Appraisal of Commuter Transport within the staff of Cambridgeshire County Council

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Abstract
The Department of Transport and Local Regions has issued guidelines encouraging public sector organisations to lead local communities by introducing travel plans to tackle traffic congestion. This paper aims to analyse the alternatives for Cambridgeshire County Council by means of a survey to 1045 of staff based in Cambridge. Firstly the paper analyses the current situation, secondly the paper generates alternatives from the survey data and finally evaluates the alternatives from a financial, environmental and operational position.

Introduction
Environmental issues have gained greater prominence over the last 10 years amongst fear of climate change and impact upon scare resources. In 1995 the United Nations expressed concern that rapid growth in population will result in an increased demand for transport with the associated higher level of waste and consumption. Such concerns are incorporated in the works of MacDonald (1998) and Schipper (1997) who highlights the growing levels of expenditure to support private transportation. The ultimate concern is of environmental degradation. Such views had been expressed earlier in the United Kingdom by Watkins (1980) where the consequences of increased motorised transport where identified as:

- Noise
- Vibration
- Air Pollution
- Visual Problems

Edge and Tovey (1995) considered the notion of sustainable mobility within sustainable cities and demonstrated that there is no relationship between transport investment and policy and land planning use. However, more recently, Van Ommeren (2000) concluded that there is 'only a marginal willingness to pay to avoid additional commuting time' (p110) and that there is 'a negative correlation of commuting distance to the possibility of moving jobs' (p140). He suggests that workers do not consider the residence – job combination primarily, and will undertake to commute for the right job. Much of the literature debates the merits for environmental management, making fundamental statements that these issues are tangible: real issues within a real world. This paper seeks to apply financial theory and practice to a real world problem. All of the above factors accentuate the need for organisations such as Cambridgeshire County Council to carefully evaluate policy options in their dual role as the county's major employer and community leader.

Cambridgeshire has an estimated mid-1999 population of 724,900, an 8.4per cent increase since the 1991 census compared to 3.2 per cent in England making it one of the fastest growing counties. Furthermore, Cambridgeshire is estimated to grow by a further 12.1 per cent by 2016. The road and rail links in around Cambridge are not unique: a city surrounded by extensive agricultural land replicates in many areas of the UK providing direct comparability with many cities and large towns. Major cities such as London, Birmingham and Manchester have different configurations of population flows and infrastructure so the results of this paper may not be directly comparable, however the principles followed would form the basis for additional applied research in these locations.

The county of Cambridgeshire will have an estimated 85,000 additional jobs by 2016, increasing faster than housing development in Cambridge and resulting in increased commuting. The Traffic Monitoring Report 2000 published by the Council stated that a daily average of 170,626 vehicles enter and leave Cambridge each day over a 12 hour period. (142,883 were cars and taxis).

Cambridgeshire's traffic growth since 1990 has been above the national average with the trend set to continue (Table 1). The most significant traffic increases have been seen on the A14 (44 per cent), A1101 (92 per cent), A141 (50 per cent) and A1123 (45 per cent).

Table 1
Traffic Growth – Cambridgeshire and National Average

	Cambridgeshire per cent	National Average per cent
Increase in Traffic (1990 – 2000)	25	14
Forecast Growth (1999 – 2016)	33-50	20-36

Source: - CCC Traffic Monitoring Report 2000 and CCC Road Traffic Reduction Report 2000

The Department for Transport, Local Government and the Regions (DTLR) requires the Council to publish a Local Transport Plan (LTP) for Cambridgeshire. The LTP for 2001 – 2006 sets out objectives and targets along with the financial investment required to develop an integrated and sustainable transport network covering all modes of transport. Existing financial commitments to support staff commuting have been calculated in excess of £447,253 and opportunity costs for the provision of a car park of £374,832 (Palazon, 2001).

The objective of this paper is to evaluate the potential for reducing single occupancy car journeys undertaken in travelling to work at Cambridgeshire County Council, County Hall.

Methodology
The paper concentrates upon primary data generated from an electronic survey of County Hall based staff. The survey was supported by UNISON, the main union for the council's employees.

Base data of all employees working at headquarters was extracted from a range of internal databases with full co-operation from relevant managers in accordance with the Data Protection Act 1998. All databases were reconciled back to the principal Human Resources database. Identifying 1,045 employees based at headquarters in April 2001. This analysis of employees was undertaken using relevant categories to establish the profile of the Council's employees and was used to test whether the survey responses are representative of all employees.

Survey questions were developed and then verified by CCC's Travel to Work Group to ensure that the incentives are in line with Council policy. The aim of the survey was to: -
- Provide data on current commuter travelling behaviour
- Gain staff commitment to the Plan by asking employees to consider incentives for reducing single car occupancy journeys
- Collection of sufficient data on which to extrapolate and evaluate travel options.

Employees completed the survey via the intranet. Of the 1,045 employees based at headquarters, 385 (36.8per cent) completed the survey. To determine whether the sample is representative of all employees enabling inferences to be made about all employees, the sample was tested for statistical significance. The Chi-squared distribution technique was used on all categories. The technique compares observed frequencies from the survey results to expected frequencies of all employees based at headquarters. For the survey results to be significantly different, the results would have to be outside an acceptable significance level of 5 per cent. Test results are shown in Table 2.

Table 2
Survey Results using Chi-squared Distribution Goodness of Fit Test

Category	χ^2 Test Result	Significance Level	Accept / Reject ✓/✗
Gender	0.038	7.879	✗
Age	19.595	39.997	✗
Full / Part time	1.245	7.879	✗
Grade	14.085	31.319	✗
Car Park Permit	0.000	0.000	✗
Permit Eligibility	3.697	14.860	✗
Distance	2.701	12.838	✗
Geographical Area	5.240	16.750	✗

These results suggest that the sample is representative of all employees since all test results fall below the significance level.

From the analysis of results, potential solutions for a travel to work plan for CCC were identified. To facilitate feasible recommendations, the staffing data were classified into settlements, these being geographic groupings of employee residences within the county. From within settlements the survey data were extrapolated to allow quantification of journeys per travel option. Each option was separately evaluated for financial impact, environmental issues, and administrative impact. Criteria within each category were then ranked and aggregated to identify the most likely successful options for CCC.

Analysis of Current Commuter Travel
Survey respondents provided data on their commuter travel behaviour for a typical working week for the following classifications: frequency of employees commuting to headquarters; days per week employees undertook business journeys; normal commuting arrival and departure times; average length of time to commute with no congestion and when roads were congested and finally the mode of transport used to travel between work and home.

As many employees use more than one mode of transport in an average week, they were asked to record the frequency of usage against defined categories. The results were then converted into average journeys using the conversion shown in Table 3.

Table 3
Conversion Table of Survey Journeys

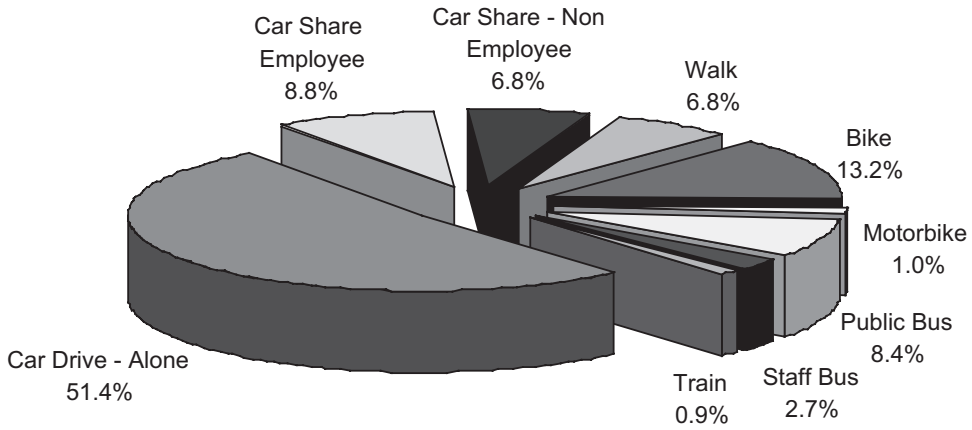
Frequency Categories	Average Journeys
Less than once a week	0.1
1 – 2 days per week	1.5
3 – 4 days per week	3.5
5 or more days per week	5.0[1]

1 A score of 5 represents daily journeys

A reconciliation of days travelled to headquarters and average journeys has been undertaken using survey results to ensure correct conversion of frequency

Survey results have identified the current travelling methods used by employees
(Chart 1), based upon 1825.3 total average journeys per week.

Chart 1
2001 Travel Methods – CCC



As the survey has been shown to be representative of all employees the following conclusions can be drawn from the results. 87 per cent of employees travel to headquarters 5 days a week, of which within this category 64 per cent travel on business less than once a week, suggesting that employees do not need their car at headquarters every day and could therefore use an alternative mode of transport. 83 per cent of employees arrive before 9.00am with the peak arriving between 8.30am and 9.00am, therefore alternative travelling methods to single car occupancy journeys would need to accommodate employees arriving during this time period. Employees travelling times are affected by congestion. This could be used to persuade employees to reduce their single car occupancy journeys. Interestingly less than 3 per cent of departure journeys are undertaken using an alternative travelling method to arrival i.e. train followed by a walk, and 67 per cent of journeys are made by car compared to the national average of 70 per cent.

Current Employee Cost

There have been no contemporary surveys to permit the formulation of a baseline to evaluate the Council's employee's cost of commuter travel; neither had the Council had any appreciation of the cost borne by its workforce. Literature has identified that motivations of individuals in implementing environmental management schemes may be resisted if the cost to the individual is perceived to be too high. To address possible adverse perceptions it became necessary to estimate existing commitments; this was achieved by: -

1. Establishing a costing basis for each travelling method (travel option);
2. Making assumptions for the basis of calculation;
3. Extrapolating survey results at settlement level;
4. Estimating current commuter behaviour for settlements where there have been no survey responses;
5. Calculating the cost for all employees.

The unit or yardstick costs were drawn from a range of sources including the Inland Revenue, bus companies and rail providers.

The rate for car drive alone has been set at 35 pence per mile based upon the Inland Revenue Fixed Profit Car Scheme, which is consistent with the rate recommended by the Automobile Association. The bicycle rate reflects the rate payable by CCC and is consistent with Inland Revenue benefit in kind regulations.

The following assumptions have been made for calculating employee cost

- **Settlement level**
  The cost per travel option for each settlement is variable.
- **Other**
  The cost for all employees living out of county that have no alternative travel options has been set at £14.00 per day based upon the average travelling distance to headquarters being 20 miles.
- **Eligible working days for employees**
  The maximum eligible working days of 230, (46 weeks) calculated as follows: -

	Days
Year	365
Saturdays and Sundays	-104
Annual leave	-23
Public holidays	-8
Total working days	**230**

Using data for settlements where survey responses have been received, survey responses have been extrapolated to all employees living within a settlement. Using Ely as an example (Table 4), extrapolated weekly journeys have been calculated.

Table 4
Example of Extrapolating Survey Journeys - ELY

	Bike	**Public Bus**	**Train**	**Car Drive Alone**	**Car Share**
Survey responses	0.1	0.2	5.1	36.5	17.3
Extrapolated journeys	0.2	0.4	10.2	73.0	34.6

Relationship Between Incentives and Travel Options
The latter part of the survey explores incentives for reducing the number of single car occupancy journeys. The relationship between each incentive and each travel option can be seen in Table 5.

Table 5
Relationship between Incentive and Travel Option

Incentive	**Walk**	**Bike**	**Public Bus**	**Staff Bus**	**Train**	**Car Share**
Introduction of new staff bus routes				✓		
Guaranteed ride home scheme to encourage public transport use			✓	✓	✓	
Guaranteed ride home to encourage car sharing						✓
Introduction of 'priority parking' in the staff car park for car sharers						✓
Introduction of more pool cars	✓	✓	✓	✓	✓	✓
A low cost loan to purchase season tickets for public transport			✓		✓	
Claiming part of the travelling journey time as flexi-time for non car driver only journeys	✓	✓	✓	✓	✓	✓
Subsidised public transport			✓		✓	

For the greatest reduction in single car occupancy journeys, travel options included in the Plan will include all associated incentives. As some travel options, for example, Car Share attract more than one incentive, the incentive achieving the greatest reduction in journeys will be used to extrapolate journeys.

As the incentives of additional pool cars and flexi-time relate to all travel options, if a plan is introduced these incentives will require implementing. The travel options on Walk and Bike are only affected by these incentives.

Analysis of the Survey Results

The survey was designed to investigate the potential for reducing single car occupancy journeys, therefore only survey respondents undertaking single car occupancy journeys were questioned on incentives. To determine which incentives to take forward in the Plan interval estimates have been calculated at the 95 per cent confidence interval. The interval estimates allow 95 per cent confidence that the percentage of employees who will be influenced by the incentives lie between the lower and upper interval estimates. Of the incentives considered, a season ticket loan for public transport was ranked last and removed from further evaluation.

Of the categories used to test survey representation, only distance and geographical area categories allow employee analysis at the settlement level. All other categories refer to characteristics of employees. Survey responses to incentives by geographical area are dependent on each other, concluding that employee attitudes to incentives depend on the geographical area in which they live and can therefore be used in the feasibility analysis of travel options, extrapolating journeys to quantify and determine benchmark costs for evaluating the Plan. The rejected results indicate that the ranges of distances within this category are independent of car sharing incentives. This test does not provide information to suggest which range within distance resulted in the rejection. Therefore distance cannot be used for further analysis.

Feasibility of Travel Options

The travel options of Car Share, Staff Bus, Public Bus and Train will be considered for the Plan using a combination of travel options as shown in Table 6. Walk and Bike travel options have been identified as part of the Plan if implemented.

Table 6
Identification of Possible Solutions for the Plan

Solution	Car Share	Staff Bus	Public Bus	Train	No Plan
1. CS	✓				
2. SB		✓			
3. PB			✓		
4. T				✓	
5. SB/CS	✓	✓			
6. SB/PB		✓	✓		
7. SB/T		✓		✓	
8. CS/PB	✓		✓		
9. CS/T	✓			✓	
10. PB/T			✓	✓	
11. SB/CS/PB	✓	✓	✓		
12. SB/CS/T	✓	✓		✓	
13. SB/PB/T		✓	✓	✓	
14. CS/T/PB	✓		✓	✓	
15. CS/SB/PB/T	✓	✓	✓	✓	
No Plan				✓	

CS – Car Share / SB – Staff Bus / PB – Public Bus / T - Train

A feasibility analysis on each possible travel option in the solution within geographical area has been undertaken to determine the effect on single car occupancy journeys based upon car share, existing public bus service, train and staff bus (using a geographical map and survey responses to identify commuter routes having the potential of more than 12 users for tax purposes).

The feasibility analysis has determined the travel options available by settlement that could reduce single car occupancy journeys. Survey responses to incentives have been analysed by journeys with the greatest reduction in journeys per travel option to be extrapolated per solution to quantify the Plan. The staff bus criteria resulted in six bus routes.

Extrapolating the Feasible Solutions

To quantify and appraise each solution, single car occupancy journeys that could be influenced by an incentive, for a particular travel option, have been extrapolated for all employees within a settlement. Where a settlement had no survey responses, it has been assumed that these employees are not interested in any of the incentives. However, any solution proposed for the Plan will provide an extrapolated and maximum cost in the event that all employees were to take advantage of the incentives. The extrapolation process required taking account of solutions containing more than one travel option. Employees were able to respond to all incentives treated as mutually exclusive with their journeys attributed to each incentive. It was therefore possible that employees could reduce their journeys by more than one travel option and in effect their journeys were duplicated. The effect of duplication has been removed by: -

1. Identifying employees by settlement and their responses to travel options thus highlighting duplicate journeys;
2. Removing duplications by apportioning across relevant travel options based upon the total ratio of journeys influenced (Total Journeys);
3. Extrapolating journeys by settlement in geographical area to provide maximum expected reduction in single car occupancy journeys.

This process was applied to all settlements within each geographical area. The example shown below is based upon the solution of Staff Bus and Public Bus for Ely (Table 7) in East Cambs (Table 8).

Table 7
Settlement Extract from Survey – Ely Responses

	TRAVEL OPTIONS				
Employee	**Staff Bus**	**Car Share**	**Public Bus**	**Train**	**Weekly Journeys**
A	Y	N	Y	Y	5.0
B	Y	Y	Y	Y	5.0
C	N	Y	N	N	5.0
D	N	N	N	N	1.5
E	Y	Y	Y	Y	1.5
F	Y	N	N	N	5.0
G	Y	Y	Y	Y	5.0
H	N	N	N	N	5.0
I	Y	Y	Y	Y	3.5
TOTAL JOURNEYS	**25.0**	**20.0**	**20.0**	**20.0**	**36.5**

Y – In favour of incentive, N – Not interested

From Table 7 it can be seen that employee A, B, E, G and I have duplicate journeys, indicating a willingness to switch to alternative travel modes.

The number of duplicate journeys was identified as shown below.

	Total Journeys
Staff Bus journeys	25.0
Plus Public Bus journeys	20.0
Less duplicates	20.0
TOTAL JOURNEYS	**25.0**

The duplicate journeys were removed using the ratio apportionment calculation shown below.

	Staff Bus	**Public Bus**
Initial Journeys	25.0	20.0
Less adjustment (Duplicated Journeys)	11.1	8.9
Journeys to be extrapolated	**13.9**	**11.1**

This was then extrapolated to the full population

	Staff Bus	**Public Bus**
Journeys to be extrapolated	13.9	11.1
Survey response rate	50 per cent	50 per cent
Extrapolated journeys	27.8	22.2

Table 8 shows the maximum extrapolated reduction in single car occupancy journeys for East Cambs, which includes the example of the settlement of Ely.

Table 8
East Cambs Extrapolated Data – Staff Bus and Public Bus

Settlement	**Staff Bus**	**Public Bus**
Bottisham		15.0
Burwell	9.8	9.8
Ely	**27.8**	**22.2**
Fordham	12.9	9.6
Haddenham		17.5
Littleport		5.0
Lode	2.7	2.7
Mepal	5.0	5.0
Cheveley		10.0
Reach	7.0	5.0
Soham	5.3	5.3
Sutton	13.0	9.2
Wilburton		7.5
Witchford	7.4	7.4
TOTAL JOURNEYS	**90.9**	**131.2**

Table 9 shows the maximum extrapolated reduction in single car occupancy journeys per geographical area, which includes East Cambs for the solution of Staff Bus and Public Bus of 222.1 journeys.

Table 9
Maximum Reduction in Single Car Occupancy Journeys - Extrapolated

Solutions	Cambridge	East Cambs	Fenland	Huntingdon	South Cambs	Out of County	TOTAL
1. CS	97.0	205.8	91.6	260.9	440.1	214.8	1,310.1
2. SB	-	167.1	34.2	248.1	123.0	-	572.3
3 . PB	87.4	196.2	48.9	183.8	330.7	65.5	912.4
4. T	-	45.0	31.3	-	39.5	42.6	158.4
5. SB/CS	97.0	256.3	99.0	320.7	466.1	214.8	1,453.8
6. SB/PB	87.4	**222.1**	67.2	279.9	323.6	65.5	1,045.6
7. SB/T	-	172.1	49.8	248.1	144.5	42.6	657.1
8. CS/PB	109.3	244.8	91.8	312.7	512.4	214.8	1,485.8
9. CS/T	97.0	220.8	91.6	260.9	440.1	228.1	1,338.4
10. PB/T	87.4	196.2	48.9	183.8	330.7	117.3	964.3
11. SB/CS/PB	109.3	261.4	99.2	335.0	523.7	214.8	1,543.4
12. SB/CS/T	97.0	261.3	99.0	320.7	388.6	228.1	1,394.7
13. SB/PB/T	87.4	222.1	82.8	279.9	231.2	117.3	1,020.6
14. CS/T/PB	109.3	229.4	102.0	312.7	539.4	205.1	1,497.9
15. CS/SB/PB/T	109.3	261.4	114.8	335.0	534.2	228.1	1,582.8
No Plan	-	-	-	-	-	-	-

CS – Car Share / SB – Staff Bus / PB – Public Bus / T - Train

Implementing all travel options would provide the greatest reduction in journeys of 1,582.8 per week. Table 9 also shows where there would be no reduction in journeys, for example, the Staff Bus solution in Cambridge, as this was identified as unviable. Journey reduction totals per geographical solution that are equal to one another reflect that not all travel options are available within a solution. For example, the totals for Car Share and Staff Bus / Car Share are both 97.0 journeys because Staff Bus is not a viable travel option for Cambridge. Total extrapolated journeys were 4,962.6 with 2,566.7 journeys being single car occupancy journeys. Based upon the maximum expected reduction of 1,582.8 it could be possible to reduce single car occupancy journeys by 61.7 per cent. This is the best-case scenario.

The maximum journey reduction totals will be considered as part of the option appraisal.

Financial Appraisal

Solutions have been appraised using the extrapolated journey data identified in Table 9 including the employees currently undertaking the travel options. The cost of journeys have been calculated using the identified daily costs for car sharing, public bus and train per settlement therefore allowing any incentive cost or saving to be applied. The cost for staff buses has been calculated using information supplied by local bus operators and the current staff bus contract at its true cost before discount with the results shown in Table 10.

Table 10
Estimated Cost of the Staff Bus

	Cost per Day £	Cost per Annum £
52 seating capacity		
Bus Operators	150 – 160	37,950 – 40,480
Current Contract – No Discount	164	41,492
18 – 35 seats	148	37,441
Under 18 seats	139	35,167

Note: - Based upon 253 days per annum

The costs taken forward in the appraisal will be £35,167, £37,441 and £41,492 depending on seating capacity required.

As benchmark costs will be used to evaluate the Plan, the cost of staff buses has been apportioned across geographical areas based upon the survey responses with the cost per geographical area shown in Table 11.

Table 11
Distribution of Staff Bus Costs per Geographical Area

Route	East Cambs		Fenland		Huntingdon		South Cambs		TOTAL	
	f.	£	f.	£	f.	£	f.	£	No.	£
Witchford	21	22,930					17	18,562	38	41,492
Soham	24	34,564					2	2,880	26	37,444
Huntingdon					29	37,444			29	37,444
Needingworth					36	36,432	5	5,060	41	41,492
Warboys					12	12,144	29	29,348	41	41,492
March	13	719	23	1,273			5	277	41	2,269
TOTAL		**58,213**		**1,273**		**86,020**		**56,127**		**201,633**

f represents frequency of use

The total cost of staff buses per geographical area has been included in the financial model.

Some incentives attract costs for the Plan that are not directly related to the journey cost but are part of the solution, for example, using the guaranteed ride home scheme. These costs will be included in the financial model. Other costs incorporated into the model are converting car park spaces to priority parking, car sharing database software and pool cars.

In addition to the cost of the Plan, there are administration and monitoring costs associated with the Plan as follows: -

Costs	Cost Basis	£
Employee Costs	50 per cent Management / 100per cent Admin time	35,000
IT Resource Costs	2 PC's and Maintenance	3,000
Overheads	Recharges within the Council	5,000
Advertising and marketing the Plan	Printing materials and cost of advertising	1,500
TOTAL		**44,500**

All costs for the Plan have been incorporated into a financial model that provides a matrix of costs and any savings for employees for each solution and geographical area. The matrix shows: -

- **Maximum reduction in single car occupancy journeys.**
  The maximum extrapolated reduction in single car occupancy journeys per solution.
- **Total Council Cost.**
  The total cost of the Plan per solution per geographical area including any subsidies from the incentives offered. Currently the subsidy for the staff bus has been applied at 50 per cent based upon the current staff bus saving 40 per cent in the true running costs and the Council meeting the shortfall for failure to recover all staff bus running costs. Subsidising public transport has been set at 10per cent as agreed through the Group.
- **Employee Cost Saved.**
  This is the cost of single car occupancy journeys saved based upon 18.54 pence per mile and includes any subsidy that the Council is providing. The calculation of single car occupancy journeys: -

	Pence per Mile
Depreciation	14.48
Oil	0.34
Tyres	0.97
Servicing	0.98
Repairs and Maintenance	3.39
Subtotal	20.16
46.2per cent of journeys are commuting	**9.31**
Fuel	**9.23**
Total Cost Saved	**18.54**

The financial appraisal has scored both the cost of the Plan for the Council and the employee costs saved by ranking both costs to provide a score.

A ranking of 0 – 15 was used with 15 indicating the most effective cost to both the Council and employee converting to a score of 15. The scores were then amalgamated and compared against the non-financial criteria. Table 12 shows the rankings of each solution for the Council and employees with the aggregate scores for the financial appraisal.

Table 12
Financial Appraisal Scores

Solution	**Cost to the Council**		**Employee Costs Saved**		**TOTAL SCORE**
	£	**Ranking**	**£**	**Ranking**	
CS	3,400	14	16,161	9	23
SB	102,951	7	17,127	10	17
PB	18,803	10	48,008	14	24
T	6,392	13	11,253	7	20
SB / CS	105,351	6	-11,048	1	7
SB / PB	119,669	1	-7,699	4	5
SB / T	105,426	6	15,094	8	14
CS / PB	16,592	11	41,118	12	23
CS / T	7,416	12	23,537	11	23
PB / T	22,528	8	50,092	15	23
SB / CS / PB	117,094	3	-12,958	0	3
SB / CS / T	109,069	4	-9,171	3	7
SB / PB / T	120,157	0	9,429	6	6
CS / T / PB	19,597	9	45,695	13	22
CS / SB / PB / T	118,149	2	-10,636	2	4
No Plan	-	15	-	5	20

CS – Car Share / SB – Staff Bus / PB – Public Bus / T - Train

Results from the financial appraisal indicate that the Council and employee rankings favour alternative solutions. The Council, objectively, favours no Plan and the employees' favour the solution of Public Bus and Train. When both scores are combined, the preferred solution is Public Bus. The financial criteria will be compared to the non-financial criteria to consider the benefits of a Plan.

Environmental Analysis

The environmental analysis considered the interest of the stakeholders (Council, Employees, UNISON, Local Residents and Partner Organisations) to the Plan and the maximum expected

reduction in single car occupancy journeys. The number of criteria for each stakeholder has provided a weighting representing the importance of each stakeholder. Criteria were agreed via the Group who also considered collectively the impact of each travel option upon the criteria.

The impact was measured in terms of a positive (+), negative (-) or neutral (0) effect on the criteria with the results shown in Table 13. The net impact provides an overall total with scores of 6, 4, 2 and 0 applied from the highest to the lowest overall totals. The scores were agreed via the Group.

Table 13
Environmental Analysis of Stakeholders

Environmental Analysis Criteria EMPLOYER	Staff Bus	Public Transport	Car Share	No Plan
Community Leadership	+	+	+	-
Link to the PSA target of increased patronage on buses	+	+	0	0
Environmentally friendly organisation	+	+	+	-
Financial Cost	-	-	0	-
Commitment to local and central government policies	+	+	+	-
Recruitment and retention of staff	+	+	+	-
Total Employer	**4**	**4**	**4**	**-5**
EMPLOYEE / UNISON				
Accessibility to Headquarters	+	0	+	0
Flexibility in working arrangements	-	+	0	0
Availability to all	-	-	-	0
Financial Cost	+	+	+	0
Reduced stress associated with traffic and parking	+	+	0	0
Travelling Distance	+	-	0	0
'Comfort' of journey	+	-	0	0
Total Employee	**3**	**0**	**1**	**0**
LOCAL RESIDENTS				
Reduction in traffic and noise pollution	+	+	+	0
Reduction in on street car parking	+	+	+	0
Total Local Residents	**2**	**2**	**2**	**0**
PARTNER ORGANISATIONS				
A partnership with the council	+	+	0	0
Knowledge and communication links with the council	+	+	0	0
Total Partner Organisations	**2**	**2**	**0**	**0**
OVERALL TOTAL	**11**	**8**	**7**	**-5**
SCORE	**6**	**4**	**2**	**0**

Note: - For any solution containing more than one option, an average score is used. Train and Public Bus will be treated together, i.e. solution of Staff Bus, Public Bus and Train the score would be (6+4)/2 = 5

The maximum expected reduction in single car occupancy journeys have been ranked 0 – 15 with a ranking of 15, scoring 30 points. The scores have been given a weighting of 2 for the benefit of the Council reducing single car occupancy journeys and employees benefiting from alternative travel options. Results have been included in Table 14.

Table 14
Environmental Analysis Scores

Solution	Reduction in Journeys			Stakeholder Analysis Scores	TOTAL SCORE
	Journeys	Ranking	Score		
CS	1,310.1	8	16	2	18
SB	572.3	2	4	6	10
PB	912.4	4	8	4	12
T	158.4	1	2	4	6
SB / CS	1,453.8	11	22	4	26
SB / PB	1,045.6	7	14	5	19
SB / T	657.1	3	6	5	11
CS / PB	1,485.8	12	24	3	27
CS / T	1,338.4	9	18	3	21
PB / T	964.3	5	10	4	14
SB / CS / PB	1,543.4	14	28	4	32
SB / CS / T	1,394.7	10	20	4	24
SB / PB / T	1,020.6	6	12	5	17
CS / T / PB	1,497.9	13	26	3	29
CS / SB / PB / T	1,582.8	15	30	6	36
No Plan	-	0	0	0	0

If financial criteria were the only consideration the optimum position for the Council is not to implement a plan. However the environmental analysis has scored this option lowest. This recognises the importance of non-financial criteria such as the benefits to stakeholders and journey reductions when considering the Plan. Overall, implementing all travel options has provided the highest score and on this analysis alone would be implemented.

Administration of Options

The administration of options has been included within the option appraisal to measure the impact of implementing the travel options with their associated incentives. Discussions have been held with the Administration Manager for the Staff Bus, Employee Benefits Manager, Office Accommodation Manager and members of the Group to determine the administration of each travel option against one another, with 3 being the highest score. The overall totals have been scored 6, 4, 2, and 0 with the outcome shown in Table 15.

Table 15
Administration of Options Scores

Option	Effect on the Council					Employee Ease of Use	TOTAL	SCORE
	Administration Time	Additional IT Resources	Control and Security	Cash Flow Effect	Implementation			
Staff Bus	3	3	3	2	3	3	17	6
Public Transport	1	2	2	1	1	1	8	2
Car Share	2	1	1	3	2	2	11	4

Note: - For any solution containing more than one option, an average score is used. Train and Public Bus will be treated together, i.e. solution of Staff Bus, Public Bus and Train the score would be (6+2)/2 = 4

Option Appraisal of Solutions

Each solution has been appraised using the financial and non-financial scores and provide the following ranking of options:

1. Car Share, Public Bus and Train (Most viable solution) score 54
2. Car Share and Public Bus score 53
3. Car Share and Train score 47
4. Care Share. score 45

The next nearest solution scored substantially less than the four listed above. All solutions meet the Council's objective for reducing single car occupancy journeys and the most viable solution above provides the most alternative travel options for employees. Financial scores for both the Council and employees were favourable and cost effective and provide the optimum solution for the Plan is *Car Share, Public Bus, Train, Walk and Bike.*

The financial cost for the Council and the employee costs saved has been summarised in Table 16.

Table 16
Cost of the Solution

Journeys	Council Cost £	Employee Cost Saved £
Extrapolated Data (1,497.9)	16,635	42,867
Administration and Monitoring Costs	44,500	-
TOTAL COST	**61,135**	**42,867**

The model has been recalculated to provide the maximum cost to the Council if all journeys were undertaken using the alternative travel options based upon the most expensive travel option per settlement. Using the cost data and employee settlement data, the maximum cost would be £59,624 before administration and monitoring costs. However, some employees indicated that they were not interested in any incentives; the costs identified represent a more accurate picture. Extrapolated data were based on the best-case scenario.

Conclusions

This research has confirmed that there may be a discernable financial implication to both parties to an environmental commuting policy, employees and employers. It has demonstrated that employees may face significant additional personal expenditure but also, with careful selection of schemes could achieve a reduction in costs. The employer, however, must be prepared to incur additional costs regardless of the option chosen. The option providing the optimum outcome incorporates a range of travel options all of which will contribute to reduce congestion within the greater Cambridge area. Not all of the findings are directly relatable to comparable cities and towns. Researchers and practitioners undertaking similar investigations may adopt the survey approach used in Cambridgeshire but must recognise local transport options and classify relevant settlements. Employee perceptions must be tackled in all related investigations and whilst other researchers may benchmark the cost findings contained within this paper it will be necessary to evaluate current financial commitments for each investigation.

Entering into the field of environmental commuting will directly support the County Council objective of community leadership whilst retaining the rights of individuals to make personal choice. Retention of choice therefore becomes a significant and critical success factor and the County Council will need to build upon the positive response form the questionnaire and develop the consensus view that promotes social responsibility within a social culture.

This research will support the County Council in achieving its objective to reduce the single occupancy car journeys however the complexity of analysis based upon a diverse range of stakeholders will not permit a single strategy plan as consensus is unlikely to be achieved.

Therefore to support this initiative the council may wish to consider linking the policy with incentives such as:

- ✓ Guaranteed ride home scheme
- ✓ Priority parking for car sharing
- ✓ Team pool cars
- ✓ Additional flexi-time
- ✓ Subsidised public transport

However these will add to the costs incurred by the employer modelled upon the survey responses developed within this paper.

Implementation of our recommendations will require further analysis; in particular the following issues must be addressed:

- Planning for and achieving a political policy supportive of environmental commuting.
- Financing of environmental policies.
- Changing community culture and expectations.
- Evaluating the impact of the policy on recruitment and retention.

As of the 1st June 2002 Cambridgeshire County Council began implementation of its Commuting Plan based upon this research after achieving political support and sufficient financing for the plan. The Council recognise the need to evaluate cultural impact and the future impact upon recruitment and retention, planning to research both aspects.

This paper has addressed a specific issue at a specific location and will be subject to a post implementation review. The methodology supporting this research provides a theoretical basis to present the findings to Councillors and Employees; as stated above the Council has accepted the findings and recommendations. Implementation now lies with practitioners who must deal with the preferences and perceptions of the workforce.

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