



ICSTI
IRELAND

Irish Council for Science,
Technology and Innovation

Technology Foresight Ireland

Report of the Construction and Infrastructure Panel

Executive Summary

The Segment:

Definition, Relevance and Contribution

The construction industry designs, produces and maintains the built infrastructure which is essential to social and economic development. Economic growth, quality of life and sense of place are directly related to the condition and efficiency of the built infrastructure.

Failure to provide and maintain the built infrastructure will undermine the economy and the social fabric and exclude Ireland from European and global opportunities. The built infrastructure accounts for over 50 per cent of national wealth.

In producing this wealth, construction is a major and consistent contributor to the economy.

Table 1. Construction Industry

Output 1998	£9 billion
<i>20 per cent of GNP</i>	
<i>70 per cent of Fixed Capital Formation</i>	
Direct Employment	105,000 - 7 per cent of Total
Indirect Employment	40,000 - 3 per cent of Total
Total Employment	145,000 - 10 per cent of Total
Exports	IR£800 million
Imports	IR£1,000 million with potential for Substitution

Construction is embedded in the national economy and therefore does not pose the same uncertainties for sustained employment as do the more mobile 'high-tech industries'. Regarded as a low-tech industry, in reality construction is innovative in its design, manufacturing and construction processes and is a significant user and adapter of an extensive range of technologies and it is responsible for a large part of our national heritage. Statistical classifications and its demand driven innovation culture has resulted in understatement of its STI content and activities in official statistics.

Failure to invest in the technological development of this industry will adversely affect its ability to maintain its contribution to the economy, to compete in the developing European and global construction environment and to provide and sustain the physical infrastructure we need between now and 2015. This issue should be taken up with the joint industry and Department of the Environment and Local Government/Construction Industry Forum which was established following the recommendations of the 1997 Strategic Review of the industry.

Trends and Issues

Europe and Ireland are entering a period of great social, political and economic change, particularly as a result of European integration. We find ourselves changing from an industrial to an information society with progressive urbanisation, an increase in households and in individuality. We can afford to aspire to a higher quality of life and economically and socially are placing greater demands on the quality and efficiency of the infrastructure. There are

uncertainties; 30 per cent of the jobs in 2015 may not exist today. **The sustainability of our physical environment is under threat. Conserving non-renewable resources, environmental protection, destruction of cultural heritage are the keywords. Present demand and indications of future growth in population requires a 50 per cent increase in housing output.** Public funding of infrastructural development is being diluted and the challenge is to replace it by public/private and private funding. Mobile capital may not always await the regulatory process. Construction needs to offer more attractive employment in an industry where the liberalisation of the market has increased opportunity and competition and the domestic industry will be more open to external competition. Information Technology (IT) will be a powerful technological driving force.

The principal issue is how can the industry become and be perceived as a competitive state-of-the-art European 21st century industry efficiently producing a sustainable and efficient infrastructure by 2015. For this to happen there must be greater public appreciation of the value of infrastructure to social and economic development and the industry that produces it must seek to achieve high public esteem. In 2015 we need an industry with a culture of quality and excellence equal to the best in Europe, using the best technology and being innovative in producing an infrastructure that also provides affordable housing and meets the special needs of a European economy and an ageing population. Employment in the industry must be safe and attractive with lifelong education and training together with registration of the principal parties to the process. In addition to technology this will require the integrated planning of total infrastructural demand, procurement policies that allow margins for research and development and an efficient harmonised regulatory environment.

Needs relating to quality, efficiency and competitiveness are identified together with the associated technology support and funding.

Strategies

The following strategies address the trends, issues and needs of the sector and are dependent at least in part on science, technology and innovation (STI), education and training. The idea is to start a change that will gather its own momentum and achieve ownership within the industry, the infrastructure and the administration. A target spend of 1.0 per cent of construction output on research and technology development (RTD) by 2015 is recommended. This is comparable with European norms.

Strategy No. 1: Changing the Culture

This has the objective of changing the internal and external perception and practices of construction and infrastructure to one that is more appropriate to the Europe of 2015. It aims to assert that infrastructure is essential to social and economic life, to make employment in construction more attractive and to provide better value on infrastructural development and operations. Steps to foster a culture of excellence and innovation are identified as are the contributions of STI and education in this process.

Strategy No. 2: Information Technology

The objective here is to upgrade the performance of construction by introducing IT in a customised and integrated manner into all aspects of the process. This is also a concern of the Forum for the Construction Industry. The STI and education elements of this strategy are identified.

Strategy No. 3: STI Access and Transfer Centre

The objective is to create a permanent centre/focus for the identification, dissemination, management, transfer and implementation of appropriate new technology and 'best practice' technologies into infrastructural development and maintenance and into the construction process. The centre should be customer and demand driven with a strong element of ownership by the industry. The principal elements are identified.

Strategy No. 4: Improving Competitiveness

This aims at improving and maintaining the competitiveness of construction and infrastructure so that customer and societal expectations for efficiency, quality, performance and life-cycle value are met in a sustainable manner. Relevant mechanisms and STI and education actions are identified.

Strategy No. 5: Increasing Tradeability

The objective is to develop and sustain the tradeability of the knowledge based and niche elements of construction.

The education and practical experience available to Irish architects, engineers and construction managers provides them with a competitive capability for Europe and beyond. There is also the potential for niche sub-contracting and craft inputs and added value building products. Suggested opportunities are identified.

Strategy No. 6: Sustaining and Maintaining the Infrastructure

The built environment represents over 50 per cent of national wealth. It is a substantial user of non-renewable resources in its creation and operation. 28 per cent of construction output is in maintenance, renovation and new uses for old. Proposals are made to promote a sustainability culture and to develop associated technologies, skills and practices.

Strategy No. 7: Materials Technology

The aim is to track and optimise the benefits to construction and infrastructure from advances in materials technology. This area offers potential to develop efficiency, competitiveness and tradeability in construction products. This warrants special treatment by way of structured and focused co-operation to realise the potential and the elements of this are detailed.

Horizontal Issues

A number of horizontal issues are identified and described. These include the public recognition of the function and value of infrastructure and the question of sustainability in the widest sense in the creation and maintenance of the built environment. Materials, energy and transportation are relevant here, as are social issues such as the impact of the construction process and the built environment on the quality of life and the provision of affordable housing.

The integrated management of the total national demand for infrastructure is relevant to balancing the peaks and troughs of construction demand and the quality of what is built. Government has the potential to do this and to set standards as a model client. Procurement policies based on competitive tendering and the fragmentation of the regulatory environment leave little financial margin for the development of the industry and for innovation and sustainability considerations. This issue needs to be addressed.

The impact of IT on the type of infrastructure required and on the operation of the construction industry needs special attention. The transfer of technologies from the materials industry and from other industries are important considerations. Finally all aspects of construction design and manufacture should benefit from the same fiscal incentives for S&T that apply to manufacturing industry.

Required Responses and Follow-up

It is important that a start is made - that the issues of ownership of STI and educational initiatives for construction and infrastructure are addressed as well as the question of sustained funding for such initiatives. A dialogue should be opened with all stakeholders starting with the Forum for the Construction Industry and the declining State investment in STI should be reversed. **Construction and infrastructure must be accorded a change in status to qualify for the same range of State and EU assistance for STI and for industrial development.**

Funding mechanisms are outlined for the proposed strategic initiatives in this report. These include start-up funding from the S&T budget of OST (Office of Science and Technology) and continuing funding from charges on industrial development and construction. This should be associated with the industry having the major influence on the funded programmes.

Indicative costs are given which amount to a total of IR£696 million based on an average spend of 0.5 per cent of output over the 15 year period to 2015. It is proposed that 60 per cent of this is borne by industry and 40 per cent by the public sector. This funding covers the developmental elements of STI, education and training and assistance for trading and company development and for quality and competitiveness.

A programme of enabling initiatives is also outlined.

Finally, it is recommended that a regular structured review be undertaken of progress with the implementation and impact of the strategies and recommendations of this Foresight exercise.

1. Overview

1.1 Segment Definition

The construction industry designs, produces and maintains the built infrastructure for the functioning of social and economic life. Typically it accounts for 20 per cent of GNP and 10 per cent of employment. It has a divided operating structure which reflects its three main components of operation, the design of buildings and facilities, the manufacture of the necessary materials and components and the on-site construction process. The principal segments are residential; non residential such as commercial, industrial, public utilities; productive infrastructure, such as that for transportation, social infrastructure and repair and maintenance. About three-quarters of what is built is unique in design and all is unique in location. Construction activity is geographically dispersed and 60 per cent of firms employ less than 10 people and the top 2 per cent of companies account for one third of output. The industry is customer driven and is perceived as being more of a service industry than a manufacturing one. It operates in a complex regulatory environment.

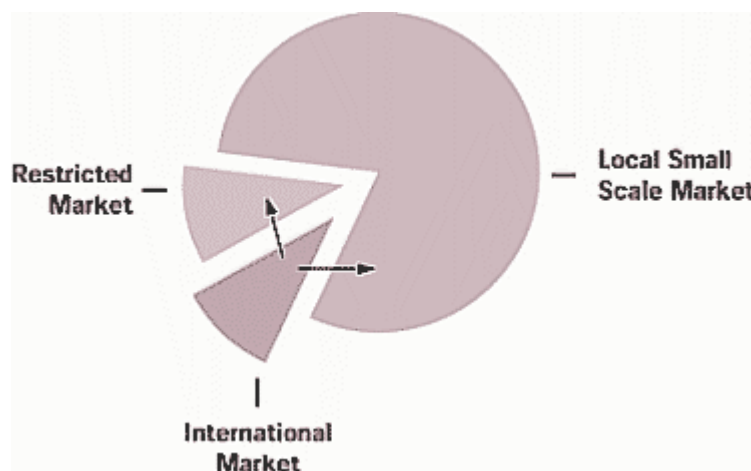
The physical infrastructure or built environment is the fixed capital end product of the construction process. It includes all surface and underground buildings and installations for uses such as residential accommodation, industry, commerce, health, education, energy supply, transportation routes and facilities, drainage, water supply, information technology conduits, parks and waste management facilities. The capacity for economic and social development is directly related to the quality and efficiency of the infrastructure. It accounts for 50 per cent of the national wealth of countries.

Failure to provide and maintain the built infrastructure will undermine the economy and the social fabric and exclude Ireland from European and global opportunities.

1.2 Global

The current value of the world construction market is estimated at e2,500 billion. Figure 1 below gives the approximate segmentation of this market.

Fig. 1. Segmentation of the World Construction Market



The international market for major infrastructural projects is increasing, aided by the developing European Single Market, the disappearance of the Iron Curtain and the progressive liberalisation of world trade. The bulk of the market remains local within national boundaries, where projects are smaller and are not attractive to international competition. Construction companies operating in the global market tend to have in-house RTD or access to such capability in public, private and third level organisations. Products tend to be project specific and there is a high level of innovation and proto-typing.

Research, development and innovation for construction and infrastructure is linked and reported on world-wide by CIB (the International Council for Building Research Studies and Documentation). The principal outputs of CIB are publications and conferences arising from international working groups. These achieve a high level of international dissemination and a modest level of conversion into practice. Ireland is represented by Enterprise Ireland and some others.

Global opportunities for Irish construction outside Europe are expected to be the exception. These opportunities are most likely to be based on aid from the developed to the developing world and related to the more mobile design and project management sector and to a lesser extent to niche building products and specialist sub-contracted inputs to international construction companies. Trade following aid is part of the scenario.

1.3 Europe

The current European (EC and EFTA countries) construction market is valued at e650 billion.

The global profile identified in section 1.2 above applies here also. There are, however, other factors and degrees of emphasis. Europe is in the innovation and wealth driven stages of development and will remain there through 2015. These stages are characterised by dependence on know-how, on a highly educated workforce and on a growing demand for services. In these stages the basic demand for new infrastructure and building is reduced. Driven by this and by the increase in land prices in urban areas renovation and modernisation of the built environment becomes the focus. At present this activity accounts for 45 per cent of construction output in Europe. (Source Ref. No. 13 – Appendix I)

97 per cent of the 1.8 million construction firms employ less than 20 people and account for 50 per cent of employment in the industry.

European research institutes are linked by the European Network of Building Research Institutes (ENBRI) and the Federation of European Highway Research Laboratories (FEHRL). In recent years ENBRI formed a pro-active RTD organisation with the construction industry to integrate research and practice. Ireland is represented in these organisations by Enterprise Ireland and the National Roads Authority. The level of investment in construction R&D amounts to 40 per cent of the average for overall European industry.

European opportunity for the Irish construction industry is similar in profile to the global opportunities in section 1.2 above. In descending order of magnitude these are design and project management, construction products and contracting. These will be returned to later on in the report.




1.4 Ireland

1.4.1 Economic Profile

The current economic profile in the industry is summarised in Table 2 below:

This places construction above agriculture and tourism in output terms.

Table 2. Economic Profile of Construction Industry

Output (1998)	<p>IR£9 billion</p> <p>20 per cent of GNP</p> <p>70 per cent of Fixed Capital Formation</p>	 <p>20% GNP</p>
<p>Direct Employment</p> <p>Indirect Employment</p> <p>Total Employment</p>	<p>105,000 or 7 per cent of employment</p> <p>Direct and Indirect employment</p> <p>145,000 or 10 per cent of employment</p>	 <p>10% Employment</p>
International Trade	<p>Exports IR£800 million</p> <p>Imports IR£1,000 million</p>	 <p>70% Fixed Capital Formation</p>
Funding	<p>Public 32 per cent; underlying trend decreasing</p> <p>Private 68 per cent; underlying trend increasing</p>	

Construction activity is cyclical, reflecting the general state of the economy. Social needs, government policy and EU funding also affect demand. The industry is substantially embedded in the economy and international tradeability of output is low. Tradeability is expected to increase in the period to 2015. As indicated in section 1.3 above, mobility of professional, craft and operative skills could increase through market and technology forces and the Irish construction industry is likely to become a more active participant in Europe.

The industry is highly regulated in relation to physical planning, health and safety, technical performance of the end product and public procurement. In addition, sustainability issues such as the conservation of non-renewable resources and the environment are increasing influences.

The achievement and maintenance of infrastructural needs and standards in the context of effective membership of EU is estimated to involve an expenditure of IR£15 billion over say a 10 year period. In addition there is an estimated potential IR£25 billion for residential

accommodation over the same period. This together with the increasing maintenance and rehabilitation sector indicates a sustained underpinning of construction demand in Ireland in the period to 2015.

1.4.2 Social Status

The social status of the industry derives from its contribution to culture and heritage, to employment and to the provision of infrastructure including housing. However, from outside the process is seen as being environmentally unfriendly and the industry is seen as a poor employer in terms of working conditions such as security of employment, health and safety and the working environment. In addition there is an unacceptable perception of the essential importance of the infrastructure to economic and social life until something goes wrong. Yet some of this infrastructure is and will become part of our heritage. This perception must change.

1.4.3 Technological Status

Statistically, expenditure on R&D is 0.06 per cent of output compared to 1.1 per cent across Irish industry.

This appears to be a distortion arising mainly from classification. R&D statistics concentrate on 'manufacturing' industry and construction is not classified as such. Most R&D is carried out by construction product manufacturers and is classified under manufacturing industry. Innovation in design and construction is conceptual and product driven and is not identified or classified as R&D. Finally public sector investment in construction R&D has declined in recent years.

The reality is different. In order to meet the demands of a growing and informed client base, the industry is innovative and adopts and adapts a wide range of technology and 84 per cent of those working in the industry have either third level, craft or on-job training skills.

A 1994 study² showed that the principle methods used by construction companies for technology acquisition were:

- employing staff with the necessary experience
- attendance of staff at education and training courses
- attendance at conferences, trade fairs and similar events
- in-house S&T programmes
- employing S&T consultants.

The most significant finding was that 40 per cent of companies acquired new technology by the recruitment of staff.

1.4.4 Current Developments

In 1997 the industry, in partnership with the Department of the Environment and Local Government completed a strategic review of the industry and through their joint Construction Industry Forum are currently engaged in implementing the recommendations of that review. The principal recommendation on technology in the strategic review related to the application of information technology throughout the industry. The review provides a context and guidance for this Technology Foresight which is seen as being complementary to it.

2. The Issues and the Forces for Change

2.1 Global

If we are to get a vision of construction and infrastructure of the future we must first get a vision of the society of the future. Mega trends have been identified which operate globally and therefore apply to the European Community and to Ireland. These trends influence the quality, quantity and location of infrastructural needs and determine what and how much is built and where. The most significant of these are:

- Population growth in developed countries is expected to peak around 2030 and in developing countries is expected to continue thereafter but at decreasing rates
- On average moderate world economic growth is expected to continue through 2015
- The sustainability imperatives of life-cycle economics, conservation of non-renewable resources, environmental protection and of cultural heritage
- Society is changing from an industrial to an information one with increasing leisure, an ageing population, a larger number of smaller families and an increase in individuality
- Global warming, the consequent extremes in weather and rising sea levels will require safer infrastructure
- Progressive urbanisation and the urban systems evolving to meet the demand of increased numbers and quality of life
- An increase in the mobility of people and goods and the associated transportation infrastructure
- IT will continue to globalise the design, management and manufacturing sectors and will facilitate increasing prefabrication and a reduction of actions on building sites.

Technology is most relevant to the last six trends.

The principle global uncertainties affecting this segment include the political will and financial capability to upgrade infrastructure in developing countries, the renewal of poor quality infrastructure built this century in Eastern Europe and Russia and the future relationships with China.

2.2 Europe

In addition to the global trends, Europe has its own characteristics. It is in the early stages of great social, political and economic change as a result of European integration, the progressive enlargement of the Community, changes in the emerging democracies of Eastern and Central Europe. It is progressively open to the liberalisation of world trade. The internal driving forces are sustainability, consumer oriented markets, labour conditions and internal and external competition. The significant trends are:

- The internal liberalisation of the construction market assisted by Information Technology and a common regulatory environment
- A continuing trend towards market mechanisms away from government. This to include the progressive privatisation of public services and utilities with public/private participation and funding and turnkey contracting

- The above two trends to produce a tension between the push for a more relaxed regulatory environment and the market demand for quality, efficiency and life-cycle value. This is a powerful force for innovation
- In order to obtain its share of the best people the construction industry needs to improve career development and opportunities, security of employment and health and safety in the workplace
- A progressive buyers market driven by increased personal individuality, high infrastructural standards and world class IT and manufacturing demanding world class facilities
- The 70 per cent of Europeans currently living in the urban infrastructure are part of a trend that is expected to continue unless substantial distance working and learning and the revolt against urban gridlock occurs. The planned European version of the 'city of tomorrow' is anticipating increasing urbanisation, requiring a progressively more integrated urban system. A sustainable balance between urban and rural infrastructures is essential
- The power, opportunity and challenge of information technology, of European industrial and social life and the infrastructure it will require
- The imperative to create and maintain a sustainable infrastructure.

For construction by 2015, the tradeability of design is expected to increase from the present 10 per cent to 25 per cent of output, for materials and products from 15 per cent to 25 per cent and for on-site contracting from 5 per cent to 15 per cent. As in other industries networking will play an increasing part in bidding for and completing international projects.

The cost profile of the built infrastructure is also changing. The indicators are that by 2015 building services may account for over 50 per cent of the cost of buildings with the balance being accounted for by the "constructed" parts, the frame, envelope and surfaces. Increased networking of this progressively 'smarter' infrastructure will continue. This has already occurred with the energy, transportation and telecommunications infrastructure. Water supply, drainage, waste management, utilisation and maintenance of buildings and safety and security of the built environment and of its occupants will join this trend. The networking of the European technology programmes for construction and infrastructure will continue to develop, but with additional emphasis such as:

- sustainability
- identification and implementation of best practice
- public/private sector technology transfer centres
- adopting, adapting and using technologies from other industries
- wider use of levies on construction output and use of infrastructure tolls to fund technological development and education
- greater use of demonstration projects
- horizontal networking with other research domains such as social and environmental sciences, transportation, heritage, IT, materials.

2.3 Ireland

The forces of change that apply to Europe will also apply to Ireland with differing degrees of emphasis. The most relevant of these together with those specific to Ireland are as follows:

2.3.1 Economic

- Cycles in the national and European economies together with the level of multi-national and inward investment are the dominant ongoing forces for change. These determine the amount and quality of infrastructure required nationally and society expectations of the construction industry
- A reduction in recent growth rates is expected between now and 2015
- Structural funds which have underpinned national infrastructural development in recent years are expected to decline and to be replaced by public/private and private funding and partnership. This is expected to continue at an increasing rate
- EMU and convergence of interest rates
- The mobility of capital for infrastructural projects will require a more efficient planning and regulatory process. IT is relevant here
- The rate of growth and renewal of housing
- Competition from Europe, and in particular European companies with local image presence.

2.3.2 Operational

At both European and national level there is acceptance that construction must effect significant cultural and operational changes to efficiently produce a sustainable 21st century infrastructure. This is the principal force for organisational change. The principal elements of this are:

- the call for an attitude of excellence for construction and infrastructure
- the growing requirement for the integration of the construction process and infrastructural management including planning and design, manufacture, construction, maintenance and operation
- the need for a user-friendly efficient and uncompromised regulatory environment from land use zoning to building control
- the availability of state-of-the-art quality manufacturing and management systems and their use by clients of the industry and users of the infrastructure
- higher standards and consumer protection requiring the registration of the principal actors in the construction process
- the developing trend for continuing education and in-service training and updating of skills
- the evolving use of partnering for skills, scale and competitiveness
- the recent establishment of the Forum for the Construction Industry.

2.3.3 Social

There is a need to correct the unsatisfactory historical and distorted social perception of construction and to a lesser extent that of infrastructure. Construction is seen as an industry providing low skilled, low waged employment in nomadic, unhealthy and unsafe working conditions. Historically it is often treated as a non-essential industry capable of being turned on or off in the context of public expenditure and employment. Seen as disruptive, invasive and polluting, an industry of necessity and not a force for economic and social development. Infrastructure is often taken as a given and only noticed when its functioning is interrupted, has insufficient capacity or it appears to cost too much. There is insufficient consciousness of

its role in underpinning social and economic life, heritage and a sense of place. There are pressures within the industry and from its clients and the users of its end product to address this. The following priorities have been identified as needing attention:

- For the Industry
 - *Environmental impact of the construction process*
 - *Health and safety on construction sites*
 - *Employment conditions and career framework*
 - *Non inclusion of a construction and infrastructural element in the civics subjects in primary and secondary education*
 - *Construction waste management*
 - *The provision of affordable housing*
 - *Sustainability*

- For Infrastructure
 - *The interaction between life styles, quality of life, expectations and values in society and the infrastructure*
 - *Economic migration, increased urbanisation and the destruction of the rural scale*
 - *The change from an industrial to an information society*
 - *Sustainability*
 - *Commercial and industrial buildings to cater for 30 - 50 per cent of all jobs that do not exist today*
 - *The availability of housing*
 - *Safety, security and vandal proofing of buildings*
 - *Construction waste management*
 - *Transportation issues*
 - *An ageing society*
 - *Consumer oriented performance based markets*

2.3.4 Technological

There are issues and forces that are technology driven, there are those that are dependent on technology and there are those that depend on industry.

The principal technology driven ones are:

- The potential of IT in its widest application to influence and change the way the construction industry will be structured and will operate in 2015 and the type of infrastructure it will be producing
- Developments in materials technology with the potential for a new generation of smart materials and components based on the new sciences like biotechnology. These will impact on new construction and on the growing repair and maintenance sector
- Developments in manufacturing technology such as prefabrication, robotics, mechanisation and tool technology

The principal technology dependent ones are:

- Sustainability of the construction process and of the built infrastructure
- The health, safety and environmental friendliness of the construction process
- Competitiveness

The ones that depend on the industry are:

- The technological image of the industry and the need to fully categorise and quantify the amount of research, development, innovation and adoption of technology actually undertaken by the industry
- Increased and sustained funding for construction and infrastructure technological research development and innovation.

Significant items include:

- For Construction and Infrastructure
 - *Potential of IT in networking and procurement*
 - *Transfer of technologies from other industries*
 - *Advanced energy systems to reduce consumption/fossil fuels and the production of greenhouse gases*
 - *Integrated building production using state of the art processes*
 - *New forms of infrastructure*
 - *Smart buildings*
 - *Operation and management technologies and systems for infrastructure*
 - *New waste management systems*
 - *A holistic approach to the product and process*
- For Manufacture
 - *Higher performance construction materials*
 - *Progressive off-site pre-fabrication*
 - *Flexible integrated design/manufacturing technologies*
 - *Smart multi-functioning materials and components*
- For Construction
 - *Controlled health and safety systems*
 - *User and environmentally friendly plant and equipment*
 - *Progressive on-site mechanisation, distance assembly robotics and tool-technology*
 - *Adaptable temporary structures for weather proof environmentally friendly working*
- For Repair and Maintenance
 - *Non intrusive repair and maintenance technology*
 - *Smart IT systems for management and maintenance of buildings*
 - *Smart durable maintenance and refurbishment products*
 - *Specialised integrated maintenance and refurbishment, design and project management services*
 - *Specialised refurbishment packages for energy, safety and waste compliance*
- Design
 - *IT integrated design detailing contract documentation systems including buildability and sustainability*
 - *Virtual reality applications.*

The competitive tendering system for construction procurement does not allow margins for the technical development of companies, the industry and the infrastructure. For this reason the cost of R&D and of technology transfer needs to be a transparent component of construction costs.

3. Strategic Questions and Recommended Strategies

3.1 Strategic Questions

Against the preceding background two strategic questions were posed by the Panel. One is market driven, the other is technology driven.

The market driven question is:

“How best can the Irish Construction Industry produce an efficient and sustainable infrastructure and meet the other requirements of the market, together with the economic, social, environmental and regulatory conditions of the world of 2015?”

The technology driven question is:

“How best can the Irish Construction Industry make use of knowledge based and other relevant technologies and product possibilities including those from other industries to develop and sustain a competitive market in the world of 2015?”

3.2 Strategic Approach

The strategic approach is that the physical infrastructure and the industry that creates it will operate to European standards in 2015. The target may be ambitious but the attitude recognises that Ireland will be even more fully integrated into Europe in 2015, that a quality infrastructure underpins our economic and social partnership with Europe and that construction Ireland will be part of construction Europe and will account for 15 to 20 per cent of GNP in terms of output and employment.

3.3 Strategic Vision

The vision of the built infrastructure is that it is an accepted and integrated part of the European infrastructure of 2015. It is one that is user and environmentally friendly, sustainable, maintained, maintainable and efficient. It also provides a sense of place for the individual. Housing is available, industrial parks are environmentally managed and the offices and distance working systems of the information society represent environmental gains for the urban system and for the individual. Technology has reduced the intrusiveness of waste management systems and sewage disposal. Road and rail transportation is a network that has reduced congestion in cities and towns and has completed its primary route development programme. Networking between transportation elements is well established. The built infrastructure is a valued and recognised component of economic and social development and national wealth.

The vision of the industry that produces the built environment, the construction industry, is one that is high in public esteem. It is an industry that uses the best technology to improve the living environment, building beautiful buildings and creating towns in which people are happy to live, work and play, providing good and affordable housing and efficient uncongested infrastructure. People are glad to commission construction in the knowledge that it will be reasonably free of worry and conflict and that the end product is safe, healthy and easy to maintain. School leavers and graduates are eager to enter a prestigious, rewarding, creative and secure career which contributes to improving the environment. Information technology liberates designers and managers for more creative tasks and to select well proven products and constructions. Contractors use IT to bid and network more effectively and to replace the dangerous and difficult site tasks by mechanisation, factory produced components and easy-

to-use materials, leaving craftsmen to use their skills productively. Construction is viewed by government as a tool for underpinning the future society by providing efficient infrastructure when and where it is needed. The Irish industry is capable of selectively competing with and in Europe. It is a profitable industry that provides a margin for research, development and innovation.

The strategies proposed below are directed to move construction and infrastructure towards the above vision.

3.4 Needs

The achievement of the above strategic vision of construction and infrastructure by 2015 requires that the following needs be addressed:

- The built environment needs to be brought up to European standards and form an integrated part of European infrastructure
- Sustainability, culture and practice for infrastructure and infrastructural development to be in place
- The integration and planning of demand for infrastructure and an integrated user-friendly regulatory environment
- Develop the competitiveness of construction in its national and international segments
- Effect a culture change in construction that addresses the above strategic vision and uses the best of appropriate technology to achieve it including new materials technologies
- Optimise the potential of IT in infrastructural development and management and in construction
- Generate sustained systems and funding for the identification, development and use of the technologies and the educational programmes needed to achieve the standards that will be required in 2015
- Change policies towards construction to allow it to benefit from State aids for industrial development and for research and development
- An integrated government/industry approach to the above
- The recognition of the national importance of construction and infrastructure.

3.5 Strategies

3.5.1 Preliminary

The Forum for the Construction Industry, which was established jointly by the construction industry and the Department of the Environment and Local Government in 1997 following the publication of the Strategic Review of the Construction Industry, is currently engaged in overseeing implementation of the recommendations of that review. It is recommended that any actions resulting from this report should be taken in full liaison with the Forum. This being a Technology Foresight exercise the strategies that are proposed below are those which are dependent at least in part on technology, education and training and they have medium to long-term objectives. They are loosely prioritised and are limited in number in recognition of budgetary and other financial realities and the intention is to recommend a few strategies that are likely to be implemented and that will make a difference. The idea is to start a change for the better that will gather its own momentum within the industry, the administration and society. A target spend of 1.0 per cent of construction output on RTD by 2015 is recommended.

3.5.2 Strategy No. 1 – Changing the Cultures

Application

Construction and Infrastructure

Objective:

To change the external and internal perception, culture and practises of construction and infrastructure to ones that are more appropriate to their national and European roles.

Suggested Elements

(Note: S denotes S&T and E denotes Education and Training initiatives)

- Demonstrate that infrastructure is essential to national life, built heritage and national wealth
- Emphasise consumer and environmentally oriented construction and a sustainable infrastructure
- (E)Include construction and infrastructure and built heritage elements in curricula in primary and secondary education including industrial and operational visits
- (S)Publish cost benefit studies on infrastructure
- Promote construction and infrastructure in a manner similar to the current promotion of food and tourism
- (E)Client education and integration with the construction process.
- (S+E)Improve health and safety on sites; progressively introduce new safety technologies and robotics. 'More brain less brawn on site'
- (E)Life long education and training for new technologies and skills
- (S+E)Develop a customised quality and value culture for construction, including adopting state-of-the-art business, world class manufacturing and real quality systems. Support this with relevant education and training
- (S)Public sector to act as ideal clients using purchasing power and procurement methods to promote quality and innovation
- Promote labelling schemes for construction performance
- Registration of the principal partners to the construction process
- Involve all partners at all levels of infrastructural development and maintenance from policy to client to construction to operative in this strategy
- Foster a culture of innovation in construction and infrastructure.

Relevant Parties:

Department of the Environment and Local Government, Construction Industry, Council/Forum, Office of Science and Technology (OST), Primary/Secondary and Third Level Education, Third Level Research and Development, EU Framework Programmes

3.5.3 Strategy No. 2 – Information Technology

Application Construction

Objective:

To introduce IT throughout the construction process

One of the recommendations of the strategic review of the construction industry, which was completed in 1997, is for a programme to establish linkages for the introduction of computerised documentation systems for the construction industry. This is to be funded jointly by the Department of the Environment and Local Government and the industry. The Forum for the Construction Industry is progressing this matter.

The Foresight strategy is for the introduction of IT into all aspects of the construction process. The present situation is that there is a wide range of software available and in use for design, management, stock control, quantities, estimating and finance. What is needed is a pro-active process to develop integrated customised and networked systems for construction by building on the existing systems.

Suggested Elements

- (S+E)Develop customised electronic data interchange (EDI) for the whole construction process
- (S+E)Develop customised capability for planning, architectural and engineering design including the use of virtual reality for dialogue with clients and the development of designs
- (S+E)Develop customised systems for project cost management including budget development, estimating, quantity surveying, cash flow, planning and final accounts
- (S+E)Develop customised systems for contracting. These to include project planning, estimating, tendering, project management cost control, statutory payments, sub-contract networking, final accounting. The objective is the 'electronic' contractor
- (S+E)Develop IT back-up systems for the evolving construction and infrastructural development projects and associated funding mechanisms. These include public/private funding, leaseback, tolling and turnkey
- Develop customised decision support systems
- (S&E)Co-ordinate all of the above in a customised IT network for the construction process
- (S+E)Support the network with database information systems for the sector including aspects such as call for tenders, sourcing of skills, products and materials, technical regulatory environment, labour relations criteria, insurance and bonding to name a few
- Educational programmes in construction IT.

Relevant Parties:

Department of the Environment and Local Government, Construction Industry Forum, OST, IT Industry, Department of Education, Third Level R&D, EU Framework Programmes.

3.5.4 Strategy No. 3 – STI Access and Transfer Centre

Application:

Construction and Infrastructure.

Objective:

To create a permanent centre/focus for the identification, dissemination, management, transfer and implementation of appropriate new technology and 'best practice' technologies into infrastructural development and maintenance and into the construction process. The centre to be customer and demand driven with a strong element of 'ownership' by the industry.

Suggested Elements

- (S)Monitoring and assessing new technology and best practice developments and developing associated databases
- (S)Monitoring and assessing co-operative R&D opportunities and funding and providing assistance with participation including the development of consortia for such participation
- (S)Development of demonstration projects
- (S)Maintaining databases on construction related third level and other STI expertise and R&D capability indicating precise specialisations and experience and where necessary networking such capability to meet industrial and infrastructural needs
- (S)Maintaining databases on STI facilities in Ireland and Europe, their applications and capacity, back-up expertise, services offered and availability
- Providing an information and referral service to the above expertise and capability, so as to develop creative linkages with the industry
- (S)Maintaining databases on the technical regulatory environment in Ireland and Europe, such as planning norms, directives, codes, procurement and building regulations, standards and technical certification requirements
- (S)Maintaining databases on certified construction products and processes in Ireland and Europe
- (S)Providing a technology brokerage service including the negotiation of licenses and other technology transfer arrangements
- The service to include the special needs of the small companies operating in the national market.

Relevant Parties:

Department of the Environment and Local Government, Construction Industry Forum, OST, Third Level Education.

3.5.5 Strategy No. 4 – Improving Competitiveness

Application:

Construction and Infrastructure

Objective:

To improve and sustain the competitiveness of construction and infrastructure.

In this context competitiveness is the ability to provide an infrastructure that meets customer and societal expectations for efficiency, quality, performance and life-cycle value.

Suggested Elements

- Develop partnering mechanisms for finance and operation. This includes capability networking, public/private and private/private financing mechanisms and development packages between the financial sector and the construction sector
- (S)Research to test and improve the project related operating structure of the construction industry
- (S+E)Demonstration projects and practical education on project appropriate integration of all actors in the development process. This includes the client, the planning process, design team, product and materials suppliers and maintenance
- (E)Adopt value based life-cycle competitiveness and sustainability approach rather than first cost
- Adopt performance based tendering
- (S)Research and develop more opportunities for off-site prefabrication, multi functional building products and advanced tools and equipment
- (S)Research and adopt low cost infrastructural maintenance technologies
- (S+E)Develop and adopt world class business, manufacturing and quality systems. The objective is to achieve the performance standards required in the end product
- (S)Identify and develop import substitution and export opportunities in the building product and materials sector
- Set targets for increased value in construction in 2015

Relevant Parties:

Department of Environment and Local Government, Construction Industry Council, OST, Third Level R&D, EU Framework Programmes, Enterprise Ireland.

3.5.6 Strategy No. 5 – Increasing Tradeability

Application:
Construction

Objective:
To develop and sustain the tradeability of the knowledge based and niche elements of construction.

The education and practical experience available to Irish architects, engineers and construction managers places them with competitive capability for Europe and beyond. There is also the potential for niche sub-contracting and craft inputs and added value building products.

Suggested Elements

- (S)Identify and develop increased tradeability of the knowledge-based aspects of construction such as design and project management with particular relevance to the use of IT
- (S+E)Identify and develop niche craft based products for quality buildings at home and abroad
- (S)Identify and develop smart multi functional building products with high added value and therefore economically exportable, e.g. multi functional façade elements
- (S+E)Identify and develop niche sub-contracting skills and enterprise, e.g. installing intelligent systems in buildings, traditional stonework and landscaping
- (S+E)Identify and develop capability in infrastructural repair and maintenance technologies (see also next strategy)
- Develop partnering capability for international participation.

Relevant Parties:

Department of Trade and Industry, Enterprise Ireland,(Trade Board, FÁS), Construction Industry Council, Department of Education and Science.

3.5.7 Strategy No. 6 – Sustainable Development - The built environment

Application:
Construction and Infrastructure

Objective:
To improve the contribution to sustainability of the construction process and of its end product, the built environment.

The built environment represents a substantial and relatively stable environmental resource and national asset. Most buildings and physical developments survive for several decades and some survive for centuries. As indicated in section 1.3, 45 per cent of construction output in Europe is in maintenance, renovation, modernisation and in creating new uses for existing buildings. The construction process and its end product is a substantial user of non-renewable resources such as land, geological materials and energy. A sustainability ethos is required for the construction and use life cycle aspects. This requires changes in approach and practice. Such changes and the associated educational programmes, technologies and skills are also tradeable.

Suggested Elements

- Develop policy on sustainability in construction and infrastructure
- (S)Develop qualitative and quantitative norms for sustainability
- (E)Develop and introduce sustainability elements in appropriate third level curricula
- (S)Research adaptations to regulatory environment to facilitate new uses for existing buildings
- Use technologies for low energy consumption in the construction processes and in the operation of the built infrastructure
- Develop improved networks for above and below ground urban services
- Develop and adopt waste management and disposal technologies
- Adopt recycling and deconstructing technologies
- (S)Identify and develop new and competitive repair and maintenance and restoration technologies and materials
- (S+E)Identify, develop and provide training in associated skills.

Relevant Parties:

Building Materials Federation, OST, Department of the Environment and Local Government, Enterprise Ireland (FÁS) Design Sector, Third Level Education.

3.5.8 Strategy No. 7 – Materials Technology

Application:

Construction and Infrastructure

Objective:

To track and optimise the benefits to construction and infrastructure from advances in materials technology.

Construction has always been a strong user and adopter of technologies and the building products and materials sector of the industry is most engaged in R&D. In addition, the Construction Products Directive (CPD) provides a progressively more harmonised regulatory environment for the introduction of new and innovative construction products in the EU. Historically and healthily, a push-pull relationship has existed between manufacturing and the rest of the sector. The materials sector has seen construction as a large market opportunity and designers and builders have seen products as solutions to performance requirements. However, materials and manufacturing technologies are advancing at an ever-increasing rate and this is expected to continue. This creates the potential for achieving improvements in the efficiency, competitiveness, tradeability, performance and sustainability of construction and infrastructure. What is proposed is a structured co-operation between demand and supply in this area, specifically between the customer, design and contractor on the one hand and the manufacturer on the other.

Suggested Elements

- (S) Establish a materials and manufacturing technology committee including all sectors of the industry, preferably in association with the Forum for the Construction Industry, and third level technology capability. This is to create a synergy between technology supply and demand
- (S) Develop intelligence and dialogue on market, regulatory and social demands on infrastructure
- (S) Develop intelligence and dialogue on the new materials technologies (such as biotechnology) and the potential for smart multi-functional materials
- (S) Increase the multi-functionality and added value of building materials and products and the off-site component of construction
- Address issues such as sustainability, compatibility between related products, toxicity, safety and the integration of the construction process
- Adapt and develop improved waste management technologies
- (S) Undertake common interest RTD programmes
- (S+E) Develop associated databases on technologies and products and information and dissemination facilities for industry and the public.

Relevant Parties:

Construction Industry Forum, Department of the Environment and Local Government, OST, Third Level R&D.

4. Horizontal Issues

The following were the principal horizontal issues:

- The essential social, cultural and economic importance of the built environment and of the industrial process that maintains it is not appropriately recognised, or established as a fundamental part of our culture
- School curricula at primary and secondary education should include the built environment and infrastructure.
- The built environment represents a substantial and relatively stable environmental resource and national asset. It is also a big user of non-renewable resources such as land, geological materials and energy, and ineffective waste management is a pollutant. The development of sustainability technologies and practices are important here. They are also a horizontal priority with particular reference to the materials, energy and transport and logistics segments
- The socio-environmental impact of the construction process and of the built environment is a horizontal issue. This relates to disruption, noise, dust and accidents during construction and to the social and economic consequences of what is built. This impinges on the quality of life, economic efficiency and on the existing and evolving physical heritage.
- Policies and initiatives on physical planning, land use, industrial development, horticulture, tourism, health, transportation, national heritage, coastal protection and environmental protection all impact on what is built, to what standard, when and where. There is a need to integrate the construction requirement of these policies to match it with capacity and to use it to even out construction cycles.
- In this context, government as a client operates separately across many spending departments. The Government as a client for infrastructural development has potential to provide value, promote quality and the development of the industry and to create more cohesiveness in the infrastructure. The Government should become a model client to set standards for other clients
- National and European procurement policies have an important bearing on technical development and innovation in construction and on the quality and efficiency of the built environment. In particular, competitive tendering, which has been given additional impetus by EU public procurement directives, results in a first cost culture and leaves no financial margin for company development, innovation and sustainability considerations.
- The concepts of value, life cycle costing and quality should be given more practical emphasis in procurement policies
- The regulatory environment governing construction and infrastructure needs to be more efficient while remaining effective. A resourced one-stop shop approach covering land zoning, environmental heritage and sustainability requirements, planning permissions, European and local technical and fire requirements is indicated. Conformity costs in time and money leave less for competitive/quality related innovation
- The social issue of the availability of housing needs to be addressed together with the potential contribution of S&T to solutions here. This is horizontal to government policy, fiscal developments and to the housing elements of construction and infrastructure
- There is a need for a structural relationship between the knowledge and IT industry and construction and infrastructure at a number of levels including:
 - The future of knowledge based working and its effect on the demand for the type and amount of infrastructure required

- The adoption of a total IT culture by construction
 - The infrastructural requirements of the information technology network.
- Much of construction innovation occurs in the construction products and materials industry and this will continue. This industry is in the manufacturing sector supplying product solutions to the construction process. Innovation synergy requires integration of this sector with construction and infrastructure. This has special horizontal relevance to the materials sector
- Horizontal technology transfer from other industries and technologies. Potential examples of this are electronic data interchange (EDI), just-in-time production, integrated design and manufacturing. Ideally construction and infrastructure should be included in a national industry-wide technology watch and transfer initiative. This is also covered in the proposed strategy element
- All aspects of construction design and manufacture should benefit from the same fiscal incentives for STI as does manufacturing industry.

5. Required Responses and Follow-up

5.1 Preliminary

The required responses given below relate directly or indirectly to the implementation of the strategies proposed in this report. The Strategic Review of the construction industry, while not directly related to 2015, has dealt with the broader issues facing the industry. The Forum for the construction industry, which was established on the recommendation of that review, is seen here as the potential developmental focus for the future. On that basis any actions arising from this report should be integrated with the work of the Forum on which both the industry and Department of the Environment and Local Government are represented.

5.2 Responses

5.2.1 Making a start

Something must happen as a result of this Foresight exercise and this something must make a difference. A dialogue should be opened with the Forum for the Construction Industry on this Foresight exercise.

5.2.2 Finance

Initial and sustained funding and 'ownership' of STI and associated educational programmes is always difficult and the sustaining of finance particularly so. Governments are wary of commitments that involve open-ended or long-term financial subvention of such programmes, nor has the industry a record of sustained funding of them. **In construction and infrastructure government funding on STI has declined in the last 15 years in a period when State investment on industrial STI has tripled. And the industry is well below the industrial average in this regard. This does not make sense in relation to the national importance of construction and infrastructure. In addition, the industry will be much more tradeable by 2015 and much more open to external competition. For these reasons the construction and infrastructure industries segment must be accorded a change in status for State and EU funding for industrial development and R&D.**

The recommended funding profile is as follows:

- For S&T
 - *Seed funding from the technology support element of structural funds devoted to the development of the infrastructure by Department of the Environment and Local Government*
 - *Seed funding from the S&T budget of OST*
 - *Sustained funding from a levy on infrastructural development (as part of local authority development contributions attached to planning permissions) and on construction output (as in Belgium) as part of statutory fees and charges on construction contracts*
 - *Sustained funding from fees from services and research contracts including those in the EU Framework Programme.*

The levy type proposals for sustained funding will not be popular with clients, developers, the construction industry and governments. In return they must obtain a high level of 'ownership' of the STI programmes and initiatives. The development and funding of STI programmes must be supervised by a board that has the largest representation from construction and infrastructure.

- For industrial development and international trading
 - *Construction to qualify for the same range of supports for industrial development, international marketing and training as does Irish based manufacturing and exporting industry.*

5.2.3 Cost of Implementing the Strategies

The indicative costs given in Table 3 below are based on achieving the target spend on STI and associated developmental activities of 1 per cent of construction output by 2015 recommended in section 3.5.1 of this report. Therefore, an average spend of 0.5 per cent of output over the 15 year period to 2015 is indicated and this amounts to a total of IR£675 million based on the current output of the industry of IR£9 billion per annum. The spend is a developmental one and covers the strategies and strategic elements recommend in Chapter 3. These include the developmental elements of STI, education and training and assistance for trading and company development and for quality and competitiveness. The burden of costs is indicated as being 60 per cent borne by industry and 40 per cent by the public sector. The sources of the funding are those 'relevant parties' identified under each recommended strategy. This means that public funding is expected to come from the Office of Science and Technology, from the EU Framework Programme, the Industrial Development Agencies under the Department of Enterprise, Trade & Employment, the Department of Education and Science, the Department of the Environment and Local Government and other relevant users of the industry such as the Office of Public of Works and the Department of Health.

The application and phasing of funding are shown in Table 3 below.

Table 3. Cost of Recommended Strategies

Year	2000	2005		2010		2015	Total Cost IR£m
Strategy 1: Changing the Culture		5MPA	5MPA	7.5MPA	7.5MPA	7.5MPA	81.25
Strategy 2: Information Technology	10MPA	10MPA	10MPA	5MPA	5MPA	5MPA	112.5
Strategy 3: STI Transfer Centre	15MPA	15MPA	10MPA	10MPA	5MPA	5MPA	150.0
Strategy 4: Improving Competitiveness		5MPA	10MPA	10MPA	10MPA	10MPA	112.5
Strategy 5: Increasing Tradeability			5MPA	5MPA	10MPA	10MPA	75.0
Strategy 6: Sustainable Development	10MPA	10MPA	15MPA	15MPA	5MPA	5MPA	150.0
Strategy 7: Materials Technology	1MPA	1MPA	1MPA	1MPA	1MPA	1MPA	15.0
						Total	696.25

Note: 5MPA = IR£5 Million per annum

5.2.4 First Initiatives

- Open dialogue on this report with Department of the Environment and Local Government and the Forum for the construction industry and develop programme and funding mechanisms (as outlined in 5.2.2 above) together with associated education and training programmes
- Reinforce the dialogue and consultation through a joint Department of the Environment and Local Government/ OST/Forum conference on STI for construction and infrastructure based on this panel report. The objective is to put this subject formally on the agendas of industry, the customer and the State
- Establish a supervisory board on construction RTD and life long education, representative of construction and infrastructure, Department of the Environment and Local Government, OST and 'horizontal' interests such as those relating to sustainability, IT, materials, as mentioned in Chapter 4 above
- Implement the strategies in Chapter 3 starting with Strategy 3 – STI Access and Transfer Centre, Strategy 2 – Information Technology and Strategy 4 – Increasing Competitiveness
- In association with the Department of Education and Science and Enterprise Ireland commence the initiative in relation to an element in education on construction and infrastructure in schools and life long learning in construction
- Adapt public procurement policies to make them RTD friendly, for instance by reducing emphasis on price based tendering.
- Change the eligibility status of construction and infrastructure to that of Irish based manufacturing and exporting industry for publicly funded STI and industrial development supports
- National management of infrastructural development and maintenance programmes to even out cycles and to provide stability for the development of the industry and for STI activities
- Pay particular attention to the special needs of smaller companies operating in the local and niche markets as mentioned in Strategy No. 3.

5.3 Follow-up

A structured review of progress with the implementation and impact of the strategies and recommendations of this Foresight exercise should be undertaken annually covering the following aspects:

- Structures in place
- Funding mechanisms and cost
- Implementation of strategies
- Inputs and outputs
- Assessment by all the parties to the initiative on the impact and achievements
- Future actions.

The first review should be carried out by this Panel, or the supervisory board recommended above.

Appendix I - Selective Bibliography

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Appendix II Panel Members

Mr. Pierce Pigott, Chairman*(s)	Principle (Chairman)*(s)	Pierce Pigott Consulting Engineer
Dr. Sean McDonagh,	(Deputy Chair)*	Dundalk Institute of Technology
Mr. Aidan Burke	Executive (s)	Construction Industry Federation
Mr. Frank Coffey	County Engineer (+)	South Dublin County Council
Mr. Roger Dunwoody	Director	Dunwoody and Dobson
Mr. Barry English	Director	Wintrop Engineering
Mr. Leo Harmon (Alternate Charlie Cullen)	Director	Ascon Limited
Mr. Billy Houlihan	Architect	Cork County Council
Mr. Neil Kerrigan	(s) Head of Division	Enterprise Ireland
Professor Owen Lewis	Professor	NUI - Dublin
Mr. John Nash	Technical Director	Aeroboard Ltd, CRH Group
Professor Philip O’Kane	(s) Professor	NUI - Cork
Mr. Nick Ryan	Senior Adviser	Department of Environment and Local Government
Mr. Ian Roberts	Director	Arup and Partners
Mr. Con Sheehan	Project Manager	ESB International
Mr. Conor Skeehan	(s) Director	CAAS
Mr. James Smyth (Alternate Vincent Traynor, Partner)	Principal	James Smyth Architects
Mr. Fergus Whelan	Industrial Officer	ICTU
Mr. Brian Woods	Partner	McArdle McSweeney Associates
Mr. Seán Dunleavy,	Technical Secretary	Seán Dunleavy Associates
<p>* Due to pressure of business, Dr. Sean McDonagh invited the Vice Chairman, Mr Pierce Pigott to assume the Chairmanship of the Panel, with Dr. McDonagh as Vice Chairman. This was effective from the fifth Meeting on 26th August 1998.</p> <p>(+) Resigned in October 1998</p> <p>(s) Member Scenario Sub-Group</p>		

Appendix III - Respondents to Wider Consultation

Mr. Hugh Brady	Brady, Shipman Martin
Dr. Nael G Bunni	Nael G. Bunni
Mr. Philip Callery	Wexford County Council
Mr. David Casserly	O'Malley Construction
Mr. John Collins	Michael Punch and Partners
Mr. Eamonn Corcoran	P.J. Walls (Civil) Ltd
Mr. Eamonn Delaney	Roadstone Dublin Ltd
Mr. C.V. Devlin	Cork County Council
Mr. Thomas Gibson	Dun Laoghaire Rathdown County Council
Mr. James Hanley	Sligo Institute of Technology
Mr. Liam Hodnett	Cork Institute of Technology
Mr. Dermot Hogan	Joseph Hogan & Sons
Mr. Paul Leech	Paul Leech GAIA Associates Ltd
Mr. Derek Maynard	Building Materials Federation
Mr. Michael McCarthy	Department of Environment and Local Government
Dr. Patrick McCormack	Consultancy and Research Unit for the Built Environment
Mr. Brian O'Mahony	ESB International
Prof. Simon Perry	Trinity College Dublin
Mr. James Pike	O'Mahony Pike Architects Ltd
Mr. Anthony Power	Athlone Institute of Technology
Mr. Colm O'Riain	O'Riain and Associates Architects
Mr. A.P. Smith	Society of Chartered Surveyors
Mr. Joe Twomey	Department of Environment and Local Government
Mr. Henk van der Kamp	University College, Dublin
Mr. Michael Webb	Paterson Kempster & Shortall (Ireland) Ltd

Appendix IV - Participants in Consultation Scenario Workshop

Mr. Colm Bannon	Irish Cement
Dr. Nael G Bunni	Nael G. Bunni
Mr. Aidan Burke	Construction Industry Federation
Mr. Oliver Carrigan	P.J. Walls
Mr. John A. Collins	Michael Punch & Partners
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Mr. Desmond Green	MinChem Environmental Services
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Mr. Michael Webb	Patterson Kempster & Shortall (Ireland) Ltd

Appendix V – Methodology

The methodology that was adopted for the Technology Foresight exercise was that recommended by the Technology Foresight Taskforce. A panel was formed of 19 representatives of all sectors of the construction industry and related planning, environmental, energy, policy and customer interests together with third level research and education. The panel held its first meeting on 29th April 1998. A First View was developed which covered a definition and profile of the segment, the issues and driving forces affecting it and the technology/product possibilities to 2015. Preliminary strategies were identified in relation to two strategic questions covering the needs of the world of 2015. The uncertainties surrounding the segment in this period were also identified. A structured wider consultation process saw the First View being sent to 350 named individuals in organisations in all sectors in and related to the construction and infrastructure domains.

Uncertainties surrounding the segment in the next 15 years or so were clustered by a sub-group of the Panel to construct contrasting scenarios for the world of 2015. These scenarios, hypothetical futures for Ireland in 2015, were used in a Scenario Workshop to validate the strategies for inclusion in the Panel report. This one-day workshop was held on 7th October 1998 and was attended by 41 people with a representative profile similar to that of the Panel.

This together with the wider consultation process allowed the Panel to identify and develop the issues and key strategies for the segment, together with the recommendations for implementation and follow-up. These are included in the final report which was endorsed by the Panel at its last meeting on 10th December 1998. The report was then submitted to Technology Foresight Taskforce. In all the Panel met seven times and the scenario sub-group twice.

Appendix VI - Outline of Scenarios Used in Workshop

Scenario 1

Island Ireland – The Sustainable European – (Equality)

2015. Europe has expanded to the East. Ireland, now a net contributor to EC coffers, suffers mild paranoia about peripherality – Payback time has arrived for some of the short-termism of the former ‘Tiger Economy’. The social divide continues to widen, with high levels of exclusion and unemployment.

However, since 2012 we have had a pragmatic government with the political will to do something about all of this. The platform is to upgrade our national capacity to participate fully in the European opportunity. This is mainly through self-help. Among other things this recognises that the creation of a sustainable quality physical infrastructure underpins our ability to become contributing citizens of Europe. After all next year is the centenary of the Easter Rising!

Scenario 2

Ireland - Keystone in Fortress Europe – (Liberty)

2015: Europe on the defensive. The weakened American and Asian economies tried to use Europe as an economic dumping ground. Europe raised the drawbridge. Selective trade barriers, a halt to economic migration from outside, the expansion of the community to the east halted and administrative decentralisation to mark the boundaries. After all this is the bicentenary of the treaty of Vienna where Europe's boundaries were redefined after Napoleon left.

Ireland is seen as a good citizen of Europe - a contributor to the Community's technology, culture and sustainable development. The new eurocredits system means we remain a nett financial beneficiary. Construction and infrastructural development is now a networked European activity. The government can afford to be laissez faire.

Scenario 3

Ireland: The Global European - (Fraternity)

2015 : An enlarged and confident Europe goes global. Capitalism with an evolving conscience, aid and trade, an open economy, partners of the world. Since 2011 the Community was operating in a sustainable manner and quality of life issues are to the fore – in the global village a dawning awareness that most of the villagers are not doing anything like as well. In the developed world post materialistic fluidity is setting in and with it comes an economically acceptable conscience, Europe's skills and resources could develop the social and economic infrastructures of the second and third worlds. Trade could follow aid. After all it's 60 years since the Marshall Plan started to rebuild Europe after the war!