Japan Society of Civil Engineers Study Tour- October 1995

Graham Dalton

Institution of Civil Engineers, London

1.0 Introduction

In October 1995 I was invited as representative of the Institution of Civil Engineers to visit Japan as guest of the Japan Society of Engineers (JSCE) to undertake a study tour of the Japanese Construction Industry. The visit took place between 1 and 14 October 1995, and was centred on Tokyo and the major industrial / commercial area of Osaka.

This report outlines some of the principal features of the Construction Industry in Japan today, and details some of the conclusions that I have drawn from my meetings and visits. It is not intended to chronicle either the places or people visited.

Given my background as a chartered civil and structural engineer with experience in heavy civil, structural and marine projects, the visit was centred upon sites of that type. The conclusions reached are therefore based upon construction work carried out in those sectors of the overall construction market.

2.0 Organisation of the Construction Industry in Japan

A notable feature of the Japanese Construction Industry is the dominance of a number of very large contracting companies. With total staff numbers in the region of 15,000, each of these is 3 times the size of their UK equivalents. With their large size comes more extensive capability. Each of the 5 major contractors works in all major areas of construction, and has large in-house design and research organisations providing dedicated support for the company's activities.

Projects promoted by government ministries are designed by the ministry (or, increasingly, their consultants), whilst in the private sector design and build is more common. A design organisation in-house of some 1,000 personnel is typical in a large contractor to undertake Design a Build activities, to support tender / proposal work, and for construction detailing of client designs.

The contractors' research organisations, which typically have a budget of $250 million, serve to solve project specific construction problems and to promote research in order to gain a competitive edge in this technology driven marketplace. Whilst a large in-house research faciliy might not be essential from an economic point of view for all the large contractors, they all consider that their research centres project an image of technical advancement that: no one contractor would wish to be the first to relinquish.

A large proportion of Japanese construction is procured by central government ministries and by municipal government, with the Ministry of Construction effectively controlling the

industry. Traditionally, government projects have been fully designed and detailed in-house. However in recent years there has been a move to increase the role of private consultants to carry out detailed design.

Independent consultants comprise a relatively young sector of the construction industry in Japan. With the first firms established in the 1950's, they do not enjoy the status or market share of their equivalents elsewhere in the world. However now that ministries are seeking to slim down their own design capability, the market for consultancy is growing rapidly. Meanwhile, design consultants are endeavouring to increase their project influence by taking on more project management activities than they have done to date. This contrasts with the role of the British Consultant, who has traditionally enjoyed a very high degree of project control, but now finds clients taking an increasing involvement, or appointing an independent project manager, with the consultants' duties reducing towards their core design activities.

The Japanese operate a system of registration for professional civil engineers. Unlike in the UK, however, this is administered by the Ministry of Construction, rather than by the JSCE as a professional body. Registration is a highly sought after qualification - at least amongst those I met and who have achieved it - and there is a surprisingly low pass rate of the order of 15% for the assessment interview and papers. With the increasing use of consultants and possibly a more mobile labour force in the future it is possible that registration will become more desirable for engineers and clients as a recognised form of formal professional qualification.

Large employers in Japan have a renowned policy of lifetime employment for their staff. This is evidenced by the very high level of company loyalty demonstrated by all the people that I met during the tour.

However, with continuing recession and an increasingly competitive market place the security of such a system becomes increasingly difficult to achieve for companies from both financial and strategic reasons.

There is an increasing level of staff mobility, particularly amongst medium and smaller firms, although I was assured that it is unheard of for someone to move from one firm to a direct competitor. Whilst there are clear benefits to be gained from having a loyal and continuous workforce, I felt that there is also a downside to the "one company career". In a competitive environment new members of a company can bring freshness of approach and technique that benefits all, leading existing teams to review or refine current practices.

3.0 Economic Status

The Japanese economy remains in relatively deep depression and shows little sign of recovery in the short to medium term. Real estate values in particular have plummeted in recent years, with an associated impact on construction as developers are left with overvalued land and

reduced Iniquity.

In the case of public works spending, central government has increased its capital works budget to support the construction industry. However this support is far smaller than the downturn in private expenditure, and the total market value is thus reducing. The effect of the recession therefore is felt to a greater extent by those firms whose workload derives principally from the private sector.

Another feature of the current Japanese market is the international pressure for the Japanese to open their domestic market to international competition. Whilst there have been a number of notable instances of outside involvement both through US / Japan trade agreement and latterly through competitive tender, it is clear that for any outside firm to succeed in Japan, it must offer a product or service for which there is currently unfulfilled demand. Whilst to an outsider the Japanese market appears effectively closed, within Japan there is a high level of concern over the perceived threat of foreign competition. This may be compared to the trepidation of industry in European states in the run up to the European open market of 1992.

4.0 Nature of Market

Whilst in Japan I visited a number of very large high profile projects, including the Akashi - Kaikyo suspension bridge, Kansai International Airport, Tokyo Bay crossing and the Tokyo Forum conference and exhibition centre. Whilst there is clearly a large number of such multi million dollar construction projects, this really serves to illustrate the overall scale of the construction industry in Japan, which is approximately ten times that of the UK for twice the population.

It was explained to me that unlike most developed nations, Japan's infrastructure has been constructed almost entirely over the past 40 years, and with the rapid economic growth over that time some systems - particularly water supply and public health - are in many areas inadequate for the current and forecast demand. There are also other possible reasons for the size of the domestic market, arising from the Japanese approach to construction and buildings in general. The European approach to use of a building is to refit, extend or refurbish from time to time to optimise performance of that building within its fixed constraints. The Japanese on the other hand will expect to demolish a structure that is not fully suited to its purpose and reconstruct. The additional cost of construction is (hopefully) then recovered through greater efficiency in subsequent use.

The size of the construction market goes some way toward explaining the number and size of the contractors' research institutes (noted above). In a market where 2 envelope tendering is an established process, and where technical excellence and construction are at least as important as price, the research centres are necessary to provide that technical edge over the competition,

and to ensure that technical solutions proposed are workable and buildable. Nevertheless it is interesting to compare with the UK market. Here a contractor's research centre would be considered an unjustifiable expense, a non -core business, and would have been either closed or sold some years ago.

Notwithstanding other influences, one should not overlook the one further important area of research that applies particularly to Japan. Seismic design. Given the dense population and relative frequency of serious earthquake events, seismic design is a continuously developing science. A lot of research resources are directed towards this key area of activity, both to prove design before construction, and to develop new structural solutions for larger and higher buildings.

Most construction work in the public sector in Japan is tendered to a list of approved contractors, with joint ventures formed at the client's request both to ensure inclusion of approved specialist contractors and to allow smaller contractors to secure part of the work. In the private sector, however, negotiation of contracts based upon long term partnering arrangements between contractor and client, is more common.

The form of competitive tendering is also different to that generally used in the UK. Often, the competitive element lies in the contract preliminaries costs, and possibly in the quantities of materials used for contactor designed elements. Fixed unit rates for work items are then prescribed by the client for all work undertaken on the project.

5.0 Health & Safety

One's initial impression of a Japanese construction site is of cleanliness and tidiness. Indeed a display of potted plants is not unknown outside the site manager's office.

Japanese contractors have been under pressure over many years to achieve high levels of safety on site, motivated by stiff penalties and removal from tender lists applicable following cases of injury and accident.

The quality of temporary works available appeared to be very high, with extensive use made of proprietary systems for walkways, platforms, railings, screens and temporary road surfaces. The good availability of these items immediately makes it easier to achieve an intrinsically safe site to work on.

Of particular note however, is the system of planning and briefing followed on most sites. At the start of each shift all site personnel assemble in a central area where the supervisor of each sub-contractor or workgroup gives a general briefing on the day's work activity, its location, particular risks or hazards, and the precautionary measures to be taken. These details are then displayed on a board (one per subcontractor) for all to see. Later each day, the supervisors again meet to agree the following day's work in detail and to plan out any potential conflict in work

area.

In addition to this planning, particular aspects of safety are targeted on a weekly or monthly basis in an effort to raise overall safety awareness.

Protective clothing is a further area in which site standards are high, with most if not all personnel wearing standard issue overalls with safety harnesses, high visibility jackets etc. as required. A notable omission however is that steel toecap footwear-universally worn on UK sites – is rarely if ever found.

Many labourers and workmen wear rubber soled canvas split toe boots, allegedly for their non-slip properties, whilst others wear relatively lightweight rubber boots.

Mr.Watanabe (left), Mr.Dalton (center), Mr.Yamamoto (right) at construction site

The safety culture is clearly well established in Japanese construction, and I detected far less of the macho tough image that is to be found on any UK site. Because construction costs are not under particularly great pressure (at least by UK standards) contractors can afford to provide the additional labour and resources required to achieve such high standards of safety. It might also be noted that since all contractors apply very similar levels of safety provision then there is no individual cost penalty incurred in competitive situations,

6.0 Engineering and the Environment

I was particularly struck during my visit to Japan by the very different approach between Japan and Europe when considering the environmental impact of any major project.

The impression that I got was that quite extensive measures will be taken to mitigate noise, visual or other impact of a new project - often at very great expense. Nevertheless, the project will proceed. In Europe, where population densities are much less than in Japan, we seem to question far more whether the proposed works should be constructed in the first place - the ultimate impact mitigation!

To European eyes, structural design is often very cumbersome in Japan, primarily as a result of the substantial member sizes that are required to resist seismic forces. This, combined with the tendency for roads and railways to be elevated in urban areas presents a picture of intense urban development.

The Japanese approach therefore seems to be one of modernity, with engineering used to

enhance the quality of life and environmental science used to minimise the impact of that construction in terms of noise and physical pollution. Design does not endeavour to maintain a rural setting or to minimize the development of semi rural land.

A notable feature of any Japanese townscape – especially in the suburbs of Tokyo, are the 20 metre or more high post and netting structures erected to contain golf balls driven from the galleries of multi storey driving ranges. These structures tower over adjacent buildings, and in places are even built on top of those buildings, and are noticeable from great distance. I was told that planning based upon visual guidelines is uncommon at present, and that aesthetic design of structures as a subject is in its infancy.

Clearly there is no equivalent of the Royal Fine Arts Commission used to promote high quality aesthetic design of buildings and integration of structures with their environs.

7.0 Future Opportunities

The construction industry in Japan remains virtually closed to foreign players. The industry has a highly developed domestic capability, with a highly skilled workforce, high levels of technical ability, and at present adequate capacity for the total market demand. In order therefore for foreign companies to enter the Japanese market they must have a particular product, capability or service to offer. If they do have this the rewards are potentially very attractive given the high relative value of the Yen and high construction costs in Japan.

Whilst in Tokyo, I concluded my tour with a visit to a sister company of my own, Schal Bovis. This is currently a relatively small office providing a service in construction management and associated project management, mainly for building development projects. Schal Bovis first worked in Japan under the umbrella of a US j Japan trade agreement. However, since that time they have been successful in winning work in straight competition on an open market. Growth in this environment is slow but steady, and Schal Bovis anticipate a continuing improvement in their market position as their capability comes to the attention of a wider market.

In the domestic market the strength of the principal contractors means that it is unlikely that a foreign company could have any particular capability that would give them a competitive edge and thus an entry into the market. Similarly, design capability - particularly in terms of seismic design - is such that overseas designers would have difficulty in becoming established.

In third countries - particularly south east Asia and the Indian sub-continent there would appear to be significant future opportunity for Anglo Japanese cooperation. For many Japanese contractors working in third countries on Japanese aided projects, there is often a role for UK consultants or suppliers who are familiar with British or other standards, with local practice or local needs.

8.0 Conclusions

There are no magic formulas adopted in Japan which make their construction industry especially efficient or unusual. Its size and apparent success are based on a number of factors reflecting both the nature of the country and Japanese priorities.

Infrastructure in Japan has been developed substantially over the last 50 years to leading international standards. This rapid progress in improving the quality of life leads to a respect for the engineering profession and a high perceived value for construction.

A challenging environment, with limited level land to support a large population, and severe natural effects including typhoons and earthquakes, mean that high quality engineering is essential to support modern life.

The high population density makes construction activity complex, and thus expensive, in urban areas.

By international standards construction costs are high in Japan, and pressure on unit rates is low, Whether continuing recession and pressure to increase competitiveness will result in reduced quality remains to be seen.

At present the Japanese construction market demands high quality, timely completion and value for money in that order of priority. The Japanese attention to detail and rigorous approach in undertaking any project leads to high quality construction. It is this attention to all the details of a project, comprehensive planning and if necessary testing of all aspects that offer the best example to engineers elsewhere in the world.

9.0 Acknowledgements

I would like firstly to express my thanks to the officers of the Japan Society of Civil Engineers for inviting me to undertake this study tour, and for the remarkable efficiency with which they made the extensive arrangements.

I was warmly welcomed by representatives of all the organisations that I visited. It was evident that many people put a lot of effort into ensuring that my visit to their organisation was informative and relevant, and my thanks go to all of those whom I met for the time and effort given.

Mr. N. Kumagai of the JSCE acted as my guide throughout the tour, both during visits and at the weekends also. His patience in answering my questions regarding all things Japanese was highly appreciated.

Finally, I would like to register my appreciation to the directors of my employer, Bovis program Management, for releasing me to undertake this visit.

Graham Dalton, November 1995

Appendix

Schedule of organisations visited and key personnel met

Date	Organisation	Location	Key Personnel
October 2	Japan Society of Civil Engineers Harbour a Port Research Institute	Headquarters, Shinjuku Research Centre, Yokosuka	Dr K Aoki Mr H Kono Mr T Kawamura Mr T Ishizuka Dr Katayama Dr S Noda
October 3	Oriental Consultants	Design Offices Tokyo Port	Dr Seino Mr A Hirotani Miss M Sato
October 4	Shimizu Corporation	Tokyo Central Station Trans Tokyo Bay	Mr Y Watanabe Mr T Gotoh
October 5	Honshu - Shikoku Bridge Authority	Akashi - Kaikyo Bridge	Mr K Imai
October 6	Kajima Corporation Kansai Airport Authority	Kobe Port Reconstruction Kansai International Airport	 Mr T Shimada
October 9	Public Works Research Institute	Tsukuba Science City	Mr T Nakaoka Mr R Oishi
October 10	British Embassy	Tokyo	Dr A COX Mr T Salusbury
October 11	Kajima Corporation	Design Offices Kajima Technology Institute	Mr K Takimoto Dr Kozo Mr M Toida
October 12	Obayashi Corporation	Tokyo Forum New Subway Station, Shinjuku	Mr H Kawamura Mr K Ando
October 13	Schal Bovis	Construction Management Office	Mr E Black Mr J Schoff