# REGULATORY

## IMPACT ANALYSIS
## GUIDELINES

FOR THE

## THAILAND GOVERNMENT

In collaboration



# REGULATORY IMPACT ANALYSIS GUIDELINES

# FOR THE THAILAND GOVERNMENT

# Contents

# Purpose of the Guidelines

Regulatory Impact Assessment (RIA) is a popular tool used by most OECD countries and increasingly by APEC developing countries. RIA is used to review existing and new legislation and regulation.

RIA provides a robust analytical approach using cost benefit analysis to evaluate the costs and benefits to ensure a regulation provides a net benefit to society.

The benefits of RIA are numerous but some of the key benefits include improving business productivity, reducing business costs, creating a business environment to invest, grow and create jobs, improving consumer choice, protecting the environment and public health and safety, and providing a foundation for improving the standard of living.

Thailand adopted the OECD Reference checklist for regulatory decision-making in 1995 and has been committed to undertaking RIAs for legislation and regulation. However, the OECD Checklist only provides a list of principles and little guidance on how to undertake RIA. As a result, a government study "RIA Situation in Thailand" found a high level of unawareness of the requirement to conduct RIA and very few RIA being prepared for Government.

Most developed countries that have introduced RIA have developed guidelines and training to support the OECD RIA Checklist. This is necessary in order to provide government agency officers with the necessary knowledge and skills to prepare RIAs.

Developed countries that have been using RIA for over thirty years have been able to improve the quality and efficiency of regulation resulting in significant cost savings to business and citizens in the hundreds of millions of dollars.

Thailand's global competitiveness ranking in 2014 was 29 out of 60 countries and scored 38 on the corruption perception index. The index indicates the perceived level of public sector corruption on a scale of 0 (highly corrupt) to 100 (clean).

The introduction of RIA similar to other developed countries will provide Thailand with the potential to improve its competitiveness ranking and to help remove corruption in its legislation and regulations. In doing so, the adoption of RIA will facilitate reforms that deliver improved standards of living and reduce income inequality.

The purpose of these Guidelines is to provide a framework for government agency officers to better understand the RIA process and to develop the appropriate skills in the Government's RIA training program.

The Guidelines cover the following topics:

- Introduction
- Scope and application of RIA
- The key elements of RIA
- Public consultation processes
- Corruption Impact Assessment
- RIA Case Study

# 1. Introduction

Government regulation is sometimes necessary to achieve certain economic, social and environmental goals. However, excessive or poorly designed regulation can impose costs on society that outweigh the benefits of regulation. These costs can have negative implications for overall economic performance, including competition, business costs, consumer choice, employment and investment opportunities.

To avoid the problems caused by poorly designed regulation, it is essential that government should not resort to regulation unless it has compelling evidence that:

- a problem exists;
- government action is warranted; and
- regulation is the best option available to government to deal with the problem in an efficient and effective manner.

Regulatory impact assessment (RIA) is a document that analyses the problem, the need for government intervention into a market, and the costs and benefits of feasible options to deal with the problem.

The purpose of the RIA is to ensure that affected stakeholders and the wider community have an opportunity to comment on all aspects of the RIA and the proposed regulation. In effect, public consultation provides government with the opportunity to seek reassurance from those directly affected that a problem exists, the scope and scale of the problem has been defined and the proposed regulation is the best option to deal with the problem. Accordingly, the RIA helps government to make an informed decision before it introduces a law or regulation.

Accordingly, best practice RIA countries have integrated the key features of the RIA process into policy development to ensure the preferred policy response has been rigorously assessed and is the best option. This is a superior approach compared to making a decision on a particular policy response and subsequently undertaking the RIA process.

The government strongly encourages its departments to integrate the key features of the RIA process into policy development to facilitate the selection of the best option and to avoid unnecessary delays to the government's response to economic, social and environmental problems.

Some OECD countries have been using RIA for over thirty years and have strengthened the standards in their RIA Guidelines over time to further improve the quality of RIAs. This has resulted in the adoption of a greater range of methodologies and approaches. In these countries, government departments have been able to learn and adjust to incremental changes to the RIA Guidelines.

Thailand is essentially at the beginning of the RIA journey and has decided to commence that journey learning and applying the fundamentals of the RIA process. The adoption of 'best practice' RIA Guidelines from some OECD countries could over-whelm government departments that do not have experience with the RIA process and jeopardize whole of government support and adoption of the RIA process.

The key feature of the RIA process that is critical to the government's success to deal with economic, social and environmental problems is the first part of the RIA; the nature and extent of the problem.

It is critical for the following reasons. Firstly, the sole reliance on high-level aggregated data to demonstrate that a problem exists will invariably lead to poorly designed regulation that fails to deal with the problem, and in most cases, will unnecessarily regulate some parts of the community; imposing additional costs that makes the targeted sector less efficient and competitive.

The following is an example of the use of high-level aggregated data. Liquor licensed premises were the third most frequent type of premises (behind residential and outdoors) for reported assaults, with data suggesting 66.7 per cent of all assaults were alcohol-related.

The limitations with this high level aggregated data is that it suggests that most liquor licensed premises are likely, at some stage, to lead to alcohol-related violence. A further problem with this reliance on high level aggregated data is that the solution will be developed and applied to all liquor licensed premises.

All OECD countries struggle to perform high quality analysis of the nature and extent of the problem and care should be taken in using RIAs from other countries that primarily use high level aggregated data.

Secondly, if the nature and extent of the problem is analyzed in appropriate detail with supporting empirical evidence it is likely to reveal, in some cases, a range of options to deal with the problem, and importantly avoid applying any policy solution to parts of the community or industry sectors that are not responsible for the problem.

Using the same example about liquor licensed premises, the use of disaggregated data reveals a different picture of the problem: In Sydney, 27 or 12 percent of hotels and nightclubs accounted for almost 60 percent of all assaults at hotels and nightclubs. 7 or 3 per cent of the 27 hotels recorded 26 percent of all assaults.

A study in Newcastle found that of the 400 or more licensed premises in the area, only 21 or 5% had an above average number of alcohol-related incidents, with four premises or 1% of licensed premises accounting for a large majority of these incidents.

At Kings Cross, which has the highest rate of assaults, in excess of 20 percent of the assaults were recorded at just 3 licensed premises; a bar/restaurant, a bar/nightclub and a bar/strip-club. A similar outcome was found at Wynyard/The Rocks area where 23.3 percent of assaults were recorded in or near 3 licensed premises.

This data analysis changes the size and extent of the problem to a handful of liquor licensed premises compared to the high level data that suggested a widespread problem amongst liquor licensed premises. Accordingly, while further causal analysis is required in respect to the handful of liquor licensed premises, it is clear that applying a regulatory solution and the associated costs to most liquor licensed premises would adversely impact on these businesses and its patrons.

Thirdly, provided the causes and the extent of the problem can be clearly defined and the costs of the problem can be quantified, the rest of the RIA is relatively straightforward in terms of undertaking a cost benefit analysis of the selected options. The costs quantified in the problem section of the RIA are later treated as the potential benefits in the assessment of the various options.

Many OECD member country RIAs make claims of market failure in the nature and extent of the problem but provide very little supporting empirical evidence. In many cases, regulatory failure is far more common and there is a litany of published studies on inefficient and ineffective regulation.

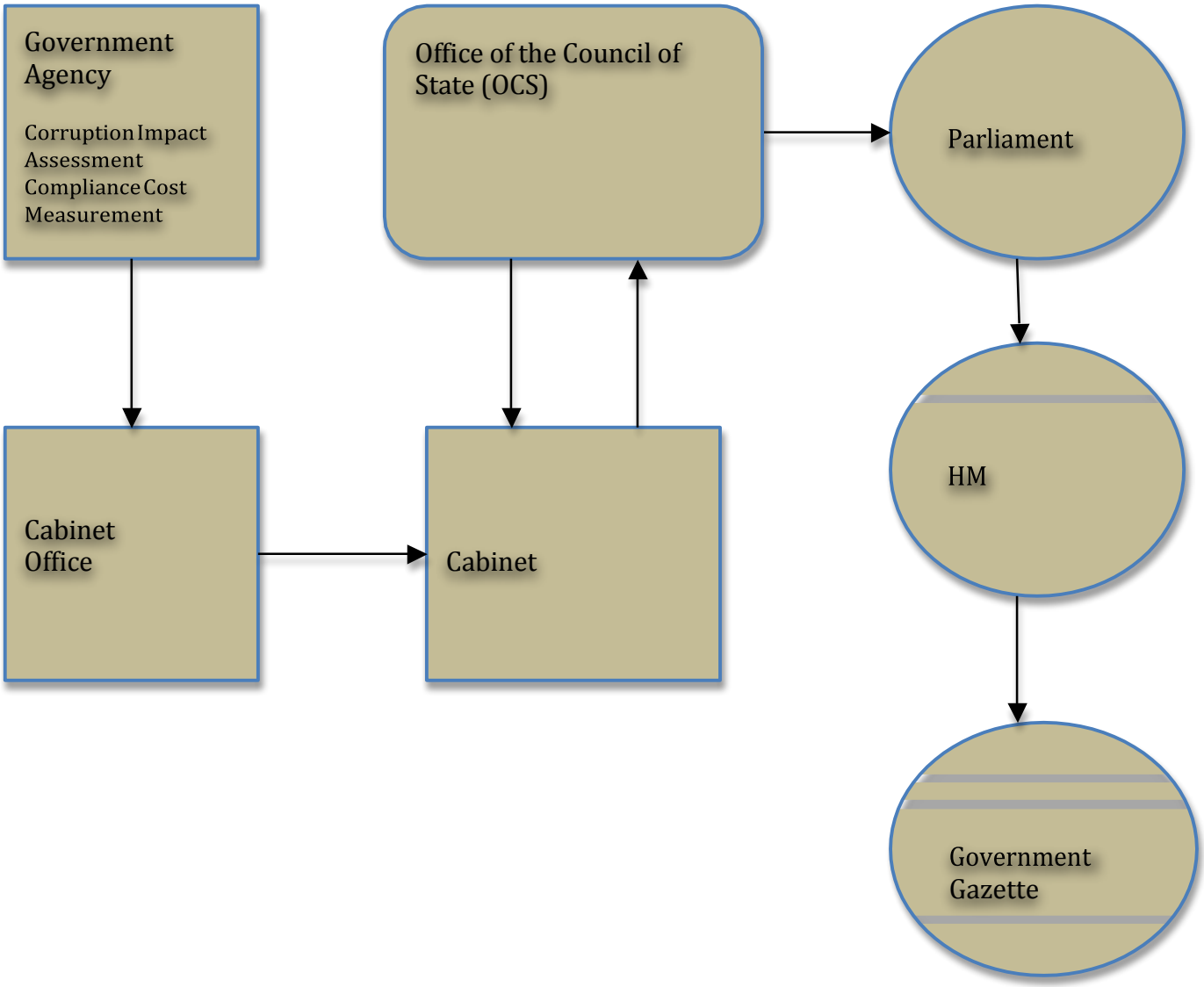
Accordingly, all governments and civil servants should apply the principle of caveat emptor to all policy issues and turn over every stone to ensure that regulation is really needed and will achieve the policy objective at minimal cost to the community!

## 2. Scope and Application of RIA

The corruption impact assessment and compliance cost measurement framework should be prepared for new and amending legislation by responsible government agencies prior to submitting proposed legislation to the Cabinet Office as shown in the diagram below.

Regulatory impact analysis (RIA) will be initially prepared by government agencies to existing primary legislation and other forms of subordinate legislation. Once the RIA system is embedded within government, RIA will need to be prepared for new and amending legislation and submitted to the Cabinet Office together with the proposed legislation.

### Thailand Legislative Process



# 3. The Key Elements of Regulatory Impact Analysis (RIA)

**Overview**

A RIA is comprised of the following seven parts:

1. Identification of the problem
2. Objectives
3. Identification of Options
4. Assessment of Options
5. Preferred Option
6. Consultation
7. Proposed Regulations

Parts 1 and 4 entail most of the content in a RIA.

The key issues that need to be dealt with are discussed below for each of the seven parts. As will be seen the key issues are discussed at a general and high level. This has one obvious limitation. Each reader will interpret differently the expected level of detailed analysis. To obviate this, these Guidelines provide a case study of how to apply the key parts of a RIA to an actual case study to demonstrate the level of analysis and critical thinking required.

## 3.1. Identification of the problem

A key weakness in RIAs prepared by OECD member countries is the tendency to limit the problem section to an overview of the problem at a high-level with aggregated data. In many cases, the actual causes are not analysed. This generally leads to an overstatement of the problem and results in an overstatement of the benefits later in the cost benefit analysis section. This makes it easier to justify the introduction of new regulations. However, it is also likely to lead to over-regulation, increased regulatory burden and non-delivery of the policy objective, for example to save lives, to protect the environment and so forth.

The problem section is the most critical part of the RIA. It provides the opportunity to understand the problem properly and to find solutions that are commensurate with the size of the problem.

To prepare a high quality analysis of the problem, you require superior analytical skills and a willingness to find and develop analyses where no data or limited data exists about the problem.

A key challenge for anyone preparing a RIA is to deal with the differing perceptions and positions of key stakeholders, including government. It is only natural that everyone in the community has a different understanding of a problem; mostly due to their limited access to knowledge of the problem.

The challenge is even greater where a Minister has made a public announcement to introduce a law or regulation or the government has an election commitment to introduce a law or

regulation to resolve a particular problem. Many civil servants preparing a RIA feel compelled to justify the Minister's position or the government's election commitment. In doing so, these RIAs misrepresent the size of the problem by excluding critical data and analyses.

It is important for Ministers and Governments to be properly advised. If your analysis of the problem is different to the Government's perception of the problem, it needs to be advised accordingly. Remember, the purpose of the RIA is to enable the decision-maker (Government) to make informed decisions. If you do not undertake a detailed analysis of the problem or omit critical analyses that would materially change the outcome of the preferred regulation, you are not providing the Government with the opportunity to make an informed decision.

Your responsibility is to give the Government the opportunity and choice to decide whether the size of the problem is x or y or z and whether they want to proceed with the preferred regulation. That is their decision. Not your decision. Just make sure that you give them the best information, not just the information you think that they want to hear!

The benefits of robust analysis of the nature and extent of the problem:

- Confirm or refute the perceived extent of the problem;
- Enable key stakeholders to make informed comments;
- Enables some key stakeholders to reconsider their previously held positions where the extent of the problem is greater or lesser than their perception of the problem;
- Enable government to make policy adjustments if the analysis of the nature and extent of the problem is materially less than the perceived magnitude and impact believed prior to the analysis. Policy adjustments could include amendments to the design of the proposed regulation so it is commensurate with the size of the problem, withdrawal of the proposed regulation, adoption of other policy alternatives that are more likely to be commensurate with the size of the problem, or a decision that there is no role for government given that other regulatory schemes address the problem or market failure was not demonstrated.

It is imperative that the proposed regulation and feasible alternatives match the nature and size of the problem. For example, if the proposed regulation is to ban children less than six years of age being transported on a motorcycle, the size of the problem must exclude motorcycle fatalities and injuries for children over six years of age as well as other fatalities and injuries incurred by other modes of transport: car, bus, truck, minivan, lorry, tractor, pedestrian etc. The purpose of the problem analysis is to measure the number of children less than six years of age that are killed or injured traveling on a motorcycle.

A robust analysis of the nature and extent of the problem is critical to regulatory reform and the development of good regulation that is efficient and effective. The following questions need to be explored and answered.

- Who is affected by the problem?
- What is the scope and scale of the problem?
- Is the identified problem a part of a larger problem? If so, what is the size of the identified problem relative to the larger problem?
- What is the cause of the problem?

- Is there sufficient empirical evidence that a problem exists?
- Is the extent of the problem identified or is its identification based only on anecdotal evidence?
- What are the economic, social and environmental costs of the problem, and who bears these costs?
- Does the problem exist currently, or is it merely anticipated?
- Is the problem a minor irritant or a significant hazard?
- Are there any technological, economic, political, administrative, social and/or environmental constraints that are relevant to the problem?
- Are there existing regulations that could deal with the problem? If yes, why are these regulations inadequate?
- What are the consequences of not taking any action?
- Could relying on the market in conjunction with the general application of existing laws and regulations solve the problem? If not, why not?
- What is the experience in other jurisdictions with different regulatory frameworks?
- What is the scope and scale of the problem in unregulated jurisdictions?
- Has the scope and scale of the problem increased/decreased in unregulated jurisdictions due to market, technological, regulatory or environmental changes?

### 3.2. Objectives

To enable proper formulation of policies, it is necessary to give careful consideration to the desired outcomes. Unless the policy goals are clearly specified, the identification of appropriate alternative means of achieving them will be compromised.

Particular care should be taken to ensure the objective is defined broadly and is not confused with the strategy for its achievement. For example, a reduction in motorcycle fatalities is an objective whereas compulsory wearing of motorcycle helmets is one strategy or means for achieving this objective. Focusing on a strategy rather than the general outcome will hinder a full and proper consideration of alternative means of achieving the desired outcome. That is finding the solution to the problem. The objective should identify the ends to be achieved or the broad policy outcomes desired rather than the means of its achievement.

### 3.3 Identification of Options

A fundamental stage in the policy development process is the identification and assessment of all feasible alternatives to the problem being addressed. Unless a full and proper assessment of feasible alternatives is undertaken, the regulatory proposal adopted may not represent the best solution to the problem. Thus, it is important to consider what the most effective tool will be to achieve the desired outcome.

Preliminary consideration of the range of options available to achieve the stated objective may identify some options that appear, after closer examination, inappropriate and unworkable. In these cases, the option should be discarded and a brief explanation provided why the option(s) is not feasible.

The remaining feasible options should be further examined in greater detail in order to provide a solid basis for a cost benefit analysis. In particular, greater detail on the likely operation of the options will address how each option will be adapted so as to provide a solution to the problem as well as potential impediments.

Depending on the option, the following questions may need to be considered:

- How would the alternative work?
- What role does government have?
- Is there sufficient commonality of interest, within an industry or professional association to ensure high levels of voluntary compliance?
- How will consumer interests be represented?
- Does the alternative discriminate against persons/groups/industries?
- Is the alternative legally feasible?
- Does the alternative restrict competition?
- What monitoring will be required and how would monitoring occur?
- Is the alternative likely to be enforceable?
- Will non-compliance be evident?

### 3.4. Assessment of Options

Cost benefit analysis measures the efficiency or resource allocation effects of a regulatory change and alternative options. It calculates the dollar value of the gains and losses for all people affected. If the sum is positive, the benefits exceed the costs. The option that provides the greatest net benefit provides the most efficient resource allocation.

Cost benefit analysis:

- provides decision makers with quantitative and qualitative information about the likely effects of each option

- encourages decision makers to take account of all the positive and negative effects of each option, and discourages them from making decisions based only on the impacts on a single group within the community

- assesses the impact of each option in a standard manner, which promotes comparability, assists in the assessment of relative priorities and encourages consistent decision making

- captures the various linkages between the regulatory proposal and other sectors of the economy (for example, increased safety may reduce health care costs), helping decision makers maximize net benefits to society, and

- helps identify cost-effective solutions to problems by identifying and measuring all costs.

Even when it is difficult to estimate some costs or benefits with precision, cost benefit analysis makes clear and transparent the assumptions and judgements made. Further, attempting to quantify costs and benefits encourages analysts to more closely examine these factors.

For most regulations, costs are normally more evident, measurable, concentrated on one group and immediate (in term of time) compared to benefits, which are often less easy to measure, more widespread and long-term.

Steps in preparing a full cost benefit analysis

1. Specify the set of options
2. Decide whose costs and benefits count
3. Identify the impacts and select measurement indicators
4. Predict the impacts over the life of the regulatory proposal
5. Monetise (attach dollar values to) impacts
6. Discount costs and benefits to obtain present values
7. Compute the net present value of each option
8. Perform sensitivity analysis
9. Conclusion

If you are unfamiliar with cost benefit analysis, you should refer to a reputable economic textbook or governments that have published on this subject. The Australian Government's Handbook of Cost Benefit Analysis (2006) provides guidance and detail across a wide range of possible policy issues. This can be downloaded from the internet.

Other relevant publications can be found on the OECD's regulatory reform website and most OECD member countries publish RIA on their websites. This resource should be used to obtain RIAs from other countries to ascertain how they measured costs and benefits on the policy issue you are working on and also to benchmark the analysis of the problem and regulatory frameworks.

### 3.5. Preferred Option

A comparison of the benefits, costs, net benefit and benefit cost ratios for each option should be summarized in a table to enable the reader to quickly compare the different outcomes.

Ideally the quantifiable costs and benefits will be discounted to generate a net present value that is greater than zero.

Some costs and benefits may be difficult to quantify. A qualitative account of these costs and benefits may be used.

Government regulators and agencies should not be concerned if the proposed regulatory option is not the best option or imposes a net cost. It should be remembered that the cost benefit analysis framework is not a precise process (given that not all costs and benefits can be quantified) and the purpose of the RIA is to seek further input from key stakeholder and the wider community to enable Government and responsible Ministers to make informed decisions.

There may be uncertainty and various risks associated with an option that is superior to the proposed regulatory option, or there may be considerable difficulties in quantifying most of the costs and benefits for most options.

It is important that Government and Ministers are provided with an honest appraisal of the costs and benefits

## 3.6. Consultation

Consultation with affected groups is integral to regulation impact analysis (RIA). Effective consultation is commenced early and preferably prior to the commencement of the RIA.

Effective consultation engages affected groups to contribute to policy development. This includes providing information and data to help the responsible department to define the extent and causes of the problem, measure the likely compliance costs, analyze the impact of any restrictions on competition and to identify feasible alternatives.

Document the consultation undertaken by identifying the groups, firms, government agencies and individuals that have participated in the consultation process.

It is important to acknowledge the contribution of any stakeholder by disclosing the information and data that helped to inform the analysis of the problem.

Similarly, it is important to acknowledge stakeholders that have provided compliance cost estimates that have been used in the assessment of the proposed regulation.

Document the views of groups affected by the proposed regulation and any evidence provided to support those views.

A response and the reasons for not accepting a particular view of a key affected group should be provided. For example, the XYZ industry federation raised concerns that the proposed regulation would impose significant compliance costs on its members.

In response to these concerns, the department held meetings with the XYZ industry federation and agreed to meet with a representative sample of its members to identify and measure the likely compliance costs. Meetings were held at the business premises of 12 selected firms where each firm provided information on the type of personnel and processes required, the likely time required and the associated costs involved with compliance of the proposed regulation. The average compliance cost was calculated at 6 baht per unit of production and represented about 0.8% of the cost of production.

With this new information, the XYZ industry federation reconsidered its submission and agreed that the compliance costs would not impose a significant burden on its members. The XYZ industry federation also agreed to notify members in its next newsletter the outcomes of the compliance study.

This provides a clear demonstration that matters raised in submissions have been considered, and contributes to the transparency of the regulatory process. This helps to build trust within the community that government is inclusive and gives consideration to matters raised and makes appropriate adjustments to the analysis and/or the design of the proposed regulations.

## 3.7. Proposed Regulations

A copy of the proposed regulations should be attached at the end of the RIA to enable key stakeholders and the wider community to comment on the scale and scope of the regulations.

# 5. COST BENEFIT ANALYSIS

**Rationale for using cost benefit analysis as the preferred method for regulatory analysis**

Regulation has positive (benefits) and negative (costs) impacts. Usually, the group that incurs the cost is different to the group that receives the benefits of the regulation. For example, motor car trader regulation imposes costs on motor car traders to be licensed and to provide warranty and disclosure requirements so that consumers are protected from faulty vehicles and can make informed decisions. Provided the benefits are greater than the costs, the regulation is deemed to have provided a net benefit to society.

However, there is an opportunity cost attached with every regulation. The opportunity cost imposed on businesses and consumers is the resources that could be allocated to other uses in the absence of regulation. Using the above example, suppose the total cost to business associated with motor car trader regulation is $10 million, then the opportunity cost to motor car traders is the foregone opportunity to have allocated the $10 million to other uses. Lets suppose that most of the $10 million cost is attributed to management and staff time complying with disclosure requirements. Lets also suppose that motor car traders spend two hours on compliance work rather than two hours on revenue generating activities: selling vehicles or providing after-sales services. The two hours expended on regulatory compliance represents the opportunity cost to motor car traders: potential foregone revenue income from their business activity. In real simple terms, they could have sold a vehicle to a customer, but were instead sitting at the desk doing compliance paperwork.

The opportunity cost of regulation involves society giving up something in order to achieve a regulatory objective and the associated benefits. For most regulations, a specific business group incurs the regulatory costs so that society can benefit from safety, environment, consumer protection and so forth.

If the opportunity cost across the total stock of regulations is significant, the cost to business can result in lower productivity, higher production costs and less competitiveness. This can ultimately affect investment and employment opportunities.

Given that regulation has positive (benefits) and negative (costs) impacts and there is an opportunity cost associated with regulation, it is important to evaluate the costs to all parties and to ensure the total benefits are in excess of the total costs that are imposed.

This is the rationale for using cost benefit analysis as the primary tool to undertake regulatory analysis. Cost benefit analysis calculates the total costs and compares these costs with the total benefits. A qualitative assessment of benefits (and sometimes costs) is still an important component of the cost benefit analysis. It allows the identification and discussion of direct and intangible benefits to be considered and possibly weighted in a partial cost benefit analysis assessment. Importantly, the cost benefit analysis facilitates informed decision-making on the best available data. For example, a partial cost benefit analysis needs to provide the cost and benefit outcome (net cost or net benefit) for those components that could be monetized and discuss whether the non-monetized benefits and costs are material enough to make a significant difference on the monetized analysis. Even if this discussion concludes that the proposed regulation is likely to generate a net benefit after considering monetized and non-monetized costs and benefits, there is still a need to consider the probability of the regulation achieving the policy objective and whether the benefits of the proposed regulation are significant compared with other problems where the government may have reason to regulate and deliver greater benefits to society.

An analysis of the average compliance cost per affected business is also important information to the decision-maker. For example, two different regulatory analyses reveal the following compliance costs. In one regulatory analysis, the business compliance cost is $50 per annum and the second regulatory analysis, the business compliance cost is $10 per unit that represents and 8% cost increase per unit. Even where the benefits cannot be monetized, a reasonable decision-maker would not consider the $50 per annum a huge impost on business. But a $10 per unit compliance cost that led to an 8% cost increase is likely to concern the decision-maker in terms of whether the flow-on effect on consumer prices and impacts on business competitiveness is worth the introduction of the regulation, particularly if the benefits to society appear somewhat small relative to other comparable regulatory matters. Even if the decision-maker requested his/her department to undertake further policy work to ascertain whether there was a lower cost alternative, the objective of the cost benefit analysis has been achieved. It has facilitated informed decision-making. In this case, the decision-maker has decided the opportunity cost to business and consumers appears, prima facie, too great to achieve the policy objective, and wants a fuller exploration of alternative compliance approaches that can deliver a lower compliance cost.

Notwithstanding the difficulties of quantifying benefits, cost benefit analysis is the only analytical framework that evaluates the costs and benefits to all parties. Cost benefit analysis is not a precise tool but should be seen as a conceptual framework to identifying all of the positive and negative impacts of a regulation and alternative approaches.

**Cost Benefit Analysis Framework**

Cost benefit analysis facilitates informed decision-making. A cost–benefit analysis should assess the costs and benefits of the regulation and the viable options. In most cases, it provides evidence that the benefits of government intervention outweigh the costs and identifies the option that provides the greatest net benefit to society. In some cases, the cost benefit analysis will also reveal that none of the options provide a net benefit to society and that government intervention is not warranted.

The full range of costs and benefits need to be identified and where possible quantified.

There are four stages to cost benefit analysis:

- Identify the groups affected by the regulation
- Identify the type of costs and benefits
- Assessment of the costs and benefits
- Decision criteria

**Identify the groups affected**

During the policy development stage and/or the drafting of the proposed regulations, the affected groups will need to be identified for the purposes of evaluating the costs and benefits. The key affected groups will include those persons, businesses, organizations, groups and industry sectors that will need to comply with the regulation and the beneficiaries will invariably be those parties that receive the goods or services from the regulated party. These parties could be consumers and other businesses for industry specific regulation, and in the case of generic regulation such as environmental regulation, the beneficiaries would be the general public.

## Type of costs and benefits

There are various costs and benefits that need to be considered in a regulatory analysis:

- direct and indirect cost and benefits
- intangible costs and benefits

Direct costs and benefits are closely related to the policy objective of the proposed regulation and the indirect costs and benefits are by-products of the proposed regulation.

Direct costs include compliance costs to those parties that need to comply with the proposed regulation and the administration costs incurred by Government in enforcing the proposed regulations.

Indirect costs comprise social and environmental costs to the community and economy-wide impacts such as a reduction in employment.

Tangible cost and benefits by definition can be valued and involve an explicit market price.

Intangible costs and benefits do not have a market price and a market variable needs to be found to approximate their value. Common intangible costs and benefits include positive and negative impacts on the environment.

The nature of the proposed regulation will determine which of these costs will need to be evaluated. At a minimum, the direct costs and benefits would need to be evaluated.

## Assessment of the Costs and Benefits

### Direct Costs

Generally, the direct costs of a regulation can be quantified. Each part of a regulation that imposes an obligation on a person, business or organization to comply with a specific provision imposes a direct cost.

Each regulatory clause should be appraised to determine whether it is likely to impose a cost and to identify the person, business, organization, group or industry sector that will incur the direct costs.

Several pieces of data are required to calculate the direct cost. These normally include the compliance time involved and the associated labor cost and the compliance frequency (one-off or periodic).

This calculation should be undertaken on a transaction basis and on an aggregated basis for the expected total transactions across the affected group.

The example below is taken from the RIA for the Motor Car Traders Regulations 2008. The example details a regulatory obligation, compliance time involved, labor cost and the total transactions. With this information, calculations are undertaken for the transaction compliance cost, the annual compliance cost to the industry and the present value (discounted) compliance cost to the industry.

**Box 1: Motor Car Traders Regulations 2008 RIA**

Regulatory obligation

The regulations require motor car traders to record information in a dealings book about the acquisitions and disposals of motor vehicles. The information includes vehicle identification number, odometer reading, name and address of owner or buyer, security interest (if any) and road worthiness certificate.

Compliance time involved

On-site consultation with motor car traders and observance of the compliance task revealed that the time involved for recording details about a motor vehicle acquisition was about 45 minutes and for the disposal of a motor vehicle about 15 minutes.

Labor Cost

To calculate the labor cost associated with the compliance time involved with a regulatory obligation, we need to establish the hourly rate. In the absence of any industry data on hourly rates paid to personnel involved in this compliance task, the analysis has drawn upon the Australian Bureau of Statistics (ABS) private sector average weekly earnings.

The ABS average weekly earnings are stated at $1,083.29. This is multiplied by 52 weeks to obtain an annual salary of $56,331

The total number of weeks worked per annum needs to exclude annual and public holidays and sick leave entitlements. This equates to 44 weeks per annum and is multiplied by number of hours worked each week (41 hours per week). This equates to 1804 hours per annum.

The $56,331 annual salary is divided by 1804 hours per annum. This equates to an hourly rate of $31.23.

The $31.23 hourly rate needs to be augmented with any wage oncosts (payroll tax, workers compensation premiums, superannuation charges) and business overhead costs to establish the actual hourly rate.

The standard salary oncosts is calculated at 16.5% and 50% for overheads. The $31.23 is multiplied by 1.165 and 1.5 and equates to $54.57 and rounded to $55.

The workings and formula used to calculate the hourly rate is provided below.

ABS Average Weekly Earnings - $1083.29 multiplied by 52 weeks
= $56,311 per annum

Number of weeks worked per annum
52 weeks minus 4 weeks (annual holidays) minus 2 weeks (public holidays) minus 2 weeks (sick leave)
= 44 weeks

Average weekly hours for full-time workers
= 41 hours

On cost multiplier (payroll tax, workers compensation, superannuation)
= 1.165

Overhead cost multiplier (rent, building and land rates, insurance and other corporate overheads)
= 1.5

= $\frac{\$56,331}{44 \times 41} \times 1.165 \times 1.5$

= $\frac{\$56,331}{1,804 \text{ hours per annum}}$

= $31.23 x 1.165 x 1.5

= $54.57

This has been rounded up to $55 for the purposes of making the calculations below.

Total transactions

To ascertain the total cost to the motor car trader industry, we need to know the total number of motor vehicle sales for both new and used vehicles. In this case, the Australian Bureau of Statistics collects data on annual motor vehicle sales.

There are 250,000 new car sales per annum and motor car traders would need to record the acquisition from the manufacturer or importer/distributor and the disposal to consumers (500,000 entries in the dealings book).

There are about 450,000 used motor car sales per annum and motor car traders would need to record the acquisition from the seller and the disposal to the buyer. Hence, a total of 900,000 entries would need to be in the dealings book across the industry.

As a result, a total of about 1,400,000 entries (500,000 new car sales and 900,000 used car sales) would be recorded in motor car traders' dealings books across the industry.

For the purposes of calculating the compliance cost, there are 700,000 acquisitions (250,000 new cars and 450,000 used cars) and 700,000 disposals (250,000 new cars and 450,000 used cars).

**Calculations**

Transaction compliance cost

With the above information, we can now calculate the compliance cost per sales transaction for each acquisition and disposal.

Per Acquisition transaction: $55 per hour (labor cost) divided by 45 minutes = $41.25

Per Disposal transaction: $55 per hour (labor cost) divided by 15 minutes = $13.75

Annual Compliance Cost

With the per transaction cost, we can now calculate the total compliance cost for the 1.4 million transactions across the industry.

700,000 acquisition transactions multiplied by $41.25 = $28,875,000
700,000 disposal transactions multiplied by $13.75 = $9,625,000
Total annual compliance cost: $38.5 million

Present Value Cost

The motor car trader regulations have a life of ten years and the costs have been discounted by 3.5% over this time period. The $38.5 million annual compliance cost over ten years equates to $385 million (undiscounted) and a present value of $320 million (discounted).

The above analysis provides two useful outcomes. Firstly, it provides an estimation of the costs on an individual transaction basis. This enables consideration of whether the compliance burden is reasonable taking into account the purpose of the regulation and whether it is likely to have a significant impact on the business or be passed onto the purchaser. In this case, the $55 cost is considered a relatively small compliance cost relative to the retail price of most motor vehicles and to the gross profit margin on a motor vehicle.

Secondly, the analysis provides the total cost in respect to this specific provision on dealings book over the life of the regulations.

This is a basic example of compliance cost calculation. Other regulations may require the calculation of costs associated with equipment and materials used as part of the compliance and/or specialist external assistance (for example, legal or accounting advice). The same methodology as used in the above example would be applied for these extensive compliance requirements.

The methodology can also be used to calculate government costs to administer regulation such as the time involved in processing and approving applications for a licence, permit, registration etc the renewal of the aforesaid, inspections and audits. The actual salaries paid to government agency personnel would be used rather than average weekly earnings.

To recap, the compliance time involved is critical and should be obtained from affected stakeholders that need to comply with the regulation. Private sector average weekly earnings should be used in the absence of reliable industry wages data and industry or government statistical data should be used to determine the total number of transactions.

**Direct Benefits**

A qualitative assessment of the direct benefits was undertaken as the several government agencies that access a motor car traders' dealings book had no data. The following qualitative assessment was provided ass shown in Box 2.

**Box 2: Qualitative assessment of the benefits**

The proposed regulation will enable Consumer Affairs Victoria to undertake routine inspections and investigations into consumer complaints, and the Motor Car Traders Guarantee Fund to assess and pay claims to consumers; both organizations are reliant on the prescribed vehicle identification information to match the motor vehicle with the motor car trader and the buyer during a contractual dispute. Similarly, Victoria Police and VicRoads rely on the prescribed vehicle identification in the dealings book to trace and match stolen vehicles being sold at a

motor car trader's premises and to ensure motor vehicles are roadworthy and transfer of clear title respectively.

As most of the information recorded in the dealings book would be undertaken by a motor car trader for stock control purposes, the only feasible alternative considered was a variation to the prescribed requirements involving less information as shown in Box 3 below.

**Box 3: Alternative - Less Information Prescribed**

An alternative is to prescribe less information than in the proposed regulation. However, most motor car traders would still keep records regarding vehicle identification for stock record purposes and enquire into whether there is any security interest in a trade-in motor vehicle and amounts to be paid out on discharge as this would be in their financial interests to ensure that they did not incur any potential financial liability prior to the sale of the trade-in motor vehicle.

The regulation and the alternative were compared. However, as the qualitative assessment of the alternative and the absence of quantified benefits required the assistance of another decision-making in the form of multi-criteria analysis – a balanced score card approach. Box 4 below shows the application of multi-criteria analysis for assessing the regulation and the alternative.

**Box 4: Multi-criteria analysis**

Not all of the benefits can be quantified and a net present value cannot be calculated. Accordingly, the multi-criteria analysis approach has been adopted to compare the net impacts of the alternatives.

In this analysis, the criteria are:

- Increased consumer protection (75 per cent);
- Reduced costs to business (15 per cent); and
- Reduced costs to Government (10 percent).

These criteria have been selected on the basis that they reflect the key costs and benefits detailed in the alternatives.

Weightings are assigned to each of the criteria reflecting their relative importance to the objectives of consumer protection and economic efficiency.
For each alternative, a qualitative score is assigned to each of the criteria, depending on the impact of the alternative on the criteria. Scores are assigned relative to the base case –either -5 if the impact is negative/undesirable/poor and +5 if there is a positive/desirable/good impact.

The following options are assessed in the Table below:

Base Case – information prescribed by the Act i.e motor car traders to determine the content of a dealings book for acquisitions and disposals of motor vehicles.

Information prescribed in the proposed regulations – same as the Act but prescribed entry requirements for the acquisition and disposal of motor vehicles.

Less information prescribed – enables the removal of some unspecified entry requirements for the dealings book.

**Table: Assessment of net impacts of alternatives**

| Criteria | | Base Case | | Proposed Regulation | | Less Information | |
|---|---|---|---|---|---|---|---|
| Criteria | Weighting | Score | Weighted Score | Score | Weighted Score | Score | Weighted Score |
| Increased consumer protection | 0.75 | 0 | 0 | +5 | 3.75 | +3 | 2.25 |
| Reduced cost to business | 0.15 | 0 | 0 | -5 | -0.75 | -3 | -0.45 |
| Reduced costs to government | 0.10 | 0 | 0 | +5 | 0.50 | +3 | 0.50 |
| **Total Score** | | **0** | **0** | | **3.50** | | **2.10** |

Under the increased consumer protection criterion, information prescribed in the proposed regulation receives a score of +5 as it covers the critical aspects that need to be included in the dealings book. A score of +3 score is allocated to the less information prescribed option as motor car traders would still maintain most of the information prescribed in the dealings book as the data collected is considered normal business practice but some motor car traders could omit critical information such as odometer readings. Accordingly, the less information prescribed option would still provide increased consumer protection but not to the full extent as scored in the information prescribed in the proposed regulation.

Under reduced costs to business, the information prescribed in the proposed regulation receives a -5 score given the compliance costs incurred (notwithstanding that some costs would be incurred as part of normal business practice) and less information prescribed receives a -3 score given that some businesses could choose to collect less data.

Under the reduced costs to Government criterion, information prescribed in the proposed regulation receives a +5 score as it provides certainty about the type of information collected by motor car traders. The less information prescribed option receives a +3 score given that motor car traders would as part of their normal business practice still collect most of the information prescribed in the proposed regulation.

The multi-criteria analysis suggests that the most attractive alternative is the information prescribed in the proposed regulation as this gives assurance that motor car traders do collect all the necessary information for the acquisition and disposal of motor vehicles.

**How to quantify the benefits when no data is available on the problem**

If the analysis of the nature and extent of the problem has not providing supporting evidence on the costs associated with the problem, it will be difficult to quantify the benefits of a proposed regulation and the alternatives.

In these cases, it is worthwhile undertaking comparative research to ascertain whether other countries have conducted empirical analyzes that can adjusted for the local situation in Thailand.

For example, the Victorian State Government in Australia, recently reviewed its safe drinking water regulations. These regulations prescribe mandatory drinking water standards, water quality and the frequency of sampling that must be undertaken by water authorities. The policy objective of the regulations is to protect public health. The regulations have been highly effective

in preventing the outbreak of waterborne diseases. Accordingly, the RIA was unable to provide data on the size of the problem (cases of deaths and hospitalizations and the associated costs).

In this regard, quantifying the benefits in the absence of the regulations is difficult without appropriate data. The Department of Health searched for empirical data from other countries where there had been outbreaks of water-borne diseases (USA, Canada and Sweden) and applied these findings to its analysis to the local situation in Victoria. As shown in Box 5 below, the Department of Health was able to estimate the incremental benefits that would arise from protecting public health from preventing these outbreaks of water-borne diseases.

**Box 5: Safe Drinking Water Regulations 2015, Victoria, Australia**

**Quantifiable incremental benefits**

The estimation of quantifiable benefits in this RIA is based on incremental cost savings arising from protection of public health in the form of reducing the risk of gastroenteritis outbreaks/cases.

In order to establish the incremental benefits under the options the following health and mortality cost assumptions have been made:

The societal cost of an epidemic outbreak would be $163.64 per person in 1995 prices, based on a Monash University and ANU report on an outbreak on a town of 11,000 people (Department of Epidemiology et al 1997). This is equivalent to $267.84 per person in 2014 prices.

The cost of a death to society is based on a value of a statistical life (VSL), which represents how much society is willing to pay to reduce the risk of death. The VSL estimate demonstrates the financial value society places on reducing the average number of deaths by one and is given as $3.5 million in 2007 (OBPR 2008). This is equivalent to $4,216,724 in 2014 prices.

**Potential health costs of an outbreak**

Case studies from similar (developed) countries with inadequate water quality regulations and monitoring help to provide the magnitude of what could potentially happen with an outbreak. The following specific outbreaks in Milwaukee, Östersund and Walkerton are used as examples where people became ill or died.

These cases of specific outbreaks are summarized in the Table below. The average number of people becoming ill with IID (infections intestinal disease) in an outbreak is around 144,100 with around 39.31% of the total population affected on average. The risk of death is more prevalent in those with suppressed immune systems.

| Country/location | Study | Year | Population affected by IID | Pathogen behind outbreak | Population affected as % of total population | Deaths | No of deaths as a % of those affected |
|---|---|---|---|---|---|---|---|
| USA/Milwaukee | Mackenzie et al 1994 | 1993 | 403,000 | *Crytosporidium* | 25.00% | 69 | 0.017% |
| Canada/Walkerton | Salvadori et al 2009 | 2000 | 2,300 | *Campylobacter jejuni* | 47.92% | 7 | 0.304% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sweden/Östersund | Widerstrom et al 2014 | 2010 | 27,000 | *Crytosporidium* | 45.00% | 0 | 0.00% |
| Average | | | 144,100 | | 39.31% | 25 | 0.107% |

**Estimated costs of a Milwaukee-type scenario in a Victoria context**

In the Milwaukee 1993 outbreak, where Crytosporidium had contaminated the city's public water supply, approximately 64 people or 93% of the 69 deaths in 1993 involved people with AIDS. Another waterborne outbreak in 1994 in Las Vegas, Nevada led to the deaths of 41 AIDS patients (Goldstein et al 1996). This is used to consider the impacts on people with compromised immune systems.

In order to estimate the cost of mortality during an outbreak in a Victorian setting the following assumptions are made:

- The population served by the largest water supplier in Victoria is estimated to be 1.74 million and represents 30.97% of the total population of an estimated 5.62 million.

- In 2011 the number of AIDS patients in Victoria was 2,282.

- AIDS patients who died in Milwaukee in 1993 (64) as a proportion of total population of AIDS patients in 1995 (653) is estimated to be 9.8%.

- The total population of AIDS patients in Victoria affected by an outbreak is estimated to be 69 (2,282 x 30.97% x 9.8% = 69).

- The probability of an outbreak occurring is 1.75%.

- The estimated number of mortalities from a waterborne outbreak is 1.22 (69 x 1.75%)

- The VSL as at June 2014 is estimated to be $4,216,724.

The cost of mortality during an outbreak in Victoria is therefore estimated to be $4,216,724 x 1.22 mortalities = $5.12 million or 4.21 million in 2014 present value dollars.

**Decision Criteria**

Net present value

Where a full cost benefit analysis has been undertaken, the future costs and benefits need to be discounted to determine the net present value. The net present value must be positive i.e NPV > 0 in order for the proposed regulation to meet the acceptance criteria. The formula and an example are provided in Box 6 below.

**Box 6: Net present value formula**

To determine the net present value (NPV) of an option, the costs and benefits need to be quantified for the expected duration of the proposal.

The net present value is calculated as:

$$NPV = \sum_{t=0}^{T} (Bt-Ct)/(1+r)t$$

where Bt = the benefit at time t
Ct = the cost at time t
r = the discount rate
t = the year
T = number of years over which the future costs or benefits are expected to occur (the current year being year o)

Consider an option that will require industry to install new equipment to limit air pollution. The equipment costs $5 million to install and will operate for the following four years. Ongoing (annual maintenance) costs to business are $1 million a year (in constant prices). The benefits are estimated at $3 million a year (in constant prices). The discount rates are 3 per cent and 5 per cent.

| | Costs | Benefits | Annual net benefit | Net present value | |
|---|---|---|---|---|---|
| | (Ct) | (Bt) | (Bt-Ct) | 3% | 5% |
| | $m | $m | $m | $m | $m |
| Year 0 | 5 | | -5 | -5.00 | -5.00 |
| Year 1 | 1 | 3 | 2 | 1.94 | 1.90 |
| Year 2 | 1 | 3 | 2 | 1.89 | 1.81 |
| Year 3 | 1 | 3 | 2 | 1.83 | 1.73 |
| Year 4 | 1 | 3 | 2 | 1.78 | 1.65 |
| Net present value | | | | 2.44 | 2.09 |

Source: Best Practice Regulation Handbook (2010) Australian Government

## Other decision-making tool to use in the absence of a full cost-benefit analysis

A full cost-benefit analysis (CBA) represents best practice in evaluating the impact of viable policy options as it gives decision-makers a strong basis for comparing policy alternatives on the basis of quantifiable (monetary) costs and benefits.

When the benefits (and in some cases the costs) of the policy options being considered cannot be sufficiently or confidently quantified and monetized, a partial cost benefit analysis should still be undertaken with supplementary decision-making tools to assist in comparing or ranking options. These include:

- _break-even analysis;
- _cost-effectiveness analysis; and
- _multi-criteria analysis.

These decision-making tools should not be used as a substitute for cost-benefit analysis but as an aid to improve a partial cost benefit analysis.

### Break-even analysis

Break-even analysis is useful where the benefits can be monetized but there is a degree of uncertainty of whether the benefits are likely to be accrued. This requires estimating the benefits needed to offset the estimated costs. Box 7 below provides an example of the use of break-even analysis.

**Box 7: Example of Break-even analysis**

A hypothetical proposal is expected to improve safety by reducing fatalities and preventing injuries and the cost of the proposal can be estimated with reasonable certainty. While there are widely used estimates of the value of a statistical life (VSL)(assumed here to be $4 million) and the value of avoided injuries, in terms of hospitalization costs and lost productivity (assumed here to be $250,000 per injury0, there may be no way of confidently and accurately quantifying how many lives will be saved and injuries will be avoided from the proposal.

It is possible to use this available information to determine how many fatalities/injuries would need to be avoided in order to justify the costs of the proposal, that is for the proposal to 'break-even'. Various combinations of fatalities and injuries prevented would see the proposal break-even. For example, if the total cost of implementing and complying with the proposal is $13 million per annum, the proposal would need to prevent three fatalities and four injuries each year to break-even, using a VSL of $4 million and the cost of injuries of $250,000. Similarly, preventing 2 fatalities and 20 injuries would also allow the proposal to break even.

Judgment needs to be exercised to determine whether such a proposal would achieve the magnitude of benefits required to break-even given the nature and size of the policy problem (e.g does the proposal target a small element of the problem?) and the expected practical effect of the proposal (e.g what is the intervention logic and what behaviors/activities are expected to change?).

In this example, if the current level of fatalities is 2 and the current level of injuries is 3, then the break-even won't be achieved. If the current level of fatalities is instead 30 and injuries is 100, then it is more likely to be achieved. In the latter case, the judgment as to whether the break-even points is feasible should be supported by objective data, for example based on historical time-series incident data and the counterfactual/baseline, overseas experience, the safety-related outcomes experienced from a similar policy proposal, or academic research.

Source: Victorian Guide to Regulation (2011), Department of Treasury & Finance, Victorian Government.

**Cost effectiveness analysis**

Cost-effectiveness analysis is used where the benefits cannot be monetized. It compares alternatives on the basis of the ratio of their costs and a single quantified measure such as lives saved. Box 8 provides an example of how to undertake cost effectiveness analysis. It is a relatively simple calculation.

However, cost effectiveness should be used prudently as it does not address the actual benefits (that is, the costs associated with the nature and extent of the problem). Without this information, it is entirely possible that the Option that provides a higher unit cost may in fact have a higher probability of saving lives. This would occur where the option that has the lowest unit cost does not address the primary causes of the actual problem (road fatalities) but has been assumed that this option will address a primary cause of road fatalities.

**Box 8: Example of Cost Effectiveness Analysis**

Two policy options are aimed at reducing road fatalities. Option A costs $20 million and would save 10 lives and Option B costs $15 million and would save 5 lives. The cost for each life saved is calculated by dividing the cost by the number of lives saved ($20 million divided by 10 lives = $2 million)

| Option | A | B |
|---|---|---|
| Cost | $20 million | $15 million |
| Lives saved | 10 | 5 |
| Cost for each life saved | $2 million | $3 million |

The analysis shows Option A has the highest cost but has the lowest unit cost in

saving lives, $2 million compared with $3 million in Option B. This would suggest that Option A is the preferred option.

**Multi-criteria analysis**

Multi-criteria analysis (MCA) can be a useful tool when it is difficult to quantify the impacts, particularly the benefits of a regulation and alternative approaches.

MCA is a balanced score card approach and requires judgments about how proposed options will contribute to a series of criteria that are chosen to reflect the costs and benefits associated with the proposals. The criteria should be consistent with the stated policy objectives for the proposal and weighting according to their relative importance to the final decision.

A qualitative score would be assigned, depending on the impact of the option on each of the criteria measured relative to the base case (i.e in the absence of regulation). A criterion rating scale from -10 to 10 is preferred as it is easier to include more information on the choices made, and this results in a greater understanding of the proposal. For example a score of 10 would indicate that the option has twice the impact of an option with a score of 5 (and five times the impact of an option with a score of 2 etc). For example, if one option incurred costs of $3.5 million per year, and another option $7 million, then the former option might receive a rating of - 5, while the latter would score -10. The score in this case would be negative as the costs incurred are relative to the base case where no costs are incurred in the absence of regulation.

Box 9 below provides an example of how to use multi-criteria analysis. The weighted scores are calculated by multiplying the score by the criterion weighting. For example in Box 9, the weighted score for Option 1 in respect to a reduction in road-related accidents is +4 and is calculated by multiplying the score of +10 by the criterion weighting (40%). The total score for each option is the sum of the weighted scores for each criterion.

**Box 9: Example of Multi-Criteria Analysis (MCA)**

To achieve a reduction in road related accidents, two options may be considered and evaluated based on the following simplified multi-criteria analysis, with the assignment of scores ranging from -10 for negative outcomes to +10 for positive outcomes relative to the base case. (Outcomes that maintain the status quo would receive a score of zero).

| | | Base case | | Option 1 | | Option 2 | |
|---|---|---|---|---|---|---|---|
| Criteria | Weighting | Score | Weighted Score | Score | Weighted Score | Score | Weighted Score |
| Reduction in road –related accidents | 40% | 0 | 0 | +10 | +4 | +5 | +2 |
| Costs of compliance | 50% | 0 | 0 | -5 | -2.5 | -3 | -1.5 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| and administration | | | | | | | |
| Improved traffic flow | 10% | 0 | 0 | 0 | 0 | -10 | -1 |
| **Total** | | **0** | **0** | | **+1.5** | | **-0.5** |

The assigned scores indicate that Option 1 is considered to reduce road-related accidents by twice as much as Option 2. Meanwhile, the compliance and administrative costs of Option 1 are higher than for Option 2. Option 1 has no expected impact on traffic flow.

In this example, Option 1 is the preferred approach because it yields a positive score of +1.5. Option 2, on the other hand, returns a negative result of -0.5 and would therefore be considered to be an undesirable proposal.

When presenting the results of MCA in a RIA, it is important tot provide sufficient commentary to explain the approach, particularly in terms of providing justification for the choice of criteria, the weightings of the criteria, and the scores assigned to the different options for each of the criterion.

Source: Source: Victorian Guide to Regulation (2011), Department of Treasury & Finance, Victorian Government.

**Expected Quality of RIA Cost Benefit Analysis**

In the early years of RIA adoption in Thailand, the skill and experience of government agency officers will restrict their ability to undertake sophisticated cost benefit analysis. Even where officers have the skill-set, the absence of robust data will prevent the use of more sophisticated analyzes.

With the improvement of data collection strategies over time, government agencies will be in a position to undertake full cost benefit analysis and employ sophisticated methodologies and analyzes.
In the interim, it is expected that at a minimum, the cost benefit analysis should cover the following:

- Where the proposed regulation imposes a direct cost (obligation to comply) on a person, business, organization, group or industry sector, the direct costs (compliance costs) are assessed.

- Where the costs and benefits of the alternatives cannot be quantified, a qualitative assessment should be undertaken.

- The cost to government in administering and enforcing the proposed regulation should be also assessed using a similar methodology to the direct costs.

- Where the benefits of the proposed regulation cannot be quantified, a qualitative assessment of the benefits should be undertaken including an analysis of the likely size of the benefit with some consideration of the weight of each benefit. It will be particularly useful to draw upon comparable RIAs from other OECD and APEC countries where they have been able to quantify the benefits and to adjust these quantified benefits to local conditions in Thailand.

- The use of other decision-making tools such as break-even analysis, cost effectiveness and multi-criteria analysis should be used where a full cost benefit analysis has not been able to be undertaken.

This minimum standard is a significant improvement compared to what existed prior to the introduction of these Guidelines. Importantly, a RIA produced using the minimum standard will enable informed decision-making by government. In particular, it should provide a clear indication of the compliance cost to directly affected stakeholders and the cost to government to administer and enforce the regulations.

Where the costs associated with the problem cannot be quantified and hence the potential benefits cannot be quantified, the RIA also provides important decision-making information that the government department does not have a good understanding of the problem, and in some cases, any surety that the proposed regulation or other options are likely to achieve the policy objective and deliver a net benefit to society.

In these cases, the cost benefit analysis in the RIA enables the decision-maker to err on the side of caution and request that further research is required on the size of the problem, the associated costs and the likely benefits that would be delivered before making a commitment to introduce the regulation. Such an outcome is probable where the cost benefit analysis has revealed significant direct costs to affected stakeholders that could affect the cost of goods and services to consumers and/or business competitiveness, investment and employment opportunities. Another issue of concern may be where the cost benefit analysis reveals significant budgetary costs to Government in administering and enforcing the regulation. Once again, the decision-maker may want further research and evidence that the policy objective can be achieved with a net benefit to society.

Accordingly, the absence of quantification of the benefits should facilitate over time improvements to the quality of data collection strategies within government so that full cost benefit analysis can be undertaken.

## 6. Regulatory Impact Analysis Template

| **REGULATORY IMPACT ANALYSIS TEMPLATE** | |
|---|---|
| Regulation Title | |
| Ministry or Regulatory Body | |
| **Executive Summary** | |
| | |
| **Notice for Submissions** | |
| **Section 1: Identification of the Problem**<br><br>Who is affected by the problem?<br>What is the scope and scale of the problem?<br>Is the identified problem part of a larger problem? If so, what is the size of the identified problem relative to the larger problem?<br>Is there sufficient empirical evidence that a problem exists?<br>Is the extent of the problem identified or is its identification based on anecdotal evidence?<br>What is the cause of the problem?<br>What are the economic, social and environmental costs of the problem?<br>Does the problem exist currently, or is it merely anticipated?<br>Is the problem a minor irritant or a significant hazard?<br>Are there any technological, economic, political, administrative, social and/or environmental constraints that are relevant to the problem?<br>Are there existing regulations that could deal with the problem? If yes, why are these regulations inadequate?<br>What are the consequences of not taking any action?<br>Could relying on the market in conjunction with the general application of existing laws and regulations solve the problem? If not, why not?<br>What is the experience in other jurisdictions with different regulatory frameworks?<br>What is the scope and scale of the problem in unregulated jurisdictions?<br>Has the scope and scale of the problem increased/decreased in unregulated jurisdictions due to market, technological, regulatory or environmental changes? | |
| | |

**Section 2: Objectives**
What are the policy objectives?

**Section 3: Options**
What are the possible regulatory and non-regulatory options that meet the policy objective and solve the problem?
Depending on the option, the following questions may need to be considered and discussed:
How would the alternative work?
What role does government have?
Is there sufficient commonality of interest, within an industry or professional association to ensure high levels of voluntary compliance?
How will consumer interests be represented?
Does the alternative discriminate against persons/groups/industries?
Is the alternative legally feasible?
Does the alternative restrict competition?
What monitoring will be required and how would monitoring occur?
Is the alternative likely to be enforceable?
Will non-compliance be evident?

**Section 4: Assessment of Options**

Steps in preparing a full cost benefit analysis:
1.Specify the set of options
2. Decide whose costs and benefits count
3.Identify the impacts and select measurement indicators
4. Predict the impacts over the life of the regulatory proposal
5. Monetize (attach baht values to) impacts
6. Discount costs and benefits to obtain present values
7. Compute the net present value of each option
8. Perform sensitivity analysis (different range of discount rates)
9.Conclusion (comparative analysis of the options)

Partial cost benefit analysis:

Where a full cost benefit analysis cannot be undertaken (mostly due to some or all of the benefits not being able to be monetized), the costs of each option should still be monetized and complemented with other decision-making criteria such as cost effectiveness or multi-criteria analysis.

For full and partial cost benefit analysis, disclose any assumptions that have been used for monetizing/quantifying costs and benefits, and the basis for those assumptions. The analysis should make transparent to the reader how cost and benefit values have been calculated. For complex calculations, it may be useful to include this information in an appendix.

**Section 5: Consultation**

**Section 6: References**

**Section 7: Appendices**

**Section 8: Proposed Regulation**

# 7. Case Study

Each reader will interpret the expected level of analysis required for the key parts of a RIA differently. This will lead to varying levels of quality RIA. To obviate this, these Guidelines show how to apply the key parts of a RIA to an actual case study to demonstrate the level of analysis and the critical thinking required to prepare a robust and high quality RIA.

The case study relates to the problem of road traffic fatalities and injuries in Thailand; specifically the government decision to ban children less than six years of age from being transported on a motorcycle.

It should be noted that the use of different types of data sets (fatalities and injuries, population, costs associated with fatalities and injuries, cost inputs such as average monthly wages, fares for alternative modes of transport, etc) that are used together to make calculations in the assessment of costs associated with the problem and the assessment of the costs and benefits for the regulatory proposal and alternatives, should cover the same period of time to ensure accuracy. Otherwise, the calculations could under-state or overstate the costs and benefits.

For the purposes of this case study, most of the different data sets are for 2010. However, other data sets are from different years and this affects the accuracy of the costs and benefits. The reader should not be overly concerned with this issue but focus on the level of analysis and the critical thinking that has been used to develop the RIA.

**Key points**

Road fatalities and injuries are a significant problem in Thailand. A number of organizations have campaigned to save children from being killed and injured whilst being transported on a motorcycle. Some of these organizations claim several thousand fatalities associated with this activity. It is important to verify the extent of the problem.

The case study also demonstrates the need to analyze the size of the problem relative to the affected population. A risk analysis reveals the probability of a child fatality and injury relative to the size of the child population and also motorcycle usage based on vehicle kilometers traveled per annum. This information is important for Government in weighing up whether the allocation of scarce resources within the economy should be applied to this problem or to another part of the road fatality and injury problem that may provide greater benefits to improving road safety.

The cost benefit analysis requires analysis of the incremental costs and benefits. That is, the additional costs and benefits incurred in the absence of regulation. Quantifying the costs of behavioral regulation can be challenging. In this case, it is important to think about the reasons an affected group uses a motorcycle. In this case, parents use a motorcycle to transport their child with them to go

shopping, work (in some cases), pre-school, health centres, visiting relatives and friends, recreation, religious etc.

The cost of a ban is not just the restriction on the freedom of parents dependent on motorcycles to transport their young children to these activities.

How many children and parents or family members will need to use alternative modes of transport?

While it is likely to be difficult to obtain data on the extent of young children being transported on a motorcycle, consideration needs to be given to an activity where the parent has no choice but to use an alternative mode of transport. For example, most children from 3 to 5 years of age attend pre-school.

How many children attend pre-school? How many parents are dependent on a motorcycle as their primary mode of transport? How will parents send their children to pre-school if they cannot use a motorcycle? Is their home within walking distance of the pre-school centre? Or do they need to take a bus or minivan, or a taxi?

Will it take longer to walk to a pre-school centre compared with a motorcycle? What is the average time difference between these two modes? What is the opportunity cost (potential income forgone) of the parent or other family member that may have to spend more time walking to a pre-school or a bus stop compared to when they traveled on a motorcycle?

What is the average operating cost of a motorcycle? Is this higher or lower than the cost of a fare for a bus or taxi? The difference in costs between motorcycles and alternative modes of transport is the incremental cost in the absence of regulation (ban).

How will a ban affect motorcycle taxis? Are there likely to be impacts on revenue and employment?

Are there any unintended consequences of a ban?

Does walking on sidewalks pose a greater risk than being a passenger on a motorcycle?

Can the current pedestrian infrastructure cope with an influx of children and parents walking to pre-school? Will it cause traffic congestion?

Does the current public transport sector (buses and taxis) have the capacity to transport additional children and parents to and from pre-school?

Are there areas that have limited or no public transport options? Remote rural areas? If so, how many parents may not send their children to pre-school?

Can low-income families afford the additional costs of public transport?

Will the ban lead to some families withdrawing their children from pre-school due to limited access to public transport options and/or affordability issues?

Will the reduction of motorcycle usage lead to a reduction in traffic congestion and motorcycle emissions?

How will the costs associated with fatalities and injuries be valued?

Will the avoided costs of fatalities and injuries be achievable?

What if families refuse to comply with the ban?

Do the police have the capacity and resources to enforce the ban?

These are the type of questions that need to be asked as part of the critical thinking behind the preparation of a RIA.

# Objectives

The objective of the proposed regulation is to prevent children less than six years of age from being killed or injured as a passenger on a motorcycle.

# Nature and Extent of the Problem

### Overview of the Road Safety Problem

Thailand has one of the worst road safety records. Thailand's total traffic accident costs were estimated at 232.8 billion baht or 2.81 percentage of GDP.[1]

As shown in Table 1, Thailand's road fatalities increased markedly from 2,104 in 1987 to peak at 16,727 in 1995 and declined to 12,858 by 2005.

**Table 1: Traffic Accidents in Thailand from 1987 to 2005**

| Year | Bangkok (No of Cases) | | | Regional (No of Cases) | | | National (No of Cases) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Accident | Fatality | Injury | Accident | Fatality | Injury | Accident | Fatality | Injury |
| 1987 | 19,745 | 752 | 6,333 | 4,387 | 1,352 | 2,256 | 24,132 | 2,104 | 8,589 |
| 1988 | 31,175 | 817 | 9,565 | 4,114 | 1,198 | 3,939 | 35,289 | 2,015 | 13,504 |
| 1989 | 31,709 | 917 | 10,005 | 6,388 | 4,451 | 3,076 | 38,097 | 5,368 | 13,081 |
| 1990 | 33,064 | 949 | 10,701 | 7,417 | 4,816 | 7,551 | 40,481 | 5,765 | 18,252 |
| 1991 | 38,355 | 1,057 | 10,778 | 7,946 | 5,276 | 8,777 | 46,301 | 6,333 | 19,555 |
| 1992 | 46,743 | 983 | 11,025 | 14,586 | 7,201 | 9,677 | 61,329 | 8,184 | 20,702 |
| 1993 | 64,006 | 1,011 | 11,031 | 20,886 | 8,485 | 14,299 | 84,892 | 9,496 | 25,330 |
| 1994 | 72,359 | 1,290 | 18,849 | 30,251 | 13,856 | 24,692 | 102,610 | 15,146 | 43,541 |
| 1995 | 64,469 | 1,284 | 21,697 | 24,898 | 15,443 | 29,021 | 94,362 | **16,727** | 50,718 |
| 1996 | 60,308 | 1,069 | 23,314 | 28,248 | 13,336 | 26,730 | 88,556 | 14,405 | 50,044 |
| 1997 | 54,324 | 903 | 20,933 | 28,012 | 12,933 | 27,828 | 82,336 | 13,836 | 48,761 |
| 1998 | 46,800 | 732 | 18,920 | 26,925 | 11,502 | 33,618 | 73,725 | 12,234 | 52,538 |
| 1999 | 37,868 | 594 | 17,104 | 29,932 | 11,446 | 35,434 | 67,800 | 12,040 | 47,770 |
| 2000 | 43,485 | 1,582 | 23,368 | 30,252 | 10,406 | 29,743 | 73,737 | 11,988 | 53,111 |
| 2001 | 45,711 | 1,519 | 22,854 | 31,905 | 10,133 | 31,106 | 77,616 | 11,652 | 53,960 |
| 2002 | 48,507 | 1,734 | 23,488 | 43,116 | 11,382 | 45,825 | 91,623 | 13,116 | 69,313 |
| 2003 | 46,806 | 1,491 | 23,597 | 48,386 | 11,718 | 50,555 | 107,565 | 14,012 | 79,692 |
| 2004 | 55,381 | 865 | 23,597 | 69,149 | 12,901 | 70,297 | 124,530 | 13,766 | 94,164 |
| 2005 | - | - | - | - | - | - | 122,040 | 12,858 | 94,364 |

Source: Department of Highways, "The Study of Traffic Accident Cost in Thailand", Final Report, Faculty of Engineering, Prince of Songkla University, September 2007. Note data was sourced from the Royal Thai Police and Bureau of Traffic Safety, Department of Highways.

However, the official government data would appear to underestimate the size of the problem. The World Health Organization estimates a much higher number of fatalities as shown in Table 2.

**Table 2: Road traffic deaths in Thailand (2010)**

| Estimated road traffic deaths | Estimated road traffic death rate (per 100,000 population |
|---|---|
| 26,312 | 38.1 |

Source: World Health Organisation – Global Health Observatory Data Repository

[1] Dr Pichai Taneerananon, "The Study of Traffic Accident Costs in Thailand" powerpoint presentation, web.worldbank.org

The Department of Highways in its "The Study of Traffic Accident Cost in Thailand", (2007) noted under-reporting of traffic accidents, fatalities and injuries due to police not attending all traffic accidents. Hospital records are more likely to provide a more accurate picture of the extent of the problem.

As a result of the under-reporting, the size of the problem will be documented ranging from the minimum size of the problem (official records) to the maximum size of the problem (based on WHO data). The costs of traffic accidents will be calculated for this range of data.

Motorcyclists represent 74 percent of road fatalities (Table 3) and motorcycles 61 percent of registered vehicles (Table 4). While the data highlights that motorcycle riders comprise the most road fatalities, the data does not provide any insight into the age distribution of the fatalities.

**Table 3: Deaths by road user category (2010)**

| Type of road user | Percentage of deaths | Number of deaths |
|---|---|---|
| Riders motorized 2 or 3 wheelers | 74 % | 10,187 |
| Pedestrians | 8% | 1,101 |
| Passengers 4 wheeled cars and light vehicles | 7% | 964 |
| Drivers 4 wheeled cars and light vehicles | 6% | 826 |
| Cyclists | 3% | 413 |
| Drivers/passengers heavy trucks | 1% | 138 |
| Drivers/passengers buses | <1% | 100 |
| Other | 1% | 138 |
| Total | | 13,766 |

Source: World Health Organization –Thailand Country Profile 2013

**Table 4: Total registered vehicles (2010)**

| | | |
|---|---|---|
| Cars and 4 wheeled light vehicles | 9,887,706 | 35% |
| Motorized 2 and 3 wheelers | 17,322,538 | 61% |
| Heavy trucks | 816,844 | 3% |
| Buses | 137,943 | <1% |
| Other | 319,798 | 1% |
| Total registered vehicles | 28, 484, 829 | |

Source: World Health Organization –Thailand Country Profile 2013

**How significant is the problem? What is the magnitude of the problem?**

## Proportion of Motorcycle Fatalities that are child passengers

A further breakdown of the high-level data is required to identify and quantify the number of children less than six years of age killed and injured as a motorcycle passenger.

The World Health Organization (WHO) cites a study based on data from a trauma registry at the Khon Kaen Regional Hospital in the northeast of Thailand that showed children 0 to 5 years and 5 to 9 years accounted for 1.8 percent and 3.9 percent respectively of the motorcycle accident patients treated at the hospital.

The WHO also cites data from the Asian Development Bank (2004) in respect to age distribution of traffic fatalities in Thailand. This data is shown in Table 5 and the percentage of child fatalities is similar to the data from the Khon Kaen Regional Hospital.

**Table 5: Age distribution of traffic fatalities in Thailand**

| Age (years) | Fatalities percent |
|---|---|
| < 5 | 1.6 |
| 5-9 | 1.8 |
| 10-14 | 2.7 |
| 15-40 | 60.4 |
| >40 | 33.5 |

Source: World Health Organization – based on data from Asian Development Bank The status of road safety in Thailand. Manila: Asian Development Bank; 2004. Report No.: Country Report: CR 09.

Another study was conducted into 214 fatal motorcycle accidents from autopsy reports performed at Ramathibodi Hospital in Bangkok (responsible for 9 out of the 50 metropolitan districts) from 2003 to 2006. In this case, 10 or 4.7 percent of the 214 fatal motorcycle accidents were to children less than 15 years. The data analysis did not provide any further breakdown of this age group.

Other jurisdictions with a similar profile

Benchmarking other countries with a similar profile where motorcycles are the predominant mode of transport and motorcycle fatalities represent most of the road toll may assist in verifying the above data. A WHO report on motorcycle safety for South East Asian countries revealed Indonesia and Bangladesh have similar profiles to Thailand. In these countries, road traffic injuries of motorcyclists comprise a reported 25 to 70 percent of the total victims. Of these victims, children less than 10 years appear to represent 2 to 3 percent.

While Australia does not have a similar profile to Thailand (children less than six years of age do not travel on motorcycles), it is still worth benchmarking the number of fatalities for children given that Australia has a strong road safety record to see where Thailand stands in comparison. Australia keeps records for

children less than 16 years of age. In 2010, children less than 16 years of age accounted for 52 passenger (motor vehicles) fatalities or 3.85% of the 1,352 road fatalities in Australia.[2]

The Thailand studies are summarized in Table 6 below. It is reasonable based on this evidence and the WHO study on South East Asian countries with a similar profile to Thailand to conclude at least 2 percent of motorcycle fatalities involve child passengers less than six years of age (given that two of the studies showed almost 2 percent for children less than five years of age).

The number of child fatalities, serious and slight injuries will be determined in the next section based on 2 percent of motorcycle fatalities, serious and slight injuries.

**Table 6: Summary of age distribution of traffic fatalities studies**

| Age (years) | Khon Kaen Regional Hospital | ADB (2004) | Ramathibodi Hospital |
|---|---|---|---|
| < 5 | 1.8 | 1.6 | - |
| 5-9 | 3.9 | 1.8 | - |
| 10-14 | | | 4.7 |

## Number of child fatalities and injuries

Calculating 2 percent of the number of fatalities from Tables 3 & 4 (official data and WHO estimations respectively), Table 7 below shows children less than six years old accounted for an estimated 204 fatalities or 2% of the 10,187 motorcycle fatalities in 2010 and an estimated 389 fatalities or 2 percent of the 19,471 motorcycle fatalities in 2010.

**Table 7: Number of child fatalities in 2010**

| | Total motorcycle fatalities | Child fatalities - 2% of total fatalities |
|---|---|---|
| Official Data | 10,187 | 204 |
| WHO estimations | 19,471 | 389 |

Note: The WHO estimation of 26,312 fatalities has been adjusted to reflect the 74 percent or 19,471 of motorcycle fatalities.

The number of serious and slight injuries was calculated based on detailed data shown in Appendix 1. This data showed a ratio of one fatality for every 13 serious injuries and 39 slight injuries. Table 8 shows the estimated number of child fatalities, serious and slight injuries.

**Table 8: Estimated Number of Child Fatalities, Serious and Slight Injuries**

| | Official data | WHO estimates |
|---|---|---|
| Fatalities | 204 | 389 |
| Serious Injuries | 2,652 | 5,057 |
| Slight Injuries | 7,956 | 15,171 |

[2] Department of Infrastructure, Transport and Regional Economics, "Road Deaths Australia" 2011 Statistical Report, Australian Government.

**What is the nature of the problem – what is the loss, harm or other adverse consequence that is being experienced, and by whom?**

## Cost of child fatalities and injuries

The human capital cost methodology was used to calculate the costs associated with child fatalities and injuries.

The human capital cost methodology comprises three cost categories: human, property damage and general crash.

The human costs category covers loss of productivity, quality of life, medical, EMS and long term care. The property damage costs category covers vehicle and non-vehicle damage costs. The general crash costs category covers insurance administration, police administration, judicial system, ERS and travel delay.

Table 9 shows the value of costs per fatality, serious injury and slight injury. The cost component for each cost category is provided for each type of crash severity in Appendix 2.

**Table 9: Value of costs according to crash severity for Thailand in 2007**

| Crash Severity | Average value of costs (baht) |
|---|---|
| Per Fatality | 5,315,556 |
| Per Serious Injury | 147,023 |
| Per Slight Injury | 34,761 |

Source: Department of Highways "The Study of Traffic Accident Cost in Thailand", (2007)

Table 10 shows the total costs for child fatalities, serious and slight injuries. The costs are calculated by multiplying the number for each crash severity category in Table 8 by the value of the appropriate crash severity category in Table 9. For example, 204 child fatalities by $5,315,556 baht = $1,084,373,424 baht and so forth.

Table 10 also shows the total cost ranges from 1,750,836,936 baht (based on official data) to 3,338,605,726 baht (based on WHO estimations).

**Table 10: Costs of Child Fatalities, Serious and Slight Injuries**

| Crash Severity | Cost (baht) based on official data | Cost (baht) based on WHO estimations |
|---|---|---|
| Fatalities | 1,084,373,424 | 2,067,751,284 |
| Serious Injury | 389,904,996 | 743,495,311 |
| Slight Injury | 276,558,516 | 527,359,131 |
| **Total** | **1,750,836,936** | **3,338,605,726** |

**In the case of risk, what is the likelihood of the adverse event occurring? What evidence do you have to support this initial assessment?**

### Risk of child fatalities and injuries

OECD countries calculate fatalities per 100,000 persons, per 10,000 registered vehicles and per 100 million vehicle kilometres traveled (VKT). These indicators measure the rate and relative risk of road fatalities taking into account human/vehicle population and traffic volumes.

The aforementioned fatality rates provide a general indication of risk for national and provincial regions. The fatality rates are more meaningful if applied to the specific road locations where fatalities occur.

### Number of child fatalities and injuries relative to the total child population

It is important to measure the number of child fatalities and injuries relative to the total child population in Thailand to ascertain the relative risk. Children less than six years of age comprise 6.5 million or 10 percent of the total population of 65 million. [3]

With this population data it is possible to estimate the number of children that are likely to be transported on a motorcycle. Given that 61 percent of registered motor vehicles are motorcycles, it is conceivable that up to 4 million children (6.5 million *61%) could be potentially transported on a motorcycle.

Using the official and WHO estimation fatality data and child population data, Table 11 shows 5.1 to 9.7 child fatalities per 100,000 population of children less than six years of age. [4] The serious and slight injuries per 100,000 population is also provided in Table 11 below.

**Table 11: Child Fatalities, Serious and Slight Injuries per 100,000 population 2010**

| Crash Severity | Official data | WHO estimations |
|---|---|---|
| Fatalities per 100,000 population | 5.1 | 9.7 |
| Serious Injuries per 100,000 population | 66.3 | 126.4 |
| Slight Injuries per 100,000 population | 198.9 | 379.3 |

Table 12 below shows that child fatalities per 100,000 of the child population are considerably lower than the fatality rate per 100,000 for the rest of the

[3] National Statistical Office (web.nso.go.th) 2005 census.

[4] Calculation:–4 million/100,000 = 40. Hence 204 fatalities/40 = 5.1 and 389 fatalities/40 = 9.7) Similar calculations were undertaken for serious and slight injuries. It should be noted that using 2005 population data with 2010 fatality and injury data has resulted in a slight over-estimation of the applicable rates.

population. For example, 5.1 compared with 22.2 for the official data.[5] This strongly suggests that parents and other caregivers are generally risk-averse and take considerable care when riding a motorcycle with a young child aboard. The OECD median fatalities per 100,000 population has been included as a benchmark for the Official and WHO fatality data. However, it is not directly comparable to the child fatality rate.

**Table 12: Comparative Fatalities per 100,000 population 2010**

| | |
|---|---|
| Official – total road fatalities | 22.2 |
| Official Child fatalities | 5.10 |
| WHO – total fatalities | 42.5 |
| WHO Child fatalities | 9.70 |
| OECD Median fatalities | 6.20 |

Note: OECD median fatalities cited from Department of Infrastructure and Transport, "International Road Safety Comparisons 2010" Statistical Report, Australian Government.

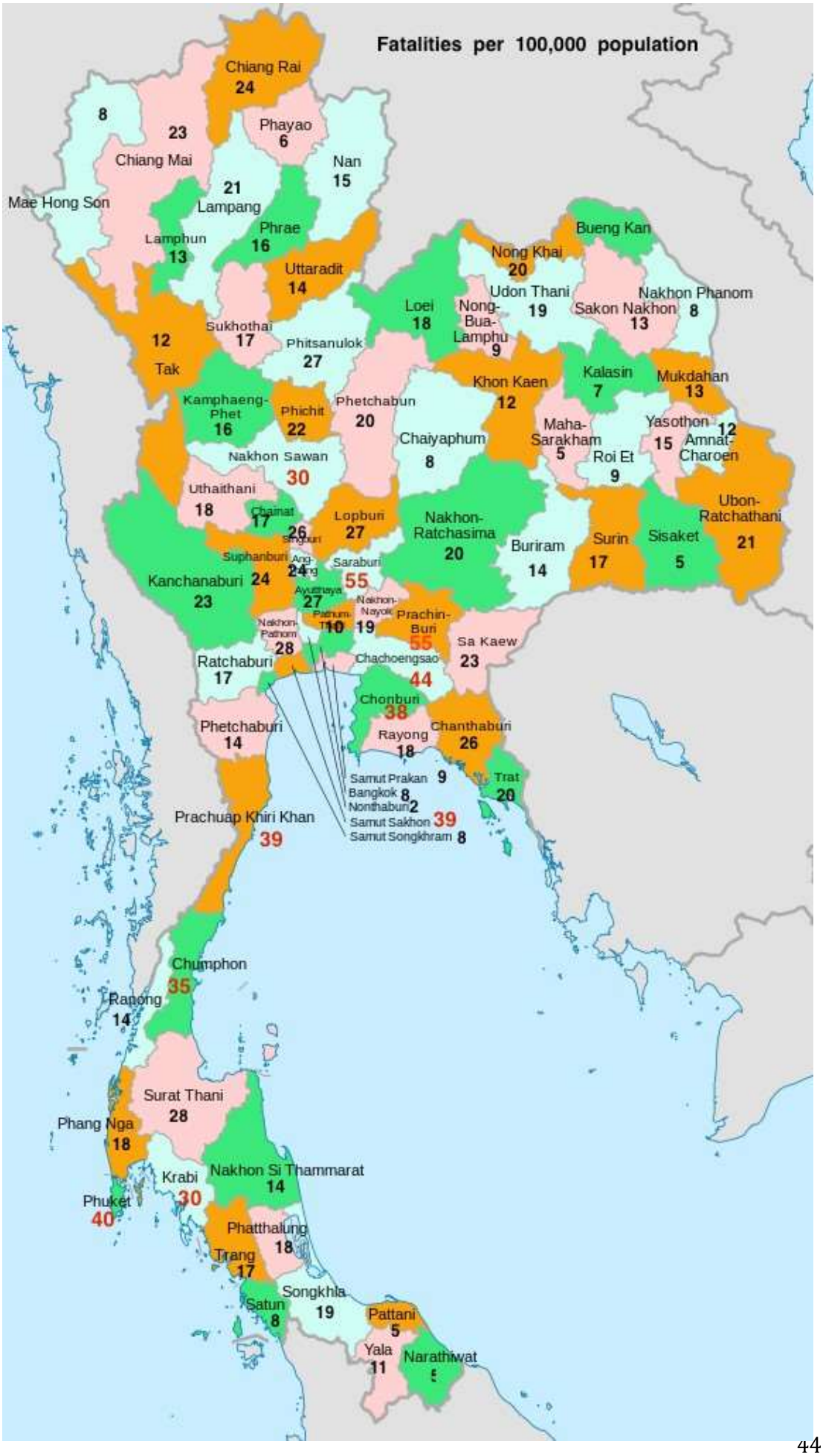
The map on the next page provides the fatality rate per 100,000 population for the 76 provinces in Thailand. The fatality rate is the general rate for all road user fatalities including child fatalities. Provincial data is based on 2005 from the Department of Highways "The Study of Traffic Accident Cost in Thailand" (2007). The detailed data is provided in Appendix 3. Ideally, 2010 provincial data should be used to be consistent with the preceding 2010 data.

Notwithstanding this, the map highlights the significant differences in the fatality rate per 100,000 population across provinces. This is not a perfect indication of risk as a small populated region may have a high fatality rate due to other factors (high transitory road traffic through the region).

There are 10 provinces with fatality rates greater than 30. These are shown in red numerals. Several provinces around and including Bangkok have some of the lowest fatality rates.

Further investigation is required to understand the differences in the fatality rates between provinces including road design, environment, volume of traffic etc.

[5] The official and WHO fatality data and population data has been adjusted to exclude child fatality and child population. For example, Official fatalities 13,562 (13,766 total fatalities -204 child fatalities)/610 (61 million i.e 65 million total population -4 million child population) = 22.2 fatalities per 100,000 population.


Fatalities per 100,000 population
Chiang Rai 24
8
23
Chiang Mai
Phayao 6
Nan 15
21
Lampang
Mae Hong Son
Phrae 16
Lamphun 13
Uttaradit 14
Bueng Kan
Nong Khai 20
Udon Thani 19
Nakhon Phanom
Sakon Nakhon 8
13
Loei 18
Nong-Bua-Lamphu 9
Sukhothai 17
12
Tak
Phitsanulok 27
Khon Kaen 12
Kalasin 7
Mukdahan 13
Kamphaeng-Phet 16
Phichit 22
Phetchabun 20
Maha-Sarakham 5
Yasothon 15
12
Amnat-Charoen
Chaiyaphum 8
Roi Et 9
Nakhon Sawan 30
Uthaithani 18
Chainat 17
Lopburi 27
Nakhon-Ratchasima 20
Buriram 14
Surin 17
Sisaket 5
Ubon-Ratchathani 21
Suphanburi 24
Saraburi 55
Kanchanaburi 23
Ayutthaya 27
Nakhon-Nayok 19
Prachin-Buri 55
Nakhon-Pathom 28
Ratchaburi 17
Sa Kaew 23
Chachoengsao 44
Chonburi 38
Phetchaburi 14
Rayong 18
Chanthaburi 26
Samut Prakan 9
Bangkok 8
Nonthaburi 2
Samut Sakhon 39
Samut Songkhram 8
Trat 20
Prachuap Khiri Khan 39
Chumphon 35
Ranong 14
Surat Thani 28
Phang Nga 18
Krabi 30
Nakhon Si Thammarat 14
Phuket 40
Phatthalung 18
Trang 17
Songkhla 19
Satun 8
Pattani 5
Yala 11
Narathiwat

## Risk Analysis –Fatalities and Injuries per 100,000 million VKT

The average number of personal vehicle VKT[6] is multiplied by the child population to determine the total number of VKT. Using the number of child fatalities, serious and slight injury data from Table 8, the relevant rates per 100 million VKT have been calculated as shown in Table 13 below.

**Table 13: Child Fatalities, serious and slight injuries per 100 million VKT (2010)**

| Crash Severity | Official data | WHO estimations |
|---|---|---|
| Fatalities per 100 million VKT | 1.8 | 3.5 |
| Serious Injuries per 100 million VKT | 23.4 | 45 |
| Slight Injuries per 100 million VKT | 70.8 | 135 |

Table 14 shows a considerable lower fatality rate for children passengers on motorcycles compared to all other motorcycle fatalities This is similar to the results in Table 12 Comparative fatalities per 100,000 population and provides further evidence that parents and other caregivers are generally risk-averse and take considerable care when riding a motorcycle with a young child aboard.

**Table 14: Comparative child and motorcycle fatalities per 100 million VKT**

| Crash Severity | Official data | WHO estimations |
|---|---|---|
| Child Fatalities per 100 million VKT | 1.8 | 3.5 |
| Motorcycle Fatalities per 100 million VKT | 26.7 | 51 |

In 2010, OECD median fatalities were 0.54 per 100 million VKT traveled and applied to fatalities for all ages groups. [7] Obviously, the median fatality rate would be even lower than 0.54 for children less than six years of age.

[6] An Analysis of VKT of Major Cities in Thailand (2010) measured 2810 VKT for personal vehicles for the Nakhon Ratchasima province. It has been assumed this is representative of all provinces other than Bangkok that has a higher VKT.

[7] OECD median fatalities cited from Department of Infrastructure and Transport, "International Road Safety Comparisons 2010" Statistical Report, Australian Government.

**What are the primary causes of the problem?**

## Primary Causes for Child Fatalities and Injuries

Road safety literature has demonstrated that there are many different contributing factors involved in crashes. These are categorized as environmental, human and vehicle factors.

Road safety empirical studies analyze these factors and seek to determine the key contributing factors that cause specific type of crashes and recommend appropriate countermeasures to prevent these crashes.

Data was recorded for 214 fatal motorcycle accidents from autopsy reports performed at Ramathibodi Hospital in Bangkok (responsible for 9 out of the 50 metropolitan districts) from 2003 to 2006.

The data comprised:

- age,
- gender,
- riding position,
- time of accidents,
- type of crash -single vehicle crash (SVC) and multiple vehicle crashes (MVC)
- crash objects
- alcohol consumption levels
- causes of death

Table 15:

| Personal Characteristics | | Number (%) |
|---|---|---|
| Gender | Male | 188 (87.9) |
| | Female | 26 (12.1) |
| Riding Position | Rider | 183 (85.5) |
| | Passenger | 31 (14.5) |
| Age, years | < 15 | 10 (4.7) |
| | 15-24 | 96 (44.9) |
| | 25-34 | 65 (30.4) |
| | 35-44 | 24 (11.2) |
| | > 45 | 19 (8.9) |
| Age (years); mean ± SD (range): 27.4 ± 10.76 (3-69) | | |

This study found most motorcycle fatalities were male riders, 15 to 34 years of age, alcohol-related and occurred from 9 pm to 6.00 am.

The study did not seek to find the causes for child fatalities that occurred whilst on a motorcycle. However, the time for most of the high risk accidents occurs when most children less than six years of age would be home and asleep.

Young male motorcyclists are the highest risk group in most countries including in Australia as demonstrated in the study, "Analysis of High Risk and High Severity Groups among Motorcyclists", Monash University Accident Research Centre - Report #77 - 1995

Motorcycle accidents in other jurisdictions

The other vehicle is commonly at fault in multi-vehicle crashes involving motorcycles. In an analysis of 900 motorcycle accidents in Los Angeles Hurt, Oullet and Thom (1981) found that the most common motorcycle accident involved another vehicle (75%) causing the collision by violating the right-of-way of the motorcycle at an intersection, usually by turning left in front of the oncoming motorcycle. In Victoria, motorcyclists are commonly the vehicle going straight ahead in right-turn crashes, being in the rear in rear-end crashes and in the ongoing lane in sideswipes. [8]

The Thailand Accident Research Center (TARC) is undertaking during 2014/15 an in-depth study of the main types of motorcycle accidents to determine appropriate countervailing measures.

Detailed analysis of the causes of accidents is lacking in Thailand due to inadequate data. Detailed data on child fatalities and injuries would require the collation of crash characteristics such as:

Crash Victims

Age – segmented age groups;
Gender – Male or Female;
X – driver, passenger and pedestrian;
Crash severity – fatality, serious injury, minor injury and property damage;
Location - capital city, other urban, rural townships and other rural categories;
Date and Time of Day;

Weather Conditions - dry, wet, slippery from rain precipitation, and frozen categories;

Distance from crash site to the home address of victims (only for national citizens);

Causal factors

Human causal factors - impairment from alcohol/drug use, driver fatigue and unlicensed categories;

[8] Haworth.N, Symmons. M & Kowadlo.N, *"Hazard Perception by Inexperienced Motorcyclists"*, Monash University Accident Research Centre, Report No. 179, Dec 2000.

Vehicle causal factors – vehicle age and vehicle defects (tyres, brakes, suspension and other defects categories) categories;

Crash Type

Crash Type – crashes that involved a pedestrian, crashes that occurred between vehicles approaching from adjacent directions (intersections only), crashes that occurred between vehicles traveling in opposing directions, crashes that occurred between vehicles traveling in the same direction, crashes that occurred while a vehicle was manoeuvring, crashes that occurred while a vehicle was overtaking, crashes between a vehicle and an obstacle in the path of travel, crashes that occurred when a vehicle left a straight roadway, crashes that occurred when a vehicle left a curved roadway and miscellaneous crashes;

Road Characteristics

Road Characteristics - intersection without traffic lights, intersection with traffic lights, midblock (section of road between intersections) and roundabout categories;

Road Type 1 - divided road and undivided road categories;

Road Type 2 - sealed road and unsealed road categories;

Road Type 3 – straight road, curved road and sloping road categories;

Road Condition - good and damaged (potholes) categories;

Road Infrastructure - no pedestrian pavement, pedestrian pavement with buildings abutting pavement (no escape area), pavement with roadside area, clear roadside with run-off area, roadside area with fixed objects (trees, poles, bridges, fences etc) categories;

Speed Zone – speed limit categories

With the collation and analysis of the range of variables used, it is likely that patterns will emerge and there may be a need to identify segments of the crash population where a subset of crash data may be more appropriate to consider.

**How is the problem currently regulated? Are there deficiencies in the existing regulatory system that might fix the problem if corrected?**

## Current regulation of the problem

Thailand law requires motorcycle riders and passengers to wear motorcycle helmets. Motorcycle helmets are a highly effective road safety intervention that reduces the frequency and severity of head injuries resulting from traffic crashes. The World Health Organisation cites the Cochrane review that claims helmet use reduces the risk of motorcycle injuries by 69% and motorcycle fatalities by 42%.[9]

It is estimated that while most motorcycle riders wear a helmet only about 9 percent of passengers wear a helmet. The government has delivered a public education program to encourage motorcycle passengers to wear helmets but this appears to have failed to reduce the high level of non-compliance.

The extent of the problem in regards to all motorcycle fatalities and serious injuries could be substantially reduced if Police enforcement together with substantial fines for not wearing a helmet were implemented.

For this to lead to broad changed community behaviour, the Police would need to allocate appropriate resources for stopping motorcyclists and to issue fines. In particular, most people must feel that there is a reasonable probability of being apprehended by a Police officer and issued a fine while riding a motorcycle. If this is not the case, change behaviour across the community is less likely. In this regard, it should be noted that about 80 percent of the Thai population ride motorcycles and that his may create a significant resource challenge to deal with so many riders and passengers

[9] Aaron Pervin, Jonathon Passmore, Mirjam Sidik, Tyler McKinley, Nguyen Thi Hong Tu c & Nguyen Phuong Nam, "Viet Nam's mandatory motorcycle helmet law and its impact on children", *Bulletin of the World Health Organization* 2009; 87:369-373.

**Assess the consequences of no action**

**What are the consequences of not taking any action?**

**Could relying on the market in conjunction with the general application of existing laws and regulations solve the problem? If not, why not?**

## Consequences of no government action

It is useful to compare the experience of other countries that mandate the wearing of motorcycle helmets where the motorcycle is the main mode of transport.

Thailand has 33.5 million registered motor vehicles and 20 million (2013) or 60 percent are registered motorcycles. Vietnam would appear to be a comparable country given that it has 26 million registered motor vehicles and 95 percent are motorized two wheelers. Similarly, Vietnam has a high road toll; in 2007 there were 12,800 fatalities or 15 fatalities per 100,000 population. An estimated 60 percent of all road fatalities occur among motorcycle drivers and passengers.

A study was conducted for all road traffic injury patients with head injuries admitted to 20 provincial and central hospitals 3 months before and after the new law came into effect on 15 December 2007. The study found a 16 percent reduction in the risk of road traffic head injuries and an18 percent reduction in the risk of road traffic death. [10]

It would appear the public perception that motorcycle helmets worn by children, particularly young children, may cause neck injuries has undermined compliance. Conflicting views expressed by the medical profession in Vietnam has divided the Vietnamese community and they have erred on the side of caution and mostly decided to not let their children wear a motorcycle helmet.

A public education campaign to counter the perception that motorcycle helmets do not cause neck injuries would more than likely need to be lengthy campaign and costly to gain the confidence of the community and to persuade most parents to ensure that their children wear motorcycle helmets. The effectiveness of such a public education campaign would be dependent on the degree of continued divisive views publicly expressed by some within the medical profession. Hence, there is a risk that such a campaign may fail to deliver an adequate increase in the proportion of children wearing motorcycle helmets to justify such an investment by government where these funds may be more

[10] Passmore J, Tu NT, Luong MA, Chinh ND, Nam NP, "Impact of mandatory motorcycle helmet wearing legislation on head injuries in Viet Nam: results of a preliminary analysis", Traffic Injury Prevention, 2010 Apr; 11 (2):202-6.

effectively used for other countermeasures that are more likely to deliver road safety benefits.

**Will the problem self-correct within a reasonable timeframe?**

There are many factors that contribute to road fatalities and injuries. Similarly, governments use a wide range of countermeasures to address these factors with the aim of improving road safety.

In this respect, it is useful to understand the impact of these countermeasures and whether these have been, or are likely to be adopted by Thailand in the coming years.

Thailand has experienced high population growth since 1950s and a high growth of vehicle ownership (particularly motorcycles) since the 1970s. Any government struggles to expand road capacity to accommodate rapid population and motor vehicle growth. New road infrastructure takes many years to build.

California, Texas and Florida experienced similar population and motor vehicle growth from 1950 to the early 2000s. While the road fatality toll in the U.S.A peaked in 1976, the road fatality toll peaked in California in 1984, Texas in 1986 and Florida in 2003. A key factor for the delay in the reduction of the road toll in these states was due to the higher population growth compared with other states. From 1950 to 2003 the population in California's doubled from 20 to 40 million, Texas from 20 to 50 million and Florida tripled from 15 to 45 million. Once the population growth curve flattened, these states experienced about a 5 percentage annual reduction in their road toll.

The population growth over the past decade in California, Texas and Florida has declined and all three states have experienced significant reductions in their road tolls.

By contrast, the United Kingdom has had minimal population growth (51 to 57 million from 1950 to 2003) and has invested heavily in road infrastructure and other safety countermeasures. This has resulted in a dramatic reduction in the road toll but would have been unlikely in the event that it had population growth like California, Texas and Florida.

The World Bank (United Nations) has forecast that Thailand's population growth will begin to decline from 2015. Based on the experiences of California et al, it is likely that as Thailand expands its road infrastructure, its road toll will also decline over the next decade.

It is difficult to determine Thailand's annual rate of reduction once its population growth curve flattens. It is problematic that Thailand would achieve a similar annual rate of reduction given that California et al had well established road networks in the 1950s and most of Thailand's roads are not divided to ensure motor vehicles, motorcycles and pedestrians are separated from each other.

Another factor that needs to be taken into account is the growth in registered passenger vehicles. In 2004, there were about 6.5 million passenger vehicles or 33 percent of the total number of registered motor vehicles. By 2013, the number of registered passenger vehicles had increased to 13 million or 39 percent of the total number of registered motor vehicles.

It is noteworthy that in 2003, Thailand introduced a requirement that expressways in Bangkok must exclude motorcycles. This was instigated primarily to reduce traffic congestion but also would provide road safety benefits to motorcyclists.

## Justification for Government Intervention

The analysis of the nature and size of the problem has revealed the following:

At a minimum, children less than six years of age comprised 204 or 2% of the 10,187 motorcycle fatalities.

Based on WHO estimations, children less than six years of age comprised 389 or 2% of the 19,187 motorcycle fatalities.

The cost to the community from child fatalities, serious and slight injuries is estimated from 1.750 billion baht to 3.338 billion baht per annum.

There were 5.1 or 9.7 child fatalities per 100,000 population of children less than six years of age. This is lower than the 22.2 to 42.5 fatalities per 100,000 population for all other road users.

The risk of a fatality for a child less than six years of age being transported on a motorcycle is 1.8 to 3.5 fatalities per 100 million vehicle-kilometers-travelled (VKT). This is lower than the 26.7 to 51 fatalities per 100,000 population for motorcyclists.

Most motorcycle accidents occur amongst male riders, 15 to 29 years, mostly intoxicated and from 9.00 pm to 6.00 am.

The law requires motorcycle riders and passengers to wear motorcycle helmets. The lack of compliance and enforcement of the current law would appear to not address the problem of child fatalities and injuries.

Public education to support the current law regarding the mandatory wearing of motorcycle helmets would appear to be problematic given the Vietnam experience where many communities refused to make their children wear a motorcycle helmet in fear that they may incur neck injuries.

Thailand, like California, Texas and Florida, have experienced rapid population and motor vehicle growth. With an expected decline in population growth, an increase in the proportion of passenger vehicles relative to motorcycles, and

improved road networks (road engineering strategies), it is likely that the number of overall fatalities and injuries will decline (including children) even if the government does not intervene and introduce any new measures.

The improvements are likely to be varied with greater declines in Bangkok and other municipal areas due to the higher ownership rate of passenger vehicles relative to motorcycles. Accordingly, there will be a lag in road safety improvement in rural areas, particularly low socio-economic areas with high motorcycle dependency and low levels of road infrastructure investment (including road safety engineering strategies).

The problem analysis has revealed a significant cost associated with child fatalities, serious and slight injuries that are incurred traveling on a motorcycle. However, the analysis also revealed that children less than six years of age are at less risk on a motorcycle compared to other road users. This is not dissimilar to other OECD countries. The significance of the cost to the community is worthy of further consideration in terms of whether a countermeasure can be developed to specifically address child fatalities and injuries incurred traveling on a motorcycle.

## Options

The following options listed below are examined to assess whether they are likely to address the problem:

- Option 1 Total Ban
- Option 2 Selective Ban targeted at high risk areas
- Option 3 Warning Signs for high risk areas
- Option 4 Public education

A description of each option is provided below.

Option 1 Total Ban

This option would impose a total ban on children less than six years of age from being transported on a motorcycle. A total ban would apply at all times in all areas throughout the country.

The total ban would affect families that use a motorcycle as their primary means of transport and who have an estimated 970,941 children less than six years of age.[11]

A total ban would restrict competition and directly affect motorcycle taxis from providing transport services to children less than six years of age. A total ban would provide advantages to bus and other taxi transport providers. However, it is not clear whether these other forms of transport have the capacity to meet the demand if a total ban was introduced.

Compliance and enforcement is problematic given the experience with compliance and enforcement of mandatory wearing of a motorcycle helmet.

Option 2 Selective Ban targeted at high risk areas

This option would impose a ban on children less than six years of age from being transported on a motorcycle in selected areas that are considered high risk areas (black spots) and have a history of multiple accidents, fatalities and injuries. .

High risk areas have not been identified and research would need to be undertaken to identify appropriate areas. The Thailand Accident Research Center (TARC) is currently undertaking a study to identify black spots in several

[11] The 970,941 children is based on 61% (percentage of motorcycle use) of 1,591,706 children enrolled in kindergartens (2007). Source of kindergarten enrolments: Australian Education International "Thailand Regulatory Factsheet 2013" cites Basic Statistics of the Ministry of Education 2007.

provinces. The results of this study could help to inform the likely number of high risks areas in Thailand. The goal of this project is to improve the road safety by implementing engineering measures, to evaluate performance of engineering measures by conducting before-after analysis, and to present the benefits of engineering measures to policy makers and provide data for other similar projects. A total of 10 black spot locations will be selected from different provinces in Thailand. Then, the process of studying sites, data collection, conceptual and detailed design, and implementation of appropriate improvement will be conducted.

Similar to option 1, a selective ban would restrict competition and directly affect motorcycle taxis from providing transport services to children less than six years of age in high risk areas. A selective ban would provide advantages to bus and other taxi transport providers. However, it is not clear whether these other forms of transport have the capacity to meet the demand if a selective ban was introduced.

Similar to option 1, compliance and enforcement would be an issue. However, enforcement would be more manageable for the Royal Thai police to enforce given the smaller areas involved compared to option 1.

Option 3 Warning Signs at high risk areas

Similar to option 2, high risk areas have not been identified and research would need to be undertaken to identify appropriate areas.

Appropriate design of warning signs would need to be installed at high risk areas. The design of the warning sign would need to clearly communicate to the motorcycle rider that they were entering an area that has a high number of accidents and fatalities. This would be similar to the 'blackspot' signs installed at high fatality intersections in Victoria, Australia.

Warning signs rely on motorcyclists and other road users to take greater care driving through these high risk areas. This option is effectively a form of self-regulation and requires voluntary compliance by all road users to take a more risk averse approach when driving through high risk areas.

Option 4 Public education

A public education campaign could be undertaken targeted at families with young children highlighting the number of child fatalities and injuries and the appropriate measures that can be taken to reduce the risk of fatality or injury. This could include revisiting the mandatory wearing of motorcycle helmets and providing medically sound advice about the merits of young children wearing a motorcycle helmet.

A public education campaign to counter the perception that motorcycle helmets do not cause neck injuries would more than likely need to be lengthy campaign and costly to gain the confidence of the community and to persuade most

parents to ensure that their children wear motorcycle helmets. The effectiveness of such a public education campaign would be dependent on the degree of continued divisive views publicly expressed by some within the medical profession. Hence, there is a risk that such a campaign may fail to deliver an adequate increase in the proportion of children wearing motorcycle helmets to justify such an investment by government where these funds may be more effectively used for other countermeasures that are more likely to deliver road safety benefits.

There is no emphatic empirical evidence that public campaigns used solely as the primary countermeasure deliver road safety benefits in terms of a reduction in fatalities and injuries. Public campaigns tend to be complementary to inform the public about the introduction or changes to countermeasures to deal with a specific road safety problem.

The effectiveness of public education is dependent on the public perceived risk of child fatalities and injuries as well as the enforcement of regulation such as the mandatory wearing of motorcycle helmets for riders and passengers. Given that the level of compliance is currently low throughout most parts of Thailand, it is unlikely that current enforcement practices are likely to improve compliance levels.

For these reasons, option 4 is not considered a feasible alternative to solely address child fatalities and injuries, and will not be considered further or assessed as a viable alternative.

# Assessment of Options

## Option 1: Total Ban Costs

### Direct Costs

A total ban would impose direct costs on families dependent on a motorcycle as their primary mode of transport. This would affect families of 4 million children less than six years of age. The direct cost to families involves two types of costs; the opportunity cost to parents or other family members to accompany their children on alternative modes of transport and the incremental cost associated with alternative modes of transport.

The opportunity cost entails the time difference between a family member taking a child on a motorcycle and alternative modes of transport. The time difference is the opportunity cost of potential foregone income that could have been derived had the family member not been required to spend additional time using an alternative mode of transport.

The incremental cost of alternative modes of transport is the cost difference on a per km basis for using a motorcycle and alternative modes of transport.

The ban would also impose direct costs on motorcycle taxis and restrict competition in the public transport sector.

These direct costs are discussed and quantified below.

<u>Opportunity cost to families</u>

It is common for families dependent on a motorcycle, for either the father or mother to transport their young children to pre-school institutions, shops as well as to make social, cultural and religious visits. The motorcycle is also critical for transporting a sick child to the local doctor, health centre or the hospital in emergency situations.

Under this option, parents would need to make arrangements for leaving their children that are less than six years of age at home with another care-giver while they went to work, shopping, transported older children to school, or made social visits to friends or family relatives, or to attend cultural and religious ceremonies.

However, not all families would need to take their young children on a motorcycle when transporting older children to school. Most Thai families have large extended families where they can rely on grandparents or older siblings to care for younger children while a parent is transporting older children to school.

It is estimated that about X percent of families have large extended families that can assist with caring for younger children when the parent needs to go to work, shop or transport older siblings to school.

Opportunity costs for family members using alternative modes of transport

It is difficult due to the absence of data to estimate the number of trips per day a child is transported on a motorcycle. However, young children from three to five years of age attend pre-school classes, kindergartens and/or childcare centres. Invariably, parents or older siblings that are dependent on a motorcycle, transport their young children on a motorcycle from home to these institutions.

A total ban would have its greatest impact in respect to sending young children to these institutions and would require parents to consider other modes of transport. Data on pre-school attendance is available and costs estimates can be undertaken. Up to 970,941 children are transported to and from pre-school whose families are dependent on a motorcycle as their primary mode of transport. It has been assumed for the purposes of calculating the costs that these families would transport their children by motorcycle notwithstanding that some of these families may currently use alternative modes of transport.

An alternative mode of transport requires six person trips per day. A family member escorting a young child to pre-school (2 person trips), the family member returning home (1 person trip), the family member leaving home to pick –up child (1 person trip) and the family member escorting the young child home (2 person trips). Using the 970,941 affected children and multiplying 6 person trips equates to 5,825,646 person trips per day of pre-school. This has been rounded to 6 million trips person trips.

Families living within walking distance of a pre-school centre could opt to walk. Given the nature of narrow lanes, many without sidewalks, this could actually pose a greater risk to young children than riding on a motorcycle, particularly if accompanied by an elderly grandparent. Both young children and the elderly are considered vulnerable pedestrians.

Alternatively, some parents could decide to use buses to undertake some of these activities. However, even in these circumstances, the family would need to be within easy walking distance of a bus stop.

In other cases, some families with the financial means could use motor vehicle taxis.

Parents would need to make appropriate transportation arrangements based on their proximity to a pre-school institution and the choice of transport modes available in the area. Walking directly to a pre-school institution or walking to a bus stop involves a cost to family members; that is the time involved that could have been used productively for other pursuits including generating an income.

Parents, older siblings and grandparents already incur this cost when they transport a young child on a motorcycle. Accordingly, the cost of a total ban would be the additional cost imposed from using an alternative mode of transport. The additional cost is known as the incremental cost.

Walking from home to a pre-school institution and walking to a bus stop would be a less efficient mode of transport compared with a motorcycle given the longer time involved in this pedestrian activity. It is estimated (based on xxxx) that a round trip for this mode of transport would involve about one hour per day, X hours per week (based on the number of days per week a child attends a pre-school institution) and X hours per annum.

An estimated X % of families could walk directly to a pre-school institution and an estimated X % of families could walk to a bus stop (based on ……). Average monthly earnings are used to determine the hourly rate for persons involved in walking with a young child. Accordingly, the estimated incremental cost of X baht per annum is based on the number of families that nominate walking as their preferred mode of transport multiplied by the daily incremental cost 50 baht.

A pre-booked passenger vehicle taxi that picked up the child and family carer from the home would have the same level of efficiency as a motorcycle, and may have superior efficiency, as vehicles tend to travel at higher speeds than motorcycles carrying young children.

<u>Incremental cost of using alternative modes of transport</u>

In addition to the incremental cost incurred by family members to use alternative modes of transport to attend a pre-school institution, the family would incur the incremental cost for paying to use these other modes of transport. That is the difference between the operating costs of a motorcycle and the other modes of transport.

In regards to walking directly from the home to a pre-school institution, there would be an incremental benefit as there are no fares associated with walking. The operating cost of an average motorcycle is X baht (based on the average time for a round trip to a pre-school institution). The estimated percentage of families that could walk directly to a pre-school institution is X % (based on ……). Accordingly, the estimated incremental benefit is X baht per day per family and X baht per annum (number of families that nominate walking as their preferred mode of transport multiplied by the daily incremental benefit X baht).

The estimated incremental cost with using a bus as the main means of transport is X baht per day. The cost of using a bus involves the fare for the family carer (four trips @X baht) and the child (two trips@ x baht. = X baht). The operating cost of an average motorcycle is X baht as discussed above. The difference in the cost between a bus and motorcycle is X baht. The estimated percentage of families that would need to use a bus to transport their child to a pre-school institution is X % (based on ……). Accordingly, the estimated incremental cost is X baht per day per family and X baht per annum (number of families that

nominate a bus as their preferred mode of transport multiplied by the daily incremental cost X baht).

The estimated incremental cost with using a passenger vehicle taxi as the main means of transport is X baht per day. This cost is based on four fares @ X baht per day (four trips for the family carer and two trips trips@ x baht. = X baht). The operating cost of an average motorcycle is X baht as discussed above. The difference in the cost between a taxi and motorcycle is X baht. The estimated percentage of families that would use a taxi to transport their child to a pre-school institution is X % (based on ……..). Accordingly, the estimated incremental cost is X baht per day per family and X baht per annum (number of families that nominate a bus as their preferred mode of transport multiplied by the daily incremental cost X baht).

The average incremental cost for the various alternative modes of transport (other than pedestrian) is estimated at 50 baht and the average incremental cost to family members accompanying their children on alternative modes of transport is estimated at 50 baht. This imposes total incremental costs of 100 baht per day per family or 97,094,100 baht per day for the families of the affected 970,941 pre-school children.

On an annual basis, this translates into a total incremental cost of almost 20 billion baht (on the assumption that pre-school operates 5 times per week, 40 weeks per annum).

A summary of the annual costs is provided below.

| | |
|---|---|
| Incremental cost to carer walking to pre-school institution | X million baht |
| Incremental cost to carer walking to bus stop | X million baht |
| Incremental cost with walking | (X million baht) |
| Incremental cost with using a bus | X million baht |
| Incremental cost with using a taxi | X million baht |
| Total incremental cost: | X billion baht |

In addition, there would be incremental costs associated with finding alternative transport for taking trips for health, cultural, religious, recreation and other social activities. As discussed before, no data exists to quantify these costs.

Restriction on Competition

The total ban would also restrict competition in the passenger transport sector. Motorcycle taxis play a large role in providing transport services and would not be permitted to carry children less than six years of age. There are an estimated 80,000 motorcycle taxis that would be affected by the total ban. It is estimated (based on survey from major motorcycle taxi firms) that young children less than six years of age comprise X % of taxi trips and the loss of revenue to the motorcycle taxi sector is estimated at about X million baht per annum.

Further consultation is required with the motorcycle taxi industry to ascertain whether the loss of pre-school children and their family member would be significant enough to impact on employment opportunities in the industry.

**Indirect Costs**

Impacts on early child development

The ban may have unintended consequences for early child development where some families have limited public transport choices or are unable to afford the additional costs of public transport.

The impact on remote rural areas may actually deter some families from sending their children to pre-school institutions where they have limited or no access to public transport.

Similarly, low socio-economic groups across the country may also withdraw their children from pre-school institutions in cases where they are dependent on public transport but due to financial hardship cannot afford the incremental costs associated with public transport.

Impacts on the capacity of alternative modes of transport

The ban would require a shift from motorcycle transport to alternative modes of transport. Other than for those families that can walk from home to their pre-school centre, it is not clear whether the current public/private bus network and motor vehicle taxis have the capacity to absorb up to 6 million person trips per day.

Impacts on the capacity of pedestrian infrastructure, congestion and road safety

Pedestrian facilities (sidewalks and bridges across busy roads) are fairly limited throughout Thailand. It is not clear whether the current road infrastructure could cope with increased pedestrians. If a significant proportion of the 6 million person trips undertaken on a daily basis to pre-schools involved walking as the alternative mode of transport, the lack of appropriate and safe pedestrian infrastructure could lead to unintended consequences of increased congestion (pedestrians spilling onto the road and stopping traffic) and the associated safety risks to young children and family members.

## Benefits

### Direct Benefits

The affected families would directly benefit from the ban in terms of no loss of life or injury to their children. Families and the wider community would directly benefit from the avoided costs associated with fatalities and injuries.

A total ban would prevent from 204 to 389 children being killed on a motorcycle. In addition, a total ban would prevent a considerable number of serious and slight injures as shown in Table 16.

**Table 16: Estimated Number of Child Fatalities, Serious and Slight Injuries**

| | Official data | WHO estimates |
|---|---|---|
| Fatalities | 204 | 389 |
| Serious Injuries | 2,652 | 5,057 |
| Slight Injuries | 7,956 | 15,171 |

The ban on children less than six years of age being transported on motorcycles would avoid the costs associated with child fatalities, serious and slight injuries and generate annual savings from 1.750 billion baht to 3.338 billion baht as shown in Table 17 below.

**Table 17: Avoided Costs of Child Fatalities, Serious and Slight Injuries**

| Crash Severity | Cost (baht) based on official data | Cost (baht) based on WHO estimations |
|---|---|---|
| Fatalities | 1,084,373,424 | 2,067,751,284 |
| Serious Injury | 389,904,996 | 743,495,311 |
| Slight Injury | 276,558,516 | 527,359,131 |
| Total | 1,750,836,936 | 3,338,605,726 |

However, as discussed in the nature and extent of the problem section, the level of compliance is an issue with road traffic laws. In particular with motorcycles, it is a requirement for the rider and passengers to wear a motorcycle helmet. Yet the level of compliance varies across Thailand and it is common for the motorcycle rider to wear a helmet while other children (including those below six years of age) to not wear a helmet.

In terms of enforcement, the modus operandi of police is to establish designated police checks points on major roads to stop and check the licence, registration and third party insurance papers of the driver and to also conduct vehicle roadworthiness where appropriate. Given that most families would undertake small trips from their home to a pre-school institution mostly along residential streets and lanes, it is unlikely that the current location of police checks would detect non-compliance with a total ban unless the police spread its resources to establish police check points at pre-school institutions.

In view of a possible low compliance with a total ban and the resource constraints of police providing police check points at X number of pre-school

institutions across the country, it is unlikely that the full benefits of a total ban would eventuate in the first few years of its operation and may always struggle to achieve the desired benefits unless supported by a public education campaign and the willingness of people to comply with the law.

**Indirect benefits**

Impact on traffic congestion and environment

The absence of about 970,941 motorcycles during the period when children are dropped off and picked up from pre-school is likely to reduce traffic congestion and the associated travel delay costs to other commuters. Parents transporting their children on a motorcycle represent about 5 percent of the total number of registered motorcycles. There is insufficient data on the proportion of registered motorcycles that are likely to be on the road at the same time as motorcycles with children traveling to and from pre-school to determine the current congestion levels and associated travel costs to predict possible cost savings under this option.

While it is difficult to estimate the reduction in motorcycle usage by families with pre-school children, the ban may also provide some environmental benefits with reductions in motorcycle emissions.

Impact on patronage levels for alternative modes of transport

Alternative modes of transport such as public and private bus companies, and taxis are likely to experience increased patronage and revenue from the proposed ban. It is difficult to estimate the expected indirect benefits to each of the different alternative modes of transport.

**Summary of Costs and Benefits**

The incremental costs to families to use alternative modes of transport to take their children to pre-school was estimated at about 20 billion baht per annum and the benefits of the avoided costs associated with fatalities, serious and slight injuries was estimated to range from 1.750 billion baht to 3.338 billion baht per annum; leaving a net cost of 18.250 billion baht to 16.662 billion baht per annum.

The ban would also have indirect costs and unintended consequences for early childhood development for families with limited access to public transport or low-income families that could not afford the additional costs associated with public transport.

The ban imposes a restriction on competition that removes the option of a main public transport provider (motorcycle taxis) providing transport options to children and families. This calls into question whether the capacity of other public transport operators and the pedestrian infrastructure can cope with up to an additional 6 million person trips on a daily basis. In the case of pedestrian

infrastructure, additional pedestrian traffic may lead to increased traffic congestion and road safety for children and family members. The increased patronage of public transport may in the medium term result in increased investment to improve capacity and the reduced motorcycle usage may offset to some extent traffic congestion.

## Option 2 Selective Ban targeted at high risk areas

## Costs

The direct costs would be the same as in option 1. However, they would be limited to specific areas that were deemed high risk and have multiple numbers of fatalities, serious and slight injuries. These high risk areas are commonly referred to as 'black spots' where the road design and topography are inherently dangerous.

It is difficult to quantify the direct costs as the number and location of high risk areas have not been identified in Thailand. In some cases, a high risk area may be specific roads that have a history of multiple accidents.

The government would incur administrative costs undertaking research into identifying high risk areas and installing appropriate road signage advising families to not transport young children on a motorcycle. These costs have not been able to be quantified and consultation is required with the Department of Highways and TARC to ascertain the cost per high risk area and the likely number of high risk areas across the country.

Enforcement would be more manageable for the Royal Thai police to enforce given the smaller areas involved compared to option 1.

## Benefits

There is no guarantee that most child fatalities and injuries are located within high risk areas. It is assumed that a selective ban would reduce an undetermined number of fatalities and injuries without significantly impacting on the freedom of families dependent on a motorcycle as their primary mode of transport to transport their young children.

In these circumstances, affected families may be able to still use their motorcycle to transport their child to pre-school by navigating their way around these high risk roads.

## Summary of Costs and Benefits

The key direct costs of a selective ban on high risk areas would be incurred by government in identifying high risk areas, installing appropriate signage and the cost of enforcement. However, depending on the number and the size of the high

risk areas, the Royal Thai Police may have the capacity and resources to effectively monitor and enforce selective bans of high risk areas.

However, until further research has been undertaken to ascertain whether there is a positive correlation between high risk areas and most child fatalities and injuries, it is difficult to assume that a selective ban would be effective in achieving a significant reduction in child fatalities and injuries to warrant public sector investment in identifying high risk areas and committing the required resources to establish high risk areas and to enforce the selective ban.

## Option 3 Warning Sign at high risk areas

## Costs

Similar to option 2, the government would need to invest public sector resources in identifying high risk areas by analyzing accident data and consulting with the local community. On the assumption that this task may take 1,000 working hours @500 baht labour cost per hour, the total cost to complete one high risk area would cost about 500,000 baht. If 500 high risk areas were undertaken, the total cost would be about 250 million baht.

A further 50 million baht may be required for design of the warning sign, management and administration of the project.

The elements of sign cost include: materials, fabrication, inventory control, maintenance and installation costs (labor and transport). A sign may cost 5,000 baht each and about 1,000 baht for labour and equipment for the installation of each sign (needs to be confirmed from the Department of Highway). An average of 10 signs may be needed for each high risk area at a cost of $60,000 baht.

If 500 high risk areas were identified across the country, the total cost of signage would be about 30 million baht.

In summary, the cost to the government could be in the order of 330 million baht. This would be a one-off cost with minimal ongoing maintenance costs to replace worn and broken signs.

## Benefits

Traffic control (signals, signs, geometry, markings) were found in an Australian study to be definitely relevant in about 20 percent of accidents and possibly relevant in a further 17 percent of accidents. It is not clear whether this would translate to Thailand.

Notwithstanding this, it has been assumed that warnings signs could potentially reduce 20 percent of accidents. Similar to option 2, there is no guarantee that there is a positive correlation between high risk areas and the location of child fatalities and injuries.

On the basis that a 20 percent reduction could be achieved, this would result in the following estimated number of avoided fatalities, serious and slight injuries as shown in Table 18.

**Table 18: Estimated Number of Avoided Child Fatalities, Serious and Slight Injuries**

| | Official data | WHO estimates |
|---|---|---|
| Fatalities | 41 | 78 |
| Serious Injuries | 525 | 1,011 |
| Slight Injuries | 1,591 | 3,034 |

This would potentially avoid the costs associated with child fatalities, serious and slight injuries and generate annual savings from 350 billion baht to 669 billion baht as shown in Table 19 below.

**Table 19: Avoided Costs of Child Fatalities, Serious and Slight Injuries**

| Crash Severity | Cost (baht) based on official data | Cost (baht) based on WHO estimations |
|---|---|---|
| Fatalities | 217,937,796 | 414,613,368 |
| Serious Injury | 77,187,075 | 148,640,253 |
| Slight Injury | 55,304,751 | 105,464,874 |
| Total | 350,429,622 | 668,718,495 |

## Summary of Costs and Benefits

The cost of identifying high risk areas and the design, manufacture, installation of warning signs is estimated at about 330 million baht. This would be a one-off cost with minimal ongoing maintenance costs to replace worn and broken signs.

There is a degree of uncertainty as to whether the warning signs in high risk areas would deliver a 20 percent reduction in child fatalities and injuries given that the actual location of child fatalities and injuries is unknown.

Given that the potential benefits are in the order from 350 million baht to 669 million baht per annum, this option has a greater probability to deliver a net benefit even if a 10 percent reduction was only achieved.

## Comparison of Options

Option 1 generates a net cost to the community based on the data that can be quantified. It is likely that the costs would be even greater if all of the costs could be quantified. Option 1 also identified several unintended impacts, particularly on early child development for families with limited access to public transport and low income families that might not be able to afford public transport.

Option 2 was not measured due to the inadequate data on the likely number of child fatalities and injuries in high risk areas.

Option 3 generates a net benefit but only achieves a potential 20 percent reduction in the number of child fatalities and injuries.

None of the options solely address the problem completely and deliver a net benefit. Further studies should be undertaken particularly into high risk areas to ascertain whether there is a positive correlation between these areas with a history of multiple accidents and most child fatalities and injuries incurred on a motorcycle.

## Consultation

Asia Injury Prevention Foundation
Office of the Consumer Protection Board
Save the Children Thailand
Royal Automobile Association of Thailand
Royal Thai Police
Thailand Accident Research Center (TARC)
Universities

Save the Children Thailand

In response to the recent proposed ban on young children riding on motorcycles, Save the Children calls for the government's attention to children below the age of two to not be allowed on motorcycles. In addition, Save the Children urges the government, and the police, to enforce the existing helmet law for all passengers, particularly all children, 2 years old and up.

With an estimated 1.3 million children in Thailand traveling on motorcycles, the Thai government has legislated that all people – including children – are required to wear a safety helmet at all times. Still, many child passengers are often seen without helmets – only 7% of children in Thailand currently wear helmets while riding motorcycles. This leads to devastating results - approximately 2600 children are killed, and more than 72,000 are injured, every year in road crashes.

Save the Children recommends that children under two should not ride motorcycles because they are at high risk of long-lasting injuries since they cannot wear helmets safely. Save the Children also recommends that children under five only ride motorcycles under close supervision of an adult.

Currently, there are no regulations by the Thai government on this matter. There is a law, however, that requires all passengers and drivers to wear helmets at all times.

Allison Zelkowitz, Save the Children in Thailand Country Director, explains, "At such a young age of two and below, children have insufficient muscle strength to support the weight of a helmet – they are more prone to injuries and should not be allowed on motorcycles at all. Children between 2 to 5 years should only ride in front of an adult, and must always wear a child-sized helmet that fits properly,

and is fastened tightly."

Save the Children seeks to minimize road crash risks to children through awareness building, education, enforcement and preventative tools and equipment to ensure safety and negate unnecessary exposure to harm.

"In Thailand, motorcycles are important in providing children access to schools and health facilities, but safety must always be the first concern." says Allison.

Save the Children also recommends the use of alternate forms of transportation for young children. These include public buses, subways, tricycles (tuk-tuks), taxis and public mini-vans.

**Save the Children in Thailand** is currently partnering with the Asia Injury Prevention Foundation in a collaborative effort called "The 7% Project," which aims to decrease motorcycle death and injury among Thai children by increasing helmet use from 7% to 60% by 2017.

# Appendices

## Appendix 1:

| Study Area | Fatalities | Serious Injuries | Slight Injuries | Property Damage Only | Total |
|---|---|---|---|---|---|
| Bangkok | 715 | 8,144 | 42,707 | 85,414 | 136,980 |
| Amnat Charoen | 44 | 757 | 2,105 | 4,210 | 7,116 |
| Ang Thong | 67 | 876 | 2,460 | 4,920 | 8,323 |
| Buri Ram | 222 | 3,021 | 8,466 | 16,932 | 28,641 |
| Chachoengsao | 306 | 2,128 | 6,187 | 12,374 | 20,995 |
| Chai Nat | 55 | 874 | 2,438 | 4,876 | 8,243 |
| Chaiyaphum | 95 | 2,583 | 7,102 | 14,204 | 23,984 |
| Chanthaburi | 136 | 1,723 | 4,841 | 9,682 | 16,382 |
| Chiang Mai | 396 | 5,014 | 14,094 | 28,188 | 47,692 |
| Chiang Rai | 287 | 3,376 | 9,519 | 19,038 | 32,220 |
| Chon Buri | 527 | 8,172 | 22,797 | 45,594 | 77,090 |
| Chumphon | 173 | 1,748 | 4,965 | 9,930 | 16,816 |
| Kalasin | 67 | 1,983 | 5,441 | 10,882 | 18,373 |
| Kamphaeng Phet | 117 | 1,717 | 4,800 | 9,600 | 16,234 |
| Kanchanaburi | 192 | 2,301 | 6,482 | 12,964 | 21,939 |
| Khon Kaen | 221 | 3,699 | 10,293 | 20,586 | 34,799 |
| Krabi | 140 | 1,577 | 4,458 | 8,916 | 15,091 |
| Lampang | 155 | 2,016 | 5,660 | 11,320 | 19,151 |
| Lamphun | 52 | 1,386 | 3,812 | 7,624 | 12,874 |
| Loei | 115 | 1,750 | 4,884 | 9,768 | 16,517 |
| Lop Buri | 205 | 1,800 | 5,152 | 10,304 | 17,461 |
| Mae Hong Son | 20 | 627 | 1,720 | 3,440 | 5,807 |
| Maha Sarakham | 51 | 1,784 | 4,883 | 9,766 | 16,484 |
| Mukdahan | 45 | 790 | 2,194 | 4,388 | 7,417 |
| Nakhon Nayok | 50 | 937 | 2,600 | 5,200 | 8,787 |
| Nakhon Pathom | 254 | 2,929 | 8,266 | 16,532 | 27,981 |
| Nakhon Phanom | 54 | 1,332 | 3,668 | 7,336 | 12,390 |
| Nakhon Ratchasima | 516 | 5,544 | 15,698 | 31,396 | 53,154 |
| Nakhon Sawan | 322 | 2,930 | 8,369 | 16,738 | 28,359 |
| Nakhon Si Thammarat | 218 | 2,238 | 6,324 | 12,648 | 21,418 |
| Nan | 75 | 1,728 | 4,766 | 9,532 | 16,101 |
| Narathiwat | 41 | 1,479 | 4,047 | 8,094 | 13,661 |
| Nong Bua Lamphu | 45 | 854 | 2,365 | 4,730 | 7,994 |
| Nong Khai | 106 | 1,693 | 4,719 | 9,438 | 15,956 |
| Nonthaburi | 21 | 1,892 | 5,129 | 10,258 | 17,300 |
| Pathum Thani | 115 | 1,523 | 4,273 | 8,546 | 14,457 |
| Pattani | 34 | 1,339 | 3,657 | 7,314 | 12,344 |
| Phang Nga | 46 | 1,082 | 2,985 | 5,970 | 10,083 |
| Phatthalung | 92 | 1,426 | 3,979 | 7,958 | 13,455 |
| Phayao | 29 | 828 | 2,275 | 4,550 | 7,682 |
| Phetchabun | 198 | 2,208 | 6,240 | 12,480 | 21,126 |
| Phetchaburi | 66 | 1,756 | 4,827 | 9,654 | 16,303 |
| Phichit | 120 | 1,166 | 3,317 | 6,634 | 11,237 |
| Phitsanulok | 227 | 1,567 | 4,558 | 9,116 | 15,468 |
| Phra Nakhon Si | 220 | 2,699 | 7,598 | 15,196 | 25,713 |

| | | | | | |
|---|---|---|---|---|---|
| Ayutthaya | | | | | |
| Phrae | 71 | 1,077 | 3,006 | 6,012 | 10,166 |
| Phuket | 152 | 1,993 | 5,595 | 11,190 | 18,930 |
| Prachin Buri | 263 | 1,687 | 4,934 | 9,868 | 16,752 |
| Prachuap Khiri Khan | 205 | 1,768 | 5,067 | 10,134 | 17,174 |
| Ranong | 26 | 590 | 1,629 | 3,258 | 5,503 |
| Ratchaburi | 143 | 2,979 | 8,241 | 16,482 | 27,845 |
| Rayong | 122 | 2,847 | 7,851 | 15,702 | 26,522 |
| Roi Et | 117 | 2,516 | 6,950 | 13,900 | 23,483 |
| Sa Kaeo | 125 | 1,285 | 3,648 | 7,296 | 12,354 |
| Sakon Nakhon | 145 | 2,115 | 5,914 | 11,828 | 20002 |
| Samut Prakan | 113 | 1,210 | 3,428 | 6,856 | 11,607 |
| Samut Sakhon | 205 | 1,540 | 4,450 | 8,900 | 15,095 |
| Samut Songkhram | 15 | 443 | 1,217 | 2,434 | 4,109 |
| Saraburi | 347 | 3,375 | 9,603 | 19,206 | 32,531 |
| Satun | 25 | 509 | 1,409 | 2,818 | 4,761 |
| Si Sa Ket | 69 | 1,964 | 5,394 | 10,788 | 18,215 |
| Sing Buri | 54 | 766 | 2,144 | 4,288 | 7,252 |
| Songkhla | 271 | 3,677 | 10,307 | 20,614 | 34,869 |
| Sukhothai | 100 | 1,410 | 3,948 | 7,896 | 13,354 |
| Suphan Buri | 201 | 2,499 | 7,031 | 14,062 | 23,793 |
| Surat Thani | 285 | 3,383 | 9,538 | 19,076 | 32,282 |
| Surin | 244 | 2,123 | 6,079 | 12,158 | 20,604 |
| Tak | 67 | 1,372 | 3,797 | 7,594 | 12,830 |
| Trang | 108 | 2,381 | 6,575 | 13,150 | 22,214 |
| Trat | 44 | 845 | 2,342 | 4,684 | 7,915 |
| Ubon Ratchathani | 384 | 4,408 | 12,444 | 24,888 | 42,124 |
| Udon Thani | 304 | 3,127 | 8,872 | 17,744 | 30,047 |
| Uthai Thani | 60 | 955 | 2,664 | 5,328 | 9,007 |
| Uttaradit | 65 | 977 | 2,731 | 5,462 | 9,235 |
| Yala | 56 | 1,251 | 3,454 | 6,908 | 11,669 |
| Yasothon | 83 | 999 | 2,815 | 5,630 | 9,527 |
| Total | 11,721 | 157,057 | 460,197 | 920,394 | 1,549,369 |

# Appendix 2

## Appendix 3

| Study Area | Population | Fatalities | Per 100,000 Population | Serious Injuries | Per 100,000 population |
|---|---|---|---|---|---|
| Bangkok | 8,500,000 | 715 | 8.4 | 8,144 | 96 |
| Amnat Charoen | 375,000 | 44 | 11.7 | 757 | 202 |
| Ang Thong | 283,000 | 67 | 23.9 | 876 | 313 |
| Buri Ram | 1,580,000 | 222 | 14 | 3,021 | 191 |
| Chachoengsao | 695,000 | **306** | **44** | 2,128 | 306 |
| Chai Nat | 332,000 | 55 | 16.6 | 874 | 265 |
| Chaiyaphum | 1,140,000 | 95 | 8.3 | 2,583 | 227 |
| Chanthaburi | 527,000 | 136 | 25.6 | 1,723 | 325 |
| Chiang Mai | 1,700,000 | 396 | 23.3 | 5,014 | 295 |
| Chiang Rai | 1,200,000 | 287 | 23.9 | 3,376 | 281 |
| Chon Buri | 1,400,000 | **527** | **37.6** | 8,172 | 584 |
| Chumphon | 498,000 | 173 | **34.6** | 1,748 | 350 |
| Kalasin | 985,000 | 67 | 6.7 | 1,983 | 198 |
| Kamphaeng Phet | 729,000 | 117 | 16 | 1,717 | 235 |
| Kanchanaburi | 848,000 | 192 | 22.6 | 2,301 | 271 |
| Khon Kaen | 1,800,000 | 221 | 12.3 | 3,699 | 205 |
| Krabi | 457,000 | 140 | **30.4** | 1,577 | 343 |
| Lampang | 753,000 | 155 | 20.6 | 2,016 | 269 |
| Lamphun | 405,000 | 52 | 13 | 1,386 | 346 |
| Loei | 634,000 | 115 | 18 | 1,750 | 278 |
| Lop Buri | 758,000 | 205 | 27 | 1,800 | 237 |
| Mae Hong Son | 248,000 | 20 | 8 | 627 | 251 |
| Maha Sarakham | 960,000 | 51 | 5.3 | 1,784 | 186 |
| Mukdahan | 346,000 | 45 | 13 | 790 | 226 |
| Nakhon Nayok | 257,000 | 50 | 19.2 | 937 | 360 |
| Nakhon Pathom | 891,000 | 254 | 28.5 | 2,929 | 329 |
| Nakhon Phanom | 713,000 | 54 | 7.6 | 1,332 | 188 |
| Nakhon Ratchasima | 2,620,000 | 516 | 19.7 | 5,544 | 212 |
| Nakhon Sawan | 1,073,000 | 322 | **30** | 2,930 | 274 |
| Nakhon Si Thammarat | 1,5000,000 | 218 | 14.5 | 2,238 | 149 |
| Nan | 478,000 | 75 | 15.6 | 1,728 | 360 |
| Narathiwat | 775,000 | 41 | 5.3 | 1,479 | 192 |
| Nong Bua Lamphu | 509,000 | 45 | 9 | 854 | 171 |
| Nong Khai | 517,000 | 106 | 20.4 | 1,693 | 326 |
| Nonthaburi | 1,174,000 | 21 | 1.8 * | 1,892 | 162 |
| Pathum Thani | 1,074,000 | 115 | 9.8 | 1,523 | 130 |
| Pattani | 686,000 | 34 | 5 | 1,339 | 197 |
| Phang Nga | 261,000 | 46 | 17.7 | 1,082 | 416 |
| Phatthalung | 520,000 | 92 | 17.7 | 1,426 | 274 |
| Phayao | 484,000 | 29 | 6 | 828 | 172 |
| Phetchabun | 995,000 | 198 | 19.8 | 2,208 | 221 |
| Phetchaburi | 474,000 | 66 | 14 | 1,756 | 374 |
| Phichit | 547,000 | 120 | 21.8 | 1,166 | 212 |
| Phitsanulok | 851,000 | 227 | 26.7 | 1,567 | 184 |
| Phra Nakhon Si Ayutthaya | 803,000 | 220 | 27.5 | 2,699 | 337 |
| Phrae | 454,000 | 71 | 15.8 | 1,077 | 239 |
| Phuket | 378,000 | **152** | **40** | 1,993 | 524 |

| | | | | | |
|---|---|---|---|---|---|
| Prachin Buri | 479,000 | **263** | **54.8** | 1,687 | 351 |
| Prachuap Khiri Khan | 525,000 | **205** | **39.4** | 1,768 | 340 |
| Ranong | 177,000 | 26 | 14.4 | 590 | 328 |
| Ratchaburi | 842,000 | 143 | 17 | 2,979 | 355 |
| Rayong | 674,000 | 122 | 18.2 | 2,847 | 425 |
| Roi Et | 1,3000,000 | 117 | 9 | 2,516 | 194 |
| Sa Kaeo | 552,000 | 125 | 22.7 | 1,285 | 234 |
| Sakon Nakhon | 1,140,000 | 145 | 12.7 | 2,115 | 185 |
| Samut Prakan | 1,262,000 | 113 | 9 | 1,210 | 96 |
| Samut Sakhon | 532,000 | **205** | **38.7** | 1,540 | 291 |
| Samut Songkhram | 194,000 | 15 | 7.9 | 443 | 233 |
| Saraburi | 633,000 | **347** | **55** | 3,375 | 536 |
| Satun | 313,000 | 25 | 8 | 509 | 164 |
| Si Sa Ket | 1,465,000 | 69 | 4.7 | 1,964 | 134 |
| Sing Buri | 212,000 | 54 | 25.7 | 766 | 365 |
| Songkhla | 1,400,000 | 271 | 19.3 | 3,677 | 263 |
| Sukhothai | 602,000 | 100 | 16.6 | 1,410 | 235 |
| Suphan Buri | 849,000 | 201 | 23.6 | 2,499 | 294 |
| Surat Thani | 1,000,000 | 285 | 28.5 | 3,383 | 338 |
| Surin | 1,400,000 | 244 | 17.4 | 2,123 | 152 |
| Tak | 539,000 | 67 | 12.4 | 1,372 | 254 |
| Trang | 638,000 | 108 | 16.9 | 2,381 | 372 |
| Trat | 225,000 | 44 | 20 | 845 | 384 |
| Ubon Ratchathani | 1,845,000 | 384 | 20.9 | 4,408 | 240 |
| Udon Thani | 1,570,000 | 304 | 19.3 | 3,127 | 199 |
| Uthai Thani | 330,000 | 60 | 18.2 | 955 | 289 |
| Uttaradit | 460,000 | 65 | 14 | 977 | 212 |
| Yala | 512,000 | 56 | 11 | 1,251 | 245 |
| Yasothon | 540,000 | 83 | 15.4 | 999 | 185 |
| Total | 67,397,000 | 11,721 | | 157,057 | |

# REGULATORY IMPACT ANALYSIS GUIDELINES FOR THE THAILAND GOVERNMENT

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