Environmental function of lakeshore vegetation

Budged: Grants for operating expenses
River account
Research Period: FY2001-2004
Research Team: River Restoration
Author: AMANO Kunihiko
NAKAMURA Keigo
OISHI Tetsuya

Abstract:
We studied the function and the restoration techniques on aquatic vegetation. As water purification functions, we examined the relation between denitrification and reedbed width, and the effect of submerged plants. We found that reedbed width is proportion to the rate of denitrification and non-vegetated lakeshore exhibited oxidative condition and no denitrification. Submerged plants changed turbid water state to clear water state according to the increment of PVI (Percentage Volume Infested). We also proposed the index, “Sand drift energy level ”, which is calculated by map information (lakeshore gradient, water depth, fetch length) and wind data, to determine the probability of vegetation growth. Moreover, we reviewed the existing conserved lakeshore area in Lake Kasumigaura. Generally, the existing area is effective in conserving lake vegetation. We found that the enclosed ratio (the degree of enclosure around lakeshore) is correlated with the increase of lakeshore vegetation area, however the high enclosed ratio might cause the deterioration of lakeshore sediment. Therefore, we propose that it is important to disturb lakeshore using a certain level of wave.

Research on water and material cycle in urbanizing river catchments

Budged: Grants for operating expenses
River account
Research Period: FY1999-2004
Research Team: Hydrologic Engineering
Author: FUKAMI Kazuhiko
KINOUCHI Tsuyoshi
IIZUMI Yoshiko

Abstract:
The purpose of this research is to understand the condition of water and material cycle and develop a simulation model for basin-scale water and material cycle.

In 2004, we clarified ground water flow with dissolved material at experimental field in the Yata River basin. Then, the program to estimate the input and out put of nitrogen was established, together with a model to estimate the concentration of nitrate nitrogen of groundwater and river water. Also, WEP model was applied to the Takasaki River basin in Chiba Prefecture to simulate the change of water cycle caused by urbanization.

Key words: urbanizing river catchments, water cycle, material cycle, model, nitrogen

Research on development of groundwater modeling considering uncertainty of permeability distribution

Budged: Grants for operating expenses
General account
Research Period: FY2002-2004
Research Team: Dam Structure
Author: YAMAGUCHI Yoshikazu
SATO Hiroyuki
ISHIBASHI Masayoshi

Abstract:
It is necessary to estimate the groundwater behavior accurately in many situations such as the design of dam foundation or the safety evaluation of the dam body and its foundation. But groundwater modeling has the uncertainty because the number of permeability test is limited. It is important to develop a groundwater model which is able to describe the uncertainty of the groundwater behavior.

In this study, we investigated the correlation between permeability and other properties using data obtained at 5 existing dams, and developed a groundwater model based on Geostatistics, seepage analysis, and percolation theory. Percolation theory is applied to the results of seepage analyses to evaluate the main flow path quantitatively and probabilistically.

Key words: groundwater, uncertainty, seepage analysis, probabilistic method

Research on technology for understanding of flow situations of underground water

Budged: Grants for operating expenses
River account
Research Period: FY2002-2004
Research Team: Niigata Experimental Laboratory
Author: YOSHIDA Katsumi
HANAOKA Masaaki

Abstract:
There are still many unclear points in behavior of underground water that induces landslides. Survey technology for understanding of flow situations of underground water in landslide grounds and for planning of arrangement of effective and proper restraining construction works are required. In this research, we established 1) vertical exploration method of fluidized bed through development of temperature logging device, 2) a fluidized bed judging method for boring survey, and 3) an underground water tracking method which uses high density oxygen water.

As a result, it became possible to execute three-dimensional presumption of flow situations of underground water that had been unclear before. This can be expected to become a help for effective planning of facilities. Moreover, total cost can be expected to be reduced drastically by intensive establishment of underground water drainage facilities on the landslide areas where underground water exists excessively.

Keywords: landslide, underground water logging, underground water tracking, temperature logging, high oxygen water tracking

Research on field measurements for evaluating dynamic properties of the surface ground

Budged: Grants for operating expenses
General account
Research Period: FY2002-2004
Research Team: ConstructionTechnology
Research Department
Author: INAZAKI Tomio

Abstract:
An in-situ measurement method is proposed to evaluate the nonlinear properties of near-surface soils under the strong motion. The method utilizes a shear wave vibrator as a dynamic loading source. A seismic and electrical cone array embedded in the near-surface monitors the instantaneous response of the ground to the vibrator oscillation. The shear wave vibrator has a power to shake the ground with 100 gal or more at 5 m to the vibrator.

The proposed method measures shear wave velocities and peak ground amplitudes as indicators of shear moduli and dynamic shear strains. Because the waves generated by the vibrator were unsuitable for velocity estimation, we generated impulsive SH-waves by hitting a plank set close to the seismic array and measured them before and during vibration. To extract the plank hitting waves obscured in large amplitude of vibrator waves, vertical stacking was implemented as well as polarization of propagation direction orthogonal to each other.

Significant decreases in shear wave velocities of plank hitting SH-waves were clearly identified with increasing vibration levels as the nonlinear response of the ground. Maximum decline of S-wave velocities reached over 30 % of the original velocities.

Results of measurements demonstrate the usefulness of the method for evaluating nonlinear properties of the ground in the field. In addition, seismic reflection surveying was conducted using the shear wave vibrator to clarify S-wave velocity structure down to the basement rock at depths. As a result, an S-wave velocity profile 1 km deep was reconstructed along a 1-km long survey line.

Key words: in-situ measurement, shear wave, nonlinear properties, surficial sediments, shear-wave vibrator

Research on methods to set trigger level of vibration type debris flow detection sensor

Budged: Grants for operating expenses
River account
Research Period: FY2003-2004
Research Team: Volcano and Debris Flow
Author: SASAHARA Katsuo
TANAKA Hidemoto
YAMAKOSHI Takao
TAKEZAWA Nagazumi

Abstract:
The vibration type debris flow detection sensor has a problem, that is, there is no method to set vibration level (hereafter, trigger level) which ground vibration of debris flow would exceed other than a method which is based on vibration caused by actual debris flow at places where the sensor had placed. Therefore, to propose a method to set reasonable trigger level for vibration sensor, we examined methods to derive the trigger level for vibration sensor by estimating ground vibration level of estimated scale of debris flow of each stream at places where the sensors had been placed, with a consideration of distance between streams and the sensors, and ground characteristics.

Key words: vibration sensor, debris flow, ground vibration, trigger level

Research on occurrece conditions of long-traveling landslides

Budged: Grants for operating expenses
General account
Research Period: FY2002-2004
Research Team: Landslide
Author: FUJISAWA Kazunori
NOMURA Yasuhiro

Abstract:
Distance that the landslide mass can reach is experimentally thought to be approximately equal to length of center line (L) (upper limit is 250m), however, some landslide soil move beyond this distance (long-traveling landslides). Long-traveling landslide can cause drastic human damages, and needs measures to predict distance of soil movement and no-physical method to be required. In this research, we aimed at clarification of conditions of long-traveling landslides occurrence by statistic analysis of landslide disasters in the past. First of all, we collected documents on landslide disasters in the past, and categorized them into movement, geological condition, terrain, underground water, etc. Then we revealed that geological factors give major influence on movement, as a result of multivariate analysis. Moreover, we found out that long-traveling landslides and other landslides can be distinguished by 92.2% by two factors, “lower slope length/width of displaced mass” and “travel angle”. Furthermore, we found out that 94.7% of landslides that had moved over 250m had flown into mountain streams, by reviewing of the past cases.

Key words: landslide, large displacement, statistic analysis, multivariate analysis, occurrence condition

Survey on landslide warning level based on precipitation index

Budged: Grants for operating expenses
River account
Research Period: FY2003-2004
Research Team: Landslide
Author: FUJISAWA Kazunori
SUZUKI Masayuki

Abstract:
To propose methods to set warning level of precipitation for landslide, we organized extensometer and water gauge data and precipitation data from Automated Meteorological Data Acquisition System. Relation between precipitation and landslide is not completely clear, however, it was found out some landslides can be predicted for their approximate risk, on the basis of precipitation data, by focusing on the number of precipitation and displacement of grounds. Moreover, we surveyed relation among ground displacement, elevation of water surface and antecedent precipitation. Then we found out that there are some differences in calculation results in each extraction condition, however, warning level of precipitation for the first stage landslide can be set by continuous and constant observation for a certain period.

Key words: warning level of landslide, ground displacement, precipitation, frequency, antecedent precipitation

Study on upgrading and systematization of highway earthworks manuals

Budged: Grants for operating expenses
Road account
Research Period: FY2001-2004
Research Team: ConstructionTechnology
Author: OSHITA Takeshi
HADA Mitsutaka
ONODERA Seiichi
NAKASHIMA Shinichiro

Abstract:
Revision of technical standards for structures of road to performance based design system has been carried out in order to promote the utilization and development of new technology, to reduce the construction cost and to respond to internationalization. With regard to earthworks, it is required to convert the existing highway earthworks manuals to the performance based description style and to re-systematize existing 8 manuals according to required function of each earth structures.
In this study, the possibility of conversion of highway earthworks manuals to the performance based description style and required function and quality of earth structures and its verification method are examined. The Construction Technology Research Team conducted a study regarding drainage, compaction, embankment, retaining wall and countermeasure for soft ground. In 2004, the information of new technology and design method in countermeasures for soft ground, quality control and execution of embankment was collected, and their applicability to the actual construction was analyzed. As well old data in the existing drainage manual, such as the rainfall intensity map and the list of freezing index, was revised. With regard to retaining wall, design simulation was carried out to point out the problems in the existing manual and to examine the consistency of the design method of retaining wall with that of other similar structures.

Research on upgrading and systematization of “Guidelines for Highway Earthwork” series

Budged: Grants for operating expenses
Road account
Research Period: FY2001-2004
Research Team: Soil Mechanics
Author: KOHASHI Hidetoshi
KIN Yoshiaki
KUWANO Reiko
FURUMOTO Kazushi
KATOU Shunji

Abstract:
The performance definition is advanced at various technical standards in order to attempt development of the new technology and reduction of the construction cost. The purpose of this study is the examination of the possibility of performance definition of Guideline for Highway Earthwork series. The result of this study is according to the following:
1) The proposal of reorganization plan which transforms the composition of the guideline from the 8 guidelines into the 6 guidelines.
2) The proposal of required performance items, demand levels and etc. required in each guideline.

Key words: Guideline for Highway Earthwork, performance definition, reorganization

Study on development and systematizing of specifications for road earthworks

Budged: Grants for operating expenses
Road account
Research Period: FY2001-2004
Research Team: Foundation Engineering
Author: FUKUI Jiro
ISHIDA Masahiro
UMEBARA Takeshi

Abstract:
In order to aim at development promotion of new technology, and curtailment of construction cost, performance regulation of technical standards is advanced. Then, this research examines the possibility of the shift to the formation of performance regulation about the present road earthwork temporary construction structure. The 2003 fiscal year, the present standard was analyzed about the design of a temporary structure, and the performance for which a temporary structure is asked was arranged. The following things became clear as a result of this research. The performance for temporary structure is asked can be summarized for safe performance and usability ability and a restoration performance. According to the performance and load state of above, regulation of the present indicator can be positioned as deemed regulation.

Key Words: Standardization, performance regulation, temporal structures

A study on the performance specification of subgrade in consideration of the durability of pavement

Budged: Grants for operating expenses
Road account
Research Period: FY2001-2004
Research Team: ConstructionTechnology
Author: OSHITA Takeshi
HADA Mitsutaka
NAKASHIMA Shinichiro

Abstract:
For performance specification of road subgrade, it is needed to develop in situ test methods that can evaluate deformation modulus of subgrade easily and with high accuracy. Handy Falling Weight Deflection meter (HFWD) and Rapid Plate Loading test meter (RPL) are portable testing machines that measure deformation characteristics of the ground surface. In order to grasp their accuracy of measurement, the time for measurement and the range of application, laboratory and field experiments were conducted. From the results, it is confirmed that HFWD and RPL can evaluate deformation modulus with almost the same accuracy as Static Plate Loading test (SPL), which is the most popular but an uneasy-to-use method. Therefore, HFWD and RPL can be used for quality check and evaluation during subgrade construction, and the value can be used for the pavement design through calculation such as elastic analyses.

Key words: subgrade, deformation modulus, plate loading test

Survey on performance specifications for roadbed that considers durability of pavement (2)

Budged: Grants for operating expenses
Road account
Research Period: FY2001-2004
Research Team: Pavement
Author: ITO Masahide
SAKAMOTO Yasufumi

Abstract:
For promotion of development of new technology and for reduction of construction cost, specifying of social capital performance in respect of design standard is advancing. Performance of pavement structures have already been specified, however, roadbed and road body that support pavement are also required to be specified in future. To do this, it is necessary to examine what kind of performance is required for roadbed after the pavement were laid, because the roadbed is one that supports traffic loads with pavement. Moreover, on the assumption of future development of theoretical design, physical constant such as elastic coefficient after completed pavement-laying should be used for indicator for evaluation of the "number of wheel passes causing fatigue failure" rather than indicators based on construction situations or material prosperities such as CBR or tamping degree that had been used before. Therefore, in this research, we examined target value and indicator to evaluate roadbed performance by demonstration methods including theoretical analysis or experiments. As a result, we were able to propose specifications of pavement performance that can secure durability and are based on actual performance in the past, by examining compressive strain that is acceptable to roadbed surface in accordance with designed traffic volume. And we revealed that this proposal could contribute to reduction of construction cost.

Key words: roadbed, road body, performance specifications, multi-layered elastic system analysis, compressive stress, compressive strain

Study on practical design procedure for pile foundation in liquefiying soils considering ground deformation

Budged: Grants for operating expenses
Road account
Research Period: FY2000-2004
Research Team: Ground Vibration
Author: SUGITA Hideki
TAKAHASHI Akihiro
TANIMOTO Shunsuke

Abstract:
For practical design procedure for pile foundation subjected to kinematic loading due to large ground deformation of liquefying soils during earthquake, there remain many uncertainties, especially after-mentioned crucial factors, in modelling of soil-foundation system: (1) determinations of appropriate combination of the superstructure inertia force and ground deformation in pseudo-static analysis and (2) sensitivity of soil model parameters in foundation performance assessment. In order to clarify these factors, physical model tests and numerical analyses were undertaken. Based on findings obtained from the physical model tests, the practical design procedure using pseudo-static seismic deformation method for pile foundation in liquefying soils is proposed. The procedure can reasonably predict pile foundation performance observed in the physical model tests, and sensitivity of soil model parameters on foundation performance is assessed for practical use of this procedure.

Key words: liquefaction, bridge foundation, ground deformation, seismic deformation method

International cooperative research for seismic performance evaluation methods of structures (1)

Budged: Grants for operating expenses
General account
Research Period: FY2000-2004
Research Team: Earthquake Engineering
Author: UNJOH Shigeki
NISHIDA Hideaki
SHIOJIMA Akihiko

Abstract:
The objective of this study is to propose the standardized seismic performance evaluation method of the bridge on the basis of cyclic loading test and shaking table test in collaboration with Federal Highway Administration (FHWA). Main results of this study are as follows; 1) In case of using scaled model, adjustment of scale factor is important especially the ductility characteristic evaluation, 2) Cyclic loading patterns are proposed based on nonlinear time historical analysis results of the RC column and 3) The guideline for seismic performance testing of bridge piers is proposed.

Key words: seismic performance evaluation, experimental test methods, bridge pier, cyclic loading test, shaking table test

International cooperative research for seismic performance evaluation methods of structures (2)

Budged: Grants for operating expenses
General account
Research Period: FY2000-2004
Research Team: Foundation Engineering
Author: FUKUI Jiro
SHIRATO Masahiro
NONOMURA Yoshinori

Abstract:
This study developed a new system to estimate the characteristic value of compressive bearing capacity of a pile. The new system is comprised of two methods based on in-situ pile load test results and past pile load test database. Both methods can account for the reliability of the number of pile load test data and the applicability of ground investigation method, and harmonize the recent international trend in design code.

Key words: pile, bearing capacity, reliability design, geotechnical parameter, characteristic value

Study on the rational design method of tunnel lining

Budged: Grants for operating expenses
Road account
Research Period: FY2000-2004
Research Team: Tunnel
Author: MASHIMO Hideto
ISAGO Nobuharu
ENDO Takuo

Abstract:
In the first part of this study, laboratory experiments and field measurements were carried out to clarify the effect of fiber reinforcements to prevent the occurrence of dry shrinkage crack. In the second, full-scale model tests simulating tunnel concrete lining were carried out to clarify collapse mechanism under a few kinds of load condition and reinforcing material. Finally, in order to establish the numerical analysis method that will be able to estimate the load-carrying capacity of tunnel lining and effect of fiber reinforcements, numerical analysis using FEM considering the development of cracks were carried out and the results were compared with experimental results.

Key words: tunnel lining, shrinkage, field measurement, loading experiment, steel fiber reinforced concrete, FEM analysis

A study on numerical modeling of deep foundations for the seismic performance assessment of highway bridges

Budged: Grants for operating expenses
Road account
Research Period: FY2001-2004
Research Team: Foundation Engineering
Author: FUKUI Jiro
SHIRATO Masahiro
NONOMURA Yoshinori

Abstract:
We proposed a new load transfer nonlinear hysteretic mechanism for Winkler type soil-pile interaction springs having experimental and geotechnical backgrounds, based on the past studies in this research project. Numerical check using the proposed model coincided well with the experimental results of single piles subjected to reversed or one-sided horizontal cyclic loads and reproduced the difference in the behavior of the piles depending on the loading patterns. In addition, we extended the proposed model in order to consider the pile-group effects.

Key words: dynamic analysis, foundation, seismic design, winkler

Study on recycling technology of wood from construction site

Budged: Grants for operating expenses
Road account
Research Period: FY2000-2004
Research Team: ConstructionTechnology
Author: OSHITA Takeshi
ITANI Masashi

Abstract:
Recycling of wood from construction site has been hovering at a low level; The rate is 55% in civil engineering work and 40% in building work. And the incineration of wood from construction site, which has been a common way to deal with the waste, will be restricted in the future because of dioxin issues. Therefore, the promotion of wood recycling focused on material recycling has become the key issue recently.

In order to complete the wood recycling manual for the public works spot, examination was carried out with well-informed persons.

Key words: construction generating wood, Recycle, Recycle chip

Design method of RC members using high strength rebar as shear reinforcement

Budged: Grants for operating expenses
Road account
Research Period: FY2001-2004
Research Team: Structure Management Technology
Author: KAWANO Hirotaka
WATANABE Hiroshi
MORIHAMA Kazumasa
NAKAMURA Eisuke

Abstract:
It is essential to prevent shear failure to ensure enough seismic performance of RC structures. Amount of shear reinforcement should be increased to obtain enough shear strength of some RC structures, which can cause difficulty to construct them because of congestion of arrangement of rebars. High strength rebar is one of alternatives to solve congestion of shear reinforcement, whereas design method for RC members using high strength rebar as shear reinforcement, has not yet been developed.

We carried out cyclic reversal loading test of RC members using high strength shear reinforcements whose yield point were approximately 800MPa and 1400MPa. Also, material test of bending corner of high strength rebars was implemented. Results of the experimental study are as follows:

1) According to JSCE standard specification for structural concrete, tensile strength of shear reinforcement up to 800MPa are allowed if characteristic strength of concrete is more than 60MPa. However, the experimental results show that high strength shear reinforcement fully functions even normal strength concrete is used.

2) High tensile strength of rebar can not be utilized if concrete is seriously damaged by inelastic load reversals.

3) High strength rebars don't perform desirable properties required as shear reinforcement if the diameter of bending corner is relatively small. For instance, failure of bending corner and decrease of tensile strength are detected.

Key words: reinforced concrete, shear, high strength rebar, properties of bending corner

Study on inspection/quality control method of concrete structures using non-destructive tests

Budged: Grants for operating expenses
General account
Research Period: FY2002-2004
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 / quality control methods of concrete structures using non-destructive tests (NDT).

The NDT methods dealt in this research project are estimation of compressive strength and thickness of concrete in structures by ultrasonic wave and impact elastic wave, cover of reinforcing bar by electro magnetic wave, and compressive strength of concrete by small size core, super small size core and BOSS(Broken Off Specimens by Splitting) specimen.

Concluding remarks are as follows;

(1) Experiments on measurement precision of NDT were carried out using several model specimens. The results showed that some NDT methods had measurement precision good enough for inspection.

(2) Relative dielectric constant of concrete should be evaluated to improve accuracy of cover thickness measurement by radar. Techniques to evaluate relative dielectric constant were also developed.

(3) Evaluation method for density of cover concrete using ultrasonic method or impact elastic wave method was developed.

(4) Size effect was identified to assess concrete strength using small size core or super small size core.

(5) Small size core specimen and BOSS specimen can be used to assess carbonation rate and chloride permeability.

Accelerated test method for polymer structural materials for construction

Budged: Grants for operating expenses
General account
Research Period: FY2001-2004
Research Team: Advanced Materials
Author: NISHIZAKI Itaru
TOMIYAMA Tomonori

Abstract:
However outside exposure test is a reliable method to evaluate the durability of polymer materials, this method has some weak points, it requires long years, for instance. Weathering test is one of the well known accelerated tests, but its correlation between outside exposure test is not enough and should be improved. In this research, we are studying correlation between the deterioration of polymer structural materials through outside exposure and accelerated tests and the environmental factors of deterioration, such as temperature, humidity, sunshine, etc., in order to improve the condition of accelerated tests.

The main result is as follows.

1) Environmental factors database was made based on the observation at four exposure sites in Japan.

2) Deterioration mechanism and rate of GFRP were investigated considering the influence of the environmental factors including moisture and ultra violet lay through outdoor exposure test and accelerated test.

3) An environmental simulation test with light irradiation was carried out based on the results of the observation of environmental factors at exposure sites, ordinal weathering test and accelerated tests only with moisture and temperature (constant and cyclic condition.). We could observe a good correlation between the environmental simulation test and the outdoor exposure test in the result of the reduction of bending strength of FRP. Ordinal weathering test showed higher acceleration speed than the environmental simulation test, however the environmental simulation test has also a possibility to adjust the test condition and to get higher acceleration speed.

Study on recovery of low noise and the low vibration function of pavement

Budged: Grants for operating expenses
Road account
Research Period: FY2000-2004
Research Team: Pavement
Author: ITO Masahide
KONAGAI Akihiro

Abstract:
The purposes of this study are to propose the method of recovery of the noise reduction function of pavement and to develop the low vibration pavement.

The research results were as shown;

1.It was proposed the method, in consideration of cost, of recovery of the noise reduction function of pavement by clean machines.

2.Three types of low vibration pavement were developed.

Key words: drainage pavement, recovery of function, permeability, vibration level, measure of vibration

Study on fire-proof characteristic of tunnel lining concrete

Budged: Grants for operating expenses
General account
Research Period: FY2002-2004
Research Team: Tunnel
Author: MASHIMO Hideto
ISAGO Nobuharu
ENDO Takuo

Abstract:
Permanent lining using plain concrete is placed in road tunnel constructed by mountain tunneling method and shield tunneling method. It has the function for fire-proofing and the stability of tunnel structure for fire is confirmed. Recently, the road tunnels which use steel fiber reinforced concrete or high strength concrete for lining by mountain tunneling method and which omit the permanent lining by shield tunneling method have been emerging. However, there is few information about the fire-proof function of high strength concrete, and the characteristic of lining concrete using such materials under high temperature condition should be examined to ensure the safety of both traffic and tunnel structure in tunnel fire. Fire-proof characteristics about tunnel lining concrete should be examined by executing the experiment to grasp the behavior of lining concrete such as failure of concrete.

The experiments were carried out by using the normal material of concrete for road tunnel lining, considering the influence of back situation in lining, procurement condition, ground condition and so on. Phenomenon of concrete bursting failure like explosion was observed in the material whose strength was high or which the high axial force was introduced. However, no critical damage such as explosion of concrete for tunnel lining with the common material was found.

Keyword: tunnel, lining, fire-proof characteristics, time-temperature curve

Survey on application of FRP to road structures

Budged: Grants for operating expenses
General account
Research Period: FY2002-2004
Research Team: Bridge Structure
Author: MURAKOSHI Jun
TANAKA Yoshiki
NAGAYA Yuko

Abstract:
For evaluating applicability of Fiber Reinforced Plastics (FRP) to highway bridge decks, Static/fatigue loading tests of an all FRP bridge deck using pultruded GFRP (E-grass/Vinyl ester) were conducted under truck wheel loading. In addition, influence of surface notch, which can occur in construction site, on structural behavior of pultruded GFRP plate was discussed. Based on the results, applicability of GFRP was evaluated involving constructibility and construction cost.

The major findings are followings; no failure was found on the all FRP bridge deck specimen after 0.7 million cycles under 100kN truck wheel loading. This result suggested developing appropriate design based on definite and abundant data on various structural properties of pultruded GFRP may put FRP bridge decks into practice. It was also found that concrete decks are economically advantageous compared to those made of FRP, even taking the advantages of lightweight and high durability into consideration.

Use of non-construction by-products to pavement

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2004
Research Team: Pavement
Author: ITO Masahide
KONAGAI Akihiro

Abstract:
The purpose of this study is to clarify the durability and the additional function of glass mixed asphalt pavement and block pavement, it examined at the laboratory and the pavement run test field.

The test results were as shown;

1.The pavement which changed 30% of aggregate for glass cullet could be constructed by improved asphalt and it could improve the visibility of road surfaces.

2.The cost of making glass mixed asphalt pavement was much cheaper than silicon carbide aggregate mixed pavement.

3.The block pavement which changed 100% of aggregate of the surface for glass cullet could be constructed and it could improve the visibility of the surfaces much better than that of the glass cullet mixed asphalt pavement.

Key words: non-construction by-products, glass cullet, asphalt pavement, block pavement, luminance

Application of information technology to develop information integrated construction technologies

Budged: Grants for operating expenses
General account
Research Period: FY2002-2004
Research Team: Advanced Technology
Author: YOSHIDA Tadashi
HIRASHITA Hirofumi
YAMAMOTO Hiroshi
KAMEI Toshiyuki

Abstract:
Efforts are being made to use information technology at the execution stage in order to perform execution control, monitoring and inspections of the finished form and quality of the products of public works projects and to achieve more efficient and more advanced mechanized execution. But it is necessary to overcome the challenge of linking and sharing information in order to use electronic data for normal construction work, and its practical introduction is still far in the future. A method that permits the linking and sharing of construction work introduction at the work execution state while considering links with the design and maintenance stages is required.

Aggressive efforts must be made to achieve standardization suited to the construction work execution process in Japan in order to prepare for international standardization of computerized construction (ISO/TC127).

Key words: mechanical construction, standardization, ISO, data model

Development of technology to shorten flyover construction work at intersections

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2004
Research Team: Advanced Technology
Author: YOSHIDA Tadashi
YAMAMOTO Hiroshi
HAYASHI Akira
ARAI Takeshi

Abstract:
The construction of flyovers at intersections is being done to mitigate traffic congestion. But the effects of on-road work including the congestion it causes have been severely criticized, so reducing this is an urgent problem. Under these circumstances, it is becoming increasingly necessary to develop flyover construction work methods that involve as little on-road work congestion as possible.

This study focuses on normal construction machinery used for flyover work at intersections to study methods of evaluating the congestion reduction effectiveness of shortening the on-road work period and narrowing the work area, and at the same time, the performance required by construction machinery that contributes to the reduction of on-road work congestion has been completed based on trends in bidding and contracting systems to promote the improvement of construction machinery and technological development.

Key words: traffic congestion, intersection flyover work, construction machinery

Development of the method to reduce on-site work period on Over-pass Construction Project

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2004
Research Team: ConstructionTechnology
Author: OSHITA Takeshi
HADA Mitsutaka
ONODERA Seiichi

Abstract:
In urban area, chronic traffic congestion at major intersections has been impeding business activities and having an adverse impact such as noise and air pollution to surrounding area. In order to address these problems, improvement projects such as over-pass have been steadily conducted; however, the on-site construction work causes the additional congestion due to the traffic control for a long period. Therefore, it is required to develop the new over-pass construction technology and evaluation method of its effect to reduce the adverse impact on road traffic and surrounding environment.

The Public Works Research Institute together with private-sector corporations have conducted joint research on 6 new methods of building overpasses that could shorten the work period by 1/4 to 1/2 from the conventional methods. This was enabled by improving bridge and banking structures, also by conducting the superstructure and substructure work of bridge at the same time in the process of construction. We have also simulated how the new methods of construction work might affect the traffic and assessed the new methods by converting the time loss of traffic into currency.

Key words: over-pass, on-site work period, rapid construction work, external cost, traffic congestion

Development of construction shortening technology on the street, such as crossing solidification

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2004
Research Team: Pavement
Author: ITO Masahide
TERADA Masaru

Abstract:
The traffic jam occurs chronic in the main intersection in the city. Moreover, it influences harmfully to an economic activity and the environment in the surrounding. Therefore, the solidification of the intersection is advanced. However, the improvement work should suppress traffic under construction and the environmental impact to the minimum. Therefore, shortening at the construction period is requested. Then, this research aims at the term of works shortening of the bridge-decks surfacing in the crossing solidification. A mixture examination, the examination construction, and durability were evaluated. And, confirmation at the construction day and the life cycle cost was evaluated for it. As a result, construction period can be shortened. Even LCC is effective to it. Three of construction methods were able to be developed. It excelled in durability and mixture property of construction period shortening pavement.

Key words: crossing solidification, construction period shortened, durability properties, life cycle cost, stone mastic asphalt pavement

Development of the rapid construction technology of grade separation project

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2004
Research Team: Foundation Engineering
Author: FUKUI Jiro
TAKEGUCHI Masahiro
UMEBARA Takeshi

Abstract:
At the crossing in a city, in order to clear up traffic congestion, intersectional improvement construction is performed, but since an adverse effect occurs in peripheral environment by the new traffic congestion accompanying construction etc., the technology development that reduces these as much as possible is needed. Then, this research, in order to develop the construction method for rapid construction of grade separation, joint research was carried out with private corporation 6 groups from 2002 to 2004. We developed six construction methods that can be reduced construction period and effect on peripheral environment.

Key words: overpass, rapid construction, reduction of traffic congestion, simultaneous construction, rationalization of footing

Evaluation and development of technology for measures against dust

Budged: Grants for operating expenses
Road account
Research Period: FY2002-2004
Research Team: ConstructionTechnology
Author: OSHITA Takeshi
HADA Mitsutaka
ITANI Masashi
OBANA Seitaro

Abstract:
The pneumoconiosis, which was caused by dust in tunneling works, has become an object of public concern. The Public Works Research Institute has conducted a cooperative study on the technology for reducing dust by shotcrete between 2002 and 2004. The study worked out new shotcrete methods and dust collector systems. They were checked by the spraying test in the model tunnel or field tests. The reviewing committee has compiled the result of this study into a guide for reducing dust in the tunnel.

Evaluation on the loosen ground around a damaged sewer pipe and its measures

Budged: Grants for operating expenses
General account
Research Period: FY2001-2004
Research Team: Soil Mechanics
Author: KOHASHI Hidetoshi
KUWANO Reiko
HORII Toshitaka

Abstract:
Damaged old sewer pipes are known to cause void or loosen part in the surrounding ground, which may lead to a cave-in in the road. However, mechanism of the void formation in the ground is not well understood. In this research, major factors for the void formation are to be clarified, aiming at the screening of potential risk around the existing old pipes and the proposal for suitable backfill properties for the new construction of underground pipes.

The generation of the ground void/cavity was simulated by a series of 2D and 3D model tests. A slit or hole was made in the base of small soil chamber. Soil with water flew out of the slit/hole and the cavity was formed around it. The experimental condition was determined based on the survey on cave-in in the road conducted in some big cities. In addition, a simple test method for the evaluation of soil-loss resistance was proposed. Results of the investigations are summarized as follows:

1. The cavity and the surrounding loosen part can be approximately quantified by the amount of soil loss, 2D image processing and X-ray CT measurements in the model tests.
2. Although proposed testing method is quick and simple, requiring no special apparatus, the results obtained from the tests showed good agreement with those from model tests.
3. The tendency of soil loss (cavity formation) depended on various soil properties such as fines content, permeability, density, degree of saturation etc. Giving weak cementation to the backfill appeared to be practically sufficient for soil loss resistance.

Investigation on redevelopment technique of concrete dams

Budged: Grants for operating expenses
River account
Research Period: FY2001-2004
Research Team: Dam Structure
Author: YAMAGUCHI Yoshikazu
SASAKI Takashi
KANENAWA Kenichi
ISHIBASHI Masayoshi

Abstract:
Considering preservation of environment and cost reduction in the public works, it is necessary to utilize existing dams and reservoirs more effectively. On the study of heightening existing dams, we developed rational design methods for heightening dams. On the study of installing new discharge facilities to existing dams, we developed rational design methods for installing new discharge facilities to existing dams.

Key words: concrete gravity dam, heightening dams, installing new discharge, stability of dam body during large earthquake

Investigation on heightening techniques for embankment dams

Budged: Grants for operating expenses
River account
Research Period: FY2001-2004
Research Team: Dam Structure
Author: YAMAGUCHI Yoshikazu
TOMIDA Naoki
SATO Hiroyuki
KOBORI Toshihide

Abstract:
Efficient use of existing dams is strongly required for natural environment conservation and cost reduction in dam construction. Objective of this study is to propose the investigation, design and monitoring methods for heightened embankment dams.

In this study, we confirmed that physical properties and/or location of concentrated leakage in existing embankment dams can be detected by electrical detection to some degree. We proposed the design method for heightening embankment dams and revealed the concrete remarks on the design. In addition, we suggested the way to measure the deformation of submerged existing dam body and/or the boundary between existing and new dam bodies was developed, and confirmed the device can monitor the displacement distribution of dam slope surface well.

Key words: embankment dams, heightening, hydraulic fracturing, Newmark Method, sliding displacement, exterioir deformation

Development of rational repair and reinforcement of damaged existing tunnel

Budged: Grants for operating expenses
General account, Road account
Research Period: FY2000-2004
Research Team: Tunnel
Author: MASHIMO Hideto
ISHIMURA Toshiaki
HAKOISHI Yasuhiko

Abstract:
In this study, to propose the design method of rational repair and reinforcement of existing tunnel lining, the followings investigation was carried out. In the first part of this study, the loadbearing capacity and the mechanism of failure of the concrete lining with repairs or reinforcements were clarified by the full-scale model test or partial model tests. The estimation method of loadbearing capacity of them was also proposed based on the model test results. Secondly, new repairs and reinforcements using new material were developed. Finally, the numerical simulation for the damaged concrete lining was carried out to evaluate the load which caused the damage.

Key words: tunnel, damaged concrete lining, prevention of concrete spalling, inner concrete lining, carbon fiber sheets

Investigation of emission volume from car in tunnel

Budged: Grants for operating expenses
Road account
Research Period: FY2000-2004
Research Team: Tunnel
Author: MASHIMO Hideto
ISHIMURA Toshiaki

Abstract:
Ventilation design of road tunnel is performed on the basis of the standard emission about soot and carbon monoxide per car. The volume of standard emission has been decreasing due to advancement of car performance and regulation of exhaust gas for car year by year. Setting method of emission volume should be established by investigating the volume through the measurement in tunnel to execute rational ventilation design. In this study the investigation about the secular change of emission was performed to grasp current situation about the volume in tunnel.

Key words: ventilation design, emission volume, soot, carbon monoxide, field measurement

Research on evaluation of structural soundness and development of bridge management system

Budged: Grants for operating expenses
General account
Research Period: FY2001-2004
Research Team: Bridge Structure
Author: MURAKOSHI Jun
FUMOTO Koichiro

Abstract:
It is necessary to establish an effective system for bridge maintenance and replacement in order to maintain a large amount of bridge stocks efficiently under limited budgets and to prolong their lifespan. The aim of this research is to develop prototype of Bridge Management System (BMS) which supports decision making of project plan for maintenance, repair and replacement of bridges.

In FY2004, program of BMS prototype which consists of 5 modules was developed. Using this prototype, case studies were conducted using actual bridge inspection data administrated by a local branch office of MLIT in order to evaluate the total life cycle costs for several repair scenarios.

Key words: highway bridge, maintenance, management system, bridge integrity evaluation, deterioration prediction, bridge inspection

Research on evaluation method of soundness of bridge substructures

Budged: Grants for operating expenses
General account
Research Period: FY2001-2004
Research Team: Foundation Engineering
Author: FUKUI Jiro
ISHIDA Masahiro
NONOMURA Yoshinori

Abstract:
There are about 140,000 highway bridges in Japan, and rational management is very important in the limited budget. Many bridge substructures are damaged because of scour of river bed around foundations. It is necessary to establish an evaluation method for soundness and safety of existent bridges.

In this research, the factor was analyzed based on the failed bridge cases by scour. Next, the estimation method to evaluate capacity of foundations on scour, and scour estimation equations were examined about the result of scour inspection. It proposed the soundness evaluation technique based on these results. It came to be able to extract the damaged bridges by scour by this technique more clearly.

Key words: foundation, scour, soundness, damage, inspection