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Contents

Introduction of Building Material Regulation Based on the Results of Research on Countermeasures for Sick House Problems

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1. Background of the Problems of Sick House

Contemporary houses and buildings contain many chemical substances used for enhancing building materials, such as adhesives, anti-termite agents, preservatives, solvents, and plasticizers. These chemical substances may emit particulates and gases that enter the human body and can cause serious influences on human health. This is the so-called sick house problems, i.e., contamination of room air by emissions of hazardous chemical substances from building materials as well as poor air ventilation, and it is jeopardizing the safety of houses and buildings. Poor air ventilation is aggravated by the thermal insulation and airtightness of building structures, which have been introduced to save energy and increase comfort. Air-conditioners, poor environments, and infrequent ventilation due to changing life-styles have also made the problem worse. Thus, sick house problems is an affliction of modern society.

2. Research and Investigations on Countermeasures for Sick House Problems

The Japanese government organized the Study Group for Healthy Houses in 1996; designated the target chemical substances (formaldehyde, toluene, xylene, anti-termite agents, wood preservatives, and plasticizers) to be preferentially regulated; drew up a "User's Manual" for consumers and a "Design and Construction Manual" for designers and constructors, the first such manuals in Japan, in conformance with the guideline for the concentrations of hazardous chemical substances presented by the Ministry of Health and Welfare (at the time) in June 1997; and mapped out the future direction of research and development. These results were compiled into quality standards for room air as part of countermeasures for formaldehyde drawn up for the Quality Indication System for Houses and Buildings which came into effect in October 1999, as well as into specifications for on-site concentration measurements added to the provision in August 2001.

The Building Research Institute of the Ministry of Construction (at the time) started a joint research between the government and private sector in 1997, which is called "Technological Development for Creating Healthy Residential Environments"; accumulated data on actual conditions; improved the measurement and assessment technologies; and compiled the "User's Guide for Constructing Healthy Houses" and "Design and Construction Guide for Constructing Healthy Houses" which contain specific numerical guidelines.

Although these research and development activities improved our understanding, many uncertainties remained regarding the actual conditions and mechanism of room air contamination, and there was insufficient data on building materials for formulating countermeasures. More data on design needed to be accumulated, and quantitative design and construction methods needed to be established.

In fiscal 2000, the Study Group for Room Air Countermeasures led by the Ministry of Land, Infrastructure and Transport, investigated the conditions and concentrations of chemical substances inside 5,000 houses, and found that the concentrations exceeded the criteria values designated by the guideline in more than one-quarter (formaldehyde) and one-eighth (toluene) of the total number of houses. This serious result led to strong calls for proper countermeasures to be developed and implemented.

To take full-scale countermeasures problems by regulating various hazardous chemical substances, the National Institute for Land and Infrastructure Management (NILIM) of the Ministry of Land, Infrastructure and Transport started a three-year comprehensive technological development project in 2001, called the "Development of Countermeasure Technology on Residential Indoor Air Quality." In this project, NILIM is clarifying the actual state of damage and mechanism of propagation of chemical substances, establishing simple techniques for measuring and assessing room air, developing new design and construction technologies which use safe housing and interior materials, and enhancing the provision of relevant information.

Meanwhile, in preparation for the meeting of the Infrastructure Arrangement Council (Committee on Countermeasures for Chemical Substances inside Houses and Buildings) in 2001, NILIM carried out various joint studies, as well as provided scientific and technological data, materials, and advice.[1] Regarding chemical substances including anti-termite agents to be applied under the floor, for which assessment and prediction methods had not been established, NILIM conducted both theoretical and experimental studies, and presented a quantitative model and technological basis for designating and assessing target substances to be controlled. NILIM also helped develop practical measurement, assessment and design technologies in consideration of chemical substance control, and means to provide the relevant information and technologies to consumers, designers and constructors.

To meet the growing necessity to counter the growing use of hazardous chemical substances in houses and buildings, NILIM is conducting comprehensive research and development on equipment and methods for objectively assessing and measuring the target substances, as well as accumulating information on the conditions and mechanism of room air contamination. To support effective administrative policies, our project also emphasizes improving the contents and system of providing information to local companies (designers and constructors) and dwellers (customers), who are the major suppliers and users of houses and buildings.

3. Necessity of Future Research and Development

As shown in the above report, the Building Standard Law currently regulates formaldehyde and chlorpyrifos. However, there has been rising demand for regulating more chemical substances, hence further research is needed. Accordingly, it is essential to accumulate scientific knowledge and formulate technological standards through our project. Taking advantage of our close links with both construction job sites and the latest research and development, NILIM will continue to provide objective opinions, data and materials to facilitate the enforcement of administrative policies.

Note:

1) In response to an inquiry from the Minister of Land, Infrastructure and Transport (October 2001), the Committee on Countermeasures for Chemical Substances inside Houses and Buildings (chaired by Professor Shuzo Murakami of Keio University) met to discuss the enforcement of chemical substance regulations by the Building Standard Law. Based on the conclusions of this committee meeting, the Infrastructure Arrangement Council compiled a report titled "First Report regarding Ideal Policies of the Construction Administration to Counter the Problems in the 21st Century, including Countermeasures for the Aging Society, Environmental Problems, and Urban Renewal" (January 30, 2002). The contents of this report can be summarized into the following three points:

1) Chemical substances in rooms in all building structures, not only houses, should be regulated by the Building Standard Law and other laws.

2) Based on present technological knowledge, only formaldehyde and chlorpyrifos are regulated at present (use of chlorpyrifos has been restricted); however, this report stipulates that other chemical substances shall be continuously monitored, and may be added to the list of regulated chemical substances according to the advanced results of future research.

3) With the values shown in the guideline of the Ministry of Health, Labour and Welfare as the criteria, the concentrations of hazardous chemical substances will be regulated to become under the designated standard based on the conditions of the amount (area) of materials emitting such substances and the ventilation facilities/design of the respective houses and buildings.

Establishment of Technological Standards for River Channel Plans and River Structure Designs

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Physical Elucidation of Phenomena

With the conventional river channel plans, the design dimensions (e.g., the configuration of river channel cross sections and the coefficient of roughness) are determined based on flood marks, and then based on these dimensions, the design high water level is decided and used as the basis for determining various facility dimensions.

However, successive research has improved our understanding of flood flows and sediment hydraulics, and it has gradually become feasible to predict river channel phenomena. For instance, a new method to obtain the coefficient of velocity (mean flow velocity/friction velocity) based on segments (characteristic sections of river channels) and sand bar configurations, and then calculate the coefficient of roughness using this coefficient and water depth, has been established. It has also become possible to calculate the rise in water level due to sand bars and bendings of river course.

Process of Drawing Up River Channel Plans

Based on such know-how, a new process of drawing up river channel plans has been established: 1) set the starting water level; 2) calculate the frictional resistance; 3) evaluate the influence of the communities of trees and other vegetation on the flood channel; 4) analyze the factors causing water-level rise; and 5) set the low water channel management line (alignment of low water channel for stabilizing the plane configuration of river channels). This procedure provides an environment-friendly, safe, and reasonable method of river channel planning.

Designing of River Structures

With the conventional methods of designing river structures, on the other hand, the levee height is determined based on the design high-water level, whereas the levee cross section is determined based on the stability of sliding failure of slopes and the infiltration conditions of the levee body. Specifically, the levee configuration was determined based on the hydraulic dimensions of each river channel, without necessarily considering all the structural failure factors (e.g., erosion due to overflow and failure due to scouring).

To improve this situation, the following measures are proposed for evaluating the safety of river facilities based on the hydraulic and/or mechanical viewpoints and using data obtained on site and by hydraulic model experiments, rather than relying on empirical rules:

1) Regarding levees, the safety of environment-friendly facilities is standardized by examining a series of design methods, such as setting the external force acting on the levees and evaluating the safety and countermeasures for external forces, while incorporating new knowledge on protection measures considering environment;

2) Regarding super levees, a standard design method is presented by clarifying the overflow properties (e.g., the amount of overflow and the shearing force due to overflow) of the flood water which flows over the levees, as well as the failure properties of levees; and

3) Regarding revetments, a method of calculating the drag (the pushing force in the flowing direction of the current) and the lift (the lifting force in the direction vertically perpendicular to the current) for each case of revetment disasters, based on hydraulic and mechanical considerations, is presented.

These research results have been compiled into technological guidelines, such as 1) "Guideline for River Levee Designs" compiled by the Flood Control Division, River Bureau, Ministry of Construction; 2) "Cabinet Order concerning Structural Standards for River Administration Facilities, etc."; and 3) "Mechanical Design Methods of Revetments" compiled by the Japan Institute of Construction Engineering, which are currently used by regional construction bureaus, work offices, and municipal governments for designing river administration and management facilities.

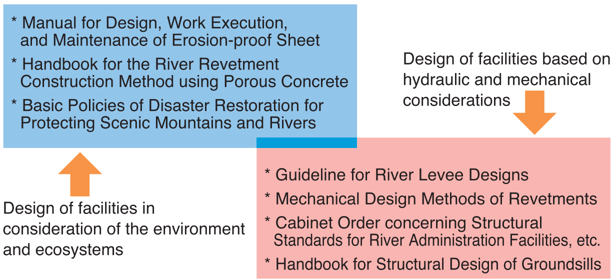


Figure 1 Guidelines of technological standards for designing river structures

The First Step for Shifting to Performance-based Design: Revision of "The Specifications for Highway Bridges"

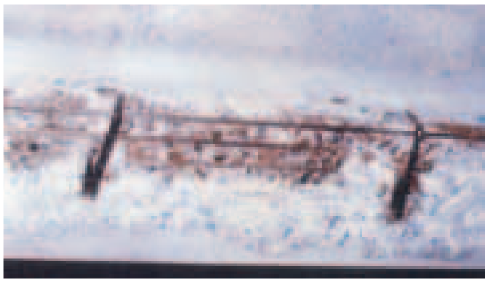
In December 2001, the Ministry of Land, Infrastructure and Transport notified that "The Specifications for Highway Bridges," which is the guideline of design standards for highway bridges, had been revised. This is the first revision since the 1996 edition, which was revised based on the experience of the Kobe earthquake of 1995. The new guideline has been applied to bridges designed and constructed since April 2002.

The focus of editorial policy of this revision includes: 1) compatibility with the current global trend that technological standards should be determined based on the performance of structures; 2) flexible exploitation of new concepts to meet the diversifying demands; 3) reduction of life-cycle costs and mitigation of maintenance works; and 4) substantial prescriptions regarding durability.

Specifically, under the main objectives of rapidly shifting to performance-based codes and enhancing awareness in the construction industry, the items regarding required performance have been extracted from the previous edition and given as prescriptions in the new edition, whereas the existing structural details and checking particulars are offered as methods for satisfying the required performance. Accordingly, the language of most of the provisions has been revised entirely from "this method shall be used" to "this method may be used," while many conventional prescriptions are retained as "deemed-to-satisfy" provisions, with which the required performance can be satisfied without particular validation, to avoid confusion in practice.

As the number of highway bridges has reached 140,000, effective use of these infrastructures is of crucial importance. Bridges should therefore be highly durable and life-cycle cost should be minimized; however, in the previous editions of "The Specifications for Highway Bridges," durability considerations were not explicitly prescribed in each provision. In the revised edition, durability is now the basis of design as an explicit prescription to be observed, rather than an optional feature.

To fully accomplish this shift to performance-based codes, the second-stage revision of this new edition should be undertaken immediately. To comply with the global trend toward unification of technological standards, the scheme of "Allowable Stress Design Methods" should be revised to the format of "Partial Safety Factor Design Methods." In addition, standards may need to be rearranged so that new concepts regarding composite structures, mixed structures, and integrated super- and sub-structures are not impeded. It is also essential to examine the separation of items that should be prescribed by the central government from those that can be decided by road managers, together with legal documentation of the respective items.


A salt-attacked PC Bridge

Damage prevention work against salt attack (steel bars coated with epoxy resin)


Research on Technologies for Zero Emission and Recycling Oriented Society

To create a recycling oriented society, it is important throughout society to reduce the quantity of waste material produced, promote the recycling and reuse of resources, and ensure appropriate final disposal.

A government decision in September 1999 set final disposal quantities of 6.5 million tons of ordinary waste material and 31 million tons of industrial waste material as targets for 2010. In May 2000, the government announced a new recycling law that stipulates the dismantling process and promotes the recycling of construction and demolition waste. The law became fully effective in May 2002.

The Building Department, Water Quality Control Department, Port and Harbor Department and Coastal and Marine Department will undertake the following research:

(1) Technical standards and environmental assessment standards for recycled materials / new materials, etc.

(2) Technology to restrict the production of construction waste materials, recover them as resources, and reduce lower their environmental load

(3) Technology for reducing waste produced during construction and dismantling of wooden buildings

(4) Technologies to reduce the environmental load caused by optimum treatment of kitchen garbage and other organic waste materials

(5) Method of planning logistics for waste and recyclable materials and recycling bases in ports

(6) Performance-based design of seawalls for controlled waste disposal taking into account large-scale earthquake motion

(7) Technologies to improve the reliability of offshore waste disposal sites for controlled waste materials

(8) Method of analyzing public acceptance of offshore waste disposal sites

R/D SIGNATURE ON JAPANESE TECHNICAL COOPERATION PROJECT ON THE REDUCTION OF SEISMIC RISK FOR BUILDINGS AND STRUCTURES IN ROMANIA

A Project Design Team organized by the Japanese International Cooperation Agency (JICA) headed by Jun-ichi Murakami, Deputy Director General of National Institute of Land and Infrastructure Management (NILIM), visited Romania from 28th July to 2nd August 2002. Based on the result of previous investigations, the team reconfirmed the Project Plan of the Ministry of Public Works, Transports and Housing, Romanian Government (MLPTL) with the cooperation of Japanese government and concluded its effectiveness for implementation, then exchanged the signature on the R/D (Record of Discussions) document with the MLPTL.

Romania is a country in Europe that is known for earthquakes. In particular, earthquake damage has been concentrated in the capital city, Bucharest. In its history it has often been prone to damage by great earthquakes. On March 4, 1977, an earthquake of moment magnitude 7.5 occurred in Vrancea county. At this time, most of the damage was concentrated in Bucharest. It was recorded that 1,578 people (1,424 people in Bucharest) were killed and the cost of the damage was 3 billion dollars (2 billion dollars in Bucharest). Moreover, 1.4 billion dollars of this sum, which was 70 percent of the total losses caused in Bucharest, were caused by building collapse.

This project aims to improve seismic retrofitting techniques, disseminate those techniques to structural engineers and draft revision of construction regulations / codes, thus to contribute to the improvement / revision of seismic regulations / codes and level up the seismic retrofitting techniques of structural engineers, for progress in safety level of the buildings and structures against earthquake.

The project is implemented by the National Center for Seismic Risk Reduction subordinated to the MLPTL, which is responsible for the earthquake countermeasures of buildings and structures, in cooperation with the Technical University of Civil Engineering of Bucharest (UTCB) and Building Research Institute (INCERC).

Term of the Project is scheduled to be five years from October 2002 to September 2007. During this period, JICA dispatches long-term and short-term experts, accepts Romanian engineers to the training in Japan and provides equipment which is necessary for the technical cooperation. The JICA organizes an advisory committee to support this Project coordinating with the NILIM and Building Research Institute (BRI) as the main cooperation organizations.

Ceremony of R/D signature (Japanese side: Mr. J. Murakami, the leader, Romanian side: Mrs. I. Treanu, the State Secretary, MLPTL)

TECHNICAL NOTE of National Institute for Land and Infrastructure Management (April-June, 2002)

No	Title of Paper	Names of Divisions
4	Emergency Management System for Natural Disasters in the United States	Erosion and Sediment Control Division
5	Operating Methods of Critical Rainfall for Warning and Evacuation from Sediment-Related Disasters	Erosion and Sediment Control Division
16	Reliability Based Design Method for Checking the Flexural Safety of Caisson Type Breakwaters	Coastal Disaster Prevention Division
17	Economic and Geographic Factors Effecting on Reclamation in Port Areas	Coastal Zone Systems Division
18	An Analysis on the Flow of North American Containerized Cargo in East Asian Region (2001)	Port Planning Division
19	An Analysis on the Flow of Northeast Asian Containerized Cargo in Hokkaido	Port Planning Division
20	An Analysis on the Port Hinterland of International Marine Container Cargo Movement by Considering Trip Distance	Port Systems Division
26	Infiltration of Stormwater to Sanitary Sewer	Wastewater System Division
27	A Study on General Evaluation of Construction Works based on Technical Difficulty	Construction Management Division
28	Experimental study on the Fatigue durability of Highway Bridge slabs.	Bridge Division
29	Study on Function of Road Spaces as Bio-tope -Toward Formation of Ecological Network-	Road Environment Division
30	Automatic Ultrasonic Testing Manual for Welded Joints of steel Highway Bridges	Bridge Division
41	Proceedings of the 33rd Joint Meeting of U.S. -Japan Panel on Wind and Seismic Effects, UJNR	Coast Division, Bridge Division, Earthquake Disaster Prevention Division, Independent Administrative Institutions Public Works Research Institute
42	The 33rd Joint Meeting U.S.-Japan Panel on Wind and Seismic Effects	Coast Division, Bridge Division, Earthquake Disaster Prevention Division, Independent Administrative Institutions Public Works Research Institute

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