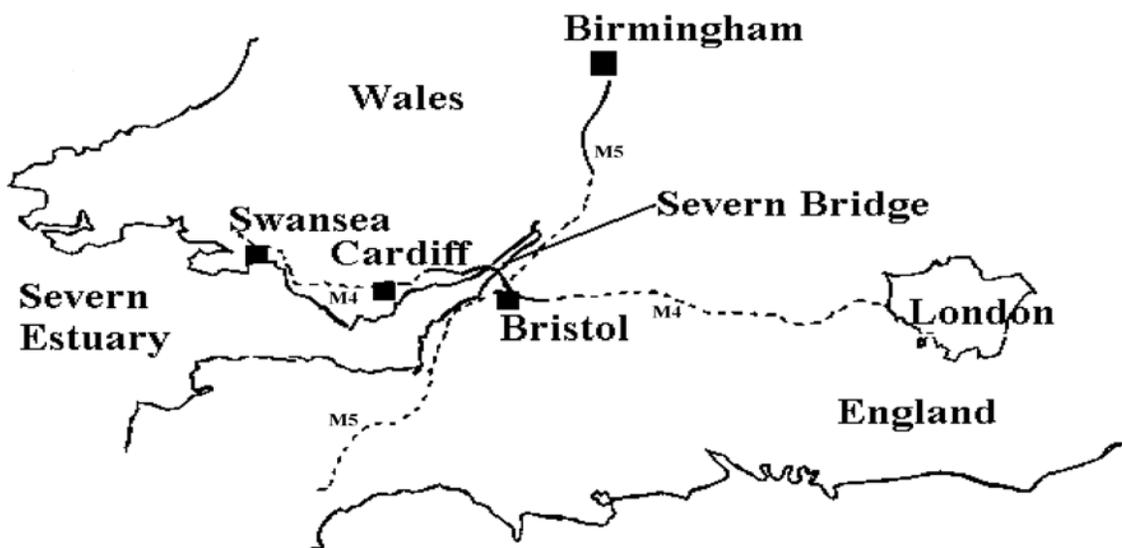


ANNEX A

CASE STUDY:

THE SEVERN BRIDGE



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1 INTRODUCTION

1.1 The project

- 1:01 The project considered here and usually referred to simply as “The Severn Bridge” actually consists of two bridges, the bridge itself and a smaller bridge over the River Wye, which flows into the Severn Estuary just below the bridges. The two bridges are joined by a viaduct; the nearest interchanges are some way to the west and to the east. The Severn Bridges and adjoining infrastructure opened on 8 September 1966 and provided a motorway-standard road link across the Severn Estuary between England and Wales. The River Wye actually forms the boundary between England and Wales.
- 1:02 The nearest direct alternative crossing was (and still is) the Severn Tunnel, a railway tunnel built in the late 19th century. The nearest road route involves a lengthy detour via Gloucester, over 40Km further up the Severn.
- 1:03 An additional motorway bridge, known as the Second Severn Crossing, was opened in the mid 1990s. This crosses the estuary a few kilometres to the south of the 1966 bridge. Following the opening of the new bridge, some renumbering of the motorway system took place, so that the designated M4 London to South Wales Motorway uses the new bridge, with the older bridge now carrying the parallel M48.

1.2 Relationship to other projects

- 1:04 Up to the changes associated with the Second Severn Crossing, the Severn Bridge was a key link in the M4 London to South Wales Motorway just west of its intersection with the M5 Birmingham to South-West England Motorway. However, it is important to note that the Severn Bridge and the few kilometres of motorway either side of it were opened before the rest of the M4 or the sections of the M5 immediately north and south.

1.3 Available studies

- 1:05 A major impact study was commissioned by the Economic Planning Councils for the South West of England and for South Wales from the University of Bath, University College Swansea and the Newport and Monmouthshire College of Technology. This was published in 1973 (Cleary and Thomas, 1973), though most of the survey work was carried out in the period up to 1970 (including some limited fieldwork in the summer of 1966, just before the bridge opened). It is important to note that this study was carried out before the section of motorway over the Bridge had been joined to the rest of the M4 or the M5. It was therefore never possible to examine the effect of the Bridge as completing a missing link in the motorway network – the missing links at the time were the inland sections.

- 1:06 A second study was carried out by the Welsh Office circa 1980, by which time the M4 in Wales was complete westward to Cardiff as were the English motorway connections to London (M4) and the Midlands (M5). The Welsh Office study was mainly concerned with the expected impact of extending the M4 from Cardiff to Swansea, but included a survey and analysis of the effects which had already been felt.
- 1:07 A third study was carried out by Cambridge Economic Consultants in 1987. This relied on the previous fieldwork and on other data sources, but carried out some additional analysis to produce more comprehensive estimates of the long-term employment effects of the Severn Bridge and the M4. For the most part, the Bridge and the Motorway were considered jointly rather than separately. This study was concerned almost exclusively with the employment impacts on Wales.
- 1:08 We have also considered an MBA dissertation which examined the impact of the tolls charged for the use of the Bridge (Miller, 1993). This makes reference to a number of reports prepared during the decision-making process which led to the building of the Second Severn Crossing; some of these may contain further analysis of the impact of the original Bridge and associated motorway developments. We have not had the opportunity to examine these.

2 PURPOSE, CONTEXT, FUNDING AND TIMING

2.1 History and purpose

- 2.01 The first proposals for a road crossing of the Severn Estuary were put forward by Thomas Telford in the 1820s, as part of a plan to improve communications between London and Ireland via the ferry port at Milford Haven in South-West Wales. These proposals were not pursued, though the ferry across the estuary (approximately where the Severn Bridge was eventually built) was improved.
- 2.02 The first fixed link below Gloucester was provided by a single-line railway bridge at Sharpness, opened in 1879. This was clearly inadequate for the volume of trade between South Wales and Southern England, and construction of the Severn Tunnel began in the same year and was completed in 1886. The Severn Tunnel apparently provided a car-carrying shuttle train at one time.
- 2.03 The first suggestions for a road crossing were put forward before 1914, and were repeated mainly by local authorities throughout the inter-war period. These proposals were taken up again in 1945. A positive decision was finally taken in 1960, now putting the Bridge in the context of the initial 1000-mile (1600Km) motorway network of the UK.
- 2.04 We have not attempted to go back to original documents about the justification for the Bridge, but from the historical summary in the Cleary and Thomas report it is clear that South Wales was seen as needing better access to Southern England (especially London and the South-East) in order to allow industrial diversification, particularly to reduce its dependence on coal mining. Bristol sought better access

to South Wales in order to improve their competitive position as a major port, industrial centre and service centre.

2.2 Cost and funding

- 2:09 The original link (ie the Severn Bridge itself, the Wye Bridge and immediately adjoining motorways) cost £16,568,000 at historical prices, which can be converted to £20,900,000 at 1966 prices (C&T, 8.12). The project was funded by the UK Government, but under arrangements whereby tolls were charged to recover the investment.
- 2:10 High maintenance costs in the 1980s meant that the outstanding deficit on the Bridge was increasing rather than being reduced (Miller, p11). The debt was effectively privatised by decisions taken under the Second Severn Crossing Act, which transferred the existing Bridge, the deficit and the right to levy tolls to Severn Crossings PLC in return for the undertaking to build the Second Crossing. The subsequent increases in tolls have become a significant political issue, particularly in South Wales where some see the tolls as a tax on local economic activity.

3 TRANSPORT AND ACCESSIBILITY EFFECTS

3.1 Travel time and costs

- 3.01 Cleary and Thomas reported (p84, para 8.16) that the Bridge reduced journeys between the two sides of the estuary by up to 50 miles (80Km) and by up to two hours travelling time (or possibly more, under congested conditions). These improvements would be experienced in full by anyone travelling from Bristol to Newport or Cardiff.
- 3.02 The time and distance savings represent a major improvement in accessibility between the two banks of the Severn, though this was significantly reduced by the imposition of tolls. C&T (8.47) report that the initial toll was 2s 6d (£0.125) per car¹. This was in the range of 2s to 3s per hour (£0.1/h to £0.15/h) which they established as the value for non-working time (paras 8.49-50). Working time was valued at 8s 9d per hour for commercial (ie goods vehicle) drivers and at 13s per hour for other drivers (eg business travellers). Operating costs per mile are reported as being in the range 3d to 5d per mile for light vehicles and 16d per mile for heavy vehicles (8.53-55).
- 3.03 Other changes associated with the opening of the Bridge included major reductions in the local railway services between North Bristol and South Wales (C&T 9.15) and in the cross-Severn ferry services (9.16). The fate of the Severn Tunnel car-carrying shuttle is not recorded, but it seems safe to assume that it

¹ Although the Cleary and Thomas report was published in 1973, after the decimalisation of UK currency, it reports prices in the pre-1971 units of pounds (£), shillings (s) and pence (d). There were twenty shillings in the pound and 12 pence in one shilling. The pound was unaffected by decimalisation.

closed as soon as the Bridge opened, if not before. The railway bridge at Sharpness closed after being hit by a ship.

3.2 Reliability

- 3.04 In the years immediately after opening, the reliability of travel times via the Bridge was a major attraction, compared with the risk of being held up by congestion in Gloucester. Cleary & Thomas (p87, para 8.39) report that Gloucester was a serious bottleneck with marked seasonal variation, with journeys that took 15 minutes in winter sometimes taking over an hour in summer.
- 3.05 By the beginning of 1979, when the surveys for the Welsh Office study were carried out, the recurrent need for repairs to the bridge and the motorway network had become a significant problem. The surveys included an invitation to add other comments related to the impact of transport on the Welsh economy. 29% of all respondents took that opportunity to express concern about the delays caused by repairs and maintenance work (p27, para 3.17). The problems continued throughout the 1980s, with occasional total closures causing chaos on the Gloucestershire road network (Miller, 1993, p7).
- 3.06 Reliability was also affected by the exclusion of high-sided goods vehicles during particularly windy weather.

3.3 Accessibility

- 3.07 The opening of the Bridge, even with tolls, clearly represented a major improvement in accessibility to the other side of the Severn for both private car and commercial truck users. The reduction in local rail and ferry services may however have reduced accessibility for persons without access to a car, though to some extent this reduction would have been remedied by the development of extended or new local and long-distance bus and coach services (C&T, 4.74-80). Opportunities for leisure travel were significantly increased by the substantial development of coach excursions, consisting of trips and tours sold to the public and of private hirings (ie coaches chartered for private group travel), predominantly from industrial areas of South Wales to shopping and tourist destinations in South-West England (4.81-90).
- 3.08 For freight, the surveys found a reduction in the use of rail, but this occurred as much in areas unaffected by the Bridge as in those affected (5.11). (It should be noted that the period of Cleary & Thomas' survey coincided with a period of rapid reduction in the railway network, with a 20% reduction in total route length between 1965 and 1970²). They did however find that before the opening of the Bridge the use of railways for freight between South Wales and South West England had been higher than normal for the distances and goods involved, and that the Bridge brought about a reduction in this use.

² Transport Statistics Great Britain 1996, Table 9.8.

3.4 Traffic volumes

- 3.09 During 1967, the first full calendar year of operation, the flow of vehicles over the bridge averaged about 16,000 per day (C&T, Appendix 2). By 1970 (the last year reported in the Cleary & Thomas survey) this had increased to 20,000 per day. By 1991 the flow had reached 51,149 vehicles per day, significantly in excess of the design capacity of 46,575 (Miller, p7).
- 3.10 The Cleary & Thomas study contains considerable detail from their traffic surveys. Of particular interest is the data reproduced here as Table 1, showing their estimates of diverted and generated traffic in August 1967, approximately a year after the opening of the Bridge. This information was obtained by asking drivers whether, had the bridge not existed, they would have made the same journey by a different mode or route (diverted). Drivers who answered “no” were assumed to be making “generated” journeys. Drivers in this category were asked whether they had chosen their destination or route specifically to see the Bridge itself; those who answered “yes” were classified as “facility created”.

Purpose	Diverted	Generated	Facility Created	Not Known	Total
Firm's Business	14,693	4,141		470	19,304
Collection and Delivery	726	727	220	21	1,694
Service and Maintenance					
Work	933	1,928		14	2,875
Shopping	655	1,941	133		2,729
Holidays	29,970	6,306	3,701	101	40,078
Visiting	14,090	7,650	1,253	40	23,033
Sightseeing	5,086	14,469	9,588	310	29,453
Paid Entertainment	2,038	5,832	595		8,465
Other and Multiple	1,882	1,124	125		3,131
Total	70,073	44,118	15,615	956	130,762

Table 1 Diverted, generated and facility created traffic by purpose: August 1967

- 3.11 The overall pattern was that
- 54% of traffic was “diverted”
 - 34% was “generated” but not “facility created”
 - 12% was “facility created”, ie journeys arranged in order to see the Bridge itself.
- 3.12 The combined proportion of “generated” and “facility created” was not surprisingly highest for sightseeing, where five-sixths of trips came into these categories. It was lowest - about one quarter – for travel on firm’s business and on holidays. None of the drivers travelling on their firm’s business admitted to

arranging their journey specifically to see the Bridge, but about one-eighth of the small number making collection, delivery or service trips did so.

- 3.13 Separate surveys of heavy vehicles (goods vehicles and a very small minority of buses) were carried out, including screenline surveys carried out for Gloucestershire County Council in August 1966 and August 1967. The location of the screenline does not seem to be stated in the C&T report, but the zones for which the information is given (Appendix 29 and Map B) are consistent with the obvious possibility, the Severn itself³. The figures show that total heavy traffic increased from 7600 vehicles per August weekday in 1966 to 8400 in 1967; of the latter, some 3000 crossed by the Bridge.

4 ECONOMIC AND EMPLOYMENT IMPACTS

4.1 Short-term impacts

- 4.01 For manufacturing industry, Cleary and Thomas examined
- organizational links
 - changes in inputs (raw materials and components)
 - changes in service inputs
 - changes in labour inputs
 - changes in the sale of outputs
 - other commercial benefits (eg vehicle utilisation)
- 4.02 For distributive activities, they examined the structure of the firms and their operations and the changes which followed the opening of the Bridge. This included the experience of retailers with regard to the patterns of shoppers' travel. At the other end of the scale, it also considered the impact of the Bridge on ports and docks in the region.
- 4.03 Cleary and Thomas provide a great deal of detailed information on changes in each of these topics, but in general they were unable, unwilling or perhaps not expected to reach any overall conclusions as to the impact of the Bridge on output or employment in the regional economies affected.
- 4.04 They did however conclude for manufacturing (9.20-29) that
- there had been no significant relocation of factories
 - both regions had become more attractive as locations for new manufacturing investment

³ In which case the results presumably exclude traffic on the M50, unless on-motorway interviews were possible at the time.

- there had been increases in purchasing of inputs and sales of outputs across the estuary, associated with increases in business travel, change in distribution arrangements and increases in choice for purchasers
 - improved links between establishments within individual firms (notably between South Wales factories and head offices in South-East England).
- 4.05 Their overall finding was that the Bridge had improved prospects for industry in South Wales without weakening those of industry in South-West England.
- 4.06 More rapid changes were observed in distribution, as would be (and was) expected:
- there was a significant increase in the number of firms operating across the estuary, with greater advantages accruing to firms (or establishments) based in Bristol and adjoining areas of South Gloucestershire, who were closer to the economic centre of the UK;
 - as with manufacturing, there were changes in the sources of supplies.
- 4.07 Cleary and Thomas estimated (9.36) that changes in distribution produced some 40 redundancies on the English side of the Bridge and 166 in South Wales (mainly in Cardiff). These redundancies were in surveyed firms wholly engaged in distribution; a similar change was estimated to have occurred in non-surveyed firms and firms primarily involved in manufacturing. About 430 new jobs were estimated to have been created on the English side and about 20 on the Welsh side, though some of the English jobs were relocations from Central Bristol to the fringes of the conurbation.
- 4.08 For retailing, anecdotal evidence suggested an increase in the number of people crossing the estuary to shop in the major centres of Bristol and Cardiff, but no net effect on sales figures was reported.
- 4.09 Apart from the figures on distribution employment quoted above, Cleary and Thomas made no quantified estimates of impacts on jobs or output.

4.2 Longer term effects

- 4.10 The Welsh Office study likewise concentrated on quantifying reactions rather than assessing net change. Its survey of firms in Gwent found that 47% of large manufacturing establishments, 84% of small manufacturers and 85% of distributive firms considered that easier access to markets had “helped to increase business” (p42, para 8.7). Of manufacturing firms which had opened factories in Gwent since 1966 (ie since the opening of the Bridge), 79% said that access to the (English) motorway network via the M4 and Bridge had been a factor in their choice of location, and 51% said it had been a major factor – though it was thought unlikely that it had been a key factor in many cases. (The availability of labour and government financial assistance were, as usual, the most frequently mentioned factors [8.10].)
- 4.11 One factor mentioned by local authorities in contributing to the Welsh Office study was that eastern Gwent was experiencing considerable demand for housing

- from people commuting either to Bristol (via the Bridge) or to Newport (via the M4).
- 4.12 It was left to the Cambridge Economic Consultants' (CEC) study to tackle the issue of estimating overall impacts. They first (pp204-7) estimated the employment created by the construction of the Bridge and of the M4 in South Wales. This was done by taking the historical cost of the Bridge (as quoted earlier) and estimated costs for the motorway⁴, applying typical cost structures for civil engineering contractors to estimate the application of this expenditure, wage rates to convert this to employment, and assumptions as to proportions of inputs purchased locally⁵. On this basis they found that the Bridge generated some 4260 person-years of employment over a five year period, and the motorway west of the Bridge generated some 10300 person-years over 20 years. Some adjustment for displacement from other projects in the region was assumed (p 207).
- 4.13 Employment in operation and maintenance was similarly calculated from estimates of the expenditure involved. For the M4 component, it was assumed that the high proportion of local traffic using the motorway meant that expenditure and employment in maintaining the rest of the road network would be reduced.
- 4.14 CEC estimated the induced impacts of the Bridge and motorway in several stages.
- 4.15 For indigenous manufacturing, ie firms which were located in South Wales before the opening of the projects, they applied a simple elasticity to an assumed cost reduction. They argued that before the projects, South Wales was a high transport-cost location; after the projects, it was an average transport-cost location. From (unspecified) studies of the variation in freight transport costs between different locations, they argued that this difference would be equivalent to about 1% of gross output. An additional 0.5% saving in costs was attributed to time savings in business travel. This would allow South Wales to reduce prices by 1.5% without reducing profitability⁶.
- 4.16 CEC suggested (p211) that the own price elasticity of output in a single region such as South Wales would be about 3, and that two-thirds of this would be achieved by increased productivity and one-third by increased employment.
- 4.17 Putting all these assumptions together indicated an increase of employment in pre-existing firms in South Wales of 1.53%, which on a base of 250,000 implied an increase of 3825 jobs. This was the preferred central estimate; the effects of different assumptions were explicitly considered (Table 2, p 212).

⁴ The sentence reporting this (in the last paragraph on p205) rather alarmingly states that the M4 in Wales is 854 miles (1366Km) long. Fortunately the figures confirm that the correct figure of 85.4 miles (137Km) was used in the calculations.

⁵ For the Bridge, it is not quite clear how the argument gets from the assumptions about the proportions of purchases in the South Wales/Bristol regions (p206) to the impact on the South Wales economy (p237); the figures seem to be the same.

⁶ CEC did not argue that firms would necessarily pass on their cost reductions, but that similar effects would arise if they used their cost reductions in other productive ways eg to offer higher quality at unchanged prices (see footnote, p 210).

- 4.18 To identify the additional effect of changes in manufacturing location, CEC first considered the findings of the Welsh Office surveys (see above). They found that the reported influences on firms which had chosen to locate in South Wales were similar to those identified in equivalent studies of Scotland and Northern England, *except* for the Severn Bridge and the M4. On this basis, they examined the differential rates of new firm location and associated employment, and found that South Wales appeared to have attracted between 9000 and 12000 jobs in firms not previously located in the region. These are additional to the 3825 jobs in indigenous firms, making a total of between 12800 and 15800.
- 4.19 CEC also carried out an analysis of differential growth in total manufacturing employment in Wales, Scotland and Northern England. This gave a total positive impact of some 18100 jobs by 1981. They argued that this was consistent with the 12800 to 15800 obtained from the other calculations, since it also included additional jobs generated by linkage and multiplier effects. This impact, of +18100 jobs, was taken as the overall impact of the Severn Bridge and M4 on manufacturing in South Wales⁷.
- 4.20 CEC estimated impacts on employment in tourism from the changes in leisure travel patterns estimated in the Cleary & Thomas surveys, supported by more recent anecdotal evidence from tourist authorities. The overall effect was estimated as a net growth of 10% to 12% in tourist activity in Wales [sic]. The summary table (p239) shows this as a short-term impact (after 4 to 5 years) of 3000-4000 jobs, and a maximum impact (15-20 years) of 6000-7000 jobs. It is not clear exactly how these absolute figures were obtained.
- 4.21 Again drawing on the Cleary & Thomas surveys, CEC estimated a short-term loss of 2000-3000 jobs in distribution, rising to 4000-5000 in the long term.
- 4.22 CEC's overall assessment, including additional effects tabulated but not discussed in their report, is shown in full as Table 2. They conclude (p239) that "this represents an increase in economic activity and employment in industrial South Wales of about 4%".

⁷ The analysis appears to have been carried out on data for Wales in total, with the results being interpreted as referring to South Wales. Given the predominance of South Wales in Welsh manufacturing, this is not wholly unreasonable, though some adjustment should probably have been made.

	Number of jobs	
	Short term impact (4-5 years)	Maximum impact (15-20 years)
1. Direct jobs in operation and maintenance of infrastructure	105	105
2. Jobs in local producers and suppliers	46	46
3. Displacement of other infrastructure projects and jobs	-50	-50
4. Net additional jobs in manufacturing industry (including linkages)	8,000-10,000	12,000-18,000
5. Net additional jobs in tourism	3,000-4,000	6,000-7,000
6. Changes in location of wholesale and retail distribution and other consumer services (net employment change)	-2,000 to -3,000	-4,000 to -5,000
7. Sub total (1+2+3+4+5+6)	9,100 to 11,100	18,300 to 26,100
8. Total after application of local income multiplier	11,800 to 14,400	18,300 to 26,100
9. Longer term impact on employment in housebuilding, public services and infrastructure and its local income multiplier effects		5,640 to 8,040
10. Total employment generated		23,940 to 34,140
11. Total additional houses built per annum (over 10 years)		6,128 to 8,739
12. Total additional population (all ages)		17,000 to 24,275
13. Total additional employment *		23,940 to 34,140

Table 2 The impact of operation on the regional economy of South Wales

NB This represents an increase in economic activity and employment in industrial South Wales of about 4%.

Source: CEC

References

Cleary, E J and R E Thomas (1973): *The economic consequences of the Severn Bridge and its associated motorways*. Bath University Press, Bath.

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