

## APPENDIX J

## **DSC PROJECT NOTE 5**

DCS

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*Author ACD*

*Review ECR*

## **SOUTH WEST PENINSULA LAND USE MODEL**

### **1 INTRODUCTION**

- 1.1.1 Devon County Council (DCC) commissioned Parsons Brinckerhoff (PB) to work on the development of a land-use/transport interaction (LUTI) model of the South West Peninsula. This work was a part of the DaSTS study of Exeter Gateway and the Far South West and as such is one of six projects that were commissioned within the South West Region as part of the Department for Transport's Delivering a Sustainable Transport Strategy initiative.
- 1.1.2 The land use and economic element of this work was sub-contracted to David Simmonds Consultancy Limited (DSC).
- 1.1.3 This report describes the work undertaken by DSC, in developing a land use model for the South West Peninsula. This has involved an application of DSC's DELTA software.
- 1.1.4 The following sections describe:
- The model design
  - The model definitions
  - The key model inputs
  - The development of Model 0.

### **2 THE SOUTH WEST PENINSULA LAND-USE MODEL**

#### **2.1 Model design**

- 2.1.1 The SWesPLUM model is a standard application of the DELTA package, similar to those that have been applied elsewhere in Britain. It includes a series of sub models that represent the decisions and actions of households, businesses and developers and the ways in which their decisions are influenced by accessibility, congestion and changes to the region's transport infrastructure. The model forecasts change in levels of population households and employment over time, starting from a base year (which in this case has been set as 2008) and forecasting forward to 2031 in single-year steps.
- 2.1.2 The key components of the model are shown diagrammatically in Figure 1. The land use model models processes at two spatial levels. At a strategic (or area) level there are two key processes modelled. First the overall growth of the economy and secondly longer-distance migration. At a local (or zonal)

level DELTA models household change, household and employment location, development of floorspace, car ownership levels and residential quality.

2.1.3 A more detailed description of the different sub-models was contained within the original Model Design Report and will also be included, on completion of the model building and testing, within the Model Description Report.

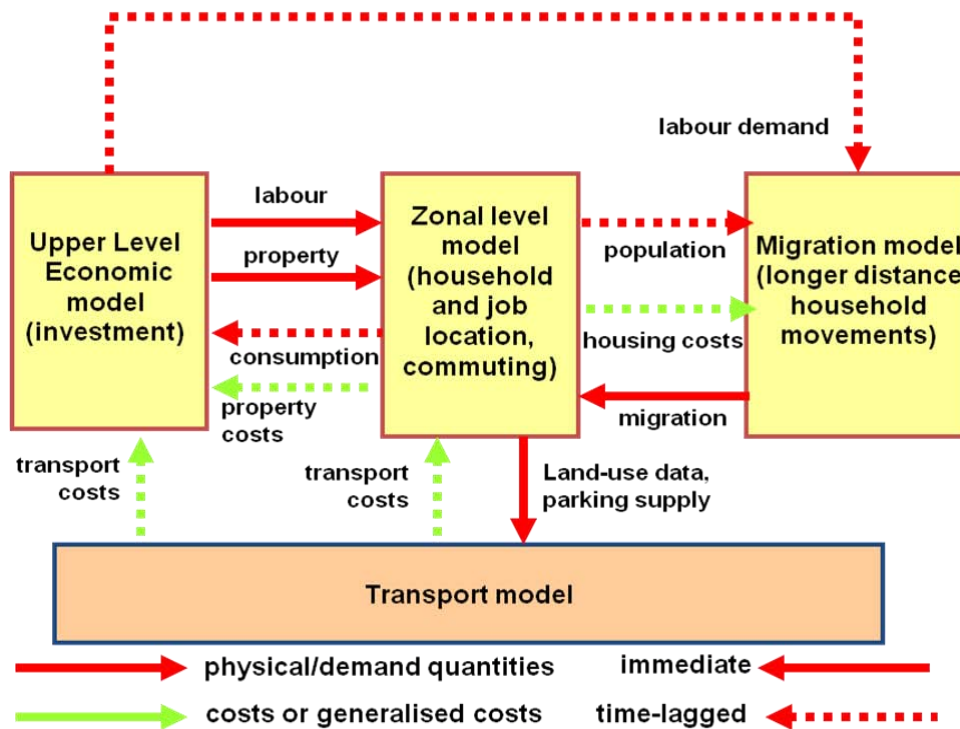
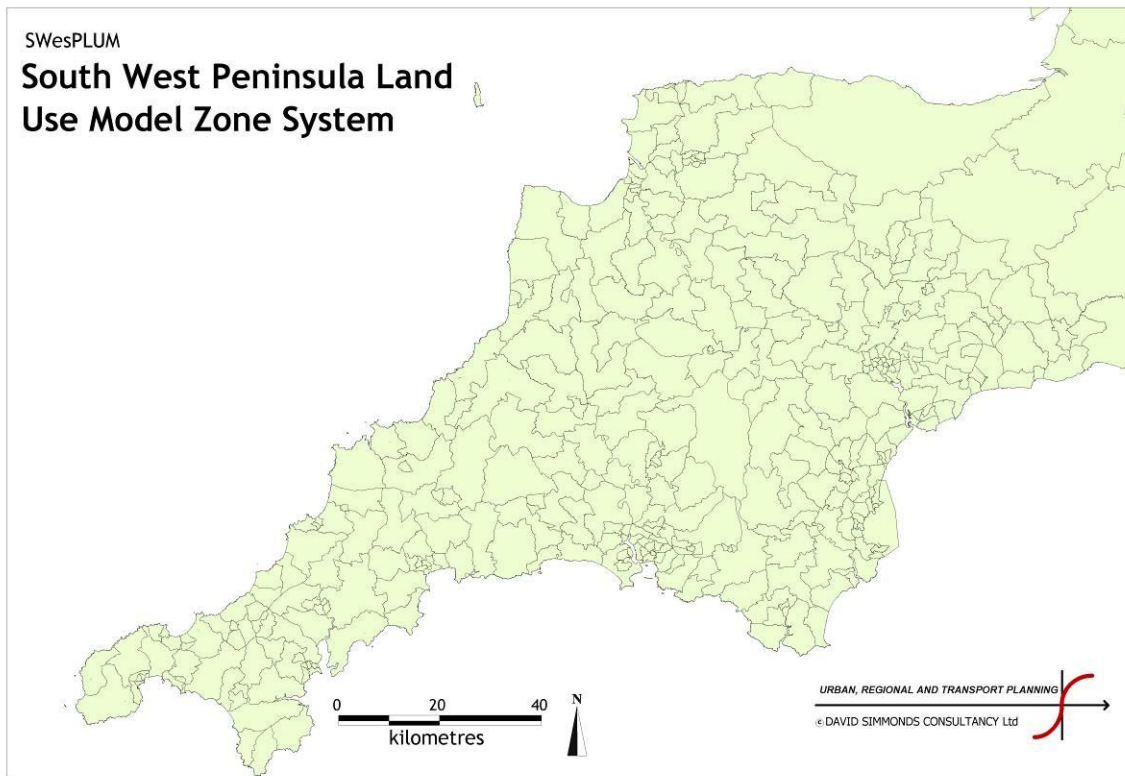


Figure 1 Structure of the SWesPLUM land use model

## **2.2 Definition of the Modelled Area**

- 2.2.1 The Modelled Area comprises a Fully Modelled Area (FMA) and a Buffer Zone. The FMA is essentially the area of interest. It comprises:
- Wards outside of Exeter and within Cornwall, Devon, Plymouth and Torbay;
  - Wards and some disaggregation of wards within Exeter and for the Plymouth Development zone;
  - Airport Zones for Exeter, Plymouth and Newquay airports; and
  - Port Zones within Plymouth.
- 2.2.2 The Buffer Area comprises of four district-wide zones. These are:
- West Somerset
  - Taunton Deane
  - South Somerset
  - West Dorset.
- 2.2.3 All of the processes mentioned in the previous section are modelled in the FMA. There is a more limited modelling within the Buffer Zone where household and employment numbers are modelled but not development or changes in floorspace.
- 2.2.4 Beyond the Buffer Zone there are External Zones covering the rest of Great Britain. These are not modelled within the land use model. However the Transport Model calculates the flows between the Fully Modelled Area and these external zones. This information is used along with the information on both flows between zones within the Fully Modelled Area and between the Fully Modelled Area's zones and the Buffer Zone in calculating generalised costs.
- 2.2.5 There are 67 external zones. These are consistent with the external zones used within transport model.



**Figure 2 The South West Peninsula Land Use Model Zone System**

### **2.3 Model design**

2.3.1 Table 2.1 shows the household activities that are distinguished within the model. There are ten household types (single adult younger, single adult older etc) and for each of these there are four different social economic levels. The combination of households types and social economic levels creates 40 different household activities.

**Table 2.1 Household Activity Types**

Activity	Household Type	Socio-Economic Level
1	single adult, younger, no children	professional and managerial occupations
2	single adult, younger, no children	associate professional, technical and trades occupations
3	single adult, younger, no children	clerical, sales and skilled operators
4	single adult, younger, no children	elementary occupations
5	single adult, older, no children	professional and managerial occupations
6	single adult, older, no children	associate professional, technical and trades occupations
7	single adult, older, no children	clerical, sales and skilled operators
8	single adult, older, no children	elementary occupations
9	single adult, retired, no children	professional and managerial occupations
10	single adult, retired, no children	associate professional, technical and trades occupations
11	single adult, retired, no children	clerical, sales and skilled operators

Activity	Household Type	Socio-Economic Level
12	single adult, retired, no children	elementary occupations
13	single parent	professional and managerial occupations
14	single parent	associate professional, technical and trades occupations
15	single parent	clerical, sales and skilled operators
16	single parent	elementary occupations
17	couple household, younger, no children	professional and managerial occupations
18	couple household, younger, no children	associate professional, technical and trades occupations
19	couple household, younger, no children	clerical, sales and skilled operators
20	couple household, younger, no children	elementary occupations
21	couple household, older, no children	professional and managerial occupations
22	couple household, older, no children	associate professional, technical and trades occupations
23	couple household, older, no children	clerical, sales and skilled operators
24	couple household, older, no children	elementary occupations
25	couple household, children	professional and managerial occupations
26	couple household, children	associate professional, technical and trades occupations
27	couple household, children	clerical, sales and skilled operators
28	couple household, children	elementary occupations
29	couple household, both adults retired, no children	professional and managerial occupations
30	couple household, both adults retired, no children	associate professional, technical and trades occupations
31	couple household, both adults retired, no children	clerical, sales and skilled operators
32	couple household, both adults retired, no children	elementary occupations
33	3+ adult households, no children	professional and managerial occupations
34	3+ adult households, no children	associate professional, technical and trades occupations
35	3+ adult households, no children	clerical, sales and skilled operators
36	3+ adult households, no children	elementary occupations
37	3+ adult household, children	professional and managerial occupations
38	3+ adult household, children	associate professional, technical and trades occupations
39	3+ adult household, children	clerical, sales and skilled operators

Activity	Household Type	Socio-Economic Level
40	3+ adult household, children	elementary occupations

2.3.2 Table **Error! Reference source not found.** shows the activities that are used to represent population not in households.

**Table 2.2 Persons not in households classification**

SWesPLUM Activity	Definition
41	All children not in households
42	All professional and managerial workers not in households
43	All associate professional, technical and trades occupations not in households
44	All clerical, sales and skilled operators not in households
45	All elementary occupations not in households
46	All non-working not in households
47	All retired not in households

2.3.3 Table **Error! Reference source not found.** shows the 25 economic activities that are used within the model.

**Table 2.3 SWesPLUM employment classification**

SWesPLUM Activity	Definition/source
101	Agriculture hunting and forestry (Non Manual)
102	Agriculture hunting and forestry ( Manual)
103	Fishing (Non Manual)
104	Fishing (Manual)
105	Mining and Quarrying (Non Manual)
106	Mining and Quarrying (Manual)
107	Manufacturing (Non Manual)
108	Manufacturing (Manual)
109	Electricity; Gas and Water Supply (Non Manual)
110	Electricity; Gas and Water Supply (Manual)
111	Construction (Non Manual)
112	Construction (Manual)
113	Wholesale and retail trade; retail
114	Wholesale and retail trade; other (non manual)
115	Wholesale and retail trade; retail (manual)
116	Hotels and catering

SWesPLUM Activity	Definition/source
117	Transport storage and communication
118	Transport storage and communication (Manual)
119	Financial intermediaries
120	Real estate; renting and business activities
121	Public administration and defence; social security (Non Manual)
122	Public administration and defence; social security (Manual)
123	Education
124	Health

- 2.3.4 A significant proportion of the study area’s housing stock is occupied as either second homes or holiday lets within the Modelled Area. Second home and holiday let owners compete with households for property. We have introduced an additional household activity to reflect this. Initially we have assumed that the proportion of second homes within each zone remains constant (at a level consistent with the numbers shown in the 2001 Census), however there will be scope to adjust this and allow for a growth or decline in the numbers of second homes if required.
- 2.3.5 The space categories used within the model are shown in Table **Error! Reference source not found.**

**Table 2.4 SWesPLUM space categories**

SWesPLUM Space category	Definition
1	Residential
2	Retail
3	Office
4	Industry (excluding warehousing)
5	Warehousing
6	Leisure/Hotel
7	Education
8	Health

**2.4 Model development data sources**

- 2.4.1 The modelling is necessarily based upon the 2001 situation, mainly in order to use the 2001 Census data. We have assembled data on the changes which have

occurred between that year and the model's 2008 base year. This has included information:

- from local authorities' monitoring systems, on development that has taken place during this seven year period;
- from ONS's Neighbourhood Statistics on the number of dwellings listed on the Council Tax Register;
- house price data for 2001;
- mid-year population estimates and small area population estimates;
- vacancy data from Exeter City Council and Valuation Office Agency;
- floorspace data from Valuation Office Agency;and
- from Annual Population Survey Workplace data on the number of people in employment within each local authority.

## **2.5 Transport modelling for SWesPLUM**

2.5.1 Parsons Brinckerhoff have developed a transport model that will interact with the land use model. Progress on this is reported separately.

2.5.2 The interaction between the transport model to the land use model will be developed as part of the next stage of model development.

## **2.6 Planning policy inputs**

2.6.1 The development model forecasts changes in floorspace for each of the land use types that were described in Table 2.4. This part of the model depends upon inputting information on both where development can occur and how much development is expected. In order that these inputs are realistic and represent the plans and aspirations of the local authorities we have consulted with the planning authorities on this matter.

2.6.2 Information has been requested, on our behalf, on:

- Developments for which planning permission has already been given;
- land or sites specifically allocated for future development;
- other commitments and likely locations for development over the rest of the development plan time period;
- likely locations for further development beyond the horizon of present plans.

2.6.3 A separate report on this exercise has been prepared.

## **2.7 Demographic and economic scenarios**

2.7.1 The model requires a scenario that defines the overall level of demographic and economic growth within the Modelled Area. Following consultation with Devon

CC it was agreed that the initial scenario would be based upon the forecasts prepared for the Regional Spatial Strategy.

- 2.7.2 The suggestion is that an additional set of growth scenarios based upon TEMPRO may be prepared at a later date.

## **2.8 The model development**

- 2.8.1 The initial work programme involved the completion of 'Model 0' by April 2010. This involved the building of the basic land use model and running it with synthetic costs (rather than with costs generated by the transport model). The subsequent stages of the process allowed for the integrating of the land use model with the transport model that Parsons Brinkerhoff are constructing.
- 2.8.2 The work to be undertaken under the first phase is complete. Model 0 has been built, and tested to ensure both that all parts of the model are running correctly and that the forecasts are reasonable.
- 2.8.3 It is important to note that with DELTA, the model is forecasting change over time in one-year steps. Whilst this allows the model to be designed in terms of recognizable processes of change, it means that there is never a full data set of spatially and temporally detailed land-use change data on which the whole model can be directly calibrated. The processes of calibrating and adjusting the model therefore rely much more on
- results from previous research into the various processes represented, and
  - testing the reasonableness of the model results against expectations and (where possible) against the findings of previous impact studies.
- 2.8.4 This is broadly comparable with the "realism testing" now required in WebTAG (Unit 3.10.4). Our approach, in this case has included reviewing results and making adjustments until the results that we get are "realistic". Given that this involves dealing with locational effects, which do not lend themselves to being readily summarised as elasticities, the judgements involved in such decisions are perhaps more complex than in typical transport modelling situations.

## **2.9 Conclusion**

- 2.9.1 The model has been built accordingly to the specification described within the original Model Design Report. Its key characteristics are:

it covers the South West Peninsula, parts of Somerset and Dorset (in less detail) and the remainder of Britain as external zones;

the zone system is based largely upon wards within the South West Peninsula;

it is a standard application of DELTA;

it will interact with the transport model;

it uses planning policy information provided by the local planning authorities;

the initial scenarios are based upon RSS; and  
the DELTA model responses have been adjusted in the light of previous  
research, previous modelling experience and a set of tests to be discussed  
and agreed.

[end]

## **DEVELOPMENT OF A MODEL TO QUANTIFY IMPACT OF CHANGE ELSEWHERE (IMCHEL)**

### **1 INTRODUCTION**

*1.1.1* Devon County Council (DCC) have commissioned Parsons Brinckerhoff (PB) to development a land-use/transport interaction (LUTI) model of the South West Peninsula. This work forms a part of the DaSTS study of Exeter Gateway and the Far South West and as such is one of six projects that were commissioned within the South West Region as part of the Department for Transport's Delivering a Sustainable Transport Strategy (DaSTS) initiative.

*1.1.2* The land use and economic element of this work has been sub-contracted to David Simmonds Consultancy Limited (DSC). A separate DSC report has described the work on constructing a land use model of the South West Peninsula. This report describes the additional work that has been undertaken to build a model that will provide evidence of the impacts on the South West Peninsula of major transport infrastructure proposals in other parts of the country.

*1.1.3* The following sections describe:

- the model overview
- the model design
- the model definitions
- data sources
- the development of the model and interface to SWesPLUM.

### **2 THE IMPACT OF CHANGE ELSEWHERE MODEL (IMCHEL)**

#### **2.1 Model overview**

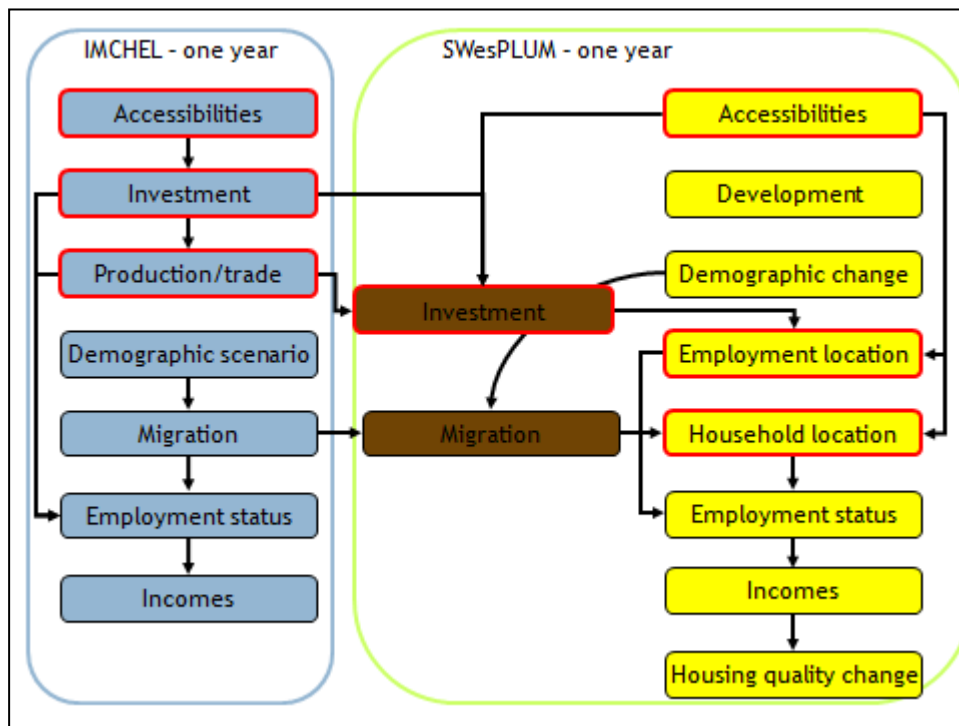
*2.1.1* The IMCHEL model comprises some, but not all, of the parts of the DELTA land-use/economic modelling package. It models economic, employment and population change over time and the manner in which the spatial pattern of this change is influenced by changing accessibility.

*2.1.2* The model may be run as a free-standing model or it may be linked to SWesPLUM. In freestanding mode it can quantify the broad impact of changes in accessibility in other parts of the country upon the South West Peninsula. As such it may be used to appraise the impact of schemes such as the electrification of the railway from London to South Wales.

2.1.3 When the model is linked to SWesPLUM it is possible to explore how the broad impact affects population, employment, levels of development etc at the finer zone level modelled within SWesPLUM.

## 2.2 Model design

2.2.1 The general structure of the model (and the linkages with SWesPLUM) are shown in Figure 1.



**Figure 1 . The key component parts of IMCHEM and SWesPLUM and their interaction within one year**

2.2.2 The key components are described in detail within the Model Description Report. Here we summarise the role of each component.

- The calculation of **accessibilities**: the estimate of costs and times for travelling between pairs of zones are summarised as generalised costs. Currently they are based upon synthetic costs, however the intention is that in the final version these costs will be provided by PB's transport model and will reflect the changes in transport infrastructure modelled there.
- **Investment**: this is a standard application of DELTA's Investment model (MK12). It forecasts future levels of investment by sector and area.
- **Production/trade**: this is a standard application of DELTA's Production and Trade model (MP12). It forecasts both patterns of production across areas and trade between areas. Along with the investment model referred to above it forms DELTA's Regional Economic Model

- **Demographic scenario.** A simplified version of the standard household transition model (MT12) has been applied. This is constrained to reflect TEMPRO's population and household estimates
- **Migration Model:** this model (MM12) models the movement of households between areas. Migration is largely driven by relative economic performance with people moving towards areas with relatively better economic performance and away from areas with relatively poor economic performance.
- **Employment Status:** this is a fairly standard application of DELTA's Employment status model (ME12). It calculates the demand for labour in terms that relate to the supply of labour and adjusts the numbers of persons in work to match the current demand for labour. (It is simpler than usual in that IMCHEL does not distinguish workers by socio-economic level or by car ownership; standard DELTA models, including SWesPLUM, do make these distinctions.)
- **Incomes:** the model takes account of different household budgets (given employment rates) and calculates consumer demand for goods and services in each areas.

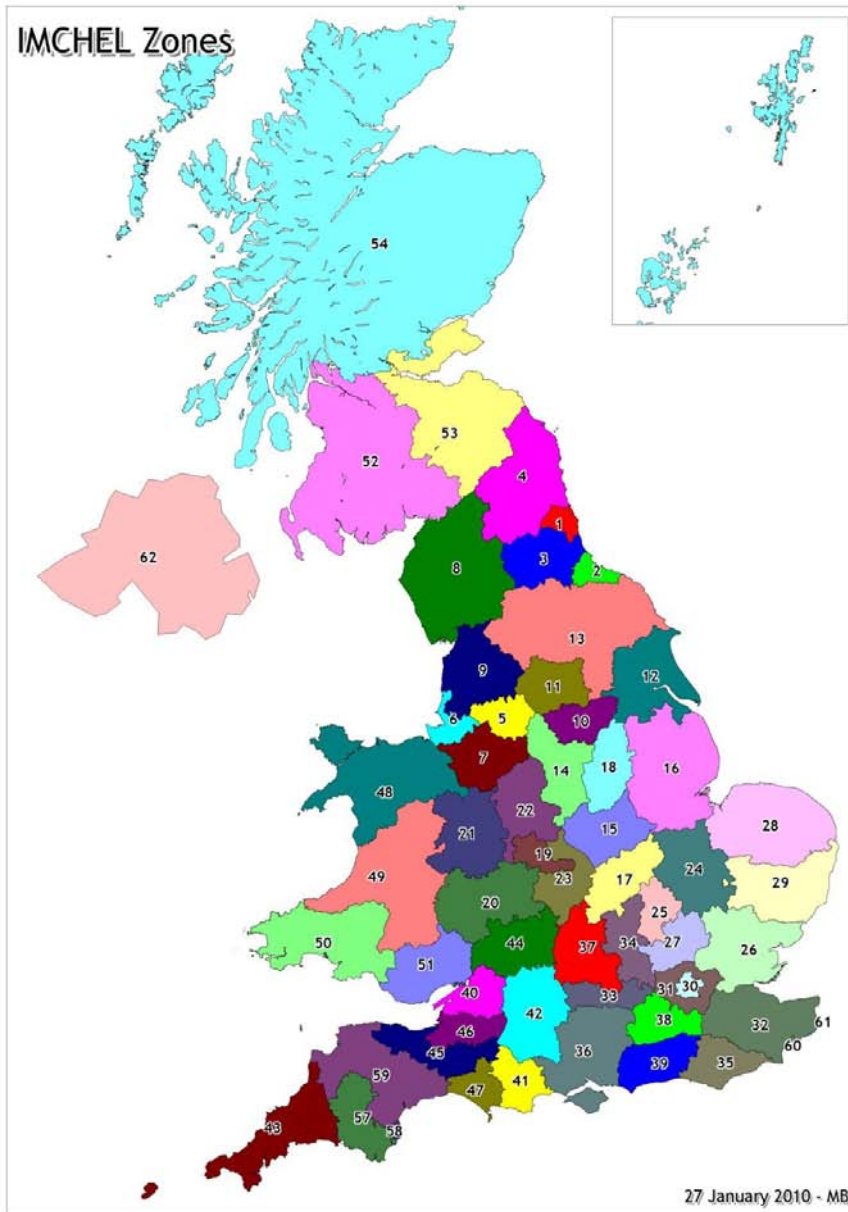
2.2.3 The model forecasts change in levels of population households and employment over time, starting from the 2008 base year and forecasting forward to 2031 in single-year steps.

## **2.3 Definition of the Fully Modelled Area**

2.3.1 The Fully Modelled Area covers the whole of the United Kingdom.

2.3.2 There are 62 zones. These are based upon counties within England and aggregations of local authority areas in Scotland and Wales. There is one zone for Northern Ireland. In addition there are specific zones representing Heathrow, Gatwick and the ports of Dover and Channel Tunnel terminal at Folkestone.

2.3.3 In most DELTA applications there are processes modelled at both a strategic and local level. The strategic modelling is undertaken at Area level whilst the local modelling is undertaken at a finer zone level. In this application we do not differentiate between areas and zones; only one spatial level is modelled.



## 2.4 Activities modelled

2.4.1 The term ‘activity’ is used throughout DELTA to refer to the various detailed categories of household and employment. In IMCHEL all household types are treated as one activity type, whilst employment is disaggregated into the seven categories shown in Table 2.1

**Table 2.1 IMCHEL employment classification**

IMCHEL Activity	Definition
11	Agriculture hunting forestry and fishing

<b>IMCHEL Activity</b>	<b>Definition</b>
12	Industry Construction and Transport
13	Distribution and Hotels
14	Finance and Business Services
15	Education
16	Health
17	Other services

2.4.2 IMCHEL does not model floorspace or changes in floorspace. It is assumed that at the scale that we are modelling that there will be sufficient capacity to ensure that demand for residential or employment floorspace resulting from increases in households or employment would always be accommodated.

## **2.5 Model development data sources**

2.5.1 A range of data sources have been used in developing the model. These include:

- 2001 Census results have been used to create the base year population and household database
- Mid-Year Population Estimates were used to generate change in population over the period from 2001 to the model's base year of 2008.
- 2008 Households based upon DCLG, GROS, WAG and NIRS&RA household projections
- The Regional Economic Model incorporated data from ONS on final demand and HM Treasury Input Output Tables

## **2.6 Transport modelling for IMCHEL**

2.6.1 Parsons Brinckerhoff are developing a transport model that will pass generalised costs to the land use model. The interaction from the transport model will be developed as part of the next stage of this project. Note that there is no plan to pass land-use data to the transport within IMCHEL, and as a result IMCHEL does not form a full land-use/transport interaction (LUTI) model.

## **2.7 Demographic and economic scenarios**

2.7.1 The model requires a scenario that defines the overall level of demographic and economic growth within the Modelled Area. These have been based upon the published TEMPRO forecasts within Great Britain, and a similar growth rate in Northern Ireland.

## **2.8 The interaction with SWesPLUM**

2.8.1 A brief description of the interaction with SWesPLUM was included within the Model Overview. The interaction has required the development of new software. This has been tested as part of this phase of model development.

## **2.9 The model development**

2.9.1 The initial work programme involved the completion of IMCHEL by April 2010. This has included the designing and building of the basic model and running it with synthetic costs (rather than with costs generated by the transport model).

2.9.2 The next step will require the linking of the land use model with the transport model that Parsons Brinkerhoff are constructing, using the modelled transport costs instead of our simpler synthetic costs.

2.9.3 The work to be undertaken under the first phase is complete. The model has been built, and tested to ensure both that all parts of the model are running correctly and that the forecasts are reasonable.

## **2.10 Conclusion**

2.10.1 The model has been built accordingly to the specification contained in DSC's Proposal for a model to assess the impact of change elsewhere. Its key characteristics are:

- it models the impact of change elsewhere (upon the South West Peninsula)
- it is a UK wide model
- once the transport modelling and the interface from transport model to IMCHEL are complete, it can be used to test the impact on the South West of major transport schemes in other regions and sub-regions.

[end]