Highways Economics Note No. 1

2005 Valuation of the Benefits of Prevention of Road Accidents and Casualties

January 2007

Department for Transport

2005 Valuation of the Benefits of Prevention of Road Accidents and Casualties

1. This note gives the Department for Transport estimates of the values for prevention of road casualties and road accidents for use in the appraisal of road schemes. Based on 2005 road accident data, the estimates are given for 2005 at June 2005 prices and values. The note also explains the basis upon which the estimates are made.

2. Estimates of the total value of prevention of road casualties and road accidents in Great Britain are also given for 2005. These do not represent actual costs incurred as the result of road accidents. They are the cost-benefit values and represent the benefits which would be obtained by prevention of road accidents.

Benefits to Society Arising from Prevention of Road Accidents and Casualties

Casualties

3. Since 1993, the valuation of both fatal and non-fatal casualties has been based on a consistent willingness to pay (WTP) approach. This approach encompasses all aspects of the valuation of casualties including the human costs and the direct economic costs i.e. an amount to reflect the pain, grief and suffering and the lost output and medical costs associated with road accident injuries.

4. The methodology for non-fatal casualties was described in an article in Road Accidents Great Britain (RAGB) 1992, and a further article in RAGB 1994 gives updated information. More detailed descriptions of methods and the underlying research have been published by the Transport Research Laboratory. In particular, a summary account of the full methodology has been published (Hopkin and Simpson, 1995). Full references are to be found at the end of this note. RAGB 1997 contained an article describing the results of recent research on the value of prevention of a road accident fatality. The research showed that a figure in the range £750,000 to £1,250,000 in 1997 prices could be regarded as being broadly acceptable. The mid-point of this range has been adopted as the basis for the value of prevention of a fatality. A similar approach has been used to derive the values for serious and slight casualties which are pegged to the fatal value. The values, updated to 2005 prices, by severity of casualty and by class of road user, are set out in Tables 1 and 2 respectively.

5. The values for the prevention of fatal, serious and slight casualties include the following elements of cost:

   - loss of output due to injury. This is calculated as the present value of the expected loss of earnings plus any non-wage payments (national insurance contributions, etc.) paid by the employer.

   - ambulance costs and the costs of hospital treatment.

   - human costs, based on WTP values, which represent pain, grief and suffering to the casualty, relatives and friends, and, for fatal casualties, the intrinsic loss of enjoyment of life over and above the consumption of goods and services.

Accidents

6. It is to be noted that the value of prevention of an injury accident is greater than the value of the corresponding casualty e.g. value of preventing a fatal accident is greater than the value of a fatality for two reasons. The first is that an injury accident is classified according to the most severe casualty but will on average involve more than one casualty – for example in 2005, a fatal accident on average involved 1.10 fatalities, 0.36 serious casualties and 0.54 slight casualties. The second reason is that there are some costs which are part of the valuation of an injury accident but which are not specific to casualties. These are:

   - costs of damage to vehicles and property

   - costs of police and the administrative costs of accident insurance

7. Details of the derivation of these costs are available in a published Transport Research Laboratory Report (Simpson and O'Reilly, 1994).

8. In Tables 3 and 5 in Appendix 1, elements of value are shown grouped according to whether they relate specifically to casualties or to accidents. The casualty related values are lost output, medical and ambulance costs, and human costs. The costs of police and property damage are shown separately as accident related costs. The total value of prevention of an accident is the aggregate of both sets of values.

9. Tables 4a-c, and 6 show values by road type. In 2002 the headings were changed from urban and rural to built-up and non built-up, but the values are on exactly the same basis as before, using speed limits as the criterion. This terminology has been made for consistency with tables in Road Casualties Great Britain. Urban roads are now defined as major or minor roads within an urban area with a population of 10,000 or more, based on the 1991 Office of the Deputy Prime Minister definition of urban settlements. Rural roads are major and minor roads outside urban areas. If values are required for urban and rural roads rather than built-up and non built-up they can be supplied on request.

10. The values to be used for injury accidents vary between built-up and non built-up roads and motorways because the average number of casualties per injury accident differs between categories of road (see Tables 4a, b and c). In addition, the cost of vehicle damage per accident varies by road category. For example, a serious accident on a non built-up road will on average involve 1.20 serious casualties, compared with 1.07 serious casualties on a built-up road, together with a greater amount of vehicle damage. Current practice is to calculate average values for prevention of accidents separately for built-up roads, non built-up roads and motorways.

Uprating of Values

11. For 2005, values have been updated using an index which reflects inflation and real per capita economic growth in the period June 2004 to June 2005. This is done by multiplying the 2004 values by a factor equal to:

$$1 + \frac{\%\text{ increase in nominal GDP per capita}}{100} = 1.0316$$

12. If values are required at June 2006 price and output levels (i.e. 2005 accidents at 2006 values) these should be calculated by adjusting the June 2005 figures given in the Appendix by the current estimates of the increase in nominal GDP per capita. For 2005–2006 the estimated Q2 per capita nominal GDP increase is 4.27%. Therefore values for June 2006 can be obtained by multiplying the estimates in Appendix 1 by 1.0427.

13. Whatever the base price level chosen, most appraisals involve forecasting values of the prevention of accidents in future years at that base price level. In this case future accident values can be derived at the selected price level by increasing the estimates by the expected long term GDP per capita growth rate, on the assumption that the real cost of each element of accident costs (such as labour costs, etc.) will rise in line with increases in output. The best working assumption to make at the moment is that GDP per capita growth will be 2.46% for 2006 and 2.20% for 2007, and these rates should be used to update for GDP growth alone.

Use of Accident and Casualty Values for Appraisal

14. The most appropriate accident or casualty value figures to use from Appendix 1 depends on the amount of information available for the scheme under review. Where large numbers of fatal, serious and slight accidents are known for the part of the network under consideration, then these may provide a reliable guide to the proportion of casualties of different severity to be expected in future. More usually, there is only data for a small number of accidents on the part of the network which is being considered. Therefore, the observed severity mix cannot be expected to provide a reliable guide to the future severity mix. In this case, or where there is no breakdown

by severity and only the total number of injury accidents is available, the average values for all injury accidents should be used. This is equivalent to assuming the national proportions of different severities.

15. A similar approach should be employed for valuation of casualties (average values by severity of casualty and by class of road user are provided in Tables 1 and 2). The variation between classes of road user is due to different proportions of each class suffering fatal, serious or slight injuries when involved in a road accident. There may be some over-estimation of average values of prevention per accident and per casualty due to under-reporting of less severe accidents. Variations between road user categories in the extent of under-reporting of less severe casualties would affect comparison of average values per casualty by class of road user.

16. In addition to values for prevention of injury accidents, estimates are provided for damage-only accidents. Since damage-only accidents are not comprehensively reported to the police, there may be no reliable information on their number. In these circumstances an estimate can be made of the value of prevention of accidents (including damage-only accidents) using an average accident value per injury accident (as in Tables 4a, b and c). These values include an allowance for damage-only accidents, which is calculated assuming an average of 17.7 damage-only accidents for every injury accident on built-up roads, 7.8 on non built-up roads and 7.6 on motorways.

17. Appendix 1 also includes Tables (4b and 4c) showing average accident values by type of road in daylight hours and in darkness.

18. In appraising road proposals, using the COBA method, the accident rates and values given in the COBA Manual (Design Manual for Roads and Bridges, Volume 13, Section 1, Part 2, Chapters 3, 4 and 5), should be used. The valuation of accidents given in the COBA Manual differs from the values shown in this note in three respects:

    i) COBA values are expressed in a 2002 price base, rather than the 2005 price base here.

    ii) In COBA, severity splits are averaged over three to five years; and

    iii) COBA uses a finer disaggregation of road categories and also details junctions separately.

The Total Value of Prevention of Road Accidents in Great Britain in 2005

19. In 2005, 2,913 fatal accidents, 25,029 serious accidents and 170,793 slight accidents were reported. In cost-benefit terms the value of prevention of these 198,735 injury accidents is estimated to have been £12,807m in 2005 prices and values. In addition, there were an estimated 3m damage-only accidents valued at a further £5,044m. The total value of prevention of all road accidents in 2005 was therefore estimated to have been £17,851m (see Appendix 1, Tables 5 and 6).

20. The above relates to the total value to the community of the benefits of prevention of road accidents, although the incidence of costs will, of course, vary between groups of road users and also between road users and other members of society (i.e. some costs, such as lost output will not be borne exclusively by casualties themselves, since the taxation and social security systems will ensure that the burden of lost output will be shared by the population at large). Also, some elements of cost, (lost output, medical costs, police and damage costs), represent direct costs which will be incurred as the result of road accidents. However, human costs, as calculated using willingness to pay methods, represent the ex ante benefit of avoidance of risk of a road accident, rather than ex post values of the consequences of an accident. Consequently, Appendix 1 gives a breakdown of the total value of prevention of road accidents by severity and element of cost (Table 5), and by severity and category of road (Table 6), without attempting to allocate costs by responsibility or final incidence.

Further Information

21. This note is the twenty-eighth in a regular series of Highways Economic Notes on Valuation of Accidents. The note is usually updated annually. Values for base dates other than 2005 can be obtained as described in paragraphs 12 and 13. Further information on the use of accident or casualty values generally, may be sought by telephoning 020-7944-6176. More detailed information on the methodology for valuation of road accidents is available in the RAGB articles and research reports listed below. TRL reports are available from TRL Ltd, Wokingham, Berkshire (telephone 01344 773131, e-mail: enquiries@trl.co.uk). Information on accident numbers and rates (rather than costs) may be obtained from two annual The Stationery Office/DfT publications, *Road Casualties Great Britain*, and *Transport Statistics Great Britain*. This and other recent Highways Economic Notes No.1 can be found on the Department's web site http://www.dft.gov.uk under Road Safety/Economic Assessment.

References

Chilton, S., Covey, J., Hopkins, L., Jones-Lee, M., Loomes, G., Pidgeon, N. & Spencer, A. (1998) *New research results on the valuation of preventing fatal road accident casualties*, In: Road Accidents Great Britain 1997, The Casualty Report, Department of the Environment Transport and the Regions.

Hopkin, J.M. and O'Reilly, D. (1993) *Revaluation of the Cost of Road Accident Casualties: 1992 Revision*, TRL Research Report 378, Transport Research Laboratory, Wokingham.

Hopkin, J.M. and Simpson, H. (1995) *Valuation of Road Accidents*, TRL Research Report 163, Transport Research Laboratory, Wokingham.

McMahon, C.M. (1995) *Valuation of Road Accidents 1994*, Road Accidents Great Britain 1994, Department of Transport.

Murray, P.A., Pitcher, M. and Galasko, C.S.B. (1993) *The cost of long-term disability from road traffic accidents, four year study – final report,* TRL Project Report 45, Transport Research Laboratory, Wokingham.

Murray, P.A., Pitcher, M. and Galasko, C.S.B. (1994) *The cost of some road accidents in the DoT serious and slight range*, TRL Project Report 106, Transport Research Laboratory, Wokingham.

O'Reilly, D. and McMahon, C.M. (1993*) Valuation of the reduction in risk of road accidents, 1992 revision*, Road Accidents Great Britain 1992, Department of Transport.

Simpson, H. and O'Reilly, D. (1994) *Revaluation of accident related costs of road accidents*, TRL Project Report 56, Transport Research Laboratory, Wokingham.

Taylor, M.C. (1990) *The cost of vehicle damage resulting from road accidents*, TRL Research Report RR256, Transport and Road Research Laboratory, Wokingham.

Health and Safety Executive Publications

Chilton, S., Dolan, P., Jones-Lee, M., Loomes, G., Robinson, A., Carthy, T. (University of Newcastle), Covey, J., Spencer, A., (University of York), Hopkins, L., Pidgeon, N., (University of Wales, Bangor), Beattie, J., (University of Sussex), (2000) *Valuation of Benefits of Health and Safety Control: Final Report*, Health and Safety Executive. (Available to download from the HSE Web site at: *http://www.hse.gov.uk/research/misc/crr_pdf/2000/crr00273.pdf*)

Valuing Health and Safety Controls: Report on the Findings of the Roads VOSL "Peg" Main Study [Available from HSE see below]

HSE publications available from: HSE Books, PO Box 1999, Sudbury, Suffolk, CO10 6FS, Tel: 01787 881165 Fax: 01787 313995 or online at http://www.hsebooks.co.uk/

Appendix 1

The Valuation of the Benefits of Prevention of Road Accidents and Casualties in 2005 at June 2005 Prices[1,2]

Table 1 – Average values per casualty by severity and element of cost

Table 2 – Average values per casualty, by class of road user

Table 3 – Average values per accident, by severity of accident and element of cost

Table 4a – Average values per accident by severity of accident and class of road: all hours

Table 4b – Average values per accident by severity of accident and class of road: daylight hours

Table 4c – Average values per accident by severity of accident and class of road: hours of darkness

Table 5 – Total value of prevention of accidents by severity of accident and element of cost

Table 6 – Total value of prevention of accidents by severity of accident and class of road

Table 1: **Average value of prevention per casualty by severity and element of cost**

2005				£ June 2005
Injury severity	Lost output	Human costs	Medical and ambulance	TOTAL
Fatal	490,960	936,380	840	1,428,180
Serious	18,920	130,110	11,460	160,480
Slight	2,000	9,530	850	12,370
Average, all casualties	9,580	33,360	1,980	44,920

[1] Note that because some elements of accident values are not quantified, total accident values may be regarded as minimum estimates

[2] All values given in the HEN1, including the Tables in the Appendix, are expressed in market prices.

Table. 2: **Average value of prevention per road casualty by class of road user[1]**

2005	£ June 2005
Pedestrian	69,660
Pedal cyclist	44,810
Bus and coach occupants	20,600
Goods vehicle occupants	44,270
Car and taxi occupants	36,420
Motorised two-wheeler riders and passengers	80,260
All motor vehicle users	39,430
Average, all road users	44,920

1 Note that the variation in value between classes of road user is due to differences in proportions of fatal, serious and slight casualties among each class of road user.

Table 3: **Average value of prevention per accident by severity and element of cost**

2005 **£ June 2005**

	Cost Element						
	Casualty related costs			Accident related costs			
Accident severity	**Lost output**	**Medical and ambulance**	**Human costs**	**Police cost**	**Insurance and admin**	**Damage to property**	**TOTAL**
Fatal	547,290	5,450	1,080,290	1,660	260	9,830	1,644,790
Serious	21,920	13,130	149,030	230	160	4,460	188,920
Slight	2,660	1,130	12,660	50	100	2,650	19,250
All injury	13,070	2,700	45,490	100	110	2,980	64,440
Damage only	–	–	–	3	50	1,660	1,710

Table 4a: **Average value of prevention per accident by severity and class of road: all hours**

2005 **£ June 2005**

	Road Class			
Accident severity	**Built-up[1]**	**Non Built-up[2]**	**Motorway**	**All**
Fatal	1,558,290	1,699,140	1,751,150	1,644,790
Serious	179,210	206,700	213,540	188,920
Slight	18,130	21,620	25,570	19,250
All injury	49,580	105,900	78,930	64,440
Damage only	1,590	2,360	2,270	1,710
Average cost per injury accident including an allowance for damage on accidents	77,820	124,280	96,160	89,820

1 Built-up roads are those roads other than motorways with speed limits of 40mph or less

2 Non Built-up roads are those roads other than motorways with speed limits greater than 40mph

Table 4b: **Average value of prevention per accident by severity and class of road: daylight hours**

2005 **£ June 2005**

Accident severity	Road Class: Built-up[1]	Non Built-up[2]	Motorway	All
Fatal	1,514,260	1,661,960	1,700,140	1,604,880
Serious	176,350	203,820	210,180	186,170
Slight	17,980	21,560	25,520	19,110
All injury	44,170	93,820	62,090	56,800
Damage only	1,600	2,360	2,270	1,710
Average cost per injury accident including an allowance for damage on accidents	72,400	112,210	79,320	82,210

1 Built-up roads are those roads other than motorways with speed limits of 40mph or less

2 Non Built-up roads are those roads other than motorways with speed limits greater than 40mph

Table 4c: **Average value of prevention per accident by severity and class of road: hours of darkness**

2005 **£ June 2005**

Accident severity	Road Class: Built-up[1]	Non Built-up[2]	Motorway	All
Fatal	1,613,970	1,754,950	1,789,030	1,698,270
Serious	184,850	212,940	219,460	194,490
Slight	18,560	21,790	25,680	19,640
All injury	64,220	137,000	119,950	84,770
Damage only	1,550	2,310	2,220	1,660
Average cost per injury accident including an allowance for damage on accidents	91,610	155,020	136,820	109,360

1 Built-up roads are those roads other than motorways with speed limits of 40mph or less

2 Non Built-up roads are those roads other than motorways with speed limits greater than 40mph

Table 5: **Total[1] value of prevention of accidents by severity and element of cost**

2005 **£(m) June 2005**

	Cost Element						
	Casualty related costs			Accident related costs			
Accident severity	**Lost output**	**Medical and ambulance**	**Human costs**	**Police cost**	**Insurance and admin**	**Damage to property**	**TOTAL**
Fatal	1,590	20	3,150	5	1	30	4,790
Serious	550	330	3,730	6	4	110	4,730
Slight	450	190	2,160	9	20	450	3,290
All injury	2,600	540	9,040	20	20	590	12,810
Damage only	–	–	–	9	140	4,890	5,040
All accidents	2,600	540	9,040	30	160	5,490	17,850

1 Note that totals may not equal the sum of their elements due to rounding

Table 6: **Total[1] value of prevention of accidents by severity and class of road**

2005 **£(m) June 2005**

	Road Class			
Accident severity	**Built-up[2]**	**Non Built-up[3]**	**Motorway**	**All**
Fatal	1,850	2,630	310	4,790
Serious	2,940	1,610	180	4,730
Slight	2,260	830	200	3,290
All injury	7,050	5,080	680	12,810
Damage only	4,010	880	150	5,040
All accidents	11,060	5,960	830	17,850

1 Note that totals may not equal the sum of their elements due to rounding

2 Built-up roads are those roads other than motorways with speed limits of 40mph or less

3 Non Built-up roads are those roads other than motorways with speed limits greater than 40mph