Modelling the accessibility of opportunities for the young unemployed of the Forest of Dean

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1. Introduction

The aim of this stage of the TRANTEL project was to produce an accessibility model to help ascertain which locations within the Forest of Dean suffer from inaccessibility problems, in relation to the transport network providing access to jobs, training and IT facilities. Once the current pattern of accessibility has been establish, the model will then be used to establish the extent to which different transport and IT schemes affect the level of accessibility in different locations, and thus to inform decision-makers on the most appropriate approach to alleviating youth unemployment within the District.

2. The location of young unemployed people in 2001

The first stage of the modelling work was to ascertain the current distribution and characteristics of young unemployed people across the district. Data from the census of population 2001 was mapped at output area level. From this data it was established that there is no obvious pattern in the distribution of young people across the district (figure 1), although there seemed to be some clustering into particular areas. One output area in particular, in the North East of the district, stands out. Over five hundred and fifty residents of this output area are aged between 16 and 24. Five hundred and thirteen of these have lower level qualifications, 203 are economically active students and 321 are listed as students who are economically inactive. Four hundred of them are female. These figures seem to suggest that this output area might contain a facility such as a nurses' home, which distorts the pattern.

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Looking at the density of young people across the district (figure 2) it becomes obvious that young people tend to be clustered in and around the towns i.e. Newent, Micheldean, Cinderford, Coleford, Lydney and Sedbury in the far south.

No obvious pattern presents itself when viewing young people as a percentage of total population (figure 3). In the south and central areas of the district, those output areas with high proportions of young people seem to be located in and close to the more urban areas, though there are exceptions to this. In the north of the district young people seem to be generally more evenly distributed, excluding of course the oddity of the output area with exceptionally high numbers of young people already mentioned, where 68% of the population are aged 16-24.

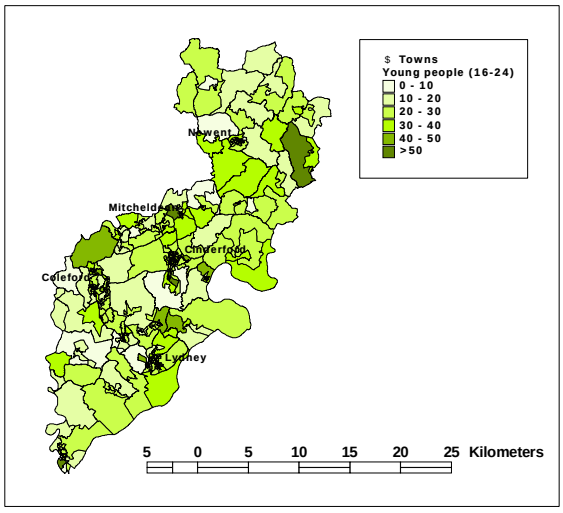

Figure 1: Population of Young People (16-24) in the Forest of Dean, 2001

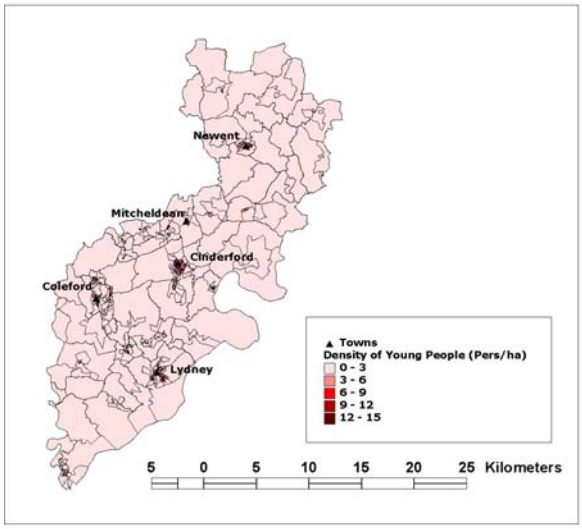

Figure 2: Density of Young People, 2001 (persons per hectare)

Areas with high youth unemployment seem to be clustered around the main towns (figure 4), comprising in each case a mix of inner areas and outer suburbs/surrounding villages. The proportion of unemployment amongst young people is as high as 40% in one output area in the NW (see figure 5), although as only 8 persons 16-24 reside in this output area, actual numbers unemployed are relatively low. The distribution of areas with high proportions of young people who are unemployed follows the same pattern as for the numbers of young unemployed, with clustering occurring in areas of all the main towns.

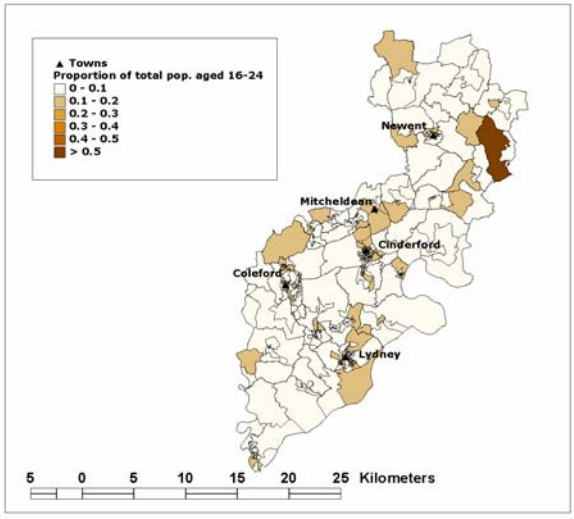

Figure 3: The proportion of total population aged 16-24, 2001

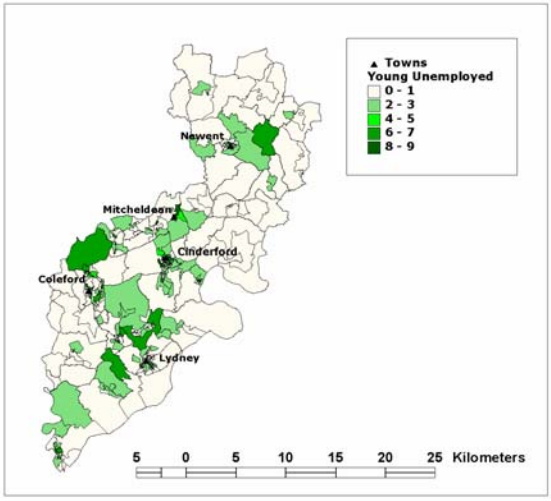

Figure 4: Numbers of young unemployed, 2001

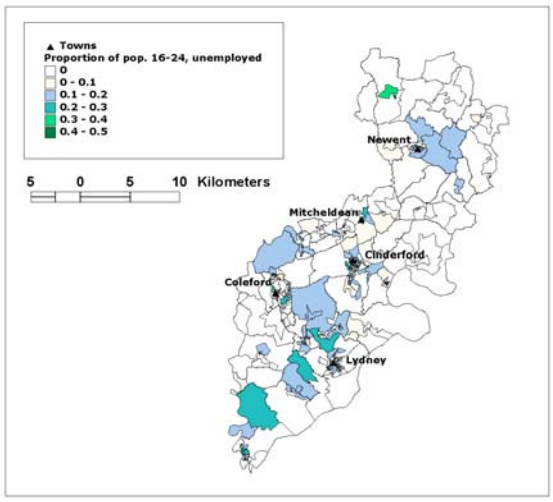

Figure 5: Proportion of 16-24 year olds who are unemployed.

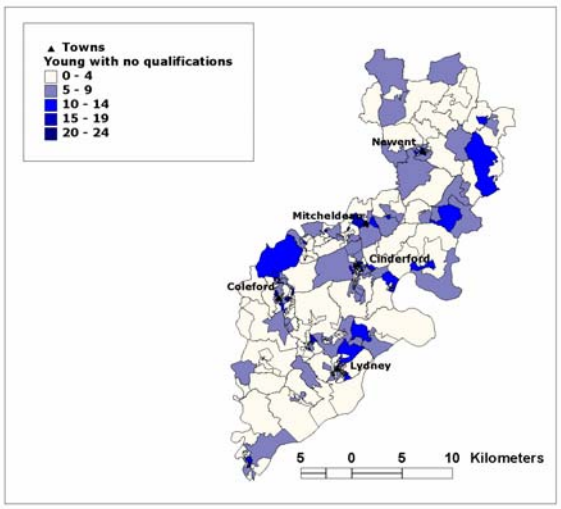

Figure 6: Distribution of young people with no qualifications, 2001

High unemployment rates and high numbers of 16-24 year olds with no qualifications tend to go together (figures 5 and 6). Although there are a few areas that have high numbers of young people with no qualifications but suffer from low youth unemployment; this is particularly noticeable in the output areas closest to Gloucester. The young unemployed with no qualifications tend to be found around the main towns, Lydney and Cinderford in particular and possibly Micheldean (figure 7). Over 60% of those with no qualifications are unemployed in some areas. Areas with high levels of unemployment amongst those with lower level qualifications are particularly clustered around Cinderford and Newent, although

some clustering is evident in the other towns (figure 8). The biggest problems of unemployment amongst those with higher-level qualifications are in the central area of the Forest of Dean, between Lydney and Coleford but also including areas of Cinderford and Micheldean (figures 9 and 10).

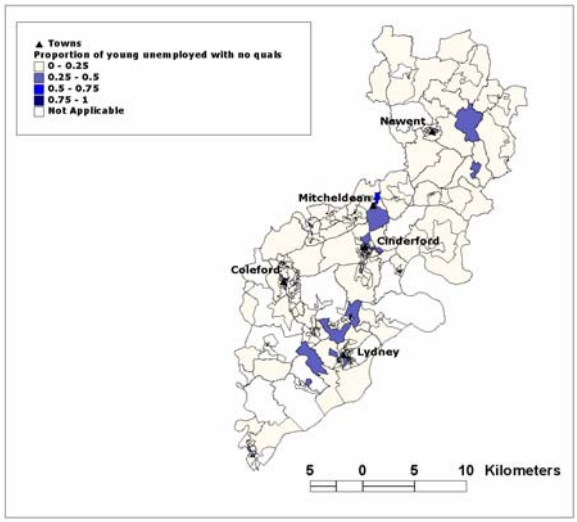

Figure 7: Proportion of young people with no qualifications who are unemployed, 2001.

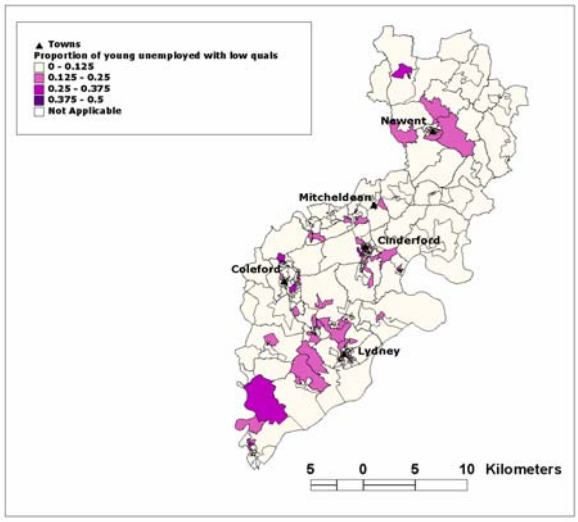

Figure 8: Proportion of young people with low level qualifications who are unemployed, 2001.

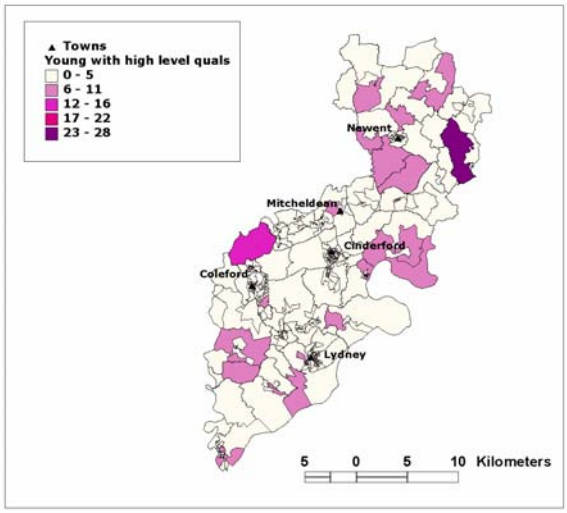

Figure 9: Distribution of young people with high level qualifications, 2001

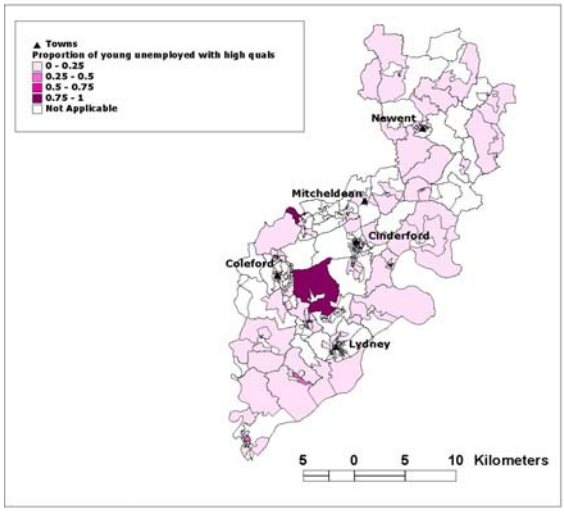

Figure 10: Proportion of young people with high level qualifications who are unemployed, 2001

The numbers are too small to do any detailed analysis by gender, only to say that unemployment amongst females seems to be generally lower than for males but follows similar patterns.

3. The TRANTEL model

A model was set up to measure the accessibility of different types of jobs, further education and training, job search facilities and IT facilities to young people (16-24). Because the measure of opportunity used for the four types of facility (employment, education, job search and IT) were different, it was not possible to combine these into a single accessibility index without the use of arbitrarily decided weightings. Instead four accessibility indices were produced, one for each facility type.

It was originally intended to use the gravity model component of the GIS-based transport model ESTEEM, developed by the Bartlett School of Planning (see Titheridge, 2002a), to calculate an accessibility index for the Forest of Dean, however for a gravity model to work effectively as a measure of accessibility the model needs to be doubly-constrained i.e. at both the origin and destination (Geurs and Ritsema van Eck, 2000). ESTEEM is only constrained to the origin, as it utilises measures of attraction other than trip rates (e.g. retail floor area). This means that where the distribution of opportunities (destinations) is uneven the take up of some opportunities could be oversubscribed and others undersubscribed and, therefore, not give a true reflection of accessibility of the opportunities in question. Thus it was necessary to develop an alternative measure of accessibility.

A simple Hanson-style (Hanson, 1959) measure of accessibility was chosen where accessibility is taken to be the number of opportunities available weighted by the inverse of the distance to those opportunities. This was then summed for each opportunity type and the natural log was taken. Equation (1) below was used to calculate the accessibility indices for education and training, job search and IT facilities. Separate sets of indices were created for each mode (car and bus).

$$A_{im} = \ln\left(\sum_j O_j d_{ijm}^{-1}\right)$$

where A_i is the accessibility of origin i to all destinations j by mode m;

O_j is the number of opportunities at destination j; and

D_{ij} is the distance by mode m between origin i and destination j.

For job opportunities it was felt that it was important to match the employment type to the gender and level of qualifications of young unemployed people in the Forest of Dean as both the characteristics can affect the types of jobs open to a person. Using data from the Labour Force Survey for Mar-May 2001, a number of chi square tests were carried out to check that there was a significant difference between the qualification profiles of employees for different occupations. These tests confirmed that there was a highly significant relationship between occupation and the highest level of qualification obtained (tables 1 and 2). There was no relationship between gender and the highest level of qualification obtained for unemployed 16-24 year olds, however, there was a significant relationship between the highest level of qualification obtained and gender for those in employment (see tables 3 and 4).

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Highest qualification obtained * Major occupation group (main job)	4035	62.1%	2465	37.9%	6500	100.0%

Highest qualification obtained * Major occupation group (main job) Crosstabulation

			Major occupation group (main job)									
			1 Managers and Senior Officials	2 Professional occupations	3 Associate Professional and Technical	4 Administrative and Secretarial	5 Skilled Trades Occupations	6 Personal Service Occupations	7 Sales and Customer Service Occupations	8 Process, Plant and Machine Operatives	9 Elementary Occupations	Total
Highest qualification obtained	Degree or equivalent	Count	28	101	93	48	13	4	25	10	21	343
		Expected Count	12.1	17.3	34.5	26.9	71.2	8.1	53.7	28.6	90.8	343.0
	Higher education	Count	7	23	43	17	31	3	14	13	29	180
		Expected Count	6.3	9.1	18.1	14.1	37.3	4.2	28.2	15.0	47.6	180.0
	GCE A Level or equiv	Count	60	48	156	130	283	37	207	61	232	1214
		Expected Count	42.7	61.1	122.2	95.1	251.8	28.6	190.1	101.1	321.3	1214.0
	GCSE grades A-C or equiv	Count	36	20	87	103	337	38	306	124	463	1514
		Expected Count	53.3	76.2	152.3	118.6	314.1	35.6	237.1	126.1	400.7	1514.0
	Other qualifications	Count	9	9	22	13	83	8	37	68	145	394
		Expected Count	13.9	19.8	39.6	30.9	81.7	9.3	61.7	32.8	104.3	394.0
	No qualification	Count	2	2	5	5	90	5	43	60	178	390
		Expected Count	13.7	19.6	39.2	30.5	80.9	9.2	61.1	32.5	103.2	390.0
Total		Count	142	203	406	316	837	95	632	336	1068	4035
		Expected Count	142.0	203.0	406.0	316.0	837.0	95.0	632.0	336.0	1068.0	4035.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1187.885[a]	40	.000
Likelihood Ratio	1027.270	40	.000
Linear-by-Linear Association	626.851	1	.000
N of Valid Cases	4035		

a. 1 cells (1.9%) have expected count less than 5. The minimum expected count is 4.24.

Table 1: Chi Square analysis of highest qualification v occupation for males 16-24.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Highest qualification obtained * Major occupation group (main job)	3887	58.2%	2792	41.8%	6679	100.0%

Highest qualification obtained * Major occupation group (main job) Crosstabulation

			Major occupation group (main job)									
			1 Managers and Senior Officials	2 Professional occupations	3 Associate Professional and Technical	4 Administrative and Secretarial	5 Skilled Trades Occupations	6 Personal Service Occupations	7 Sales and Customer Service Occupations	8 Process, Plant and Machine Operatives	9 Elementary Occupations	Total
Highest qualification obtained	Degree or equiv	Count	22	95	123	94	3	21	36	2	16	412
		Expected Co	11.4	14.1	38.2	85.6	5.6	65.7	105.3	10.0	76.1	412.0
	Higher educatio	Count	6	2	53	55	3	36	29	0	27	211
		Expected Co	5.9	7.2	19.5	43.9	2.9	33.7	53.9	5.1	39.0	211.0
	GCE A Level or	Count	41	20	91	308	19	193	312	14	195	1193
		Expected Co	33.1	40.8	110.5	248.0	16.3	190.3	304.8	28.9	220.4	1193.0
	GCSE grades A equiv	Count	30	11	79	308	25	251	488	45	347	1584
		Expected Co	44.0	54.2	146.7	329.3	21.6	252.7	404.7	38.3	292.6	1584.0
	Other qualificati	Count	7	4	9	34	1	69	61	16	50	251
		Expected Co	7.0	8.6	23.2	52.2	3.4	40.0	64.1	6.1	46.4	251.0
	No qualification	Count	2	1	5	9	2	50	67	17	83	236
		Expected Co	6.6	8.1	21.9	49.1	3.2	37.6	60.3	5.7	43.6	236.0
Total		Count	108	133	360	808	53	620	993	94	718	3887
		Expected Co	108.0	133.0	360.0	808.0	53.0	620.0	993.0	94.0	718.0	3887.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1196.221[a]	40	.000
Likelihood Ratio	937.562	40	.000
Linear-by-Linear Association	559.049	1	.000
N of Valid Cases	3887		

a. 3 cells (5.6%) have expected count less than 5. The minimum expected count is 2.88.

Table 2: Chi square analysis of highest qualification v occupation for females, 16-24

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Highest qualification obtained * Economic activity (reported)	13179	100.0%	0	.0%	13179	100.0%

Highest qualification obtained * Economic activity (reported) Crosstabulation

			Economic activity (reported)			
			In employment	ILO unemployed	Inactive	Total
Highest qualification obtained	Degree or equivalent	Count	756	36	142	934
		Expected Count	565.2	67.0	301.8	934.0
	Higher education	Count	391	25	72	488
		Expected Count	295.3	35.0	157.7	488.0
	GCE A Level or equiv	Count	2412	163	1262	3837
		Expected Count	2321.9	275.4	1239.7	3837.0
	GCSE grades A-C or equiv	Count	3115	362	1321	4798
		Expected Count	2903.4	344.4	1550.2	4798.0
	Other qualifications	Count	663	150	362	1175
		Expected Count	711.0	84.3	379.6	1175.0
	No qualification	Count	638	210	1099	1947
		Expected Count	1178.2	139.8	629.1	1947.0
Total		Count	7975	946	4258	13179
		Expected Count	7975.0	946.0	4258.0	13179.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1033.025[a]	10	.000
Likelihood Ratio	1040.288	10	.000
Linear-by-Linear Association	648.811	1	.000
N of Valid Cases	13179		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 35.03.

Table 3: Chi square analysis of highest qualification and employment status for 16-24 year olds in employment

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Highest qualification obtained * Sex	8025	100.0%	0	.0%	8025	100.0%

Highest qualification obtained * Sex Crosstabulation

Count

		Sex		
		Male	Female	Total
Highest qualification obtained	Degree or equivalent	343	413	756
	Higher education	180	211	391
	GCE A Level or equiv	1218	1194	2412
	GCSE grades A-C or equiv	1528	1587	3115
	Other qualifications	409	254	663
	No qualification	397	241	638
	Don't know	24	26	50
Total		4099	3926	8025

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	81.065[a]	6	.000
Likelihood Ratio	81.766	6	.000
Linear-by-Linear Association	46.923	1	.000
N of Valid Cases	8025		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 24.46.

Table 4: Chi square analysis of highest qualification and gender for unemployed 16-24 year olds

Jobs were sub-divided into nine categories based on occupation. The jobs available in each occupation type were weighted according to gender and qualifications. Three levels of qualifications were used (none, low level qualifications and high level qualifications).

$$A_{ilmn} = \ln(\sum_{jk} W_{klm} O_{jk} d_{ijn}^{-1})$$

where A_{ilmn} is the accessibility of young people living in origin i of gender l and qualifications n to all destinations j and for all opportunity types k by mode m;

W_{klm} a weighting applied to each opportunity type k to represent the degree to which people of different genders k and qualification levels m are employed in that occupation;

O_{jk} is the number of opportunities at destination j of type k; and

D_{ijm} is the distance by mode m between origin i and destination j.

The weightings W were derived from Labour Force Survey data for March-May 2001 by cross-tabulating main occupation by the highest level of qualification obtained and by gender. The proportion of males and females with each level of qualification obtainment employed in each occupation was then calculated. It was assumed that those with the highest levels of qualification would be eligible to apply for jobs requiring only low level or no qualifications. Similarly, it was assumed that those with low level qualifications would be able to apply for jobs requiring no qualifications. Thus cumulative totals employed in each occupation were used in the calculations to obtain the weightings (see tables 5 and 6).

To avoid a duplication of effort, many elements of ESTEEM, including its user-interface, network routing algorithms, and data handling procedures were utilised. The algorithms to calculate accessibility as specified above were added to the ESTEEM executable and the ArcView extension scripts were adjusted to handle the additional output variable.

In order to measure the distance to opportunities required to calculate the accessibility indices, the TRANTEL model uses output area population centroids to represent the origin of journeys and workplace centroids to represent journey destinations in the case of employment. The location of educational facilities, job search facilities and IT centres are represented individually, rather than as centroids as is the case for employment. The origins and

										Cumulative
Male, 16-24										
Qualification/ Occupation	**Managers & Senior Officials**	**Professional**	**Assoc. Professional & Technical**	**Admin. & Secretarial**	**Skilled Trades**	**Personal Services**	**Sales & Customer Services**	**Process Plant & Machine Operatives**	**Elementary Occupations**	**Total**
High Level	143	203	408	317	845	95	637	340	1070	4058
Low Level	108	79	272	252	801	88	598	317	1020	3535
None	3	2	7	6	98	5	48	64	180	413
All Qualifications	**143**	**203**	**408**	**317**	**845**	**95**	**637**	**340**	**1070**	**4058**
Female, 16-24										
Qualification/ Occupation	**Managers & Senior Officials**	**Professional**	**Assoc. Professional & Technical**	**Admin. & Secretarial**	**Skilled Trades**	**Personal Services**	**Sales & Customer Services**	**Process Plant & Machine Operatives**	**Elementary Occupations**	**Total**
High Level	111	133	361	811	54	621	999	96	727	3913
Low Level	83	36	185	662	48	564	934	94	684	3290
None	5	1	6	12	3	51	73	19	92	262
All Qualifications	**111**	**133**	**361**	**811**	**54**	**621**	**999**	**96**	**72**	**3913**
All, 16-24										
Total Opportunities	**254**	**336**	**769**	**1128**	**899**	**716**	**1636**	**436**	**1797**	**7971**

Source: LFS Mar-May 2001

Table 5: Employment in each occupation type by gender and qualification

Percent of jobs available

Male, 16-24

Qualification/ Occupation	Managers & Senior Officials	Professional	Assoc. Professional & Technical	Admin. & Secretarial	Skilled Trades	Personal Services	Sales & Customer Services	Process Plant & Machine Operatives	Elementary Occupations	Total
High Level	56	60	53	28	94	13	39	78	60	51
Low Level	43	24	35	22	89	12	37	73	57	44
None	1	1	1	1	11	1	3	15	10	5

Female, 16-24

Qualification/ Occupation	Managers & Senior Officials	Professional	Assoc. Professional & Technical	Admin. & Secretarial	Skilled Trades	Personal Services	Sales & Customer Services	Process Plant & Machine Operatives	Elementary Occupations	Total
High Level	44	40	47	72	6	87	61	22	40	49
Low Level	33	11	24	59	5	79	57	22	38	41
None	2	0	1	1	0	7	4	4	5	3

All, 16-24

Qualification/ Occupation	Managers & Senior Officials	Professional	Assoc. Professional & Technical	Admin. & Secretarial	Skilled Trades	Personal Services	Sales & Customer Services	Process Plant & Machine Operatives	Elementary Occupations	Total
High Level	100	100	100	100	100	100	100	100	100	100
Low Level	76	35	59	81	94	91	94	95	95	85
None	3	1	2	2	11	8	7	19	15	8

Source: LFS Mar-May 2001

Table 6: Percent of jobs available in each occupation type by gender and qualification (assuming that jobs requiring lower level qualifications are available to those with higher level qualifications).

destinations are attached to the nearest link in the network at its nearest point using dynamic segmentation. The shortest distance between each origin and destination is calculated using the appropriate network i.e. the road network for car journeys and a separate bus network for bus journeys. The distance from the origin or destination to the network is not included in the calculations. If the distance from the origin or destination to the nearest link of the network is greater than 4000m then an accessibility value to 0 is returned. Journey times and travel costs are not taken into account.

Accessibility by non-motorised modes or by rail is not modelled.

4. Baseline data

Jobs opportunity was measured as the daytime workplace population of each ward in Gloucestershire, taken from the Census of Population 2001.

Opportunity for further education and training was measured as the number of student places at each further education establishment in Gloucestershire.

Job search opportunities were represented by the size of the job centre, measured by their client list as data on the number of vacancies handled by each facility was unavailable. Private employment agencies were included as well as Government job centres.

The availability of IT facilities was represented by the number of terminals available at each location. Terminals for public use in libraries, council offices and community centres were included, as were terminals in Internet cafes. Internet kiosks provided by BT were also incorporated.

The distance to the opportunities was measured along the network using ESTEEM's shortest path algorithm. For young people with a car, the distance was calculated using Bartholomew's 1:200,000 road network. This includes all major roads and some minor roads.

For those without a car, the distance was calculated using a network representing frequent bus services (at least hourly on weekdays) that was originally created for the URBASS project (see Titheridge, 2000; 2002b). As this network is rather sparse, it was necessary to include a limit on the distance a person would be expected to travel to a bus stop. This was set at 4km, representing an hour's walk.

The weightings used in calculating the accessibility indices for job opportunities were produced using Labour Force Survey data for 2001 on the numbers of the workforce from each gender with each qualification level in nine occupation categories (see table 6).

Data on car availability amongst young people in the Forest of Dean was unavailable so it was not possible to establish accurate weightings for the two modes and, thus, it was not possible to combine the indices for the two modes into a single set.

5. Results (2001) situation

Tables 7 and 8 summarise the results.

Gender	Transport	Qualifications	Summary of Accessibility Indices for output areas		
			Total	Mean	St. Dev
Male	With a car	None	1688	6.36	0.58
		Low Level	2252	8.60	0.57
		High Level	2306	8.80	0.56
	Without a car	None	1455	5.55	2.38
		Low Level	1953	7.45	3.13
		High Level	1997	7.62	3.20
Female	With a car	None	1488	5.68	0.58
		Low Level	2169	8.28	0.57
		High Level	2240	8.55	0.56
	Without a car	None	1300	4.96	2.13
		Low Level	1879	7.17	3.01
		High Level	1937	7.39	3.10

Table 7: Summarises the access to job indices obtained for each output area showing current accessibility levels, 2001.

Facility Type	Transport	Summary of Accessibility Indices for output areas		
		Total	Mean	St. Dev
Job Search	With a car	2025	7.73	0.29
	Without a car	1670	6.37	2.66
Education	With a car	693	2.59	0.21
	Without a car	557	2.43	0.90
IT	With a car	699	2.61	0.53
	Without a car	617	2.47	1.23

Table 8: Summarises the indices obtained for each output area showing current accessibility levels, 2001.

5.1 Access to jobs

Young males (16-24) with a car but no qualifications living in the far south of the district are worst off with regards to accessibility to jobs than their counterparts living in other areas of the Forest of Dean, with long distances to travel to the main towns, and to Gloucester in particular (figure 11). Those living in the main towns and those living close to the border with Gloucester have the highest levels of accessibility to jobs. Young males with low qualifications who have access to a car are better off generally than those with no qualifications (figure 13). This is particularly noticeable in the extremes of the district where accessibility was generally poor and in the town centres, where having some qualifications opens up a wider range of job opportunities. Young males with high level qualifications living in the main towns or in the area closest to Gloucester have better access to jobs that their counterparts with no or only low level qualifications (figure 15).

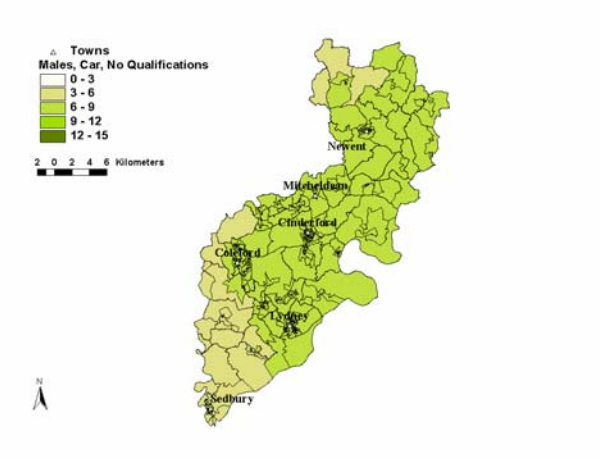

Figure 11: Accessibility to job opportunities for males with no qualifications but with access to a car

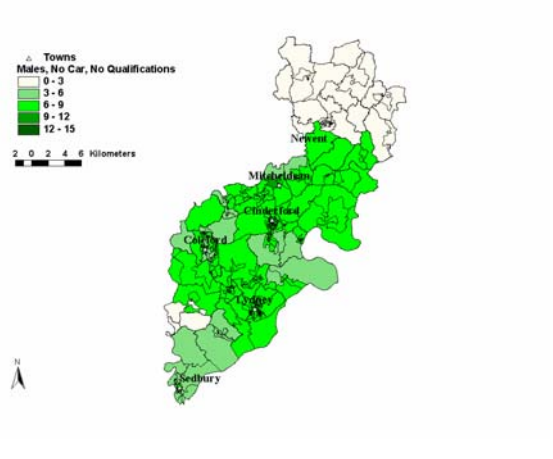

Figure 12: Accessibility to job opportunities for males with no qualifications and no access to a car

Young males who are reliant on the bus and have no qualifications are best off in terms of access to jobs if living in the central area, close to the main towns, or along the bus routes serving Gloucester i.e. in the area north of Micheldean (figure 12). Those in the far north of the district have very low levels of accessibility, as there are no frequent bus routes serving this area. The model gives these areas zero accessibility, as they are more than 4 km from a bus route. It should be noted that there will be some jobs which are accessible on foot, particularly for those living in Newent. However, walk trips are not modelled within the TRANTEL accessibility model so cannot be taken into account. Having low-level qualifications, in contrast to no qualifications, increases the accessibility of jobs for those living close to bus routes and in the town centres, but does little to help those in the far north

or southwest corner of the district (figure 14). Even having high-level qualifications does not alleviate the bus problems in the north of the district (figure 16).

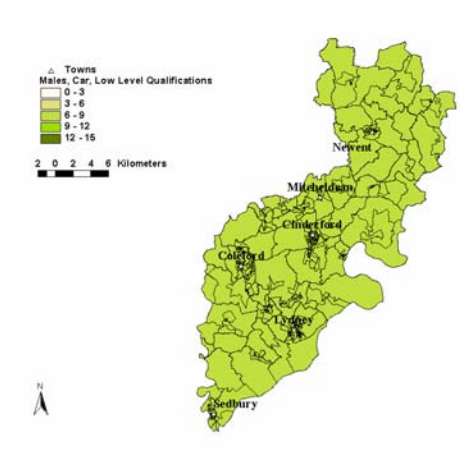

Figure 13: Accessibility to job opportunities for males with low level qualifications but with access to a car

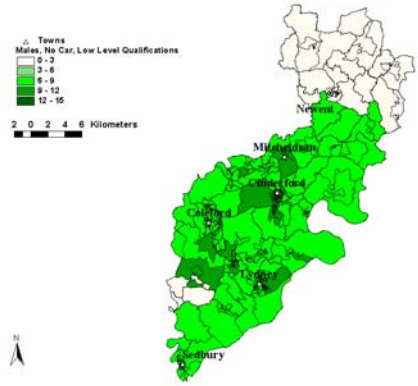

Figure 14: Accessibility to job opportunities for males with low level qualifications and no access to a car

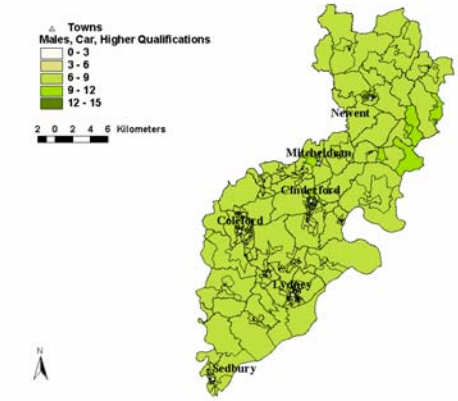

Figure 15: Accessibility to job opportunities for males with high level qualifications but with access to a car

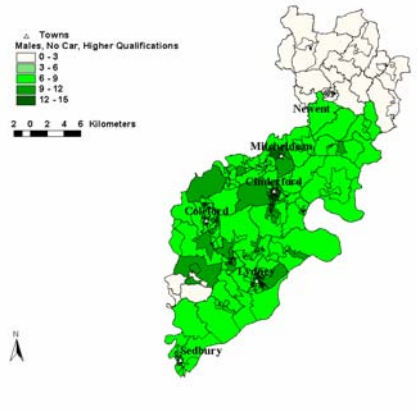

Figure 16: Accessibility to job opportunities for males with high level qualifications and no access to a car

For young females with no qualifications the level of access to opportunities was low across the district, except for those living in the main towns (figure 17). For those reliant solely on the bus, access to opportunities was extremely poor for those living in the north of the district or in the southwest corner (figure 18). The level of accessibility to jobs for those females with low level qualifications and access to a car was fairly ubiquitous across the district and generally twice that for no qualifications (figure 19). Access to jobs for those females reliant on the bus was generally better for those with low level qualifications than those with no qualifications, except in the north and south-west corners of the district where no

improvement was evident (figure 20). However, as already mentioned, this lack of change in these two areas has much to do with the model assumptions, as in areas with no regular bus service opportunities within walking distance were not taken into account. The level of access to opportunities for females with high-level qualifications seems to be little better than for those with lower level qualifications. The difference was more noticeable for bus users (figure 22) than for car users (figure 21).

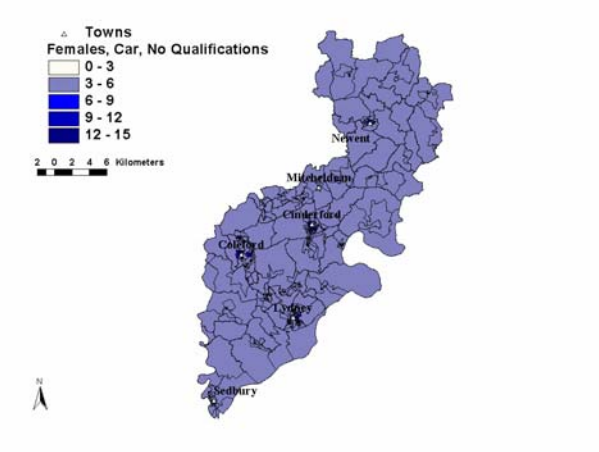

Figure 17: Accessibility to job opportunities for females with no qualifications but with access to a car

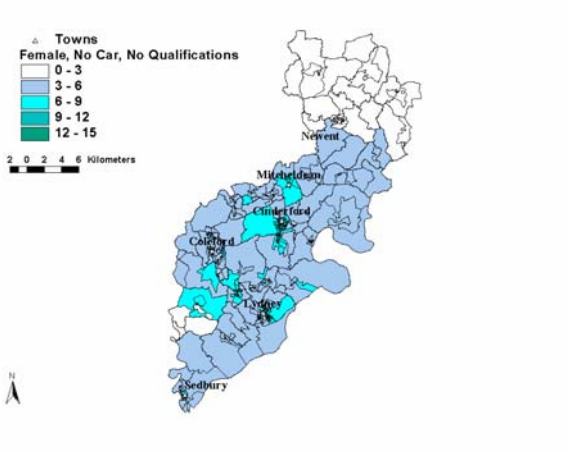

Figure 18: Accessibility to job opportunities for females with no qualifications and no access to a car

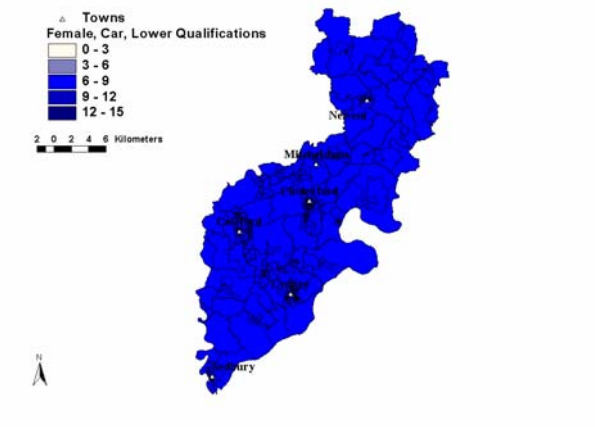

Figure 19: Accessibility to job opportunities for females with low level qualifications but with access to a car

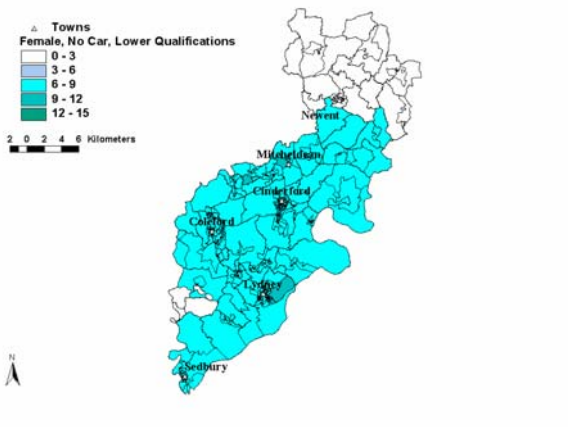

Figure 20: Accessibility to job opportunities for females with low level qualifications and no access to a car

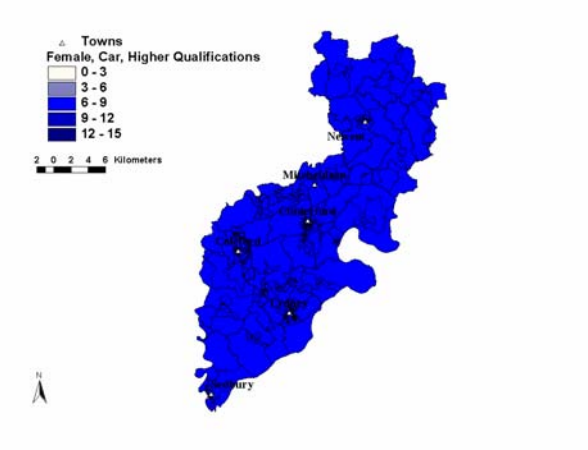

Figure 21: Accessibility to job opportunities for females with high level qualifications but with access to a car

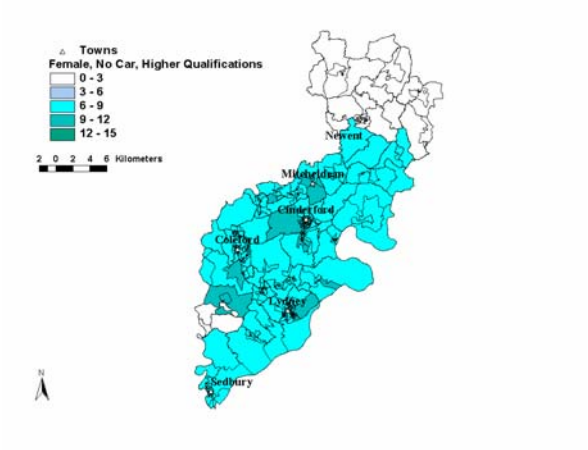

Figure 22: Accessibility to job opportunities for females with high level qualifications and no access to a car

Access to job search facilities

Similar levels of access to job search facilities are seen across the district (figure 23). Access seems to be only problematic for those reliant on the bus (figure 24), who live in the more rural areas of the north and south west of the district.

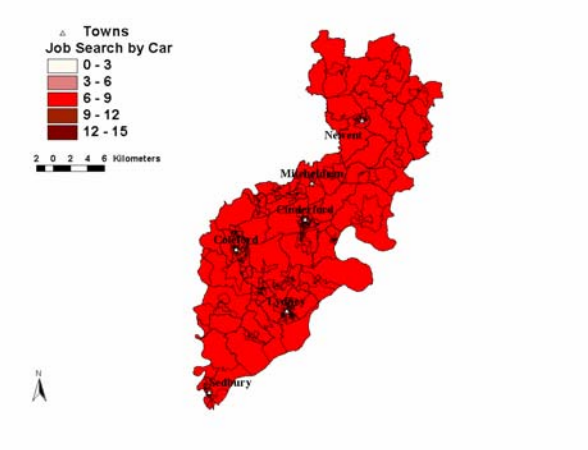

Figure 23: Accessibility indices to job search facilities for those with access to a car

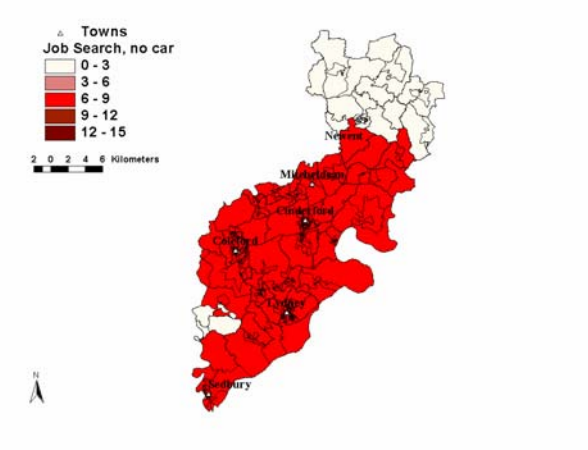

Figure 24: Accessibility indices to job search facilities for those without access to a car

Access to education and training

The highest levels of access to education and training are experienced by those living closest to Gloucester with access to a car (figure 25). Access to education and training for those with

a car is poorest in the south of the district, i.e. furthest from Gloucester. For those reliant on the bus, access to education and training was highest for those living just north of the central area (figure 26). Those living in the far north of the district without access to a car suffer from very poor levels of accessibility to educational facilities.

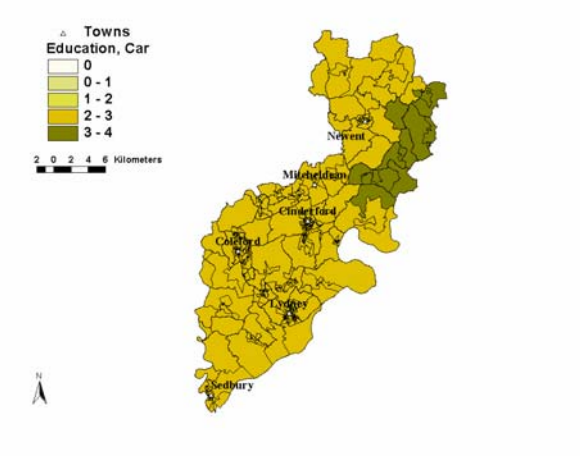

Figure 25: Accessibility indices to education facilities for those with access to a car

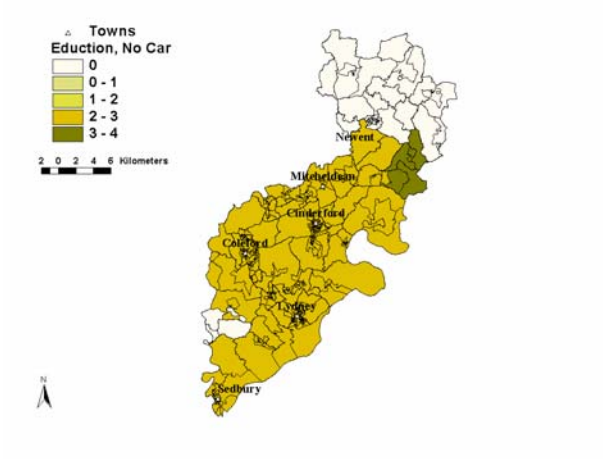

Figure 26: Accessibility indices to education facilities for those without access to a car

5.2 Access to IT facilities

Levels of access to IT facilities for those with access to a car are highest in the areas around the main towns, as well as in the areas close to Gloucester (figure 27). Access to IT facilities in the far south of the district (i.e. around Sedbury) is low.

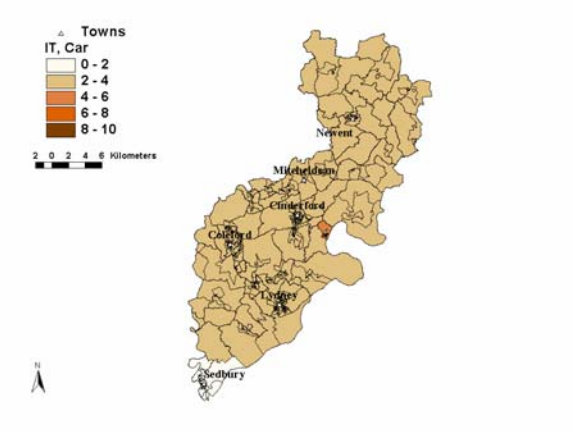

Figure 27: Accessibility indices to education facilities for those with access to a car

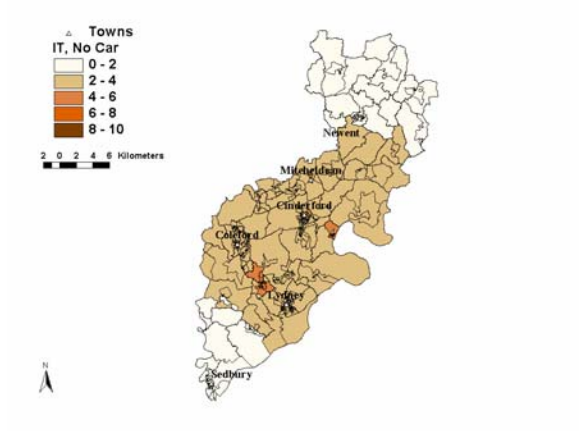

Figure 28: Accessibility indices to education facilities for those without access to a car

For those using the bus to access these facilities, the highest levels of accessibility are experienced by those living in central area (i.e. around Lydney, Coleford, Cinderford and Micheldean). Once again, those living in the far north of the district without access to a car have no access to these facilities (figure 28).

6. Scenario Modelling

A number of different schemes were tested for their effect on the accessibility of the area. These were 1) the introduction of a demand responsive bus feeder service, 2) a vehicle club, 3) the opening of five telecentres to provide access to job search and training facilities, as well as virtual jobs, 4) installation of internet kiosks in every village, and 5) a scheme for recycling/renovating old computers and supplying them to the young unemployed (Tool for YU). The reasons for choosing these schemes is outlined in working paper 5. This highlights a further scheme (extending Foyer Schemes to the young unemployed as a way of providing an affordable "relocation package"), which it was not possible to model. This is because this scheme would require relocation of the young unemployed to areas outside of that covered by the model. The assumptions made in order to model each of the schemes outlined above are described below.

6.1 DRT

As the accessibility model uses a fixed transport network, modelling a flexible route bus service is not straightforward. It was felt that a suitable proxy would be to use the current full bus network (not the network of frequent services used in the baseline model). This is a smaller network than used for cars, thus reflecting the longer distance travelled to get to a destination if one goes via DRT rather than by car. The network is relatively comprehensive, covering all the main settlements and most of the smaller settlements, thus reflecting the wider coverage achieved using DRT compared with conventional services. It was assumed that enough DRT service areas would be operating to cover the whole district.

6.2 Vehicle Club

The assumption in modelling the vehicle club was that everyone would have access to a motor vehicle and therefore the road network was used to create the accessibility indices. Again, the assumption used is that the scheme in question is of sufficient size to cover the whole district.

6.3 Telecentres

From the analysis of the 2001 census data and the 2001 accessibility maps seven possible locations for telecentres were identified: Newent, Bream, Sedbury, Lydney, Coleford, Cinderford, Micheldean and Nailsbridge. Newent and Sedbury were in or close to areas where access to jobs, particularly by public transport was difficult. Lydney, Coleford, Cinderford and Micheldean were identified as centres with high numbers of young unemployed people. Nailsbridge and Bream were mid-point locations between these four main centres.

It was assumed that each telecentre would provide 15 terminals, all with Internet and email access and that five centres would be built. These were added to the list of IT facilities used to model the baseline situation. The model was run a number of times for different combinations of telecentre locations.

Run 1: Newent, Micheldean, Cinderford, Coleford and Lydney

Run 2: Newent, Micheldean, Cinderford, Lydney and Sedbury

Run 3: Newent, Cinderford, Coleford, Lydney and Sedbury

Run 4: Newent, Nailsbridge, Bream, Lydney and Sedbury

The effect of providing telecentres on the availability of virtual jobs was also modelled, based on the assumption that all terminals within the five telecentres provided would be used for teleworking. The breakdown of occupations that these telecentres would be likely to provide for is given in table 9.

Occupation	**Jobs provided per telecentre**
Senior Managerial	0
Professional	2
Associate Professional and Technical	3
Administration and Secretarial	2
Skilled Trades	0
Personal Services	0
Sales and Customer Services	8
Process, Plant and Machinery Operators	0
Elementary	0
TOTAL	15

Table 9: Assumed job types provided each telecentre.

For this case it was assumed that the telecentres would be provided at Newent, Cinderford, Coleford, Lydney and Sedbury (as for run 3 above). This was the combination of centres that produced the greatest increase in accessibility to IT facilities (see section 7 below).

Kiosks

One internet access point was added to the baseline data for every settlement listed in the Bartholomew's gazetteer.

6.4 Tools for YU

One terminal for every young unemployed person resident was added to the baseline data using output area centroids. This assumes that enough computers are available to do this and that everyone eligible for a computer takes the opportunity to get one.

7. Scenario Results

Tables 10 to 12 summarise the results.

Scheme	Gender	Qualifications	Summary of Accessibility Indices for output areas		
			Total	Mean	St. Dev
Vehicle Club	Male	None	1688	6.36	0.58
		Low Level	2252	8.60	0.57
		High Level	2306	8.80	0.56
	Female	None	1488	5.68	0.58
		Low Level	2169	8.28	0.57
		High Level	2240	8.55	0.56
DRT	Male	None	1669	6.37	0.58
		Low Level	2253	8.60	0.56
		High Level	2306	8.80	0.55
	Female	None	1489	5.68	0.57
		Low Level	2169	8.28	0.55
		High Level	2238	8.54	0.54

Table 10: Summarises the access to job indices obtained for each output area showing accessibility levels resulting from each scheme.

7.1 Access to jobs

Only three of the schemes tested were assumed to directly affect access to jobs; these were the DRT and Vehicle Club schemes, and the provision of telecentres. The indirect affect of increased access to education, it facilities and job search facilities on access to jobs was not modelled, i.e. through having obtained better qualifications, or broadening the location and range of jobs being searched.

Given the assumptions used to model the Vehicle Club scheme, it is unsurprising that the result is to bring the level of access to job opportunities for those currently without access to a car up to the levels experienced by those with access to a car.

Scheme & Transport	Gender	Qualifications	Summary of Accessibility Indices for output areas		
			Total	Mean	St. Dev
Telecentres accessed by car	Male	None	1668	6.37	0.58
		Low Level	2253	8.60	0.57
		High Level	2306	8.80	0.56
	Female	None	1488	5.68	0.58
		Low Level	2170	8.28	0.57
		High Level	2240	8.55	0.56
Telecentres accesed by bus	Male	None	1456	5.56	2.38
		Low Level	1953	7.45	3.13
		High Level	1997	7.62	2.38
	Female	None	1300	4.96	2.14
		Low Level	1879	7.17	3.02
		High Level	1938	7.40	3.11

Table 11: Summarises the access to job indices obtained for each output area showing accessibility levels resulting from providing additional jobs through telecentres.

Facility Type	Scheme	Transport	Summary of Accessibility Indices for output areas		
			Total	Mean	St. Dev
Job Search	Vehicle Club		2025	7.73	0.29
	DRT		1998	7.63	0.35
Education	Vehicle Club		693	2.59	0.21
	DRT		666	2.54	0.23
IT	Vehicle Club		699	2.61	0.53
	DRT		686	2.62	0.64
	Telecentres 1	With a car	870	3.32	0.67
		Without a car	777	2.97	1.56
	Telecentres 2	With a car	861	3.29	0.63
		Without a car	771	2.94	1.53
	Telecentres 3	With a car	874	3.34	0.65
		Without a car	787	3.00	1.53
	Telecentres 4	With a car	852	3.25	0.55
		Without a car	781	2.98	1.51
	Kiosks	With a car	871	3.32	0.43
		Without a car	823	3.14	1.47
	Tools for YU	With a car	1238	4.72	0.72
		Without a car	1176	4.49	2.07

Table 12: Summarises the indices obtained for each output area showing the accessibility levels resulting from each scheme.

The DRT scheme did not perform quite so well, but substantial improvements over the current levels of access experienced by those without access to a car were achieved, bringing levels experienced by this group almost up to the same level as for those with access to a car. The biggest benefits were to those living in the north of the district. Those in the far north and far south of the district benefit the least, partly due to the long distances of these two locations from either the main employment centres in the Forest of Dean or from Gloucester. Careful planning of the DRT service areas would be needed to ensure that these areas get the full benefit of this scheme. The benefits of DRT were similar for both genders, and all qualification levels (figures 29-34).

Providing virtual jobs through the telecentres had minimal impact of the level of accessibility experienced by any of the groups.

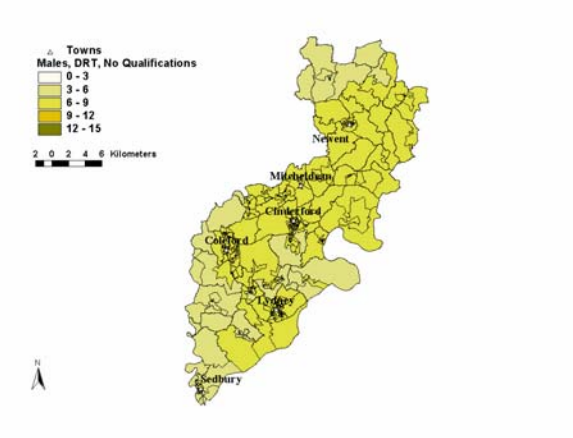

Figure 29: Accessibility indices to job opportunities for males with no qualifications using DRT

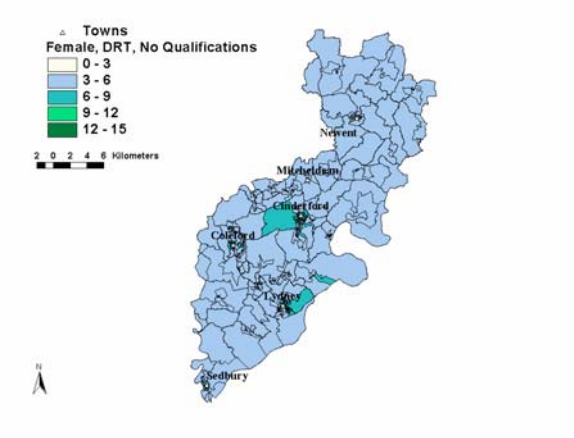

Figure 30: Accessibility indices to job opportunities for females with no qualifications using DRT

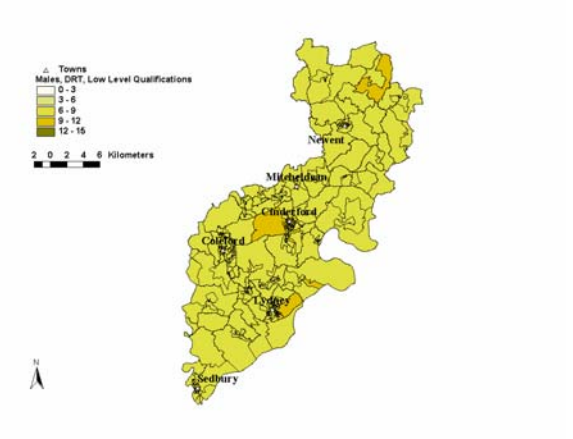

Figure 31: Accessibility indices to job opportunities for males with low level qualifications using DRT

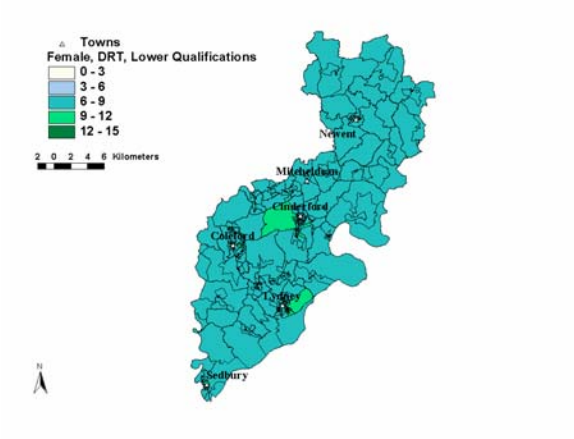

Figure 32: Accessibility indices to job opportunities for females with low level qualifications using DRT

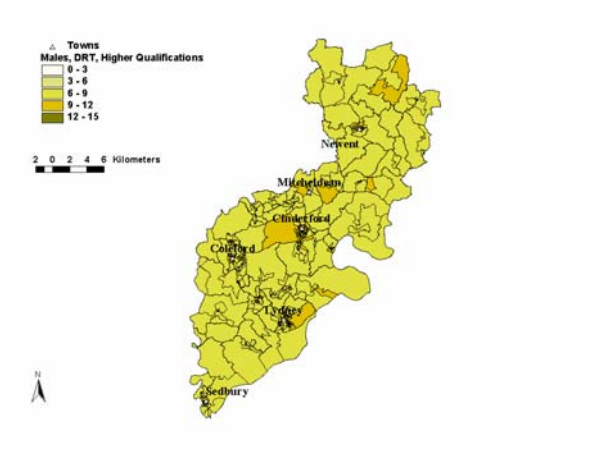

Figure 33: Accessibility indices to job opportunities for males with high level qualifications using DRT

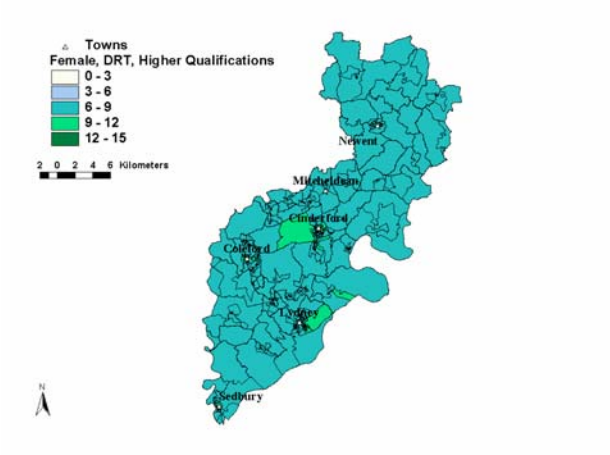

Figure 34: Accessibility indices to job opportunities for females with high level qualifications using DRT

Access to job search facilities

Again, only two of the schemes tested directly affected access to job search facilities; as for access to jobs, these were the DRT and wheels-to-work schemes. The Vehicle Club scheme effectively gave those without access to a car the same level of access to job search facilities as those with access to a car, with similar levels of access across the district, removing the problems suffered by those currently reliant on buses in the north and southwest corners of the district. The DRT scheme also alleviated the problems of poor access to job search facilities suffered by bus users in these two areas of the district (figure 35).

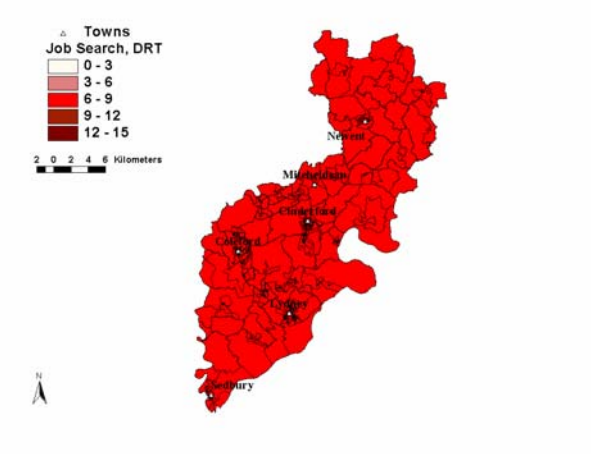

Figure 35: Accessibility indices to job search facilities for those using DRT

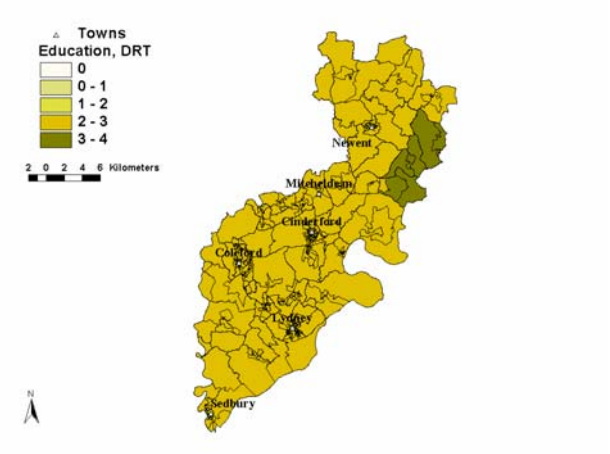

Figure 36: Accessibility indices to education facilities for those using DRT

Access to education and training

The two transport-based schemes (DRT and Vehicle Club) were modelled for their affect on the level of access to education and training facilities for young people in the Forest of Dean. The Vehicle Club scheme provided the biggest improvements in access to those living in the north of the district. However, all those previously reliant on the car would see improvements to their levels of access to education and training through this scheme. The DRT scheme did not perform as well as the Vehicle Club scheme, but did provide much better access than currently provided by the bus service (figure 36).

7.2 Access to IT facilities

All five schemes analysed were deemed to impact directly on the level of access by young people to IT facilities.

Both the Vehicle Club (figure 37) and the DRT schemes improved access to IT facilities for those young people without access to a car. Those living in the north of the district benefited in particular. Provision of additional transport options, however, did little to improve the levels of access for those living in the far south of the district around the town of Sedbury (figure 38).

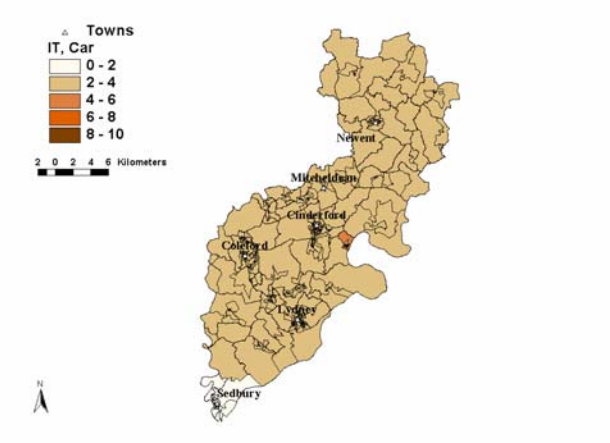

Figure 37: Accessibility indices to IT facilities for those using Vehicle Club or their own Car

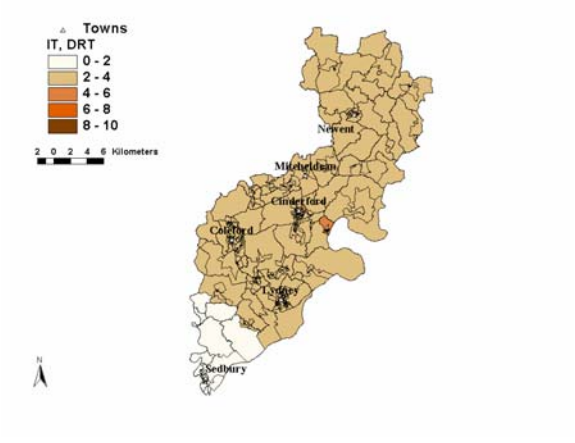

Figure 38: Accessibility indices to IT facilities for those using DRT

Provision of telecentres in the main towns increased already relatively high levels of access to IT facilities for those living close to these facilities. Levels of access were also improved for

those living in the surrounding areas. Overall, the biggest improvements for those with and those without access to a car, were gained from run 3, with the five telecentres located at Newent, Cinderford, Coleford, Lydney and Sedbury respectively. The gains in accessibility from run 1, with telecentres at Newent, Cinderford, Coleford, Lydney and Micheldean were only slightly less than those for run 3.

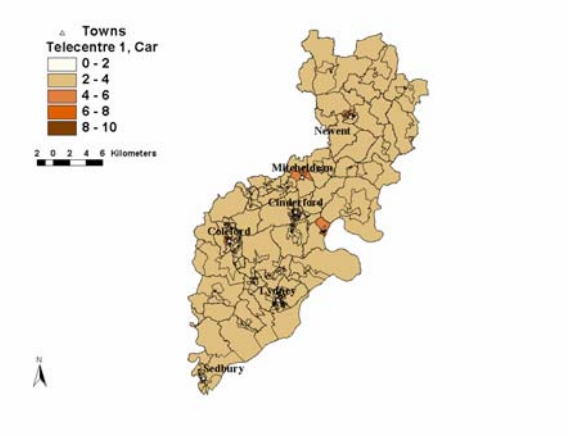

Figure 39: Accessibility indices to IT facilities by Car, Telecentres Run 1

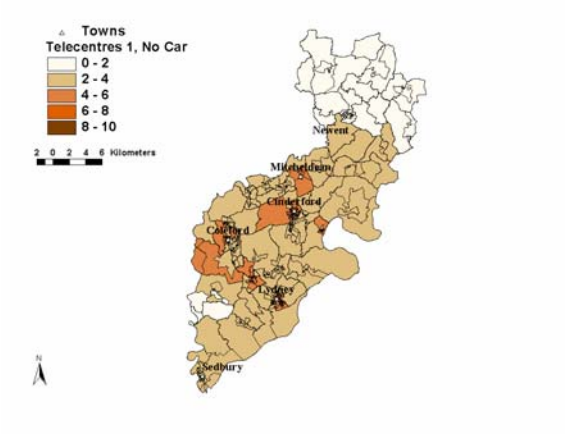

Figure 40: Accessibility indices to IT facilities by Bus, Telecentres Run 1

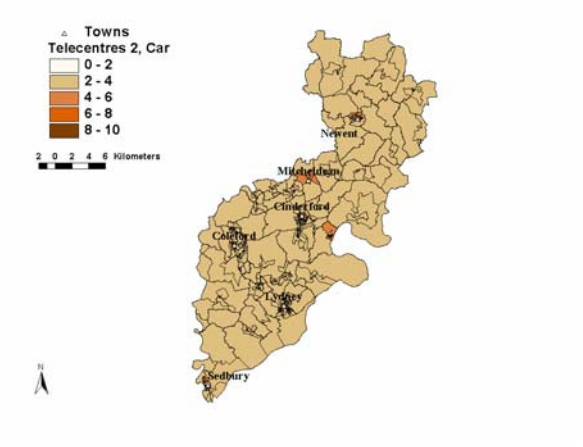

Figure 41: Accessibility indices to IT facilities by Car, Telecentres Run 2

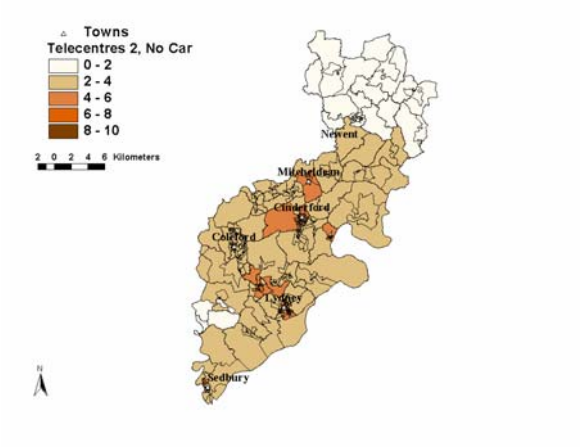

Figure 42: Accessibility indices to IT facilities by Bus, Telecentres Run 2

Provision of kiosks in every settlement throughout the district produced a higher level of access than the current provision provides, and a more even distribution of access than achieved through the telecentres. However, it should be remembered that the accessibility model used in this analysis does not distinguish between the quality of the provision.

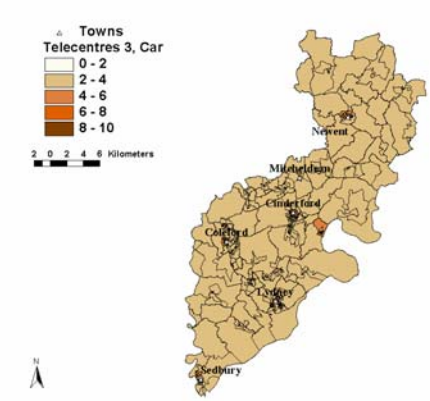

Figure 43: Accessibility indices to IT facilities by Car, Telecentres Run 3

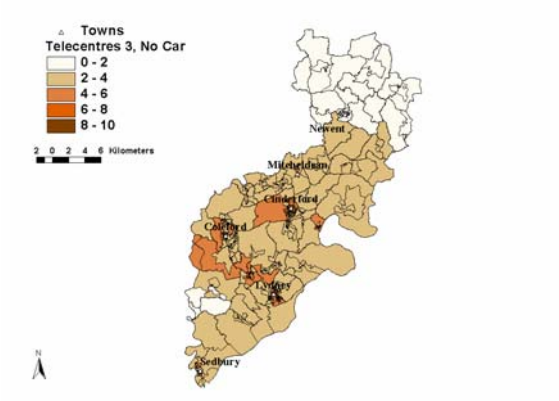

Figure 44: Accessibility indices to IT facilities by Bus, Telecentres Run 3

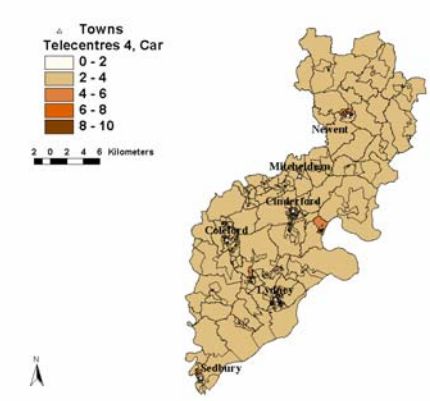

Figure 45: Accessibility indices to IT facilities by Car, Telecentres Run 4

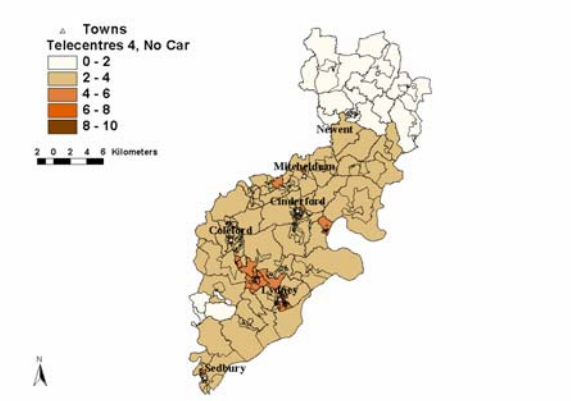

Figure 46: Accessibility indices to IT facilities by Bus, Telecentres Run 4

Providing every young unemployed person with access to a home computer, as expected, out performed all other schemes, in terms of providing access to IT facilities.

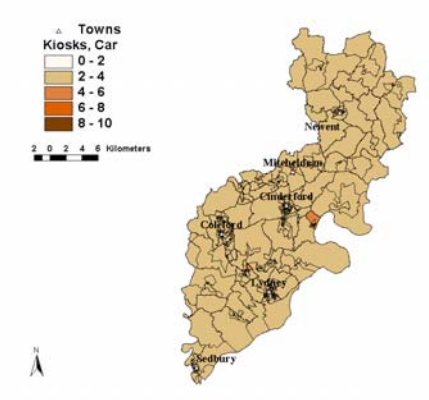

Figure 47: Accessibility indices to IT facilities by Car, Kiosks

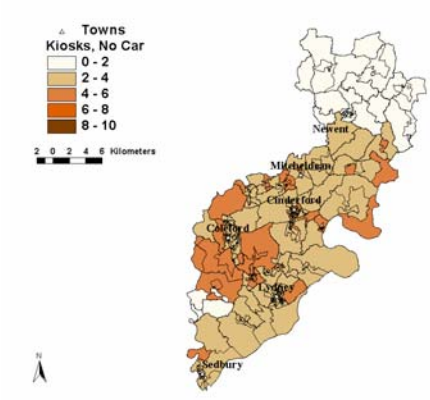

Figure 48: Accessibility indices to IT facilities by Bus, Kiosks

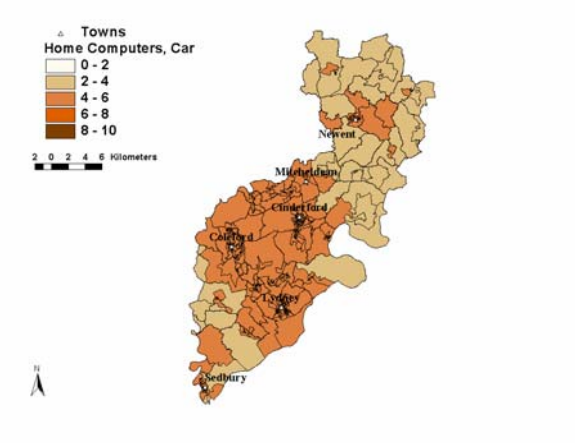

Figure 49: Accessibility indices to IT facilities by Car, Tools for YU Scheme

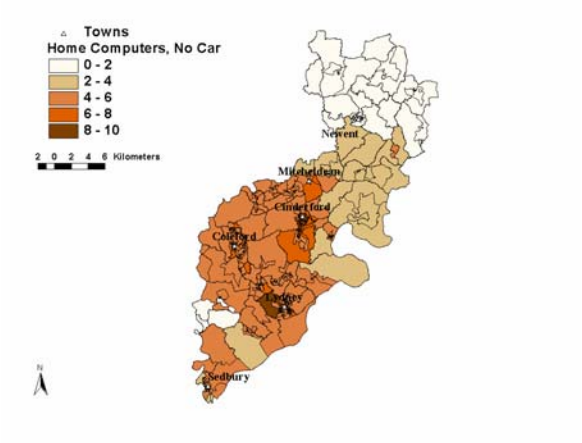

Figure 50: Accessibility indices to IT facilities by Bus, Tools for YU Scheme

8. Conclusions

The distribution of young people in the Forest of Dean follows that of the general population, with higher densities found around the towns of Newent, Micheldean, Cinderford, Coleford, Lydney and Sedbury. Areas of high youth unemployment also tend to be found in these areas. Youth unemployment is over 30% in a number of areas. Lack of qualifications seems to be one factor contributing to the high youth unemployment rates, although there are obviously other factors at work as high youth unemployment and lack of qualifications does not correlate exactly. High unemployment amongst those young people with low-level qualifications is evident around the towns of Lydney, Cinderford and Newent, and also in the far south west of the District, where there are few public transport services. Unemployment amongst people with high-level qualifications is greatest in the central area between Coleford and Lydney.

The results from the TRANTEL modelling exercise show that those without access to a car are significantly worse off in terms of access to jobs, education, job search and IT facilities, than those with access to a car. The level of accessibility experienced by those without a car varies more widely across the district than for car users, as evidenced by the much larger standard deviation from the mean level of accessibility (tables 7 & 8). Those living away from the main bus routes into Gloucester in the North and South West of the District are particularly badly affected by the lack of car availability.

The level of accessibility for young females is generally lower than for young males, reflecting the distribution and types of jobs available within Gloucestershire. Those without qualifications have a much reduced level of access to job opportunities compared with those with some, all be it low level, qualifications. Lack of transport seems to exacerbate the problem of lack of qualifications. Access to education and IT facilities was generally highest closest to Gloucester where a higher number of these types of facilities are provided.

In terms of increasing access to jobs, out of the three schemes tested in this respect, the vehicle club scheme had the greatest affect on accessibility levels. Providing virtual jobs through telecentres had minimal effect, possibly limited by the size of the telecentres (15 terminals in each of 5 centres). Far bigger improvements in access to jobs for those without qualifications could be achieved by increasing their level of qualifications, whilst those with low level qualifications would benefit more from better transport provision than from increasing their qualifications to degree level (purely in terms of numbers of jobs they would have access to. Of course, high-level qualifications bring about additional benefits not included in this study). It should be noted that the level of accessibility of education facilities for those without access to a car, or for those living in the west of the District were generally poor. This could be contributing to the numbers of young people in the area without qualifications.

The Tools for YU scheme out performs all other schemes aimed at increasing access to IT. One would hope that increasing access to IT would have the knock on effects of increasing education levels and creating virtual jobs. However, it remains to be seen whether such a scheme could be implemented on as massive a scale as assumed in this modelling exercise, which assumed that all young unemployed people would gain their own PC through the scheme. If only a small proportion of the computers needed can be funded, then it may be better to adopt on of the other schemes, which allows a few computers and/or internet access points to be accessed by many.

It is obvious from this research that poor transport and lack of qualifications amongst 16-24 year olds in the Forest of Dean are combining to create the problem of high youth unemployment. It has also become evident that these are not the only factors, as the research has highlighted areas where unemployment is high despite high accessibility levels. It may be that the model is as yet too crude, failing to pick up public transport issues such as

unreliability, interchange problems and lack of, for example, early morning services. However, it is equally likely that there are other factors involved such as low travel horizons and lack of knowledge about the opportunities available.

9. References

Geurs and Ritsema van Eck (2000) Modelling Accessibility. Delft University, Delft.

Hansen W G (1959) How accessibility shapes land use, *Journal of the American Institute of Planners, 25,* 73-76

Titheridge H (2000) Balancing Housing and Facility Provision: the transport implications. *URBASSS Working Paper 8*, The Bartlett School of Planning, University College London. Sept. 2000.

Titheridge H (2002a) ESTEEM v1.32 User Manual, The Bartlett School of Planning, University College London, July 2002.

Titheridge H (2002b) Assessing the Transport Implications of Housing and Facility Provision in Gloucestershire, in Kidner et al (Eds.) *Socio-economic Applications of Geographical Information Science: Innovations in GIS 9*. Taylor and Francis, London.