contract and deployment of new and upgraded assets into service. LU is now able to specify the desired reliability, from systems to discrete asset and also how it should be delivered onto the operational railway. This approach will also be applied to the Docklands Light Railway (DLR).
- (b) **Transition lines:** Northern and Sub Surface Lines (SSL), (District, Circle, Hammersmith & City and Metropolitan lines). The key focus for these lines is to ensure that levels of customer service are protected and enhanced whilst the core upgrade work is delivered. To achieve this, specific attention will be paid to the reliability and maintenance of life expired assets, whilst also incorporating key lessons learnt from both the Jubilee and Victoria line upgrade programmes.
- (c) **Legacy lines (those yet to be upgraded):** Bakerloo, Piccadilly, Central and Waterloo & City lines: The challenge for the legacy lines is to continue to deliver the required levels of customer service, whilst managing the risk of

performance degradation caused by the failure of ageing assets. To combat this problem, investment in the legacy lines prior to any major upgrade will continue to be targeted on the most vulnerable elements of each line. This will ensure that performance levels can be maintained, in line with rising levels of customer demand. The optimal solution for achieving that aim will involve a mixture of asset, staff and customer facing initiatives.

## **Assets**

- 6.2 The primary focus for the Asset work stream is on fleet, signalling and track systems, as these are the main contributors to LCH. The reliability improvement delivered since 2007/08 has been achieved by targeting the most prominent areas of concern and then applying a mix of renewal and replacement interventions. Delivering a significant step-change in the reliability of legacy assets to 2015 will present a range of challenges, because potential interventions can be costly and complex. On that basis, the merit of each initiative will be closely scrutinised to ensure a good reliability return on investment.
- 6.3 The new rolling stock on the Victoria and Metropolitan lines has seen a 50 per cent reduction in LCH associated with fleet failures. In addition to the new trains delivered on the Victoria line and those now being delivered on the SSL network (both of which have on board diagnostics), LU will deliver a series of reliability improvements to the Central and Piccadilly lines. For the Central line, the programme will aim to tackle major sources of unreliability that stem from power, electrical and train coupling components. The scale of potential customer benefit that can be achieved is estimated in the region of 3,500km worth of uplift to the fleet's Mean Distance Between Failures, coupled with a drop of 200,000 LCH per annum. Similarly, the Piccadilly line fleet will benefit from a programme of improvements to the traction package, the auxiliary power supply, a braking system upgrade and an overhaul of the communication systems. Customers on both lines will experience less service disruption due to the life extension works.
- 6.4 For signals, the reliability programme will focus on the installation of remote condition monitoring equipment on a range of assets including the machines that drive sets of track points, parts of the signalling systems and point heaters. New to 2013, the improvements currently being developed will be implemented to bring about further reliability improvements. Completion of this package of work will enable LU to migrate towards a predictive maintenance philosophy, where customer affecting asset failures can be intercepted before they occur. Network Rail has recently undertaken a trial on a similar initiative (Intelligent Infrastructure Programme) and has witnessed a 40 per cent improvement in the number of failures observed. The beneficial implication for LU infrastructure is currently being assessed, but is believed to be broadly comparable.
- 6.5 A further example of LU leveraging new technology is the trial of Wi-Fi head mounted cameras. The aim is to use this technology to send live video back to relevant experts to support faster fault diagnosis and rectification on asset failures.
- 6.6 For track, a comprehensive replacement programme, significantly improving the overall condition of the asset, continues to be delivered. This £200m programme has recently been ramped up to increase planned volumes on the Jubilee,

Northern and Piccadilly lines, a change that will take the total level of replacement to 50km between 2011 and 2015. The delivery of these works is critical as track condition underpins the performance of both trains and signalling equipment. Moreover, an estimated 50 per cent performance improvement is forecast to occur through the life of the renewed assets, as a direct result of this programme. As part of the renewals activity, modern and upgraded components will be installed, and these are designed to be significantly more resilient in their performance. New to 2013 the track programme will be complemented by investing £22m on an enhanced level of rail grinding; taking the current level of 70km per annum up to 150km. When delivered, this will reduce propagation of track defects and vastly reduce the number of service limiting temporary speed restrictions across the network.

- 6.7 An Automatic Track Monitoring System (ATMS) is being rolled out across the network providing the capability to continuously monitor track condition, via the use of in-service trains. The implementation of this technology allows real time understanding of track movement on the network, together with provision of synchronised automatic video and recording of noise and vibration levels underneath the train. The increased data and intelligence gathered enables LU to proactively identify track related defects and respond with targeted preventative maintenance. This helps to ensure that the service provided to customers is protected from the disruptive impact of failures. It is estimated ATMS will save approximately 100,000 LCH per annum.
- 6.8 A significant reliability benefit will be realised through the delivery of the upgraded SSL 'End State Track Layout' works, and although the majority of work is due to complete after 2015, some sites will be implemented earlier. For example, at Harrow-on-the-Hill, LU plan to renew historically unreliable points and crossings, to reduce the number of delays experienced by Metropolitan line customers. Post 2015, the new track formation and assets will be delivered at key central locations such as Edgware Road, Baker Street and Aldgate, thus benefiting an increased number of customers.
- 6.9 In respect of the wider core asset renewal programme, LU will look to adopt and install standardised asset designs and components where appropriate (for example, escalators). This will result in distinct financial benefits, which can be realised through a single joined up procurement approach. A reinvigorated focus will be placed on embedding reliability initiatives into commercial arrangements with LU suppliers, and the structure of new contracts will be designed in a way that enshrines the need for reliable products and services into any future procurement exercise. This will enable LU to become more effective in designing, procuring and integrating reliability within the supply chain.

### **Customer**

- 6.10 The programme will focus on improving LU's effectiveness in how it communicates with customers, clearly articulating ways in which they can help to support reliability improvement on the network. This will involve developing a more integrated, multi-channelled approach to explaining to customers how they can help to reduce delays in areas such as people falling ill on the train, the use of PEAs, boarding and alighting trains and litter.

- 6.11 LU also recognises that it must assist this drive where possible by reviewing the interface and interaction between assets and customers e.g. introduction of PEA covers on the Central and Bakerloo lines and possibly on the SSL. This initiative will build on the exceptional near 90 per cent improvement observed on the Jubilee, Northern and Piccadilly lines of accidental usage.
- 6.12 People falling ill on trains is the largest customer related factor causing delays, thus LU will look to improve the effectiveness of the response provided by staff already trained in first aid. To further improve how this problem is addressed, LU is making the current trial of BTP trained medics operating on the network permanent. New to 2013, there are plans to work with medical professionals at major London hospitals to explain the balance of risks to the ill customer with those travelling on the rest of the network (e.g. on crowded trains stopped in tunnels). The initiative will seek to provide information for use in hospital communications and LU would also make staff available to brief hospital staff as appropriate.
- 6.13 The programme will also review how LU staff can further help to reduce customer related delays to the service. This includes further development of the 'Station Assistant Train Services' role which, during the peaks, helps to keep busy trains moving and the overall system working effectively. A new trial is planned for 10 central London locations (including Oxford Circus, London Bridge, Victoria, King's Cross St. Pancras) and will analyse the impact of on-time departures. If the trial is successful in delivering reliability benefits to customers, it will be further rolled out to other key locations on the network.
- 6.14 In 2011, LU successfully installed litter bins on a number of below ground stations; there are currently 1,000 bins on the network. This programme will continue by improving the cleaning regime at stations and providing an additional 150-200 litter bins throughout the Underground, with the aim of reducing the number of delays caused by litter interfering with the operation of trains, track and signals.
- 6.15 Following the success of vastly improved signage, introduced during the Games, to aid movement around the network, LU is exploring the potential for further enhancements in visual signage at four key stations, King's Cross St. Pancras, Stratford, Paddington and London Bridge. The beneficial impact of improved signage enables smoother customer flow through stations and reduces congestion at potential hotspots.
- 6.16 In addition, TfL is developing a Travel Demand Management (TDM) programme that builds on the success of the London 2012 Get Ahead of the Games campaign. This campaign used marketing and communications to help customers avoid hotspot locations where crowding and delays were forecast at times of peak demand. TfL is currently working to identify hotspots where TDM can be applied to achieve reductions in crowding on trains and in stations. Stations already identified include London Bridge (whilst the National Rail redevelopment takes place) and Bank and also Clapham North, Clapham Common and Clapham South stations which experience congestion during peak times.

## Staff

- 6.17 LU staff have been critical in improving reliability performance across the network (including during the 2012 Games). To meet the reliability target, it will be imperative that TfL continues to develop interventions aimed at increasing the effectiveness of proactive and reactive staff behaviour. This is particularly important for members of staff who interface directly with customers and specific attention will be directed towards:
- (a) exploring new ways of working, utilising improved technology that will reduce delays and disruption to our customers;
  - (b) developing systems in support of the deployment of operational resources in a way that will maximise customer benefit at a local level and a network wide level, by sharing best practice and utilising technology opportunities;
  - (c) carrying out a review of any operational errors to learn from them, reduce their frequency and reduce their impact: and
  - (d) seeking to continue improving operational capability such that response to incidents is faster.

## Upgraded lines

- 6.18 **Victoria line:** January 2013 saw the introduction of a 33 trains per hour service on the line. This marked a significant milestone in the completion of the upgrade and delivered a capacity enhancement to the line, which in turn resulted in a faster, more frequent and reliable service for customers. The programme will now move to focus on areas where additional benefits can be realised by the new and upgraded assets.
- 6.19 The overall performance of the line will be examined, adopting a whole system approach to examine the interface of assets, staff, customers and supporting processes. Through that review, the major LCH contributing failures will be analysed down to their root cause level, with the aim of developing a targeted suite of reliability interventions and initiatives to systematically eradicate them. The current approach and future improvement programme will therefore seek to:
- (a) build on the progress already made to date to deal with reliability issues caused by the new sensitive edge door system on the new fleet of trains. LU will launch a specific initiative in 2013 to examine how best to eradicate delays caused by the operation of sensitive door edges on the new fleet, a major cause of LCH on the line. A range of potential solutions is currently being explored which include modifying the door system or possible installation of door performance monitoring equipment. The eventual solution will be shaped by the need to deliver the maximum possible benefit to customers and the biggest possible reduction in delays. In parallel, the programme will look to communicate with both staff and customers on the line, to ensure they interact with the assets to further enhance the benefits of any change; and



- (b) launch a feasibility study in 2013 to assess the reliability benefits of utilising Wi-Fi technology and installing remote condition monitoring equipment on the signalling system. This will further support the move towards a system of predictive maintenance across LU, where potential signal failures are automatically detected by new equipment, and remedied before they impact the service provided to customers. This would have a significant impact on the level of delays experienced on the line.

6.20 **Jubilee line:** the Jubilee line has now been upgraded and delivers faster, more reliable services for customers. It is consistently one of the best performing lines. To maximise the benefits that the upgrade has delivered we have identified the following additional steps:

- (a) extending the current signalling system to include all depots. This will enable train movements to be managed more efficiently and ensure that trains can be more easily introduced into service each day, thereby providing a more reliable service overall;
- (b) reduce the number of redundant secondary systems such as axle counters on the line. This will ensure increased availability of the signalling system, and result in fewer failures and delays for customers using the line;
- (c) migration to Wi-Fi signalling therefore moving away from existing wire based loops which are the communication system that enables a train to be tracked and managed on the Jubilee and Northern lines. These loops can be easily damaged and have the potential to stop the trains. By replacing them with a wireless system, the potential for damage and service delay is removed; and
- (d) remote condition monitoring of rolling stock and the signalling system will provide invaluable real time data on the performance of the assets. By monitoring key components. This intervention can significantly reduce the number of failures by enabling maintenance to be accurately targeted to condition and not time. A feasibility study is being progressed to determine the assets and components that would most benefit from being monitored.

6.21 **DLR:** The focus will initially be on delivering further significant improvements on fleet reliability through provision of enhanced maintenance activities and the development of more systematic approach to root cause analysis and elimination of failures. Also, given the DLR's franchising model, LU will incentivise the next franchisee more highly on reliability issues.

## **7 Delivering the 30 per cent reliability target**

7.1 Progress and performance will be closely managed and reviewed using the streamlined governance structure already in place as part of the RAMS programme. The LCH performance challenge will be allocated across LU directorates and feed into existing performance management processes with regular updates to the Mayor and the Rail and Underground Panel.

7.2 The LU Directors have agreed that there will be a senior executive assigned to and working with the line teams on a weekly basis. This is to support and drive the reliability improvements at across all parts of the system, Assets, Staff and Customer to deliver each lines contribution to the overall 30 per cent improvement. This will ensure that line specific LCH reduction remains the key day-to-day driver of decisions across each line.

**List of appendices to this paper:**

None

**List of Background Papers:**

None

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