THE FORESIGHT VEHICLE INITIATIVE COMPREHENSIVE HEALTH IMPACT ASSESSMENT: *EXECUTIVE SUMMARY*

1. How was the HIA process initiated?

1.1 This Executive Summary of the Foresight Vehicle Initiative (FVI) comprehensive health impact assessment (HIA) encapsulates the work undertaken by IMPACT, The International Health Impact Assessment Consortium, based in the Department of Public Health at the University of Liverpool in conjunction with colleagues most notably from Keele University and University College, London. The Department of Health, in association with the FV Steering Group, commissioned IMPACT as part of the Government's commitment to investigate the health impacts of Government department policies. The initial terms of reference of the commission were to assess the health impacts of the FVI strategy to the year 2020 within the United Kingdom and,

> **'... to make recommendations to the Foresight Vehicle Steering Group for revising the strategy to maximise the potential health gain and minimise any harm.'**

1.2 The primary role of the HIA has therefore been to inform the decision-making in this strategy revision process. The expected outcome of this process is that the revised strategy would ensure that health gain is maximised and health risks are mitigated against. As a result, the Department of Health would be in a position to endorse the revised strategy.

2. What is the Foresight Vehicle Initiative?

2.1 The FVI is a Government sponsored strategy, which has set out to develop and demonstrate new road vehicle technologies and working practices for example alternatively powered vehicles and design processes. It achieves this primarily by funding new research. The FVI LINK programme is a research fund of £80 million made up from the Department of Trade & Industry (DTI), Department for Transport (DfT), Engineering and Physical Sciences Research Council (EPSRC), the Highways Agency and industry. To date 73 projects have been sponsored since 1997 and these have usually been academic and industry partnerships. The approval, technical monitoring and evaluation of the projects are co-ordinated by the Thematic Groups.

2.2 The health impacts of the FV strategy were examined at the 'development' stage (primarily manufacturing) and at the 'operation' stage (primarily use).

3. What methods were used in the comprehensive HIA?

3.1 The HIA methods used were based on the 'Merseyside Guidelines for Health Impact Assessment' (Scott-Samuel, Birley, Ardern, 1998) and are depicted in figure 1. In these, a prospective, comprehensive HIA is defined as an in-depth investigation of a policy, programme or project, involving critical analysis of available evidence from a range of data sources, including the opinions, experience expectations of those who may be affected (stakeholders) and those with expert knowledge (key informants). Unlike most rapid HIAs it involves the collection and analysis of new data, qualitative and quantitative, from a range of different sources and using different methods. Particular attention was paid in this HIA to the research design to ensure a rigorous process was developed and robust methods were used.

3.2 Profiling was used to firstly define the current baseline for a selected data set. The data set consisted of demographic, health and health determinant indicators, which were identified as factors most likely to be affected by the FV strategy. Projections and forecasts of these data to 2020 were subsequently defined based on underlying trends.

3.3 A comprehensive audit and critical analysis of policies that related to the health and health determinant indicator set was also undertaken. Within this analysis, both the impacts the FV strategy will have on these policies and the policy context of FVI were discussed.

3.4 Participative, qualitative methods, for example focus group discussions, semi-structured interviews, were used to collect data on the knowledge, views and experiences of stakeholders and key informants. Two samples were generated, one from groups affected by the development stage of FVI and one from groups affected by the operation of road vehicles. New approaches to HIA were used to identify and involve different population groups, for example people of different socio-economic circumstances, to help assess the evidence on the potential differential distribution of impacts.

3.5 Quantitative approaches were used to estimate the potential 'added value' of FV technologies and practices by comparing the health impacts arising from their operation with the impacts resulting from other transport policy interventions. This involved estimating the potential health impacts for three scenarios:

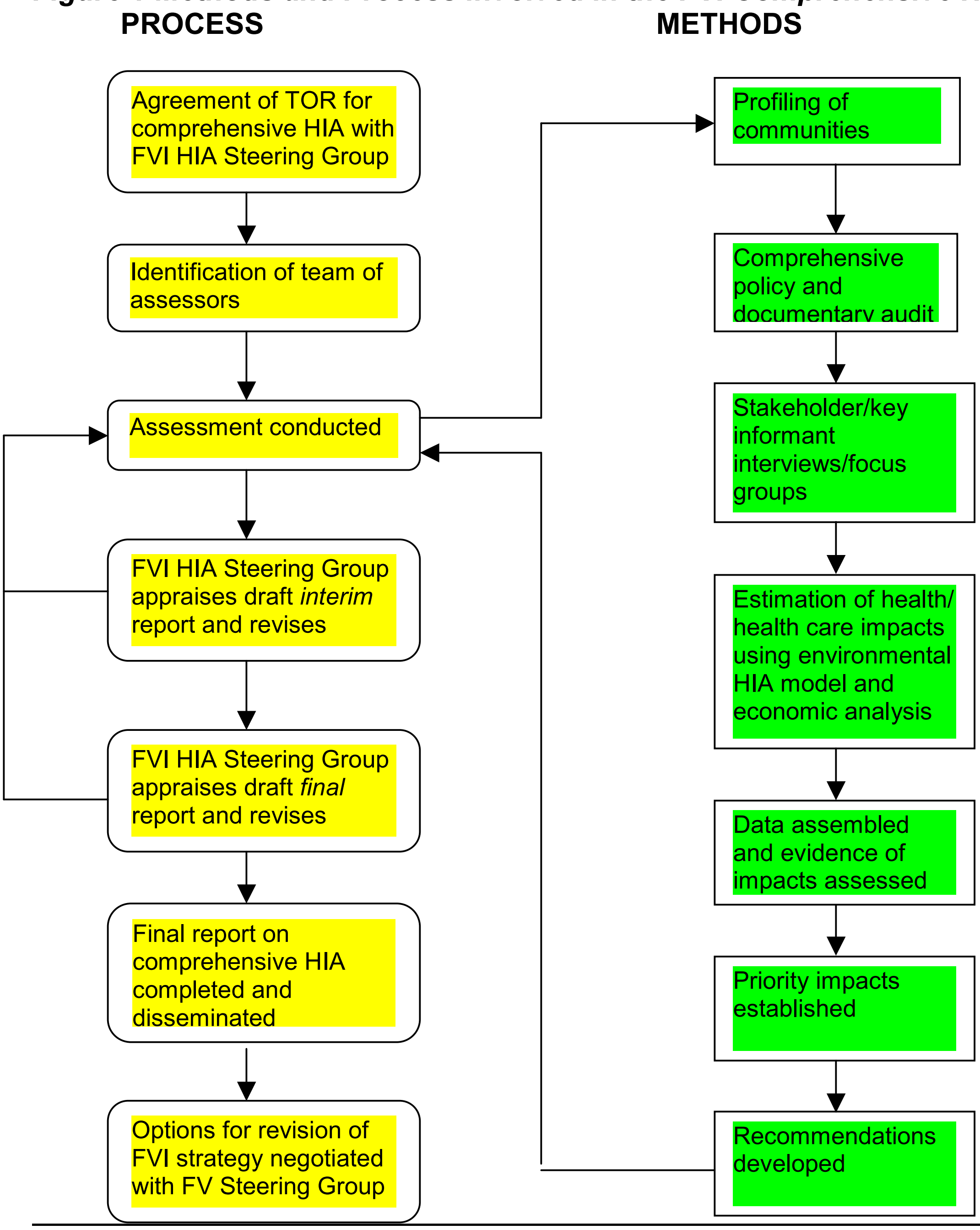
- Scenario A - health impacts based on the 'world as is' (no policy interventions, no FVI)
- Scenario B - health impacts (from 2000-2029) based on underlying trends (including policy interventions, but no FVI)
- Scenario C - health impacts (from 2000-2029) based on underlying trends, including policy interventions and FVI

3.6 An epidemiological model (ARMADA) was used to provide quantitative estimates of the health effects of changes in health determinants, such as air pollutants, due to the introduction of the FV technologies. Official documents and national statistics were used to estimate changes in health determinants for Scenario A and B. However, Scenario C required estimates of the changes due to FVI use to be generated. A consensus panel, email discussion group and various other methods were used with FV Steering Group members and Thematic Groups to generate these estimates.

3.7 An economic analysis was also undertaken on the ARMADA annual estimates of deaths and serious injuries from RTAs as well as first hospital admissions for respiratory and cardiovascular disease due to air pollution. 'Willingness to Pay' estimates and NHS inpatient costs were then applied to the economic analysis.

3.8 Finally, evidence from all of these data sources was pulled together and analysed, identifying and prioritising the potential health impacts arising from the FV strategy as a result of the development and operation of its products and services.

Figure 1 Methods and Process involved in the FVI Comprehensive HIA



4. How does it build on the earlier rapid HIA of the FV strategy?

4.1 The rapid HIA described the potential health impacts of the FV strategy in broad terms. This was based on the analysis of existing data. However it was only able to speculate about the likelihood and direction of certain impacts, as well as the scale of these and other impacts. Examples of these include the extent to which the FV strategy will contribute to the forecasts for air pollutant reductions and reduce the variations in impacts for different groups of people and associated health inequalities.

4.2 Specific objectives were set for the comprehensive HIA that built on the evidence from the rapid HIA, allowing a more considered prioritisation of the impacts. The recommendations based on this comprehensive evidence-base will help inform the FV Steering Group and ensure optimal decision-making in the strategy's revision.

5. What are the key findings from the comprehensive HIA?

5.1 The following account summarises the evidence from the analysis of the data collected from the different stages of the HIA using the methods described above. It presents the evidence for scenarios A, B and C, providing a context for the impacts of FVI in C. It presents the evidence of impacts on the following health determinant category areas:

- Personal, family and lifestyle factors
- Socio-economic factors
- Physical environment factors
- Policies and services

The evidence also includes an analysis on the impacts on health inequalities. Shading is used to indicate the relative priorities of different health impacts; the darker the shading the higher priority. These are not necessarily all priorities for the FV Steering Group.

Table 1 Impacts on personal, family and lifestyle factors

Scenario A Health Impacts: no underlying trends	Direction	*Scenario B* Potential Health Impacts: underlying trends	Direction	*Scenario C* Potential Health Impacts: underlying trends and FVI	Direction
Population Personal safety: RTAs - numbers steady. KSIs resulting from RTAs, decreasing rates. Emerging psychological effects, eg PTSD, from RTA survivors. Occupational fatalities, injuries (see Table 3 below)	- -/+ - 	***Population*** Personal safety: Probable reductions in RTAs. Reduction targets for KSIs - Approx. 35,000 fewer deaths, 444,000 fewer serious injuries (2000-2029). Reduction in mental health issues arising from fewer serious casualties Occupational fatalities, injuries (see Table 3 below)	+ + +	***Population:*** Personal safety: Probable small scale reductions in RTAs. Reductions in KSIs from eg developments in telematics, sensors, new materials - Approx. 20 fewer deaths, 2000 fewer serious injuries (2000-2029). Reduction in mental health issues arising from fewer serious casualties Occupational fatalities, injuries (see Table 3 below)	+ + +
Physical activity: Reductions in walking, cycling with increase in mechanised transport. Increased risk of obesity, hypertension, heart disease, diabetes from reductions in physical activity. Reduction in mental well being from reductions in physical activity.	- - -	Physical activity: Probable increase in cycling trips to 300% 2000 levels by 2010. Reductions in risk of obesity, hypertension, heart disease etc from increase in activity - health outcomes not quantified. Increase in mental well being.	+ + +	Physical activity: No direct impacts - may contribute to walking, cycling by reducing perceptions of safety risks, air pollutants.	+
Personal mobility: Increase in mobility and modal choices. Increase in expectations, demand for mobility, travel modes. Increase in independence, control and well being resulting from increased mobility.	+ - +	Personal mobility: Probable increase in mobility and healthier travel modes. High demand for mobility maintained. Increase in independence and well being from increased mobility.	+ - +	Personal mobility: Probable increase in mobility by developments in telematics, eg real time information, better use of the infrastructure reducing congestion. Some sceptical about tech. developments off-setting increase in car volume, use.	+ -

Disposable income: High proportion of household income spent on travel costs. Less income available for, eg healthy food.	- -	Disposable income: May reduce travel costs by educing travel time, but highly speculative.	?	Disposable income: May contribute to reduction in travel costs by improving fuel efficiency, reducing travel times, but highly speculative.	?
Disposable time: Increase in daily travelling time in household. Increase in stress, anxiety associated with travelling; reduces quality of life.	- -	Disposable time: Probable reductions in travelling time as a result of reduced congestion eg 58 million hours saved in local travel.	+	Disposable time: Probable reductions in travelling time	+
Family relationships: Reductions in contact between family members, from work patterns/hours, travel-related issues. Lack of family contact/support effects mental health.	- -	Family relationships: No direct impacts - may be increase family contact, by reducing barriers to travelling but highly speculative. Decrease in people working long hours, may increase family contact, & positive health outcomes.	? +/+	Family relationships: No direct impacts - may increase family contact, by reducing barriers to travelling but highly speculative. Unclear FV impacts on auto. motive industry working patterns/hours.	? ?
Affluent population groups Personal mobility: Increase in mobility (eg, distances travelled) through car ownership.	+	***Affluent population groups*** Personal mobility: Probable increase in mobility on roads if reductions in congestion. Increase in car ownership, car use.	+ -	***Affluent population groups*** Personal mobility: Probable increase in mobility for car users, especially older or disabled people, with improved vehicle design, automation. Perpetuates car ownership, use.	+ -
Physical activity: Reductions in walking, cycling with increase in car travel. Increase in car travel to school for children. Decrease in children's stamina, alertness, academic performance with low physical activity levels, in addition to long term health impacts.	- - -	Physical activity: Some increase in cycling, walking but likely increase in car ownership, use, distances travelled.	+	Physical activity: No direct impacts - may contribute to walking, cycling by reducing perceptions of safety risks, air pollutants.	+

Personal safety: RTAs involving cars KSIs of car occupants, higher rate of fatalities per billion km, cf bus, rail travel, lower rate and injury severity, cf pedestrians, cyclists. Child car occupants most at risk.	- -/- -	Personal safety: Reductions in RTAs involving cars eg with safer driving, improved infrastructure, better enforcement. Likely reduction in KSIs of car occupants, decreasing relative fatality rate per billion km cf pedestrians, cyclists. Likely increase in slight casualties for older drivers. Reduction in child KSIs of 50% by 2010, includes child car occupants.	+ +/- - +	Personal safety: Reductions in RTAs involving cars (as above). Reduction in KSIs for car occupants with FV-derived techs. Compared to eg to pedestrians, cyclists by 5:1. May reduce KSIs for older drivers through increased automation.	+ +/- +
Child development: Inhibition of child development with increase in car travel, less opportunities for casual social interactions, play. Socialisation into car travel.	- -	Child development: Wider car ownership, car travel by children reducing numbers involved in social interactions. Increased socialisation into car travel.	- -	Child development: No direct impact - may inhibit further by increasing car use, travel.	-
Travelling experience: Increase in well being from pleasure of driving Increase in stress, anxiety from driving conditions, eg congestion, travelling time	+ -	Travelling experience: Mixed response to more automated driving conditions. Decreases in stress, anxiety from driving conditions if reduce congestion, travelling time.	-/+ +	Travelling experience: Mixed response to more automated driving conditions. Decreases in stress, anxiety from driving conditions if reduce congestion, travelling time.	-/+ +
Less affluent population & vulnerable groups Personal safety: RTAs lower rate involving cyclists, pedestrians, relative to car users. KSIs, higher rate for cyclists, pedestrians per billion km relative to car occupants. Increase in fear for personal safety whilst travelling on public transport.	- - -	***Less affluent population & vulnerable groups*** Personal safety: Probable reductions in RTAs involving pedestrians, cyclists from road safety initiatives. Likely reductions in non-car occupant KSIs, but at a lower rate cf car occupant KSI reductions. No reductions in fear for personal safety whilst using public transport. **Unclear reductions in health inequalities.**	+ +/- - ?	***Less affluent population & vulnerable groups*** Personal safety: Reductions in RTAs involving pedestrians, cyclists from safer vehicles. Reductions in non-car occupant KSIs, but 5:1 in car occupant favour. No impact on reductions in fear for personal safety whilst using public transport. **Health inequalities probably exacerbated**	+ +/- - ?

Personal mobility: Reduced mobility relative to car users due to public transport eg lack of affordability, access, information. Increase in social isolation relative to car users & associated risk of mental health problems. Reductions in access to basic services, employment etc with reduced mobility. People on low incomes, ethnic minority groups, people with mental health problems, people with disabilities, older people, rural areas are most adversely affected.	- - -	Personal mobility: Likely increase in mobility of people reliant on public transport through targets increasing access, punctuality and reliability; still less mobile relative to car owners/users. Reductions in social isolation for some. Increase in access to basic services, etc but less accessible than car users. The same groups are still likely to be more disadvantaged relative to more affluent, car-using groups, but less so compared to their baseline position in 2000 δ **maintain relative health inequalities.**	+/- +/- -/+	Personal mobility: No direct impact - probably contributes to small scale increases in mobility of people reliant on public transport, but less so than increase in mobility of car users. **Health inequalities probably remain.** Probable increase in mobility of car owning older people, people with disabilities. **Probable reduction in inequalities due to mobility issues for these groups.**	- - + **+**
Physical activity: Groups most at risk of heart disease morbidity/mortality are less affluent/ vulnerable groups; reduced physical activity trends resulting from increase in mechanised transport will affect them more adversely.	-	Physical activity: Some increase in physical activity, but greater relative risk of heart disease of less affluent/vulnerable groups unlikely to be affected. **Unclear reductions in health inequalities.**	+/- ?	Physical activity: No direct impacts - may contribute to walking, cycling by reducing perceptions of safety risks, air pollutants. **Unclear reductions in health inequalities.**	+ ?
Travelling experience: Increase in stress, anxiety when planning and making a journey due to travelling conditions, eg poor access, fear of crime, lack of information. Increased social isolation and associated mental health effects from 'travel avoidance' behaviour.	- -	Travelling experience: Reductions in stress due to improvements in access, reliability, punctuality, but action on other issues, eg affordability, information, fear of crime, unclear. Reduction in social isolation, and associated mental health problems, compared to baseline, but not cf. car users δ **maintain relative health inequalities.**	+/- +/-	Travelling experience: No direct impact on improving the travelling experiences on public transport; technologies may be 'trickled down' to public transport vehicles, second hand vehicles in the longer term. No impact on reducing social isolation due to travel-related problems.	-/+ -
Disposable income: Lack of affordability of public transport; higher rate of increase of public transport travel costs cf car travel. Higher proportion of household income likely to be spent on travel costs, relative to more affluent, car using groups.	- -	Disposable income: Impacts on public transport travel costs relative to car travel unknown. **Unclear reductions in health inequalities.**	? ?	Disposable income: No direct impact on reducing public transport travel costs. **Unclear reductions in health inequalities.**	- ?

Child development: Inhibits child development by removing 'street play' opportunities as a result of increasing congestion, infrastructure development, traffic volume.	-	Child development: Increase in play opportunities with reductions in congestion, 'home zones' etc.	+	Child development: Indirect impact on child development by eg, reducing congestion.	+

Table 2 Impacts on socio-economic environment factors

Scenario A **Health Impacts: no underlying trends**	**Direction**	*Scenario B* **Potential Health Impacts: underlying trends**	**Direction**	*Scenario C* **Potential Health Impacts: underlying trends and FVI**	**Direction**
Population Economic growth: Direct impact of transport growth on GDP growth; decoupling of road traffic growth from GDP growth (0.8:1).	-/+	***Population*** Economic growth: GDP forecast to grow by 26% to 2010, but traffic growth is slower (0.6:1). Investment in transport (£180b by 2010), offset by revenue generated in transport sector: minimum net cost to economy.	+	***Population*** Economic growth: Ambiguous net impacts of FVI on GDP from, eg possible reductions in industry transport costs, and from auto. production.	?
Variable positive impact of a transport improvement on GDP; current economic model does not consider health impacts in cost/benefit analysis.	+/-	No data accessed on % growth of GDP due to UK auto. industry.	?	Probable increase in productivity by increasing: ➢ competition through collaboration between auto. manufacture, supply, R&D sectors. ➢ innovation through R&D ➢ total investment as % GDP through R&D. NB NOT VALUED BY MNCs.	+ + + +
UK automotive industry represents 5.3% GDP - no trend data accessed.	+	Probable increase in inward investment in UK. Speculative net increases in inward investment in auto. industry - dependent on several factors.	+ +	[NB No data recorded on what former FVI R&D projects in development or production.]	
Inward investment - direct impact on UK car production (& GDP). Trend data shows increase in car production since 1986; £16b inward investment since 1995, but also disinvestment/ production re-location/consolidation.	+/-	Probable increase in UK productivity. Reduction in productivity 'gap' between countries speculative. Impacts for UK auto. industry unclear.	+ + ?	Probably no reduction on productivity 'gap' as a result of FVI developments.	-
Labour productivity (GDP per worker per hour) in UK 20% less than US, Germany, France - predominantly in manufacturing sector. No productivity data on UK auto. industry accessed.	-/?	**Economic growth with slower traffic growth will have probable positive health outcomes.**	**+**	Speculative impact on inward investment in auto. sector, retention of MNCs in UK.	+
No direct health outcomes -economic growth helps sustain and develop employment, which directly and indirectly have positive health effects. Increase in GDP increases revenue from taxation for public services, including health.	**+**			**Speculative health impacts from +/-GDP.**	**?**

Economic activity and work: Slight increase in employment levels as a result of economic growth supported by access to transport system. UK automotive industry employs approx. 850,000 across all sectors - trend data indicate significant workforce reductions. **Employment 'health enhancing' reduces risk from physical, psychological ill health, premature mortality (3 excess deaths for every 2000 unemployed men).**	+ + **+/-**	Economic activity and work: Probable increases in economic activity by improving access to transport system, reducing other travel barriers to work. Probable decrease in employment in UK auto. industry. **Improvement in health outcomes for previously unemployed people or people who have enhanced employment.** **Negative health outcomes for people made redundant from auto. industry, eg crude estimates from a 50% reduction in the workforce yield an excess of approx. 500 deaths.**	+ - **+** **-**	Economic activity and work: Ambiguous views on impacts of FVI on employment, particularly in auto. industry; but may have some limited 'protective' effect for skilled, professional workers. Probable positive impacts in automotive R&D employment through 'centres of excellence'; also highly skilled occupations, eg in virtual design, electronic communications. **Probable positive health impacts from FVI, but on small scale.**	-/+ + **+**
Social capital/community spirit: No change in community spirit trends. High road traffic volumes, speeds, congestion, lack of mobility reduce social support networks. **Social support impacts on health outcomes, directly & indirectly - reduces risk of all cause, heart disease mortality, ill health, mental health problems, and child development.**	- - **-**	Social capital/community spirit: Increase in social support networks with eg, overall reductions in traffic volumes, speeds, congestion, increase in access. **Increases in social support will have indirect and direct positive impacts on health outcomes.**	+ **+**	Social capital/community spirit: Probable increase in social support networks but on very small scale. **Small-scale positive health impacts based on this.**	+ **+**

Health inequalities		***Health inequalities***		***Health inequalities***	
Economic growth: GDP output per head **above** UK average in southern regions. Extent of impacts of road transport on this unclear. GDP output per head **below** UK average in North East, Yorks. & Humberside, North West & Merseyside. Extent of impact of road transport on this unclear. Regional variations in GDP influence employment in these areas. Unclear of investment into UK auto. industry regionally. **Definite, indirect, negative health outcomes in low GDP output areas cf high output areas δ health inequalities.**	+ - - ? **-**	Economic growth: Unclear of regional transport investments. Investments will have probable positive impacts on regional GDP outputs. Investments in infrastructure will benefit those travelling long distances most. Targeting transport investment to areas of low GDP output will probably reduce regional variations in GDP (& health inequalities). Unclear regional inward investment in auto. industry - dependent on several factors. Disinvestment/re-location of auto. manufacturers/suppliers from deprived areas will widen regional variations in GDP. **Unclear impacts on health inequalities.**	? + +/- + ? - **+/-**	Economic growth: FVI unlikely to have significant impact on regional variations in GDP outputs. **If FVI projects are developed/produced in specific, targeted areas, eg to reduce these GDP variations could help reduce health inequalities.**	- **+**
Economic activity: Increase in employment opportunities in regions with high GDP output and for people with increased mobility, ie if car owner. Fewer employment opportunities in regions with low GDP output. Unemployed people more reliant on public transport; public transport offers less mobility, further reducing employment opportunities ('downward spiral'). **Definite, indirect and direct, negative health outcomes in low GDP/unemployment areas cf higher GDP/employment areas exacerbated by reduced mobility δ health inequalities.**	+ - -	Economic activity: Probable increase in employment opportunities in regions with high GDP output, with increased mobility, removal of travel barriers to work; especially applies to car owners. Removal of some travel barriers, eg access, reliability of public transport will increase mobility and employment opportunities for some. If mobility of groups reliant on public transport not increased at a faster rate cf affluent, car owner groups, they will continue to be disadvantaged in employment opportunities. **Health inequalities probably maintained.**	+ + - -	Economic activity: Probable decrease in employment for unskilled workers. Skilled workers, professionals may be 'protected'. Skilled/professional workers already less exposed to health risk factors compared to unskilled workers; greater risk of unemployment of unskilled workers widens inequalities further albeit for small numbers. **If FVI used to enhance mobility of non-car users by further reducing travel barriers, could help increase employment opportunities, reducing health inequalities.**	- + - **+**

Social capital/community spirit: Travel-related issues, eg mobility, high traffic volumes in urban areas, increase social isolation and reduce community spirit. Also social isolation in rural areas. Health outcomes from lack of social support described above.	- - -	Social capital/community spirit: Likely net positive impact on social support networks from reductions in congestion, increasing access, mobility. **Forecasts indicate an increase in congestion (7%) in some urban areas, with a probable negative impact on social support and health outcomes, cf less congested areas δ health inequalities exacerbated between these areas.**	+ **-**	Social capital/community spirit: Likely small scale, net positive impact on social support networks from reductions in congestion, increasing access, but probably greatest positive effect on affluent car owners as their mobility further enhanced. **Health inequalities probably maintained.** **If FVI used to reduce congestion, increase mobility of public transport users, this could help to increase social support, reducing health inequalities.**	+/- **-** **+**

Table 3 Impacts on physical environment factors

Scenario A		***Scenario B***		***Scenario C***	
Health Impacts: no underlying trends	**Direction**	**Potential Health Impacts: underlying trends**	**Direction**	**Potential Health Impacts: underlying trends and FVI**	**Direction**
Population		***Population***		***Population***	
Traffic-generated air pollution: Definite impacts on key air pollutants - PM_{10}, N0x, C0. Also $S0_2$, 0_3, VOCs.	-	Traffic-generated air pollution: Probable improvements in air quality by 2010 due to definite reductions in air pollutant emissions from vehicles, congestion.	+/+	Traffic-generated air pollution: Probable small scale improvements in air quality due to definite reductions in emissions from vehicles with FV-derived technologies.	+
Trend data shows reductions in PM_{10}, $S0_2$, N0x, C0 due to technological developments; still issues for urban N0x, PM_{10}, rural O_3.	+/-	**Probable decline in air quality after 2019, due to increasing traffic volumes.**	**-/-**	Vehicles with FV-derived technologies could reduce emissions in:	
Short term increases in PM_{10}s - alone or in combination - responsible for increases in mortality, reductions in lung function, increases in respiratory symptoms. PMs in urban areas estimated responsible for 8,100 premature deaths (mainly cardiovascular, respiratory), 10, 500 new hospital admissions per year. Carcinogenic properties of diesel, petrol exhaust emissions also probable risk to human health.	-	Probable reductions in $C0_2$ emissions.	+	➢ PM_{10} by up to 100%	+
				➢ N0x by 70-100%	+
				➢ C0 by 20-100%	+
		Probable short/long term health benefits from improvements in air quality.	**+**	**Probable improvements in traffic management will contribute to improvements in air quality, especially in vulnerable, urban areas.**	**+**
Definite impacts on $C0_2$ with implications for climate change.	-			Probable small scale reductions in $C0_2$ emissions due to FVI.	+
Probable, med/long term health effects of climate change include excess deaths from heat waves, floods.	-			**Probable short/long term health benefits from improvements in air quality.**	**+**

Accidents and hazards at work: Direct impacts on accident rates by transport manufacturing sector. Trend data shows reduction in occupational fatalities; proportion of serious injuries, 3-day absences remains steady. Probable excess in occupational mortality/disease for certain job groups in auto. industry, eg in lung cancer, chronic bronchitis, emphysema, pleural & peritoneum cancers. Occupational hazards include asbestos, metal dust & fume, brazing & soldering fumes. Aromatic amines still cause for concern. Definite impacts on work-related ill-health: ➢ metal & electrical processing - deafness/ear conditions, vibration white finger, lower respiratory conditions, pneumoconiosis, T&P, ➢ manufacturing, assembly - contact dermatitis ➢ repetitive assembly - RSI ➢ designers, other professionals - work-related stress/anxiety from various known, eg noise, chemical irritants but also unsuspected agents, eg working styles. Definite impacts on productivity due to work-related ill health.	- + - - - - - - -	Accidents and hazards at work: **Probable reduction in:** ➢ **work-related ill-health of 20% by 2010** ➢ **working days lost due to work-related ill-health of 30% by 2010** **due to occupational health policy initiatives.**	**+** **+**	Accidents and hazards at work: **Probable impact of FVI technology development/manufacture on work-related ill health, but unclear direction.**	?
Traffic-generated noise pollution: Definite impacts of traffic on ambient noise levels. Trend data shows a rise in ambient sound levels and noise complaints. Noise impacts on health outcomes directly, eg mental health, cardiovascular effects, hearing loss, and indirectly, eg sleep, academic performance, communication, child development.	- - -	Traffic-generated noise pollution: Probable reductions in noise levels outside the home. Probable positive impacts from traffic by reducing congestion, better traffic management, enhanced traffic speed enforcement etc. **Probable small scale impacts on health outcomes from reductions in traffic-generated noise pollution.**	+ + +	Traffic-generated noise pollution: Probable small scale reductions in noise pollution from the whole parc due to FV developments. Probable reduction in noise emissions from vehicles with FV-derived technologies of 7% by 2010, 15% by 2020. **Probable small scale impacts on health outcomes from reductions in traffic-generated noise pollution.**	+ + **+**

Physical access: Definite impacts of transport on accessing goods and services. Indirect impact of access to services eg health services and goods, eg healthy food choices, on health outcomes. Direct impacts on well being.	+ +	Physical access: Probable impacts on access to goods and services by improving access to the transport system, reducing out of town developments etc. **Probable indirect impact on health outcomes by improving access to basic amenities etc**	+ **+**	Physical access: Speculative small scale impact on access by improving personal mobility. **Speculative small scale impacts on health outcomes.**	+ **+**
Civic design/land use: Trends in car use, ownership probably impact on frequency/location of out of town developments. Out of town developments probably perpetuates car use, ownership. Indirect impacts on health outcomes by reducing access to cheaper goods, other amenities, diverting trade from town centres.	- - -	Civic design/land use: Probable impact on land use from road building/repair programmes to cater for increase in traffic volumes. Better traffic management will have long term benefits on effective land use. **Probable short/long term negative impacts on mental health in communities where green space built on, but positive impacts where mobility enhanced.**	- + **-/+**	Civic design/land use: Indirect small scale, med/long term impacts on land use by better traffic management. Future implications for civic design, eg battery recharging points for electric vehicles. **Speculative, small scale impacts on health outcomes.**	+ ? **+**
Health Inequalities Traffic-generated air pollution: Greater exposure of car users to poor outdoor air quality (predominantly traffic-generated) cf. pedestrians, cyclists. Greater exposure of urban households to poor indoor air quality (from outdoor air) cf affluent &/or rural households. Urban households experience greatest net exposure to key air pollutants. **Definite negative impacts on health outcomes of urban householder's cf other areas δ health inequalities.**	- - - **-**	***Health Inequalities*** Traffic-generated air pollution: Greatest improvements in air quality probably at the roadside. Speculative whether some urban areas will meet EC, NAQS limits, due to increase in congestion. **Health inequalities probably maintained in some areas.**	+ **-**	***Health Inequalities*** Traffic-generated air pollution: Probable small-scale reductions in congestion, better traffic management will contribute to reducing health inequalities between congested, urban areas and others. Other FVI vehicle-specific impacts may not favour urban areas over others, increasing health inequalities **Unclear if FVI impacts will have net reduction in health inequalities due to improvements in traffic-generated air pollution.**	+ - ?

Accidents and hazards at work: Professional workers, eg designers less exposed from occupational hazards, less at risk from occupationally related mortality or disease. **Certain job groups in the auto. industry suffer excess mortality from occupational causes cf professionals δ health inequalities.**	+ **-**	Accidents and hazards at work: **Unclear impact of policy initiatives on health inequalities between occupational groups.**	**?**	Accidents and hazards at work: **Unclear impacts of FVI on health inequalities between occupational groups.**	**?**
Traffic-generated noise pollution: Greatest exposure to traffic noise in urban areas cf rural &/or affluent households. **Definite negative impacts on health outcomes for urban householder's δ health inequalities.**	**-** -	Traffic-generated noise pollution: **Probable reductions in congestion etc will reduce noise exposure in some urban areas, not others δ reductions in health inequalities in some areas.**	**+**	Traffic-generated noise pollution: **Probable small-scale impact of FVI on reducing health inequalities in some areas not others due to differential exposure to noise pollution.**	**+**
Physical access: Car ownership provides greater mobility impacting positively on accessing key services and goods. People without cars report access difficulties to, eg hospital (17%), GP (16%). **Indirect, negative impacts on health outcomes of people without use of car cf. car users δ health inequalities.**	+ - -	Physical access: Most people will benefit from improvements in access to the transport system, and so access to basic amenities. **Car owners will probably maintain their existing enhanced mobility, enhanced access to amenities over public transport users δ maintaining health inequalities.**	+ **-**	Physical access: Probable small-scale increase in mobility for car users, older people, people with disabilities will improve access to services for some vulnerable groups δ **reductions in health inequalities for some people, areas not others.**	+/-
Civic design/land use: Affluent, car-using groups less adversely affected by changes, eg location of goods, services out of town centre, cf. groups reliant on public transport. **Indirect, negative health impacts on people reliant on public transport cf. car owners, users δ health inequalities.**	+/- -	Civic design/land use: Unclear impacts of policy initiatives on civic design, land use & health inequalities.	?	Civic design/land use: Unclear impacts of FVI on civic design, land use & health inequalities.	?

Table 4 Impacts on policies and services

Scenario A		*Scenario B*		*Scenario C*	
Health Impacts: no underlying trends	**Direction**	**Potential Health Impacts: underlying trends**	**Direction**	**Potential Health Impacts: underlying trends and FVI**	**Direction**
Population Public transport: Decrease in bus travel associated with deregulation, increase in car ownership, and increase in fares. No direct health outcomes - public transport system provides mobility to people without cars, for accessing jobs, goods and services, which directly and indirectly impact on health.	- -	***Population*** Public transport: Probable increase in bus travel of 10% by 2010. Increase in reliability, access, customer satisfaction of bus services. No direct impacts on health outcomes - increases mobility etc	+ + +	***Population*** Public transport: Speculative indirect, med/long term impact of FVI on bus services: ➢ increase access by reducing overall congestion, better use of infrastructure ➢ reduce running/travel costs by increasing efficiency, applying FV technologies No direct impacts on health outcomes - increases mobility etc	+ + +
Health services: Definite, large scale, negative impacts on health service activity due to traffic-related injuries, ill health, eg ➢ approx 1 million serious injuries from RTAs , ➢ approx 18 million first hospital admissions from respiratory/ cardiovascular (from air pollution) Trend data show decrease in rate of demand in, eg elective, emergency admissions from traffic-related ill health.	- - +	Health services: Probable, large scale positive impacts by various policy initiatives on reducing traffic-related injuries, ill health, eg ➢ approx 444,000 fewer serious injuries (compared with A) ➢ approx 78,000 fewer first hospital admissions (compared with A) Probable, large scale NHS cost savings: ➢ approx £113m from fewer injuries (compared with A) ➢ approx £24m from fewer first hospital admissions (compared with A)	+ +	Health services: Probable, small scale positive impacts from FVI on reducing traffic-related injuries, ill health, eg ➢ approx 2,000 fewer serious injuries (compared with B) ➢ approx 23,000 fewer first hospital admissions (compared with B) Probable, small scale NHS cost savings: ➢ approx £0.5m from fewer injuries (compared with B) ➢ approx £7m from fewer first hospital admissions (compared with B)	+ +

Health inequalities Public transport: Fare increases above the rate of inflation, cf motoring costs, impacting on mobility, disposable income, access etc of non-car users, eg people on low incomes, children etc.	-	***Health inequalities*** Public transport: Increasing/improving public transport will benefit groups dependent on it. Will not increase rate of mobility of public transport users above to above car users δ **health inequalities maintained.**	+ -	***Health inequalities*** Public transport: Speculative whether FVI will have small scale, med/long term impacts on bus travel by reducing congestion in urban areas, travel costs etc Will not increase rate of mobility of public transport users to above car users δ **health inequalities maintained.**	+ -
Health services: Greatest demand for health services in areas/populations with poorest health, eg areas of multiple deprivation, but with poorest access.	-/-	Health services: Policies will probably have marginal effects on reducing traffic-induced health inequalities. Mirrored (to some extent) in health service demand.	-/+ -	Health services: FVI will probably maintain existing rates of demand for health services from different areas/population groups δ **health inequalities maintained.**	**-**

6. What are the priorities for the FV Steering Group?

6.1 There are a number of priorities for the FV Steering Group emerging from the HIA findings that will maximise health gain, mitigate against health risks and reduce health inequalities:

Table 5 Priorities for the FV Steering Group

Priorities

Personal safety:

- Reduce incidence of RTAs levels
- Reduce KSIs for pedestrians and cyclists
- Reduce KSIs for car occupants

Personal mobility:

- Increase the mobility of people reliant on public transport
- Increase the mobility of older people and people with disabilities

Public transport travel experience:

- Improve the public transport 'travel experience' for current and future users

Economic growth & economic activity:

- Maintain % GDP output from UK auto. industry
- Reduce regional GDP output variations
- Increase inward investment into UK auto. industry
- Increase productivity of UK auto. manufacturers and suppliers
- Increase training opportunities for unskilled workers in the auto. industry

Physical and work environments:

- Reduce traffic-generated air pollution, particularly in urban areas
- Reduce accident rates in transport manufacturing sector
- Reduce excess mortality/disease for key job groups in auto. industry
- Reduce work-related ill health in auto. industry

6.2 These may not seem that different to some current priorities. However, it is clear from the HIA that in spite of significant improvements that will be made by the FVI and various other policy initiatives, traffic-related health issues and the potency of the UK automotive industry in economic and employment terms, will need the on-going attention of the FV Steering Group. It cannot be over-emphasised that the initial concerns of the rapid HIA about the impacts on health inequalities have now been vindicated; in fact they are far more extensive than previously assessed. The Steering Group is urged to tackle these.

7. How might these priorities be achieved?

7.1 These priorities might be addressed as follows:

- Themes for FV research calls
- Prospective HIA screening of FV research proposals
- FV project monitoring and evaluation
- FV product development follow-up
- FV Steering Group membership
- FV profile

7.2 Themes for FV research calls

It is recommended that these priorities are included as priorities in future research calls. For example,

- pedestrian friendly car designs
- speed limiter technologies
- in-vehicle alcohol/drug detection sensors - ignition interlock devices
- in-vehicle/car air pollutant sensors - driver/passenger information
- 'all air pollutant' emission reduction technologies
- PM vehicle emission characteristics and relative toxicity
- air quality in-car communication/traffic management systems
- communications/navigation for buses, coaches, public transport users
- 'infotainment' for buses, coaches
- occupational health hazards and use of new materials, tools or working practices

It is noted that ideally proposals need to be further from market than currently - 'the big idea' rather than 'variations on a theme'.

7.3 Prospective HIA screening of FV research proposals

It is recommended that all FV research proposals be screened using an HIA screening tool. The proposed tool would be designed specifically for FV use and would include validated health risk/determinant factors against which the proposals would be assessed. It would use a checklist approach and would be developed for completion within 2 hours. Two options are proposed for undertaking the assessment: commissioning training for FV research applicants in using the HIA screening tool or commissioning an HIA professional to undertake all the HIAs prior to funding decisions.

7.4 FV Project monitoring and evaluation

It is recommended that approved research projects are monitored and evaluated against key health risk/determinants, in order to be able to assess their health impacts retrospectively as well as the FV strategy as a whole.

7.5 FV Product development follow-up

It is recommended that data be collected to monitor the uptake, development and production of FV products and practices in order to collect intelligence on the likely impact of the FV strategy on the automotive industry and the parc.

7.6 FV Steering Group membership

It is recommended that the membership of the FV Steering Group is extended to include a representative from the Health and Safety Executive or Occupational Health Partnership Board. In addition it is recommended that they convene a thematic group with specific responsibility for developing occupational health in the 2020 auto industry. Further a representative from a passenger transport authority, eg Merseytravel is recommended to join the Steering Group, to facilitate technology developments being fast-tracked into public transport developments, for the benefit of public transport users.

7.7 FV Profile

It is recommended that the FV research products are vigorously promoted raising the profile of design engineering research, the positive industry-academic partnerships, and the benefits to UK automotive manufacturers and suppliers this brings.

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On behalf of the FVI HIA Steering Committee.

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