

Executive Summary

This report seeks to identify and quantify the environmental and safety impacts of the M5 South West Motorway (M5).

The primary objectives of the study were to:

- Identify the environmental impacts of the M5 and compare to the broader road network;
- Identify the road safety impacts of the M5 and compare to the broader road network;
- Calculate the benefit (if any) to motorists of using the M5 and compare this to the tolls charged;
- Calculate the benefit to the general community (if any) arising from the presence of the M5.

Study Plan, Data Sources and Procedures

The analysis was based on the year 2000, with all estimates of cost savings being based on pre-GST 2000 conditions.

The estimates of travel time and other travel variables relate to vehicle trips made during the am/pm peak on a typical weekday.

The impacts and benefits of the M5 are considered at several levels:

- The benefits to M5 users, or potential users, when the M5 is used for a particular trip;
- The benefits to the wider Sydney road network or environment, through reduced emissions across the city.

The study draws on a range of data sources and analysis procedures in order to address the expected set of impacts and benefits at each of the two levels. The primary data sources and procedures were:

- Estimates of travel time and other travel variables, from transport network analysis and traffic simulation models, previously calibrated and applied in the corridor;
- Research findings (eg., models) relating to vehicle fuel consumption, air emissions and noise; and
- Design and condition of water management and pollution control devices for the M5.

1. Environmental Impacts

1.1 Vehicle Emissions

Estimates of vehicle emissions were developed using models that drew on estimates of fuel consumption on routes in a network that relate fuel consumption to the average speed along the route.

At the level of a particular trip, for an individual M5 user, the model produced significant emissions savings. For a car, the emissions savings on the M5 compared to the main alternative route were:

- Up to 95% for hydrocarbons;
- Up to 66% for oxides of nitrogen;
- Up to 50% for carbon dioxide;
- And up to 50% for particulates (see table 3.5a).

The benefits to the wider Sydney network were calculated using the different estimates of emissions for each vehicle class. This indicates that the M5 reduces emissions from all vehicles over the Sydney network by the order of:

- 4.0% for Hydrocarbons;
- 1.6% for Oxides of nitrogen;
- 2.8% for Carbon dioxide; and
- 2.6% for Particulates.

1.2 Noise

Twenty sections of road within the M5 corridor were chosen to indicate the level of noise across types of road and areas within the M5 Corridor. The estimated noise levels for these sites 'with the M5' and 'without the M5' were determined (see table 4.7). The findings were that:

- There is a small decrease in noise level on the north-south feeders to the M5 in
- The 'without M5';
- The noise levels of two sites along Canterbury Rd increased significantly in the 'without M5' case; and
- The noise levels at all other selected sites are higher in the 'without M5' than the 'with M5' case, by the order of 0 to 2.5 dB.

In addition to the general savings in noise, the traffic noise in the corridor will have been reduced by the M5 noise attenuation devices. Using traffic data at Hammondville plaza for 24-hour periods, and established noise estimation models, it was possible to estimate the L10 (18h) noise levels at the Hammondville Public School, located south of the M5 carriageway and west of the M5 Hammondville plaza. The estimates for the above location, with and without the noise attenuation barriers indicate that the devices significantly reduce traffic noise and, further, the reduced noise level is below the environmental standard of 63 db(A) for adjacent activities such as the school.

1.3 Water Management and Pollution Control

The study also assessed the quality of the existing stormwater quality controls on the M5 and estimated the benefits of these water quality controls. The assessment estimated the

annual average pollutant loads that would be discharged into the downstream environment under two conditions, giving pollutant loads:

- Without any water quality controls; and
- With the M5 water quality controls.

The benefits to the environment are the reduced pollutant loads that have been trapped by the M5 water quality controls. The overall pollutant load reductions for all the M5 control basins indicate that whilst the overall nutrient (TP and TN) reductions are in the order of 25% to 30%, a much larger reduction of approximately 80% is achieved for Suspended Solids (SS). This is considered to be a significant improvement in water quality.

The capture of such large pollutant loads for SS is also considered to be significant for all other sediment-bound pollutants such as heavy metals and other pollutants. In addition to the water quality controls which control the above pollutants, a series of additional devices also exist on the M5, some of target the removal of oil and free hydrocarbons from the road runoff, and others such as the traps, target the removal gross pollutants and coarse sediments.

2. Road Safety Impacts

The accident histories on sections of the M5 and Canterbury-Milperra Road routes that are of comparable length were extracted. These indicated that between 1997 and 2002 the number of accidents on M5 was 475, which was significantly lower than on the alternative route, which recorded 1,471 accidents.

When a standard value for injury accidents, which includes fatalities, is applied the estimated accident cost reduces by about \$0.60/trip if a driver uses the sections of M5 rather than the sections of Canterbury-Milperra route.

An estimate of the impact of M5 on total accidents and road safety over the Sydney road network was obtained by estimating the accident levels and cost 'with M5' and 'without M5'. If the M5 was removed from the road network there would be a shift of traffic from the freeway/tollway roads to highway and arterial roads. These non-freeway/tollway roads have a higher rate of accidents, and thus costs, due mainly to the presence of intersections.

The estimated change in accident costs indicating an annual increase in the costs of \$4,789,044.

3. Benefits to M5 Users or Potential Users

The primary benefits which drivers will derive from using the M5, rather than alternative routes, result from reductions in travel time, vehicle fuel, vehicle operating cost items (eg., maintenance cost) and 'other benefits' (eg., reduced accident risk).

3.1 Travel Time Savings and Benefits

The estimates of travel times for vehicles using the M5 and alternative routes were obtained from the transport-traffic models.

All comparisons show a time saving by using the M5 with the most significant time saving being 33 minutes when compared to the alternative route which travels westbound from the M5 East to Camden Valley Way. This route indicates that significant time savings can be achieved from using the M5 even when traveling in the contra-flow direction during the morning peak.

There are well established average values-of-time to reflect the benefit which drivers obtain from a savings in travel time. When values-of-time for 2000 were applied to the estimated time savings the time travel cost savings obtained for cars ranged from \$1.58 to \$7.23.

3.2 Fuel Consumption Savings and Benefits

There exists a well established hierarchy of vehicle fuel consumption models. These indicate that reliable estimates of fuel consumption on routes in a network can be obtained from models that relate fuel consumption to the average speed along the route.

The value of fuel savings to drivers will be the average pump price for the fuels used by each vehicle class and when the prices are applied to the estimated fuel savings, the fuel cost savings were obtained. The fuel cost savings indicate that there is a fuel-related benefit from drivers using the M5 over all of the five selected routes, with the size of the savings reflecting the length of the route and congestion during the morning peak.

3.3 Other Vehicle Operating Cost Savings and Benefits

Reductions in travel time, distance and stops are also likely to lead to savings in other vehicle operating cost items, in particular tyre wear, oil consumption and vehicle maintenance. These 'other' cost items are influenced by the kilometres of travel and stops and estimates of these variables for each of the selected routes were obtained from the calibrated transport-network models. The number of stops is significantly reduced through use of the M5 for each of the selected routes, and this leads to small savings in vehicle operating cost.

3.4 Total Travel Benefit

The estimated cost savings for each of the items (travel time savings, fuel consumption reduction) represent a component of the 'user benefit' from choosing the M5 for the respective selected trip. M5 users will pay a toll for each trip and the total travel benefit for a driver using M5 for a particular trip is thus given by:

Total travel benefit for the trip = [user benefits – toll(s)]

The estimated total travel benefit from using the M5, exclusive of ‘hassle’ and accident reductions indicates that drivers will obtain a net benefit (ie., after toll payment) from using the M5 for each of the five selected route, with the benefits being marginal on the shorter routes. Most drivers are likely to also ‘factor in’ perceived benefits from ‘hassle’ and accident reduction, and this will increase the benefits from using M5 for each of the selected routes.

4. Sydney Road Network and Environment

The presence of the M5 as a component of the road network in the south-west region of Sydney causes changes in travel patterns for many drivers, as they seek to ‘optimise’ their route choices. This leads to changes in vehicle volumes, and associated travel conditions over the ‘impacted’ network and to reductions in travel time, fuel consumption and emissions (gaseous and noise) from the levels that would occur if the M5 did not exist.

Thus to estimate the total impacts and benefits of M5 on travel time, fuel consumption, emissions, noise and accidents in the Sydney road network it was necessary to estimate the total impacts and benefits of the M5 through a form of ‘*with-and-without M5*’ analysis.

4.1 Travel Time Savings and Benefits

An estimate of the total time savings from the presence of the M5 was obtained by:

- Extracting the estimated total vehicle-hours in Sydney with M5 and without
- M5;
- Calculating the reduction in travel time with M5; and
- Calculating the benefits in travel time reductions, using the established value-of time.

The presence of the M5 has reduced total vehicle hours by 4.9% for all three defined vehicle classes, with associated time cost savings of 6.9%. It should be noted that the percentage travel time savings and associated benefits for particular trips within the M5 corridor will be much larger than those across the total Sydney network. The absolute savings are, however, substantial.

4.2 Fuel Savings and Benefits

The set of fuel-to-average speed models was used to calculate average speeds for each type of road and each vehicle class.

The resulting estimates of fuel consumption for each vehicle class were calculated. This indicates that the M5 reduces fuel consumption over the Sydney network by the order of 3% to 3.3% for each vehicle class.

Conclusions

With the available data it has been possible to identify and quantify the environmental impacts of the M5 and estimate the benefits to current or potential users and the wider community in Sydney. The primary impacts and benefits can be summarized as follows:

- For a range of trips through the M5 corridor, there is a total benefit (ie., after allowance for payment of tolls) if drivers choose to use the M5 rather than the next best alternative route.
- These benefits result from savings (ie., reductions) in travel time, fuel consumption, vehicle operating costs, accidents and driving 'hassle'.
- If drivers choose to use the M5 for these trips, then there is also a significant reduction in the emissions (ie., air and noise) generated within the M5 corridor, leading to benefits to the wider community in the corridor.
- The existence of the M5 impacts on the wider road network in Sydney, causing significant savings (ie., reductions) in travel time, fuel consumption, vehicle operating costs, accidents, air emissions and noise emissions.
- The M5 water quality and pollution control devices cause significant reductions in several pollutants, in particular phosphorous, nitrogen and suspended solids.