技術開発の成果

Results of Technology Development

【総合技術開発プロジェクトの成果について】General Technology Development Projects: End Results

No.	研究課題名 Project name	研究期間 Period	予算額 Budget	主な研究開発成果	Main findings and other results
1	新耐震設計法の開発 Development of new seismic design methods	S47〜S51 1972-1976	￥513,882,000	1．本研究開発の成果は、建設省「新耐震設計法（案）」としてとりまとめられ、現在の建設省所管施設の耐震設計の基本となっている。 2．建築基準法令における耐震規定を大正13年の耐震基準の導入（市街地建築物法）以来56年ぶりに抜本的に改正し（S56.6施行）、地震力を動的荷重として取り扱う規定を定めた。耐震設計法の確立により、大規模高層建築物の普及が促進。また一般建築物の耐震性が大きく向上した。 3．道路橋示方書・同解説Ⅴ耐震設計編の改正（S55.5）。従来は部材の弾性領域の特性のみを考慮して設計されていた道路橋に対し大地震の際に部材に生ずる塑性領域での挙動を考慮した設計法が取り入れられた。	1. The results of this research and development have been compiled in the Ministry of Construction's draft for a New Seismic Design Method and form the basis for current seismic design methods of civil facilities. 2. Requirements for earthquake resistance in laws and ordinances specifying building standards had not undergone radical reform in 56 years, i.e., since the introduction of earthquake resistance standards in the Urban Building Law of 1924; they were revised, and implemented in June of 1981, to treat seismic forces as dynamic loading. The establishment of the Earthquake-Resistant Design Method lent impetus to the spread of skyscrapers in Japan and greatly improved the earthquake resistance of ordinary buildings. 3. In May 1980, Specification for Highway Bridges Part V Seismic Design were amended. Road bridge design, which until then had taken into account framework members only in the elastic range, began to take into account the dynamics of members in the plastic range during major earthquakes.
2	海洋構造物建設技術の開発 Development of technology for the construction of offshore structures	S47〜S51 1972-1976	￥449,799,000	1．海浜流の観測法と予測法を開発し、海浜公園、発電所、埋め立て等沿岸域の利用・開発の際の防災及び環境アセスメント、海岸防災施設の効果の評価に用いている。 2．被覆による防食や電気防食技術を開発し、海洋鋼構造物防食指針を作成。本州四国連絡橋・東京湾横断道路及び関西国際空港の杭基礎等の防食基準に反映。	1. Measurement and prediction methods of coastal currents were developed. These methods will be used to prevent natural disasters associated with, and to provide environmental assessments concerning, the use and development of shoreline regions for seaside parks, power stations, and landfills; and to evaluate the effectiveness of coastal disaster control facilities. 2. The project has led to the development of anticorrosion technologies based on shielding and on electricity, and to the drafting of guidelines for corrosion treatment in offshore structures. They are also being reflected in the anticorrosion standards established for pile foundations used in the Honshu-Shikoku Bridge, the Trans Tokyo-Bay Highway, and the Kansai International Airport.
3	新道路交通システムの開発 Development of new road transport system	S48〜S51 1973-1976	￥151,147,000	1．新しい交通システムとして、一般道路上を走行する場合はワンマンバスとして運行し、専用ガイドウェイでは完全自動運転されるデュアルモードバスシステムの開発を行った。 2．本システムは、技術的には十分実用に供し得る段階に至っていることを確認した。 3．本研究により開発された要素技術の一部は、後のガイドウェイバスシステムの開発に生かされ、ガイドウェイバスシステムは、平成元年度福岡で開催されたアジア・太平洋博覧会会場内の輸送システムとして採用された。また、名古屋市において平成２年度に事業化され、平成12年度の実用化へ向けて建設中。	1. A dual-mode bus system has been developed as a new transport system in which the vehicle is driven by a driver on ordinary roads, and is operated fully automatically on a dedicated guideway without a driver. 2. It has been confirmed at present that the system is already technically fully applicable. 3. Some of the technical elements developed in this research project have been applied to the Guideway Bus system. The Guideway Bus was used in Fukuoka in 1989 at the Asia-Pacific Exposition for visitors' transport within the fairgrounds. It was commercialized in Nagoya in 1990, and the operation will start in 2000.
4	住宅性能総合評価システムの開発 Development of comprehensive housing performance evaluation systems	S48〜S52 1973-1977	￥294,703,000	1．住宅が備えるべき性能（耐久性、遮音性、安全性等）の評価基準の策定。 2．住宅金融公庫の融資対象となる住宅の性能基準に反映。 3．昭和57年に制定された住宅性能保証制度に反映され、竣工後一定期間内に生じた欠陥等が保証されることになった。 4．建設省工業化住宅性能認定制度の音響性能指標の導入（S 55建設省告示改正）へ反映。 5．住宅の遮音基準等JIS作成へ反映。	1. Evaluation criteria were formulated for desirable housing performance parameters (durability, soundproofing, safety, etc.). 2. They are reflected in housing performance criteria for dwellings eligible for Housing Loan Corporation financing. 3. They are reflected in the housing performance guarantee program established in 1982, assuring that defects, etc., do not occur within a certain period following completion of construction. 4. They are reflected also in the introduction of acoustic performance indices in the Ministry of Construction's industrial housing performance certification program (amended in Ministry of Construction notification in 1980). 5. They are reflected in the drafting of JIS standards, including housing soundproofing standards.

3.新道路交通システムの開発
ワンマンバスとガイドウェイバスの両方の機能を備えたデュアルモードバスシステム
Development of the new road transport system
The dual-mode bus system consists of buses that can not only run automatically on guideways but also be driven by a driver on ordinary roads.

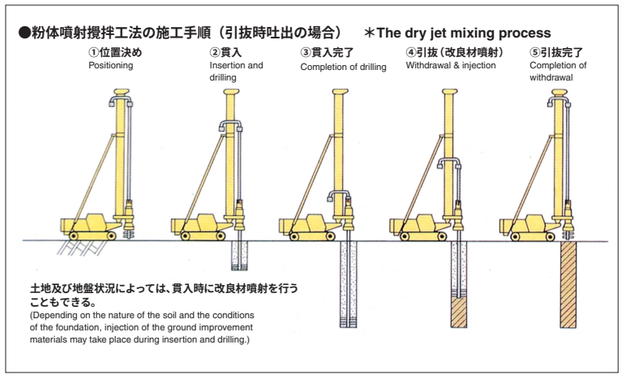
7 技術開発の成果／Results of Technology Development

技術開発の成果
Results of Technology Development

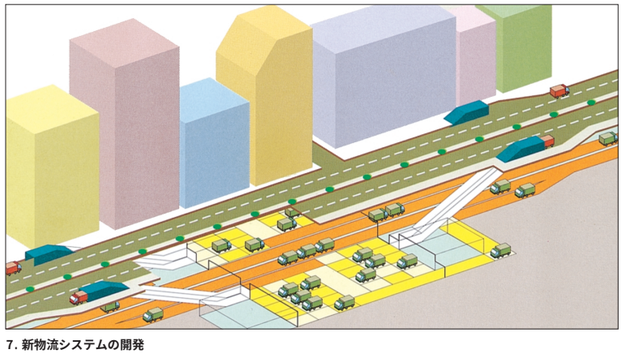
【総合技術開発プロジェクトの成果について】General Technology Development Projects: End Results

No.	研究課題名 Project name	研究期間 Period	予算額 Budget	主な研究開発成果	Main findings and other results
5	小規模住宅新施工法の開発 Development of new construction methods for small-scale housing	S49〜S50 1974-1975	￥57,300,000	1．柱を使わずに２インチ×４インチの部材により壁と床板を作る木造住宅工法であるツーバイフォー工法のわが国への導入に当たっての技術開発。 2．木造住宅の安全性、居住性の向上、施工の合理化、工期の短縮に効果を上げている。 3．ツーバイフォー工法について昭和52年に建築基準法第38条に基づく技術的基準の制定、住宅金融公庫仕様書への反映。	1. Technology was developed for the introduction to Japan of “two-by-four” building techniques using timber precut to standard dimensions to build the floors and walls of houses without supporting pillars. 2. The new techniques are showing their effect in terms of increased safety, comfort, efficiency, and rapidity of construction of wooden houses. 3. Regarding the “two-by-four” method, technical standards based on Article 38 of the Building Standard Law were established in 1977, and the method has been reflected in Housing Loan Corporation specifications.
6	新地盤改良技術の開発 Development of new soil improvement technology	S50〜S54 1975-1979	￥412,539,000	1．本研究で開発された地盤改良工法の二重管式複相注入工法は、現在の薬液注入工法の主流。また「薬液注入工法技術指針（案）」を基に日本薬液注入協会の「薬液注入の設計・施工指針」が作成されている。 2．深層における地盤改良工法として開発された粉体噴射攪拌工法（ＤＪＭ工法）は、高強度の改良効果があり、深層混合処理工法の代表的な工法として広く使用されており、平成６年度までに活用実績は約1,800件（1,260万㎥）に達している。	1. Bimode grouting method using a duplex tube, one of the ground improvement methods which was developed through this research, is now the main method of chemical grouting. It has led to the formulation of guidelines for chemical grouting design and execution by the Japan Chemical Grout Association based on draft Guidelines for Chemical Grouting Methods and Technology. 2. The dry jet mixing (DJM) method, developed as a deep underground improvement technique, has a powerful solidifying effect. It is one of the most widely used deep mixing methods, applied in about 1,800 cases (12,600,000 cubic meters) by fiscal 1994.
7	新物流システムの開発 Development of new freight transport system	S51〜S55 1976-1980	￥361,093,000	1．新しい物資輸送システムとして、一般道路上と専用ガイドウェイを走行することが可能な車両を用い、貨物輸送の効率化と省力化を図るデュアルモードトラックシステムの開発を行った。特に、走行実験を行い、車両の管理システム、超音波式車間距離制御技術等の開発を行った。 2．地下物流システムの開発において、本研究の成果が活用され、さらに環境面を考慮した電気自動車によるデュアルモードトラックを開発中である。	1. A dual-mode truck system was developed to make the shipping of goods more efficient and to save labor using dual-mode trucks that can run both on ordinary roads and on dedicated guideways. Efforts were focused on running tests in developing vehicle control systems and technologies for ultrasonic devices to maintain a safe distance between vehicles. 2. The results of this project are being applied to develop an underground freight transport system. Electric-powered dual-mode trucks are now being developed to lessen environmental disruptions.
8	地下水涵養技術の開発 Development of groundwater utilization technology	S51〜S55 1976-1980	￥410,127,000	1．本研究で開発された遮水壁工法を用いて、長崎県野母崎町地下ダムの工事を実施。 2．本研究で開発された止水・取水工法等の地下水涵養技術は住宅・都市整備公団により改良され、雨水の有効利用もできる砕石空隙貯留法に発展した。	1. An underground dam has been built at Nomozaki-cho in Nagasaki Prefecture using water barrier methods developed as part of this project. 2. The groundwater utilization technology developed in this project (methods for collecting and taking water) has been improved by the Housing and Urban Development Corporation and effectively extended to the storage of rainwater in spaces between crushed stone fragments.
9	都市防火対策手法の開発 Development of urban fire prevention methods	S52〜S56 1977-1981	￥320,932,000	1．防火上効果的な緑地、空地等の延焼遮断帯の設置及び避難路の確保に関する研究。 2．本研究を基に中央防災会議の決定に基づき三大都市圏、地震防災対策強化地域等の関係地方公共団体において、避難地、避難路等の都市防災施設に関する「都市防災構造化対策事業計画」（S61 9. 25都市局長通達）の策定推進。 3．防災公園の技術基準の策定。	1. This research concerns the securing of parks and other green open spaces, vacant lots, and passages and routes that can be effectively used during disasters to allow people to escape danger. 2. Based on this research and on the resolutions of the National Committee on Natural Disaster Prevention, local governments in Japan’s three largest metropolitan areas and municipalities designated as priority areas for earthquake disaster prevention programs are working toward the formulation of Urban Disaster Prevention Program Plans (via a guidance by Director General of Urban Bureau of MOC dated September 25, 1986) that will provide evaluation routes and places of refuge and other facilities needed in the event of a natural disaster. 3. Technical standards have been formulated for the creation of prevention parks.

5. 小規模住宅新施工法の開発
２インチ×４インチの部材で壁と床板を作るツーバイフォー工法
Development of new construction methods for small-scale housing
Wall and floor frameworks are built with dimensional timber (“two-by-fours”).



6. 新地盤改良技術の開発
深層における地盤改良工法として開発された粉体噴射攪拌工法
Development of new soil improvement technology
The dry jet mixing method was developed as a deep-level foundation improvement technique.



7. 新物流システムの開発
新たな貨物輸送システムとして開発したデュアルモードシステム
Development of the new freight transport system
Dual-mode trucks are used in this freight transport system.

7 技術開発の成果／Results of Technology Development

技術開発の成果
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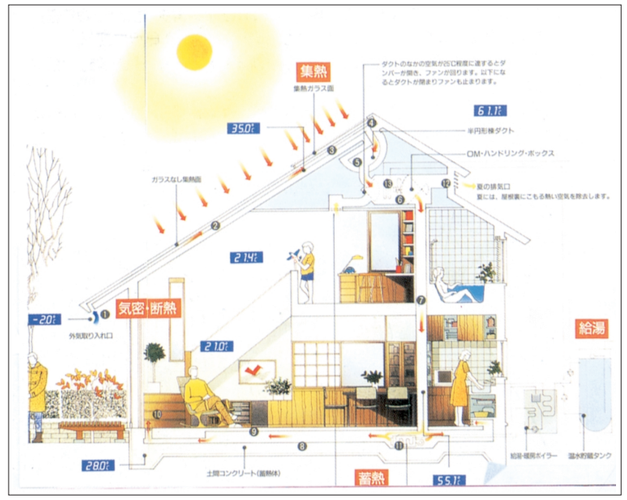
10	省エネルギー住宅システムの開発 Development of energy-saving housing systems	S52〜S56 1977-1981	￥355,315,000	1．二重ガラス戸、床や壁の蓄熱材を使用し、太陽熱の効率的利用により省エネルギー化を図ったパッシブ・ソーラー・ハウスの開発。 2．住宅金融公庫融資の省エネルギー対策工事の割増し貸付の審査基準に反映。 3．太陽熱温水器、給湯設備等の省エネ機器の優良住宅部品認定基準に反映。	1. Passive solar houses have been developed that save energy by effectively using solar heat trapped by double glass doors and by using insulating materials in floors and walls. 2. This research has been reflected in inspection standards related to loan incentives for energy-saving construction of houses financed by the Housing Loan Corporation. 3. Results have also been reflected in certification standards for outstanding energy-saving housing fixtures and equipment such as solar water heaters and hot water boilers.
11	建設工事環境改善技術の開発 Development of technology for improving construction work environments	S52〜S56 1977-1981	￥298,526,000	1．高周波杭打機及び場所打ち杭工法の開発、実用化。 2．建設工事用遮音シート及び遮音パネルについての標準規格（案）のとりまとめ。 3．低騒音型土工機械（ブルドーザ）の遮音対策に取り組み、15dB（A）の低減に成功。 4．コンクリートポンプ車の騒音対策に取り組み、10dB（A）の低減に成功。 5．建築物の破壊解体工事の騒音、振動予測を含めた工法選定マニュアル（案）をとりまとめ、「建設工事に伴う騒音振動対策技術指針」（S62.3.20）、「建設工事に伴う騒音振動対策ハンドブック」（S62.6）の改正に反映。	1. High-frequency pile-driving machines and methods for use with cast-in-place concrete piles were developed and applied. 2. Draft specifications have been compiled for construction site sound-proofing sheets and panels. 3. Efforts to reduce noise made by bulldozers and other construction equipment by 15 dB (A) were successful. 4. Efforts to reduce the noise of concrete pump trucks by 10 dB (A) were successful. 5. A draft manual was compiled to assist in the selection of construction methods, including prediction of noise and vibration levels during building demolition. It was reflected in the revision of the Guidelines for Technology for Combating Noise and Vibration on Construction Sites (March 20, 1987) and the Handbook of Measures for Combating Noise and Vibration on Construction Sites (June 1987).
12	沿道地域の居住環境整備に関する総合技術の開発 Development of various technologies related to improvement of the roadside living environment	S53〜S57 1978-1982	￥324,718,000	1．沿道地域整備の計画手法を開発し、「幹線道路の沿道の整備に関する法律」（S55.5）における沿道整備道路の指定基準等に反映。 2．道路交通による騒音、振動及び排出ガスの予測手法を開発し、この予測手法は「建設省所管道路事業環境影響評価技術指針」（S60.9通知）、「道路環境整備マニュアル」（H1.1）に採用された。 3．環境施設帯や遮音壁の効果に関する成果については現在検討中の「道路構造令」の改正に反映させる予定である。	1. Planning methods for roadside area improvement were developed and reflected in criteria for designation of improvable roadside areas in the May 1980 Law Regarding the Improvement of Roadsides Along Main Arteries. 2. Methods for predicting levels of noise and vibration, and densities of exhaust gases generated by road traffic were developed and adopted in the September 1985 notification entitled Technical Guidelines for Environmental Impact Assessments of Road Works Under Jurisdiction of Ministry of Construction and in the January 1989 Road Environment Improvement Manual. 3. It is planned to reflect the findings regarding effects of environmental facility belts and noise barriers in the revision of the Road Structure Ordinance now under examination.
13	建築物の耐久性向上技術の開発 Development of technology for improving buildings' durability	S55〜S59 1980-1984	￥373,523,000	1．既存建築物に係る劣化診断・補修交換、新設建築物に係る耐久設計・施工管理の技術指針の作成。 2．「官公庁施設の建設等に関する法律」に基づく「国家機関の建築物の保全に関する技術的基準」（S57.5）に反映。	1. Technical guidelines were formulated for diagnosing deterioration, repairing and replacing defective parts of existing buildings, and designing and implementing methods of making new buildings more durable. 2. The results have been reflected in the May 1982 Technical Standards Regarding Safety of Buildings Housing State Institutions based on the Law Regarding the Construction, etc., of Government and Municipal Office Buildings.
14	建設事業への廃棄物利用技術の開発 Development of waste utilization technology in the construction industry	S56〜S60 1981-1985	￥339,907,000	1．改良土を用いた埋め戻し技術、高有機質土の適正処理技術、再生骨材を用いたコンクリートの利用技術の開発。 2．下水汚泥の土質改良材、路盤材及びコンクリート骨材、廃木材等の建設資材への利用について技術開発。 3．石炭灰のアスファルト舗装材への活用を開発。「アスファルト舗装要領」（S63.11）にも反映。	1. Technology was developed for backfilling underground pipelines with stabilized soil; treating high organic soil rationally; and using recycled aggregate and some by-products for concrete structures. 2. Technology was developed for using sewage sludge as soil improvement material, and for using base course material, concrete aggregate, and wood debris as construction materials. 3. Technology for using coal ash as asphalt paving material was developed, and the findings were compiled in the Outline Regarding Asphalt Pavement (November 1988).



10. 省エネルギー住宅システムの開発
太陽熱の効率的利用により省エネルギー化を図ったパッシブ・ソーラー・ハウスのイメージ図
Development of energy-saving housing systems
Artist's conception of passive solar house designed to save energy by efficiently using the sun's heat.

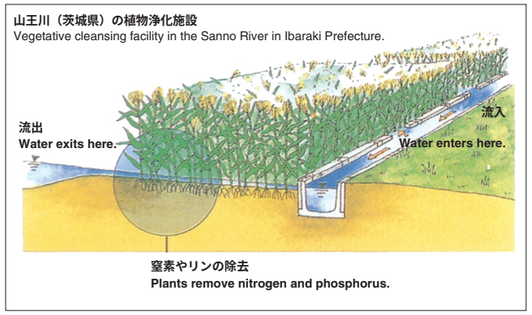
11. 建設工事環境改善技術の開発
地盤振動や騒音を抑える高周波杭打機
Development of technology for improving construction work environments
High-frequency pile-driving machine designed to reduce ground vibration and noise.

7 技術開発の成果／Results of Technology Development

技術開発の成果
Results of Technology Development

【総合技術開発プロジェクトの成果について】General Technology Development Projects: End Results

No.	研究課題名 Project name	研究期間 Period	予算額 Budget	主な研究開発成果	Main findings and other results
15	震災構造物の復旧技術の開発 **Development of repair technology for buildings and infrastructure damaged by earthquakes**	S56〜S60 1981-1985	￥344,533,000	1．地震により損傷を受けたり、耐久性が低下した土木構造物、建築物等について被災形状・程度に応じた復旧技術及び復旧の総合的評価手法を開発。 2．本開発を基に「土木構造物の震災復旧技術マニュアル（案）」、「建築物の震災復旧マニュアル（案）」をとりまとめた。これは、その後のわが国の地震被害の復旧法の基本として広く活用されている。 3．本研究成果を基に、道路施設に関しては、道路震災対策便覧－震災復旧編－（日本道路協会、S63.2）がまとめられた。 4．「土木構造物の震災復旧マニュアル（案）」は米国のニューヨーク大学地震工学研究センターにより英訳（Manual for Repair Methods of Civil Engineering Structures Damaged by Earthquakes）刊行され、平成元年サンフランシスコを襲ったロマ・プリエータ地震の復旧に有効に利用されると同時に、世界各国の地震被害の復旧に役立てられている。	1. Repair technology and general evaluation methods for repair were developed that are responsive to the type and extent of damage to infrastructure and buildings whose durability is impaired as a result of earthquake damage. 2. Based on the development of this technology, two draft manuals have been compiled (Manual of Repair Technology for Infrastructure Damaged by Earthquakes and Manual of Repair Methods for Buildings Damaged by Earthquakes) and have been widely used since then as the basis for the repair of earthquake-damaged structures in Japan. 3. Based also on the results of this research, a handbook of earthquake emergency measures for road facilities, specifically their restoration after an earthquake, was compiled in February 1988 by the Japan Road Association. 4. One of the above manuals, Manual for Repair Methods of Infrastructure Damaged by Earthquakes, has been translated into English at the New York University Seismic Engineering Research Center and used effectively in restoration work after the Loma Prieta earthquake that hit San Francisco in 1989 as well as in other post-earthquake repairs around the world.
16	湖沼の総合的水管理技術の開発 **Development of general lake and marsh water management technology**	S57〜S61 1982-1986	￥234,139,000	1．河川水を低湿地へ導入することにより自然浄化能力を活用した水質浄化技術の開発。 2．湖沼の総合的水質改善技術として土壌の浄化能力を活用した雑排水の土壌処理技術、流入河川における不織布脱水材によるろ過等の水質改善技術を開発。 3．湖沼の総合的管理手法マニュアルが作成され、霞ヶ浦や琵琶湖などの水質浄化に役立っている。	1. Technology was developed to redirect river water, letting it flow into and through low-lying marshy land to let plants exercise their natural cleansing action on the water. 2. Soil treatment and filtration technology was developed to treat tributary effluents using the cleansing power of soil and nonwoven materials as filters to improve water quality comprehensively in lakes and marshes. 3. A general lake and marsh water management method manual was compiled and has been useful in purifying water in Lake Kasumigaura and Lake Biwa.
17	建築物の防火設計法の開発 **Development of fire safety design methods for building**	S57〜S61 1982-1986	￥268,178,000	1．出火拡大防止・煙制御・耐火設計等で構成される総合防火設計法の作成。 2．建築基準法第38条に基づく大臣特認を受ける建築物に適用され、新しい建築技術の普及・拡大に役立っている。	1. General fire prevention design methods were established; they consisted of ways to prevent fires from spreading, control smoke, and design buildings to be fire-resistant. 2. These methods have been applied to buildings approved by the Minister of Construction based on Article 38 of the Building Standard Law and are contributing to the spread and development of new building technology.
18	雪に強い都市づくりに関する総合技術の開発 **Development of methods and technologies for city planning in snowy regions**	S57〜S61 1982-1986	￥203,554,000	1．積雪地域における降積雪に対する除排雪等を効率的に行うことを目的に道路管理等に必要な気象予測手法の開発を行った。 2．建築構造について、屋根の形態、雪おろし等を勘案した荷重設定指針の策定。 3．中心市街地における雪に強い交通体系・施設整備及び防雪街区整備に関する計画指針の策定。	1. Weather prediction methods were developed to operate efficient snow removal works for roads. 2. Design-load guidelines for architectural design in snowy regions were established, taking into account roof shapes and methods of snow-removal. 3. Guidelines were also established for planning traffic systems, facilities, and snow-defense districts to secure urban core areas against snowstorm damage and paralysis.
19	エレクトロニクス利用による建設技術高度化システムの開発 **Development of systems for upgrading building technology through the use of electronics**	S58〜S62 1983-1987	￥295,087,000	1．盛土の密度をリアルタイムに測定することを可能とするＲＩを活用した測定器を開発。迅速な施工管理が可能となるため広く活用。 2．レーザー光を利用したブルドーザの排土板制御技術を開発。排土板の位置・高さ・姿勢を自動制御することができ、オペレータの負担を軽減。 3．ロボットによる自動化施工に適した建築構法を開発し、その試行実験を行った。 4．建築の企画から設計、施工に至る生産過程の情報の標準化と情報処理体系を整備することにより、建築施工における生産性の向上等を図る上で役立っている。	1. Instruments were developed that use radioisotopes to enable real-time embankment density measurements. They are now used widely because they allow for swift construction management. 2. Technology for controlling bulldozer blades using laser beams was developed. This enables automatic control of blade position, height, and tilt, reducing operator stress. 3. Building processes that are adapted to robotized, fully automatic construction methods were developed and tested. 4. The resulting standardization of production process information and improvement of the information processing system throughout the construction process, from construction planning to design, are contributing to higher productivity in building construction.



16. 湖沼の総合的水管理技術の開発
自然浄化能力を活用した水質浄化技術
Development of general lake and marsh water management technology
Vegetation's natural cleansing power is harnessed to purify water using this technology.

19. エレクトロニクス利用による建設技術高度化システムの開発
ブロックの組積を自動で行うロボット
Development of systems for upgrading building technology through the use of electronics
Robots automatically collect and assemble blocks.

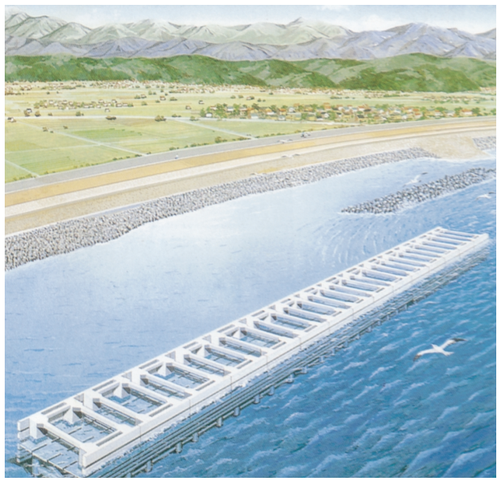
7 Results of Technology Development／技術開発の成果

技術開発の成果
Results of Technology Development

【総合技術開発プロジェクトの成果について】General Technology Development Projects: End Results

No.	研究課題名 Project name	研究期間 Period	予算額 Budget	主な研究開発成果	Main findings and other results
20	コンクリート耐久性向上技術の開発 **Development of technology to improve durability of concrete structures**	S60〜S62 1985-1987	￥543,846,000	1．コンクリート構造物の塩害とアルカリ骨材反応による早期劣化問題を契機として技術開発。 2．フレッシュコンクリート中の塩化物量測定方法を開発し、「フレッシュコンクリート中の塩化物量総量規制」として昭和61年６月通達。 3．前項を受けて、昭和61年度版JIS A 5308の「レディーミクストコンクリート」の改訂に「フレッシュコンクリート中の塩化物量総量規制」が盛り込まれる。 4．アルカリ骨材反応を生じる骨材の試験方法を開発。 5．安全な骨材の使用、低アルカリ型セメントの使用、抑制効果のある混合セメントの使用等の「アルカリ骨材反応暫定対策」を作成し、昭和61年通達。その後対策を見直し、「アルカリ骨材反応抑制対策」を作成し、平成元年７月通達。 6．前２項を受けて昭和61年度版JIS A 5308の「レディーミクストコンクリート」の改訂にアルカリ骨材反応対策が盛り込まれ、平成元年度版で修正がなされる。	1. Technology was developed to solve the problem of early deterioration of concrete structures due to alkaline aggregate reaction and salt attack. 2. A method of measuring chloride levels in fresh concrete was developed, and in June 1986 it was set forth in a Ministry of Construction notification: Regulations on Chloride Levels in Fresh Concrete. 3. Regulations on Chloride Levels in Fresh Concrete have since been incorporated in the 1986 edition of JIS A 5308, Ready Mixed Concrete. 4. Testing methods evaluating alkali reactivity of aggregate were developed. 5. Tentative countermeasures for alkaline aggregate reaction have been compiled, including the use of safe aggregate, low-alkalinity cement, and blended cement. A notification was sent out in 1986. These measures were later revised and compiled in a July 1989 notification, Measures to Minimize Alkaline Aggregate Reaction in Concrete. 6. Following items 4 and 5, Measures to Minimize the Alkaline Aggregate Reaction in Concrete were incorporated in the 1989 edition of JIS A 5308, Ready Mixed Concrete.
21	バイオテクノロジーを活用した新排水処理システムの開発 **Development of new wastewater treatment systems employing biotechnology**	S60〜H1 1985-1989	￥650,974,000	1．バイオテクノロジーを用いた下水処理手法として、有機物除去用（省面積型、エネルギー回収型）、窒素除去用のバイオリアクターを開発。また同時に高効率の汚泥処理バイオリアクターを開発。 2．下水道事業団大阪北東エースセンター、宮崎県都城市、三重県二見町の終末処理場等で本下水処理手法を活用。 3．窒素除去、小型化、省エネ化を可能とする高性能合併浄化槽の技術開発。 4．固定化微生物を用いたバイオセンサー（BOD、アンモニア性窒素）を開発。	1. Space-saving and energy-recovery bioreactors for removing organic substances and nitrogen from sewage using biotechnology were developed. High-efficiency sludge treatment reactors were also developed at the same time. 2. The resulting sewage treatment processes are being applied in Miyakonojyo City in Miyazaki Prefecture and at such full-scale treatment plants as the Futami-cho Chaya Clean Center in Mie Prefecture and Hokuto Ace Center in Osaka, run by the Japan Sewage Works Agency. 3. High-performance combined *jokaso* (purification vat) technology has been developed that removes nitrogen, saves space, and saves energy. 4. Biosensors using fixed microorganisms have been developed to detect biological oxygen demand and ammonium nitrogen.
22	海洋利用空間の創成・保全技術の開発 **Development of technology for creating and preserving marine space**	S61〜H2 1986-1990	￥341,212,000	1．沿岸域に多目的利用空間を創造するための１１種類の新しい消波構造物を開発し、その機能、構造設計法、施工法を明らかにした。 2．開発された消波構造物は、海域制御構造物といいＭＭＺ（マリン・マルチ・ゾーン）計画実現のための大水深消波構造物として位置付けられている。 3．開発された技術は、中部地方建設局のパイロット事業として駿河海岸・蒲原海岸・下新川海岸における新型離岸堤の建設に活用。 4．さらに長崎県のハウステンボスにおいて柔構造潜堤式（フレキシブルマウンド）が実用化され効果を上げている。	1. Eleven types of new wave-absorbing structures were developed to create multipurpose coastal and shoreline spaces. Their functions, structural design methods, and building methods were clarified. 2. The newly developed wave-absorbing structures are regarded as deep-water wave-control structures for implementing the Marine Multi-Zone (MMZ) plan, which is intended to control the coastal marine environment. 3. The technology is being used on a trial basis by the Chubu and the Hokuriku Regional Construction Bureaus to build new offshore breakwaters in the Suruga, Kambara, and Shimoniikawa coasts. 4. In Nagasaki's Huis ten Bosch resort area, "flexible mounds" are being put to effective use.
23	新木造建築技術の開発 **Development of new wooden housing construction technology**	S61〜H2 1986-1990	￥342,989,000	1．木造建築物の各部の応力、変形等について、安全性を確かめることができる構造設計体系を確立。構造計算マニュアル、加工・施工マニュアルを作成。また、結露害防止設計法並びに床衝撃音防止設計法が提案された。 2．体育館等の大空間を有する建築物や中層建築物などは、従来ほとんど木造以外の構造によっていたが、本研究により大断面木造建築物として建設が促進。 3．木造建築物における高さ制限の緩和、防火壁設置義務の免除等の建築基準の合理化（Ｓ62建築基準法改正）に活用された。	1. A structural design system was designed to enable stress and deformation safety to be verified in each part of wooden structures. Manuals on structural calculations and on processing and construction were produced. Design methods for preventing the damage caused by condensed-and for reducing the impact noise of floor structure were proposed. 2. In the past, it was very rare for gymnasiums and other large structures and moderately tall buildings to be built of wood. This research project promoted the construction of wooden buildings with large cross sections. 3. The research has been applied to the rationalization of building standards in the amended Building Standard Law of 1987, namely through the easing of limitations on the maximum height of wooden buildings and their exemption from the fire wall requirement.

21. バイオテクノロジーを活用した新排水処理システムの開発
滞留時間、反応槽容量をそれぞれ従来の1/2にした包括固定化窒素除去プロセス（下水道事業団大阪北東エースセンター）
Development of new wastewater treatment systems employing biotechnology
The comprehensive nitrogen fixing and removal process at Osaka's Hokuto Ace Center, run by the Japan Sewage Works Agency, halves previous retention times and reactor volumes.



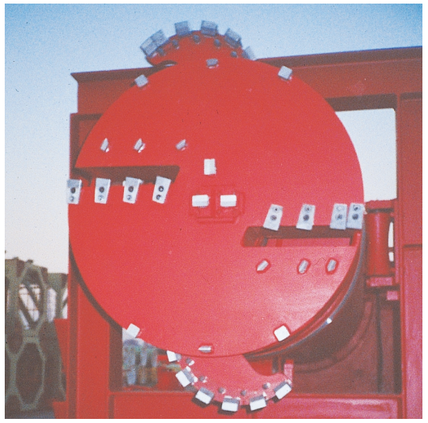
22. 海洋利用空間の創成・保全技術の開発
多目的海洋利用空間を創出するための消波構造物（下新川海岸）
Development of technology for creating and preserving marine space
Wave-absorbing structures, such as the one shown here along the coast at Shimoniikawa, create space by the shoreline that can be used for many purposes.

7 Results of Technology Development／技術開発の成果

技術開発の成果
Results of Technology Development

【総合技術開発プロジェクトの成果について】General Technology Development Projects: End Results

No.	研究課題名 Project name	研究期間 Period	予算額 Budget	主な研究開発成果	Main findings and other results
24	地下空間の利用技術の開発 Development of underground space utilization technology	S62〜H3 1987-1991	￥501,109,000	1．都市の高密度化に対し、大深度、大断面の地下空間の利用を可能とするため、建築計画技術、掘削工法、耐震設計法、止水工法等を開発した。都市部の地下空間利用を円滑にするため地中地図を試作した。また多数の地質ボーリングの結果を自動的に集約して図化する技術を開発した。 2．トンネルについては、大断面シールド（直径13メートルを20メートルへ）、楕円断面シールド等の研究開発を行った。特に東京など軟弱地盤での泥水シールドの切羽の安定等の研究は３車線道路トンネルを建設するのに必要な技術として、今後の事業への反映が期待されている。 3．都市の拠点地区における地下利用計画策定のための技術資料を作成。	1. Construction planning technology, excavation methods, earthquake-resistant designs, and water sealing methods were developed to enable the use of large underground spaces at great depths in response to overcrowding in cities. Underground mapping was tested as a way to facilitate the use of underground urban space. Techonology was also developed to automatically collect and graphically plot the findings of multiple geological borings. 2. R&D was also carried out on large-section (13-meter to 20-meter diameter) and elliptical-section shields for tunnel excavation. In particular, technology for promoting the stability of tunnel faces in mud shield tunnels, which is needed for the construction of three-lane automobile tunnels in soft ground such as the Tokyo area, is being counted on to facilitate future civil engineering projects. 3. Technical documentation was drawn up for the formulation of underground space utilization plans in key urban districts.
25	災害情報システムの開発 Development of disaster information systems	S62〜H3 1987-1991	￥344,100,000	1．災害状況の適確な把握と被災施設の復旧等の効率化のため、ヘリコプターに搭載したVTRカメラによる映像を地図の上にオーバーラップさせる技術、法面観測における熱映像ビデオ観測システムなどの基本技術を開発した。 2．河川、道路等の基幹施設の被災状況を迅速に把握し、災害情報を適切に伝達するシステムを開発した。 3．市街地の建築物の構造別比率データに基づき地震発生後の市街地火災の延焼拡大を予測し、それにより最も安全性の高い住民の避難誘導を支援するシステムを開発した。 4．建設本省、地方建設局、事務所、出張所に導入し、災害復旧に活用できる技術及びシステムを開発し、これを災害情報ガイドライン（案）（H４.３）としてとりまとめた。	1. Disaster information systems were developed, including a system for thermographic video observation of roadside embankments and technology for superimposing images taken using a VTR mounted on a helicopter onto maps in order to facilitate post-disaster assessment and more efficient repairs of damaged facilities. 2. A system was developed to swiftly assess the extent of damage to rivers and roads and other key facilities after a natural disaster and transmit this emergency information to control centers. 3. Based on categorical data on the percentage of damaged structures, a system was developed to assist people's evacuation to the safest locations by predicting the extent of the spread of fires in urban areas after an earthquake. 4. Technology and systems were developed which can be used for post-disaster reconstruction and they were adopted by the Ministry of Construction, regional construction bureaus, and local offices of the ministry. The technology and systems were then compiled into emergency information guidelines in March 1992.
26	長寿社会における居住環境向上技術の開発 Development of technology to improve the urban／housing environment in an aging society	S62〜H3 1987-1991	￥271,358,000	1．屋外通行部分におけるスロープや階段、浴室、便所等への手摺の設置、床の段差の解消などを内容とする「長寿社会対応住宅設計指針（案）」の作成。 2．上記内容を受け、公営住宅法に基づく公営住宅建設基準（建設省令）を改正（H３.７、H５.６）。 3．高齢化社会に対応した都市施設整備、地区整備の計画指針（案）を作成。	1. Draft Guidelines for Housing Design Responsive to the Needs of an Aging Society were compiled, calling for the installation of outdoor ramps and handrails for stairs, bathrooms, and toilets, and the elimination of steps between floor levels. 2. Based on these recommendations, public housing construction standards have been revised through a Ministry of Construction ordinance in accordance with the provisions of the Public Housing Law (July 1991, June 1993). 3. Draft planning guidelines for the upgrading of urban facilities and districts were compiled taking into account the aging of society.
27	建設事業への新素材・新材料利用技術の開発 Development of new materials utilization technology in the construction industry	S63〜H4 1988-1992	￥516,499,000	1．地盤注入材、被覆材料、コンクリート、盛土材料、FRPケーブルなどの新素材を土木構造物へ利用するための技術開発を行った。またこれらの材料の利用に当たって耐久性評価手法を研究した。 2．新素材利用のための指針（案）を作成し、試験施工により実用性を確認した。 3．繊維補強コンクリート・新金属材料、新機能性外装材などの新素材を建築物へ利用するための指針を作成。	1. Technology was developed to use such new materials as grouting materials, coating materials, concrete, banking materials, and fiber reinforced plastic cable in civil engineering work. Methods were also studied for evaluating the mechanical properties and the durability of these materials in actual use. 2. Guidelines for the use of new materials have been drafted and their practical utility has been verified in test construction work. 3. Guidelines have been formulated for the use of fiber-reinforced concrete, new metal materials, new high-performance sheathing materials, and other new materials in buildings.



24. 地下空間の利用技術の開発
楕円断面の掘削が可能なシールド
Development of underground space utilization technology
This shield can be used to excavate an elliptical section.

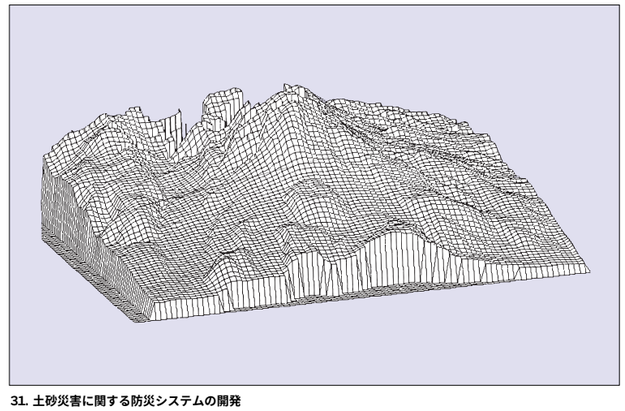
27. 建設事業への新素材・新材料利用技術の開発
発泡スチロールブロックを盛土の材料に利用したEPS工法
Development of new materials utilization technology in the construction industry
The EPS process uses styrofoam blocks to build embankments.

7 技術開発の成果／Results of Technology Development

技術開発の成果
Results of Technology Development

【総合技術開発プロジェクトの成果について】General Technology Development Projects: End Results

No.	研究課題名 Project name	研究期間 Period	予算額 Budget	主な研究開発成果	Main findings and other results
28	鉄筋コンクリート造建築物の超軽量・超高層化技術の開発 Development of super-lightweight, super-high-rise technology for structures made of reinforced concrete	S63〜H4 1988-1992	￥348,661,000	1．従来の鉄筋コンクリートの３〜４倍程度の強度を有する高強度コンクリートを用いた建築物の設計法、施工法等を整備。 2．開発された技術は、従来より長スパン（柱間隔）のフラットスラブ構造の建築物や超高層の建築物の建設への活用が見込まれる。	1. Design and construction methods using super-high-strength concrete having 3 to 4 times the strength of ordinary reinforced concrete were compiled. 2. This technology is expected to be used to build structures composed of flat slabs with longer spans (distances between pillars), and to build skyscrapers.
29	建設事業における施工新技術の開発 Development of new construction process technology	H2〜H6 1990-1994	￥825,490,000	1．建設工事における省人化を図るため、自動化オープンケーソン工法、自動化フィニシャーなどの自動化施工機械及び施工の自動化技術の開発。 2．工場生産の部材（ユニット鉄筋、埋設型枠、大型コンクリート二次製品等）を活用することにより、鉄筋コンクリート構造物の施工の合理化を図る技術の開発。 3．足場の組立・解体時の墜落事故を予防するユニット化した仮設足場組立・解体技術、建設機械と作業員等の接触事故をセンサーにより未然に防止する技術等の建設工事の安全性向上のための技術の開発。	1. Automated construction technology and construction machine technology were developed to automate such operations as open caisson work, asphalt finishing, etc., and to save labor in construction. 2. Technology was developed that will facilitate the rationalization of reinforced concrete structure construction by using factory-made components (unit reinforcements, buried forms, large precast concrete, etc.). 3. Technology was developed to improve the safety of construction work using unit scaffolding assembly and disassembly technology that prevents workers from falling during these operations and sensor and control technology that stop operations before dangerous contact between a worker and a construction machine.
30	社会資本の維持更新・機能向上技術の開発 Development of technology for maintaining, renovating and upgrading infrastructure	H3〜H7 1991-1995	￥662,199,000	1．橋梁、ダム・河川ゲート、海岸堤防、下水道施設の診断技術、耐久化、メンテナンスフリー化等の技術、トンネル壁面清掃自動化技術の開発。 2．ミニマムメンテナンス橋の提案、維持管理のための橋梁マネージメントシステムの開発。 3．建築物の過去の実績データに基づくライフサイクルコスト算定手法の開発。 4．建築物の高耐久性塗装、高耐久性金属材料の評価、設計手法等の開発及び改修・更新を考慮した設備計画・設計技術及び設備機器の開発。	1. Development of technology to diagnose the condition of bridges, gates for dams and rivers, shoreline embankments, and sewage facilities, to improve their durability, to lessen their need for maintenance, and to automate cleaning of tunnel walls. 2. Proposal of minimum-maintenance bridge designs and development of bridge management systems. 3. Development of methods for estimating life cycle costs based on past data for buildings. 4. Development of methods for evaluating and designing highly durable paints and metallic materials used in building, and development of technology and equipment for planning and designing facilities in which consideration is given to repair and renovation.
31	土砂災害に関する防災システムの開発 Development of landslide and pyroclastic flow disaster prevention systems	H4〜H7 1992-1995	￥278,750,000	1．火砕流本体部と熱風部に対する導流堤、フェンス等の応急対策工の開発。 2．溶岩ドームの計測手法と地形の定量化（数値地形モデルの作成）に基づく斜面安定解析による火砕流の危険区域の推定手法の開発。 3．大規模斜面滑動に対するAEセンサー、すべり面検知ケーブルによる監視技術の開発。 4．大規模斜面滑動の前兆現象の把握等による危険区域、危険度の推定手法の開発。	1. Development of emergency facilities, such as training dikes and fences, to prevent disasters caused by pyroclastic flows and hot ash clouds. 2. Development of methods for predicting hazardous areas in terms of pyroclastic flows generated by the collapse of lava domes based on techniques for measuring and quantifying the topography of lava domes (producing digital terrain models). 3. Development of monitoring technology using acoustic emission (AE) sensors and landslide detection cables for large-scale landslides. 4. Development of methods for predicting hazardous areas and estimating their degree of risk based on techniques for assessing precursor phenomena predictive of large-scale landslides.
32	省資源・省エネルギー型国土建設技術の開発 Development of resource- and energy-saving construction technology	H3〜H7 1991-1995	￥591,261,000	1．設計・計画段階において、土木構造物のライフサイクルを通じたエネルギー消費及びCO_2の排出量を予測する手法を開発し、省資源・省エネルギー型構造物を設計するためのガイドラインを開発した。 2．エネルギー消費量及びCO_2排出量の把握に必要な各種資機材のエネルギー及びCO_2原単位を作成し、建設工事に伴うエネルギー消費量及びCO_2排出量を把握することができるシステムを開発した。 3．常温型舗装及び省エネセメントの利用技術を開発し、現場へ導入するための利用技術指針（案）を作成した。 4．省資源・省エネルギー型地域・市街地を計画するためのガイドラインを策定した。	1. This project developed methods for predicting the amounts of energy consumed and CO_2 emissions during the life cycle of civil engineering works and buildings, and guidelines for the design of resource-saving and energy-saving structures. 2. A system was developed to estimate energy consumption and CO_2 emissions during construction work using energy consumption and CO_2 emission units for different types of raw materials and components, which were also obtained in this study. 3. Technology was developed to devise applications for energy-saving cement, as well as paving methods that do not require use of heated materials. Draft technology application guidelines were produced to facilitate their use at construction sites. 4. Guidelines were formulated to plan more resource-efficient and energy-saving regions and urban areas.



31. 土砂災害に関する防災システムの開発
雲仙普賢岳山頂付近の数値地形モデル
Development of landslide and pyroclastic flow disaster prevention systems
Digital terrain model of the summit of Unzen-Fugendake and surrounding vicinity by synthetic aperture radar

7 技術開発の成果／Results of Technology Development

技術開発の成果
Results of Technology Development

【総合技術開発プロジェクトの成果について】General Technology Development Projects: End Results

No.	研究課題名 Project name	研究期間 Period	予算額 Budget	主な研究開発成果	Main findings and other results
33	建設副産物の発生抑制・再生利用技術の開発 Development of methods for controlling construction by-product generation and methods for utilizing recycled materials	H4〜H8 1992-1996	￥592,193,000	1．建設発生土・建設汚泥、コンクリート塊等の建設副産物の発生抑制及び再生利用に関する技術開発。建設副産物の再生利用のための技術基準の策定。 2．「コンクリート副産物の再利用に関する用途別暫定品質基準（案）」通達（H６.４）。 3．「発生土利用基準（案）」通達（H６.７）。 4．「建設発生土利用技術マニュアル」を作成（H６.７）。 5．「建設汚泥再生利用技術暫定マニュアル（案）」を作成。	1. Development of methods to control the generation of construction by-products and the recycling of them, such as excess soil, sludge and concrete fragments. Establishment of technical standards and guidelines for the recycling of construction by-products. 2. Notification of the “Provisional Quality Standard for Recycling Concrete By-products (Draft)” (April 1994) 3. Notification of the “Standard for Recycling Construction Excess Soil (Draft)” (July 1994) 4. Compilation of the “Technical Manual on Recycling Construction Excess Soil” (July 1994) 5. Compilation of the “Provisional Technical Manual for Recycling Construction Sludge (Draft)” (February 1996)
34	美しい景観の創造技術の開発 Development of landscaping technology	H5〜H8 1993-1996	￥401,931,000	1．美しい市街地をつくるための、建築物と道路施設の計画・調整の技術的手法の開発。 2．橋梁（渡河部）の景観創造技術の開発。 3．河川施設の治水機能を保ちながら、生態系を保全・創造し、美しい河川景観を創造する技術の開発。 4．歴史的・文化的施設の評価手法と景観に配慮した施設の保存・活用技術の開発。 5．景観材として、色調やテクスチャーがいいコンクリート、表面に緑化ができるコンクリート材料の開発。 6．景観シミュレータとしてのCGシステムの開発。	1. Development of technology for the planning and coordination of building structures and road facilities to beautify urban areas. 2. Development of bridge landscaping technology. 3. Development of technology to preserve and create ecosystems and to landscape riverside areas attractively while continuing to take measures to control floods. 4. Development of technology for evaluating historical and cultural facilities and for their preservation and use with landscaping considerations in mind. 5. Development of types of concrete that are better suited for landscaping, with pleasant colors and textures and on whose surface plants can grow. 6. Development of computer graphics systems for use as landscape simulators.
35	大都市地域における地震防災技術の開発 Development of technology for earthquake disaster prevention in large metropolitan areas	H4〜H9 1992-1997	￥649,264,000	1．地形・地盤条件変化部における地震動増幅の評価法の開発。 2．大地震時における液状化判定手法の開発。 3．近接構造物等の新しい形式の都市構造物の耐震計算法の開発。 4．軟弱地盤における構造物の地下・基礎部分の耐震設計法の開発。 5．都市域でも適用可能な液状化・流動化対策工法の開発。 6．都市域における断層調査法の開発。 7．RC構造物の地震時せん断耐力の評価法等の震前対策に関する技術の開発。 8．非破壊検査による地中構造物の被災度判定手法及びマイクロパイルによる杭基礎の補強法等の震後対策に関する技術の開発。 9．軟弱地盤におけるセメント系固化材を用いた改良地盤の設計及び品質管理技術の開発。 10．新技術による既存建築物の耐震性向上技術の開発。 11．上記５.の検討成果に基づき、「河川堤防の液状化対策工法設計施工マニュアル（案）」、「液状化対策技術マニュアル（案）」をとりまとめ、前者は、河川堤防の耐震対策技術に活用されている。また、本課題の成果は、兵庫県南部地震後の各種構造物の耐震設計の高度化に活用されている。	1. Estimation methods for seismic ground motion amplification in areas where topographic and ground conditions change. 2. Estimation methods for liquefaction potential during large earthquakes. 3. Seismic design methods of new types of urban structures, including adjacent structures. 4. Earthquake resistant design methods for underground portions and foundations of structures built on soft ground. 5. Countermeasures against liquefaction and ground flow that can be applied even in urban areas. 6. Fault detection methods for urban areas. 7. Technology for pre-earthquake measures, such as methods for evaluating shear strength of existing RC structures under seismic load. 8. Technology for post-earthquake measures, such as methods for assessing damage to underground structures through non-destructive inspections and methods for reinforcing pile foundations with micropiles. 9. Design and quality control of improved ground with soil-cement for soft grounds. 10. Increase seismic ability of existing buildings using new technology. 11. “Design Manual of Countermeasures Against Liquefaction of Subsoil with River Dikes (Draft)” and “Design Manual of Countermeasures Against Liquefaction (Draft)” were compiled on the basis of paragraph 6 above and the former is used in the seismic strengthening of river dikes. In addition, the results of this work are used to improve the earthquake-resistant design of various structures following the Hyogoken Nanbu earthquake.

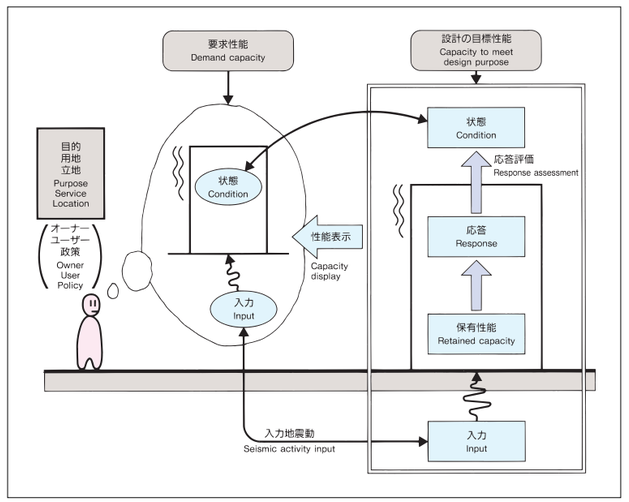
34. 美しい景観の創造技術の開発
橋梁（渡河部）の景観創造技術（広島市・鶴見橋）
Development of landscaping technology
Technology for creating landscapes surrounding bridges (across rivers)
(Tsurumi Bridge, Hiroshima)

7 技術開発の成果／Results of Technology Development

技術開発の成果
Results of Technology Development

【総合技術開発プロジェクトの成果について】General Technology Development Projects: End Results

No.	研究課題名 Project name	研究期間 Period	予算額 Budget	主な研究開発成果	Main findings and other results
36	防・耐火性能評価技術の開発 Development of assessment methods for fire safety performance	H5〜H9 1993-1997	￥376,906,000	1．実際の火災の特性に応じた建築材料・構法・設備の試験方法の確立。 2．国際調和に適した試験法の技術的内容の開発。 3．海外試験機関における試験結果の相互認証システムの開発。 4．規格・認証制度の国際化に対応できる新防・耐火性能評価技術の確立。	1. Establishment of test methods for building materials, construction methods, and facilities conforming to actual fire conditions. 2. Development of technical details for testing methods in conformity with international agreements. 3. Development of reciprocal confirmation systems for results of tests conducted by foreign testing organizations. 4. Establishment of new fire prevention and resistance assessment methods adaptable to international regulations and certification systems as they are implemented.
37	新建築構造体系の開発 Development of a new engineering framework for building structures	H7〜H9 1995-1997	￥491,281,000	1．性能評価に基づく建築構造体系の提示。 2．性能評価の工学的意義を明確にした「性能評価指針（案）」の開発。 3．性能評価シートによる性能表示方法の開発。 4．目標性能設定の枠組み（水準設定の要因と構造）の提示。 5．目標性能設定にかかわる基本事項（現行水準、許容リスク、社会が求める性能水準）の研究・整備。 6．性能指向の体系に対応した社会機構の提示。 7．建築基準法令の性能規定化に向けての原案提示。	1. Presentation of a new engineering framework based on performance assessments. 2. Development of (proposed) performance assessment guidelines that clarify the engineering significance of performance assessments. 3. Development of performance indication methods using performance assessment sheets. 4. Presentation of a framework (standards and organization) for setting target performance. 5. Research and development of basic items related to the setting of target performance (current levels, permissible risk, performance levels requested by society). 6. Presentation of social mechanisms responsive to performance-oriented systems. 7. Presentation of a draft aimed at the stipulation of performance in the Building Standard Law.
38	次世代鋼材による構造物安全性向上技術の開発 Development of structural safety improvement technology utilizing new-generation steel	H8〜H10 1996-1998	￥291,461,000	1．次世代鋼材の利用可能性の評価を行った。 2．鉄筋のガス圧接継手の新たな品質管理、検査指針（案）を作成した。 3．鋼材の靭性値、溶接方法、接合詳細、骨組特性等を考慮した鋼構造建築物の設計指針（案）を作成した。	1. Evaluation conducted of the utilization possibilities of new-generation steel. 2. Preparation of an examination and quality control guideline (proposed) for gas pressure welding joints made of reinforcing bars. 3. Preparation of a design guideline (proposed) for steel structure buildings, taking into account toughness of steel, welding methods, joint details, and frame characteristics.
39	統合情報システム活用による建設事業の高度化技術の開発 Development of advanced construction technologies using CALS	H8〜H10 1996-1998	￥436,695,000	1．建設事業の各段階において、受発注者間で受け渡す地形・地質・測量・設計・施工情報の交換基本ルールを提案した。 2．デジタル写真の要件を提案し、デジタル写真管理基準改訂案をとりまとめた。 3．建設事業を通して効率的に図面情報を活用するためにCAD製図基準（案）を作成した。 4．施工段階において受注者から発注者へ電子データを納品する際のフォルダ構成を定めた納品ガイド（案）を作成した。 5．建設事業における情報共有システムの構築マニュアル（案）を作成した。 6．建設事業における情報を統合的に管理する統合情報データベースシステムを提案し、現状の建設生産システムの効率化を図るための建設生産情報管理、情報の共有化、支援情報のあり方を提案した。 7．建設事業の設計から施工、維持管理にわたる一貫したプロセスモデルを提案した。 8．統合情報システムを活用した建設生産情報管理モデルを提案し、建築生産システムのあり方、及び情報技術の要件を提案した。	1. At each level of the construction project, basic rules for the exchange of information about topography, geology, surveys, plans, and the progress of construction were proposed. 2. Requirement for digital photographs were surveyed, and a proposal for revision of the management standards for digital photographs was compiled. 3. Preparation of making CAD data (proposed) in order to use data efficiently through construction process. 4. Preparation of delivery guidelines defining the folder configuration the order client should use when delivering electronic data to order placer in the construction phase. 5. Preparation of a manual (proposed) for construction an information-sharing system for construction projects. 6. An integrated database system for managing all information pertaining to construction production system more efficient, proposals were made for construction production information management, information sharing, and general guidelines for supporting information. 7. Continuous process models were proposed to cover the various stage of construction projects: planning, implementation, maintenance. 8. A construction production information management model using an integrated information system was proposed, proposals were also made for general guidelines for construction production system and information technology requirements.



37. 新建築構造体系の開発
性能を基盤とした設計のコンセプト
Development of a new engineering framework for building structures
Design concept based on capacity.

7 技術開発の成果／Results of Technology Development

官民連帯共同研究終了課題一覧

Completed Joint Public-Private Research

NO.	課題名／Project name	研究期間／Period
1	**外装材の補修・改修技術の開発** Improvement of techniques for repair of existing exterior wall and roof waterproofing systems	S61〜S63／1986-1988
2	**路車間情報システムの開発** Development of road/automobile information systems	S61〜S63／1986-1988
3	**室内環境の最適化システムの開発** Development of systems for optimizing indoor environments	S62〜H1／1987-1989
4	**既設構造物の点検・補修システムの開発** Development of systems for inspection and repair of existing structures	S62〜H1／1987-1989
5	**小口径管渠掘進制御システムの開発** Development of small-bore tunneling operation control systems	S63〜H2／1988-1990
6	**衛星測量システムの建設事業への応用技術の開発** Development of technology for applying surveying systems to construction work	S63〜H2／1988-1990
7	**道路橋の免震構造システムの開発** Development of isolation systems for highway bridges	H1〜H3／1989-1991
8	**建築物のノン・アスベスト化技術の開発** Development of asbestos abatement techniques in buildings	H1〜H3／1989-1991
9	**建築構造物の制振構造の実用化技術の開発** Development of active seismic control of building structures	H2〜H4／1990-1992
10	**建築設備の劣化診断システムの開発** Development of a deterioration diagnosis system for building equipment	H2〜H4／1990-1992
11	**緑化空間創出のための基盤技術の開発** Development of basic technology for creating space for flowers and greenery	H3〜H5／1991-1993
12	**地図情報の自動認識システムの開発** Development of systems for automatic recognition of map information	H3〜H5／1991-1993
13	**ICカードによる施工情報システムの開発** Development of construction site management systems using IC cards	H4〜H6／1992-1994
14	**新地盤探査技術の開発** Development of new techniques for subsurface exploration	H4〜H6／1992-1994
15	**有機系接着剤を利用した外装タイル・石張システムの開発** Development of exterior tile and finishing stone surfacing systems using organic adhesives	H5〜H7／1993-1995
16	**高性能・高機能性コンクリートの開発** Development of high-performance heavy-duty concrete	H5〜H7／1993-1995
17	**住宅・建築物のコスト低減に資する設備のモジュール化技術の開発** Development of modular technology for building equipment for cost reduction of housing and building	H6〜H8／1994-1996
18	**地域内物資集配送システムの開発** Development of a community material collection and transport system	H6〜H8／1994-1996
19	**構造物の防汚技術の開発** Development of dirt-proofing technology for structures	H7〜H9／1995-1997
20	**効率的な湖沼底泥処理技術の開発** Development of technology for processing mud at lake and marsh bottoms	H7〜H9／1995-1997
21	**GISの標準化に関する調査** Research on GIS standardization	H8〜H10／1996-1998
22	**建築物における基礎杭の性能評価技術の開発** Development of new evaluation technology for piles	H8〜H10／1996-1998
23	**地盤環境保全型建設技術の開発** Development of soil environment preservation construction technology	H9〜H11／1997-1999
24	**健康的な居住環境形成技術の開発** Development of technology contributing to a wholesome residential environment	H9〜H11／1997-1999