

Research on the desalination method for the concrete structures deteriorated by salt attack

Budget: Grants for operating expenses

General account

Research Period: FS2005 – 2007

Research Team: Structure Management
Technology

Author: WATANABE Hiroshi

KOGA Hirohisa

NAKAMURA Eisuke

Abstract:

In this project, the desalination method is discussed as a repairing technique for concrete structures deteriorated by salt attack. Some experiments were carried out to discuss the relationship between the removed chloride ions and electric current in concrete during desalination. In addition, advantage and disadvantage of some calculation methods were discussed. As a result, after a sufficient repairing period, usually eight weeks, residual chloride ions in concrete can be roughly estimated by electric current in concrete, while it is difficult to predict the required time to achieve such conditions. These results are assembled as the draft of the guideline on desalination method for concrete structures.

Key words: concrete structures, corrosion induced by chloride ion, repairing, desalination method

Study on inspection / quality control method of concrete structures using
semi-destructive and non-destructive Tests

Budget: Grants for operating expenses
General account
Research Period: FS2005 – 2007
Research Team: Structure Management
Technology
Author: WATANABE Hiroshi
MORIHAMA Kazumasa
KATAHIRA Hiroshi
KOGA Hirohisa
NAKAMURA Eisuke

Abstract:

Purpose of this research is to propose inspection and quality control methods of concrete structures using semi-destructive tests (SDT) and non-destructive tests (NDT). The SDT and NDT methods dealt in this research project are estimation of compressive strength of concrete in structures by small size core(SC), super small size core, BOSS(Broken Off Specimens by Splitting) specimen, ultrasonic wave(UW), impact elastic wave(IEW), mechanical impedance, and rebound hammer, cover of reinforcing bar by electro magnetic wave(EW), electro magnetic induction(EI) and pulsed electro magnetic force acoustic method. For 3 years, experiments of SDT and NDT are carried out using 11 structures.

Results of experimental study are as follows;

- 1) Precision of cover depth measurement of reinforcing bar by electro magnetic wave were less than 200mm and within 15% of actual cover depth, and electro magnetic induction were less than 100mm and within 15%.
- 2) Measurement precision of compressive strength of concrete in structures by SC, BOSS, UW and IEW were within 15% of ϕ 100mm core.
- 3) Trial manuals for measurement of cover depth of reinforcing bar and compressive strength of concrete in structures executed by MLIT(Ministry of Land, Infrastructure, Transport and Tourism) were modified according to the results of (1) and (2).
- 4) Method of estimating for cover depth of reinforcing bar and compressive strength of concrete in structures using SDT and NDT were and developed into testing methods and inspection manuals.

Key words: concrete structures, non-destructive test, semi-destructive test, inspection, testing methods

Study on the new system of the materials for construction

Budged: Grants for operating expenses

General account

Research Period: FS2007

Research Team: Advanced Materials

Author: NISHIZAKI Itaru

Abstract:

The system of materials for construction was reconsidered in order to confirm the present state of the research of PWRI related to construction materials. Elemental materials, composite materials and applied material are often confusingly systemized, and systematic division of these materials was useful to find the feasibility of new application of new materials and new composite materials.

Key words: construction materials, system, advanced materials

A study on lifetime estimation of polymeric construction materials

Budgeted: Grants for operating expenses

General account

Research Period: FS2005—2007

Research Team: Advanced Materials

Author: NISHIZAKI Itaru

TOMIYAMA Tomonori

Abstract:

Although polymeric materials have excellent properties such as light weight, high strength and high-corrosion resistance, initial costs of them are higher than traditional materials. Therefore, in order to obtain the benefits of polymeric materials in construction use, it is necessary to expect lifetime of them by appropriate methods and to assess total life cycle costs of them. The purpose of this study is to establish the lifetime prediction method of polymeric materials based on results of accelerated degradation tests. Corn-based polylactide resin and novel reversibly fusible epoxy resin have been picked up as research targets. Degradation behavior of those materials in accelerated weathering tests and immersion tests have been systematically investigated. Based on the results, the most suitable method to predict lifetime of those materials has been examined in each environmental condition.

Key words: polymer, construction, materials, life, durability, prediction

Survey of problem by superannuation of earth structure and research direction

Budgeted: Grants for operating expenses

General account

Research Period: FS2007

Research Team: Soil Mechanics

Author: KOHASHI Hidetoshi

Abstract:

In the development of Japanese social capital, we are required to avoid total destruction of existing enormous stock of the social capital, to prolong its life span by reinforcement, repairing, or ordinary maintenance in the future, from the point of the financial condition as much as environmental preservation. In this study, I examined the definition of the superannuation, performance limit state, the present state of reinforcement and repair technology in the field of earth structure, and suggested what research would to be done by PWRI. As a result, I got the outlook that the studies related to the influence on many kinds of object by earth structure's extraordinary situation, related to the method of getting viewpoint of maintenance from the collapse experiment, related to the what part of earth structure to be easily removed for renewal.

Key words: earthstructure, superannuation, maintenance, performance limit state

Study on the application of High Grade Soil to banking on soft ground and to
protecting on slope surface

Budget: Grants for operating expenses

General account

Research Period: FS2003–2007

Research Team: Soil Mechanics

Author: KOHASHI Hidetoshi

KATOU Shunji

MASUYA Yugo

Abstract:

In this study, the International Research Cooperation on Road Earthworks between PWRI and research institutes of Thailand, Indonesia and Laos started. In Thailand and Indonesia, we carried out the development of the land creation technology using air foam mixed stabilized soil in the area that acquisition of the creation materials or the high quality soil is difficult. In addition, we carried out the examination about the deep mixing soil stabilization method with low improvement ratio in Thailand, and the result contributed to establishment of the design method. In Laos, we carried out the examination about the low cost protection technology using plant seeds mixed soil against the slope failure.

Key words: soft ground, countermeasure, air foam mixed stabilized soil, seeds mixed stabilized soil, trial construction, international research cooperation

Research on the utilization of Knowledge Database in geo-engineering

Budged: Grants for operating expenses

General account

Research Period: FS2007

Research Team: Geology

Author: SASAKI Yasuhito

Abstract:

This research reported on the utilization potentiality and preferable scheme of knowledge database in the field of geo-engineering research. Knowledge databases used in some institutions were firstly researched and divided into four types by its data style. Next, researchers on engineering geology and geotechnical engineering in PWRI discussed the needs and preferable utilization methods of knowledge database. As the result, knowledge database is useful especially in the field of geological disaster and earthwork trouble management. Preferable scheme of knowledge database is proposed as follows. The knowledge database should be made by the utilization of technical consultation database that is already used in PWRI. Some new functions should be added for it, for example free keyword search, description of knowledge or lesson by the cases, exhibition function, and communication function with data users and researchers.

Key words: knowledge database, knowledge, lesson, failure, trouble

A study on specific rocks containing harmful mineral for effective utilization of as a dam
concrete aggregate

Budget: Grants for operating expenses

River account

Research Period: FS2004–2007

Research Team: Geology

Author: SASAKI Yasuhito

ASAI Kenichi

Abstract:

This study examined mechanism and control method of deterioration of concrete caused by pyrite, which is one of the harmful mineral which causes quality of concrete to decline. Exposure tests on mortar and concrete using aggregate that contains pyrite, observation using a polarizing microscope and observation and chemical analysis using a scanning electron microscope were conducted. The result of the exposure tests is that in almost all samples, the relative dynamic modulus of elasticity remained at 90-100% of the initial value, and there is no evidence of dramatic decrease. The other samples showed the same trend, and no clear differences have yet appeared, regardless of whether exposure condition (indoor/outdoor), whether or not the aggregate had been oxidization-treated, and whether or not the samples had been neutralized. In addition, no outward signs of deterioration, such as fissuring, lamination, etc., have ever appeared in any of the samples. The result of the observation and chemical analysis is that in case of deterioration of pyrite in concrete, reactive components such as ferrous hydroxide, glauberite, ettringite, gypsum, etc. are produced. However, an amount of these reactive components is very small, and no signs of rapid deterioration caused by intense reaction of pyrite and concrete or mortar were appeared in any of the samples. The result of these examinations is as follows: in case that the content of pyrite in concrete is within 5wt%, pyrite-induced deterioration of concrete hardly progress under the condition that no water and air intrude from outside like interior concrete of dam.

Key word: harmful mineral, pyrite, exposure test, polarizing microscope, electron microscope

Development of estimation method for seismic damage using advanced sensor

Budgeted: Grants for operating expenses

General account

Research Period: FS2003—2007

Research Team: Earthquake Engineering

Author: UNJOH Shigeki

SAKAI Junichi

Abstract:

The objective of this study is to develop sensing technology to estimate the seismic damage of structures using advanced sensors. The method that evaluates seismic damage of reinforced concrete columns that fail in flexure have been developed based on the results from shaking table tests of 12 reinforced concrete column specimens. The damage detection system using the proposed method is developed, and applied to actual bridges.

Key words: seismic damage, damage detection, reinforced concrete column, shake table test

High earthquake resistant structure system based on seismic isolation

Budgeted: Grants for operating expenses

Road account

Research Period: FS2003—2007

Research Team: Earthquake Engineering

Author: UNJOH Shigeki

SUGIMOTO Ken

OKADA Takao

Abstract:

The seismic isolation bridges using lead rubber bearings and high damping rubber bearings have been constructed. However, these isolation bridges have sometimes difficulties on large displacement response between deck and abutment and the applicability for soft soil condition because of the possibility of resonance effect. Based on these conditions, it is necessary to develop the new seismic isolation device and excessive displacement stopper including the verification of the performance and to propose the seismic design method.

In this study, seismic design method and verification procedure of seismic isolation bridge with sliding bearings and rubber buffers as high earthquake resistant structure system are proposed through analytical and experimental studies.

Key words: Seismically Isolated Bridge System using sliding bearing, friction force, Shake Table Tests, verification procedures, simulation analysis

Development of design criteria and design procedures for unseating prevention systems
of bridges based on failure scenarios

Budget: Grants for operating expenses

Road account

Research Period: FY2004 – 2007

Research Team: Earthquake Engineering

Author: UNJOH Shigeki

SAKAI Junichi

Abstract:

The unseating prevention systems are installed in preparation for the unexpectedly large seismic force or displacement due to larger intensity of ground motion, failure of the surrounding ground, etc. It is necessary to develop more rational and reliable design criteria and procedures of unseating prevention system based on possible failure scenarios. Based on observations of actual damage from past earthquakes and analytical investigations, the required seismic performance of unseating prevention devices are determined according to the failure scenarios.

Keywords: bridge, extreme earthquake, unseating prevention system, failure mechanism, design requirements

Study on origin and behavior of recalcitrant dissolved organic matter

Budged: Grants for operating expenses

General account

Research Period: FS2005—2007

Research Team: Water Quality

Author: SUZUKI Yutaka

KITAMURA Tomokazu

KUSAKABE Taketoshi

Abstract:

To identify and elucidate origin, quality and behavior of the recalcitrant dissolved organic matter (DOM) in the waters, it is essential to develop methodologies and/or indices for characterization of DOM. In this study, the fluorescence characteristics of DOM in Kasumigaura Lake and their inflowing rivers, were investigated with three dimensions excitation-emission matrix (EEM) fluorescence spectroscopy. Results in the fiscal year were as follows:

- 1) Major seven peaks at the position of Ex230/Em300 (Peak1), Ex230/Em340 (Peak2), Ex230/Em425 (Peak3), Ex280/Em340 (Peak4), Ex320/Em425 (Peak5), Ex345/Em435 (Peak6), Ex500/Em525 (Peak7) were found in the EEMs spectra of the Kasumigaura Lake,
- 2) The Peak3 was found in most spectra of river waters. It is considered that Peak3 could be originated from fulvic acid-like organic matters.
- 3) The Peak1 were thought to be affected by the phytoplankton activities. It is indicated that organic matters which appeared at Peak3, Peak5, and Peak6 are supplied from rivers.

Key words: dissolved organic matter, 3D-EEMs, Kasumigaura Lake

Primary approach to evaluation of the effect of global climate change on river water quality

Budget: Grants for operating expenses

General account

Research Period: FS2007

Research Team: Water Quality

Author: SUZUKI Yutaka

Abstract:

Long-term change of river water quality was evaluated using the intake water quality data listed in the Statistics of Drinking Water in Japan, whose term ranged 36 years. Water temperature has the tendency of increase in accordance with the atmospheric temperature, and pH shows rapid increase in recent years which might be caused by the activated photosynthesis promoted by the increase of the nitrate concentration. Iron concentration is also decreasing; the reason of which is not clear but the pH increase might be one possibility.

Key words: global climate change, water quality, global warming

Research on countermeasures against progressive failure of embankment dams
damaged by shear deformation

Budget: Grants for operating expenses

General account

Research Period: FS2005 – 2007

Research Team: Dam Structure

Author: YAMAGUCHI Yoshikazu

SATO Hiroyuki

HAYASHI Naoyoshi

Abstract:

By the fault displacement during the 1999 Kocaeli Turkey Earthquake and the 1999 Chichi Taiwan Earthquake, many lifelines such as bridges, dams and tunnels were severely damaged. Mitigation measures for lifelines against catastrophic failure due to fault displacement are very important. In recent years, for many lifelines the guidelines for seismic performance evaluation during large earthquakes are proposed, and they allow some damage to lifelines during large earthquakes. Therefore, we should conduct research on countermeasures against progressive failure of embankment dams damaged by shear deformation caused by fault displacement or sliding failure due to large earthquakes.

Because dams are structures to store water, we should consider secondary damage after fault displacement or sliding failure such as erosion in core zone where concentrated seepage is caused by shear deformation. In this research, we conduct experiments on seepage failure in shear deformed zone, and experiments on critical filters changing grain size distribution which work effectively to protect core zone from progressive erosion due to concentrated seepage.

Key words: shear deformation, fault displacement, seepage failure, earth core, critical filter

Research on integrity evaluation of dams

Budgeted: Grants for operating expenses

General account

Research Period: FS2004—2007

Research Team: Dam Structure

Author: YAMAGUCHI Yoshikazu

IWASHITA Tomoya

KOBORI Toshihide

SASAKI Susumu

HAYASHI Naoyoshi

Abstract:

The cost reduction and labor-saving are strongly required in safety management and soundness evaluation for dams because of the limited personnel and budget. The deterioration of existing dams, and the appearance of new-fashioned dams such as trapezoid-shaped CSG dam and CFRD make the dam behavior more complicated. In addition, on March 30, 2005, notification regarding the “Draft of Guidelines for Seismic Safety Evaluation of Dams” systematically describing methods of evaluating seismic safety of dams subjected to large-scale earthquakes was proposed by Ministry of Land, Infrastructure and Transport. Therefore, dam managers should pay attention to the damage due to large earthquake motions. In this study, we will propose the new measurement methods corresponding to the complicated behavior of aged and new-fashioned dams, and soundness evaluation method in consideration of damage generated by large earthquake motions.

Key words: dam, Concrete Face Rockfill Dam (CFRD), slide type inclinometer, Global Positioning System(GPS), integrity evaluation , safety management

Research on rehabilitation and reinforcement of concrete dams

Budgeted: Grants for operating expenses

River account

Research Period: FS2005—2007

Research Team: Dam Structure

Author: YAMAGUCHI Yoshikazu

IWASHITA Tomoya

KOBORI Toshihide

Abstract:

There are many effective methods for rehabilitation and reinforcement of the concrete structures in the field of bridges and tunnels, and a lot of practical cases are reported. In the dam engineering field, there are many cases of rehabilitation methods against the water leakage through concrete dam bodies. However, the strengthening measures have not been established. Because the crack damages are expected in concrete dams due to large-scale earthquake motions, it is strongly desired to develop rehabilitation and reinforcement method.

In this research theme, we studied the method of rehabilitation and reinforcement for concrete dam bodies and general concrete structures. And, we selected add-on concrete method, anchoring method, and combined method of add-on concrete method and anchoring method. Numerical simulations were conducted to evaluate the effect of rehabilitation and reinforcement for concrete dam body to large-scale earthquake motions, and the strengthening measures for concrete dam body were evaluated.

Key words: concrete dam, rehabilitation, reinforcement, add-on concrete method, anchoring method, nonlinear analysis

Inland volcanic eruption and its impact on large watersheds

Budged: Grants for operating expenses

General account

Research Period: FS2007

Research Team: Volcano and Debris Flow

Author: TAMURA KEIJI

YAMAKOSHI Takao

Abstract:

In case of large eruptions of inland volcanoes, it is considered that watersheds could be disturbed to large extent. Japan has had no such experience for nearly 100 years. In this study, large domestic volcanic eruptions in the past and recent overseas eruptions were reviewed from the point of view of the impacts on surrounding watersheds. As a result, it is inferred that the scale of eruptions, the area of the affected watersheds and manner of sediment supply onto the watersheds, such as fall deposits or flow deposits.

Key words: Inland volcano, sediment discharge, impact on large watersheds

Study on the method to evaluate risks of landslide-induced debris flows using new
geographical data

Budget: Grants for operating expenses

River account

Research Period: FY2005 – 2007

Research Team: Volcano and Debris Flow

Author: TAMURA KEIJI

UCHIDA Taro

Abstract:

In the FY 2007, the authors linked a simple hydrological model and the infinite slope stability model to predict spatial pattern of critical steady-state rainfall required to cause slope instability. Here we propose a new stochastic method for evaluation of shallow landslide susceptibility combined simple hydrological model, the infinite slope stability model and soil thickness-frequency relationship model. We also proposed the method for large catastrophic landslide hazard mapping using rock-uplift rate, geology and topography.

Key words: new geographical data, shallow landslide, deep sheeted landslide, debris flow, risk evaluation

Research on measurement evaluation of landslides of early development stage

Budgeted: Grants for operating expenses

River account

Research Period: FS2005—2007

Research Team: Landslide

Author: FUJISAWA Kazunori

KASAI Mio

Abstract:

In this study LiDAR-derived DEMs were analyzed to characterize landslide geomorphic features associated with their evolution stage and activeness. Analysis was carried out for the 2 study sites by employing two geomorphic filters, slope and the eigenvalue ratio, to find the patterns of these changes as landslides evolve. While landslides at the early evolutionary stages commonly contain higher density of slope units above 45 degree than their surroundings for both the sites, the patterns basically differ between them probably due to the difference of underlying bedrock hardness. The eigenvalue ratios expressed the recent activeness of landslide mass well but in a different manner, reflecting dominant landslide processes peculiar to each site.

Key words: landslide topography, landslide evolution, landslide activity , laser profiler, DEM analysis

A research for activity characteristics of earthquake-induced landslides in snow-melting season

Budget: Grants for operating expenses

General account

Research Period: FS2006 – 2007

Research Team: Snow Avalanche and
Landslide Research Center

Author: HANAOKA Masaaki

MARUYAMA Kiyoteru

HAS Baator

SUZUKI Soki

Abstract:

A large number of landslide hazards occurred by the Mid-Niigata Prefecture earthquake, and reactivity in snow-melting season of those landslides was concerned since the earthquake occurred in late October, 2004. Under the situation of estimated occurrence of huge earthquake and inland earthquake by active fault in near future, we began this study because we think it is important to conduct detailed investigations for the landslide deformation which induced by strong earthquake, clarify the risk evaluating method for post-earthquake landslide. In this study, based on the in-situ measurement results conducted in landslide sites induced by the Mid-Niigata Prefecture earthquake, we revealed the post earthquake deformation of the landslides, and discussed the landslide characteristics and risk valuating method for post-earthquake landslides. The results show, very few landslides deformed according to the measurement data, and, according to the DEMs comparison immediately after, as well as periods after the earthquake, 21 landslides showed some deformation in 91 studied landslides.

Key words: post earthquake, landslide, deformation, risk evaluating method

A study on characteristics of shear strength changing of landslide mass induced by earthquake

Budget: Grants for operating expenses

River account

Research Period: FS2005 – 2007

Research Team: Snow Avalanche and
Landslide Research Center

Author: HANAOKA Masaaki

MARUYAMA Kiyoteru

HAS Baator

SUZUKI Soki

Abstract:

Triggered by the strong shaking of the Mid-Niigata Prefecture earthquake, abrupt sliding of landslides destroyed amount of roads and lifelines, and blocked rivers in many places. As a result, these landslide hazards isolated the villages in a longtime, brought serious influences to the life and environment of the hilly areas, around the Chuetsu region. Under this situation, we started this study from 2005 fiscal year, conducted geomorphological and geological investigation of the cases of landslides induced by the Mid-Niigata Prefecture earthquake, and also carried out shearing strength test of the landslide mass. We had constructed a risk evaluation method of earthquake-induced landslide, on the basis of discussion of the sliding mechanism, occurring factors of earthquake-induced landslides.

Key words: earthquake; landslide; causal factor, ring shear test; risk evaluation method

A study on the standard of construction place of the porous asphalt pavement

Budged: Grants for operating expenses

Road account

Research Period: FS2005—2007

Research Team: Pavement

Author: KUBO Kazuyuki

KANO Takashi

Abstract:

Experience of construction of porous asphalt pavement increased rapidly, because the porous asphalt pavement can improve safety in the case of the rain and reduce tire road noise. But, the standard of construction place of the porous asphalt pavement is not arranged.

So, I studied to propose the standard of construction place of the porous asphalt pavement from the noise reduction effect and a durable point of view. The noise reduction effect was checked using environment census data. And the durability of the porous asphalt pavement was checked using a pavement management system data. As a result,

- 1) The noise reduction effect of the porous asphalt pavement was found to be smaller at an intersection and under the elevating structure road.
- 2) The noise reduction effect of the cold area falls earlier rather than a general area. And its durability in the cold areas was found to be worse than that in general areas.
- 3) It is better to construct porous asphalt pavement in summer rather than in winter.
- 4) Porous asphalt pavement can provide almost the same effect comparing with sound wall with cheaper cost is higher than the sound insulation wall.

Key words: porous asphalt pavement, noise reduction effect, durability, difference between cold and general area

Research on technical improvement for selection of road route

Budgeted: Grants for operating expenses

General account

Research Period: FS2007

Research Team: Tunnel

Author: MASHIMO Hideto

KADOYU Katsunori

Abstract:

In this research, we examined strategies required in future for reduction of geological risks in each stage of road construction. The result showed that it is necessary to create a manual for improvement of geological survey of land surface, investigation manual, which corresponds to the assumed geological risks in works, and risk management method which corresponds to situations of the country.

Key words: tunnel, geological risk, investigation, risk management

Research on methods to select measures against deformation of existing tunnel

Budgeted: Grants for operating expenses

Road account

Research Period: FS2005—2007

Research Team: Tunnel

Author: MASHIMO Hideto

KADOYU Katsunori

Abstract:

The method to presume the causes of tunnel deformation from the result of investigation and periodical inspection, the quantitative measures against deformation evaluated by numerical analysis and large-scale experiments of tunnel lining, and the methods to select countermeasures corresponding to the state of deformation were examined in this research. As a result, flow chart about the cause of crack occurrence was studied. Also the relation between crack occurrence and load acting on tunnel by numerical analysis of situation of crack was presumed, and state of the load of the tunnel lining was evaluated. The application range of measures for spalling and the effects and applications of reinforcement measure for load were also proposed.

Key words: tunnel, deformation, large-scale experiment, crack, reinforcement measurement

A study on rational design method of tunnel in deeper underground

Budgeted: Grants for operating expenses

Road account

Research Period: FS2004—2007

Research Team: Tunnel

Author: MASHIMO Hideto

ISHIMURA Toshiaki

MORIMOTO Satoshi

Abstract:

In order to reduce the cost for tunnel constructed in deeper underground, the rational design method of tunnel structure considering ground characteristics in the deeper underground with shield tunneling method and the rational design method of support structure of the large section tunnel by enlarging section with NATM have are studied. Concerning design method of tunnel structure, analyses of field measurement results of the shield tunnels, which are constructed in the diluvial clay, are carried out. Design load on tunnel in the deeper underground is estimated, and design method of shield tunnel segment considering the ground characteristics in the deeper underground is proposed. Numerical analyses of the tunnel with large width constructed by excavating divided section at several operations are carried out, and the design of widening the tunnel space in deeper underground with non-open cut method is studied.

Key words: deeper underground, shield tunnel, earth pressure, execution load, coefficient of ground reaction

A study about a design method of road tunnel ventilation facilities

Budged: Grants for operating expenses

Road account

Research Period: FS2005—2007

Research Team: Tunnel

Author: MASHIMO Hideto

ISHIMURA Toshiaki

Abstract:

It is necessary to specify the amount of emission and correction coefficient to velocity and gradient reflecting the latest automobile exhaust gas regulations, for rational design of ventilation facilities in road tunnel. In terms of the amount of emission, field surveys on the density of automobile exhaust gas in the road tunnel, which is in service, are carried out. The amount of emission with the consideration of recent exhaust gas regulations is estimated, and the amount of emission per car used in design of ventilation facility is proposed. In terms of correction coefficient to velocity and gradient, the engine bench tests using the cars, which are content with new short-term and long-term automobile exhaust gas regulations, are carried out. The amounts of emission of funnel fume in different velocities and longitudinal gradients are measured. With these results and the results of engine bench test using the cars, which are content with past short-term and long-term automobile exhaust gas regulations, correction coefficient to velocity and gradient, in which the ratio of cars with automobile exhaust gas regulations is considered, is proposed.

Key words: road tunnel, ventilation plan, field survey, engine bench test, correction coefficient to velocity and gradient

Research on influence of deicing salt on durability of concrete structures

Budgeted: Grants for operating expenses

General account

Research Period: FS2005—2007

Research Team: Bridge

Author: MURAKOSHI Jun

TANAKA Yoshiki

NAGAYA Yuko

Abstract:

In Japan, most of deterioration of reinforced concrete decks on highway bridges has been caused by fatigue due to cyclic loading of heavy vehicles. However, since spike tires were prohibited in 1990s, salt use for deicing road surface has been increasing. Attention should be paid to not only fatigue, but also chloride-induced deterioration on the concrete decks. Some cases of the deterioration due to deicing salt were already reported so far. In this research, investigations using old removed bridges or bridge decks, and various laboratory tests including a truck wheel loading test using a real-size reinforced concrete deck containing an artificial deficiency, were conducted. From the results, several findings regarding fatigue mechanism of concrete decks were obtained. In addition, influence of water ingress and spalling of upper cover concrete on the mechanism, water paths from road surface to concrete decks covered by ordinary asphalt pavement, interactive deterioration due to fatigue and chloride-induced corrosion, and issues from the viewpoints for maintenance of concrete decks of highway bridges were discussed.

Key words: reinforced concrete decks, fatigue, chloride-induced deterioration, interactive deterioration, asphalt pavement, coefficient of water permeability

A study on seismic performance verification with nonlinear dynamic numerical
calculations for highway bridges

Budgeted: Grants for operating expenses

General account

Research Period: FS2003–2007

Research Team: Foundation Engineering

Author: NAKATANI Shoichi

SHIRATO Masahiro

Abstract:

Toward the practical use of nonlinear dynamic numerical calculations for seismic design of foundations, this study clarifies the issues that are associated with the setting and modeling of outcrop input motion, piles, soil-pile interaction springs, threshold values, and partial factors and seeks the means of solving them. Especially, the influence of the uncertainty in soil and pile resistances on the design result is examined and a modifier to the partial factors that are considered in the current static verification is proposed to incorporate such influence into design.

Key words: pile foundation, nonlinear dynamic numerical calculation, seismic performance, threshold value, uncertainty in soil Resistance

Development of effective utilization techniques of biomass originated products in the farming area

Budget: Grants for operating expenses

Research Period: FS2006—2007

Research Team: Regional Hydrogen use

Research Unit

Author: HIDEISHIMA Yoshiaki

SYUDOU Yuukou

OOKUBO Takashi

Abstract:

Gradually, Biogas-plant has the important role of the management of waste biomass in rural area of Hokkaido. The energy system centering on hydrogen attracts attention as the next generation energy system for the low environment load and the efficiency. The study aims to develop technologies for the conversion of biogas to into hydrogen, and clarify the properties of by-products after the conversion process. And furthermore, the preliminary view of regional socio-hydrogen stands on the environmental conservation is considered. The following results are introduced throughout the study.

- 1) It is confirmed that the developed BTH (biogas to hydrogen) system is good for the co-production of hydrogen gas and Benzene in all results of experiments. The practical large BTH plant can be designed and constructed on the basis of the investigated data of material and energy balances.
- 2) The basic technologies of Benzene-utilization originated from biogas to storage and transport the hydrogen gas are substantiated. It is also clarified that the by-product (cyclohexane) from bio-Benzene is applicable as an addition of gasoline.
- 3) Two BTH plant models in rural area (dairy farming management) and urban area provided with biogas plant and a model of methane gas supply from isolate large-scale dairy farm are surveyed on view points of hydrogen gas productivity and economical balance. Proposed each model will be realized in near future.
- 4) The micro grid system consisted with base of commercial electric power and fluctuation of decentralized power sources produces the stable of power supply and the efficient consumption of electric power. It is also estimated that the introduction of micro grid system in local network brings the reduction of global warming gas exhaust.

Key words: biogas, hydrogen and fuel cell, methane direct reforming, organic hydride, mixed fuel