

Transport Infrastructure Development in an Economic Crisis Environment



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 RAILHOW

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an Economic Crisis Environment”**

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1 Preface

The transportation industry will face new and emerging challenges in the future, which may dramatically reshape transportation priorities and needs. A modern, high-quality transportation network is vital to the economy and is a prerequisite for future growth.

Most of the Countries are challenged with identifying, prioritizing and investing in infrastructure that delivers real economic, social and environmental benefits and in many cases to contribute to diversifying the economy. But how to select the best projects or initiatives, when the financial resources are limited?

This book addresses the challenges for developing the transport infrastructure in a financial crisis environment. A strategy for infrastructure development in a crisis environment is presented as also a simple methodology for the selection of projects and other initiatives. The methodology is explained in an example. International best practices (Singapore, Malaysia) are presented.

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PART A: Challenges and best practices

2 Addressing the challenges of the transport sector in a crisis environment

2.1 The big challenges for the transport system

The transport system is confronting a number of big challenges over the coming years and decades. The challenges include the following:

2.1.1 Understanding and responding to changes in future demand

To reduce the uncertainty, we face around future demand for personal travel, we need to understand better the factors affecting the changing patterns of demand. These include social trends, as well as the speed in development, acceptance and impact of new technologies.

There is also a need to build flexibility into the system where we can — this will allow us to respond more quickly to changing patterns of demand and reduce the probability that we will make investments that will become unnecessary.

Finally, we must recognize that **our investment decisions will shape demand patterns and not just react to them**. We should move away from the attempt to simply predict and then provide for future demand. Instead, we should discuss what kind of access we want and decide how to **invest in promoting the future**.

2.1.2 Funding the transport system in the longer term

Understanding **how much investment** to make in the transportation system and **how to fund that investment** is a major ongoing challenge for each government.

2.1.3 Support economic growth

Understanding the transport-economic growth relationship, and hence **why and when to invest in transport infrastructure**, is the main objective for a government.

Transport plays a key role in fostering economic growth. We must prevent unnecessary regulatory obstacles to international freight and guarantee that **our strategies promote the smooth functioning of our ports, roads and rail infrastructure**.

While transport investment has historically driven financial development, this advantage is mostly seen when an economy is developing, and as a country develops the transport systems required to maintain a modern economy. Once these networks have been established, the focus shifts towards decreasing the cost of doing business along these routes (addressing bottlenecks) in order to preserve overall competitiveness.

In growing regions, investment in the transportation sector can decrease costs and boost overall competitiveness. However, **investment in new transport systems on its own is unlikely to reverse the decline in declining regions.** While investments in local transport infrastructure could assist in generating employment in the short term, the maintenance costs could become an extra burden for a declining area in the medium term. In order to support declining regions effectively, transport investment needs to be part of a broader package of policies to establish the local financial environment needed to promote growth.

2.1.4 Embracing the technology challenge and opportunity

Intelligent transportation systems are revolutionizing transportation worldwide, offering some of the greatest opportunities for improving safety, effectiveness and environmental outcomes.

Globally, government and regulators will be challenged to stay up with the pace of technological change and guarantee that transport rules and regulations or other barriers do not prevent the adoption of new technology or a business model or prevent developers from investing in research and development (R&D). We have seen, for instance, a fast increase in the use of remotely piloted aircraft (or "drones"), which are used for an increasingly broad range of civilian apps, including aerial photography, search and rescue, and agricultural crop spraying. Another example of new technologies coming is autonomous driving.

The government will play a key role in assisting realize the advantages of these technologies— as an investor, facilitator, and regulator. In most cases, however, the private sector will lead the development of new technologies. Their success will depend on whether customers value them, and the government may not need to be involved.

2.1.5 Responding to transport's environmental externalities

Transport faces a major challenge in responding to two environmental externalities: **reducing its level of greenhouse gas emissions** and **meeting the growing cost of extreme weather events**.

2.2 Economic Crisis and Consequences for the Transport Sector

Following questions to be addressed for investment in the transport infrastructure investment in an economic crisis environment, when the available financing sources are limited:

- Why is transport infrastructure important for the economy?
- How can this investment in transport infrastructure be made?
- When is it appropriate to invest in transport infrastructure?
- What kind of transport infrastructure investment is considered important for the economy?

PART B: A strategy for infrastructure development in an economic crisis environment

3 The outline of the proposed strategy

The outline of the strategy suggested for the development of the transport infrastructure development in an economic crisis environment and presented next is based on the discussion in “PART A: Challenges and best practices” (Figure 1).

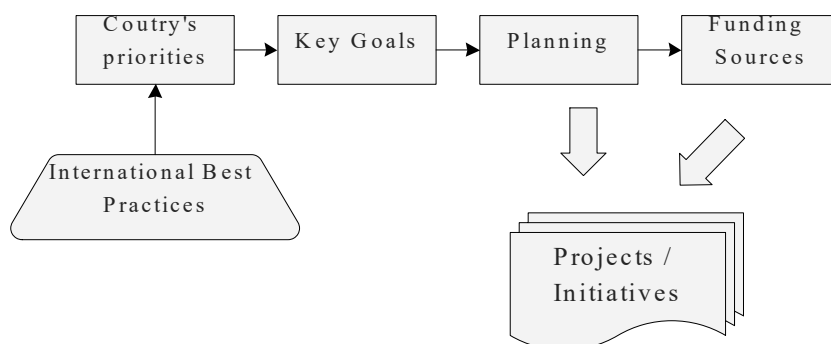


Figure 1: The outline of our strategy

3.1 Country priorities

The priorities of each country must be in line with its (future) vision. The vision enshrines the country's long-term objectives and describes the future development pillars. The development of transport must fit in with the vision. In creating the vision and its priorities, international best practices could provide helpful input.

3.2 Key goals

Based on the Country’s priorities defined, the key goals for the transport development need to be identified.

Next, are examples of key goals:

1. Development of a National Transport Strategy. Recognition of the role of all modes of transport – cooperation of the transport modes for an efficient transport system.

2. Establishment of a world-class transport system (it may take 10 to 15 years to achieve the vision of a world-class transport system).
3. Place the country, e.g. within the top 30 in the World Bank Logistic Performance Index by 20XX¹.
4. Improve the efficiency of transport operations and maintenance.
5. Adaptation of new technologies and exploration of innovative approaches through greater use of technology and greater private sector involvement.
6. New technology to maximise the capacity of the roads by upgrading and installing intelligent traffic management systems.
7. Provide an attractive public transport system to be the cornerstone of the land transport strategy.
8. Infrastructure investments to be associated with national logistics development plans, economic diversification efforts, and to facilitate international trade.
9. Investments on infrastructure and latest technology for upgrading ports, airport facilities, new road and rail links.
10. Development of the national transport network to connect international transport corridors in order to enhance effectiveness and decrease logistics costs.
11. Improvement of road safety.

3.3 Planning priorities

Next step is to plan the necessary actions.

Following, are examples of areas to be considered when planning new infrastructure (or upgrading existing one):

¹ See: <https://lpi.worldbank.org/>

1. Identification of transport problems. Recognition of the need for both capacity enhancement and demand management. Understanding how transport demand and conditions might change in the future for appraising/prioritising elements of the transport strategy;
2. Integrate urban development with transport planning.
3. Better integration of the functions of planning, development, implementation and management of all transport infrastructure and policies.
4. Integration of national transport infrastructure with international transportation corridors.

3.4 Funding the infrastructure

After the planning phase is finished, funding the infrastructure is the next step. Funding mechanisms should be identified.

3.5 Projects / Initiatives (Key Interventions)

Future projects and initiatives need to be defined on the basis of previous steps, with a clear implementation timetable and required funding.

An example of projects / initiatives (key interventions) and their characteristics are provided in Section 4.

The appraisal criteria are presented in Section 5, and a methodology for the selection of projects / initiatives (key interventions) is presented in Section 6.

Finally an example of a cost-benefit analysis for the selection of the projects is provided in ANNEX A.

4 Key interventions

Key interventions are projects and soft measures (initiatives).

4.1 Key projects

Key projects to be identified as described in Section 3.5.

4.2 Soft measures (Initiatives)

In many cases, soft measures (as like changes in the institutional framework) can improve the efficiency of the transport infrastructure, without investing in expensive projects. Next, some examples.

- (1) Better integration of the functions of planning, development, implementation and management of all transport infrastructure and policies.
- (2) Establishment of a robust performance monitoring mechanism and enforcement system. Several Key Performance Indicators (KPIs) to be introduced.
- (3) Establishment of a new or modification of the current regulatory/institutional framework. Significant change of mindset among the operators; we must find ways to give incentives so that operators will continually improve their services and be more responsive to the changing needs and demands of their customers.
- (4) Understanding how transport demand and conditions might change in the future for appraising/prioritising components of the transport strategy (use of an analytical basis).

4.3 Characteristics of interventions

4.3.1 Types of Investment / Spending

We can distinguish following types of investment / spending

- (1) New Infrastructure
- (2) Maintenance of core infrastructure
- (3) Maintenance of secondary (non-core) infrastructure
- (4) Operation
- (5) Regulatory / institutional framework
- (6) Soft measures

4.3.2 Categories of Investment / spending

Investment refers to new infrastructure. For each type of investment / spending following categories apply.

- (1) Road Infrastructure
- (2) Rail Infrastructure
- (3) Port Infrastructure
- (4) Aviation Infrastructure
- (5) Logistics Infrastructure
- (6) Public transport
- (7) Road safety

5 Appraisal criteria

5.1 Criteria for investment appraisal (new projects)

Following are examples of criteria for investment appraisal:

- (1) Is investment fitting with the vision of the Country?
 - a. Does the investment contribute to the diversification of the economy?
 - b. Is it a smart infrastructure investment?
 - i. On the long term, does investment promote competitiveness, productivity, innovation, lower prices, and higher incomes?
 - ii. In the near-term does it create new jobs?
 - c. Does investment enhance the quality of life?
- (2) Is investment fitting with the National Transport Strategy?
- (3) Is investment fitting with the Country's Logistics Strategy? (Is the investment associated with national logistics development plans?)
- (4) Is the investment part of a transport system, where all transport modes are cooperating to improve efficiency?
- (5) Is investment related to intelligent transport systems?
- (6) Is investment providing an attractive public transport system?
- (7) Is the amount of investment clear? The benefits? The funding? Do we get good value for what we spend? (Is the investment justified by a feasibility study?)
- (8) Is the investment in a growing region (so investing in the transport system can reduce costs and increase relative competitiveness)?
- (9) Is the investment in regions that are declining (so investment in new transport systems on their own is unlikely to reverse

their decline)? If yes, transport investment is a part of a wider package of measures aimed to support growth in those regions that are declining?

- (10) Does the investment contribute to the enhancement of international trade?
- (11) Is there any option to recover all or part of the costs through a fare or similar system?
- (12) Does the investment increase the safety of the transport system?
- (13) Does the investment increase the accessibility of transport facilities?
- (14) Does the investment increase the capacity of transport facilities?

5.2 Ongoing projects for the construction of new infrastructure

For projects that are ongoing, the criteria for new projects to be considered (Section 5.1).

Additional criteria could be:

- Progress status of the project (is the project in an early stage or close to be completed?)
- Contractual implications if project will be cancelled
- Implications for the local society
- Safety measures required to prohibit access to an incomplete transport infrastructure
- Possibility to continue the project by private funding.

5.3 Criteria for maintenance projects appraisal

Following are examples of criteria for maintenance projects appraisal:

- (1) Is funding for corrective or for preventing maintenance?
- (2) Is funding part of an asset replacement strategy?
- (3) Maintenance is to a project that
 - a. contributes to the diversification of the economy?
 - b. is associated with national logistics development plans?
 - c. contributes to the enhancement of international trade?
 - d. enhances the quality of life?
 - e. is suitable for economic growth and helps maintaining our competitive edge?

6 Methodology for the selection of projects and other initiatives

Following questions to be answered when it comes to the selection of projects and other initiatives:

- How to make sure that the projects will achieve the strategic objectives of the government in general and especially achieve the strategic objectives of the respective Ministry of Transport?
- Are the limited resources (mainly financial) allocated to proper projects?
- Which projects should be selected to continue, and which should be dismissed?

A simple **cost-benefit analysis based on a multi-criteria analysis** for the evaluation of the project benefits is suggested to be used.

The methodology suggested includes the identification, prioritization, selection of projects. We can simplify this continuous process in four key steps:

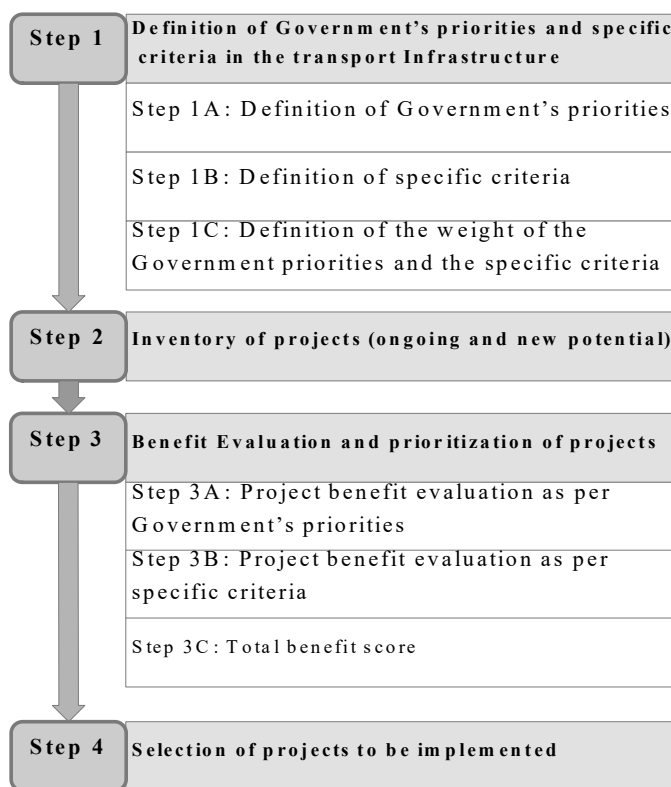


Figure 2: Methodology for the evaluation of the project benefits

Based on the methodology presented, we can evaluate the benefits of potential projects (or other interventions), as follows.

All next are examples. Criteria to be defined as per the specific case, considering the priorities set up by the specific Country.

To be noted:

The methodology described should not be applied on small scale projects, but on a project program, that means on inter-related projects that can produce increased benefits when handled together and meet strategic business objectives to create value addition for stakeholders.

Example:

The dualization of a road between City A and B for 20 km is not meeting strategic objectives to increase road safety. The strategic objective could be to improve road safety in Region X, so the project program is the dualization of certain roads in the whole Region.

Step 1: Definition of basic government’s priorities and specific criteria in the transport Infrastructure

Step 1A: Definition of basic government’s priorities

For the prioritization of projects, the basic government’s priorities in the transport infrastructure and weight values need to be defined.

All next are examples. Criteria to be defined as per the specific case, considering the priorities set up by the specific Country.

In Table next, values are only as an example.

Table 1: Government Priorities in the Transport sector

Type of infrastructure		Priority (values as an example)
1	Road Infrastructure	30%
2	Rail Infrastructure	100%
3	Port Infrastructure	100%
4	Aviation Infrastructure	60%
5	Logistics Infrastructure	100%
6	Public transport	80%
7	Road safety (improvement of current road infrastructure)	100%
8	Regulatory / institutional framework	100%
9	Soft measures	90%

Step 1B: Definition of specific criteria

In this step we need to define specific criteria that are beyond the basic government's priorities. They could be e.g. based on the National Transport Strategy, the Logistics Strategy etc.

All next are examples. Specific criteria to consider the priorities set up by the specific Country.

Table 2: Definition of specific criteria (example)

Criterion		Importance for the government ²	
1	Is investment fitting with the Country's Vision?	Does the investment contribute to the diversification of the economy?	100%
		On the long term is investment promoting competitiveness, productivity, innovation, lower prices, and higher incomes?	90%
		In the near-term does it creates many thousands of jobs?	90%
		Does investment enhance the quality of life?	60%
2	Is investment fitting with the National Transport Strategy?	100%	

² values as an example

A strategy for infrastructure development in an economic crisis environment - Methodology for the selection of projects and other initiatives

	Criterion	Importance for the government²
3	Is investment fitting with the Country's Logistics Strategy? (Only for projects related to logistics)	100%
4	Is the investment part of a transport system, where all transport modes are cooperating to improve efficiency?	80%
5	Is investment related to intelligent transport systems?	50%
6	Is investment providing an attractive public transport system?	70%
7	Is the amount of investment clear? The benefits? The funding? Do we get good value for what we spend? (Is the investment justified by a feasibility study?)	80%
8	Is the investment in a growing region (so investing in the transport system can reduce costs and increase relative competitiveness)?	100%
9	Is the investment in regions that are declining (so investment in new transport systems on their own is unlikely to reverse their decline)? If yes, transport investment is a part of a wider package of measures aimed to support growth in those regions that are declining?	100%
10	Does the investment contribute to the enhancement of international trade?	60%
11	Is there any option to recover all or part of the costs through a fare or similar system?	70%

Criterion		Importance for the government ²
12	Does the investment increase the safety of the transport system?	100%
13	Does the investment increase the accessibility of transport facilities?	80%
14	Does the investment increase the capacity of transport facilities?	80%

Step 1C: Definition of the weight of the government priorities and the specific criteria

In this step we need to define the weight of the government priorities and the specific criteria. In Table next, values are only as an example.

Table 3: Weight of the government priorities and the specific criteria

Government priorities	40%
Specific criteria	60%

Step 2: Inventory of projects (ongoing and new potential)

This step consists of taking inventory of projects: ongoing and potential new projects as proposed by the different Departments of our Organization.

Step 3: Benefit Evaluation and prioritization of projects

Evaluation methodology

Projects will be evaluated as per following criteria categories:

- a. Prioritization of projects, as per government's priorities in the transport Infrastructure
- b. Project evaluation as per specific criteria

Score given will be weighted as per Step 1C.

Step 3A: Project evaluation as per the government's priorities

For the prioritization of projects, as per the government's priorities in the transport infrastructure, weight values to be defined.

In the blank cells in Table 4, following values to be used:

- 1=YES (Project is a government priority),
- 0=NO (Project is not a government priority).

In Table next, values are only as an example.

Table 4: Prioritization of projects -weight for priorities (as per Table 1)

Type of infrastructure		Priority (values as an example)	Project 1	Project 2	Project X
1	Road Infrastructure	30%			
2	Rail Infrastructure	100%			
3	Port Infrastructure	100%			
4	Aviation Infrastructure	60%			

Type of infrastructure		Priority (values as an example)	Project 1	Project 2	Project X
5	Logistics Infrastructure	100%			
6	Public transport	80%			
7	Road safety (improvement of current road infrastructure)	100%			
8	Regulatory / institutional framework	100%			
9	Soft measures	90%			

Step 3B: Project benefit evaluation as per specific criteria

In the next table, the specific criteria for the project evaluation are presented. The weight values to be defined.

In the blank cells in Table 5, use a scale from 1 to 10:

- 10 = good (project fits best to the specific criterion)
- 1 = poor (project doesn't fit to the specific criterion)

In Table next, values are only as an example.

Table 5: Specific Criteria (as per Table 2)

Criterion			Importance for the government ³	Project 1	Project 2	Project X
1	Is investment fitting with the Country's Vision?	Does the investment contribute to the diversification of the economy?	100%			
		On the long term is investment promoting competitiveness, productivity, innovation, lower prices, and higher incomes?	90%			
		In the near-term does it creates many thousands of jobs?	90%			
		Does investment enhance the quality of life?	60%			
2	Is investment fitting with the National Transport Strategy?	100%				

³ values as an example

A strategy for infrastructure development in an economic crisis environment - Methodology for the selection of projects and other initiatives

Criterion		Importance for the government ³	Project 1	Project 2	Project X
3	Is investment fitting with the Country's Logistics Strategy? (Only for projects related to logistics)	100%			
4	Is the investment part of a transport system, where all transport modes are cooperating to improve efficiency?	80%			
5	Is investment related to Intelligent transport systems?	50%			
6	Is investment providing an attractive public transport system?	70%			
7	Is the amount of investment clear? The benefits? The funding? Do we get good value for what we spend? (Is the investment justified by a feasibility study?)	80%			
8	Is the investment in a growing region (so investing in the transport system can reduce costs and increase relative competitiveness)?	100%			
9	Is the investment in regions that are declining (so investment in new transport systems on their own is unlikely to reverse their decline)? If	100%			

Criterion		Importance for the government ³	Project 1	Project 2	Project X
	yes, transport investment is a part of a wider package of measures aimed to support growth in those regions that are declining?				
10	Does the investment contribute to the enhancement of international trade?	60%			
11	Is there any option to recover all or part of the costs through a fare or similar system?	70%			
12	Does the investment increase the safety of the transport system?	100%			
13	Does the investment increase the accessibility of transport facilities?	80%			
14	Does the investment increase the capacity of transport facilities?	80%			

Step 3C: Total benefit score

The total evaluation score combines the score of

- a. SCORE 1 for prioritization of projects, as per basic government's priorities in the transport infrastructure (Step 3A)
- b. SCORE 2 for Project evaluation as per specific criteria (Step 3B)

Step 4: Selection of projects

Having prioritized projects based on Step 3, this step aims to "draw the line" in determining which projects will be implemented, considering also the required total investment cost (or better the life cycle cost).

Step 3 takes into consideration the benefits of the projects and not their cost. In order to select the "best" projects as per their cost and benefits, the cost/benefit ratio can be calculated. The project selection can be based on the ranking based on this ratio.

A ranking of the projects to be executed can be elaborated, based on the cost/benefit ratio (see example Annex A).

The appraisal as per Step 4 shall be only as a guidance. The final selection should take into consideration also political decisions etc.

In ANNEX A, an example of a multi-criteria analysis applied on four projects is provided:

- Project 1: Rail connection to port
- Project 2: Road connection to Freight Center
- Project 3: Road dualization between City A and B
- Project 4: Construction of a Logistics Center

7 Selection of projects considering budget constraints

Let us imagine that we have to prepare our investment plan for the year 20XX⁴. Of course we cannot execute projects that are exceeding the available budget for this year.

The different Departments of our Organization submitted their project proposals, but the total cost is exceeding by far the available budget.

So how, to elaborate an investment plan that includes the projects that fitting best to the government priorities, the specific criteria defined and also the total project cost is within the available budget?

Based on the methodology discussed in Section 6, we can calculate the cost/benefit ratio of all proposed projects and select the projects with a total cost not exceeding the available budget.

In Annex B we will present an example on the selection of projects considering budget constraints.

⁴ Or multi annual investment plan

8 References

- [1] Scottish Executive Social Research, “*A Review of National Transport Strategies Across Developed Countries in Europe and Elsewhere*”, 2006
- [2] “*New Zealand Transport Strategy*”, 2008
- [3] Singapore, Land Transport Authority, “*White Paper - A World Class Land Transport System*”, 1996
- [4] Malaysia, Economic Planning Unit, Prime Minister’s Department, “*Strategic Paper 13 - Providing Seamless Transport System*”

9 ANNEX A: Example of a cost-benefit analysis for the selection of the projects

Next we will provide an example of a cost-benefit analysis for the selection of the projects. In this example, we will have to select between four projects.

Project 1: Rail connection to port A

Project 2: Road connection to a Freight Centre

Project 3: Road dualization in Region X

Project 4: Construction of a Logistics Centre

First, we will rank all projects as per basic government priorities and specific criteria (Step 3C, Section 6), without considering the costs of the projects.

The final selection will take into consideration not only the highest rank, but also the cost of every project, so it is calculating the cost/benefit ratio of the projects (Step D, Section 6). So, we will consider the basic government priorities, the specific criteria defined and also the project cost.

In Annex B, we will discuss how to select projects taking into account budget constraints.

Step 1: Definition of basic government's priorities in the transport Infrastructure

- Basic government Priorities as per Section 6.
- Specific Criteria as per Section 6.

Step 2: Inventory of projects (ongoing and new potential)

In our example, we have to examine four projects as per Table 6.

Table 6: Projects planned

<i>Project</i>	<i>Budgeted cost (USD)</i>
Project 1: Rail connection to port A	350,000,000
Project 2: Road connection to Freight Centre	200,000,000
Project 3: Road dualization in Region X	180,000,000
Project 4: Construction of a Logistics Centre	250,000,000

Step 3A: Prioritization of projects - as per the basic government's priorities

In next step, we will proceed to a prioritization of projects - as per the basic government's priorities defined in Step 1.

Following values to be used:

- 1=YES (Project is a government priority),
- 0=NO (Project is not a government priority).

Table 7: Prioritization of projects - as per the government's priorities

			Project 1	Project 2	Project 3	Project 4
			1=YES, 0=NO			
1	Road Infrastructure	30%	0	1	1	0
2	Rail Infrastructure	100%	1	0	0	0
3	Port Infrastructure	100%	1	0	0	0
4	Aviation Infrastructure	60%	0	0	0	0
5	Logistics Infrastructure	100%	1	1	0	1
6	Public transport	80%	0	0	0	0
7	Road safety (improvement of current road infrastructure)	100%	0	0	1	0
8	Regulatory / institutional framework	100%	0	0	0	0
Total score:			3.0	1.3	1.3	1.0
Government priorities weighted:			40	17	17	13

Example:

- The Total score for project 2 is calculated:
 $1 \text{ (Road Infrastructure)} \times 30\% + 1 \text{ (Logistics Infrastructure)} \times 100\% = 1.3$
- The weighted score for government priorities is calculated by giving to the project with the highest score the full value of the government priority. Other projects are getting a score pro rata. So, project 1 is the project with the highest Total score, so it gets $40\% \times 100 = 40$. Project 2 score is calculated pro rata:
 $\frac{1.3}{3.0} \times 40\% \times 100 = 17$.

Step 3B: Project benefit evaluation as per specific criteria

In this step, we will calculate the project benefits as per specific criteria.

A scale from 1 to 10 to be used.

- 10 = good (project fits best to the specific criterion)
- 1 = poor (project doesn't fit to the specific criterion)

Table 8: Project benefit evaluation as per specific criteria:

Criterion			Importance	Project 1	Project 2	Project 3	Project 4
1	Is investment fitting with the Country's Vision?	Does the investment contribute to the diversification of the economy?	100 %	10	10	1	10
		On the long term is promoting competitiveness, productivity, innovation, lower prices, and higher incomes?	90%	8	8	2	6
		In the near-term does it creates many thousands of jobs?	90%	8	8	8	8

A strategy for infrastructure development in an economic crisis environment - ANNEX A: Example of a cost-benefit analysis for the selection of the projects

Criterion		Importance	Project 1	Project 2	Project 3	Project 4
	Does investment enhance the quality of life?	60%	1	1	8	1
2	Is investment fitting with the National Transport Strategy?	100%	10	10	10	4
3	Is investment fitting with the Country's Logistics Strategy? (Only for projects related to logistics)	100%	10	10	10	n/a
4	Is the investment part of a transport system, where all transport modes are cooperating to improve efficiency?	80%	6	10	1	10
5	Is investment related to Intelligent transport systems?	50%	1	5	1	10
6	Is investment providing an attractive public transport system?	70%	1	1	3	1
7	Is the amount of investment clear? The benefits? The funding? Do we get good value for what we spend? (Is the investment justified by a feasibility study?)	80%	9	9	2	10
8	Is the investment in a growing region (so investing in the transport system can reduce costs and increase relative competitiveness)?	100%	7	7	n/a	7

A strategy for infrastructure development in an economic crisis environment - ANNEX A: Example of a cost-benefit analysis for the selection of the projects

Criterion		Importance	Project 1	Project 2	Project 3	Project 4
9	Is the investment in regions that are declining (so investment in new transport systems on their own is unlikely to reverse their decline)? If yes, transport investment is a part of a wider package of measures aimed to support growth in those regions that are declining?	100 %	n/a	n/a	3	n/a
10	Does the investment contribute to the enhancement of international trade?	60%	10	5	1	5
11	Is there any option to recover all or part of the costs through a fare or similar system?	70%	3	1	1	5
12	Does the investment increase the safety of the transport system?	100 %	5	1	10	1
13	Does the investment increase the accessibility of transport facilities?	80%	10	10	1	n/a
14	Does the investment increase the capacity of transport facilities?	80%	n/a	n/a	1	5
Total score:			86.3	83.1	39.7	83.4

A strategy for infrastructure development in an economic crisis environment - ANNEX A: Example of a cost-benefit analysis for the selection of the projects

Criterion	Importance	Project 1	Project 2	Project 3	Project 4
Specific criteria weighted:		60	58	28	58

Example:

- The Total score for every project is calculated by multiplying the importance with the score given per criterion and summarizing all scores for the particular project.
- The Total score for the specific criteria is the weighted score and is calculated by giving to the project with the highest score the full value of the specific criteria. Other projects are getting a score pro rata. So, project 1 with the highest Total score, gets 60% X 100 = 60. Project 3 score is calculated pro rata: $\frac{39.7}{86.3} \times 60\% \times 100 = 28$

A strategy for infrastructure development in an economic crisis environment - ANNEX A: Example of a cost-benefit analysis for the selection of the projects

Step 3C: Total evaluation score

Evaluation as per Step 3a and 3b

Table 9: Total evaluation score

	Project 1	Project 2	Project 3	Project 4
Government priorities weighted:	40	17	17	13
Specific criteria weighted:	60	58	28	58
Total score:	100	75	45	71
RANK:	1	2	4	3

So, the ranking as per government priorities and specific criteria are:

Table 10: Ranking as per government priorities and specific criteria

RANK	PROJECT
1	Project 1: Rail connection to port
2	Project 2: Road connection to Freight Center
3	Project 4: Construction of a Logistics Center
4	Project 3: Road dualization between City A and B

A strategy for infrastructure development in an economic crisis environment - ANNEX A: Example of a cost-benefit analysis for the selection of the projects

Step 4: Selection of projects as per the cost-benefit analysis

The ranking as per cost-benefit analysis is as per table next:

Project [1]	Budgeted cost (USD) [2]	Score [3]	Cost to benefit [4] = $[2]/([3]*100,000)$	Rank [5]
Project 1: Rail connection to port A	350,000,000	100	35	2
Project 2: Road connection to Freight Center	200,000,000	75	27	1
Project 3: Road dualization in Region X	180,000,000	45	40	4
Project 4: Construction of a Logistics Center	250,000,000	71	35	3

Conclusion:

Step 3C provided the ranking of the projects as per basic government priorities and specific criteria, without considering the costs of the projects. As per this step, Project 1 was the best project (highest score).

Step D takes into consideration not only the highest score, but also the cost of every project, so it is calculating the cost/benefit ratio of the projects. As a result, Project 2 is the best project, as it gets the highest value (score), taking into account the basic government priorities, the specific criteria defined and also the project cost.

10 ANNEX B: Selection of projects considering budget constraints

Let us imagine that we have to prepare our investment for the year 20XX. The available budget for this year is 700.000.000 USD.

The different Departments of our Organization submitted in total fifteen project, but the total cost is 5,490,000,000 USD exceeding by far the available budget. Of course we cannot execute projects that are exceeding the available budget for this year.

So how, to elaborate an investment plan that includes the projects that fitting best to the government priorities, the specific criteria defined and also the total project cost is within the available budget.

Based on the methodology discussed in Section 6, we will calculate the cost/benefit ratio of all proposed projects and select the projects that their total cost is not exceeding the available budget.

Table 11, presents in columns 1 and 2 all projects proposed with their planned cost. In column 3, the total score as per Step 3C of the methodology in Section 6 is calculated. The cost/benefit ratio of all projects is presented in column 4, and finally in column 5 the relative ranking is provided: a value 1 indicates the highest cost/benefit ratio and value 15, the lowest one.

ANNEX B: Selection of projects considering budget constraints

Table 11: Cost benefit analysis of all projects

PROJECT	COST (USD)	SCORE - benefits	COST / BENEFIT	RANK
(1)	(2)	(3)	(4)=(2)/(3)	(5)
PROJECT 1	1,000,000,000	120	83	13
PROJECT 2	900,000,000	75	120	14
PROJECT 3	70,000,000	48	15	3
PROJECT 4	120,000,000	125	10	2
PROJECT 5	250,000,000	90	28	7
PROJECT 6	450,000,000	85	53	9
PROJECT 7	350,000,000	55	64	10
PROJECT 8	400,000,000	60	67	11
PROJECT 9	150,000,000	65	23	6
PROJECT 10	240,000,000	80	30	8
PROJECT 11	110,000,000	48	23	5
PROJECT 12	700,000,000	53	132	15
PROJECT 13	520,000,000	76	68	12
PROJECT 14	50,000,000	115	4	1
PROJECT 15	180,000,000	110	16	4
Total Cost:	5,490,000,000			

Next Table 12 lists all projects as per their ranking. In column 6, the cumulative budgeted cost is provided. So, we can conclude, that the first six projects (Project Nr. 14, 4, 3, 15, 11, 9) with a total budget of 680,000,000 USD can be included in our investment plan.

ANNEX B: Selection of projects considering budget constraints

Table 12: Projects listed as per ranking

PROJECT	COST (USD)	SCORE - benefits	COST / BENE- FIT	RANK	BUDGET CUMMU- LATIVE (USD)
(1)	(2)	(3)	(4) =(2)/(3)	(5)	(6)
PROJECT 14	50,000,000	115	4	1	50,000,000
PROJECT 4	120,000,000	125	10	2	170,000,000
PROJECT 3	70,000,000	48	15	3	240,000,000
PROJECT 15	180,000,000	110	16	4	420,000,000
PROJECT 11	110,000,000	48	23	5	530,000,000
PROJECT 9	150,000,000	65	23	6	680,000,000
PROJECT 5	250,000,000	90	28	7	930,000,000
PROJECT 10	240,000,000	80	30	8	1,170,000,000
PROJECT 6	450,000,000	85	53	9	1,620,000,000
PROJECT 7	350,000,000	55	64	10	1,970,000,000
PROJECT 8	400,000,000	60	67	11	2,370,000,000
PROJECT 13	520,000,000	76	68	12	2,890,000,000
PROJECT 1	1,000,000,000	120	83	13	3,890,000,000
PROJECT 2	900,000,000	75	120	14	4,790,000,000
PROJECT 12	700,000,000	53	132	15	5,490,000,000
Total Cost:	5,490,000,000				

11 ANNEX C: International best practices

Next, the cases of Singapore and Malaysia are presented.

11.1 Singapore

The government in Singapore set up the Land Transport Authority (LTA) in September 1995 to lead improvements to the land transport system. The LTA's mission is to provide Singaporeans with a world class transport system.

The Land Transport Authority published in 1996 the “*White Paper - A World Class Land Transport System*”. This White Paper sets out how the Authority intends to achieve its mission, its transport vision for Singapore, its operating philosophy, and the initiatives it will undertake in the short and long term.

In Singapore, the Land Transport Authority (LTA) published in 1996 the "White Paper - A World Class Land Transport System". Next, the Executive Summary is given (see [3]):

11.1.1 Introduction

The government set up the Land Transport Authority (LTA) in September 1995. The LTA's mission is to provide Singaporeans with a world class transport system. This White Paper sets out how the Authority intends to achieve its mission, its transport vision for Singapore, its operating philosophy, and the initiatives it will undertake in the short and long term.

A world-class transport system will not come easy. But achieving it is not impossible if we get our basics right, dare to **try out bold and imaginative solutions and have the political will to carry them out. It is important that we succeed because a high standard of transport enhances the quality of life, is good for economic growth and helps us maintain our competitive edge.**

Our vision is a system that meets the needs and demands of a dynamic and growing city with a population that will increasingly expect high standards in service and infrastructure. Whatever the individual preferences of commuters and the various transport choices Singapore offers, the overall system must provide high-quality service, is convenient, accessible, comfortable, safe, speedy, and affordable to the majority of Singaporeans. **We must also continue to get good value for what we spend.**

This means providing commuters with a wide spectrum of transport choices, while ensuring that they are effectively integrated. The range of services must be broad enough with sufficient differentiation in service standards and cost to suit each individual's preference and pocket. The cost to users of these services will depend on the cost of providing the services.

The task before the LTA is hence a challenging one.

Fortunately, for Singapore, our basic policies and infrastructure are sound and have been tested over the years. Indeed, in many areas we are at the forefront, being acknowledged widely for our achievements, for example, in managing traffic in the city using the world's first ever Area Licensing Scheme (ALS), in having a Mass Rapid Transit (MRT) system which has won international acclaim and in operating one of the few commercially viable bus services in the world.

But we can do much better. The formation of the LTA will allow us to **better integrate the functions of planning, development, implementation and management of all transport infrastructure and policies.** We are now well poised to tackle this important challenge.

11.1.2 A world-class transport system

A **world-class transport system** must provide commuters with highly efficient, comfortable and convenient rides in free-flowing traffic. Having a world-class public transport system is a key component of

this system. There is no running away from this; public transport is and will always be the major mode of transport.

The system we aim to provide will offer convenience, reliability, ease of use, comfort, affordability and competitive travel times.

Improving public transport means not only improving bus or train travel.

It means improving all the intermediate and end-point facilities that make for a complete door-to-door journey: linkways, service information and provision, even customer service, are vital components of a world-class transport system.

To achieve this, we will need a **major change of mindset among the operators and the providers of infrastructure**. We must **find ways to give incentives, so that operators will continually improve their services and be more responsive to the changing needs and demands of their customers**. This way, services can be pegged at the highest sensible levels while providing good value for money.

The key is in providing a comprehensive range of public transport services, each being developed to the highest quality commensurate with the fares charged, and all well integrated to provide a seamless journey. The choices include:

- Mass Rapid Transit (MRT) to serve heavy transit corridors;
- Light Rail Transit (LRT) systems to serve as feeders to the MRT network;
- Buses to continue serving the less heavy corridors to complement MRT-LRT network;
- Premier bus services to provide higher grade of bus service; and
- Taxis to provide car-like services.

We will expand our rail network so that it is as comprehensive in coverage as the London Tube or Paris Metro which started in 1863 and

1900 respectively. We must progressively build up our network so that access to one of these services is within walking distance and sized to match our city. Our target should be a high percentage of trips on quality public transport as in Zurich, where 75% of trips into the city centre are by public transport.

As for private transport, we will use road pricing to optimise road space and keep key roads and expressways free flowing. Once the cost of congestion becomes more transparent, motorists will be better able to make more informed transport decisions.

Achieving our vision of a world-class transport system will depend on our success in tackling the following key areas:

- Integrating transport and land use planning;
- Expanding the road network and maximising its capacity;
- Managing demand of road usage; and
- Providing quality public transport choices.

11.1.3 Initiatives to improve the transport system

It will take 10 to 15 years to attain our vision of a world-class transport system. In the short and medium term, LTA will undertake various initiatives to improve our transport system.

11.1.3.1 Integrating land use, town and transport planning

LTA will **integrate urban development with transport planning**. Having a proper mix of developments and the highest building densities concentrated at and around MRT stations will ensure maximum accessibility for commuters to key nodes of employment, housing, leisure and other social activities. Commuter facilities and building developments will be fully integrated.

We should target for more high rise developments near MRT stations. Where appropriate, LTA should develop sites on top of or adjacent to MRT stations when constructing new rail lines. LTA must demonstrate

the feasibility and benefits of building developments over new and existing stations.

11.1.3.2 Developing a comprehensive road network

Our goal is to build a more comprehensive road network. The government will spend 51.1 bn to expand our road network by another 225 lane km over the next five years. The immediate improvements to speed up traffic flows include:

- The Seletar Expressway (SLE), Tampines Expressway (TPE) and Nicoll Highway extensions;
- The upgrading of Jalan Ahmad Ibrahim into an expressway and Telok Blangah Road into a semi-expressway; and
- The transformation of 7 major junctions into 2- to 4-tier interchanges.

LTA is seriously studying the feasibility of the Singapore Underground Road System (SURS). While SURS promises the equivalent of 40% more road capacity within the city centre, it is extremely costly to build and to operate.

Capital cost is estimated at \$4.8 bn and operating cost is about \$80 mn a year.

11.1.3.3 Harnessing technology to maximise network capacity

LTA will use **technology to maximise the capacity of our roads by upgrading and installing intelligent traffic management systems**. Many promising improvements may be realised over the next few years if computer, telecommunications and information technologies continue to advance rapidly and become more affordable:

Some of the initiatives LTA will undertake over the next 2 years are:

- Creating more green waves. LTA will extend the Green Link Determining (GLIDE) intelligent traffic light system to cover the whole island. This will increase the capacity of junctions and smoother traffic flow;
- Creating "virtual slip roads" by allowing motorists to turn left

at selected traffic light junctions even though the red signal is on, similar to the American right-turn- on-red system; and

- Adopting traffic monitoring systems like the Automatic Network Travel Time System (ANTTS) and close circuit televisions to monitor traffic conditions in real-time. LTA will further develop these systems to provide navigational and traffic information to commuters through the radio, telephone hotlines or variable message signs.

11.1.3.4 Demand management

We need a judicious mix of ownership and usage measures. The Vehicle Quota System (VQS) has worked well. We need to retain the scheme even after we introduce more extensive usage measures like Electronic Road Pricing (ERP). With VQS, the car to population ratio will be 1:7 by year 2010, compared to 1:10 now. However, we will continue to refine VQS further in the light of experience, try new ideas and close off loopholes.

Usage measures like road pricing are also needed. If they are effective, we can release more Certificates of Entitlement (COEs) to enable more Singaporeans to own cars. Electronic Road Pricing (ERP) will start in 1997. It will automate the existing manual road pricing schemes, and can be progressively extended to other congested roads. ERP will allow us to shift from ownership towards usage-based charges.

We will also rationalise the road tax structure and apply a more uniform basis to it, taking into account social and equity considerations. The tax adjustments will be significant. For scheduled buses, they will fully offset the impact of ERP.

We will also give rebates to help motorists adjust to the ERP. ERP charges for taxis will be phased in over several years.

11.1.3.5 Improving public transport

Providing an attractive public transport system is the cornerstone of our land transport strategy. We will make public transport a more competitive transport mode.

Bus operators must be more customer- oriented. LTA will work with the operators to make the following improvements in the next 2 years:

- Improving travel times through more bus priority schemes like priority at traffic light junctions and bus lanes;
- Introducing more choices like BusPius services, air-conditioned express services, supplementary services and intra-town services;
- Improving commuter facilities by providing bus arrival times at bus stops, over the phone, Teleview or Internet. Commuters can therefore plan the timing of their trips from home;
- Providing better bus services by refurbishing bus stops, providing more covered linkways and overhead pedestrian bridges and comprehensive display of service information; and
- Encouraging higher operational efficiency. With the Global Positioning System (GPS) technology which uses satellites to pin- point the location of buses, bus operators will be able to significantly improve their scheduling and introduce mid-way services to relieve overcrowded spots.

We will expand our MRT network. We envisage a 160 km network including:

- The Woodlands line- 16 km- to open in February 1 996;
- The North-East line (NEL) - 20 km;
- The Kallang line- 16 km;
- The Northshore line - 20 km.

The MRT network will serve heavy traffic corridors. LRTs will serve as feeders to the MRT network, mainly lighter corridors and in areas where there is sufficient ridership. We are studying the feasibility of running LRTs in Orchard Road/Marina South and some housing estates.

Taxis play an important role in offering personalised service at the high end of public transport. As long as the cost of operating taxis is

correctly priced relative to private cars, we should allow market forces to determine the supply and demand of taxis. This is the key to providing a service that meets the demand of commuters. Other measures to improve the service include:

- Periodic evaluation and publication of the performance of taxi operators and incentives for the best performing fleet operator;
- Differential pricing to address the acute shortage of taxis during peak periods;
- Flexibility for operators to offer a wider variety of services; and
- Using CPS technology to improve the radiophone service to better match demand and supply.

11.1.3.6 Supporting Measures

We should not discount the contributions of other transport-related measures. These would include better pedestrianisation, good cycle facilities at MRT and bus interchanges away from the city, and parking policies such as more park and ride schemes.

11.1.3.7 Road safety and air quality

LTA will continue to work with the Ministry of the Environment (ENV) and the Traffic Police (TP) to keep our roads safe and the air clean. This will be done through regular reviews of vehicle standards, public education and enforcement programmes. In addition, we will pay more attention to noise alleviating measures.

11.1.4 Financing framework

Our financing framework must continue to be based on the concept of partnership. **The government provides for transport infrastructure, commuters pay for operating cost and operators operate efficiently under the scrutiny of the Public Transport Council (PTC).**

Our vision of a world-class transport system calls for a comprehensive rail network. However, such a system is very costly to build and also costly to operate. This White Paper sets out the framework which will

serve as a social contract between the government, the operators and commuters on how we want to grow our future rail network.

Our **financing system** must be based on 3 sound principles:

- Fares have to be realistic and revised periodically to adjust for justifiable cost increases;
- We must recover operating cost; and
- We need a sustainable policy on asset replacement.

First, fares have to be realistic and revised periodically. This is because manpower and other operating costs will rise with time, and the possible major gains in productivity improvement from the reorganisation of our public transport system have already been reaped. Commuters will be assured of affordable fares, but they must be prepared to pay for inevitable cost increases and higher service levels. Fare increases will be scrutinised by PTC and approved only if they are fully justified. Future adjustments will be in small regular steps, rather than large irregular jumps.

Second, we must recover operating cost by charging correct fares. This is the condition which must apply to all projects if we want a robust network and avoid cross-subsidising loss-making operations.

Third, we need a sustainable policy on replacing operating assets like trains and signalling equipment. Each generation should pay for its own consumption of services and assets.

The current policy calls for government to provide transport infrastructure, including the first set of operating assets; commuters to share financial responsibility through fares covering both operating cost and the cost of second set of operating assets; and operators to extract efficiency dividends within the fare structure and service standards approved by PTC.

This is a prudent but conservative policy. However, the current arrangement is financially burdensome and exerts upward pressure on fares. It also stifles the extension of the rail network.

We will revise the requirement for asset replacement: government to continue funding infrastructure and the first set of operating assets, and commuters to continue paying fares which cover operating costs including depreciation. However, the second set of operating assets will be financed by fare revenue covering only the historical cost of the first set of operating assets, while government co-finances the balance.

The revision will help us to develop a comprehensive rail network to support our vision of a world-class transport system. The rail operators will not have to worry about future rises in the cost of operating assets and can then focus on improving customer service and operational efficiency. The new formula will balance the responsibilities and interest of the 3 main stakeholders- commuters, operators and the government.

LTA can now review all rail projects and implement those which are considered viable in terms of financing, ridership and realistic and affordable fares. Even with this change, some projects may still not be viable. For marginal projects, we can consider implementing them if commuters find the projects worthwhile to them, as evidenced by their willingness to cover operating costs.

This financing framework reflects the government's commitment to providing Singaporeans with a quality rail network charging affordable fares. The government will continue to invest in rail extensions that are justified. The North-South/East-West line and the Woodlands line already cost \$6.3 bn. The NEL will cost \$5 bn. LRT projects now under evaluation could cost another \$1 bn.

11.1.5 Conclusion

If we can achieve all that is set out in this White Paper, Singapore will have a transport system that will be as widely acknowledged as its port and airport as among the best in the world.

But LTA cannot do this alone. **We will have to work with many other agencies which share the objective of improving the infrastructure**

and quality of life in Singapore. More importantly, we will need the **co-operation, understanding and support of the people.**

Singaporeans must understand the challenges ahead, and be prepared for the changes to come. We must start solving tomorrow's transport problems today.

Otherwise the problem will only grow and we would have condemned future generations to even greater difficulties. We must act quickly lest we end up besieged by the many painful dilemmas which face so many congested cities. We therefore seek both understanding and co-operation from the people as we embark on this exciting enterprise. Their feedback and suggestions will be most welcome.

Many of the improvements we have outlined will take several years to complete, and for the effort to bear fruit. This is the nature of the problem. Indeed, the exercise is not one in which the problem can be tackled once and for all. It will have to be managed all the time, and the improvements made continually. But if we stay true to the philosophy and approach of this White Paper, we should be able to have the world-class transport system that Singaporeans deserve.

11.2 Malaysia

In Malaysia, in the *Tenth Plan 2011-2015* and the *Eleventh Plan, 2016-2020*, the government placed a strong emphasis on the development of transport infrastructure, namely road, airport, port and rail to serve the needs of the people and the industries.

According to the Global Competitiveness Report 2014-2015, Malaysia ranked 25 for infrastructure out of 144 countries. This achievement was made possible with the development in transport infrastructure such as increased length of paved roads and railway tracks as well as the expanded capacity of ports and airports. A bigger role of the private sector in providing funds to support infrastructure development, particularly highways, also contributed to infrastructure improvement.

(Source: [4])

11.2.1 Tenth Plan, 2011-2015

In the Tenth Plan 2011-2015, the government placed strong emphasis on the development of transport infrastructure, namely road, airport, port and rail to serve the needs of the people and the industries. This development brought increased benefits to the people. For instance, air passengers carried reached 85.1 million in 2014 as compared to 61.3 million in 2010.

11.2.2 Eleventh Plan, 2016-2020: Way Forward

The focus of transport infrastructure development during the Eleventh Plan will be on higher utilisation of existing facilities with an emphasis on better delivery, quality of services and capacity improvement. Network expansion will focus on connecting underserved areas. Integrated transport planning will be geared towards providing mobility and connectivity for goods and people. Towards achieving this, better coordination and collaboration between various stakeholders is required.

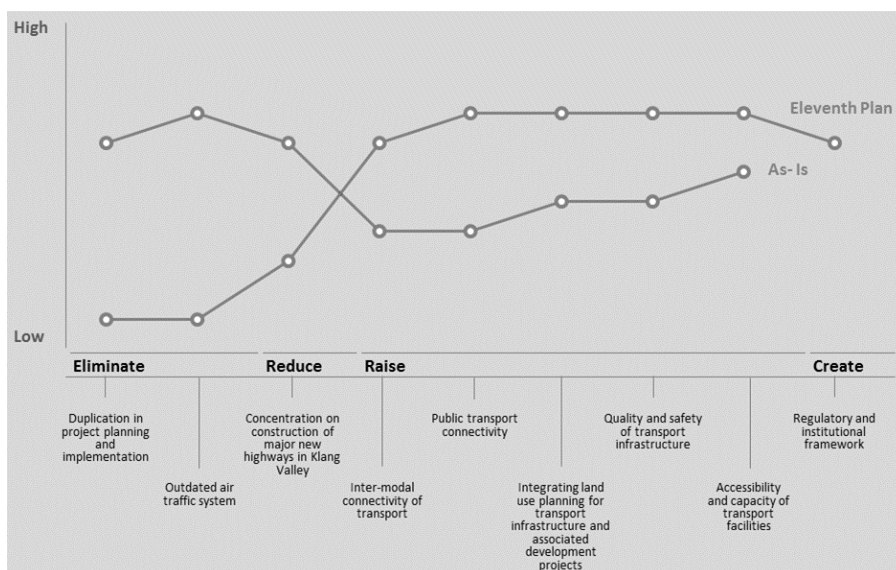


Figure 3: Strategy Canvas for Transport Infrastructure Development

11.2.2.1 Road

Prioritising Regional Connectivity for New Highways

Highway development will be focused outside the Klang Valley and other urban areas to provide regional connectivity to new growth areas and maximise the potential of cities to achieve balanced economic development. In order to sustain the growth in Klang Valley and other major cities including Georgetown, Pulau Pinang; Johor Bahru, Johor; and Kota Kinabalu, Sabah, priority will be concentrated in further improving public transport services and reducing traffic congestion.

Road infrastructure development continues to be vital in fostering growth and development of the economy. The Highway National Development Plan (HNDP) will be used to identify roads for upgrading and new alternative routes. Thus, a comprehensive needs analysis will be implemented in road planning to ensure effective decision-making.

Emphasis will be given on new highway projects, which act as a catalyst to support economic growth outside major cities. For instance,

the Pan Borneo Highway is expected to promote better connectivity for movement of people, goods and services in Sabah and Sarawak. Further development of the Central Spine Road, Kota Bharu–Kuala Krai Highway and Lebuhraya Pantai Timur will improve connectivity in Peninsular Malaysia and catalyse growth in the east coast region as well as reduce the urban-rural development gap. The completion of the West Coast Expressway in 2019 is expected to provide better access to the west coast of Perak and Selangor.

Shifting Towards Preventive Maintenance

Maintaining assets in good condition is crucial to ensure the road network continues to be effective and serves its functions to the required quality standards throughout its lifespan. The life-cycle costing approach in planning, implementation and maintenance will be adopted in road development. This approach will allow comparative cost assessments to be made over a specific period, taking into account relevant economic factors in terms of initial capital costs, future operational and asset replacement costs. This will enable a shift in focus on preventive maintenance.

The durability of road infrastructure will be enhanced by intensifying the utilisation of advanced materials and innovative technology in road construction and maintenance. For instance, the application of new and improved pavement technologies such as polymer modified asphalt, concrete pavement and recycled asphalt pavement in future road construction will increase pavement lifespan and reduce pavement maintenance. The usage of new technology will also be incorporated into road guidelines and specifications. Smooth and reliable road pavement will contribute to lower fuel consumption as well as reduce wear and tear of vehicles.

Improving Road Safety

Road safety will be improved during the Eleventh Plan period. Existing funds will be optimised to finance road safety enhancement programmes under the Black Spot Mitigation Programme and Road Safety Audit. This will reduce road fatalities by 50% by 2020 as per

the recommendations of the United Nations Decade of Action for Road Safety 2011-2020.

The Black Spot Mitigation Programme will be intensified to reduce the rate of accidents caused by engineering factors. This programme involves rehabilitation works at accident-prone spots. It will also address accident occurrence on state roads as the analysis in the Highway National Development Plan shows a high accident rate, especially involving motorcycles on state roads compared to federal roads. In addition, response time to address road hazards, including landslides and potholes, will be shortened.

Extending Connectivity in Rural Areas

Efforts will be continued to improve connectivity to rural areas. There are still many villages which are not connected by roads, especially in Sabah and Sarawak. Special focus will be given to the development of rural roads to link the less developed areas to the main road network in these states. In particular, a rural-urban network of roads will be constructed in both states to link with the new Pan Borneo Highway.

The Blue Ocean approach will be used to provide basic road connectivity to remote areas by fully utilising available materials with local labour. The construction of basic roads under the Jiwa Murni programme will be continued during the Plan period to provide access to basic social amenities and services such as health and education. This is expected to create economic opportunities for the residents and further alleviate poverty among rural households.

11.2.2.2 Port

The focus of the ports subsector will be on improving capacity and strengthening governance while leveraging information and communications technology (ICT) and technological solutions to facilitate port activities. The hub ports will also continue to improve their ranking in the World's Top 20 Container Ports. The role of other ports will be streamlined as supporting ports to ensure competitiveness.

Improving Land Connectivity

Road and rail upgrading, as well as integrated planning and development for new linkages, will be intensified to promote a multimodal transport system. A built-in mechanism for periodic engagement between all stakeholders and transport planners will be strengthened to avoid fragmented planning. Efforts will be undertaken to shift from road- to rail-based transport in delivering cargo to and from hinterland to port.

Improving Accessibility and Expanding Capacity

Accessibility to ports will be improved to cater for bigger vessels by undertaking channel deepening works. In addition, various port operators will undertake capacity expansion works, which include building additional berths and wharves as well as land reclamation. These improvements will attract more international liners and mega vessels with capacities of 18,000 TEUs to call at the major ports.

Reserving Land Bank for Future Expansion

As the custodian of federal ports, the Ministry of Transport will integrate land use planning among the different stakeholders through periodic engagements with state and local authorities. This is to ensure a built-in mechanism is in place for every stakeholder to be aware of future port development as stipulated in the respective port development master plan. This will foster mutual understanding and assure commitment from the respective states in order to support the growth of ports.

Creating a Port Community System (PCS)

All port authorities are required to establish their PCS, which is an open electronic system that enables intelligent and secure information exchange between public and private stakeholders. PCS optimises,

manages and automates smooth port and logistics processes through a single submission of data and connects transport and logistics chains. This will help to improve the efficiency and competitiveness of port operations and strengthen strategic alliances among stakeholders.

Crafting the National Port Policy

The National Port Policy will foster systematic development and growth of ports as well as jetties by introducing policy measures and strategy options. It will also provide the legal framework to govern port and jetty development, besides streamlining all ports and jetties according to their functions. The major hub ports will be served by secondary ports, hence strengthening port operations while supporting the national logistics chain.

11.2.2.3 Airport

The liberalisation of air services and increasing competition among airlines have generated higher demand for air travel. In addition, promotion activities to attract business and tourist travellers will further increase air travel in the country. To cater for this increase, the airports, specifically the main international gateways, will continue to be upgraded in terms of its capacity and efficiency. Strategies for the airport sector will include strengthening institutional and regulatory frameworks, improving capacity and reviewing rural air services.

Establishing the Malaysian Aviation Commission

The Malaysian Aviation Commission will be an independent regulatory body that oversees national development objectives as well as manages the capacity of operators and competition via licensing and route allocation. It will transform the civil aviation institutional and regulatory frameworks, focusing on aviation development including policy and planning, economic regulation and consumer protection, while the technical, safety and security aspects will remain with the Department of Civil Aviation. This transformation will further intensify efforts to streamline all airports according to their hierarchy, whereby international airports serve as major gateways, domestic

airports support the international airports and STOLports serve the rural areas.

Corporatizing the Department of Civil Aviation

The government will assess options to corporatize DCA to ensure financial and management independence. The corporatisation of DCA will improve the capacity, quality and competency of its human resource. In addition, DCA will review technical, safety and security procedures to provide clear regulations and guidelines to further enhance the civil aviation industry.

Upgrading System and Airport Infrastructure

A new Kuala Lumpur Air Traffic Control Centre will be built to replace the National Control Centre at Subang, Selangor to improve aircraft movement capacity over the airspace. In addition, the communication, navigation and surveillance, as well as air traffic management (ATM) systems, will be upgraded to support air traffic movement. The upgraded system will increase aircraft movement at Kuala Lumpur International Airport (KLIA) from 68 per hour to 108 per hour, hence improving the efficiency of KLIA and supporting its growth.

Sultan Ismail Petra Airport, Kelantan will be upgraded, including runway widening and lengthening, taxiway improvement, terminal expansion as well as enhancing other supporting facilities. The upgraded airport will cater to the increasing travel demand in the airlines' industry.

Strengthening Rural Air Services

The government will continue to improve rural air services by carrying out short take-off and landing airstrip (STOLport) improvements. This will include a newly upgraded airport in Mukah, Sarawak, as well as the possibility to relocate the Lawas STOLport. The improvement of STOLports will ensure connectivity and safety of rural air services is enhanced. The rural air services routes will be rationalised to ensure sustainable operations and continuity of service.

11.2.2.4 Public Transport

Public transport modal share is targeted to achieve 40% in the Greater Kuala Lumpur/Klang Valley region and 20% in other capital cities by 2020. To achieve this, the focus will be on providing services that are well-connected, accessible, affordable, convenient, reliable and safe to encourage the shift from private vehicles to public transport. Strategies to improve overall public transport services will cater to rural, rural-urban, urban and intercity mobility. Facilities for mobility-impaired persons will be improved, particularly at stations and terminals.

Improving Urban Connectivity

By the end of the Plan period, it is expected that 75% of the population will reside in urban areas. Therefore, concerted efforts to implement the National Land Public Transport Master Plan are crucial. The Master Plan has outlined the travel demand by using passenger per hour per direction (pphpd) for different corridors in the urban areas. Based on the travel demand assessment, identification of suitable modes, namely feeder bus, bus rapid transit (BRT), monorail, LRT, mass rapid transit (MRT) or commuter will be appropriately determined for implementation. Towards achieving the target of 40% public transport modal share for Greater Kuala Lumpur/Klang Valley, the public transport capacity will be expanded through the implementation of new projects such as KVMRT Line 2 (Sungai Buloh-Serdang-Putrajaya), LRT3 (Bandar Utama-Klang) and monorail for Putrajaya and Cyberjaya as well as the BRT KL- Klang corridor.

Public transport modal share for other capital cities is targeted at 20% from the current rate between 3% and 8%. Towards realising this target, studies will be carried out to identify the pphpd for each corridor in major cities with a focus on integrated transport planning. During the Plan period, stage bus services will be revamped under the Stage Bus Services Transformation (SBST) Programme through migration of the current fare-box collection model to gross-cost service contract model. The SBST Programme will be extended to other cities and rural areas.

Improving Intercity Connectivity

The Master Plan, in addition to identifying public transport requirements for urban areas, outlines measures to strengthen the intercity connectivity. Rail will be the transport backbone in facilitating intercity mobility. Major public investments for rail will focus on upgrading rail infrastructure and extending electric train services to other cities.

Bus services will be rationalised to make it efficient, affordable and safe. Under this Plan, the express bus network will also be restructured for more regular and frequent services without neglecting low demand areas.

Improving Rural and Rural-Urban Connectivity

Rural areas need efficient public transport services to facilitate movements within and to urban centres. The Stage Bus Services Transformation Programme will be extended to these areas to improve access to social services and promote economic activities. Small-scale buses will be used to increase the frequency and reliability of public transport for commuting. This programme will complement initiatives by the Ministry of Rural and Regional Development to improve road connectivity.

During the Plan period, innovative and non-traditional public transport service options will be considered for remote areas. An alternative community-based public transport system that offers adequate services will be introduced. The system will deliver a wide range of community-led transport services that cater to both individuals and groups. One of the options is 'dial-a-ride system', which provides door-to-door service through phone calls for people who do not have access to conventional public transport facilities.

Introducing the National Transport Model

During the Plan period, a national transport model, which consists of integrated and coordinated analytical tools, will be introduced to strengthen -agency collaboration in formulating integrated transport

policies. A national multi-modal land public transport model will be developed to guide the assessment of current and future mobility demand, based on trends in economic and demographic indicators. This model will also facilitate assessment for capacity requirements, which provides important data to agencies, local authorities and developers on types of investments that are needed to deliver the required services. In addition, the tools will also assist ministries and agencies to better analyse land- use planning and the potential effect on transportation system development.

Promoting Transit-Oriented Development

In optimising land use and transport infrastructure in urban areas, - oriented development (TOD) will be encouraged to generate higher income for public transport operators. TOD is designed to optimise the utilisation of space, especially in urban areas and to attract private investment for commercial and residential purposes. TOD will reduce traffic congestion and improve air quality, making cities more liveable. This effort will help in achieving sustainable development.

11.2.3 Conclusion

Developing efficient and affordable transportation networks is imperative in supporting the transformation into an advanced economy and the whole nation by 2020. Achieving this requires consistent and coordinated efforts to optimise the limited resources and active leverage participation of the private sector. During the Plan period, emphasis will be given to improving inter-modal connectivity, accessibility and capacity of the transportation infrastructure as well as integrated planning and strengthening of the regulatory framework.

About the Author



- Civil Engineer (MSc.) from the University of Hannover in Germany
- Master Executive MBA degree from the Athens University of Economics & Business
- Over 30 years of experience in the railway sector, including eight years in Director positions at Greek Railways Organization (OSE S.A.)
- In 2013 and 2014 worked within the team who started the development of the Omani National Railway Network (2135 km double track).
- From 2015 till today working as Senior Railway Expert at the Ministry of Transport and Communications in Oman
- In February 2019 launched own website **www.railhow.com**, aiming to be the touchstone for people who are working within the engineering sector by offering practical, yet impactful knowledge and learning experiences.
- His professional interests focus on the efficiency of the railway system. In recent years, he is speaking at several railway congresses in Europe, Asia and the Middle East.

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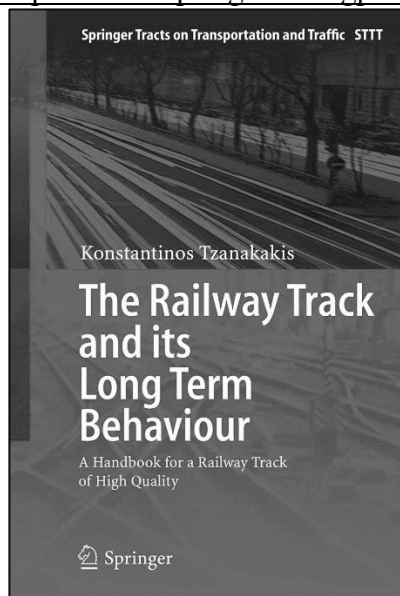
Author webpage: www.railhow.com

Books by the author

“The Railway Track and Its Long Term Behaviour: A Handbook for a Railway Track of High Quality”

Published by **Springer**, 2013

<https://www.springer.com/gp/book/9783642360503>



The book provides the necessary functional knowledge of the track behaviour, covering the function of the various track components, their interaction as elements of the track system, and the interaction of the systems track and railway vehicles.

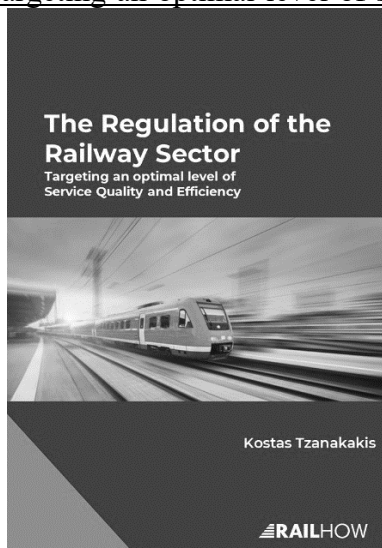
Presents important tools and future challenges for infrastructure managers.

The Regulation of the Railway Sector

Targeting an optimal level of Service Quality and Efficiency

Published by **RailHow**, 2019

<https://railhow.com/resources/the-regulation-of-the-railway-sector-targeting-an-optimal-level-of-service-quality-and-efficiency/>



The objective for the railway sector is to ensure an optimal level of service quality (including public interest considerations) and a high level of productive efficiency (and therefore a minimum level of subsidy where one exists).

Regulation is a vital tool for achieving the social, economic and environmental policy objectives of governments. Governments have a broad range of regulatory schemes reflecting the complex and diverse needs of their citizens, communities and economy.

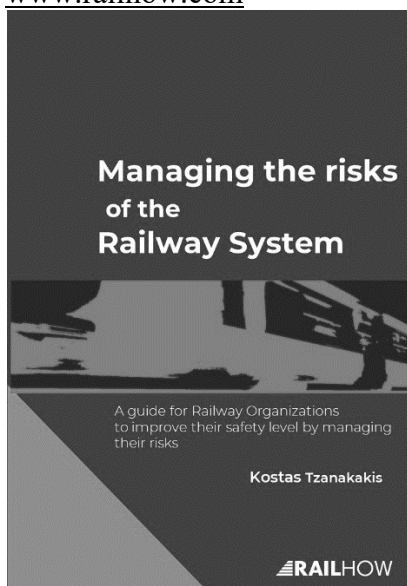
This Guide aims to assist in establishing the best regulatory framework for an optimal level of service quality and efficiency of the railway system.

Managing the risks of the Railway System

A guide for Railway Organizations to improve their safety level by managing their risks

To be published by **RailHow** in 2019

www.railhow.com



A guide to help Railway Organizations to improve their safety level by managing their risks.

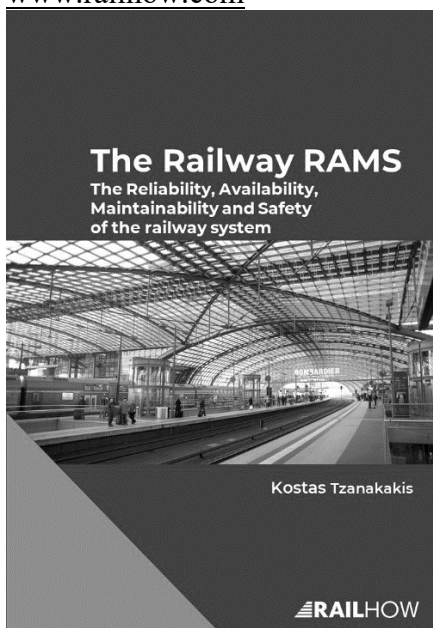
Guidelines are provided for the elaboration and implementation of an effective framework for risk management so that Railway Organizations can take decisions and manage the risks that affect their strategic, programme, project and operational objectives.

All the terms related to risk and safety are explained with many examples. A roadmap for risk management is suggested and risk management techniques are described so that the risks of the railway system can be effectively managed.

The Railway RAMS - The Reliability, Availability, Maintainability and Safety of the railway system

Published by RailHow in 2019

www.railhow.com



RAMS is an engineering discipline that integrates Reliability, Availability, Maintainability and Safety characteristics of a railway system into the product design.

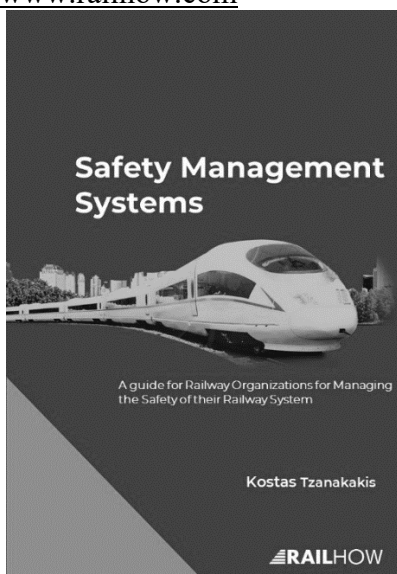
RAMS will be introduced. The RAMS parameters will be presented in detail, with many examples. The system's lifecycle (the RAMS lifecycle) or also called the "V Model", the terms and procedures for "verification", "validation" and "assessment", the various types of approval, the safety assessment and the role of the Safety Assessor, the RAMS requirements, the specific RAMS targets for the all subsystems and components of the railway system are presented.

Safety Management Systems

A guide for Railway Organizations for Managing the Safety of their Railway System

To be published by **RailHow** in 2019

www.railhow.com



Infrastructure Manager(s) and Train Operating Companies (Railway Undertakings) must design, construct or manufacture, maintain and operate their railway system in a safe manner.

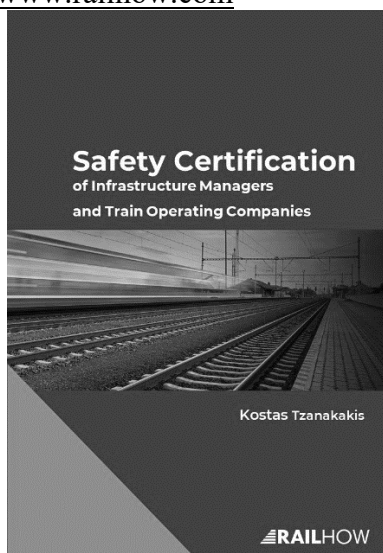
How to control the safety of the system? What parameters need to be considered?

This Guide will provide an understanding of how to manage the safety of the railway system and the railway operations of the Infrastructure Manager(s) and Train Operating Companies. It provides practical advice and suggestions in developing and managing the safety by developing and implementing a proper Safety Management System (SMS), to meet the requirements of safety, as set up in the legal frameworks.

Safety Certification of Infrastructure Managers and Train Operating Companies

To be published by RailHow in 2019

www.railhow.com



This Guide is intended to provide practical advice and assist the Railway Agencies, industry stakeholders and other relevant parties with duties under the applicable rail safety legislation for issuing and maintaining a Safety Certificate.

The principles of certification, as well as the processes and requirements for issuing, securing and maintaining certification, are presented.

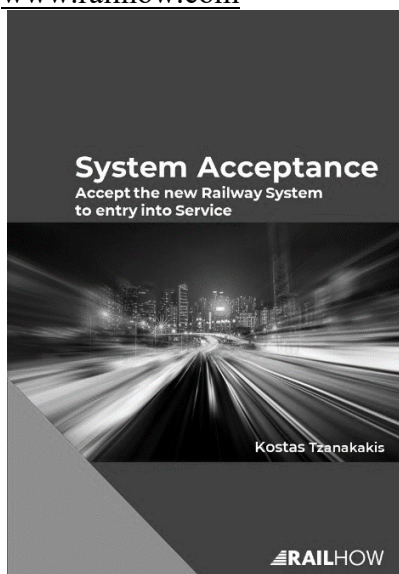
Those processes are based on processes applied in the European Union and Australia.

System Acceptance

Accept the new Railway System to entry into Service

To be published by **RailHow** in 2019

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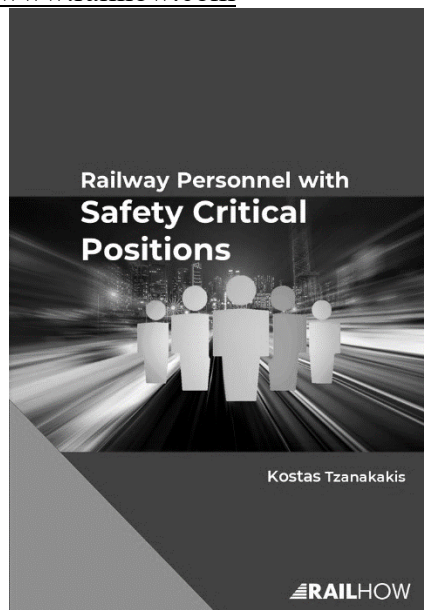


A guide providing practical advice and suggestions to assist the Infrastructure Manager(s) and Train Operating Companies (Railway Undertakings) in all stages of the life cycle of the railway infrastructure and rolling stock in order the designed and constructed or manufactured system including their components, meets the basic requirements for safety, reliability and availability, health, environmental protection and technical compatibility, and can be placed in service.

Railway Personnel with Safety Critical Positions

To be published by RailHow in 2019

www.railhow.com



People (humans) are components of complex, socio-technical systems, such as railways. There are two main dimensions to be considered: the capabilities and limitations of the individual person and the collective role of all the people in the system.

This Guide is aimed at those responsible for managing and assuring the competence of individuals and teams in the railway and especially for managing and controlling staff who carry out safety-critical tasks.

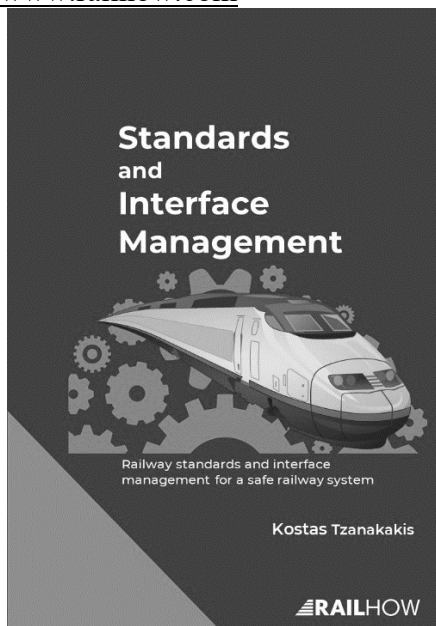
Tasks that should be considered as safety-critical, are presented in detail, including training requirements, requirements for fitness and fatigue management.

Standards and Interface Management

Railway standards and interface management for a safe railway system

To be published by **RailHow** in 2019

www.railhow.com



This Guide provides a general overview of the railway standards and the interface management governing the design, construction, maintenance or modification of the railway system (incl. all sub-systems and components), the traffic control, train operations, needed for a safe railway system.

Kostas Tzanakakis
**Transport Infrastructure Development in an
Economic Crisis Environment**

A strategy for infrastructure development considering budget constraints

This book addresses the challenges for developing the transport infrastructure in a financial crisis environment. A strategy for infrastructure development as also a methodology for the selection of projects and other initiatives is presented in detail, considering budget restraints. International best practices (Singapore, Malaysia) are presented.

ISBN: 978-0-359-77583-5

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