Potential impacts of teleworking on transport systems

Peter White[1]
Helena Titheridge[2]
David Moffat[3]

[1] School of Architecture and the Built Environment, University of Westminster
[2] University College London
[3] Steer Davies Gleave

This is an electronic version of an article published in Logistics & Transport Focus, 13 (11). pp. 26-29, November 2011.

TRANSPORT PLANNING

AUTHORS
Peter White FCILT
Helena Titheridge
David Moffat

Avoiding travel in congested peak periods' featured highly in the survey as reasons to work from home: for full-day – 39% – and part-day teleworking –35%

Potential impacts of teleworking on transport systems

CILT's Transport Planning Forum has investigated how teleworking could impact on our transport systems – and come to some fascinating conclusions.

A meeting hosted by the University of Westminster as part of the CILT Transport Planning Forum programme, included this presentation on the impact of teleworking on transport, which drew on the following to present a picture of the current role and potential impacts of teleworking:

- Data published in the annual reports from the National Travel Survey (NTS) in Britain[1]
- A study undertaken jointly by the University of Westminster, University College London and Imperial College London, funded by British Telecom and Transport for London, which examined organisational perceptions of teleworking, analysed NTS data, and evaluated some possible outcomes [2, 3]
- A study by David Moffat[4], in which a large sample of staff at the Department for Transport (DfT) in London, and regional Government Offices (GOs) were surveyed to identify their present extent of teleworking, and attitudes toward its wider use

For the purposes of this paper, teleworking is defined as working away from the traditional workplace – typically the worker's home – by use of ICT, typically computer and phone. It could be the entire basis on which someone works, or be undertaken for part of the day or week. We may thus distinguish between teleworkers – people who work all or part of their time in this form – and teleworking – the proportion of total work time spent in this form.

The National Travel Survey (NTS) shows that the proportion of the working population doing all their work at home rose from 3% in 2002 to 5% in 2009.[5] It should be noted that this may include some traditional occupations, as well as teleworking per se, although net growth in recent years is likely to be associated mainly with teleworking. In addition, a similar proportion of the working population work from home at least one day a week: 6% in 2007 and 2008. A limitation of the NTS is that part-day teleworking – for example, checking emails at home then travelling mid-morning to the office – is not covered. Work by Lyons et al[6] at the University of the West of England indicates that this is substantial.

Interviews with organisations in the London region indicated that much of the teleworking by their employees was by those in high status, non-manual occupations, whose type of work was suited to this, often on an informal basis. Conversely, there was much less scope among those in other occupations, especially those requiring physical presence of the worker – for example, in catering or transport. The association with

higher income was confirmed in published data from the 2007 NTS[7] for those working from home at least one day in the survey week. Of the top income quintile, 10% did so; in the lowest quintile, 3%. This association with income level could point to a social equity issue, in that those on higher incomes may have the greater flexibility, including opportunities to reduce travel costs, that arises from teleworking.

Broadly similar findings arise from studies in Norway[8], especially in respect of the informal nature of telework, and its use by higher status individuals. Further studies in the UK, notably by Penfold et al[9], confirm a preference for part-day or part-week, rather than full-time, teleworking.

How does this relate to transport?

The most obvious potential impact on transport is from the elimination of the home – work commuting return trip. In the case of a worker commuting by car with no other occupants, this produces an approximately pro rata reduction in vehicle-km travelled for that purpose, subject to any offsetting effects. In the case of public transport, reductions in capacity costs would depend on scheduling decisions by the operator, such as using a smaller vehicle or shortening train length. Given the loss of revenue, the net effect on profitability would depend on the marginal costs of such capacity – typically higher than revenues in the peak.

From the traveller's point of view, a saving in costs is likely to be obtained. Time released from travel – conventionally assumed to be a disutility – could be used for other purposes, and activities at home mixed with work. From the viewpoint of society as a whole, reductions in congestion, energy use and environmental impacts could be beneficial, together with a potential economic gain from improved productivity of those who telework. However, some offsetting rebound effects could also arise, including greater use of cars for local journeys on days teleworked.

From the employer's point of view, higher productivity and job satisfaction might be obtained. Recruitment could be improved. Reductions in costs of office space might be obtained, especially where substantial change – such as a shift to hot desking – might be attained.

A number of studies in the UK and the USA have identified reductions in total distances travelled on days teleworked, and a net reduction in travel as a whole. However, due to the relatively small proportion of teleworking, such savings may be modest overall – an estimate of 1% reduction in vehicle-km in the US case, for example.[10]

Further analysis of NTS data

A set of data from 2002 to 2004 was examined. Figure 1 shows the relationship between distance travelled – grossed up to an annual total – and frequency of working at home, both for all purposes, and for commuting. As might be expected, where frequency of working at home is lowest – less than once or twice a year – total distance travelled is more than in the case of those who work from home three or more days a week. For commuting the difference is more marked, as one would expect. However, intermediate categories do not show the simple relationship that might be assumed – indeed, those working from home one or two days a week showing the highest total distance travelled.

This is not necessarily a cause and effect relationship, but may simply indicate the association with higher income and status mentioned above. However, while part-week teleworking might permit, or be associated with, higher distances travelled, between home and work, it does not follow that those shifting to this work pattern will relocate further from their work.

Figure 2 shows trips per person per year for the same categories. Here much less variation is evident around an average of 1,200 trips a year, although the proportion of commuting falls, and of business trips rises, as frequency of homeworking increases. Analysis of gender differences from the NTS data set suggests little difference by gender, after allowing for typical male/female differences in travel.

Survey of DfT and GO staff

An internet-based survey was carried out in summer 2009 of staff employed by the DfT, principally at its main central London office, and of staff working for the

Distance travelled per year by frequency of working at home

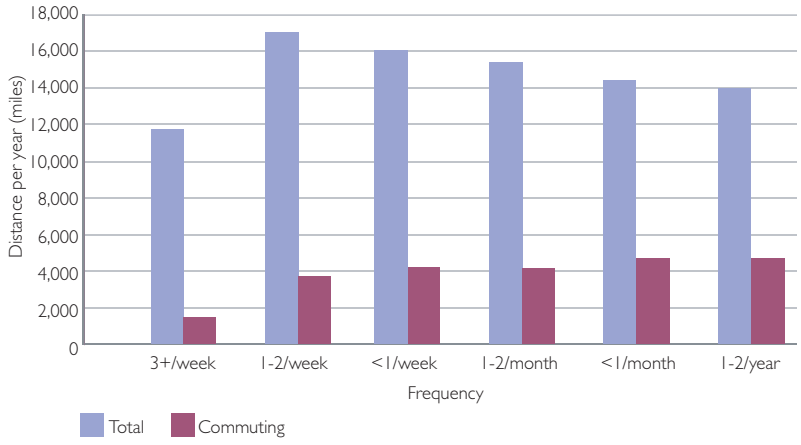

Figure 1 Source: NTS data

Trips per person per year by frequency of working at home

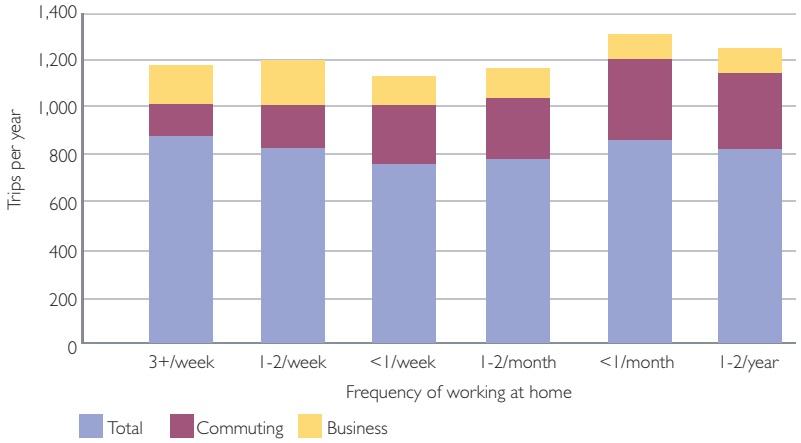

Figure 2 Source: NTS data

How would home working impact on rail operators? In the case of public transport, reductions in capacity costs would depend on scheduling decisions by the operator, such as using a smaller vehicle or shortening train length.

More home teleworking reduces traffic congestion at peak periods

regional GOs throughout England, with the agreement of these organisations.

Table 1 shows the frequency of teleworking, both for part-day and full-day patterns. As might be expected, this is on average somewhat greater than the national averages derived from the NTS, being for a professional, non-manual sample. A total of 21.3% worked for a full day at home at least once a week, and 23.2% part-day. There was a tendency for those who worked full days at home at least once a month to also telework part-days at least once a week, probably making use of the same technology.

A question was also put regarding the desired – as distinct from current – level of full-day teleworking among respondents. Figure 3 shows the resultant distributions. It can be seen that a general preference existed for more frequent teleworking than experienced at the time of the survey. Note that the distributions shown are two aggregate distributions, and it does not follow that an individual currently at a given level – such as once a week – would opt for that immediately above. For example, among those teleworking once a week, the strongest preference was for teleworking twice a week, but some preferring higher frequencies, and others wishing to retain their present frequency. In the case of very high frequencies of teleworking, some expressed a preference for less frequent teleworking. It is particularly noteworthy that the preference for teleworking every day was relatively rare, the highest preference being for once a week – 14% of the then current pattern, 32% of preferred.

Further analysis of the sample indicated a number of relationships:

- A positive association between full-day and part-day teleworking by the same respondents
- A higher frequency of teleworking by those of higher civil service grade
- A higher frequency of teleworking by DfT staff central London than GO staff
- A higher frequency of full-day teleworking among those based in London, east and south-east regions, probably associated with greater commuting distances

Further analysis of relationships with journey times and distances showed that those with a journey to work time over 90 minutes were more likely to telework at least once a week than the sample as a whole, those with a time of under 30 minutes less so. Those with a journey time of 31 to 90 minutes were more likely to telework a part-day once a week, and those with a journey of over 90 minutes to work part-days more than twice a week.

Respondents were asked to identify barriers to teleworking, giving up to three categories each. The top five factors were:

- 'Need contact with colleagues' – 39% of all responses
- 'Inadequacy of IT facilities' – 34.6%
- 'Prefer contact with colleagues' – 19.2%
- 'Line manager doesn't encourage it' – 18.3%
- 'Don't have line manager's permission' – 11%

Note that four of the five factors are social or behavioural rather than associated with technology as such.

Likewise, respondents were asked about their motivations for teleworking:

- 'Gets more work done' – 75% of all responses
- 'Frees up more time' – 55%
- 'Greater flexibility' – 68%
- 'Helps to produce higher quality work' – 44%
- 'Avoid travel in congested peak periods' featured highly for full-day – 39% – and part-day teleworking – 35%
- 'Reduce transport costs' – 35%

Economic appraisal of teleworking

Traditional economic appraisal in transport places high importance on savings in travel time, which typically comprises the largest benefit. These are usually derived from evaluation of marginal changes in travel time, consistent with willingness to pay. Three main categories are applied in evaluation: savings in travel time in the course of paid work – on the assumption that such savings would be converted into productive work; commuting; and other – all personal travel time savings. It is noteworthy that such estimates are rarely applied to large discrete savings in travel time that arise when a journey is entirely eliminated.

In the case of teleworking, we can quantify some aspects of benefits – notably travel time and cost savings, but not all – for example, job satisfaction. The travel time savings might be simply in the form of savings in personal time between home and work, for which the 'commuting' value would be appropriate. If, however, all or some of these time savings were converted into additional work, then the much higher working time value would be appropriate. Note that this will not necessarily intrude in to existing personal time – for

Frequency of full day teleworking vs desired frequency

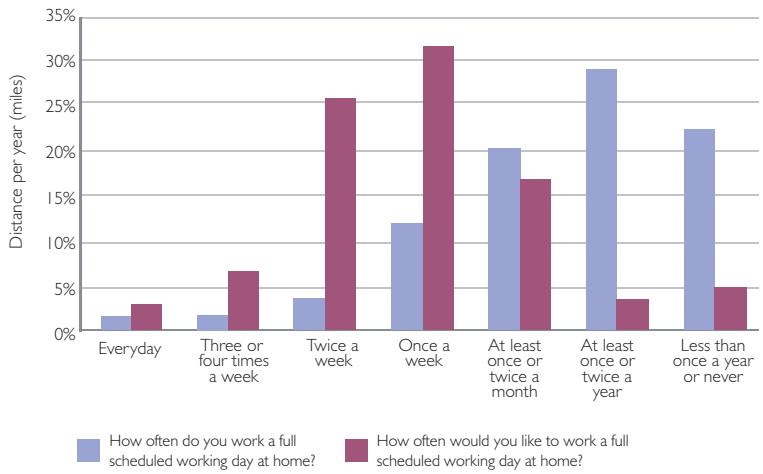

Figure 3

example, if someone worked at home one day a week, saving one hour's travel in each direction, one hour might be used for additional work at home, the other hour saved for personal activities at home.

In the case of the DfT/GO sample, the question: 'How does the ability to work from home affect your working hours in a week?' produced 636 responses. Of these, 55.2% reported that their working hours a week had increased.

The following assumptions were made in respect of economic benefits from teleworking, for 2009 values:

- Time savings in working time at £30 an hour
- Commuting time at £5.55 an hour
- Average additional working hours a week estimated from the survey at 1.6

On this basis, a saving of 95,000 hours' travel time a year was estimated from the DfT/GO sample, an economic benefit of £527,250 a year at the commuting rate. Some 33,000 extra hours were worked a year, giving £990,000 a year at the rate of £30 an hour. If the extra working hours were taken entirely from the journey time savings, then the net saving at commuting time rate would be reduced to 62,000 hours, or £344,100. Hence, the ratio of working time savings to commuting time savings would be 2.88.

These assumptions can be varied, but the findings remain fairly robust. For example, if the extra time worked were reduced from 1.6 hours to 1 hour, with a corresponding rise in commuting time gains, such benefits would still substantially exceed commuting time savings.

Estimates were also made from the DfT/GO sample of CO_2 transport savings from teleworking. In monetary terms, these were negligible in relation to the journey time savings and additional work outputs described earlier.

Frequency of working a full day at home

How often do you work at home?	Full day (%)	Part day (%)
Every day	1.4	1.5
Three or four times a week	1.6	4.9
Twice a week	4.4	7.6
Once a week	13.9	9.2
Less often but at least one or twice a month	25.9	23.9
Less often but at least once or twice a year	29.9	25.7
Less than once a year or never	22.9	27.1

Table 1 Source: responses to survey of DfT and GOs staff

Possible future trends

As indicated earlier, the trend toward greater teleworking is not dramatic, although growth is evident both in full-time and part-week working at home. Further growth may be expected as the structure of employment changes toward non-manual working. However, substantial employment remains – and may be increasing in some cases – in those sectors requiring physical presence of the worker, such as hotels and catering. A strong emphasis remains on face-to-face working in some other occupations, such as financial services.

A greater stimulus might arise from external events – for example, a major epidemic or period of sustained severe weather. This might encourage a shift that would remain afterward, but the extent of this is uncertain.

A clearer potential may be that for spreading the peak through part-day teleworking, already found convenient for many. In particular, this may enable a shifting for the morning peak period, both of car and public transport use.

ESSENTIALS

About the authors

Peter White, University of Westminster; **Helena Titheridge**, University College London; **David Moffat**, Steer Davies Gleave

Acknowledgements

Provision of data from the NTS was of great assistance in permitting a more detailed analysis of patterns described above. Consent to undertake the survey of DfT and GO staff, and to present the overall results from this, is gratefully acknowledged, together with the assistance of all staff who responded to the survey.

References

1. Annual data from the National Travel Survey (NTS) is published by the Department for Transport (DfT) and available on its website. Until 2008 inclusive a hard copy report was provided of the main findings. Subsequently, data has been provided in the form of separate tables.
2. WHITE, P, CHRISTODOULOU, G, MACKETT, R, TITHERIDGE, H, THOREAU, R and POLAK, J, 'The role of teleworking in Britain: its Implications for the Transport System and Economic Evaluation' *Proceedings of the European Transport Conference*, October 2007, The Netherlands
3. WHITE, P, CHRISTODOULOU, G, MACKETT, R, TITHERIDGE, H, THOREAU, R and POLAK, J, 'The Impacts of Teleworking on Sustainability and Travel', in Manzi, Lucas, Lloyd Jones and Allen (eds) *Social Sustainability in Urban Areas*, Earthscan, London, 2010
4. MOFFAT, D and WHITE, P, 'Potential role of time savings through teleworking' Paper at Universities' Transport Study Group Annual Conference, University of Plymouth, January 2010 (unpublished)
5. National Travel Survey 2009, Table NTS 804
6. LYONS, G, HADDAD, H and JONES, T, 'Introducing Consideration of Varied-Spatiotemporal Workers to the Study of Teleworking' Paper at 11th International Conference on Travel Behaviour Research, Kyoto, 2006
7. National Travel Survey: 2007 Interview Data, Table 5.8
8. HJORTHOL, R and NOSSUM, A, 'Teleworking: A Reduction in Travel Time or Just Increased Flexibility?' *Proceedings of the European Transport Conference*, October 2007, The Netherlands
9. PENFOLD, C, WEBSTER, S, NEIL, H and GRAHAM, J, *Understanding the Needs, Attitudes and Behaviours of Teleworkers*, DfT, 2009
10. CHOO, S, MOKHTARIAN, P and SALOMON, I, 'Does Telecommuting Reduce Vehicle-Miles Travelled? An Aggregate Time-Series Analysis for the US' *Transportation*, vol 32, 2003

END