Research regarding improving of prediction methods in road construction environmental impact assessment

Budged: Grants for operating expenses
Road account
Research Period: FY2003-2005
Research Team: Advanced Technology
Author: YAMAMOTO Hiroshi
HAYASHI Akira
YOSHIDA Kiyoshi

Abstract:
We aimed improving prediction methods enacted in 2000 in the Construction Noise, Vibration, and Atmospheric Impact Assessment. Regarding dust fall, it was concluded that the vertical dispersal breadth and the horizontal dispersal breadth of dust is equal to that of gaseous substances, that it is possible to apply the Plume Model that considers gravity settlement, and that regarding the quantity blown up from bare ground, it is appropriate to apply the formula that shows that the standard value produced set for each type of soil increases and decreases according to the square of the wind speed. Regarding noise, experiments to analyze the quantity of sound by construction machinery were done using a microphone array in an anechoic room, and we verified that it is possible to analyze each A-weighted sound power level by multiple construction machines.

Key words: construction noise, environmental impact assessment, microphone array, dust fall

Utilization of thinned timber in civil engineering fields for CO2 fixation and creation of recycling-based society

Budged: Grants for operating expenses
General account
Research Period: FY2002-2005
Research Team: ConstructionTechnology
Author: OSHITA Takeshi
ONODERA Seiichi
TSUTSUMI Shouichi

Abstract:
In forestry, management of thinning timber is indispensable, in order to grow good quality timber and to make CO2 fixation cycle more efficient function. However, it is carried out only about 40% among required thinning area in recent years, and nearly half of the thinned timber is left unused in the forest, because it is less competitive in price. In order to contribute to growing high quality artificial forest and fix CO2, construction of recycling-based society is called for by proposing the utilization of thinned woods. Through this research, the utilization of the thinned wood as light foundation improvement material by a mass of short pile was proposed, and the modification characteristic of the improvement foundation and cost was examined.

Key words: soft ground, thinned timber, stable improvement of the floating type, centrifugal model experiment

Utilization of thinned timber in civil engineering fields for CO2 fixation and creation of recycling-based society (2)

Budged: Grants for operating expenses
General account
Research Period: FY2002-2005
Research Team: Advanced Materials
Author: NISHIZAKI Itaru
NITTA Hiroyuki

Abstract:
In this study, the purification technology of polluted soil by using “wood ceramics” has been examined in order to find a new application of thinned woods in civil construction area. Environmental endocrine disruptor and removal performance of wood ceramics coated with titanium dioxide (photocatalyst) was investigated.

The main results are as follows.

1) A variety of organic poisonous substances were able to be resolved by using the wood ceramics that spread the photocatalyst on the surface.

2) It was thought that this method was effective as the purification technique such as environmental hormones not adsorbed easily by the soil.

Advanced removal of residual organic matter in secondary effluent for wastewater reuse

Budged: Grants for operating expenses
General account
Research Period: FY2002-2005
Research Team: Recycling
Author: OZAKI Masaaki
OCHI Shuichi
MAKI Takanori
SHOJI Hitoshi

Abstract:
In order to promote the reuse of effluent of wastewater treatment plant, the advanced removal of residual organic matter by biofilm was studied. Although nitrification was observed in all the reactor using some kinds of fixed media, the decrease of organic matter (TOC) was occured in the reactor using either chemo-treated or activated carbon as media. This suggests that the treatment ability depends on not the sureface characteristics but the size of media. Moreover, from the PCR-cloning analysis of the biofilm, the proliferation of phylum Acidobacteria, Bacteroidetes, and Nitrospirae was observed. These groups are known to autotrophic bacteria (Nitrospirae) or heterotrophic bacteria utilizing soluble microbial products (Acidobacteria and Bacteroidetes).

Key words: secondary effluent of wastewater, residual organic matters, fixed media, biofilm, microbial community analysis

Studies on identification methods and behaviors of pathogenic organisms

Budged: Grants for operating expenses
General account
Research Period: FY1999-2005
Research Team: Recycling
Author: OZAKI Masaaki
SUWA Mamoru
TOYAMA Akiko

Abstract:
In 2005, we assessed oocyst collection rate by using different sample-preprocessing methods to improve the collection rate in influent wastewater in detecting Cryptosporidium with PCR method. As a result, we assumed that detection sensitivity in collection of oocycsts in influent wastewater would slightly improve compared to the conventional method because crude centrifugal pretreatment with 100G as a pretreatment would improve collection rate. We clarified the current determinate quantity and detection limit value of viruses to obtain stable measurement value corresponding to low-concentrated specimens as well as examined reverse transcription efficiency of viral gene extracted from concentrated specimens to improve detection sensitivity. As a result, we found that reverse transcription and detection sensitivity were improved by adjusting concentration of additive primer to 10μM and template gene dosage to 0.5μg.

Status of pollution and fate of polycyclic aromatic hydrocarbons in lake sediment

Budged: Grants for operating expenses
River account
Research Period: FY2002-2005
Research Team: Recycling
Author: OZAKI Masaaki
YAMASHITA Hiromasa

Abstract:
Environmental pollution caused by hazardous organic substances has become a problem: the hazardous organic compounds that exist in watersheds concentrate in closed water bodies via rivers. In particular, several papers have reported on the pollution of bottom sediment of closed water bodies with polycyclic aromatic hydrocarbons (PAHs). We are investigating to clarify the status of pollution and fate of sediment with PAHs.

The research results in FY2005 were as follows.

1. Inflow rivers, water channels, air depositions and sediments can presumably be classified as load sources with different watershed or emission source characteristics.
2. PAHs loads flowing into waters seemed to contain not only air deposition PAHs emitted from combustion, but also PAHs derived from oil spills transported by road runoff in wet weather.
3. The load from air deposition PAHs in the soluble fraction were larger than in the particle fraction when benzene rings of the PAHs were smaller than 4 and vice verse when they were 5 or more. BaP load by direct air deposition on the lake surface was estimated to be 14% of the total BaP load flowing into the lake.
4. It is assumed that because BaP concentration in outflow rivers was higher than in inflow rivers in dry weather, BaP that flowed in and settled was lifted from the bottom and re-suspended , but the volume of transportation was estimated to not be large enough to equalize the concentration distribution in all areas of the lake sediment.

Key words: polycyclic aromatic hydrocarbons (PAHs), lake sediment, occurrence

Evaluation on self-remediation capability of dioxin contaminated ground

Budged: Grants for operating expenses
General account
Research Period: FY2002-2005
Research Team: Soil Mechanics
Author: KOHASHI Hidetoshi
KUWANO Reiko
MORI Hirotoshi

Abstract:
Contaminated soil is to be constrained securely and to be under careful observation usually for more than two years. During this controlled period, contaminants may be purified or become harmless by the microbiological action in soil. This research examines potential capability of soil, aiming at the application for bio-remediation of dioxin contaminated ground.

It was found that YA extracted from various kinds of dioxins contaminated soil shows high capability for decomposition of low chlorinate dioxins in the aerobic condition. It was also confirmed that Dehalocccoides species play an important role in the degradation of high chlorinate dioxins, which is only effective in the anaerobic environment. Soil samples taken from a dioxin contaminate ground site were monitored under aerobic and anaerobic conditions to examine the degree of natural attenuation of dioxins for one year. A series of column tests with X-ray CT scanning were also performed to study how micro-bacteria can move in the soil.

The main findings for the overall research are as follows:
1. The YA can decompose 1 to 4 chlorinate dioxins in the aerobic condition.
2. Dehalocccoides species is effective in the anaerobic condition.
3. In order to enhance the function of effective micro-bacteria, control of the environment surrounding the bacteria is the most important.
4. A column test combined with a X-ray CT scanning is a powerful tool for the investigation on the behaviour of micro-bacteria in soil. The movement of micro-bacteria in soil does not seem to be the same as water or soluble materials.

Development of countermeasure for high water contained dioxins contaminated soil

Budged: Grants for operating expenses
General account
Research Period: FY2003-2005
Research Team: Soil Mechanics
Author: KOHASHI Hidetoshi
MORI Hirotoshi

Abstract:
In this research, a geo-synthetic container to dewater and contain high water contained dioxins contaminated soil and a water treatment plant to purify dioxin contaminated drainage have been developed.

As the results;

1) A geo-synthetic container called the Eco-Tube has an ability to contain dioxins contaminated soil up to 99.9%. The application of the method has been considered.

2) A treatment system for dioxins contaminated drainage has been developed. The system has an ability to reduce dioxins in the drainage to 1/1000.

3) Publishing a manual of countermeasure for dioxin contaminated soil is preceded based on the past research results. This manual enables civil engineer how to deal with dioxins contamination on construction sites by showing appropriate way of an emergency countermeasure, an investigation, a countermeasure and monitoring.

Key words: dioxins, soil, groundwater, manual, water treatment

Development of management method for soil and groundwater contamination in construction works

Budged: Grants for operating expenses
River account, Road account
Research Period: FY2002-2005
Research Team: Soil Mechanics
Author: KOHASHI Hidetoshi
FURUMOTO Kazushi
MORI Hirotoshi

Abstract:
There occasionally exist soil and groundwater contamination in construction sites. A permanent countermeasure, such as decontamination, is desirable, but from time and economical reason the containment method is more suitable in actual. In this research, the evaluation method with a convective diffusion analysis, containment method and monitoring method has been developed.

In this research, the behavior of the contaminants in the ground is studied and the evaluation method for impact of the soil and groundwater contamination is proposed. In addition, we settle a basic idea for an inspection and countermeasure for soil and ground water contamination and the manual for soil and groundwater contamination in construction site has been published.

We'll precede the research to build an effective management method for soil and groundwater contamination.

Key words: soil contamination, investigation, impact evaluation, management method, monitoring

A study on the ecological impact of geo-environments and its change

Budged: Grants for operating expenses
General account
Research Period: FY2001-2005
Research Team: Geology
Author: SASAKI Yasuhito
ITO Masami

Abstract:
This paper described a study on investigation, estimation, and evaluation method of ecological impact by ground condition and its artificial change.

The results are as follows.

1.Applied geoecology was proposed as a new engineering system for ecosystem preservation from the geological and geographical point of view.

2.Literature study on relationship between ground condition and ecosystem clarified the importance of micro-topography, soil type, water condition in soil, and shallow geological properties.

3.New some investigation technique was developed and verified such as aerial laser survey, soil strength penetration test, geoecological profiling method.

4.Above technique were systematized as a manual on investigation, estimation, evaluation, and countermeasures of geo-environments and its change for ecosystem preservation.

Key words: ecosystem, ground, geology, topography, geoecology

Development of an evaluation method for heavy metal pollution caused by specific rocks

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Geology
Author: SASAKI Yasuhito
ANAN Syuji
ITO Masami

Abstract:
The aim of this study is to establish the evaluation method regarding the exudation of heavy metals and acidic water from specific rocks. Using waste rock samples, we carried out some leaching tests and chemical analyses under various conditions.

The result of this study is summarized as follows;

1) The risk map for the heavy metal pollution in Japan has been developed. It will be useful for the evaluation of heavy metal pollution risk.

2) The X-ray fluorescence spectrometric analysis (XRF) can be effectively used as a simplified method to evaluate the pollution risk caused by the waste rocks.

3) Elution properties of heavy metals from varied rocks are systematically related to the type of acid of solvent, the acidity of solvent and the character of the element.

4) Pollution risk of the exudation of acidic water can be estimate by the content and the form of sulfur and calcium in the rocks.

5) A long-term elution test under the conditions similar to these in natural environment has been designed in this research project.

6) A provisional manual for the exudation of heavy metals from specific rocks has been developed.

Key words: waste rock, heavy metals, acidic water, pollution risk, leaching test

Research on indexing of the river bed environment towards preservation and restoration of river environment

Budged: Grants for operating expenses
General account
Research Period: FY2003-2005
Research Team: River Restoration
Author: AMANO Kunihiko
DENDA Masatoshi
TOKIOKA Toshikazu

Abstract:
We have conducted two case studies to investigate the relationship between river bed environment and living organisms. First case study was done in a middle-stream reach in the Chikuma river. Benthic invertebrate communities in the research field was surveyed and related to the physical environment. Benthic invertebrate distribution seemed to be controlled by velocity distribution, Micro-scale shape of river bed strongly influences the flow characteristics. Since flow characteristic controls micro-habitat environment, it can determine the distribution of the species and biomass of benthic invertebrate communities.

Another research field is the downstream section of Kawamata dam. We have analyzed the temporal change of river bed from dam completion to present time by using a series of aerial photographs. We have shown that the process of river bed change can be estimated by the method. The river bed condition was similar throughout the research area in Kawamata site before the construction of the dam. However, the distribution of benthic invertebrate communities in the downstream of Kawamata dam at present clearly showed the effect of dam construction. The effect of the dam on the benthic invertebrate communities can be induced by the change of river bed structure and organic matter discharged from dam.

Research on indexing of the river bed environment towards preservation and restoration of river environment (2)

Budged: Grants for operating expenses
River account
Research Period: FY2002-2005
Research Team: Aqua Restoration Research Center
Author: KAYABA Yuichi
MINAGAWA Tomoko

Abstract:
Healthy rive bed provides important ecological function. In this research, actual situations of river bed deterioration caused by various types of human impacts were recognized and we tried to establish the indices for the grade of the deterioration. We conducted the filed survey for river bed form and substrate in reach downstream of a dam, and analyzed the effects of the substrate change on macro invertebrate community. As a result, the removal of fine sediments from substrate and the occurrence of boulder would influence on several taxa. It can be said that those taxa would be indicator species for the substrate change.

Research on estimation technique of water quality and ecosystem in lakes and marshes

Budged: Grants for operating expenses
General account
Research Period: FY2003-2005
Research Team: River Restoration
Author: AMANO Kunihiko
TOKIOKA Toshikazu

Abstract:
Since water quality variation in lakes is the result of the responses by ecosystem to the hydraulic and hydrologic conditions, countermeasures which can change these conditions can improve water quality in lakes. For example, restoration of aquatic macrophytes will suppress the bottom sediment resuspension and this will decrease the growth of phytoplankton which is the major cause of water quality deterioration. We have developed a numerical simulation model which can estimate the function of macrophytes to suppress the bottom sediment resuspension. The model can be used to assess the water quality improvement effect by the restoration of aquatic macrophytes.

Aquatic life influenced by division of stream network around river, and its restoration

Budged: Grants for operating expenses
General account
Research Period: FY2002-2005
Research Team: River Restoration
Author: AMANO Kunihiko
MURAOKA Keiko
OISHI Tetsuya

Abstract:
Paddy field area is important as a habitat of fishes, and as a spawning ground of several fishes who live in rivers. In recent years, the stream between river and paddy field area are divided for the convenience of water management. In this research, the influence for fish caused by division of river and paddy field area was investigated. Restoration of the water-network around river and a paddy field area was considered and half-Denil fishway was contrivede to improve the water-network. Also, the cost index of ecological network(CIEN) was proposed to compare the suitability of restoration plans.

Key words: stream network, a paddy field, temporary water area, fishes habitation environment, cost index of ecological network

Performance of the artificial lagoon to control diffuse pollutants

Budged: Grants for operating expenses
General account
Research Period: FY2002-2005
Research Team: River Restoration
Author: AMANO Kunihiko
NAKAMURA Keigo

Abstract:
The term, “Artificial lagoon (AL)” means an artificially constructed small lake or pond at a river mouth in a lake. The AL aims to control diffuse pollutants of the river flowing into a lake. The first AL was installed in 1998 at the river mouth of the Kawajiri River flowing into Lake Kasumigaura in Japan; Four ALs have been constructed until now. This paper compares the performance of the four ALs. The removal ratio calculated the percentage of deposit load in the AL by inflow load was 6.8~46 % for CODMn, 1.6~27 % for total nitrogen, and 8.2~87 % for total phosphorous. The load rate (g/m2/day) estimated by the inflow load per area per day explains the removal ratio the best. The load rate is the most crucial factor to design AL. We also published “the guideline for the design of Artificial Lagoon.”

Key words: nonpoint source, stormwater treatment wetland, lake, pollution, constructed wetland

A study on influence of catchment area and river form on river ecosystem

Budged: Grants for operating expenses
River account
Research Period: FY2002-2005
Research Team: River Restoration
Author: AMANO Kunihiko
DENDA Masatoshi
TOKIOKA Toshikazu
TSUSHIMA Koji

Abstract:
We have investigated the relationships between land use in watershed area, river water quality, and river ecosystem. GIS system was employed to analyze the relation between land use and river water quality. Stable isotope ratios of carbon and nitrogen were determined for nitrate, particulate organic matter (POM), periphyton, aquatic insects and fishes in three research rivers to survey the dynamics of organic matter. Survey in Chikuma river showed that benthic insects consume allochthonous organic matter (terrestrial plants) in upstream area and autochthonous organic matter (aquatic periphyton) in mid to downstream area. Nitrogen isotope analysis showed that nitrogen load from sewage was utilized by attached algae on river bed at downstream implying the strong effect of sewage discharge on river ecosystem. Stable isotope analysis for nitrogen and carbon was also employed to presume the usage of temporary water area by fishes and the effect of flush from dam on the attached algae on river bed.

Key words: geographical information system, stable isotope ratio, river ecosystem, temporal water area, flush from dam

Studies on impact response in river environment

Budged: Grants for operating expenses
River account
Research Period: FY2003-2005
Research Team: River Restoration
Aqua Restoration Research Center
Author: AMANO Kunihiko
KAYABA Yuichi
MINAGAWA Tomoko
MURAOKA Keiko
NAKAMURA Keigo
DENDA Masatoshi
OISHI Tetsuya

Abstract:
Last several decades, human impacts like river works have deteriorated river ecosystem. In order to realize a sustainable ecological system in rivers, a new approach to predict responses influenced by the impacts has to be developed. In this research, several types of the impacts are taken, and the process between the impacts and response will be cleared.

We studied about influence of cut-off channel affecting fishes and river plants and technique to avoid and decrease influence of them, increase of maintenance flow discharge affecting fish habitat, murky waters raised by river channel modify affecting fish, and methods to predict influence on habitats changed by cutting down terrace.

Studies concerning to river ecosystem

Budged: Grants for operating expenses
River account
Research Period: FY2001-2005
Research Team: River Restoration
Aqua Restoration Research Center
Author: AMANO Kunihiko
MURAOKA Keiko
MINAGAWA Tomoko
NAKAMURA Keigo
DENDA Masatoshi
OISHI Tetsuya
TOKIOKA Toshikazu

Abstract:
For carrying out river environment projects, it is necessary to comprehend the river response to the river work projects scientifically, however, the knowledge of river environment is quite limited both engineering and ecology. In this research we conducted the study of river environment under interdisciplinary research frameworks (River Ecology Research Group) in the Tama River, the Chikuma River, the Kizu River, the Kita River, and the Sibetsu River. At the Kizu River, we proposed to make use of geological data in the basin to track sediment movement efficiently. In the Chikuma River reaech, the fisical river data gatherd with remote sensing and lazor profiler was applied to GIS with hydraulic model and it made possible to understand river environment efficiently. The ecological model was also applied at the Chikkuma River to elucidate the function of the temporary water area (TWA) as a spawning place and we proposed necessary condtions of TWA as fish redd. The GIS-base water quality model in the Chikuma River was studied with landuse data and stable isotope. At the Tama River, sediment augementation was conducted after the restoration of gravel river bed. We studied the effect of the sediment supply on attached algae.

Key words: River Ecology Research Group, Tama River, Kizu River, Chikuma River, stable isotope, GIS, robinia pseudoacacia

Research on the new bottom sediment quality improvement techniques suitable for lake bottom ecosystem

Budged: Grants for operating expenses
River account
Research Period: FY2003-2005
Research Team: River Restoration
Author: AMANO Kunihiko
TOKIOKA Toshikazu

Abstract:
Suppression effect on bottom sediments resuspension by aquatic macrophyte Trapa in Inba marsh was shown by field measurement and numerical simulation. While vegetation was dense, turbidity measured inside of it was lower because of the wave attenuation by vegetation. Suppressed resuspension by vegetation will enhance the irradiance at the bottom of the marsh. This will improve the chance for submersed macrophytes to survive. If we can rehabilitate submersed macrophytes to Inba marsh, they will keep suitable environment by themselves. Improving light condition will be the key to the rehabilitation of submersed macrophytes. Also investigated was the distribution of density of propagule in lake bottom sediment and the germination potential of propagule in Kasumigaura. We have shown that the densely distributed propagule was found in the vicinity of the river mouths and bays. Germination tests for sediment samples taken from several depths showed that the density of propagule was high at the depth of 40-50cm from sediment surface, and the number of germination of aquatic macrophytes was high at the depth of 30-40cm from sediment surface. Age determination of the bottom sediment showed that these layers of sediment correspond to the sediment which was accumulated during period when submerged plants were dominant in the lake.

Key words: bottom sediments, submerged plants, propagule bank, age determination

Development of new wildlife location system using information technology

Budged: Grants for operating expenses
River account
Research Period: FY2001-2005
Research Team: River Restoration
Author: AMANO Kunihiko
DENDA Masatoshi

Abstract:
In this study, we developed a new wildlife location system using information technology.

Main subjects of this study are
①Development and communization of new wildlife location system,
②Development a new research method for wildlife using the system which was developed in this study.

In subject ①, we succeed in developing Multi Telemetry System(MTS) which can track wildlife, one point per three minute, with an average error about 10～20m and demonstration experiment which tried to track middle size mammal using MTS. To communize MTS (miniaturization, low budget, expansion of intended wildlife), Advanced Telemetry System(ATS) was developed. A demonstration experiment which tried to track fish using ATS was performed successful. In subject ②, It is appeared that Geographic Information System(GIS) is useful tool to analyze relationship between physical environment and behavior data which was acquired by ATS .It has possibilities to estimate behavior of wildlife using GIS, ATS. It can be seen that ATS has possibilities to get more quantitative animal behavior data than exiting research method. Preference habitat of wildlife can be see n from observation results of tracking wildlife using ATS. It indicate that conservation of wildlife habitats can be achieved successfully.

Studies on practical use of monitoring technologies for countermeasures of riverbed dioxins

Budged: Grants for operating expenses
General account
Research Period: FY2003-2005
Research Team: Water Quality
Author: SUZUKI Yutaka
KOMORI Koya

Abstract:
Establishment of "Act on Special Measures concerning Countermeasures against Dioxins" in 2000 requires proper dioxin treatment. Bottom sediment environmental criteria for Dioxins were announced in July 22, 2002, which requires countermeasures to reduce dissolution and re-suspension of dioxin in water when dioxin exceeds the criterion value (150pg-TQE/g). As a higher number of samples are needed for researches of dioxins including identification of contaminated areas and management of countermeasure implementations, both simple measurement methods and continuous monitoring device will be necessary on site. This research was intended to develop a simple measurement method for riverbed dioxin countermeasures and to develop a continuous monitoring device for dioxins.

Key words: dioxins, simple measurements, monitoring, turbidity, dredging constructions.

Studies on underwater behaviors of chemical substances originated in municipal effluent

Budged: Grants for operating expenses
General account
Research Period: FY2001-2005
Research Team: Water Quality
Author: SUZUKI Yutaka
KOMORI Koya
OKAYASU Yuji

Abstract:
It is reported that surfactant decomposed substances and human- and animal-derived hormones in water environment may cause endocrine disruptions on wild organisms. It is necessary to figure out behaviors of such substances in water environment including water and bed mud as well as their influences on water areas in order to take effective measures against risks related to their generation and emission sources. This study intends to develop research and analysis methods for endocrine disruptions derived from municipal effluent including surfactant decomposed substances and human- and animal-derived hormones in rivers and bottom sediments. It also intends to clarify phenomenon of variations in water environment such as decomposition and generation. We developed methods to analyze estrogen and nonylphenols and focused on sewage treatment systems in basins and conducted field investigations in different basins (Tama River and Ohtsu River) to find out behaviors of those substances in water environment. We also conducted field investigations and laboratory experiments on bottom sediments utilizing Tega Lake in Chiba prefecture and bottom sediments of Miharu Dam reservoir in Fukushima prefecture.

Key words: nonylphenols, estrogen, conjugates, lakes, behaviors, simulation models

Studies on estrogen-like substance index by bioassay

Budged: Grants for operating expenses
General account
Research Period: FY2001-2005
Research Team: Water Quality
Author: SUZUKI Yutaka
MIYAJIMA Kiyoshi

Abstract:
It is questioned that fish is being feminized by female hormone-like substances (estrogen) in sewage treated water and in rivers, which the sewage treated water is discharged to. This study conducted field investigations in nationwide scale rivers and sewage plants as well as in-depth research inside sewage plants. We also conducted exposure tests on fish (in vivo bioassay) with specified substances and searched for substances, which induced estrogen-like actions. We conducted microanalysis with high-sensitivity equipment as well as research and examination through direct measurement of estrogen-like activity (in vivo bioassay) with genetically-modified yeast. We intend to establish simple index for fish feminization in rivers and sewage treated water using the obtained information and results from the bioassays.

Studies on influences of chemical substances in water environment on ecosystems

Budged: Grants for operating expenses
General account
Research Period: FY2003-2005
Research Team: Water Quality
Author: SUZUKI Yutaka
MIYAJIMA Kiyoshi

Abstract:
This study was intended to examine test methods to assess influences of chemical substances in the environment on aquatic ecosystems by using bio assay method. It was intended for rice-fish, water fleas and green alga and applied individual test methods suitable for environment water including river water.

We took river water into a test tank with rice-fish in and examined test methods to comprehend toxicity to eggs, young fish and adult fish by continuously exposing rice-fish to the water in consideration of variations in water quality and conducted exposure tests in actual rivers.

In terms of water fleas, we examined test methods, which required less preparation for toxicity tests, in consideration of environment water with fewer sample water quantity and with irregular sampling frequency. We conducted tests on chemical substances (drug medicine) identified in actual environment water using standard substances.

In terms of green alga, we examined test methods with small quantity of water to handle environment water, which required processing of multiple samples at a time with a small quantity of sample water and tested on actual river water as well as drug medicine. We also conducted tests on fractionation and concentration methods for substances included in actual river water and examined expression state of toxicity.

We confirmed the following findings from these studies:
1) In terms of toxic action of chemical substances included in environment water to fish, even environment water with quality variations such as river water can be tested on site by applying methods to expose sample water by continuously flowing it;
2) toxicity of shellfish and alga can be rapidly tested with a small amount of sample water by applying a test method, which can handle environment water with limited sampling frequency and collection quantity;
3) we could assess risks of two kinds of antibiotics from results of tests on inhibition of alga growth through toxicity tests on individual chemical substances identified in water environment;
4) adoption of solid-phase extraction methods enabled fractionation and concentration of environment water component with various substances and detection of toxicity,

which could not be detected in raw water.

Key words: water environment, chemical substances, ecosystem influences, bioassay, drug medicine

Studies on assessment and improvement methods for river purification projects

Budged: Grants for operating expenses
River account
Research Period: FY2003-2005
Research Team: Water Quality
Author: SUZUKI Yutaka
KOMORI Koya

Abstract:
River purification projects have been implemented by river direct purification facilities to achieve water quality objectives set by Foundation of River & Watershed Environment Management. However, sufficient information is unknown about what quality improvement effects have been confirmed or whether functions at river direct purification facilities have been maintained. Design methods and maintenance management methods necessary to maintain proper functions of direct purification facilities have not been fully investigated. Therefore, researches to clarify these issues are demanded by public administrations and construction sites.

In this study, PWRI offered training on assessment and improvement of river purification projects as a common theme with Water Quality Network of the Ministry of Land, Infrastructure, Transport and Tourism. PWRI also conducted investigations at actual facilities and experiments using test plants focusing on removal of traces of contaminated substances (estrogen-like activities, etc.) as well as ammonia at river direct purification facilities.

Key words: river purification facilities, estrogen-like activities, ammonia removal

Studies on assessment of river quality from the viewpoint of aquatic ecosystems

Budged: Grants for operating expenses
River account
Research Period: FY2000-2005
Research Team: Water Quality
Author: SUZUKI Yutaka
MIYAJIMA Kiyoshi

Abstract:
Although river ecosystems have been strenuously researched in terms of physical causes such as river bed materials and structures as well as river water quantity, the relationships with river quality has not been fully clarified. This study focused on urban rivers with rapidly changing water quality due to influent sewage treated water yet with improved overall water quality and investigated relationships between aquatic organisms living there and river quality to verify the relationships.

This study examined 12 sewage plants all over the country in terms of the relationships between water quality and biota based on research results on living organisms and water quality conducted in water areas with influent sewage treated water. We conducted field investigations in Tama River to examine mixed state with treated river water, actual conditions of benthic fauna and biological concentration of trace substances. We further conducted experiments on transitional state of trace substances from under water to attached alga in test channels with treated water flowing to obtain findings below:

1) Organism species found can be limited due to chlorine for disinfection and ammonia concentration.

2) Treated water discharged into river will flow down the river while being separated from river water mass and require time and distance before it is mixed.

3) Separation between river water and treated water may cause variations in benthic fauna during winter.

4) Accumulations of heavy metals will not largely influence on water, attached alga or benthic animals.

5) We found that classification of benthic animals by eating functions may enable comprehension of water quality changes caused by influent treated water. We conducted basic examinations on water quality assessment from the perspective of aquatic biota.

Key words: water quality, trace substances, ecosystem influences, sewage treated water, aquatic ecosystems

Studies on substance transitions between bottom sediments and water

Budged: Grants for operating expenses
River account
Research Period: FY2001-2005
Research Team: Water Quality
Author: SUZUKI Yutaka
ABE Chika

Abstract:
In closed water areas such as lakes, contaminants coming in from watershed or generated inside tend to accumulate in bottom sediments near interface of water. They may have adverse influences on water quality by dissolving out of bottom sediments depending on seasonal changes in bottom layer environment. Therefore, it is critical to clarify behaviors of contaminants under environment where bottom sediments and water exist to conserve sound water environment. This study intends to clarify transitional phenomenon of nutrient salts between bottom sediments and water from the perspective of eutrophication countermeasures.
Between 2001 and 2005, we conducted field investigations in lakes and dam reservoirs with eutrophication phenomenon, experiments on bottom layer environment improvement as well as laboratory experiments using bottom sediment samples. We verified findings below:
1) In terms of mechanism of nutrient salts dissolving from bottom sediments, we clarified the influences of environmental conditions of bottom layer water on bed mud pore water concentration and on dissolution rate, relationships between bed mud quality and dissolutions as well as dissolution characteristics in bed mud re-suspension associated with lake water flows.
2) In terms of development of dissolution estimate methods, we extracted index effective in dissolution rate estimate by utilizing water quality monitoring systems for water columns and bed mud surface layers based on continuous measurements with DO and ORP sensors, which PWRI jointly developed. We also built a model for dissolution quantity estimate.
3) In terms of dissolution testing methods, we summarized and proposed critical subjects, which had not been explained in the current manual.

Key words: bed mud, nutrient salts, dissolution, DO, ORP, monitoring

Development of experimental grasping methods for river ecological functions and examination of experimental clarifications

Budged: Grants for operating expenses
River account
Research Period: FY2001-2005
Research Team: Aqua Restoration Research Center
Author: KAYABA Yuichi
MINAGAWA Tomoko
NAKAMURA Keigo

Abstract:
In Aqua Research Restoration Center, four main subjects have been conducted using experimental streams and ponds, in order to recognize the ecological function of inland water. The main subjects conducted are as follows; 1) Habitat structures and ecological function of lotic and riparian zone. 2) Relationship between water quality and submerged plants, 3) Conservation of plants dependent on gravel and sand bars and 4) Exhibition methodology regarding the information of river and stream ecology. Fundamental study was completed, and the development of detailed techniques such as evaluation or designing techniques will be expected in near future.

Basic investigations on normal river flow rate in consideration of fluctuations

Budged: Grants for operating expenses
General account
Research Period: FY2001-2005
Research Team: River Restoration
Author: AMANO Kunihiko
KAYABA Yuichi
MINAGAWA Tomoko
DENDA Masatoshi
TASHIRO Takashi

Abstract:
In this research, we conducted researches on how to influence on water quality and aquatic organisms, and flow regime, and the influence on habitats and its organisms of sediments supply, in order to develop water flow management harmonious with river ecosystem.

Main results acquired in this research are as follows.

1) New method to evaluate the metabolism rate of organic matter was developed, and we recognized the dynamics of organic matter in both normal flow and floods events utilizing this method.

2) It became clear that the characteristics of responses of attached algae, macro invertebrate and fish behavior for medium-magnitude-floods,

3) Evaluation method to improve the grade of river bed periphyton was developed based on the view of maintaining healthy scenery of river bed and the food quality for Ayu fish,

4) Actual situation of river bed consolidation brought by filter-feeding cadisfly, which tend to be predominant species in rivers without effective floods, were recognized,

5) We made clear about the influence of sediments augmentation and its problems based on the review of previous studies and researches using experimental streams, and several viewpoints we have to pay attention for sediments augmentation were acquired.

Technique for turbid water treatment using natural coagulating agent

Budged: Grants for operating expenses
General account
Research Period: FY2003-2005
Research Team: Dam Hydraulic
Engineering
Author: KASHIWAI Josuke
YUKI Kazuhiro

Abstract:
Long term turbid water remaining is one of the main water quality problems in Japan's reservoirs. Selective withdrawal facilities and fences for controlling turbid water flow have been employed as countermeasures against the problem. Effects of countermeasures are, however, limited and deposition waiting is sometimes only the performance we can choose in case that the whole of reservoir water turned to be turbid, which can be occurred by large flood inflow or water circulation in a reservoir. The coagulating agent is expected to be an effective countermeasure in such whole water turbid conditions. Treatment of deposited sediments, however, should be a serious problem in the case of artificial agent. Natural coagulating agents/soil colloids, which can be deposited in the reservoir, are considered in this study, and the results of the study show that turbid components of reservoirs can be coagulated themselves by controlling PH condition, PH control is not necessary if allophane is used as the coagulating agent with appropriate treatment. Methods for practical use of allophane are also examined.

Key words: dam reservoir, long term turbid water remaining, coagulation, allophane

Research on geotechnical properties of the surficial sediments in large urban area

Budged: Grants for operating expenses
General account
Research Period: FY2005
Research Team: ConstructionTechnology
Research Department
Author: INAZAKI Tomio

Abstract:
Shear wave velocities of surficial unconsolidated sediments were investigated in correlation with geotechnical properties determined by laboratory testing. The S-wave velocity data, all of them were accurately measured in boreholes using the PS suspension logging tool, were collected from four sites, 49 boreholes, and more than 2,300 points in Tokyo Metropolitan area. The original waveform data wherever possible was collected and reanalyzed them to have high quality and precision on S-wave velocities. N-values obtained by in situ Standard Penetration Test (SPT), bulk densities, solidities, and mean grain sizes measured by the standard soil test, and elastic constants determined by tri-axial dynamic loading tests were correlated with the S-wave velocities at the same horizons in the same boreholes. Lithofacies based on detailed core investigation were taken account of in the correlation analysis. Conventionally, S-wave velocities were correlated to N-values. However the dynamic range and measurement accuracy of SPT is too low to compare with S-wave velocity data obtained using the suspension logging tool. So it is possible to estimate N-values from S-wave velocity data using an empirically synthesized equation, but is very hard to estimate S-wave velocities from the low quality SPT data. A clear relationship was recognized between S-wave velocities and solidities, and it varies with lithofacies and depositional age. This means that S-wave velocities are good indicators for the evaluation of depositional environments.

Key words: Tokyo Metropolitan area, surficial sediments, shear-wave velocity, N-value, geotechnical property

Study on the economical design method of stabilized soil foundation

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: ConstructionTechnology
Author: OSHITA Takeshi
ONODERA Seiichi
TSUTSUMI Shouichi

Abstract:
Recently, there has been increased cases of construct the structure on soft ground because of the constraint of the land use. The soft ground is deep layer in many cases. However, most of the deep mixing method is designed to stabilize the bearing layer. It does not take the layer's strength and friction into consideration. As an economical alternative, we have focused our attention on the floating type of the deep mixing method and conducted centrifugal experiment to find out about its attributes as well as issue in design.

From the experiment, we quantitatively estimated the settlement of the floating type of the deep mixing method.

Studies on investigation, measurement and hazard assessment technologies for rock-mass slopes (1)

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Geology
Author: SASAKI Yasuhito
KURAHASHI Toshiyuki
YAJIMA Yoshinori

Abstract:
In this study, we developed methods to detect deterioration inside rock-mass slopes using air tracer tests and geophysical logging methods for the purpose of creating hazard maps of individual slopes as well as extracting locations, which needed countermeasures. We compiled a part of the development into a research manual. Three-dimensional measurements and 3-dimensional elastic wave tomography for slopes with lasers have enabled detailed description of rock-mass slopes and quantitative and planar mappings on rock-mass slope deteriorations based on changes in elastic wave velocity. This has further enabled extraction of dangerous deteriorations.

Key words: rock-mass slopes, deteriorations, air tracer tests, geophysical logging methods, 3-dimensional elastic wave tomography

Studies on investigation, measurement and hazard assessment technologies for rock-mass slopes (2)

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Landslide
Author: FUJISAWA Kazunori
ASAI Kenichi

Abstract:
In this study, we examined methods to extract destabilized rock-mass blocks with vibration measurement through on-site measurement and analysis of measurement results described below:
1) As a result of measurements by artificially destabilizing rock-mass blocks, we found that destabilized rock-mass blocks would increase amplitudes;
2) With measurement on actual rock-mass slopes, we could distinguish stabilized blocks from destabilized blocks and extract especially unstable blocks;
3) As a result of re-observation of cracks on rock-mass blocks based on the measurement results, we found that rock-mass blocks would vibrate while being divided into smaller blocks;
4) As a result of measurement on slopes with agglutinate rock-mass, we confirmed rock-mass adhesive methods could stabilize rock-mass from changes in vibrations. These results have verified that measurement of vibrations on rock-mass slopes is effective in extracting destabilized rock-mass blocks and can be an effective method to evaluate effects of countermeasures. Based on these results, we have compiled methods to measure and analyze this method as well as points of concerns into a manual (draft).

Key words: rock-mass slopes, microtremors, vibrations

A study on geotechnical evaluation of a loosened rock-mass for dam foundation

Budged: Grants for operating expenses
River account
Research Period: FY1999-2005
Research Team: Geology
Author: SASAKI Yasuhito
KURAHASHI Toshiyuki

Abstract:
This paper described the geotechnical evaluation of loosened rock-mass for dam foundation, which is fractured and faulted with open fractures. We collected 196 dam foundations in loosened rock-masses all over Japan. Geotechnical analysis and grouping lead to clarify the mechanism and characterized a loosened rock-mass. Variety of rock property values such as P-wave velocity, density and sum of fracture width were useful as quantitative indicators for loosening.

Key words: dam foundation, loosened rock-mass, open fracture, indicator

Study on the evaluation method of the potential of lahar at the volcanically disturbed watersheds

Budged: Grants for operating expenses
River account
Research Period: FY2001-2005
Research Team: Volcano and Debris Flow
Author: KURIHARA Junichi
YAMAKOSHI Takao

Abstract:
Deposition of tephra changed the hydrologic properties of the river basins around the volcano and intensified erosion processes, and hydrological characteristics of watersheds changes through volcanic activity.

A purpose of this study is to propose the evaluation method of the potential of lahar occurrence in the volcanically disturbed watersheds, which consists of the evaluation method of the hydrograph of lahar and the estimation method of sediment volume based on research of hydrologic and erosion conditions at the watersheds affected by tephra. In this study, post-eruption hydrological and erosion properties at the Miyakejima volcano are clarified through field hydrologic measurements and the integrated basin-wide prediction model of water and sediment discharge are developed. In addition, gully development process is clarified. Through these knowledge and analysis, the evaluation method of the potential of lahar occurrence and estimation method of sediment volume was proposed.

Key words: volcanic eruption, volcanic ash, hydrograph of lahar, estimation method of sediment volume, Miyakejima Island

A study on the improvement of simulation model and hazard map for mudflow

Budged: Grants for operating expenses
River account
Research Period: FY2002-2005
Research Team: Volcano and Debris Flow
Author: KURIHARA Junichi
AKIYAMA Kazuya

Abstract:
Warning and evacuation system should be established to mitigate the disaster by mudflow. Also, hazard area of mudflow inundation should be estimated. But, it is difficult to identify those areas accurately in urban area, since the mechanism of mudflow inundation in urban area is complicated under the influence of structures such as buildings, roads and bended flow channel.

In this study, numerical experiment was conducted to make the simulation model of sedimentation and inundation, under the condition of complicated shape of the land, accurate by using unstructured grids. In addition, a technique of making hazard map for mudflow by using GIS, and a technique of designing the countermeasure facilities were suggested.

Key words: mudflow inundation, sedimentation, hydraulics model experiment, unstructured grid

Study on the simulation model of debris flow fan on the terraced configuration

Budged: Grants for operating expenses
River account
Research Period: FY2003-2005
Research Team: Volcano and Debris Flow
Author: KURIHARA Junichi
AKIYAMA Kazuya

Abstract:
The method to estimate debris flow hazard areas on terraced configuration have not been made clear yet. The purpose of this study is to provide the versatile method to estimate hazardous area of debris flow inundation on the terraced configuration, clarifying the change of debris flow deposition form affected by terraced configuration and the relationship between the form of terraced configuration and debris flow inundation area referring the cases of past disaster.

In this Study, hydraulic experiment was conducted on the terraced flume to clarify the change of form of debris flow deposition affected by terraced configuration, and the method to estimate hazardous area by debris flow was examined.

Studies on effective rainfall to predict occurrence of debris flows based on runoff characteristics

Budged: Grants for operating expenses
River account
Research Period: FY2003-2005
Research Team: Volcano and Debris Flow
Author: KURIHARA Junichi
YAMAKOSHI Takao

Abstract:
Early warning and pre-evacuation are critical to prevent sediment-related disasters. Warning and evacuation standards for debris flow predictions are currently established by individual municipalities based on precipitations. As regards on-site operations, decrease in false alarm rate is the issue, which requires development of more accurate methods to predict debris flow occurrences reflecting characteristics of individual hazardous locations. In this study, we collected and organized hydrology observation data all over Japan and clarified rainfall-runoff characteristics of watersheds with different geological conditions. We also analyzed individual runoff cases using tank models to identify the model parameters. Based on these results, we proposed methods to set effective precipitations by geological conditions suitable for landslide predictions.

Key words: rainfall-runoff, tank models, half-life period, effective rainfall

Studies on landslide monitoring methods using anchor load meters and optical fiber information networks

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Landslide
Author: FUJISAWA Kazunori
ISHII Yasuo

Abstract:
In this study, we built FEM analysis model capable of expressing anchors and figured out anchor deterrent effect influences and anchor behaviors in active landslides. We also investigated current status of landslide automatic observation systems and points of concerns in terms of methods to utilize anchor load meters as landslide monitoring methods. As a result, we found that constriction effects on slip planes were smaller than values obtained by the existing design method and that the longer the distance from ground surface to slip plane was, the smaller the effects became. As a result of analysis with varied slip plane shapes, we found that anchor tensioning force in case of landslide differed depending on slip plane shapes and that anchors casted near the edge of landslide tended to have larger tensioning force. We also verified that variations in anchor tensioning force had correlativity with amount of ground surface displacement and that sliding situation could be assessed by monitoring tensioning force. In terms of landslide monitoring methods, we summarized points of concerns in building automatic monitoring systems.

Key words: landslides, anchors, finite element method, constriction effects, landslide automotive observation system

Studies on formations and variations of particular layers inside snowpack

Budged: Grants for operating expenses
General account
Research Period: FY2003-2005
Research Team: Snow Avalanche and
Landslide Research Center
Author: HANAOKA Masaaki
KANEKO Masanori

Abstract:
Occurrence of surface avalanche correlates to balance between shear strength of particular layers (weak layers), particularly weak against upper and lower layers within snowpack such as “depth hoar”, “graupel”, and “wet granular snow”, and shear force of snow accumulated on the upper layers. It is necessary to comprehend snow layer structures in consideration of this balance to predict avalanche occurrence. We conducted snow pit observations and weak layer tests every other few weeks for two winters from 2003 in Happo One in Hakuba village, Nagano prefecture where PWRI conducts comprehensive avalanche observations in terms of formations and variations in weak layers, which would cause surface layer avalanche. As s result, we detected total 5 weak layers including “solid-type depth hoar” and “granular snow” all through the research period and could estimate causes of weak layer formation from temperature and precipitation. However, we attempted to track changes over time to find out that these weak layers were not confirmed on the following observation and that weak layers were not conserved but kept changing. The weak layer detected on the observation at the end of February 2004 was assumed to be formed at the same time as another weak layer, which caused the surface avalanche observed a few days before.

Key words: weak layers, Happo One, surface avalanche

Research on strength decrease mechanism of landslide soil mass in a tertiary landslide

Budged: Grants for operating expenses
General account
Research Period: FY2002-2005
Research Team: Snow Avalanche and
Landslide Research Center
Author: HANAOKA Masaaki
MARUYAMA Kiyoteru
KOJIMA Shin-ichi

Abstract:
Sediment disasters prevention measures using software is becoming important. In addition, establishing a risk-assessment technique for landslide slope is an important problem as well. This research was conducted to clarify the strength decrease mechanism of the landslide soil mass. This forms the basic for the risk-assessment of the landslide slope. A chemical analysis and an X-ray diffraction of the landslide clod of the mud stone zone were done to determine the chemical weathering mechanism.

The result were as follows.

(1) The amount of smectite in assumed slip surface is larger than that of the circumference. This is confirmed by four landslides, and it becomes the strong clue to decide the depth of the slip surface.

(2) The elution of Na2O contained in the soil of the landslide influences the decline of the strength of the soil. The amount of elution of Na2O shows a tendency to grow big in the little slope of the degree of the slant. This can be used for the risk-assessment of the landslide slope.

Key word: mud stone, landslide, weathering

Studies on landslide behaviors with optical fiber sensors

Budged: Grants for operating expenses
River account
Research Period: FY2002-2005
Research Team: Snow Avalanche and
Landslide Research Center
Author: HANAOKA Masaaki
MARUYAMA Kiyoteru
KOJIMA Shin-ichi

Abstract:
In comprehending landslide behaviors necessary to prevent and reduce landslide disasters, the current most effective extensometers to measure cracks and strains on ground surface has issues such as
1) difficulty with properly placing extensometers when landslide behaviors are not prominent;
2) difficulty with ground surface measurement in snow covering seasons.

Concerning this (these), we have researched on development of methods for planar behavior researches on landslides using optical fiber sensors and made effective achievements to be practically used on site by methods to directly bury optic fibers with orthogonal arrangement methods in terms of 1) above and by developing extensometers combined with optic fiber and mechanical mechanisms in terms of 2) above.

Key words: optical fiber extensometers, landslide behavior research

Studies on setting hydraulic conductivity in residual pore water pressure estimate with seepage flow analysis

Budged: Grants for operating expenses
River account
Research Period: FY2003-2005
Research Team: Landslide
Author: FUJISAWA Kazunori
SUZUKI Masayuki

Abstract:
For the purpose of proposing a method to calculate residual pore water pressure on slopes around reservoirs using seepage flow FEM analysis, we conducted in-situ permeability tests and underwater level observations using boreholes and vertical shafts as well as seepage flow analysis based on the results of these tests. As a result of underwater level observations and analyses, we found that lowered reservoir water level could be calculated with sufficient accuracy by conducting seepage flow FEM analysis using hydraulic conductivity obtained through permeability tests on saturated ground as well as using parameters to reproduce water level distribution variations in rainfalls. We further conducted permeability experiments using shafts and permeability tests by saturating borehole to find out hydraulic coefficient. As a result, we found that saturated hydraulic conductivity could be measured in-situ unsaturated ground by injecting two shafts between boreholes to control ground water level between shafts and by conducting permeability test.

Key words: in-situ permeability tests, unsaturated ground, observations, vertical shafts, infiltration experiments

Studies on methods to extract landslide hazardous spots

Budged: Grants for operating expenses
River account
Research Period: FY2003-2005
Research Team: Landslide
Author: FUJISAWA Kazunori
ISHII Yasuo

Abstract:
To reduce landslide disasters, it is important to extract landslide hazardous spots and assess the risks to create hazard maps. This study examined algorisms to automatically extract landslide blocks from DEM data and improvement of risk assessment methods by analyzing correlations between landslide hazardous spot research items and existing disaster occurrence data. The findings verified the possibility to automatically extract landslide sites with typical landslide terrains through extraction of landslide areas by utilizing gradient/slope-laplacian/roughness or gradient/over ground and underground openness as well as assessment algorisms by combining landslide boundaries using knick lines other side of knick lines. We also focused on landslide hazardous spot research items including “landslide histories”, “landslide terrain clarity”, “landslide susceptibiliy” and “geological conditions”, which have been confirmed to have high correlation with disaster occurrence by correlation analysis and verified that proper hazardous assessment could be improved by correcting arrangement of existing research items.

Key words: digital elevation models (DEM), risk assessment, correlation analysis, landslide hazardous spot research

Studies on functions and rational designs of landslide piling works

Budged: Grants for operating expenses
River account
Research Period: FY2002-2005
Research Team: Landslide
Author: FUJISAWA Kazunori
ISHII Yasuo

Abstract:
This study compared existing design methods for landslide piles and FEM analysis results and examined applicability of the existing design methods by using FEM analysis model capable of examining relative relationships between deformation coefficient of sliding soil mass and pile flexural stiffness. The study also clarified that influences of sliding soil mass property value and distances between piles on ground failure around the piles using FEM analysis to examine methods to set proper distances between piles for landslide pile works. Based on those results, we further examined rational methods to design landslide piles with 3-dimensional FEM analysis. We found that when ßl, which is obtained from sliding soil mass deformation coefficient, pile flexural stiffness and pile length in sliding soil mass, becomes less than 3, the maximum bending moment from FEM analysis tends to exceed maximum bending moment from dowel pile methods and that landslide pile design methods can achieve safe side design when ßl is approximately larger than 1.5. We also found that the maximum distance between landslide piles varied depending on property value of sliding soil mass and that FEM analysis enables setting of distances between piles. We further extended FEM analysis to 3-dimensional and proposed rational design methods for landslide piles as well as possibility of cost reduction.

Key words: landslides, landslide piles, finite element methods, distances between piles, design methods

A study on repair and rehabilitation for pre-stressed concrete structures in service

Budged: Grants for operating expenses
Road account
Research Period: FY2003-2005
Research Team: Structure Management Technology
Author: WATANABE Hiroshi
HISADA Makoto
NAKAMURA Eisuke

Abstract:
Repair and rehabilitation techniques are essential to extend the service life of existing pre-stressed concrete structures. Recently, a lot of repair methods and materials have been developed for extending the service life of pre-stressed concrete structures. However, at present, there are no established methods to select repair methods suitable for the condition of existing structures, such as their exposed environment, degree of their defects, etc.

This research project was carried out to develop repair method for pre-stressed concrete structures to achieve better performance of load carrying capacity and durability. Experimental study to assess material performance for repair and develop design method of repair system was conducted. Repair Manual was developed based on these research results.

Key words: pre-stressed concrete structures, repair, rehabilitation

Research on reinforcement method for river levees

Budged: Grants for operating expenses
River account
Research Period: FY1998-2005
Research Team: Soil Mechanics
Author: KOHASHI Hidetoshi
FURUMOTO Kazushi
MORI Hirotoshi
SAITO Yukiko

Abstract:
From 1996, Japanese Ministry of Land, Infrastructure and Transport has been carried out an inspection of river levees and found relatively weak points. The reinforcement measures against the flood should be implemented to such weak points found in this inspection effectively and efficiently. In this research, we have tried to classify the soil composition in river levees and find some patterns which is weak against the seepage of water. Moreover, experiments about reinforcement methods for river levees are carried out.

From the result of a series of considerations, it was confirmed as follows,
1) The condition of river levee which is vulnerable to seepage flow is categorized.
2) The effects of reinforced methods (drain works, short fiber reinforced method, etc.) are revealed.
3) With using numerical analysis of seepage flow, results of experiment could be simulated approximately.

In addition the criterion of selecting reinforcement method is suggested based on these results.

Key words: river levee, countermeasure for seepage, drain works

A study on seismic countermeasure techniques of road embankment on liquefiable ground

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Ground Vibration
Author: SUGITA Hideki
SASAKI Tetsuya
ISHIHARA Masanori

Abstract:
After Hyogoken-Nanbu earthquake, improvement of seismic performance of earth structure, for example embankment, has been needed. More economical seismic countermeasures are needed because the countermeasures cost very much. The purpose of the study is to propose rational design method and economical seismic countermeasures for road embankment. In this study, a series of centrifuge model tests performed in order to investigate deformation mechanisms of road embankments and underlying liquefiable soils and the effects of seismic countermeasures to reduce liquefaction-induced embankment settlement.

The followings were found:

(1)A simplified method to predict embankment settlement based on the deformation mechanisms was proposed.

(2)Effects of each countermeasure and synergy effects of some different countermeasures were cleared.

(3)A simplified method to predict settlement of embankment with remedial measures and a design method for remedial measures to reduce liquefaction-induced embankment settlement were proposed.

Key words: road embankment, liquefaction, earthquake, countermeasure, centrifuge model test

Seismic designing method for bridge abutment on liquefiable ground

Budged: Grants for operating expenses
Road account
Research Period: FY2001-2005
Research Team: Ground Vibration
Author: SUGITA Hideki
KONDOH Masuo
TAKAHASHI Akihiro
TANIMOTO Shunsuke

Abstract:
Findings obtained from physical model tests and numerical analyses in the project form the conclusion as follows:

Piles supporting a bridge abutment are in critical situation against bending when a large earthquake shock arrives. Since, at this moment, the kinematic load induced by the pile--liquefiable layer soils interaction is not prominent, forces considered in this state for the design calculation, i.e., inertia force of abutment and seismic earth pressure acting on abutment, are sufficient to assess the foundation capacity. Thus, the finding supports that the analytical model used in the current design calculation is appropriate for the foundation capacity assessment.

On the other hand, permanent deformation of the abutment is dominated not by the forces considered in the current design calculation but by the kinematic load induced by the pile--liquefiable layer soils interaction. This finding recommends the assessment of permanent deformation of the piled bridge abutment subjected to the kinematic load induced by the pile--liquefiable layer soils interaction.

Key words: liquefaction, bridge abutment, physical model tests, finite element analyses, earth pressure, permanent deformation

Study on rational design and construction method of substructure for super long span bridges

Budged: Grants for operating expenses
Road account
Research Period: FY1998-2005
Research Team: Ground Vibration
Foundation Engineering
Author: SUGITA Hideki
KONDOH Masuo
TANIMOTO Shunsuke
NAKATANI Shoichi
TAKEGUCHI Masahiro

Abstract:
For the construction of channel-connecting highways, the rationalization of design and construction method of the bridge foundation is required. This study aims to propose new type foundation such as piled foundation for the super long-span bridges. In this study, it was clarified that piled foundation decreases residual displacement of foundation. A simple dynamic analysis method was proposed and it was clarified that the method can reproduce residual displacement by using resistance value of ground and piles in conventional design criteria.

Key words: bridge foundation, piled foundation, centrifuge test, dynamic analysis, residual displacement

Performance based seismic design method for under-ground structure

Budged: Grants for operating expenses
Road account
Research Period: FY2003-2005
Research Team: Ground Vibration
Author: SUGITA Hideki
SASAKI Tetsuya
ISHIHARA Masanori

Abstract:
Safety of underground structure during liquefaction was not clarified enough because of it's complicated phenomena. Therefore, it is necessary to clear factors affecting seismic performance of underground structure and to propose a seismic performance based design method for the seismic safety improvement of underground structure.
In this study, a performance based design method for underground structures during liquefaction and a prediction method for up-lift displacement of underground structure with sheet piles were studied in order to propose a seismic design method for underground structure in liquefiable layer.
The followings were found:
(1) A performance based design method for underground structures during liquefaction was proposed.
(2) A prediction method for up-lift displacement of underground structure with sheet piles was proposed.

Key words: underground structure, earthquake, liquefaction, countermeasure, centrifuge model test

Research on seismic design for underground structures based on performances

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Earthquake Engineering
Author: UNJOH Shigeki
KOBAYASHI Hiroshi
OKADA Takao

Abstract:
The development of seismic design for large scale underground structures is required because projects such as urban highway tunnel and deep subterranean structures have been planed recently. The experiments to investigate the shear capacity of RC deep beams and the numerical analyses for underground structures in the longitudinal direction were performed to evaluate the seismic performance based on the ductility of large-scale underground structures. Size effect in shear strength of RC deep beam and the effect of shear reinforcement were evaluated. The analytical method for seismic evaluation in the longitudinal direction was proposed. This method on beam-spring models evaluates the deformation of underground structures as well as FEM model analysis. Based on these results, the outline of seismic design manual for large scale underground structures was proposed.

Key words: underground structures, seismic design, seismic deformation method, deep beam, axial strain transmitting characteristics

Research on seismic retrofit measures based on the performance of total bridge system

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Earthquake Engineering
Author: UNJOH Shigeki
KOBAYASHI Hiroshi

Abstract:
After the 1995 Kobe earthquake, the usual seismic retrofit method is found difficult to apply for bridges including river bridges and mid to long span bridges because of the strict construction condition and also economical reasons. Therefore the development of cost-effective seismic retrofit method is required. The objective of this study is to develop the seismic retrofit measures considering the performance of total bridge systems, which do not require the strengthening of each member such as substructures. A seismic design procedure which limits the displacement response of whole bridge systems with abutment is proposed and some methods are introduced. The evaluation for backfill soil of bridge abutment is studied from the results of the loading test for an actual bridge abutment in US. Then experimental and analytical study to improve the evaluation method of the shear strength of RC wall type columns, which is a dominant design issue on seismic evaluation of this type of columns, was carried out. It should be noted that "The examples of the seismic retrofit methods for existing bridges" based on this study is published. Furthermore, the policy for seismic retrofit of mid to long span bridges and particular bridges were summarized.

Key words: existing bridges, seismic retrofit, total bridge system, shear capacity, displacement constraint method, abutment, the examples of the seismic retrofit methods for existing bridges, long span bridges, damage analysis, simplified damage evaluati

Development of seismic design method for long-span bridges against large-scale earthquakes

Budged: Grants for operating expenses
Road account
Research Period: FY1998-2005
Research Team: Earthquake Engineering
Author: UNJOH Shigeki
ENDO Kazuo

Abstract:
This study has explored the reasonable seismic design method for a long-span suspension bridge with emphasis on a tower against a large-scale earthquake. Pushover analyses of 3 types of tower, steel, RC and CFT (Concrete Filled Tube) towers, were performed to evaluate the force vs. displacement relationships and the damage characteristics. Nonlinear dynamic analyses were also conducted to investigate the compatibility of static pushover analyses to dynamic responses. Based on these results, a seismic performance evaluation method for superstructures of a long-span suspension bridge was proposed.

Key words: long-span suspension bridge, tower, pushover analysis, seismic performance evaluation method

Rationalisation of liquefaction remediation techniques for river dike foundation

Budged: Grants for operating expenses
River account
Research Period: FY2000-2005
Research Team: Ground Vibration
Author: SUGITA Hideki
TAKAHASHI Akihiro
ISHIHARA Masanori

Abstract:
Purpose of this project is to rationalise liquefaction remediation techniques and their design methods for river dike foundation. Findings obtained from physical model tests and numerical analyses in the project form the conclusion as follows:

Mechanism of liquefaction-induced settlement of river dikes was identified with a series of centrifuge model tests and empirical permanent settlement prediction method for river dikes is proposed.

Simple dynamic analysis methods for settlement prediction of river dike whose liquefiable foundation is remedied by several techniques are proposed and are implemented in the draft of design manual for liquefaction remediation for river dike foundation.

Scope of application of the settlement prediction methods mentioned above is extended to the super levee and the method is implemented in the draft of super levee design manual.

Key words: liquefaction, earthquake retrofit, ground improvement, settlement assessment

Investigation of dynamic analysis considering crack propagation for concrete gravity dam

Budged: Grants for operating expenses
River account
Research Period: FY2003-2005
Research Team: Dam Structure
Author: YAMAGUCHI Yoshikazu
SASAKI Takashi
KANENAWA Kenichi

Abstract:
The crack generation in concrete dam body is one major type of damage modes to concrete gravity dams during large earthquakes, and to rationally evaluate the safety of dams during earthquakes is required by simulating of dynamic behaviors of dams more realistically. In nonlinear analysis considering crack propagation, the influence of the input material properties on the results of analysis is large. So the purpose of this research is to propose the method of setting the input physical properties in nonlinear dynamic analysis.

Firstly in this study, we performed parametric study with variation of tensile strength and fracture energy. Through this parametric study, it is clear that the effect of the tensile strength of concrete is larger than that the fracture energy of concrete for the crack propagation of concrete gravity dam.

And second, we conducted shaking table tests on small and large scale unreinforced concrete models made of low-strength concrete, in order to investigate the actual crack propagation and compare of the test results with the results by the numerical analyses using smeared crack model. Through the comparison, we had proposed how to set a tensile softening curve and a damping matrix for the numerical method.

Key words: concrete gravity dam, shaking table test, non-linear dynamic analysis, tensile softening curve and damping matrix

Research on performance-based design for concrete dams

Budged: Grants for operating expenses
General account
Research Period: FY2003-2005
Research Team: Dam Structure
Author: YAMAGUCHI Yoshikazu
SASAKI Takashi
SATO Hiroyuki
KANENAWA Kenichi

Abstract:
The reliability concepts need to be introduced into the design method of concrete dams.

The objective of this research is to propose partial factors for loads, mechanical properties of materials and analytical methods for design of concrete gravity dams. Those factors should suit to specified reliability levels of system and those will be used in the performance-based design of concrete dams.

In this study, we conducted the analysis by the first-order reliability method (FORM) to get reliability indexes and sensitivity coefficients by with talking account of the safety against the overall-sliding, overturning, tensile fracturing, and local shear fracturing. From the consideration of those indexes and coefficients, we evaluated effects of fluctuation of load s and strengths on the safety of concrete gravity dams, and calculated the partial factors for loads and strength. And, the effects of differences of evaluation methods of stresses in the dam body were also studied.

Key words: gravity concrete dam, FORM, reliability index, sensitivity coefficient, partial factor

Research on rational design and construction method of dam foundation grouting

Budged: Grants for operating expenses
River account
Research Period: FY2001-2005
Research Team: Dam Structure
Author: YAMAGUCHI Yoshikazu
SATO Hiroyuki
NAKAMURA Yousuke

Abstract:
Considering the preservation of environment and the safety of dams, it is necessary to investigate rational and economical grouting design and construction method under the complicated geological condition.

In this fiscal year, we have continued the research on (1) rational permeability evaluation for high permeable zone, (2) correlation between Lugeon values and other physical/geological data and (3) possibility of omission of check holes. Because this fiscal year is the last year of this research, we also conclude our research results in the past five years as well as the results in this year.

Key words: dam, grouting, check hole, high permeable zone

Research on rational design method of embankment dams

Budged: Grants for operating expenses
River account
Research Period: FY2002-2005
Research Team: Dam Structure
Author: YAMAGUCHI Yoshikazu
SATO Hiroyuki
NAKAMURA Yousuke

Abstract:
To meet the social request for cost reduction in dam construction, it is necessary to establish the rational design method of embankment dams. Because density and strength of embankment dam materials have the dispersion, and because their stress-strain relationship shows the feature of strain softening, we should investigate the influences of such characteristics of embankment dam materials.

In this fiscal year, we have continued the research on (1)the strength evaluation considering stress-strain relationship and (2)the design method considering the variability of strength and density, and have summarized the results of four-year research.

Key words: embankment dam, strain softening, variability of strength and density

Research on design and quality control methods of dam construction with heterogeneous strength

Budged: Grants for operating expenses
River account
Research Period: FY2003-2005
Research Team: Dam Structure
Author: YAMAGUCHI Yoshikazu
SASAKI Takashi
NAKAMURA Yousuke

Abstract:
From the viewpoint of effective use of resources and cost reduction, the establishment of the method for effectively utilizing the low-quality materials, such as CSG, is very important in the dam construction. However, CSG has the dispersion in a quality much larger than concrete. Therefore, the design and quality control methods for such materials should be established.

We investigated the effects of the grain size distribution of raw material and the content of the fine-grained material on the physical properties of CSG by laboratory tests. And, we conducted the study on the required strength of CSG by the mean of statistical study. Through the consideration of results, we proposed rational methods for the design and the quality control of CSG.

Key words: dam, CSG, fine-grained material, strength, deformability, statistical study science

Rationalization of mechanical design on dam rock foundation under complicated geological condition

Budged: Grants for operating expenses
River account
Research Period: FY2002-2005
Research Team: Dam Structure
Author: YAMAGUCHI Yoshikazu
SATO Hiroyuki
TOMIDA Naoki
NAKAMURA Yousuke

Abstract:
In this fiscal year, we investigated the scattering of the nonlinear deformability parameters evaluated by performing high precision triaxial compression testing for undisturbed specimens of soft rocks. In addition, the effects of the scattering of the deformation modulus of rock foundations on the assessment of the settlement of the foundation surface and strain in the elongation direction due to the construction of an embankment dam was carried out with stochastic deformation analysis. We finally summarized the results of the four-year research on “rationalization of mechanical design on dam rock foundation under complicated geological condition”.

Key words: dam, rock foundation, soft rock, nonlinear deformability, scattering

Hydraulic design methods for outlet facilities installed tunnel inside

Budged: Grants for operating expenses
River account
Research Period: FY2004-2005
Research Team: River and Dam Hydraulic Engineering
Author: KASHIWAI Josuke
MIYAWAKI Chiharu

Abstract:
In order to promote effective use of existing dams, additional installations of outlet facilities seem to be increase. Additional facility is installed inside of a tunnel if there is not sufficient space for it in a dam body, and rational design methods of this kind of facilities are required. Goals of this investigation are to elucidate the hydraulic characteristics and phenomena of air entrainment, and to propose design methods of tunnel dimension and air supply system. Items of the investigation are flow conditions in a tunnel, pressure reduction at the upstream end of a tunnel without air supply system, influence of model scale on above phenomena, effect of air supply system on the pressure reduction phenomena and methods for deciding tunnel section and air supply system. These items were examined through hydraulic model experiments using one outlet and uniform section tunnel model. Influences of two outlets and contacted tunnel section were also investigated.

Key words: outlet facility, tunnel, air entrainment, hydraulic model test, Weber number

Research on development of evaluation methodology for bridge aerodynamic stability

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Bridge Structure
Author: MURAKOSHI Jun
FUMOTO Koichiro
INAGAKI Yukiko

Abstract:
Aerodynamic stability of highway bridge is usually investigated by wind tunnel tests, which often spend long time and much cost. The research aims at development of evaluation methods for aerodynamic stability of bridge girders without wind tunnel tests.

In FY2005, focusing on simplified twin-girder bridges, simple prediction formulae of critical wind speed for flutter and galloping, and of critical wind speed and amplitude of vortex-induced vibrations were proposed based on the results of wind tunnel tests and field vibration measurements.

Key word: twin- girder, aerodynamic stability, wind tunnel test, vibration experiment, database

Research on superstructures of super long-span bridges with good efficiency and aerodynamic stability

Budged: Grants for operating expenses
Road account
Research Period: FY1999-2005
Research Team: Bridge Structure
Author: MURAKOSHI Jun
FUMOTO Koichiro
TAKAHASHI Minoru
INAGAKI Yukiko

Abstract:
One of the most important subjects in designing long-span bridges is to ensure aerodynamic stability. Structural analysis on 2 different types of cable system and wind tunnel test of a 1/125 full scale bridge model were conducted. Based on the results, a cable-stayed suspension bridge, which applies mono-duo type cable system with combination of slotted box girder and box girder, were proposed to ensure aerodynamic stability.

Also, wheel running tests of full-scale models of open grid decks with different structural details were carried out to investigate the fatigue durability. Based on the results of fatigue life estimation, structural details were proposed from the point of view of fatigue resistance for practical use.

Key words: super-long bridge, aerodynamic stability, cable-stayed suspension bridge, open grid steel deck, fatigue, wheel running test

A study on countermeasure methods to reduce traffic-induced vibration on bridges

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Bridge Structure
Author: MURAKOSHI Jun
FUMOTO Koichiro
NAGAYA Yuko

Abstract:
The effective countermeasures to reduce traffic-induced vibration on bridges and surrounding areas are required to ensure good environmental condition and to improve the durability of bridges. This research aims to clarify the dynamic responses of bridges of subjected to truck-traffic running, to propose their estimation methods of bridge dynamic responses and to develop effective countermeasures to reduce traffic-induced vibration.

In this research, an analytical model for simulating dynamic bridge response by truck running was proposed, and it was clarified analytical results roughly agree with experimental results on a test bridge in PWRI. As for countermeasures to reduce traffic-induce vibration at expansion-joint, focusing on extended concrete decks, the structural details were proposed considering durability and maintenanceability. The effects of the extended decks on reducing traffic-induce vibration were clarified by field measurements before and after experimental construction at a site.

Key words: traffic-induced vibration, countermeasure to reduce vibration, extended deck system

A study on the evaluation method of bearing capacity of the new type foundation

Budged: Grants for operating expenses
General account
Research Period: FY2002-2005
Research Team: Foundation Engineering
Author: NAKATANI Shoichi
TAKEGUCHI Masahiro

Abstract:
In recent years, construction of a highway bridge is performed in the part where grounds, such as an along the bay area, are soft. If soft ground becomes thick, since the penetration depth of foundation will become deep and foundation structure will become a large-scale foundation. Therefore development of more rational foundation structure on the soft ground is needed. Then, this research is done for the development of the technique to evaluate the load bearing capacity of soft ground reinforced by reinforcement material etc.

As a result, we clarified the qualitative increase in bearing capacity, and the reduction effect of settlement by the difference among the number of reinforcement materials, foundation conditions, etc. And we also clarified those mechanisms.

Key words: pile, spread foundation, ground reinforcement, bearing capacity

Studies on Technologies to Utilize Recycle Materials from Other Industries (1)

Budged: Grants for operating expenses
General account
Research Period: FY2001-2005
Research Team: Material and Geotechnical Engineering Research Group
Advanced Materials Recycling
Soil Mechanics
Author: MEIARASHI Seishi
NISHIZAKI Itaru
TOMIYAMA Tomonori
OZAKI Masaaki
MIYAMOTO Ayako
KOHASHI Hidetoshi
MORI Hirotoshi

Abstract:
This study intends to propose methods to assess engineering performance and environment safety of recycle materials to utilize materials recycled from wastes in other industries for public work fields and compile research findings into “Manual for Technologies to Utilize Recycle Materials from Other Industries.” In 2004, we revised the manual draft based on the research findings then to reflect subjects pointed out in expert committee. We further confirmed reactive characters of alkali aggregates when using glass cullet for concrete aggregates with Mortar-Bar Expansion Method and found that glass cullet owned responsiveness to alkali aggregates and that it was effective to use low-alkali Portland cement or blast-furnace cement. In 2005, we completed “Manual for Technologies to Utilize Recycle Materials from Other Industries in Construction Works” (Edited by PWRI, published by Taisei Publishing Co., Ltd.) based on “Manual for Technologies to Utilize Recycle Materials from Other Industries” completed in the previous year. We further conducted preliminary research to establish index for economic efficiency of recycle materials, which was not mentioned in detail in the manual. Based on the research findings, we examined case studies with waste seashells, which were not actively recycled, and found that waste seashells could be economically utilized as alternative to concrete fine aggregates.

Key words: Recycle materials from other industries, environment safety, social systems, economic efficiency, seashells

Studies on Technologies to Utilize Recycle Materials from Other Industries (2)

Budged: Grants for operating expenses
Road account
Research Period: FY2001-2005
Research Team: Advanced Materials
Author: NISHIZAKI Itaru
NITTA Hiroyuki
KATO Yuya

Abstract:
It is a critical subject to develop applications for construction waste wood, which has limited applications and demand. On the other hand, air pollution caused by automobile emissions is becoming a problem around arterial roads in urban areas, which requires effective countermeasures. Then, we intended to utilize porous carbon materials (wood ceramics), which could be obtained by carbonizing waste wood, as part of pavement materials to develop new pavements, which purify air pollutant (NOx, etc.).

This study clarified optimal usage of wood ceramics in applying them to pavement materials to develop such pavements. We further clarified NOx removal characteristics by using wood ceramics covered by photocatalytic titanium dioxide.

Key words: construction waste wood, wood ceramics, titanium dioxide, NOx removal pavements, air purification

Developments of the Technology in the construction sludge recycle

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: ConstructionTechnology
Author: OSHITA Takeshi
TSUTSUMI Shouichi

Abstract:
Although it is required to recycle construction sludge as the society is driven towards recycle-oriented, the recycling rate still remains low (45%). The construction sludge accounts only about 10% of all construction waste discharged. However, it makes about 40% of all construction waste finally disposed. In 1999, “The recycle guidelines of the construction sludge” was published by PWRI, and have been promoting this task of recycling construction sludge. As the guidelines are soon to be revised we conducted the following surveys: the actual condition survey for the construction sludge recycle, making the database of the new technologies and recycling cases of the construction sludge, and the recycling cost survey considering the recycling rule in principle.

Key words: construction sludge, recycle, recycling rule in principle, actual condition survey, date based of the new technologies and recycling cases

Developments of technologies to effectively utilize recycled aggregates and unused aggregates

Budged: Grants for operating expenses
General account
Research Period: FY2001-2005
Research Team: Structure Management Technology
Author: WATANABE Hiroshi
KATAHIRA Hiroshi

Abstract:
This study intends to develop elemental technologies and quality assessment standards to effectively utilize recycled aggregates and unused aggregates for concrete aggregates. One of the issues with recycled aggregate concrete is to ensure freeze-thaw resistance. We examined causes to influence freeze-thaw resistance of recycled aggregate concrete and the improvement methods. Establishment of methods to accurately assess freeze-thaw resistance of recycled aggregates enables sorting of recycled aggregates with significant freeze-thaw resistance, which will further prevail recycled aggregate concrete. From this perspective, we examined simple methods to test freeze-thaw tests on recycled aggregates. In terms of unused aggregates, we investigated quality of hardened concrete when using aggregates, which did not meet physical specifications such as density and absorption rate and examined possibility of its effective utilization.

Key words: recycled aggregates, freeze-thaw resistance, test methods, freezers, low-quality aggregates

Developments of methods to assess porous concrete durability

Budged: Grants for operating expenses
River account, Road account
Research Period: FY2003-2005
Research Team: Structure Management Technology
Author: WATANABE Hiroshi
KATAHIRA Hiroshi

Abstract:
While porous concrete has been drawing attention for its application to river revetments and road pavements as environment-friendly concrete, its durability is not fully clarified.

This study conducted experimental examinations on
1) freeze-thaw resistance;
2) repetitive drying and wetting resistance;
3) resistance against eluviations of calcium hydrate caused by flowing water. As a result, we clarified characteristics of porous concrete for 1) through 3) above and proposed test methods to assess 1) and 2).

Key words: porous concrete, durability, freeze-thaw, repetitive drying and wetting, eluviations

Investigation of effective use of low quality fine aggregate for dam concrete

Budged: Grants for operating expenses
River account
Research Period: FY2003-2005
Research Team: Structure Management
Technology
Author: WATANABE Hiroshi
KATAHIRA Hiroshi

Abstract:
This research project is carried out to propose the effective use technology of low quality fine aggregates for dam concrete.

The following results are obtained from the experimental study with using several kinds of fine aggregates.

When low quality fine aggregate was used in concrete,

1) Unit water increased to obtain required workability, however this obstacle is possible to be overcome by effective use of concrete admixture.

2) Compressive strength and durability against freeze-and-thawing action was not affected.

3) Little degradation of durability against freeze-and-thawing action was observed.

Based on the above result, we have proposed tentative advice notes for the use of fine aggregate which does not satisfy quality requirement in the current standard specification for concrete dam construction.

Key words: concrete, low quality fine aggregate, fresh properties of concrete, compressive strength, freeze-thaw resistance, drying shrinkage

Studies on technologies to effectively utilize plant and shrub waste as green materials

Budged: Grants for operating expenses
General account
Research Period: FY2003-2005
Research Team: Recycling
Author: OZAKI Masaaki
OCHI Shuichi
MIYAMOTO Ayako
MAKI Takanori

Abstract:
We conducted researches on development of technologies for greening and use of logged and pulled materials, a public work surplus, as spraying materials, technologies to use them as gardening materials for recycle technologies and technologies to carbonize grass materials derived from green land management as well as conducted researches on driftwood to gain basic knowledge about creating database of plant and shrub emergence. As a result, we figured out outline of emergence of driftwood at the national level as well as clarified driftwood emergence phenomenon in dams. We also found that blasting-processed wood could be used as a slope spraying material and also as a gardening material as alternative to peat moss if it was further composted. Basic carbonization experiments using grass materials indicated low-temperature and short time carbonization method was promising.

Key words: plants and shrubs, driftwood, dams, greening, blasting, peat moss, compost, carbonization

Research on asphalt specifications and recycling (1)

Budged: Grants for operating expenses
Road account
Research Period: FY2001-2005
Research Team: Advanced Materials
Author: NISHIZAKI Itaru
SASAKI Iwao
NITTA Hiroyuki

Abstract:
Aging of asphalt binder is considered as one of the reasons for the surface cracking in asphalt pavement such as longitudinal top-down cracking. Because the current specification covers no measure to evaluate service-life aging, some binders may become brittle rapidly at the beginning of service-life despite initial performance meets the requirement. This study, therefore, intends to develop test methods and performance-based specifications for asphalt binder considering life-span aging. Porous asphalt pavement has been widely used in Japan, and waste materials from those roads will increase rapidly. It is urgent issue to develop recycling techniques of pavement contains high-viscosity modified binders. This study develops recommendations on a mixture design procedure and quality control methods.

Following issues have been resulted for the findings of this study:
1) Asphalt property surveillance showed that pavement asphalt criteria utilizing accelerated aging tests should be introduced, instead of the current asphalt specification that specifies only initial properties.
2) It was confirmed that asphalt degradation due to ultraviolet rays causes surface cracking of ordinal pavement and pop-out damage of porous asphalt pavement, and carbon black addition can be one of the countermeasures.
3) Residual penetration estimating method applying infrared spectroscopy that can skip binder extraction procedure has been proposed, and variation in aging of binder within recycled mixtures was examined.
4) As for the development of porous asphalt pavement recycling, it was pointed out that mixture testing should consider service temperature for mixture design without binder extraction.

Research on asphalt specifications and recycling (2)

Budged: Grants for operating expenses
Road account
Research Period: FY2001-2005
Research Team: Pavement
Author: KUBO Kazuyuki
KONAGAI Akihiro

Abstract:
In spite of the fact that drainage asphalt pavements, which have rapidly spread recently, will need to be renewed in years to come, the ways of recycling porous asphalt concrete have yet to be established.

This paper explores conditions and problems of recycling porous asphalt concrete as aggregate for porous asphalt mixture or dense graded asphalt mixture.
Findings derived from this research are as follows
The asphalt mixture with the recycled aggregate from porous asphalt concrete can be produced and constructed with few problems as long as the recycled aggregate is heated to at least 160℃

Pavement serviceability required for roads of as heavy traffic as national highways can be met as long as the mix proportion of the recycled aggregate is about 30% or less.

Key words: drainage asphalt pavement, porous asphalt mixture, recycling, temperature, asphalt plant

Research on environmental safety of construction materials (1)

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Advanced Materials
Author: NISHIZAKI Itaru
MORIYA Susumu

Abstract:
Along with the recent increasing environmental awareness, the construction industry is demanded to confirm environment safety of construction materials used for ground improvement and clarify influences on environment. We researched waterproof sheet, geogrids, geotextiles and styrene foams and analyzed endocrine disrupters, which might be contained. We conducted experiments on absorption and desorption of endocrine disrupters by behaviors of endocrine disrupters dissolving from ground materials as well as soils to summarized perspectives on safety of ground materials to ground environment.

Key words: environment safety, ground materials, endocrine disrupters, dissolution behaviors, absorption, desorption

Research on environmental safety of construction materials

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Soil Mechanics
Author: KOHASHI Hidetoshi
MORI Hirotoshi
MASUYA Yugo

Abstract:
An evaluation method for soil materials is essential to ensure environmental safety of construction material. In this research, an environmental effect of hexavalent chromium leached from cement treated soil and simplified leaching method of lead and arsenic for soil material was researched.

From the results of researches, it was concluded as follows;
1) types of soil and cement agent affect on leaching value of hexavalent chromium,
2) hexavalent chromium leached from cement treated soil has low potential of diffusion to surrounding soil,
3) characteristic of leaching of lead and arsenic for simplified leaching test was observed.

Key words: cement treated soil, simplified leaching test, hexavalent chromium, lead, arsenic

Development of road slope evaluation techniques using road disaster prevention map

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Soil Mechanics
Author: KOHASHI Hidetoshi
KATOU Shunji
MASUYA Yugo

Abstract:
In this study, in order to explore the direction for studies in the field of road disaster prevention, we carried out activities such as the establishment of road disaster database, analysis of road disasters, analysis of the standard rainfalls at precautionary closure sections, study on defects in road management.

Key words: road disaster prevention map, slope disaster, precautionary closure section, defects in road management, risk management

Development of risk management technique using hazard map for road slope disaster prevention

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Geology
Author: SASAKI Yasuhito
KURAHASHI Toshiyuki
YAJIMA Yoshinori

Abstract:
A hazard map that plainly displays the kind and degree of danger for the road slopes is required in examining the priority of the implementation of countermeasures. To establish a slope hazard management technique, we carried out a case study of hazard mapping in four different areas. Also we developed hazard area estimation methods, as follows:
1.Fragility analysis of failure area in disaster area caused by heavy rain
2.Hazard area estimation programs based on landslide simulation using GIS system
3.Shallow Landslide Simulation System (SLSS)
4.Hazard area estimation system for rock mass failure (HES)

Key words: road slope, hazard map, fragility, hazard area estimation

Studies on new corrosion prevention materials for dam and river management facilities

Budged: Grants for operating expenses
River account
Research Period: FY2002-2005
Research Team: Advanced Materials
Author: NISHIZAKI Itaru
MORIYA Susumu
TOMIYAMA Tomonori

Abstract:
We conducted exposure tests on corrosion resistant metal materials and coating materials for rivers and examined corrosion resistance assessment and assessment of applicability of compound materials to river management facilities to obtain the findings below. While coatings on aluminum alloy may have a slight decrease in coating film thickness in freshwater environment, no deterioration is found on the film itself, which achieves corrosion prevention effects on aluminum basis materials. Use of stainless steel in river environment causes natural potential ennoblement by attachment of microbe and possibly increases local corrosion sensitivity. Underwater contact with carbon steel will increase corrosiveness of stainless steel itself, but corrosion of carbon steel will be more activated compared to non-contacted carbon steel. Repainting on steel materials in river environment may require sufficient plast processing and use of organic zinc rich paint. FRP owns durability sufficient for applications in river environment and is suitable for water gates, which are submerged all the time.

Key words: river management facilities, corrosion prevention materials, corrosion resistance metal materials, corrosion prevention coatings, microbe corrosion, compound materials, exposure tests

Study on the effective utilization of natural rock materials to civil engineering structures

Budged: Grants for operating expenses
General account
Research Period: FY2004-2005
Research Team: Geology
Author: SASAKI Yasuhito
YAJIMA Yoshinori

Abstract:
As environmental aspect has become important for designing and constructing civil engineering structures, it is increasing to use natural materials such as rocks for these structures. However, rocks vary widely on quality, according to rocktype and surrounding conditions, a rock may deteriorate quickly. Therefore, this study clears required durability of rocks for civil engineering structures.

We investigated utilizing situation and deterioration of rock materials, and we carried out durability test in order to understand a mechanism of deterioration. Additionally, to evaluate durability of civil engineering structures, we also investigated non-destructive strength test using Equotip hardness tester.

Key words: rock material, civil engineering structure, Equotip hardness tester, non-destructive strength test

Test survey concerning development and efficient use for deicer

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Advanced Materials
Pavement
Author: NISHIZAKI Itaru
TOMIYAMA Tomonori
KUBO Kazuyuki
TERADA Masaru

Abstract:
In this research, novel admixtures which had equivalent performance of chloride compound type anti-freezing admixtures and little harmful impact on the environment were studied. As the results, non-chloride deicer with sodium acetate nonhydrate was developed. It had deicer equivalent to calcium chloride and its corrosiveness or toxicity was smaller than chloride compound type deicer. In addition, the following were examined: the prediction model of road surface baced on thermal energy balance, the technique for quantitatively evaluating of road surface condition in winter, the prediction method of peak and/or attenuation of salinity concentration on road surface. As the result, basic knowledge on effective and efficient spreading method of deicer was obtained. Based on the results, “The Standard for Spreading of Non-chloride Type deicer”, which was provisional plan, was suggested.

Key words: deicer, non-chloride, environmental burden, slipping friction, snow ice road temperature, density of residual medicine

Research on distractive property of drainage asphalt pavement

Budged: Grants for operating expenses
Road account
Research Period: FY2003-2005
Research Team: Pavement
Author: KUBO Kazuyuki
KAMATA Osamu

Abstract:
There are many reports that drainage asphalt pavements damage at early stage. Road administrators repair damaged areas by methods of thinking independently. It is needed that these methods are arranged and effective methods are selected. After this work, it is needed to show effective methods for damage forms that effective methods are not found.
Therefore document investigation and hearing investigation of local bureaus are performed. As a result, it was found that destruction of drainage pavements at early stage are aggregate scattering, pot-hole and partial plastic flow in many cases. The generation of aggregate scattering can be decreased by change air void rate and so on. But the generation of partial plastic flow and pot-hole caused by destruction of base course are not found effective methods. Then, effective methods that prevent partial plastic flow are researched by investigation of test course and experiments.

Key words: drainage asphalt pavement, early breakage, partial plastic flow, under water, transformation resistance of binder course, stripping resistance, adhesiveness between surface course with binder course

Research on life extention for pavement

Budged: Grants for operating expenses
Road account
Research Period: FY1998-2005
Research Team: Pavement
Author: KUBO Kazuyuki
YABU Masayuki
SAKAMOTO Yasufumi
TERADA Masaru
TANIGUCHI Satoshi

Abstract:
This paper analyses results from past investigations of test pavements to propose a method for evaluation of pavement fatigue resistance, a method for evaluation of pavement serviceability and structures for longer life pavements. The analysis shows that the initial deflection of the surface is a good indicator for pavement fatigue resistance while the qualities of materials used and the deflection of the road surface are good indicators for pavement serviceability. It is also shown that pavements designed with enlarged TA and composite pavements have longer lives.

Key words: long life pavement, fatigue resistance, serviceability, performance, sustainability

Research on the performance appraisal method of a pavement road surface

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Pavement
Author: KUBO Kazuyuki
TERADA Masaru
AYABE Takayuki

Abstract:
The "technical standard about the structure of pavement" was taken out in July, 2001, and a number of plastic modification rings, flat nature, and noise value, water permeability, etc. were specified as a performance index of pavement. However, since development of the appraisal method of these performance index is not enough, performance regulation-ization has not permeated the spot. Then, in order to make performance regulation of pavement permeate the spot, the measurement conditions and the evaluation method of evaluating a pavement road surface performance appropriately are developed.

Then, the measurement condition and the evaluation method of appropriately appreciable of the pavement road performance were examined so that the performance regulations of the pavement might infiltrate the site. As a result, the noise value developed a handy tire/road noise evaluation method. Examination of the number and water proposed the evaluation method of appropriately appreciable of the condition of the site. Smoothness proposed the method of appropriately appreciable of the site in consideration of the global standard such as IRI.

Key words: examination of the number, WT test, confirmation of correspondence of smoothness, IRI, water permeability test, performance evaluation method

Research on the evaluation method of pedestrian road pavement

Budged: Grants for operating expenses
Road account
Research Period: FY2003-2005
Research Team: Pavement
Author: KUBO Kazuyuki
SAKAMOTO Yasufumi
OHASHI Sachiko

Abstract:
This paper analyses results from some investigations of pedestrian road pavements to propose a viewpoint of the evaluation for which pedestrian road pavement is asked, a method of quantifying and expressing amenity, safety, etc. The analysis shows that it is necessary to care about the permissible limit of the user about the performance which falls with access. It is also shown that the evaluation of users, such as amenity and safety, can be explained by the profile (unevenness) of a road surface.

Key words: pedestrian road pavement, amenity, safety, performance index, evaluation method

Survey of the improvement of steel bridge repainting technologies

Budged: Grants for operating expenses
General account, Road account
Research Period: FY2001-2005
Research Team: Advanced Technology
Author: YAMAMOTO Hiroshi
ISHIMATSU Yutaka
KAWAKITA Kenji

Abstract:
Steel bridges are social infrastructure whose durability is assured by painting. The paint film protects the steel structure from corrosion. In order to maintain a good paint film condition, it is necessary to repaint them appropriately after a certain stipulated period. The durability of the paint film is determined by the corrosion resistance of the coating material and substrate surface quality. The surface preparation is said to have a particularly great impact on the repainting of an existing steel bridge. Therefore, the theme of this research was surface preparation technologies for steel bridge repainting.

In order to perform the maintenance interval more efficiently, problems were clarified through a actual condition survey. Then, we studied appropriate surface preparation for heavy duty coating system (fluoro resin paint). The heavy duty coating system has effect on improvement of paint film durability and to preserve the environment. We focused on the quantity of adhesion salt that has a great impact on deterioration of the paint film, and studied about the acceptable value for surface preparation and the procedure to reduce that quantity below the acceptable value. And then, the life cycle cost (LCC) in a case where this procedure was applied was obtained and compared with that of the conventional procedure.

Key words: steel bridge, painting, surface preparation, adhesion salt

Survey of the improvement of steel bridge repainting technologies (2)

Budged: Grants for operating expenses
Road account
Research Period: FY2003-2005
Research Team: Advanced Materials
Author: NISHIZAKI Itaru
MORIYA Susumu

Abstract:
Corrosion prevention with coatings is essential to ensure durability of steel structures including bridges. However, reduction in maintenance and management cost is demanded along with increase in completed social capital stocks. Therefore, streamlined maintenance and management such as use of coatings with higher durability and less painting frequency is the critical issue. We examined workability of new coating materials with performance assessment tests and durability assessment tests to reduce painting frequency and costs as well as painting methods with more efficient painting.

Key words: steel bridge paintings, painting cost, performance assessment tests, durability assessment tests, painting methods

Study on soundness check and reinforcement of existing ground anchor

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: ConstructionTechnology
Author: OSHITA Takeshi
ONODERA Seiichi

Abstract:
The ground anchor has been applied in lots of sites since the first introduction in Japan more than 40 years ago. Among those that were constructed at an early stage, there are some anchors whose construction and anti-corrosion technology were immature. Problems such as breaking and protruding of anchor tendon due to the corrosion have come to be seen lately. In order to prevent these problems, it is necessary to develop methods to check the soundness of existing anchors and to repair or reinforce the defective anchors.

In this study, the soundness of actual anchors which were constructed about 20 years ago was investigated to see the actual situation as well as potential problems of old anchors, to look into the applicability of some soundness check measures. Basic test on corroded prestressing tendon was carried out to examine the applicability of Ultrasonic Detection method as soundness check of anchor tendon. And based on the test and investigation results of past few years, the draft of “Manual for inspection, soundness tests and repair of ground anchor” was prepared.

Key words: ground anchor, soundness check, ultrasonic detection method, corrosion, reinforcement

Studies on re-assessment of countermeasures for alkali aggregate reaction inhibitors

Budged: Grants for operating expenses
General account
Research Period: FY2003-2005
Research Team: Structure Management
Technology
Author: WATANABE Hiroshi
KOGA Hirohisa
KAWANO Hirotaka
HISADA Makoto

Abstract:
The basic ideas for mitigation of ASR in Japan have been established in 1986 as “the provisional countermeasures for ASR in concrete”. In this project, case study of ASR in existing structures was carried out to review the countermeasures for ASR. Experimental studies were also carried out to examine the effect of sodium ions brought as sea wind or deicing salt. Research results show that the provisional countermeasures have been worked effectively. In addition, experimental studies and investigation of existing structures were carried out to develop the technical guidance on the appraisal of concrete structures deteriorated by ASR.

Survey of the efficient use of sidewalk snow disposal methods

Budged: Grants for operating expenses
Road account
Research Period: FY2003-2005
Research Team: Advanced Technology
Author: YAMAMOTO Hiroshi
YAMAGUCHI Takashi

Abstract:
To ensure winter pedestrian space in snowy regions, snow removal methods based on mechanized snow removal and a variety of methods of washing away or melting snow are adopted. Each method has its strong points and weak points and they are selected according to the target management level etc., but trial and error efforts to increase efficiency accounting for weather conditions, site conditions, and costs are continuing. In Japan where weather conditions and site conditions vary particularly widely between regions, the selection of snow removal methods accounting accurately for these differences is an important challenge that must be overcome to lower the cost of winter road management.

Therefore, this study was a fact-finding survey of the way that various snow removal methods are applied to ensure winter pedestrian space and the costs of these methods to clarify the characteristics of each method. And methods of selecting snow removal methods accounting for weather conditions such as snowfall and for site conditions were studied to summarize concepts to guide the rational selection of snow removal methods.

Key words: winter pedestrian space, snow removal methods, mechanical snow removing, snow melting equipment, winter road management

Studies on applicability of FRP to road structures

Budged: Grants for operating expenses
Road account
Research Period: FY2001-2005
Research Team: Advanced Materials
Author: NISHIZAKI Itaru
KISHIMA Takeshi

Abstract:
Road structures in coastal areas are in tough corrosion environment due to sea salts, which requires tremendous amount of cost for corrosion countermeasures. Therefore, application of structural materials with high salt erosion prevention performance to construction structures is demanded. This study focused on FRP (Fiber reinforced plastic) as structural materials with high salt erosion prevention performance and examined its applicability to plate girder pedestrian bridges with high general versatility. We verified that methods, which conform to design methods of road bridge specifications easing restrictions on live load deflections, were applicable. In terms of individual elemental technologies, we verified that built-up main girder members combining small cross section members were applicable in consideration for economic efficiency and that axial force was even more critical than steel materials at bolt joints.

Key words: FRP, plate girder pedestrian bridges, main girder member design methods, built-up main girder members, bolt joints

Test research on corrosion resistance improvement with metal coatings

Budged: Grants for operating expenses
Road account
Research Period: FY2001-2005
Research Team: Advanced Materials
Author: NISHIZAKI Itaru
MORIYA Susumu

Abstract:
Even heavy corrosion prevention coatings on steel structures may not have expected corrosion prevention effects on corner members due to insufficient coating film thickness. Corrosion resistance can be ensured by applying metal coating materials with distinguished corrosion resistance on coating films. This study was intended to ensure corrosion resistance of steel structure coating films and examined corrosion resistance and workability of a method to apply titanium foil sheet, which titanium foil and basis materials were integrated into, on coating films.

We investigated high corrosion resistant tapes exposed in the past and summarized review subjects for applying titanium foil sheet to steel structure coating films. Then, we selected materials and examined coating specifications for titanium foil sheet and further examined influences of titanium foil sheet edges and damages. As a result, we found that applying titanium foil sheet to coating films ensured corrosion resistance. We compiled the research findings into a manual for improving corrosion resistance of heavy corrosion prevention coatings with titanium foil sheet (draft).

Key words: heavy corrosion prevention coatings, titanium foil, titanium foil sheet, corrosion resistance

Research on the advanced technology for road slope monitoring and stability evaluation

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2005
Research Team: Soil Mechanics
Author: KOHASHI Hidetoshi
KATOU Shunji
MASUYA Yugo

Abstract:
This study carries out the development of road slope monitoring system with optical fiber sensor and the stability evaluation. By the model experiment on water retention feature of the soil and field test on optical fiber sensor, the evaluation method of slope failure was examined.

Key words: road slope, monitoring, optical fiber sensor, stability evaluation

Research on evaluation of safety and countermeasure for void of sluice pipe in river levees

Budged: Grants for operating expenses
River account
Research Period: FY2002-2005
Research Team: Soil Mechanics
Author: KOHASHI Hidetoshi
FURUMOTO Kazushi
MORI Hirotoshi
SAITO Yukiko

Abstract:
The sluice pipe which is installed across the river levee is important structure for flood control. However, it may be found a void between the sluice pipe and its basement/levee, especially which is supported by pile. Such void may generate the piping phenomenon around sluice pipe. Although an inspection of the void has been carried out, an evaluation method of safety for the river levee around sluice pipe has not been established yet. In this research, we have considered to establish the evaluation method. The design method of seepage control work around sluice pipe has been also investigated.

From the actual condition survey and model tests, it was confirmed as follows,

1) The relationship between the safety of the levee around sluice pipe and the circumstances surrounding the sluice pipe.

2) The grout work for void is not durable in certain condition (ground condition, structural condition).

3) The effect of seepage control work differ from the condition of soil around the control work.

Key words: sluice pipe, piping, seepage control works

Behavior of supplied sediment from dam

Budged: Grants for operating expenses
River account
Research Period: FY2003-2005
Research Team: River and Dam Hydraulic Engineering
Author: KASHIWAI Josuke
SAKURAI Toshiyuki
INOUE Kiyotaka

Abstract:
From the viewpoints of sustainable use of dam reservoirs and river restoration, sediment supply to a river downstream from a dam reservoir is required. Sedimentation countermeasures, such as sediment bypassing, flushing, and resettling in river area, have been increasingly employed. In order to supply sediment to a river downstream, it is necessary to estimate and evaluate sediment performances in a river. In this investigation, in order to elucidate supplied sediment behaviors mainly concerning the flushing process of resettled sediment or draw down sediment flushing process during a flood, as follows examinations were carried out. The characteristics of resettling sediment scouring were examined by physical model test and numerical simulation using plane two-dimensional movable bed model developed in this study. In order to predict the downstream riverbed variation, the one-dimensional movable bed model was developed and the setting methods of upstream boundary condition were examined. The characteristics of behavior of supplied sediment by the sediment flushing were also analyzed by the one-dimensional model. Based on the above mentioned results, the impact of supplied sediment behaviors on downstream riverbed formation was examined in the viewpoint of sediment discharge property.

Key words: sediment management, sedimentation, sediment flushing, sediment resettlement, erosion, sediment discharge

Relationship between discharge variation of dam downstream and river restoration

Budged: Grants for operating expenses
River account
Research Period: FY2004-2005
Research Team: River and Dam Hydraulic Engineering
Author: KASHIWAI Josuke
YUKI Kazuhiro

Abstract:
Since the discharge variation is reduced by the control function of a dam reservoir, river environment is influenced by the reduction of discharge fluctuation. That may damage the normal growth of attached algae, which is important feed of fishes, and change riverbed situation for benthos by the accumulation of fine sediment. Fine sediment accumulation may also reduce the spawning places. Goals of the investigation are to find the examination methods for deciding the required frequency, discharge rate and duration of flushing operation, and propose reservoir management methods for flushing operation. Items of the investigation were hydraulic experiments for the erosion condition of deposited fine sediment, design of the test facility for algae separation, hydraulic experiments for ascertaining the hydraulic characteristics of the facility, examinations for the flushing operation requirement and examinations for saving methods of the water storage capacity for flushing.

Key words: attached algae, flushing operation, algae separation, fine sediment

Abrasion of sediment transport channel by sand and gravel

Budged: Grants for operating expenses
River account
Research Period: FY2002-2005
Research Team: River and Dam Hydraulic Engineering
Author: KASHIWAI Josuke
INOUE Kiyotaka

Abstract:
In order to supply sediment to dams downstream or prevent capacity loss of dam reservoirs, facilities, which transport inflow sediment to downstream rivers, should be developed. That requires establishment of countermeasure technology against abrasion. Goals of the investigation are developing estimation methods of abrasion and understanding abrasion characteristics of lining materials. Items of the study are examination of estimation methods for abrasion quantities that can apply various shapes of hydraulic facilities, finding relationship between abrasion quantity and abrasion load quantity of lining materials especially for concrete, development of abrasion test machine for the concrete lining materials and examination of planning methods for lining hydraulic structures. Concerning the estimation methods of abrasion, hydraulic model test was employed.

Key words: sediment management, sedimentation, sediment transport facility, abrasion damage, collision energy

Study on the counter-erosion work using fungi and similar kinds

Budged: Grants for operating expenses
General account
Research Period: FY2003-2005
Research Team: Volcano and Debris Flow
Author: KURIHARA Junichi
AKIYAMA Kazuya

Abstract:
A purpose of the study is to verify the applicability of the previously-proposed mitigation method using fungi against sheet erosion, which had been verified for the counter-erosion of the red-soil at Okinawa islands, to the other soils and improve its usability and effects.

In this study, erosion rate formula in consideration of anti-erosion effects of the fungi and lichen was examined, and environmental condition for growing the fungi and lichen was examined by conducting laboratory and field experiments.

Studies on maintenance and management of landslide prevention anchor methods

Budged: Grants for operating expenses
River account
Research Period: FY2004-2005
Research Team: Snow Avalanche and
Landslide Research Center
Author: HANAOKA Masaaki
MARUYAMA Kiyoteru
KOJIMA Shin-ichi

Abstract:
Extremely large tension is applied to ground anchors, that is a work method with structure more complex than that of pile work and that requires careful maintenance. Anchors executed as landslide countermeasures are subject to particularly large tension from the slopes, and their functions are also harmed by many other factors: the large quantity of groundwater in the ground that impacts the anchor part and metal materials plus frequent groundwater fluctuation and rocks falling from the slope above the ground anchors. As this shows, it is important to maintain landslide anchor work, but it is not easy to maintain objects installed under ground, and there is tendency for their inspection to be omitted.

This research was a fact-finding survey that identified problems with the maintenance of anchors installed in landslide ground and studied the possibility of a new inspection method focused on the vibration properties of the landslide slope to efficiently detect abnormalities.

The results of the anchor survey revealed that almost all anchor inspections are visual inspections performed from a distance about once a year. A field fact-finding survey confirmed many fallen and loose anchor top protection caps without successfully identifying trends in locations prone to damage, but it pointed out the need for measures to deal with heavy vegetation growth that interferes with inspections.

The inspection method study confirmed that in anchor reaction plates, the dominant frequency tends to change along with variation of the tension, but in an anchor group, it failed to obtain a significant result such as the anticipated dominant frequency etc. as a landslide block.

In the future we wish to also study a reliable and efficient method of inspecting anchor work that is an important challenge.

Study on safety of long road tunnels

Budged: Grants for operating expenses
Road account
Research Period: FY2003-2005
Research Team: Tunnel
Author: MASHIMO Hideto
ISAGO Nobuharu

Abstract:
In recent years, some large scale fire accidents have occurred in long tunnels in foreign countries. From those accidents, it has been rerealized that it is important to ensure evacuation environment for users during tunnel fire. While evacuation passages need to be built to ensure evacuation environment, the standard method to build evacuation tunnels in addition to main tunnels is costly and currently limited to a few tunnels. The way to ensure evacuation passages economically is required.

In this study, the method to excavate cross section of a main tunnel slightly wider than usual and build a wall between roadway and side space to utilize the space separated from the roadway as evacuation passage or between roadway and sidewalk to utilize the sidewalk as evacuation passage in the case of tunnels with sidewalks was examined. Also safety countermeasures in relation to evacuation guidance using information technologies in case of tunnel fire was examined.

Key words: tunnels, emergency facilities, evacuation passages, tunnel fire

Studies on flood forecasting and warning systems for developing countries

Budged: Grants for operating expenses
General account
Research Period: FY2005
Research Team: Disaster Prevention
Author: YOSHITANI Junichi
SUWA Yoshio

Abstract:
We researched flood forecasting and warning systems of 6 countries in a special session on flood forecasting and warning specially organized during "the 14th conference on public works research and development in Asia".

Majority of reports by the participants did not cover flood damage analysis; therefore, the effectiveness of flood forecasting and warning systems was not identified. Some reports suggested that a flood forecasting and warning system be not always contribute to reduce flood casualties, that the reduction be sought by identifying the critical part of the total disaster management system, that community disaster management system take root in society first before developing a forecasting and warning system, and that needs for flood forecasting and warning system varies by region, river, and flood event.

In response to these findings, this theme is dissolved in order that research focus may be put into identifying critical parts in the total disaster management system by analyzing individual flood damage.

Key words: damage analysis, developing countries, flood forecasting and warning, response, community based disaster management, sustainable

Development of the method for evaluation of water resources in poorly-gauged river basins

Budged: Grants for operating expenses
General account
Research Period: FY2002-2005
Research Team: Hydrologic Engineering
Author: FUKAMI Kazuhiko
INOMATA Hironori

Abstract:
The purpose of this research is to develop evaluation methods of water resources in poorly-gauged river basins in which lack basic hydrological data such as rainfall and discharge observation data is not sufficient. A method which reconstructs past rainfall distribution by downscaling meteorological re-analysis data archived from 1948 of which the spatial resolution is too coarse to be used for hydrological analysis was developed. In addition to that, the applicability of satellite-based rainfall distribution data which is composed of currently available satellites data to runoff analysis at river basins was examined. A non-hydrostatic model which downscales the spatial resolution of globally archived re-analysis data up to 0.1°mesh of rainfall distribution data was developed. The result was compared to ground-based rainfall data at the Mekong River basin to examine the accuracy of temporal and spatial distribution of reconstructed rainfall data. Examination of the applicability of satellite-based rainfall data was conducted by comparing the observed discharge value to that calculated with runoff models using the satellite-based rainfall data as input. In this research, examinations at the Mekong River basin with BTOPMC which has some applications to large basins and the Pursat River basin (one of the river basins which flow into the Tonle Sap Lake connected to the Mekong River) with PWRI Distributed Model Version.3 which is applicable to medium scale river basins were conducted.

Key words: non-hydrostatic numerical model, water circulation model, satellited-based rainfall data

Research on the improvement of accuracy for flood discharge observation

Budged: Grants for operating expenses
River account
Research Period: FY2004-2005
Research Team: Hydrologic Engineering
Author: FUKAMI Kazuhiko
IMAMURA Hitoki
HAGINO Mutsumi

Abstract:
It has been indicated that difference between hydraulic characteristics of streamflow, such as change of vertical and cross-direction flow distribution at the time of flood, can degrade the quality of discharge observation data. This research aims to identify actual condition of hydraulic structure of flood flow and its influence on discharge observation accuracy basing on measurement data observed at site.

Data observed at site with ADCP and hydraulic water depth current meter was used to discuss hydraulic structure of flood flow and was also compared to float observation data.

The result showed that the difference of discharge data observed with emergency method and standard method was less than 5%. Coefficient of correction that calculated with data from ADCP or hydraulic water depth current meter was a bit smaller than ordinary coefficient of correction. Velocity distribution at cross direction vibrates at certain width and this is thought to influence discharge observation value.

Key Word: discharge observation, flow distribution, ADCP, float observation, coefficient of correction

Research on multipurpose use of radar raingauge

Budged: Grants for operating expenses
River account
Research Period: FY2003-2005
Research Team: Hydrologic Engineering
Author: FUKAMI Kazuhiko
IMAMURA Hitoki
HAGINO Mutsumi

Abstract:
This research aims to propose measures for multi-purpose use of radar raingauge and two measures were suggested as advanced use method for risk management of heavy rain. One is to develop the system that assesses flood risk more relatively by comparing past heavy rainfalls or rainfalls of each channel even the object basins do not have enough past hydrologic data or real-time rainfall data or discharge data. This system is designed for medium and small size river basins that have more flood disaster recent years. Simulated discharge wave pattern create method (mesh type combination rational formula model) with rainfall data was developed and real-time risk determination method using this model was proposed. This enables categorizing flood risk into 2-3 levels. The other is to develop the method to clarify characteristics of temporal and spatial distribution of heavy rain that causes flood disasters and judge the risk by DAD analysis with combined radar rainfall data. The possibility to establish a real-time monitoring system using maximum DA position and DD analysis intercept value at each period as factor in genesis of water disasters was discussed.

Key words: mesh type rational formula, DAD Analysis, national radar raingage, flood risk, real time monitoring system

Study on integrated hydrological model and its verification

Budged: Grants for operating expenses
River account
Research Period: FY2001-2005
Research Team: Hydrologic Engineering
Author: FUKAMI Kazuhiko
INOMATA Hironori

Abstract:
Recently, many hydrological models have been developed in many countries. However there is no technical references that show which hydrological models should be selected and applied to interested watersheds. In this study, a technical reference which enables river engineers to select a hydrological model to an interested watershed effectively was finally summarized. Hydrological models were classified and arranged by practical views such as the scale of areas and the characteristics of watersheds, the objective of their application, etc. in the technical reference. Two methods to identify objectively and quantitatively which hydrologic model is most rigorous and stable were also proposed in the technical reference. There are the Jackknife and the Monte Carlo simulation based method. The two methods for assessing the stability of hydrologic models were verified through an application to experimental basins.

In addition to that, hydrological database was designed and set up to meet the needs to examine hydrologic models as described above.

Key words: hydrological model, stability assessment method, technical reference, hydrological database

Study on the development of low flow management support system

Budged: Grants for operating expenses
River account
Research Period: FY2000-2005
Research Team: Hydrologic Engineering
Author: FUKAMI Kazuhiko
INOMATA Hironori

Abstract:
Ensuring low flow discharge is proposed as one of the objectives in the recovery plan for water circulation system in basin. For that purpose, a tool which can analyze how much low flow management alternatives like water effective utilization, re-distribution or change of water utilization rule affect river flow condition is required. In this study, two analytical methods were developed and verified for the Yasu River which is one of the rivers flowing into the Biwa Lake as a case study. One of them, WEP model, estimates how much change of water utilization at farm land affects river flow and the other one, PWRI-distributed hydrologic model (Ver.3), estimates how much forest condition affects to river flow condition. In addition to that, a low flow management system, RiverWare developed by the US Bureau of Reclamation, which utilizes the two analysis methods described above was proposed and verified in the same target area.

The simulation results of both WEP model and PWRI Distributed Model Version.3 showed high applicability. In the RiverWare simulation, dam operation rules and artificial water intake were input with the user friendly interface implemented in RiverWare. The simulation result showed not only the high applicability to a Japanese river basin but also the high operability of RiverWare.

Key words: low flow management, water balance in agricultural watershed area, hydrologic system in forest-covered watershed area, basin-wide hydrologic model