

Evidence Measure Review No.4

Access restrictions



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Measure No.4: Access Restrictions

Removing, filtering or controlling the flow of vehicles in a street or part of a city with the intention of encouraging other modes (public transport, cycling and walking) and improving the public realm

Cities can limit vehicular traffic by use of physical barriers or signed regulation, allowing exceptions for specific vehicles or groups. They can also exclude vehicular traffic at all times, or at defined times from a particular area (i.e. for pedestrianisation).



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Key messages:

- ✓ Pedestrianisation and access restrictions can bring considerable benefits to towns and cities - although the range of quantitative evidence is limited.
- ✓ Pedestrianising shopping streets tends to increase retail revenues and the value of property on those streets.
- ✓ Road closures do not cause 'traffic chaos' as critics often fear; drivers adapt their behaviour in ways that are not yet fully understood, but which avoid the worst consequences of congestion.
- ✓ Benefits include: improvements to the urban environment, reduced traffic in central areas, reduced air and noise pollution and modal shift towards sustainable mobility.
- ✓ There will normally be some increased traffic on surrounding streets. The extent of traffic displacement depends upon the existence of 'spare capacity' on the surrounding streets.

4.1 Context and background

'Restrictions on through traffic' (or 'access restrictions' for short) refers to situations where vehicular traffic is limited, either physically, or by signed restrictions. In some instances, particular categories of vehicle may still have access, e.g. buses, taxis, local residents or deliveries, even when general traffic is not. Restrictions such as these will affect access to a wider network of streets.

Potential interventions

- Barriers, permanent, or moveable (e.g. rising bollards)
- Legal restrictions, indicated on signs and entailing penalties for infractions.
- Pedestrianisation schemes

Pedestrianisation refers to the exclusion of vehicular traffic at all times, or at defined times each week. The definition does not include temporary closures. Bicycles may or may not be

allowed through pedestrianised streets or plazas. Exceptions may be made for emergency vehicles and deliveries to adjoining properties (these exceptions may or may not be time limited).

Pedestrianisation may be considered a sub-set of access restrictions, although there is a 'grey area' between the two, depending on the nature of the restrictions on vehicular access. Where access restrictions do *not* create pedestrianisation, either:

- a) some categories of motor vehicle (apart from deliveries and emergency vehicles) e.g. buses may be allowed through and/or
- b) barriers may create no-through roads but general traffic may still be able to drive up to either side of the barriers for local access.

Several of the evaluations described below include elements of pedestrianisation and other access restrictions, as part of schemes to remove traffic from a wider area – typically a town or city centre.

4.2 Statement of the Extent and Sources of Evidence

Considering the prevalence of pedestrianisation and access restrictions there is surprisingly little relevant, up-to-date, high-quality evidence available. There are many descriptive case studies available on-line, but these provide very little quantitative evidence on the impacts of such changes. The available quantitative evidence does not generally satisfy the criteria for establishing causality i.e. no-one has proved that pedestrianisation or road closures *caused* specific changes in travel behaviour or (with one exception) economic impacts. In addition, each study generally considers only limited types of impact e.g. traffic flows or retail spending but not both.

The evidence covered in the item reviews include four peer-reviewed articles, one book¹, one book chapter and three reports from EU funded projects (Civitas and NoiseinEU). The four peer-reviewed articles provide the main evidence on the traffic impacts of road closures and the impacts of pedestrianisation on the retail economy. Of these, two are based on international evidence – much of it from Europe – but these are both rather old: one was published in 1993², one in 2002³, but drawing on evidence going back as far as the 1960s; a chapter in a recent book⁴ provides more up-to-date outcome information on one of those case studies. Another article reported on a case study of Oxford in the UK around the year 2000⁵. The most rigorous and recent evidence on the effects of pedestrianisation on retail spending was based on a comparison of two streets in Hong Kong⁶.

Two of the EU-funded evaluations describe the impacts of pedestrianisation and road closure programmes on the centres of two Spanish cities – Burgos⁷ and Vitoria-Gasteiz.⁸ Finally, an evaluation was conducted on the noise reduction impacts of pedestrianising a single street in Aix-en-Provence in France⁹.

4.3 Summary of What the High-quality Evidence Claims

4.3.1 The Impact of Road Closures or Access Restrictions on Traffic Volumes

Two of the sources describe two stages of a project which ran from the late 1990s¹ until publication of the final article in 2002³. This project remains the most comprehensive study of the traffic impacts of road closures and road capacity reductions available in the published literature. Many other writings have cited it, but none that we were able to review added much to its specific findings in respect of permanent road closures (several publications have

studied the effects of temporary road closures in other circumstances¹⁰).

The study used secondary data collected by local authorities in 10 countries, 6 of them in Western Europe. Most of the data came from the UK or Germany. The road closures or capacity reductions were for a range of reasons. Most of the 63 cases were temporary road closures (the descriptions were not always specific on this); some were capacity reductions due to bus lanes and others were permanent closures due to pedestrianisation of city centres, for example. The aim of the study was to examine the impact of the closures or capacity reductions on vehicles flows on the altered area and on parallel or alternative routes.

A large majority of the interventions were successful in reducing overall traffic levels. Some traffic was displaced onto surrounding roads but not all. Some of the traffic "disappeared". In 51 of the 63 cases the total volume of traffic in the monitoring area fell. The range was +25.5% to -146.6%. The median reduction was 11% and the mean was 21.6%. The scale of traffic reduction from installing bus lanes was lower than the other schemes, most of which involved actual closures. In a few cases congestion worsened in the short-term but predictions of "traffic chaos" were very rarely fulfilled. There was some evidence that such predictions published in the media may have contributed to traffic reduction, because drivers were warned to avoid those roads. Only two of the interventions were subsequently reversed, due to perceptions that congestion had worsened. Drawing partly on professional opinions, the authors ascribe the disappearing traffic phenomenon to a range of different behavioural responses including: route changes, reduced frequency of travel, more trip chaining, modal shift, changes of destination and in the longer term changes of job or residential relocation³.

A recent book chapter provides more context and longer-term traffic outcomes from one of the cases reviewed in the earlier study – the Cambridge Core Traffic Scheme, which also had further stages in more recent years⁴. Cambridge in the UK is a rapidly growing city with a radial road network converging on a historic centre with limited road capacity. It has a ring-road which is mainly two-lane and is bypassed further out on two sides by a motorway and dual carriageway. During the 1990s, the highway authority decided that increasing road capacity to accommodate increasing traffic volumes within the city would not be possible. They decided instead to close roads to through traffic in 6 stages between 1992 and 2008. Some of the closure points have rising bollards allowing buses, taxis and some other exceptional vehicles through. In other places a permanent physical barrier allows cyclists and pedestrians but not motor vehicles through. Traffic crossing the cordon (on the river which bisects the city centre) fell by 8.4% between 1996 and 2000 (including 3 of the 6 stages)³. Between 2002 and 2008 (when 2 more stages were implemented) it fell by a further 16%⁴. Traffic volumes on the radial routes remained fairly stable, whereas traffic volumes in the surrounding county rose. These falls occurred despite a strongly rising population and rapidly growing economy; average household income grew by 15% above inflation between 2001 and 2011.

Cambridge already had a strong cycling culture and the closure points (which allow bicycles and pedestrians to pass through) provided an advantage in terms of distance to cyclists i.e. journeys by car became longer than the equivalent journeys by bike. The modal share of people cycling to work increased by 6 percentage points from 1991 to 2011.

Methodologies and Caveats

All the above studies drew on secondary data collected by local authorities, over which the authors had neither control nor oversight. The conclusion that some of the traffic 'disappeared'³, depends upon the authorities identifying and correctly measuring traffic on all

relevant 'surrounding roads'. No attempt was made to control for other factors influencing changes in traffic volumes (although the more recent book chapter describes several of these factors e.g. population growth and economic growth)⁴.

The behavioural explanations offered for the disappearing traffic were largely conjectural (although those behaviours have been observed in other contexts). Two of the explanations – that some people change their destinations or their routes for some journeys implies that measuring traffic on *surrounding* roads would not capture the *total* traffic impact. For example, if access through a city centre was made more difficult, some people living in the northern suburbs of a city might stop travelling to destinations in the south of the city. The journey might still be made, but to a different destination. If they decided to travel to another destination in the northern suburbs instead, those journeys would not be captured by the traffic monitoring. Depending upon the layout of roads around the city, some drivers might also change their routes to follow an outer ring-road or a motorway, which would also be excluded from the traffic monitoring.

4.3.2 Case studies of pedestrianisation and access restrictions in city centres

There are many descriptive case studies of city centre pedestrianisation schemes available online, including some published by EU bodies¹¹ and national government bodies¹². Some of these provide useful practical information about the experience of implementing such schemes. Unlike most of the published case studies, the 3 sources reviewed below include quantitative before-and-after monitoring of several indicators. Both evaluations showed significant falls in traffic, within the controlled area and on surrounding streets. Both showed improvements in air quality and one showed significant modal shift in travel to the city centre.

Two evaluations were conducted of pedestrianisation and access restriction scheme for the centre of Burgos⁷ and Vitoria-Gasteiz⁸ in Spain. The projects and their evaluation were both partly-funded by the EU Civitas programme. Burgos already had a pedestrianised historic centre and recently completed a partial outer ring-road (on 2 sides of the town). The Civitas project expanded the pedestrianised area and removed through traffic from a wider central area of 4 square km. Rising bollards control access to this area, with permits issues to residents and delivery vehicles.

Vehicle, pedestrian and bicycle flows were measured in the area subject to the restrictions from 2000–4 and again after the interventions in 2006/7 and in 2008. Traffic flows on the surrounding roads were also measured annually. Modal share across the city was measured at the baseline, in 2006/7 and in 2008. A sample of 250 residents was surveyed in 2007 and in 2008 to gauge public opinion towards the access restriction measures. Traffic within the restricted area fell by 97%. The pedestrian count rose by 115%. The cyclist count rose even more rapidly but from a very low base (from 30 to 248). Traffic on the surrounding roads also fell very slightly between 2006 and 2007. The modal share of travel by car fell from 36.6% in 2000/4 to 31.9% in 2008. Public transport use rose from 11.9% to 27.2%. The share of journeys on foot fell (presumably many of the increased pedestrians counted in the central areas were arriving by public transport). Only 16% of people surveyed disagreed with the access restrictions in 2007, falling to 14% in 2008. PM10 pollution at the 4 monitoring stations fell substantially; NO2 emissions fell slightly.

The SUMP for Vitoria-Gasteiz aims to establish a limited network of through roads between 'superblocks', in which through traffic is limited. Phase 1 in 2008 introduced the central superblock (which also contains pedestrianised streets) alongside a new tram system. Access to the central superblock was previously controlled by rising bollards. These were

expensive to maintain and frequently damaged by vehicles. Phase 2 (the Civitas project) in 2011 replaced that system with a time-limited number plate recognition system. If a vehicle takes less than a certain time to cross the area, it is considered through traffic and is fined. Otherwise, the vehicle is considered a resident, visitor or delivery vehicle.

Traffic flows on 3 affected streets were measured at 3 stages: beforehand (2006), after phase 1, the superblock and tram installation (2011), and after phase 2, the change to number plate recognition (2012). Air pollution and public acceptance were measured in 2011 and 2012. The acceptance survey was conducted by telephone to a random sample of 400 citizens. Most of the traffic reduction (between 60% and 89% on 3 monitored streets) was achieved by the superblock system but the camera-controlled number recognition system removed a further 6 to 8% of the (original) traffic levels. PM10 pollution fell by 7% and NOx by 1% in phase 2. The public were asked to rate their acceptance of the access restrictions on a scale from 1 to 10. The average acceptance level rose from 6.2 to 6.5 after implementation. (More "positive" measures scored higher e.g. the tram system averaged 7.9 in 2012).

The pedestrianisation of Oxford in the UK provided another case study⁵. The pedestrianised zone itself was fairly small - through traffic was removed from a wider area, particularly through the use of bus gates, which allowed buses but not general traffic through. Traffic entering the city centre fell by 17%, whilst total visitor numbers remained stable. Pedestrian volumes in the pedestrianised streets increased slightly. There was a 9% increase in the number of visitors to the city centre by bus, including expansion to park and ride sites, more than compensating for the loss of visitors by car. Retail floorspace reached a record level and retail property rents rose more quickly than elsewhere. There were small reductions in air pollution levels and road collisions.

Methodologies and Caveats

The explanations of methodology in the two Spanish studies were limited in detail. For example, the location of the air quality monitoring stations (in relation to the city centre), the definition of the "surrounding roads" and the methods used to calculate modal share were not defined in Burgos. No attempt appeared to have been made to control for any other factors that might have influenced traffic volumes and air pollution. The Oxford study drew on data collected by the local authority and business organisations, so its robustness would rest on the effectiveness of their methods (which would not generally have been scrutinised by the author).

4.3.3. The Impact of city centre pedestrianisation on visitor numbers and retail businesses

This section draws on one Anglo-German meta-study and a quasi-experimental study of pedestrianisation in Hong Kong.

The meta-study, which was published in 1993, remains the most comprehensive review of evidence on the impact of pedestrianisation (and traffic-calming) on retailing². The article, based on UK and German data, is mainly a meta-study, although it also reports the findings of some primary research. The secondary data included 6 UK studies and 11 German studies; some of the studies covered several towns in each country. The data collected by the different studies spanned the period from 1965 until 1992.

The primary data showed increases in pedestrian flows ranging from 18% to 92%. One measure on one street showed a decline of 3%, where the 'after' survey was conducted before reconstruction was complete. A study of 6 German towns showed that retail turnover increased for 64% of businesses surveyed with the largest concentration (32.4%) reporting an

increase between 5% and 10%. The effect was slightly more positive in the larger towns than smaller towns. Some of the other studies found that there was sometimes a slight fall in turnover immediately following pedestrianisation. In the longer-term, shops on pedestrianised streets tend to benefit, whereas those on trafficked streets nearby tend to suffer. One of the UK studies showed that rents on pedestrianised streets were 80% higher than on vehicular streets, although the change in rents immediately following pedestrianisation in 14 towns was similar to the national trend.

The report describes resistance to pedestrianisation proposals from traders and their representative organisations in several towns, however they “virtually never campaign for the abandonment of a scheme once it has come into operation...traders are often the main people to voice a desire to extend its boundaries or period of operation.”

A quasi-experimental evaluation was conducted of the pedestrianisation of a shopping street in Hong Kong in 2003⁶. Although this raises obvious questions about cultural and spatial differences from European contexts, it is included here because it is, as far as we were able to find, the only rigorous academic study of this question, which enables causal inferences to be drawn.

Both the intervention and control streets are busy shopping streets. The intervention street suffered from overcrowding and conflict between pedestrians at busy times. Since 2003 it has been closed to traffic from 4pm to midnight on Mondays to Saturdays and from noon to midnight on public holidays. On the control street, pavements were widened and traffic calmed but it remains open to traffic. Data was obtained from government sources on the rateable values and physical characteristics of shops for the tax years 1999/2000 and 2008/9. Rateable value, which is an assessment of market rent conducted by the authorities for tax purposes, was used as a proxy, since rents (which are commercially sensitive information) would not be directly available to a researcher. Independent variables were collected for a regression analysis: age, size, frontage, distance from station, corner location and two dummies for the year and the pedestrianised street. Rateable values were already higher on the intervention street before pedestrianisation. They rose on both streets but considerably more on the experimental street. The regression model explained 51% of the variation in rateable values (adjusted R²). After controlling for other factors pedestrianisation added 17% over and above the traffic calming and pavement widening on the control street. The changed environment on the intervention street, with activities such as street theatres and 'live forums' led to more noise in the late evening. As a result, the pedestrianisation was shortened, to end at 11pm instead of midnight.

Methodologies and Caveats

The studies reviewed by the meta-study came from a range of sources, including local authorities and a couple of student dissertations. The published article gives only limited information on the methods they used. In most cases, the effects on retail spending depending on self-reporting by businesses, which raises questions about the robustness of the evidence. The studies do not report any statistical analysis controlling for external factors.

There are several differences between Hong Kong and European cities - specifically the much higher population density and lower car ownership in Hong Kong. Whether that would increase or reduce the impact of pedestrianisation on shopping behaviour is not obvious. However, the broad conclusion is consistent with the available European evidence, including the meta-study.

4.3.4 Noise reduction benefits of pedestrianisation

This section is mainly based on a noise evaluation conducted on a single street, la rue d'Italie, in Aix-en-Provence, France, before and after pedestrianisation¹³. It also draws on a magazine published by the local authority for its residents¹⁴ and minutes of the city council meetings¹⁵, which provide some broader context on the pedestrianisation programme in that town.

Extending the existing pedestrianised area of the city centre formed part of the programme of the mayor Joissans on her election in 2001. A consultation showed that 60% of the public supported it in principle. It was preceded by an increase in parking capacity of 4,800 judged essential to avoid "killing trade" in the city centre. A smaller area of the city centre had been pedestrianised for many years. A network of minibuses and 'Diablins' (slow-moving electric vehicles) serve the central areas.

La rue d'Italie was one of the streets in the newly-extended pedestrian zone. Rising bollards controlled by intercoms allow access for residents, traders and emergency vehicles. A one-hour traffic count and sound measurement was taken before the intervention and shortly afterwards. The number of vehicles moving along the street fell from 155 to 25. Of the latter, 10 were cars (residents or other essential users) with access rights; 13 were motorised 2-wheel vehicles which illegally rode past the bollards (compared to 16, legally circulating before). Average noise level fell by 5 decibels. The contribution of vehicles to total noise levels fell from 56% to 10%.

The city council minutes provide some limited information on the budget (the project was implemented in stages). The cost of installing 34 rising bollards with an intercom and camera linked to a central control point was budgeted at €552,083.

Methodologies and Caveats

The evaluation was conducted on just two days which could have been subject to random variations. The researchers estimate that the fall in noise levels would have been larger (14Db) were it not for building works which were happening in the 'after' phase only.

4.4 Lessons for Successful Deployment of this measure

The evidence in this review has mainly come from the UK, Germany and Spain, although the broader Evidence database includes studies from many other countries in Europe and elsewhere. Most of that evidence is descriptive – and favourable towards pedestrianisation and access restrictions. Some of it also describes political conflicts within local authorities and strong opposition (e.g. a study of the removal of through traffic from the centre of Groningen in the Netherlands¹⁶). This broader evidence base suggests that both pedestrianisation and access restrictions can be implemented almost anywhere – and particularly within Europe. Whether the benefits and costs would vary widely in different contexts is more difficult to assess. The international meta-study of pedestrianisation schemes found that the retail benefits are greater in larger cities than in small towns², Although this should not be regarded as a universal statement. Both pedestrianisation and access restrictions have been successfully implemented in small towns in many countries.

The main barriers to implementation relate to local opposition, particularly from shop owners and motorists who perceive that road closures will increase congestion, journey times and/or journey distances. Involving stakeholders in scheme designs may help to alleviate some of those concerns, although there is also evidence that brave decisions and successful implementation are the best ways of overcoming opposition.

Cities which embark on a gradual process of pedestrianisation and access restrictions may experience a longer-term decline in urban traffic volumes, coupled with modal shift⁴; this has been the experience of Cambridge and also of Groningen. In the case of Cambridge, those trends accompanied a period of rapid economic expansion and population growth.

4.5 Additional benefits

As well as the evidence of economic and financial benefits of interventions discussed above, there are a number of additional benefits that are claimed for policies promoting access restrictions to promote sustainable mobility:

- **Improved street environments:** Reducing traffic levels can lead to the creation or improvement of 'street life', through community activities and events such as 'street parties'.
- **Community cohesion:** More people using streets, and interacting with neighbours and other pedestrians can help create greater social cohesion within a community, in itself reinforcing the more communal street environment.

4.6 Summary

Although the range of quantitative evidence is limited, the available evidence, quantitative and qualitative, shows that pedestrianisation and access restrictions can bring considerable benefits to towns and cities. There is some evidence of opposition to such changes – usually stronger before implementation than afterwards – but very few examples of such measures being reversed or judged to have failed. The main advantages are: improvements to the urban environment, reduced traffic in central areas where traffic would otherwise be most concentrated, modal shift towards sustainable mobility and reduced air and noise pollution. Pedestrianising shopping streets tends to increase retail revenues and the value of property on those streets. There may, however, be short-term declines during and immediately after implementation. Shops on trafficked streets bordering a pedestrianised area may also suffer a decline.

Road closures do not generally cause 'traffic chaos' as critics often fear; drivers adapt their behaviour in ways that are not yet fully understood, but which avoid the worst consequences of congestion. However, there will normally be some increased traffic on surrounding streets. The extent of traffic displacement depends upon the existence of 'spare capacity' on the surrounding streets. The example of Cambridge suggests that (contrary to received wisdom) the benefits may be greatest where convenient alternative routes for general traffic do *not* exist. In those cases, the opportunity for traffic displacement may be very limited – greater modal shift may occur instead. Improvements to the urban environment may have assisted Cambridge's economic expansion, but the main reasons were unrelated. Although it cannot be proven that removing traffic contributed to economic expansion in Cambridge, the opposite can be stated with some confidence: that removing traffic from the inner areas did not prevent rapid economic expansion, as is sometimes feared.

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