# *Appendix J – Reliability Benefits*

# Lake Lothing Third

# Appendix E

# Crossing Reliability Report

**Lake Lothing Third Crossing, Lowestoft**

18 December 2015

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# Tables

# 1 Introduction

## 1.1 Overview

This document presents the results for the reliability analysis. It has been prepared on behalf of Suffolk County Council (SCC).

The term reliability refers to variation in journey times that individuals are unable to predict (journey time variability). Such variation could come from recurring congestion at the same period each day or from non-recurring events, such as incidents. It excludes predictable variation relating to varying levels of demand by time of day, day of week, and seasonal effects which travellers are assumed to be aware of.

Different methods to estimate reliability impacts have been developed for public transport and private vehicle trips on inter urban motorways and dual carriageways, urban roads, and other roads. All the methods require a unit to measure travel time variability and this is generally the standard deviation of travel time (for private travel) or lateness (for public transport)[1].

## 1.2 Methodology

Alternate routes are more readily available in urban areas than on motorways, allowing drivers to avoid incidents which can reduce capacity on a certain route.

In order to carry out the reliability study, the following pieces of information are necessary for each OD trip:

- Number of trips
- Distance
- Time

There are several variables, whose combination defines the total number of scenarios, as shown below.

[1] TAG Unit A1.3, Department for Transport (2014)

| VARIABLE | Description | number |
|---|---|---|
| Purposes | Business (car, lgv, hgv), commuting, other | 5 |
| Time intervals | AM pre, AM, AM post, IP, PM pre, PM, PM post, OP, WE | 9 |
| Time periods | 2020, 2035 | 2 |
| Scenarios | DM, DS | 2 |
| **Total Combinations** | | **180** |

*Table 1-1 Variables defining total number of scenarios*

To forecast changes in standard deviation of travel time from changes in journey time and distance:

$$\Delta\sigma_{ij} = \mathbf{0.0018}\left(\left(t_{ij}^{2}\right)^{\mathbf{2.02}} - \left(t_{ij}^{1}\right)^{\mathbf{2.02}}\right) d_{ij}^{\ -\mathbf{1.41}}$$

VOT = value of time (£/sec)

T = number of trips (1 = before improvement, 2 = after improvement)

t = journey time (s) (1 = before improvement, 2 = after improvement)

d = distance (km)

i,j = subscript denoting quantity from zone I to zone j[2]

The reliability ratio enables changes in variability of journey time to be expressed in monetary terms.

**VOR = Value of Time x Reliability Ratio**

The recommended value of the reliability ratio for all journey purposes by car is 0.8 (based on evidence compiled for a workshop arranged by the Netherlands Ministry of Transport).

The value of time (Pence per minute) is taken from the SATURN model, and its dependant on the variables listen in Table 1-1 above.

[2] TAG Unit A1.3, Department for Transport (2014)

| 2020 | | | | |
|---|---|---|---|---|
| **PURPOSE** | **USER CLASS** | **AM** | **IP** | **PM** |
| **Commuting** | **Car** | 15.05 | 14.94 | 14.75 |
| **Business** | **Car** | 51.07 | 49.95 | 49.11 |
| | **LGV** | 23.08 | 23.08 | 23.08 |
| | **HGV** | 23.38 | 23.38 | 23.38 |
| **Other** | **Car** | 18.99 | 19.74 | 20.36 |

*Table 1-2 Values of time for 2020 model*

| 2035 | | | | |
|---|---|---|---|---|
| **PURPOSE** | **USER CLASS** | **AM** | **IP** | **PM** |
| **Commuting** | **Car** | 19.93 | 19.81 | 19.60 |
| **Business** | **Car** | 67.79 | 66.48 | 65.21 |
| | **LGV** | 30.93 | 30.93 | 30.93 |
| | **HGV** | 31.33 | 31.33 | 31.33 |
| **Other** | **Car** | 24.52 | 25.45 | 26.40 |

*Table 1-3 Values of time for 2035 model*

The value of reliability can then be used to estimate the reliability benefit using the following formula:

$$\textbf{\textit{Reliability benefit}} = -\sum \Delta\sigma_{ij} \left(\frac{T_{ij}^{2}+T_{ij}^{1}}{2}\right) \times 0.8 \times VOT$$

It is then necessary to annualise these benefits for each time interval by using coefficients obtained from TUBA.

| | Time Interval | Factor |
|---|---|---|
| 1 | AM Pre | 251 |
| 2 | AM | 252 |
| 3 | AM post | 256 |
| 4 | IP | 1523 |
| 5 | PM pre | 254 |
| 6 | PM | 248 |
| 7 | PM post | 253 |
| 8 | Off Peak | 3036 |
| 9 | WE | 2688 |

*Table 1-4 Annualisation Factors*

# 2 Results

The total benefit is calculated for each purpose and time interval to establish the total benefit for the 2020 and 2035 scenarios, as can be seen in Table 2-1 below.

| | TIME INTERVAL | TRIPS/H | | BENEFIT/H [£] | | ANN FACTOR | BENEFIT/Y (£,000) | |
|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2035 | 2020 | 2035 | | 2020 | 2035 |
| 1 | AM PRE | 12,406 | 14,052 | 82 | 166 | 251 | 20,696 | 41,713 |
| 2 | AM | 17,828 | 20,249 | 369 | 1,648 | 252 | 92,879 | 415,208 |
| 3 | AM POST | 16,021 | 18,239 | 227 | 865 | 256 | 58,168 | 221,361 |
| 4 | IP | 15,035 | 17,697 | 517 | 1,789 | 1523 | 787,038 | 2,725,118 |
| 5 | PM PRE | 17,695 | 20,143 | 392 | 1,778 | 254 | 99,587 | 451,738 |
| 6 | PM | 19,085 | 21,639 | 818 | 2,766 | 248 | 202,913 | 685,987 |
| 7 | PM POST | 13,969 | 15,882 | 138 | 274 | 253 | 34,920 | 69,219 |
| 8 | OP | 3,132 | 3,697 | 20 | 32 | 3036 | 60,636 | 96,357 |
| 9 | WE | 7,143 | 8,435 | 41 | 72 | 2688 | 109,803 | 194,166 |
| | TOTAL | | | **2,604** | **9,390** | | **1,466,640** | **4,900,867** |

*Table 2-1 Total Benefits for each time interval*

Assuming a linear trend, the total benefit is calculated for each year between 2020 and 2035, as seen in Table 2-2. After 2035, the benefits is assumed flat, which is in line the TUBA fundamentals, where it follows similar assumptions.

| YEAR | BENEFITS/Y (£,000) | BENEFITS/Y (£,000) (2010 prices) | DISCOUNT RATE [%] |
|---|---|---|---|
| 2020 | 1,466,640 | 1,039,728 | 3.5 |
| 2021 | 1,695,588 | 1,161,386 | 3.5 |
| 2022 | 1,924,537 | 1,273,626 | 3.5 |
| 2023 | 2,153,485 | 1,376,947 | 3.5 |
| 2024 | 2,382,434 | 1,471,824 | 3.5 |
| 2025 | 2,611,382 | 1,558,710 | 3.5 |
| 2026 | 2,840,331 | 1,638,035 | 3.5 |
| 2027 | 3,069,279 | 1,710,214 | 3.5 |

| | | | |
|---|---|---|---|
| **2028** | 3,298,228 | 1,775,638 | 3.5 |
| **2029** | 3,527,176 | 1,834,681 | 3.5 |
| **2030** | 3,756,125 | 1,887,700 | 3.5 |
| **2031** | 3,985,073 | 1,935,036 | 3.5 |
| **2032** | 4,214,022 | 1,977,011 | 3.5 |
| **2033** | 4,442,970 | 2,013,935 | 3.5 |
| **2034** | 4,671,919 | 2,046,100 | 3.5 |
| **2035** | 4,900,867 | 2,073,787 | 3.5 |
| **2036** | 4,900,867 | 2,003,659 | 3.5 |
| **2037** | 4,900,867 | 1,935,902 | 3.5 |
| **2038** | 4,900,867 | 1,870,437 | 3.5 |
| **2039** | 4,900,867 | 1,807,186 | 3.5 |
| **2040** | 4,900,867 | 1,746,073 | 3.5 |
| **2041** | 4,900,867 | 1,687,027 | 3.5 |
| **2042** | 4,900,867 | 1,629,978 | 3.5 |
| **2043** | 4,900,867 | 1,574,858 | 3.5 |
| **2044** | 4,900,867 | 1,521,602 | 3.5 |
| **2045** | 4,900,867 | 1,470,147 | 3.5 |
| **2046** | 4,900,867 | 1,420,432 | 3.5 |
| **2047** | 4,900,867 | 1,372,398 | 3.5 |
| **2048** | 4,900,867 | 1,325,988 | 3.5 |
| **2049** | 4,900,867 | 1,281,148 | 3.5 |
| **2050** | 4,900,867 | 1,502,394 | 3 |
| **2051** | 4,900,867 | 1,458,635 | 3 |
| **2052** | 4,900,867 | 1,416,151 | 3 |
| **2053** | 4,900,867 | 1,374,904 | 3 |
| **2054** | 4,900,867 | 1,334,858 | 3 |
| **2055** | 4,900,867 | 1,295,979 | 3 |
| **2056** | 4,900,867 | 1,258,232 | 3 |
| **2057** | 4,900,867 | 1,221,584 | 3 |
| **2058** | 4,900,867 | 1,186,004 | 3 |
| **2059** | 4,900,867 | 1,151,460 | 3 |
| **2060** | 4,900,867 | 1,117,922 | 3 |
| **2061** | 4,900,867 | 1,085,362 | 3 |
| **2062** | 4,900,867 | 1,053,749 | 3 |
| **2063** | 4,900,867 | 1,023,057 | 3 |
| **2064** | 4,900,867 | 993,260 | 3 |
| **2065** | 4,900,867 | 964,330 | 3 |
| **2066** | 4,900,867 | 936,242 | 3 |
| **2067** | 4,900,867 | 908,973 | 3 |
| **2068** | 4,900,867 | 882,498 | 3 |
| **2069** | 4,900,867 | 856,794 | 3 |
| **2070** | 4,900,867 | 831,839 | 3 |

| | | | |
|---|---|---|---|
| **2071** | 4,900,867 | 807,611 | 3 |
| **2072** | 4,900,867 | 784,088 | 3 |
| **2073** | 4,900,867 | 761,251 | 3 |
| **2074** | 4,900,867 | 739,078 | 3 |
| **2075** | 4,900,867 | 717,552 | 3 |
| **2076** | 4,900,867 | 696,652 | 3 |
| **2077** | 4,900,867 | 676,361 | 3 |
| **2078** | 4,900,867 | 656,662 | 3 |
| **2079** | 4,900,867 | 637,536 | 3 |

*Table 2-2 Benefits by year*

The above table can be summarised as follows:

| PERIOD | BENEFITS (£,000) (2010 prices) |
|---|---|
| **2020** | 1,039,728 |
| **2020-2035** | 26,774,357 |
| **2020-2079** | 79,752,211 |

*Table 2-3 Total Benefits*

To summarise:

- The benefit calculated for the year 2020 is equal to £1.46 million considering a discount rate of 3.5% this value is equal to £1.03 million in 2010.
- The Benefit calculated for the year 2035 is equal to £4.9 million. Considering a discount rate of 3.5% this value is equal to £2.07 million in 2010. For the benefits we have assumed a linear trend between 2020 and 2035 and flat thereafter.
- The total benefit calculated for the 60 years (2020-2079) is equal to £79.75 million (2010 prices). It has used a discount rate of 3.5% from 2010 to 2049 and 3.0% from 2050 onwards.