

Annual Report

Department of
Architecture and Building Engineering

2014

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Overview of Research Activities

ARCHITECTURAL PLANNING / CITY PLANNING

Tohru YOSHIKAWA

Development of Methods for Analyzing Network of Community Facilities

Tohru YOSHIKAWA and Ryo SANUKI

In Japan, reconstruction of community facilities network is demanded by social informatization, aging and maturation. To provide theoretical models and examples of the reconstruction planning, convenience of community facilities and their most suitable placement were analyzed. During this year, the relationship between the accessibility to regional facilities, especially food facilities, and population distribution was analyzed.

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. In this year, a theoretical study was conducted on a new evaluation index of social benefit for facilities with distance decay of utilization ratio using the logit model.

Masumi MATSUMOTO

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.

- 1) Research using sensors to monitor elderly people's behaviors in their homes.
- 2) Research on community salons and support for senior citizen.
- 3) Research on various community activities for elderly people and their relationship with the professionals working in community comprehensive care centers.

Studies on Regeneration and Revitalization of New Towns

Masumi MATSUMOTO

Tama New Town is the largest new town developed over 40 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 Suwa-Nagayama District of Tama New Town.
- 2) Research on neighboring commercial areas of Tama New Town.
- 3) Studies on community activities initiated by women residing in Tama New Town.

Studies on the Positioning of Interior Design in Housing Design Processes

Masumi MATSUMOTO

Conducted hearings to over 20 architects on the design making processes relating to housing designs.

ARCHITECTURAL DESIGN AND HISTORY

Katsuhiko KOBAYASHI, Akira KINOSHITA and Sho KADONO

Analyses on Composition of Modern and Contemporary Architecture

Katsuhiko KOBAYASHI, 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 2014, designs of recent high-rise buildings such as architectural works of Álvaro Joaquim de Melo Siza Vieira and Steven Holl were analyzed. Parts of these studies were and are to be published in Summaries of Technical Papers of Annual Meeting, A.I.J.

Development of Architectural Design Method

Katsuhiko KOBAYASHI, 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 2014, relations between theory and design practice were pursued through four design works of our master program students.

Research on Design of Architectural Conversion and High-rise Buildings

Katsuhiko KOBAYASHI, Akira KINOSHITA, Sho KADONO

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 very useful and important. For these several years, we have made research survey on architectural conversion and high-rise buildings as well. In the academic year of 2014, we made investigation on converted buildings and high-rise buildings in North America, East Europe, Indonesia and Turkey. Parts of these studies are to be published in Summaries of Technical Papers of Annual Meeting, A.I.J.

Study on English Baroque Architecture

Akira KINOSHITA

Sir John Vanbrugh was not only one of the English Baroque architects but was a prominent comic dramatist. As an architect, Vanbrugh was aware that landscape plays an important part in architectural design. "Landscape" here is not something that belongs to a single building and gives value to it; it is based on a new viewpoint that glances over the whole nature and positions an architecture within it. The notion of "landscape" made a crucial change to the evaluation methods of architecture, from the evaluation of the architecture itself based on its proportion or artistic design, to

the evaluation of its picturesque beauty together with its surrounding landscape. This study, standing on the hypothesis that the discovery of “landscape” was due to the flourishing of city culture in London, examines how Vanbrugh describes the city and how city people in his play sees the countryside. This study is going to be published in Summaries of Technical Papers of Annual Meeting, A.I.J.

Yukimasa YAMADA

Studies on the Architectural History of Catholic Churches in the Northern Vietnam

Yukimasa YAMADA

Christianity in Vietnam, since its introduction early in the sixteenth century, has been evolving and expanding to an indigenous culture among the society, convention and thoughts different from European countries. We are focusing attention on three Catholic dioceses that have been played most important rolls in the history and culture of Christianity in the Northern Vietnam, Bui-Chu diocese, Thai-Binh diocese and Phat-Diem diocese. Collaborating with the administration office of each diocese, we attempt to conduct surveys and analysis of existing historical churches. In this fiscal year, we tried to focus on non-wooden churches in Bui-Chu diocese, and also discussed their architectural characteristics like planning and space composition, based on the field survey in August 2013. And we made a presentation about Father Tran Luc and Phatdiem Cathedral at a public symposium by RikkyoUniversity Centre for Asian Area Studies.

Surveys and Studies on the Preservation of Traditional Villages and Vernacular Architecture in Asia and Japan

Yukimasa YAMADA

Since a number of traditional villages and vernacular architecture with historical and cultural values have been disappearing rapidly in the Asian countries, their preservation is an urgent issue. Making surveys and studies from this point of view, in this fiscal year, we have conducted a survey on traditional Dai's villages and houses in the Southern Yunnan Province, China, and we reported their transformation influenced by tourism at the annual meeting 2014 of A.I.J.

Studies on Historic Architecture and Urbanism in the Islamic World

Yukimasa YAMADA

Although numbers of the historic architecture in the Islamic world have their own peculiar features in the architectural techniques and designs, their nature has not yet been understood adequately in Japan, nor has their urbanism as their agglomeration. In a series of our successive studies on the architectural history and urbanism in Islam, we discussed the historical background of

reconstruction and present situation of mosques designated as Cultural Relics Preservation Units in Qinghai, and also reported the management and administration of mosques in Ning Xia, China.

Masao KOIZUMI

2) Overview of Research Activities

(1) Research on Accessibility of Urban and Architectural Space

Masao KOIZUMI

The First Stage of the Research is to analyze the Relationship between Housing and the City. This Research will be generalized into an Analysis of Relation between Architecture and Urban City.

These Researches will cover Areas such as; Type of Connection and Distance between Housing and the City, an Arrangement of Territories, Strength of the Boundary between Different Territories, etc. These Basic analyses will be developed into Research and Practice of a Design Method concerning Accessibility in an Urban Scale.

(2) Research on Housing Transformation Reflecting the Change of Family

Masao KOIZUMI

Today a Family Style has transformed because of an Increase of Divorce and the rapid Progress of the Aging Society. But still most of the Houses are planned for so called "Nuclear Family".

The Goal of this Research is to develop a Planning Method for Housings and propose a new Typology, through the Analysis of Contemporary Japanese Family and their Life Style. Collective Housing will be a main Target for this Theme.

CONSTRUCTION MANAGEMENT AND BUILDING MATERIALS

Yoshinori KITSUTAKA and Koichi MATSUZAWA

Influence of carbonation on the durability of ALC panel

Yoshinori KITSUTAKA and Koichi MATSUZAWA

In this study, the influence of carbonation on the durability of ALC (autoclaved lightweight concrete) panel and the effect of finishing materials on the prevention of carbonation progression of ALC panel were investigated. The compressive strength and the Young's modulus of ALC was reduced according to the progress of carbonation. The degree of carbonation for ALC was reduced by coating the topcoat material on ALC surface. The finishing materials which have a high moisture resistance and a water resistance showed a high reduction of the degree of carbonation. The bending strength and stiffness of ALC panel was reduced according to the the progress of carbonation and was improved by preventing the carbonation of ALC by coating a finishing material.

Evaluation of the degradation for reinforced concrete structures using digital x-rays pictures

Yoshinori KITSUTAKA and Koichi MATSUZAWA

Evaluation method of the degradation of reinforced concrete structures using digital X-rays pictures was investigated. We focused on the X-ray observation technique for the three dimensional evaluation of the corrosion on reinforcement surface in concrete. The X-ray shielding rate of the corrosion on the reinforcement which was produced by the salt spray testing machine was measured by the three dimensional X-ray irradiation apparatus. The corroded reinforcement was embedded in concrete and the thickness distribution of corrosion for circumferential direction on reinforcement surface was measured by the three dimensional X-ray irradiation apparatus. Corrosion accelerated test was performed for the reinforced concrete specimen with a crack by the salt spray testing machine and the degree of corrosion on reinforcement of reinforced concrete is evaluated.

Influence of Coarse Aggregate on Fracture Properties of Concrete Subjected to High Temperature Heating

Koichi MATSUZAWA and Yoshinori KITSUTAKA

In this research, the influence of coarse aggregate on the fracture properties of concrete subjected to high temperatures up to 800°C was reported. The fracture properties were evaluated based on tension-softening curves which were determined by polylinear approximation through inverse analysis of load versus crack mouth opening displacement (CMOD) curves, obtained from wedge-splitting tests using a dedicated analysis program. The follow conclusions were found in this study: The initial cohesive stress of mortar was higher than that of concrete. And the fracture energy of concrete was higher than that of mortar

Influence of High Temperature Heating on Pull-Out Properties of Mechanical Anchor embedded in Concrete

Koichi MATSUZAWA and Yoshinori KITSUTAKA

Surface layer of concrete becomes the most heavily damaged part affected by high temperature heating when concrete structure is subjected to fire accident. In the surface layer of concrete structures, the anchor bolts are used for fixing the equipment or the seismic strengthening elements. This paper reports on the investigation into the influence of high temperature heating up to 1000°C on pull-out properties of two types of mechanical anchor embedded in concrete. Relationship between the pull-out strength of anchors and the fracture energy was also investigated.

Tomoyuki GONDO

Conventional House Production System in Asian Region

Hirotake Kanisawa, Tomoyuki Gondo, Kazuya Shide

In China, wooden house production increased steadily. From interviews with contractors and Chinese association report, we analyzed the current situation of wooden house production in China. In South-East Asian country, we expect active house production. We interviewed with Japanese contractor's branch and local construction company and analyzed the difficulty to transport Japanese technologies to these region.

Lack of Skilled Workers and Necessity of Industrialization

Shuichi Matsumura, Hirotake Kanisawa, Tomoyuki Gondo

To deal with the lack of skilled workers, we record several problems in construction site of an industrialized house builder, and propose some improvement plan. In Singapore, the government strongly push forward to industrialize construction to reduce the number of foreign workers. We did research on these total system in Singapore.

Sangjun YI

IMPROVING THE EFFICIENCY OF PUBLIC FACILITIES MANAGEMENT

Sangjun YI

In Japan, many infrastructural works were constructed during the period of rapid economic growth following the Second World War. Today, the cost of repairing, improving, and maintaining those facilities is on the rise. Public facilities of the municipality face a similar situation. However, although many municipalities realize the need for public facilities management, they hesitate to take concrete steps toward a solution because of their fear of increasing costs, a lack of know-how, and an uncertainty about what to change. Another problem is that in many municipalities, maintenance and management is not the concern of the entire organization but rather the responsibility of the building repair department. This study showed that all of the public facility activities, such as planning, operation, and maintenance efficiency, are included in public facility management, and the cause of the municipality's mismanagement was not only related to technology and fiscal conditions but also to the municipality's structural organization. Moreover, the purpose of this study is to explain the current state of the municipality's organizational structure and its approach to public facility management and to identify the organizational structures and management processes that are most efficient.

Liao YuChia

DECISION-MAKING METHODOLOGIES CONSIDERING LIFE-CYCLE COST UNCERTAINTY

The current Japanese housing market lacks a form of support for the provision of more

explicit decision-making processes for potential homeowners, which undermines the value of a property and potential risks it may carry. The complications associated with the homeowners' decision-making process regarding their options for home refurbishment arise from having to deal with the multiple parameters of uncertainties such as budgetary restraints, personal taste, and unpredictable financial circumstances. This research studies a decision-making method in two approaches, indicated below, particularly for homeowners encountering diverse uncertainties.

1. This research proposes a new method of Life-Cycle Cost (LCC) evaluation by applying binomial probability distribution to the existing evaluation method, quantifying the effect of uncertain factors, such as interest rates, inflation rates, and volatility.
2. Using three alternative options, the study will demonstrate the decision-making process on energy-saving condominium refurbishment, verifying the applicability of the proposed LCC evaluation.

STRUCTURAL ENGINEERING

Manabu YOSHIMURA

[Gravity Load Collapse of Reinforced Concrete Columns with Decreased Axial Load]

Manabu YOSHIMURA

During past severe earthquakes, large numbers of reinforced concrete buildings suffered story collapse

owing to gravity load collapse of columns following shear failure.

By contrast, even though columns suffered severe damage following shear failure, many buildings did not experience story collapse.

When columns are about to collapse, some of the axial load sustained by them transfers to the neighboring durable columns through girders.

In other words, the axial load that the RC columns were subjected to decreased to less than the initial value when they underwent axial shortening because of shear failure.

As a result, the structural performance of the columns improved.

This study aimed to experimentally examine the effect of variable rates of axial load decrease on the column collapse drift.

that effect was quantitatively evaluated.

[Ductility Indices for Shear-failing Columns]

Manabu YOSHIMURA

The Standard for Seismic Evaluation for Existing RC Buildings defines ductility indices for columns

with various failure modes and assigns values of 0.8 and 1.00 to 1.27, respectively to Very Brittle Column and Shear Column.

In the past studies a method to determine ductility indices for shear-failing columns with the shear-to-flexure strength ratio less than 0.73 was proposed, where columns deformation capacity until collapse and the effect of dynamic responses were considered.

In this study the above ratio increased from 0.73 to 0.87 to reflect test results more accurately.

The estimated ductility indices were a bit smaller than the value prescribed by the Standard for Very Brittle Column

and similar to the values for Shear Column.

Kazuhiro KITAYAMA

1. Seismic Performance and Different Limit States for Prestressed Reinforced Concrete Cruciform Beam-Column-Slab Subassembly Forming Beam Yield Mechanism

Kazuhiro KITAYAMA and Toshiki ENDO

An ultimate objective of this study is to propose estimation method which can evaluate easily deformation capacity at different limit states with good accuracy for prestressed reinforced concrete (PRC) flexural beams, eventually aiming to formulate a performance-based seismic design methodology for PRC buildings.

Actual buildings have both slabs and transverse beams. Therefore, three beam-column-slab subassembly specimens with transverse beams were tested under cyclic load reversals to investigate hysteretic characteristics and the process of damage for PRC beams with slabs. A surface deformation along post-tensioning tendons, i.e., a plain bar or a deformed bar, and a contribution ratio of post-tensioning tendons to ultimate bending capacity for a PRC beam section were varied for specimens.

Lateral force capacity attained to the peak for all specimens at or after yielding of post-tensioning tendons, after beam longitudinal bars yielded in tests. Concrete crushing at beam ends and buckling of longitudinal bars occurred for a PRC beam using post-tensioning plain tendons. Crack patterns in slabs were almost same for subassembly specimens with plain or deformed beam tendons regardless of poor or good bond along post-tensioning tendons. When an equal contribution ratio of post-tensioning tendons to ultimate bending capacity for a PRC beam with a T-shaped section due to slabs was provided under top and bottom tension in the beam section, crack patterns in the T-shaped beam resembled those in a PRC beam with a rectangular section in a plane beam-column subassembly specimen tested recently. This exhibits that an influence of slabs on crack patterns was negligible for PRC beams with a contribution ratio of post-tensioning tendons to beam ultimate bending capacity of 0.74. Different limit states for PRC beams were studied through crack widths,

concrete condition in compression and strain in longitudinal bars and post-tensioning tendons.

2. Failure Mechanism in Reinforced Concrete Beam-Column Joint Subjected to Tri-Directional Loading – Effect of Column Axial Load -

Kazuhiro KITAYAMA and Toshiki ENDO

A new mechanism of joint hinging have been proposed by Shiohara, professor at the University of Tokyo, Japan, for reinforced concrete (R/C) beam-column joints which is observed when an ultimate flexural capacity of a column section is close to that of a beam section in a R/C frame. Recent experimental studies to verify the joint hinging mechanism have been conducted using 2D plane interior and exterior beam-column subassemblage specimens. There are, however, few tests which use 3D beam-column-joint subassemblages with orthogonal beams to each other which frame into a column such as a corner beam-column joint. For corner columns in actual R/C buildings, a loss of capacity to sustain column axial load resulting from severe damage to a corner joint led to partial story collapse of the building by past earthquakes.

Therefore seismic performance of a corner beam-column joint in R/C frames was studied by testing two three-dimensional beam-column subassemblage specimens without slabs under both constant column axial load and bi-lateral load reversals. A column-to-beam flexural strength ratio was varied from 1.4 to 2.3 by changing the magnitude of column compressive axial load. A 2D plane corner joint specimen was also tested for comparison. General findings taken from the study are summarized as follows.

- (1) Although a joint shear capacity margin of 1.6 estimated by AIJ seismic provisions was provided to a corner beam-column joint in the test to prevent shear failure, all joints failed severely by joint hinging under bidirectional lateral cyclic loading after beam and column longitudinal bars and joint hoops yielded.
- (2) Peak story shear force in the transverse direction under tri-directional loading was 0.74 times the ultimate beam flexural capacity computed by a section analysis for a corner beam-column subassemblage with a column axial stress ratio of 0.04 (a column-to-beam flexural strength ratio of 1.4). Beams did not develop fully their flexural performance due to joint flexural failure. In contrast, peak story shear force under tri-directional loading almost attained to the ultimate beam flexural capacity for a subassemblage with a column axial stress ratio of 0.12 (a column-to-beam strength ratio of 2.3), whereas lateral-load carrying capacity descended severely after the peak capacity, attributed to severe damage in a joint region.
- (3) When column compressive axial load increased from a stress ratio of 0.04 to 0.12, the ultimate flexural capacity for a corner joint computed as a resultant force of two orthogonal story shear forces under bi-lateral horizontal loading was enhanced to 1.2 to 1.4 times by large column axial load. A joint flexural capacity with an axial stress ratio of 0.12, however, declined heavily after the peak

capacity, leading to axial collapse of the subassembly. This should be noted for seismic design to R/C buildings when a little amount of column longitudinal bars and joint lateral hoops is provided by the lower bound required by Japanese law or seismic provisions.

(4) It is revealed that the ultimate capacity of the corner beam-column joints under bi-directional lateral loading can be estimated based on the new mechanism of joint hinging.

(5) Hysteresis loops resulted in more pinching shape for a plane exterior beam-column subassembly than those for 3D space subassemblies, especially showing spindle shape for the 3D space subassembly with a column axial stress ratio of 0.12. This was caused by restraint on widening of diagonal cracks in a beam-column joint due to large compressive axial load to a column.

(6) Bond transfer along beam longitudinal bars which was anchored by an end plate in a beam-column joint concrete disappeared at the vicinity of peak story shear capacity, i.e., at a story drift angle of 1.5 % for subassemblies with a column axial stress ratio of 0.04 and 3 % with a column axial stress ratio of 0.12.

3. Failure Mechanism in Reinforced Concrete Beam-Column Joint Subjected to Tri-Directional Loading – Effect of Amount of Column Longitudinal Reinforcement -

Kazuhiro KITAYAMA and Toshiki ENDO

Static loading tests to two reinforced concrete (R/C) three-dimensional corner beam-column subassembly specimens were carried out in 2013 to investigate the effect of column compressive axial load on failure mechanics of joint hinging proposed by Shiohara at the University of Tokyo. The Shiohara's proposal pointed out that failure mode of a R/C beam-column-joint frame depends greatly on the ratio of an ultimate flexural capacity of a column section to that of a beam section at a center of a beam-column joint (called a column/beam-capacity-ratio hereafter); joint hinging tends to develop when a column/beam-capacity-ratio is close to unity. Note that a column/beam-capacity-ratio is varied by changing not only the magnitude of column axial load but also the amount of column longitudinal reinforcement.

Therefore three 3D corner beam-column subassembly specimens (two without slabs and one with slabs having a thickness of 70 mm) were tested in 2014 under tri-directional loading where a column/beam-capacity-ratio of 1.5 and 2.6 was set by placing column longitudinal reinforcement of 8-D16 (SD295A) and 8-D19 (SD490) respectively. Column section was reduced to a depth of 300 mm from 350 mm for specimens in 2013. Beam longitudinal reinforcement was mechanically anchored by an end plate within joint concrete with a horizontally projected length of 255 mm corresponding to 0.85 times the column depth. Concrete compressive strength ranged from 75 to 78 N/mm².

General conclusions are drawn from the study as follows except for the specimen with slabs because of obscure moment distribution in the subassembly caused by loading trouble.

(1) Both 3D corner beam-column subassembly specimens without slabs failed in joint hinging with an increase in story drift. For the subassembly with a column/beam-capacity-ratio of 1.5, beam longitudinal bars yielded at a column face and a reentrant corner within a beam-column joint, and column longitudinal bars and joint lateral hoops also yielded during loading cycle at a story drift angle of 1 %. For the subassembly with a column/beam-capacity-ratio of 2.6, in contrast, beam longitudinal bars at a column face and joint lateral hoops yielded during loading cycle at a story drift angle of 1 %, but column longitudinal bars yielded during loading cycle at a story drift angle of 1.5 %.

(2) Story shear force descended in a longitudinal direction during bi-directional horizontal loading at a story drift angle of 1 % for the subassembly with a column/beam-capacity-ratio of 1.5 when story drift in the longitudinal direction was kept constant under orthogonal loading. At the bi-directional loading, a point on the capacity plane, which has two axes perpendicular to each other representing each story shear force in the longitudinal and transverse directions, was located on the ultimate joint flexural capacity curve which was assumed to depict an ellipse based on the new mechanism of joint hinging in each direction.

(3) When a column/beam-capacity-ratio increased from 1.5 to 2.6, the ultimate flexural capacity for a corner joint computed as a resultant force of two orthogonal story shear forces under bi-lateral horizontal loading was enhanced to 1.05 to 1.2 times by large amount of column longitudinal reinforcement. This indicates that the ultimate flexural capacity for joint hinging was enhanced by the increase in a column/beam-capacity-ratio due to increasing amount of column longitudinal bars. For the subassembly with a column/beam-capacity-ratio of 2.6, joint hinging failure occurred under bi-directional horizontal loading at a story drift angle of 1.5 % after beam bars yielded.

(4) Referring to 3D corner beam-column subassembly tests conducted in 2013, the capacity enhancement of the ultimate flexural capacity for joint hinging under bi-directional horizontal loading generated from the increase in column compressive axial load was approximately 1.15 times that generated from the increase in the amount of column longitudinal reinforcement. In summary, column compressive axial load has a greater influence on the ultimate joint hinging capacity than the amount of column longitudinal reinforcement.

4. Finite Element Analysis for Failure Mechanism in Reinforced Concrete Cruciform Beam-Column Joint

Kazuhiro KITAYAMA

Static loading tests to five reinforced concrete (R/C) cruciform beam-column subassembly specimens were carried out in 2011 to verify adequacy of a failure mechanics model for a beam-column joint proposed by Shiohara at the University of Tokyo. After beam and column longitudinal bars and joint lateral hoops yielded, a beam-column joint eventually failed in bending

moment for all specimens. Three-dimensional nonlinear finite element analysis under monotonic loading was carried out in 2014 for one specimen tested in 2011. Failure mechanism for joint hinging was researched in detail by comparing results obtained by the analysis with test results. Bond characteristics along beam and column longitudinal bars around concrete were taken into account by using Naganuma's model. The bond strength and the slip at the bond strength were determined on the basis of test results.

Elastic stiffness obtained by the analysis agreed well with test result. Beam longitudinal bars yielded at the column face at a story drift angle of 0.8 % in the analysis, comparing with test result. However, peak story shear force of 123 kN by the analysis was 1.13 times greater than the test result of 108 kN. Beam collapse mechanism was eventually formed in the analysis, which was not able to trace the test result. Monotonic loading analysis can not generate penetration of diagonal crack propagating from the reentrant corner to the center in a beam-column joint, which was perceived by Shiohara. This caused enhancement of the peak strength in the analysis and difference in failure mode of the subassemblage.

5. Flexural Behavior in Precast Prestressed Concrete Beam-Column-Slab Frame Assembled by Post-Tensioning Unbonded Tendons

Kazuhiro KITAYAMA, Kiwoong Jin and Kiyomi KANEMOTO (Shimz Corporation)

It is very effective for sustaining civil infrastructure to lengthen a respective building life. A rational building construction way and a rehabilitation method for existing buildings are, moreover, required for conservation of global environment and a society with an aging population and a low birthrate.

It is a promising construction method to build moment resisting frames for resolving such problems that precast concrete beams and columns are connected by post-tensioning unbonded tendons which pass through these precast concrete members (called as a PCaPC frame) from following reasons; first, damaged beams or columns due to earthquakes can be replaced by new ones, second, there is no need to inject grout mortar into a sheath tube where post-tensioning tendons run through, and third, a damage-control is possible such that a damage concentrates on the end of a beam and a column.

Therefore, earthquake resistant performance in a PCaPC frame was studied through static cyclic loading tests to two interior beam-column-slab subassemblages with transverse beams assembled by post-tensioning unbonded tendons, which were designed to develop beam hinging failure. Slab reinforcing bars are usually placed to pass through a transverse beam. For one specimen, however, slab reinforcing bars adjacent to a column were terminated at the face of a transverse beam. This was intended to mitigate severe damage to slab concrete. A column-to-beam ultimate flexural capacity ratio for subassemblage specimens was decided to be 1.67 and 1.83 to prevent joint hinging

failure. Concrete compressive strength was 70 N/mm² approximately.

Following findings were obtained from the study.

- (1) Concrete severe crush at beam ends resulted in beam hinging failure for both specimens judging from following observation; first, strain in post-tensioning unbonded tendons increased beyond the elastic limitation and those stresses almost reached yield strength during loading, second, beam and column longitudinal bars did not yield and third, load-carrying capacity of subassemblages descended after beam concrete crushed at the interface between a beam and a column.
- (2) Damage to slab concrete was slightly mitigated when slab bars adjacent to a column were terminated at the face of a transverse beam.
- (3) Peak story shear capacity obtained by tests ranged from 0.98 to 1.10 times the computed ultimate bending moment of beams. Slab bars terminated at the face of a transverse beam also contributed to bending capacity of a T-shaped-section beam since those slab bars had a development length of 8.3 times the bar diameter from the column face. This resulted in the story shear capacity equivalent to that for the subassemblage with passing slab bars. Hysteresis loops depicted an origin-oriented shape for both specimens.
- (4) Whether slab bars were terminated or not, the effective width of a slab on beam flexural capacity attained to 0.1 times the beam span length, which is provided by the AIJ Standard for Structural Calculation of R/C Structures, at a story drift angle of 0.3% to 0.6%, and exceeded 0.2 times the span length of the beam at a story drift angle of 1% to 1.5%.

6. Beam-Column Joint Failure in Precast Prestressed Concrete Moment-Resisting Frame Assembled by Post-Tensioning Unbonded Tendons

Kazuhiro KITAYAMA, Kiwoong Jin and Kiyomi KANEMOTO (Shimz Corporation)

A beam-column joint hinging failure, which was proposed by Shiohara, was broadly known for reinforced concrete (R/C) moment-resisting frames when an ultimate flexural capacity of a column section is close to that of a beam section in a R/C frame at the center of a beam-column joint. In contrast, for moment-resisting frames which consist of precast concrete beams and columns connected by post-tensioning unbonded tendons (called as a PCaPC frame), the joint hinging failure is not verified through laboratory tests.

Therefore, in order to study on a failure mechanism of a beam-column joint in PCaPC frames, two exterior beam-column subassemblage specimens and four interior beam-column subassemblage specimens were tested under cyclic load reversals.

For plane exterior beam-column subassemblage specimens, a ratio of gross sectional area of column longitudinal reinforcement to column sectional area was determined as 0.62 % (6-D13) and 1.30 % (8-D16), resulted in a column-to-beam ultimate flexural capacity ratio of 1.31 and 1.90 respectively. Column axial load of 400 kN (axial stress ratio of 0.08) and a joint shear capacity

margin of 1.47 was common. For interior beam-column subassemblage specimens, two plane specimens with a column-to-beam ultimate flexural capacity ratio of 1.32 or 2.11 and one specimen with slabs and the other with both slabs and transverse beams having a column-to-beam ultimate flexural capacity ratio of 1.19 were fabricated. Column axial load of 800 kN (axial stress ratio of 0.15) was common. A joint shear capacity margin ranged from 1.3 to 1.5. Concrete compressive strength ranged from 41.8 to 45.0 N/mm² in a column including a beam-column joint, 77.5 to 82.3 N/mm² in a beam and 81.9 to 83.4 N/mm² in a slab.

Conclusions drawn from the tests are summarized as follows.

- (1) A column-to-beam ultimate flexural capacity ratio did not govern seismic behavior such as relationship between story shear force and story drift for plane interior and exterior beam-column subassemblage specimens since plane specimens failed in beam flexure. Story shear force calculated from beam ultimate flexural capacity obtained from the section analysis agreed with peak story shear force in the tests.
- (2) Damage to a beam-column joint in 3D subassemblage specimens was mitigated due to slabs and transverse beams covering a joint panel surface. Beam-column subassemblage specimens with slabs alone or both slabs and transverse beams failed in not joint hinging but beam flexure although a column-to-beam ultimate flexural capacity ratio was 1.2 for the specimens.
- (3) Damage and distortion to a beam-column joint increased abruptly after beam flexural failure in a beam-column subassemblage specimen with slabs alone, indicating that shear failure occurred simultaneously with hinging failure in a beam-column joint. Hysteresis shape shifted from origin-oriented to spindle shape for the subassemblage specimen.

7. Seismic Behavior and Damage of Reinforced Concrete School Building by the 2011 East Japan Earthquake

Kazuhiro KITAYAMA and Toshiki ENDO

Seismic performance evaluation and non-linear earthquake response analysis to a multi-degree of freedom system were carried out in 2013 for a reinforced concrete (R/C) four-story school building which suffered moderate damage by the 2011 East Japan Earthquake. The seismic capacity indices I_s for the building were smaller than 0.7 for the first to third stories. Damage to another R/C four-story school building located in the neighborhood of the damaged building by the 2011 Earthquake was, on the other hand, quite slight although the seismic capacity indices I_s were smaller than 0.7. Then this study aimed to investigate the reason for the difference in damage level to two school buildings.

The school building, which is located on the Hoshakuji-plateau at an eastern suburb area of Utsunomiya City in Tochigi prefecture, was designed according to old seismic code and constructed in 1978. The building is supported by PC pile foundations with a length of 22 m. A representative

span length in a longitudinal direction is 8.7 m. A typical column has width of 600 mm and depth of 600 mm or 700 mm to a longitudinal loading direction, reinforced by deformed bars longitudinally with a diameter of 22 mm or 25 mm and plain-bar-hoops with a diameter of 9 mm spaced at 100 mm on centers whose shear reinforcement ratio ranges from 0.23 % to 0.51 %. The building had not been retrofitted at the 2011 Earthquake although the seismic capacity indices I_s for the first to third stories in a longitudinal direction did not satisfy a required value of 0.70 as mentioned later.

Minor shear cracks occurred for a short column in a north frame. A non-structural wall within a frame suffered shear cracks classified as Grade 2. Thus the damage of the building was classified into the slight level. Ceiling elements fell down in a small area of corridors in the fourth story. A seismic joint was damaged between the building and an adjacent class-room building. Cracks in peripheral soils were also observed around the building.

The seismic capacity evaluation of the building according to the second level procedure in "Standards for seismic performance evaluation of existing reinforced concrete buildings," which was issued from Japan Building Disaster Prevention Association (JBDPA) in 2001, was carried out by using an available computer software called "RC Shindan 2001 Vr2". Concrete compressive strength which was obtained by a cylinder test using drilled cores from the building ranged from 27.7 N/mm² to 36.5 N/mm². Concrete compressive strength of 26 N/mm² was adopted for the seismic capacity evaluation. The structural design index, SD, and the time index, T, was estimated to be 0.79 to 0.88 and 1.0 respectively.

The seismic capacity index I_s in a longitudinal direction for the building was 0.51 for the first story, 0.66 for the second story, 0.69 for the third story, which were less than the threshold value of 0.70 required by the standard, and 0.97 for the fourth story. Both shear- and flexural-failure-type columns, which were judged from the seismic capacity evaluation, intermingled and the I_s value was determined at the ductility index F of 1.0 in the first story. A number of shear-failure-type columns decreased for upper stories. There are many ductile columns with the ductility index F equal to or greater than 2 for the third and fourth stories. The product of the cumulative strength index CT and the structural design index SD was greater than 0.45 for the first to third stories, which suggests that the building has considerable lateral load carrying capacity. The seismic capacity index I_s in a transverse direction ranged from 0.90 to 2.13, indicating sufficient lateral load carrying capacity due to many shear walls.

The seismic capacity indices I_s in a longitudinal direction were less than 0.7, however greater than 0.5 for the first to third stories, and the indices CTSD were greater than 0.45. These show that lateral load carrying capacity of the building was not probably inferior. This is one reason why damage to a super-structure of the building remained just slight. As another reason, it is probable that damage to foundations of the building, which was guessed from peripheral soil damage, reduced an earthquake-induced load to a super-structure of the building.

Non-linear earthquake response analyses to a multi-degree of freedom system were carried out by inputting earthquake accelerations in a east-west direction measured on the ground surface at Haga and Mashiko observatories. Mass of the four-story building was lumped at each floor level. Each mass was connected by a shear spring. A critical viscous damping ratio of 3 % was assumed to be proportional to the instantaneous stiffness of the building. A tri-linear envelope curve was provided to the hysteresis model for each story with yield strength equal to the lateral story capacity which was obtained as the cumulative strength index CT in the seismic capacity evaluation, and kept the lateral capacity almost constant after the peak capacity. The origin-oriented model was used for hysteresis rules for the first and second stories, providing a yield story drift angle of 0.4 % which corresponds to the ductility index F of 1.0. In contrast, Takeda model was used for hysteresis rules for the third and fourth stories, providing a yield story drift angle of 0.67 % which corresponds to the ductility index F of 1.27. A natural period of the multi-degree of freedom system was 0.29 second. A response story drift for the fourth story was largest among stories to earthquake motions, and exceeded largely the yield story drift. This was probably caused by the smallest initial stiffness in the fourth story comparing with other stories. This analytical result is, however, different from actual slight damage to the building. More study in detail is necessary.

8. Analytical Modeling of Reinforced Concrete Column for Frame Analysis

Kazuhiro KITAYAMA

This research is a fundamental study for reinforced concrete (R/C) frame analysis to determine a value of some properties for a multi-spring (M/S) element incorporated into top and bottom ends of a R/C column. When a column is replaced with the line element having the M/S element at both ends in actual design process for R/C buildings, axial springs representing both longitudinal steel bars and concrete are provided to the M/S element according to the column section. In usual frame analyses to investigate lateral load carrying capacity of the designed building, however, it is not verified whether such a modeled column with the M/S elements can trace well kinetic behavior obtained by a monotonic loading test to the column. Although it is very important for a modeled column with the M/S elements, especially, to reproduce the yield drift of the column, structural design for R/C buildings is frequently conducted without consideration about that. That is a big problem.

The appropriate value for an imaginary spring length expressing a plastic hinge zone, which is assumed to calculate the deformation of the column modeled with the M/S elements, was therefore researched to estimate the yield drift of the column. Note that the M/S elements are treated as zero-length. The computed yield drift using the M/S element model was compared with the estimated value using the yield stiffness degradation ratio to the elastic stiffness proposed by Sugano in 1971 instead of a loading test result to the R/C column. Test results for R/C columns with a shear span ratio less than 2 which had been used by Sugano when formulating the yield stiffness

degradation ratio were used again in this study to confirm the accuracy of the computed yield drift by the M/S element model. Following conclusions were drawn from the study.

(1) For R/C columns with a shear span ratio equal to or greater than 2, the yield drift obtained by the M/S element model agreed well with the drift estimated by Sugano's stiffness degradation ratio when an imaginary spring length was assumed to be the column depth and equal to or less than one-sixth the clear height of the column. On the other hand, for R/C columns with a shear span ratio less than 2, the M/S element model underestimated the yield drift of columns.

(2) For R/C columns with a shear span ratio less than 2, the M/S element column model modified by considering degradation of shear stiffness caused by diagonal shear cracks was used, and the yield drift obtained by the modified model was compared with the test result. The yield drift obtained by the modified model, however, underestimated the test result regardless of consideration on the shear stiffness degradation for the modeling. This is probably caused by following two factors; first, the shear stiffness degradation evaluated by Ochiai was deduced from not column tests but beam test results without axial load, and second, additional deformation attributable to slippage of longitudinal bars around concrete was inadequate in the modeling.

9. Interaction between Seismic Retrofit and Damage to Piles for Reinforced Concrete Buildings

- Study Using Coupled System among Soil, Piles and Superstructure -

Kazuhiro KITAYAMA

Several reinforced concrete (R/C) buildings suffered damage under the 2011 East Japan Earthquake though seismic retrofit to those buildings was already carried out. Among them, there were R/C buildings which suffered not only minor or moderate damage to the superstructure, but also severe damage to the pile foundation.

A number of seismically retrofitted buildings whose foundation suffered minor or more damage was approximately one-quarter the total number of seismically retrofitted buildings, judging from field reconnaissance conducted by the Architectural Institute of Japan. This ratio was more than twice the damage ratio of non-retrofitted buildings whose foundation suffered minor or more damage. This was probably caused by the enhancement of lateral load carrying capacity of the superstructure due to seismic retrofit, leading to concentration of excessive stress to the pile foundation. Such seismic retrofit to the superstructure of R/C buildings tended to intensify damage to the pile foundation under earthquake excitation.

Therefore, an analytical study using a coupled system among soil, piles and the superstructure was intended to investigate the interaction between seismic retrofit and damage to the pile foundation for R/C buildings. In this academic year, recent studies for the same theme were surveyed in literature. Soil condition and detail of pile foundations were researched for a four-story R/C school building in Ichikai Town, which was demolished due to severe damage during the 2011

Earthquake to both the superstructure and the pile foundation regardless of seismic retrofit.

Noriko TAKIYAMA

Experimental Study on Static Behavior of Frames with Uneven Large Section Beams of Traditional Wooden Structure

Noriko TAKIYAMA

We research on understanding the seismic performance of frames with uneven large section beams and clarify the influence of the height of beams and the shape of fitting type joints on the behavior of the frame. In this study, we conducted a cyclic loading test for four test frames with spans of one or two and investigated the seismic performance and failure behavior. The major findings for the two-span frames are summarized as follows. (a) They caused fatal damage more readily than the one-span frames. The column that was caught in the even beams broke before other damage occurred. (b) Because of the asymmetry of the frame or the shape of the column-beam joints, the shear forces had directional dependence.

Reinforcement Effect and Changes in Vibration Characteristic of Brick Wall under Joint Replacement Method by New Materials

Noriko TAKIYAMA

In past study, we conducted investigation on existing buildings and experiment on specimens to understand the relationship between reinforcement of masonry wall and vibration characteristics. We conducted microtremor measurements were on real historic masonry walls before and after reinforcement. However, microtremor measurement and bending test are not yet conducted on just same subject. Additionally, recently, there are some advanced materials: such as aramid rods, cellulose nanofiber and so on. The aramid rods have already applied to joint replacement method. So, we conducted microtremor measurements on masonry wall specimens at each stage in the construction: inserting stainless pins and joint replacement by aramid rods or cellulose nanofiber as intramural reinforcement: and attached steel frame as extramural reinforcement. Finally, bending tests were conducted on just same subject to clarify the relationship between the change of vibration characteristics and stiffness raising rate.

Present State Analysis for Renovating Facilities in Densely Built-up Wooden House Areas

Noriko TAKIYAMA, Ryo SANUKI, Masumi MATSUMOTO, Tomoyuki GONDO and Shigeru AOKI

We research on buildings and their surroundings for disaster prevention in Chuo-3, Ota City, one of the areas in Tokyo, Japan that is Densely Built-up Wooden House Areas in Tokyo, Japan. We conducted an exhaustive survey of 383 buildings and roads in the northwest area of Chuo-3. The

buildings and their surroundings were considered. Next, we conducted microtremor measurements on the ground in the area. The major findings of the investigation are summarized as follows. (a) Over 80% of the buildings are detached houses, and some have billboard architectures. Slate and pantile are used as the roofing material for all the buildings. (b) The buildings are densely packed. Some adjoin the frontal road with a separation of 2 m or less. (c) According to the microtremor measurement of the ground, the H/V spectrum changed gradually from the west to the east.

Kazushige YAMAMURA

Research on Live Loads on Buildings

Kazushige YAMAMURA

Earthquake Response Observation of The Small-scale High-rise Building

Kazushige YAMAMURA

Kiwoong JIN

「Seismic Performance of Precast Prestressed Concrete Frame assembled by post-tensioning unbonded Tendons with Different Length」

Kiwoong Jin, Kazuhiro KITAYAMA, Yuji TAJIMA (Asiss Corporation) and Kiyomi KANEMOTO (Shimz Corporation)

Not only seismic retrofitting methods for existing buildings but also reasonable construction methods are necessary to provide sustainable building structure. The unbonded PCaPC structure is one of latest construction methods to build moment resisting frames, where precast concrete members are assembled by post-tensioning unbonded tendons with no grout injection inside the sheaths. In this method, a damaged member due to earthquakes can be easily replaced than other construction methods since the grouting work is eliminated, and damaged areas are localized at its critical sections making the damage-control possible. In this study, in order to improve the economic efficiency and the construct ability, reversed cyclic loading tests with PCaPC beam-column subassemblage specimens assembled by different length of unbonded tendons were carried out, and their effects on the seismic capacity focused on hysteretic characteristics as well as damage process were precisely investigated based on the test results.

「Seismic Capacity Evaluation of Precast Prestressed Concrete Frame with slab Assembled by Post-tensioning Unbonded Tendons」

Kiwoong Jin, Kazuhiro KITAYAMA, Yuji TAJIMA (Asiss Corporation) and Kiyomi KANEMOTO (Shimz Corporation)

The unbonded PCaPC structure, where the damage-control and the replacement of damaged

members due to earthquakes are possible, is one of the effective construction methods providing sustainable buildings, so its seismic capacity evaluation is necessary. Several studies on the seismic performance of this structure have been carried out; however, there are few studies considering both slabs and transverse beams in actual buildings. Therefore, PCaPC beam-column subassembly specimens, which have slabs and transverse beams, assembled by unbonded tendons were tested under reversed cyclic loadings, and their seismic capacity was precisely investigated. The effects of cut-off of slab reinforcement around the RC column, which was newly devised in this study, on the hysteresis loops and damage conditions were also discussed based on the test results.

「Seismic Capacity Evaluation of RC Frame with URM Infill Wall」

Kiwoong JIN, Yoshiaki NAKANO (The Univ. of Tokyo), and Ho CHOI (The Univ. of Tokyo)

In parts of the world where earthquakes frequently occur, damaged RC buildings often have unreinforced masonry (URM) infill wall, and the seismic capacity evaluation of URM infill wall built in boundary RC frame is necessary. In this study, the failure mechanism and lateral load bearing capacity of RC frame with URM infill wall along with the lateral drift angle were experimentally investigated from cyclic loading tests. A simplified backbone curve estimation method for URM infill wall with boundary RC frame was also proposed.

ENVIRONMENTAL ENGINEERING

Nobuyuki SUNAGA

Research on Comfortable Bioclimatic Architecture

For the benefit of preserving global environment, the effective use of energy consumed in architecture and the utilization of natural energy are indispensable factors for architectural design. Furthermore to popularize Zero Energy Building and Bioclimatic Architecture (BA) which is designed by considering energy conservation, natural energy utilization and comfortable environment, it is necessary to clarify the actual performance of BA and to establish evaluation methods which are simple and widely acceptable for the public. We have been engaged in the research of these themes, and, in recent years, we give high priority to improve building stocks.

In this academic year (2014/04 – 2015/03), we mainly carried out following studies and activities.

1. Effect of Home Energy Management System (HEMS) and Energy Saving Action

We have been studying the effect of HEMS on the energy conservation in detached houses with PV system by field measurement and questionnaire survey, collaborating with a house maker from 2010. In this academic year, we carried out 14 times questionnaires for 76 families to study about the recommendation extent of energy saving action and life-style for each family. We examined about the energy saving actions which have little stress and easy continuation, and proposed the

recommended energy saving actions considering the family construction and environmental consciousness of residents.

2. Long-life, Environmental Friendly House by Tokyo Metropolitan Government (TMG)
[Collaboration with Assistant Professor Eiko Kumakura]

We are studying about the performance of 16 detached houses which have high thermal performance, a solar floor heating and hot water system and HEMS from 2013. And also we are examining the outside thermal environment in this site which has much green and a soil pass way in the center.

3. Effect of Thermal Insulation/ Strategies for Disasters for RC Apartment House in TAMA NEW TOWN

We are studying about the effect of out-side thermal insulation for RC apartment houses in TAMA NEW TOWN from monitoring and questionnaire survey. Last year, we clarified the effect of thermal insulation (thick outside insulation and evacuated glass for windowpane) at the surface temperature and vertical temperature difference of room. In this year, we examined it from the viewpoints of heatstroke and showed the control of relative humidity is important in order to prevent the heatstroke, and so on.

4. Improvement of Thermal Performance of Apartment House in Asia [Collaboration with Assistant Professor Eiko Kumakura]

We carried out the literature survey about the thermal performance of apartment house and clarified that there are small number of study about it in Japan and in China. Especially papers studied about the summer environment are very few. So we started to monitor the indoor climate and the questionnaire survey in 4 cities, Tokyo, Kumamoto (in Japan), Hangzhou and Quindao (in China).

5. Active Energy-Saving Control System for Air-conditioning Utilizing Adjustment Behavior of Occupants

A new energy-saving control system for Air-conditioning has been developed. This system is able to install to the existing small and medium-sized building and to reduce the room conditioning deterioration by energy-saving action. This system utilizes SaaS-type BEMS to manage and operate the equipment remotely via Internet and is characterized by sensing occupants' on/off operation onto the air-conditioning. We monitored an office in mid-size building in Tokyo throughout 2 years and clarified the marvelous performance of this system that the average room temperature is about 27 centigrates and the energy saving rate is 46%. The paper about this system got the Best Oral Presentation Award of GRE2014.

6. Effect of Ceiling Radiant Cooling System with Dehumidification Function [Collaboration with Assistant Professor Nobutaka Fukudome]

Our laboratory and cooperation companies developed this system about 10 years ago. Last two years we examined the performance of this system in a library of university in Tokyo by monitoring changing its operation ways. From the results we discussed the appropriate operation method of this

system.

7. Energy Efficiency Refinement of Residential Building

We have been studying about the energy and thermal performance of a Japanese wooden house refined in 2011 (built in 1983). In this year, we did literature survey about the actual retrofit of residence and the state measures for energy-saving. We made a chronological table of refinement examples and concerning measures, and showed the diffusions of solar collector and PV power generator are very few.

8. Cross-ventilation Effect of Outward Window

We did experimentation about the cross-ventilation effect of a newly developed outward window that consists of the upper opening and the lower opening and each opening open to the opposite direction. It is shown this window has good cross-ventilation effect in the one-side opening room.

9. Other outcome, social contribution and award

1) Agreement about the international exchange program between The School of Civil Engineering and Architecture, Zhejiang Sci-Tech University in China and our Graduate School of Environmental Sciences was signed at April in 2014.

2) N. Sunaga did an invited lecture, titled "Effects of HEMS and Energy-Saving Behaviors in High-Performance House", at the international conference BECC JAPAN 2014 (Behavior, Energy & Climate Change Conference), Sept. 2014.

3) N. Sunaga played as the chair of the 4th titled "Innovative Bioclimatic Architecture" of GRE2014 (Grand Renewal Energy 2014) international conference which was held at Tokyo Big Site in July.

4) N. Sunaga played as a reviewer of abstracts for PLEA2015 (Passive and low energy architecture), the biggest international conference in the bio-climatic architecture field.

5) N. Sunaga is working by the director of Japan Solar Energy Society, and also played as the chairman of Thermal Environment Committee of Architectural Institute of Japan.

6) Tsukasa Ogino (a doctoral course student) got the Best Oral Presentation Award of GRE2014.

Akihiro NAGATA

Effect of Chairs on the Thermal Sensation When Seated

Akihiro NAGATA

Although people spend a significant amount of time sitting chairs in buildings, few studies explicitly address the effect of chairs on thermal sensation. There are several effects of chairs on thermal sensation such as the heat conduction via contact body parts, the radiation shielding by a chair and the change of the heat convection characteristics. In this study, we have improved simulated soft buttocks, which were developed last year, and measured heat flux around of buttocks of the thermal manikin.

Thermal and Anti-Dew Performance Performance of the Window

Akihiro NAGATA

The thermal performance of the window vary a great deal depending on shading devices. In this study, we have visualized flow patterns and measured velocity filed by PIV(Particle Image Velocimetry).

Masayuki ICHINOSE

(1) Development and verification of radiative cooling and heating system assisted by a slight air flow

Masayuki ICHINOSE, Nobutaka FUKUDOME, Kitaro MIZUIDE (Nikkensekkei Co., Ltd.), Kazuki YAMADA (TONETS Corp.)

This is a project for head-office building newly planned. The characteristic of this system is that radiative cooling and heating panel is equipped in overall ceiling and ventilation air is flowed intentionally to enhance thermal comfort. For high efficiency of the air conditioning system, the temperature of circulating water is moderate and Desiccant air handling unit is installed.

(2) Study on the actual environmental performance of commercial and office buildings in Asian cities

Masayuki ICHINOSE, Ngyuen DONG GIANG, Nobutaka FUKUDOME

Most of the operating commercial and office buildings may often have some problems concerning about indoor climate and energy consumption, because actual performance of this kind of buildings are often different from assumed performance. For example, excessive capacity of HVAC system that includes chiller, pump, pipe, fan, duct and coil may cause low system performance and unadequate indoor climate. The most important point is that actual performance of these buildings should be clarified, improved and verified by the observational study.

(3) Study on the comprehensive environmental evaluation of the urban large scale hospital in Bangkok

Masayuki ICHINOSE, Sutida Sattayakorn, Nobutaka FUKUDOME

High functional large scale hospitals are being built in Asian city and some of them have characteristic architectural style. This research project tries to clarify the characteristics of space syntax, internal environment and energy consumption by on-site investigation.

(4) Effect of water body on the surrounding thermal environment

Masayuki ICHINOSE, Nedyomukti Imam Safii, Wong NYUK HIEN (National University of

Singapore), Nobutaka FUKUDOME

(5) Retro-reflecting window film with spectral selectivity against near-infrared solar radiation for improving thermal environment of inside and outside buildings

Masayuki ICHINOSE, Takashi INOUE (Tokyo University of Science), Wong NYUK HIEN (National University of Singapore)

Solar heat shielding against solar radiation over the entire building envelope is one of the most effective measures for achieving air-conditioning energy savings and preventing heat-island phenomena in warmer climate regions. In this paper, we propose a new heat-shielding film, which possesses a retro-reflective property and a wavelength-selection property, while having the same degree of transparency as transparent glass. It is comparatively easy to apply the film proposed herein to a wide variety of buildings and architecture, including new and existing buildings. The proposed film embodies an innovative heat-shielding technique that makes it possible to effectively return solar radiation toward the sky, while minimizing the secondary effects to other buildings, to the ground, and so on. In order to verify these effects, several aspects of quantitative evaluation are demonstrated.

(6) Investigation of practical calculation model for solar heat and light considering spectral characteristics of solar and building facade

Masayuki ICHINOSE

This research suggest practical and accurate calculation model. This model reflect spectral characteristics of solar and building facades by using color temperature of black body for visible radiation and two wave-bands including Ultra violet and visible and Near infrared for overall solar heat radiation. Approximate method of color temperature and two wave-bands are verified in the various conditions of solar altitude and climate. This study is based on the long-term spectral solar irradiance data that is separated to direct and diffuse components.

(7) Development of integration of Building Information Modeling and architectural environmental simulation

Masayuki ICHINOSE

Integrated scheme for HVAC design including heat load simulation, studying system and stream of air was investigated and verified. This scheme includes the process that convert from building model described by International Foundation Classes to elements for the architectural environmental simulation including heat load and Computation Fluid Dynamics. In this process, the versatile method is found out and the desired elements supposed for integrating with the architectural

environmental simulation.

Eiko KUMAKURA

「Landscape design process using thermal environmental simulation for passive residential district project in Japan」

Eiko Kumakura, Kazuaki Nakaohkubo(Saga University)and Akinobu Murakami(Tsukuba University)

This research aims to broaden the landscape design process by introducing a thermal environmental simulation tool into the design practice. In the landscape design process, a previously implemented thermal simulation tool was used to evaluate the effects of tree shape, position, and ground materials on the outdoor thermal environment. The evaluation of landscape design included quantifications of incident solar radiation on building windows, surface temperature, and mean radiation temperature (MRT). During each phase, diagrams and interviews with landscape architects were analyzed. As a result, the MRT distribution images were used to design the position of the walking areas and benches. However, more detailed design materials were needed, such as those affecting the trade-off between the solar-shading effects on indoor and outdoor spaces, in order to determine the optimal positions for trees planted nearest to the houses.

「3D Reconstruction of Tsunami-Stricken Villages in Japan with CityEngine」

Eiko Kumakura, Akinobu Murakami (University of Tsukuba), Jan Halatsch (SmarterBetterCities), Antje Kunze (SmarterBetterCities)

This project started in 2013 to rebuild parts of Tohoku, Japan before the 2011 Tohoku earthquake and the tsunami, to offset the loss of landscape where the community sense had been fostered for the local people. The project aimed to collect the geological information, information on houses, public facilities, agricultural land and forest, and to acquire those information from the workshop with local survivors, and then rebuilt the lost landscape by CityEngine. We created 3D scenes of the six villages in CloudCities, enabling sharing and discussion of 3D design between all stakeholders, including residents. The viewer displays 2D ArcGIS Online maps next to the 3D scene for convenient comparison. And then, we have held several workshops in order both to acquire the feedback from the residents again to make the models more elaborated ones, and to discuss how the residents sensed the landscape in their ordinary life from the analysis of particular parts to which they paid attention in the scene. The increase in the number of comments from the residents to 3D scenes provided, and the change in the contents of those comment from abstract ones to more concrete ones were observed.

「Energy-saving Features in Detached Houses with a Common Garden Path in Summer」

Eiko Kumakura, Nobuyuki Sunaga

This study examines energy-saving factors via a resident questionnaire and measurements of outdoor thermal environment according to the uses of common garden areas surrounding detached houses. The research district is located in western Tokyo, and has one common garden path running south to north through the middle of the district. The thermal environment was measured at the common path on sunny days in August 2014. There are ground-level air conditioner (A/C) outlets along (A), producing higher temperatures at 18:00. In particular, air temperature along the narrow path increased by 2 °C. Therefore, all greenery throughout the district was watered from 17:30 to 18:00 using recycled rainwater and tap water. Consequently, average air temperature of the path decreased by 0.8 °C, whereas that near outdoor A/C outlets decreased by 1.5 °C. Furthermore, A/C energy consumption during watering periods decreased by 130 Wh/H compared to non-watering days, which is attributed to improved A/C coefficient of performance by reducing the surrounding air temperature.

List of Research Activities

ARCHITECTURAL PLANNING / CITY PLANNING

Tohru YOSHIKAWA

1. Refereed Articles

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Katsuhiko KOBAYASHI

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Yukimasa YAMADA

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Masaya SHICHIJO, Yukimasa YAMADA and Mikako NAGAI 2014

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Masao KOIZUMI

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3-2. Research Reports

Masao KOIZUMI and others, Lecture of the Daito Trust Construction Rented Accommodation,
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Masao KOIZUMI and others, interview 「Way of enjoying public space」, e-hamaclub, 2014.5

Masao KOIZUMI and others, panel discussion 「Rented Accommodation forum 2014」, Daito Trust
Construction Rented Accommodation, 2014.8

Masao KOIZUMI and others, interview 「LIVE ENERGY」, Tokyo Gas, 2014.12

Masao KOIZUMI, Lecture 「House of LCCM」, Hideo Shimizu Office, 2014.6

Masao KOIZUMI, Lecture 「9 key words for health supporting house」, Association of New Urban
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Masao KOIZUMI and others, JIA panel discussion 「link the architects to the local residents」 , JIA Kanagawa, 2014.9

Masao KOIZUMI, Lecture of the career after high school, Hachioji Higashi High School, 2014.11

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Masao KOIZUMI and others, Discussion「Project ECHO CITY」, Nikkei Business Publications Inc. , 2014.11

Masao KOIZUMI and others, Symposium 「Next phase of the suburban residential area in the future」 , JIA Kanagawa, 2015.2

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Akira KINOSHITA

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Yoshinori KITSUTAKA

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4) SHIMMURA Kesuke, KITSUTAKA Yoshinori, MATSUZAWA Koichi, MIZUTANI Yoshikatsu, SHIRASAKA Kohei, The study on the effect of finishing materials applied to the development of ALC crack, Summaries of Technical Papers of Annual Meeting, AIJ, A-1, pp.451-452, 2014. (in Japanese)

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6) TAMURA Asuka, KITSUTAKA Yoshinori, MATSUZAWA Koichi, KUMANO Yasuko, TAMURA Masataka, Study on Influence of Gloss on Impression of Exterior Wall Panel, Summaries of Technical Papers of Annual Meeting, AIJ, A-1, pp.463-464, 2014. (in Japanese)

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Koichi MATSUZAWA

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- 2) Akihiko KATTA, Koichi MATSUZAWA, Yoshinori KITSUTAKA, Yasuei YAGISAWA, Study on Pull-Out Properties of Mechanical Anchor Bolt Embedded in Concrete after High Temperature Heating, Proceedings of the Japan Concrete Institute, Vol.36, No.1, pp.1354-1359, 2014. (in Japanese)
- 3) Y. Kitsutaka, Y. Uchida & K. Matsuzawa, Mechanical properties of corroded rebar in deteriorated reinforced concrete members, Concrete Solutions 5th International Conference on Concrete Repair, 359-365, 2014.
- 4) Kenta Koyasu, Yoshinori Kitsutaka and Koichi Matsuzawa, Evaluation of the degradation for reinforced concrete structures using digital x-rays pictures -Three dimensional observation on the corrosion of reinforcing bar in concrete-, The 6th Asian Concrete Federation International Conference, pp.172-177, 2014.
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- 8) KATTA Akihiko, MATSUZAWA Koichi, KITSUTAKA Yoshinori, YAGISAWA Yasuei, Study on pullout properties of mechanical anchor bolt in concrete after subjected to high temperature, Summaries of Technical Papers of Annual Meeting, AIJ, A-1, pp.979-980, 2014. (in Japanese)
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Sangjun YI

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(1) Possibility of Addition New Value to Existing Old Wooden House- Case Study of the 70 Year Old Traditional Japanese Wooden House Improved by Life Extension Repairing Method - : Kenji HIRAI, Takuo NAGAI, Yukio KOMATSU, Makiko FUJIHARA, Hiroki TSUTSUMI and Sangjun YI(Seisan Symposium Paper, Vol. 29, PP.187-192、 2013.7)

(2) THE EVALUATION PROCESS TO THE DEVELOPMENT PLAN FOR OPTIMIZING THE TOTAL AMOUNT OF PUBLIC FACILITIES : Yuki MIZUIDE, Hiroki TSUTSUMI, Sangjun YI, Takuya UMIKAWA, Junki TSUNEKAWA and Yukio KOMATSU (Seisan Symposium Paper, Vol. 29, PP.205-210、 2013.7)

(3) A study on performance improvement for the existing wooden shops -Focused on seismic

retrofitting of the shops facade- : Shunichi Ohdate, Makoto Tsunoda, Sangjun YI(Conference Paper on Architecture Institute of Japan Kanto Branch 2012, 2013.4)

(4) Research on the maintenance management present condition of a public school plant: Japan-South Korea comparison by questionnaire survey : Yuri Komatsuzaki, Sangjun YI, Yukio Komatsu (Conference Paper on Architecture Institute of Japan Kanto Branch 2012, 2013.4)

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(1) Improving the Efficiency of Public Facilities Management in Municipalities-Focused on the Present Conditions and the Prospects of Municipalities - : Sangjun Yi, Hiroki Tsutsumi, Kenji Hirai, Sanuki Ryo, Yukio Komatsu (Conference on Architectural Institute of Korea, Vol.34 no.2, pp.63~64, 2014.10)

(2) A Study on Construction Members for Comprehensive Renovation of the External Wall in Office Building : Shiori TAKEMOTO, Makoto TSUNODA, Sangjun YI (Conference on Architectural Institute of Korea, Vol.34 no.2, pp.137~138, 2014.10)

(3) DECISION-MAKING METHODOLOGIES CONSIDERING LIFE-CYCLE COST UNCERTAINTY -Case study on energy-saving condominium refurbishment- : Yuchia LIAO, Sangjun YI, Sanuki RYO (Conference on Architectural Institute of Korea, Vol.34 no.2, pp.415~416, 2014.10)

(4) A Study About Positive Utilization Of Non-Repair Closed School-Buildings : Ryosuke TERAOKA, Makoto TSUNODA, Sangjun YI (Conference on Architectural Institute of Korea, Vol.34 no.2, pp.135~136, 2014.10)

(5) A Proposal For Regional Revitalization Methods By Townscape Redevelopment And The Decentralization Of City Hall : Shunichi OHDATE, Makoto TSUNODA, Sangjun YI, Hiroki Tsutsumi (Conference on Architectural Institute of Korea, Vol.34 no.2, pp.129~130, 2014.10)

(6) Possibility of Local government Condition Analysis by Public Information : Kenji Hirai, Sangjun Yi, Hiroki Tsutsumi, Yukio Komatsu (Conference on Architectural Institute of Korea, Vol.34 no.2, pp.681~682, 2014.10)

(7) A study on construction members for comprehensive renovation of the external wall in office building : TAKEMOTO Shiori, TSUNODA Makoto, YI Sangjun (Conference on Architectural Institute of Japan, F-12, pp.847-848, 2014.9)

(8) A study on the wood supply organization aimed for using of local materials :IMAI Misato, TSUNODA Makoto, YI Sangjun(Conference on Architectural Institute of Japan, F-12, pp.863-864, 2014.9)

(9) A Study on the redevelopment method of public facilities -Verification of maintenance policy and evaluation of facility- :Junki TSUNEKAWA, Hiroki TSUTSUMI, Sangjun YI, Yuki MIZUIDE, Ryo SANUKI (Conference on Architectural Institute of Japan, F-12, pp.1-2, 2014.9)

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- (1 1) Study on Current Condition of Local Government by Public Information :HIRAI Kenji, TSURUHARA Taro, YI Sangjun, TSUTSUMI Hiroki, KOMATSU Yukio (Conference on Architectural Institute of Japan, F-12、 pp.19-20、 2014.9)
- (1 2) Study on the Evaluation about Assets and Finance of Local Government - Comparison and Evaluation by Grouping of Local Government - :SHIZUKI Yamamoto, YUKIO Komatsu, YI Sangjun (Conference on Architectural Institute of Japan, F-12、 pp.21-22、 2014.9)
- (1 3) Studies on maintenance costs of Public facilities in local authorities :NAKAMURA Meiko,YI Sangjun,HIRAI Kenji, KOMATSU Yukio (Conference on Architectural Institute of Japan, F-12、 pp.23-24、 2014.9)
- (1 4) Experimental Research about Prformance Gain Repair of an Existing RC building ~ Effectiveness by External Insulation Finishing System ~ :YAMASHITA Etsuo, HIRAI Kenji, YI Sangjun, KOMATSU Yukio (Conference on Architectural Institute of Japan, F-12、 pp.59-60、 2014.9)
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- (1 7) A study on "renovate while living" in condominium -Focusing on the construction influence and supervision, construction management- :CHU Kaito, TSUNODA Makoto, YI Sangjun (Conference on Architectural Institute of Japan, F-12、 pp.265-266、 2014.9)
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3-1. Monographs / Technical books

- (1) Public Facility Management Hnadbook, kensetsunews ,2014.7

3-2. Research Reports

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- (2) The Research Report for the Public Facility Management in MA city, 2015.3
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- (5) Current as of the facility management. Symposium 2014 for making study room in the new age, Yokohama, Kanto Gakuin University, 2014.11.28
- (6) Public Facility Management for the next generation, citizen symposium, Kamakura City, 2014.11.23
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- (8) it's practice time of public facility management now!, Citizen Symposium of Public Facilities, Aizuwakamatsu City, 2014.11.7
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- (10) The Introduction of Facility Stock and The Present Condition of Japan, Taipei City(Taiwan), 2014.09.26
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- (12) The Introduction of Facility Stock and The Present Condition of Japan, National University of Kaohsiung(Taiwan), 2014.09.23
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Liao YuChia

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3-1. Speech

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<http://www.abri.gov.tw/utcpagebox/CHIMAIN.aspx?ddsPageID=CHIMRA&DBID=1662>

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STRUCTURAL ENGINEERING

Manabu YOSHIMURA

Takaya NAKAMURA and Manabu YOSHIMURA: Collapse Test of Reinforced Concrete Columns Failing in Shear with Decreasing Axial Load, Journal of Structural and Construction Engineering, AIJ, Vol.79, No.701, pp.987-994, 2014.7 (in Japanese)

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Takaya NAKAMURA and Manabu YOSHIMURA: Gravity Load Collapse of Reinforced Concrete Columns with Decreased Axial Load, Second European Conference on Earthquake Engineering and Seismology, Istanbul, 2014.8

Kazuhiro KITAYAMA

1. Refereed papers

(1) Tetsuya SHIMA, Kazuhiro KITAYAMA and Toshiki ENDO 2014 Seismic Performance and Different Limit States for Prestressed Reinforced Concrete Frame with Slab Dominated by Beam Flexural Behavior, Proceedings of the Japan Concrete Institute, Vol.36, No.2, pp. 727-732 (in Japanese).

2. Proceedings for Oral Presentation

(1) Kazuhiro KITAYAMA and Tetsuya SHIMA 2014 Seismic Performance of Prestressed Reinforced Concrete Frame with Slab Dominated by Beam Flexural Behavior (Part 3 Effective Width of Slab on Beam Flexural Capacity), Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, Structures IV, pp. 767-768 (in Japanese).

(2) Tetsuya SHIMA and Kazuhiro KITAYAMA 2013 Seismic Performance of Prestressed Reinforced Concrete Frame with Slab Dominated by Beam Flexural Behavior (Part 4 Estimation of Different Limit States), Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, Structures IV, pp. 769-770 (in Japanese).

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(4) Sunghoon SONG, Kenta KURIMOTO, Kioong JIN, Kazuhiro KITAYAMA, Kiyomi KANEMOTO (Shimz) and Yuji TAJIMA(Assis) 2014 Seismic Performance of Unbonded Precast Prestressed Reinforced Concrete Frame with Different Lengths of Tendon, Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, Structures IV, pp. 745-746 (in Japanese).

(5) Koichi SATO, Hiromu KATAE, Kazuhiro KITAYAMA and Toshiki ENDO 2014 Failure Mechanism of R/C Corner Column-Beam Joint under Tri-directional Loading (Part1. Outline of Test and Results), Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, Structures IV, pp. 421-422 (in Japanese).

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(7) Takashi ARAI, Kenta KURIMOTO, Kazuhiro KITAYAMA, Kiyomi KANEMOTO(Shimz) and Yuji TAJIMA(Assis) 2014 Seismic Performance of Beam-Column Joint in Precast Prestressed Concrete Frame Assembled by Unbonded Tendons, Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, Structures IV, pp. 741-742 (in Japanese).

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(10) Kazuhiro KITAYAMA 2015 January 4.2.4 Estimation of Restoring Force Characteristics for R/C Beams, 4.4.2 Seismic Behavior of R/C Beam-Column Joint under Tri-directional Loading, Symposium on Performance Evaluation for Reinforced Concrete Members, Architectural Institute of Japan, pp. 123-124, 136 (in Japanese).

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(2) Architectural Institute of Japan, Guidelines for Structural Design and Construction of Prestressed Concrete Buildings Based on Performance Evaluation Concept (Draft) (in Japanese), 2015 February

(3) Joint Editorial Committee for the Report on the Great East Japan Earthquake Disaster, Report on the Great East Japan Earthquake Disaster, Building Series Volume 5, Damage to Building Foundations / Features and Damage of the 2011 Tohoku Tsunami (in Japanese), March 2015.

3-3. Manuals / Reviews

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Noriko TAKIYAMA

1. Refereed papers

1) M. Sugino, T. Nakanishi, Y. Moriya, N. Takiyama and Y. Hayashi: Evaluation of Dynamic Behavior of Two-Storied Traditional Wooden Frames against Pulse-like Ground Motions. Journal of structural and construction engineering, Architectural Institute of Japan, Vol.79, No.700, pp.801-809, June, 2014. (in Japanese)

2) N. Takiyama, Y. Nambu, C. Watanabe and Y. Hayashi: Structural Properties and Seismic Performance Evaluation of Unique Wooden Frame Using Oblique Nuki. Journal of structural and construction engineering, Architectural Institute of Japan, Vol.79, No.701, pp.691-698, July, 2014. (in Japanese)

3) R. Okazawa, J. Jiao, Y. Kimura, S. Kobayashi, N. Takiyama, C. Watanabe and Y. Hayashi: Disaster Measures and Maintenance of Traditional Wooden Houses among 7 Districts with Different Vulnerability to Disaster. Journal of technology and design, Architectural Institute of Japan, Vol.20, No.46, pp.1151-1156, Oct., 2014. (in Japanese)

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1) H. Yokota, A. Nakagawa, Y. Nambu, N. Takiyama and Y. Hayashi: Evaluation of Structural Properties of Column-to-Beam (Sashigamoi) Joint with Tusk Tenon of Traditional Wooden Houses. Architectural Institute of Japan Kinki Chapter Research Meeting, vol.54, Structures, pp.293-296, 2014.5. (in Japanese)

2) N. Takiyama, Y. Hayashi, C. Watanabe, Y. Nambu, S. Kobayashi and H. Yamamoto: Structural Properties Evaluation of Unique Boat House Using Oblique Nuki, Part I: Structural Investigation, Proceeding of the WCTE 2014, Quebec, Canada, August, 2014

3) Y. Hayashi, N. Takiyama, Y. Nambu, S. Kobayashi and H. Yamamoto: Structural Properties Evaluation of Unique Boat House Using Oblique Nuki, Part II: Cyclic Loading Test and Shear Force Estimation, Proceeding of the WCTE 2014, Quebec, Canada, August, 2014

4) H. Yokota, Y. Moriya, Y. Nambu, N. Takiyama and Y. Hayashi: Experimental Study on Evaluation of Restoring Force Characteristics of Beam-column (Sashigamoi) Joint with Tusk Tenon of Traditional Wooden Houses, Part 1: Experimental Plan and Outline of Result. Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, Structures III, pp.471-472,

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5) Y. Moriya, H. Yokota, Y. Nambu, N. Takiyama and Y. Hayashi: Experimental Study on Evaluation of Restoring Force Characteristics of Beam-column (Sashigamoi) Joint with Tusk Tenon of Traditional Wooden Houses, Part 2: Evaluation of Restoring Force Characteristics. Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, Structures III, pp.473-474, 2014.9. (in Japanese)

6) Y. Shibuya, Y. Nambu, N. Takiyama and Y. Hayashi: Static Loading Tests for Wooden Frame with Large Hanging Wall, Part 1: Experimental Outline, Horizontal Force and Main Damage. Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, Structures III, pp.239-240, 2014.9. (in Japanese)

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8) C. Watanabe, Y. Nambu, R. Okazawa, M. Sugino, N. Takiyama and Y. Hayashi: The Survey of Wooden Houses In The Important District of Groups of Historic Buildings in Gojoshinmachi, Nara, Part 1: The Feature of the District and Houses. Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, Structures III, pp.603-604, 2014.9. (in Japanese)

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10) T. Kumagai, N. Takiyama and K. Kobayashi: Alteration of Space Structural Element before and after Conversion of Historic Brick Building. Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, pp.205-206, 2014.9. (in Japanese)

11) N. Idate and N. Takiyama: Effects of Mechanical Properties on Arrangement of Aseismic Elements of Traditional Wooden Houses, Part I: Static Loading of Frames with Large Section Beam. Architectural Institute of Japan Kanto Chapter Research Meeting, 85(I), pp.309-312, 2015.3. (in Japanese)

Kazushige YAMAMURA

1. Refereed Papers

Jun TOBITA, Toshihide KASHIMA, Mitsuru NAKAMURA, Tomiichi UETAKE, Kazushige YAMAMURA, Katsumi KURITA, Hiroshi KAMBARA: DATABASE OF EARTHQUAKE

RESPONSE OBSERVATION OF BUILDINGS IN JAPAN, AIJ Journal of Technology and Design, Vol.46, pp.901-904, Oct. 2014 (in Japanese)

2. Proceedings of Oral Presentations

ONODERA Miyuki, KANEKO Hinako, OMORI Takayuki, MINAMI Susumu, YAMAMURA Kazusige, IMAGAWA yurika, KATOU Atsuto: Dynamic Characteristics and Damping Evaluation of Existing Building based on Microtremor Measurement, Summaries of Technical Papers of Annual Meeting Architectural Institute of Japan, B-2, pp.993-994, Sept. 2014 (in Japanese)

KANEKO Hinako, OMORI Takayuki, ONODERA Miyuki, MINAMI Susumu, YAMAMURA Kazusige: Relation between seismic indexes and natural periods by microtremor measurement of existing medium-low storied buildings: Summaries of Technical Papers of Annual Meeting Architectural Institute of Japan, pp.987-988, Sept. 2014 (in Japanese)

OMORI Takayuki, MINAMI Susumu, YAMAMURA Kazusige: Analyses of Vibration Characteristics of the Existing Middle-rise SRC Building: Proceeding of the 86th Architectural Research Meetings, 2014, Kanto Chapter, Architectural Institute of Japan, 2088, Feb. 2015 (in Japanese)

3. Others

3-1. Monographs / Technical books

co-authored: AIJ Recommendations for Loads on Buildings(2015), Architectural Institute of Japan, Feb. 2015 (in Japanese)

Kiwoong JIN

1. Refereed Papers

Kiwoong JIN, Ho CHOI, and Yoshiaki NAKANO : Simplified Evaluation Method of Backbone Curve for URM infill with Boundary RC frame, Proceedings of the Japan Concrete Institute, Vol.36, No.2, pp.589-594, 2014. 7. (in Japanese)

2. Proceedings of Oral Presentations

Sunghoon SONG, Kenta KURIMOTO, Kiwoong JIN, Kazuhiro KITAYAMA, Kiyomi KANEMOTO and Yuji TAJIMA : Seismic Performance of Unbonded Precast Prestressed Reinforced Concrete Frame with Different Lengths of Tendon, Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, C-2, Structures IV, pp.745-746, 2014. 9. (in Japanese)

Kiwoong JIN, Ho CHOI, and Yoshiaki NAKANO : Seismic Performance of RC Frames with URM Infill considering Beam Deformation (Part.4 Simplified Backbone Curve Evaluation Method of

URM Infill), Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, C-2, Structures IV, pp.829-830, 2014. 9. (in Japanese)

Kiwoong JIN, Ho CHOI, Kazuto MATSUKAWA, and Yoshiaki NAKANO : Simplified Backbone Curve Estimation Method of URM Wall Infilled RC Frame, Bulletin of Earthquake Resistant Structure Research Center, Institute of Industrial Science, The University of Tokyo, No.47, 2014.

ENVIRONMENTAL ENGINEERING

Nobuyuki SUNAGA

1. Refereed Papers

Tsukasa OGINO, Kosuke SAKAI, Satoshi SHIDA and Nobuyuki SUNAGA , A Study on Energy Saving Air-Conditioning Control System Utilizing Adjustment Behaviour of Occupants, Journal of Environmental Engineering (Transactions of AIJ), Vol.79, No.704, pp.871-881, Oct., 2014

Hideki MIKI, Masayuki ICHINOSE, Nobuyuki SUNAGA, Tamio NAKANO and Noriyoshi ICHIKAWA, Trial to Make 3D Parts Data in Air-Conditioning Facility Domain, AIJ Journal of Technology and Design , Vol.20, No.46, pp.1125-1130, Oct., 2014

Tsukasa Ogino, Kosuke Sakai, Kosuke Ito and Nobuyuki Sunaga, Examination of Indoor Thermal Environment and Energy Performance by Active Air-conditioning Control System utilizing Adjustment Behavior of Occupants, Proc. of the 30th PLEA International Conference, Paper_5C_2682, Dec., 2014

2. Proceedings of Oral Presentations

2-1. Invited Lecture

Nobuyuki SUNAGA, Yasuhiko HATA, Yuki KUWABARA, Hiroko ONODERA, Yuta ENDOH and Yuhji KAWAKAMI, Effects of HEMS and Energy-Saving Behaviors in High-Performance House, Proc. of BECC 2014 , P.23, Sept., 2014 & <http://seeb.jp/wp-content/uploads/2014/10/2014BECC5-2Sunaga.pdf>,

2-2. Internation Conference

Masahiro Kinoshita and Nobuyuki Sunaga, Thermal performance of four cool/heat pits in school buildings in Tokyo, Proceedings of Grand Renewable Energy 2014, O-At-3-2, Jul., 2014

Kiyoshi Nakata and Nobuyuki Sunaga, Study of daylighting in office buildings focusing on the color temperature of daylight transmitted through windowpanes, Proceedings of Grand Renewable Energy

2014, O-At-4-2, Jul., 2014

Nobuyuki Sunaga, Hiroki Otsuka, Hideo Ichiboji, Yasuo Iwahashi and Lise Guillerm, Energy and thermal performance of a retrofit house in Japan, Proceedings of Grand Renewable Energy 2014, O-At-5-1, Jul., 2014

Tsukasa Ogino, Kosuke Ito, Kosuke Sakai and Nobuyuki Sunaga, A study on an energy saving air-conditioning control system utilizing adjustment behavior of occupants, Proceedings of Grand Renewable Energy 2014, O-At-7-3, Jul., 2014

Yuta ENDOH, Nobuyuki SUNAGA, Yasuhiko HATA, Hiroko ONODERA and Yuji KAWAKAMI, Study on suggestons of energysaving behavior suitable for household characterristics - Factors that influence the practice -, Proceedings of Grand Renewable Energy 2014, O-At-7-4, Jul., 2014

2-3. Annual Meeting of Academic Society in Japan

Kiyoshi NAKATA, Nobuyuki SUNAGA, Masayuki ICHINOSE, Relationship between Color Temperature and Comfort in Daylighted Office, Summaries of Technical Papers of Annual Meeting, A.I.J., D-2, pp.561-562, Sept., 2014

Sho SASAKI , Nobuyuki SUNAGA , and Yasumoto YAMAMOTO, Study on Improvement of Building Environment Performance for High Schools in Tokyo - The Proposal of Suitable Design Guide for the Shaping of School Buildings -, Summaries of Technical Papers of Annual Meeting, A.I.J., D-2, pp.153-154, Sept., 2014

OGURA Keisuke, SUNAGA Nobuyuki, OTSUKA Hiroki, ICHIBOJI Hideo, Study of Thermal and Light Environmental Performance of the Shoji with Light-Transmitting Insulation Material - Comparison with Typical Window Units -, Summaries of Technical Papers of Annual Meeting, A.I.J., D-2, pp.137-138, Sept., 2014

OKAJIMA Emiko, SUNAGA Nobuyuki and NAKASHIMA Fu, Study on the Effect of Thermal-Insulation Retrofit in Apartment House of Tama-Newtown, Summaries of Technical Papers of Annual Meeting, A.I.J., D-2, pp.547-548, Sept., 2014

NAKASHIMA Fu, SUNAGA Nobuyuki and OKAJIMA Emiko, "Study on the Effect of Thermal-Insulation Retrofit According to Position of Dwelling Units in Apartment House in Tama-Newtown", Summaries of Technical Papers of Annual

Meeting, A.I.J., D-2, pp.549-550, Sept., 2014

SUNAGA Nobuyuki, OKAJIMA Emiko and NAKASHIMA Fu, Research on Energy Self-support Building and City Considering Disaster 1. Requirement of Apartment House without Refuge, Summaries of Technical Papers of Annual Meeting, A.I.J., D-2, pp.551-552, Sept., 2014

HATA Yasuhiko, MATSUMOTO Kenzo, SUNAGA Nobuyuki, ONODERA Hiroko, ENDOH Yuhta and KAWAKAMI Yuji", Study on the Energy-Saving Action in Home Part1. Research outline and attribution of houses and occupants, Summaries of Technical Papers of Annual Meeting, A.I.J., D-2, pp.587-588, Sept., 2014

KAWAKAMI Yuji, SUNAGA Nobuyuki, ONODERA Hiroko, ENDOH Yuta, HATA Yasuhiko, MATSUMOTO Kenzo, Study on the Energy-Saving Behavior in Home Part 2. Examination of characteristic and reduction potential of the energy consumption, Summaries of Technical Papers of Annual Meeting, A.I.J., D-2, pp.589-590, Sept., 2014

NAKANO Ikuya, SUNAGA Nobuyuki, ONODERA Hiroko, ENDO Yuhta, KAWAKAMI Yuji, HATA Yasuhiko and MATSUMOTO Kenzo, Study on the Energy-saving Action in Home Part3. Consciousness and Effect of Energy-saving Action on Heating, Summaries of Technical Papers of Annual Meeting, A.I.J., D-2, pp.591-592, Sept., 2014

ONODERA Hiroko, SUNAGA Nobuyuki, ENDOH Yuta, KAWAKAMI Yuji, HATA Yasuhiko, MATSUMOTO Kenzo, Study on the Energy-Saving Action in Home Part4. Consciousness and effect of energy-saving action on hot water supply, Summaries of Technical Papers of Annual Meeting, A.I.J., D-2, pp.593-594, Sept., 2014

ENDOH Yuta, SUNAGA Nobuyuki, ONODERA Hiroko, KAWAKAMI Yuji, HATA Yasuhiko, MATSUMOTO Kenzo, Study on the Energy-Saving Behavior in Home Part 5. The change of electric power consumption and energysaving consciousness by taking energy-saving actions, Summaries of Technical Papers of Annual Meeting, A.I.J., D-2, pp.595-596, Sept., 2014

Masahiro KINOSHITA and Nobuyuki SUNAGA, Experimental Study on the Performance of Cool/Heat Pit in School Building in Tokyo Part 5. CFD Simulation of the Effect of Pit Lengths and Footing Beam Shapes, Summaries of Technical Papers of Annual Meeting, A.I.J., D-2, pp.625-626, Sept., 2014

OGINO Tsukasa, SAKAI Kosuke, MASUI Shuhei and SUNAGA Nobuyuki, Study of the Active Energy Saving Air-Conditioning Control System Utilizing Adjustment Behaviour of Occupants Part1. Following Performance of Active Energy Saving Air-Conditioning Control and Power Reduction Result in Summer, Summaries of Technical Papers of Annual Meeting, A.I.J., D-2, pp.1283-1284, Sept., 2014

MASUI shuhei, SUNAGA Nobuyuki, OGINO Tsukasa and SAKAI kousuke, Study of the Active Energy Saving Air-Conditioning Control System Utilizing Adjustment Behaviour of Occupants Part2. Evaluation of Thermal Environment and Control Method in Summer, Summaries of Technical Papers of Annual Meeting, A.I.J., D-2, pp.1285-1286, Sept., 2014

Shuhei MASUI, Nobuyuki SUNAGA, Tsukasa OGINO, Study of the Active Energy Saving Air-Conditioning Control System Utilizing Adjustment Behaviour of Occupants Part3. Winter Measurements and Subjective Evaluation of Thermal Environment in Office, Summaries of Technical Papers of Annual Meeting, SHASEJ, p.93-96, Sept., 2014

Yuta ENDOH, Nobuyuki SUNAGA, Yuji KAWAKAMI, Hiroko ONODERA, Yasuhiko HATA, Study on trends in use of air-conditioning, effect of its energy-saving behavior and influence factor in high-performance houses, Summaries of Technical Papers of Annual Meeting, SHASEJ, p.145-148, Sept., 2014

Yuji KAWAKAMI, Nobuyuki SUNAGA, Yuta ENDOH, Hiroko ONODERA, Yasuhiko HATA, Study of the characteristic and the reduction potential of energy consumption for highly efficient houses, Summaries of Technical Papers of Annual Meeting, SHASEJ, p.149-152, Sept., 2014

Shuhei MASUI, Nobuyuki SUNAGA, Tsukasa OGINO and Kousuke SAKAI, Study of Indoor Thermal Environment and Energy Performance by Active Air-conditioning Control System utilizing Adjustment Behavior of Occupants Part 3 Measurement Results in Case of Personal Control of Indoor Unit in Summer, Proceedings of JSES/JWEA Joint Conference, pp.79-82, Nov., 2014

Fu NAKASHIMA and Nobuyuki SUNAGA, Relation between Thermal-Insulation Retrofit and Heat Disorders in Apartment House in Tama-Newtown, Proceedings of JSES/JWEA Joint Conference, pp.101-104, Nov., 2014

Keisuke OGURA, Nobuyuki SUNAGA, Literature research on Renovation of Detached houses

towards Energy Efficiency Improvement –Research of Administration Policy and Analysis Using the Architecture Magazine-, Proceedings of JSES/JWEA Joint Conference, pp.105-108, Nov., 2014

Yuta ENDOH, Nobuyuki SUNAGA, Yasuhiko Hata, Hiroko ONODERA and Yuji KAWAKAMI, Study on ease of implementation and energy reduction effect of energy-saving behaviors in high performance house, Proceedings of JSES/JWEA Joint Conference, pp.453-458, Nov., 2014

Akihiro NAGATA

2. Proceedings of Oral Presentations

1) Masaki Suzuki and Akihiro Nagata, Effects on heat and wind environment caused by hedge, Summaries of Technical Papers of Annual Meeting, AIJ, D-1, pp.1135-1136, 2014 (in Japanese)

2) Yuichi Murai and Akihiro Nagata, Study on Effective Heat Capacity of Room Considering Furniture, Summaries of Technical Papers of Annual Meeting, AIJ, D-2, pp.5-6, 2014 (in Japanese)

3) Keni Kitazawa, Junki Hoshino and Akihiro Nagata, Heat transfer of lower back and the thigh when seated, Summaries of Technical Papers of Annual Meeting, AIJ, D-2, pp.369-370, 2014 (in Japanese)

4) Haiyuan Yu, Akihiro Nagata et. al., A study on Heat Transfer Between the Window and the Steel Frame, Technical Papers of Annual Meeting, SHASEJ, pp.281-284, 2014(in Japanese)

5) Takashi Yanai, Kouichi Shinagawa and Akihiro Nagata, Study on air conditioner design method in consideration of thermal load diversity (Part 1) Case study of the thermal load diversity in the work place, Technical Papers of Annual Meeting, SHASEJ, pp.177-180, 2014(in Japanese)

6) Kouichi Shinagawa, Takashi Yanai and Akihiro Nagata, Study on air conditioner design method in consideration of thermal load diversity (Part 2) Case study of the indoor environment and energy consumption on the situation of thermal load diversity, Technical Papers of Annual Meeting, SHASEJ, pp.181-184, 2014(in Japanese)

3. Others

3-1. Monographs / Technical books

“Sustainable Urban and Architectural Design in an Era of Smart Cities”(4-2-1 Thermal Environment Analysis, pp.126-132), edited by AIJ, Shokokusha, 2014(in Japanese)

3-3. Manuals / Reviews

Akihiro NAGATA,

“Standard for Calculation of Energy Performance of Buildings”, p.55, Journal of JABMEE, 2015.3 (in Japanese)

Masayuki ICHINOSE

1. Refereed Articles

- 1) Kiyoshi Nakata, Nobuyuki Sunaga, Masayuki Ichinose, Study of Daylighting Office Buildings; Focusing on the Color Temperature of Daylight Transmitted Through Windowpanes, Grand Renewable Energy 2014, Tokyo, O-At-4-2, July 2014
- 2) Masayuki Ichinose, Takashi Inoue, Tsutomu Nagahama, Retro-reflecting window film with spectral selectivity against near-infrared solar radiation for improving daylighting and mitigation of heat-island, Advanced Building Skins 2014, Bressanone Italy, pp.123-136, October 2014

2. Proceedings of Oral Presentations

3. Others

3-1. Monographs / Technical books

3-2. Research Reports

- 1) Wong Nyuk Hien, Sustainable Urban and Green Building Design in the Tropics, Tokyo Metropolitan University, July 2014 (Coordinator)
- 2) Dana Buntrock, Not your Daddy's Oil Shock, November 2014 (Coordinator)
- 3) Actual situation of residential buildings in Japan and discussion about "sustainable vs affordable", Paris, Green City 2014 (Invited lecture)

3-4. Works/Products, etc.

Eiko KUMAKURA

1. Refereed Articles

- Eiko Kumakura, Akinobu Murakami, Sachiko Yamamoto and Mikko Ishikawa: Reconstruction of Tsunami-Stricken Villages using Procedural modeling, journal of the Japanese Institute of Landscape Architecture, Vol.78, No. 5 (in printing, in Japanese)
- Eiko Kumakura, Akinobu Murakami, Kazuaki Nakaohkubo: A case study of landscape design for residential common space using a thermal environmental simulation tool, the 2nd Asia conference of International Building Performance Simulation Association, Proceedings, Nagoya, Japan, 2014. 11

2. Proceedings of Oral Presentations

- Eiko Kumakura, Numerical Simulation of the Solar Shading Effects of Trees, Seminar at

National University of Singapore, Singapore, 2014. 11. 4

•Akinobu Murakami, Eiko Kumakura, Jan Halatsch and Antje Kunze, Digital archive of community memories before the 2011 Tohoku earthquake and tsunami in Japan – Rebuilding lost place and landscape using CityEngine, 5th Digital Earth Summit 2014, Proceedings, Nagoya, Japan, 2014. 11

•Eiko Kumakura, Akinobu Murakami, Kazuaki Nakaohkubo: Landscape design process using thermal environmental simulation for passive residential district project, Summaries of Technical Papers of Annual Meeting, A. I. J., D-1, pp. 1047-1048, 2014. 9(in Japanese)

•Eiko Kumakura, Akinobu Murakami, Syunsaku Miyagi and Hiroki Takahashi: Landscape design process using thermal environmental simulation for passive residential district project in Japan, Ground Renewable Energy, Proceedings, Tokyo, Japan, 2014.7

•Eiko Kumakura, Akinobu Murakami and Kazuaki Nakaohkubo: Landscape design process using thermal environmental simulation for passive residential district project, conference of Hear Island Institute International in Japan, Proceedings, Saga, p66-67, 2014.7

•Eiko Kumakura and Jan Halatsch : 3D Reconstruction of Tsunami-Stricken Villages in Japan with CityEngine and ArcGIS Online, 2014 Esri 3D Mapping forum, 2014. 7, San Diego