

Technical Note – Gravity Model and Accommodation Strategy Review

Client name
East Suffolk Council

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Revision History

Revision	Revision date	Details	Authorised	Name	Position
0.1	16/09/2020	Draft for Review	BC	B. Carey	Associate Director

1.0 Introduction

- 1.1 AECOM has been working with Suffolk Council to review the transport proposals for the Sizewell C development being promoted by EDF Energy. A key element of the work undertaken was to review the gravity model developed by WSP, which distributes workers from the development to residential locations across the wider study area. The review highlighted a number of limitations with the gravity model, but concluded that the limitations would have little impact on the work undertaken to date.
- 1.2 Following the discussions with Suffolk Council, AECOM was contacted by East Suffolk Council regarding some additional work to review the gravity model in respect of the accommodation strategy being put forward by EDF energy to accommodate the increase in workers to the area. Two key tasks were identified to undertake this review:
- Undertake a further review of the gravity model, with a particular focus on understanding the sources of data in the model and any limitations around this data;
 - Undertake a review of the accommodation strategy produced by EDF energy to understand how the gravity model has informed the strategy.
- 1.3 The outcome of the review undertaken is summarised in the remaining sections of this technical note.

2.0 Gravity Model

- 2.1 The review of the gravity model is summarised in two parts:
- An overview of how the gravity model operates;
 - A review of the data inputs into the gravity model.

Gravity Model Operation

- 2.2 WSP has developed a gravity model to estimate the residential distribution of the peak construction workforce for Sizewell C. It is estimated that 7,900 workers will be needed at the peak of construction, with a further 600 workers needed to operate the associated developments.
- 2.3 The breakdown of the workers at the site is outlined below:
- Circa 2,000 home-based workers and recruited from the local area;
 - 600 associated development workers recruited from the local area;
 - 5,880 non-home based workers who would require temporary accommodation within 60 minutes of the Sizewell C site.
- 2.4 The gravity model contains seven separate models to estimate the distribution of these home-based and non-home-based worker types as follows:
- Home based (main): Based on the residents with specific construction skills, mainly within a 90-minute commuting area;
 - Home-based (associated development staff): Based on the full working age population within 45 minutes;
 - Home-based (site services): Based on the full working age population within 45 minutes (as these jobs are relatively lower paid, workers are not expected to commute longer than 45 minutes);
 - Non-home-based (tourist): Based on the number of workers at peak likely to stay in tourist accommodation within 60 minutes travel from the site and the existing supply in that sector.

- Non-home-based (PRS): Based on the number of workers at peak likely to stay in private rented accommodation within 60-minutes travel from the site and the existing supply in that sector;
 - Non-home-based (owner occupied non-operational): Longer-term construction workers estimated to take up accommodation in the owner-occupied sector within 60 minutes of the site;
 - Non-home-based (owner occupied operational): Operational staff at peak construction who will either be recruited from the local area or who will move permanently to the area. (operational staff must live within 25 miles of the site);
 - Campus and Caravan: Residents of campus accommodation do not form part of the gravity model but the number assumed to live in campus accommodation impacts on the non-home based worker using other accommodation types.
- 2.5 The type of temporary accommodation required by non-home based workers at peak demand has been estimated based on experience at Sizewell B, recent monitoring at Hinkley Point C. and incorporating estimates for types of roles required and associated contract type and earnings. It can be broken down as follows and forms an input into the gravity model:
- 3,000 workers living in project accommodation;
 - 880 workers anticipated to have bought homes and live in the owner occupied sector;
 - 800 workers living in tourist accommodation;
 - 1,200 workers living in the private rental sector.
- 2.6 The gravity model distributes these workers based on their inputs to the model as follows:
- How far individuals are willing to commute;
 - Affordability and availability of accommodation;
 - Availability of local workforce;
 - Cost of journey.
- 2.7 The distribution of home-based workers within the gravity model is informed by the combination of the travel cost and the local available workforce, whilst the distribution of non-home-based workers is determined by the travel cost and the availability of affordable accommodation. The gravity model has been calibrated to observed data of how far people will travel to work using a beta value within the gravity function. The observed data used to calibrate the model is based on two sources; observed data from Sizewell B and a 2005 study carried out by IFF research. Whilst the 2005 study is considered old, there is limited data sources, which replicate similar conditions to the Sizewell C site.
- 2.8 All else being equal, workers would be distributed from locations closest to the site with the lowest cost of journey. However, availability of workforce or accommodation is also taken into account in the gravity function to determine an attractiveness factor. A worked example of the gravity function is outlined overleaf.
- 2.9 AECOM previously reviewed the operation of the gravity model to identify any concerns to Suffolk County Council and how this might impact on the Transport Assessment work being undertaken. The focus of this review was on the suitability of the methodology for distributing workers between Sizewell C and available accommodation but did not question in detail the assumptions on inputs informing the gravity model. Discussions on these inputs were being undertaken elsewhere.
- 2.10 Overall, the review of the gravity model found a number of small issues with the gravity model but concluded that these would be unlikely to impact on the conclusions of the transport assessment work. However, the review did note that whilst the gravity functions considers the availability of accommodation/workers in determining the attractiveness of a location, it does not have this as a constraint. If job numbers were to increase, there could be a situation where the number of workers in an area exceed available accommodation. The inputs into the gravity model, including the number of workers, is discussed in the following section.

Data Inputs

- 2.11 There are a number of inputs into the gravity model, which impact on where workers are distributed across the Suffolk area. The accommodation strategy has been developed to ensure there is suitable accommodation for the large number of non-home based workers expected to be residing in the Suffolk area during the construction of Sizewell C. Any change to the inputs into the gravity model would impact on where workers could be expected to live. Depending on the level of change, this could mean that changes to the accommodation strategy would be necessary. Given that the accommodation strategy is focussed on accommodating non-home based workers, the review of data inputs into the gravity model is concentrated on those inputs which impact on the distribution of non-homed based workers.
- 2.12 **Number of Workers:** At peak construction, it is estimated that there will be a requirement for 5,880 non-home based workers. The number of workers is estimated based on the experience elsewhere and any change to the number of workers will impact on the outcome of the gravity model. The split between non-home-based (5,880) and home-based workers (2,000) has been estimated on the skills required during the construction period and the availability of these skills within the local area. The assessment of available skills within the local area is based on information from the 2011 census data. Given the level of granularity the data is needed at, this is considered the best available data source.

Gravity Function Example: Non-home based tourist accommodation

The calibration parameter for non-home based tourist accommodation is 0.15. The parameter has been adjusted to ensure distanced travelled to the site replicates observed data.

Example 1

The journey cost from a camping and touring park within Hollesley with Eyke is 33.

There are 180 beds at the camping and touring park and all of them are considered affordable. However, only 50% of them are available. This leaves 90 beds.

The gravity is function is $\text{exponential}(-0.15 \times 33) \times 90 = 0.64$

The attractiveness of the site is 0.64

Example 2

The journey cost from some self-catering cottages within Aldeburgh is 11.1

There are 52 beds at the self-catering cottages but only 90% of them are considered affordable. All of the beds are however available. This leaves 46.8 beds.

The gravity function is $\text{exponential}(-0.15 \times 11.1) \times 46.8 = 8.8$

The attractiveness of the site is 8.8

Result

The percentage of workers who will reside in each site will be determined by the attractiveness of the site divided by the total of the attractiveness across all sites. If there were only 2 sites as identified above, this would result in the following:

Attractiveness of all sites: $8.8 + 0.64 = 9.44$

Site 1: $0.64 / 9.44 = 7\%$

Site 2: $8.8 / 9.44 = 93\%$

2.13 Type of Accommodation: The type of accommodation required by non-home-based workers is also estimated based on experience from Sizewell B and Hinckley Point C. Should workers require a different type of accommodation to what is assumed as an input into the gravity model, this will impact on the distribution of workers. It is assumed that 3,000 workers will live on campus accommodation or in a caravan park; 2,400 of these workers will live on campus accommodation with a further 400 caravan pitches (with an estimated occupancy of 1.5 workers per caravan) being provided on land east of Eastlands Industrial Estate in Leiston. It is recognised that the campus accommodation will not be available at the start of the construction, although the caravan pitches are expected to be available. Whilst the 3,000 workers living in campus accommodation/caravan park is not distributed within the gravity model, any change to these assumptions would impact on the demand for other accommodation types and therefore the outputs from the gravity model.

2.14 Tourist Accommodation Stock, Availability and Affordability: In 2014, Visit East Anglia provided EDF energy with a detailed database of registered tourist accommodation, which set out the location and size of tourist accommodation across the area. This has been used as an input into the gravity model. Whilst it is recognised that the data is old and therefore things will have changed, it is expected to be an underestimate of the tourist accommodation available due to many providers not being registered with Visit East Anglia at the time. More recent data on availability of tourist accommodation is not readily available at the detail required to inform the gravity model.

2.15 The affordability and availability of tourist accommodation assumptions in the gravity model are set out in the following table.

Table 1: Affordability and Availability of Tourist Accommodation

Accommodation Type	Affordability	Availability
Serviced	15%	100%
Hostel	15%	100%
Self-Catering	90%	100%
Touring Caravan and Camping Sites	100%	50%*
Holiday Parks	0%	0%*
Serviced Apartments	0%	0%

*Reduced to 50% due to planning restrictions for the year-round use of caravans.

*Holiday parks not included due to ambiguity over their function, operation and restrictions on use.

- 2.16 Occupancy rate information for tourist accommodation is available from Visit England at a regional scale. Data between 2016-2019, as set out in the accommodation strategy, showed occupancy ranges from 63% in the winter to 85% in the summer months. Information from the Suffolk Coast Tourism Strategy (2013-2023) notes that the average bed space occupancy in 2012 ranges from 40% per annum for hostels through to 58% for hotels, self-catering accommodation and camping and caravan sites. This does not appear to be taken account of in the gravity model, but it is recognised in the accommodation strategy that the demand for tourist accommodation is far less than available capacity even in the peak summer months. It is noted however that this is on a regional scale and could vary by individual area.
- 2.17 SZC Co. has estimated the affordability of accommodation based on the accommodation allowance available to non-home based workers under the Construction Industry and Joint Council Working Rule Agreement (£40.76 per night at the time of the assessment). This is an input into the gravity model by type of tourist accommodation. The gravity model does not take account of how affordability might vary by local area.
- 2.18 **Private Rental Accommodation Stock, Availability and Affordability:** The number of private rented bedrooms available within the 60-minute area of the Sizewell C site has been taken from 2011 census data. The number of housing units has been extracted from Census and then converted to bedrooms using the average number of bedrooms for each area. This shows that there are 99,000 private-rented bedrooms within the 60-minute area, with a greater proportion of these bedrooms being distributed across the urban areas. There is no distinction within the gravity model to account for some types of private rental accommodation being more attractive than others.
- 2.19 It is noted that this data is 10 years of age but given the level of detail required for the gravity model, no alternative data source is easily accessible. The English Housing Survey estimates that the private rental sector has grown in the East of England by 30% since the 2011 census was undertaken. Given the data input into the gravity model will therefore likely underestimate the availability of accommodation, it is considered a reasonable data source to be used in the distribution of workers.
- 2.20 The gravity model assumes that all accommodation in the private rental market, and within the 60-minute journey time of Sizewell C, is available and affordable.
- 2.21 **Owner-Occupied Accommodation Stock, Availability and Affordability:** The gravity model assumes a proportion of workers at the Sizewell C site will purchase accommodation in the area. The availability of this accommodation for purchase within the study area is based on the number of family homes, which were identified in the 2011 census. Whilst it is again recognised that this data is old, it is estimated that the private housing sector in Suffolk has grown by 4% since the census was undertaken and therefore will potentially underestimate the availability of accommodation.
- 2.22 Affordability is not a consideration in the availability of owner-occupied accommodation.
- 2.23 **Cost of Journey:** The attractiveness of an area to non-home based workers is a function of both the available accommodation and the cost of the journey to Sizewell C. In the gravity model for Sizewell C, cost of the journey is the generalised cost. This takes account of journey time, parking time and waiting time (when using park and ride).
- 2.24 The generalised cost information has been extracted from the VISUM traffic model for the study. The traffic model is subject to an ongoing review and any changes to generalised cost will need to be reflected in an updated gravity model. Whilst this could impact on the outputs from the gravity model, the changes will likely impact on the entire study area and would therefore be unlikely to impact on the conclusions from the gravity model.
- 2.25 In reviewing the data inputs that have informed the gravity model, where 2011 census data has been used, a check has been undertaken to ensure the inputs correlate with downloaded census data. No issues have been identified as part of this review.

3.0 Accommodation Strategy

- 3.1 The accommodation strategy has been developed to ensure there is suitable and available accommodation within the Suffolk area to accommodate the level of non-home based workers, which will be needed during the peak period of construction for the Sizewell C site.
- 3.2 At the macro level, the accommodation strategy uses assumptions on number of workers and types of accommodation required to demonstrate that there is available accommodation available within the Suffolk area. The outputs from the gravity model however, show where there may be issues with accommodation supply when smaller spatial areas are considered.
- 3.3 This is summarised below for the three main accommodation types for non-home based workers when excluding the provision of site accommodation for 3,000 workers. Whilst the review identifies where there may be issues at the local level, it does not comment on the suitability of mitigation measures in these areas identified in the accommodation strategy, as this is outside of the scope of this review.
- 3.4 **Tourist Accommodation:** The inputs to the gravity model show that there is available tourist accommodation within 60-minutes of the Sizewell C site to accommodate the 800 non-home based workers who are expected to seek tourist accommodation.
- 3.5 The outputs from the gravity model however, show that the demand for this accommodation will be concentrated in those areas closest to the Sizewell C site. When accounting for availability and affordability, this shows that demand for tourist accommodation in Leiston could occupy 84% of the available stock. This would therefore impact on the tourism accommodation sector in this area.
- 3.6 Although the accommodation strategy acknowledges that there will likely be more pressure on available tourist accommodation within the areas closest to the Sizewell C site, it also recognises that there are likely to be other market responses which come into play, such as demand influencing supply and conversions to Air BnB.
- 3.7 The gravity model does not take into account that in the summer months there will be more demand for tourist accommodation. The non-home-based workers at the Sizewell C site could therefore displace tourists, who it is suggested have higher average daily expenditure than workers, and impact on the local economy. The accommodation strategy recognises this concern but states that it would be a commercial decision for accommodation providers to decide whether to let accommodation to workers or tourists.
- 3.8 **Private Rental Sector Accommodation:** Similar to tourist accommodation, at the macro level, there is available accommodation in the private rental sector to accommodate the level of demand from non-home-based workers at the Sizewell C site. It is estimated that Sizewell C workers will only require 1.2% of available bed spaces within the area.
- 3.9 The gravity model however shows that workers are likely to seek accommodation close to the site in order to limit their travel time and to concentrate where there is a substantial amount of accommodation. The gravity model shows that workers would concentrate in Leiston, Aldeburgh, Yoxford and Saxmundham. At the peak period of demand, this shows that the demand for accommodation will exceed the frictional vacancy in all four of these areas. Given workers are likely to maximise their accommodation allowance and take accommodation at the lower end of the available stock, this could impact on the availability of accommodation for local residents of these areas, with a particular impact on those people in the lower income and vulnerable groups. The accommodation strategy therefore recognises that mitigation would be needed in these areas in the form of accommodation management and a housing fund.
- 3.10 **Owner-Occupied Accommodation:** Workers at the Sizewell C site seeking to buy accommodation will require less than 1% of available housing stock within the area. The demand for owner-occupied accommodation is therefore likely to have a negligible impact on the housing market across the entire study area.
- 3.11 Similar to other accommodation types however, workers are likely to concentrate closer to the Sizewell C site. Outputs from the gravity model show that demand for owner-occupied accommodation within the Leiston area could account for 11-12% of the available accommodation. However, the accommodation strategy states that this demand would build up over a number of years and the housing market should be able to react to this change in demand.
- 3.12 Overall, the accommodation strategy considers that a conservative approach has been adopted in assessing where demand for Sizewell C workers may impact on available accommodation within the local area. This is due to the assumptions that there will be no uptake of holiday park accommodation or latent accommodation, and that the available accommodation within the gravity model is likely an underestimate as a result of limitation on available datasets.

4.0 Summary

- 4.1 WSP have produced a gravity model to show where workers at the Sizewell C site will reside. An accommodation strategy has subsequently been developed by EDF Energy to ensure that the number of non-home-based workers required at the Sizewell C site during the peak period of construction can be accommodated in the local area. East Suffolk Council requested that AECOM undertake a review of the gravity model to understand the data sources used in the model and how these impacts on the accommodation strategy.
- 4.2 The review of the gravity model has identified the different data sources impacting on the outputs of the gravity model. It is acknowledged in this technical note that the data sources used are considered reasonable given the level of spatial detail that is required to inform the gravity model. However, it is also noted that assumptions around availability and affordability are applied at the macro level, and this could under, or over, estimate the impact of Sizewell C workers in local areas.
- 4.3 The note has summarised how the outputs from the gravity model have informed the accommodation strategy for the Sizewell C development. This has identified where there are likely to be local issues of accommodation supply where mitigation measures may be necessary.
- 4.4 Although this review has shown how differences in some of the data sources used in the gravity model could impact on the distribution of workers, and thus the level of accommodation needed in individual areas, the inputs which have the greatest impact on the outputs of the gravity model are as follows:
 - Assumptions on number of workers;
 - Assumption on split between home-based and non-home-based workers;
 - Assumptions on type of accommodation required for non-home-based workers.
- 4.5 The inputs to the gravity model around these assumptions are based on experience from both Sizewell B and Hinckley Point C. Sensitivity testing has not been undertaken to inform the accommodation strategy should there be any changes in these assumptions.