9 CONCLUSIONS

9.1 Study Findings

Of the various concepts addressed in this study to provide a fixed transportation link between Labrador and the Island of Newfoundland, a tunnel bored under the Strait of Belle Isle, at its narrowest point, is the most technically and economically attractive. A bridge or combination of causeway and bridge would be subject to very large construction and operating risks because of the challenging physical environment and would have very high capital costs. Additionally these structures could have adverse effects on the oceanography and climate of the study area. A tunnel would not be subject to the same environmental constraints.

Of the three tunnel concepts studied, a drill and blast tunnel would be more difficult to seal against water ingress and would be longer than a bored tunnel due to its greater depth; an immersed tube tunnel would be exposed to high risk from iceberg scour which would have to be accommodated through expensive ditching in bedrock or massive protection works. A tunnel created by using modern tunnel boring machines, on the other hand, with their superior water sealing capacity would allow placement at a higher level in the bedrock and consequent shorter length than in the case of a drill and blast tunnel.

The construction cost of a bored tunnel would be approximately $1.2 billion in 2004 dollars. The total development cost for financing purposes, including escalation and interest during construction would be approximately $1.7 billion. The construction period would be six years and an additional five years would be required for planning, additional studies and investigations and environmental assessments for an overall development period of 11 years.

Based on traffic projections over a 30 year period, the most economic tunnel arrangement would be an electric train shuttle, operating through a single tunnel with staged operation in each direction that conveys road vehicles on custom-designed rail cars. A rail tunnel results in a much smaller cross-section from that required in a road tunnel due to reduced ventilation requirements.

The economic and business case analyses were carried out for three scenarios:

- A base case for a fixed link for transportation only
- An upgraded ferry case providing increased level of service
- The base base augmented by revenue from the installation of a HVDC cable in the tunnel.

The analyses, developed by considering traffic diversion from existing services, growth in service and facility demands, the impact of both construction and operating jobs, and the inclusion of potential revenue from incorporating electrical transmission cables in the tunnel, showed that a fixed link would not attract private sector financing under normal economic and business case criteria. Using relatively optimistic diversion and growth assumptions resulted in negative rates of return and less than unity cost benefits ratios over the period of the study. This result, however, may be considered not atypical in the realm of public transportation infrastructure.

The upgraded ferry option, while not providing the same level of service, is a lower capital cost alternative but would require an annual subsidy financing approach to the crossing.

Including costs and revenue for the transmission lines has an effect on the overall viability of the fixed link. Incorporating the HVDC cables in the fixed link rather than constructing a submarine installation, reduces the capital cost to an HVDC proponent by approximately $390 M. This cost reduction includes the cost of the cable, for which a rental would be charged by the fixed link proponent.

Of the financing methodologies addressed, some form of PPP (Public Private Partnership) arrangement would appear to be the most appropriate. An infusion of approximately $1.4 billion from public sources would be required to make the proposition attractive to the private sector.

A review of the potential impact of industrial development in Labrador on the use of the fixed link concluded that of four industries – mining, forestry, offshore gas, and hydroelectricity - only the last was likely to have a significant potential benefit. In addition to the benefit derived from being able to incorporate high voltage transmission cables into a fixed link, one could make an argument that an overall hydroelectric development on the Lower Churchill, and possibly other rivers in southern Labrador, could lead to industrial development (such as aluminium smelting) in the area. Locating such a capacity in the vicinity of the fixed link terminus on the Labrador side would be more or less synergistic with the overall objective of government of physically linking the two parts of the province, providing electrical power to the Island from sources in Labrador, and providing an opportunity for social and economic success in northern Newfoundland and Labrador.

9.2 Future Required Activities

In order to progress the study to a full feasibility study and environmental assessment, the following activities would be required:

- Further geotechnical investigation along the proposed alignment. For the feasibility study, this would include the first stage of a two-stage borehole investigation within the Strait. This investigation would be costly due to the water depths involved. The expected cost would be of the order of $10 million. The second stage of the borehole investigation would be undertaken later, in the detailed design period, and could cost up to $20 million.
- Investigation of the ambient environmental conditions particularly along the two shorelines and within the proposed terminus areas.
- Further refinement of traffic projections. This would involve the execution of an origin/destination survey and additional tourism surveys. Considering the relative lack of sensitivity to traffic demand shown for this facility, these surveys may be deemed unnecessary. However, a full environmental assessment may require these surveys.
- Investigation of activities required for a full environmental assessment including public involvement and impact analyses.

The total cost of a full feasibility/environmental assessment study would therefore vary according to the content, certain aspects are essential and are as follows:

• Phase 1 geotechnical investigation allowance for this activity	$10.0 million
• Environmental data collection	$0.5 million
• Study Engineering Scope	$0.5 million
• Full environmental assessment	$4.0 million
Total	$15.0 million

Other activities are considered either optional or may be defined in a separate study as follows:

• Surveys for traffic projection		$0.5 million
• Economic Analysis		$0.3 million
	Total	$0.8 million

The cost estimates presented in this report are to an estimate accuracy ±30%. The result of undertaking the above noted feasibility/enviromental assessment studies would be that the estimate accuracy would be improved to ±20%.