
Economic Perspective 2

THE SKYE CROSSING: CONSTRAINTS TO CONSTRUCTION

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Introduction

In recent years the debate regarding the construction of a road crossing to the Isle of Skye has been resurrected; the government is now committed to the building of a crossing although the venture, under current proposals, is likely to be financed using both private and public money. If completed, a fixed crossing linking Skye with the mainland will bring substantial time saving benefits to those who make regular journeys using the existing ferry service between Kyle of Lochalsh, on the mainland, with Kyleakin, on the island.

The Scottish Office requested prospective tenderers to submit their designs by the end of 1989 and it was their intention to provisionally award the concession by the end of 1990. However, pressure is now being put on central government to consider, on environmental grounds, the construction of a tunnel instead of the road bridge. If this proposal is accepted, the natural beauty of the nearby countryside will be protected from spoiling by the bridge structure.

The purpose of this paper, however, is not to consider the arguments for a fixed link; nor is it to consider directly the viability of a tunnel link or that of a bridge. Instead, using standard approaches to investment appraisal, it attempts to estimate the cost constraint faced by the engineers, given certain conditions imposed by government.

Constraints and assumptions

The co-operation between private and public enterprise that has been suggested should occur is unusual within the United Kingdom experience. For a period, determined by government, the crossing will be operated within the private

sector by the consortium which wins the competition to tender. After that time, the crossing will become publicly owned.

It is intended that the cost of construction will be recouped by tolls paid by motorists. However, two restrictions are placed on these tolls - first, the structure of tolls must be compatible with those currently charged by Caledonian MacBrayne, who operate the existing ferry service which the road crossing may replace, and, second, a concessionary period, with a preferred maximum of 20 years, would be given to the construction company. The construction costs, and maintenance costs, must be recovered by the construction company during that period because of the reversion to public ownership thereafter.

A relatively small amount of financial assistance is expected to be given to the construction company from government. This is to take the form of a contribution towards the costs of the approach roads to the crossing (which will be adopted on completion and be publicly maintained thereafter).

The effect of these conditions is to place a twenty year payback period on the investment and to limit the toll to a maximum of that charged by the existing ferry operators. The restrictions thus determine the basic assumptions to be placed on this analysis ie the period of analysis will be 20 years and the toll is fixed at that of the present crossing. It is reasonable to assume that demand will be relatively inelastic because of the essential nature of the service being provided - the only substitute which is available is the present ferry crossing.

The calculations have been made at 1990 prices and present values of future costs and benefits are based on a real discount rate of 7%. This

approximates the real rate of return on capital employed by major construction companies in recent years.

Estimation of construction costs

The estimation of the costs of construction have been carried out using the standard principles of investment appraisal. However, rather than attempting to determine the viability of a project, given costs and returns, the maximum outlay on construction required to obtain a given rate of return has been estimated. This may be done using a very straightforward procedure.

The basic problem implies that the Net Present Value of the project must be equal to zero. By estimating the present value of revenues over the 20 year concession period received by the construction consortium, the maximum total costs that can be incurred are given ($PV_r = PV_c$). These costs, however, include the original costs of construction and the recurrent expenditure on maintenance. Consequently, the maintenance costs must be subtracted from the total costs incurred to give the maximum viable cost of construction.

Figures relating to other estuarial crossings in the UK suggest that the recurrent expenditure maintenance and administrative activities was, on average, approximately equal to 1.1% of construction costs, at 1989 prices. A similar allowance has been made for recurrent expenditure in the calculations relating to the Skye crossing.

Calculation of revenues

The only revenue to be received by the construction companies will be that pertaining to tolls charged to the users of the crossing. An estimate of that revenue may be obtained from estimates of future traffic flows which, in turn, can be derived from extrapolation of previous flows.

The projected traffic flows for the crossing have been derived subject to assumptions regarding the diversion of users from the ferry to the new crossing. It is assumed that local car users (which constitute approximately 50% of all car users), commercial vehicles and service buses (assumed to be 80% of all bus and coach traffic) will use the new crossing in both directions; this assumption may be justified on the grounds of convenience to residents and commercial (but non-

tourist) users. The remainder of traffic, which is, effectively, tourist-related, will be assumed to use a ferry crossing during one journey and the new crossing on the other journey. This latter assumption is based on the notion that tourists may wish to travel "over the sea to Skye" on one leg of the journey. The take-up rates, in relation to the existing ferry traffic, will thus be assumed to be 75% and 90% for cars and commercial vehicles respectively. For the purpose of comparison, an alternative take up rate of 100% by both categories of vehicle will also be analysed.

Results and conclusions

Traffic projections were derived from least squares regression of traffic against time and were carried out for both car and HGV traffic. These gross projected traffic flows were then reduced, as described above, to allow for variations between the demand for road links between tourist and non-tourist related users. Expected revenue at 1989 prices was then derived by applying toll levels of £3.80 per car and £13.60 per HGV and these revenue streams were discounted back to determine their present values (see appendix).

It should be noted that these tolls do not reflect any concessions that may be made to regular users of the crossing.

The total cost of the operator was then set equal to the present value of the returns, ie

$$PV_{rev} = C_r + C_c \tag{1}$$

where PV_{rev} is the present value of revenues

C_r is the present value of recurrent costs and C_c is the present value of construction.

Given the assumption that running costs equalled 1.1% of construction costs per annum, using standard discounting formulae, the discounted value of the recurrent costs may be determined by using the following equation:

$$C_r = 0.011C_c(1-(1+i)^{-n})/i \tag{2}$$

where C_r and C_c are as before;
i is the discount rate;
 and *n* is the period being considered.

Furthermore, given that the present value of the total costs must equate the present value of the total revenues, it is possible to derive the cost of construction by substituting (2) into (1) and rearranging to give:

$$C_c = PV_{rev} / (1 + .011 (1 - (1+i)^{-n})/i) \quad (3)$$

The derived figures are given in the appendix.

Under the assumptions given above, the present value of the estimated revenues would be £13.7m. The cost of construction required for a return of 7% to the constructors is then estimated to be £12.6m. Annual maintenance and administrative costs are estimated to be approximately £139,000. The £6m committed by government to the building of the approach roads is additional to these figures.

If the existing ferry service is withdrawn after the opening of the new crossing and all traffic transfers to the fixed crossing, revenues would be estimated to increase to £17.4m, allowing the overall cost of construction (excluding the grant by government) to rise to £16.0m with recurrent expenditure being approximately equal to £176,000 per annum (see appendix).

Conclusions

The appraisal given above indicates that the cost of construction of the proposed fixed crossing to the Isle of Skye should lie within the range £12.6m to £16.0m, excluding the grant by government. The total cost of construction, therefore, should lie in the range £18.6m to £22.0m. This compares with the estimated cost of construction of a bridge of between £15.5m and £19.6m at 1986 prices. The cost of construction of a tunnel has been estimated at £28m in 1986 prices. After allowing for inflation, these estimates become £19.7m, £24.9m and £35.5m respectively.

The viability of the crossing being constructed as a private venture must therefore be in doubt. The desirability of constructing a fixed crossing, however, may be seen by considering the benefits accruing to the road users - for example, the savings in queuing time, the convenience of 24 hour access to and from the island etc - although some additional costs relating to fuel consumption, vehicle maintenance etc may be incurred. These effects should be taken into consideration if it was argued, on the basis of

the above, that the provision of the fixed link should be abandoned.

It is clear from the analysis that more public funding is necessary if this fixed link is to be provided under the proposed terms of co-operation with private enterprise; given current philosophy, it is difficult to envisage government condoning extra expenditure on the project, unless it is obtained from the European Regional Development Fund (ERDF). However, it is doubtful if such a project could be accommodated within the appropriate programme of the ERDF.

As alternatives, the maximum payback period for the contractors could be extended or the restriction on the level of tolls could be relaxed. However, these also may not be politically acceptable; indeed, concern has already been raised regarding the level of tolls which are being proposed when compared with other estuarial crossings (for example, the Forth Bridge charges 40p per car and the Tay Bridge charged 30p). Even higher tolls would bring about even more reaction and a 50% increase in tolls would still only allow construction costs to rise to £19m (excluding the contribution by government).

The overriding conclusion that must therefore be drawn from this analysis is that the fixed link to Skye is an unattractive venture for private industry to undertake. Some relaxation of the conditions of the contract, together with extra financial support, is necessary before the project can go ahead under the ownership regime envisaged by government.

Notes

1. Data used in the regression analysis was obtained from A Bridge to Skye, a feasibility study commissioned by the Highland Regional Council.
2. The regression analysis was carried out using the TSP statistical package and other calculations were made using the spreadsheet QUATTRO.

Appendix

Lease squares regressions

Cars: $C = -16480096 + 8447.40 * \text{Year} [R^2 = .95]$

Others: $0 = -1314454 + 676.57 \cdot \text{Year} [R^2 = .94]$

Estimated revenues and costs

- 1. Real interest rate = 7%
- Take up (cars) = 75%
- Take up (others) = 90%

Present value of toll revenues = £13.74m
Cost of construction = £12.62m
Recurrent costs = £ .14m pa
Present value of recurrent costs = £ 1.12m

- 2. Real interest rate = 7%
- Take up (cars) = 100%
- Take up (others) = 100%

Present value of toll revenues = £17.44m
Cost of construction = £16.02m
Recurrent costs = £ .18m pa
Present value of recurrent costs = £ 1.42m