

Annual Report

Department of
Architecrure and Building Engineering
Tokyo Metropolitan University

2021

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OVERVIEW OF RESEARCH ACTIVITIES

Architectural Planning / City Planning

Kenji TAKEMIYA

(1) Study on architectural planning of medical facilities

Kenji Takemiya

Medical facilities are constantly changing in response to advances in medical technology and changes in the medical system. This series of studies aims to clarify the current status and problems of medical facilities. This year, remarkable results have been achieved at intensive care unit in hospital.

(2) Study on architectural planning of community facilities

Kenji Takemiya

- 1) We conducted questionnaire survey and field survey on the community center in Machida City.
- 2) We conducted a survey about the community center in Tama City in a similar way of 2019/2020, to clarify the changes in facility usage after spread of COVID-19.

(3) Research on welfare facilities for children and the elderly

Kenji Takemiya

- 1) In Japan, the number of facilities for childcare support is increasing. We conducted an interview survey on facility management and usage of childcare support facilities in Tokyo. We have summarized the planning requirements for facility planning.
- 2) We collected materials about the libraries which have the food and drink space, conducted an interview survey, and clarified the characteristics of the design method of them.

These studies are to be published in Summaries of Technical Papers of Annual Meeting, AIJ.

Tohru YOSHIKAWA

Theoretical Study on Compactness of Cities

Tohru YOSHIKAWA

In Japan, urban policies for compact cities are being conducted considering the decrease in population, the lower birth rates, the aging society and the serious global environmental issues.

Considering this situation, the study explored what is the compactness of cities. In this fiscal year, the project deepened the method to quantify walking accessibility considering vertical movement using GIS, and applied the method to Tama Monorail and Nippori-Toneri Liner.

Development of the evaluation method for the existing building stock on the basis of location

Tohru YOSHIKAWA

It is the problem important to our country, which is leaving for the low birthrate and aging society, to utilize a large quantity of buildings accumulated after the war as effective social property. To this end, methods easy to use for evaluating the existing building stock easily would be effective. Therefore, this study aimed at the development of the method to evaluate existing stock buildings based on the location. Especially in this fiscal year, this project theoretically compared the function forms of the consumer surplus and the visitor number as evaluation indexes of the social benefit on the facilities for which the utilization rate decays according to the distance.

Motoki TORIUMI

Masumi MATSUMOTO

Studies on Regeneration and Revitalization of New Towns

Masumi MATSUMOTO

Tama New Town is the largest new town developed 50 years ago in Japan. This series of studies aims to research and develop the methods for regeneration and revitalization of living environment of new towns, mainly exemplified by Tama New Town.

- 1) Research on housing conditions and lifestyles in Tama area.
- 2) Studies on governing body of an old condominium apartment.
- 3) Studies on community activities initiated by women residing in Tama New Town.

Studies on Sustainable Living of Elderly People in their Local Communities

Masumi MATSUMOTO

This series of studies aims to research on the living environment of elderly people who continue to live in the same community, and to research and develop supporting systems for such people.

Ryo SANUKI

I conducted urban planning and urban analysis research using urban spatial analysis methods and GIS. Not only that, I also conducted applied research in different fields such as public facility and infrastructure policies, healthcare policies, utilization of public space, and industrial location and guidance. Specifically, there were the following four themes. (1) Study of regional evaluation methods using public facility management and its evaluation methods, (2) Consensus building process in public facility restructuring with the participation of residents, (3) Utilization of public facilities and space in Asian countries, and (4) Analysis of various events in urban space (medical resource allocation, industrial location, etc.) by applying urban analysis.

Architectural Design and History

Masao KOIZUMI

(1) Research on urban design methods

Masao KOIZUMI

Analysis on design methods of Yokohama city where developed urban design with progressive way, and engaged in an exhibition about urban design in the gallery.

(2) Research on revitalization of downtown area

Masao KOIZUMI

We researched and proposed about new urban design methods, such as utilization of abandoned houses and discovering human resources about town management, on declining downtown area of local city.

Yoshihiko ITO

A Study on the Architectural and Urban Impact of the Transformation of Islamic Cities into Christian Ones in the Medieval Iberian Peninsula

Yoshihiko ITO

This study focuses on the transformation of Islamic cities and architecture in the Iberian Peninsula, which was conquered by Christians between the second half of the 11th century and the end of the 15th century. In particular, the focus was on the Great Mosque of Cordoba, a Friday mosque founded by the Umayyads at the end of the 8th century, which was gradually reconstructed as a cathedral after the transition from Islamic to Christian rule.

Fuminori NOUSAKU

Akira KINOSHITA

Analyses on Composition of Modern and Contemporary Architecture

Akira KINOSHITA

One of the main purposes of architectural design research is to clarify morphological principles that give birth to architectural beauty. For this purpose, it is important and effective to abstract compositional principles and compositional methods from existing architectural works and to examine the design principles. In the academic year of 2021, Analysis on the campus design of Tohin-Gakuen designed by Tange and his associate Jiro Inadzuka through a postgraduate dissertation study.

Development of Architectural Design Method

Akira KINOSHITA

In architectural design research, it is also important to apply design principles and compositional methods abstracted by analyses to actual architectural design works. Thereby theory and practice, in other words, basic research and high-level application would be synthesized. In the academic year of 2021, relations between theory and design practice were pursued through a design works of four master program students.

Research on Design of Architectural Conversion

Akira KINOSHITA

It is becoming one of the crucial social subjects in the architectural field of Japan to find out various methods to revitalize the existing building stocks. Among these methods, architectural conversion is particularly useful and important. For more than 10 years, with my research associates, I have made research survey on architectural conversion abroad. In the academic year of 2021, I published two articles on Canadian cities of Toronto and Montreal in periodical journal. Now I and other members of the study are preparing to publish a book on this subject in coming May.

Study on Landscape Architecture and City in Early Modern Period

Akira KINOSHITA

In the academic year of 2021, I worked on the analysis of the relation between architectural design and the development of astronomical study, survey technologies, and navigation technologies in the latter half of the 17th century, focusing on Sir Christopher Wren and Robert Hooke, who made

significant contributions on the theory and practice in architecture of the period.

Construction Management and Building Materials

Yoshinori KITSUTAKA

Shear Repeated Fatigue Properties of Post-installed Anchor Bolts

Yoshinori KITSUTAKA and Yoichiro KUNIEDA

Demand for mechanical anchor bolts has been increasing for seismic retrofitting of existing concrete structures and installation of equipment, as they allow precise positioning and are easy to secure. Concrete structures are affected by earthquakes during their service life. The joints of mechanical anchor bolts are subjected to cyclic loading under an earthquake, which leads to drop accidents of ceiling members and equipment. To ensure the seismic safety of a structure, it is crucial to grasp the behavior of its joints with anchor bolts during an earthquake. This study reports on shear pull-out tests by monotonic and cyclic loading conducted on metal-based mechanical anchor bolts to investigate the fracture properties and shear pull-out resistance of joints between concrete and anchor bolts. In this study, the following were pointed out. A method of testing under cyclic shear pull-out loads of mechanical anchor bolts was proposed. Difference was observed between the maximum loads by monotonic and cyclic shear pull-out tests.

Development of Risk Estimation System for Building Exterior Wall Repair

Yoshinori KITSUTAKA, Yoichiro Kunieda

With the aim of extending the life of buildings from an environmental and economic point of view, it is of great importance to estimate the future loads for building repairment. Therefore, in this study, aiming at risk estimation throughout the life cycle in building repair, we focused on the outer wall of the building i) to apply an estimation method of pollution properties by particle method (PM) analysis, and ii) to suggest an estimating formula of gloss retention decrease of coating materials. In the former approach, the simulation results of PM analysis with different particle size settings were compared with the actual experimental results held last semester, and the analysis efficiency was discussed. In the second approach, thermal environmental analysis software was applied to evaluate the surface temperature of exposure specimens in references. As a result, an estimating formula of gloss retention decrease of coating materials was improved.

Method for Estimation of Exterior Tile Detachment

Yoshinori KITSUTAKA, Yoichiro Kunieda

There is concern that the exterior tiles will be detached due to deterioration over time, and the risk of

peeling off due to external forces such as earthquakes will increase. In this study, we proposed a method to estimate the stress distribution and displacement at the joint mortar part due to the detachment properties of the exterior tile. An impact testing has been done for artificially detached tile specimens since last semester to experimentally clarify the load-residual displacement correlation. We also developed a stress and peeling amount estimation tool at tile joints using Finite Element Method (FEM). It allowed to evaluate the increase of displacement durability for different repairment methods. The accuracy of estimation with the tool was examined by comparing with the test piece results.

Makoto TSUNODA

Studies on Housing Production System allowing the Residents to Participate in Construction

Makoto TSUNODA

Residents may participate in housing construction. This allows you to customize your home in own way and stimulates the distribution of pre-owned homes. It also helps with measures against vacant houses. These acts were called DIY (Do It Yourself). Currently, it has become popular due to the expansion of tools and materials and the introduction of technology through SNS. The fact that the work done by specialized contractors has become more familiar is also considered to be one factor that reminds us. In order to establish housing production in which residents participate, it is necessary to build assistive technologies that allow partial participation. For example, it is important to remove barriers to resident participation and lower the hurdles for participation.

In this year, from the contents of the owner's participation in the construction of the condominium, we grasped the business system of the remodeling company when the owner participated and clarified the points to keep in mind of the creator and the resident and searched for a production system useful for the owner's participation in the construction. One of the tasks that the current remodeling company lacks is the clarification of the risk assumption and guarantee range of the owner's participation. Furthermore, in response to the owner's request for participation, such as wanting to experience construction, wanting to make it according to his own taste, and wanting to reduce costs, the work contents that can be planned by the remodeling-related entity and the incidental work by the necessary contractors were presented.

Research on Building System Design for Renovation in Buildings Stock.

Makoto TSUNODA

In recent years, many performance improvements have been implemented through renovation as one of the means for long-term use of buildings. In new construction, we use various construction methods to meet the required performance. However, in the renovation, there is a

completely different condition that the existing state exists. Therefore, the contents of the construction method will reflect the functions of the components that are not seen in new construction. As a result, a relationship can be found between the role of the members and the performance improvement in each renovation construction method. Especially in renovation, it is often practiced under a wide range of requirements and limited conditions. Therefore, it is considered that the contents of the construction method are directly reflected in the constituent members.

In this year, From the transition of the composition of the double skin, which is typical of the environmental consideration glass façade, the reasons that influenced the spread and the reasons why it continues to be adopted were extracted, and the ideal technical elements necessary for future maintenance were presented. The width of the cavity required for maintenance over time is smaller in the rental building than in the company's own building, so it is necessary to consider how to fit the cleaning method in the future. In addition, although more than half of the respondents had a maintenance deck, there were cases where the deck itself was emphasized as a design element, and it can be said that this method can be applied to existing double skins

Studies on methodology of the building improvement to be compatible with value of property and utility.

Makoto TSUNODA

Buildings that are still usable are often removed for some reason. There are various reasons for removal, such as the performance at the time of completion cannot be maintained and the way the building is used has changed. There are various reproduction methods to solve these situations. To improve the asset value when extending the life of an existing building, there are maintenance and improvement of various performances. The addition of new performance that has not been possessed until now is also targeted. Similarly, in order to improve the utility value, in addition to changing the state of the building itself, it is also required to change the function of how it is used. These two value enhancements are not independent of each other. Therefore, a program for architectural regeneration should be devised in consideration of the trade-off between the two. Nowadays, various reproduction methods such as renovation and conversion can be seen, but the reproducibility is low in addition to the strong individuality as an architecture. Therefore, the purpose is to construct a more general methodology that includes multiple value enhancements to further promote future architectural regeneration.

In this year, focusing on the design method of the converted exhibition facility, we extracted the architectural operations performed during the renovation and conversion, and grasped what kind of architectural operation combination was used for the renovated exhibition space. In addition, we organized the exhibition space that is not created in the newly built museum, the

ingenuity and problems unique to the converted exhibition facility, and searched for useful knowledge for the design of future museum architecture. By creating a diversion flow and performing comparative analysis, it was clarified under what background the diversion to the exhibition facility was examined and influenced the selection process of the design method. It is considered useful to consider the part to be preserved and the part to be modified on a large scale in a long time axis in order to expand the possibility of a new design method.

Studies on Activation Technique of Public Building Stock

Makoto TSUNODA

In Japan, demolition and new construction based on declining in the durability and increased availability of buildings continues to be practiced. This practice is unfavorable from the viewpoint of utilization of the existing building stock. Activation technique is necessary for leading preservation and improvement of the public property.

In this year, in addition to clarifying the actual conditions of regular surveys and inspections conducted before the renewal of the government building, we grasped the outline of the renewal method and the outline of the building survey conducted for the renewal study. In addition, by focusing on how the results of regular surveys and inspections are utilized, the relationship and differences between the method of the government building renewal study process and the building survey conducted for the study were presented. Furthermore, as an organizational system for the continuous use of regular surveys and inspections, we presented a type in which external specialists continuously consider, a type in which government building staff always cooperate, and a type in which the entire public facility is managed collectively.

Yoichiro KUNIEDA

Shear Repeated Fatigue Properties of Post-installed Anchor Bolts

Yoshinori KITSUTAKA and Yoichiro KUNIEDA

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Development of Evaluation Tool for Noise Generation in Demolition

Yoichiro Kunieda

There is a huge concern for noise generation at demolition sites with which the implementation could be suspended by considering neighbors physical and mental impacts. Accordingly, project planning should be decided by how to control noise and vibration generated in demolition. In this study, an evaluation tool for noise generation was developed for quantitative comprehension of noise impact at project design stage. In detail, the 4D evaluation tool of demolition waste generation developed by authors was applied to generate the sound source from the confliction results between

excavators and building elements. Sound ray method, one of the major methods in geometric acoustics approach, was applied to estimate the sound level distribution including site borders. It was found that the estimation behind barriers was not accurate enough for practical application due to a lack of consideration of wave properties of sound represented by diffraction phenomenon.

Structural Engineering

Kazuhiro KITAYAMA

1. Axial Collapse Mechanism for Reinforced Concrete Beam-Column Joint Failing in Joint Hinging

KITAYAMA Kazuhiro and Jin Kiwoong (Meiji University)

Collapse of buildings is induced by a loss of ability for sustaining vertical loads due to dead and live loads. These vertical loads are carried mainly by columns, which are divided into two parts, i.e., a region along clear height and its upper and lower beam-column joint regions. Collapse of reinforced concrete (R/C) buildings subjected to past earthquakes has occurred in Japan by a sway mechanism in a particular story caused by column shear failure or flexural failure at a top and bottom of columns. Many buildings, however abroad, suffered collapse due to a loss of axial load capacity at beam-column joints (Moehle 2003, Park and Mosalam 2013). Those buildings had unconfined beam-column joints without hoops or small column sections, being different from usual R/C buildings in Japan.

However, almost the whole collapse occurred in Japan for a R/C five-story city office building during Kumamoto Earthquake in 2016 due to axial failure at beam-column joints located in a perimeter frame (Mukai 2016), which was designed according to old seismic provisions in Japan. Beam-column joints in the building seemed to fail in joint-hinging prior to axial collapse (Saito, Mukai and Shiohara 2018).

This study, therefore, aims to reveal a mechanism leading to joint axial collapse after joint-hinging failure in R/C frames under three-directional earthquake excitations, and estimate the limit drift capacity at joint axial collapse for a building. For these objects, three-dimensional R/C beam-column subassembly specimens are tested statically under horizontal bi-directional load reversals and axial load. A macro-model which can represent seismic behavior from joint-hinging failure to axial collapse in beam-column joints is proposed. Studies were carried out in the 2021 academic year as described below.

(1) Buckling of Column Longitudinal Bars in Beam-Column Joint

Tests to corner column-beam subassembly specimens conducted by the authors revealed

that buckling of column longitudinal bars in a corner column-beam joint, placed along column two faces perpendicular to each other without framing beams, causes joint axial collapse. The story drift angle when buckling of column bars within a joint occurred in the tests was decided based on the sudden reversal of a curvature in a cross-section of the bar which was obtained from longitudinal strains measured by two strain gauges. The buckling length of the column bar was, then, identified. A compressive strain of the column bar which begins to buckle in a joint was estimated by the Kato's method proposed in 1992. The estimated compressive strain in some cases agreed somewhat with a measured strain in the tests.

(2) Deformation Mechanism in Beam-Column Joint Reaching Axial Collapse

Crush of core concrete and local buckling of column longitudinal bars within a corner column-beam joint, placed along column two faces perpendicular to each other without framing beams, caused an abrupt inclination of the upper column to the lower column when axial compression was applied to the column, inducing a loss of ability for sustaining vertical load in the beam-column joint. A macro-model which represents mechanical behavior in a corner column-beam joint when reaching joint axial collapse after joint-hinging failure, accounting for both the force equilibrium and the deformation compatibility at crush of the joint core concrete. The length and compressive strain of column longitudinal bars when these bars buckle in the joint, which were taken by the manner as afore-mentioned (1), were used in the model. The rotation angles of the upper column relative to the lower column at a joint region obtained by the macro-model, ranging from 1.8 % to 4.6%, corresponded almost to the measured values in the tests at which the measured angle started to increase suddenly. This indicates a probability to predict occurrence of concrete compressive failure in a beam-column joint, which leads to joint axial collapse.

(3) Joint Hinging Failure and Axial Collapse of Beam-Column Joint in Collapsed Building by 2016 Kumamoto Earthquake

The five-story R/C city office building suffered from almost whole collapse due to axial collapse in beam-column joints at a perimeter frame during Kumamoto Earthquake in 2016 (Building Research Institute 2021). The building, designed according to the old seismic code in Japan and built at 1965, consists of beam-column moment-resisting frames with two bays each with a span length of 8.91 meter in two principal directions of the building. Seismic damage to the building concentrated on the fourth and fifth stories. Especially a fourth-story column fell out of the perimeter frame due to heavy damage to beam-column joints at the top and bottom of the column, causing almost whole collapse of the building. The perimeter column in the fourth story had a rectangular section with a depth of 700 mm and a width of 650 mm, and contained four and eight longitudinal bars with a diameter of 22 mm and 19 mm respectively whose cross-sectional area ratio

to gross sectional area of the column was 0.84 %.

Beam-column joints in the perimeter frame, where three beams orthogonal to each other frame into the joint region, damaged heavily during the earthquake. Behavior leading to axial collapse after joint-hinging failure at this type of a beam-column joint is not investigated yet. Then, the collapse mechanism was studied in the perimeter frame of the building, taking account of bi-directional lateral loads and varying column axial load induced by the sum of beam shear forces when flexural beam yielding occurred.

The orbits of the story shear resistance under bi-directional lateral loading to the beam-column subassemblages removed from the building were illustrated in the study. The ultimate flexural capacity of a beam is illustrated by a rectangular surface, while the joint-hinging capacity is indicated by an elliptical surface. It was supposed from these figures that the joint-hinging failure occurred not under uni-directional loading during the earthquake, but under bi-directional loading. Even if the computation predicted that the joint-hinging failure occurs without beam yielding under bi-directional loading, the beam-column joint did not fail actually during the earthquake when the column-to-beam ultimate flexural capacity ratio was greater than 1.4.

(4) Tri-Directional Loading Test for R/C Beam-Column Joint Reaching Axial Collapse after Hinging Failure

Tri-directional loading tests to R/C perimeter column-beam subassemblages, where three beams orthogonal to each other frame into the beam-column joint, were planned to study axial collapse after joint-hinging failure in the beam-column joint because there are no researches like this. Specimens with an half scale were designed to yield in beams under uni-directional lateral loading, but to fail in joint-hinging under bi-directional lateral loading, which is the same mechanism as that for the building collapsed by Kumamoto Earthquake. Column and beam sections, the span length and the height in specimens are common to those in recent tests conducted by the authors to facilitate comparison with each test result. Test parameters are the arrangement of joint lateral hoops (three D6 hoops and six D4 hoops in the beam-column joint region), the arrangement of column longitudinal bars (8-D16 and 8-D13) and a number of framing beams into the joint, i.e., a corner column-beam joint with two beams and a perimeter column-beam joint with three beams.

Four subassemblage specimens were fabricated in the 2021 academic year. Concrete compressive strength after four weeks from concrete casting was 60 MPa. Loading tests to the specimens will be conducted in the 2022 academic year.

2. Dawn of Reinforced Concrete Building in Western World and Japan

KITAYAMA Kazuhiro

A reinforced concrete (R/C) structure was invented at a middle of the 19th century in

France and spread to the western world. A method to construct R/C beams and columns for buildings was devised for instance by F. Hennebique in 1890's. It appears that an apartment building located in a city of Franklin at Paris, designed by Auguste Perret, a French architect, and built in 1904, is the first one in the world which was made of reinforced concrete in the whole building. In contrast, a warehouse for diving devices at Sasebo Naval Port consisting of R/C beam-column moment-resisting frames was designed by Mashima Ken-saburo, a Japanese civil engineer, and built in 1905 in Japan. An office building, which was designed by Endo Oto, a Japanese architect, and called Mitsui Bussan Ichigo-kan, was made totally of reinforced concrete in 1911.

This shows that a R/C building was born at the time almost same in the western world and Japan. In other words, the period to adopt a reinforced concrete structure for buildings in the western world was longer than that in Japan, although reinforced concrete was invented in the western world. It takes about fifty years in the western world to adopt a R/C structure for construction of buildings. Then, why was the period to adopt a reinforced concrete structure for buildings different between the western world and Japan? The reason is supposed that a traditional construction method for buildings was different between them. Whereas a space for buildings in the western world had been constituted by walls consisting of piled stones and bricks, traditional buildings in Japan had been constructed by using wooden beam and column members. Japanese people were, therefore, familiar with beams and columns to build a house. It seemed to be easy in Japan that building construction materials are replaced from woods to reinforced concrete. Moreover, adoption of a reinforced concrete structure was accelerated for Japanese buildings because Sano Toshikata, a Japanese pioneer for seismic design, advocated the superiority of a R/C structure to earthquake resistant performance through the reconnaissance of damaged buildings by San Francisco Earthquake in 1906.

In summary, it is a hypothesis shown above that a vernacular construction method for traditional buildings restrained an introduction of reinforced concrete in the western world, and promoted this to the contrary in Japan. The hypothesis will be discussed in future.

Jiro TAKAGI

Toshikazu KABEYASAWA

An evaluation of the strength of the reinforced concrete multi-story wall under tensile force

This study was carried out under the Project Research of the Building Standards Development Promotion for MLIT. The contribution of shear force in tensile wall and compressive wall was

investigated in the multi-story reinforced concrete shear wall with opening in 1st story. The contribution of shear force is obviously different in FEM analysis and frame analysis. The test specimens of multistory wall frame are designed and constructed for the loading test in next year.

A study on out of plane strength of reinforced concrete wall under wave load

An analytical study is carried out by FEM on the out of plane loading test of the reinforced concrete wall with the SRF sheet reinforcement under water pressure. It is different between deformation distribution in RC and SRF specimens. the maximum water level greatly increased due to the change the collapse mechanism between the unreinforced RC specimen and SRF reinforced specimen.

A study on damage control design using columns with wing wall

It compared the ductility factor under the equivalent energy dissipation status and the member stress between moment resisting frame and wall frame with wing walls. The member stress in the wall frame is reduced and does not concentrate in the specific floor. On the other hand, the sum of the ductility factor in the frame increases rather than the moment resisting frame.

A study on the land slide load on the buildings

The damage to the building caused by the land slide occurred in Hiroshima Prefecture was simulated by fluid analysis. The height of the sediment is compared among the damage, simulation and calculation by Japanese standard. The height with the current calculation underestimates the damage and simulation results because the sediment height does not take into account the pile-up effects.

A study on the vulnerability assessment of cities to tsunami using GIS

It proposed an evaluation method of the vulnerability for cities under tsunami using Geographic Information. Non-wooden and over three-story buildings are extracted, and the allowable inundation depth of the building was calculated based on the building width and height. The number of the building with large floor is important for the disaster prevention of cities under tsunami rather than the number of the tall buildings.

Noriko TAKIYAMA

Improved Restoring Force Estimation of Japanese Traditional Wooden Structure with SASHIGAMOI

Noriko TAKIYAMA

According to regional characteristics and cultural differences, there are various specifications in SASHIGAMOI joint in Japan. In the limit strength calculation which is one of calculation methods

used in the seismic performance evaluation of traditional wooden residents, the shear forces of all earthquake resistant elements are simply added and the restoring force is given for each seismic element without considering the different detail of SASHIGAMOI joint. In past study, to figure out the fracture mode and the restoring force characteristic, we performed cyclic loading test on 8 specimens with same external dimension method but different joint shape. And, we also aimed to construct the evaluation formula to estimate the restoring force and compare with results of experiment. Moreover, to simulate the experiment, we modeled the specimens, and compared the results of simulation with the experiment to investigate the accuracy of the simulation. And, we also tried to estimate the restoring force of wooden frame by the proposed estimation method. In this year, based on past study, we tried to propose the improved method of shear force of the frame with SASHIGAMOI controlled by axial force of SASHIGAMOI.

Seismic Behavior of Joints of Existing Wooden Frame with Reinforced by Aramid Fiber Sheet

Noriko TAKIYAMA

High-performance aramid fiber sheets are a new class of composite materials made up of weaved polyamide fibers. In this study, the seismic performance and failure behavior of timber column-ground sill joints reinforced with aramid fiber sheets were investigated. In a past study, we conducted many bending tests under cyclic loading for three column-ground sill specimens. After reinforcing the specimens with aramid fiber sheets, the joint strength improved but was dependent on the method of attaching the sheet. It was found that the seismic property is unstable because of many failure mode. So, we proposed an improvement in the method of attaching the fiber sheet to the joint. Then, we used vertical splitting sheet, to stabilize the failure mode and to improve deformation performance. Therefore, we could control the failure of column-ground sill joints. We has kept to conduct the loading test of full-scale frame, to understand seismic property of frame, and tried to constructed analysis model. In this year, we conducted bending tests under cyclic loading and pull-out test for some column-ground sill specimens, aimed to become stabilizing estimated value of the shear force, based on sensitivity analysis for the wooden frame reinforced by splitting aramid fiber sheet.

Seismic Property of Traditional Wooden House in IPDGHB, Fukushima

Noriko TAKIYAMA

The Odatsuki district in Fukushima prefecture, which was registered as an IPDGHB (Important Preservation District for Groups of Historic Buildings), contains many traditional mad-walled townhouses. The purpose of this study was to analyze the structural and vibration characteristics of mad-walled townhouse in Odatsuki district, by investigation existing townhouses and loading test of real scale frame.

Field Survey of Traditional Townscape and Wooden Houses in Hachioji

Noriko TAKIYAMA

There are some traditional wooden houses in Hachioji. We investigate about the feature of townscape and nature of whole this district, design, structural and environmental property of wooden houses, to preserve cultural value of traditional townscape and wooden houses of this district.

Kazushige YAMAMURA

Environmental Engineering

Akihiro NAGATA

A Study on the Performance of Air Curtain

Akihiro NAGATA

- (1) We conducted full scale air curtain model experiments for a delivery entrance in order to clarify the influence on objects such as paper money by air curtain flows using marker-based image processing taken with a high-speed camera.
- (2) We introduced the power-law model for the pressure drop loss caused by air curtain and investigated the method to incorporate air curtain into ventilation network calculation.

Masayuki ICHINOSE

- (1) Practical Study on Building Façade and MEP for Improving Balance of Solar Radiation and Energy in Urban Area

Façade design and mechanical system for urban large-scale building are studied for energy conservation and improving outside/inside building. Data that includes building information, energy consumption, indoor environment, mechanical system operation, occupants' sensation for indoor environment and local weather data are collected and analyzed. Building performance database and methodology with higher reliability and transparency will be established by increasing number of sample buildings.

- (2) Element Technology of Sustainable Building for Local Climate and Culture All Over the World Measures and policies of building area for carbon neutral that contains building regulation / Green Building certification are investigated in all over the world. Target level for renewable energy

application is influenced by political aspect but energy conservation level is specified by climate and culture. As the result, building façade performance and efficiency of air conditioning are major factors.

(3) Degradation Model for Building Parts / MEP and Integration with BIM-FM

To improve accuracy of life cycle assessment of building, forecasting model for degradation of building parts and mechanical system are suggested. Based on the actual building operation data, Weibull process model are applied and accuracy of forecasting is improved. This model can reduce 20 to 30% of life cycle cost compared to conventional table methodology.

On the other hand, there are also issues of aggregation and utilization of big data around building operation. BIM utilization for facility management to construct open frame database is studied.

(4) ZEB Study for ASEAN

ASEAN where a lot of Japanese architectural enterprises are moving consumes energy next to China and India because of demand of air conditioning. From the result of investigation, ASEAN's GHG mitigation effect by energy conservation in the building is much higher than Japan because of dependency of charcoal power plant. Building performance level of ZEB ready in Japan has more than 60% reduction effect on GHG compared to current building. The most effective countermeasures are 26 degree C set point, appropriate processing of ventilation and improvement of COP for AC.

(5) Environmental Performance Evaluation for Revitalization of Housing Complex

Effect of Refining on energy conservation and improving indoor environment of old rental housing building are studied. It is found that mitigation effect on GHG during 30 years is 10 to 20% and healthcare cost for elder is 50%.

Masayuki OGATA

Infection risk mitigation in urban and built environments

In considering effective and sustainable countermeasures against COVID-19, we have organized effective countermeasure methods based on the nature of exposure to aerosol particles, including aerosol and micro-droplet infection routes in addition to the conventional droplet, contact, and airborne infections. Experiments were conducted to evaluate exposure to aerosol particles using the developed simulated cough generator, and the effects of wearing masks and installing desk partitions in indoor spaces to reduce exposure were experimentally clarified. We also conducted a literature survey on SARS-CoV-2, COVID-19, and infection control measures in the building environment,

and disseminated information on how air-conditioning facilities should be used in the event of a new coronavirus outbreak through the publication of papers and the release of materials on the websites of the Architectural Institute of Japan and the Air-Conditioning and Sanitary Engineering Society of Japan.

Evidence reviews of air-conditioning system design guidelines for healthcare facilities

To prevent the spread of infection in medical facilities, not only must medical personnel implement appropriate infection prevention measures at the operational stage, but they must also design buildings and building equipment so that a hygienic environment can be maintained in consideration of infection control measures. In Japan, there are hospital facility design guidelines by the Japan Medical and Welfare Equipment Association, which are referenced as de facto standards, but the scientific basis is not always clear. An international comparison of medical facility design guidelines and a literature review of recommendations was conducted to examine the level of evidence. The hospital facility design guidelines by the Healthcare Engineering Association of Japan, for which the principal investigator served as a member of the revision working group, are scheduled to be published in May 2022.

LIST OF RESEARCH ACTIVITIES

Architectural Planning / City Planning

Kenji TAKEMIYA

1. *Refereed Papers*

Hikaru ABE, Kenji TAKEMIYA

Analysis of the current status of facility planning and usage of psychiatric day care units, AIJ J. Technol. Des. Vol. 28, No.68, 344-349, Feb., 2022 DOI <https://doi.org/10.3130/aijt.28.344>, (in Japanese)

2. *Proceedings of Oral Presentations*

ASAI Haruka, TAKEMIYA Kenji

Current situation and new perspective to floor planning of neonatal intensive care units, Summaries of technical papers of annual meeting E-1, AIJ, pp. 689-690, 2021(in Japanese)

IIDA Anju, TAKEMIYA Kenji

Consideration on the floor planning of the palliative care units, Case study on units approved within 10 years since the establishment of the system, Summaries of technical papers of annual meeting E-2, AIJ, pp. 693-694, 2021(in Japanese)

TAWARA Shihomi, TAKEMIYA Kenji

Study on development and space utilization of the facilities for care prevention service -Targeting day care facilities for the elderly who are deemed independent, Summaries of technical papers of annual meeting E-3, AIJ, pp.763-764, 2021(in Japanese)

SUNAMURA Mina, IRIE Miharu, TAKEMIYA Kenji

Utilization of the lounges and rooms without a reservation -Comparative study on the community centers before and after the spread of COVID-19 infection- (part1), Summaries of technical papers of annual meeting E-4, AIJ, pp.781-782,2021(in Japanese)

IRIE Miharu, TAKEMIYA Kenji

Analysis of questionnaire survey on utilizing facilities -Comparative study on the community centers before and after the spread of COVID-19 infection- (part2), Summaries of technical papers of annual meeting E-5, AIJ, pp.783-784, 2021(in Japanese)

ITABASHI Asuka, TAKEMIYA Kenji

Comparative analysis on utilization of the community centers in Tama city before and after the spread of COVID-19 infection, Summaries of technical papers of annual meeting E-6, AIJ, pp.785-786, 2021(in Japanese)

SAWADA Haruno, TAKEMIYA Kenji

Facility Situation and Floor Planning of Intensive Care Unit in Japan: The changes between 2007 and 2020, Summaries of technical papers of annual meeting E-7, AIJ, pp.687-688, 2021(in Japanese)

KATSURAGAWA Rieko, TAKEMIYA Kenji

Space planning for convalescent rehabilitation- Case study on the hospitals with recovery phase rehabilitation ward -, Summaries of technical papers of annual meeting E-8, AIJ, pp.691-692, 2021(in Japanese)

ODA Koji, TAKEMIYA Kenji

Feasibility analysis on palliative care units in core hospitals in rural areas : A case study of Kushiro-Nemuro medical area, Summaries of technical papers of annual meeting E-9, AIJ, pp.695-696, 2021(in Japanese)

SHIBATA Yuka, SHIMADA Koki, TAKEMIYA Kenji

Consideration of the number of person in open space analyzed by images shot every 15 minutes - Utilization characteristic of sterically continuous staff space located between wards in I hospital (Part1) -, Summaries of technical papers of annual meeting E-10, AIJ, pp.697-698, 2021(in Japanese)

SHIMADA Koki, TAKEMIYA Kenji

Consideration of the staying time in open space and staff activities - Utilization characteristic of sterically continuous staff space located between wards in I hospital (Part2) -, Summaries of technical papers of annual meeting E-11, AIJ, pp.699-670, 2021(in Japanese)

KOIKEDA masaki, TAKEMIYA kenji

A Study on the layout and floor planning of hospital management departments, Summaries of technical papers of annual meeting E-12, AIJ, pp.707-708, 2021(in Japanese)

ENOMOTO Risa, TAKEMIYA Kenji

Study on the operation and facility planning of emergency medical facilities

Case study on the published facilities in “ER DESIGN”, Summaries of technical papers of annual meeting E-13, AIJ, pp.721-722, 2021(in Japanese)

SEKI Minako, TAKEMIYA Kenji

A study on design method of juvenile welfare institutions aiming for community symbiosis –A case study on Seiji Nii architect & associates projects, Summaries of technical papers of annual meeting E-14, AIJ, pp.883-884, 2021(in Japanese)

Tohru YOSHIKAWA

1. *Refereed Papers*

Yuki MIYAMOTO, Tohru YOSHIKAWA, Ryo SANUKI, RELATION BETWEEN THE CHARACTERISTICS OF THE BUILDINGS BY REDEVELOPMENT PROJECTS AND THE CHANGES IN COMMERCIAL ACCUMULATION AROUND THEM OF LOCAL CITIES IN JAPAN, Journal of Architecture and Planning (Transactions of AIJ), Vol.87, No.793, pp.596-607, (in Japanese), 2022.

Takuro KOJO, Tohru YOSHIKAWA, FORMULATION OF AN INDICATOR OF CENTRALITY THAT CONSIDERS TRIP GENERATION AS WELL AS TRIP DISTANCE AND COMPARISON WITH INDICATORS USING GRAPH THEORY, Journal of Architecture and Planning (Transactions of AIJ), Vol.86, No.785, pp.1948-1959, (in Japanese), 2021.

Nobuhisa BAN, Tohru YOSHIKAWA, THE EFFECT OF TOWN PLANNING SYSTEM AT THE CENTER OF TOKYO BASED ON FACTORS OF REAL ESTATE PRICE OF SECONDHAND CONDOMINIUMS, AIJ Journal of Technology and Design, Vol.27, No.66, pp.949-954, (in Japanese), 2021.

2. *Proceedings of Oral Presentations*

Tohru YOSHIKAWA, Equality of the Indexes to Evaluate Buildings for Public Facilities with Distance Decay of the Utilization Ratio in Short-term Optimal Sequential Building Removal Process, The 22th Conference of the International Federation of Operational and Research Societies (IFORS 2021), TC-4, Mathematical models of urban operations research, Abstract No.7395, 2021.

MIKASA Urara, SANUKI Ryo, YOSHIKAWA Tohru, Research of the location tendency of “Machi Libraries”, Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, Urban Planning, pp.463-464, (in Japanese), 2021.

YAMANO Fumiya, YOSHIKAWA Tohru and SANUKI Ryo, A study of urban fragmentation by

station facilities from the viewpoint of liveliness, Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, Urban Planning, pp.461-462, (in Japanese), 2021.

YOSHIKAWA Tohru, Site-based comparison of indexes to evaluate buildings for public facilities with distance decay of the utilization ratio, Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, Urban Planning, pp.459-460, (in Japanese), 2021.

TSUNODA Masaki, YOSHIKAWA Tohru, Optimization of facility location and size considering staying time, Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, Urban Planning, pp.457-458, (in Japanese), 2021.

WATANABE Kota, YOSHIKAWA Tohru and SANUKI Ryo, Study on Relation between Local Airports Features and Land Use around them, Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, Urban Planning, pp.433-434, (in Japanese), 2021.

3. *Others*

3-2 *Research Reports*

Taku Kitagawa, Tohru Yoshikawa, Ryo Sanuki, A Study on Effect of Urban Plantations on Pedestrians Using Caption Evaluation Method, Reports of the City Planning Institute of Japan, No.20, pp.57-59, (in Japanese), 2021.

Yasuhiro YOSHIDA, Tohru YOSHIKAWA, Analysis of the color of advertisements in front of the station in relation to the characteristics of the station -For private railways in the western suburbs of Tokyo-, Reports of the City Planning Institute of Japan, No.20, pp.50-56, (in Japanese), 2021.

3-3 *Manuals / Reviews*

YOSHIKAWA Tohru, The initial response of Tokyo Metropolitan University to COVID-19, Studies on Tama New Town, No.23, pp.16-18, (in Japanese), 2021.

YOSHIKAWA Tohru, Tama New Town and infectious diseases, Studies on Tama New Town, No.23, pp.75-76, (in Japanese), 2021.

YOSHIKAWA Tohru, Mussorgsky and urban development in existing urban areas, Studies on Tama New Town, No.23, pp.158-159, (in Japanese), 2021.

Motoki TORIUMI

Masumi MATSUMOTO

Ryo SANUKI

1. *Refereed Papers*

1. Ryo SANUKI, Shih-Hung YANG : Research on methods of information sharing and consensus building with citizens on public facility management in Japan , Papers on Property Management, Taiwan Institute of Property Management, 2021.6
2. Taro Ichiko, Maki Miyano, Ryo Sanuki, Shigeaki Kitajima, Jin Yoshikawa, Shigeru Hiraki : A study of hilly-suburb community resilience to enhancing adaptive capacity for landslide risk - A case report in Hachioji city, Tokyo -, Journal of Social Safety Science, Vol.39, pp.299-308, 2021.11
3. Yuki MIYAMOTO, Tohru YOSHIKAWA, Ryo SANUKI : Relation between the Characteristics of the Buildings by Redevelopment Projects and the Changes in Commercial Accumulation Around Them of Local Cities in Japan - Focusing on Changes in the Number of Facilities in Commercial Accumulation -, Proceedings of the Architectural Institute of Japan, Vol.87, No,793, pp.596-607, 2022.3
4. Ryo SANUKI, Shih-Hung YANG : Research on the Improvement and Application of Methods for Citizen Workshops on Public Facility Management, Journal of Property Management, Vol.13, No,1, pp.1-14, 2022.3
5. Ryo SANUKI : Methods of citizen workshop on public facility reorganization, Bulletin of Institute of Architectural Environmental Engineering, No.45, pp.31-39, 2022.3

2. *Proceedings of Oral Presentations*

1. Kota WATANABE, Tohru YOSHIKAWA, Ryo SANUKI : Study of Relation between Local Airports Features and Land Use around Them, Summaries of technical papers of Annual Meeting, Architectural Institute of Japan, pp.433-434, 2021.9
2. Fumiya YAMANO, Tohru YOSHIKAWA, Ryo SANUKI : A study of urban fragmentation by station facilities from the viewpoint of liveliness, Summaries of technical papers of Annual Meeting, Architectural Institute of Japan, pp.461-462, 2021.9
3. Urara MIKASA, Tohru YOSHIKAWA, Ryo SANUKI : Research of the location tendency of "Machi Libraries", Summaries of technical papers of Annual Meeting, Architectural Institute of Japan, pp.463-464, 2021.9

3. Others

1. Taku Kitagawa, Tohru Yoshikawa, Ryo Sanuki : A Study on Effect of Urban Plantations on Pedestrians Using Caption Evaluation Method, Reports of City Planning Institute of Japan, No.20, pp.57-59, 2021.5
2. Ryo SANUKI : Reorganization of public facilities and wide-area cooperation from the perspective of city planning, JFMA Journal, No.202, p.50, 2021.4
3. (Web magazine interview) <https://jichitai.works/article/preview/918>
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Architectural Design and History

Masao KOIZUMI

3. Others

3-1. Monographs/Technical books

Masao KOIZUMI, "Essays on Environmental Architecture : Towards a new modern architecture", Kenchikugijyutsu, 2021.4

3-2. Research Reports

Masao KOIZUMI, lecture "Essays on Environmental Architecture: Towards a new modern architecture", The Solar Design Consortium, 2021.7.9

Masao KOIZUMI, lecture "Step-up training for the next generation housing -Introduction of the design methods of utilization of renewable energy", Gifu prefecture, 2021.9.22

Masao KOIZUMI, lecture "LCCM and carbon neutral", Training program of wooden craftsman, JIA Kyushu, 2021.9.30

Masao KOIZUMI and others, symposium "The school for tomorrow", Moderator, JIA Kanagawa, 2021.10.31

Masao KOIZUMI and others, symposium "Housing and life style in modern Japan – between admiration and reality", Housing Research Foundation, 2021.11.24

Masao KOIZUMI and others, lecture "Woodenhouse and decarbonization", Shizuoka association of architects & building engineers, 2022.1.8

Masao KOIZUMI, study session“Decarbonization of housing”, Sotetsu realestate, 2022.1.27

Masao KOIZUMI, lecture“Signifiacnce of LCCM in decarbonized society”, Oita center for climate change actions, 2022.2.14

Masao KOIZUMI and others, symposium“Selection system of architects for tomorrow”, JIA Kanagawa, 2022.3.5

Masao KOIZUMI and others, exhibition“Urban Design Yokohama”,Space design, 2022.3

Masao KOIZUMI and others, exhibition“Urban Design Yokohama”,Model exhibition, 2022.3

3-3. *Manuals/Reviews*

Masao KOIZUMI and others, “ Collaboration and conflict on architecture, / Kotobukicho, Yokohama-shi health welfare interchange center”, Kenchiku Jurnal, Kenchiku Jurnal, May, pp.4-9, pp.22-25, 2021.5.1

Masao KOIZUMI and others, “Challenge of LCCM demonstration house”, IBEC 238, IBEC, pp.57-58, 2021.6.1

Masao KOIZUMI, “Design methods for new environmental architecture”, Kenchiku gijutsu Nov. , Kenchikugijutsu, pp.74-76, 2021.10.17

Masao KOIZUMI, “My house”, Network SE 178, New Constructor's Network, p.27, 2021.11

Masao KOIZUMI, interview“Architect creating space for living”, NARIWAI web site, NARIWAI, 2022.1

Masao KOIZUMI and others, catalog“Urban Design Yokohama”, Yokohama-City, BankART, pp.36-37, pp.174-175, 2022.3

3-4. *Works / Products, etc.*

Masao KOIZUMI and others, Tamagawa Nogemati Park, architectual design proposal, finalist, Setagaya-ward, 2021.6

Masao KOIZUMI and others, Kikuna elementary school, architectual design proposal, second prize,

Yokohama-city, 2021.6

Masao KOIZUMI and others, Shimokamata and Shimokatmata-nishi elementary school, architectural design proposal, finalist, Edogawa-ward, 2021.7

Masao KOIZUMI and others, Mihomura elementary school, architectural design proposal, second prize, Miho-village, 2021.7

Masao KOIZUMI, Shinyoshida-daini elementary school gymnastic hall, renovation design proposal, second prize, Yokohama-city, 2021.8

Masao KOIZUMI and others, Totsuka elementary school, architectural design proposal, finalist, Yokohama-city, 2021.9

Masao KOIZUMI, Awa municipal building, architectural design proposal, finalist, Chiba-city 2021.9

Masao KOIZUMI, Tokushima culture and art hall, architectural design proposal, juror, 2021.4.16

Masao KOIZUMI, FUTURESCAPE PROJECT 2021, juror, 2021.10.2

Masao KOIZUMI, Sreet furniture design competition, juror , 2022.12.18

Masao KOIZUMI, Original coaster contest for SDGs and future earth, juror, Ishii Zoen, 2022.2.1

Masao KOIZUMI, JIA Kanagawa architectural week-architects' festival, organiser, JIA Kanagawa, 2022.3.4-3.6

Masao KOIZUMI, Toda elementary school governing committee, Toda educational committee, 2022.3

Masao KOIZUMI, BIM Promoting Committee, Ministry of Land, Infrastructure, Transport and Tourism (MLIT), 2021.9

Masao KOIZUMI, BIM environment arrangement committee, MLIT, 2021.8

Masao KOIZUMI, BIM model project evaluating committee, MLIT, 2021.4

Masao KOIZUMI, WG on mid-small type model project of BIM, MLIT, 2021.9

Masao KOIZUMI, ZEH road map follow up committee, Ministry of Economy, Trade and Industry(METI),2021.10

Masao KOIZUMI, Committee on study of architectural design fee, MLIT,2021.10

Masao KOIZUMI, Public building prize Kanto District, jurors,Public Buildings Association, 2022.2

Masao KOIZUMI, exhibition“Urban Design Yokohama”, executive committee , 2022.3

Masao KOIZUMI, working group of architectural design congress, committee, Architectural Institute of Japan (AIJ), 2022.3

Masao KOIZUMI, selection committee of AIJ Prize technology section, deputy secretary general, AIJ, 2022.3

Masao KOIZUMI, task force on in the field of academic, art, technology, committee, AIJ, 2022.3

Masao KOIZUMI, “ Excite Yokohama 22” promotion committee, committee, Yokohama-city, 2022.3

Masao KOIZUMI, advisory board on “ Supporting program of revitalization of downtown”, deputy of chairperson, Japan Foundation For Regional Vitalization
2022.3

Masao KOIZUMI, JIA Kanagawa, representative, 2022.3

Yoshihiko ITO

2. *Proceedings of Oral Presentations*

- Rethinking the Christianization Process of Iberian Islamic Cities ---Transformation Patterns in Architecture and Urban Structure--- (Annual Congress of the Association of Medieval Studies in Japan, Poster Presentation, Audience Award. 2021.6.20)
- Conversion, Transformation, and Demolition of Congregational Mosques in Iberian

Post-Islamic Cities (Annual Congress of Architectural Institute of Japan, 2021.9)

3. *Others*

3-3 *Manuals / Reviews*

Yoshihiko ITO, "Bloom, Architecture of the Islamic West", *Seiyo Chusei Kenkyu*, 2021.12.

Fuminori NOUSAKU

Akira KINOSHITA

3. *Others*

3-3 *books*

KADONO Sho, Akinoshita Akira, et. Al., *from Architectural Conversion to Urban Renovation*, Building Center of Japan, 2022, May

3-3 *Manuals / Reviews*

KINOSHITA Akira, *Urban Renew and Spread by Renovating Existing Buildings in Overseas Cities, Architectural Conversion in "Liberal City"*, Toronto, The Building Letter a Monthly Journal for Building Engineers, May 2021, pp.13-24

Akira KINOSHITA,

Urban Renew and Spread by Renovating Existing Buildings in Overseas Cities, Architectural Conversion in the "Cité de Culture", Montreal, The Building Letter a Monthly Journal for Building Engineers, June 2021, pp.13-20

Construction Management and Building Materials

Yoshinori KITSUTAKA

2. *Proceedings of Oral Presentations*

- 1) Yasuko KUMANO, Masaki UEMURA, Yosuke UCHIMURA and Yoshinori KITSUTAKA: Study on the influence of hardening accelerator on hardening time of primer material for plaster at low temperature, Part3, Summaries of Technical Papers of Annual Meeting, AIJ, Construction Materials, pp.697-698, 2021.9 (in Japanese)

- 2) Daichi SATO, Koichi IMASAWA, Yoshinori KITSUTAKA and Yoichiro KUNIEDA: Effect of Major Constituent Minerals on Mechanical Performance of ALC at High Temperature, Summaries of Technical Papers of Annual Meeting, AIJ, Construction Materials, pp.705-706, 2021.9 (in Japanese)
- 3) Satoshi SASAKI, Yoshinori KITSUTAKA and Yoichiro KUNIEDA: A Study on Joints Strength and Delamination Properties of Tile Finishing -Part1 Delamination Properties of Uplifted Tile Joints by Dynamic Impact Test, Summaries of Technical Papers of Annual Meeting, AIJ, Construction Materials, pp.937-938, 2021.9 (in Japanese)
- 4) Wakana YAJIMA, Satoshi SASAKI, Yoshinori KITSUTAKA and Yoichiro KUNIEDA: A Study on Joints Strength and Delamination Properties of Tile Finishing -Part.2 A Consideration of an Analysis Method About Delamination Properties of Uplifted Title Joints, Summaries of Technical Papers of Annual Meeting, AIJ, Construction Materials, pp.939-940, 2021.9 (in Japanese)
- 5) Keigo YOSHIDA, Haruka OGAWA, Yoshinori KITSUTAKA and Yoichiro KUNIEDA: Impact of interior materials on refurbished architecture on impression evaluation -Part1 Relationship between aging elements of interior materials of existing buildings and psychological evaluation-, Summaries of Technical Papers of Annual Meeting, AIJ, Construction Materials, pp.991-992, 2021.9 (in Japanese)
- 6) Haruka OGAWA, Keigo YOSHIDA, Yoshinori KITSUTAKA and Yoichiro KUNIEDA: Impact of interior materials on refurbished architecture on impression evaluation -Part2 The relationship of the physical quantity and the psychological evaluation value of the interior material in Reconstructed architecture-, Summaries of Technical Papers of Annual Meeting, AIJ, Construction Materials, pp.993-994, 2021.9 (in Japanese)
- 7) Misaki TABATA, Yoshinori KITSUTAKA and Yoichiro KUNIEDA: Impression evaluation relating to color harmony of elements of residential interiors, Summaries of Technical Papers of Annual Meeting, AIJ, Construction Materials, pp.995-996, 2021.9 (in Japanese)
- 8) Koya SASAKI, Yoshinori KITSUTAKA and Yoichiro KUNIEDA: Proposal of method for estimating shear repeated fatigue properties of metal-based post-installed anchor bolts, Summaries of Technical Papers of Annual Meeting, AIJ, Construction Materials, pp.1119-1120, 2021.9 (in Japanese)
- 9) Honoka SUSAKI, Yoshinori KITSUTAKA and Yoichiro KUNIEDA: Study on the Characteristics of the recycling gypsum added Geopolymer Concrete, Summaries of Technical Papers of Annual Meeting, AIJ, Construction Materials, pp.937-938, 2021.9 (in Japanese)
- 10) Yoichiro KUNIEDA, Yoshinori KITSUTAKA, Masahiro YOSHIOKA and Hikaru HIROKAWA: Application of MPS Method to Risk Estimation of External Wall Contamination with Rainwater, Summaries of Technical Papers of Annual Meeting Japan Society for Finishing

Technology, pp.93-96, 2021.10 (in Japanese)

- 11) Mayu IKEDA, Yasuko KUMANO, Masaki UEMURA and Yoshinori KITSUTAKA: Study on The Simplification of the Interior Plastering Construction Using a Base Sheet Material Part1 Study on Base Sheet Materials for Interior Plastering, Summaries of Technical Papers of Annual Meeting Japan Society for Finishing Technology, pp.165-168, 2021.10 (in Japanese)
- 12) Yasuko KUMANO, Mayu IKEDA, Masaki UEMURA and Yoshinori KITSUTAKA: Study on The Simplification of the Interior Plastering Construction Using a Base Sheet Material Part2 Construction Using the Base Sheet Material and Long-term Secular Change Survey after Construction, Summaries of Technical Papers of Annual Meeting Japan Society for Finishing Technology, pp.169-172, 2021.10 (in Japanese)

Makoto TSUNODA

2. Proceedings of Oral Presentations

FUNATO Sakumi, TSUNODA Makoto, Study on the renovation method from detached house to shop -In the cases of Koganei city, Tokyo., Summaries of Technical Papers of Annual Meeting, AIJ, Architectural Planning and Design, pp.185-186, Sep. 2021 (in Japanese)

HIGUCHI Tomoyuki, TSUNODA Makoto, A study on effects of floor plan changes on elevation in traditional houses, Summaries of Technical Papers of Annual Meeting, AIJ, Architectural Planning and Design, pp.433-434, Sep. 2021 (in Japanese)

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