MONITORING OF THE M4 BUS LANE: THE FIRST YEAR

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Introduction

The Highways Agency has installed approximately 6km of bus lane on the eastbound M4 between Junctions 3 and 2 into London. This bus lane is reserved exclusively for buses, coaches and taxis, and began operation on 7th June 1999. Its primary aim is to reduce the journey times of buses, coaches and taxis without significantly affecting other vehicles.

The bus lane scheme includes new road layouts at the start and end of the bus lane, and new reduced speed limits of 50mph through Junctions 4 and 3, and 40mph approaching the start of the elevated section into London.

(a) Before the bus lane was installed (speed limits shown)

(b) Bus lane (in red) in operation (speed limits shown)

To assess the effect of the bus lane, traffic data was collected before the bus lane opened (during October and November 1998) and has been collected since the bus lane opened (from June 7th 1999). Data was collected from the M4 and the adjoining road network (A312, A4). All aspects of the performance of the M4, the bus lane and the adjoining roads during the past year have been studied. The results have been compared against the performance before the bus lane opened, with particular reference to the eight-week period during October and November 1999 when data has been compared against the same period before the bus lane opened.
This document contains a summary of the main results of the monitoring. TRL have produced a comprehensive report on the first year of the bus lane scheme; this report (PR/T/125/2000) is available from Stuart Beale at the Highways Agency (0117 9878507).

**Principal results**

- During peak periods, both buses and cars are benefiting from the bus lane scheme. Buses are saving on average 4.1 minutes during the morning peak period, and 2.9 minutes during the evening peak period. Cars are saving on average 1.3 minutes in the morning peak and 0.6 minutes in the evening peak.

- During off-peak periods, journey times for both buses and cars have increased as a result of the reduced speed limits along the section. Typical car journey times in uncongested conditions have increased from 4.7 minutes to 5.4 minutes.

- Journey times for cars and buses have become more reliable following the introduction of the bus lane.

- There is a benefit of 900 person-hours per weekday due to a reduction in delay during peak periods, which is offset by a loss of 700 hours per weekday due to the reduced speed limits, giving an overall benefit of 200 person-hours per weekday. There is a loss of 350 person-hours each weekend day because of the reduced speed limits. Therefore, on average, there is an overall saving of 300 person-hours per week as a result of the bus lane scheme.

- Traffic noise levels have been reduced by about 1dB(A).

- Further benefits may have been achieved through a reduction in accidents. This is the subject of a longer-term study, but Police staff have perceived a decrease in the number of accidents attended since the reduced speed limits were implemented.

- The flows on the M4 now that the bus lane is open are similar to those before the bus lane opened, therefore the benefits observed have been achieved with similar flow levels.

- The introduction of the bus lane has changed the general traffic behaviour. Before the bus lane opened, a queue formed where the M4 narrowed from three lanes to two, with drivers queuing for up to ten minutes. Now that the bus lane is open, the queueing behaviour has been replaced by intermittent stop-start driving behaviour (shockwaves), with car drivers typically stopping once or twice as they travel towards the elevated section, but otherwise travelling faster than before. It is this change in behaviour that enables both cars and buses to benefit from the bus lane scheme.

- The benefits arising from the installation of the M4 bus lane are site specific. Prior to the bus lane scheme opening, there was a bottleneck where three lanes were reduced to two 1.5km before the elevated section, and an upstream junction where one third of traffic left the motorway. This meant that the installation of the bus lane scheme enabled cars to benefit, as well as buses and taxis, as two lanes of traffic now flow continuously from Junction 3 onto the elevated section. If a similar scheme was installed at another location without these characteristics, it is unlikely that cars would benefit.
- The new road layouts at Junction 3, at the start of the bus lane and at the merge area are all working well. The dedicated exit slip road at Junction 3 has reduced the congestion at that point, and the design of the merge area at the end of the bus lane has smoothed the transition from three lanes to two prior to the elevated section.

- On some days, shockwaves propagate back from the elevated section, and cause congestion to the west of Junction 3. This is a result of only two lanes being available to cars and other vehicles after Junction 3.

- The surrounding roads have not been affected by the bus lane scheme. Quicker journey times on the M4 mean that motorists should not need to divert, and there is no evidence that they are doing so.

- On average, about 3700 vehicles per day use the bus lane: 3100 are taxis, 500 are buses and 100 are minibuses. A typical peak hour flow is 250 taxis and 60 buses/minibuses. The number of buses and minibuses using the bus lane each day is consistent; the number of taxis using the bus lane depends on the amount of congestion on the M4.

- On average, 7% of the vehicles on the M4 into London use the bus lane, but they contain 21% of the people, including drivers.

**Traffic behaviour**

Before the bus lane opened, three lanes were available to traffic until 1.5km before the elevated section. Allowing the traffic to continue in three lanes created a bottleneck where the M4 narrowed from three lanes to two, frequently causing long queues of slow moving traffic. Approximately one third of traffic left at Junction 3, leaving the inside lane under-utilised through Junction 3. The traffic was effectively in two lanes at that point.

The bus lane scheme removes the bottleneck because it causes the majority of traffic passing through Junction 3 to stay in two lanes up to and over the elevated section. The loss of one lane through Junction 3 has not caused any additional queueing in normal conditions.

One of the main effects of the bus lane scheme has been to change traffic behaviour on the eastbound M4. Following the elimination of the bottleneck, the main causes of congestion are shockwaves of slow moving traffic propagating back from the 2-lane elevated section. When traffic slows down on the elevated section for any reason during a period of high flow, a shockwave is started, resulting in intermittent stop-start driving conditions between Junction 3 and the start of the elevated section. These shockwaves were also present before the bus lane opened, but were absorbed in the general queueing at the bottleneck.
From a car driver’s perspective, 3km of queueing has been replaced by 6km of intermittent stop-start driving. Speeds typically vary from 0mph to 50mph during the stop-start conditions, with drivers typically stopping only once or twice as they pass through the section being monitored.

Traffic speeds during the peak periods are generally higher than before the bus lane opened. There is more variation from minute to minute, reflecting the shockwave behaviour that has replaced the general queueing. Traffic speeds are lower during the off-peak periods, as a result of the new 50mph speed limit.

Traffic behaviour to the west of Junction 3 has been affected by the bus lane scheme. Before the bus lane opened, the traffic queues at the bottleneck did not generally affect Junction 3 or...
the London-bound motorway upstream of Junction 3. Separate areas of congestion were present at the merge and diverge areas west of Junction 3 on many occasions.

Now that the bus lane is open, on some days the shockwaves extend back through Junction 3 and cause congestion, with the overall congestion west of Junction 3 being worse than it was before the bus lane opened. The new design of the Junction 3 exit slip has reduced the congestion caused by the exit slip; the performance of the other slip roads west of Junction 3 has not changed significantly.

**Bus lane use**

Since the bus lane opened, the number of vehicles using the bus lane each weekday has varied between 3000 and 4750. On average 3700 vehicles per day use the bus lane: 3100 are taxis, 500 are buses and 100 are minibuses. The greatest variation is in the number of taxis using the bus lane: between 2400 and 4100 per day. The more congestion on the M4 between Junctions 3 and 2, the more taxis use the bus lane. The number of buses/coaches and minibuses using the bus lane each day has remained quite consistent since the bus lane opened; these are mostly scheduled services. There has been no increase detected in the number of buses using the M4 following the opening of the bus lane.

During peak periods, almost 100% of eligible vehicles use the bus lane. A typical peak hour flow is 250 taxis and 60 buses/minibuses. During off-peak periods, the percentage take up is approximately 70% for taxis, 90% for buses and coaches and 50% for minibuses. There are very few "rogue" vehicles using the bus lane (less than one car per hour). The number of vehicles using the bus lane rose throughout the first year of operation and usage peaked during May 2000.

On average, 7% of the vehicles on the M4 into London use the bus lane, but they contain 21% of the people, including drivers.
Journey times

Congestion occurs on the eastbound M4 into London during the morning and evening peak periods. There is little congestion outside these times. The pattern of journey times for cars before and after the bus lane opened is similar, although the traffic behaviour is now different.

The bus lane scheme has resulted in journey time savings during peak periods for all vehicles. A direct comparison of journey times during October and November 1998 and the same period in 1999, before and after the bus lane opened, has shown that both cars and buses are saving time. Buses are saving on average 4.1 minutes during the morning peak period of 6:30 to 9:30, and 2.9 minutes during the evening peak period of 17:30 to 20:30. Cars are saving on average 1.3 minutes in the morning peak and 0.6 minutes in the evening peak.

Comparison of weekday journey times
Journey time (M4 J4 - start of elevated section) (8.4 km)
All weekdays (including incidents)

<table>
<thead>
<tr>
<th>Time period (weekday)</th>
<th>“Before”</th>
<th>“After”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Car &amp; Bus</td>
<td>Car</td>
</tr>
<tr>
<td>0630-0730</td>
<td>9.8</td>
<td>9.4</td>
</tr>
<tr>
<td>0730-0830</td>
<td>13.4</td>
<td>11.1</td>
</tr>
<tr>
<td>0830-0930</td>
<td>7.1</td>
<td>7.8</td>
</tr>
<tr>
<td>0930-1630</td>
<td>5.1</td>
<td>5.9</td>
</tr>
<tr>
<td>1630-1730</td>
<td>5.7</td>
<td>6.4</td>
</tr>
<tr>
<td>1730-1830</td>
<td>10.3</td>
<td>9.7</td>
</tr>
<tr>
<td>1830-1930</td>
<td>12.1</td>
<td>10.9</td>
</tr>
<tr>
<td>1930-2030</td>
<td>7.2</td>
<td>6.8</td>
</tr>
<tr>
<td>2030-0000</td>
<td>4.7</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Journey times for both buses and cars during off-peak periods have increased, as a result of the reduced speed limits along the section.
The journey time reliability for buses has improved throughout the day since the bus lane opened. The journey time reliability for cars has improved during the evening peak period, and has become slightly worse towards the end of the morning peak period, as the congestion takes longer to clear on some days.

Traffic flows

There has been no major change in traffic flows as a result of the bus lane opening. The flows now that the bus lane is open are similar to those before the bus lane opened, therefore the benefits observed have been achieved with similar flow levels. The flows vary according to the time of year, with flows during the summer being higher than during the winter.

Benefits of the bus lane

The number of people in each vehicle using the M4 has been estimated by observation. For cars this figure is 1.2, for taxis it is 2.5, and for buses it is 15. Combining these occupancy figures with flows and journey time savings provides an estimate of the person-hours saved by the bus lane scheme.

There is a benefit of 900 person-hours per weekday due to a reduction in delay during peak periods, which is offset by a loss of 700 hours per weekday due to the reduced speed limits. At weekends, the delay caused by the lower speed limits exceeds the time saved during congested conditions: there is a loss of 350 person-hours each weekend day as a result of the bus lane scheme. Therefore, there is an overall saving of 300 person-hours per week as a result of the bus lane scheme.

Traffic noise levels have been reduced by about 1dB(A). There have been no changes detected in the levels of vehicle emissions.

Further benefits may have been achieved through a reduction in accidents. This is the subject of a longer-term study, but Police staff have perceived a decrease in the number of accidents attended since the reduced speed limits were implemented.

Speed compliance

The number of vehicles exceeding the speed limit rose following the introduction of the new lower speed limits. The number of vehicles exceeding the new 50mph speed limit is double the number that exceeded the national speed limit before the bus lane scheme was installed. The compliance during the winter is better than during the summer, possibly due to poorer weather and lighting conditions.

Traffic on the adjoining network

Traffic on the adjoining network has not been adversely affected by the bus lane scheme. Queues at the Junction 3 roundabout are no worse than they were before the bus lane opened and journey times along the alternative A4 route are slightly shorter than during the “before” period. It is still over twice as fast to travel on the M4 between Junction 3 and Junction 2 than it is on the adjoining network. There is no incentive for traffic to divert, nor is there any
evidence that it is doing so. Any congestion on the M4 has not affected the performance of the adjacent network.

Road layout

The new road layouts at Junction 3, at the start of the bus lane and at the merge area are all working well. The dedicated exit slip road at Junction 3 has reduced the congestion at that point, and the design of the merge area at the end of the bus lane has smoothed the transition from three lanes to two prior to the elevated section.

Feedback

Feedback has been obtained via comments in the press and a bus/coach company survey. When the bus lane first opened, there was a large amount of adverse publicity in the press and on the radio. However, when monitoring results were published by the Highways Agency, publicity for the bus lane improved and in general, recent press comments about the bus lane have been favourable. Bus and coach companies, and their drivers, all said they thought the bus lane was a very good idea, because their journey times had improved as a result of the bus lane scheme.

Conclusions

The bus lane scheme has met its primary aim set out before the scheme was installed. The scheme has resulted in time savings during peak periods for all types of vehicles. On average, each bus is saving 3 minutes and each car is saving 1 minute during each peak period.

The general public has a perception that not enough vehicles use the bus lane. The reasons for the restriction in numbers could be included in further publicity. The number of vehicles using the bus lane influences the benefits of the bus lane scheme. If too many vehicles were to use the bus lane, a bottleneck might reappear where the three lanes are reduced to two. Therefore, large numbers of other potentially eligible vehicle types should not be allowed to use the bus lane.

The benefits arising from the installation of the M4 bus lane are site specific. The design is specific to this location and cannot easily be transferred to other locations. However, the Highways Agency is gaining valuable operational experience that will be of assistance when considering similar schemes.