NORTH EAST SCOTLAND FREIGHT FORUM

Wellington Road Traffic Signals - Before and After Journey Time Surveys

nestrans

ABERDEEN CITY COUNCIL

StratMoS

The Interreg IVB North Sea Region Programme

Prepared by: ..... Checked by: .....

Paul Finch
Associate Director

Andrew Robb
Graduate Consultant

Approved by: .....

Neil Halket
Regional Director

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First Floor, 499 Union Street, Aberdeen, AB11 6DB
Telephone: 01224 597450 Website: http://www.aecom.com

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Capabilities on project:
Transportation

Executive Summary

Commission
AECOM was commissioned by Aberdeen City Council, under the terms of the North East Transportation Framework Commission (Lot 1) to undertake before and after journey time surveys on Wellington Road. The work aims to assess the impact of revised traffic signal timings, which were designed to give an extended green time to freight vehicles at two signal controlled junctions on this route. This work forms part of the ongoing support provided by AECOM in the implementation of projects within Nestrans' Freight Action Plan. The traffic signal re-timing project, and its evaluation, also forms part of the Interreg IVB StratMoS demonstration project DP3. For this study, Streetwise Data Collection undertook the survey, with AECOM providing analysis and reporting.

Methodology
The journey time survey recorded a sample of vehicle registration numbers at two locations on Wellington Road, one 300m in advance of the signal controlled junctions at Greenbank Road and the second just prior to Hareness Road, some 500m after the second signal controlled junction.

At each location, tablet PCs were used to record a sample of vehicle registration plate details (the last 3 numbers/letters), and classified these per lane, and by vehicle type (Car and LGV, OGV1 and OGV2). The surveyors aimed to capture the majority of OGV1 and OGV2 vehicles, and aimed to capture a representative sample of cars/vans. Each entry was time stamped at the point at which the vehicle passed the surveyor. Through use of specialist software, journey times and journey speeds could be calculated for each successfully matched pair of observations.

Summary of Results
Analysis of the journey time data demonstrates that for the targeted traffic flows (southbound freight vehicles in the off peak period), measurable journey time savings have been achieved following the introduction of the signals re-timing project.

Across all vehicles, the mean journey time has reduced by 08 seconds, however average journey time savings of 09 seconds and 12 seconds per vehicle have been achieved for OGV1 and OGV2 vehicles respectively.

Summary of Mean Journey Time Changes (HH:MM:SS)

	Before Mean Journey Time	After Mean Journey Time	Mean Journey Time Improvement	Percentage Journey Time Improvement
All Vehicles	00:02:03	00:01:55	00:00:08	6.5%
Cars and LGVs	00:01:47	00:01:41	00:00:06	5.6%
OGV1	00:01:59	00:01:50	00:00:09	7.6%
OGV2	00:02:12	00:02:00	00:00:12	9.1%

Capabilities on project:
Transportation

1 Introduction

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1.1 Commission

AECOM was commissioned by Aberdeen City Council, under the terms of the North East Transportation Framework Commission (Lot 1) to undertake before and after journey time surveys on Wellington Road. The work aims to assess the impact of revised traffic signal timings, which were designed to give an extended green time to freight vehicles at two signal controlled junctions on this route. This work forms part of the ongoing support provided by AECOM in the implementation of projects within Nestrans' Freight Action Plan. The traffic signal re-timing project, and its evaluation, also forms part of the Interreg IVB StratMoS demonstration project DP3.

For this study, Streetwise Data Collection undertook the survey, with AECOM providing analysis and reporting.

1.2 Background to Study

Wellington Road (A956) has been identified from previous work as being a key freight corridor for the city and surrounding areas. It links the main trunk road from the south of Aberdeen (A90) to the principal industrial estates in the area, Aberdeen Harbour, the City Centre, and forms one of two North-South through routes for HGVs in Aberdeen. Southbound (out of the city) the route is uphill, with two signal controlled junctions located on uphill gradients, at Craigshaw Drive and Greenbank Road. Whilst the route is dual carriageway in these locations, HGVs suffer a disproportionate journey time disadvantage if they do not proceed through these junctions on the green phase, due to having to make a standing start on a gradient. Due to the high volume of commuter flows on the route, the extended green time for HGVs is only being activated during off-peak periods.

The signals project was developed so as to detect HGVs approaching these two junctions, and if appropriate, extend the green time allocated to that movement, thus increasing the proportion of HGVs that can proceed through the junctions without having to stop. The signalling work was completed during Mid March 2011.

1.3 Structure of Report

The following chapter details the methodology for the surveys, whilst Chapter 3 presents the key results from the surveys.

An Appendix presents a series of cumulative frequency journey time charts for different categories of vehicle.

2 Survey Methodology

2.1 Survey Period

The pre-works journey time survey was undertaken on Tuesday 01 March 2011, and the post works survey undertaken on Tuesday 29 March 2011. On both occasions, the weather was fine and sunny, and there were no road works or other traffic incidents affecting traffic at the survey location.

On both days, the surveys were undertaken between 0930 – 1200, and 1330 – 1600.

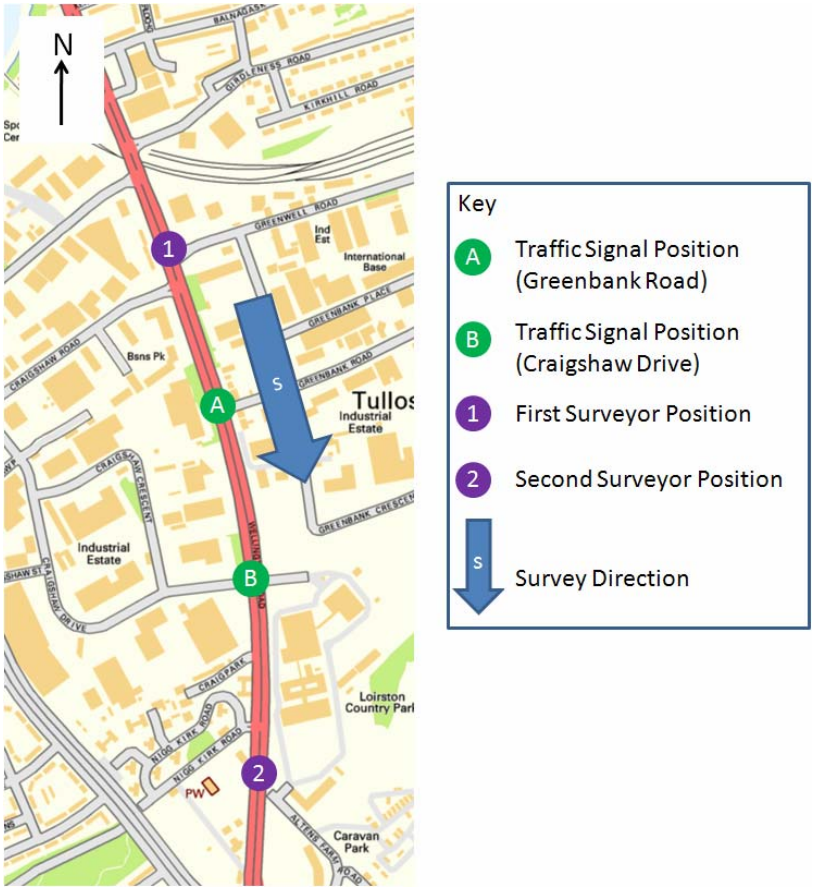
2.2 Survey Methodology

The journey time survey recorded a sample of vehicle registration numbers at two locations:

- One 300m in advance of the signal controlled junction at Greenbank Road; and
- The second just prior to Hareness Road, some 500m after the second signal controlled junction.

The locations of the signalised junctions and the locations where the surveyors were stationed are shown in Figure 2.1 below.

Figure 2.1 – Survey Location



Capabilities on project:
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At each location, tablet PCs were used to record a sample of vehicle registration plate details (the last 3 numbers/letters), and classified these per lane, and by vehicle type (Car and LGV, OGV1 and OGV2). The surveyors aimed to capture the majority of OGV1 and OGV2 vehicles, and captured the representative sample of cars (silver cars were sampled). Each entry was time stamped at the point at which the vehicle passed the surveyor.

Through use of specialist software, journey times and journey speeds could be calculated for each successfully matched pair of observations. The two surveys were undertaken according to plan, yielding a representative sample of journey times within each vehicle category.

Survey results were presented in Excel Format by the survey company Streetwise, which enabled further analysis of the journey time results by AECOM.

Prior to analysis, the journey time results were checked and verified, with a small number of journey times being removed from the data sets, as the times were outwith the feasible range of journey times that would be expected (less then 50 seconds, greater than 5 minutes). This would indicate either-

- registration plate mis-match;
- vehicles stopping en-route other than at the traffic junctions; or
- vehicles travelling significantly slower than the vast majority of other vehicles.

In each of these cases, retention of these measurements would alter the comparison of before and after data sets.

3 Survey Results

3.1 Journey Time Analysis

The before and after journey times were analysed in the following categories:

- All vehicles, AM only, PM only, AM and PM survey combined;
- Cars and LGVs, AM only, PM only, AM and PM survey combined;
- OGV1, AM only, PM only, AM and PM survey combined; and
- OGV2, AM only, PM only, AM and PM survey combined.

OGV1s and OGV2s were classified as per the following definitions, which are presented in the UK's Design Manual for Roads and Bridges. It is noted that Buses and Coaches (PSVs) were not included within the survey.

Commercial vehicle (cv)	cv class*	cv category
	Buses and Coaches	PSV
	2-axle rigid	OGV1
	3-axle rigid	
	3-axle articulated	OGV2
	4-axle rigid	
	4-axle articulated	
	5-axle articulated	
	6 (or more) -axle articulated	

* Classed by axles in contact with the road
PSV = Public Service Vehicle
OGV = Other Goods Vehicle

For each data set, the following details were calculated for the valid data set:

- Number of valid results – confirms the sample size;
- Minimum journey time and Maximum journey time – confirms the data range;
- Mean journey time – provides an arithmetic average journey time;
- Median journey time – confirms the middle point of the journey time distribution;
- 85th percentile speed of the speed distribution;
- Standard deviation of data set – measures spread of data around the mean;
- Mean + 1 x Standard Deviation – 84% of the journey times would be forecast be within this limit; and
- Mean + 2 x Standard Deviation – 97.5% of the journey times would be forecast to be within this limit.

In addition, percentage cumulative frequency distribution charts have been produced for all vehicles, Cars and LGVs, OGV1, and OGV2, which have been presented in the Appendix to the report.

3.2 Survey Results

Table 3.1 – All Vehicles – Journey Times (hh:mm:ss)

	Sample	Min	Max	Mean	Median	85th %	SD	Mean+1SD	Mean+2SD
AM Before	216	00:00:54	00:04:20	00:02:05	00:02:06	00:02:43	00:00:40	00:02:45	00:03:25
AM After	197	00:00:53	00:03:45	00:01:56	00:01:55	00:02:38	00:00:39	00:02:35	00:03:15
Change		00.00.01	00:00:35	00:00:09	00:00:11	00:00:05	00:00:01	00:00:10	00:00:10
PM Before	209	00:00:53	00:03:57	00:02:00	00:01:55	00:02:46	00:00:38	00:02:38	00:03:16
PM After	213	00:00:52	00:03:31	00:01:54	00:01:45	00:02:40	00:00:40	00:02:34	00:03:14
Change		00:00:01	00:00:26	00:00:06	00:00:10	00:00:06	-00:00:02	00:00:04	00:00:02
All Before	425	00:00:54	00:04:20	00:02:03	00:02:01	00:02:44	00:00:39	00:02:42	00:03:21
All After	410	00:00:52	00:03:45	00:01:55	00:01:49	00:02:38	00:00:40	00:02:34	00:03:14
Change		00:00:02	00:00:35	00:00:08	00:00:12	00:00:06	-00:00:01	00:00:08	00:00:07

Taking all vehicle types, it can be seen that the two sets of survey data reveal:

- A decrease in the absolute range of the data;
- A decrease in the mean journey time of 08 seconds;
- A decrease in the median journey time of 12 seconds;

- A decrease in the 85th percentile speed of 06 seconds;
- A slight increase in the SD of the distribution of 01 second; and
- Decreases in the vehicle speeds that would fall within 1 and 2 SD's of the mean of 08 seconds and 07 seconds respectively.

Table 3.2 – Cars and LGVs – Journey Times (hh:mm:ss)

	Size	Min	Max	Mean	Median	85th %	SD	Mean+1SD	Mean+2SD
AM Before	51	00:00:54	00:03:30	00:01:46	00:01:42	00:02:21	00:00:39	00:02:25	00:03:04
AM After	19	00:00:56	00:03:45	00:01:43	00:01:27	00:02:20	00:00:46	00:02:29	00:03:16
Change		-00:00:02	-00:00:15	00:00:03	00:00:15	00:00:01	-00:00:07	-00:00:04	-00:00:08
PM Before	51	00:00:56	00:03:57	00:01:48	00:01:41	00:02:24	00:00:35	00:02:23	00:02:58
PM After	30	00:00:57	00:02:56	00:01:39	00:01:33	00:02:17	00:00:35	00:02:14	00:02:49
Change		-00:00:01	00:01:04	00:00:09	00:00:23	00:00:07	00:00:00	00:00:09	00:00:09
All Before	102	00:00:54	00:03:57	00:01:47	00:01:40	00:02:23	00:00:37	00:02:24	00:03:01
All After	49	00:00:56	00:03:45	00:01:41	00:01:33	00:02:19	00:00:39	00:02:20	00:02:59
Change		-00:00:02	00:00:12	00:00:06	00:00:07	00:00:04	-00:00:02	00:00:04	00:00:02

Taking cars and LGVs, it can be seen that the two sets of survey data reveal:

- A decrease in the absolute range of the data;
- A decrease in the mean journey time of 06 seconds;
- A decrease in the median journey time of 07 seconds;
- A decrease in the 85th percentile speed of 04 seconds;
- A slight increase in the SD of the distribution of 02 seconds; and
- Decreases in the vehicle speeds that would fall within 1 and 2 SD's of the mean of 04 seconds and 02 seconds respectively.

As would be expected, the journey times for cars and LGVs are less than for all traffic.

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Table 3.3 – OGV1 – Journey Times (hh:mm:ss)

	Size	Min	Max	Mean	Median	85th %	SD	Mean+1SD	Mean+2SD
AM Before	67	00:00:58	00:03:13	00:01:59	00:02:01	00:02:27	00:00:32	00:02:31	00:03:03
AM After	58	00:00:55	00:03:03	00:01:50	00:01:47	00:02:31	00:00:37	00:02:27	00:03:04
Change		00:00:03	00:00:10	00:00:09	00:00:14	-00:00:04	-00:00:05	00:00:04	-00:00:01
PM Before	57	00:00:54	00:03:19	00:01:59	00:01:52	00:02:47	00:00:38	00:02:37	00:03:15
PM After	60	00:00:52	00:03:00	00:01:51	00:01:48	00:02:32	00:00:36	00:02:26	00:03:02
Change		00:00:02	00:00:19	00:00:08	00:00:04	00:00:09	00:00:02	00:00:11	00:00:13
All Before	124	00:00:54	00:03:19	00:01:59	00:01:58	00:02:37	00:00:35	00:02:34	00:03:09
All After	118	00:00:52	00:03:03	00:01:50	00:01:48	00:02:32	00:00:36	00:02:27	00:03:03
Change		00:00:02	00:00:16	00:00:09	00:00:10	00:00:05	-00:00:01	00:00:07	00:00:07

Taking OGV1s, it can be seen that the two sets of survey data reveal:

- A decrease in the absolute range of the data;
- A decrease in the mean journey time of 09 seconds;
- A decrease in the median journey time of 10 seconds;
- A decrease in the 85th percentile speed of 05 seconds;
- A slight increase in the SD of the distribution of 01 seconds; and
- Decreases in the vehicle speeds that would fall within 1 and 2 SD's of the mean of 07 seconds.

Table 3.4 – OGV2 - Journey Times (hh:mm:ss)

	Size	Min	Max	Mean	Median	85th %	SD	Mean+1SD	Mean+2SD
AM Before	98	00:00:58	00:04:20	00:02:18	00:02:20	00:02:55	00:00:42	00:02:59	00:03:41
AM After	120	00:00:53	00:03:32	00:02:00	00:02:07	00:02:39	00:00:39	00:02:40	00:03:19
Change		00:00:05	00:00:48	00:00:18	00:00:13	00:00:16	00:00:03	00:00:19	00:00:22
PM Before	101	00:01:01	00:03:27	00:02:07	00:02:02	00:02:50	00:00:38	00:02:46	00:03:24
PM After	123	00:00:54	00:03:31	00:01:59	00:01:50	00:02:47	00:00:42	00:02:41	00:03:23
Change		00:00:07	-00:00:04	00:00:08	00:00:12	00:00:03	-00:00:04	00:00:05	00:00:01
All Before	199	00:00:58	00:04:20	00:02:12	00:02:12	00:02:53	00:00:40	00:02:53	00:03:33
All After	243	00:00:53	00:03:32	00:02:00	00:01:57	00:02:46	00:00:41	00:02:40	00:03:21
Change		00:00:05	00:00:48	00:00:12	00:00:15	00:00:07	-00:00:01	00:00:13	00:00:12

Taking OGV2s, it can be seen that the two sets of survey data reveal:

- A decrease in the absolute range of the data;
- A decrease in the mean journey time of 12 seconds;
- A decrease in the median journey time of 12 seconds;
- A decrease in the 85th percentile speed of 07 seconds;
- A slight increase in the SD of the distribution of 01 seconds; and
- Decreases in the vehicle speeds that would fall within 1 and 2 SD's of the mean of 13 seconds and 12 seconds respectively.
- Considering the maximum journey times, it can be seen that a reduction of 48s was achieved across both data sets, although this maximum journey time saving relates to comparisons of single lorry movements which is not necessarily statistically robust.

With OGV2s being a particular target of the project, it is notable that the survey results show measurable reductions in the maximum journey times, mean journey times and median journey times for this vehicle category.

3.3 Summary

Analysis of the journey time data demonstrates that for the targeted traffic flows (southbound freight vehicles in the off peak period), measurable journey time savings have been achieved following the introduction of the signals re-timing project.

Across all vehicles, the mean journey time has reduced by 08 seconds, however average journey time savings of 09 seconds and 12 seconds per vehicle have been achieved for OGV1 and OGV2 vehicles respectively.

Table 3.5 – Summary of Mean Journey Time Changes (HH:MM:SS)

	Before Mean Journey Time	After Mean Journey Time	Mean Journey Time Improvement	Percentage Journey Time Improvement
All Vehicles	00:02:03	00:01:55	00:00:08	6.5%
Cars and LGVs	00:01:47	00:01:41	00:00:06	5.6%
OGV1	00:01:59	00:01:50	00:00:09	7.6%
OGV2	00:02:12	00:02:00	00:00:12	9.1%

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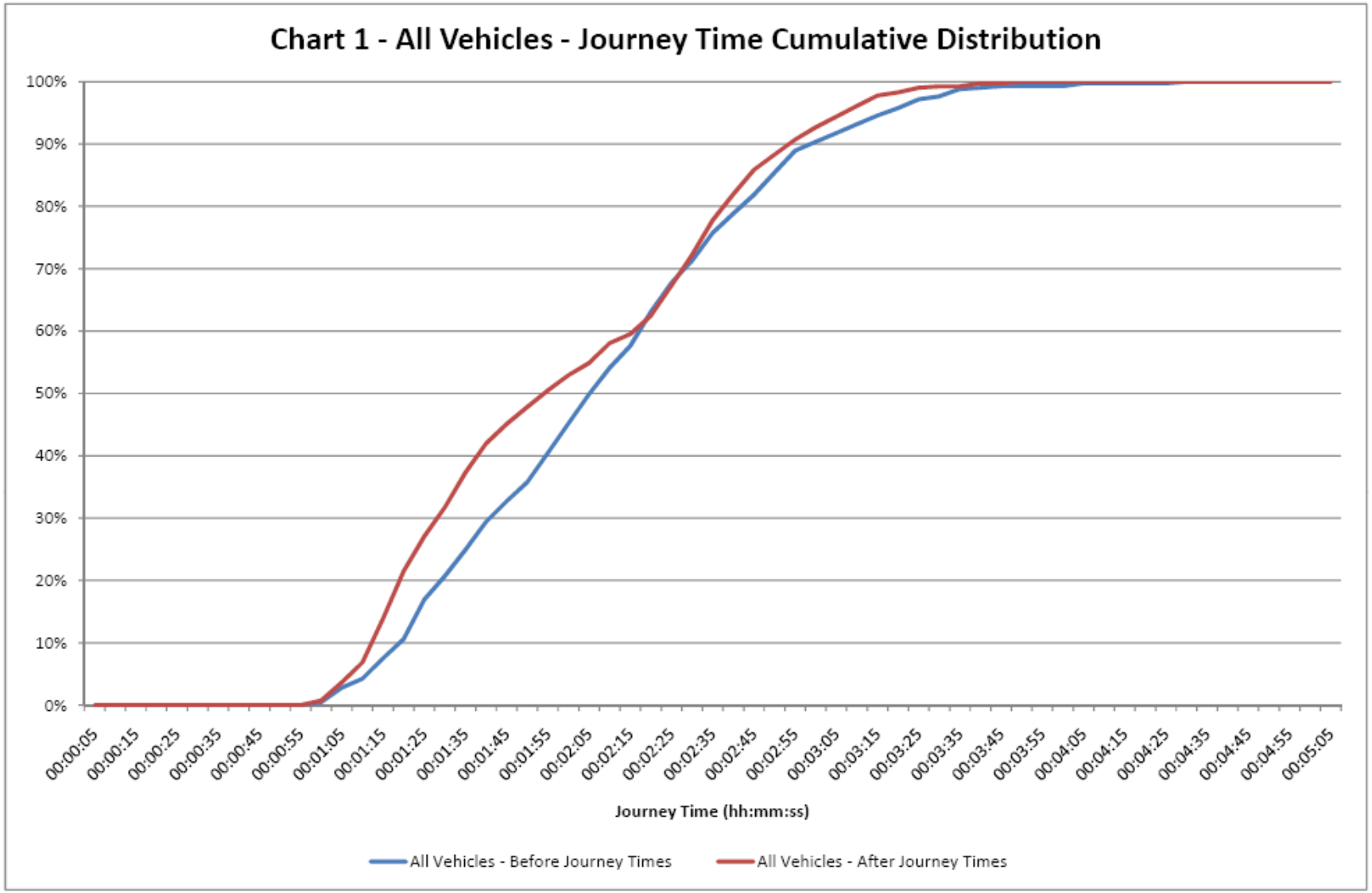
Appendix – Frequency Distribution Charts



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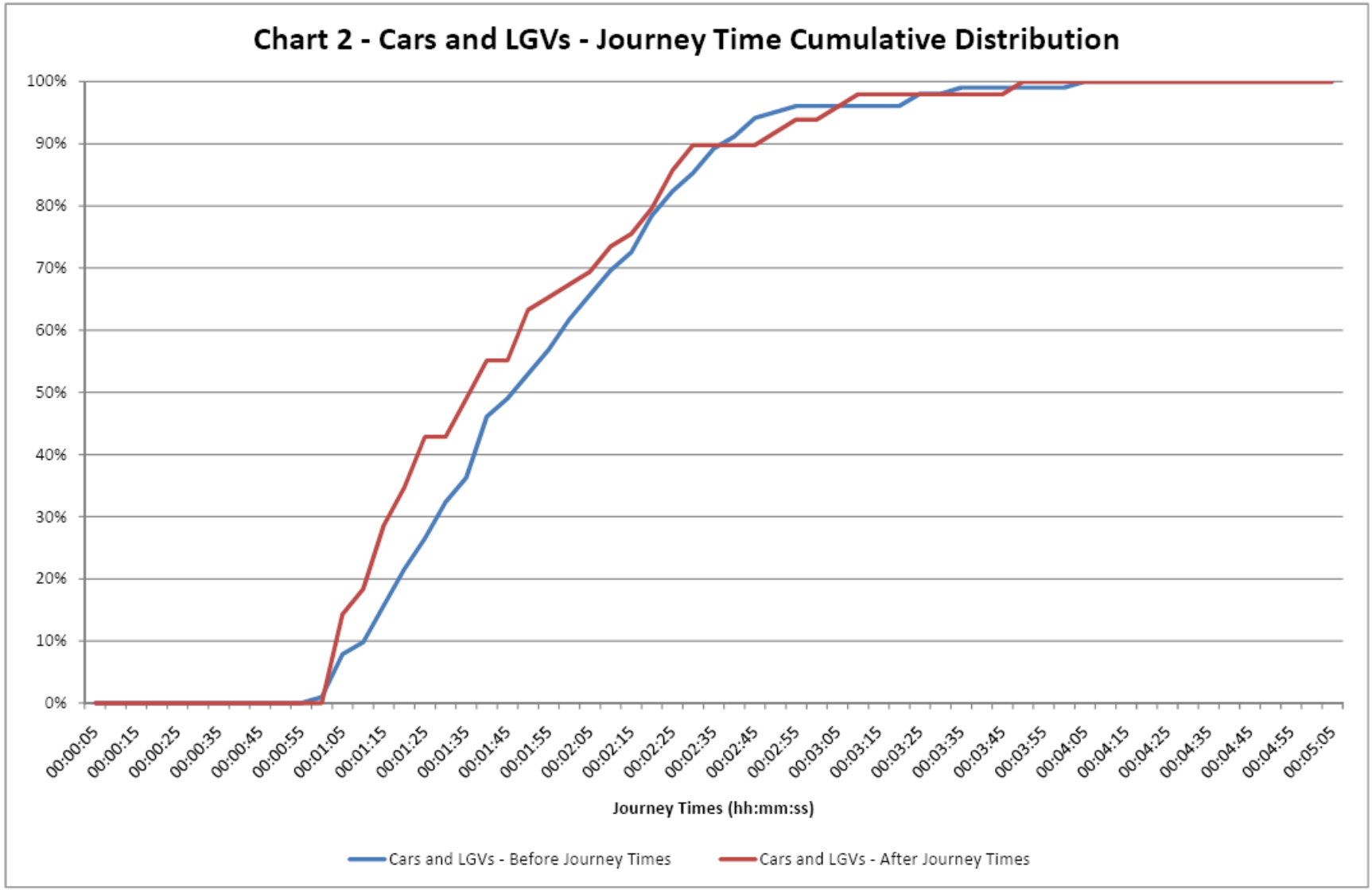

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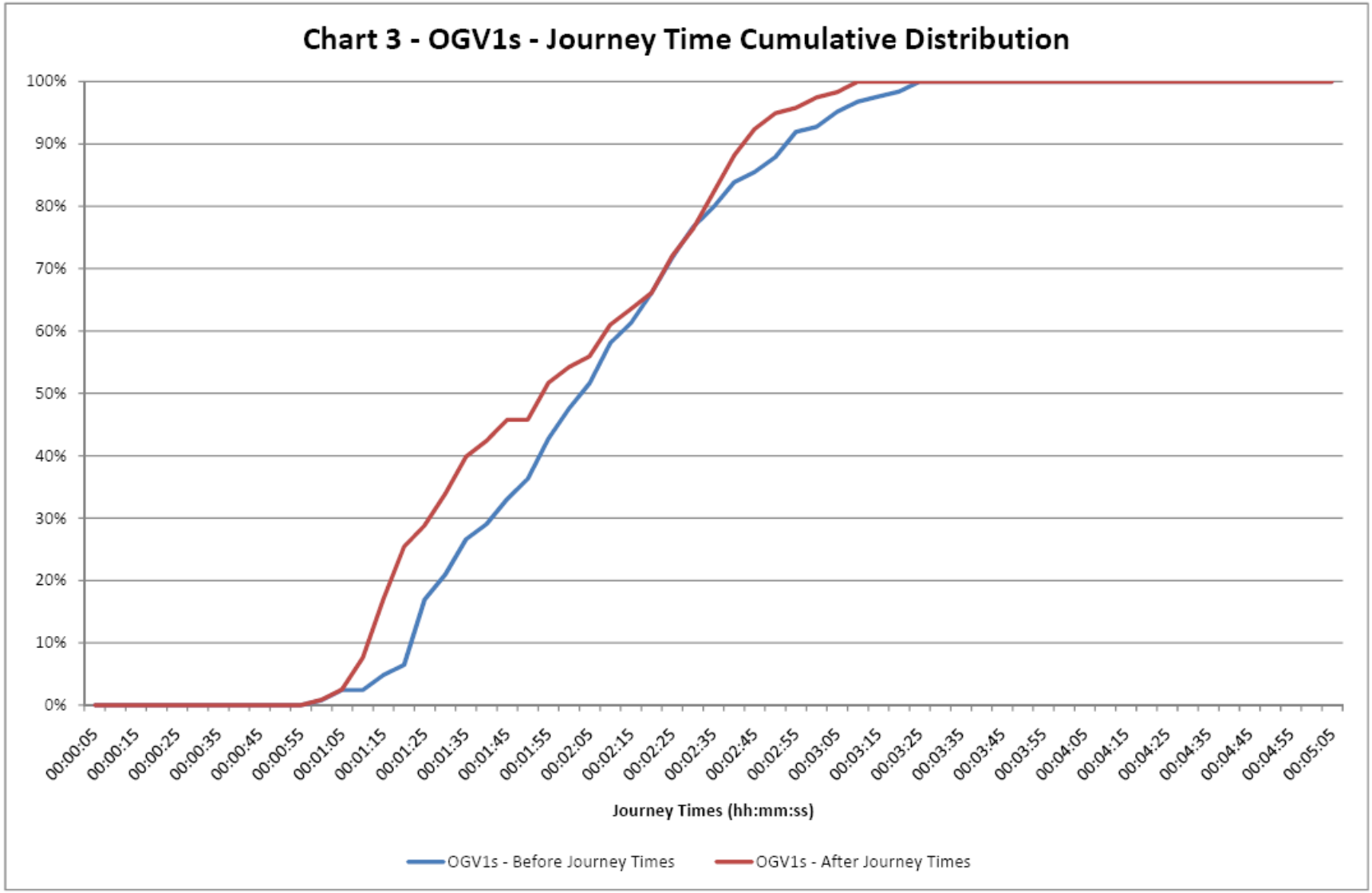

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