

Special New Year's Feature

Overseas deployment of Japanese concrete technology: Issues and future outlook

Panel members:

Eisuke YAMAMOTO:

Civil Engineering Department No. 3, Overseas Branch, Obayashi Corporation.

Handles the Asian market. Was stationed overseas for a total of nine years, primarily handling on-site projects, in Bangladesh, Singapore, South Korea, and UAE (Dubai). Currently involved in construction management for Oceania and island nations of Southeast Asia (Taiwan, Philippines, etc.).

Hiroshi YOKOTA:

Graduate School of Engineering, Hokkaido University.

Worked at the Port and Airport Research Institute until 2009. Traveled to Egypt, Iran, Cambodia, Indonesia, Philippines, and East Timor on short-term assignments as a JICA expert, and served as an instructor in JICA group training programs. Engaged in technical instruction and technology transfer related to harbor maintenance and management at the request of the Ministry of Land, Infrastructure, Transport and Tourism, traveling to Brunei, Indonesia, and twice to Myanmar.

Yasuo INOKUMA:

Engineering Development Department, Corporate Strategy Headquarters, Central Nippon Expressway Company.

Handles the construction and management of expressways in Japan from the standpoint of an ordering party. Spent time in Malaysia as a JICA expert at the Malaysian Highway Authority (1991-1993). Handled technical cooperation services during his time in Malaysia, including technical instruction and technology transfer related to expressway and the development of standard bridge designs.

Yuichi KANEKO:

Nuclear and Thermal Power Civil Engineering Department, Civil Engineering Operation Center, Tokyo Electric Power Services Co.

Involved in study of the structure and durability of aqueduct tunnels of existing thermal power plants in Indonesia and Malaysia. In the JSCE Concrete Committee's subcommittee on international comparison of earthquake resistant design techniques for concrete structures, he handles the area of comparative earthquake resistance design for bridge piers using each country's standards.

International Affairs Subcommittee

Coordinators: Yoshinobu NOBUTA (Kajima Corporation)
Yoshinobu OSHIMA (Kyoto University)

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Nobuta: Thank you for gathering here today. JSCE has a variety of active committees including the Concrete Committee, and international contributions are an important pillar of the activities of each committee. The Concrete Committee includes an International Affairs Subcommittee, whose activities include holding joint seminars with overseas institutions and introducing the Standard Specification for Concrete Structures at international conferences. This newsletter is one of the important functions of this subcommittee, and its purpose is to communicate information on Japanese technology to persons overseas.



Mr. Nobuta

I believe that Japanese concrete technology has reached a level that can fully meet the demands of domestic and international society today. However, with regard to Japan's high level of technological capabilities and the concrete engineers who implement those capabilities, there is still room for improvement concerning international recognition, utilization, and greater activity. For today's panel, we have invited persons who have a variety of experiences and thoughts concerning Japanese technology in other countries. The purpose of this panel discussion is to think about issues and the future outlook for overseas deployment of Japanese concrete technology, and communicate the information gleaned through this dialogue to overseas researchers and engineers by way of the newsletter.

First of all, based on your past experiences, I would like to ask you to share your comments regarding technologies that play a useful role in other countries, Japanese technologies that ought to become more widespread, and technologies that are of interest from the perspectives of other countries.

Inokuma: Some of the Japanese technologies that are strengths from an international perspective would be quality control, PC construction, and earthquake resistance. Japanese technology includes an enormous amount attention to details. When we showed concrete structures that we have made in Japan to persons from completely different fields in Japan, they were impressed at the excellence of our concrete technology. This concrete had a neat surface appearance with very consistent dimensions. It might be an indicator of durability, but I think "More is not always better". With respect to other specific technologies, quite a few outstanding suspension bridges have been built in Asia and elsewhere with Japanese aid; but within Japan, in order to get to that point, we had to go through an era of technologies such as the expansion of non-



Mr. Inokuma

uniform cross sections. Those other countries are now leaping past those technologies to the latest technological developments, but I think that there are also some strong Japanese technologies from the recent past that could be utilized more widely overseas. In addition, there are other good technologies that could be used overseas as well, such as precast segments, high quality high-strength concrete, and so-called high-performance concrete. I think we could do more to promote the use of those technologies in other countries, as an earlier stage than technical standards.

Yamamoto: In a project in Dubai, we used something that was similar to high-performance concrete. However, this decision was not made in relation to the new Japanese standard specifications. That sort of concrete was being manufactured on the ordinary local market.

Nobuta: I suppose permission would have been needed to use high-performance concrete in that case. Would there be any problem in getting permission?

Yamamoto: Of course, the principle is that materials are used in accordance with the specifications; but in this case, it was a grade of concrete that was frequently used by local ready mixed concrete producers, so there was no problem in using it.

Nobuta: I suppose that it must have been costly to use that grade of concrete. How was the cost burden handled?

Yamamoto: Our role was to handle the design and construction plus additional items, so we had to take care of all that on our own. We had initially considered the use of high-performance concrete at the design stage, but we decided not to use it for the sake of cost savings, and the construction work was begun. Then, as reinforcing steel of approximately D51 was being densely wrapped, we found that the space below it was not being filled with concrete. Considering that it would have taken a great deal of time, effort, and space to proceed, we decided that it would be better to switch materials, after all. The cost of switching materials was about the same or a little higher than the cost of not switching, but considering unseen risks, we made the comprehensive judgment that it was better to switch to high-performance concrete.



Mr. Yamamoto

Kaneko: Japan is the world leader in many technologies. Therefore, when the conditions are extremely challenging and risks are so high that a project can only be handled by companies with high technological capabilities, I think that Japanese companies can basically win those kinds of projects, hands down. However, when the conditions are commonplace, it is not necessary to use particularly high technological capabilities, so we won't get anywhere by submitting a proposal of outstanding technical strengths. It is often difficult to win projects overseas just simply on the basis of price competition. Therefore, Japanese companies end up putting a great deal of effort into added value.

Yokota: I agree that Japan is quite advanced in individual technologies, and I'd say that it has reached the top spot in the world. However, it seems to me that Japan is very weak in the area of construction management for the overall process from planning to design and execution.

Nobuta: Aspects such as management and the use of local workers can make a huge difference in whether or not a project proceeds smoothly. If engineers who really have a good understanding of the work methods are there at the worksite, the work can proceed properly and profitably. However, the conditions are different in the case of large-scale construction projects in foreign countries, such as those in Dubai and Algiers which have been attracting so much attention lately. Therefore, in the operation of a construction site, it is important to give consideration to issues related to contracts,

familiarity with contracts, and understanding. It is necessary to respond to the influence of management in addition to technology.

However, I am not saying that it is impossible to be successful on the basis of technology. For example, a variety of proposals were submitted for the tunnel under the Bosphorus strait, and of course cost was an issue, but the project was won by a Japanese corporation, and I think we need to recognize that sort of accomplishment.

Kaneko:

A number of years ago, at an international seminar on earthquake resistant design that was held in Japan, there was an activity where participants developed comparative designs using the standards of various countries. Several conditions were established, and different structures were designed under the respective codes. We had anticipated that the designs would reflect the differences in design standards, but in actuality, looking at the results, there was a stronger effect from the characteristics of the designers themselves. There is currently a trend toward performance-based design around the world, and I think that we have come to a time when it does not really matter which standards are used, as long as the persons creating the design and the persons receiving the design have a shared understanding concerning the results that will be obtained on the basis of the rules and principles, instead of merely designing structures in accordance with a set of standards. It is fine to use JSCE's standard specifications unless there is some reason not to do so, as it may be necessary to use other standards that are determined by laws or contracts. Therefore, I think we ought to make an effort to promote greater use of JSCE's standard specifications overseas as well.



Mr. Kaneko

Nobuta:

One of the activities that JSCE is targeting is to expand the use of Japanese technical standards overseas. Mr. Inokuma, you have indicated that the promotion of Japanese technical standards should be secondary.

Inokuma:

"Secondary" is not really a good expression. Technical standards as a policy are important, because this is a contractual condition with the contracting government. However, since that policy has been in place for a very long time, it is difficult to replace it with another. When I indicated that technical standards are secondary, I meant that it's necessary to clearly explain the approach behind the Standard Specification for Concrete Structures; that is, it's the content of the standards that is important, and as long as the content is sound, any policy can be acceptable.

A comparative design activity was mentioned earlier, and I have participated in comparative design for bridges. At that time, I reflected that although standards exist as a policy, they do not indicate how to handle the detailed aspects such as loads and load configurations. The engineers make judgments as appropriate, and as a result there are going to be variations in the end under the policy. Although there are variations, the amount of difference is small. For these reasons, I don't think it really matters about the policy, even though a great deal of weight is placed on the policy.

Another issue is the question of which standards, specifically, to promote as Japanese standards, and I think that is a difficult question.

- Kaneko: In the Euro Code, ACI, and the like, the main focus is on buildings. If we present the Standard Specification for Concrete Structures as a Japanese standard, and tell people that these are civil engineering specifications, their response is to ask, "How about buildings then?" So the next step is to present building standards. In practically all cases, buildings are still being designed by the allowable stress design method, unlike the case of the Standard Specification for Concrete Structures; so if we say that buildings are something different altogether, that tends to raise a lot of questions in the minds of foreigners, and they wonder what sort of strange place Japan might be. This is not an ideal way to begin a discussion concerning design. I think there are various problems to be solved, including that sort of thing.
- Yamamoto: Speaking from my own experience related to construction, after it has been decided that construction work will be based on a certain set of standards, there has never been a decision to switch to Japanese specifications because of some technical problem that arises. Occasionally, when that sort of problem arises, the Japanese specifications have been used for reference purposes. Still, there are great difficulties when presenting the Standard Specification for Concrete Structures to designers or consulting engineers. We can show them what is written in the Japanese specifications, but they are not convinced of its soundness. They are completely unfamiliar with the Japanese specifications, so they have to decide for themselves whether or not they can trust it. They ask probing questions including the background, such as the grounds for what is written in the specifications. I think there is a prior need for an English translation of the specifications. If I had an English version and could present them with that, it would be completely different from my giving them something that I've translated into English myself. I think that an English version of the specifications has to be a requirement.
- Nobuta: The Standard Specification for Concrete Structures is positioned as code for code writers. It indicates the fundamentals, and it can be used as a reference in developing specifications for a particular project. In other words, I think that our basic approach should be to ask them to apply a specific portion of the Standard Specification for Concrete Structures to a specific portion of the construction specifications. I do not believe it is the case that the entire content of the Standard Specification for Concrete Structures can be used for the construction specifications of every structure. In this sense, it is necessary to note the importance of the content of the specifications.
- Yokota: I agree. Because this means standard specifications, it is important to take it to the specifications of individual construction projects.
- Kaneko: In the case of design based on the examination of performance as mentioned above, if both the designer and the party receiving the design can make judgments based on a proper understanding of the background of the standards, then no matter which standards are used, it is important to verify their safety or reliability, etc. However, most people, and even most Japanese engineers, have practically no knowledge of the data on which a formula is based. I think when Japanese engineers sufficiently understand the standards including its background, it opens up to use the standards in the background of the standards would lead to the use of the Japanese standards in foreign countries as well, but that could only be done by a small minority of truly high-level engineers. This may also depend on improving the level of engineers overall.

Inokuma: Speaking of standards, the question of what JSCE is targeting is important. To change the subject somewhat, if the Japanese standards are code for code writers, we need to take Japanese code to the ISO and try to have wording included that is based on the Japanese standards. Unless we set our sights as high as that, no matter how good the Japanese standards are said to be within Japan, I don't think it will be possible to earn worldwide recognition.

Nobuta: Since the subject of ISO has come up, I'd like to ask Dr. Yokota for his thoughts. The specifications have been revised with consideration for ISO, including coordination of terminology; but ISO standards concerning construction methods, for example, are quite different from the Japanese approach, and the conclusion is that since the Standard Specification is Japanese, it is not feasible to completely incorporate the ISO standards.

Yokota: ISO has standards in three major categories: materials & construction, design, and maintenance & management. With a great deal of effort, Japanese standards in areas such as construction and testing methods have been taken to the ISO; but it would not pass if it came to a vote, since Japan as a whole has only one vote. There are performance requirements concerning design within ISO 19338, and these requirements are met by JSCE's specifications, building structural design standards, and pre-stressed concrete standards. The work of revising ISO 19338 will begin soon, and we plan to make a variety of proposals in order to have the approach of performance-based design of the Japanese specifications incorporated more fully into the text at that time. Also, Subcommittee 5 is developing ISO simple design methods for countries that do not have their own design standards; and if we ignore that and consider that it has nothing to do with Japan, the ISO will end up adopting simplified design methods that are based on some other country's standards. That would be highly advantageous for that country, and so Japan must also present some kind of proposal. Personally, I am making preparations to present a proposal on a design method of concrete tank. If that really becomes an ISO standard, I think the specifications' approach of detailed examination of performance could become a little



Dr. Yokota

more widespread in the world. It won't be explicitly stated that this is based on JSCE's standard specifications, but I feel that this would make our work overseas a little easier. We are working on that now in the area of maintenance and management. In order to develop a proposal for an ISO framework based on the maintenance and management section of the specifications, we are working to get other Asian nations involved to initially develop this in the form of an Asian Concrete Model Code, and then submit a proposal to ISO based on that Asian Concrete Model Code.

Nobuta: I understand that there is a perceived need for at least an English translation of the standard specification. In fact, the English version of the Standard Specification for Concrete Structures is already being sold overseas. However, is it being placed at overseas worksites?

Yamamoto: No, it is not.

Yokota: If it isn't being used, it won't sell; and if it isn't sold, it won't be used. This is a difficult problem of which comes first, the chicken or the egg. Therefore, it is decided to distribute it free at the next publishing.

Nobuta: I think the Standard Specification for Concrete Structures should definitely be taken to worksites, because in addition to using it as specifications, it can be used as a reference on construction work, or as a source of technical information.

Next, I would like to move on to the subject of engineers. I would like to hear from you about aspects such as the role of Japanese engineers, their past contributions, issues of technical levels and qualifications of engineers, ways that personnel should be trained with an eye to overseas projects, and the types of engineers who are trusted from a foreign perspective.

Yamamoto: When a Japanese engineer meets people in other countries, qualifications are an important point. I think that it would be advantageous when meeting someone for the first time if Japanese qualifications were really widely recognized, so that people in other countries could immediately understand an engineer's technical capabilities just by looking at his business card. People in other countries also share our general notion of the average Japanese person as being hardworking and highly skilled, but since the actual relationship is that of host and guest, it is not easy for a Japanese engineer to immediately earn recognition among engineers of another country. It may take one or two years of interactions until people think, "If he says so, it must be OK." Things go better once that has happened, but it takes a very long time to get to that point. However, I think the situation would be different if the title of *gijutsushi* [Professional Engineer, Japan] were more widely recognized around the world.



Yokota: I think Japanese engineers are trusted anywhere they go, and most of them do their jobs meticulously. Still, I think it does take time to build trust. In the past, many Japanese engineers have taken the time to gradually build trust, and I think their reputation is a product of that. I think it is important to draw upon your own strengths in order to obtain trust. It's important to have your own convictions and know just where to draw the line. That way, I think that things will go smoothly, although it does take time.

Inokuma: Generally speaking, I think that Japanese engineers give a first impression of having a rather weak presence. People may not be able to understand what they're saying and may not know what qualifications they have. They are really at a disadvantage compared to engineers from other countries, because they are handicapped from starting out in that way, and they need to make a great effort to get their point across with poor English skills. Japanese engineers may or may not be able to overcome this disadvantage, but the only way is to make a beginning wherever they can, with sound

and consistent statements. About the qualifications, for example, it would be nice if everyone had a doctoral degree, but that isn't likely to happen.

Nobuta: The International Affairs Subcommittee has discussed this from the standpoints of both technology and engineers, and some are of the view that it may be necessary to handle and use Japanese technology differently in developing countries than in somewhat mature countries.

Inokuma: There doesn't seem to be a market in mature countries, and even if there were, mature countries have their own consultants and contractors; so I think that the market will be mainly for infrastructure building by countries that can be expected to develop in the future. I believe this applies worldwide, and not only for Japan.

Nobuta: I think Japanese technology can make a valuable contribution in construction projects where advanced technologies are needed both for design and for execution, including projects that are carried out under very difficult conditions such as the tunnel under the Bosphorus strait.

Yamamoto: That's right, there are two kinds of projects: those that require advanced technologies, and those that can be done with general-purpose technologies, in which low cost is the main thing.

Nobuta: What about the potential for markets that require advanced technologies? If there is some potential, I think that we should go after it.

Yamamoto: Yes, that ought to be pursued. In the area of household appliances, when it isn't possible to win based on price, the response from Japan is to increase the added value and sweep aside the competition based on some kind of technology. I think it's the same process as that. Of course, many projects are decided on the basis of price alone, but even when that happens, there are cases in which foreign competitors are unable to match our technologies, and that is why still today, we keep hearing from overseas contractors. Therefore, our outlook does not have to be completely gloomy. As long as we keep on gathering experience, there will definitely be an increase in the work that we can obtain.

Inokuma: It's an advantage if there is some advanced technology that can only be provided by a few Japanese companies, and if the consultant incorporates that technology at the design stage. Since it is a fact that price competition always has to be one of the fundamentals, I think we should focus our efforts more on the consultant's side, and on earlier stages in the process from planning and design to construction.

Yokota: As you implied, it's desirable for the specifications to be written to include technology as added value. We tend to add value even if when it isn't written into the specifications, and ultimately that



is not profitable. The Japanese tend to be meticulous, as someone said earlier, and I think that can sometimes be a misfortune.

Inokuma: The specifications should include proper indications of quality management that will result in a long usable lifetime, and that sort of thing. I think the strength of the Japanese is to provide high quality that extends the usable lifetime, instead of excessive quality.

Nobuta: Thank you. Last, I would like to invite you to exchange views on the subject of communicating information to other countries.

Yamamoto: From our standpoint of construction, it doesn't go smoothly unless you know the situation of the region, so I think it is important to conduct well-founded sales efforts that are grounded in the country's circumstances, while also paying plenty of attention to technical exchange with a local partner. I think that many opportunities still remain for Japanese companies overseas as long as we collaborate with local engineers and take the stance of specializing in advanced technologies and focusing our sales efforts in that area, and I believe we should take that approach.

Inokuma: As I stated earlier, one of Japan's strengths is to provide quality management that will result in a longer usable lifetime. I believe that it is best to focus our sales efforts overseas on these areas which are Japan's strengths, including earthquake resistant design.

Kaneko: I have been involved with the maintenance and management section of the specifications since early on. I think that JSCE includes more foresight and its level is higher as a result of my having clearly pointed out from such an early stage that concrete structures cannot last a very long time without care, and having indicated the importance of carefully providing for the passage of time in the standards and engaging in this kind of study and planning, from very early on. This is also reflected in the Asian Concrete Model Code, so in that sense, one could say that Japanese engineers are making a good effort. Still, I wish that more people in more places around the world would read the specifications. Also, since the act of building something is quite damaging to the environment, it is important to use things for as long as possible once they have been built. For that to happen, it is necessary to build things with a high level of quality; and therefore, Japanese technology can make a contribution in terms of the environment as well.

Yokota: There are various kinds of interfaces with other countries, and I think that we are no longer living in a time when we can focus only on Japan when thinking about things. I expect that we will get results if we show a little more interest in matters related to other countries. Also, even if you have some outstanding technology, no one will take a look if you keep quiet and don't say anything about it. Because Japan is lacking in PR skills, it is important to consider how to promote outstanding technological capabilities. It is necessary to develop an overall system that includes both "hard" and "soft" aspects to offer to other countries, including elements such as PR; because if we really focus only on construction technology, things will not go smoothly with technology alone. I think it's important to take a systemic approach when dealing with many different aspects.

Nobuta: Thank you all for your participation today.