

Road environmental impact assessment and preservation technology

1. Outline of Studies and Activities

Social and Road Administration Movements	Activity			
	① Roadside air quality	② Road traffic noise	③ Natural environment	④ Conceptual stage
1995 Supreme Court Decision on National Highway 43 Lawsuit				2009 Publication of NILIM Technical Note “Guidelines for the Planning Process at the Conceptual Phase of Public Works (Commentary)” ¹⁷⁾
1998 Road Council Report Revision of Environmental Noise Standards (From L ₅₀ ¹⁾ to L _{eq} ²⁾ evaluation)				
1999 Environmental Impact Assessment Law fully enforced	2000 Publication of the first edition of the “Environmental Impact Assessment Technique for Road Projects”			
2001 Amendment of Automotive NOx/PM Law (PM added to regulations)		2001 Publication of “Study on Calculation and Evaluation Method for Road Traffic Noise in a Roadside Built-Up Area” ⁵⁾	2002 Publication of “Study on the Function of Road Spaces as Biotope” ¹²⁾	
2003 Publication of “Guidelines for Public Participation Procedures at the Conceptual Stage of Public Works Projects under the Jurisdiction of the Ministry of Land, Infrastructure, Transport and Tourism”	2003 Publication of “Calculation Base for Motor Vehicle Emission Factors” ³⁾	2004 Revision of “Technical Methodology for Road Traffic Noise” ⁶⁾	2004 Publication of “Study on Conservation of Mammal Habitat” ¹³⁾	
2006 Revision of Competent Ministerial Ordinance (Technical Guidelines) for Environmental Impact Assessment	2007 Publication of the fully revised version of the technical method ¹⁾ corresponding to the revision of the Competent Ministerial Ordinance (Technical Guidelines)			
2008 Issuance of the Administrative Vice Minister’s Circular “Guidelines for the Planning Process at the Conceptual Stage of Public Works”		2010 Publication of “Durability on Noise Reduction Effect and Condition of Double-Layer Porous Asphalt Pavement” ⁷⁾	2007 Publication of a collection of case studies of environmental conservation measures for animals, plants, and ecosystems	
	2012 Revision of “Calculation Base for Motor Vehicle Emission Factors” ⁴⁾	2011 Revision of “Technical Methodology for Road Traffic Noise” ⁸⁾		
2013 Full enforcement of the revised Environmental Impact Assessment Law *Addition of the Letter of Consideration procedure and Reporting procedure	2013 Publication of the completely revised version of the technical method accompanying the addition of the Letter of Consideration procedure and the Reporting procedure ²⁾			
		2014 Publication of “Reference Book on Road Traffic Noise Abatement Measures” ⁹⁾	2013 Publication of “Case Studies (2012 Edition)” ¹⁴⁾	
		2015 Revision of “Technical Methodology for Road Traffic Noise” ¹⁰⁾	2016 Publication of “Case Studies (2015 Edition)” ¹⁵⁾	
		2020 Revision of “Technical Methodology for Road Traffic Noise” ¹¹⁾		

Note 1: L_{50} (Tile noise level of 50%), the noise level corresponding to the median of the noise levels that vary within a certain time period.

Note 2: L_{eq} (Equivalent noise level), the noise level corresponding to the average of the total energy of the fluctuating noise within a certain time period

1) Background Events, Social Changes, etc.

From the 1970s to the 1990s, a series of lawsuits were filed against road administrators in the Tokyo metropolitan, Chukyo, and Hanshin areas for air pollution and noise damage, and the courts found the road administrators liable. In 1998, the Road Council issued a report entitled “Toward the Realization of a Better Roadside Environment” in response to these lawsuits, and it was decided that road administrators would further promote environmental measures.

In addition, environmental noise standards were revised in 1998, and the Environmental Impact Assessment Law was fully enforced in 1999, establishing a new procedure for method statements for environmental impact assessments and expanding the scope of opinion hearings. Due to these changes, it became necessary for road developers to enhance their technical knowledge in conducting surveys, forecasts, and evaluations of environmental impacts and environmental measures.

Furthermore, the importance of obtaining the public’s understanding from the conceptual stage of social infrastructure projects has increased, and public involvement (PI) is now being implemented to obtain a wide range of opinions from various stakeholders and reflect them in the planning. The environmental impact assessment procedure is now required at the conceptual stage of a project, and was newly established in 2013 as a procedure for a letter of consideration. In response to these changes, it became necessary to ensure transparency, objectivity, rationality, and fairness in the planning process as well as the appropriateness of the plan itself for road projects, and to enhance the knowledge for smooth implementation of environmental impact assessments.

2) Outline of Research and Activities

Based on the results of professional and technical studies and research on environmental impact assessments, we published a guide for road developers, “Environment Impact Assessment Technique for Road Projects” (hereinafter referred to as “Technical Methodology”), in 2000. Since then, we have continued to conduct surveys and studies that contribute to reducing the environmental impact of road projects, and have revised the Technical Methodology and prepared case studies based on the results of the following studies ① to ④.

① Development and improvement of roadside air quality forecasting and evaluation methods

Roadside air quality is affected by chemical reactions between the air pollutants in vehicle emissions, roadside background concentrations (concentrations from sources other than the subject road), meteorological conditions, and ozone in the air. In particular, air pollutants in automobile exhaust gas were expected to decrease in the future as regulations were tightened year by year. Therefore, we improved the prediction and evaluation methods for roadside air quality, including the calculation and revision of air pollutant emissions per vehicle km (emission factor), by analyzing atmospheric observation data and measuring vehicle exhaust gas under actual driving conditions.

② Development and improvement of prediction and evaluation methods for road traffic noise

Noise measurements and model experiments were conducted along roadsides and at NILIM’s premises to improve the prediction methods for road traffic noise (e.g., noise calculation method behind buildings in urban areas, development of noise prediction methods around intersections, etc.) and to understand the noise reduction effects of sound barriers and low-noise pavement, for which various new technologies were being developed.

③ Development of conservation technologies to reduce the impact of road projects on the natural environment

Field surveys and demonstration experiments were conducted to establish and improve technologies for creating habitats and alternative habitats (biotopes, etc.), preventing roadkill by dividing animal migration routes, preserving raptor nesting environments, and transplanting rare plants. In addition, we surveyed environmental conservation case studies that could be used as references in other projects, and prepared a systematically organized collection of case studies.

④ Development of a planning process and environmental assessment method for road projects at the conceptual stage

The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) drafted guidelines with advice from experts on the concept and mechanism (planning process) for formulating appropriate plans for public works projects by evaluating and examining them from social, economic, environmental, and other perspectives while widely obtaining the opinions of stakeholders through PI. Explanatory materials were also prepared for practitioners.

In addition, the “Letter of Consideration” procedure introduced by the revision of the Environmental Impact Assessment Law is positioned as an assessment of the environmental aspects of the planning process at the conceptual stage, and we prepared methods for surveying, predicting, and assessing the environmental impact according to the planning maturity level at the conceptual stage.

2. Main Research Results

① Development and improvement of roadside air quality forecasting and evaluation methods

In the environmental impact assessment of road projects, the amount of air pollutants emitted from vehicles is one of the key factors in the prediction of roadside air quality. To determine this quantity, the volume of traffic by vehicle type and the amount of air pollutants emitted when one vehicle of each type travels one kilometer (emission factor) are required. The emission factor is expressed as a function of the average driving speed, which changes from year to year due to changes in the composition of vehicle types by year and stricter emission regulations. In the evaluation of road and street projects, emission coefficients are also used to calculate the reductions in NO_x, SPM, and CO₂ emissions resulting from an increase in the average driving speed due to road maintenance.

For this purpose, NILIM conducted measurements using a chassis dynamometer (Photo 1), which is an exhaust gas measurement device that simulates actual driving, and also studied the composition of vehicles on the road by year and model, and calculated the emission factors that take into account the fact that different emission regulations apply to different years and models of vehicles. From these studies, it was found that due to stricter emission regulations in recent years, SPM emissions for heavy duty vehicles, for example, will be reduced by 90% from 2018 (FY2000 estimate) to 2030 (FY2010 estimate) (Figure-1). The emission factors obtained were reflected in the technical method for air quality related to vehicle driving, etc., and in the method for calculating NO_x, SPM, and CO₂ emissions in the evaluation of road and street projects.

② Development and improvement of prediction and evaluation methods for road traffic noise

In the field of road projects, it is required to predict noise under complex conditions in urban areas and to predict the effects of environmental preservation measures using new technologies.

To this end, NILIM developed a noise calculation method behind buildings and a noise prediction method around intersections, as well as clarifying the noise reduction effect of two-layer drainage pavement (1 to 3 dB less than normal drainage pavement)



Photo-1 Emission gas measurement simulating actual driving

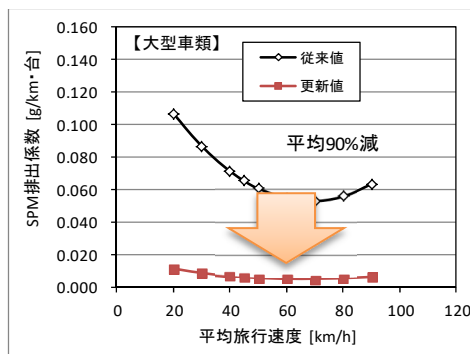


Figure-1 Reduction of SPM emission factors for heavy duty vehicles

through actual measurements (Figure-2). The results obtained were reflected in the ASJ RTN, a road traffic noise prediction model developed by the Acoustical Society of Japan. In addition, based on the findings of the Acoustical Society of Japan, which are presented when the ASJ RTN is revised every five years, the technical method for noise related to automobile driving was revised approximately once every five years.

③ **Development of conservation technologies to reduce the impact of road projects on the natural environment**

In order to reduce the impact of road projects on the natural environment, various conservation technologies are required for different types of rare plants and animals.

For this reason, NILIM prepared and published technical materials for road developers on technologies to reduce the impact of roads (roadkill, etc.) on the migration routes of mammals and other animals, and on technologies to create habitats and alternative habitats (biotopes, etc.) that will be lost due to road projects. In addition, with the advice of experts, NILIM conducted demonstration tests on rare plants that were considered difficult to transplant, and verified the effectiveness of conservation techniques using transplantation and seeding (Photo 2). Furthermore, among the examples of conservation of the natural environment implemented by road developers in various regions, those that can be used as references for other projects were categorized, organized, and published as a collection of case studies.

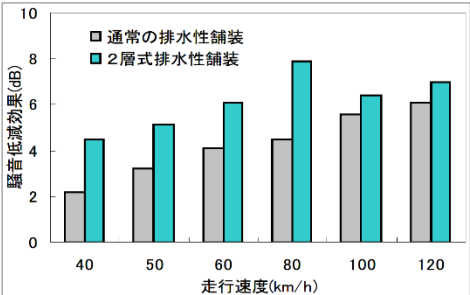


Figure-2 Comparison of noise reduction effect between

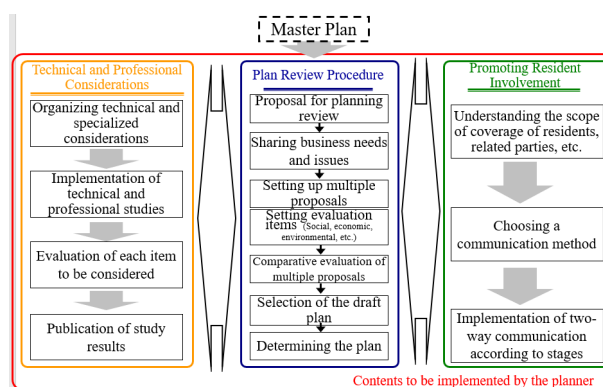


Photo-2 Verification of rare plant transplantation techniques

④ Development of a planning process and environmental assessment method for road projects at the conceptual stage

In order to ensure that the planning process comprehensively considers various aspects such as social, economic, and environmental aspects, NILIM prepared a draft of the “Guidelines for the Planning Process of Public Works at the Conceptual Stage,” a directive issued by the Administrative Vice Minister of MLIT, and also prepared and published explanatory materials for the guidelines.

The Letter of Consideration procedure for environmental impact assessments corresponds to the environmental aspects of the establishment and comparative evaluation of multiple alternatives in the conceptual planning process (Figure-3). Therefore, a technical basis was needed to enable road developers to smoothly implement the Letter of Consideration procedure consistent with this process, and NILIM examined the study, forecasting, and evaluation methods for multiple proposals for a wide route strip in the conceptual phase, and revised the technical methodology.



(Evaluation of environmental aspects in the central red box corresponds to the Letter of Consideration procedure of the environmental impact assessment.)

Figure-3 Positioning of the planning process and the Letter of Consideration procedure in the conceptual phase
(Additions to explanatory material)

3. List of Related Reports and Technical Documents

- 1) “Environmental Impact Assessment Technique for Road Projects (FY2007 Edition),” NILIM Technical Notes No. 382-400
- 2) “Environmental Impact Assessment Technique for Road Projects (FY2012 Edition),” NILIM Technical Note No. 714
- 3) “Calculation Base for Motor Vehicle Emission Factors,” NILIM Technical Note No. 141
- 4) “Grounds for the Calculation of Motor Vehicle Emission Factors Using Environmental Impact Assessments of Road Projects, etc. (Revision of FY2010),” NILIM Technical Note No. 671
- 5) “Study on Calculation and Evaluation Method of Road Traffic Noise in a Roadside Built-Up Area,” NILIM Technical Note No. 2
- 6) “Environmental Impact Assessment Technique for Road Projects (2) (Revision of FY2004),” NILIM Technical Note No. 153
- 7) “Durability on Noise Reduction Effect and Condition of Double-Layer Porous Asphalt Pavement,” NILIM Technical Note No. 573
- 8) “4. Noise 4.1 Noise Caused by Road Traffic (Revision of FY2010) Environmental Impact Assessment Technique for Road Projects,” NILIM Technical Note No. 617
- 9) “Reference Book on Road Traffic Noise Abatement Measures (2014),” NILIM Technical Note No. 806
- 10) “4. Noise 4.1 Noise Caused by Road Traffic (Revision of FY2014) Environmental Impact Assessment Technique for Road Projects,” NILIM Technical Note No. 842
- 11) “4. Noise 4.1 Noise Caused by Road Traffic (Revision of FY2020) Environmental Impact Assessment Technique for Road Projects,” NILIM Technical Note No. 1124
- 12) “Study on the Function of Road Spaces as Biotope - Toward the Formation of an Ecological Network,” NILIM Technical Note No. 29
- 13) “Study on Conservation of Mammal Habitat – Investigation on Prevention Measures Against Animal Roadkill,” NILIM

Technical Note No. 152

- 14) “Technical Reference on Environmental Impact Assessment Technique for Road Projects - Fauna, Flora and Ecosystem on 1. Planning Stage Consideration Items,” NILIM Technical Note No. 720
- 15) “Technical Reference on Environmental Impact Assessment Technique for Road Projects - Examples of Environmental Conservation Measures on 13. Fauna, Flora, and Ecosystem (Revision of FY2015),” NILIM Technical Note No. 906
- 16) “Vice Minister of Land, Infrastructure, Transport and Tourism Official Notice for Strategic Environmental Assessment,” NILIM Technical Note No. 46
- 17) “Guidelines for the Planning Process in the Conceptual Phase of Public Works (Commentary),” NILIM Technical Note No. 533

4. Future Outlook

Compared to when the Environmental Impact Assessment Law was enacted, measures have been taken for both roads and automobiles, and environmental issues have been resolved on roads. On the other hand, since new road construction and reconstruction projects are scheduled for implementation in the future, we will continue to develop and disseminate environmental impact assessment and conservation technologies based on the latest scientific knowledge in order to avoid or reduce environmental impacts caused by projects and ensure transparency, objectivity, rationality, and fairness in environmental impact assessments.