

Project on occupational accident prevention measures implemented for the construction demand related to the Tokyo Olympic and Paralympic Games

Study of occupational accident prevention measures that should be handed down as legacy measures 2021 Report [Excerpt]

Japan Construction Occupational Safety and Health Association

1. Project overview

Construction of competition facilities, infrastructure development, redevelopment and related projects were intensively carried out in preparation for the Tokyo Olympic and Paralympic Games. Pertaining to the investment in construction, actions have been taken to prevent occupational accidents and address various other problems at each site. In light of this, it is desirable to study the actual situation and cases, to leverage findings for future construction projects.

This survey was conducted last year as well, and the same method was used this year to summarize the occupational accident prevention measures that should be handed down as legacy measures.

2. Survey method

Working groups were held with various experts to study the content of the survey itself and how each project was carried out.

A written survey was carried out on the clients and other stakeholders of the Olympic- and Paralympic-related construction projects using a survey form created by the working groups.

In addition, we conducted discovery meetings based on the results of written surveys with two companies.

3. Subjects of the survey

(1) Written survey

	Venue Name	Owner	Type of Construction	Competition/Type
1	Ariake Gymnastics Centre	The Tokyo Organising Committee of the Olympic and Paralympic Games	Temporary facility	[Olympic] Artistic Gymnastics [Paralympic] Boccia
2	Aomi Urban Sports Park	The Tokyo Organising Committee of the Olympic and Paralympic Games	Temporary facility	[Olympic] Cycling (BMX Freestyle, BMX Racing), Skateboarding
3	Odaiba Marine Park	The Tokyo Organising Committee of the Olympic and Paralympic Games	Temporary facility	[Olympic] Triathlon, Swimming (Marathon Swimming 10km) [Paralympic] Triathlon
4	Oi Hockey Stadium	Tokyo Metropolitan Government	Permanent facility	[Olympic] Hockey
5	Sea Forest Waterway	Tokyo Metropolitan Government	Permanent facility	[Olympic] Rowing, Canoe Sprint [Paralympic] Canoe, Rowing
6	Yumenoshima Park Archery Field	Tokyo Metropolitan Government	Permanent facility	[Olympic] Archery [Paralympic] Archery
7	Asaka Shooting Range	The Tokyo Organising Committee of the Olympic and Paralympic Games	Temporary facility	[Olympic] Shooting [Paralympic] Shooting

(2) Discovery meeting




	Venue Name	Owner	Type of Construction	Competition/Type
1	Japan National Stadium (Olympic Stadium)	JAPAN SPORT COUNCIL	Permanent facility	[Olympic] Opening and Closing Ceremonies, Athletics and Football [Paralympic] Opening and Closing Ceremonies, Athletics
2	Ariake Gymnastics Centre	The Tokyo Organising Committee of the Olympic and Paralympic Games	Temporary facility	[Olympic] Artistic Gymnastics [Paralympic] Boccea

4. Survey form content

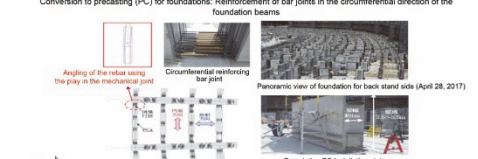

The following 11 items were included in the survey of the clients.

1. Did the Client or other involved party conduct risk assessments or take any other steps during the design stage or review hazards that must be considered during construction to reduce the risk of occupational accidents? Did the owner establish any other systems or measures? If yes, please note the specifics.
2. Was BIM/CIM used during the design and/or construction stages? If so, please provide examples of how the use of BIM/CIM contributed to health and safety during construction.
3. As the Client, are there any hazards you wish the designer had considered during the design stage? If yes, what hazards do you wish had been considered?
4. Was the issue of reducing possible hazards during construction taken into consideration during the design stage? For example, did the Client and designer meet or otherwise coordinate on this issue? In the case of an inclusive order for both design and construction or ECI (early contractor involvement) or other contract, did the Client, designer, and Contractor hold meetings or otherwise coordinate from the initial design stage? If so, what type of issues did this coordination focus on?
5. As the client, do you think that taking the elimination or reduction of risks into consideration from the design stage leads to better health and safety during construction? Please note your opinion regarding this question.
6. Please note the construction methods used and key elements adopted, including the implementation of risk assessments, to eliminate or reduce work risks during the design and/or construction stages. In these cases, please note the stage at which these methods and elements were adopted. (Give examples of constructions and methods that saved labor or mechanized process, including construction cases and new technologies.)
7. Did any measures focus on preventing the falls, collisions, or public injury that often occur during construction work? If so, please note the measures that were taken.
8. Did any measures focus on ensuring a safe, secure, and rewarding worksite for women and younger workers? If so, please note the measures that were taken.
9. Please note any other health and safety measures taken during construction on this project that seem to you, as the client, unique.
10. What occupational accident prevention measures do you wish to see the construction industry retain in the future? These do not need to be examples of measures actually taken. Please note your opinion as a client ordering construction.
11. Please note your impressions of the construction of facilities for the Olympic and Paralympic Games.

5. One example from the survey result (Asaka Shooting Range)

7. Asaka Shooting Range		
<p>Construction Project Name: Tokyo Olympic and Paralympic Games Temporary Overlay Development (Part 6) Asaka Shooting Range</p> <p>Construction site: Nizuka, Niza City, Saitama Prefecture and others</p> <p>Client: The Tokyo Organising Committee of the Olympic and Paralympic Games</p> <p>Designer: NES Overlay Ltd.</p> <p>Contractor: NES Overlay Ltd.</p> <p>Construction period: January 21, 2019 to March 31, 2021 (Construction suspended: June 1, 2020 to December 13, 2020)</p>		
1	<p>Did the Client or other involved party conduct risk assessments or take any other steps during the design stage or review hazards that must be considered during construction to reduce the risk of occupational accidents? Did the owner establish any other systems or measures? If yes, please note the specifics.</p>	<p>⇒Yes</p> <p>(Design stage)</p> <ul style="list-style-type: none"> We took advantage of the features of the design-build method to make sure that safety was fully coordinated with the construction contractor from the implementation design stage and that the plan was fully coordinated. <p>(Other initiatives)</p> <ul style="list-style-type: none"> During the construction stage, in addition to the construction of temporary infrastructure such as prefabricated buildings and tents for operation, seats for spectators, and competition space, various constructions such as bringing in and installing equipment necessary for operation were planned, and we were able to perform different construction operations side by side to each other. Safety management and instructions were implemented by contractors as necessary to prevent accidents, including needed supervision and instructions for the various construction workers entering the construction site. We established contact procedures to quickly ascertain accurate information and to respond appropriately in the event of an accident. We clarified the contact system within the Organising Committee, created a reporting form, and established system for confirming recurrence prevention measures. We established a safety patrol system appropriate to our role as a client. We directly checked the work clothing, protective equipment, work environment and so forth and construction organization documents, as well, at the construction site.
2	<p>Was BIM/CIM used during the design and/or construction stages? If so, please provide examples of how the use of BIM/CIM contributed to health and safety during construction.</p>	⇒No
3	<p>As the Client, are there any hazards you wish the designer had considered during the design stage? If yes, what hazards do you wish had been considered?</p>	<p>⇒No</p> <ul style="list-style-type: none"> Since the representative company of the contractor joint venture was a foreign company and English was often used in the implementation design drawings and study materials, there was a language barrier. For example, when a Japanese construction company of the joint venture created a construction drawing or construction plan, the sharing of study and information related to safe work procedures often did not go smoothly. At the construction site, we asked the contractor to arrange for an interpreter capable of construction technical terms, and had them translate pertinent documents as well as provide interpretation at the site in an effort to prevent occupational accidents.
4	<p>Was the issue of reducing possible hazards during construction taken into consideration during the design stage? For example, did the Client and designer meet or otherwise coordinate on this issue? In the case of an inclusive order for both design and construction or ECI (early contractor involvement) or other contract, did the Client, designer, and Contractor hold meetings or otherwise coordinate from the initial design stage? If so, what type of issues did this coordination focus on?</p>	<p>(Design to reduce risk, meetings between related parties, etc.)</p> <ul style="list-style-type: none"> During the design stage, we, the client, took advantage of the benefits of the design-build method, held regular meetings every two weeks with the designers, contractors, subcontractors, and consultants of the contractor joint venture to ensure communication and coordination, and proceeded with the implementation design by utilizing the collective knowledge of construction and manufacturing to reduce risks. <p>(Content of meetings)</p> <ul style="list-style-type: none"> During the regular meetings, workability and safety considerations were studied to reduce the risk during construction by taking advantage of the benefits of the established systems and structures of the contractor and maximizing the use of design that was already familiar to the construction workers. Actively studying ways to reduce or eliminate construction related risks during the design stage, such as investigating the unit size of steel frame members by backcasting from the transportation and assembly plan for steel frame members is an effective way to improve health and safety during the construction period.
5	<p>As the client, do you think that taking the elimination or reduction of risks into consideration from the design stage leads to better health and safety during construction? Please note your opinion regarding this question.</p>	<ul style="list-style-type: none"> Actively studying ways to reduce or eliminate construction related risks during the design stage, such as investigating the unit size of steel frame members by backcasting from the transportation and assembly plan for steel frame members is an effective way to improve health and safety during the construction period.
6	<p>Please note the construction methods used and key elements adopted, including the implementation of risk assessments, to eliminate or reduce work risks during the design and/or construction stages. In these cases, please note the stage at which these methods and elements were adopted. (Give examples of constructions and methods that saved labor or mechanized process, including construction cases and new technologies.)</p>	<p>(Use of risk assessment to select safer construction methods, and evaluation and improvement of risk reduction measures)</p> <ul style="list-style-type: none"> We used a danger/harm factor identification sheet to categorize the 12 types of construction work (pile work, truss assembly work, membrane structure work, formwork, reinforcement bar work, etc.) to be used during the construction stage for the temporary venue construction to identify those that posed risks of danger or harm We comprehensively studied risk reduction measures during the planning stage, such as ways to eliminate or modify dangerous work. (By selection of construction method, etc.) We used the risk management sheet to classify the items for the temporary venue construction, rig and de-rig frame, loading and unloading, construction machinery, cranes and tools, rig and de-rig soft goods, trusses, rig and de-rig turrets and pile construction. Our plan was to be organized in a way to perform completely different tasks such as installing unit houses, installing security fences, wiring, and developing fields and equipment for competitions. We believe that the staging and coordination of work processes out of consideration for the order of the construction was an important factor for safety management. In addition, in regard to construction projects placed by other departments of the Organising Committee, we carried out process coordination among the contractors with consideration to information coordination with the contractor so that the construction could be carried out safely.
7	<p>Did any measures focus on preventing the falls, collisions, or public injury that often occur during construction work? If so, please note the measures that were taken.</p>	<p>⇒Yes</p> <p>(Prevention of falls and collisions)</p> <ul style="list-style-type: none"> We were able to use a groundwork approach for the ballistic net steel truss assembly work at the clay target shooting site, whereby reducing the amount of aerial work needed. All aerial work was kept at the minimum required and made safer using elevated platforms or aerial work platform vehicles. We trained workers engaged in aerial work such as temporary truss assembly work to use harness-type safety belts Installed lifting equipment with handrails for height differences of 1.5 meter or more (as a rule, we also installed even if less than 1.5 meter in height difference)  <p>(Prevention of public disasters)</p> <ul style="list-style-type: none"> We coordinated the loading and unloading of construction vehicles and assigned security guards to the gate to prevent public disasters with third parties.
8	<p>Did any measures focus on ensuring a safe, secure, and rewarding workplace for women and younger workers? If so, please note the measures that were taken.</p>	<p>Women-Oriented Initiatives</p> <p>⇒Yes</p> <ul style="list-style-type: none"> We installed women's toilets Over 50% of the Western-style toilets installed were for female construction workers.  <p>Youth-Oriented Initiatives</p> <p>⇒Yes</p>
9	<p>Please note any other health and safety measures taken during construction on this project that seem to you, as the client, unique.</p>	<p>(Health management of construction workers such as heat stroke prevention and mental health measures)</p> <ul style="list-style-type: none"> The work area for constructing the piles at the clay target shooting site was far from the worker rest area and there was no shade at all, so we installed a tent and cooler box near the work area to allow for appropriate breaks and hydration. We installed water servers and refrigerators in various places such as construction site offices, meeting rooms, and worker stations. We also installed an ice machine in the worker rest area.  <p>(Measures for foreigners involved in the construction work)</p> <ul style="list-style-type: none"> Over 50% of the Western-style toilets installed were for foreign construction workers
10	<p>What occupational accident prevention measures do you wish to see the construction industry retain in the future? These do not need to be examples of measures actually taken. Please note your opinion as a client ordering construction.</p>	<ul style="list-style-type: none"> If the contractor joint venture was a foreign company, we needed to carefully check whether foreign workers had a Japanese license for heavy equipment such as forklifts and had attended the corresponding training. For example, a holder of a forklift license issued by another country could mistakenly think they do not have to take forklift training in Japan. At this site, we confirmed worker qualifications in advance to ensure foreign workers had the proper licenses and training required in Japan.
11	<p>Please note your impressions of the construction of facilities for the Olympic and Paralympic Games.</p>	<ul style="list-style-type: none"> Because the contractor was a foreign company and there were cultural differences, there were some cases where communication was not successful, resulting in partial confusion. In the future when working with foreign companies such as designers, contractors, and consultants, for such construction projects, it is necessary to carefully design the systems in advance to ensure that the ordering method and contract form can be properly used.

6. One example from the discovery meeting survey result (Japan National Stadium)

<p>Q According to the responses, consideration for workability and safety (elimination and reduction of occupational accident risks) based on construction method proposals from the construction team were incorporated during the design stage based on knowledge of construction work (construction technology investigations). In addition, those opinions were proactively incorporated into the actual design. Can you share more details?</p> <p>A (1) Parts that use concentric circles and shared cross-sections and that avoid complicated shapes and details were adopted for all kinds of materials, and in order to proceed with construction in the circumferential direction, we always worked with the same shape, same span, same quantity, and symmetry. This made it possible to use the equipment repeatedly and created a learning effect which facilitated the processes, and improved quality and safety.</p> <p>(2) By incorporating a precast (PC) design for most of the RC and SRC structural parts and receiving approval from the Minister, precast members including foundations could be manufactured at an early stage, thereby significantly reducing the risk of various accidents and disasters as well as saving labor during site frame construction work.</p> <p>Conversion to precasting (PC) for foundations: Reinforcement of bar joints in the circumferential direction of the foundation beams.</p>  <p>Contractor comments There were about 3,500 pieces of foundation beams, and since they were oval, we constructed them at an angle. By using PC for the foundation beams, we were able to decrease the number of workers on site, which also reduced the amount of health and safety management required by the prime contractor.</p>	<p>(3) By anticipating on-site installation using utilization of roof members, we were able to incorporate the member composition, cross section, fit, and so forth into the design after simulating how to build the unit. This made it possible to significantly reduce aerial work. Also, we devised a way to easily join the units, thereby significantly reducing the risk of falls and accidents resulting from falling objects.</p> 
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7. Occupational accident prevention measures that should be handed down as legacy measures

We have summarized the occupational accident prevention measures that should be handed down as legacy measures based on the responses from all seven companies and the discovery meeting survey with two companies.

(1) Health and safety measures by clients:

- In order to effectively utilize the facility as a legacy, we will continue to upgrade the design and construction and BIM information by using BIM from the design stage, with a view to renovating it not only for design and construction but also for versatility after the Olympic and Paralympic Games.
- Thanks to the Design-Build used, on-site verifications that included the clients, designers, and contractors were held starting in the design stage, and regular meetings and task forces were held once a week or every two weeks. During those meetings, the construction period, cost, and safety were fully coordinated with the contractor starting from the implementation of the design stage. Further, information on places where congestion of construction works was expected, on the entry of third parties due to events, and so forth was shared to help prevent accidents from happening.
- The most important thing in preventing occupational accidents is to make sure the construction period is appropriate. Ensuring an appropriate construction period

Most of the important factors of construction depend on whether the construction period is appropriate, such as safety, quality, and cost. Since the construction period for projects for events like the Olympic and Paralympic Games, is shorter, it is best that the process flow of planning, ordering, design and construction is systematically advanced in a manner that ensures there is no time strain in the construction work when the baton is finally passed to that stage. This approach was the best occupational accident prevention measure in this worksite.

- In the future when working with foreign companies as a designers, contractors, consultants, and so forth

for such construction projects, it will be necessary to carefully design the systems in advance to ensure that the ordering method and contract form can be properly realized.

(2) Promotion of risk assessment and so forth:

- Frontloading, which examines the prevention of occupational accidents at construction sites starting in the design stage, is effective as an occupational accident prevention measure.
- In a stadium with 3,500 pieces of foundation beams, precasting was able to reduce the amount of labor and made the work of joining components safer. In addition, by reducing man-hours, we were also able to reduce the amount of health and safety management needed.
- At the stadium, where BIM was used, the roof was the main focus, though not the entire area. BIM was useful because there was a cantilever with a 60m overhang, it was oval, and very difficult to construct. Using BIM made it possible to see how the drawings fit, check the dimensions, and study whether the work could be done safely or not.
- In order to reduce the risk anticipated during construction, materials of various survey results (boring survey, soil analysis results, etc.) were presented to the contractor starting in the design stage and reflected in the design conditions for structural calculations for the building. The contractor also checked the site and tried to reduce the risk during construction by confirming whether the design as specified could be constructed at this site without danger. Specifically, starting in the design stage, we anticipated the risks pertaining to the raised part of the H-shaped steel frame built in the coastal area and the frame of the H-shaped structure for installing the video board.
- The design drawing for the closing dike, floodgate, and the attachment part on the north side of the eastern cutoff were 3D modeled (3D-CAD), which was useful for interference checks during the design stage and construction planning during the construction stage. Deepening the understanding of the shape of the structure in the construction plan also contributed to the health and safety of the project. In addition, during the implementation design stage, we decided to reexamine the types of work that involved diving to reduce the associated risks, and to revise the temporary support work (number of girder steps) associated with the construction of the floodgate.
- Actively studying ways to reduce or eliminate construction related risks during the design stage, such as investigating the unit size of steel frame members by working backwards from the transportation and assembly plan for steel frame members was an effective way to improve health and safety during the construction period.
- We used a danger/harm factor identification sheet to categorize the 12 types of construction work (pile work, truss assembly work, membrane structure work, formwork, reinforcement bar work, etc.) to be used during the construction stage for the temporary venue construction to identify those that posed risks of danger or harm.
- Our plan was to be organised in a way to perform completely different tasks such as installing unit

houses, installing security fences, wiring, and developing fields and equipment for competitions. We believe that the staging and coordination of work processes out of consideration for the order of the construction was an important factor for safety management. In addition, in regard to construction projects placed by other departments of the Organising Committee, we carried out process coordination among the contractors with consideration to information coordination with the contractor so that the construction could be carried out safely.

(3) Thorough prevention of fall accidents:

- In the technical proposals at the time we made our orders, we adopted a lift-up method that reduced the amount of aerial work with beams. This reduced aerial work and shortened the construction period.
- In order to reduce the risk of workers falling during construction, the roof shape had a simple one-sided flow to improve workability and was designed with safety in mind.
- All aerial work was kept at the minimum required and the risk of collisions and falls was reduced by using elevated platforms and aerial work platform vehicles.

(4) Creating more attractive construction sites:

- The initiative to post photos of workers sincerely engaged in their work at the construction site and present those photos to the workers and their families was very well received by workers and helped to increase motivation. Many workers provided positive feedback about how this was the first time they had ever shared photos of themselves on the job with their family.
- We installed women-only rest areas and nap rooms. Also, women's social gatherings between JVs (Joint Ventures) of different industries were implemented to create a comfortable working environment for women.
- The young foremen of the prime contractor and subcontractors participated in the monthly foreman's meeting, in which communication with the younger people was proactively supported by giving them an opportunity to feel free to consult about problems in the site, workplace improvement, etc.
- In order to keep aware of everything going on at the entire site, we entrusted the inspection work and reporting to young workers.
- Many staff members worked hard to achieve a single goal with a strong sense of mission to maintain the venue for the Games. It was a very busy but rewarding experience.
- Nurses were stationed at the site and a health counseling room was set up. We consulted with an occupational physician to set up the health counseling room.
- As a measure against heat stroke, water supply stations were set up at various sites and up to about 2,800 liters of drinking water was prepared per day. In addition, we provided light, normal, and strong taste sports drinks as well as roasted barley tea. We also had an air-conditioned mobile rest area (minibus) that moved around the site.

- We trained approximately 350 workers as paramedics. This was done more as a safety awareness initiative than out of a concern that we would really need that many people trained as paramedics, and it proved to be effective in increasing safety awareness.

In this way, it is clear that we were able not only to improve health and safety efforts in the construction stage, but also to expand the health and safety improvement efforts to the clients and designers in the early stages of the project. Such efforts contributed not only to improving health and safety, but also making the design more advanced, making the construction more streamlined and efficient, shortening the overall construction period, and increasing opportunities for women and young people to actively enter the construction industry.

The Tokyo 2020 Olympic and Paralympic Games came to a successful finish, and so it is our hope that these efforts will be retained as legacy efforts and measures that the entire Japanese construction industry can apply going forward, not just for special construction projects like those for the Tokyo 2020 Olympic and Paralympic Games.