Aberdeen Rapid Transit

Detailed Options Appraisal

Technical Note H – Hansen Accessibility Analysis

On behalf of:

nestrans

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Registered Office: Buckingham Court Kingsmead Business Park, London Road, High Wycombe, Buckinghamshire, HP11 1JU
Office Address: 3rd Floor, Randolph House, 4 Charlotte Ln, Edinburgh EH2 4QZ
T: 0131 297 7010 E: info.edinburgh@stantec.com

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	Name	Position	Signature	Date
Prepared by:	Emma Schneider Emily Seaman George Daugherty	Principal Transport Planner Senior Associate Senior Associate	ESc ES GD	15/02/23
Reviewed by:	Emily Seaman	Senior Associate	ES	15/02/23
Approved by:	Scott Leitham	Director, Transport Planning	SL	15/02/23
For and on behalf of Stantec UK Limited				

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1 Introduction

1.1 Overview

1.1.1 Hansen indicators provide a measure of accessibility from a specific origin to all destinations in a study area, weighted by chosen criteria. High scores indicate good accessibility, and low scores suggest there is poor accessibility according to the chosen criteria.

1.1.2 The key accessibility indicator which has been used to quantify change in accessibility change is the Hansen Indicator for *Change in Accessibility to Employment*. The change represents how accessible the area is in terms of accessing employment between the reference case and each option scenario.

1.1.3 In this instance the change in public transport and road journey times between each pair of origins/destinations has been weighted by the number of jobs at the destination zones as the 'criteria'. The results of each origin – destination (O-D) pair were then summed over all origin zones and the global change in employment accessibility (as a percentage) between the reference case and the option was calculated.

1.2 Context

1.2.1 The implementation of ART will not widen the currently existing bus network coverage as there are already public transport services operating along all the ART corridors; however, substantially improved public transport journey times on ART corridors with increased service frequencies, will vastly improve the accessibility of jobs, education and social opportunities, which may now become 'time' accessible.

1.2.2 Bus stop rationalisation, as proposed under Options 3A, 5A, 5 and 5P would require passengers to walk further to access a stop; however, this will mean buses spend less time dwelling at stops and support reductions in journey times. It is noted that during the development and consultation on the Bristol metrobus scheme, no significant concerns were raised around accessibility issues due to increased bus stop spacing. A balance is needed between bus stop spacing to reduce journey times alongside ensuring accessibly to the ART network for all.

1.2.3 Those living within walking distance of the ART corridors, and those for whom use of Park & Ride sites is viable, will benefit from the ART network. Those for whom interchange is now required, under Options 3 and 5 (from a feeder service) may experience a disbenefit in accessibility, especially if they have mobility issues, luggage, a pram etc. making interchange difficult. In addition, any reduction in existing services on parallel routes may also reduce accessibility for those whose services are impacted.

1.2.4 ART will improve connectivity between some of Aberdeen's major employment/education sites (Arnhall, Prime Four, Kirkhill Industrial Estate, Aberdeen Airport, Bridge of Don, University of Aberdeen, North East of Scotland College, Robert Gordon University's Garthdee Campus, and the city centre) and residential areas. This will reduce time spent commuting and provide a wider pool of potential employees to recruit from, improving the match between jobs and skill sets.

1.2.5 Hansen analysis has been undertaken to understand the impact that ART could have on access to jobs. For this analysis, public transport travel times reflect the full door-to-door journey, including the walk to/from the stop, waiting time at the stop and time on board the vehicle. This means that accessibility analysis addresses both the shorter bus journey times but also the wider stop spacing/longer walking distance to/from stops seen under Options 3A, 5A, 5 and 5P.

2 Methodology

2.1 Hansen Employment Accessibility Calculation

2.1.1 The Hansen calculation for the change in accessibility to employment requires the number of jobs within each zone and travel times between each zone pair. Jobs data was acquired from the Business Register and Employment Survey (BRES) 2020, and travel time data for AM peak came from ASAM19.

2.1.2 The Hansen calculation considers the 'deterrent' effect of travel time by means of a negative exponential function which is hypothesised to describe the relationship between travel duration and the likelihood of travel.

2.1.3 The Hansen value for each origin-destination pair has been calculated using the following formula:

$$Hansen_{ij} = E_j * e^{-\lambda t_{ij}}$$

Where:

- E is the number of jobs (employment) at the destination zone j
- t is the journey time (public transport) in minutes between the origin (i) and destination (j)
- λ is the deterrent coefficient factor. For this analysis λ has been set as 0.044 for public transport[1] commuting.

2.1.4 The Hansen values are calculated for each origin-destination pair, before being summed across all origin-destination pairs.

2.1.5 Finally, the change in accessibility is calculated as:

$$Change\ in\ Accessibility_s = \frac{\sum Hansen^s{}_{ij}}{\sum Hansen^r{}_{ij}}$$

Where:

- s is scenario (Do Something)
- r is the reference case (Do Nothing)

[1] Source: https://webarchive.nationalarchives.gov.uk/ukgwa/+/http:/www.dft.gov.uk/pgr/regional/ltp/accessibility/guidance/gap/technicalappendix6informatio3639

3 Hansen Accessibility Analysis Results

3.1 Headline Results

3.1.1 The outcome of the Hansen employment accessibility analysis for the 2045 is shown in the table below. These values indicate the change in employment accessibility generated by each Option, compared with the Do Minimum for travel by public transport and by road.

Table 3.1: Hansen Employment Accessibility Analysis (2045)

Scenario	Option	AM Peak		Interpeak		PM Peak	
		PT	Road	PT	Road	PT	Road
With policy	2	4%	-2%	4%	-1%	4%	-2%
	5A	11%	-2%	10%	-1%	11%	-2%
	5	12%	-1%	11%	-1%	13%	-2%
	5P	12%	-1%	11%	-1%	13%	-1%
Without policy	5	12%	-2%	11%	-1%	13%	-2%

3.1.2 Public transport accessibility to jobs is improved by all options, but most notably by Option 5 and its variants. Hansen analysis shows an increase in accessibility by public transport to jobs of 4% under Option 2, 10-11% under Option 5A and 12-13% under Options 5/5P in the 'with policy' scenario'. Similarly, employment accessibility is estimated to improve by 11-13% for Option 5 under the 'without policy' scenario.

3.1.3 The accessibility change values presented in the table reflect the change in employment accessibility seen across the whole ASAM region, and as might be expected, public transport accessibility improvements are more pronounced along the ART corridors.

3.1.4 Figure 3.1 illustrates the ASAM zone level changes to employment accessibility between each option and the Do Minimum for the 'with policy' scenario. These results should not be depended upon at an individual zone level, but the broad trends observed

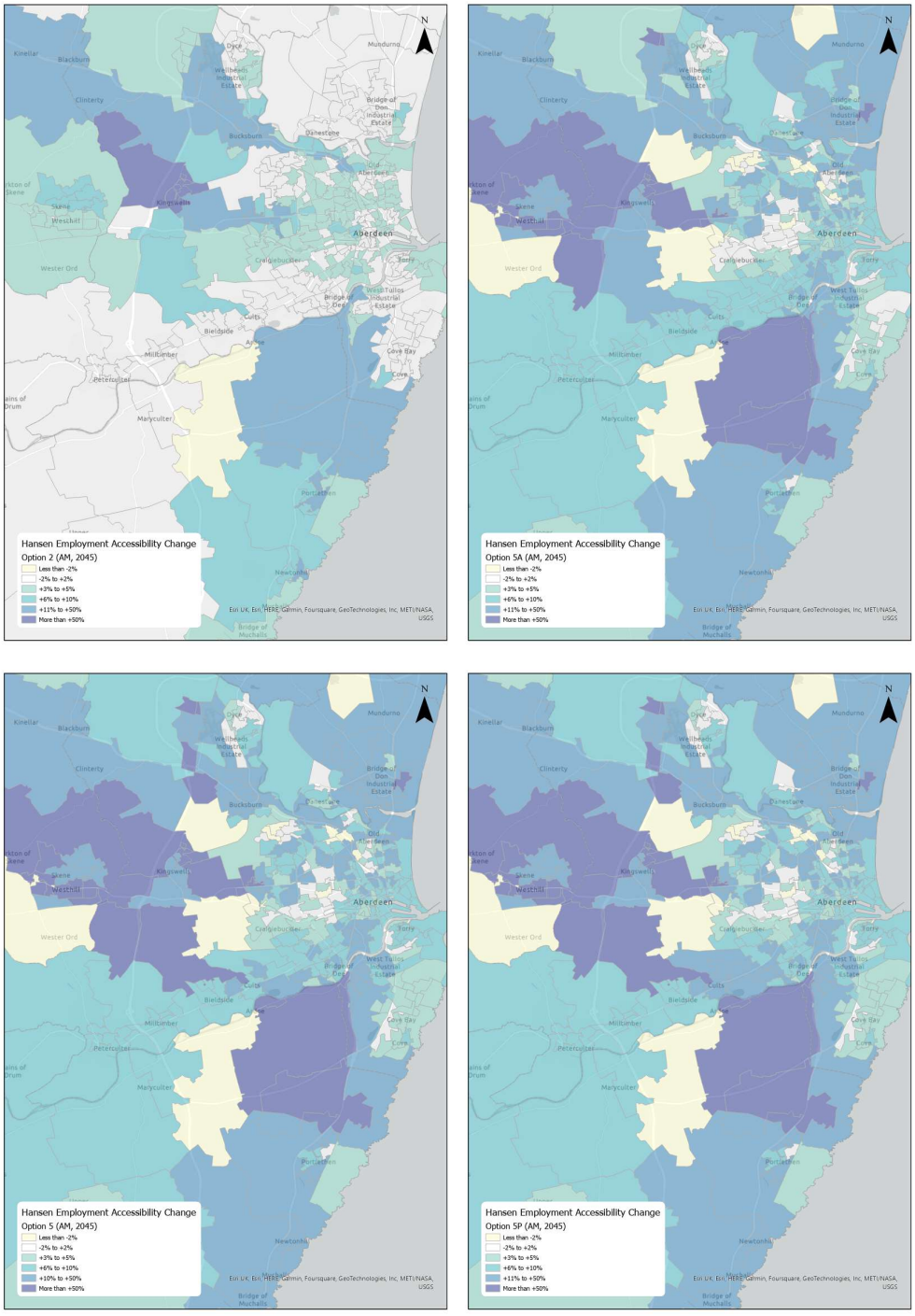

Figure 3.1: Employment Accessibility Change Comparison (Public Transport, AM 2045)

3.1.5 Hansen analysis specifically shows employment accessibility improvements of:

- 10% or more along the A944 between Kingswells and Mastrick, along the A90S between Portlethen and Bridge of Dee and along A96 between Woodside and Kintore under Option 2.

- 25% of more along the same sections under Options 5A, 5 and 5P, as well as improvements of 10% or more along the A956N corridor up to Cruden Bay and substantial improvements of over 50% in the vicinity of Westhill. These more substantial improvements will be generated by reducing journey times to areas of high employment density.

3.1.6 Under all options, there is a small reduction in accessibility by road of up to 2%, which is expected given that the additional bus priority infrastructure will reduce road space available for general traffic.

3.2 Summary

3.2.1 Hansen employment accessibility analysis shows that Option 2 can provide a small improvement of around 4% in terms of public transport access to jobs, while options 5A, 5 and 5P provide substantial improvements of approximately 12% under both the 'with policy' and 'without policy' scenarios. These more substantial improvements in employment accessibility will reflect the fact that Options 5A, 5 and 5P are more capable of reducing journey times to areas of high employment such as Westhill and Kingswells.