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Environmental Assessment for Small- and Medium-Scale Road Projects Implemented in Local Authority Areas: A Case Study from Thailand

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Abstract: In developing countries like Thailand, an Environmental Assessment (EA) is conducted only for projects prescribed by environmental legislation. Numerous projects, especially those that are small- and medium-scale in size and scope, are implemented in areas by a local authority without any type of EA. Based on a comparative analysis of the environmental status of large-, medium- and small-scale road development projects implemented by a local authority in Thailand, this paper attempts to justify the enforcement of EAs for medium- and small-scale projects. The justification is mainly based on the perceptions of people affected by these projects. Environmental impact scores, computed on the basis of people's perceptions, reveal that, irrespective of the size of a project, the impacts caused by different sized projects are perceived as similar. Since every development project is implemented for the purpose of human development, this paper proposes to integrate environmental screening and initial EAs into the existing development control measures enforced by urban planning regulations and laws.

Keywords: Environmental assessment, Local authority, Road development projects, Small- and medium-scale projects, Environmental impacts

INTRODUCTION

Rapid urban growth and urbanisation cause numerous problems in the cities of developing countries. Urban local authorities try to solve these problems by implementing various strategies that include developing infrastructure and services, housing and settlements, alleviating urban poverty, improving slums, securing land tenure and controlling land usage. Managing urbanisation in developing countries is a very challenging task, especially in the context of cities growing beyond administrative limits without the adequate support of infrastructure networks, land usage planning and development control.

Bangkok, the capital of Thailand, for example has grown over its limits and now encompasses the surrounding five provinces to form a mega city. Since it was established 200 years ago, the city has grown steadily in size and function. Originally, the city only covered 4.14 square

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kilometres (km^2). Presently, the city covers an area of 1,568.73 km^2, and is divided into 50 districts. The population of Bangkok has increased from 1.6 million in 1958 to 5.6 million in 1999 (BMA, 2000). The registered population of the city is around 7 million people while the day time population is around 10 million. In parallel to the increase in population, the urban area of Bangkok has grown far beyond the established boundaries of the city and into the five neighbouring provinces—Nakhon Pathom, Nonthaburi, Pathumthani, Samuth Prakarn and Samuth Sakorn—to form the Bangkok Metropolitan Region (BMR). However, strict urban planning regulations are limited to the city limits known as the Bangkok Metropolitan Administration (BMA) area. The areas beyond the city limits are under the jurisdiction of the respective provincial and local governments where urban planning regulations are not as stringent as those of BMA. The capacity for urban development control and environmental management in the areas adjacent to the city limits are often very weak. This means that the inner city area governed by the BMA is subject to stringent urban planning and environmental management regulations, while the outer city areas governed by the respective provincial administration grow haphazardly without adequate developmental control and environmental management. Numerous small- and medium-scale projects are implemented in the outer city areas by both the public and private sectors without the supervision of proper developmental control and environmental assessments. To overcome this deficiency, the Department of Local Administration (DoLA) under the Ministry of Interior has recommended that the local authorities, such as the municipalities and Tambon Administration Organisations (TAO)[1] set up committees to oversee local development projects (Mongkolchaiarunya, 2003). These committees should be composed of the mayor or administrator as the chairperson, as well as representatives from the municipality or TAO, government offices, academic institutions, NGOs, local communities, civic groups and the private sector. One task for this committee is to develop an Environmental Management System (EMS) at the local government level. However, this task is quite challenging for most local authorities and therefore, they are unable to follow the recommendations of the DoLA. One of the main reasons why it is difficult to construct an EMS is the absence of a separate unit in charge of environmental management at the local authority level. In reality, environmental management is a task that is divided among several divisions such as public works, public health, public safety, community development and development planning; in other words, there are several Local Government Units (LGUs)

1 Tambon Administration Organization (TAO) is the smallest body of local administration in Thailand. TAOs manage development work at the Sub-district (Tambon) and Village (Muban) levels and function the direct Supervision at the District (Amphor) Head office.

throughout its hierarchy. While the higher order LGUs, such as Nakhorn Municipalities, are capable of coordinating environmental management tasks among the different divisions, the lower order LGUs such as TAOs struggle to integrate environmental management into their routine work, since environmental expertise is lacking at this lowest level of local administration.

The decentralised administration systems that have been functioning in Thailand since 1999 have delegated decision-making on development initiatives to local authorities under the purview of the provincial administration (Mongkolnchaiarunya, 2005). However, environmental management tasks pertaining to these development initiatives are not yet fully functional at the local authority level. The directive by DoLA for local authorities to set up EMS at the local government level suggests an increase in the capacities of LGUs to perform these tasks.

As a result of the present deficiency in environmental management, numerous development projects, especially infrastructure development projects, are implemented by local authorities in Thailand without enforcing adequate development control and environmental management measures. Since only large-scale and prescribed projects are legally required to receive an Environmental Impact Assessment (EIA) and a mitigation process, there is no legal provision that enforces EAs for medium- and small-scale projects that are implemented within these municipalities; they can only be subjected to development control measures under the existing planning regulations. This paper argues for EAs for small-scale projects overseen by local authorities as part of a development control process in lieu of a legally enforceable EIA. We argue that project-based environmental management under the existing development control procedure is a more viable alternative for local authorities than a comprehensive EMS. To demonstrate this idea, this paper first presents an analysis of the environmental impacts caused by some large-, medium- and small-scale road development projects that have been implemented by a local authority in the periphery of the BMR. On the basis of the findings, this paper highlights the need for an EA as part of the development control process for medium- and small-scale projects.

THE NEED FOR ENVIRONMENTAL ASSESSMENTS OF MEDIUM- AND SMALL-SCALE PROJECTS

Since the introduction of EIA in the USA through the national Environmental Policy Act of 1969, many developed countries have adopted the EIA policies (Mokhehle and Diab, 2001). By contrast, the adoption of EIAs in developing countries has been slow, as developmental goals take priority over environmental concerns. However, this situation has changed since the late 1980s, mainly as a result of the Rio Earth Summit in 1992 (Lee and George, 2000). International funding agencies have also played a major role in promoting the use of EIA procedures (Glasson et al., 1999). One of the major hindrances to the use of EIAs as an effective environment tool is that the environment has a low priority in political matters; the underlying development imperative that characterises many developing countries tends to regard the EIA as an anti-development tool (Abaza, 2000). EIAs are seldom integrated into the developmental planning process, being viewed as an independent process with environmental consultants often working separately from the main project and planning process. As a result, the outcome of an EIA often fails to influence decisions (Lee and George, 2000).

During the time when EIA was becoming a popular environmental management tool, UNEP (1988) recommended that an EA or considerations to be incorporated in every stage of the project cycle. In other words, even without a legal mandate, an EA should play a part in every decision-making stage of a project. In the same way, the professionals who engage in project planning, designing, detailing, implementation, construction and post-construction monitoring are expected to incorporate EAs at every stage of a project. The local authorities involved in scrutinising and approving project proposals should also incorporate EAs in their decision making.

In practice, the use of an EA as a tool for environmental management depends on the scope and integrity of the EA process (Sadler, 1996). While EA refers to a generic form of environmental assessment, an EIA is the most common environmental impact assessment tool used for predicting the impacts of development projects. An EA, on the other hand, is a systematic process that examines the environmental consequences of development projects (Glasson et al., 1999). In other words, an EA studies the probable changes in the various socio-economic and biophysical characteristics of the environment that may result from a proposed or impending project (Mitchell, 2002; Canter, 1996; Jain et al., 1993). The overall purpose of undertaking an EA is to seek ways to avoid or minimise the adverse effects of a proposed project to the greatest extent and to promote the maintenance, restoration or enhancement of the quality of the environment as much as possible (EPA, 1992). Therefore, an EA helps achieve the ultimate goal of a project by formulating a suitable environmental management plan that minimises adverse effects and enhances positive impacts (Haque et al., 2000; World Bank, 1991).

Generally, large-scale road projects require an EIA as a condition for national and international funding, but some donor agencies do not explicitly introduce or consider an EA when the main purpose of funding deals with small- and medium-scale projects. In developing countries, some government agencies implement even large-scale road projects without conducting an EIA despite being legally required.

In contrast to the general notion that an EA is for large-scale projects, Spaling (2003) has stressed the need for EAs even for community-based small-scale development projects. Spaling (2003) makes this case based on his experience with projects implemented by Canadian non-government organisations and their partners in sub-Saharan Africa. Small-scale projects funded by the United States Agency for International Development (USAID) and the Canadian International Development Agency (CIDA, 1997) require an EA prior to planning approval (CARE, 2001). Conventional framework of an EA is simplified and adapted to community-based small-scale development projects to maximise socio-economic benefits and reduce adverse environmental impacts (Chowdhury and Amin, 2006). Examples of such small-scale projects are: community wastewater systems, community water supply systems, community-based sanitation projects, small-scale income generation projects, waste management projects, slum resettlement projects and various kinds of construction projects (CARE, 2001; CIDA, 1997; Knausenberger et al., 1996).

Despite the successes of integrating EAs into all scales of donor funded projects, publicly or privately funded projects are yet to be subject to environmental scrutiny, especially for the case of small- and medium-scale projects. For large-scale development projects (prescribed projects) in Thailand, an EIA has to be conducted to assess the possible environmental impacts and propose subsequent mitigation measures irrespective of the location of the project. The Ministry of Natural Resources and Environment (MNRE) has produced guidelines for EIAs to ensure that proper procedures are followed for all projects that can potentially impact the environment. A summary of the major events in the history of EIAs in Thailand is given in Table 1.

An EIA is a legal requirement in many developing countries as well. However, such requirements are not enforced for non-prescribed projects that are small- and medium-sized. For example, most road projects implemented by local authorities are small- and medium-scale in nature, and they are rarely subjected to any type of EA before implementation. Furthermore, many local authorities have overlooked the possibility of incorporating an EA as a legal requirement. In Thailand, for example, there is no municipal legal requirement for EAs for small-and medium-scale infrastructure development projects, although they may create adverse impacts on the environment if not planned, designed and implemented properly. Even for the case of large-scale prescribed projects[2], the implementation of mitigation plans, environmental monitoring and the enforcement of regulations regarding safety and pollution are under the scope of national or regional authorities, and the role of local authorities in environmental management is kept at a minimum level. If an EA was conducted for every project implemented at the local authority level, there would be better decision making regarding sustainable development. This article argues that EAs are required for infrastructure development projects (IDPs)[3] implemented at the local authority level irrespective of their scale. This argument is based on an environmental performance study of road development projects implemented in an urban fringe area of Bangkok.

Table 1. Summary of Major Events in the History of EIA Practice in Thailand

Year	Event
1975	Thailand had the first experience in doing an Environmental Impact Assessment (EIA) for a development project.
1992	The First Ministerial Decree of the Ministry of Science, Technology and Environment (MSTE) setting EIA requirement for all sizes and types of expressways, motorways and rail mass transit system and projects of all sizes and types within watershed Class 1B.
1992	The Office of the Environmental Policy and Planning (OEPP) emphasised the need of EIA for projects proposed by the government agencies and private sector according to the notification on types and sizes of projects.
1996	The Second Ministerial Decree of the MSTE set EIA requirement for all sizes and types of new or upgraded highways or roads, as defined by the Highway Act, that traverse the following areas: (1) Wildlife sanctuaries and non-hunting area according to the Protection and Conservation of Wildlife Act, (2) National parks as defined by the National Park Act, (3) Watershed Class 2, (4) Reserved mangrove forests and (5) Coastal zone within 50 meters from high tide level.
1996	OEPP received a technical assistance (TA) from the Asian Development Bank (ADB) to strengthen the EIA process.
1996	OEPP prepared a guideline for public participation in EIA.
2000	OEPP has already delegated the authority to some provinces in reviewing EIA reports on housing, community service and resort projects.

Source: OEPP, (2001)

2 Prescribed projects are projects that require an EIA to assess possible impacts and thereafter propose mitigatory measures, according to environmental regulations.

3 Infrastructure re Development Projects are essential for urban growth projects, such as developing road networks and drainage and water supply systems.

PROFILE OF THE STUDY AREA AND THE METHOD OF DATA COLLECTION

The present study was conducted in two municipalities of the Samuth Sakorn province, which is one of the provinces of the BMR. Since this province is adjacent to the city of Bangkok, it attracts many urban functions as well as people from other areas. The rapid urbanisation in this province is most visible in the Nakhon Samuth Sakorn (NSS) and Muang Krathum Baan (MKB) municipalities.[4] Several road projects as well as other IDPs have been implemented in these municipalities to support the urbanisation process. These areas were selected for this study because they represent the rapidly developing urban fringe areas in BMR.

Within the general context of IDPs, this study mainly focuses on road projects performed in these two municipalities within the ten-year period prior to this study. The specific objective of this study was to investigate and compare the environmental impacts of different scales of road development projects (large, medium and small). Expressways and highways implemented by the Department of Highways (DoH) with 4 or more lanes and wider than 30 meters are considered as large-scale projects; these are technically arterial roads. Medium-scale projects include local highways (collector roads) implemented by local authorities that have 2 lanes and a width of 12 to 30 meters Small-scale projects consist of local roads and community roads (access roads) implemented by local authorities with 1 or 2 lanes and a width of 6 to 12 meters. The 14 road projects studied here are represent-tative of the development projects undertaken in NSS and MKB. Of these 14 road projects, 4 are large-scale projects that traversed through the study area, while the majority (6) are small-scale projects: 2 of these are located in MSS and 4 in MKB. The others are medium-scale projects initiated by the two municipalities. Table 2 lists the selected projects, indicating their year of construction, funding agency and the level of EA used in the development process. To achieve the objective of the study, a hypothesis was formulated for empirically testing the physical impacts of road projects in the immediate impact areas.[5] We hypothesised that irrespective of the scale of the projects, the environmental impacts within the immediate impact areas were perceived as similar by the affected stakeholders when the environmental conditions

4 These are municipalities that have been identified as urban municipalities in Samuth Sakorn province.

5 Immediate impact area is defined as the area parallel to each road with a width of 100 m as measured from the centre line of the road to each side.

were compared before and after the completion of the construction projects.

The records at the Department of Highways (DH), Department of Public Works and Town & Country Planning (DPWTCP), and the two selected urban local authorities gave no indication that any of the surveyed road projects had any form of EA prior to their implementation. Apparently, EAs had been overlooked even for large-scale projects, although the proponents and funding agencies of these projects were either government agencies or local government units. As a result, no information was available on the state of the environment in the study areas prior to the implementation of each project. Thus, in the absence of recorded data on the state of environment before and after the construction of these projects, a social survey was selected as the best method to investigate the environmental impacts. The perceptions of people affected by the road development projects were considered as a proxy to the measure of environmental impacts created by these road development projects. The respondents were divided into three main groups as follows:

Group 1: The respondents affected by large-scale projects (LSP), where intercity highways and expressways were constructed;

Group 2: The respondents affected by medium-scale projects (MSP), where local highways and arterial roads were constructed;

Group 3: The respondents affected by small-scale projects (SSP), where collector roads and community roads were constructed.

Data were collected between April to May 2004 using a standardised questionnaire and face-to-face interviews. A random sample of 402 respondents was drawn from areas that were served by the 14 road projects performed in the two municipalities since 1994. The respondents were asked questions about their perceptions on the implementation of road development projects and the resulting environmental impacts. A five-point scale was used to record the perceptions, ranging from 1 (insignificant impact) to 5 (most severe impact).

Table 2. List of Projects Selected for Analysis

Type of project	Year of construction and/or reconstruction	Funding and/or donor agency	Environmental Assessment before construction
Large-scale projects			
Praramsong road (Highway No. 35)	1999–2002 (8 lanes)	Department of Highways	Preliminary environmental assessment
Ekkachai road	1994 (4 lanes)	Department of Highways	No assessment
Jitmanee road	1994 (4 lanes)	Department of Highways	No assessment
Satethakit road	1996–1999 (4 lanes)	Department of Highways	No assessment
Medium scale projects			
Duem Bang road	2004 (2 lanes)	Provincial Administration Organization (PAO)	No assessment
Thumkunakorn road	1999 (2 lanes)	Municipality	No assessment
Suthivatvithi road	1999 (2 lanes)	Municipality	No assessment
Sukhonthawin road	1996–1997 (2 lanes)	Municipality	No assessment
Small scale projects			
Somanutmakkra road	2004 (2 lanes)	Municipality	No assessment
Tawai road	2004 (2 lanes)	Municipality	No assessment
Donkaidee road	1995 (2 lanes)	Municipality	No assessment
Tesaban 3 road	1995 (2 lanes)	Municipality	No assessment
Jareonsawas road	1994 (2 lanes)	Municipality	No assessment
Aungthong Thani road	2001 (2 lanes)	Private investor	No assessment

CHANGE IN ENVIRONMENTAL CONDITIONS BASED ON THE STAKEHOLDERS' PERSPECTIVE

The general perceptions of the respondents regarding the physical environmental conditions that prevailed along the roads before and after the construction of the roads are summarised in Table 3. The results indicate that people perceived environmental problems after the implementation of the projects.

Table 3. Perceptions of Respondents on the Existence of Physical Environmental Problems Before and After Construction of Roads

Physical environmental problems	Before project implementation		After project implementation	
	No. of respondents (n= 402)	%	No. of respondents (n= 402)	%
Air quality	203	50.5	332	82.6
Noise level	191	47.5	306	76.1
Vibration	134	33.3	285	70.9
Surface water	208	51.7	269	66.9
Ground water	102	25.4	242	60.2
Land use	130	32.3	138	34.3
Natural resources	69	17.2	121	30.1
Land erosion	57	14.2	106	26.4

A detailed analysis of respondents' perceptions in relation to the three types of road projects is shown in Table 4. The data indicate that a change in the air quality in the study areas was perceived as the most serious problem after the construction projects. Specifically, 82.6% of all respondents indicated that the road construction projects affected the air quality by generating enormous amounts of dust and smoke. The next most critical problems were the noise and vibration caused by the construction vehicles. Table 4 indicates that 76.1% and 70.9% of all respondents perceived noise and vibration as major impacts of the construction of projects, respectively. Similarly, 66.9% and 60.2% of respondents indicated that the surface and ground water conditions near the project areas deteriorated due to the road construction projects; as expected, air and sound pollution were perceived as more critical issues than water pollution.

At a glance, the data in Table 4 indicate that perceptions of the physical environmental problems were ranked in similar orders for the three different types of road projects. In other words, changes to the air quality and increased noise levels were perceived as the two main problems that resulted from the LSPs, MSPs and SSPs. For the LSPs and SSPs, vibration was revealed as the third most critical problem, while for MSPs, the third most critical issue was surface water contamination. This variation may be due to the specific physical conditions of the areas where these projects took place. In order to assess whether there are any significant differences in the perceptions among the three main groups of respondents, an ANOVA test was conducted using the environmental impact scores (1 means insignificant impact and 5 means most severe impact).

Test of differences

It was hypothesised that "irrespective of their scale, the physical environmental impacts of road development projects are perceived by respondents as similar." An ANOVA test was initially conducted to investigate whether the mean impact scores representing the respondents' perceptions were the same or not. A summary of the mean scores of respondents on their perceptions of the physical environmental impacts of the projects and the corresponding p value from the ANOVA test are shown in Table 5. The result of the ANOVA test shows that there is no significant difference among the mean impact scores with a 95% confidence level for the air quality ($p = 0.064$ for the increase in air borne dust and $p = 0.193$ for the increase in air pollution). This result means that the respondents' perceptions of the air quality associated with all three scales of projects are the same. A similar result was found for the noise level, as no significant difference exists among the mean impact scores ($p = 0.371$ and $\alpha = 0.05$); this result means that the respondents' perceptions of the noise

Table 4 .Perceptions of Respondents on the Physical Environmental Problems Created by Road Development Projects

Physical environmental problems	LSP		MSP		SSP		Total	
	No. of respondents (n=138)	%	No. of respondents (n=156)	%	No. of respondents (n=108)	%	No. of respondents (n=402)	%
Change in air quality	118	85.5	131	84.0	83	76.9	332	82.6
Increased Noise	112	81.2	115	73.7	79	73.1	306	76.1
Vibration	107	77.5	105	67.3	73	67.6	285	70.9
Surface water contamination	96	69.6	113	72.4	60	55.6	269	66.9
Ground water contamination	88	63.8	104	66.7	50	46.3	242	60.2
Land use changes	28	25.9	49	31.4	61	44.2	138	34.3
Deterioration of natural resources	49	35.5	51	32.7	21	19.4	121	30.1
Land erosion	40	29.0	46	29.5	20	18.5	106	26.4

Note: LSP= Large-scale Projects, consisting of highways and expressways
MSP= Medium Scale Projects, consisting of local highways and arterial roads
SSP= Small Scale Projects, consisting of local and community roads

Table 5. Summary of Mean Impact Scores and Results of ANOVA T-Test According to the Three Scales of Projects

Environmental impacts	Mean impact scores LSP	Mean impact scores MSP	Mean impact scores SSP	ANOVA significance	Inference of respondents' perceptions
Air quality	3.30	3.66	3.54	.064	Mean impact scores indicate severe impacts by dust from MSP and SSP. ANOVA test results show no significant difference among the three scales of projects.
• Increase in air borne dust	3.08	3.39	3.18	.193	
• Increase in air pollution (smoke)					
Noise level	3.23	3.45	3.37	.371	Mean impact scores indicate severe impacts of noise by MSP. No significant difference associated with the three scales of projects according to ANOVA test.
• Increase in noise level					
Vibration level	3.01	3.47	3.29	.025	Severe impacts due to vibration by MSP. There is a significant difference in impacts by different scales of road projects according to ANOVA test.
• Increase in vibration					
Surface water condition	2.85	3.24	3.38	.090	Severe impacts by flooding due to MSP. There is a significant difference on impacts from flooding by the three scales of road projects.
• Contamination/Degradation	2.18	2.15	2.31	.858	
• Depletion	2.81	3.69	3.32	.001	
• Flooding					
Ground water condition	3.02	3.36	3.78	.011	Severe impacts on ground water by SSP. There is a significant difference impacts on ground water by the different scales of projects.
• Contamination/Degradation	2.34	2.72	2.22	.166	
• Depletion					

Note: Values in underscore denote severe impact and values in bold denote significant difference in the mean scores between three respondent groups at 95% confidence level (Sig. < .05 the difference among the mean scores are significant and Sig. > .05 the difference among the mean scores are insignificant). The descriptions of mean impact scores are: 1.00–1.79= Insignificant impact, 1.80–2.59= Less impact, 2.60–3.39= Moderate impact, 3.40–4.19= Severe impact and 4.20–5.00= Most severe impact pollution were the same regardless of the scale of the road project. However, the ANOVA results pertaining to vibration show that there is a significant difference among the mean impact scores (p = 0.025 and α = 0.05), implying that different scales of projects generated different vibration-related impacts as perceived by the respondents. The ANOVA test on water-related issues also showed a significant difference among the mean impact scores, with a 95% confidence level for the surface water quality (p = 0.001 and α = 0.05 for local flooding) and ground water quality (p = 0.011 and α = 0.05 for ground water contamination).

Overall, the analysis of the perceived environmental impacts by all projects, ranging from small-scale to large-scale, indicates that the increase in air borne dust is a major concern while the other environmental issues are considered to have a moderate or less of an impact. The noise level, vibration and flooding caused by the medium-scale projects are also perceived as having severe impacts on the respondents. In terms of ground water contamination or degradation, small-scale projects are also perceived by the respondents as causing severe impacts. This may be due to the specific locations of the medium- and small-scale road projects. The mean impact scores and ANOVA results (p value) shown in Table 5 indicate that perceived impacts from vibration, flooding, and ground water contamination or degradation are different among the three project scales. All of the other environmental issues are perceived by the respondents as similar, irrespective of the scale of the projects. In other words, from the perspective of the people affected by the projects, all types of road construction projects — whether large- or small-scale — cause environmental impacts of the same magnitude. Although this requires verification using empirical data, this study questions the validity of limiting EAs to only large-scale development projects. The latest EIA techniques incorporate social impact assessments as well as stakeholders' perceptions as part of an EIA. Therefore, limiting EIAs to only prescribed projects is not desirable in terms of environmental management.

Comparison of the respondents' perceptions and the actual measurement data

Subsequent to the ANOVA test, multiple comparisons using Post Hoc tests were conducted for a pair-wise comparison of the mean scores for each impact variable of the three project scales. The reason for this pair-wise comparison was to identify significant differences in the mean impact scores between the groups of respondents. Table 6 shows the results of the pair-wise comparisons.

The results of the Post Hoc test (see Table 6) show that there are significant differences in the mean impact scores pertaining to air-borne dust, vibration and flooding

Table 6. Comparison of Mean Impact Scores with Post Hoc Tests

Physical environmental impacts	difference in mean impact scores between pairs		Inference based on the difference between mean impact scores
	p value LSP - MSP	P value MSP - SSP	
Air quality			Post Hoc tests indicate a significant difference pertaining to dust generated by LSP-MSP but no significant difference between MSP-SSP.
• Increase in air borne dust	.020	.484	
• Increase in air pollution	.075	.283	
Noise level			There is no significant difference of mean impact scores pertaining to noise between LSP-MSP and MSP-SSP.
• Increase in noise level	.162	.627	
Vibration level			There is a significant difference in mean impact scores between LSP and MSP, meaning that the vibration by LSP and SSP are perceived as different by the respondents.
• Increase in vibration	.007	.335	
Surface water condition			A significant difference of impacts by flooding between LSP and MSP. This indicates that the flooding impact by LSP and SSP are perceived as different.
• Contamination/Degradation	.082	.577	
• Depletion	.910	.588	
• Flooding	.000	.174	
Ground water condition			All p values higher than .05 indicate that there is no significant difference of mean impact scores between LSP-MSP and MSP-SSP.
• Contamination/Degradation	.111	.084	
• Depletion	.133	.100	

Note:Values in bold denote significant difference in the mean impact scores between two respondents' groups at the 95% confidence level.

between LSP and MSP (p value less than 0.5 as indicated in bold type). No such differences in the mean impact scores between MSP and SSP are noted. This means that the impacts made by MSP and SSP are the same for all environmental indicators. Moreover, most environmental indicators show no significant differences between LSP and MSP. The overall conclusion from these findings is that, contrary to general belief, MSPs and SSPs generate environmental impacts similar to those generated by LSPs.

The analysis presented above is totally based on the perceptions of people near the project construction sites. To verify whether or not their perceptions are reasonable, the state of the environment was assessed using a selected set of environmental quality indicators, which were then compared against the corresponding Thai National Standards (see Table 7). A single reading for each quality indicator was taken at a specific point on the sides of the large-, medium- and small-scale roads. The 3 selected road projects include: the Ekkachai Road (large-scale), which was upgraded in 2005 by the Department of Highways; the Thamkunakorn Road (medium-scale), which was upgraded in 2005 by the Samuth Sakorn Municipality and the Somanut Makkra Road (small-scale), which was upgraded in 2004 by the Muang Samuth Sakorn Municipality. Although a single reading was not representative of the 14 total road projects in general or the 3 specific projects listed above, the readings indicated that none of the measurements (except the noise level by the side of Ekkachai Road) exceeded the maximum levels set by Thai National Standards. Moreover, drainage and flooding along the 3 selected roads were evaluated by visual inspection and records at the respective municipalities. These tests revealed that the small- and medium-scale projects were indeed detrimental to the environment, the result of these projects being conducted without integrated drainage systems. In contrast, no detrimental consequences were revealed for the large-scale road projects, which had better designs and integrated drainage systems.

Assuming that the above comparison holds true for all of the roads studied and their surrounding areas, the following conclusions can be drawn based on the analysis:

1. The affected people perceive that negative environmental impacts were generated by all three sizes of projects, as indicated by the perceived increase in air borne dust, air pollution (smoke), noise level, vibration, surface water contamination, surface water depletion, flooding, and ground water contamination and depletion.

Table 7. Monitoring Data among Three Scales of Road Projects (single reading only)

Characteristics of physical impacts	Measurement data from different scales of road projects			Thai National Standard	Inference
	Large-scale	Medium scale	Small scale		
Air quality[i]					
• Air borne dust (mg/m3)	0.207	0.156	0.063	0.33	Air borne dust generated by all scales of projects has not reached the level of pollution.
Noise level[ii]					
• Sound level (dbA)	75.2	65.6	61.1	70.0	Noise level generated by large-scale projects exceeded the level of pollution.
Surface water condition[iii]					
• Contamination					No national standard available to assess water quality on road sides. The existing standards are for drinking water.
- Turbidity (NTU)	42	10	8	-	
- Total suspended Solids (mg/l)	61.5	56.0	28.0	-	
- Total Dissolved Solids (mg/l)	742	10544	5262	-	
Ground water condition[iv]					
• Contamination					Ground water conditions generated by all scales of projects have not reached the level of pollution.
- PH	7.2	7.7	7.3	7.1-8.5	
- Color (Pt-Co)	1	2	2	5	
- Turbidity (NTU)	1	1	1	5	
- Hardness(mg/l as CaCo3)	220	147	229	300	

Source: Trethanya, 2009

i Air quality measurement was taken for air borne dust by TSP test using Gravimetric-High Volume method.

ii The measurement was taken using the method of Equivalent Continuous Sound Level (Leq) for 24 hours.

iii There is no national standard available to assess the surface water quality on road sides. The existing standard is for surface water need for drinking purposes.

iv Ground water quality data was obtained from the source of municipal water supply (shallow bore hole).

2. The environmental quality measurements indicate that the noise level of the large-scale road projects is the only negative environmental impact, as it exceeded the Thai National Standard for what is acceptable.

If the affected peoples' perceptions were to be taken seriously, it can be concluded that negative environmental impacts prevail irrespective of the scale of the projects. If only large-scale road projects are legally required to conduct an EIA before implementation, and even this measure is often overlooked by the public sector, there appears to be a serious problem with addressing the negative environmental impacts generated by all types of road projects. This situation calls for a more serious application of EIA regulations for large-scale projects, irrespective of who implements the projects, and EAs are required for the medium- and small-scale projects implemented by local authorities.

The data collection process in this study also included interviews with some executive officers of road development agencies (i.e., DH, DLH and DPWTCP). These officers confirmed that the large-scale road projects in the two study areas were implemented without EAs. According to the officers, only significantly sized national highways and private sector investments such as toll ways go through the EIA process. The main reasons cited for why the other roads were neglected included the central government's budget and time restrictions. Usually government agencies receive a budget for developmental work each year, which should be spent within the financial year. Any unspent budget has to be returned to the government. This system forces the authorities to complete developmental projects within a strict schedule, and, therefore, they normally overlook developmental control and environmental management, focusing only on design and construction. Only the special projects that are not under the direct supervision of local authorities or projects that receive prior approval for longer duration are exempted. The interviews with the executives of the road development agencies revealed that neither the large-scale projects implemented by national or regional road development agencies nor the small and medium-scale projects implemented by the local authorities and the private sector are subject to serious scrutiny regarding developmental control and environmental management. The only environmental management technique used is monitoring the post-construction noise and air quality by the Pollution Control Department (PCD). However, even this measure is limited to only large-scale road projects. Therefore, it is necessary to search for alternative strategies that integrate environmental management measures in the planning stage of infrastructure development projects.

CONCLUSION AND RECOMMENDATIONS

In the areas studied in this report, past road development projects led to poor physical environmental outcomes. The physical environmental problems that resulted from these projects include: air pollution, high noise levels, flooding, and wastewater overflow. The analyses presented in section 4 reveal that the environmental conditions resulting from the road development projects in the areas studied were not completely improved by the governing authorities. The data also indicate that noise levels of the large-scale road projects exceeded the acceptable noise pollution levels. Therefore, physical problems resulting from road development projects still persist, as indicated by peoples' perceptions and environmental data.

Although the data analysis in this paper is limited to road infrastructure projects, it is assumed that other infrastructure projects, regarding systems such as water supplies and sewage, can generate similar environmental impacts. Therefore, this study attempts to examine the prospect of integrating EA into the existing development control measures taken by local authorities. It was revealed threre are financial restrictions on the local authorities and a lack of scientific expertise on environmental systems, cause-effect relationships, mitigation measures and construction techniques. These factors make it difficult to conduct a comprehensive EIA before implementing infrastructure development projects. However, it is arguable that an EA is easier to carry out than a "comprehensive assessment" or a "full EIA." Three methods for integrating EAs into small and medium infrastructure projects implemented by local authorities are outlined below.

Declaration of a local environmental policy:

Although environmental legislation is the most common environmental management policy tool, some local governments do not even have environmental bylaws. As stated above, there is not separate environmental management department in the local government structure in Thailand. Therefore, the local authorities should be guided by the Ministry of Interior to declare explicit environmental policies to suit their local contexts. It is reiterated here that having a clear environmental policy is the first step towards formulating a suitable EMS for local authorities.

Integration of an EA into the planning and construction approval process:

Enforcing EAs for small and medium projects will be a challenging task for the development control divisions of local authorities that have limited capacities. Moreover, this task may require a dramatic change in the organisational culture because it is usually the attitude of local government offices not to venture outside their set routines and regulations. Therefore, developing an environmentally responsive culture among local authorities will require significant attitudinal change among administrators and officers. As a first step towards this goal, environmental screening can be made mandatory. As a subsequent step, EAs in the form of Initial Environmental Examinations (IEEs) can be incorporated into the development control procedure. This means that checking and approval should go beyond the use of conventional tools such as urban planning regulations.

Consolidation of Public Works and Planning Divisions in local authority offices:

Presently, municipal planning the local authority offices is a responsibility of the Planning Division, while development control is handled by the Public Works Division. Environmental management is not a specific task assigned to any one division. In all instances, several divisions engage in environmental management related tasks. This is a major stumbling block in establishing an Environmental Management System (EMS) in local authority offices. Therefore, in line with the previous two suggestions, consolidation of the Public Works and Planning Divisions into a Development Planning and Management Division is proposed. This will enable local authorities in Thailand to integrate environmental planning and management measures into conventional development plans and thereby enforce an EA as part of the approval procedure.

The introduction of an EA into the planning and development control processes of local authorities is a vital change required to establish an environmental management system within local authorities. In fact, this would be the first step towards bringing an environmental management culture at the organisational level of local government.

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REFERENCES

Abaza, H. (2000). *Strengthening future environmental assessment practice: An international perspective in environmental assessment in developing and transitional countries*. New York: John Wiley and Sons.

Bangkok Metropolitan Administration. (2000). *Bangkok Statistic.* Bangkok: Bangkok Metropolitan Administration.

Canter, L. (1996). *Environmental impact assessment.* 2nd ed. New York: McGraw Hill.

CARE. (2001). *Environmental assessment and monitoring guidelines for SHAHAR project*. Dhaka: Environment Unit-IFSP.

CIDA, Canadian International Development Agency. (1997). *Handbook on environmental assessment of non-governmental organizations and institutions programs and projects.* Ottawa: Canadian International Development Agency.

Chowdhury, F. J. and Amin, A. T. M. N. (2006). Environmental assessment in slum improvement program: Some evidence from a study on infrastructure projects in two Dhaka slums. *Journal of Environmental Impact Assessment*, 26(6): 530—552.

Enviromental Protect Agency. (1993). Environmental impact assessment. Washington DC: United Nations Environmental Protection Agency.

U.N., Environmental Protect Agency. (1992). *Environmental impact assessment*. Washington DC: United Nations Environmental Protection Agency.

Glasson, J., Therivel, R. and Chadwick, A. (1999). *Introduction to environmental impact assessment.* London: UCL Press Limited.

Haque, M., Tariquzzaman, S. I., Ahmed, A., Ahmed, R. U., Rahman, A. and Chowdhury, F. J. (2000). *EIA training manual in selected sectors for professionals and managers.* Dhaka: National EIA Association of Bangladesh (NEAB).

Jain, R. K., Stacey, G. S. and Balbach, H. E. (1993). *Environmental assessment*. New York: McGraw-Hill.

Knausenberger, W., Booth, G., Bingham, C. and Gaudet, J. (1996). *Environmental guidelines for small-scale activities in Africa: Environmentally sound design for planning and implementing humanitarian and development activities.* Washington: United States Agency for International Development (USAID).

Lee, N. and George, C. (2000). *Environmental assessment in developing and transitional countries.* New York: John Wiley and Sons.

Mitchell, B. (2002). *Resources and environmental management*,.2nd ed.. London: Prentice Hall.

Mokhehle, L. and Diab, R. (2001). Evolution of environmental impact assessment in a small developing country: A review of Lesotho case studies from 1980–1999. *Impact Assessment and Project Appraisal Journal*, 19(1): 9—18.

Mongkolnchaiarunya, J. (2003). Developing alternative solid waste management practices in local governments: A case study of Yala Municipality. PhD diss., Asian Institute of Technology (AIT), Bangkok.

Mongkolnchaiarunya, J. (2005). Promoting a community-based solid waste management initiative in local government: Yala Municipality, Thailand. *Journal of Habitat International*, 29(1): 27—40.

OEPP, Office of Environmental Policy and Planning. (2001). *Strengthening capacity of OEPP in transportation.* Bangkok: Ministry of Science Technology and Environment.

Sadler, B. (1996). *Environmental assessment in a changing world: Evaluating practice to improve performance. Final Report, International study of the effectiveness of environmental assessment.* Ottawa: Canadian Environmental Assessment Agency and International Association for Impact Assessment.

Spaling, H. (2003). Innovation in environmental assessment of community-based projects in sub-Saharan Africa. *The Canadian Geographer*, 47(2): 151—168.

Trethanya, S. (2009). Environmental Management System for Infrastructure Development Projects Implemented within Extended Urban Areas: A Case Study of Samuth Sakhon Province. PhD diss., Asian Institute of Technology (AIT), Bangkok.

United Nations Environmental Programme. Regional Office for Asia and Pacific (1988). *Environmental impact assessment, basic procedures for developing countries.* Bangkok: Regional Officer for Asia and Pacific.

World Bank. (1991). *Environmental assessment sourcebook: Policies, procedures, and cross-sectoral issues. Volume 1:* Washington, The World Bank.