Examination Category
(Building Work)
Textbook for
the Written Examination

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Chapter 1: What is Important in the Japanese Construction Site

Chapter 2: Laws and Regulations that Must Be Observed When Working Onsite in Japan

Chapter 3: Construction Work Types and Operations

Chapter 4: Greetings, Terminologies, and Tips on Community Living at Construction Sites

Chapter 1: What Is Important in the Japanese Construction Site

1.1 Teamwork

In construction work, there are many processes before completion. Specialty contractors in various job categories take on work from the general contractor and proceed with their part of the construction, then passing the baton to the next process. Teamwork among specialty contractors is important to ensure a good flow throughout the construction work. During construction, the foreman consults with the site supervisor and gives instructions to the technicians. At construction sites, senior technicians work side by side with less experienced junior technicians to offer them advice.

1.2 Japan's Construction Work Assignments

There are various patterns of work assignments for construction projects in Japan, depending on the scale of the project. For example, a typical large-scale construction project is carried out by a plan similar to that in Figure 1-1, from the ordering of the work to its execution. In small-scale construction projects such as general housing, the client (the person ordering the building to be build) places the order with a construction company, which acts as the prime contractor and proceeds with the housing construction project while managing the specialty contractors.

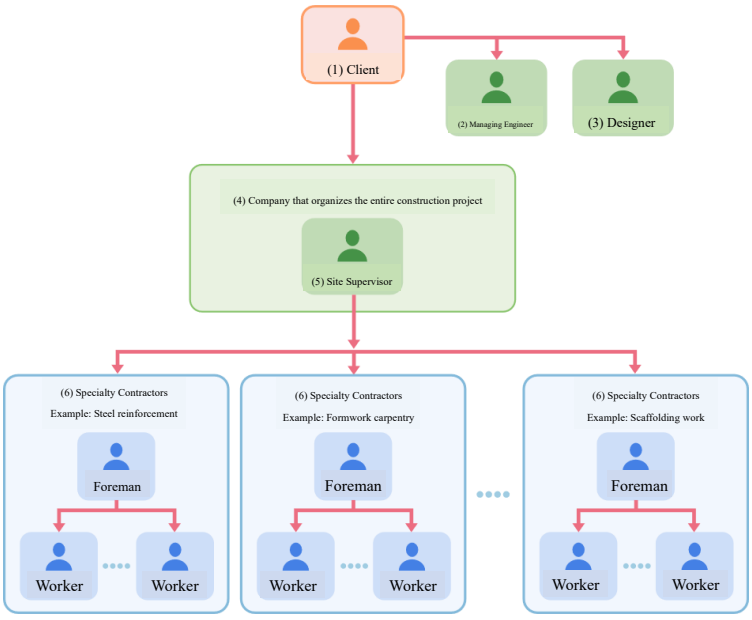


Fig. 1-1 Example of a work assignment

[(1) Hacchusha] (Client)

Asking a contractor to take on a construction project is called *hacchu* (order placement). The organization or company that places that order is *hacchusha* (the client). Examples of clients include the Ministry of Land, Infrastructure, Transport and Tourism, local governments, private companies, and individuals.

[(2) Kanrisha] (Managing Engineer) The engineer in a position to confirm that the construction is being carried out in accordance with the drawings.

[(3) Sekkeisha] (Designer) The engineer who prepares the design documents to realize the requirements of the client.

[(4) Koji zentai wo matomeru kaisha] (The company overseeing the entire project) Commonly referred to as the *zenekon* (general contractor).

[(5) Genba kantoku] (Site supervisor)The engineer who supervises and directs the construction site.

[(6) Senmon koji gyosha] (Specialty contractors) Specialists for each construction process. Several workers will perform the work under the direction of the foreman.

1.3 Construction Career Up System

In Japan, the Construction Career Up System is in place. The Construction Career Up System is being promoted as a system that registers the work performance and qualifications of each technician so as to realize fair evaluation of skills, improvement of construction quality, and streamlining of on-site work. There are four technician levels, and once registered in the system, each technician is issued a card representing their level.

Figure 1-2 Card examples

Figure 1 -3 Career Up System levels and colors of cards

The following three categories are subject to technician evaluation.

- Experience (number of working days)

- Knowledge and skills (qualifications held)

- Management skills (training for registered core engineer/experience as a foreman)

Level 2 requires a minimum of 645 working days (3 years) after system registration, so everyone starts at Level 1.

1.4 Greetings

What is deemed important at construction sites in Japan is to prevent onsite accidents. To this end, a variety of initiatives are undertaken every day. The most basic and important aspect of this effort is greetings. When passing workers in the corridor, it is customary to greet each other by saying “ohayogozaimasu (good morning)” or “otsukaresamadesu (thank you for your hard work)” in the morning. Workers from different job categories greeting each other creates a sense of unity, and this creates a pleasant environment in which to work together. Commonly used greetings include “otsukaresamadesu” and “Goanzenni (Be safe today),” which are explained in detail in Chapter 4.

1.5 Morning Meeting

At Japanese construction sites, a meeting of all workers is held daily before work begins. This is called *chorei* (morning meeting). There are two types of morning meetings: general morning meetings and morning meetings by job category. The primary purpose of both morning meetings, also referred to as *anzen chorei* (safety morning meetings), is to prevent accidents on construction sites.

1.5.1 General Morning Meeting

The general morning meeting mainly consists of the following.


During a morning meeting

(1) Greetings from the site supervisor

The greeting of the site supervisor is intended to promote a sense of unity among the workers and to ensure that the day's work proceeds safely and pleasantly.

(2) Radio calisthenics

Warm up exercises before work awaken the body and mind, thus preventing injury. Radio *taiso* (radio calisthenics) is a series of exercises set to music that is well known in Japan, and are performed at morning meetings. Sometimes it is conducted without music, and in such a case, workers move their bodies while counting “1, 2, 3, 4” loudly.

(3) Confirmation of work content

Each foreman who will be working that day informs everyone of the day's work and personnel placement. Workers of different job categories are working together at the site. It is important for workers in other job categories to know the overview of the day’s work in order to prevent hazards. It also helps to know how it will affect your own work. Also at this time, introductions of new workers (called newcomers) on their first day may be made. If you are being introduced as a newcomer, speak

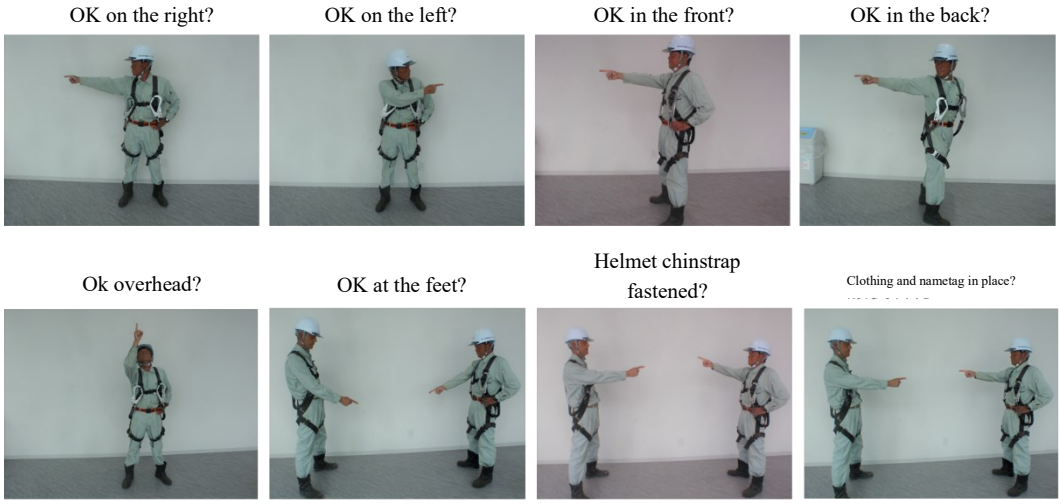
loudly and clearly to state your name, the company to which you belong, etc.

(4) Hazard prediction activities (KY activities)

Hazard prediction activities, also known as KY (Kiken Yochi) activities, are conducted by imagining situations where accidents might occur during the day's work, detecting hazards, and preventing accidents before they occur. In particular, when work is to be performed differently than before, such as when construction materials are to be transported, large construction equipment is to be moved, or new job categories are to be added, take the utmost care in predicting hazards and sharing them with all members of the team.

(5) Checking for safety

Generally, at the end of the morning meeting, the following safety checks are performed out loud in pairs.



Safety check

(6) Greetings and start work

After safety has been checked, everyone says, “kyo mo goanzen ni!” (have a safe day!). The general morning meeting is concluded and the work begins. After this, morning meetings by job categories are held.

1.5.2 Morning Meeting by Job Category

After the general morning meeting, morning meetings by job categories are held.

(1) Safety chant (touch and call)


Touch and call

Everyone says out loud the safety slogan aloud, with fingers pointing. In addition to confirming safety, this helps promote a sense of unity in teamwork. The following is an example of a chant.

“Zero saigai de iko, yoshi!” (Let's achieve zero disasters, good!)

(2) Hazard prediction activities (KY activities)

KY activities

Photo 1-4 KY activities

KY activities related to the entire work site are conducted during the general morning meeting, and similarly, KY activities are conducted before starting work at each job category. KY activities generally follow these steps.

[Danger detection]

Extract *kiken no point* (potential dangers). Have workers speak freely on each task about possible hazardous conditions and actions for today's work content. Sometimes workers are nominated to make a presentation in order to share their dangerous experiences and to increase each person's sensitivity to danger as his or her own, thereby preventing accidents.

[Consideration of countermeasures]

Discuss and formulate countermeasures for each potential danger. Once the countermeasures are determined, write them in the Hazard Prediction Activity Chart.

Hazard Prediction Activity Chart

Group work content		
Potential dangers	Here's what we do.	
Today's safety goals		
Company name		Leader name / Worker people

[Determination of Action Goals]

Decide on the items of particular importance and set them as today's goals.

[Shout out]

All members conduct *shisa kosho* (point and call) at the KY board on which the decided action goals are written, and recite the following.

"XXX, yoshi!" (XXX, good!) "Kyo mo ichinichi anzensagyo de ganbaro! Oh!" (Let's have another day of safe work! Yes!)

Chapter 2: Laws and Regulations that Must Be Observed When Working Onsite in Japan

As a country governed by the rule of law, Japan has many laws. You are probably already aware of the laws that pertain to your daily life, such as road traffic laws. Here are some of the laws that you should be aware of that pertain to the construction industry, with a focus on labor laws.

2.1 Labor Laws

Labor law is the name by which laws on labor issues are collectively referred to. This section provides an overview and key points of basic labor laws that you should be aware of when working in the construction industry.

2.1.1 Labor Standards Act

(1) Overview

Japan is a liberal country, and as a rule, contracts can be concluded freely. However, since workers are in a weaker position compared to employers, the Labor Standards Act has been established to protect them.

Minimum working conditions are set forth in the Labor Standards Act, and any part of the condition that does not meet the standards is considered illegal and subject to the provisions of the Labor Standards Act. Working conditions refer to all treatment in the workplace, including not only wages and working hours but also conditions related to dismissal, accident compensation, health and safety, communal housing, etc.

(2) Key Points

- Deciding Working Conditions

Working conditions are to be determined on an equal footing between employer and worker, and workers and employers are required to keep their promises.

- Equal Treatment

Employers are prohibited from discriminating in wages, working hours, or other working conditions on the basis of a worker's nationality, creed, or social status.

- Prohibition of Forced Labor

Employers are prohibited from forcing workers to work against their will by the use of physical violence, intimidation, confinement, or any other means that unjustly restricts that worker's mental or physical freedom.

- Prevention of Power Harassment

Power harassment is defined as an act of taking advantage of one's superiority in the workplace to cause mental or physical pain or damage the work environment beyond the scope necessary for the job.

Under the Act on Comprehensively Advancing Labor Measures, and Stabilizing the Employment of Workers, and Enriching Workers' Vocational Lives (commonly known as the Power Harassment Prevention Law), it is mandatory to take preventive measures such as establishing a policy stipulating that power harassment is not allowed in the workplace and providing a consultation service. At public institutions, the Labor Bureau has a consultation corner.

- Making the Working Conditions Explicit

Employers are required to clearly indicate the following six items.

(1) Period of labor contracts (2) Criteria for renewal of fixed-term labor contract (3) Place of employment and nature of work to be performed (4) Matters related to end times, overtime, breaks, holidays, and vacations (5) Matters related to wage determination, payment methods, closing dates, payment dates, and salary increases (6) Matters related to retirement and termination of employment

- Prohibition on Establishing the Compensation for Loss or Damage in Advance

It is prohibited to make a contract that stipulates a monetary penalty or establishes the amount of compensation for breaching the labor contract in advance.

- Restrictions on the Dismissal of Workers

A worker may not be dismissed for a period during which he/she is off work for medical treatment for an injury or illness sustained on the job, nor for 30 days thereafter.

- Advance Notice of Dismissal

If a worker is to be dismissed, 30 days' notice must be given.

- Wages

It is required to pay (1) in currency, (2) directly to the worker, (3) in full, (4) at least once a month, and (5) on a fixed date. (Five Principles of Wage Payment)

- Statutory Working Hours

In principle, employees are not allowed to have workers work more than 40 hours per week and 8 hours per day.

- Breaks

If the working hours exceed 6 hours, a 45-minute break must be provided, and if the working hours exceed 8 hours, a 1-hour break must be provided at the same time during the working hours.

- Statutory Days Off

An employer must provide a worker with at least one day off per week.

- Off-Hours Work and Work on Days Off

Off-hours work (overtime) is allowed in cases of temporary need and when a 36 (*saburoku*) agreement (labor-management agreement based on Article 36 of the Labor Standards Act) is concluded and submitted, and the stipulated premium wages must be paid. Temporary needs refer to disaster restoration work. Surcharge rates are 25% or more for regular overtime, 35% or more for work on days off, and 25% or more for late-night overtime.

The maximum overtime hours are 45 hours per month and 360 hours per year. This upper limit takes effect in April 2024 for the construction industry, but it is recommended to adhere to it before 2024 in order to prevent health problems caused by long working hours.

- Annual Paid Leave

Workers who have worked continuously for six months from the date of hiring and have worked at least 80% of the total working days are entitled to 10 working days of annual paid leave, with one working day added for each additional year of continuous service, and after two years and six months, two working days are added for each additional year of continuous service, up to 20 working days.

Years of service	0.5 year	1.5 years	2.5 years	3.5 years	4.5 years	5.5 years	6.5 years or more
Number of days granted	10 days	11 days	12 days	14 days	16 days	18 days	20 days

In addition, it is illegal for employers to buy back paid vacation time that workers did not use.

2.1.2 Industrial Safety and Health Act

(1) Overview

Life, body, and health are of utmost importance to workers, and the purpose of the Industrial Safety and Health Act is to ensure workers' safety and health in the workplace and to facilitate the creation of comfortable work environments so that they will not be harmed by work.

(2) Key Points

- Safety Flags, Etc.

Safety First signs, the Safety Flag (the symbol of the Safety Week), and Safety and Health Flag (the symbol to promote health and hygiene in addition to safety) are displayed at construction sites to remind workers of the importance of zero accidents and zero injuries and to raise awareness regarding safety and hygiene management.

Examples of the Safety and Health Flag

- Responsibilities of the Worker

In order to prevent industrial injuries, workers are required to observe the necessary particulars and cooperate with measures to prevent industrial injuries taken by employers and other related parties.

- Safety and Health Education

Safety and health education is required when new workers are hired or when the nature of the work is changed. In addition, special training, such as the skill training course, is required for crane operation.

- Causes of Work-Related Accidents

Looking at the number of fatalities in work-related accidents in the construction industry in FY2021 by cause, the overwhelming majority were due to Crashes and Falls (110 out of 288), followed by Collapsing/Crumbling (31), Caught-In/Between/Entanglement (27), Traffic Accident (Roads) (25), and Struck-By (19) (-> 7.1 Fatalities in Construction Work). Prevention of Crashes and Falls is important particularly in high-place work, and scaffolds must be erected to provide working platform and enclosures at least 40 cm wide. In principle, the full-harness fall protection gear should be used (see 7.2.4 Equipment for Work Safety).

- Prevention of Heat Stroke

In summer, it is necessary to provide shade, water, and salt lozenges to prevent heat strokes, and to be prepared to respond to emergency situations.

- Risk Assessment and KY Activities

Risk assessment is a method for identifying and eliminating potential dangers or hazards in the workplace. Business operators are obligated to make efforts to prevent occupational accidents by conducting risk assessments and implementing accident prevention measures based on the results of the risk assessments. Hazards are always present at construction sites, and hazard prediction activities (a.k.a. KY activities) are widely practiced to prevent accidents by identifying potential risks that may occur at the site.

- Medical Checkup

Companies are required to conduct medical checkups for their employees. There are *teiki kenko shindan* (regular medical checkups) that must be conducted within a year from the previous checkup, and medical checkups conducted at the time of hiring.

- Stress Check

Workplaces with 50 or more employees are required to conduct stress checks once a year by a physician, public health nurse, or other health professional to ascertain the extent of psychological strain on a regular basis.

2.1.3 Minimum Wage Act

(1) Overview

Minimum wages are established to improve working conditions, stabilize workers' lives, improve the quality of the labor force, and ensure fair competition in business. Employers must pay workers at least the minimum wage, and there are penalties for violations.

(2) Key Points

- Regional Minimum Wages

Since prices and workers' wage levels vary by region, regional minimum wages are determined by prefecture. It applies to all employed workers and their employers at workplaces in each prefecture, regardless of employment status or job category. Minimum wages are publicly announced in the official gazette and notified in various ways such as on the website of each prefectural labor bureau.

2.1.4 Industrial Accident Compensation Insurance (Workers' Compensation Insurance) Act

(1) Overview

When a worker is injured, becomes ill, is left with a disability, or dies as a result of a work-related or commuting accident, workers' compensation insurance provides insurance benefits to the victim or

his/her surviving family. All hospital treatment costs are paid by workers' compensation insurance, and the employer is responsible for all insurance premiums.

In the unlikely event of an accident, priority will be given to rescuing victims after confirming safety. In addition, since the Labour Standard Inspection Offices will conduct an accident investigation to determine whether an accident is work-related or not, it is necessary to keep as accurate and detailed a record of the time, circumstances and condition of the accident as possible.

(2) Key Points

- Occupational Accidents

Occupational accidents are those in which there is a certain causal relationship between the work and the injury, and which are caused by the affected worker's conduct as part of his/her work or by the management conditions of the facilities and equipment at the workplace.

- Commuting Accidents

Commuting accidents are those that occur between the residence and the place of employment, or while traveling from one place of employment to another. The requirement is for accidents to occur on reasonable routes and methods. For example, if you are registered to use a bus but are involved in an accident while riding a bicycle, you are not eligible.

- Medical Treatment Benefits

When receiving medical treatment at a hospital, the cost of the treatment will be covered.

- Payment for Loss of Salary during a Temporary Absence from Work

Benefits are paid when a person is unable to work due to medical treatment for an injury or illness and cannot receive wages.

- Benefits for Surviving Family

In the event of death due to an industrial accident, a pension or lump-sum payment and funeral expenses are provided to the bereaved family.

- Nursing Care Benefits

Benefits are paid when an injury or illness is not yet cured after one year and six months of medical treatment and the patient is still disabled and receiving nursing care.

- Special Insurance Coverage System by Workers' Compensation Insurance

Workers' compensation insurance covers employed workers, but there are some non-workers who deserve protection similar to that of workers, based on the actual nature of their work and the circumstances under which the accident occurred. The special insurance coverage system of workers' compensation insurance was established to protect these workers by allowing them to enroll in the system to the extent that it does not undermine the original intent of the workers' compensation insurance system. Eligible applicants are employers of small and medium-sized companies in the construction industry, their family workers, and independent contractors.

- Injury-Hiding

When an injury or illness occurs as a result of an occupational accident, the employer must submit the *rodosha shishobyo hokoku* (Report on Worker's Death, Illness or Injuries) to the Labour Standard Inspection Offices and apply for workers' compensation. However, employers will experience disadvantages, as companies that have suffered serious industrial accidents are no longer allowed to participate in biddings for public works projects. Therefore, there have been cases where employers chose not to submit the Report on Worker's Death, Illness or Injuries but instead instructed the victims to receive treatment at a hospital using normal health insurance, as if their injuries were caused by their own negligence. This is called *rosai kakushi* (injury hiding), which is a violation of the Industrial Safety and Health Act and a crime. Please do not cooperate with injury-hiding.

2.1.5 Employment Insurance Act

(1) Overview

Employers who employ people are required to have employment insurance. The same applies to foreign nationals. When a person enrolls in the employment insurance, a *koyo hoken hihokenshasho*

(employment insurance card) is issued to the person. Employment insurance consists of *shitsugyoto kyufu* (benefits for unemployment) and *koyo hoken nijigyo* (employment insurance services).

Benefits for Unemployment are benefits (payments) provided to those who have lost their jobs or are undergoing educational training. Premiums are paid by the worker himself/herself and the employer, and are also paid by the national treasury (i.e., by the national and local governments).

(2) Key Points

- Requirements for Employment Insurance Benefits

(1) An insured person (the person with the insurance) of employment insurance has separated from service (left the job) and is in the state of *shitsugyo* (unemployed), meaning that he/she is unable to find a job in spite of his/her willingness and ability to work.

(2) The insured must have been insured for a total of at least 12 months in the two years prior to the date of separation.

In general, when a specified skilled worker with a foreign national becomes unemployed, he/she can receive benefits in the same way as a Japanese national. If you lose your job, you are not required to return to your home country immediately, but can stay until your status of residence expires, as long as you are looking for a job. If you have stayed in Japan without engaging in activities related to *tokutei gino* (specified skills) for more than three months without a justifiable reason, such as staying in Japan for more than three months without looking for a job, your status of residence may be revoked.

- Employment Insurance Benefits

Employment insurance benefits include *kyushokusha kyufu* (job applicant benefits). For the Job Applicant Benefits, basic allowance is provided when a person is unemployed. The basic allowance is equivalent to 45-80% of the daily wage for the six months prior to separation from employment. The number of days for which benefits can be received is between 90 and 360 days, to be determined based on the age on the date of separation from employment, the period of time insured, the reason for separation, and other factors.

2.1.6 Act on the Improvement of Employment of Construction Workers

(1) Overview

Officially, it is the *kensetsu rodosha no koyo no kaizento ni kansuru horitsu* (Act on the Improvement of Employment of Construction Workers). The *kensetsu koyo kaizen keikaku* (construction employment improvement plan) was formulated to improve the employment environment in the construction industry, and it defines basic points for measures to improve employment, develop and improve abilities, and promote the welfare of those working in the construction industry.

(2) Construction Employment Improvement Plan

*The Minister of Health, Labour and Welfare has announced the *dai 10ji kensetsu koyo kaizen keikaku* (Tenth Construction Employment Improvement Plan) for the period from FY2021 to FY2025 (March 2021). The Plan includes the following.

- Recruitment and training of young people

*Secure and develop workers by promoting the Construction Career Up System (CCUS), etc.

- Preparation of a foundation for creating an attractive working environment

*Improve long working hours in anticipation of the implementation of the regulation on overtime work hours with penalties (FY2024)

*Improve wages and promote labor and social insurance enrollment

*Make the full-harness type the general rule for fall prevention equipment for high-place work in order to ensure the use of appropriate protective equipment in accordance with the possible fall distance to prevent industrial accidents.

- Promotion of vocational skills development and skill transfer

*Provide vocational training for personnel who are the future of the construction industry

- Establishment of a system to promote employment improvement

*Promote CCUS, and normalize the new *ninaite-3-po* (the new triple-law for construction work

providers) (the Act on Promoting Quality Assurance in Public Works, the Construction Business Act, and the Act for Promoting Proper Tendering and Contracting for Public Works) in the industry.

*Utilize construction-related subsidies

- Addressing foreign workers

*Improve employment management of foreign workers

*Appropriate acceptance of technical intern trainees and specified skilled workers with foreign nationals

2.1.7 Vocational Abilities Development Promotion Act

(1) Overview

The Vocational Abilities Development Promotion Act aims to enhance the vocational abilities of workers by, for example, improving the content of vocational training and skill tests.

(2) Key Points

- Vocational Training

Vocational training is training to develop and improve the abilities of workers by providing them with the skills and knowledge necessary for their jobs. Vocational training conducted by private employers, etc. that meets legal standards and is accredited by prefectural governors is called Accredited Vocational Training.

- Trade Skills Tests

The Trade Skills Test is a national system that tests the level of skills possessed by workers and certifies these skills by the government. If you pass the Trade Skills Test, you will be issued a Certificate of Passing the Examination, and may call yourself a *ginoshi* (Certified Skilled Worker). As of April 1, 2022, there are 32 different types of Trade Skills Tests in the construction field, with special, first, second, third, and basic grade classifications, or single-grade. There are Trade Skills Test for each job category, but some job categories may not have a Trade Skills Test.

2.2 Construction Business Act

The Construction Business Act was established to contribute to the promotion of public welfare by achieving five objectives. The goal is to promote the sound development of the construction industry by ensuring that both the client and the specialty contractor who undertakes the work sign and execute (perform) an appropriate contract.

Five Objectives

1. Improvement of qualifications of persons engaged in construction business (Construction Business License)

2. Proper contracting for construction work (estimates and contracts)

3. Ensuring proper construction (Chief Engineer and Managing Engineer)

4. Protection of the client (On-Site Agents, Work Ledger, Work Plan)

5. Promotion of sound development of the construction industry

The Construction Business Act requires permits for the following 29 types of businesses.

Civil engineering business / Construction business / Carpentry business / Plastering business / Scaffolding and earthwork business

Masonry business / Roofing business / Electrical construction business / Plumbing business / Tile, brick and concrete block business

Steel structure construction business / Steel reinforcement business / Paving business / Dredging business / Sheet metal business

Glazing business / Painting business / Waterproofing business / Interior finishing business / Machinery and equipment installation business

Heat insulation business / Telecommunication engineering business / Landscaping business / Well drilling business / Fittings business

Water and sewerage facilities business / Fire protection facilities business / Sanitation facilities business / Demolition business

2.3 Building Standards Act

The law establishes minimum rules that must be followed when constructing or using a building. This law was enacted to ensure that rules regarding the construction and use of buildings are observed so that people can live safely and securely. The Building Standards Act consists of two parts: *tantai kitei* (individual provisions) and *shudan kitei* (collective provisions).

[Tantai kitei] (Individual Provisions) Standards are established for the safety and durability of the building itself, earthquake resistance, fire prevention and seismic standards, roofs, exterior walls, lighting and ventilation in living rooms, toilets, performance of electrical equipment, etc.

[Shudan kitei] (Collective Provisions)These provisions are designed to ensure a good urban environment created when buildings are built together in an area. For example, there are standards for sites and roads, building coverage ratio, floor area ratio, height restrictions, various slant plane restrictions, fire prevention districts, and other regulations. In principle, this applies within City Planning Areas and Quasi-city Planning Areas.

2.4 Waste Management Act

The official name of this law is *haikibutsu no shori oyobi seisou ni kansuru horitsu* (Waste Management and Public Cleansing Act). The law was created to protect people's living environment by controlling waste generation and properly disposing of generated waste through recycling and other means.

Gomi (waste) can be divided into two categories: those generated through business activities and those generated by households.

Waste generated through business activities is further divided into two categories: *sangyo haikibutsu* (industrial waste) and *jigyokei ippan haikibutsu* (commercial waste). Construction sites are busy with many contractors coming and going, each generating waste through their construction process that must be disposed of. In order to remove this waste from the construction site, *haikibutsu shushu*

unpangyo no kyoka (waste collection and transportation permit) must be obtained. This is to be done by the prime contractor who receives the construction order directly from the client, with a few exceptions. This alone may cause subcontractors to not properly address industrial waste they generate. Therefore, this law also applies to subcontractors with respect to *hokan* (storage) of industrial waste at construction sites.

The prime contractor is required to prepare a manifest (construction waste control slip) regarding the disposal of industrial waste to confirm the series of processes until the proper final disposal of the waste. Final disposal includes recycling. Workers on site must handle waste according to this manifest.

2.5 Construction Material Recycling Act

The Construction Material Recycling Act is a law that encourages the proper disposal and recycling of waste materials. The official name of this law is *kensetsu koji ni kakawaru shizai no saishigenkato ni kansuru horitsu* (Construction Material Recycling Act). The Construction Material Recycling Act requires that construction waste be separated by material type to promote recycling and reuse. Waste generated at construction sites must be stored in a designated area according to the classification method determined at the site.

2.6 Air Pollution Control Act

The Air Pollution Control Act specifies emission standards, etc., for air pollutants emitted or dispersed from factories and workplaces by type of substance and by type and size of the facility. In addition, when construction work involving demolition, remodeling, or repair of buildings or

structures in which asbestos (specified dust) is used, it requires notification to the prefectural governor at least 14 days prior to the start of the specified particulates emission or other work.

2.7 Noise Regulation Act and Vibration Regulation Act

The purpose of this law is to protect the living environment and to help protect the health of the public by regulating the noise and vibration generated by factories and construction work, and by establishing permissible limits for automobile noise. In designing construction work, the following items must be considered in order to investigate the location conditions around the construction site and to reduce noise and vibration overall.

- Selection of low-noise and low-vibration construction methods
- Selection of low-noise construction equipment
- Planning work hours and processes
- Determining the placement of construction equipment that create noise and vibration
- Installation of soundproofing facilities, etc.

2.8 Water Pollution Prevention Act

This law was enacted to prevent water pollution of public waters and groundwater. When discharging sewage generated from construction sites into sewers or rivers, the standards set by each prefecture must be followed.

2.9 Fire Service Act

The Fire Service Act is intended to

1. prevent, warn against, and suppress fires, and to protect the lives, bodies, and property of the people from fire,

2. mitigate damage caused by fires or earthquakes and other disasters, and

3. maintain order and contribute to the promotion of public welfare by properly transporting people who have become injured or fallen ill due to disasters, etc.

In buildings, regulations are set for fire extinguishing equipment such as fire extinguishers, indoor fire hydrants and sprinklers; evacuation equipment such as evacuation ladders; and alarm systems in order to prevent fires, warn of and extinguish fires, and rescue people from fires.

2.10 Water Supply Act

The Water Supply Act is the law governing waterworks. The law was established to improve public health and living conditions by ensuring a clean, abundant, and affordable water supply. For this purpose, engineers and technicians as stipulated by the Water Supply Act must be assigned and work must be performed under their direction.

2.11 Sewerage Act

The Sewerage Act is intended to promote the sound development of cities, improve public health, and preserve the quality of public waters through the development of sewerage systems. Wastewater that causes the following should not be discharged into the public sewer system.

- It corrodes sewer facilities.
- It generates toxic gases when mixed with other wastewater.
- It clogs the sewer pipes.
- It makes it dangerous to work inside sewer pipes.
- It will reduce the efficacy of the biological treatment in the sewage treatment plant.
- It makes the sludge generated at sewage treatment plants and other facilities difficult to treat and dispose of.

For the above reasons, water with levels of hydrogen-ion concentration, suspended solids, cadmium, lead, total chromium, copper, zinc, etc. above the standard values should not be discharged. Wastewater generated at construction sites includes the following.

- Drainage from washing of batcher plants that produce concrete
- Drainage from washing of fixtures
- Rainwater and spring water that has traveled over/through concrete
- Wellpoint drainage, deep-well drainage (depending on size)

Water that travels over or through concrete becomes highly alkaline wastewater, which requires neutralization treatment with carbon dioxide gas or chemicals.

2.12 Gas Business Act

The Gas Business Act regulates the city gas business, which supplies gas through pipelines, in order to ensure safety and protect gas users. Because gas leaks and improper ventilation can lead to fatal accidents, detailed regulations have been established regarding machines, appliances, and exhaust ventilation used when gas is consumed.

2.13 Electricity Business Act

Electricity can cause fires, equipment accidents, and personal injury if handled improperly. For example, electrical leakage can lead to serious disasters such as fire or electric shocks. The purpose of the Electricity Business Act is to ensure public safety and protect the environment by establishing standards for the proper and reasonable operation of the electricity business, protecting the interests of electricity users and regulating the construction, maintenance, and operation of electric facilities. In addition to the Electricity Business Act, laws and regulations concerning the safety of electrical facilities include the Ministerial Order to Provide Technical Standards for Electrical Equipment

(Technical Standards for Electrical Equipment), the Electrical Appliances and Materials Safety Act, the Electricians Act, and the Act on Ensuring Fair Electric Business Practices (Electric Business Act).

2.14 Telecommunications Business Act

The Telecommunications Business Act regulates telecommunications businesses that provide telecommunications services to subscribers by installing lines and other facilities. The Telecommunications Business Act applies not only to wired communications that pass signals over metal wires, but also to wireless communications and communications via optical fiber. Improper construction when connecting telephones, computers, and other terminals to the telecommunication lines of telecommunication carriers can cause communication line failures. Therefore, it is mandatory that construction work be performed and supervised by *koji tanninsha shikaku* (licensed installation technician).

2.15 Radio Act

The Radio Act is intended to promote public welfare by ensuring the fair and efficient use of radio waves. A license is required for the use of transmitting equipment, depending on the output of the radio waves and the frequencies it uses. It is illegal to use a transceiver that requires a license without a license. The use of transceivers made overseas is also illegal unless they are approved in Japan. It is necessary to observe laws and regulations regarding radio waves at public construction sites and large construction sites where transmitting equipment is used.

2.16 Civil Aeronautics Act

The Civil Aeronautics Act establishes methods to ensure the safety of aircraft navigation and the prevention of obstructions caused by aircraft navigation. Depending on the height of buildings and

construction equipment such as cranes, they may interfere with the safe navigation of aircraft. Obstacle lights must be installed on properties that are 60 meters or higher from the ground or water surface. In addition to height, any property that may obstruct the approach to the airfield or seriously impair the safety of aircraft navigation also requires the installation of obstacle lights.

Recently, unmanned aerial vehicles (drones) have been used for surveying in construction projects. Drones weighing 100 g or more are required to be registered as unmanned aircrafts. There are also rules that must be observed regardless of the no-fly zone (no flying while intoxicated, no flying at night, no flying out of sight, etc.).

2.17 Parking Lot Act

The Parking Lot Act is the law regarding the development of facilities for automobile parking in cities. Its purpose is to facilitate road traffic, thereby contributing to public convenience and maintaining and promoting the functions of the city by stipulating matters necessary for parking facility and equipment. When undertaking parking lot construction, the local government must be notified prior to the start of construction.

Chapter 3: Construction Work Types and Operations

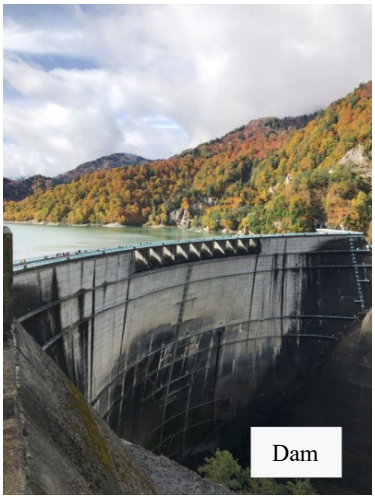
3.1 Construction Work Types

Construction work can be divided into three main types: civil engineering work, building work, and lifeline infrastructure/equipment installation.

3.1.1 Civil Engineering Work

Civil engineering work involves the natural environment, such as oceans, rivers, mountains, and forests. This work creates the infrastructure that supports our daily lives and economy, and includes the following types of construction

[Dam koji] (dam construction) Dams are built to regulate the amount of water flowing into rivers. The two purposes of dams are *chisui* (flood control) and *risui* (water utilization). In flood control, water is stored during heavy rains to adjust the amount of water flowing into the river so that the river does not overflow and cause flood damage. In terms of water utilization, it plays a role in regulating the amount of water available so as to ensure stable water supply in agriculture and industry. Hydroelectric power generation is also conducted at the same time. Japan is a country with many rivers flowing from mountains. There are more than 3,000 dams in Japan that are built for flood control and/or water utilization. Dam construction is a large-scale project, and therefore, roads are built and the flow of the river is changed before the construction of the actual dam begins. Also, a great number of large construction equipment will be used.


Dam

[Kasen/kaigan koji] (river and coastal construction) Various types of construction work for rivers and the sea. This important work protects people and property from disasters and includes construction of breakwaters, tide walls, river revetments, levees, and waterways. The work also includes

preservation and creation of river environments that consider local flora and fauna, in order to preserve the natural environment.


Breakwater


Tide wall

[Doro koji] (road construction) This is the construction of roads for people and vehicles to pass through. Roads include highways, national roads, prefectural roads, and municipal roads. There are also agricultural and forestry roads. In addition to paving the surface with asphalt or cement, a variety of specialized work is performed. Examples include installation of signs and markings, installation of traffic signals and streetlights and the necessary electrical work, landscaping to improve the scenery, brick and block work, construction of sidewalks, and drawing white lines on road surfaces. Currently, there is a lot of work being done to fix the old roads.

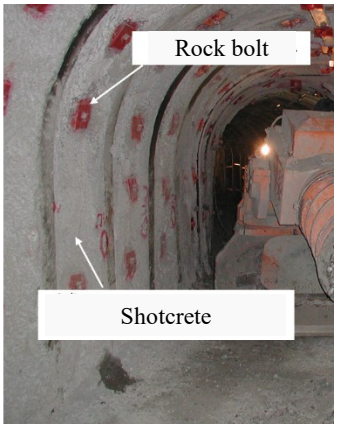

Road construction

[Tunnel koji] (tunnel boring) Tunnels are used in the construction of railroads, roads, waterways, and other infrastructure facilities. There are various types of tunnels and construction methods, and the construction method is selected according to the geological conditions to be dug. There are four types of tunneling methods: the mountain tunneling


Tunnel construction

method, open-cut method, the shield method, and the pipe-jacking method.

[Sangaku tunnel] (mountain tunneling method) Tunnels dug by excavating hard rock mainly in mountainous areas. The tunnel is excavated by blasting or tunnel boring machines, and a method called NATM is used to support the tunnel by installing shotcrete, steel shoring, and rock bolts on the excavated surface.



[Kaisaku tunnel] (the open-cut method) Method of excavating from the ground surface using earth-retaining shoring to prevent the ground from collapsing. This is called *kaisaku koho* (the open-cut method). The tunnel is constructed in the excavated space. In this method, the area outside the tunnel is filled back again after tunnel construction.

[Shield tunnel] (the shield method) The shield method uses a tunneling machine, called a shield machine, which is specially designed for tunnel excavation. First, a shaft is constructed as a base for the shield machine to dig the tunnel. The shield tunneling machine is then launched horizontally from the shaft, and while excavating, concrete or steel panels called segments are assembled at the rear of the machine to build the tunnel. It can be used when digging soft ground, even if there is an existing structure directly above it.

[Suishin tunnel] (the pipe-jacking method) Tunnels that are constructed by attaching a tunneling machine, a lead shield, or a cutting wheel to the end of a factory-manufactured jacking pipe between the launching and receiving shafts, and then thrusting the jacking pipe into the ground from the

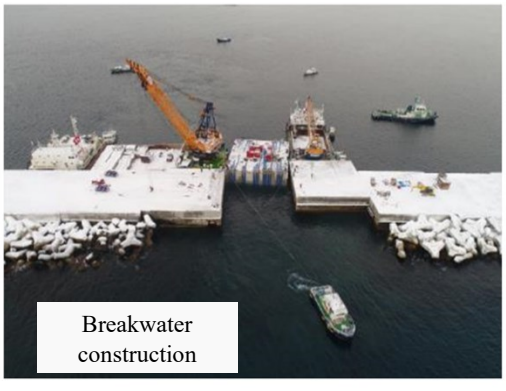
launching shaft using the thrusting force from the jack. The jacking pipes used include concrete pipes, ductile pipes, and steel pipes, and are mainly used for social infrastructure (sewage, water, electricity, communication, gas, etc.) in urban areas.

[Kyoryo koji] (bridgework) What provides passage across oceans and rivers are called *kyoryo* (bridges). Depending on the structure, there are girder bridges, truss bridges, arch bridges, rigid-frame bridges, cable-stayed bridges, suspension bridges, and others. Construction is carried out in two major processes: *kabuko* (the substructure construction) and *jobuko* (the superstructure construction). In the substructure construction, foundations are laid to support the bridge. In the superstructure construction, the main body of the bridge is constructed for vehicles and people to cross. Methods include the bent method, the cable erection method, the incremental launching method, the traveler crane bent method, and the floating crane method. The best construction method is selected for the work depending on the location where the bridge is to be built.


Bridgework

[Kaiyo doboku koji] (marine civil engineering work) Construction of facilities such as ports and airports on oceans and rivers. This includes building port facilities such as quays where ships can dock, breakwaters to prevent waves, safe passage for ships, reclaimed land where factories and other facilities, as well as undersea tunnels, offshore bridges, and other structures such as offshore wind


Panoramic view of the port


Breakwater construction

power generation towers.


Diver

Because marine civil engineering work facilities and structures are very large, construction is done with a large machine called *sagyosen* (work vessels) that can dig the seafloor and lift heavy objects. Another feature of marine civil engineering work is the use of surveying equipment to measure the shape of the seafloor and the use of *sensuishi* (divers), or people who can work underwater in the sea.

[Tetsudo koji] (railroad construction] Construction work completed through the involvement of almost all specialized work related to construction, including not only civil engineering work but also electrical work and building work.

[Josuido koji] (water and sewage works) These can be civil engineering works, water facility works, or sewer pipe works. Civil engineering works here include site development work for water treatment facilities and sewage treatment plants.


Sewage works

[Saigai fukkyu koji] (disaster restoration work) Every year in Japan, roads, rivers, and other civil engineering facilities are damaged by typhoons, torrential rains, earthquakes, and other natural disasters. This construction work is to quickly restore damaged facilities. Various public civil engineering facilities such as rivers, coasts, erosion control facilities, roads, ports, water and sewage systems, etc. are included.


Disaster restoration work

[Sonota no doboku koji] (other civil engineering works) Other works include airport construction, land readjustment, agricultural civil engineering work, erosion control, and forestry civil engineering work.

Airport construction

3.1.2 Building Work

Kenchiku koji (Construction work) is the process of creating buildings necessary for living, including residential homes such as condominiums and houses, buildings, hospitals, schools, and restaurants.

Buildings can be classified by structure as *tekkin* concrete *zo* (reinforced concrete), tekkotsu zo (steel-frame), tekkotsu tekkin concrete zo (reinforced steel frame concrete construction), moku zo (wooden-frame), concrete block-zo (concrete block), etc.

Reinforced concrete buildings are constructed by pouring concrete into a reinforcing steel formwork. A steel-frame building is of a structure that uses steel sections as columns and beams. The difference between the two is that one uses rebars while the other uses steel sections, and the structure that uses both is a called a reinforced steel frame concrete construction. Reinforcing bars are assembled around the steel sections, and concrete is poured to create the building. Wooden-frame structure is a structure often used in general housing, and refers to building structures that use wood for columns and beams. In a concrete block structure, concrete blocks are piled up while reinforcing steel bars are passed through the cavities in the blocks and reinforced with mortar and other materials.

Relatively large scale construction projects such as buildings, condominiums, etc. are carried out in the following sequence.

[Junbi koji] (preparation work) Enclosure is erected around the site where the building is to be constructed, and temporary construction offices and rest areas for construction workers are built. In

addition, electrical and plumbing work for the construction will be conducted.

The site where the building is to be constructed is subjected to a ground survey (boring survey) to investigate the layer that will support the piles (bearing layer). Trial digging is also conducted to determine if there are any underground obstructions or archaeological sites.

[Yamadome koji] (soil retaining structure work) The process of preventing soil walls from collapsing as a result of excavation work is called *yamadome*. A temporary wall is built underground to shore the wall so that it will not collapse (called *shihoko* (shoring)).


Soil retaining structure work

[Kui koji] (piling work) Piles are embedded in the ground to support the building. The tip of the pile should reach the bearing layer in the ground. There are two types of piling methods: *bashouchi concrete kui* (cast-in-situ concrete piles) are made on site, and *kisei kui* (precast piles) are factory-made and delivered to the site.

[Do koji] (earthwork) Excavation of the ground to build structures below ground level. Construction equipment such as backhoes and clamshells are used for excavation. *Zando* (surplus soil from excavation) is removed by dump trucks or other means. It will also be necessary to pump out the water that comes out during the excavation.


Loading earth and sand using a backhoe

[Chika kutai koji] (underground frame construction] The structural part of a building consisting of foundation, columns, beams, walls, floors, etc. is called *kutai (*the frame). After completion of the earthwork, the underground frame will be constructed. From here on, various specialty contractors come and go. For example, there is rebar work

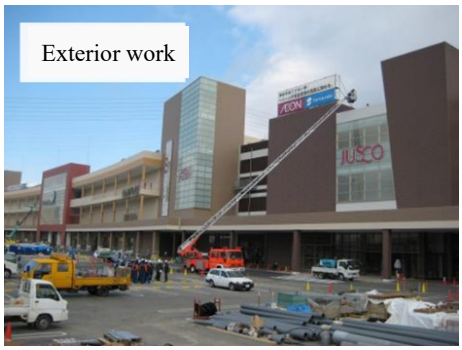

Underground frame construction

to support the frame, rebar splicing work such as pressure welding to connect the rebars, building formwork into which concrete is poured, concrete pumping work to pour concrete into the formwork, and various types of equipment installation work. Cooperation among contractors is important to ensure that construction proceeds as planned.

[Chijo kutai koji] (above-ground frame construction] The construction of a large building involves the use of heavy-gauge steel sections. This construction is called *tekkotsu koji* (steel framing work). A mobile crane is used to lift the steel section, position it, and bolt it in place. Generally, after the construction of columns, beams, and floors for three floors is completed (the section directly above the foundation), the construction of the upper floors will proceed after the concrete pouring is completed. Tower cranes are used to hoist steel sections to the upper floors.


Above-ground structural

[Nai/gaiso shiage koji] (interior and exterior finishing work] When the frame construction is finished, the building's exterior work begins. Interior and exterior work involves many specialty projects, including waterproofing, sheet metal, roofing, tiles, curtain walling, plastering, painting, and fixtures. To make the building look beautiful, masonry work is also done using marble, granite, and other stone materials.

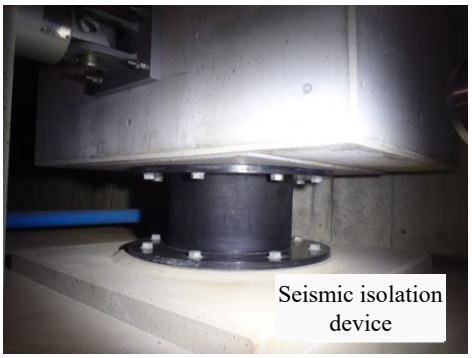

Exterior work


Interior work

[Taishin koji] (seismic work) Seismic work makes buildings more resistant to earthquake shaking, thereby preventing them from collapsing. According to the Building Standards Act, a building must be able to maintain its functionality in the event of an earthquake of intensity 5 or similar, and must have a structure that does not collapse in the event of a large-scale earthquake of intensity upper 6 to 7. Seismic work includes improving seismic resistance, vibration control, and seismic isolation.

- Seismic resistance work: pillars and beams are solidly built to withstand large earthquakes.
- Vibration-control work: energy-absorbing mechanisms such as dampers are installed in buildings to control the vibration.
- Seismic isolation work: seismic isolation devices such as isolators and dampers are installed in the foundation to reduce the transmission of earthquake energy to the building.

Building after vibration control construction



Seismic isolation device

[Iji/hozen/kaishu koji] (maintenance/preservation/renovation work) To keep completed buildings in good condition for a long time, it is important to create a maintenance and preservation plan and conduct renovation work accordingly. For example, the following renovation work will be performed.

- Exterior: cleaning of exterior walls, resealing, exterior design changes, waterproofing retrofitting, etc.
- Interior: barrier-free, conversion , treatment work for building materials including asbestos, layout changes, etc.

Conversion: taking an existing structure and redesigning the interior for a new use.

Asbestos: a material used in the past for fireproofing, thermal insulation, and fire prevention. Its use is now prohibited due to its health hazard.

- Facilities: replacement of lighting fixtures (LED, etc.), renewal of air conditioning equipment, renewal of water supply and drainage equipment, renewal of sanitation equipment, etc.

When installing or replacing equipment on a concrete frame, anchors must be embedded into the frame for anchorage. These anchors are called *atoseko anchor (*post construction anchors). There are two types of anchors: metallic and adhesive.

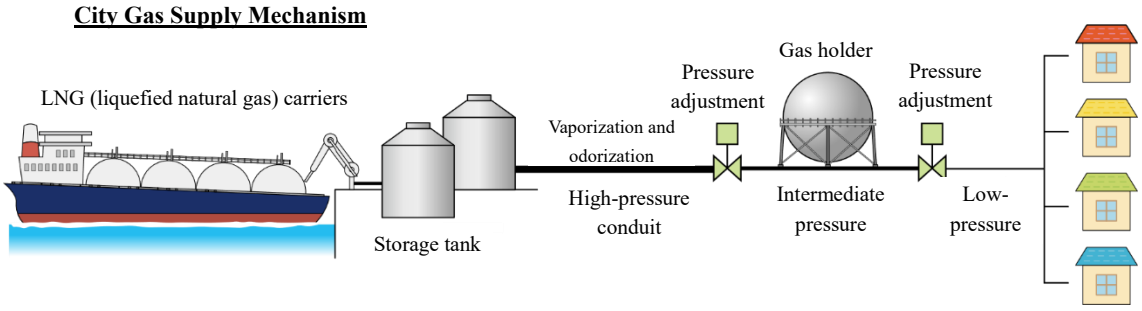
3.1.3 Lifeline Infrastructure/Equipment Installation

(1) Lifeline infrastructure work

Facilities indispensable for daily life, such as electricity, gas, and water, are called *lifeline* (lifeline infrastructure). In today's information society, communication facilities such as telephones and the Internet can also be considered lifeline infrastructure.

[Denki koji] (electrical work) Electricity produced at power plants is sent into buildings via transmission lines from transformer facilities at substations through poles or underground. Electricity sent into the building goes through the distribution board and is supplied to various locations in the building. This is achieved through electrical work. An accident unique to electrical work is *kanden jiko* (electric shock accidents). To prevent electric shock accidents, it is necessary to communicate the on and off status of power before work is performed, and that safety checks, such as voltage checks of the charging section, are performed before commencing work.

[Toshi gas koji] (city gas work) Liquid natural gas transported by large tankers is placed in storage tanks. Gas in storage tanks passes through gas pipes buried underground, vaporized and odorized along the way, before being stored in spherical tanks called gas holders. Gas stored in gas holders is delivered, with adjusted pressure, to factories, various facilities, and homes through pipes. City gas work mainly involves the construction of pipelines through which gas passes and the installation of equipment for gas use.



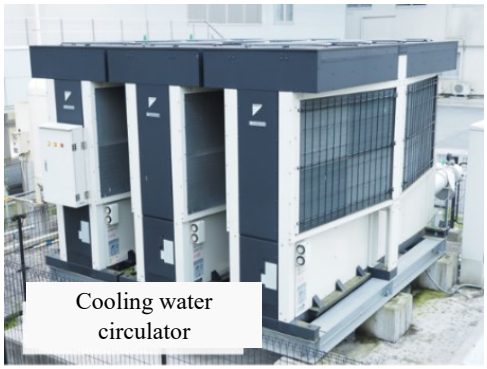
[Josuido koji] (waterworks/sewage work) In waterworks, water taken from rivers and other sources is turned into clean water at water treatment plants and stored in clean water reservoirs and distribution reservoirs. Water drawn from groundwater is disinfected before being clean water reservoirs and distribution reservoirs. Water from the distribution reservoir is delivered to all parts of the water supply area via water mains buried underground. Holes are born into the water mains, from which the water service lines are branched and connected to the home or building interior. Waterworks involve burying water mains and pulling service lines into the building. In sewage work, sewage used in buildings is collected in sewer mains, turned into clean water at sewage treatment plants, and discharged into rivers or seas. In areas where there are no sewer mains, sewage is treated at a sewage treatment facility and the resulting clean water is discharged into rivers or seas.

[Denki tsushin koji] (telecommunications work) This work involves the construction of networks for conveying and using information, primarily telephone construction and the Internet. There are two types of information transmission methods: wired and wireless. Facilities for wired signaling from the telecommunication buildings creating the telecommunication network to users, such as households, are called access *setsubi* (access facility). Communication cables are used for wired transmitting of signals. Cables for telecommunication facilities include metal and fiber-optic cables. Recently, fiber-optic cables are more widely used. Telecommunications work also includes telecommunications civil engineering work, which is the construction of conduits for communication cables, manholes, handholes, and cable tunnels (for communication cables). This work will also involve excavation using construction equipment.

In addition, in order for users to utilize network services such as the Internet and information infrastructure, it is necessary to construct electric power facilities for communication to realize uninterrupted power supply, switching equipment to connect to communication destinations, transmission equipment for high-capacity communication, and wireless equipment for satellite and mobile communication. LAN and other construction work will also be performed inside the building.

(2) Equipment Installation

After the frame construction is completed, various work on equipment and facilities takes place to make the building a place of living for people, including interior and exterior work. Equipment installation includes electric equipment that supplies power to lighting, electrical appliances, IT equipment, and electric motors, as well as to disaster prevention equipment and other items necessary for human life; air conditioning equipment that makes rooms comfortable; and water supply, drainage, and sanitation facilities to maintain a healthy and hygienic lifestyle for people. As with the frame construction, many specialty contractors come in and out of the


Cooling water circulator

construction site to complete the building.

[Reito kucho setsubi koji] (refrigeration and air conditioning installation) Installation of equipment that adjusts temperature and humidity and cleans the air for comfort.

[Kyuhaisui eisei setsubi koji] (water supply, drainage, and sanitation facilities installation) Installation of facilities necessary to maintain a hygienic and clean living environment using water and hot water. Installation includes piping for water supply, drainage, gas, etc., and fixtures to supply cold and hot water, etc.


Water feeding pump

[Ho'on/horei koji] (heat/cold insulation work) Work related to piping and equipment that requires heat insulation, thermal insulation, cold insulation, and dew-proofing.


Heat/cold insulation work


Heat/cold insulation work

【Shobo setsubi koji】(fire fighting equipment installation) Installation of equipment to protect people and buildings from fire. For example, installation of *kasai jushinki* (fire alarm receivers) that receive signals from detectors and transmitters installed in the building and notify the building itself and the fire department of the occurrence of fire, installation of sprinklers that automatically spray water when sensing heat from a fire, and installation of shoka pump (fire pumps) to supply water during fire fighting activities.


Sprinkler


Fire alarm receiver


Fire pump

3.2 Major Specialized Works

3.2.1 Earthwork


Hydraulic excavator

Civil engineering work at the sites include excavation of land; loading, hauling and filling of earth and sand; backfilling; compaction; pushing and grading. If a machine such as a hydraulic excavator cannot be used to perform these tasks, the work is done by hand. This man-powered work is called *doko* (earthwork). Earthwork includes the following tasks

[Kussaku sagyo] (excavation work) The process of digging out and removing earth, sand, and rocks is called *kussaku sagyo*. Explosives are sometimes used to destroy rocks and other materials, and this is called *happa* (blasting). The foundation of the building is buried under the ground. Digging the ground for this purpose is called *negiri*.

[Dosha no tsumikomi/unpan sagyo] (loading and hauling earth and sand) When excavators and dump trucks cannot be used to load and haul earth and sand, the work is done by hand.

[Morido/kirido sagyo] (embankment and cutting soil) *Morido* (filling) is the process of leveling slopes and uneven land by heaping up soil. Cutting and leveling the ground is called *kirido* (cutting soil).

[Umemodoshi sagyo] (backfilling) The process of filling in the structure and the extra space created around it with soil after excavation of the ground and construction of the basement or foundation is completed.

[Shimekatame sagyo] (compaction work) The process of reducing the amount of space between earth and sand by tamping or vibrating the ground to prevent it from settling.

Compaction by hand guided rollers

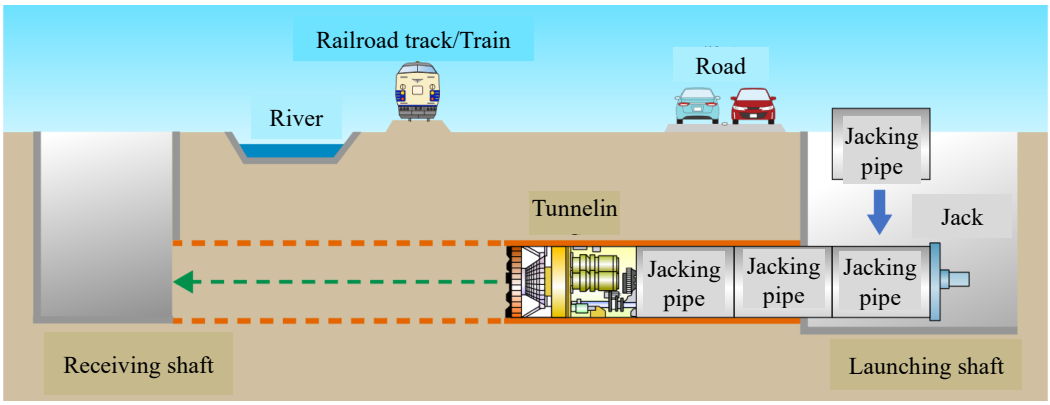
[Suichu pump no secchi to haisui] (installation and drainage of submersible pumps) On sites where a lot of water comes out, submersible pumps or similar devices are installed to pump out the water.

[Norimen no tofu/uetsuke sagyo] (slope surface application and planting work)

Mortar is sprayed and applied to the slope to prevent the slope from collapsing. There is also a method of planting the entire slope surface with mats embedded with seeds, fertilizers, and bed material for plants.

3.2.2 The Pipe-Jacking Tunneling Method

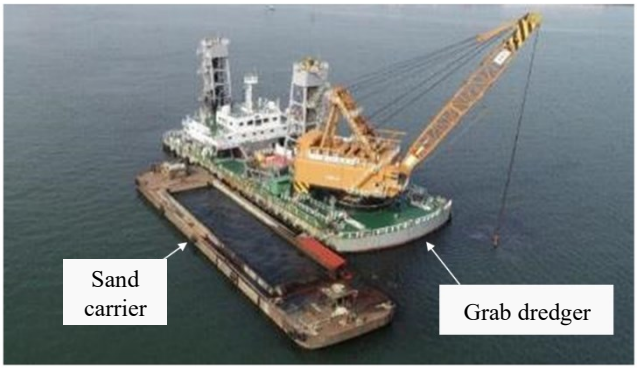
The pipe-jacking tunneling is the same type of construction method as the shield method in that it uses tunneling machines to excavate tunnels. When the tunneling machine is ready, it is launched from the pre-built launching shaft to start excavating the tunnel. In the pipe-jacking method, factory-made pipes are connected to the tunneling machine and pushed into the ground by jacks installed in the launching shaft. This process is repeated to build the tunnel.



3.2.3 Marine Civil Engineering Work

The following are typical examples of marine civil engineering projects that involve the construction of port facilities and offshore structures.

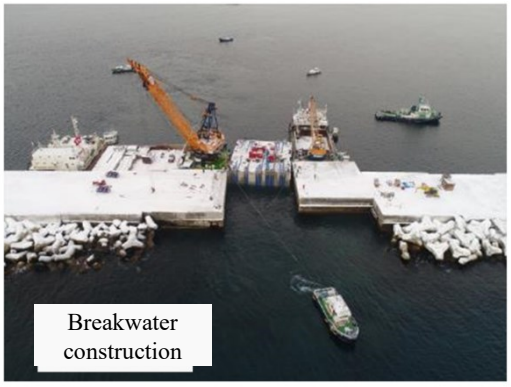
[Shunsetsu koji] (dredging work) The process of removing sediment from the bottom of an ocean or river. The work involves the use of work vessels called *shunsetsusen* (dredgers) to construct a safe passage for ships through which they can pass without hitting the seabed, and safe places in harbors for ships to dock.



[Umetate koji] (reclamation work) The process of collecting earth and sand to create new land. During construction, sediment removed by dredging is transported by boat or machine to the reclamation site and placed in the sea to construct the site.

[Ganpeki koji] (quay construction) *Ganpeki* (quay) is a facility in a port where ships stop to load and unload cargo. Quay construction is done by building walls with steel sheet piles to keep sediment from collapsing into the sea and piles to build pillars to support the structure.

[Bohatei koji] (breakwater construction) *Bohatei* (breakwater) is a facility that prevents waves from entering a harbor so that ships can safely stop, load, and unload their cargo. In breakwater construction, stones are placed on the seabed to flatten it out, a box made of concrete called a caisson is placed on top, and earth and sand are placed inside the caisson to stabilize it.



Breakwater construction

3.2.4 Well Drilling Work

The process of digging the ground to create a well is called *sakui koji* (well drilling). There are several types of well construction work.

[Suigensei koji] (water source well work) Work to access and pump up groundwater. A special machine called a boring machine is used to excavate down to underground water veins. Before construction of a well, it is important to investigate not only the quality of the water, but also the impact of the well on the surrounding area where the water is used.

[Kansokusei koji] (observation well work) *Kansokui* (observation wells) are used to determine the state of geological formations. For example, there are observation wells to determine the status of ground subsidence. Ground subsidence is measured by burying iron tubes into the hard strata and

observing the top of the tubes.

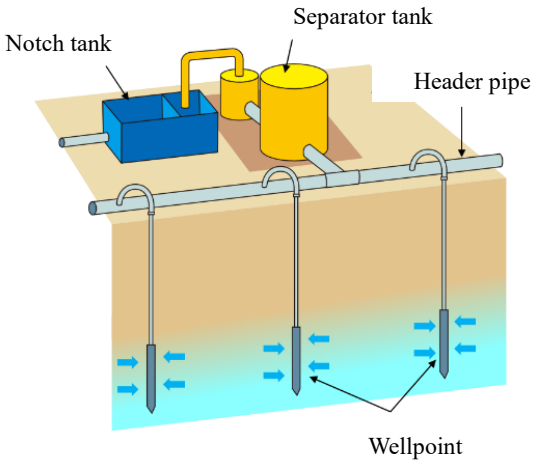
[Onsensei koji] (hot spring well work) Work to access and pump up hot spring water. The well is dug to approximately 500-1000 meters. Some permits are required for hot spring well work because natural gas can be released during the drilling process, which can lead to disaster.

[Chinetsusei koji] (geothermal well work) Work to drill wells for geothermal power generation. The wells are approximately 2,000 m deep and require a higher level of technology than other well drilling projects because of the potential for hot water, steam, and hazardous substances to be released.

3.2.5 Wellpointing

When excavating below the water table for construction of building foundations, underground pipes, or burying septic tanks, it is necessary to pump up and drain groundwater. Wellpointing is one of the methods used for dewatering. A series of wellpoints, or collection pipes connected to the header pipe, are driven into the ground to pump up groundwater using vacuum pumps. The pumped up groundwater up is drained through discharge pipes. The maximum depth possible for wellpointing is about 10 meters, and for deeper groundwater, a different method called deep well is used.

Wellpointing not only allows construction without water (called dry work), but also stabilizes weaker grounds. This method has many advantages in terms of economy, stability, and efficiency.



3.2.6 Paving Work

Hoso koji (paving) is the process of laying asphalt or concrete on a road. This work is important to ensure that people and vehicles can use the road safely. Pavement also serves to improve landscaping. After surveying the site, the following work is performed.

[Rosho koji] (subgrade layer work) Paved roads have several layers beneath the surface layer of asphalt or concrete. *Rosho* (subgrade layer) is the lowest layer that receives all the weight. After digging down to about 1 meter using heavy machinery, sand is spread evenly at the bottom.

[Roban koji] (aggregate base layer work) The layer above the subgrade layer is called *roban* (aggregate base layer)t. Crushed stone or other material is placed on top of the subgrade layer to create two layers. A heavy machinery called a roller is used to compact the material.

[Kiso koji] (foundation layer work) The asphalt is laid and evened out over the aggregate base layer using a machine called an asphalt finisher. After the layer is laid and evened out, rollers are used again for compaction.


Asphalt finisher

[Hyoso koji] (surface layer work) Finally, durable, water-resistant and non-slip asphalt is laid and compacted.

3.2.7 Mechanical Earthwork

The earthwork described in 3.2.1 conducted by machinery is called *kikai doko* (mechanical earthwork). To drive and operate the machine, the operator must complete the prescribed skill training courses and safety training.

[Kussaku sagyo] (excavation work) Excavation using hydraulic excavators. If there are large rocks or boulders, rock drills are used.

[Oshido/tsumikomi/unpan sagyo] (dozing/loading/transporting work) *Oshido* (dozing) means to push earth and sand using bulldozers and other machinery for transport. Wheel loaders and hydraulic

excavators are used to load dump trucks.


Excavation


Loading

[Morido/shimekatame] (embankment/compaction) Plains are raised by piling soil and compacting it using bulldozers. Slope surfaces are shaped by attaching a slope bucket to a hydraulic excavator. Rollers dedicated to compaction and other machines are also used.


Embankment


Slope shaping

3.2.8 Piling Work

Piling work is the use of concrete or steel pipe piles to build a foundation that supports a building or structure. Foundation piling work is performed for high-rise buildings and large structures such as bridges. Foundation piling is a method used primarily as a foundation for structures built on soft ground. By inserting the circular columns into the hard strata, structures can be built even on soft land. Because it improves the durability of structures, it is often used to build heavy structures in Japan, where the ground is often soft and disasters such as earthquakes and typhoons are frequent.


Piling work

Pile materials include wood, steel, and concrete.

There are two main methods.

[Kisei kui koho] (precast piling method) The piles are fabricated in a factory, transported to the construction site, and driven into the ground. There are two methods of construction: driving them in with a pile driver and embedding piles. Because methods using pile drivers generate large noise and vibration, embedding methods are used in some construction sites.

[Bashouchi kui koho] (cast-in-situ concrete piling method) This method makes piles at the construction site. A hole is dug for the pile, a cylindrical cage made of reinforced steel is placed in the hole, and fresh concrete is added to create the pile.

3.2.9 Scaffolding Work

In the olden days in Japan (Edo period), when a fire broke out, there were craftsmen who would destroy houses to prevent the fire from spreading to neighboring houses. Because the work is done at high places, it was called *tobi-shoku*, using the Chinese character for *tobi* (black kite), which is a bird. When building, work must be done at high places, which is where *tobi-shoku* (steeplejacks) come into play. For example, when painting, construction cannot proceed without scaffolding for the work. The *tobi* that builds this scaffold is called *ashiba-tobi*. In addition to this, there are the following types of *tobi* jobs

[Tekkotsu-tobi] (steel frame steeplejack) Uses steel sections to assemble the framework of high-rise buildings and condominiums. Steel sections are lifted by crane and bolted together.

Tekkotsu-tobi

[Kyoryo-tobi] (bridge frame steeplejack) Assembles steel sections for bridges, dams, steel towers, and highways.

[Juryo-tobi] (heavy-duty steeplejack) Carries and installs machinery and equipment weighing several hundred tons.

[Soden-tobi] (power line steeplejack] Engages in electrical work at heights, such as pulling power lines from steel towers, and inspecting and maintaining power lines.

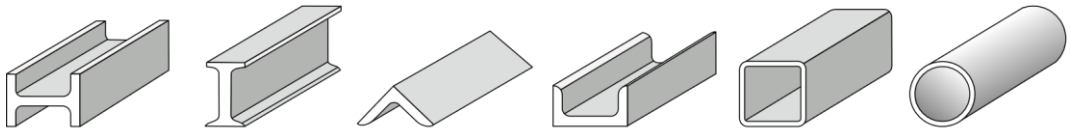
[Machiba-tobi] (local building steeplejack) *Machiba-tobi* builds scaffolding for local buildings, especially houses and condominiums.

3.2.10 Steel Framing Work

Steel framing work is the process of assembling the framework of a building, such as columns and beams, using steel sections. Steel sections are broadly classified into the following categories based on the shape of their cross-sections.

Steel Framing Work

Types of steel sections



H-beam I-beam Angle Channel Square bar Round bar

Categorization by thickness is *keiryo tekkotsu* (light steel sections), which use steel materials less than 6 mm thick, and *juryo tekkotsu* (heavy steel sections), which use steel materials 6 mm or thicker.

Structures made of steel sections include braced, rigid-frame, and truss structures. Braced structures are reinforced by placing braces between columns. In a rigid-frame structure, steel columns and beams are joined to each other at the joints by a method called *gosetsugo* (rigid joints). It has excellent earthquake resistance and provides more open space on the inside of the building. Truss structures are based on triangle shapes and are used in roofs, domes, and bridges.


Safety gear for steel framing work

There are two types of steel framing methods: *tatenige hoshiki* (build-away method) and *suihei tsumiage hoshiki* (horizontal stacking method). *Tatenige hoshiki* uses a mobile crane to assemble the building from the back of the lot toward the front. *Suihei tsumiage hoshiki* uses a tower crane to assemble one floor at a time. This method is used for building skyscrapers.

3.2.11 Steel Reinforcement Work (Rebar Work)

Concrete-covered structures, such as buildings and bridges, use steel bars as a framework, although they are not visible from the outside. Reinforcing steel bars are used to build this framework. This process is called *tekkin seko* (rebar installation). In human terms, the reinforcing steel is the bone and the concrete covering the reinforcing steel is the muscle. Rebar is cut and bent at the processing plant and transported to the construction site for assembly. When constructing a building, the first step is to build a concrete foundation. Reinforcing steel bars are always used in these foundations. Once the foundation is built, the framework construction follows, including columns,


Rebars


Rebar processing plant

walls, beams, and floors, in which reinforcing bars are also used.

After the rebar work is completed, *katawaku koji* (formwork carpentry) is conducted to build forms for pouring concrete around the rebar. The person who does this work is called *katawaku daiku* (formwork carpenter). Thus, it is important to work with technicians in other job categories, such as formwork carpentry and rebar splicing work, in the rebar installation process.


Rebar bending


Rebar work

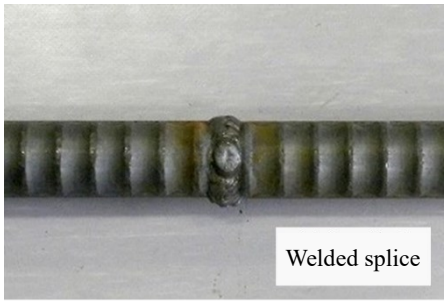
3.2.12 Rebar Splicing Work

Rebars are made in standard lengths of 12 m or less. If 12 m is not long enough, two rebars are joined together to make one long rebar. This construction is called *tekkin tsugite koji* (rebar splicing work). Since the strength of the joints between the two rebars affects the strength of the entire building, a high level of technical skill is required for joint splicing. There are several types of splicing methods, as follows.

[Gas assetsu tsugite] (gas pressure welded splice) A method of splicing rebars by heating the joint between the two rebars and applying pressure in the axial direction. The joints are heated by a flame with oxygen and acetylene gas or oxygen and natural gas. The gas pressure welded splice is the most commonly used method.


Gas pressure welded splice

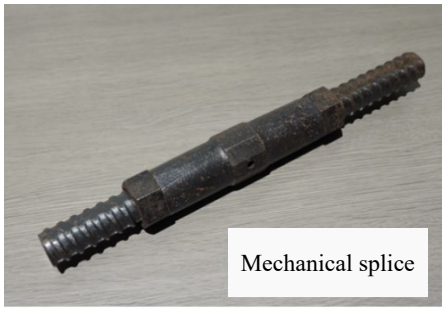
[Yosetsu tsugite] (welded splice) A method using arc welding to join the welding faces of rebars. This method is


Welded splice

used for rebars with large diameters, precast concrete columns, beam main bars, and *sakigumi tekkin* (preassembled rebars) that cannot be pressure welded.

[Kikai-shiki tsugite] (mechanical splice) A method of joining threaded steel bars using a part called a coupler.

[Kasane tsugite] (rebar lapping) A method used with thin rebars. The portion where the rebars overlap each other (the joint portion) is joined as one by some method, such as arc welding. Where the reinforcing bars intersect in slabs, the rebar lapping method is used, after which they are joined together by concrete.


Mechanical splice


Rebar lapping

3.2.13 Welding Work


Arc welding work

Welding is the joining of two or more members by applying heat and/or pressure. Technicians who weld are also called *kaji-ko*.

Welding work is conducted at various construction sites to weld steel materials. Examples include welding for rebar splicing, welding of rebar cages for piles in piling work, welding of steel sections for building frames, and welding of sheet piles (steel plates) in soil retaining structure work. It is more airtight and lighter than joining with screws or bolts. There are many welding methods, but the three main types are fusion welding, pressure welding, and soldering.

[Yusetsu] (fusion welding) The most common welding method. There are two methods of welding:

one is to melt the base metal (the material to be welded) and the other is to melt the welding rod and the base metal. Welding methods include arc welding, gas welding, laser welding, and beam welding. The process takes little time because of the small number of steps required, and even large base metal parts can be welded, but the disadvantage is that quality varies depending on the skill of the technician.

[Assetsu] (pressure welding) A welding method in which heat and pressure are applied to the surfaces of the base metals to be joined. It is also called *koso setsugo* (solid-state bonding) because the welding is done without melting the base metal to the point it becomes liquid. There are several methods of pressure welding, but gas pressure welding is often used to connect rebar to rebar at construction sites.

[Rosetsu] (soldering) A welding method in which a filler that has a lower melting temperature than the base metal is melted to act as an adhesive to join the materials.

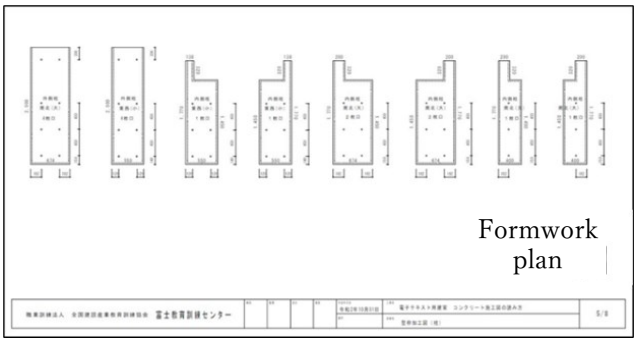
3.2.14 Formwork Carpentry

A building covered with concrete is created by pouring concrete into a form. This form is called *katawaku* (formwork). *Katawaku koji* (formwork carpentry) is the process of building the formwork that cover the reinforcing steel bars installed by rebar work. The person who does this work is called *katawaku daiku* (formwork carpenter). In Japan, a craftsman who builds wooden buildings is called *daiku*. The word *daiku* (carpenter) is used for the formwork because it is made by working wood, just as in wooden buildings.


Formwork carpentry

Since concrete is poured into the formwork, the formwork is subjected to great pressure from the inside. If the formwork cannot withstand this pressure, it will break and the concrete will leak out. To prevent this, the formwork must be adequately supported and reinforced from the outside. For reinforcement, steel tubes are used. Reinforcing the formwork with steel tubes is called *shihoko* (shoring).

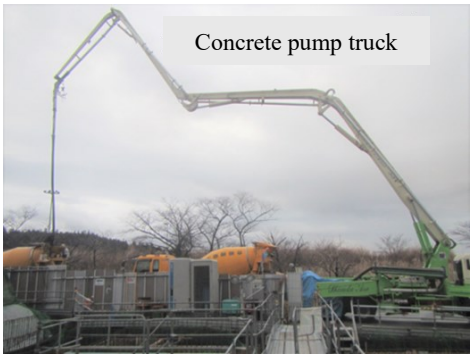
Although the formwork is removed when the building is completed, it is an important part of the work, creating the shape of the building. High processing skill is required to accurately create formwork that matches the complex shapes of buildings. In addition, the ability to read drawings called *kakozu* (formwork plans) is required to build the formwork.


Formwork plan

Once the concrete has been poured, the formwork is no longer needed. It is also the formwork carpenter's job to remove the formwork after confirming the prescribed strength. In the construction of buildings and condominiums, dismantled formwork is reused on upper floors.

3.2.15 Concrete Pumping Work

Once the formwork is completed, concrete is poured (called *dasetsu* (placed)) into it. In the old days, *doko sagyo* (earthwork) involved making concrete on site by mixing cement and aggregate on site, and the concrete was carried in *neko*, or a wheelbarrow, poured into the formwork, and poked with a poking stick to remove air bubbles inside. Today, quality-controlled concrete (called ready-mixed concrete or *nama-con*) is delivered to the construction site by a concrete agitator truck (*nama-con* truck) and transferred to pump trucks. Fresh concrete is pumped into the formwork using hydraulic or mechanical pressure by means of concrete pumps. This is called concrete *asso* (concrete pumping).


Concrete pump truck


Neko (wheelbarrow)

During the placement process, air bubbles end up in the concrete. Vibrators are used to vibrate the all the concrete in the formwork from corner to corner in order to remove unwanted air in order to prevent deterioration of concrete strength. This process is called *shimekatame* (compaction). Fresh concrete hardens over time, so it must be worked efficiently. For this purpose, teamwork among three persons is important: the concrete pump *sosa* operator (the operator), *tsutsusaki sagyoin* (the hose operator) who controls the end of the concrete pump hose, and *doko sagyoin* (the earthworker) who performs the compaction.

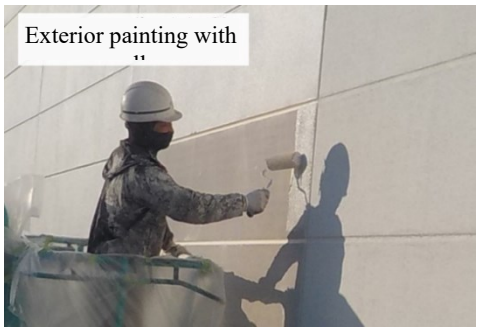

Concrete Placement Work

3.2.16 Painting Work

Painting work is a process used to protect and improve the durability and aesthetics of a building's roof and walls. A high level of knowledge about paints is necessary in order to properly choose different paints depending on the surface material to be painted.

Methods of applying paint to the surface material include the following.

[Hake nuri] (brush painting) A painting method that uses *hake* (brush) to apply the paint. Different types of brushes are used depending on the area to be painted.


Exterior painting with

[Roller nuri] (roller painting) A painting method that uses a roller brush. It is suitable for painting large surfaces, such as exterior walls, because it can paint large surfaces efficiently. In terms of finish quality, brush painting is superior.

[Air spray toso] (air spray painting) A method in which paint is sprayed onto the surface in the form of a mist. Air compressed by an air compressor is mixed with liquid and sprayed using an air spray gun.


Air spray painting

3.2.17 Landscaping Work

In Japan, *teien* (gardens) have long been enjoyed as a practice of recreating and appreciating natural landscapes in gardens. *Zoen* is the process of creating landscape using various types of trees, plants, and stones. Landscaping requires not only knowledge of construction, but also knowledge of the characteristics of trees and plants. It also requires an aesthetic sense for balanced placement of trees and stones. Landscaping includes the following types of work.

[Shokusai koji] (planting work) Planting trees and plants on the grounds around the building (called *gaiko*).

[Okujo ryokka koji] (rooftop greening work) The greening of building rooftops and walls.

[Hiroba koji] (park work) The construction project to create parks with lawns or athletic fields.

[Koen setsubi koji] (park facility installation) Building flower beds, rest areas, fountains, and walking paths in the park.

[Ryokuchi ikusei koji] (green space cultivation work) Work to improve soil, installing supports for trees, etc. in order to cultivate trees, lawns and floriculture.


Pruning of black pine


Lawn maintenance

3.2.18 Plastering Work


Trowels dedicated for inside and outside corners

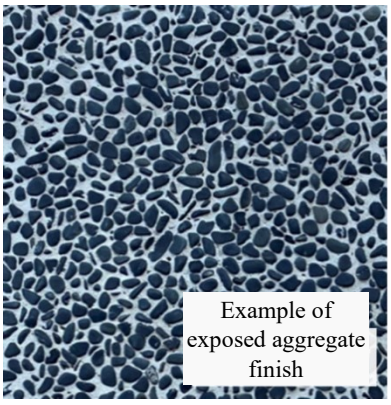
Sakan koji (plastering work) is the process of applying various types of finishing materials using a tool called *kote* (trowel) after the building is completed. It is similar to painting work, but the tools used are different. It is also a job category with many jargons that have been used for a long time.

Materials used include wall clay, mortar, Japanese plaster, normal plaster, and fibers. In particular, wall clay and Japanese plaster are materials that have been used in Japan since the old times. Because plastering is often done on the exterior walls and interiors of buildings, workmanship is especially important, and therefore requires a high level of skill for a beautiful finish. In recent years, it has become an artistic profession that incorporates different methods of surface finishing. *Fukitsuke koji* (spray-on work), in which the traditional plastering process is replaced by machines, is now also performed. Also, finishing work called *togidashi* (polished aggregate finish) and *araidashi* (exposed aggregate finish) in which aggregate is exposed on the surface.


Example of a Japanese plaster wall

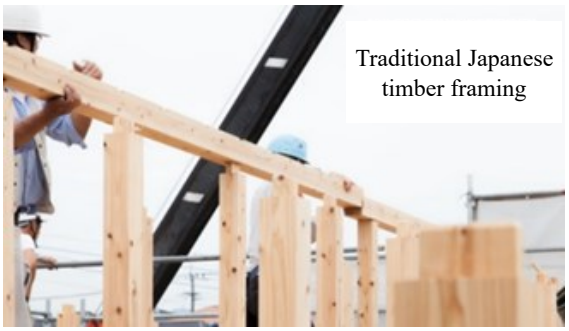
[Togidashi koji] (polished aggregate finish) Finishing work that polishes and flattens the surface of the stone to bring out its luster.

[Araidashi koji] (exposed aggregate finish) Finishing work that exposes small stones called *taneishi* on the surface. After mixing and kneading *taneishi* into the cement, lime, and other materials, the mixture is spread onto the construction surface. Then, *hake* or brush is used to wash away the mortar on the surface.


Example of exposed aggregate finish

3.2.19 Carpentry Work

Since ancient times, many wooden buildings such as temples, shrines, and houses have been constructed in Japan. The job of *kenchiku daiku (*carpenter) is to build these wooden buildings. In the construction of houses, small companies called *komuten* are often contracted to take on the entire work from design to lumber processing, construction, and construction management. The expertise required depends on the type of building, and there are many jobs where the word *daiku* (carpenter) is used, such as those listed below.



Traditional Japanese timber framing

[Machi daiku] (town carpenter) The most common carpenter, also known as *kaoku daiku* (house carpenter). A carpenter who works on wooden houses. When uttering the word *daiku-san*, most Japanese people think of *machi daiku*.

[Zosaku daiku] (joinery carpenter) After the building structure is complete, this carpenter decorates the interior with doors, shoji screens, *fusuma* (sliding doors), and other interior decorations.

[Miya daiku] (shrine and temple carpenter) A carpenter who builds or repairs temples, shrines, and other structures. To make a building that can withstand wind and rain for hundreds of years, knowledge of wood and advanced techniques for connecting wood to wood are required.

[Katawaku daiku] (formwork carpentry)→ See 3.2.14.

3.2.20 Roofing Work

Many Japanese houses use a roofing material called *kawara*. Roofing with *kawara* is called *kawara-buki*. *Kawara* are tiles made of clay, shaped and fired in a kiln. Roofing materials can also be metal shingles and of other materials. Regardless of which material is used, knowledge and techniques on work to prevent rainwater from entering the building (called *amajimai*) are required. In addition,

because the work will be performed on a slope, the construction of scaffolds with good workability and practicing of safe conduct to prevent falls are also required. Roofing work is not only roofing, but also includes the following work.

[Yane fukikae koji] (re-roofing work) Work to remove existing roofing materials and tarps, and replace them with new roofing materials.

[Yane kasanebuki koji] (roof overlaying work) New roofing materials are applied on top of the existing roof.

[Shikkui hoshu koji] (Japanese plaster repair work) Material called *shikkui* (Japanese plaster) is used to protect exposed areas of soil used to tile the roof. When Japanese plaster cracks or collapses due to typhoons or heavy rains, roof leaks can occur, damaging the building. Japanese plaster repair work must be periodically conducted.


Japanese plaster repair work

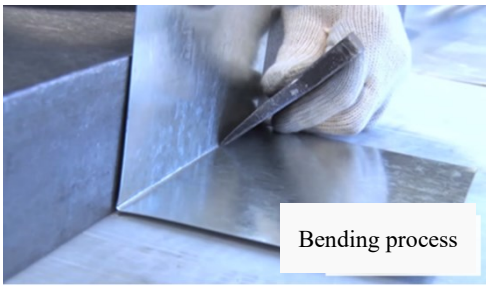

Gutters in need of repair

[Amadoi kokan koji] (gutter replacement work) Replacement of broken gutters.

[Yane toso koji] (roof painting work) Painting on the roof. This is done when the existing roofing material has lost its waterproofing function.

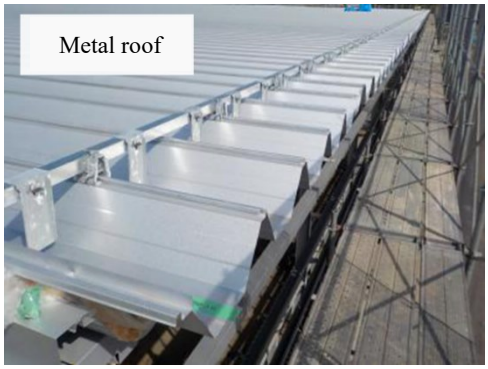
3.2.21 Architectural Sheet Metal Work

Kenchiku bankin koji (architectural sheet metal work) refers to the processing of metal sheets to make metal products needed for buildings and installing them in buildings. Metal sheets are usually thin. They are processed by cutting, bending, forming, and joining. The

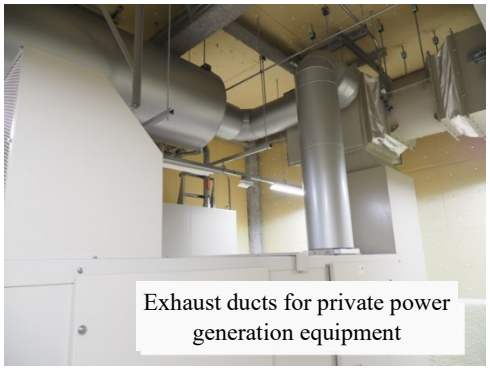

Bending process

following work is performed in architectural sheet metal work.

[Yane koji] (roofing work) The process of attaching a roof to a building is called *yane wo fuku*. There are various types of roofing materials including *kawara*, but roofing work using sheet metal in particular is done by architectural sheet metal workers. In addition, rainwater must be drained systematically to protect the building from rainwater that falls from the roof. This is called *amajimai* (rain-proofing). The fabrication and installation of the hardware necessary for rain-proofing is also a part of architectural sheet metal work.


Metal roof

[Duct koji] (duct work) Pipes that carry air are called ducts. Ducts, also called airways, include smoke exhaust ducts that carry smoke outside in the event of a fire, air conditioning ducts that carry cold, warm, and fresh outside air to the inside, and exhaust ducts that exhaust heat and odors generated in machinery rooms, electrical rooms, and lavatories to the outside. In duct work, sheet metal is processed to match the installation location, and installation work is performed.


Exhaust ducts for private power generation equipment

[Gaiheki koji] (exterior wall work) Wall materials such as siding and corrugated sheets are used to construct the exterior walls of buildings.

[Kanban/kanamono] (signboards/hardware) Architectural sheet metal work also includes the processing and installation of signboards as well as hardware used in various locations. Hardware used in visible locations must be not only precise but also beautiful.

3.2.22 Tiling Work

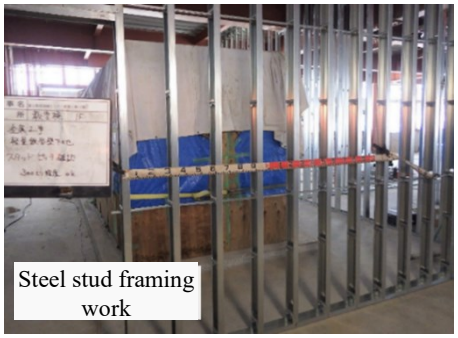
Tile *bari koji* (tiling work) is the process of installing tiles on walls and floors. Tiling a building can give it a beautiful exterior. Tiles also serve to protect the building and increase its durability. Falling tiles from a building can cause fatal accidents, so installation knowledge and skills are required not only to finish the tiles beautifully but also to prevent them from falling off.


Tiling work

Tiling work often involves other job categories. Tiling work around the installation sites for the water supply and drainage systems and embedded electrical fixtures must consider piping and electrical work. For example, if tiled without considering the pipe outlets, further pipe work cannot be performed. In addition, *toriai* (the line where different structures meet) with sashes, etc., around openings must be considered.

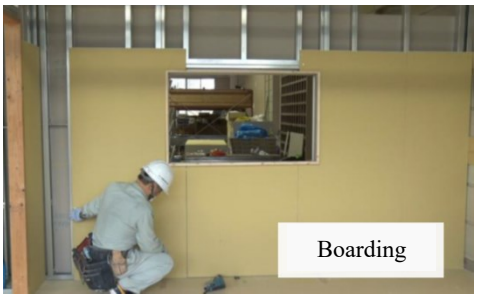
3.2.23 Interior Finish Work

The interior work of a building is called *naiso shiage koji* (interior finish work). Interior finish work includes the following types of work.


Steel stud framing work

[Kosei shitaji koji] (steel stud framing work) Construction of the framework for walls and ceilings using materials calledLGS (Light Gauge Steel or Light Gauge Stud). The construction of this framework is also called keiten koji. LGS is sometimes referred to as studs.

[Board hari] (boarding) Plasterboard is applied over the steel stud frame. To make the grooves between the plasterboards less noticeable when wallpaper is hung over the plasterboards, the grooves are smoothed out with putty.


Boarding

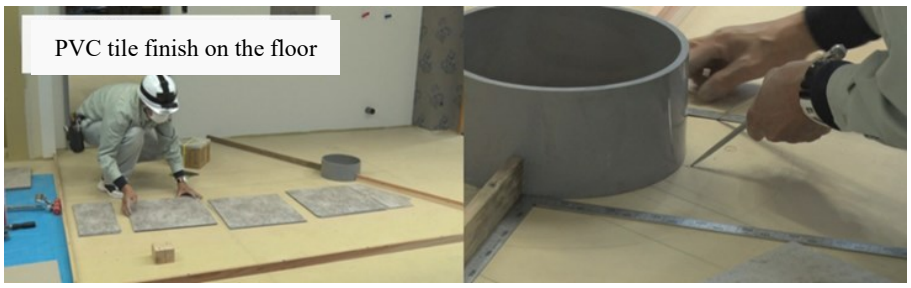
[Cloth bari] (wallpapering) Hanging wallpaper, the wall finishing material, over the plasterboard base.

[Toso shiage] (paint finish) Instead of wallpaper, paint is used to finish the work.

[Yuka shiage] (floor finishing) Work to lay tiles, carpets, tatami mats, etc. on the floor.

[Curtain koji] (curtain work) Work to cut and sew the fabric to make curtains and hang them. This also includes work on curtains (large curtains) used on stages and other venues.

[Yuka shiage (enka vinyl tile)] (floor finishing (vinyl chloride tile)) Processing materials to match the shape of the floor.


PVC tile finish on the floor

3.2.24. Interior Finishing Work

The interior finishing work on buildings described in 3.2.23, excluding steel stud framing and boarding, is called *hyoso koji* (surface work). It mainly refers to finishing walls, ceilings, and floors. Depending on the materials used, there are a variety of finishing methods.

[Kabe shiage (wallpaper)] (wall finish (wallpaper)) Hanging wallpaper over plasterboards. The grooves between the plasterboards are filled in with putty and smoothed out so that the wallpaper will

not appear uneven.


Wallpaper finish

[Tenjo shiage (wallpaper)] (ceiling finishing (wallpaper) Work must be done always facing up, and the skill to spread and hang the wallpaper straight without bending is necessary.


Ceiling wallpaper finish

3.2.25 Fittings Work

Buildings have many openings. *Tategu* (fittings) are doors, windows, *fusuma* (sliding doors), *shoji* (paper sliding doors), etc. that fit the openings in the buildings, and the frames used to attach them. Fittings include wood, sash and other aluminum, plastic, steel, and stainless steel fittings. *Tategu koji* (fittings work) is the installation of factory-made fittings on site. Fittings work includes shutter installation and automatic door installation.


Fittings work

3.2.26 Sash Setting Work

Of the fittings work, the installation of metal fittings is called sash *koji* (sash setting work). This includes not only aluminum sashes for windows, but also installation of metal fixtures such as bathroom doors, screens, curtain walls, etc.

Many aluminum sashes are replaced in condominium renovations. In such cases, if the sash frames were to be replaced as well, carpentry, plastering, and painting work would be required, which would make the project costly and time consuming. Cover *koho* (overlay method) resolves this problem. In the overlay method, the old frame is not removed, but instead a new frame is placed on top of it to install the new sash.

3.2.27 Polyurethane Spray Foam Insulation Work

Rigid polyurethane foam is used as a building insulator because of its thermal insulation properties.

Fukitsuke urethane dannetsu koji (polyurethane spray foam insulation work) is work in which rigid polyurethane foam liquid is directly sprayed onto a frame, etc. using a dedicated spraying machine in order to form the rigid polyurethane foam on site. This method of construction allows for a gapless insulation layer.

Polyurethane spray foam insulation work

Sprayed surface after the work

Fukitsuke urethane dannetsu koji-yo gen'eki (rigid polyurethane foam liquid) consists of the polyol component and the polyisocyanate component, and the polyol component is mixed with additives such as catalysts, foaming agents, and foaming regulators.

If the concrete surface to be sprayed is contaminated with dust or oil, the adhesive property will be

compromised and result in the foam peeling off, so the surface to be sprayed must be cleaned well.

Before starting, the foam is sprayed onto a square board of about 450 mm per side to check the foam density. During construction, thickness is checked at 4~5 m intervals using a polyurethane foam thickness gauge.

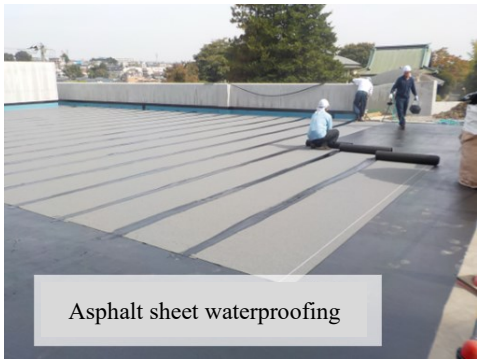
3.2.28 Waterproofing Work

The work done to prevent rainwater and snow from entering the interior of a building is called *bosui koji* (waterproofing). Waterproofing work can be divided into five main types, depending on the materials used.

[Urethane bosui koji] (polyurethane waterproofing work) A method of waterproofing by applying liquid waterproofing material to the surface. This method can waterproof places with complex shapes. It is suitable for waterproofing terraces, balconies, and rooftops, as well as for repairing leaking areas.

[FRP bosui koji] (FRP waterproofing work) A method in which fiberglass mats are laid down, and polyester resin is applied on top of the mats. This method is durable and dries quickly.

[Sheet bosui koji] (sheet waterproofing work) A method in which synthetic rubber or synthetic resin sheets are attached with adhesive. This method can cover large surfaces at once.


Asphalt sheet waterproofing

[Asphalt bosui koji] (asphalt waterproofing work) A method in which synthetic fiber cloth sheet soaked with asphalt is attached to the base surface. To improve adhesion between the base surface and the sheet, asphalt primer is applied to the base surface before the sheet is applied.

[Sealing bosui koji] (sealing waterproofing work) A method used to waterproof the grooves between members. Primer is applied to the grooves before filling with sealant.


Sealing waterproofing work

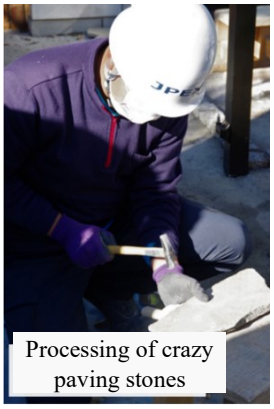
3.2.29 Masonry Work

Ishi koji (masonry work) is the work of processing stones from various parts of the world and installing them where needed. Craftsmen who work with stones are called *ishiku* (stonemasons), and are referred to as *ishiku-san*. Masonry work is not related to the structure of the building, but it can give the building a luxurious feel. This work does not allow mistakes, because if the stone cracks or breaks during processing, it cannot be used anymore. In addition, long experience is required to create a beautiful crazy paving finish using random stones of various shapes.


Bathtub construction for spa facilities

Stones used include not only natural stone such as *dairiseki* (marble) and *mikageishi* (granite), but also *giseki* (imitation stones) that resemble stones and concrete blocks.


Work to pile up blocks


Processing of crazy paving stones

3.2.30 Electrical Work

Electrical work is an important job that supports the lives of many people. There are many types of electrical work involved in construction. Construction work dealing with high voltage is very dangerous. Without the right knowledge and the skills to conduct the job carefully and accurately, it can lead to fires and other disasters. Therefore, there are many tasks that can only be performed by a qualified *denki kojishi* (electrician). There are two types of electrician certifications: Class I and Class II. Class I certification is required to perform sufficient electrical work in large buildings and factories. Electrical work can be divided into two main categories, generally referred to as *gaisen koji* (outside line work) and *naisen koji* (inside line work).


Overhead wiring work

[Gaisen koji] (outside line work) Work to connect electric wires at utility poles and underground to supply electricity to the building. Wiring that is pulled into a building using utility poles is called *kaku haisen* (overhead wiring). *Chichu haisen* (underground wiring) is when cables are run through a structure buried underground and pulled into the building.

[Naisen koji] (inside line work) Work to enable use of electricity in the building. Typical construction projects include the following.

- Grounding work to prevent electric shock and electrical leakage
- Installation of substations
- Installation of power equipment
- Installation of power storage facilities
- Installation of power generation equipment
- Installation of distribution boards
- Supplying power to heating and cooling equipment


Installation of an outlet box

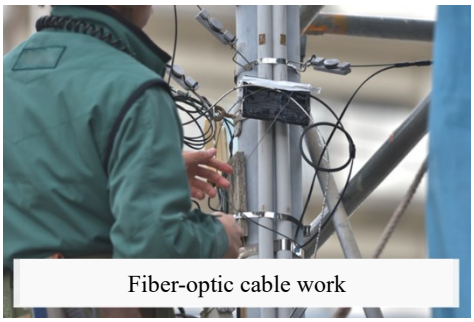
- Installation of electric lighting equipment

- Wiring and installation of switches, outlets, etc.

3.2.31 Telecommunications Work

Among electrical work, work related to telecommunications equipment such as telephones, television, and the Internet is called *denki tsushin koji* (telecommunications work). There are two methods for transmitting information: wired methods using cables and wireless methods using radio waves. Cables are divided into metal cables using copper wires and optical cables using optical fiber.

Since telecommunications work is related to lifeline infrastructure, lack of correct knowledge and skills can lead to major network failures. Therefore, there are some construction projects that can only be performed by qualified *koji tanninsha* (installation technician) or *denki tsushin shunin gijutsusha* (chief telecommunications engineer). Typical and familiar telecommunications facilities include the following.



Fiber-optic cable work

[Yusen setsubi] (wired facilities) Poles, overhead and underground cables, fiber-optic cables, cable arrester, telephone equipment, PBX (telephone switchboard), etc.

[Musen setsubi] (wireless equipment) Wireless equipment, antennas, etc.

[Tsushin doboku setsubi] (telecommunications civil engineering work) Pipelines, cable tunnels, manholes, etc.

[Kokan denso setsubi] (switching and transmission equipment) Subscriber switching system, relay switching system, transmission equipment, etc.

[Tsushin denryoku setsubi] (communication power equipment) Power equipment (rectifiers, storage batteries, engines, etc.)

3.2.32 Pipe Work

This work enables delivery of water, oil, gas, steam, etc. to where it is needed through metal pipes, etc. This includes plumbing for water supply, drainage, fire suppression systems, room coolers and air conditioners. Thus, pipe work is an important job that supports safe and comfortable civic life.

Basic skills include the ability to cut pipe material (cutting), connect pipes (joining), and assemble pipes, all with accuracy.

Pipe work

3.2.33 Freezing and Air Conditioning Apparatus Work

Freezing and air conditioning apparatus refers to equipment that uses refrigerants, such as air conditioners and freezers. Freezing and air conditioning apparatus work involves the installation of freezing and air conditioning apparatus, including refrigerant piping, and requires piping skills such as copper pipe fabrication.

Typical examples of freezing and air conditioning apparatus include the following.

The freezing and air conditioning apparatus work includes disassembly, assembly, installation, and adjustment work, as well as piping work, for freezing and air conditioning equipment such as freezing apparatus, refrigerating apparatus, freezers, packaged and separate-type air conditioners, home air conditioners, commercial refrigerators and freezers, freezer/refrigerated showcases, transportation refrigeration units, etc.

3.2.34 Water Supply, Drainage, and Sanitation Facilities Installation

Facilities that use cold and hot water to keep buildings hygienic and clean in order to maintain a safe and comfortable lifestyle for citizens are called *kyuhaisui eisei setsubi* (water supply, drainage, and sanitation facilities), and include the following types of work.

Example of water supply and drainage work

- Installation of water supply facilities
- Installation of drainage and ventilation facilities
- Installation of water heaters
- Installation of sanitation equipment
- Gas equipment work

Hot water tank

[Kyusui setsubi koji] (water supply facility installation) Installation of pumps and water receiving tanks as well as pipe work to supply water from the water main through distribution pipes to toilets, kitchens, etc.

[Haisui/tsuki setsubi] (drainage/ventilation system installation) Work to discharge dirty water from toilets and kitchens to the main sewer line.

Toilet

[Kyuto setsubi] (water heater) Work to enable heating and supplying of hot water.

[Eisei kigu setsubi koji] (sanitation equipment work) Installation of toilet bowls, wash basins, etc.

3.2.35 Heat/Cold Insulation Work

This work aims to keep hot things from getting cold and cold things from getting warm. Installing heat- and cold-insulating materials (materials that do not transfer heat easily) on ducts and pipes reduces heat loss and fuel consumption. Also, attaching a heat insulator to the surface of a hot object is a safety measure that prevents burns. Equipment subject to heat/cold insulation work includes air conditioning and sanitation facilities.

Heat/cold insulation for pipes

3.2.36 Furnace Installation

Ro (furnace) is equipment that applies heat to various materials to burn or melt them. *Chikuro koji* (furnace installation) is the construction and maintenance of a furnace. Typical furnace installation includes the following.

[Shokyakuro] (incinerator) Used to burn household and industrial waste.

[Cupola] A furnace for melting iron. Iron is melted by the heat from burning coke. Melted iron is used for casting.

[Shodonro] (annealing furnace) A furnace used to make the properties of metal materials uniform.

[Dasshuro] (deodorizing furnace) A furnace used to eliminate the odor of bad-smelling exhaust gas. Odors are removed through oxidation reactions of odor components.

[Alumi yokairo] (aluminum melting furnace) A furnace used to melt aluminum scraps and ingots to make products. Melted aluminum is called molten aluminum.

[Biomass boiler] A boiler that uses wood chips, construction waste, and other materials from the factory as fuel instead of fossil fuels. The heat from the burning process is used to heat water. It is also used in combination with a system that uses steam to turn a turbine in order to generate electricity.

[Denkiro] (electric furnace) A furnace used to melt metals such as iron. It uses the heat generated by

eddy current induced by electromagnetic induction.

3.2.37 Fire Fighting Equipment Installation


Fire fighting equipment installation

This equipment work is necessary to minimize damage to buildings, people, and property in the event of a fire or other disasters, and must be installed and maintained in accordance with the Fire Service Act. Firefighting equipment installation includes *shobo no yo ni kyosuru setsubi* (equipment used for firefighting) such as extinguishing fires, sending alarms, and facilitating evacuation; *shobo yosui* (water for firefighting); and *shoka katsudojo hitsuyo na shisetsu* (facilities necessary for firefighting) such as smoke exhaust systems and emergency outlets. Facilities used for firefighting as defined by the Fire Service Act include the following.


Emergency broadcasting equipment and surveillance camera equipment

[Shoka setsubi] (fire extinguishing equipment) Equipment that allows building occupants to extinguish fires (e.g., installed in hallways), sprinklers, etc.

[Keiho setsubi] (alarm equipment) Alarm equipment that automatically detects smoke and heat, emergency bells, and emergency broadcasts.

[Hinan setsubi] (evacuation equipment) Equipment for evacuation in the event of a fire. Evacuation slides and ladders are installed.

3.2.38 Demolition Work

Buildings and structures eventually require rebuilding or removal due to aging or other reasons. *Kaitai koji* (demolition work) is the process of breaking down a building or structure. Demolition work includes not only the visible parts above ground, but also the underground frame. Demolition work in densely populated or busy areas requires careful attention to vibration, noise, and falling demolition materials. Since asbestos, which is harmful to health, may be used in buildings, a survey is conducted in advance so as to take measures to prevent asbestos from flying around or being inhaled by workers and others during demolition. The dismantled waste material is called *kaitai gara* (demolition debris). Demolition debris is sorted into concrete, steel, etc., and disposed of. Asbestos and other harmful materials require special treatment.

Demolition work

Demolition debris

3.3 Qualifications Required for Construction Work

In construction work, some tasks require a license, and some tasks may not be conducted without undergoing skill training courses or special education.

3.3.1 Types of Qualifications Under the Industrial Safety and Health Act

There are three types of qualifications under the Industrial Safety and Health Act: *kokka menkyo ga hakko sareru kokka shikaku* (national qualification for which a national license is issued), *gino koshu* (skill training course), and *tokubetsu kyoiku* (special education). Skill training courses are conducted by organizations registered with the respective prefectural labor bureaus. Upon completion

of the skill training course and acquisition of skills, *rodo anzen eiseiho niyoru gino koshu shuryosho* (skill training course completion certificate under the Industrial Safety and Health Act) will be issued. For the work specified in the Industrial Safety and Health Act, *sagyo shuninsha* (operations supervisor) must be assigned at the work site to direct the workers who perform such work. Also, the Industrial Safety and Health Act states that "Before assigning a worker to dangerous or hazardous operations specified by Order of the Ministry of Health, Labour and Welfare, an employer must educate that worker in safety or health as it relates to the operations, pursuant to Order of the Ministry of Health, Labour and Welfare. (Article 59 Clause 3)." This education is called *tokubetsu kyoiku* (special education). There are two ways to be educated: outside the company or within the company.

3.3.2 List of Qualifications, Etc. Under the Industrial Safety and Health Act

(1) Cranes, etc.

To work with a crane, derrick, mobile crane, construction lift or slinging equipment, a license, completion of a skill training course, or completion of special education is required for each type of lifting capacity.

Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles
Crane and derrick operators	Operation of cranes and derricks having a lifting capacity of 5 tons or more	License (crane and derrick operator, an operator's license that limits the type of machine allowed to operate to cranes)	Safety Health Act Order 20(6)(8) Safety Ordinance for Cranes 22,108
	A floor-operated system having a lifting capacity of 5 tons or more, and the operator moves along with the moved load	License (crane and derrick operator) or a person who has completed the skill training course	Safety Health Act Order 20(6) Safety Ordinance for Cranes 22
	1. Operation of cranes and derricks having a lifting capacity of less than 5 tons 2. Operation of a telpher having a lifting capacity of 5 tons or more.	License (crane and derrick operator) Persons who have completed the skill training course Persons who have completed special education	Safety & Health Ordinance 36(15)(17) Safety Ordinance for Cranes 21,107
Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles

Mobile crane operator	Operation of mobile cranes having a lifting capacity of 5 tons or more	License (mobile crane operator)	Safety Health Act Order 20(7) Safety Ordinance for Cranes 68
	Operation of mobile cranes having a lifting capacity of 1 ton or more but less than 5 tons	License (mobile crane operator) or a person who has completed the skill training course	Safety Health Act Order 20(7) Safety Ordinance for Cranes 68
	Operation of mobile cranes having a lifting capacity of less than 1 ton	License (mobile crane operator) Persons who have completed the skill training course Persons who have completed special education	Safety & Health Ordinance 36(16) Safety Ordinance for Cranes 67
Construction lift operator	Operation of construction lifts	Persons who have completed special education	Safety & Health Ordinance 36(18) Safety Ordinance for Cranes 183
Slinger	Slinging of cargo lifting appliances with a limited load of 1 ton or more, or cranes, mobile cranes or derricks having a lifting capacity of 1 ton or more	Persons who have completed the skill training course	Safety Health Act Order 20(16) Safety Ordinance for Cranes 221
	Slinging of cargo lifting appliances with a limited load of less than 1 ton, or cranes, mobile cranes or derricks having a lifting capacity of less than 1 ton	Persons who have completed special education	Safety & Health Ordinance 36(19) Safety Ordinance for Cranes 222

(2) Gondola

Completion of special education is required to be qualified to operate gondolas for exterior renovations, window washing, etc. of high-rise buildings.

Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles
Gondola operator	Gondola operation	Persons who have completed special education	Safety & Health Ordinance 36(20) Safety Ordinance for Gondolas 12

(3) Construction machines, etc.

Completion of special education is required to operate or work with the construction machines listed in the table below. Vehicle-type construction machines are construction machines that can propel itself using power. Heavy machinery such as bulldozers, power shovels, bucket wheel excavators, and concrete pump trucks are vehicle-type construction machine.

Operations supervisor and worker(s)	Duties		Qualification (Education) Requirements	Regulations/Articles
Vehicle-type construction machines Operator (for leveling, hauling, loading, excavating)	Machinery weight 3t or heavier	Driving services for vehicles that are powered and capable of self-propulsion to an unspecified location. However, this excludes driving on the road.	Persons who have completed the skill training course	Safety Health Act Order 20(12)
	Machinery weight Less than 3t		Persons who have completed special education	Safety & Health Ordinance 36(9)
Vehicle-type construction machines Operator (for foundation work)	Machinery weight 3t or heavier	Driving services for vehicles that are powered and capable of self-propulsion to an unspecified location. However, this excludes driving on the road.	Persons who have completed the skill training course	Safety Health Act Order 20(12)
	Machinery weight Less than 3t		Persons who have completed special education	Safety & Health Ordinance 36(9)
For foundation construction Construction machine operator	Work operating a machine equipped with power-driven system and other than that capable of self-propelling to unspecified places.		Persons who have completed special education	Safety & Health Ordinance 36(9-2)
Vehicle-type construction machines Operator of working attachment (for foundation construction)	Operation of working attachment of a machine equipped with power-driven system and capable of self-propelling to unspecified places (excluding operation in the operator's seat on the body)		Persons who have completed special education	Safety & Health Ordinance 36(9-3)
Vehicle-type construction machines Operator (for compaction)	Roller driving operations (except for driving on the road)		Persons who have completed special education	Safety & Health Ordinance 36(10)
Persons operating the working attachment of vehicle-type construction machine (for concrete placement)	Operation of working attachment for concrete placement machines		Persons who have completed special education	Safety & Health Ordinance 36 (10-2)
Vehicle-type construction machines Operator (for demolition) (Breakers, steel section cutting machines, concrete crushers,	Machinery weight 3t or heavier	Driving services for vehicles that are powered and capable of self-propulsion to an unspecified location. However, this excludes driving on the road.	Persons who have completed the skill training course	Safety Health Act Order 20(12)
	Machinery weight Less than 3t		Persons who have completed special education	Safety & Health Ordinance 36(9)

gripping machines for demolition)				
Boring machine operator	Operation of boring machines		Persons who have completed special education	Safety & Health Ordinance 36 (10-3)
Operator of an aerial work platform	Work operating (excluding the case of traveling on the road) a vehicle for work at height with the working platform of 10 m or more in height		Persons who have completed the skill training course	Safety Health Act Order 20(15)
	Work operating (excluding the case of traveling on the road) a vehicle for work at height with the working platform of less than 10 m in height		Persons who have completed special education	Safety & Health Ordinance 36 (10-5)
Transporting vehicle on rough terrain Operator	Work operating a vehicle with a maximum loading capacity of 1 ton or more (excluding the case of traveling on the road)		Persons who have completed the skill training course	Safety Health Act Order 20(14)
	Work operating a vehicle with a maximum loading capacity of less than 1 ton (excluding the case of traveling on the road)		Persons who have completed special education	Safety & Health Ordinance 36(5-3)
Operator of powered vehicles on railways	Work operating a powered vehicle that transport people or cargo by rail		Persons who have completed special education	Safety & Health Ordinance 36 (13)
Operations supervisor and worker(s)	Duties		Qualification (Education) Requirements	Regulations/Articles
Forklift Operator	Work operating a forklift with a maximum load of 1 ton or more (excluding the case of traveling on the road)		Persons who have completed the skill training course	Safety Health Act Order 20(11)
	Work operating a forklift with a maximum load of less than 1 ton (excluding the case of traveling on the road)		Persons who have completed special education	Safety & Health Ordinance 36(5)
Shovel loader Operator	Work operating a shovel loader or a fork loader with a maximum load of 1 ton or more (excluding the case of traveling on the road)		Persons who have completed the skill training course	Safety Health Act Order 20(13)
	Work operating a shovel loader or a fork loader with a maximum load of less than 1 ton (excluding the case of traveling on the road)		Persons who have completed special education	Safety & Health Ordinance 36(5-2)

(4) Hoist

A hoist is a machine used for lifting and lowering, transporting, pulling work, etc. It is also called a winch. Completion of special education is required to operate hoists with power-driven systems.

Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles
Hoist operator	Hoists with power-driven system (excluding electric hoists, air hoists and other hoists pertaining to gondolas)	Persons who have completed special education	Safety & Health Ordinance 36(11)

(5) Grinding wheel

A grinding wheel is a tool for grinding and polishing mainly metals, and is attached to a grinder or a grinding machine. Grinding operations using grinders and grinding machines are hazardous because the disk-shaped grinding wheel rotates at a high speed. Therefore, completion of special education is required to engage in work involving replacement of grinding wheels or their test runs.

Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles
Grinding wheel replacement test run operator	Replacement of grinding wheels or their test runs at the time of replacement	Persons who have completed special education	Safety & Health Ordinance 36(1)

(6) Welding

Welding is a technique that uses heat to melt materials in order to join them together. Due to possibilities of electric shock, adverse effect on eyes from light, skin burns, and ignition and explosion of combustible materials,completion of special education is required to engage in gas welding and arc welding work. In addition, when welding using acetylene welding equipment or gas welding equipment using manifold, it is mandatory to have a gas yosetsu sagyo shuninsha (gas welding operations supervisor) who instructs workers on how to proceed with the work. To be appointed as a supervisor, a license is

required.

Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles
Gas welding operations supervisor	Welding, cutting, and heating of metals using acetylene welding equipment or gas welding equipment using manifold	License	Safety & Health Ordinance 314,316
Gas welder	Welding, cutting, or heating of metals using combustible gas and oxygen	Persons who have completed the skill training course	Safety Health Act Order 20(10)
Arc welder	Welding, cutting, etc. of metals using arc welding machines.	Persons who have completed special education	Safety & Health Ordinance 36(3)

(7) Electricity

Juden denro (charged circuit) in the table below refers to an exposed electric circuit that is turned on and can cause electric shocks if touched. Due to the risk of electric shock, completion of special education is required to engage in construction work involving charged circuits.

Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles
Electrician (High or low voltage)	Laying, inspection, repair, and operation of charged circuits or their supports, and operation of switchgear with exposed charged portions	Persons who have completed special education	Safety & Health Ordinance 36(4)

(8) Blasting and quarrying

Happa (blasting) is the process of boring a hole in a rock, setting explosives inside it and detonating it. A blasting operator's license is required to perform blasting work at quarry sites and construction sites. In addition, to perform excavation work at a height of 2 m or more for quarrying, completion of the skill training course is required.

Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles
Blasting operator	Blasting operations (boring, feeding, wiring, igniting, and inspecting and treating misfires and residual gunpowder)	License (blasting operator)	Safety Health Act Order 20(1), Safety & Health Ordinance 318
Quarrying excavation operations supervisor	Excavation work for the extraction of rock as defined in Article 2 of the Quarrying Act where the height of the excavation surface is 2 m or more	Persons who have completed the skill training course	Safety & Health Ordinance 403,404

(9) Oxygen deficiency work

There is a risk of anoxia (oxygen deficiency) and sulfide poisoning in manholes, underground passageways, sewers, and tunnels. Completion of a skill training course is required to work in places where it is likely to cause anoxia, and completion of special education is required to work in places where it is likely to cause sulfide poisoning.

Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles
Operations supervisor of work with oxygen deficient danger	Work in Class I and Class II places with danger of oxygen deficiency	Persons who have completed the skill training course (Class I and Class II)	Anoxia Ordinance 11
Workers engaging in work with oxygen deficient danger	Operations related to work with oxygen deficient danger	Persons who have completed special education	Safety & Health Ordinance 36(26) Anoxia Ordinance 12

(10) Dust

Substance particles generated by crushing or piling up of materials and dispersed into the air are called *funjin* (dust). Prolonged work in areas where there is always dust drifting in the air can be harmful to the human body due to continuous inhalation of dust. Completion of special education is

required to work in these locations on a regular basis.

Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles
Specified dust worker	Regular work pertaining to the specified dust operation	Persons who have completed special education	Safety & Health Ordinance 36(29) Dust Ordinance 22

(11) Hazardous substances

Completion of special education is required to work with hazardous substances.

Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles
Operations supervisor for specified chemical substances and tetra-alkyl lead, etc.	Work that produces or handles specified chemical substances (arc-welding operations supervisor) Work involving tetra-alkyl lead, etc.	Persons who have completed the skill training course	Specified Chemical Ordinance 27,28 Tetra-alkyl Lead Poisoning Ordinance 14,15
Lead danger operations supervisor	Operations related to lead work (excluding those conducted by remote control in isolated rooms)	Persons who have completed the skill training course	Lead Ordinance 33,34
Asbestos operations supervisor	Work to manufacture or handle specified asbestos, etc.	Persons who have completed the skill training course	Asbestos Ordinance 19
Asbestos handling worker	Work such as demolition of buildings or structures in which asbestos, etc. is used	Persons who have completed special education	Asbestos Ordinance 27
Tetra-alkyl lead workers	Operations such as handling tetra-alkyl lead	Persons who have completed special education	Safety & Health Ordinance 36(25) Tetra-alkyl Lead Poisoning Ordinance 21
Organic solvents operations supervisor	Work in indoor worksites, tanks, etc. where organic solvents and substances containing 5%	Persons who have completed the	Organic Solvent Ordinance

	or more organic solvents are handled	skill training course	19,19-2
Waste treatment facility workers	Handling of soot and dust, burnt ash and other burnt residues associated with the work at waste treatment facilities	Persons who have completed special education	Safety & Health Ordinance 36(34)
	Work on maintenance and inspection, etc., of equipment such as waste incinerator and dust collector, etc. installed in waste treatment facilities	Persons who have completed special education	Safety & Health Ordinance 36(35)
	Work of dismantling, etc., equipment such as waste incinerators and dust collectors, etc., installed in waste treatment facilities, and work handling soot and dust, burnt ash and other burnt residues associated with the work	Persons who have completed special education	Safety & Health Ordinance 36(36)

(12) Freight handling and cargo handling operations

Stacked cargo is called *hai*, stacking cargo high is called *haizuke*, and unloading cargo is called *haikuzushi*. Poor stacking techniques can lead to the load collapsing and causing serious accidents. Completion of special education is required to perform the duties listed in the table below.

Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles
Cargo stacking operations supervisor	Cargo stacking or unstacking operation for a cargo pile having a height of 2 m or more (excluding work performed solely by the operator of the cargo handling machine)	Persons who have completed the skill training course	Safety & Health Ordinance 428,429
Stevedoring operations supervisor	Work of loading cargos to a vessel, unloading cargos from a vessel, or moving cargos in a vessel (excluding work performed without using cargo lifting appliances on a vessel of less than 500 tons gross tonnage).	Persons who have completed the skill training course	Safety & Health Ordinance 450,451
Slinger	Slinging of cargo lifting appliances with a limited load of 1 ton or more, or cranes, mobile cranes or derricks having a lifting capacity of 1 ton or more	Persons who have completed the skill training course	Safety Health Act Order 20(16) Safety Ordinance for Cranes 221
	Slinging of cargo lifting appliances with a limited load of less than 1 ton, or cranes, mobile cranes or derricks having a lifting capacity of less than 1 ton	Persons who have completed special education	Safety & Health Ordinance 36(19) Safety Ordinance for Cranes 222

(13) Hyperbaric work

Completion of special education is required to work in areas with high atmospheric pressure. In particular, licenses are required for operations supervisor for work inside hyperbaric chambers and divers.

Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles
Operations supervisor for work inside hyperbaric chambers	Work inside a high-pressure chamber (work performed inside a workroom or shaft where the inside pressure exceeds the atmospheric pressure, by means of a caisson method or other compressed air methods)	License	High Pressure Work Ordinance 10
Air compressor technician	Work operating an air compressor for sending air to a work chamber or man-lock chamber	Persons who have completed special education	Safety & Health Ordinance 36(20-2) High Pressure Work Ordinance 11
Air adjuster valve technician	Work operating valves or cocks for adjusting the amount of air to be delivered to working chambers or diving workers	Persons who have completed special education	Safety & Health Ordinance 36(21,23) High Pressure Work Ordinance 11
Pressure regulating technician	Work operating valves and cocks for adjusting the amount of fresh air to be delivered to or air to be let out of a man-lock chamber	Persons who have completed special education	Safety & Health Ordinance 36(22) High Pressure Work Ordinance 11
Recompression chamber operating technician	Work operating a recompression chamber	Persons who have completed special education	Safety & Health Ordinance 36(24) High Pressure Work Ordinance 11
Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles

Hyperbaric chamber workers	Operation pertaining to work in hyperbaric chamber	Persons who have completed special education	Safety & Health Ordinance 36(24-2) High Pressure Work Ordinance 11
Diver	Operation carried out in water using diving apparatus while receiving the air supply from an air compressor or by manual pump, or from a compressed-air cylinder	License (diver)	Safety & Health Ordinance 20(9) High Pressure Work Ordinance 12

(14) Other construction work

Completion of skill training courses or special education is required to engage in the construction work listed in the table below.

Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles
Concrete breaker Operations supervisor	Breaking operations using concrete breakers	Persons who have completed the skill training course	Safety & Health Ordinance 321-3,-4
Excavating natural ground and shoring operations supervisor	Excavation work, fitting or removing struts or waling of shoring of the natural ground where the height of the excavating surface is 2 m or more	Persons who have completed the skill training course	Safety & Health Ordinance 359,360, 374,375
Tunnel excavation, etc. operations supervisor	Work of excavating tunnels, etc., or muck loading associated with it, assembling of tunnel shoring, lock bolt fastening or work to spray concrete, etc.	Persons who have completed the skill training course	Safety & Health Ordinance 383-2,-3
Operations tunnel lining, etc. operations supervisor	Assembly, moving, dismantling, and concrete pouring of tunnel concrete form shoring and other work to cover tunnels, etc.	Persons who have completed the skill training course	Safety & Health Ordinance 383-4,-5
Workers inside the tunnel	Excavation, covering, etc. of tunnels, etc.	Persons who have completed special education	Safety & Health Ordinance 36(30)
Concrete form shoring assembly, etc. operations supervisor	Assembly or disassembly of concrete form shoring	Persons who have completed the skill training	Safety & Health Ordinance 246,247

		course	
Scaffolding assembly, etc. operations supervisor	Work to assemble, dismantle or alter suspended scaffolding, overhanging scaffolding or scaffolding of a height of 5 m or more	Persons who have completed the skill training course	Safety & Health Ordinance 565,566
Scaffolding assembly and other operations	Work related to the assembly, dismantling or alteration of scaffolding	Persons who have completed special education	Safety & Health Ordinance 36(39)
Operations supervisor and worker(s)	Duties	Qualification (Education) Requirements	Regulations/Articles
Operations supervisor for the assembly, etc. of the steel frames of buildings, etc.	Work to assemble, dismantle or alter the frame of buildings or towers that is composed of metallic members (limited to those with a height of 5 m or more)	Persons who have completed the skill training course	Safety & Health Ordinance 517-4,-5
Steel bridge installation, etc. operations supervisor	Work to install, dismantle and alter bridge superstructures composed of metallic members (limited to those whose height is 5 m or the portion of such superstructure with a bridge span of 30 m or more)	Persons who have completed the skill training course	Safety & Health Ordinance 517-8,-9
Wooden building erection, etc. operations supervisor	Work to assemble construction members of wooden buildings or work of mounting roof and exterior wall backings	Persons who have completed the skill training course	Safety & Health Ordinance 517-12,-13
Concrete structure demolition, etc. operations supervisor	Work to dismantle or demolish concrete structures with a height of 5 m	Persons who have completed the skill training course	Safety & Health Ordinance 517-17,-18
Concrete bridge installation, etc. operations supervisor	Work to install, dismantle and alter bridge superstructures (limited to those whose height is 5 m or the portion of such superstructure with a bridge span of 30 m or more)	Persons who have completed the skill training course	Safety & Health Ordinance 517-22,-23
Rope work at height	Work performed using lifting equipment, and in which the worker is held in place by such lifting equipment, at a height of 2 m or more where it is difficult to provide a working platform	Persons who have completed special education	Safety & Health Ordinance 36(40)

Chapter 4: Greetings, Terminologies, and Tips on Community Living at Construction Sites

sites use special words and terms that are not often used in everyday life. Understanding these important not only for smoother communication, but also to ensure that the work proceeds safely and

4.1 Greetings, Emergency Warnings, Etc.

is more likely to have a good impression of those who greet him or her. Also, the choice of phrases can brighten someone's day. Greet everyone cheerfully, even if you don't know them.

4.1.1 "Ohayogozaimasu."

Ohayogozaimasu" is good morning, and is the basic morning greeting. Say "Ohayogozaimasu!" in the morning to everyone when it is the first time seeing them that day.

4.1.2 "Goanzenni."

There are many hazards on construction sites. In addition to considering your own safety, use "Goanzenni" to express your hope that your colleagues will also be safe, and that they may conclude the day's work without any accidents or injuries. Since the phrase shows consideration for the other person, those who hear it will feel encouraged in doing their work.

For example, at the end of the morning meeting, everyone says "Kyo mo ichinichi goanzenni" before starting work, expressing the wish for everyone to have a safe day. Also say, "Goanzenni!" when you pass by someone who is engaged in dangerous work. The person to whom it is said can go to the work site with a positive feeling and a desire to be careful.

4.1.3 “Otsukaresamadesu.”

“Otsukaresamadesu” is a phrase that expresses gratitude and appreciation for the other person's work and hardship. Unlike “Goanzenni” (“stay safe”), “Otsukaresamadesu” can be used not only at construction sites, but anywhere there are workers. It can be used when passing each other in an office, break area, hallway, etc. If you see someone leaving after work, cheerfully say, “Otsukaresamadeshita!” to thank them and send them off.

4.1.4 “Gokurosama.”

“Gokurosama” is a phrase used to _ and show appreciation for what the other person has done for you Although this term can be used for people who are superior to you, such as site supervisors, foremen, and seniors, most Japanese people consider it impolite to use it when speaking to superiors. It is probably best not to use “Gokurosama” with your superiors.

On the other hand, if a superior says to you, “Gokurosama!” it means that they are grateful to you. Reply with an energetic “Arigatogozaimasu!”

4.1.5 “Shitsureishimasu.”

“Shitsureishimasu” (excuse me) is a common phrase used by everyone, not just in the construction industry. *Rei* refers to courtesy (manners), and *shitsu* means to lose. The original meaning of the word is “lacking in manners,” but this phrase is not offensive.

For example, when entering a room, you might say, “Shitsureishimasu (for interrupting your conversation),” indicating that you are aware that you might be interrupting someone who is working in the room.

When the person you need to urgently speak to is in conversation with someone else, you say, “Shitsureishimasu.”

When you are leaving while someone else is still working, you can use the phrase “Osakini

shitsureishimasu" (I will take my leave)." To that, say, "Otsukaresamadeshita."

4.1.6 "Abunai"

When you are concentrating on your work, you may not realize the danger that is approaching you. When people sense that a person is in danger, the first thing they say is "Abunai!" If the danger comes from an object falling down from above or from the side, they will say, "Abunai! Yokero!" ("Look out! Dodge!") If you hear a voice yelling, "Abunai!", react immediately.

4.2 Terms Used on Construction Sites

4.2 explains the terms you need to know when working under the direction of a foreman or senior staff member.

4.2.1 Terms Related to Layout Marking

[Sumidashi] (layout marking) Drawing various reference lines on the ground, etc. that are necessary for construction. Traditional line markers and laser markers are used.

[Kijunzumi] (reference marking) The horizontal and vertical lines that are used as a reference when building. From the reference marking lines, the axis lines of the columns and walls are drawn.

[Torishin] (axis line) The line that passes through the center. Sometimes it is used to refer to *kabeshin* and *hashirashin*.

[Nigezumi] (offset marking) A line drawn when a reference marking cannot be drawn due to obstructions. It is also called *kaerisumi*. The line is drawn parallel to or as an extension of the reference marking. The distance from the reference marking is written down for future information.

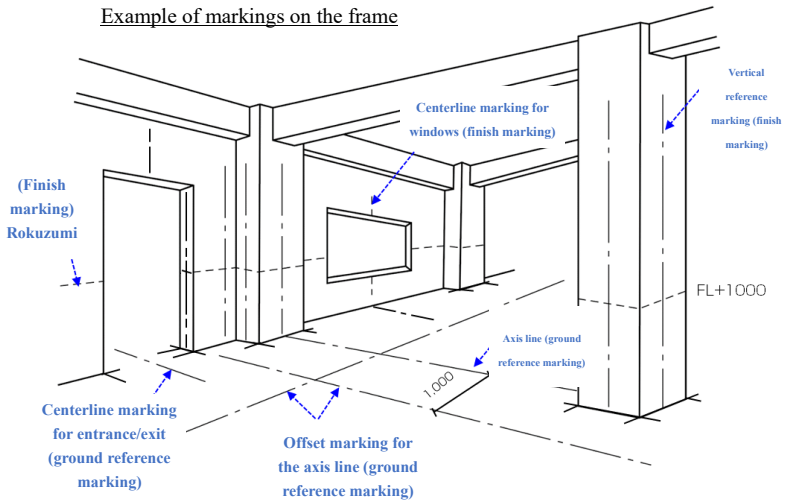
[Rokuzumi] (level marking) Horizontal lines to indicate the standard height, also called *rikuzumi*. Also called *koshizumi*, *mizuzumi*, and *suiheizumi*.

[Tatezumi] (vertical reference marking) Vertical lines indicated on the surfaces of walls, columns, and other surfaces.

[Jizumi] (floor reference line) Reference lines drawn directly onto horizontal surfaces such as floors.

[Shiagezumi] (finish marking) Lines that indicate the finished dimensions based on the axis lines and the building frame surfaces.

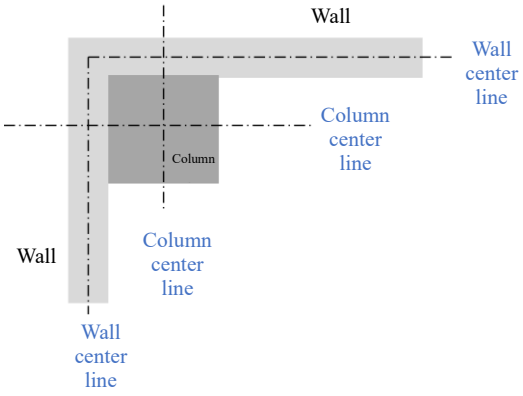
Example of markings on the frame



[Kabeshin] (wall center line) A line through the center of the wall.

[Hashirashin] (column center line) A line through the center of the column.

[Oyazumi] (parent marking) A line used as a reference for the next process of layout marking work, such as drawing the axis line and the level marking.



[Kane wo furu] (perpendicular marking) Drawing a perpendicular line.

[Sumitsuke] (marking out) Marking wooden members for fabrication.

4.2.2 Terms Related to Temporary Enclosures

[Yarikata] (temporary enclosure) A temporary enclosure made so that the reference lines (centerlines of columns and walls, horizontal line, etc.), position of the building, right angle, and leveling (height reference) can be found. It is made with wooden stakes and boards called *mizunuki*. In civil engineering, the term *chobari* is used.

[Mizunuki] (board) Boards hammered horizontally onto the wooden stakes to make a temporary enclosure.

[Mizumori] (leveling) It is to establish the leveling as the standard for the height of a building. It is called *mizumori* because it uses a tool called *mizumori-kan*.

[Jinawahari] (setting out) A process of marking the ground to determine the position of a building. Rope or tough tape is used.

[Mizuito] (level line) A string indicating the level, stretched between the boards in a temporary enclosure. This is the reference for the axis line.

[Benchmark/BM] A reference point for the height of a site or building. It will not be removed until the building is completed. With BM as the reference, higher positions are indicated by "+" numbers and lower positions by "-" numbers. Example: GL=BM+200

[GL] Abbreviation for Ground Level or Ground Line. It is the height of the surface of the land on which the building is to be built.

[FH] Abbreviation for Formation Height. The height of the planned lot.

[FL] Abbreviation for Floor Level or Floor Line. The height of the finished surface of the floor. The first floor is represented as 1FL and the second floor as 2FL.

[SL] Abbreviation for Slab Level or Slab Line. The finished height of the slab.

[CH] Abbreviation for Ceiling Height. This is the height from the FL to the finished ceiling surface.

4.2.3 Terms Related to Earthwork

[Dokoji] (earthwork) Construction work to create the ground base, foundations, and underground structures for buildings.

[Morido] (embankment) The process of creating a flat surface by heaping up soil on slopes, uneven land, and land with low elevation.

[Dankiri] (terracing) When embanking a steep slope, stair-like shapes are cut to prevent the soil from sliding down.

[Shimekatame] (compaction) The process of applying pressure to soil, sand, or asphalt to reduce the gaps between particles and increase their density (called *mitsujitsu*). For example, compaction is used to create a firm aggregate base layer during pavement construction.

[Ten'atsu] (machine compaction) Compaction of soil using tire rollers, etc. Compaction of broken stones and gravel by small machines such as rammers is also called *ten'atsu*.

[Umemodoshi] (backfilling) The process of filling in soil up to the *doma* level (ground under the house) inside and outside of a building after the completion of underground work such as underground beams.

[Tsukikatame] (compaction by tamping) The process of increasing the density of the backfilled soil using rammers, plates, or other means.

[Roban] (aggregate base layer) The layer created above the subgrade layer. It serves to disperse the forces transmitted from the asphalt surface layer and transfer them to the subgrade layer.

[Rosho] (subgrade layer) The portion of the ground supporting the pavement that is approximately 1 m from the temporary surface of the pavement.

[Hyoso] (surface layer) The uppermost layer in asphalt pavement.

[Jinawahari] (setting out) A process of marking the perimeter of the foundation with a rope, vinyl string, etc to indicate the scope of the foundation. The term is used in architecture.

[Nekiri] (foundation excavation) This is the process of digging (called *kussaku*) a hole to the bottom

of the foundation using heavy machinery or other equipment.

[Neire nagasa] (footing depth) The length or depth from the excavation floor to the top of the foundation or pile.

[Subori] (unprotected excavation) When the ground condition is good and there is no danger of collapses, excavation is done without *dodome* (earth retaining) to prevent the soil from collapsing.

[Dodome] (earth retaining) Taking measures to hold back slopes, fill, excavated trenches, etc. to prevent them from collapsing.

[Yoheki] (retaining wall) A wall-like structure of for *dodome* (earth retaining) is called *yoheki*.

[Bashouchi] (cast-in-situ) Concrete work in which concrete is cast directly on-site instead of using factory-cast concrete products. It is also called *genbauchi* (on-site placement). For example, there are two types of piling methods: *kisei kui koho* (precast piling method) and *bashouchi* concrete *kui koho* (cast-in-situ concrete piling method).

[Utsu] (placing/casting) *Utsu* means to beat, but in construction terminology, pouring concrete is called *utsu* or *dasetsu suru* (casting/placing).

[Yobori] (extra excavation) The excavation of extra space for the work area during foundation excavation.

[Sukitori] (grading) The process of scraping excess undulations on the site and the excavation floor to create a flat surface at a predetermined height.

[Tokozuke] (bottom leveling) After excavating to almost the planned depth, the process of accurately leveling and finishing the excavation floor.

[Kuima sarai] (leveling between the piles) The soil between and around the piles accumulated during bottom leveling is dug up and leveled.

[Dan bane] (step excavation) In order to remove the excavated soil (called *haido*) when the foundation excavation is deep, the ground is left stair-stepped and the excavated soil is successively flung up to the upper level.

[Jiyama] (untouched ground) The term refers to the ground in its natural state.

[Norimen] (slope) A sloped surface, also called *nori*. On a construction site, it refers to a sloped excavation surface.

[Yama ga kuru] (landslide) The collapsing of the soil retainer or an excavated slope. This often leads to onsite disasters.

[Yamadome] (soil retaining) The use of sheet piles and other means to hold back the soil to prevent the ground from collapsing. If there is room on the site, the open-cut *koho* (open-cut method) is used to cut the ground at an angle. If there is not enough room on the site, the *yamadome kabe* open-cut *koho* (soil-retaining wall open-cut method) is used to provide walls and shoring.

[Yaita] (sheet piles) Boards used to stop earh/soil.

[Koyaita] (steel sheet piles) Steel sheet piles with grooved ends so that they can be joined to each other.

[Mizukae] (water drainage) To drain the water that accumulates at the excavation floor by making a water pit, using a pump. etc.

[Kamaba] (water pit) A pit where a water pump is installed for water drainage.

[Yamazuna] (sand from mountains) Sand collected from land. It has a higher water retention capacity than sand collected from rivers.

[Mizushime] (water compaction) The process of compacting backfilled soil by pouring water into the soil. This is done to make the backfill more dense. For example, when steel sheet piles for soil retaining are pulled out, some surrounding sediment comes out along with the piles. If backfilled as it is with gaps, it will cause sinking after a while. Water compaction is performed to prevent this sinking.

[Manbo] (counting) Counting the number of trucks and people entering the site, as well as the number of logs and wood piles.

4.2.4 Terms Related to Subgrade and Foundation Work

[Jigyo] (subgrade] The area under the foundation slab or work related to it. Sand, gravel, broken stones, nonstructural concrete, and piles are used to support the foundation slab. There are a variety of subgrade work depending on the type of material.

[Kiso] (foundation) The portion that transfers the weight of the structure (called *kenzobutsu kaju* (building load)) directly to the ground. Types include shallow foundation and pile foundation.

[Chokusetsu kiso] (shallow foundation) A foundation that transfers the building load directly to the ground. A foundation that covers the entire bottom of the building is called *beta kiso* (mat foundation). In addition, a foundation shaped like an inverted letter "T" that is constructed only where a particular load is applied is called a footing. Both are used in locations where the ground is solid and firm.

[Kui kiso] (pile foundation) A foundation built in areas where the ground is weak. Cylindrical columns called *kui* (piles) are driven in to reach solid ground to support the building load.

[Slab] Originally, the word "slab" meant a flat plate or stone slab, but in buildings, it refers to a flat area such as a floor or foundation. A slab that supports a building is called *kozo* slab (structural slab), a structural slab that refers specifically to the foundation is called *kiso* slab (foundation slab), and a slab without beams is called a flat slab, and so on, in combination with various other words.

[Kui jigyo] (pile foundation work) Work for pile foundation. There are precast concrete pile foundation work, steel pile foundation work, and cast-in-situ concrete pile foundation work.

[Kiso menshin] (foundation isolation) A system that absorbs horizontal forces applied to a building in the event of an earthquake and reduces the forces transmitted to the building. This construction method is necessary for constructing buildings and condominiums in Japan, where earthquakes are common. It is installed between the ground and the foundation.

4.2.5 Terms Related to Scaffolding and Temporary Construction

[Scaffolding] There are various types of scaffolding depending on use and structure. On a construction

site, it refers to a temporary floor or walkway assembled with circular hollow section or special materials. Framed scaffolding, tube scaffolding, and ringlock scaffolding are often used.

[Sagyo yuka] (working platform) A scaffold floor is made of scaffold boards (called *nunoita* (scaffold plank with hooks)) and other materials stretched over the floor so that people can work on top of it.

[Karigakoi] (temporary enclosure) Temporary enclosures that separate the construction site from the adjacent land or road in order to restrict access to the site by persons not involved in the construction to prevent danger and theft.

4.2.6 Terms Related to Rebar, Formwork, and Concrete Placement Work

[Haikin] (rebar placement) Placement and assembly of reinforcing bars. Rebar placement methods include double reinforcement, single reinforcement, and staggered reinforcement.

[Hiroidashi] (calculation) To calculate the materials required, their quantities, and labor (how many people it will take) from the drawings and specifications.

[Asobi] (play) Margin and play.

[Aki] (space) The distance between the rebars.

[Kankaku] (spacing) Distance between centers of rebars.

[Sute concrete] (nonstructural concrete) Concrete that is placed flat with a thickness of 5 cm to 10 cm, mainly for layout marking and erecting formwork. It is abbreviated as *sutecon*. In addition to establishing a reference for the marked height, nonstructural concrete is used as a base for accurate placement of formwork and rebars.

[Kessoku] (tie) To tie something up. In rebar work, special binding wire is tied at the intersection of the reinforcing bars using a tool called a hacker. There are two types of knots called *tasukigake* (cross tie) and *kata dasuki* (simple tie)

[Kaburi atsusa] (concrete cover thickness) The distance between the rebars and the surface of the

concrete covering them.

[Tatekomi] (formwork erecting) The process of erecting the formwork in accordance with the layout marking lines.

[Noro] (cement slurry) Cement dissolved in water is called *noro*. In formwork carpentry, concrete can leak from gaps between the joints of the formwork, and this is also called *noro*.

[Anko] (temporary lid) When making a complicated groove or notch in concrete, this member prevents the concrete placed in that area from pouring into said groove or notch. It is removed after the concrete has set.

[Ten'yo] (reuse) The use of the same formwork material at a different site. When the structure of each floor is the same in a construction project such as a building, the formwork used is moved up to the floor above and used again.

[Panku] (blow-out) When the formwork breaks during placing or hardening (setting) of concrete and the concrete flows out. Blow-outs occur when the shoring is not sufficient.

[Kugi jimai] (nail removal) Removal of nails from the formwork in order to reuse the formwork material. This is why the term is used to refer to putting away the formwork.

[Uchikomi] (second pouring) Pouring concrete into the formwork and packing without gaps.

[Uchikasane] (additional pouring) Pouring concrete on top of concrete that has not hardened yet. If the concrete is not poured before the previous batch has hardened, cold joints will occur. When the outside temperature is below 25°C, the second pour should be done within 150 minutes; when the outside temperature is above 25°C, the second pour should be done within 120 minutes.

[Cold joint] Joint that occurs when the timing of the second pouring is not appropriate.

[Uchitsugi] (staging) Pouring concrete on top of concrete that has already hardened. Staging is performed at locations determined to have no structural or waterproofing problems.

[Shimekatame] (compaction) A term that also appears in earthwork, but in concrete placement, poured concrete is vibrated with a vibrator or the formwork is tapped with a rubber hammer to

eliminate gaps in the concrete and make it dense.

[Tamping] The process of tamping the surface of the slab formwork so that the concrete placed in the slab becomes dense.

[Nerimaze] (mixing) Mixing cement and aggregate uniformly.

[Haigo] (blend) The ratio of each material used to make concrete.

4.2.7 Terms Describing Fit and Condition

[Osamari] (fit) A word used to describe the balance of the arrangement of things. It is used to mean *osamari ga ii* (well-fitted) or *osamari ga warui* (poorly fitted).

[Toriai] (interface) The part where two or more different members meet, or the treatment of that part. When two parts collide with each other at a point where they should not collide, it is called *toriai ga warui* (poor interfacing). The phrase "poorly fitted" is also used in the same sense. The phrase *tenjo to kabe no toriai* (the ceiling-wall interface), refers to the joint between the ceiling and the wall.

[Mitsuke] (visible face) *Men* (face) of a member that is visible from the front when the construction is finished.

[Miegakari] (visible part) Similar to *mitsuke*, this term refers to the visible part of a construction member. While *mitsuke* indicates and entire surface that is visible, *miegakari* refers to a part that it is visible through a gap or at an angle.

[Miekakure] (hidden part) The opposite of *miegakari*, it means "less visible." It refers to something that is visible or not visible, meaning a member that becomes visible when something is moved or flipped.

[Tori] (straightness) The state of being in a straight line. If something is bent or distorted, it is called *tori ga warui* (not straight). The process of checking to see if something is straight is called *tori wo miru*.

[Tsura] (surface) The surface. It is also called *men*.

[Tsuraichi] (flush) The state in which the surfaces of two members are flat and aligned. It is used as *tsuraichi ni suru* (make flush).

[Sori] (concave) A line or curved surface that is in a concave state.

[Mukuri] (convex) A line or curved surface that is in a convex state.

[Roku] (horizontal) Refers to a horizontal state, also called *riku*. For example, a horizontal roof is called *roku yane* (flat roof).

[Furoku] (uneven) Refers to a state in which a surface is uneven. Also called *furiku*.

[Mechigai] (misalignment) Refers to a state in which the surfaces of planks**,** boards, tiles, etc. are not flush with each other when they are joined together, or the joints are not aligned.

[Ogamu] (leaning) A term used to describe a building or other structure that should be standing upright, but is leaning.

[Kane] (right angle) A right angle.

[Korobi] (tilted) When a pillar or wall that should be vertical is tilted. It is also used for sloped columns.

[Nige] (tolerance) The allowable variation in terms of dimensions or installation that is set in advance. Nige (tolerance) is set in order to absorb material processing errors and on-site installation errors.

[Mikiru] (trimming) To clean up the joint portion of two works. The member used to do this is called *mikirizai* (trimmer). For example, the border between the floor and the wall is neatly finished with trimmers. Also, when painting walls, curing tape can be applied to the joints to ensure that the finish has no gaps.

[Najimi] (adhesion) When two or more members are combined, this term is used to describe that the joints are tightly adhered to each other. When the adhesion is good, it is referred to as *najimi ga ii* (good adhesion) and when the adhesion is poor it is referred to as *najimi ga warui* (poor adhesion).

[Sute] (nonstructural) A term for materials that are not related to the structure or finish of the material itself, but are used to improve the fit of the construction. For example, it is used as in *sute* concrete

(nonstructural concrete).

[Beta] (fully spread) The term to describe something being spread over the entire surface without **gaps**. *Beta kiso* (mat foundation) is a type of foundation in which concrete is poured to cover the entire bottom of the building. *Beta nuri* is a coating applied to the entire surface.

[Fukashi] (over-dimensioned) Refers to the portion of the finished project that is larger than indicated in the design. It is also used to indicate when the finished surface is made visible from the front. *Fukasu* means to make *fukashi*.

[Temodori] (rework) To redo a process that has already been completed, used as in *temodori ga okoru* (rework occurs).

[Dandori] (preparation) To consider the method of construction and plan the procedure in advance to avoid rework.

[Tenaoshi] (retouch) To correct a part of the work that has already been done. Retouching is conducted when there are any portions that differ from the blueprints or have defective workmanship.

[Dame] (deficiency) A term used to indicate that there are oversights or unfinished portions of a building project that is almost complete. Finishing that part is called *dame naoshi* (deficiency correction)".

[Tappa] (height) Height.

[Uwaba] (upper end) The term used to describe the upper end of an object or a member.

[Shitaba] (bottom end) The term used to describe the bottom end of an object or a member.

4.2.8 Terms Related to Length, Breadth, and Width

[Pitch] Spacing between allocations.

[Ou] (laying out) To take the dimensions from the reference position.

[Sunpo] (length) Length.

[Ikken] (1 ken)A unit of length used in Japan since ancient times. Approx. 1.8 m. 1818 mm to be

exact.

[Isshaku] (1 shaku) A unit of length used in Japan since ancient times. Approx. 30.3 cm.

[Issun] (1 sun) One tenth of *isshaku*. Approx. 3.03 cm.

[Hitotsubo] (1 tsubo) A unit of area used in Japan since ancient times. 1 tsubo = 1 ken x 1 ken.

4.2.9 Terms Describing Building Structure

[RC structure] RC is abbreviation for Reinforced Concrete. A building structure in which concrete is poured into formwork with reinforcing steel bars and hardened. Also called *tekkin* concrete *zo*.

[S structure] S is abbreviation for Steel. A building structure that uses steel sections for columns and beams. Also called tekkotsu zo.

[SRCstructure] A building structure combining S and RC structures. Reinforcing bars are assembled around the steel section, and then concrete is poured. Also called tekkotsu tekkin concrete zo.

[Moku zo] (wooden-frame structure) A building structure that uses wood for posts and beams.

[Concrete block zo] (concrete block structure) A building structure made of stacked concrete blocks.

4.2.10 Terms Related to Electrical and Telecommunications Work

[Setsuzoku] (connection) In general, the term *setsuzoku* (connection) refers to connecting two or more things. When communication lines are connected to each other, it is also called *kessen* (wiring).

[Haisen] (wiring) Running metal cables, fiber-optic cables, etc.

[Rikaku] (clearance) Separation of wiring and piping from each other. The distance is called the *rikaku kyori* (clearance distance).

[Zetsuen] (insulation) To prevent electric current from flowing from one part to another.

[Kantsu] (penetration) To drill a hole in a wall, floor, ceiling, etc. all the way through to the opposite side.

[Kanro] (conduit) A pipe through which electric wires pass. The method of burying wires underground using pipes is called *kanroshiki* (conduit method).

[Maisetsu] (underground installation) Burying electric cables, etc. underground. There are three main methods of underground installation.

- Conduit method: A method in which rigid vinyl or metal pipes are buried and cables are passed through them.
- Direct burial method: Wiring is done using dedicated direct burial cables.
- Cable tunnel method: A method in which a dedicated tunnel or common trench is built to carry electric lines.

[Kaku haisen] (overhead wiring) This method uses utility poles to route cables into the building.

[Haikan suru] (piping) To install a pipe to pass a cable through.

[Tsusen] (wire pulling) Running cables through piping.

[Slab haikan] (slab piping) Piping that is buried in the floor or ceiling of a building.

[MDF] Abbreviation for Main Distribution Frame, which is a wiring panel used to manage and connect communication lines from inside to outside of a building.

[Inpei] (conceal) To cover up with something so that it is not noticeable. For example, making air conditioner piping inconspicuous by passing it through the wall is called *inpei haikan* (concealed piping).

[Roshutsu] (exposed) To be visible on the surface without concealing it. The opposite of *inpei haikan* is *roshutsu haikan* (exposed piping).

[Fuseru] (creating an outlet) Using end members to create a pipe outlet from the ceiling slab.

[Kanden] (electric shock) Electric current flowing through the human body.

[Roden] (electric leakage) Electricity flowing to parts where it should not.

[Secchi/earth] (grounding/earth) An electrical connection between electrical equipment or circuits and the earth. This is done to prevent electric shock in the event of a leakage and to protect

communication equipment from damages.

[Hiraishin] (lightning rod) Equipment to protect buildings and people from lightning. It receives lightning and promptly discharges the current caused by the lightning into the atmosphere.

[Hiraiki] (surge protector) A device that protects communications equipment, terminal equipment, etc. from lightning strikes.

[Tanraku] (short circuit) A connection between two points in an electric circuit with a low-resistance conductor. Also called short.

[Teiatsu] (low voltage) A voltage within the range of 750V or less for DC and 600V or less for AC. Together with *koatsu* (high voltage) and *tokubetsu koatsu* (extra-high voltage), they are defined in the Ministerial Order to Provide Technical Standards for Electric Equipment.

[Koatsu] (high voltage) A voltage in the range of 750 V to 7000 V for DC and 600 V to 7000 V for AC.

[Tokubetsu koatsu] (extra-high voltage) This refers to voltages exceeding 7,000 V for both DC and AC.

[Acchaku] (crimp) Joining by applying pressure. In electrical work, there are special tools (such as crimpers) for crimping core wires and crimp terminals.

[Chokuryu] (direct current) A current that does not change in magnitude or direction with time. Also called DC (Direct Current).

[Koryu] (alternating current) A current that periodically changes in magnitude and direction. Also called AC (Alternating Current).

[Tenmetsu] (flashing light) When a light flashes on and off.

[Hifuku] (coating) The vinyl or insulating portion covering the core wire.

[Ichijigawa/nijigawa] (primary/secondary side) The side where electricity enters the electrical facility is called the primary side, and the side where electricity leaves is called the secondary side.

[Mashishime] (retightening) The process of checking for looseness of screws and retightening them.

[Marking] After retightening, the screws may loosen due to vibration after a certain period of time. Marking is done to show that this certain screw has loosened.

[Tsuden] (energized) Electricity is live.

[Ataru] (examine) To examine something. In electrical work, the word is used to check the energized state using a voltage tester or to check the voltage and current using a measuring instrument.

[Kashimeru] (crimping) To tightly fasten a wire joint by using crimpers to crush a crimp terminal such as a ring sleeve.

[Shikomu] (prep) To prepare for the work in advance.

[Furu] (reroute) To change the piping or wiring route to avoid obstructions.

[Seru] (interference) When objects are about to collide with each other.

[Tobu/ochiru] (trip) When the breaker is tripped and the circuit is opened.

[Φ] Diameter. The correct reading is *fai* (phi), but in the building industry it is called *pai*.

4.2.11 Terms Used in Lifeline Infrastructure/Equipment Installation

[Kucho] (air conditioning) Adjusting the temperature, humidity, etc. in a room. It is short for *kuki chowa setsubi*.

[Ondo] (temperature) The degree of hot and cold. In Japan, the unit used is ℃ (Celsius).

[Shitsudo] (humidity) The percentage of moisture in the air. Humidity is described by saying that it is “damp and humid” when there is a lot of moisture and “fresh and low humidity” when there is little moisture. The unit used is %.

[Kanki] (ventilation) Replacing dirty air in a room with fresh air.

[Haien] (smoke ventilation) To discharge smoke and other substances generated in the event of a fire from the inside of a room to the outside.

[Eisei] (hygiene) Refers to protecting people's health and maintaining cleanliness. The term *eisei*

setsubi (sanitary facilities) refers to facilities related to water (e.g., toilets, bathrooms, etc.), excluding the kitchen.

[Shinimizu] (stagnant water) Refers to water in a storage tank or piping that has remained still and unmoving for an extended period of time.

[Bari] (burr) An excess portion of metal or plastic that protrudes from the edge of a product during the processing process. *Bari tori* (deburring) is the process of removing burrs for a smooth finish.

[Gyakuryu] (backflow) Liquid or gas flowing in the opposite direction to the correct flow.

[Bunki] (branching) Splitting of a single pipe into two.

[Shinshuku] (elongation and contraction) When a material stretches or shrinks.

[Jabara] (bellow) Tubular-shaped object that expands and contracts.

[Lining] Coating the surface of pipes and ducts with a thin film, also called coating. Depending on the thickness of the coating, a thicker coating is called a lining and a thinner coating is called a coating, but they are often used interchangeably.

[Roei shiken] (leakage test) A test to check for water leakage (called leakage) after the piping is finished. There are also water pressure test, full-load test, etc.

[Suiatsu shiken] (water pressure test) A test to confirm that there is no leakage by putting water in pipes such as water supply pipes and hot water pipes to apply pressure.

[Mansui shiken] (full-load test) A test in which drainpipes are filled with water to confirm that there are no leaks.

[Kobai] (gradient) A gentle slope to allow water to flow.

[Osui] (sewage) Drainage from toilets and urinals.

[Zatsu haisui] (domestic wastewater) Wastewater from baths, washrooms, and kitchens.

[Shin] (axis) The centerline of a pipe or duct.

[Saki] (end) The end of the piping.

[Tsura] (flange face) The face of the flange.

4.3 Precautions for Communal Living

4.3.1 5S Activities

In order to create a safe, pleasant and comfortable working environment, an activity called 5S has been implemented in Japan. 5S stands for five words starting with S: Seiri (sort), Seiton (set in order), Seisou (shine), Seiketsu (standardize), and Shituke (sustain). At times, 3S activities, which take the three elements of “sort,”” set in order” and “shine,” and 4S activities, which adds “sustain” to these activities, are carried out.

(1) Sort

Sort refers to the process of separating the necessary from the unnecessary, discarding what is unnecessary and putting away what will be used later. Sorting allows you to quickly retrieve what you need to work on. Only bring materials to the site that will be used for the foreseeable future, and refrain from bringing in items that will not be used for an extended period of time, in order to stay organized.

(2) Set in order

Set in order refers to putting necessary items in their designated places. Keep materials and other items brought to the site parallel and perpendicular to each other, and maintain tidiness for easy access. In particular, tools and other items that have been used should be returned to their designated places so that they can be easily found by the next user. Also, report any damaged or flawed items to the person in charge.

(3) Shine

Clean up after the work is completed so that the next workday can begin pleasantly.

(4) Standardize

Standardize means organizing, tidying and cleaning to maintain a clean standard. There are generally set standards for when, what, and how much should be done so that cleanliness can be maintained no matter who does it.

(5) Sustain

Sustain means to teach the rules and give instructions to ensure that sort, set in order, shine and standardize are being adhered to. It is important that everyone follows the rules that have been established.

4.3.2 Workers' Break Facility

On the construction site, temporary buildings are erected to use as the field office and the workers' break facility. The field office is a place for administrative work, meetings, etc. The workers' break facility is a place for workers to change clothes, eat, and take a break. Make sure to follow the established rules in the workers' break facility to ensure that all workers feel comfortable.

(1) Smoke only in the designated areas

Smoking is not permitted on the construction site and in the break facility. Smoke only in the provided smoking area. Hiding to smoke in non-designated spaces is also not allowed.

(2) Littering is prohibited

Throwing garbage away outside of designated places is called *poi sute* (littering) in Japan. Littering is prohibited. Take recycling into consideration, and properly separate and dispose of garbage in designated areas. If you find trash on the ground, actively pick it up and dispose of it in the designated area. Also, do not work while chewing gum. Not only does it lead to littering, but it can also lead to accidents such as accidentally biting one's tongue when there is a falling object.

(3) Place helmets and safety belts in designated areas

Helmets and safety belts should not be left scattered after use. Make sure to put them away in designated places before taking a break.

(4) Put personal belongings in lockers

Loss of personal belongings can be the source of trouble. Keep your personal belongings in a locker.

(5) Hand washing, disinfection, and gargling

When entering and exiting the break facility, take care of hygiene by washing hands, disinfecting,

gargling, etc.

(6) Check the bulletin board

The bulletin board may contain not only information for everyone, but also information that is useful to individuals, such as insurance information. Make a habit of checking the bulletin board.

4.3.3 Clothing Precautions

In Japan, there is a saying, “A disorderly attire represents a disorderly mind.” It means, “A person who dresses sloppily does not posses inner beauty,” but on the construction site, it has the added element of safety. The following attire is not permitted.

(1) Entering the worksite wearing short sleeves and shorts

There are many hazards on construction sites. Only the hands and face should be exposed during work. Wear work clothes appropriate for the work at that site. Do not enter the worksite in short sleeves or shorts. Also, wash your work clothes to maintain cleanliness.

(2) Jackets with the front left open

Do not leave your jacket unbuttoned and open in the front. There are many protrusions at the worksite, and getting caught on them can lead to injury or accident.

(3) Rolled-up sleeves

To prevent injury, sleeves should be rolled down to the wrists.

(4) Walking with hands in pockets

Do not walk with your hands in your pockets. This posture hinders response in case of sudden falls, which can lead to injury or accident.

4.3.4 Language

Communication is important for smooth operations at construction sites, and there is a term *horenso*

that describes the key to communication. It is a word play using the vegetable called *horenso* (spinach). *Horenso* is a combination of the words *hokoku* (report), *ren*raku (contact), and *sodan* (consult). Be mindful to use a cheerful tone, focus on the points you want to discuss, be clear, and state your conclusions first.

Report: to inform seniors and the foreman of the progress and results of work.

Contact: to communicate job-related information, your schedule, etc. to your seniors and the foreman.

Consult: to tell a senior staff member and the foreman if a problem arises or if you have any questions.

4.3.5 Cleanup

Always clean up after work completion. Clean up afterwards with the intention of setting up and preparing for the next day's work. If you used fire, make sure it is extinguished.