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NATIONAL RAILWAY MASTER PLAN

CONSOLIDATED BACKGROUND PAPERS




INDONESIA
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APRIL 2010

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This document has been published by the Indonesia Infrastructure Initiative (IndII), an Australian Government funded project designed to promote economic growth in Indonesia by enhancing the relevance, quality and quantum of infrastructure investment.

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ACKNOWLEDGEMENTS

This report has been prepared by Harral Winner Thompson Sharp Klein, Inc., which was engaged under the Indonesia Infrastructure Initiative (IndII), funded by AusAID, as part of its initiative to support the development of a Railway Master Plan by the Ministry of Transport – Directorate General of Railways (DGR).

The support and data provided by the Indonesian Ministry of Transportation, and particularly DGR is gratefully acknowledged. The report draws substantially on the several Directorates under DGR as well as on PT Kereta Api (Persero), the state-owned national railway. Any errors of fact or interpretation are solely those of Harral Winner Thompson Sharp Klein, Inc.

HARRAL · WINNER · THOMPSON · SHARP · KLEIN

Jakarta, April 19, 2010

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ACRONYMS

AAR	Association of American Railroads, the private co-ordinating and technical regulatory association of major North American railways. The AAR publishes standards for the design of rolling stock and manages the commercial accounting between different cargo railway companies.
AEI	Automatic Equipment Identification, an electronic method of tracking the movement of railway rolling stock and containers.
AGT	Automated Guideway Transit: A technology that uses a fixed guideway and advanced technologies to guide cars without the use of crews and dispatchers, often used at airports to connect terminals.
AREMA	American Railway Engineering and Management Association, a professional association of North American railway civil engineers that publish standards for the design and capacity of infrastructure.
ATC/ATO/PTC	Automatic Train Control/Automatic Train Operation/Positive Train Control – several related technologies that permit safe operation of trains at higher speeds on the same track.
BAPPENAS	Badan Perencanaan dan Pembangunan Nasional (National Development Planning Agency).
BOT	Build – Operate – Transfer: method of private participation in a publicly owned enterprise.
BUMN	Badan Usaha Milik Negara (state-owned enterprises). Sometimes also used to refer to the Ministry for State-Owned Enterprises (Kementerian BUMN).
CME	Co-ordinating Ministry of Economy
DBOM	Design – Build – Operate – Maintain: method of private participation in a publicly subsidized and publicly owned new enterprise.
DFBOO	Design – Build – Operate – Own: method of 100 percent private development and ownership in perpetuity.
DKA	Djawatan Kereta Api - designation for Indonesian State railway agency before 1991 reforms.
DGR	Directorate General Railways (Direktorat Jendral Perkeretaapian)
DRTT	Directorate of Railway Traffic and Transportation (Lalu Lintas dan Angutan Kereta Api)
DMU	Diesel Multiple Unit – a passenger train composed of passenger carriages coupled together in a train-set, some of which are self propelled using diesel engines to create traction power. Typically, distributed diesel-electric traction units are used on several coaches in a train set.

EMD	A particular brand of locomotive: Electro Motive Diesel
EMU	Electrical Multiple Unit – a passenger train composed of passenger carriages coupled together in a train-set, some of which are self propelled using electric motors to create traction power. Typically, electric-motors are distributed across several coaches in a train-set. Electric power may be provided by overhead wire (a catenary), or via a low-mounted third rail system (usually seen in metros).
GTK or gtk	Gross Tonne Kilometer – a measure of freight work including the weight of the freight wagon and locomotives. A tonne moving one kilometer is 1 GTK. GTK is a typical measure for calculating train access charges (TAC).
HSR, HST	High Speed Railway or High Speed Train (a railway system or train set capable of speeds in excess of 260 kilometers per hour)
IFRS	International Financial Reporting Standards.
IMO	Infrastructure Maintenance and Operation , sometimes shorthand to refer to IMO Payments
KCJ	PTKA Commuter Jabodetabek
KPH or kph	A measure of speed, kilometers-per-hour
KPPU	Commission for Business Supervision
MoF	Ministry of Finance
MoPW	Ministry of Public Works
MoT	Ministry of Transportation
MRT	PT Mass Rail Transit
NRMP	National Railway Master Plan
NTK or ntk	Net Tonne Kilometer – A measure of freight work, a tonne of goods (excluding the weight of the freight wagon and locomotives), a tonne of goods moving one kilometer is 1 NTK.
NTSC	Komisi Nasional Keselamatan Transportasi or National Transportation Safety Committee.
kVDC, kVAC	kilo-Volts Direct Current, kilo-Volts Alternating Current
Perda	Peraturan Daerah or Regional Regulation; subordinate to UU/Perpu PP and Perpres in hierarchy of legal authority.
Perjan	Perusahaan Jawatan (departmental agency; status of railway prior to 1991)
Perpres	Peraturan Presiden or Presidential Regulation; subordinate to UU/Perpu and PP in legal hierarchy.

Persero	Perusahaan (Negara) Perseroan; State owned Limited Liability Company.
Perum	Perusahaan Umum (Public Corporation).
Perumka	Perusahaan Umum Kereta Api; Indonesia railway name 1992-1998.
Perpu	Peraturan Pemerintah Pengganti Undang-Undang (Government Regulation in Lieu of Law, with Undang-Undang or UU, the highest legal document under the Indonesian Constitution).
PKM or pkm	Passenger Kilometers – a measure of passenger volume; one passenger moved one kilometer is 1 PKM
PP	Peraturan Pemerintah or Government Regulation, subordinate to UU/Perpu in legal hierarchy. Regulation 56/2009 on Railway Organisation and Regulation 72/2009 on Railway Traffic and Transportation have this status.
PPP	Public-Private-Partnership
PSO	Public Service Obligation
PT	Perseroan Terbatas (Limited Liability Company)
PTKA	Perseroan Terbatas Kereta Api Indonesia - Persero or PT Kereta Api (Persero): Indonesia's national railway; also sometimes cited as PTKA or PTKAI
RMP	Railway Master Plan, comprised of this NRMP and Master Plans prepared by Provinces or other sub-national jurisdictions
RPJMN	Pelaksanaan Rencana Pembangunan Jangka Menengah Nasional (National Medium Term Development Plan)
RPJPN	Rencana Pembangunan Jangka Panjang Nasional (National Long Term Development Plan)
TAC	Track access charges
TKM or tkm	Tonne kilometers – a measure of railway work, typically one tonne moved one kilometer is 1 TKM.
TRKA	Tim Revitalisasi Kereta Api (Technical Team on National Railways Revitalisation)
UU	Undang-Undang (Law passed by the national assembly); along with Perpu, the highest legal statute under the Indonesian Constitution. Law 23 on Railways/2007 has this status.
VHST	Very High Speed Train (capable of speeds greater than 300 kilometers per hour.

EXECUTIVE SUMMARY

The DraftNational Railway Master Plan (NRMP) 2010-2030 Consolidated Report draws upon seven workpapers produced by Harral Winner Thompson Sharp Klein, Inc. between November 2009 and March 2010, as well as the Draft Railway Master Plan produced by the Directorate General Railways (DGR) in April 2009. While written in the form of a draft final NRMP, it is unofficial and represents the work of the consultant team only. It may be supplemented, edited, or otherwise modified by the DGR, or used simply as a cross-check on DGR's own work. DGR will then issue a Final NRMP that complies with the requirements for such a plan, as specified by Law 23 on Railways/2007.

Introduction (Chapter 1)

This chapter describes the scope of the NRMP. It includes a summary of the relationship of the NRMP to sub-national railway master plans as well as to other governmental economic planning activities. It outlines the statutory basis of the NRMP. Finally, it addresses the purpose of each of the subsequent chapters of the NRMP.

Present Governance of the Rail Sector (Chapter 2)

This chapter reviews general business policies and regulations in Indonesia, including the country's mixed international reviews in terms of ease of doing business (Indonesia's ranking is 122 of 183, or at around the top amongst the bottom third of countries compared to a global good practice economy). These perceived weaknesses adversely affect the prospects for private sector investment in railways and other transport, as well as in other business sectors. It concludes that an objective of this NRMP, therefore, must be to reduce perceptions of risk associated with the general business environment for potential investors in the rail sector. It notes that this requires a sector-specific institutional framework that ensures fairness, promotes competition while reducing bureaucracy, and adopts standardised and transparent accounting procedures.

National and metropolitan spatial plans are then discussed along with the fact that the provisions for the Railway Master Plan in both Law 23/ 2007 and Regulation 56 of 2009 mandate that the plan co-ordinate with and accommodate plans developed across these three governmental levels.

The national transportation system planning framework is addressed next, together with the fact that, although released under ministerial (MoT) decree, the national transportation system plan is a product of interagency deliberations, since legislation governing the multi-modal transport system involves a number of national and sub-national jurisdictions. It notes that the new procedures on the development of integrated planning documents have not been fully settled and that an effort to prepare a multi-modal roadmap for freight transport and logistics is underway in the Co-ordinating Ministry of Economic Affairs (CMEA). It is observed that the NRMP requires a concerted effort to encompass other related initiatives impacting on inter-modal competition for both passenger and freight traffic, as well as potential intra-modal competition and management within railways. Railway planners must be aware of the planning assumptions, and especially the proposed infrastructure development plans for highways, seaports, and airports, that are being made by other key players, including sub-national developments. This chapter observes that the rail sector does not uniformly have advantages over other modes and must be effectively co-ordinated with those modes and that co-ordinated master plans for each mode can, however, improve the effectiveness of the National Transportation Planning Framework.

Chapter 2 notes the importance of Law no. 32/2004 on regional governance to the NRMP. Implementation of the law will provide freedom for regional governments to regulate and manage infrastructure facilities and resources on their own responsibilities, without central government approval (aside from compliance with those existing national laws and regulations that are not replaced by provisions of Law No. 32/2004). On the one hand, this provides opportunities for PTKA (and, potentially, additional national rail operators and/or infrastructure managers) to work with regional governments in providing sustainable transportation solutions, improving transport services to communities, encouraging economic growth and developing more inter-regional transportation options. MoT/DGR approval of a joint PTKA-regional authority initiative will not be required advance approval. On the other hand, DGR must review regional initiatives carefully to verify that finance for the project can not only be arranged for the project development phase, but that the project is likely to be financially sustainable over the long term.

The role of the Ministry of State-Owned Enterprises is discussed, noting that PTKA is a state-owned enterprise (Badan Usaha Milik Negara or "BUMN"), which has a distinct status under Indonesian law. It is noted that the changes in railway industry structure mandated by Law 23/2007 have important implications with regard to ownership status. The NRMP envisions that national railway infrastructure will remain state-owned for the foreseeable future. However, the same will not be true for railway operators. The NRMP does not plan to seek a majority state ownership in any new rail operators that may seek to compete with PTKA. It is also noted that when the above-rail operations of PTKA become fully legally separated from infrastructure management, the PTKA successor operator may cease to be a BUMN and the government may withdraw from its majority ownership of the enterprise.

The role and organisation of the MoT and its subordinate units are described, followed by a more detailed riview of the DGR and its Directorates. Finally, Indonesia's railway sector's legal/ regulatory framework is described in detail, including specifically the recent amendment of Law no. 13/1992 on Railways by Law no. 23/2007 on Railways. The chapter addresses the important changes of the law in the abolition of the monopoly right of PTKA, by providing an opportunity to the private sector to organise enterprises of railway infrastructure (including management of tracks, electrification systems, signaling, stations and other fixed assets and associated maintenance services) and operations (that is, above-rail freight and passenger services, including management of rolling stock and associated equipment and assets related to train operations). Other revisions related to decentralisation (to comply with the regional devolution policy) are described that allow local governments (LGs) to act as investor and operator of railway infrastructure and facility for their territories.

The history and present status of Perseroan Terbatas Kereta Api Indonesia - Persero, (shortened to PT. Kereta Api [Persero] or PTKA) is described in detail.

Current Condition of the Rail Sector (Chapter 3)

Chapter 3 reviews the current condition of railway operations in Indonesia. It concludes that the rail network is in reasonably good condition and is capable of higher performance with only incremental spending. Significant improvements in both passenger and freight services can be achieved. It notes that neither widening of the cape gauge lines nor double tracking is a pre-requisite to moving large amounts of passengers or of freight. More important is to organise services effectively, and to build a railway that is capable of high density movements. For PTKA, the analysis shows that its investment program could be more effective by concentrating on improving the capability of existing infrastructure by increasing axleloads and by increasing speeds.

Given the changes contemplated in Law 23/2007, another conclusion reached is that PTKA should organise itself more transparently to take advantage of its current strengths in infrastructure maintenance and operations. It is expected that the current subsidy and track access charge (TAC) system could be greatly improved by the development of an accurate accounting system that permits better visibility in the losses generated in subsidised passenger services, particularly in infrastructure operations and maintenance costs.

The chapter observes that productivity and profitability could also be increased by developing infrastructure and operating plans in closer co-ordination – so as to allow larger train sizes, and in designing passenger services that are more competitive in the market place.

National Goals and Projections for Rail Sector Development (Chapter 4)

Chapter 4 reviews the vision of the Tim Revitalisasi Kereta Api or TRKA (Technical Team on National Railways Revitalisation) for large potential increases in railway market shares and then turns to an assessment of opportunities to increase market share. First passenger-related markets are discussed, first focusing on Jabodetabek commuter and urban services and then addressing opportunities in other metropolitan areas in Java and other Islands. Finally, intercity passenger opportunities are discussed.

Turning to freight, a commodity by commodity analysis is provided, followed by an island-by-island review. Comparisons are provided between the current and prospective market shares on Indonesia's major Islands and other island economies.

Based on market analysis, chapter 5 concludes that the prospects for Indonesian railways approaching TRKA's vision of greatly increased markets hinge on three separate initiatives:

- Reversal of past trends of reducing the size of the network and with at least a doubling of the physical scope of the rail network needed, based largely on development of infrastructure in areas previously unserved by rail;
- Acceleration of the rate of growth in passenger and freight traffic on existing line segments, through substantial investments in infrastructure and rolling stock; and
- Creation of specialised public and private railway services independent of PTKA in compliance with Law 23/2007, in order to take full advantage of devolution policy and private and public sector investment in niche markets.

NRMP Institutional Reform Strategy (Chapter 5)

Chapter 5 addresses NRMP strategy with respect to competition policy, calling for equal emphasis on taking advantage of both ex-ante competition (promoting competition for market segments via concessioning rail infrastructure developments and related actions) and ex-post competition (opening rail services to competing operators using common infrastructure). Next, the chapter addresses government interventions to promote competition and increase the viability of railway operations, including TAC, infrastructure maintenance and operation cost allocation (IMO) framework, and passenger service obligation (PSO) support. Procedures that will be implemented to increase the clarity and transparency of these mechanisms are addressed.

Improvements in the capabilities of the Directorate General Railways (DGR) to provide needed technical regulation are described, including safety programs and regulation of standards. Licensing policy for railway service providers and for infrastructure managers is outlined in detail.

Arrangements for the necessary degree of economic regulation required (mostly limited to dispute resolution) are outlined. Procedures for the deliberate creation of economic oversight arrangements within the MOT are discussed, with placement of the oversight body outside of DGR to be implemented in order to eliminate conflict of interest in dispute resolution.

Finally, the time phasing of institutional reform through the four phases of the NRMP is described.

NRMP Rail Sector Investment Strategy (Chapter 6)

This chapter focuses on the identification, order of magnitude quantification, and broad prioritisation of investments that are needed to revitalise Indonesia's national railway system – both infrastructure and equipment – and enhance its role in the economic and social development of the nation. It also considers the possibilities for private sector participation in financing these investments, and measures that can enhance the potential for private sector participation.

Review of the level of technology and institutions suggests that a substantial portion of investment in railway infrastructure should focus on upgrading the capacity and economic efficiency of the existing infrastructure. Efforts should be made to end some current practices that seek to expand capacity by replicating what appears to a significant degree to be obsolete, inefficient technologies. Thus, this chapter focuses largely on analysing, and then proposing investment plans to improve the existing route structure's basic effectiveness, efficiency, and safety. Axle loadings, bridge clearances, soil stability under older lines, and speeds/grades are shown to be the investment priorities for the largest part of the government's investment in railway infrastructure.

The proposed **infrastructure investments** to upgrade the existing main lines to a minimum 22.5 ton continuous axle load capability and provide an infrastructure that will support 150-kph train services on the Java North Coast main line (but exclude the costs of proposed new urban railways) are shown in the table below.

Table 1: Infrastructure Enhancement Investments

Investment Category	Java	Sumatra	Total (USD million)
Track, Turnouts, Level Crossings	$1,119	$332	$1,451
Bridges *(Sumatra estimated)*	$3,700	$1,000	$4,700
Signals	$996	$293	$1,289
Special Terminals	$250	$50	$300
Total	**$6,065**	**$1,675**	**$7,740**

Of this investment, approximately USD 4 billion would be spent in the first five year period, and the entire infrastructure enhancement would be completed by the end of the second five year period. The infrastructure enhancement investments are described in chapter 3.

Indonesia's railway **rolling stock** fleet is aging and a substantial portion of it is already operating beyond its economic useful life and should be retired soon. In addition, most of the remaining **rolling stock** will need to be replaced over the planning period.

Table 2: Summary of Rolling Stock Investments

Rolling Stock Type	Average Age (years)	USD (million) for Equipment to be Replaced Now	USD(million) for Additional Replacements by end of Period	Total Rolling Stock Investments USD (million)
Locomotives	26.4	$620	$330	$950
DMUs	17.2	$133	$133	$266
EMUs	12.8	$81	$660	$741
Coaches & other	27.4	$1,000	$1,500	$2,500
Freight Wagons	34.6	$111	$138	$249
Total		**$1,945**	**$2,761**	**$4,706**

In total, approximately USD 4,700 million will be required to simply replace existing rolling stock, nearly USD 2,000-million is needed in the short term, another USD 2,700 in the longer term. Rolling stock investments are described in chapter 4.

If rail market shares are to increase, additional investment will be required to accommodate new services and volumes of traffic – new rolling stock investment needs could easily equal investments for replacement – USD 9,400 million or more. One way to minimise the capital cost of new and replacement equipment is to increase speed (thereby utilisation) and to increase capacity of the equipment. Such speed and capacity increases require the substantial investments in infrastructure discussed in chapter 3. With these enhancements, the capacity of passenger equipment can be increased substantially using bi-level rolling stock and faster services. Freight wagon capacity can be more than doubled, reducing investments needed for equivalent capacity by half.

The investment needed to revitalise Indonesia's existing railways and provide enhanced capacity to existing assets will be substantial – to the tune of USD 15,000 million over the next 20 to 25 years. Investment for high-speed railway lines, new special purpose railways, urban metro systems will be additional to those described in this chapter.

Guidelines for Sub-National Railway Master Plans (Chapter 7)

Chapter *7, Development of Sub-National Railway Master Plans,* contributes to the NRMP by defining specific guidelines for preparing provincial/district/city railway master plans. Law no. 23 of 2007 requires the national RMP to provide guidance and coordination for the development of sub-national RMPs. Although sub-national RMPs are separately developed by the sub-national authorities; the MoT/DGR provides oversight to insure that sub-national RMPs and specific sub-national projects are consistent with the national RMP and the national planning and laws.

This oversight will:

- comply with the NRMP national network plans, spatial plans, and capital-investment plans;
- provide "due diligence" guidelines on core issues to avoid financial and regulatory major mistakes;

- provide conformance with the financial and technical options that will be licensed by DGR at sub-national government levels;
- communicate the importance of well-developed, economically and financially sound sub-national RMPs to the achievement of national goals in the rail sector; and
- ensure that any sub-national railways does not inhibit the development of other sub-national railways.

Consistent with Law no. 23 of 2007, chapter 7 regards any rail line that will be connected to the core rail network originally operated by PTKA, as a development project to be incorporated into the national RMP. This inclusion happens because of the potential impact on the core network. In addition, any separate railway or special-purpose railway of national importance must be incorporated into the national RMP using guidelines consistent with this chapter.

Articles 7 through 12 of Law no. 23/2007 require the MoT, supported by its DGR to develop this NRMP to include virtually all fixed guideway systems as well as conventional, existing rail lines. Fixed guideways include all design from conventional, standard-gage coal mining railways to fundamentally new technologies to move people at high speeds.

The formal *Strategic Plans* specify that 75 percent of the capital expenditure is to be funded by sources other than the government's budget. These sources may include LGs, BUMN, and the private sector[1] Therefore, the purpose of the NRMP must be to insure that sub-national efforts expend funds to maximize economic efficiency and effectiveness.

The scope of Chapter 7 may be summarised as this:

> *How does Indonesia's DGR use the NRMP to insure that this 75 percent investment provided by the local and private sub-national investment is invested intelligently?*

Chapter 7 does not select which specific sub-national projects should be executed. Chapter 7 only sets out the criteria for (i) approving sub-national projects, (ii) adding national funds to approved plans, and (iii) for eventually licensing a sub-national project if the project is financially and operationally sustainable. Therefore, this chapter's scope does not prioritise development projects. The development of mineral resources, cities' mass transit, or of ports are decisions that depend upon interagency coordination and the principal of devolution.

The NRMP does not specify or favour any specific technology or project. The NMRP will propose specific technical criteria for interoperability, for financial due-diligence, for ease of leasing, and for ease of "step-in" by another operator or owner should the initial operator or owner fail.

A Vision for the Indonesian Rail Sector (Chapter 8)

Chapter 8 addresses the strategic future of Indonesian railways with particular attention to the implications of the new railway law and how it might be implemented. This chapter considers the alternative developments and describes a future railway environment with multiple participants, a transparent regulatory system, and a substantial investment program that is partly met by private investors who not only are involved in extractive industries but are involved in general rail freight

[1] P. 67, Section E. Also p, 70 of a translation into English of the January, 2010 edition.

services, passenger services and in the development of terminals and related infrastructure that is so important to the development of rail transport.

It is hard to over emphasise the critical part that the regulatory environment plays in the development of a new and more robust rail sector in Indonesia. The key elements of the RMP are composed of both regulatory changes and of investments. Regulatory changes can enhance the attractiveness of the rail sector to private investors and help both national and local/regional governments develop new rail services.

The RMP is composed of a series of investments in the national railway infrastructure that will help modernise and increase the capacity of the existing network while also expanding it. The focus of the RMP in the near future should be on modernising and upgrading the major main lines of the existing railway network. These investment programs represent a major effort to improve the standard of principal main lines to increase axle loads, raise train speeds, increase loading gauge, and replace aging rolling stock with modern equipment that can take advantage of these improvements. This includes higher-speed passenger equipment, capable of speeds of 150 kph or more on the North Island main line, new rolling stock designed for the relatively difficult terrain of the southern main lines that will permit increased speeds and improved passenger services once infrastructure standards have been raised. While the southern main line may not be capable of the same kinds of average speeds, improved infrastructure and more specialised rolling stock can improve average speeds significantly and make rail passenger services competitive over a wider area.

The same upgrading of standards will help develop the existing infrastructure in Sumatra but, given the separate nature of these railway lines, additional investment will be needed to fully develop rail transport. Here, Indonesia is already discussing a number of private single purpose railways. These developments should be advanced to enhance the growth of private multi-purpose railways where none exist till now. The interconnection of the national network with these multi-purpose railways (and the single purpose ones as well) should be encouraged – the value of networks increases with their extent and interconnectedness.

In the long term, government investment will be needed to provide Very High Speed Trains (VHST) passenger services. Here, a new infrastructure will be needed – separated from urban development by elevation or by more permanent fences and fewer level crossings, closure of streets and highways, or the development of overpasses and underpasses for permit unimpeded rail operations. New rolling stock will also be needed for these new services. These investments are so large as to require some time to plan, develop and for the economy to grow sufficiently so that more of the operating costs can be borne from passenger revenue.

These investment needs are so large that private participation is likely to be the force behind rail developments on Indonesian islands that do not currently have rail services. The DGR should make every effort to have private rail investments serve multiple purposes – mineral developments, freight services for other customers, and passenger services where these are in demand. The government may wish to joint venture with some private investors to extend a special purpose railway to urban areas to provide community services.

CHAPTER 1: INTRODUCTION

The Government of Indonesia (GOI) recognises that rail transport is an important mode for the mass transport of people and goods. Beginning in the 1990s, GOI implemented a number of railway reforms, in addition to developing strategies for the improvement of road transport, development of toll roads, and expansion of air travel. However, by 2007 it was clear that the government owned and operated rail system was not adequately participating in transport growth. Its infrastructure was insufficient and required substantial investment while services were not substantially improving. There was an ongoing requirement for increased subsidies by the existing railway but it was still losing market share. It became clear that a different strategy was needed to achieve greater dynamism in the rail sector.

Railway Law no. 23/2007 was the first step in developing this new dynamism. The new law states that to the extent possible, railways should be organised economically and managed like businesses interacting in a competitive environment. Railways should be responsive to the demands of customers and compete on the basis of service, price and efficiency with other components of the transport sector. Recognising that rail infrastructure is inherently a monopoly, the new law requires that the existing railway be re-organised as an enterprise, with the infrastructure owned by the government but with the potential for private sector "above rail" operations. The law, supported by 2004 legislation on regional governance, also provides greater freedom for LGs and even private entities to build, own, and operate new railway lines, buy and operate rolling stock, and provide rail services over the national network.

The new law sets the stage for the development of a much broader based system of railway lines, operators, and service providers while giving the MOT, through the DGR, the responsibility for developing a regulatory environment that encourages private and public investment and allows for a more dynamic approach to railway development. The DGR is charged in the law with preparing the NRMP that describes national railway policy, sets the framework for technical and organisational regulatory environment, and defines the conditions under which the national government will participate in railway development.

In summary, Law no. 23/2007 provides for continued evolution of government involvement in the rail sector. The law (1) formally separates provision of railways' infrastructure from railway service operations, (2) provides a general framework for the potential future development of private rail sector operators, private infrastructure managers and a variety of public-private partnerships, and (3)anticipates much greater decentralisation of the public role in the rail sector. Provincial governments, regions, municipalities and localities are encouraged to develop sub-national Railway Master Plans (RMPs) that could include a variety of public-private developments. Law no. 23/2007 mandates RMPs at the national, provincial and subordinate government levels. The NRMPmust be completed in 2010. DGR produced an initial draft NRMP in 2009 and will have primary responsibility for the final product. This Consolidated Report builds on portions of the DGR draft as well as findings and conclusions produced by the consulting firm Harral Winner Thompson Sharp Klein, Inc. (HWTSK) in a series of workpapers supporting DGR in its efforts to produce a final NRMP that meets statutory requirements. It is produced in the format of a draft final NRMP. It reflects international best practices in railway restructuring applied to Indonesian circumstances as perceived by HWTSK, with the expectation that, it will receive close scrutiny by Indonesia's own transport and public policy specialists, who have far greater knowledge and insight into Indonesia's unique political, social, and economic circumstances. It is anticipated that, as in any other democracy, significant give and take across the diverse stakeholder groups may result in significant modifications in order to forge a coalition with sufficient political support to ensure adoption and implementation of the NRMP.

1.1 BACKGROUND

A Master Plan for an economic sector must be based on a sound understanding of how the sector has been governed. **Chapter two (Governance of the Indonesian Rail Sector)** provides this background. As chapter two notes, the rail sector in Indonesia has been operated since independence as a state activity in the form of a single national railway. The railway was first operated as a government department reporting to a larger directorate for land transport within the transport ministry. Then it was operated as a state corporation with a greater commercial focus, but still with a continued public mission. The national railway is currently operated as a State Owned Enterprise (Badan Usaha Milik Negara) that is expected to function as a normal commercial enterprise/limited liability company within an environment of public investment, public service obligation arrangements and public-private partnerships developed in cooperation with government. The current legal status of the single existing railway service provider provides the possibility of minority private ownership and allows for the potential of competing private or public rail services. However, at present, all railway services are still provided by a single, 100 percent government-owned carrier.[2]

Parallel to these changes in provision of railway services, the government's oversight of the railways and other economic sectors also evolved. This has resulted in a political environment in which state planning functions have refocused from centralised direction of the economy to provision of strategic guidelines within the framework of a far more market-directed economic system. A separate Ministry of Public-Owned Enterprises (Kementerian Negara BUMN) was created to oversee the transition of government economic activities to state owned enterprises and (in many cases) to the private sector.

As noted above, despite the reforms in rail sector governance to date, rail sector results have not been satisfactory. **Chapter three (Current Condition of the Rail Sector)** reviews rail sector performance and compares that performance to several international benchmarks.

1.2 PURPOSE AND OBJECTIVE

The mandate to develop the NRMP is largely driven by two factors, discussed at greater length in **Chapter four (National Goals and Projections for Rail System Development**). These are:

- The necessity to expand transport capacity to meet the demands of a growing economy.
- The desire to take advantage of the energy efficiencies and savings in external/social costs that the rail mode potentially offers.

Within major metropolitan areas, rail services have the potential to serve very high volume, spatially concentrated, short-distance movements of passengers with less congestion and environmental pollution (air, noise, and accidents) than road transport. Between cities, rail freight as well as rail passenger services can lower transport costs and provide competitive services that can slow the growth of road congestion and road investment demands with increased safety and a smaller environmental footprint. In chapter four, the NRMP sets out aspirational goals for the rail sector in terms of percentage shares of the passenger and freight transport markets, but meeting these targets will depend on the changing composition of the economy and in population demographics. All modes have roles to play in contributing to economic wealth. As the economy grows, market

[2] Including PTKA's Jakarta commuter services, Jabodetabek, which officially became a subsidiary of PTKA on 15 September 2008.

share targets for the rail sector may be adjusted upward or downward, depending on economic and population trends. It is certain, however, that the rail sector is currently underperforming, and the targets initially set herein represent reasonable targets for public and private initiatives to strive towards.

Implementation of this NRMP rests on three strategies:

(1) Improving the policy, legal and regulatory framework to be supportive of both private and public initiatives in the rail sector **(see Chapter five: NRMP Institutional Reform Strategy**)

(2) Developing sensible investment initiatives for revitalisation and expansion of the existing mainline network in Java and Sumatra, and completion of railway projects of national importance for economic growth. This includes rail lines to exploit Indonesian mineral resources and selected city-port linkages on islands currently without rail service **(see Chapter six: NRMP Investment Strategy)** and

(3) Providing rail investment and organisational reform guidance that is responsive to pressing urban and local needs **(Chapter seven: Guidance for Sub-National Railway Master Plans.)**

The NRMP will also more precisely define the allocation of risks and investment returns across development and operational periods and between public and private parties. Part of this task is implementing changes in the institutional/ organisational framework that facilitates effective working relationships among the key stakeholders and reduces risks associated with potential conflicts stemming from ill-defined roles and authorities. In Chapter five (NRMP Institutional Reform Strategy), plans to modernise the policy/legal/regulatory framework for the rail sector are defined. Goals and objectives for structural reforms are outlined for each of the four time periods making up the 20-year NRMP.

Based on international experience, a critical issue for railway sector planning is providing guidance and strengthening provisions for project review and "due diligence." This function is essential to ensure that railway initiatives are both financially sustainable and economically beneficial to the Indonesian nation. The involvement of private finance alone does not assure revitalisation of rail services. Opportunities for private participation do not inevitably result in meaningful inflows of private investment. Similarly, public investment in rail capacity at all levels of government often have resulted in projects that have failed to achieve target objectives and even had to be abandoned. ***A Railways Master Plan must establish a framework for the realistic evaluation of sector development choices at the sub-national level, as well as for core national programs. It must assure that scarce resources are not wasted on unsustainable ventures and that the respective risks of project implementation and operation are allocated to the parties who are best positioned to control or manage each.***

1.3 SCOPE

The RMP is mandated by Law no. 23/2007 on Railways, which requires in Articles 7-12, that the MoT, supported by its DGR develop the NRMP. Based on the law and interpretations made since the Law's passage, the scope of the NRMP:

- Includes national, provincial and regional/city components (Article 7). In addition, development of sub-national RMPs also require guidance and coordination at the national level. The national RMP must not only provide a plan for the main intercity rail network and for special rail networks for projects of national importance, but also an "umbrella" for the sub-national rail master plan components. The NRMP will provide guidelines and "templates" for sub-national RMPs, which will be separately developed by the sub-national authorities responsible under the oversight of MoT/DGR. (Chapter eight)

- Must be coordinated with other planning instruments, specifically the National Development Plan/National Spatial Plan and the National Transportation System Plan (Article eight). While the latter is a MoT responsibility, national development planning and the spatial/land use components concerning the control of infrastructure development are interagency responsibilities with leadership from the National Development Planning Agency, the Badan Perencanaan dan Pembangunan Nasional (BAPPENAS). Interagency coordination implies interaction not only at the stage of developing broad policy targets, but also coordination at the stage of reviewing specific project plans. The coordination ensures that both initial resource commitments and downstream financial sustainability are consistent with national development goals.
- Focuses on a plan for *infrastructure development* on the existing railway network and new lines ("Elucidation" or Article seven). This narrows the scope of this NRMP in that, say, regulation of shipper tariffs or rolling stock standards is relevant for the most part only to the extent that they impact infrastructure plans. The NRMP is not intended to preempt the commercial decisions of private enterprises regarding how they price their services or management decisions as to the resources needed to best respond to market opportunities. Similarly, the NRMP does not intend to substitute its judgement of local transit and commuter needs from those of the public institutions most closely involved in urban transport. It does, however, establish an environment that will both encourage investment and reduce risks of adverse investment outcomes.
- As specified in Law no. 23/2007, Article eight, the Master Plan for national railways defined in paragraph (1) shall at least include:
    - A definition of national policy for the governance of and projected role of railway transportation in relation to the other transportation modes (Chapter three);
    - Projections of passenger and goods movement according to trip origin and destination (Chapter four);
    - A plan to meet national railway infrastructure needs (Chapter six, Section 6.1);
    - A Plan to meet national railway rolling stock needs (Chapter six, Section 6.2); and
    - A plan to meet human resources needs (Chapter eight)
- Covers a 20 year period (TOR). This duration is not explicitly specified in the Law no. 23 itself but is the consensus timeframe, consistent with other national planning exercises.
- Provides a detailed national action plan over the 20-year time frame, *broken down into 5-year staging periods.* Again this is not in the Law no. 23 itself but is consistent with the staging of government planning exercises in Indonesia generally.[3] The draft NRMP, which is to be modified and perfected as a result of this effort, uses the following end dates for the 5-year periods: 2014, 2019, 2024 and 2029.

This NRMP designates the four stages making up the 20-year plan as follows:

- Stage 1: Stabilising the railway sector through strategic investment (2010-2014);
- Stage 2: Transitioning to a sustainable public and commercial railway Environment (2015-2019);
- Stage 3: Maximizing the contribution of the private sector to railway development (2020-2024);
- Stage 4: Transforming Indonesian rail transport to world class status (2025-2029).

[3] For example, the duration of the current national long-term development plan (NDP) (Law no. 17/2007) is from 2005 to 2024, with a series of supporting medium-term plans. The current medium-term plan (Presidential Regulation No. 7/2005) is from 2005 to 2009. BAPPENAS is now drafting the second medium-term plan of 2010 – 2014.

These designations are intended only to capture a leading focus of each stage. But they do not imply that any stage is exclusively devoted to one particular activity.

1.3.1 NRMP Steps to Reduce Business Risk

If substantial private sector investment – particularly foreign investment – is to be attracted to the rail sector, the RMP must reduce the uncertainties faced by such potential investors. The NRMP, thus, specifies that the following measures be implemented by MoT/DGR early in the 2010-2014 phase of the plan:

- Dissemination of the safety and standards regulations contained in Regulations 56 and 72 of 2009, development of procedures to address any questions concerning those regulations by railway industry participants or sub-national authorities, and drafting of specific licensing requirements based on the new regulations;
- Determination of the scope, organisation and location of the economic regulatory/dispute resolution function that will be available to railway users, private operators of rail services and manager of railway infrastructure and rail industry suppliers and implementation of interim administrative measures pending approval of a formal Peraturan Pemerintah (PP) or government regulation on this subject; and
- Explicit and detailed determination of the respective functions of DGR and the infrastructure manager(s) envisioned under Law no. 23/2007 on railways.

1.3.2 NRMP Vertical Separation Requirements

The recent regulations referenced above are definitive as to what constitutes railway infrastructure and what functions constitute “infrastructure management,” but are somewhat less definitive on how the infrastructure management task would be organised among public and private entities. This flexibility is appropriate to the regulations, which must cover rail infrastructure developed at all governmental levels. At lower levels, city or regional rail projects are likely to involve a great deal of outsourcing, either to national public rail operators or to private contractors, and the regulations appropriately accommodate variances in organising the infrastructure activity, allowing organisational issues to be defined more specifically in the licensing process.

This NRMP, however, specifies that in the 2010-2014 phase, DGR will define the degree of accounting, legal and/or organisational separation to be required between train operations and infrastructure management and specify a schedule for obtaining the degree of separation required by law and regulation. During this period, DGR must spell out how and over what time period it plans to issue separate licenses for infrastructure management and train operations that are now vertically integrated. For at least a transitional period, PTKA may be licensed as an agent for both infrastructure management and train operations, and leave the current structure of PTKA intact. This NRMP requires that PTKA modify its accounting system in the 2010-2014 period in a manner that separates infrastructure and train operating functions in compliance with Law no. 23/2007 and Regulation 56 of 2009.

1.3.3 Due Diligence under the NRMP and Sub-national RMPs

Under the NRMP, the management of PTKA (and its potential rail service competitors) will have primary responsibility for investment decisions related to rolling stock and other non-infrastructure

expenditures. The MoT, supported by the DGR, is the authority with responsibility for contracting for technical development of major national rail infrastructure investment programs. Sub-national authorities will take the lead in developing regional/municipal projects with technical assistance from MoT/DGR. However, assuring coordination with national plans may best be achieved by vesting interagency panels with explicit due diligence review functions rather than simply providing for initial licensing and general undefined coordination. This NRMP defines explicit provisions for due diligence review of both national public investment programs and regional public investments that exceed defined threshold levels. Due diligence review processes are defined in **Chapter seven: Guidelines for Sub-National Railway Master Plans.**

1.3.4 Evaluation Framework for Evaluating NRMP Goals

While it is not possible to incorporate detailed project financial and economic analysis within the NRMP itself because of the number and diversity of the projects and options, the NRMP requires that medium term strategies (the successive five-year phases) incorporate more supporting data for the targets projected and provide some initial overall screening to assess the potential feasibility of the major components of the proposed program. Such assessments (i) separate the rail sector into passenger and freight components, geographic area (at a minimum Java, Sumatra, and Kalimantan), and type of service, (ii) specify policy objectives for each sector component and (iii) tie aspirational goals to underlying investments that would be required as well as to sound market projections.

The NRMP also specifies that evaluation procedures for any subsequent prospective investments, should include "without project-with project" financial analysis (that is financial assessment from the investor perspective) and economic analysis (from the national economic benefit perspective) for any major public investments. Rigorous procedures for such evaluations originally developed by the international financing institutions (IFIs) have long since been adapted for use in Indonesia by BAPPENAS, MoF and other agencies for use in detailed project level evaluations. Consistent with these practices, they will be required for projects implemented under the NRMP.

1.3.5 Uniformity versus Flexibility in Railway Development Initiatives

While development of explicit procedures for project assessment is required under the NRMP, development of a national RMP does not necessarily mean that all projects of national importance should be managed by a single entity or subject to the same regulatory constraints. A program to interconnect the rail lines in Sumatra into a general purpose network, for example, must be assessed differently, and involve a different set of participants than a dedicated export coal line in Kalimantan or a high speed rail corridor in Java. Non-uniform application of the national NRMP is mandated by the fact that an ambitious expansion of Indonesian railway service will require massive investments. The price of obtaining such investments is likely to require understandings and contractual relationships that increase the attractiveness of the investment to diverse sources of private and public capital. In this respect, the NRMP will follow the tradition of Indonesian pragmatism that has served the country well over the last decades.

1.4 STATUTORY BASIS

The NRMP is prepared in accordance with Law no. 23/2007 on Railways (UU). The NRMP is designed to be consistent with the National Spatial Plan and other Master Plans for transportation, such as National Transportation System (Sistranas) and Master Plan of Land Transportation.

Railway Law no. 23/2007, and hence this NRMP, takes into account and, in part, incorporates by reference, a number of other national laws and regulations, as follows:

1.4.1 Transportation Laws Impacting Intermodal Integration

- Law no. 14/1992 on Traffic and Road Transportation
- Law no. 17/2008 on Shipping
- Law no. 1/2009 on Aviation

1.4.2 Laws Impacting the Conduct of Enterprises

- Law no. 28/1997 on Police of Republic of Indonesia
- Law no. 5/1999 on Prohibition of Unconstructive Monopoly and Business Competition
- Law no. 8/1999 on Consumer Protection
- Law no. 17/2003 on State Finance
- Law no. 19/2003 on State Owned Enterprises
- Law no. 32/2004 on Regional Governance
- Presidential Regulation No. 67 of 2005, as amended

1.4.3 Government Regulations Impacting Railway Infrastructure and Operations

- Government Regulation No. 19/1998 on conversion corporate format of PERUMKA (Indonesia Railway Company) into Partnership Company
- Government Regulation No. 69/1998 on Railway Infrastructure and Facility
- Government Regulation No. 81/1998 on Railway Traffic and Transportation
- Government Regulation No. 38/2007 on Allocation of Governmental Affairs to National, Provincial and District/City Governments.
- Regulation No. 56/2009 on Railway Organisation
- Regulation No. 72/2009 on Railway Traffic and Transportation

1.4.4 Government and Ministerial Regulations Impacting Private Participation in Railways Infrastructure and Operations

- Reg MIN FINANCE: 38/PMK.01/2006: Implementation Instructions for the Control and Management of Infrastructure Provision Risks
- Reg CMEA: KEP-01/M.EKON/05/2006: Procedures of the National Committee for the Acceleration of Infrastructure Provision
- Reg CMEA: PER-03/M.EKON/06/2006: Procedures and Criteria for Compilation of List of Priorities for Public Private Partnership Infrastructure Projects

- Reg: PER-04/M.EKON/06/2006. Evaluation of PPPs Requiring Government Support
- Presidential Regulation Number 36 /2005 Concerning Procurement of Land for Implementation of Development for Public Interest
- Presidential Regulation Number 13/2010: Government Cooperation with Business Enterprises in Infrastructure Provision

1.5 RATIONALE

A Master Plan for National Railways is required by Law no. 23/2007 on Railways, due to the gap between the need for national railway organisation/development and the existing condition of national railway infrastructure and service, attributed in part to lack of planning for efficient use of limited funds and resources.

CHAPTER 2: PRESENT GOVERNANCE OF THE RAIL SECTOR

As described in this section, the institutional framework for the Indonesian rail sector was only slowly modified after independence, although it accelerated in the last two decades, to make it more responsive to market forces. However, the changes envisioned in Law no. 23/2007, to be implemented through the NRMP, will vastly accelerate the pace of change, with the intent of a virtual order-of-magnitude change in the role of the rail sector in the Indonesian economy. The challenge of accomplishing this vision is great, but can be met with determined effort.

2.1 CURRENT INDONESIAN TRANSPORT POLICY ENVIRONMENT

The primary national government institutions in charge of transport in general and the railway sector in particular, are many and powerful. The national government institutions include:

- The MOT, as the technically expert agency, particularly its subordinate, the Directorate General Railways (DGR);
- The State-Owned Enterprises Ministry (BUMN) as the holder of government's share in corporatised components of former stage agency enterprises, including transport units;
- The MOF, as the authority of state finance for transport undertakings proposed by the National Development Planning Agency (BAPPENAS);
- The BAPPENAS, as the planner of medium- and long-term national developments;
- The Coordinating Ministry of Economy (CME) as the integrator of sector and inter-sector policies.
- The Ministry of Public Works (MoPW) (encompassing the former Ministry of Settlements and Infrastructure) and its equivalents at sub-national jurisdictional levels are also important players in the transport sector, concentrated in the roads sector.
- Numerous interagency coordination committees at both national and the various sub-national levels.

While all the above agencies(and others at sub-national levels) have an interest in efficient rail service that is well coordinated with other modes, there has, till date, been an absence of a clearly articulated rail sector strategy that would permit all agencies to interact more effectively on railway issues. The NRMP contained herein is intended to overcome this deficiency.

2.1.1 General Business Policy and Regulation

Despite the very substantial economic progress made by Indonesia in the Suharto period, the country continues to receive mixed international reviews in terms of general business policy and regulation. The World Bank/ International Finance Corporation (IFC) report *Doing Business 2010: Indonesia*[4] provides a serious critique of real and perceived constraints posed by business policy and law. Overall, Indonesia's "ease of doing business ranking" is 122 of 183, or at about the top of the bottom third of countries compared to a global good practice economy. This ranking is far below neighbouring Singapore, ranked number one; Malaysia, ranked 12; and Thailand, ranked 23; though it is somewhat better than the Philippines, ranked 144.

[4] A co-publication of The World Bank and the International Finance Corporation.

The areas where Indonesia ranked particularly poorly are revealing: business start-up, 161; employing workers, 149; enforcing contracts, 146; and tax obligation issues, 126. All of these issues are particularly sensitive in the transport sector because large capital investments are required. In transport, particularly urban transport, labour strife, contract and tax issues, and initial establishment of services are matters of great concern, even in countries with a reputation for good business practices. Indonesia's best business rankings, although not outstanding, were for protecting investors (41) and for cross border trade (45). Both are areas where there has been a strong government commitment to support economic growth and offer optimism with regard to NRMP objectives to solicit private sector investment.

The absence of well-established Indonesian institutions and transparent procedures to enforce laws governing private investment (whether by Indonesian nationals or foreigners) and fair competition is an additional inhibition. Indonesia established a Commission for Business Supervision (KPPU) in 1999. However, the powers of the commission and its relationship to other commissions, courts and state agencies are still being sorted out. Precedents that instill business confidence remain to be well established. Furthermore, as illustrated above by the number of government entities having an interest in the rail sector, bureaucratic complexity poses a potentially intimidating threat to delay project schedules and to introduce barriers to proposed transactions.

The NRMP recognises that these perceived weaknesses adversely affect the prospects for private sector investment in railways and other transport, as well as in other business sectors. Since the 1990s, Indonesia has moved toward private participation in provision of public infrastructure, including electric power, toll roads, and telecommunications (both through PPPs and wholly private ventures). However, railroads, both inter-urban and local, remain public enterprises, managed and financed at the national level. The rail sector has had difficulty attracting private investment. *An objective of this NRMP, therefore, is to reduce perceptions of risks associated with the general business environment for potential investors in the rail sector. This requires a sector-specific institutional framework that ensures fairness, promotes competition while reducing bureaucracy, and adopts standardised and transparent accounting procedures (see Chapter five).* Furthermore, an objective of this NRMP is to reduce the technical risk of incompatible, competing technologies by establishing interoperable, modern technology norms that are applicable across multiple government levels and jurisdictions and conform with globalised trade practices (see Chapter seven).

2.1.2 National and Metropolitan Spatial Plans

A key component of the national planning framework for transport is the National Spatial Planning Coordination Board. The board is chaired by the Coordinating Minister for the Economy (CME). The board is located within BAPPENAS and is headed by BAPPENAS' director. The Directorate General of Spatial Planning (DGSP) of the MoPW is charged with managing the practical implementation of the board's plan. Spatial planning in Indonesia is driven, in part, by a growing need for coordinating the management of natural resources and for ensuring that infrastructure development activities take proper account of land use, environmental policy and zoning restrictions. The Indonesian parliament passed the first spatial planning law [5] in October 1992. This law defined spatial planning as a plan-making process (prose's perencanaan tata ruang), plan implementation (pemanfaatan ruang), and development control (pengendalian pemanfaatan ruang).

Currently, the direction of spatial planning in Indonesia is governed by the National Spatial Plan (NSP/RTRWN). Like the Railway Law no. 23 of 2007 and the NRMP, the National Spatial Plan (Rencana Tata Ruang Wilayah Nasional, or RTRWN), as stated as Government Decree no. 26/2008,

[5] The Spatial Planning Law 24/1992

encompasses a hierarchal system of development. It extends downward from the scale of national, island, provincial, regency/city, and then specific areas. NSP/RTRWN is arranged to coordinate structure and spatial development plan among all areas in Indonesia to attain synergy, coordination and avoid competition among the areas.

The GOI has a three-tiered sub-national government structure, consisting of provinces (33 including regions with special status), cities (92 urban local authorities) and "regencies" (359 rural local authorities). All these units have authority to draft socioeconomic development and spatial plans. The provisions for the RMP in both Law no. 23/ 2007 and Regulation 56 of 2009 mandate that the plan coordinate with and accommodate plans developed across these three government levels.

In summary, this NRMP and the guidance it prepares for sub-national RMPs, hence, is coordinated with:

(1) National Spatial Plan;
(2) Provincial Spatial Plan;
(3) District/City Spatial Plan;
(4) Master Plan of National Railway;
(5) Master Plan of Provincial Railway;
(6) Provincial Master Plan of Other Network of Transportation Modes;
(7) Regency Master Plan of Other Network of Transportation Modes.

The NSP/RTRWN is currently organised as a guideline or direction of developing a potential area with the aim of "effectiveness, production efficiency and national distribution". Direction of the layout actualisation is to be elucidated by each of the related departments or sectors.

In the NSP/RTRWN, the island is considered as the primary unit of area development. The island is considered to provide the largest activity in the classification of area development in the national scope. The direction of spatial development for islands in the NSP/RTRWN is displayed in the table below. From the table, it is apparent that the NSP/RTRWN uses common sense area for the development direction in islands. Natural resources for both scenery and development are spread among all Indonesian territories. The strategy of area or national development is based on this reality, rather than a system which is not in accordance with characteristic of area or national development.

Table 3: Direction of Island Spatial Development in Indonesia[6]

Island	Development Direction
Java-Bali	Agriculture for national food supplies; natural resources which conserves space, especially for land-caught fishing, plantation with agro-tourism, oil and natural gas; processing industry that conserves space and water and is friendly to the environment; controlled housing.
Sumatera	Agriculture for national food supplies; natural resources mainly forestry; wild fishery, tourism, and plantation with agro-tourism, marine-industry, oil and natural gas, and mining.
Kalimantan	Natural conserved area (tropical forest) and water; natural resources, mainly forestry, catch-fishery, and plantation with agro/forest and marine industry; mining, oil and natural gas production, processing industry.

[6] Source: Government Decree 26/2008 RTRWN

Island	Development Direction
Sulawesi	Agriculture for national food supplies; space-saving natural resources, especially for land caught-fishery, tourism and plantation with agro/forest and marine-industry; production of oil and natural gas; mining; development of processing industry.
Nusa Tenggara	Agriculture for national food supplies; natural resources, especially fishery and marine-industry, oil and natural gas production; tourism; processing industry.
Maluku-Papua	Natural conservation area, development of natural resources especially land-caught fishery, tourism, forestry and plantation with agro/forest and marine-industry; oil and natural gas production; mining, processing industries.

Planning direction to these islands is further translated into well-understood regional areas. It is then further sharpened to the provincial city/regency level. The Law no. 26 of 2008 stipulates that the levels for spatial planning are of the National Development Center (NDC/PKN), the Regional Development Center (RDC/PKW) and the Local Development Center (LDC/PKL) in the NSP/RTRWN. These levels guide development of economic interaction patterns using the trigger of traffic pattern of people and freight in the development of transportation network. *The NRMP recognizes that the sub-national development of railway resources at the island, provincial and lower government levels, taking into account spatial planning at those levels, is absolutely critical to the success of the NRMP.* ***Chapter seven: Guidelines for Sub-National Railway Master Plans*** *takes account of this established framework for spatial planning.*

2.1.3 National Transportation System Planning Framework

Although released under Ministerial (MoT) Decree, the national transportation system plan is also a product of interagency deliberations, since legislation governing the multi-modal transport system involves a number of national and sub-national jurisdictions. The new procedures about how such integrated planning documents will be developed have not been fully settled. An effort to prepare a multimodal roadmap for freight transport and logistics is underway in the CMEA. This effort is pursuant to an earlier government decision mandating logistics and supply chain standards and regulations. Moreover, there are several transport related planning documents or regulations already enacted and other new regulations are scheduled for release.

Preparation of the RMP requires a concerted effort to encompass other related initiatives impacting inter-modal competition for both, passenger and freight traffic, as well as potential intra-modal competition and management within railways. It is unlikely that any specific target with respect to the outcomes of competitive market processes would be agreed among the many different planning authorities, nor should they be sought. However, railway planners must be aware of the planning assumptions, and especially the proposed infrastructure development plans, for highways, seaports, and airports, that are being made by other key players, including sub-national developments. *This NRMP recognizes that the rail sector does not uniformly have advantages over other modes and must be effectively coordinated with those modes. For example, water-borne transport commonly has cost advantages over rail for high volume bulk transport. Similarly, road carriers may have a cost and service advantage for multiple-point distribution services and diverse passenger movements. Coordinated master plans for each mode can, however, improve the effectiveness of the National Transportation Planning Framework. That objective of the NRMP takes precedent over any market share targets for the rail sector.*

2.1.4 Development Planning and Transport Policy

As with many newly independent nations that emerged from the Colonial era after World War II, Indonesian economic development policy began with a strong central planning focus. This focus has slowly moved towards acceptance of a market-based economy that evolves under the diverse initiatives of private sector enterprises. In the transport sector, and the rail sector in particular, the evolution towards reliance on private enterprises and market forces has been at a particularly cautious pace; in large part because the Indonesian rail sector is primarily oriented toward passenger traffic. Passenger rail transport inevitably involves a strong public sector component because of relationships with spatial planning, urban development, massive infrastructure investment, and the frequent need for public service obligation (PSO) arrangements or direct public subsidies. Recent changes in the policy/legal environment point toward increased reliance on market forces and the private sector. Nonetheless, this NRMP must address the pace and degree to which further liberalisation may be implemented and the degree to which central Government direction and finance may still be required, particularly for major infrastructure development.

Indonesia retains a formal long-term development planning process to set a priority agenda for all major infrastructure development. This development planning process naturally has a direct impact on transport policy, but it is conducted on a complex interagency basis, with BAPPENAS, rather than the sectoral ministries, taking the lead role. The national planning process focuses on more than the creation of new infrastructure (transport, communications, power, and other utilities) needed to support economic and population growth. The process also focuses on improving the efficiency of existing infrastructure and on opening sectors to greater private sector participation. For transport, this process includes rehabilitating rail transportation, increasing national road networks across the country, increasing investment in rural roads, and enhancing the inter-island sea-transport, with supporting land transport logistics, particularly through rail and terminal connecting facilities. The process involves many parties, is complex, and is not particularly transparent.

2.1.5 Law no. 32/2004 on Regional Governance

Law no. 32/2004 on Regional Governance (supported by Law no. 33/2004 on Financial Balance between National and Regional Governments) gives sub-national governments the authority to initiate infrastructure development projects under their own responsibility, including initiatives in the rail sector. As stated in Law no. 32/2004, the Indonesian government deems it necessary to increase regional autonomy by allowing regional governments “extensive, concrete and accountable authorities in proportionate manners, as performed through regulation, allocation and use of national resources and national and regional financial balance in compliance with the principles of democracy, community participation, equal distribution, regional potentials and diversity to be done within the framework of Indonesia unity.”

Implementation of the law will provide freedom for regional governments to regulate and manage infrastructure and facilities and resources on their own responsibilities, without central government approval, beyond compliance with existing laws and regulations. On the one hand, this provides opportunities for PTKA (and, potentially, additional national rail operators and/or infrastructure managers) to work with regional governments in providing sustainable transportation solutions, improving transport services to communities, encouraging economic growth and developing more inter-regional transportation options. MoT/DGR approval of a joint PTKA-regional authority initiative will not be required advance approval.

On the other hand, DGR will review regional initiatives carefully to verify that finance for the project can not only be arranged for the project development phase, but that the project is likely to be financially sustainable over the long term. This is particularly vital for urban and commuter passenger

services, where fares are often projected to cover only a portion of costs and the regional authority will need to plan for continued support for transport services through tax revenues or other sources. South Asian experience shows that, with the correct initial design and fares, operating revenues can eventually cover operating costs if the necessary discipline is imposed at the beginning. While regional authorities bear the core responsibility for transport investments undertaken under Law no. 32/2004, this NRMP specifies procedures designed to ensure that proper due diligence is conducted, whether that due diligence is led by BAPPENAS, or by BUMN (as long as PTKA remains an SOE subject to the oversight of the BUMN ministry). In either case DGR will require adherence to these procedures where funding support is expected to be provided through the MoT.

2.2 MINISTRY OF STATE-OWNED ENTERPRISES

PTKA is a state-owned enterprise (Badan Usaha Milik Negara or "BUMN"), which has a distinct status under Indonesian law. The legal ownership of such enterprises is vested in the Ministry of State-Owned Enterprises (Kementerian BUMN). The government objective is that BUMNs should be able to compete with the private sector. This requires development of management initiatives and commercial flexibility, but it is recognised that the old civil service staffing of these entities requires substantial reform. Therefore, since the 2003 enactment of the "BUMN Law"[7], efforts have been made to tighten up the organisation of BUMNs. This tightening up includes implementation of good corporate governance, and implementation of a program to privatise and restructure BUMNs to make them financially sound and able to contribute more to the country. To make BUMNs more competitive, the BUMN Law reduced them to only two types: state-owned limited liability companies or Persero (with at least 51 percent state capital participation) and public service companies or Perum (which are entirely owned by the state). As a consequence, all departmental enterprises (Perusahaan Jawatan or Perjan) had to be converted to Persero or Perum. The national railway is subject to this structure and moved from Perjan to Perum (1991) and then (1998) Persero status, as described below.

2.2.1 Regulations Governing State-Owned Enterprises

Because PTKA is a BUMN, it is useful to consider the special rules concerning BUMN's before making any NRMP recommendations. These rules are summarized below:

A 2005 law sets out the basic rules for business combinations of BUMNs by way of merger, consolidation and acquisition.[8] A merger is defined as a legal action undertaken by one or more BUMNs to merge with another existing BUMN, with the merging company being dissolved. The law requires that a business combination proposal must be prepared by the Minister of State-owned Enterprises (the "BUMN Minister"), discussed with other relevant ministers, e.g., the Minister of Finance and other technical ministers related to the business of the particular BUMN, and approved by the President of Indonesia. A business combination should not be detrimental to the interests of the BUMN, minority shareholders, employees (i.e. it should avoid mass terminations), creditors, business competition or the public. In addition, a Persero should also follow the applicable procedures for the merger, consolidation and acquisition of ordinary limited liability companies. This means that the directors of the BUMN must prepare a joint proposal and plan for the business combination, notify creditors, publish a newspaper announcement, and perform other actions required by business law. The law also provides for changes in corporate form without liquidation.

[7] Law no. 19 of 2003 Regarding State-owned Enterprise.
[8] GR No. 43 of 2005 Regarding Merger, Consolidation, Acquisition and Change of Form of State-owned Enterprises ("GR 43").

A number of legal provisions distinguish between state capital participation in BUMNs and ordinary limited liability companies, providing greater controls due to the state budget commitment in BUMNs. State capital participation may be reduced by way of (i) privatisation, (ii) the transfer of a BUMN's assets to another BUMN or to an ordinary corporation as new participation, or as participation in a newly-established BUMN, or as state assets that are inseparable from the national government revenues/expenditure budget (commonly abbreviated APBN), (iii) the spin-off of a BUMN subsidiary to become a new BUMN, or (iv) a corporate restructuring (including a quasi-reorganisation or dilution). For a capital reduction, numerous procedures must be followed and approvals obtained.

BUMN legislation provides for several means of dispute resolution focusing on ***employer-employee relations***:

1. Mediation: settling a rights dispute, an interest dispute, an employment termination, or a dispute between labour unions at one company through negotiations mediated by one or more independent mediators.
2. Conciliation: settling an interests dispute, an employment termination dispute, or a dispute between labour unions at one company through negotiations conciliated by one or more independent conciliators.
3. Arbitration: settling an interests dispute or a dispute between labour unions at one company outside an industrial relations tribunal pursuant to an agreement made in writing between the conflicting parties that refers the dispute to an arbitrator. The arbitrator's decision is stated to be final and binding on the parties but is subject to cancellation in certain circumstances upon application to the Supreme Court.
4. Legal appeal: If arbitration fails, then disputes go to a special Labour Court, which is a special court set up within the District Court. The procedural law that applies to the Labour Court consists of the civil procedures applicable for the District Court, except for those matters specifically regulated. The Labour Court hearing is chaired by a judge, with one ad hoc member judge nominated by a labour union and one ad hoc member judge nominated by an entrepreneur's association.

2.2.2 Prospective Changes in State Ownership under the NRMP

The changes in railway industry structure mandated by Law no. 23/2007 have important implications with regard to ownership status. The NRMP envisions that national railway infrastructure will remain state-owned for the foreseeable future. However, the same will not be true for railway operators. The NRMP does not plan to seek majority state ownership in any new rail operators that may seek to compete with PTKA. Such operators therefore will not be subject to the authority of the Ministry of State-Owned Enterprises. (It is possible, however, that a new operator could be majority-owned by a sub-national public body and would be subject to legislation governing such public entities). It is also the intent of the NRMP that, when the above-rail operations of PTKA become fully legally separated from infrastructure management, the PTKA successor operator will cease to be a BUMN and Government will withdraw from its majority ownership of the enterprise. This will put the PTKA successor on an equal footing with other operators that do not have BUMN obligations. This conversion is not expected to occur until the third or fourth phase of the NRMP, but it is consistent with the objectives of the Ministry of State-Owned Enterprises objective of reducing state ownership and promoting the private sector economy.

2.3 MINISTRY OF TRANSPORTATION

Government responsibility for the rail sub sector in Indonesia since independence has been and remains with the national government ministry responsible for transportation. The formal titles of the transportation ministry and its scope have changed over the years. As noted above, however, the term MOT is referenced throughout.

2.3.1 Overall Responsibilities

The Minister of Transportation's role is defined as to assist the President in performing government duties in the field of transportation. These duties include:

- National policy formulation, technical policy development, and policy implementation for the transport sector.
- Management of properties and assets under the responsibility of the MOT.
- Supervision and implementation of government tasks in the transport sector.
- Submission to the President of evaluation reports, suggestions and advice relative to transport issues.

The MOT has the primary role among national government agencies for implementing reliable transport services that are competitive and provide value-addition to the national economy, with the principal exception of roads and highways development, which, at the national level, is the primary responsibility of the MoPW DGR, while responsibilities for provincial and local roads have been devolved to the respective sub-national levels.

MOT's responsibilities include:

- Maintaining the level of transport services and transportation facilities.
- Implementing consolidation through restructuring and reform in the field of transportation infrastructure.
- Increasing community access to transportation services, and
- Improving the quality of transportation services that are reliable and provide added value.

The MoT currently has the structure and staffing levels as shown in the accompanying table. The Directorate of Sea Transportation is by far the largest unit with the Ministry primarily because most labour forces operating the ports—including stevedores, tug and dredge operators, maintenance workers, security forces, and office clerks remain government employees, similar to the labour regime of the national railway in earlier decades, prior to its restructuring as an enterprise. The civil aviation staff is large for similar reasons. By comparison, staff numbers for both, the DGLT and the DGR are small principally because the bulk of operating employees in these two sectors are mainly employed in the private sector.[9]

[9] In the case of Railways, most employees were reclassified when they were transferred to PTKA when the railway was restructured as an enterprise. In the case of land transport, most personnel are either road transport owner-operators, construction and maintenance contractors, or their employees or sub-contractors, while road infrastructure planning and development is the responsibility of the Ministry of Public Works Bina Marga Directorate or its sub-national equivalents, not MoT.

The primary responsibility for safety and technical regulation of the various modes is inside the specific Directorates within the MOT. The Directorate Generals also have a wide range of policy and administrative functions. However, economic regulation, aside from licensing entry of new private rail transport firms, is extremely limited. The multiplicity of small operators in the motor carrier market and bus markets has resulted in little attention to economic oversight in those market segments, except to some extent for taxi services in major markets, e.g. Jakarta. Rail and the few large urban rail transport services were traditionally operated as units of national public departments, so these did not require independent regulatory bodies. While the corporatisation of these units has moved forward, development of an independent economic regulatory structure has lagged behind. What economic regulation that does exist, is still handled by the line directorate generals for each mode. Currently these line directorate generals are as described below.

Ministry of Transport Units	Staff Size (2008)
Secretariate General	972
Inspectorate General	230
Directorate General of Land Transportation	610
Directorate General of Sea Transportation	17,953
Directorate General of Civil Aviation	6,899
Directorate General of Railways	409
Education and Training Agency	2,633
Research and Development	247
National Search and Rescue	1,388
Total	**31,341**

2.3.2 Directorate General of Land Transportation

The DGLT encompassed both road and railway, as well as inland waterways, until 2006, when the current railway directorate was created. There are currently four Directorates within this DG as outlined below:

- Road Traffic and Transportation.
- Directorate of Waterways and Ferries.
- Directorate Urban Transport Systems. (Note that this directorate has some coordinative functions that impact on urban rail transport.)[10]
- Land Transport Safety Directorate. (Note also that the Land Transport Safety Directorate may have some coordinative functions that impact railway transport.)

2.3.3 Directorate General of Sea Transportation

DGST is the largest General Directorate, as public sector operating units are very prominent in the maritime transport segment. It contains five directorates as listed below.

- Directorate of Traffic and Sea Transport
- Directorate of Ports and Dredging
- Directorate of Ships and Shipping
- Directorate of Navigation
- Directorate of Sea Security and Coast Guard (KPLP)

[10] Articles 4 through 11 of Law no. 23/2007 may be read to imply that urban mass transit fixed guideway systems are in the scope of the MoT's special railway category of the RMP, despite such urban rail systems being physically independent of the general system of railways and employing unique technologies.

Ports policy is of significant importance to PTKA and/or to special purpose railways associated with import/export traffic, particularly for the development of container movements and for export of coal. *The NRMP does not spell out a formal relationship with the Ports Directorate because the need for coordination will arise in connection with specific initiatives that may encompass a wide range of infrastructure requirements on both the rail and port components for creating effective connectivity. A task force for due diligence on any such national infrastructure projects may be led by BAPPENAS under present institutional arrangements.*

2.3.4 Directorate General of Civil Aviation

The DGCA is responsible for MoT policy formulation in the field of air transport, aviation safety, air worthiness certification, airport engineering, electronics and electrical facilities aviation; for policy implementation in the field of air transport, aviation safety, air worthiness certification, airport engineering, electronics and electrical facilities aviation; for formulation of standards, norms, guidelines, criteria, and procedures in the field of air transportation; provision of technical assistance and evaluation; and general administration of the DGCA. It is the second largest unit within MoT due to its functions in operating public airports and air traffic control and navigation units.

2.3.5 Directorate General of Railways

The DGR is responsible for the preparation and implementation of national policy in the field of railway transportation, infrastructure, safety, and railway facilities engineering, together with the formulation of standards, norms, guidelines, criteria and procedures in these fields. The Directorate retains control of the specifics of investment in any infrastructure, information technology, or rolling stock that is used for any purpose that is not strictly and completely commercial for-profit.[11] The DGR decides what the investment program will be and then manages the purchase or construction programs. These programs amount approximately USD 300 million per year.

Of current importance, DGR is responsible for the development of this NRMP. Further description of DGR's functions follows in Section 2.4.2.

2.3.6 National Transportation Safety Committee

In addition to the line agencies within MoT, Indonesia also has a National Transportation Safety Committee (NTSC), established by Presidential Decree in 1999 (Keppres No. 105/1999), as a permanent independent institution responsible to the public through the MOT.[12], Indonesia's NTSC is responsible for the investigation of the safety deficiencies of aviation, maritime and land transport. Although the NTSC so far has dealt primarily with aviation, it has investigated railway derailments and track condition issues. Based on the results of accident investigations, the NTSC recommends actions to be taken to prevent the recurrence of similar accidents. The NTSC conducts research and studies necessary to perform its duties, and to identify possible safety deficiencies. The sole objective of the NTSC is to prevent accidents/incidents, not to apportion blame or liability.

[11] Even in the case of private for-profit investments, presumably the safety standards, norms and guidelines promulgated by DGR would be expected to be adhered to.
[12] Presidential Decree. 105/1999

2.3.7 Other MoT Units

MoT also contains a General Secretariat, Inspectorate General, Training Center, and Research and Development Agency. Each of these units will play a significant role in administration of the NRMP.

2.4 RAILWAY SECTOR LEGAL/REGULATORY FRAMEWORK

2.4.1 Railway Law

Based on inputs from varied parties that Law no. 13/1992 on railways was incompatible with progress in technology and fulfillment of customer demand, the government amended that law into Law no. 23/2007 on railways. One of the important changes is the abolition of the monopoly right of PTKA by providing an opportunity for private sector to organise enterprises of railway infrastructure (including management of track, electrification systems, signaling, stations and other fixed assets and associated maintenance services) and operations (that is, above-rail freight and passenger services, including management of rolling stock and associated equipment and assets related to train operations). This abolition of monopoly status is intended to encourage private investment in railways, as either operators (expected to improve quality of railway service) or investors in railway infrastructure and rolling stock, and to expand coverage of railway network in Indonesia. Other revisions relate to decentralisation (to comply with the regional devolution policy) that allows LGs to act as investor and operator of railway infrastructure and facility for their territories. In the future, it will be possible to undertake railway investment and funding using Public Private Partnership (PPP), private financing, or local public funding. The revised or amended law also addresses authority, service standardisation, certification, licensing and protection of customer's rights. The law recognises that the railway is an economic sector to be organised by sector participants in manners that are efficient, professional and supportive to national economy. Railway infrastructure and service businesses, which were previously bureaucratic in nature, are to be changed to a corporate focus that emphasises service reliability, efficiency, and direct interaction with economy and industry.

Law no. 23/2007 requires both restructuring of PTKA and promotion of private sector involvement, including possible sale of state assets, concessions granted through the schemes of PPP, franchising, leasing and/or Build, Operate and Transfer (BOT) arrangements. Regional devolution with an increased role for regional/local public bodies is also required. The law also states that, "the body of railway infrastructure management should be separated from the one managing railway operations, thereby allowing equitable access to rail tracks without discriminating against any operator." To respond to the law, PTKA is expected to investigate means to obtain cooperation in railway investment and operation and expansion of inter-modal transportation with both the private sector and LGs, while it is likely to retain its domination over intercity railway transport in Indonesia. However, the law requires implementation detail in the definition of, and boundaries between, these services as well as on what constitutes an acceptable degree of separation, and on what constitutes an acceptable period of transition to separation. (Members of the European Union (EU) have taken over a decade to resolve these matters and there remain quite significant differences in interpretation and implementation among EU member states). As in other countries, PTKA is expected to remain extensively involved in all railway businesses due to its extensive managerial and technical experiences that have been developed over many years. *Providing an implementation strategy for the aspects of Law no. 23/2007 is one of the major tasks of Chapter five: Institutional Reform Strategy.*

2.4.2 Directorate General Railways Organisation and Responsibilities

There are three Directorates within DGR, in addition to a central planning office. Each will be key units in implementation of this NRMP. ***[Note DGR may choose to update its draft NRMP description of directorate functions in substitute for this section.]***

Directorate of Railway Traffic and Transportation (Lalu Lintas dan Angutan Kereta Api), which has the responsibility to prepare and implement policies in the field of network development and transportation between cities, urban transport, promotion and business development. Its functions include:

- Formulation of standards, norms, guidelines, criteria and procedures in the field of network development, traffic and transportation between cities, traffic and urban transport, promotion and business development.
- Preparation of the formulation and provision of technical assistance in the field of network development, transportation between cities, urban transport, promotion and business development.
- Preparation of the general plan of the railway network, including trains for special purposes.
- Formulation and implementation of promotional materials and business development in the field of railways.
- Implementation of evaluation and reporting in the field of network development, traffic and transportation between cities, traffic and urban transport, promotion and business development.

Directorate of Technical Support [Infrastructure] (Direktorat Teknik Prasarana). Its mission is to provide reliable, secure, safe, convenient, well maintained infrastructure, adequate and capable of supporting the needs of national development; to support a competitive, efficient, affordable, environmentally friendly, sustainable network, supported by professional, independent and productive human resources, and to support the growth of a business climate conducive to the development of private participation, to otherwise contribute to accelerating economic growth and creating jobs. The Directorate is charged with restoring services and infrastructure facilities to the level of normal conditions to improve the safety and smooth running of railways; increasing the capacity and quality of railway transportation services to support the increasing demand for passenger services and goods that have exceeded the existing capacity; and supporting opportunities to the private sector to play an active role in the development of railways in Indonesia.

Directorate of Safety and Technical Support (Direktorat Keselamatan dan Teknik Sarana) has the responsibility for improving the conditions of railway facilities and rolling stock for the safe and efficient operation of trains, for increasing railway capacity to meet increased demand for both passengers and goods, and to support the realisation of an effective transportation system. Its functions are described as follows:

- Preparation and implementation of policies in the field of engineering and fitness facilities, railway safety management, advocacy and civil investigators, as well as accreditation and certification of human resources including labour inspectors, testers, operations, infrastructure maintenance and rail facilities.
- Formulation of standards, norms, guidelines, criteria and procedures in the above fields.
- Provision of technical assistance in these fields.
- Investigation of safety-related actions and guidance of civil servants in the field of railways.
- Oversight of the management of facilities maintenance owned by the State Railway.

- Implementation of evaluation and reporting in the field of safety and technical standards for railway rolling stock.

2.5 RAILWAY OPERATING ENTERPRISE (PTKA)

PTKA (the Indonesian state-owned railway company) is a public transportation body that not only performs parts of the government's functions (under the DGR) in serving the public, but is also supposed to make profit (as a limited liability company). In accordance with Law no. 23/2007, the DGR is to make policies and develop railway organisation (infrastructure and facility/transportation) by regulating, controlling and supervising railway organisation. However, it is not chartered to undertake the commercial management of PTKA or to serve on the board of directors for the company, which has an independent board of directors. Government, under the new law is authorised to appoint (a) a state owned company to operate the infrastructure, (b) a private company, or (c) a company owned or operated by regional governments. This NRMP does not envision revoking PTKA's licenses to provide infrastructure *and* railway operating services in the near term, but does envision a systematic process of accounting separation, subsidiary creation and eventual corporate separation. (See Chapter five). The resulting organisational structure is expected to improve investment and competition climate to achieve better railway for Indonesia.

As noted, the new law provides for the separation of infrastructure management and railway service ("above-rail" train operations) functions, on what nominally appears to be the Western European model of "vertical separation." Within the European Union (EU), the scope of the separation of infrastructure management and train operations is spelled out in some detail in numerous EU directives, together with an elaboration of how access to the railway infrastructure should be granted to above-rail operators. European rail carriers responded to these rules through accounting, organisational and legal changes that were tailored to rail sector conditions in each country (both EU members and prospective members and associates) and detailed terms and conditions of access have been formally published as "Network Statements" by the railway authorities responsible for infrastructure. This process has not yet been implemented in Indonesia, but the NRMP envisions a similar evolutionary process.

2.5.1 Historical Evolution of Railway Infrastructure Management and Rail Service

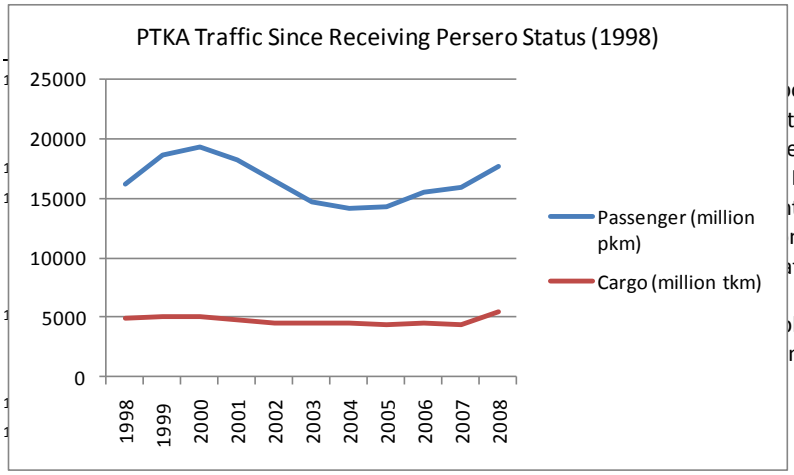
From Independence to the present, the management of railway infrastructure and the provision of passenger and freight rail service has been in the form of a single, vertically integrated public monopoly. After Indonesia gained independence in 1945, the colonial rail network was organised as a state entity designated Djawatan Kereta Api or DKA, with the status of a departmental agency under the ministry responsible for transportation. Several reorganisations and name changes followed, for the railway as well as the Ministry, but the rail network operators remained civil service public entities, run as departmental agencies (Perusahaan Jawatan or Perjan)[13] until 1991. In that year, the government's increased focus on the railway sector and its strong desire to increase sub-sector efficiency led to a decision to convert the railways from a departmental agency (Perjan) to a somewhat more autonomous and commercially oriented "public corporation," (Perusahaan Umum or Perum).

[13] A departmental agency in Indonesia is a public service as provided by a department, a directorate general, or a directorate, or by a regional government; its capital is part of the State budget of the related department and its staffing is an ordinary part of the department or regional government's composition. It is not managed by a board of directors but is led by a head of a department, a directorate general, a directorate or a regional government.

Consequently, the organisational structure was changed to that of a state-owned enterprise, named Perusahaan Umum Kereta Api (abbreviated to Perumka), which was intended to have a more commercial management focus, while maintaining an obligation to provide public services and preserving a good deal of policy oversight in the controlling Ministry. The expected commercialisation of Perumka was strengthened by the passage of Law no. 13/1992 on railways that was part of a broader restructuring of State Owned Enterprises (BUMN)[14]. Government accompanied this change with a set of policies and action plans that included strengthening the railway management capacities and systems, modernising the railway operating regulations and encouraging private sector participation (PSP). To support the development of Perumka, the Government sought and obtained World Bank assistance through a Railway Technical Assistance Project (RTAP) (1987-1993) and two private sector development loans (1989-90; 1990-91). Its objectives were also supported by the 1995-97 World Bank Country Assistance Strategy. This strategy called for supporting infrastructure investments to eliminate bottlenecks, improving the regulatory framework for private sector participation, increasing operational efficiency, and strengthening infrastructure sector management. Prior to the completion of the RTAP, government requested continued bank support for plans to improve performance of Indonesia railways in the Railway Efficiency Project (1997-2002). Implementation of this project was severely impacted by the Asian economic crisis that ensued shortly thereafter, and the project had only limited impact.[15]

These government supported international technical assistance efforts, concluded that the 1991 restructuring creating Perumka was inadequate to create the desired commercial focus in railway operations. After several studies were prepared on the necessary restructuring, it was decided that a further organisational move away from government status was necessary. Perumka – legally a "Perum" or a wholly state-owned public corporation requiring Ministerial approval over financial matters – therefore was converted to a "Persero" – a state controlled limited liability company. This Persero would be more fully controlled by its board of directors[16]. Hence, in 1998, Perumka became Perseroan Terbatas Kereta Api Indonesia - Persero, (shortened to PT. Kereta Api [Persero], PTKA), a state owned enterprise, through Government Regulation no. 19/1998[17]. PTKA was intended to provide high quality services that were competitive and profitable in order to increase company's value[18]. Under this reform, private sector investment in PTKA became acceptable, but at least 51 percent of the company's shares are required to be owned by the State through direct capital investment[19]. In related adjustments, the Jabodetabek (Jakarta metropolitan area) suburban railway was separated from the Java intercity rail system. In addition a Joint Decree of BAPPENAS, MoF and the MoT and its implementing regulations were issued to establish the legal basis for Public Service Obligation (PSO) agreements, Infrastructure Maintenance and Operation (IMO) agreements, and Track Access Charges (TAC). The government also established a high level Inter Agency Coordination Committee (IACC) and a Restructuring Task Force (RTF) to see the reforms through.

Despite these changes, however, results from the railway reform efforts still proved disappointing. The newly established Persero was not immediately reorganised along "line of business" principles as



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Report (SCL41060), June 29, 2005.
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ment Regulation No. 12 / 1998 on Persero

had been intended, and the exact terms of PSO, IMO, and TAC arrangements were never agreed to and implemented. The company's assets were not revalued, tariff rationalisation plans were not carried out in a timely manner, and a framework for PSOs was never adopted. As the accompanying chart demonstrates, passenger and freight traffic volumes remained basically stagnant over the last decade and there have been only limited changes in the composition of services[20]. In the context of a growing economy, this indicates that rail transport has declined in market share.

This disappointing rail sector performance led eventually to the passage of the current Law no. 23/2007 on railways, with its mandate to create a RMP, incorporating a detailed phasing in of policy, regulation and operational reforms, supported by an investment plan targeting dramatic increases in railway infrastructure development. The current policy environment reflecting these latest changes is described below. This description recognises the difficulty of accomplishing major reforms in the transport sector unless structural changes are accompanied by (1) a strong policy commitment about the role of the different transport modes, (2) the financial resources to overcome past infrastructure deficiencies and asset under-investment, and (3) a realistic transition strategy.

2.5.2 PTKA Current Structure

The national Indonesia railway company, although restructured to provide a commercial focus, remains a government owned institution with an exclusive position in intercity and most regional and municipal rail service. As noted previously, the railway was reorganised in 1998 as Perseroan Terbatas Kereta Api Indonesia (Persero), commonly abbreviated to PT Kereta Api (Persero) or PTKA. PTKA is used for brevity throughout this NRMP.

Based on Law no. 19/2003, Article 21 paragraph (1), the Management of PTKA is obligated to prepare an annual "Long-Term Company Plan" (Rencana Jangka Panjang Perusahaan or RJPP). The RJPP represents a strategic plan delineating the company's targets and objectives to reach over the next five year time period. Furthermore, Article 21 paragraph (2) requires that the RJPP, after signing by the Company Management and Commissioner, is to be presented at a General Assembly of Share Holders (RUPS) for validation. These provisions are carried over into Law no. 23 (2007) via Article 215, which specifies that all provisions that were included in the prior law remain valid unless contradicted by the new law.

In accordance with the 2002 Decree of the Minister of State-Owned Companies, the Management of PTKA is obligated to prepare the RJPP as guideline to company management for improving the company efficiency and productivity in the next five years.[21] The RJPP is also required to refer to KEP-100/MBU/2002 on Evaluation of Health of State-Owned Companies. The regulations and laws then state that the RJPP document "shall be prepared with systematisation and shall include the essentials as stipulated by the aforementioned Decree of the Minister of State-Owned Company." PTKA has produced the required plans and reports.

[20] The most significant change has been price adjustments that have shifted the mix of passenger services towards a more commercial type of service.

[21] No.KEP-102/M-BUMN/2002 dated 4 June 2002 on Preparation of Long-Term Plan of State-Owned Company,

CHAPTER 3: CURRENT CONDITION OF THE RAIL SECTOR

Indonesia currently has one railway, a wholly state-owned limited liability company, PTKA. It is controlled by its board of directors but subject to the oversight of the DGR and several other government bodies. Institutional relationships are described in Chapter two: Present Governance of the Rail Sector. This chapter reviews the status of railway activity in Indonesia, railway operating characteristics, and generally reviews the condition and position of the railway within the Indonesian transport sector.

PTKA is actually four unconnected rail systems on two of Indonesia's major islands. All four railway systems are built to Cape Gauge (1067 mm) using a relatively light standard. The map below shows the major rail systems in green lines.

Indonesia is reported to have nearly 6,000 kilometers of railway lines, of which approximately 4,500 kilometers are currently in operation, and the remaining lines are out of service at the moment. About 400 kilometers of the rail network is electrified (1.5 kV-DC) for local commuter services in and around Jakarta. PTKA has approximately 560 diesel-electric locomotives, 30 four car Electrical Multiple Units (EMUs), 130 diesel-electric rail cars for passenger services, 1,200 locomotive-hauled passenger coaches in a variety of configuration, including dining coaches, and about 10,000 freight wagons, many of which are 2-axle freight wagons. The network relies on a variety of systems, both electrical and mechanical, for train control. Most PTKA lines use R54 and R43 rail, concrete sleepers, and a 250 mm ballast section. Typical axle loadings on Java are 15 tonnes per axle with some lines able to handle 18-tonnes/axle. This relatively light axle loading (more typical of narrow gauge railways is a 22.5 tonne axle loading) tends to limit the usefulness of the railway for freight services (since most 2-axle freight wagons weigh approximately 18-tonnes, leaving only 12 to 15 tonnes for lading; most 4-axle wagons weigh 25 tonnes, yielding a wagon payload of approximately 35 tonnes – a low limit for bulk commodities, typically a railway mainstay).

PTKA's own internal analysis of its current trends and its plans to exploit or remedy the potentials and problems as revealed in its Long Term Corporate Plan 2009-2013 have been reviewed in preparation of this report. Statistics characterising comparable rail systems were also reviewed; most of the comparable rail systems were similar to Indonesia's railway system, that is, railways with legacy rail technologies, high population densities, mineral and fuel deposits near water transport, and growing economies.

The new railway law (no. 23/2007) allows for the possibility of other users accessing the national rail network to provide rail-based services and encourages private investment in railway lines and facilities to promote investment and growth in the rail sector. Based on this new law, a private investor has formally proposed to build and operate a new rail system on Kalimantan. One of the issues to be addressed in this chapter is how PTKA is organised and structured to respond to the new railway law.

An effective NRMP must include an accurate assessment of the current status of the railway network. This assessment starts with a brief examination of railway history in Indonesia to provide context for today's condition and structure. Then, a rough comparison of Indonesian railway with other similar railways for size, scale, and economic context, examines overall efficiency of the railway against a selection of peers. Given the intended focus of the NRMP on infrastructure development, primary attention will be given to what can and cannot be done effectively with the type of gauge and track conditions prevalent on the Indonesian railway.

Since the primary focus here is on the national RMP, primary attention will be placed on the intercity lines and other nationally important strategic lines, such as the coal lines. The discussion will also review track condition – derailment statistics, broken-rail reports, history of slow-orders, number of sleepers replaced by year, gross ton kilometers on rail segments, and other indicators that the track structure is, or is not, satisfactory. The electrification/catenary system will be reviewed as part of infrastructure. The age and condition of major assets – locomotives, freight wagons, passenger equipment, etc. – as well as human resources, information systems and so forth are also reviewed. Non-infrastructure assets are assessed primarily in terms of their impact on infrastructure requirements, including discussion of the trade-offs between infrastructure and non-infrastructure costs and investment needs.

3.1 INDONESIA'S RAILWAY LEGACY

3.1.1 Technology and Public Policy Objectives

During 1942-1945, the Japanese forces of occupation largely succeeded in relaying Indonesia's railways of various gauges inherited from earlier decades to standardise on its own 1.067 meter gauge, which was retained by the Dutch Colonial administration when it returned, and has been subsequently ever since.

By 1950, when Indonesia gained full independence, the renewal needs of the railway reflected decades of war and economic catastrophe. It appears that most lines were repaired in kind; that is, with the capacity limitations originally built into them almost thirty years earlier. When Indonesia's first diesel-electric locomotives were ordered in the early 1950s, these locomotives had an unusual bogie arrangement of A1A + A1A, the extra axles being used to reduce the axle loadings (weight per axle) on the lightly built track structure. Locomotives of that era with this bogie arrangement usually carried two 10-cylinder diesel engines; however, Indonesia's low axle loadings tracks did not permit more than a single eight-cylinder engine to be used.

Dieselisation continued with motive power being of the same unusual design, very small diesel engines – eight cylinders instead of 12 or 16 cylinders – mounted on six axles, of which only four might be powered instead of usual all six axles. The small diesel engines employed did not generate enough power for the other two "dummy" axles. The middle wheels in each bogie were used to distribute the weight of the locomotive across more axles, not for tractive effort. Locomotives with this design were ordered as late as 1982, long after the A1A bogie had become obsolete elsewhere.[22]

Main-line speeds remained low: between 60 and 120 kilometers per hour, with most in the 100 kilometers per hour range for passenger trains. Vacuum brakes remained standard on the limited number of new coaches ordered, limiting the weight of wagons and coaches, and hence of trains.

Axle loadings remained within the 12 to 13 tonne limits and the speeds attained on many lines were below the pre-World War II standards. Both freight and passenger wagons were relatively inefficient – heavily built, but with overall carrying capacity limited by the low axle loadings that predominated on the lines. This made cargo wagons particularly inefficient, since wagons often weighed more than the cargo they carried.

According to various accounts, investment in the national rail system remained at a level sufficient to maintain simple functionality up through the 1980's. Trains were operated, assets were repaired, and some assets replaced, even modernised. But the value-added by these inadequately-compensated activities drifted to the margins of Indonesia's economy.

Telling of these efforts was the goal of restoring the Jakarta to Bandung passenger express trains to their 1930's timetable – a time table that existed 40 years' earlier. These efforts were short-lived because of underfunding of infrastructure routine maintenance. The national system also began to abandon the ultra-light tramways that remained. Technical progress remained limited: steam locomotives were not eliminated until the mid-1980's. The elimination of steam engines and the abandonment of the increasingly costly tramways they operated over did act to reduce the rail networks' financial losses. Unlike the road system, the losses on the national railway system were noticeable. No new services, passenger or cargo, were introduced during this period. Instead, in the 1980's, the concept of public funding of third class railway passenger services was built into the compensation system.

When, in 1991, the PJKA was "reformed" into PUKA, (a Perumka, or generalised publicly owned corporation), it was hoped it would create new, profit-motivated services that would eliminate the need for government subsidies by generating profits in these new services that would cross-subsidise the losses stemming from the increasing masses of third class travelers. The hopes were partly realised. New passenger services were created and the PUKA approached above-the-rail self sufficiency. By 1994, the PUKA reported a modest operating profit. The PUKA engaged in a program to upgrade tracks. Concrete ties and heavier rail on some passenger lines permitted the establishment of commercial classes of passenger service. The subsidised third class volume continued to grow, reflecting Indonesia's growing urbanisation and population, and the simple fact that the service was subsidised.

In the end, the government subsidies did not match the costs associated with providing train services. It also appears that any operating profits from the provision of higher priced commercial services were drained off to support the third class services rather than supporting further investment in infrastructure or renewal of equipment.

[22] An example of a similar effort was the B – 2 – B diesel-hydraulic BB204 series supplied with MTU and Voith

Table 4: Passenger Kilometers by Class of Service

Year	1981	1991	2000	2008
Commercial Main Line	986	1929	5765	4924
Third Class Subsidised	3,689	5,801	8,517	6,223
Jabodetabek	621	788	3,164	3,959
Total	7,277	10,509	19,446	17,114
Commercial Main Line	14%	18%	30%	29%
Third Class Subsidised	51%	55%	44%	36%
Jabodetabek	9%	7%	16%	23%

Source: PTKA Statistics

In 1997, the economic crisis ended the growth of traffic and much of the investment in the railways until 1999. From 1998 until recently, passenger volumes have remained about constant. *Nonetheless, it must be recognised that the initial reforms were successful in the Java passenger business in certain key aspects:* The railway services in Java were transformed from a Ministerial social service, where over half the riders were subsidised third class ticket holders, to a commercial component of the economy. By 2008, only one third of the riders were third class, despite the number of third class riders having increased by almost seventy percent. Commuters – Jabodetabek – and commercial riders increased 540 percent and 400 percent, respectively. The reforms and what investment funds were available had created a Javanese urban commuter and intercity business railway service.

Axle loads were also raised on a number of lines, and the process continues today. Technical improvements were made that permitted faster and heavier wagons and rolling stock. These improvements include replacing vacuum brakes with automatic air brakes; the use of heavier and continuously-welded rail, the use of concrete ties, and the installation of modern signals.

Freight, however, was generally neglected. Sumatra continued to haul coal, and this service remained economically important. But wagon size remained limited and net-to-tare ratios were poor. Many branch lines were operated on a “flag stop” timetable, with freight trains operated “as needed”; the intermittent freight service further reducing the value-addition by the railways.

The economic crisis of 1997 also appears to have had the effect of largely locking the railway into its current technical limitations. The existing locomotive fleet was built for approximately fourteen tonne axle loads and speeds typically of 100 kilometers per hour or less. Furthermore, the fleet is not presently configured to utilise a major advantage of EMD and GE diesel-electric: the ability to couple two or more locomotives into multiple-unit (“MU”) operation, permitting heavier or faster trains. This fleet, while being modernised, is not able to generate the tonne-kilometers per hour to create attractive freight revenue streams or to operate longer, more profitable, and faster passenger trains.

The modernisation and expansion of capacity on main lines appears to have been done in ways that are atypical of modern railroads, whether publicly or privately owned. There has been a lack of standardisation in infrastructure investments. PTKA now has not less than three different types of modern track fasteners, and the main lines have at least three different designs of automatic traffic control signaling. A national rail network, for reasons of operating efficiency and maintenance

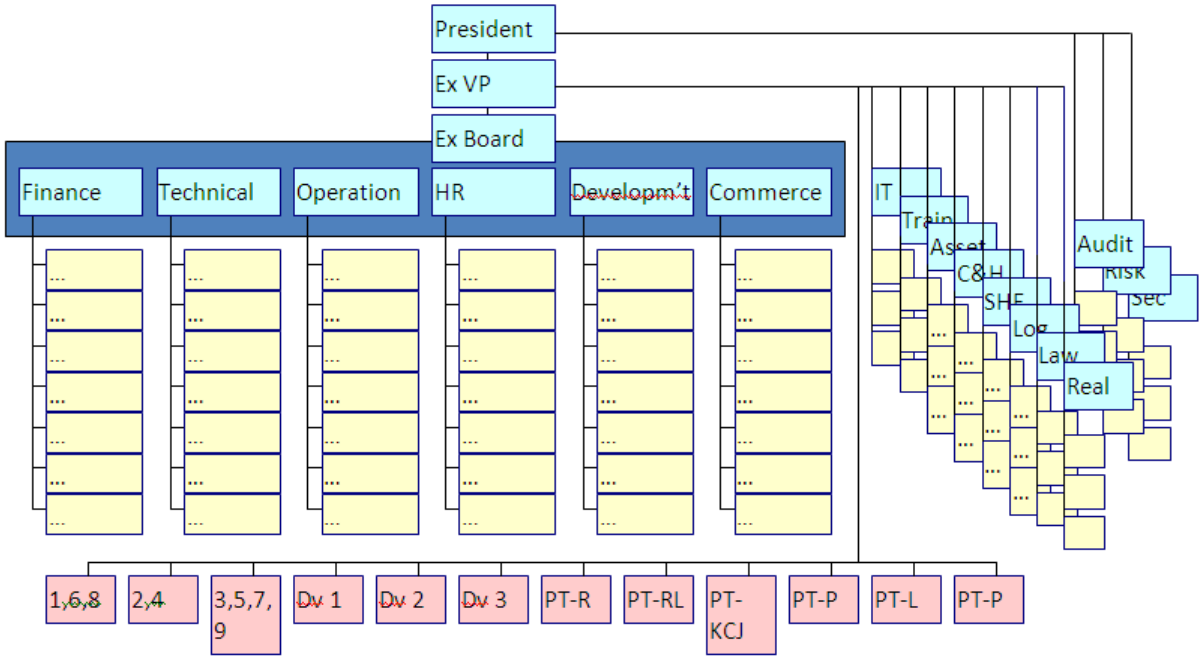
economies, will tend to standardise infrastructure designs. Informal discussion suggests the current behaviour has been influenced by the source of development bank financing rather than by engineering and maintenance cost considerations.

Another atypical practice is the choice to expand capacity by adding more tracks – double tracking – rather than by increasing the capacity of each track through the use of more intensive signal density, heavier wagons, longer trains, or faster and more powerful locomotives. Indonesia continues to add double track in Java's main inter-city corridors, and in the Jabodetabek region. Between 2002 and 2006, Indonesia constructed over 110 kilometers of double track to improve capacity and remove bottlenecks.

3.1.2 Organisation Size and Structure

PTKA currently employs some 26,000 staff divided among a number of organisational units. Its roots are in the colonial era as a government sponsored public service and its current organisation structure reflects this tradition. The current structure has an executive board composed of key departmental officers with most of the organisation units reporting to the executive vice president. Including field units and owned enterprises, the executive vice president has some 26 direct reports, according to the PTKA official organisation diagram.[23]

Figure 1: PTKA official organisation diagram



PTKA explains that its organisation structure is a matrix-based structure with the headquarters organised along departmental lines and field units organised similarly. It is a complex, internally focused structure. Customer relationships are managed at the departmental or field unit level.

Even though the new railway law, calling for other railway access to PTKA's infrastructure was passed in 2007, the railway appears to have taken no steps to structure itself for such access or to provide sufficient accounting details necessary to develop infrastructure access charges. Although PTKA has

[23] PTKA official in 2009.

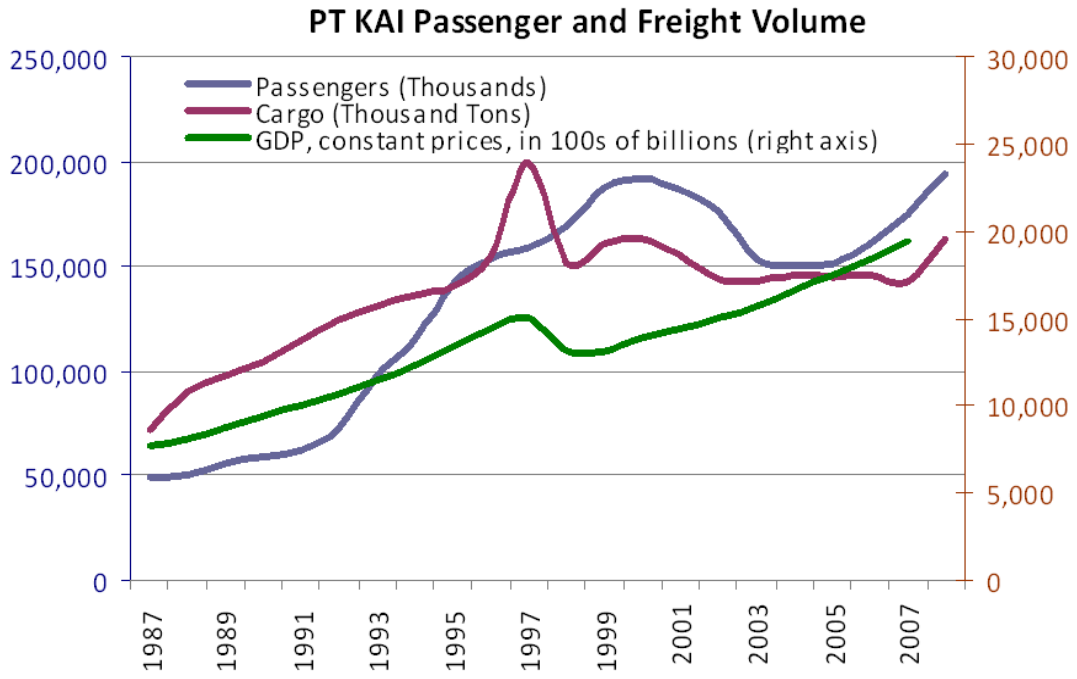
taken recent steps to improve the capacity of its Information Technology resources, and has explored lines-of-business costing approaches, there remains a vast amount of work to be done in this area.

3.2 CURRENT PERFORMANCE CHARACTERISTICS

3.2.1 Recent Traffic Trends

Railway passenger traffic grew rapidly from 1987 to the Asian financial crisis of 1997, climbing from some 50 million passengers to nearly 200 million passengers by the time it peaked in 2000. After that, traffic declined and has only recently recovered to the 2000 level with the recovering economy.

Figure 2: PT KAI Passenger and Freight Volume



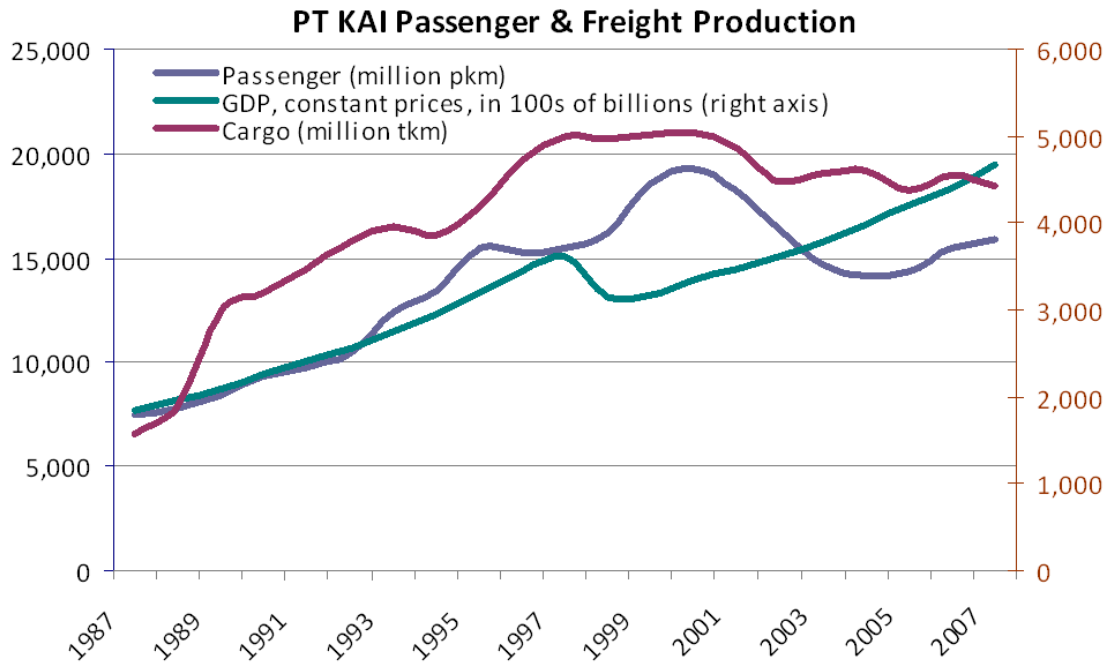
Source: PT KAI submissions to the Directorate General Railways

Railway freight traffic grew quickly as well, from about 8.5 million tons in 1987 to a peak of about 24 million tons in 1997, after which freight traffic declined to about 17 million tons and remained relatively flat, rising again only in the last two years. Note that freight traffic did not increase with the recovering economy, indicating that railway market shares declined throughout the period after 2000 until the modest reversal experienced in 2008.

When measured by production (passenger kilometers and tonne-kilometers), the picture is not significantly different. Passenger production climbed from about 7.5 million passenger-kilometers in 1987 to a peak of a little over 19 million passenger-kilometers in 2000 before declining to the 15 million passenger-kilometer range for the last decade. The green line in the chart below provides a reference to GDP growth in the economy (in constant prices). It shows passenger traffic climbing in the wake of the 1997 financial crisis and then declining as GDP recovers.

Freight traffic grew from about 1.5 million tonne-kilometers in 1987 to 5 million tonne-kilometers in 2000, remaining at that high level even after the Asian financial crisis. Over the last decade, freight production has remained at around 4.5 million tonne-kilometers while GDP grew at a rapid rate, indicating a fall in rail market share over the period.

Figure 3: PTKA Passenger & Freight Production



Source: PT KAI submissions to the Directorate General Railways

Over this period, passenger patronage has remained concentrated almost entirely on the island of Java (consistently around 98 percent of all passenger trips, and 95 percent of all passenger kilometers). Average passenger trip lengths have remained between 95 and 100 kilometers, indicating the dominance of urban passenger services.

3.2.2 Financial Issues and Recent Performance

Currently PTKA operates as a commercial enterprise with some passenger services provided a direct subsidy through a PSO type contract with the MOT. PTKA operates many passenger services on a commercial basis and provides third class intercity services as well as urban rail services in Jakarta (through its Jabodetabek operation) under the PSO arrangements.

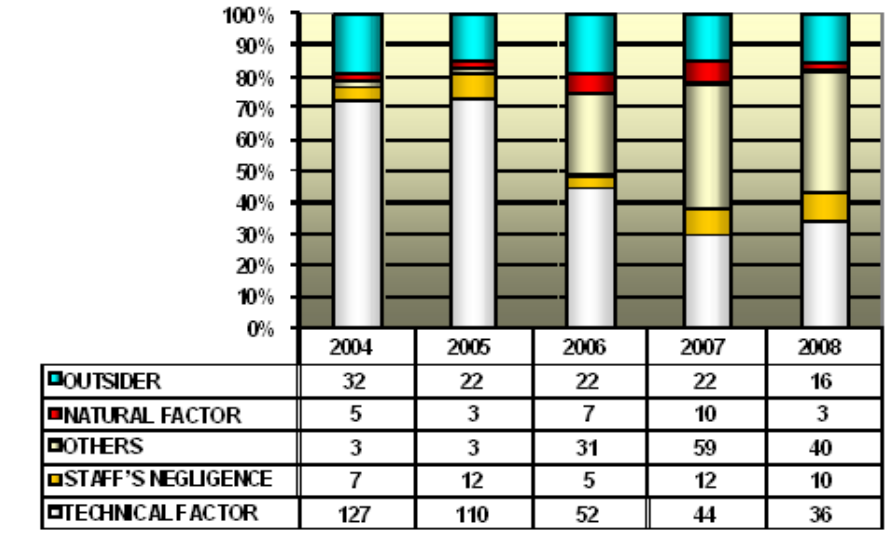
Since 2002, revenue for passenger services has remained relatively constant at about 1,500 billion rupiah while freight revenue has climbed from about 400 billion to nearly 1,200 billion rupiah in 2006, as a result of freight tariff increases. It is possible that rail market share has declined (or rail traffic remained relatively constant in the face of a growing economy) as a result of price elasticity.

Government also compensates PTKA for infrastructure operations and maintenance through a payment covering those charges while charging the railway for access to the infrastructure. In recent years, it has been the custom to set access charges for use of the infrastructure exactly equal to PTKA spending for infrastructure operations and maintenance indicating that there is no specific subsidy for railway infrastructure. However, the Government plans and constructs railway infrastructure. Theoretically, there should be significant interchange between government and PTKA in the development of investment plans, however, there appears to be only nominal coordination to date.

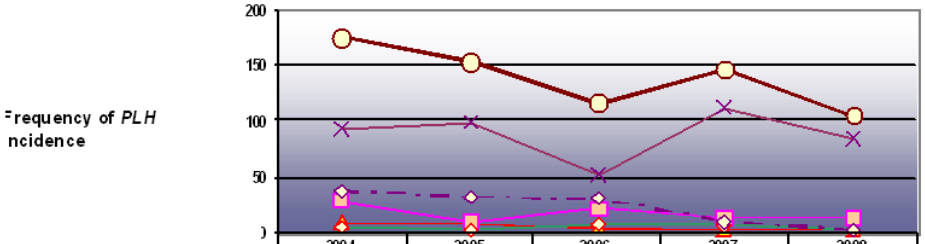
3.2.3 Safety Issues

Railway safety performance has improved steadily over the past five years, with PTKA caused accidents declining significantly.

Figure 4: Contribution Percent and Number of Accidents resulting in Significant Human Fatalities and Injuries



	2004	2005	2006	2007	2008
OUTSIDER	32	22	22	22	16
NATURAL FACTOR	5	3	7	10	3
OTHERS	3	3	31	59	40
STAFF'S NEGLIGENCE	7	12	5	12	10
TECHNICAL FACTOR	127	110	52	44	36



	2004	2005	2006	2007	2008
Train vs. Train Collision	9	9	5	3	2
Train vs. Motor Vehicle Collision	30	10	22	14	13
Jumping-Off Coach	92	99	52	114	84
Flood / Landslide	5	3	7	6	3
Other	38	32	31	10	3
Series 6	174	153	117	147	105

Source: PTKA 2009 Corporate Plan

3.3 ASSESSMENT OF RAILWAY INFRASTRUCTURE

The condition and performance of the railway has been reported in many sources as below par and below expectations for the fast growing economy of Indonesia. In an effort to determine firsthand the condition of the railway, several different investigative measures were conducted. First, the railway was inspected in some detail. Most of the main lines of PTKA in Java and many of the associated facilities were inspected over several inspection trips.

The inspections were premised on several reports that the railway was in poor physical condition, had poor discipline, and had a number of safety defects. The inspections revealed the opposite. On the basis of several days of inspections throughout Java, including the main line from Jakarta to Bandung, Kroya, Yogyakarta, Solo, Madium, Surabaya, Semarano, Cirebon and back to Jakarta, the inspections revealed that PTKA is in generally good condition and that operating and safety discipline is reasonably high.

Even so, the inspections revealed a number of troubling aspects of Indonesia's railways. There appears to be a significant preference for building double track to increase railway capacity. PTKA management and staff understand that there are a number of ways to increase railway capacity before double tracking should be considered, however, double tracking appears to be the first choice. This is often an issue that arises in cases where the railway operator is not responsible for infrastructure investment since many ways to increase capacity require changes in operating practices and may increase operating expenses to some extent. This means including increasing speed limits; fleeting trains, one behind the other, in the same direction; operating fewer but longer trains (which usually requires more locomotives per train; and which may require building longer passing sidings). Another way to increase capacity is to improve signaling and train control systems. This aspect of line capacity appears to have been largely neglected on Indonesia's rail network. Inspections revealed many kilometers of rail line where train controls were provided by mechanical semaphore signaling systems – a train control technology that is not normally employed on modern railways because of the limited capacity they provide and the high operating costs associated with such systems.

Inspections also revealed a number of constraints in locomotive depots where unit exchange programs for locomotive parts, are all hampered by a lack of spare parts. Thus, many locomotives must wait for common parts to be shipped to the main locomotive workshop for repair, then shipped back and locomotives in the workshop for overhaul must wait for their parts to be cleaned, inspected and repaired rather than simply having new (or previously repaired and reconditioned) components used in replacement. Inspection found that locomotives are typically in the workshop for over 30 days rather than a more typical 7 to 10 days.

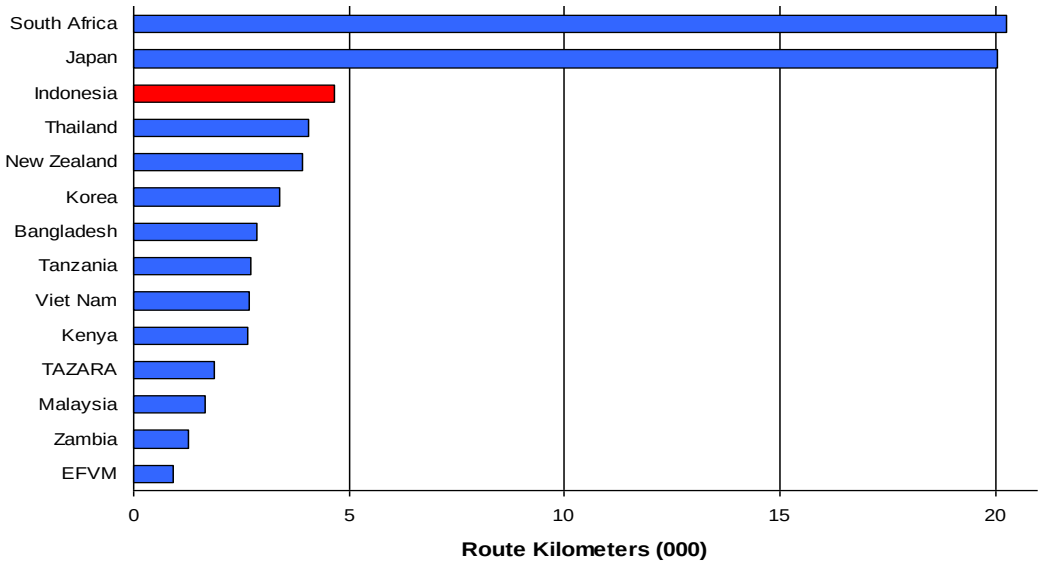
While some new investment in infrastructure does seem to go to increasing axle loadings, most does not. In fact, there is no discernable program to increase the carrying capacity of the railway network, nor to provide higher clearances for modern bi-level passenger coaches or double stack container services. The inspection process also revealed that PTKA has a number of older inefficient two-axle freight wagons stored in sidings and storage tracks as shown in the picture below. These old wagons clog the network, represent idle money and send a poor message to employees.

Another observation arising from the inspection is that much detailed infrastructure maintenance work is done using hand tools. PTKA could increase speeds on many lines if methods capable of achieving more precise standards were used. Many of PTKA's main lines are capable of operation at 100 kph or even 125 kph with more precise and more frequent maintenance of the infrastructure. In addition, more precision maintenance of railway infrastructure can increase its life, provide greater capacity, and provide more responsive and more commercially valuable rail services. The inspection suggests higher investments in infrastructure maintenance machinery, including laser-guided tamping machinery, rail grinders, and perhaps ballast compacting machinery. Some parts of the main line infrastructure have soft sub-soils, such conditions can be mitigated by various methods, including geo-textiles, increased depth of ballast, chemical injection (e.g., lime injection) to stabilise soils conditions. Using these tools, train speeds on the northern mainline could be increased and the greater investments required for double tracking set back some years.

3.4 INTERNATIONAL BENCHMARKING

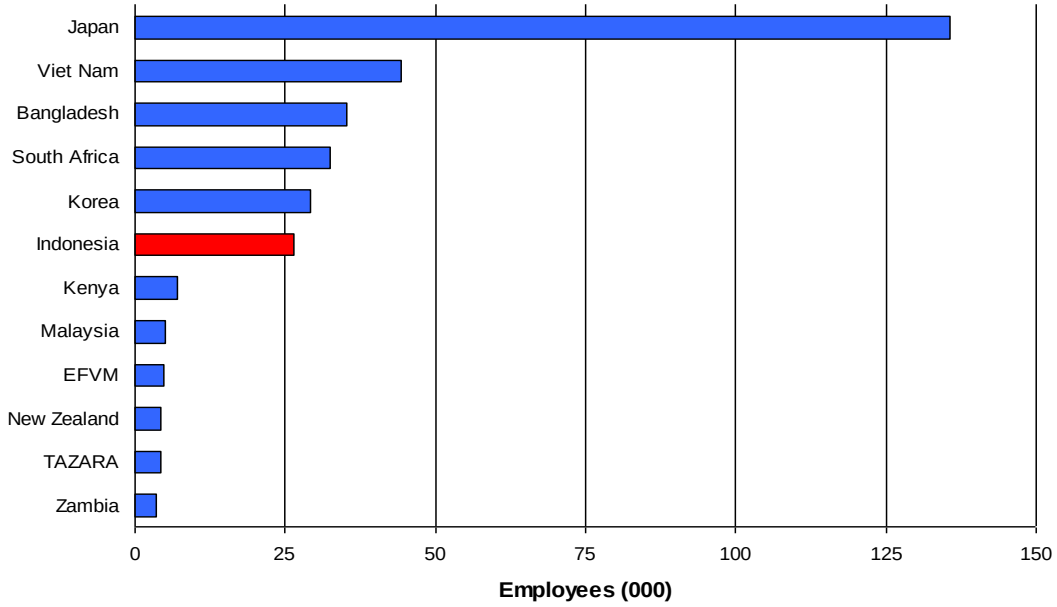
Benchmarking railway performance can be useful for comparing railways, at least on a size and scale basis. Caution is always in order when comparing railways. The analysis here compares PTKA with similar railways – generally ones with similar gauge and geographic conditions. The purpose in this analysis is to develop a general idea about how PTKA compares with other railways and what that comparison indicates about Indonesian railway activities. In the following analysis, similar railways are selected for comparison. All the railways are meter or cape gauge rail lines.

Size of Rail Network



Among many other narrow gauge railways, PTKA is pretty typical at a reported 4,700 kilometers of network. As can be seen, several countries have larger networks, many have smaller ones. For the most part, smaller railways in Central and South Africa that have little traffic have not been included in the benchmarking comparison. [24]

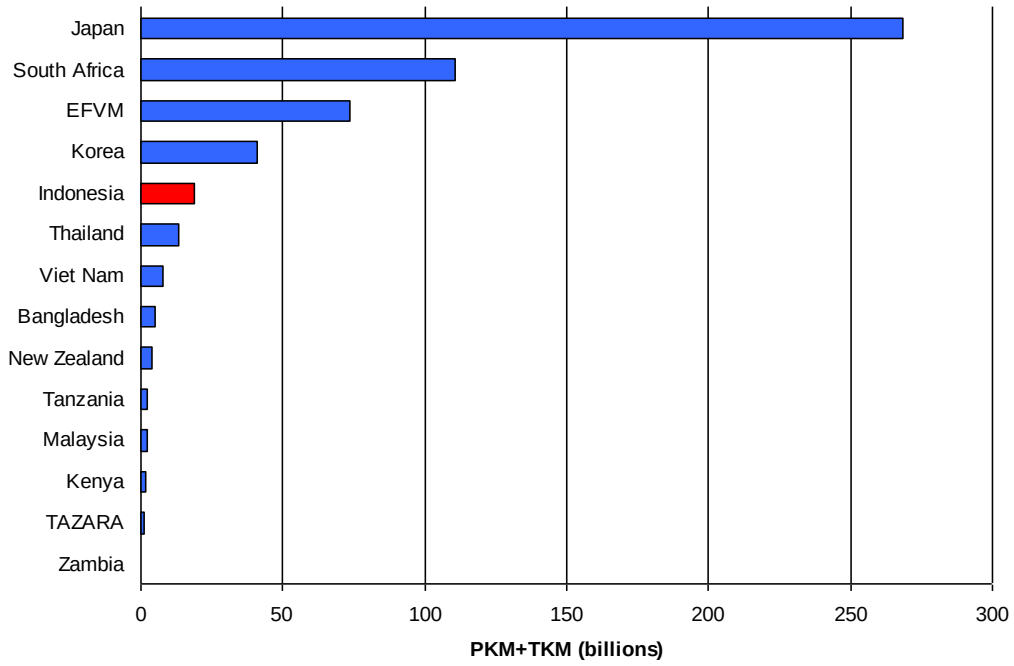
Railway Employment



[24] All comparative tables in this Chapter are based on the World Bank railway database and Directorate General Railways data.

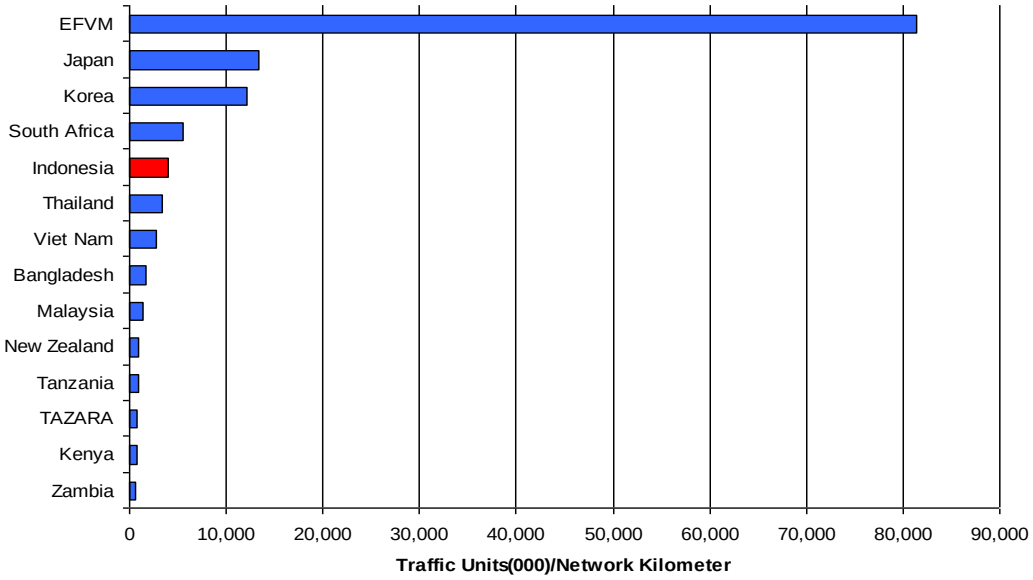
PTKA employment levels are generally consistent with those of other railways of its size. However, productivity measures are more interesting.

Work Performed: Traffic Units Generated



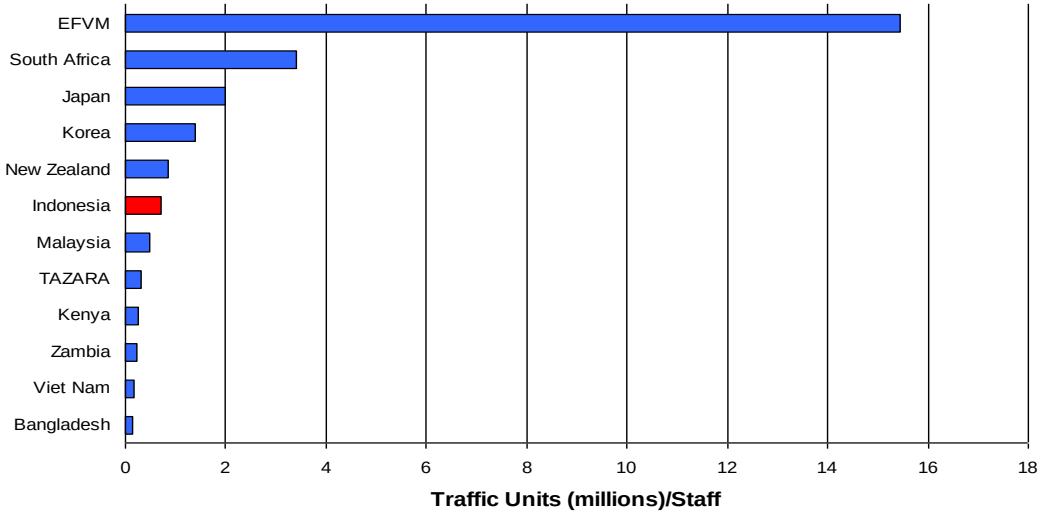
Some narrow gauge railways carry much more traffic than PTKA. In Japan, it is passenger services, while in South Africa it is a combination of coal traffic and passenger traffic. EFVM is a specialised iron ore railway in Brazil that also provides passenger and general freight services.

Network Density: Traffic Units per Network Kilometer



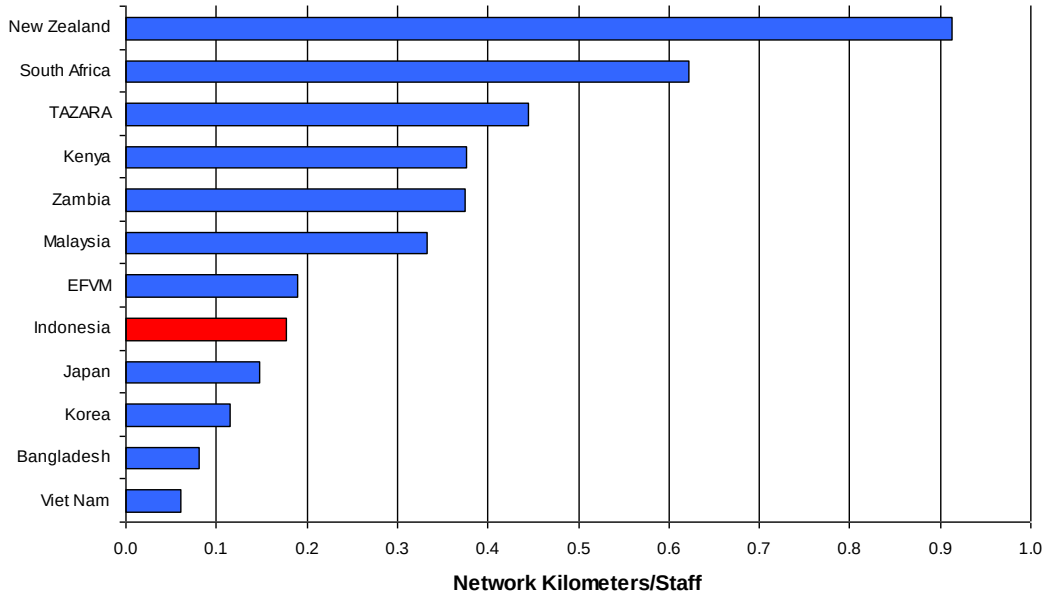
Gauge is not a primary determinant of the capability of a rail network. Some narrow gauge rail networks are highly productive. In this case, EFVM because of its iron ore, Japan because of high density passenger services. EFVM is an instructive example of a high-capacity narrow gauge railway line. It is double track but not electrified. There are double cross-overs every 7 kilometers; trains are large and heavy. The line moves nearly 120 million tonnes each year.

Employee Productivity: Traffic Units per Staff Member



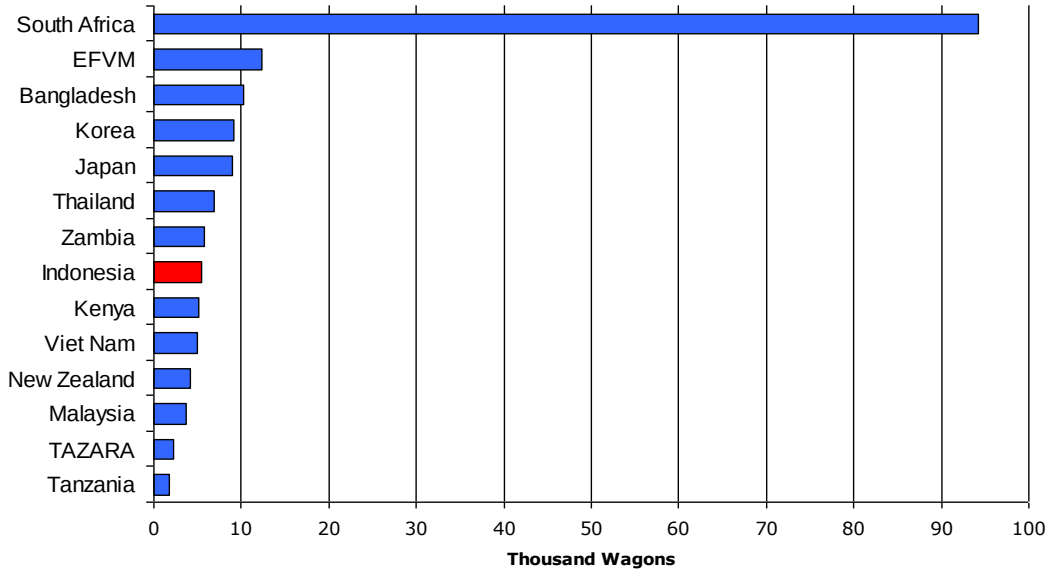
High network density helps productivity measures. Indonesia ranks in the middle of railway productivity. New Zealand is an interesting case – an island nation with significant trade between two major islands but with much lower population density than Indonesia. New Zealand achieves relatively high employee productivity by being ruthlessly efficient.

Employee Productivity: Network Kilometers per Staff Member



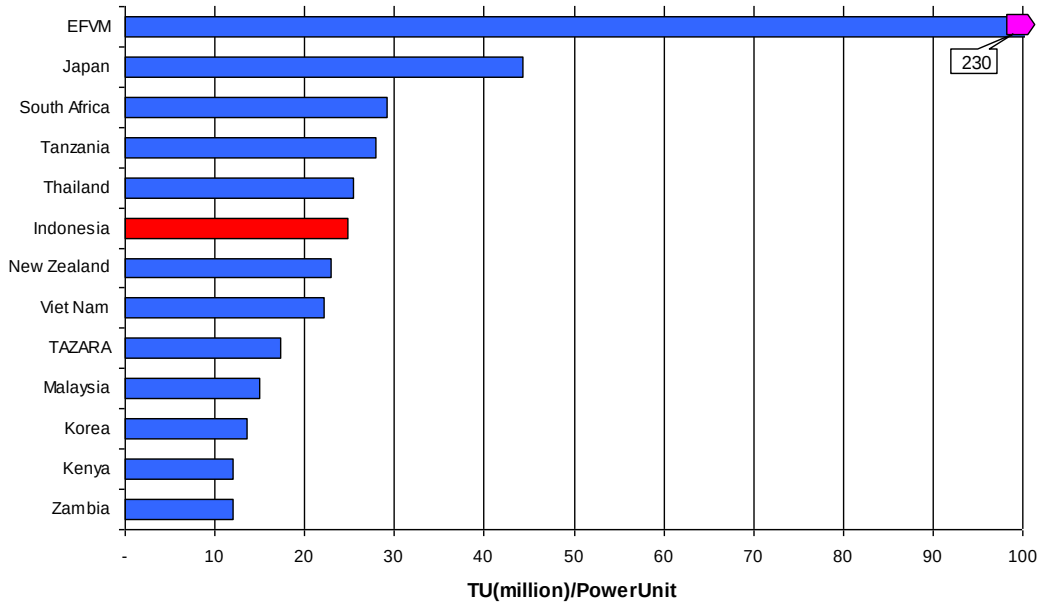
Network-kilometers-per-staff member is a traditional productivity measure that tends to compensate for longer rail networks and highly productive infrastructure maintenance departments. Outsourcing maintenance activities can also tend to improve employee productivity on this measure.

Motive Power Fleet Size: Locomotives and MU Power Units



On this measure, Indonesia has a relatively small fleet. South Africa has a large number of MU units and high passenger load. A more interesting measure is the productivity of the locomotive fleet.

Motive Power Productivity: Traffic Units Per Locomotive (power unit)

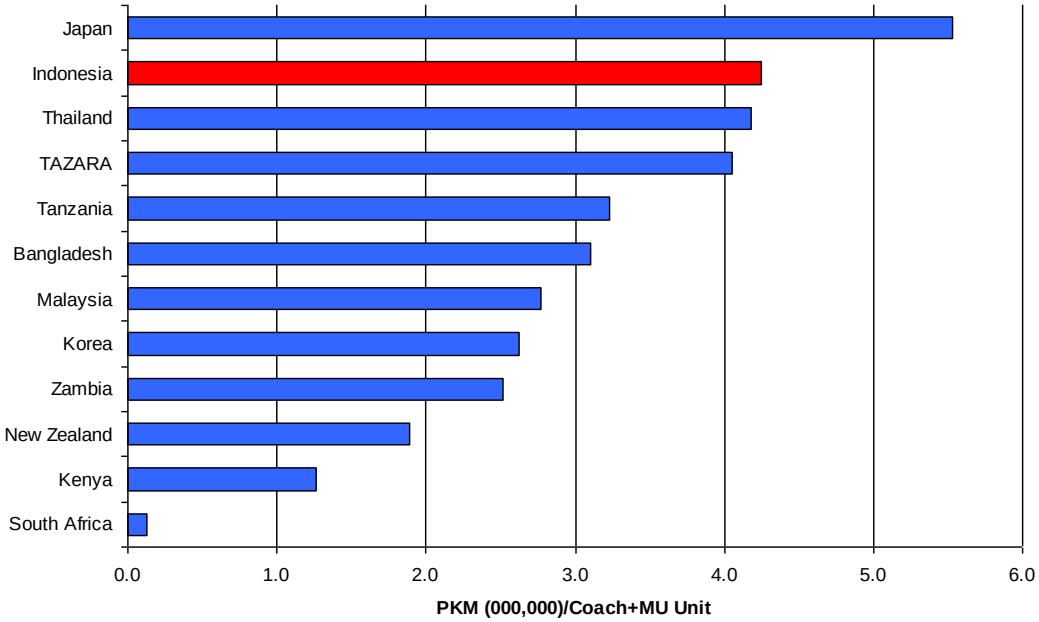


In this case, the number of locomotives is adjusted to include the number of power units in electric passenger trains. Dense infrastructure (advanced signal systems, electrification) and high axle loads help EFVM and Japan achieve high productivity. Indonesia is in the middle of the group.

Freight Wagon Fleet: Thousand Wagons

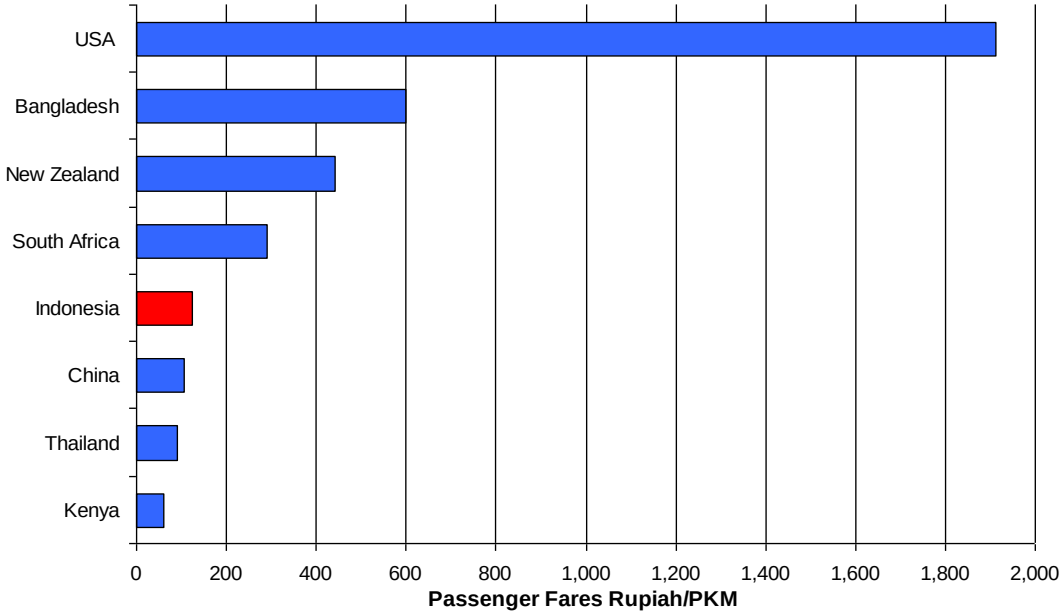
PTKA is focused on passenger transport; it has a relatively small freight wagon fleet. South Africa has a large fleet for coal movements and general freight services. Many of these wagons are not used. EFVM has a large and highly productive fleet of iron-ore wagons but also provides general freight services.

Passenger Vehicle Fleet Productivity: PKMs per Coach or Multiple Unit



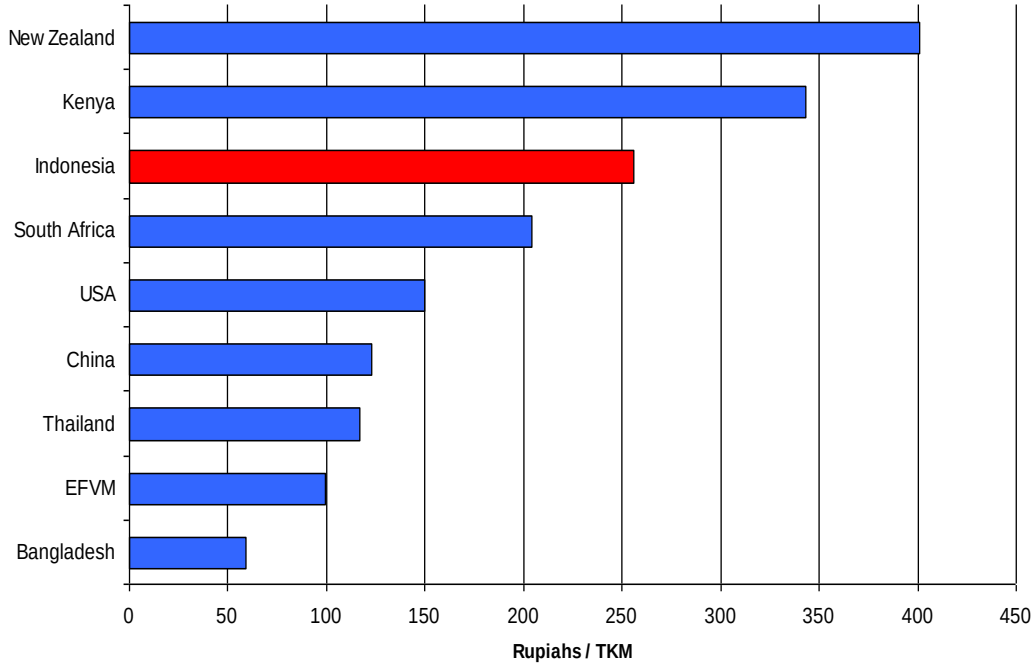
Indonesia's passenger vehicle fleet is very productive, even comparing it to Japan, a very high density operation. A higher proportion of urban transport trips helps increase PTKA passenger vehicle fleet productivity.

Passenger Fares: Rupiahs per Passenger-Kilometer (PKM)



PTKA's average passenger fares are quite low, even compared to China. Again, this is reflective of a high proportion of urban passenger transport trips in the PTKA number. The US number is included to indicate that prices in a highly subsidised market need not necessarily be low.

Freight Charges: Rupiahs per Tonne-Kilometer (TKM)



PTKA's freight charges are relatively high. Freight tariffs are a function of many different elements including the competitive environment, government regulation and subsidy, and the overall efficiency of the network. New Zealand freight tariffs are quite high as the railway owns and operates an interisland rail ferry whose revenue and charges are included in the railway revenue measures. In this case, freight charges in countries that compete with Indonesia in global markets have been included. –China and USA freight charges are important since manufacturers and minerals producers in those countries, who might be customers of Indonesian companies, may evaluate sources in part through comparison with domestic transport rates. To illustrate, in order to be competitive, Indonesian rail rates on export coal might well have to be significantly lower than PTKA current average rates.

The benchmarking analysis shows Indonesian railways to be in the middle of the pack of similar railways, more productive than some in some measures, but less productive than others overall. *The important element of this benchmarking comparison shows that narrow gauge is not necessarily a limitation to success for either passenger or freight services. Narrow gauge railways can move large amounts of freight and/or large numbers of passengers.*

3.5 SUMMARY & CONCLUSIONS

This review of current railway operations in Indonesia shows that the rail network is in reasonably good condition and is capable of higher performance with only incremental spending. Significant improvements in both passenger and freight services can be achieved. Neither widening of the Cape Gauge lines nor double tracking is a pre-requisite to moving large amounts of passengers or of freight. More important is to organise services effectively, and to build a railway that is capable of high density movements. For PTKA the analysis shows that its investment program could be more effective by concentrating on improving the capability of existing infrastructure by increasing axle loads and by increasing speeds).

Given the changes contemplated in Law no.23/2007, another conclusion that can be reached is that PTKA should organise itself more transparently to take advantage of its current strengths in infrastructure maintenance and operations. It is expected that the current subsidy and TAC system could be greatly improved by the development of an accurate accounting system that permits better visibility in the loses generated in subsidised passenger services, particularly in infrastructure operations and maintenance costs.

Finally, it is likely that productivity and profitability could also be increased by developing infrastructure and operating plans in closer coordination – so as to allow larger train sizes, and in designing passenger services that are more competitive in the market place.

CHAPTER 4: NATIONAL GOALS AND PROJECTIONS FOR RAIL SECTOR DEVELOPMENT

4.1 RAILWAY REVITALISATION AND EXPANSION TARGETS

4.1.1 Market share targets

This NRMP has considered the following ambitious railway sector goals, as recommended by the Tim Revitalisasi Kereta Api or TRKA (Technical Team on National Railways Revitalisation) in its 2009 Final Report to support Indonesia's economic growth ambitions:

- An increase in the railway market share in passenger transport from approximately 4 percent currently up to 10-20 percent by 2015 and as much as 25 percent by 2025.

  To achieve the above passenger transport objectives, the NRMP will focus initially on improvement of railway's role in passenger transport in commuter service. To support the above general passenger market share targets, TRKA observes that Jabodetabek railway's market share would have to be increased to 10-15 percent by 2015 and to as much as 30 percent by 2025. This illustrates that improved commuter service in the capital region must have priority in the early years of the NRMP.

  Attention will also be given to improvement of the inter-city mainline connecting the major cities of Java, with particular attention to the incremental costs for alternative measures to upgrade railway technology to improve the speed, capacity, and quality of services in the key Surabaya-Semarang-Cirebon-Jakarta north corridor.

- An increase in the railway freight market share from low current levels to 5-10 percent of national ton-kilometers by 2020.[25]

  When inter-city mainlines are improved on Java to support modern bi-level passenger coaches and heavier, more powerful locomotives, the additional cost of introducing modern double-stack container cars, carriers for automobiles and other bulk goods will be lowered, creating potential economies of scope for railway freight services for large-volume point-to-point services, e.g., between manufacturing plants and regional distribution centers. Given the structure of the markets, including generally short distances on Java, the total volume of tons or ton kilometers will not likely be large, but will present enhanced profit niches for alert railway operators.

The full attainment of the 5-10 percent freight market share envisioned by TRKA will not only require the rail network to be expanded on Java, but will rely especially heavily on the full exploitation of rail coal transport and other rail bulk transport on Sumatra and Kalimantan, supporting private sector and provincial government initiatives. Railway freight opportunities in Sulawesi and Papua, given the characteristics of the regional economies, appear very limited. At this point, the natural resources, economic geography, and population densities on these islands suggest that their immediate transport needs be better addressed by development of road transport, since their financial well being could be hobbled if costly railway developments to pursue only modest cargo volume opportunities were undertaken. The initiation of rail service on Sulawesi and Papua will therefore depend on sub-national governments developing convincing feasibility assessments indicating viable

[25] Existing statistical data on the current railway freight market share is somewhat imprecise, largely because of data limitations on the road sector. Some 2009 estimates indicated that the rail share of Indonesian freight movements might be about 3 percent of freight transportation ton kilometers. Another study, based on an origin-destination study estimate places the rail share of freight tons at 0.63 percent. The latter estimate includes small local road movements and non-commercial deliveries for which other modes do not compete and is not comparable to normal ton-kilometer measures of intercity freight shares.

urban/commuter service opportunities or on the private sector and/or public sector uncovering niche opportunities that are not presently apparent. Under the NRMP, the DGR will be prepared to evaluate any such opportunities under the procedures described in chapter seven. While recognising there is the potential for increasing profit niches in railway freight services on Java and that possible opportunities could arise elsewhere, this NRMP emphasises the importance of commodity transport primarily in south Sumatra and Kalimantan, including especially rapid development of coal transport by rail. This NRMP goal will enable the continued development of these Indonesian resources that otherwise may be blocked by lack of access to water transport and adverse environmental impacts of road transport.

4.1.2 Structural Changes to Achieve Targets

In the passenger market segment, network expansion plans will begin with PPP initiatives to construct and sustain urban-commuter services in the large metropolitan areas on Java, Sumatra, and Kalimantan. In the freight market segment, network expansion will focus on (a) lines that will enable the exploitation of mineral resources, and additionally agricultural resources (such as palm oil production) in an environmentally friendly manner and (b) building intermodal links that will enable Indonesia to more effectively utilise its water-borne transport assets and slow the growth of demand for expensive road capacity expansion where possible.

The market share targets above are considered to be achievable through systematic improvements in rail sector efficiency, supported by prudent public and private sector investment. They are not dependent on technological breakthroughs or order-of-magnitude expansions in the size of the rail sector.

In the long term (beyond 2025), the NRMP also envisions Java-Sumatra and Java-Bali interconnections may be constructed, and Very High Speed Trains (VHST) may be developed. Each of these latter undertakings is quite expensive and is dependent on the availability of scarce resources that are released by the completion of more urgent priorities and that are generated by a continued high rate of GDP growth. It is not possible to develop definitive schedules for such initiatives at this time, but the NRMP provides for pre-feasibility studies for such programs to be undertaken in or before phase three (2020-2024) of the master plan. By this period, the plan's degree of success in achieving the market share targets cited above should be reasonably apparent and opportunities to successfully fund and sustain transformative technological changes to the rail sector may be more precisely defined.

4.2 PAST RAIL SECTOR TRENDS: INSUFFICIENT TO SUPPORT NRMP GOALS

The NRMP recognises that any chance of attaining the ambitious market share visions enunciated by TRKA will depend on a sharp break with the past performance of the rail sector, specifically PTKA. The NRMP considers that three changes are essential to progress toward the TRKA aspirations. These are:

- Past trends of reducing the size of the network must be reversed and the physical scope of the rail network substantially increased;
- The rate of growth in passenger and freight traffic on existing line segments must be accelerated; and
- Specialised public and private railway services independent of PTKA must be encouraged in compliance with Law no. 23/2007 in order to take full advantage of devolution policy.

4.2.1 Physical Size of System

As noted in chapter 3, the existing Indonesian rail network is limited to Java and Sumatra, although plans have been made for railway development in Kalimantan and Sulawesi. Its total length is nominally 6,720 km, out of which 2036 km, or almost one third is in non-operating condition. Java accounts for about fully 78 percent of the operating lines, compared to 54 percent of the total population of Indonesia and only 7 percent of the land area. Sumatra accounts for 22 percent of the operating lines, compared to about 20 percent of the population and 23 percent of the land area. The other Islands, with 26 percent of Indonesian population and 70 percent of the land area have no railway infrastructure.

	Total	Operated	Closed
Sumatra railway network	1,860 Km	1.348 km	(512 Km)
Java railway network	4,675 Km	3,425 km	(1,250 Km)

This NRMP considers expansion of the rail network to be essential, both in Java where it is most extensively developed and on other Islands. The NRMP will not mandate that presently closed lines be all reopened, as some are undoubtedly obsolete due to subsequent changes in population patterns and economic activity. However, DGR will review the status of all closed lines and seek the input of PTKA as to the potential for reopening. If PTKA concludes that lines should remain closed due to their not making a contribution to corporate profits, DGR, in cooperation with the BUMN Ministry, should consider opportunities for transferring the lines to local government or selling the property to private interests for use in railway service.

The draft NRMP issued by DGR in 2009 envisioned a doubling of intercity lines by 2025, as described in the attached table. This would include some element of double-tracking, but mostly would be accomplished by new line construction in islands and geographic areas not served by rail and largely not connected to the current network. In addition, some 3,300-3,600 kilometers of urban rail lines were projected (about 2,000 km in Java, 1,200 km in Sumatra and 150 km in Makassar, the largest city on the island of Sulawesi). The result would be an intercity network of 11,600 kilometers, and a total of 15,000 kilometers including urban systems. Expansion on Java would partly depend on whether a separate and dedicated right-of-way is built for VHST and whether all currently closed lines are reopened, so it is possible that traffic targets can be met with a lower amount of track additions if these assumptions prove unnecessary. However, the largest passenger opportunities are dependent on new urban and commuter line construction and the largest freight opportunities are for coal and other bulk transport requiring new line construction.

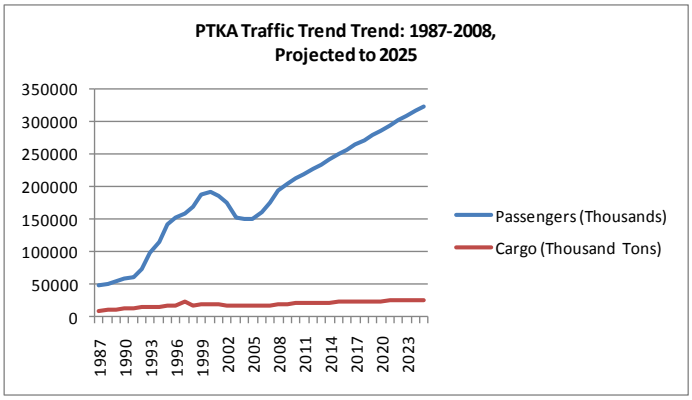
DGR Goals for Intercity Network (kms)			
Island	Minimum 2025 requirement for rail network (km)	Length of existing lines	Length of railways track not yet constructed
Java	6800	3300	3500
Sumatra	2500	1300	1200
Kalimantan	1100		1100
Sulawesi	200		200

The NRMP considers that without expansion of rail infrastructure to at least twice the current system, inclusive of urban systems, the TRKA targets cannot be achieved. As implementation of the

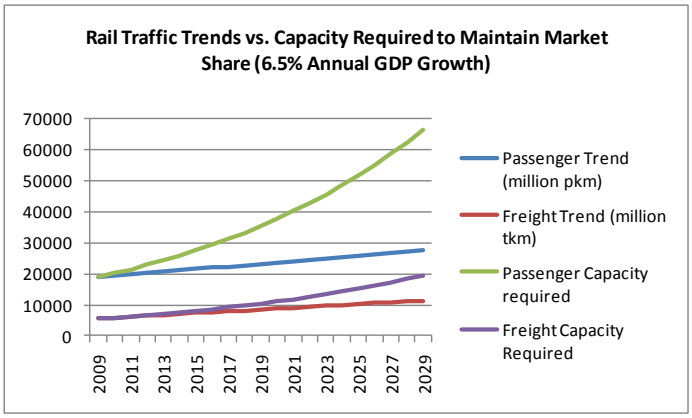
NRMP proceeds, railway network expansion goals must continuously be assessed in terms of both new opportunities and competing priorities stemming from the evolution of the Indonesian economy.

4.2.2 Past Railway Traffic Performance

To provide some perspective on the challenges faced in revitalising the rail sector, the NRMP reviewed past traffic trends and extrapolated those trends into the future. The accompanying chart looks at PTKA's performance since 1987, when the railway was still a state agency and just before the reforms of the 1990s began. Over that period, both passenger traffic and freight traffic grew substantially. If PTKA equaled that performance until 2025, by that year it would be carrying some 324 million passengers and over 26 million tons of freight. This extrapolation assumes that this level of growth would take place over the current PTKA network, as PTKA's 1987-2008 expansion was achieved without any significant expansion (and in fact a shrinkage) of the infrastructure. The extrapolation also implies a commensurate level of investment support to the existing network as provided over the 1987-2008 period, adjusted for economic growth and inflation. While railway freight traffic growth has not been impressive, extrapolated passenger growth initially appears substantial.

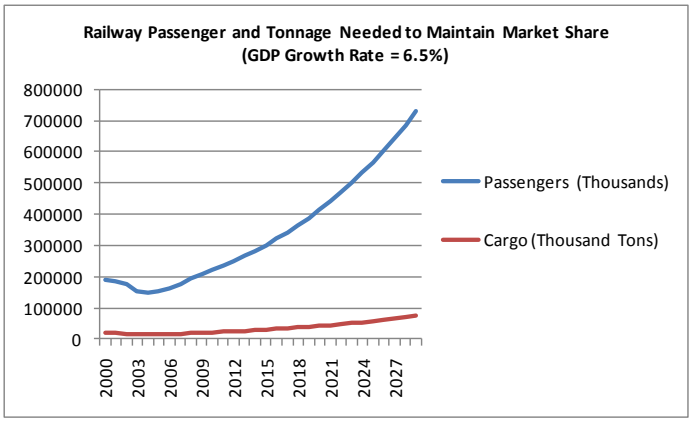


The NRMP, however, must assess the above trends against Indonesia's projected overall transport requirement expansion and the TRKA market share goals. Indonesian transport demand for both passenger and freight is expected to grow roughly in line with GDP. GDP is, in turn, projected by government to grow at an annual rate of about 6.5 percent over the 20-year period of the NRMP. In this case railway passenger kilometer and freight ton-kilometer capacity would have to grow at a 6.5 percent annual rate, just to maintain market share. *As the accompanying chart shows, under the trend scenario displayed above, the rail sector would lose market share to other modes.* This is obvious in the case of freight, where the very modest increases or decreases in rail tonnage would be dwarfed by the cargo volumes anticipated to be associated with the healthy economic growth anticipated for the economy. However, even the doubling of rail passenger traffic that would stem from a continuation of 1987-2008 trends would likely not increase rail market share. Population growth and rising per capita income is very likely to more than quadruple passenger demand by 2025 and drive a similar increase in overall transport demand.



To illustrate the likely requirement for the rail sector to simply maintain its market share, the accompanying chart shows the passenger and freight tonnage volumes that would carried by rail should it increase volume by 6.5% annually,; that is at a pace equal to the Government's 6.5% GDP

growth projections, assuming unitary income elasticity of demand for both freight and passengers, i.e. that rail traffic demand grows equi-proportionately to GDP growth.[26] Since transport is a derived demand stemming from the growth of the economy, matching rail transport growth to economic expansion rates is a reasonable general surrogate for maintaining a stable market share. Under this scenario, the Indonesian railway sector would need to carry over 700 million passengers and 73 million tons annually by 2025 *simply to maintain its existing market share*. Past trends would result in only half that needed increase.



The NRMP considers the above trend data to be persuasive evidence that TRKA market share targets *cannot* be met without substantial geographic expansion of the system and the development of new private sector and public sector rail service providers to better respond to local and specialised markets. To merely hold market share on the existing system will require a doubling of traffic growth over that experienced in the 1987-2009 period. That itself will require a heroic effort on the part of PTKA. To more than keep pace with GDP growth the rail sector will require development of urban/commuter services requiring new infrastructure, special rail projects in Kalimantan and Sumatra, filling gaps in the Sumatra network, instituting high speed services on Java and other expansions of the rail sector far beyond the PTKA network in place over recent decades.

Moreover, PTKA simply cannot be assumed to be the monopoly rail service provider in future years. It should contribute to the expansion of rail service substantially, more than it did over the 1987-2009 period. However, to approach the higher market share targets of TRKA, vast additional new investment will be required and much of that investment is likely not to be made by PTKA and may be largely focused on new infrastructure in geographical areas not presently served by PTKA.

The NRMP must give equal attention to sustaining and improving PTKA *and* to new rail capacity creation.

4.3 PASSENGER MARKET SEGMENT ANALYSIS

As demonstrated in conferences and workshops conducted in 2009, increases in railway market share will not result automatically from increases in GDP or from growing concerns over congestion or environmental issues. Instead, DGR and railway service providers must focus on specific market opportunities and develop strategies to develop passenger and freight business "from the ground up." This section provides the NRMP's assessment of key passenger opportunities; the next section addresses freight opportunities.

[26] Government projects a rate of 6%-7%. The Port Master Plan forecast uses the intermediate figure of 6.5% and that is adopted here. David Wignall Associates, National *Port Master Plan Strategic Traffic Forecast for Directorate General of Sea Transportation,* December 2009 at 6.

4.3.1 Java Passenger Potential: Jabodetabek

Jabodetabek is an official term given to the metropolitan area surrounding Jakarta Indonesia -- in 2000, including four municipalities and three regencies. Its population in the 2000 census by the Indonesian government was officially mentioned as 23.3 million, making it by far the largest metropolitan area in Indonesia. It is approximately the sixth largest metropolitan area in the world. Jabodetabek electrified commuter rail service is operated by PTKA Commuter Jabodetabek (KCJ), a subsidiary of state railway PTKA separated from the main company in August 2008. It serves routes across Greater Jakarta, including tracks linking the city's main stations to Serpong, Bogor, Depok, Tangerang and Bekasi. In 2008, KCJ was used by 347,000 passengers per day or around 125 million a year, but has ambitions of tripling passengers by 2013. This depends on plans to acquire 50 used train sets from Japan as part of an investment program of over USD 100 million and is not likely feasible in this short time frame. The NRMP defers this objective to the second phase on the master plan (2015-2019).

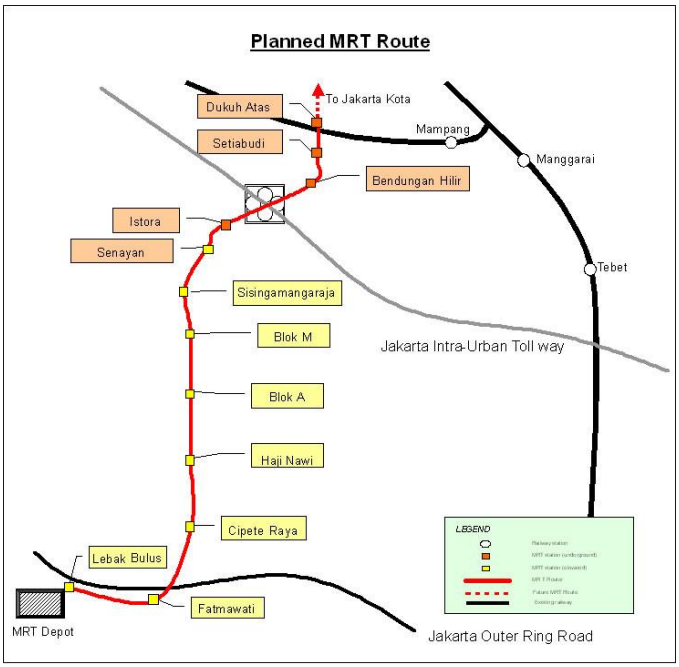
The TRKA regards the further development of railway service (including metro service) in Jabodetabek as a major opportunity, and the NRMP concurs. PT Kereta Api Indonesia Commuter Jabodetabek (KCJ) has targeted 2.2 million passengers as a goal, but it has to be supported with major improvements in railway operating practices. The need for railway rolling stock is very large since the density of passengers has been enormous. This is reflected in the large amount of passengers sitting on the roof or hanging on the railway doors. The number of electric railway units demanded compared to the available units often reaches 150 percent ratio, so that the addition of railway is urgent. With that target in mind, PT KCJ needs to undertake measures such as reactivating damaged electric trains in its warehouse to add to the existing four passengers train units in one series. In addition, maintenance or replacement of signaling devices, points, tracks, and communication system also need to receive sufficient budget to reduce travel disruptions. PT KCJ has to focus to the maximum extent possible on serving pent-up passenger demand, while still achieving a reasonable profit. Without PSO arrangements, all profits (and more) will have to be returned to be invested in train procurement. The operations of electric train or KRL in Jabodetabek needs to be improved to provide whole day service (between 05.00 am -02.00 am) to add transportation mode alternatives, especially for workers returning after 21.00. Therefore, PT KCJ needs to repair the train stations and build new stations by its own efforts or through partnership with private sector. KCJ must take advantage of private sector opportunities, especially cooperation with real estate developers that can be included in the construction/refurbishment/maintenance of train stations. In accordance with the subsidiary arrangements recently declared by the government, the target and initial stage of management separation is going forward in two operational regions i.e. Commuter Trains Jabodetabek and Babaranjang South Sumatera Railway. Both were declared to be independent subsidiaries separated from PT Kereta Api's central management. The NRMP supports this separation and DGR will monitor the results of this organisational change in terms of greater responsiveness to rail service demand.

At present, Jabodetabek is estimated to comprise about approximately 70 percent of national passengers but to transport only 2-3 percent of the traffic in Jakarta. TRKA has urged that a target for Jabodetabek be set for an annual increase of passengers of 9-10 percent per year. While less than the above company goal, this is itself an ambitious goal, and will require an extremely dedicated effort to be sustainable over the 2029 time frame of the RMP, as it would imply transport of about 550 million passengers in 2025 in the Jakarta region alone. Around the world, ten rail/metro systems carry over one billion passengers annually and 21 carry over 550 million per year, but these are largely underground systems constructed at great expense over many decades. Nonetheless, NRMP considers the target, while ambitious, to be achievable and incorporates this goal into the master plan.

Meeting the TRKA aspirations for expansion of rail traffic in the Jakarta area may depend as much on the development of the Jakarta Mass Rapid Transit System (MRT) as it does on PTKA/KCJ. MRT is an ongoing transportation infrastructure project in Jakarta that will be comprised of a partially elevated and partially underground railway system. Construction of the first phase of the project is due to start in 2010 and is planned to be operational in 2015. The first phase is a single line system of 14.3 kilometers (8.9 mi) long from Lebak Bulus to Dukuh Atas. Initial development was funded through a pre-construction loan by the Japan Bank for International Cooperation (JBIC), now merged into the Japan International Cooperation Agency (JICA). It consists of:

- Basic Design package, managed by the DGR
- Management and Operation package, managed by the Bappeda (Jakarta Regional Planning Board)
- Construction assistance in tender, managed by the PT MRT Jakarta

In 2009 a second loan for 48,150 billion Yen to build the MRT System was signed by the Indonesian Government and JICA. Proceeds will be forwarded to the Jakarta City Administration as a grant, and the city will then seek another two loan agreements through the national government to the amount of 71,867 billion yen. The total amount of loans from JICA for the initial development of MRT is estimated at 120,017 billion yen, or over USD 1.3 billion. The initial MRT system is projected to carry 340,000 passengers per day or around 124 million per year. If completed successfully, combined with above-ground commuter rail, it could ensure that that the rail sector would make the market share target on the 2009 draft NRMP of 12 percent, as measured in passengers, if not passenger-kilometers.



International experience shows that commuter rail and mass rapid transit systems are typically delayed in implementation, often by many years. Even given national government investment commitments and generous PSO payments over the time period and fare increases for non-economy passengers as personal incomes increase, financing growth from the current traffic base of PTKA will be extremely challenging. In the 2010-2014 period, DGR is tasked to provide additional detail on plans in effect to attain market share targets in the Jabodetabek area and will provide further on objectives within the framework of the five year project phases. The simplified table below sets out time-phased steps for Jabodetabek rail services. DGR will provide a much more detailed time-phased planning schedule within each planning period.

Program for Jabodetabek Urban Rail Expansion				
	2010-2014	2015-2019	2020-2024	2025-2029
KCJ Commuter services	○ Financing Arrangements ○ Station upgrades ○ Fleet expansion	○ PSO, schedule, tariff adjustments ○ Negotiated loan agreements	Network expansion	Fleet modernization and expansion
Mass Rapid Transit	○ Complete financing ○ Construction programs	○ Begin MRT operation ○ Feasibility studies for additional MRT lines ○ Financing plan for expansion	○ Initiate expansion construction ○ Expanded fleet procurement	Opening of additional lines

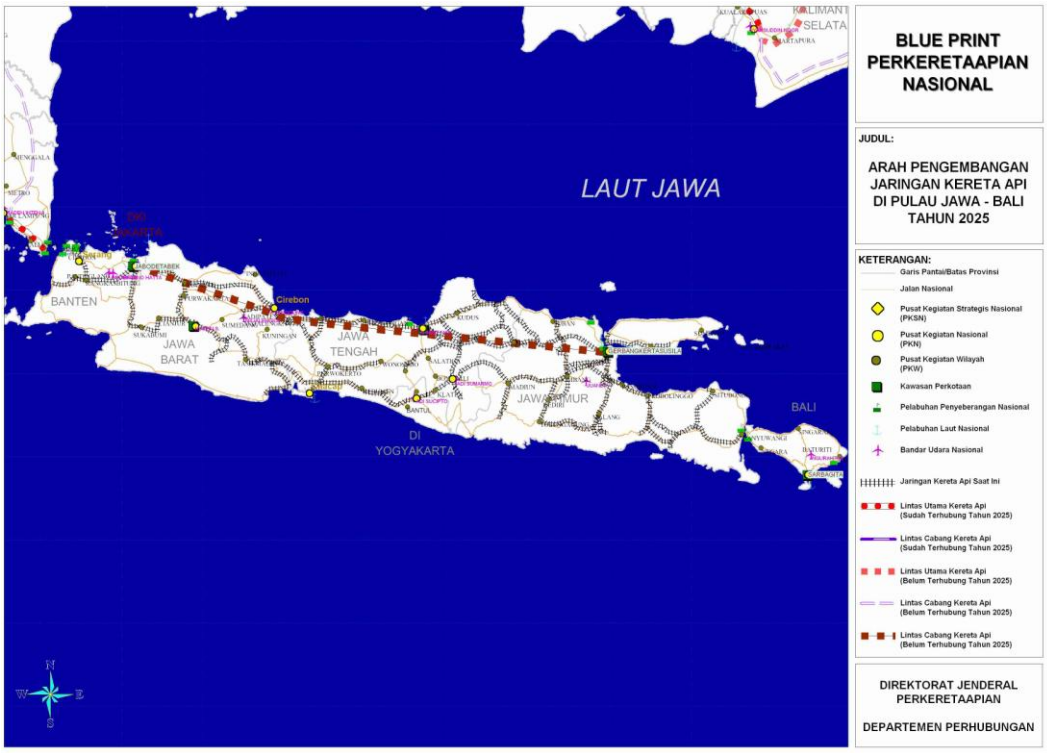
4.3.2 Other Metropolitan Areas

Government has offered guidelines that metropolitan cities with a population above five million persons shall establish rail based public transportation to fulfill the development of intercity transportation demand. Jakarta is a metropolitan city that is late in developing MRT compared to other cities such as Bangkok, Manila and Kuala Lumpur. Other cities are not as late as Jakarta, but they need to prepare MRT development plans now. For that purpose, the support of regional governments and private sector is much needed and are provided in chapter seven of this NRMP.

MRT service is expected to be integrated with commuter trains that currently exist or will be established in metropolitan areas, through schedule and ticket integration. The provision of metropolitan railway transportation service is intended to reduce the burden of transport costs on the society and at the same time reduce pollution in big cities. For metropolitan cities, mass transportation system is a must.

4.3.3 Jakarta-Surabaya High-Speed Line

The MOT and DGR have plans to develop a high-speed-rail (HSR) train and track project covering a distance of 683 kilometers between Jakarta and Surabaya in East Java, as displayed in the accompanying map. The project has been estimated to cost some USD 5.14 billion and the government would facilitate the process of securing the license and guarantee legal certainty for investors agreeing to build and operate the project, which might possibly be built and operated without involving PTKA. Detailed feasibility and engineering design studies have not yet been completed. It is possible that the results of such analysis, given investment costs and required fare/subsidy levels, will recommend something less than the highest speeds of European and Japanese Very High Speed Train (VHST) networks, i.e., over 300 kph. However, there is a strong political desire for a modern passenger rail system approaching the general HSR range. While DGR projects that the rail line would not be complete and operational until after 2025, pre-feasibility, feasibility and engineering design studies, along with financing arrangements and contractor selection would all need to be completed prior to 2025 if the project were to become reality in the 2026-2030 period.



This major undertaking, together with interim lower-cost *higher*-speed alternatives (offering speeds in the range of, say, 125-160 kph) is described in greater detail in chapter six of this NRMP within the framework of the five year project phases. To illustrate, the simplified table below sets out time-phased steps that might be taken toward a high speed rail capability. The NRMP should contain a much more detailed time-phased planning schedule.

Program for Increasing Java Rail Network Speeds				
	2010-2014	**2015-2019**	**2021-2024**	**2025-2029**
High Speed Service Preparation	◦ Pre-Feasibility Studies ◦ Feasibility Studies	◦ Definitive financing plan ◦ Negotiated loan agreements	◦ Contractor selection ◦ Initiate construction ◦ Rolling Stock Procurement	Construction completion Initiate Operations
Interim Speed Improvement	◦ Maintenance upgrades ◦ Schedule adjustments to improved track conditions	◦ Rolling stock acquisition ◦ Electrification? ◦ Schedule adjustments to improved rolling stock	◦ Plan for equipment reallocation on HSR introduction ◦ Gauge conversion initiated?	

Along with developing metropolitan transit services in Jabodetabek, and encouraging private sector development of rail coal transport capacity, a higher speed railway corridor, even if not at peak technology limits, is among those with the greatest potential for transforming the Indonesian rail sector. The DGR strategy for system development therefore should be outlined explicitly in the NRMP.

4.3.4 Java Passenger Potential: Railway Line to Soekarno-Hatta Airport

Currently, the access from Jakarta to Soekarno-Hatta Airport can only be reached through toll roads, which suffer greatly from traffic congestion during rush hours. The only available public transport means to the airport are DAMRI buses and taxis. Given the constraints on public transport, the government invited the private sector to construct the Soekarno-Hatta Airport Railway. Letters of Interest from seven private enterprises have been submitted through a tendering process in accordance with President Regulation no. 67 of 2005 regarding PPP in Infrastructure Provision, reflecting relatively high interest to build and operate the airport railway. At this stage, bidding for the concession grant has commenced. If the private involvement process in airport railway construction experiences a deadlock, DGR will recommend another alternative, i.e., building the infrastructure independently using the State Budget (APBN), rather than performing open tender to operate the facility/rolling stocks.

The railway line linking Jakarta to Soekarno-Hatta International Airport in neighbouring Banten province has been in planning for many years and development should be underway in the near term if the above issues are resolved. It would connect Manggarai railway station in central Jakarta with Soekarno-Hatta international airport via Muara Angke station -- a distance of 33.7 kilometers. The government, through DGR, prepares for this type of rail investment, with the process to be monitored by the transportation minister. RaiLink, a joint venture between state-owned railway company PT Kereta Api and airport operator PT Angkasa Pura II, is a competitor for this work, estimated to cost some USD 400 million. The airport railway line would be expected to ease road traffic to the airport and its operation would be under a separate management from PTKA. Development of financial arrangements is well underway.

Specific passenger ridership targets for this major venture should be incorporated in the NRMP. When completed, the rail line would be anticipated to carry about 20-30 percent of passengers to/from the airport, or about 6-10 million passengers annually at current airport volumes. Because this project is far advanced, it is included in the 2010-2014 phase of the NRMP.

4.3.5 Java Passenger Potential: Surabaya Metropolitan Area

The French railway company, Société Nationale des Chemins de Fer Français (SNCF), in conjunction with French consultanting firm, AREP Groupe,recently completed a study to improve rail transport in the city of Surabaya. The consultant team studied transport flows line by line, forecast the traffic on the Surabaya rail hub, examined the feasibility of linking two existing lines, and created a financial model of project feasibility. The study[27] found that rail service had only an insignificant 1.2 percent share of Surabaya metropolitan area traffic, which was dominated by motorbikes (44 percent), private autos (23 percent) and buses (29 percent). The study concluded that implementation of the project could increase the rail share of traffic to as many as 63 million passengers in 2025, still a rail share of only a little over six percent but still a considerable improvement over current performance. The feasibility study included estimates of the percent funding that might be obtained from PTKA (65 percent) and for the Central Government (15 percent), Regional Government (15 percent) and towns and cities (5 percent). It also addressed the various categories of costs where public intervention might be required (resettlements, land acquisition, environmental mitigation, etc.).

This project, and others similar to it, are the type of railway infrastructure developments that need to be incorporated into the RMP on a more specific basis as the plan is updated to incorporate additional five year periods. In addition to expressing government intent with respect to the

[27] SNCF, Summary Report, Phase 2: Study Of The Regional Rail System For Surabaya, East Java

development of the project at issue, such specification will provide guidelines to other sub-national entities. This will contribute to the realism of other sub-national feasibility studies and help to clarify the prospects of public support. The phase or phases of the Master Plan in which development is anticipated to occur should be identified and target operational dates established.

4.4 FREIGHT/PASSENGER POTENTIAL APART FROM DEDICATED PASSENGER PROJECTS

4.4.1 General Freight Initiatives

Cargo transported by railway until now consists of fuel, fertiliser, cement, coal, plantation products, containers, quartz sand, rubber, passenger's cargo delivery, etc. TRKA recently concluded that, given unconstrained resources, the amount of transported railway cargo could be increased from 20 million tons (2008) to 400 million tons (2014). Unfortunately, investment resources are constrained; infrastructure upgrades, equipment acquisition and the development of new enterprises to exploit mineral resources and take advantage of Indonesian economic opportunities will take a considerably longer time period. The NRMP applauds the TRKA target freight tonnage target as an ambitious goal that might be reached under ideal circumstances, but only by 2029 at the earliest.

The NRMP agrees with TRKA that the largest freight market share opportunity is coal railway transportation from hinterlands of Bengkulu, South Sumatera and Kalimantan to ports. Other possibilities may include containers from Jakarta to Surabaya, steel from Cilegon to Surabaya, crude palm oil (CPO) in North Sumatera, packaged water transportation, iron sand from South Tasikmalaya to Cilacap, etc.

To increase private sector interest in this cargo freight business, the NRMP will support LGs to develop cargo railway transportation in their regions, in partnerships with the private sector. In some cases, freight infrastructure and locomotives can later be utilised for passenger transportation. In macro perspective, the optimalisation of cargo transport using railway can potentially balance the transportation flow that is currently focused on roads. As discussed in chaper five, the NRMP will create appropriate regulations so as to give easy access for operators and entrepreneurs, and the development of rolling stock and infrastructure, in order to improve efficiency of production delivery through railway transportation. MOT and Ministry of Trade need to synergise in order to maximise railway cargo transport to ports. This will improve efficiency of logistics delivery cost for business players.

4.4.2 Sumatra Passenger/Freight Potential: Trans-Sumatra Railway

About four million passengers and some 14 million tons of freight are now carried on PTKA lines in Sumatra, with volumes sharply restrained by the separation of the lines into three separate systems. The long-term strategy for increasing railway market share in Sumatra lies partly in the ongoing, but long deferred plan to create a Trans Sumatra Railway from Banda Aceh on the far northwest of the island to Bakauheni in the southeast.[28] If completed, the line would link the full length of Sumatra to Bakauheni harbour and from there via ferry to Merak port on Java. The concept of a 29 kilometer rail or road over the Sunda Strait to connect Merak port on Java island has also been discussed, but feasibility studies have not been conducted. The Trans-Sumatra rail line would compete with the existing Trans-Sumatra Highway. The highway was built in the 1970s and is said to be in poor condition, but major World Bank funding has been allocated for upgrading. Now scheduled by DGR to be completed sometime after 2025, the Trans Sumatra Railway would reach some 2,151

[28] PTKA's predecessor published a book on these plans as early as 1970.

kilometers across eastern coast of Sumatra Islands. In 2009, DGR estimated that the strategic project would cost around USD 7.1 billion, but will obviously cost more in post-2025 values.

According to the SNCF study referenced, the railway would be developed in seven sections or railway blocks. The first block, partly inspired by the international impetus to provide tsunami rebuilding relief would be some 484 kilometers between Banda Aceh and Besitang. SNCF has studied the project feasibility of that segment. The remaining six blocks were: Rantau Prapat - Duri - Dumai: 246 km; Duri - Pekanbaru - Teluk Kuantan - Muaro: 397 km; Teluk Kuantan - Muaro - Bungo - Jambi: 370 km; Jambing - Palembang - Tanjung Api-api: 340 km; Kilometer Tiga - Bakauheni: 70 km; and Tebing Tinggi – Bengkulu. These segments would link to and/or consist of improvements to existing rail lines. Although DGR has indicated interest in converting the Trans Sumatra Line (as well as lines in Java) to standard gauge, SNCF's feasibility study for the first segment concluded that the Cape (1067 cm) gauge now used throughout Indonesia was preferable, due to connectivity with the existing regional lines in the Medan region, which would otherwise require gauge conversion. It appears, however that the standard gauge option will go forward.

SNCF, addressing the line segment that would connect Banda Aceh to the metropolitan area of Medan, estimated that between 5.2 and 11.5 million passengers would be attracted to that portion of the Trans Sumatra system alone, more than the current passenger volume for all of Sumatra.

Although Trans-Sumatra would not be completed until after 2025, the DGR should, as in the case of Jabodetabek and Java rail speed improvement programs, produce a detailed time-phased planning schedule that would contribute to the ultimate development of the interconnected network. In the case of Trans Sumatra, this should include not only planning for the network as a whole, but also should address segments of the line where completion prior to 2025 may be justified and urban and port branch lines that would feed into a Trans-Sumatra main line.

As with the earlier tables, the table below is merely illustrative of the kind of project-specific development activities that will be elaborated in successive five-year phases.

Program for Sumatra Rail Network Development				
	2010-2014	2015-2019	2020-2024	2025-2029
Trans-Sumatra Full Network Completion	○ Finalise strategy (e.g. PTKA or new operator, gauge and infrastructure standards)	○ Pre-feasibility studies ○ Feasibility studies ○ Routing/design studies	○ Financing Plan ○ Negotiated loan agreements	○ Construction Completion
Pre-2025 Regional Segment Expansions on Trans-Sumatra Route	○ Pre-feasibility-feasibility studies, segments a, b, c… ○ Select priority segments for early development	For priority segments: ○ Financing plan ○ Negotiated loan agreements	For priority segments: ○ Contractor selection ○ Initiate construction ○ Rolling stock procurement	

Program for Sumatra Rail Network Development				
	2010-2014	2015-2019	2020-2024	2025-2029
Private Branch Connections to Coal Origins and Ports	○ Concessioning strategy ○ Negotiate agreements	○ Provide infrastructure development support, trail operating support and/or rolling stock if included in agreements	○ License operations ○ Monitor performance	
Urban Commuter Connections	○ Evaluate sub-national initiatives ○ Develop DGR support strategy	○ Provide infrastructure development support, trail operating support and/or rolling stock if included in agreements	○ License operations ○ Monitor performance	
Note: as the RMP evolves, specific project schedules for individual projects of a given type (e.g., coal-port branches) may fall in different phases, depending on priorities, funding opportunities, timing of private sector initiatives.				

4.5 FREIGHT OPPORTUNITIES BY COMMODITY

As with most railways around the world, the core freight commodities carried by PTKA are bulk commodities. Together, coal, cement and petroleum products account for over 90 percent of rail tonnage, with agricultural products, fertiliser and containerised products accounting for most of the remaining 10 percent. Railway transport of general goods traffic is minimal. A relatively positive outlook for the rail sector is that production and consumption of two of the three main commodities transported; coal and cement, promise to grow rapidly. The petroleum products outlook is less bright for several reasons, but demand should continue to increase at a moderate rate. The prospects of these diverse market segments are reviewed below.

4.5.1 Coal

Coal is the largest freight commodity on Indonesian railways and is likely to remain so. Forecasts for coal production show Indonesian coal production more than doubling from 2008 to 2025, from about 229 tons annually currently to some 569 tons per year. This production is concentrated in Sumatra and in Kalimantan and has been able to take advantage of direct access to barge/vessel transport to both domestic and export markets. However, increased coal production should generate substantial new rail traffic on both islands. In Sumatra, the railway already handles some 11 million tons of coal and recent agreements offer the potential to double that volume.

Year	Production (mt)	Incremental Increase Tonnes (mt/a)	Incremental Increase Percent (%)
Historic			
2000	77		
2001	92	15	20%
2002	103	11	12%
2003	114	11	11%
2004	132	18	16%
2005	153	20	15%
2006	194	41	27%
2007	217	23	12%
2008	229	12	6%
Forecast			
2008	229		
2009	249		
2010	269		
2015	369		
2020	469		
2025	569		
2030	669		
Growth Rates (%/a)			
2000 - 2008	14.6		
2008 - 2030	5.0		
Linear Growth (mt/a/a)			
2000 - 2008	19.0		
2008 - 2030	20.0		

Table 21 – Forecast of Indonesian Coal Production (Million Tonnes)

In October 2009 it was announced that Indonesian coal producer PT Tambang Batubara Bukit Asam had won a permit to build a 307 kilometer/USD 1.06 billion railway on Sumatra island with a capacity to transport 20 million metric tons of coal a year.[29] In Kalimantan, coal is currently being shipped from mines with access to river barges and is transported to vessels offshore. In the future, however, production is projected to shift to mines further inland without barge access and pre-feasibility studies for rail transport have already been conducted. A 2002 study by the Institute of Energy Economics Japan[30] concluded that six railway branches from mine locations could be constructed totaling 1,240 km in total length and involving an estimated USD 1.7 billion of total capital outlay that would carry some 52.70 million tons of coal annually. In September 2009, preliminary agreement was given by the Bappenas in Jakarta on "the Puruk Cahu-Bangkuang railway line," the first of four proposed additional sections of rail stretching across Central Kalimantan province to connect coal mines and ports. The line was expected to carry 10 million tons per annum during the first 10 years of its operation, later increasing to 20 million tons, meaning that about 500 million tons of coal will be transported by the railway over the course of a 30-year concession.

The robust coal transport outlook is supported by projections of rapidly expanding domestic coal consumption and well as export demand. Numerous coal-fired power plants are scheduled to come on line in the immediate future, alongside the conversion of currently oil-fired plants to coal. As shown in the following table, driven by electric power demand generated by Indonesia's rapid GDP growth, coal consumption could readily triple by 2025.

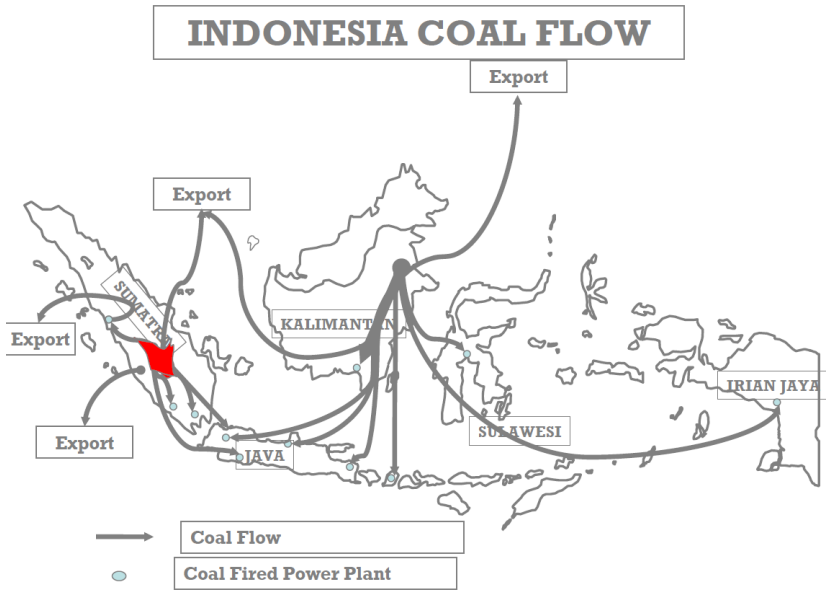
[29] Jakarta Globe, October 21, 2009.

[30] Institute of Energy Economics Japan, Preliminary Feasibility Study on Railway Coal Transportation in Kalimantan, Indonesia March 2002.

COAL DOMESTIC CONSUMPTION 2005-2025

Consumer	2004 (R)	2005	2010	2015	2020	2025	Remark:
1. Electricity	23.0	26.2	49.2	74.8	119.2	156.5	Electricity growth 7%
2. Cement	5.5	6.5	10.0	11.00	13.0	17.0	In average 1 ton coal = 6.6. ton cement resulted
3. Metalirgy industry and Pulp peper	1.3	1.5	7.0	10.0	11.0	12.0	
4. Small Industries (textile, briect burning roof/llimstone, etc)	0.02	1.0	5.0	7.0	9.0	10.0	Direct Use+ briquette
5. UBC	-	-	1.7	8.5	17.0	25.5	UBC Product for export
6. Liquefaction	-	-	2.0	10.8	27.0	37.8	
Total	29,82	35.2	74.9	122.1	196.2	258.8	

Based on the above information, it is possible that by 2025, the influx of new coal traffic alone could increase Indonesian rail coal tonnage and ton-kilometers by as much as five times' current volumes. As shown in the attached graphic, virtually all of this potential rail traffic, which could reach 70 million tons or more, would be transport from the coal origins, as currently about 75 percent of Indonesian coal production is for export via ocean vessels. This could drop to 50 percent with the explosion in domestic coal consumption, but most domestic consumption is at ocean-side or near ocean-side facilities located specifically to take advantage of cheap water transport. There are, however, three important aspects of this prospective rail traffic to be highlighted:



All of the Kalimantan traffic and much of the Sumatra volume will be over newly constructed lines in the producing areas and relatively little of this traffic will flow over the existing rail network. Rail coal transport volumes are likely to have minimal impact on rail freight traffic within Java. This may be regarded as a positive factor as coal movements for the most part will not be competing for track capacity needed to support passenger traffic growth.

Development of rail coal transport capacity appears to be taking place on the basis of private rail concessions, rather than under the auspices of PTKA. While PTKA may be able to develop a role in

some, if not all, of the rail concessions, it is likely that the rail services will be organised as subsidiaries of the mining companies or as stand-alone limited liability companies. They would not be organised as Perseros or subject to the BUMN regulations for State-Owned Enterprises.

While coal traffic may contribute greatly to rail freight volumes*, it will contribute much less to rail market share.* This is because (a) as shown in the graphic, most domestic movements will entail vessel movements with as long or longer haul than the rail movement, (b) if plants are not situated to directly accept vessel delivery, most hauls from the vessel landing will be short and final delivery may be by port or conveyor, (c) barge and truck transport from mines to ports and plants will not cease with the initiation of rail service from only a portion of mining operations, but is likely to grow as well, and (d) for cement and industrial facilities using coal as inputs, the outputs from these facilities are likely to be truck-oriented movements to diverse consumers, for which it is difficult for rail to compete.

4.5.2 Cement

Cement is the second largest commodity carried by PTKA after coal, about 20 percent of tons carried. However, PTKA currently handles only a moderate market share of cement transported for domestic consumption. According to the Indonesian cement industry, in 2006 some 25.3 million tons of cement were consumed in Sumatra and Java. In that year 3.4 million tons of cement were carried by PTKA, mostly in Sumatra, or about 11 percent of the volume (or 13 percent on just the rail served islands of Sumatra and Java). Cement is normally a heavy haul commodity for which rail has a competitive advantage for hauls of 500 kilometers or more. However, inputs to cement production are sufficiently common that cement facilities can often be located near population centers, resulting in short hauls that advantage trucks. In Java and Sumatra, plant waterside locations further limit rail market penetration. The accompanying map demonstrates this problem: most Indonesian cement plants are located near water and, in many cases, near population centers. The combination of these factors limits rail opportunities.

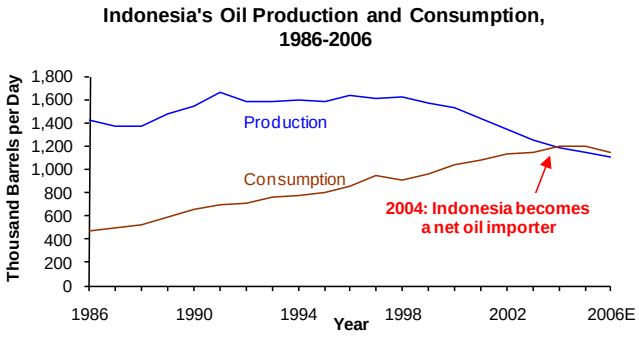
Future cement domestic consumption potential is likely to continue to be limited by producer locational decisions that take advantage of Indonesia's archipelago status. To illustrate, in 2008, Holcim Indonesia, a subsidiary of one of the world's leading producers of cement and aggregates (operating in 70 countries) developed plans for a greenfield cement plant of 1.7 million tons capacity per year in Tuban, East Java, Indonesia. The plant will be located adjacent to limestone and clay quarries and within two kilometers of a small port facility with a dedicated jetty for the cement facilities. Coal from Kalimantan and gypsum from Thailand will be imported over this jetty and outbound cement for other Indonesian islands and export will move via conveyor to the port. Crushing facilities, the cement plant, a dedicated power plant and associated infrastructure will be connected by short private roads and conveyors. There will be no rail connections and distribution of cement to diverse receivers in Java will be made via a fleet of some 200 trucks.

4.5.3 Petroleum Products

Demand for petroleum products in Indonesia is projected to grow moderately over the next several years, driven by population and GDP growth but slowed by several factors:

- The decline of domestic petroleum production and increased reliance on more expensive foreign sources.
- Conversion of oil-fired power plants to coal.
- Reduction of fuel subsidies and introduction of fuel surcharges.

As shown in the accompanying graph, Indonesian oil production leveled off in the early 1990s and by the end of the decade, production began to decline. In 2004, Indonesia became a net petroleum importer. According to the US Energy Information Administration, Indonesia's two largest oil fields are Minas and Duri, which are operated by Chevron and located along the eastern coast in Sumatra. However, these fields are mature and production at these locations has been on the decline. Various oil exploration projects are underway in Indonesia. However, to date, these projects have not brought sufficient new oil resources on-stream to offset the declining production levels at older fields.



Source: EIA *International Energy Annual*; *Short-Term Energy Outlook*

One of Indonesia's last undeveloped oil fields is the Cepu block, located in East and Central Java. ExxonMobil's local subsidiary discovered 250 million barrels of proven oil reserves in the Cepu Contract Area in 2001, and today the company estimates that the area could hold up to 600 million barrels of recoverable oil reserves. In 2006, after several years of negotiations, ExxonMobil and PT Pertamina signed a joint agreement (JOA) for the Cepu field. Each company will have a 45 percent stake in the project, with the remaining 10 percent held by provincial governments in East and Central Java. The shift of production to this area may not be especially beneficial to PTKA because of its greater proximity to population centers. Also, as illustrated in the attached map, like coal and cement producers, petroleum resource developers take advantage of low cost water transport whenever possible. Most reserves are located offshore or onshore near the refineries, further limiting rail potential.

Indonesian domestic petroleum consumption grew by an average of 4 percent per year from 1990 to 2005. Given the factors noted above, the prospective growth outlook appears to be closer to 3

percent per year, the figure employed in the recent traffic forecast compiled for the National Ports Master Plan (NPMP).[31] The NRMP adopts this forecast herein.

4.5.4 Container Traffic

The above-referenced traffic study for the Port Master Plan estimates port container traffic, international and domestic, in 2007, at 8.5 million twenty-foot equivalent units (TEUs), or about 85 million tons, using an average figure of ten tons per TEU.[32] There will be some additional container traffic that moves by land transport between Indonesian producers and consumers without passing through seaports, but the volume is anticipated to be relatively small. Since PTKA carries only about 250,000 tons of container traffic, the rail market share of the container business would be only about 0.3 percent, even ignoring domestic, non-port container transport.

Container traffic via ports is anticipated to grow rapidly through 2025. The Port Master Plan forecast places its base case container growth rate at 5.5 percent per annum through 2014 and 8 percent per annum from 2015-2030; a high case rate is projected at 8 percent per annum through 2014 and 9 percent per annum from 2015-2030. With this rate of growth in container traffic, PTKA will need expanded container capacity even if it does not significantly expand market share. While there are likely to be some significant niche markets for container rail transport, potential is limited by the close location of container ports to major metropolitan areas.

4.5.5 Other Freight Possibilities

Fertiliser is another potential growth area, driven by expansion of the agricultural sector and the availability of natural gas resources for fertiliser production. In 2007, Indonesia had some five fertiliser companies, some with multiple plants, producing some 9.8 million tons per year for domestic use and exports. In addition, about 500,000 tons of fertiliser were imported in 2009. As shown on the attached map, these facilities tend to be located waterside, as is the case for most Indonesian industrial facilities. PTKA carries about 400,000 tons of fertiliser, or roughly four percent of the market.

Company	DESIGN CAPACITY (Ton / Year)			
	UREA	SP-36	ZA	NPK
PT Pusri	2.262.000			
PT Pupuk Kaltim	2.850.000			
PT Petrokimia Gresik	462.000	1.000.000	650.000	300.000
PT Pupuk Kujang	1.140.000			
PT PIM	1.140.000			
Total	7.854.000	1.000.000	650.000	300.000

Fertiliser consumption is likely to grow by as much as six percent annually to 2025, a combination of low to moderate growth for ordinary food crops and very rapid growth for the palm oil industry.

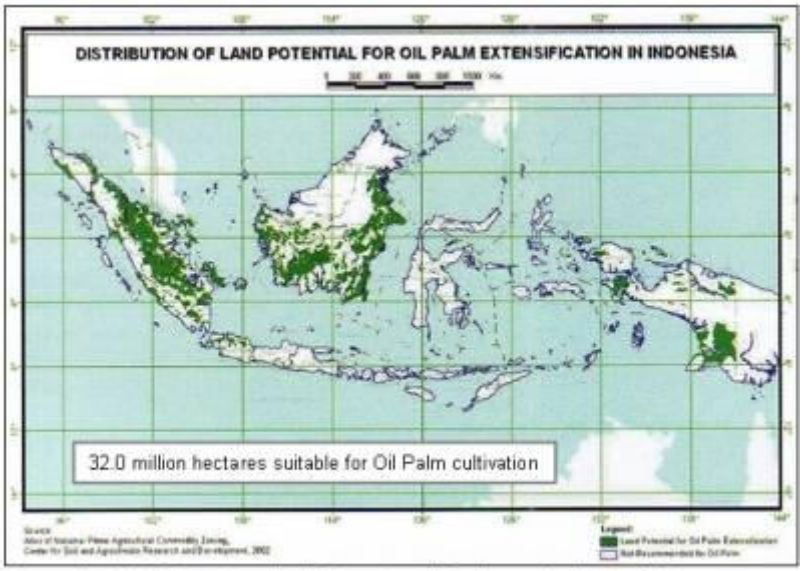
Palm oil production is located mostly in Sumatra and Kalimantan. Production is projected to grow by as much as 12 percent per year. As the map below shows, much of palm oil production is situated for

[31] David Wignall Associates, National Port Master Plan Strategic Traffic Forecast for Directorate General of Sea Transportation, December 2009

[32] Wignall at 31.

easy access to vessels and about 75 percent of the palm oil crop is exported. Most palm oil processing is undertaken at plantation sites, again minimising land transport requirements.

INDONESIA: Map of Suitable Palm Expansion Areas



Source: Center for Soil and Agroclimate Research and Development, Indonesia 2002

4.5.6 Implications for 2029 Rail Tonnages

The Indonesian rail sector faces substantial requirements to increase freight capacity, even if the railways only maintain their current market share for each of the significant commodities in the current rail consist. The table below shows the tonnage projections for commodities carried by PTKA that were made in this NRMP and in the traffic analysis made for the Ports Master Plan study. Focusing on these commodities alone, tonnage – all modes – is likely to rise by two and a half times between 2009 and 2025, from 535 million tons to 1,359 million tons. This is driven by major increases in key commodities such as coal, palm oil and containers.

As shown on the bottom line, if the railways retain only their current share for each commodity carried, they would need to haul almost 120 million tons annually. Since these projects assume that new lines will be constructed to handle coal in Kalimantan and Sumatra, considerable investment in infrastructure will be required, along with substantial investments in locomotives and wagons. This projection may raise overall rail market shares slightly (assuming that commodities that use rail significantly grow at a faster rate than non-rail commodities). However, the five-fold or more increase in rail market share posited in the draft NRMP would be exceedingly hard to reach.

As a matter of priority, the NRMP should address, as much specifically as possible, how the rail sector can meet the predictable growth in freight transport demand without *losing* market share – most particularly without losing market share to road transport (that can in some circumstances[33] be less efficient and more environmentally damaging). If rails can meet that formidable challenge, attention may then be redirected to targets to increase rail market share.

[33] Where, for example, government subsidies for fuel inputs and lax enforcement of vehicle axleload limits distort shipper choices in favor of road transport, as commonly claimed in Indonesia.

Potential Growth in Freight Transport Requirements (million metric tons, all modes)								
	Coal	Petroleum Products	Cement	Containers	Fertilizer	Agricul. Products	Palm oil	Total
2009	249	65	30	80	10	79	21	535
2010	269	67	32	86	11	83	23	572
2011	282	69	34	93	11	88	26	603
2012	297	71	35	101	12	92	29	637
2013	311	73	37	109	13	97	33	672
2014	327	75	39	118	14	101	36	710
2015	343	78	41	128	14	106	41	752
2016	360	80	43	140	15	112	46	796
2017	379	82	45	152	16	117	51	843
2018	397	85	47	166	17	123	57	893
2019	417	87	50	181	18	129	64	947
2020	438	90	52	197	19	136	72	1005
2021	460	93	55	215	21	143	81	1066
2022	483	95	57	234	22	150	90	1132
2023	507	98	60	255	23	157	101	1203
2024	533	101	63	278	24	165	113	1278
2025	559	104	66	303	26	173	127	1359
Potential 2025 Rail Traffic with no Increase in Modal Share for Each Commodity:								
(metric tons)	78	5	7	9	1	10	8	119

4.6 FREIGHT AND PASSENGER OPPORTUNITIES BY ISLAND

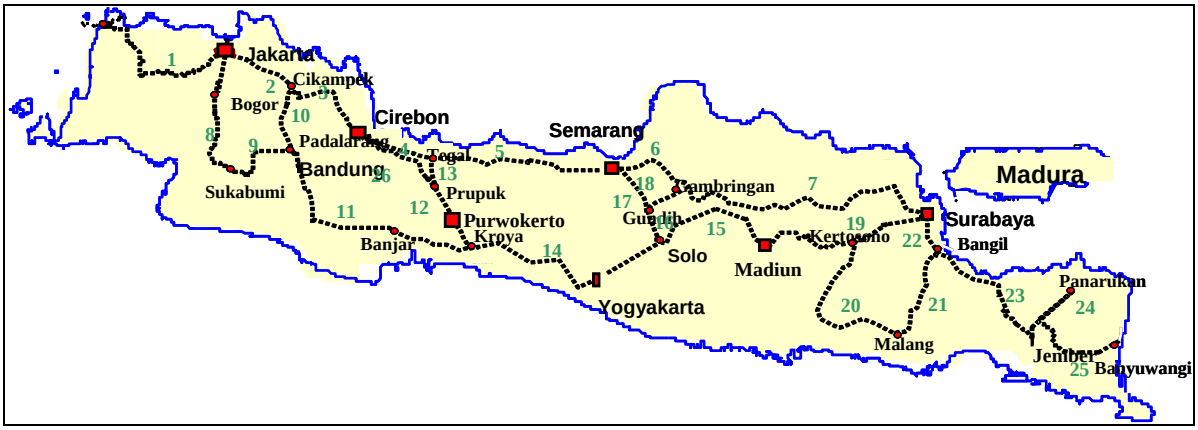
4.6.1 Java

Java is the most heavily populated island in the world, with over a 20 percent larger population and double the population density of Japan's Honshu island (937 persons/km^2 vs. 452/km^2), which is about 63 percent larger in land area. The 3,425 kilometers of rail network on Java, however, are only about a sixth of the extensive systems on Honshu. In 2005, Japan's railways carried 146 billion passenger kilometers, at least 80 percent on Honshu Island. Great Britain, the third most populated island in the world, with about half the population of Java, is about 50 percent larger in land mass than Java, but has over 16,000 rail route kilometers or about four times the route miles on Java.[34] It carried about 45 billion passenger kilometers in 2005. Virtually an island due to its closed northern border, South Korea has about 40 percent the population of Java and a little over half of Java's population density (about 487 persons/km^2), but supports a comparable rail network of about 3,500 kilometers, plus urban-suburban services. It carried some 31 billion passenger kilometers in 2005 according to international statistics (including urban transport). This represented some 14.3 passenger kilometers, according to PTKA data. About 95 percent of the Indonesian passenger-kilometers were related to Java transport.

[34] World Development Indicators Database.

As the map below indicates, most of the major cities are already interconnected in Java, although there may be opportunities for shortening service routes in some cases. However, it appears that the main requirements in Java would relate to:

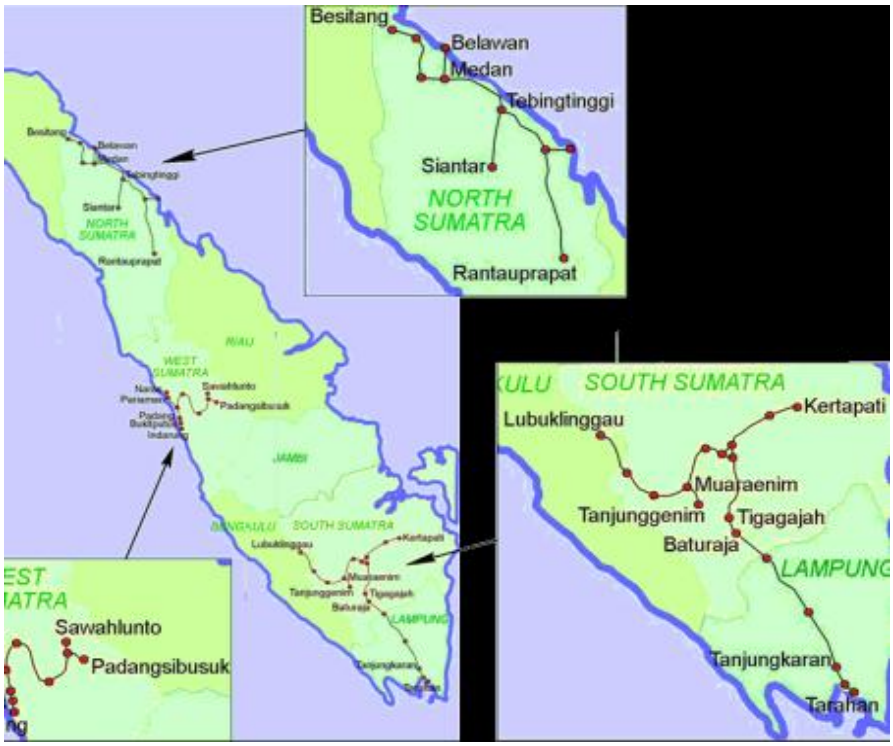
- upgrading existing lines (including restoring some out-of-service network segments),
- building access lines to key facilities and intermodal connections such as key ports and the international airport, and
- expanding urban services, notably in the Jakarta and Surabaya regions.



4.6.2 Sumatra

Sumatra's rail system is quite different from the rail network on Java, and is divided into three widely separated systems that fail (i) to meet the needs of intercity passenger and freight transport and (ii) do not adequately serve newly emerging developments in the coal and plantation sectors.

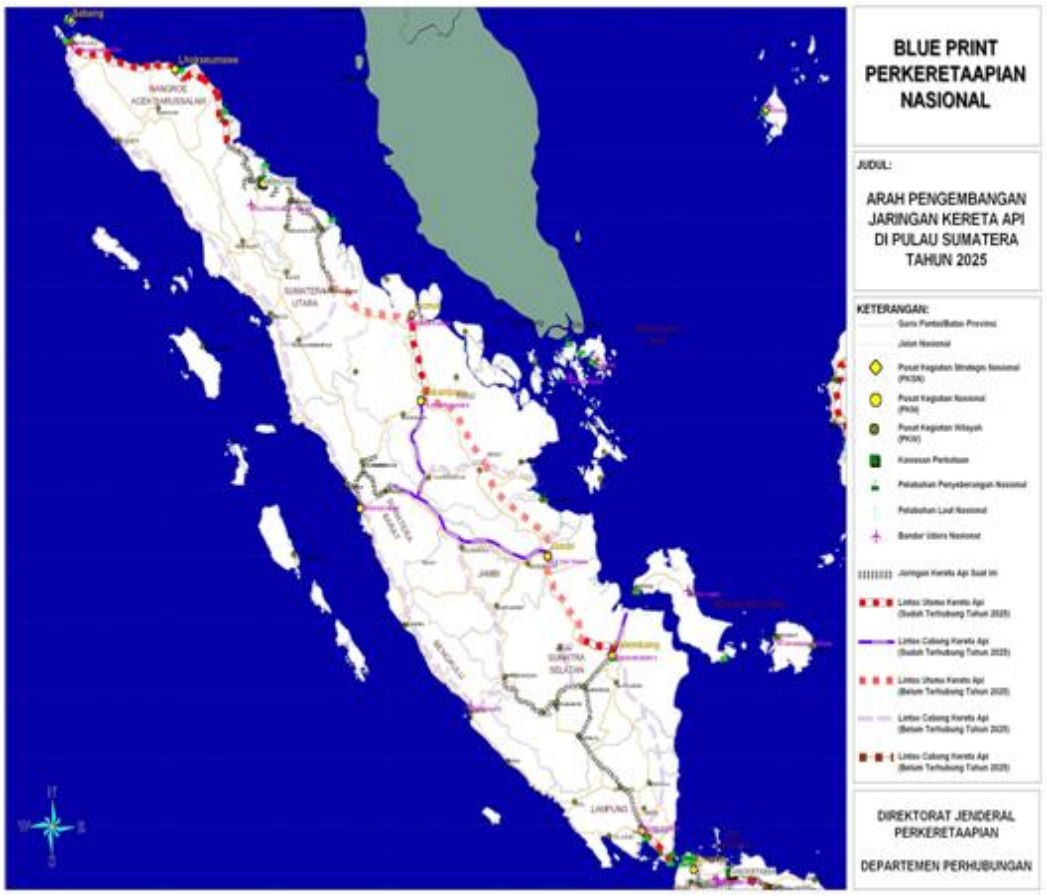
Sumatra has two large municipal areas in Medan (over two million inhabitants) and Palembang (population over 1.3 million), three other cities with population over 700,000 (Padang, Bandar Lampung and Pekanbaru) and numerous other towns over 100,000 people. As shown on the map below, rail interconnections between the major population centers are quite limited. The north Sumatra center of Medan is connected only by road to the central cities of Pekanbaru and Padang, neither of which is connected by rail with the southern cities of Palembang and Bandar Lampung.



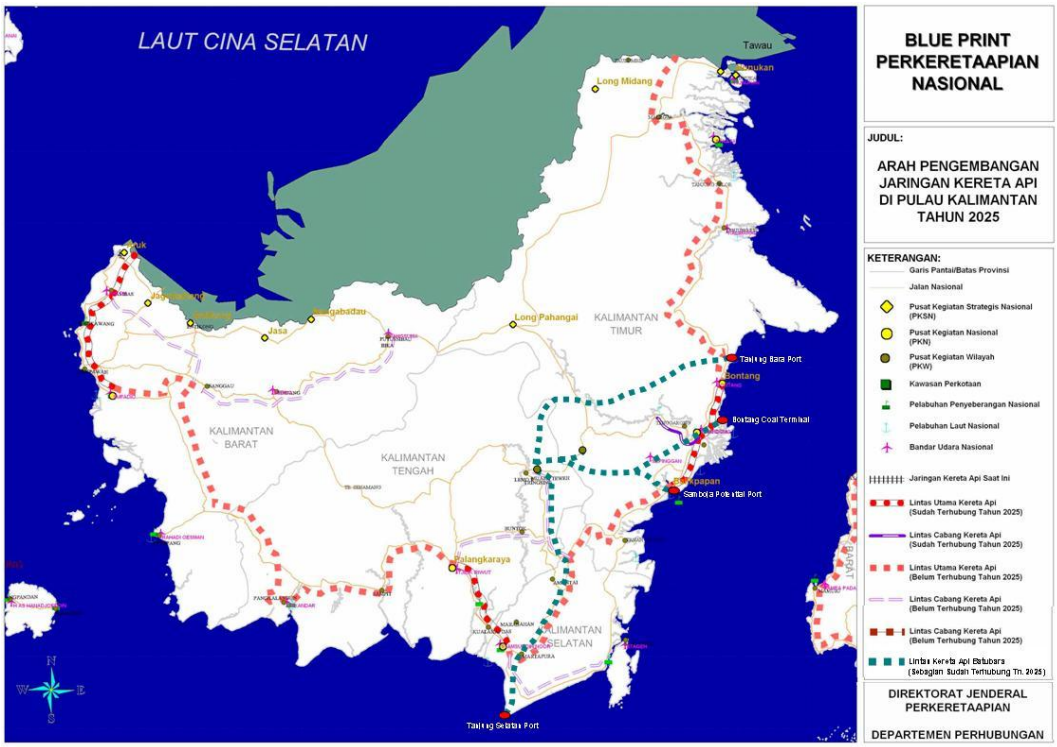
DGR's rail plan for 2025 is to provide for these interconnections via constructing a new line along the east side of the island that would connect the Medan region line to Pekanbaru and Palembang and then add an extension north of Medan to Banda Aceh at the far north end of the island. In addition, two other sections (indicated in red in the map below) would be built prior to 2025). Other sections of a main line across the length of Sumatra (marked in light orange/pink) might not be completed until after 2025. DGR has accepted plans advocated by senior government officials that this new "Trans-Sumatra Line" would be standard gauge with planned axle loads of 18-22 tons and would be connected by spurs to all major ports. Despite a recent consultant study[35] recommending a continuation of the current gauge as the most cost-effective solution, a short initial section has been built as standard gauge. Urban/commuter lines would be expanded and improved in all three urban clusters.

The projected Trans Sumatra additions are depicted on the following map and further discussed in the next chapter.

[35] SNCF International, Study of the Nanggroe Aceh Darussalam Railway (from Banda Aceh to Medan), 2005.



4.6.3 Kalimantan



Kalimantan, the Indonesian territory on Borneo Island, is the largest of the three jurisdictions, containing roughly 9-11 million of the island's estimated 15-16 million inhabitants and about two-thirds of the island territory (about five million persons live in East Malaysia and some 400,000 in Brunei). With no existing rail systems, Kalimantan covers a 22 percent larger land area than Sumatra and nearly four times the land area of Java. Kalimantan is lightly populated, with only about 9 million inhabitants, and coal and other freight business would likely have to be the foundation for developing railway service. Presently, minerals development, logging and palm oil tree cultivation make use of inland waterway to transport their products to the ocean, but mining is beginning to move into areas where barging is not possible.

As shown in the accompanying map, NRMP plans for rail development by 2029 are to create rail lines, both, to serve mining operations (lines in blue-green) and to provide some links to the modest population centers on the island (lines in red). Specifically, DGR plans to: (i) develop railway access for production centers (mines, plantation, forestry, etc.) and for passenger services; (ii) develop the new railway lines as standard gauge with 18-22 tons axle loadings, and (iii) after 2025, eventually (lines in light orange/pink) connect the lines with Malaysia and Brunei (as part of Trans Asia Railways plans). The blue-green lines on the map would serve coal mining areas and may be constructed in the short term as special projects with private sector funding. None of the displayed routings have been finalised. Provincial desires in Central Kalimantan, where the mines are located, to favour internal routes to Central Kalimantan ports could result in longer alternative routings should private financing sources agree. The light orange/pink lines represent long term plans and might not be substantially funded or constructed until beyond 2025.

The NRMP notes that Kalimantan is divided into four provinces (East, West, South and Central Kalimantan). The Borneo territory of East Malaysia is divided into two (Sarawak and Sabah) and Brunei occupies a small northern area. Currently, none of the three Kalimantan provinces have rail service, nor does Sarawak or Brunei. Sabah has a small meter gauge line of 134 kilometers that has recently been out of service and is not connected to the Indonesian border (but is being revived for tourists). There appears to be little opportunity for near term international rail traffic and DGR long term international rail plans would require completely new cross-jurisdiction construction. As noted above, Kalimantan has only about nine million inhabitants and its main municipal areas are relatively small (200,000 to a little over 1,000,000 population), so that urban railway and intercity passenger links are marginal unless part of the infrastructure costs can be shared with freight services.

The extensive coal resources in Kalimantan, however, offer a solid base for future railway developments. As can be seen in the accompanying figure, coal mines located mostly across East, Central and Southern Kalimantan offers major opportunities for railway coal transport. Several separate coal line proposals have completed feasibility assessment and are in various stages of negotiations between sponsors, the provincial governments and the national government. Current prospects for the latter include the following initiatives.

➢ Central Kalimantan:

The government of Central Kalimantan province has plans to construct a 185 kilometer coal-specific railway network from Murung Raya district to Mengkatip, South Barito district. The railway network's construction cost is estimated to be Rp 7.6 trillion, which will be fully covered by private consortium. Current plans call for the award of 30-year concession, and some 11 countries have reportedly expressed an interest in taking part in the project. Government is currently working to ready the project for tender, and make it more attractive to potential investors. A feasibility study for the project has been completed, and the government is now trying to purchase land. Of the land, 70 percent is already under government control, with the remainder under private control. With a low population density in the region, land acquisition should not pose a considerable problem. Government has announced that it will award a competitive pricing scheme to entice investors to the project by providing a degree of security of income, although the pricing formula will be determined at a later date.

➢ South Kalimantan:

The government of South Kalimantan province has plans to construct a railway network in order to overcome problems in transporting mining products, plantation products, and other natural resources. The construction of the railway network would include track from Banjarmasin to Tanjung City, Tabalong District, towards the border of South Kalimantan and East Kalimantan that will take management of roads now used extensively for coal and other freight transport, so that they can be used for other transportation. (Coal transport has been a heavy user of public roads often resulting in traffic congestion and high number of accidents.)

➢ East Kalimantan:

The government of East Kalimantan province is cooperating with a South Korea investor to construct a coal transport railway, the investment needs for which is Rp 9 trillion, which would be provided by South Korean companies (Posco Incorporate Ltd. and Canatect Co. Ltd.). In the initial stage it will only be used for coal transport, but following an increase of regional economic growth, it could be adapted to serve passenger and other property transportation needs.

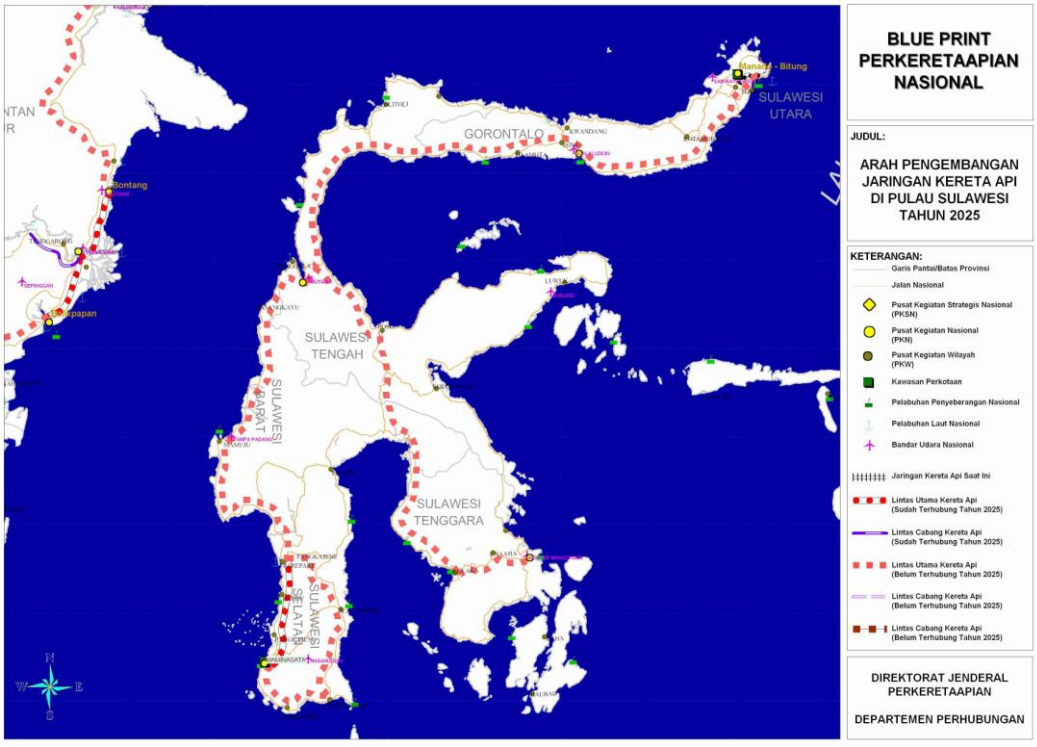
In April 2010, another investor (MEC Holdings, based in the United Arab Emirates) announced plans to invest USD 5.2 billion in infrastructure, including a smelter, railway and power plant, to support its coal mine in East Kalimantan, with the intent to market coal domestically as well as for export. It indicated interest in expanding an initial 130 kilometer railway to as much as 1,000 kilometers. The mine has nearly 2 billion tons of reserves and about 30 percent of production will go to the domestic market. The rest will be exported to India and China. The main customer for the domestic coal supply will be the planned joint-venture power plant between MEC and Indian state aluminum maker NALCO, which will supply power to their joint-venture alumina smelter, both near the coal mine. The power plant will cost USD 1.2 billion, with a capacity of 1,400 megawatts. The proposed USD 1 billion railway will have a capacity of 70 million tons a year of coal and will connect MEC's mine to the coastal port in Bengalon, for export of the coal and import of other raw materials, Koneru said. MEC expects the railway to be operational and ready to deliver coal in 2011. The NRMP expects this venture and others like it to be developed on a PPP basis involving the government as well as a private operator.

In summary, coal-driven rail developments in Kalimantan are likely to comprise the largest contributor to increased railway market share. The NRMP notes that rail-port coal traffic on

Kalimantan that is intended for export will contribute ton-kilometers to the rail market share that is not shared with any other mode, but that rail-port traffic that is moved onward by vessel to domestic power plants or other domestic users will generate at least as many vessel ton-kilometers if not more. While increased domestic vessel traffic could hold railway market shares below TRKA targets, this is not an adverse outcome given the cost-efficiency of waterborne traffic and its contribution to Indonesian GDP. Consequently, NRMP will find it acceptable to measure railway market shares in terms of overland traffic for purposes measuring TRKA goal achievement.

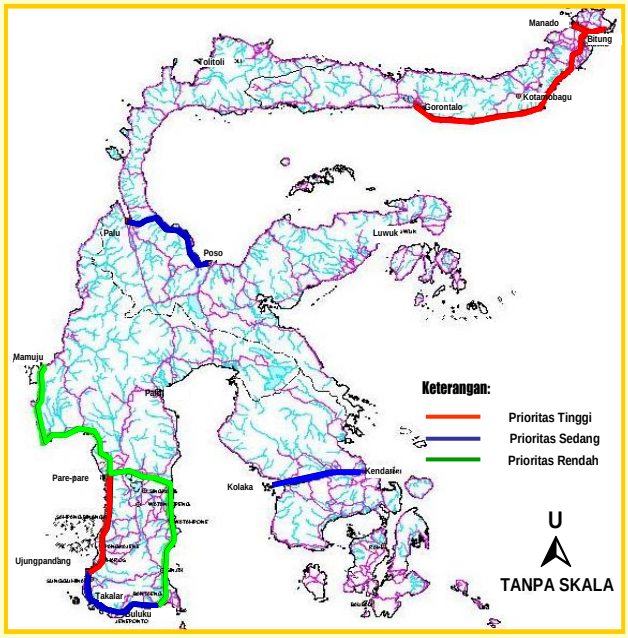
4.6.4 Sulawesi

Sulawesi, an island with a population of around 16 million currently has no rail service. As noted earlier, however, Sulawesi's population is larger than Japan's Kyushu island, which does have substantial passenger rail service. The island has one large municipality, Makassar (population 1.1 million), a substantial city in Manado (over 400,000 residents) and about seven towns of over 100,000 people. DGR envisions eventual development of an urban/commuter rail service in the Makassar municipal region and a linear Y-shaped network connecting the cities spread out along the Sulawesi coast. Sulawesi's economy is based largely on agriculture, fishing industries and tourism and there is little mining development.



The results of feasibility studies show that a railway project is feasible to support regional transportation connecting Makassar-Parepare-Mamuju-Palu and Makassar-Parepare-Palopo-Palu, with the total network length of 150 km.

The development of rail service will proceed deliberately here, due to more urgent immediate priorities on Java and Sumatra. Only urban/suburban services in the Makassar region (shown in the lower red line on the above map) are expected to be completed within the second phase (2015-2019) of the NRMP.



Sumber : Studi Kelayakan Jalan KA Sulawesi, 2005

4.6.5 Papua

Some preliminary analysis has been given to possible construction of a limited railway network to connect the areas that have the potential to both, passenger and goods traffic, with priority on: Jayapura - Sarmi, Sarmi - Nabire, Nabire - Manokwari, Manokwari - Sorong, Nabire - Timika and Merauke - Jayapura;

4.6.6 Outside Java Rail Development in General

According to government regulation no. 2 of 2008 regarding National Spatial Plan, railway network should be built in every large island. The MOT has implemented this government regulation by conducting feasibility studies on the construction of railway networks in various regions. The NRMP will follow up the ex-Java railway network construction gradually starting from Medium Term Development period of 2010-2014 (Direction from Vice Minister of Transportation on 15 December 2009). Outside of Java and, to a lesser extent, Sumatra, the NRMP initially will rely heavily on supporting several regional governments that have planned to construct railways in their own regions, i.e., Bengkulu, South Sumatera, Central Kalimantan, South Kalimantan, East Kalimantan and South Sulawesi. Bengkulu: The government of Bengkulu Province plans to start the first stage of 29 km track construction from the total of 195 km railway track and build three train stations including central station in Pulau Baai port. Budget for the construction of the railway track and two stations is obtained from State Budget (APBN) totaling to Rp 400 billion, whereas the central station construction fund is derived from Regional Budget (APBD) of Bengkulu Province. The remaining cost will be covered by private sector, specifically coal mine operator transport affiliates.

4.7 INTERNATIONAL COMPARISONS

4.7.1 General Comparisons

For a number of years, the role of the rail subsector in Indonesia has eroded relative to other modes. Despite the stagnation of rail transport over the last decade, it should be noted that the volume of passengers and passenger kilometers that PTKA carried, place Indonesia railways well within the top 20 passenger railways worldwide. It falls well below the extensive passenger systems of China, India, Japan and Russia and those of the core developed countries of the EU (France, Germany, the UK and Italy). However, PTKA transports more passengers than most other rail systems globally. It is not an insignificant passenger carrier. While the rail share of freight traffic is low, this also should be placed in context. Indonesia is an archipelago and its most populated island is relatively small. These characteristics result in:

- Short hauls for which railways are less competitive.
- No transit traffic interchanged with other railways.
- No export or import traffic interchanged with other railways.
- Competition with less costly coastal and inland waterways transport by vessel and barge, and
- Inability to compete for inter-island transport by vessel or air.

Given these conditions, the Indonesian rail sector performance should not be compared with mainland-based rail systems with longer domestic hauls, regional connections with other rail systems and little to no significant competition with waterborne transport.

4.7.2 Comparative Analysis of Island Economies

As stated in the preceding section, it is unreasonable for Indonesia to set objectives for enhanced rail service in comparison with mainland countries with large contiguous jurisdictions, rail interconnections with other countries and little competition to rail from water commerce. For that reason, the NRMP provides a comparison between the rail service and demographic profile of Indonesia's main islands and other major islands with rail service. South Korea is included, as the closed border to the north gives it many island characteristics. The comparisons with other major islands are shown in the following table.

Comparison of Rail Networks and Demographic/Economic Factors in "Island Economies"

Island/Country	Population	Island Pop. Rank	Pop. Density (persons/ Km²)	Land Area (km²)	Rail Length (km)	Rail Pas. Modal Share	Rail Freight Modal Share	GDP per capita ($ PPP)
Java	124,000,000	1	935.6	138,794	3,425	7.3%	0.6%	3,900
Honshu, Jap.	103,000,000	2	451.8	225,800	22,000	28.7%	5.2%	34,100
Great Britain	61,800,000	3	281.3	209,331	16,000	5.4%	5.7%	36,700
South Korea	48,379,000		538.9	100,140	6,763	21.4%	12.6%	27,700

Comparison of Rail Networks and Demographic/Economic Factors in "Island Economies"								
Island/Country	Population	Island Pop. Rank	Pop. Density (persons/ Km²)	Land Area (km²)	Rail Length (km)	Rail Pas. Modal Share	Rail Freight Modal Share	GDP per capita ($ PPP)
Luzon, Ph.	46,288,000	4	483.1	104,688	1,060			3,300
Sumatra	45,000,000	5	90.4	443,066	1,348	7.3%	0.6%	3,900
Taiwan, Chi.	22,200,000	6	657.0	34,507	1,588	39.6%	3.1%	31,100
Sri Lanka	20,700,000	7	315.5	65,268	1,948			4,400
Mindanao, Ph.	19,793,000	8	209.1	97,530	None	--	--	3,300
Madagascar	18,600,000	9	34.1	587,713	637	n.a.	n.a.	1,000
Hispaniola	17,400,000	10	241.5	73,929	1,695	n.a.	n.a.	8,200
Borneo	16,000,000	11	21.5	748,168	None	--	--	3,900
Sulawesi	16,000,000	12	97.0	180,681	None	--	--	3,900
Kyushu, Jap.	13,350,000	13	371.0	37,437	2,102	28.7%	5.2%	34,100
Ireland	5,900,000	19	70.0	84,241	3,800	5.1%	0.7%	45,500
South Isl., NZ	4,362,632	20	16.3	145,836	2,128	<1%	11-15%	27,900
Puerto Rico	3,940,000	25	432	9,100	96	n.a.	n.a.	17,300
Madura	3,525,000	27	796	4,429	None	--	--	3,900
Bali	3,380,000	28	600	5,632	None	--	--	3,900
North Isl., NZ	3,059,000	30	71	43,082	2,000	<1%	11-15%	27,900
Lombok	2,536,000	32	245	10,360	None	--	--	3,900
Notes:(1) GDP and rail share data for countries only; (2) Kalimantan is 72% of the Borneo land area, shared with East Malaysia and Brunei, and about 11 million of the estimated 16 million population.								

Java's island-rail system is best compared to Honshu (Japan), Great Britain, and South Korea, with perhaps the best comparison to South Korea. While Java has a greater population density than any of the comparators, all of those areas have substantial population densities and they are in generally the same geographic area range. Each of the three areas have larger rail networks than Java and two of the three have a passenger rail share of over 20 percent. All three countries (along with Taiwan) have some form of high speed rail service. Freight rail shares are lower, with only South Korea above ten percent. New Zealand's two islands, with a much lower population density and little passenger traffic, have a rail freight share estimated between 11 and 15 percent, largely due to the integration of the rail network with interisland ferry services and ports, combined with the successful development of specialised services for the dairy and meat industries as well as coal and metals and industries with a high percentage of interisland traffic and exports. In all cases, the railway market

shares in these economies have resulted in part from about 5-6 decades of continued economic growth. As Indonesia's rapid growth began in the 1970s, with GDP per capita levels lagging far behind the comparison, it may be reasonable to expect that two decades may yet be required to achieve similar results.

The comparison does imply that there is significant room for railway market share expansion in Java, particularly on the passenger side, but that large expansions in rail traffic will require a much more extensive physical network closely integrated with key industries and ports. Aspirations for high market shares, therefore, cannot outstrip the pace in which new infrastructure can be financed and constructed and appropriate rolling stock acquired. For practical financial and technical reasons, therefore, the NRMP, therefore, guards against excessive optimism for passenger and freight traffic increases in the first (2010-2014) phase of the NRMP.

Sumatra is comparable to the Philippine's Luzon Island at around 45 million inhabitants, but is much lower in terms of population density (90/km^2 versus 539/km^2). Although about four times the geographic area of Luzon, Sumatra's three disconnected systems totaling some 1,348 kilometers are only slightly larger than the 1,060 kilometer network in Luzon. Similarly, although Sumatra is double the population of Taiwan and has over ten times the land area, the rail network only slightly exceeds the 1,118 kilometer system in Taiwan. In fact, it is less extensive than rail systems in Ireland and New Zealand, despite their much smaller population.

- With no existing rail systems, Kalimantan covers a larger land area than Sumatra, but Kalimantan is lightly populated with only about 9-11 million inhabitants. In many ways Borneo and Kalimantan are similar to Madagascar, with its large land area, low population density and limited rail service. In these circumstances, bulk freight business, such as coal, must be the foundation for expanded rail service. Efforts to develop special natural resources based rail service in Kalimantan are being actively promoted by the provincial governments on that island. As per the NRMP, the opportunities to greatly expand rail freight traffic through such ventures can be considered. The NRMP will strongly support the initiatives of private sector enterprises and sub-national governments to develop such services, subject to the principles enunciated in chapter 7.

Sulawesi is larger than Java in land area and has a population larger than Japan's Kyushu Island, which does have substantial passenger rail service. However, while Kyushu is proximate to Honshu and has a substantial industrial base, Sulawesi is relatively isolated and dependent on agricultural and fishing industries. In the absence of major new discoveries of economically exploitable deposits of coal or other bulk minerals, it is unlikely that freight railway developments on Sulawesi could prove financially or economically viable. The NRMP does consider urban and commuter passenger services to be feasible and will support the initiatives of sub-national governments to develop such services, subject to the principles enunciated in Chapter 7.

Again, the NRMP calls attention to the fact that an important difference in all of the above cases where there are sizeable rail systems is that, despite Indonesia's rapid recent GDP growth, per capita GDP in these comparator countries is in every instance over seven times or more of that of Java and Indonesia in general. In view of this fact, the Indonesian railway performance in terms of passenger service on Java is impressive. In 16 years, Indonesian GDP per capita is expected to rise to between USD 10,000 - USD 15,000 or about half of that of Korea today, with higher incomes concentrated in Java. Given the population of Java and rising incomes, an objective of increasing rail transport to levels of South Korea or Great Britain is certainly reasonable. However, personal auto transport rises with prosperity, and it is conceivable that, as in Great Britain, rail transport could stagnate somewhere below 10 percent despite substantial improvements in quality of service.

CHAPTER 5: NRMP INSTITUTIONAL REFORM STRATEGY

In this chapter, the NRMP addresses key issues in rail sector institutional development in order to achieve Indonesia's aspirational goals for revitalising the rail sector. Development of a regulatory framework, in turn, requires production of both written regulations and processes, and production of the institutional capacities to implement, modernise, and enforce these regulations and processes.

Chapter 5 shows the phasing-in of regulations during the several stages of the NRMP. Provisions for infrastructure access may be structured in the first stage of the NRMP, and in some cases, these provisions are required by law. However, the full institutional implementation may not be required until the third or fourth stage of the NRMP, if private sector operations over the infrastructure do not materialise before that stage. Given such considerations, structural changes within the Ministry of Transport (MoT) and Directorate General Railways (DGR) may be implemented gradually, with the economic and technical functions progressively formalised as multiple public and private operations gradually increase the potential for conflict and the regulatory workload.

The chapter addresses, first, NRMP institutional objectives and issues that must be addressed in the early stages of institutional reform. Next, regulatory capacity development requirements within MoT and DGR are addressed. Finally, a road map is provided for the phased introduction of required changes.

5.1 MINISTRY OF TRANSPORT STRUCTURE AND THE NRMP

The MoT is well-structured to implement the technical regulation required to ensure that independent public and private entities that may emerge under the NRMP comply with reasonable safety standards, have appropriately qualified staff, are properly licensed, and operate equipment that meets acceptable industry standards. Preparation of appropriate regulations is being implemented in stages. DGR's existing directorates are appropriate administrative bodies to carry out these functions. DGR must build on recently-developed regulations by developing licensing procedures and formats for implementing its role in technical regulation. If foreign investment is sought, DGR should endure that there are accurate translations of regulations and license requirements in English and any other appropriate languages.

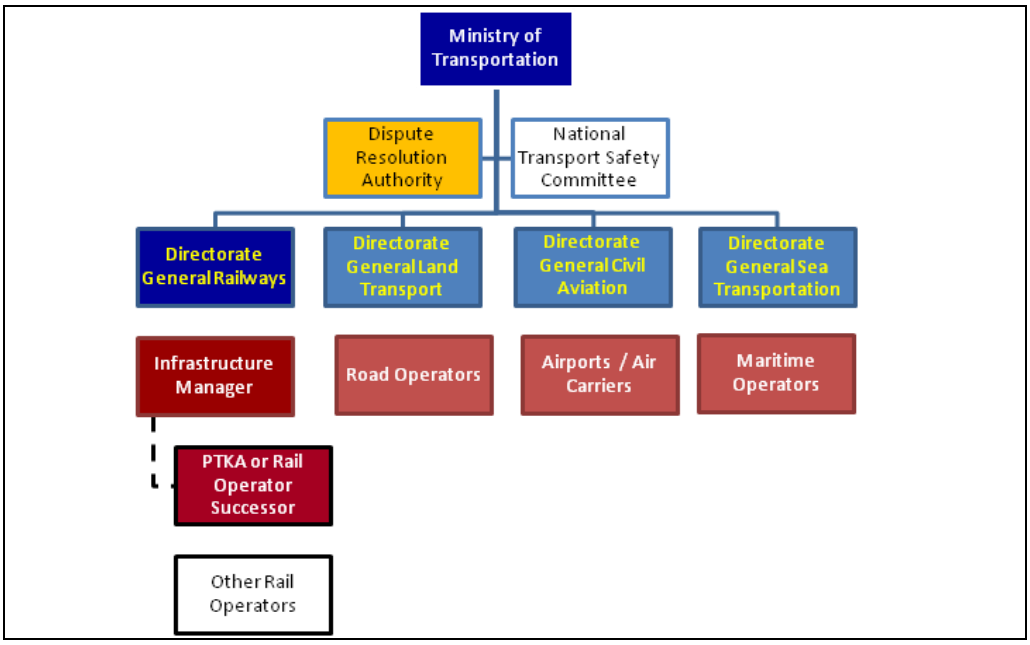
The existing DGR directorate structure is appropriate to DGR's role under the NRMP. However, the specific responsibilities of DGR's Planning Office and each of the three directorates should be periodically reviewed with respect to the functions to be performed under the NRMP and in implementation of the new law. While technical regulation functions fall naturally within the boundaries of the directorates as currently defined, it is not always apparent what the lead directorate for sub-national NRMP coordination, access issues and development of special purpose rail segments should be. Administrative orders should be issued to clarify these responsibilities.

MoT, at present, does not have a clear definition of economic regulation/dispute resolution procedures and there is no designated body within or outside MoT to carry out these functions. In view of the low railway market shares in both passenger and freight service, economic regulation should be minimised. However, disputes do arise and it is possible that certain freight shippers or passenger classes from time to time will have a legitimate complaint against unfair pricing or service terms. Further, the vision of separating infrastructure management and railway service and the possible entrance of new carriers to operate on the infrastructure may give rise to a new category of potential disputes: disputes over access charges and terms and conditions. To account for this, the NRMP will provide, by year-end 2010 that a body be created to resolve disputes.

This framework will include the following:

- Functions will be limited to resolving complaints regarding charges or service inadequacies;
- The complainant will bear the burden of proof to establish unfairness of charges or terms;
- Arbitration will be first mandated to resolve the dispute, with the regulatory body only having the authority to specify a solution in the event that arbitration fails;
- An interim administrative office will be created within MoT to address issues in phases one and two (2010-2019). By phase three, a formal independent board or committee of no more than three to five members should be established by phase three of this NRMP (2020-2024) to perform this function. Fixed, but staggered terms, should be established to ensure independence. Nominations should be made either by the MoT or the CMEA, to be recommended in the NRMP.
- The dispute resolution body will be located outside of the DGR because DGR regulations may be the subject of the dispute; and
- Assuming Government approval, the body will be established as an independent authority attached to the MoT. This last provision is designed to reduce bureaucratic overhead, given the limited functions anticipated of an economic regulator.

The chart below illustrates the recommended placement of the economic regulator/dispute resolution entity. Whether this recommendation or some alternative structure is accepted, the functions, composition and bureaucratic placement of the entity should be determined in the NRMP by year-end 2010.



5.2 RMP RECOMMENDATIONS RE: STATE-OWNED ENTERPRISES

BUMN serves a valuable function in overseeing a smooth transition from government dominated sectors of the economy to more commercially-oriented SOEs to withdrawal of majority state ownership and complete privatisation. As a Persero, PTKA is an SOE and falls under the jurisdiction of BUMN as well as MoT. Because of the public interest in passenger transport in particular, PTKA as an integrated company would appear likely to remain in SOE status indefinitely. However, PTKA's

oversight by BUMN as well as MoT does subject it to constraints that would not be faced by an ordinary limited liability company. The NRMP will consider whether the separation of infrastructure management functions and train operations offers the opportunity to convert at least the train operations activity to an ordinary limited liability company (PT) from its current Persero status, perhaps retaining Persero status only for the infrastructure management function. Such a development could be more attractive to private investors and its desirability should be determined no later than Phase two (2015-2019) of implementation of the NRMP.

In addition, in developing sub-national entities for both train operations and infrastructure management, the NRMP will develop a position as to whether Persero status is necessary to support the initiative, or whether the regional municipal body may proceed to organise infrastructure development and/or train operations through contracts to ordinary PTs. As a general policy to reduce the bureaucratic complexity in the rail sector and in keeping with BUMN policy, the NRMP will seek to avoid creating SOEs whenever possible.

Traditionally, government-operated railway services operate in a business climate with some significant differences from pure private sector enterprises. On the one hand, there is a strong commitment to placing state enterprises on a commercial basis with a gradual evolution to privatisation. On the other hand, the entities which are being moved toward a more commercial basis are subject to substantially greater government involvement in their management than are comparable businesses in the private sector, with greater attention typically given to labour protection. The managers in the corporatised enterprise generally have counterparts in the parent ministry, which sets up potential conflicts over authority and responsibilities between the parent ministry and the corporatised enterprise.

From another perspective, potential or existing private competitors may perceive, or fear the possibility, that the state owned enterprise in process of commercialisation will receive preferential treatment from the government. The NRMP mitigates these concerns by providing that DGR develop formal and transparent licensing procedures to be applied equally to private sector companies and BUMN enterprises and, similarly, by formalising TAC, IMO and PSO terms and conditions in a non-discriminatory manner.

5.3 INTRODUCTION OF PRIVATE AND PUBLIC SECTOR INTRA-MODAL COMPETITION

Implementation of Law no. 23/2007 necessitates creation of new institutional structures for the railways sector. The new structures replace the public monopoly for integrated provision of railways infrastructure and services with a new structure encouraging intra-modal competition for railway services where feasible; operating over a shared infrastructure in many (but not necessarily all) cases. This industry framework, commonly described as “vertical separation” (where control of railway infrastructure is separated from management of train operations and commercial freight and passenger services), is a valid model for Indonesian rail sector reform, properly encompassed within the NRMP.

As described in the next section, however, international experience suggests that the transition to a fully vertically separated railway industry should proceed deliberately. The intra-modal competition resulting from such separation will usually lag behind legal organisational changes and efforts to force competition through restrictions on interactions between previously integrated railway infrastructure and service components can be highly disruptive and undermine initiatives to increase rail sector market share. In this respect, the four-phase structure of the NRMP is a valuable tool in planning for realistic steps to introduce intra-modal competition over the next 20 years. The NRMP considers separation of PTKA infrastructure and above-rail service accounts to be mandatory in the first NRMP phase (2010-2014), along with full implementation of subsidiary status for Jabodetabek

commuter operations. In the second phase (2015-2019), infrastructure and above rail operations should be fully housed in separate subsidiaries and full legal separation of Jabodetabek should be considered. By the third phase (2020-2024), full legal separation of the infrastructure enterprise from PTKA could be accomplished. By the fourth phase (2024-2029), if not before, elimination of PTKA's Persero status and elimination of majority government ownership should be possible.

In assessing the extent to which intra-modal competition is likely, it is useful to consider the economic distinction between ex-ante and ex-post competition (also described as "competition for the market and "competition in the market." Law no. 23/2007 opens the rail sector to both forms of competition.

5.3.1 Ex-Ante Competition

Regarding ex-ante competition, the elimination of PTKA monopoly rights and the phased-in separation of infrastructure management and above-rail railway services offer some significant opportunities to introduce competition:

- **Special Railways**

Currently, there are numerous near-term possibilities for the development of dedicated coal lines in Sumatra and Kalimantan, as well as potential development of rail links for other mineral resources on these islands. Over the longer term, there may also be possibilities for dedicated lines serving sustainable lumber, palm oil and agricultural/plantation developments. PTKA may have an interest in serving as the operator for these ventures, or in participating in the operation in these developments, but it has no entitlement to do so under Law no. 23. The mine operator or producer may wish to operate the rail service itself or through a subsidiary or independent contractor, and perhaps in conjunction with sub-national authorities. If so, it should be permitted to propose its plan to the government (including senior officials as well as MoT and DGR), which can decide among competing proposals.

After such a special railway project is awarded, competition ceases for the duration of the project/concession. However, the ex-ante competition leading to the award can contribute significantly to the selection of a superior cost-efficient outcome. This efficiency can be enhanced if there are national standards for evaluating and licensing special purpose railways to ensure that proposals are consistent with rational national goals. Chapter 6 elaborates on such standards for rolling stock and infrastructure.

The NRMP notes that "special railway" is a term reserved for where a single firm uses a rail facility exclusively for the movement of its own product or input materials and does not carry for reward. "Special purpose" railways serving multiple industrial customers would, under Law no. 23/2007, be classified as public railways and be subject to Perpres no. 67/2005 as amended by Perpres no. 13/2010 (which has specific provisions regarding unsolicited proposals, including language to the effect that unsolicited proposals are only permitted for projects not included in sector master plans). As private sector railway infrastructure development has only recently started to become a reality, the proper interpretation of the applicable law is still under development and precedents for acceptable commercial practices under either special or special purpose railways are not well developed. One matter that needs resolution is whether two or more separate companies may form a joint venture to share use of a privately-built infrastructure without violating the single-company restriction on special railways. Similarly, clarification is required as to whether a "special purpose" project not specifically designated in the NRMP, but subject to due diligence review and approval

under NRMP procedures, creates any conflicts with Perpres no. 67/2005 or related statutes. The NRMP will give high priority in resolving these issues in the initial stages of the first phase (2010-2014), so as to not inhibit private sector investment in railway infrastructure.

- **Municipal/Regional Passenger Projects**

Law no. 23 will allow sub-national governments to develop commuter/local transport projects independently of PTKA and/or DGR (although DGR should retain ultimate licensing authority to ensure compliance with national law and regulations). This can be beneficial to the local authorities, since they can reach out to PTKA for proposals and then seek out other partners if PTKA is uninterested or the authority feels that it can find a more cost-efficient alternative. Again, this is a form of ex ante competition that will cease on conclusion of a contract for the passenger services, but can result in more effective local passenger service arrangements. Most sub-national urban rail projects will likely rely primarily on ex ante competition among potential contractors and/or concessionaire in order to produce efficient exclusive franchises, simply because having multiple operators competing in a congested urban area is likely to be logistically unworkable or entail unacceptable safety hazards. In other words, for capital-intensive urban rail projects, the economies of scale often create natural monopolies, so that competition in the franchise bidding phase can be particularly useful.

- **Port Access Projects**

Like the local passenger services referenced above, Law no. 23 will permit local authorities to seek competitive bids from PTKA and others to construct feeder lines from local ports to PTKA mainlines or population centers. Such ex ante competitive opportunities might also involve private port interests as well as local government. Active ex post competition between operators on short branch lines is unlikely to be unworkable except perhaps where industry affiliated operators may provide such services (such as rival container service operators).

Under this NRMP, DGR policy support of competition in the railway sector will include support for projects based on ex ante competition, rather than focusing exclusively on creating above-rail competition among multiple train service operators.

5.3.2 Ex-Post Competition over Shared Infrastructure

Vertical separation contributes to the options available in ex-ante competition, but tends to be advocated as a means of creating ex-post competition that may continue indefinitely after one or more additional operators are given access to the railway infrastructure. Experience, however, suggests that a new operator virtually never attempts to compete with the incumbent railway over the whole network. Instead, the new operator will seek out a niche market in a specialised commodity area, a particular region, or a specific service/equipment type. This is likely to be the case in Indonesia and that new rail operator entrants using shared infrastructure will likely emerge more slowly than ex-ante projects. There are, however, several possibilities for specialised new entrants. The NRMP gives priority to those noted below.

- **Jabodetabek Non-electrified Commuter Services**

The bulk of commuter services in the greater Jakarta area are electrified services currently exclusively provided by the PTKA subsidiary KCJ, which may become wholly independent. Consistent with the above comments, urban rail projects are likely to be developed on the basis of exclusive franchises. (Possibly including a competition between KCJ and the MRT system under development for certain limited high density routes). Outside of the core urban area, however, PTKA has non-electrified lines in the Jabodetabek region and it is also possible to operate diesel powered trains on electrified segments. With metropolitan area sprawl continuing, opportunities may arise for longer-haul commuter service entrants to seek to operate competitive services on PTKA or KCJ lines or some combination of both, using diesel or, where catenary is in place, electrified equipment. There could, for example, be potential competitors who would consider contracting for third class passenger services at lower PSO payments than PTKA or KCJ on selected segments with unmet demand. Under procedures described in Chapter 7, the NRMP considers that DGR may offer licenses to such ventures following an appropriate due diligence review.

➢ Other Metropolitan Area Commuter Services

Major metropolitan areas on Java and Sumatra mostly have some PTKA area service, even though it may not meet local commuter needs. New public or PPP rail services instituted by local government may well seek to use existing rail structure for part of their services, rather than operate exclusively on new infrastructure. Where this occurs, the new service may compete with certain PTKA services. DGR may offer licenses to such ventures following an appropriate due diligence review.

➢ Specialised Intercity Passenger Services

It is possible that entrepreneurs may seek to establish train operations to service, say, tourism or high-end business travellers by offering more luxurious accommodations, fewer stops or some combination of niche services. In the long term, if and when a high speed rail line is constructed, it is also possible that an entrepreneur may attempt to launch a slower, but lower cost, service to serve a niche market. As above, DGR may offer licenses to such ventures following due diligence review.

➢ Industry-Specific Freight Services

Opportunities for intra-modal competition in freight services are somewhat limited by short hauls relative to rail sector averages. However, there are some situations, especially in Java, where a new entrant that has the financial capability to provide its own rolling stock could provide competition to PTKA. Containerised services appear the leading possibility here, given the need for specialised platform rolling stock and for sophisticated logistical coordination which could pose obstacles for PTKA domination of the container market. A firm or group of firms committed to container transport could find a niche for some dedicated container operations. Apart from container traffic, the most likely sources of interest in an independent operator with access to rail infrastructure may be major cement producers and private port operators that have invested in feeder connections to main lines. In all cases, potential new freight train operations are likely to be limited to particular routes and cargo types and may qualify as special railways feeding into the main network. As above, the NRMP will require DGR due diligence review prior to issuing of licenses.

At the present time, the relatively low productivity design of the PTKA routes inhibits industry-specific freight services. Low axle loads and the resulting low net-to-tare ratios, restricted loading gauges caused by bridges, and the low productivity of locomotives are not attractive. Upgrading of infrastructure and upgraded standards for rolling stock can promote competition, as well as increase

productivity. The NRMP supports such upgrading of infrastructure and rolling stock as detailed in Chapter 6.

- **Rolling Stock and Terminal Leasing Services.**

Potential competition in supplying freight cars, higher-productivity locomotives, freight and passenger terminals, and passenger coaches merits some attention. For example, urban and commuter new railway initiatives may find a source of capital investment funds (or a means to reduce internal financial burdens) by leasing rolling stock and station and maintenance shop capacity to PTKA or perhaps to other new railway entrants. PTKA has developed a number leasing initiatives that might serve as a model for other rail sector participants. It is also noteworthy that PTKA is aggressively retiring almost its entire fleet of cargo wagons, and is down to 4,000 on the way to 3,000. This leaves room for a new entrant to provide special purpose railways and/or urban and commuter lines with higher efficiency rolling stock, as an adjunct to its main rail service activity.

One objective of the NRMP is to encourage development of an Indonesian railway supply industry. This, however, will not be done at the cost of productivity or of competition. The further development of PTKA capacity will be encouraged, but it will not be insulated from competition either for product or for services. In establishing equipment standards, DGR will not draw specifications so tightly as to make PTKA, or any other supplier, the exclusive provider.

5.3.3 DGR Policy to Support Rail Sector Competition: Special Projects

As noted above, to promote rail sector competition, the NRMP will clarify the standards and procedures that would be followed in assessing the treatment of prospective initiatives of both the ex-ante and ex-post variety. Regarding ex ante competition, some may argue that not requiring PTKA participation in “special railways” or “special projects” could deprive PTKA of income that could be used productively for fleet modernisation or other purposes. With regard to ex-post competition, there is one potential line of argument that excess competition on existing routes could starve PTKA revenues that go to cover overhead costs, while new entrants other traffic are allowed to carry traffic at price greater than marginal cost but less than full average cost of the network as a whole.

These concerns, however, will be addressed by (1) a sound concessioning strategy for special projects that maximises concession fees to government consistent with national policy for exploitation of the natural resources and (2) appropriate levels of access charges for use of infrastructure (see discussion below). With regard to the latter point, separation of infrastructure from railway operations greatly reduces the fixed costs associated with train operations. The separation will place the incumbent train operator, PTKA, and new entrants on a much more level playing field than if the train operator is responsible for infrastructure costs.[36] The NRMP calls for access charges to be non-discriminatory to all railway operators providing similar services.

[36] Under vertical integration of infrastructure and operations, high fixed costs of infrastructure produce the necessity for demand-based differential pricing of services to achieve a normal financial return on capital (so- called Ramsey pricing). Allowing new entrants on the system that do not adequately contribute to infrastructure costs undermines the allocational optimality potential of Ramsey pricing. This may or may not be offset by gains in technical efficiency (Hirschman’s ‘X-efficiency’) superiority of new entrant because of competitive or contestable tensions. The prospective “destructive competition” impact of new entrants can be largely remedied by access charge policy.

5.4 PUBLIC CHARGING AND FINANCIAL SUPPORT MECHANISMS

5.4.1 Track Access Charges (TAC)

DGR's core responsibility here is to define a clear policy on access charges that produces an equitable sharing of the fixed cost burden between PTKA and any new public or private entrant using established infrastructure. DGR is obligated under Law no. 23/2007 to enunciate a TAC framework before year-end 2010. This can be accomplished, but full implementation will take time to develop and will require attention to the adequacy of accounting and the development of infrastructure cost studies based on accurate accounts. Improving the cost accounting should be a major policy initiative. Current PTKA accounting detail is not sufficient to compute TAC on the basis of current system-wide PTKA infrastructure costs. Proper cost collection centers must be created to take into account the very substantial differences in infrastructure maintenance and renewal costs of different line segments (plus any new infrastructure construction costs). This includes the need to distinguish between technological differences among line segments: electrified versus non-electrified lines, axle and loading gauges, soil stability, and many other distinctions.

Initial Steps toward TAC Definition. The first step in defining access charges is to define the access charge objective. In Europe, three different philosophies have emerged:[37]

The first objective may be termed *Full Cost Recovery (FCR)*, after base public sector investment (in Indonesia, IMO). This approach, which might be designated FC-, expects the railway service providers on particular line segments to pay for the full costs of maintaining and renewing that infrastructure, less base public contributions felt to be in the public interest. Costs are then allocated among users by a relatively simple formula. The formula often uses gross ton kilometers (since it is the weight of the train, not numbers of passengers, which generates most infrastructure costs).

This approach is typically applied by countries with serious budget constraints and, more particularly, to urban/commuter passenger traffic. In urban/commuter operations, service providers tend to place relatively uniform cost burdens on the infrastructure and the service involves a cost distribution between national and sub-national public bodies. This approach may be particularly appropriate to Indonesia, especially for urban/commuter transport.

The second approach in Europe is *Marginal Cost* (MC) charging, where the marginal cost to the infrastructure imposed by train operators takes into account presumed externalities associated with railway service, such as environmental benefits and congestion relief. This approach appears to be in line with the rationale of Law no. 23/2007 in promoting rail service. However, the MC approach results in substantially less recovery of infrastructure costs. Consequently MC increases the level of Government IMO payments are needed to sustain and improve infrastructure. This approach is too expensive to recommend it as the base approach in Indonesia.

The third approach to TAC in Europe may be referred to as *Marginal Cost Pricing with Markups* (MC+). This is, in fact, the preferred approach in the EU and has been adopted in some form in most EU countries (whereas Eastern European countries rely more on FC- pricing of access). MC+ pricing seeks to recover at least part of maintenance and renewal costs, traffic management costs, and, sometimes, a contribution to new investment above the marginal cost burden on infrastructure imposed by train operations. It may be combined with FC- applications for certain traffic in order to achieve this end. This approach may be appropriate for Indonesian intercity passenger and rail freight operations, where FC- pricing of infrastructure might not provide sufficient incentives to rail service providers to achieve rail sector objectives of the NRMP.

[37] See, for example, European Council of Ministers of Transportation, *Railway Reform and Charges for the Use of Infrastructure,* (2005).

TAC calculation factors. TAC formulae vary substantially among European countries, with the primary basis being a gross ton kilometer charge. The accompanying table illustrates some of the variations.[38] In addition to gross ton kilometers represent, other factors may be used as an attempt to more accurately capture cost causality, as some elements of infrastructure costs (e.g., maintenance of turnouts) may relate more directly to number of trains or other factors than gross tonnage.

Where the MC+ pricing philosophy is adopted, it is also quite common to have a two-part TAC. The first part is a variable cost component to capture marginal costs with some markup. The second part is a fixed cost component to contribute to cost recovery over marginal costs. Under MC+ pricing, it is common for TAC charges to vary among different classes of traffic. The intent is to be non-discriminatory among rail service providers actually competing with one another, and also to increase the contribution of infrastructure costs of classes to traffic that will not be discouraged by higher rates. In other words, TAC pricing may contain an element of demand-based Ramsey pricing to reduce the burden on public infrastructure support (IMO). This NRMP considers that DGR should base its initial TAC formula on a simple gross ton kilometer calculation applied uniformly to all shippers operating over given line segments, perhaps supplemented with an annual fixed charge. This approach has the advantage of increasing transparency by accounting for the public burden of developing infrastructure through distinct IMO payments and the public interest in offering non-compensatory transport services through PSO payments. When multiple operators emerge in later NRMP periods, DGR might consider a more complex approach, but this tends to undermine public accountability and engender conflict among railway stakeholders and is, in any event, unnecessary until significant third party rail operators appear.

	Pricing principle	Fixed charges	Charges per gross t-km	Train-km	Path-km	Other
Austria	MC+		✓	✓		
Belgium	FC–					See Appendix A
Bulgaria	MC+		✓	✓		Charges per train path
Czech Republic	MC+		✓	✓		
Denmark	MC+			✓		Charges per train for bottlenecks and bridges
Estonia	FC-	✓	✓	✓		
Finland	MC+		✓			
France	MC+	✓		✓	✓	
Germany	FC-			✓		
Hungary	FC			✓	✓	
Italy	FC- (Traffic management only)	✓		✓	✓	Also charge per node
Latvia	FC			✓		
Netherlands	MC			✓		
Poland	FC			✓	✓	
Portugal	MC			✓		
Romania	FC	✓	✓		✓	
Slovenia	FC			✓		
Sweden	MC+		✓			Oresund bridge surcharge
Switzerland	MC+		✓	✓		Also charge per node
UK	MC+	Franchisees only		✓		Per vehicle km by type of vehicle

In moving towards the approach described above, the NRMP would change past policy to the extent that the intent of the original TAC formulation was to provide for TAC but to introduce them having regard to road user charges policy where traffic was contestable (road users' charges are subsidised as fuel is sold at the pump for less than the price of crude). The above policy would make TAC strictly cost-based and focus adjustments to account for special infrastructure cost burdens posed by modal policies on the IMO and adjustments to account for operating cost burdens or suppressed revenues for social reasons on PSO adjustments. The PSO-IMO-TAC mechanism was conceived as a means of putting the financial relationship between GOI and PTKA on a sound and transparent footing while permitting entry of private operators on equal terms. NRMP policy would improve the transparency of the PSO-IMO-TAC mechanism by more narrowly focusing the purpose of each element.

[38] *Ibid.* 2005 data.

5.4.2 Infrastructure Maintenance and Operation Cost Allocations (IMO)

DGR is obligated under Law no. 23/2007 to develop an IMO framework in 2010. Under vertical separation, a sustainable IMO program cannot be established without a prior computation of the percent of FCR to be obtained from TAC based on FC- or MC+ pricing approaches. In other words, IMO should be the residual amount of public investment to account for particular burdens on rail infrastructure required after a cost-based access charge regime is established. In the past, because infrastructure management and train operations were part of a common entity and TAC were imputed in a vague manner, the implicit calculation of IMO and TAC largely had the affect of one offsetting the other. This has no economic basis and needs to be corrected. DGR should, first, develop a specific estimate of TAC revenues that can be obtained without undermining the goals of an expanding railway service industry. The estimates may be done separately for urban/commuter and intercity railway services. IMO budget projections can then be derived from these estimates, subject to one further adjustment addressed below – a computation of public service obligation payments.

5.4.3 Public Service Obligation (PSO) Payments

As with TAC and IMO, the DGR is obligated under Law no. 23/2007 to establish a PSO strategy during 2010. PSO payments are directed toward offsetting special burdens on above-rail service providers, just as IMO payments account for special burdens on infrastructure. Like IMO, a rational PSO policy cannot be established without calculating an estimate of TAC revenues. Put another way, passenger services (or freight services, for that matter) may be subsidised in two manners: (1) by TAC payments that are below FC even after accounting for public IMO payments, or (2) imposing TAC charges that are at or near FC, but making up for them through PSO payments. The latter is preferable for transparency reasons: IMO payments should make the infrastructure provider whole without discriminating among service providers; PSO payments should make the service provider burdened by social policy whole without complicating IMO payments.. *A service that cannot pay for its use of infrastructure through a TAC computation on a MC basis and also cannot cover the variable costs of train operations will not be supported by combined IMO/PSO subsidies.* Such weak financial capacity is a strong indication that the railway service should be discontinued in favour of a more financially viable transport service. In general, the NRMP will restrict PSOs to urban/commuter services and third class intercity passenger services. Freight and commercial passenger services should require public support only through carefully considered IMO contributions to the rail infrastructure network.

5.5 ENCOURAGEMENT OF PRIVATE SECTOR INVESTMENT

Under Law no. 23/2007, private investors are encouraged to enlarge the economic and environmental role of railways in Indonesia by providing private finance and commercial management skills to extend the scope and quality of railway services. Broadly three types of developments are envisaged:

- improvement of the existing railway network currently under the management of PTKA, including Java, South and West Sumatra lines;
- expected new rail lines related primarily to new mining developments on the islands of Sumatra and Kalimantan; and
- sub-national railways consistent with local needs and the constitutional policy of devolution of government functions.

Current private sector interest in railway investments appears largely confined to the special projects reflected in (B) above, where development of transport capacity if an adjunct to the efficient exploitation of resources. Largely confined to prospective coal developments at present, there may be some downstream potential for private investment in rail capacity for other minerals development projects and perhaps some projects in the lumber/plantation/agricultural sectors. *Because of their near-term potential, DGR should give development of private sector interest in these special projects high priority in the 2010-2014 phase of the RPM.*

The sub-national railway projects in item (C) offer some potential opportunities for private sector investment in connection with PPP-type programs. Sub-national projects will likely consist mainly of urban and commuter railway developments. While infrastructure may be financed entirely with public funds, rail operations are likely to be contracted or concessioned to the private sector. Supported by a PSO Agreement and projected fares, such a private sector operator could well invest in rolling stock or other assets*. DGR should support such sub-national opportunities for private sector participation by not being overly restrictive on rolling stock standards as long as they meet safety requirements and by developing clear license requirements for commuter rail operators by, or before the 2015-2019 NRMP phase. Dispute resolution rules and procedures should also be defined by the 2015-2019 period, following the guidelines offered in Chapter 7.*

Substantial private sector investment in the PTKA mainlines in Java and Sumatra, as envisioned in item (A), is not likely as long as PTKA is 100 percent government-owned or even a 51 percent Persero. Once infrastructure separation is fully accomplished and PTKA becomes an above-rail operator only, the BUMN should consider relieving PTKA of its BUMN/ Persero status and transferring majority ownership to the private sector. Based on EU precedents, it is likely that the vertical separation regime may not be fully accomplished until the third phase of the NRMP. Unless the BUMN moves more quickly, beginning in the 2020-2024 DGR should promote and develop supporting legislation for the privatisation of PTKA.

5.6 INSTITUTIONAL FRAMEWORK CAPACITY DEVELOPMENT NEEDED TO SUPPORT OBJECTIVES

In determining policy on the regulatory roles, functions and powers appropriate for inclusion in the NRMP, several principles were considered:

- The regulatory structure should be driven by the market structure of the rail industry.
- Markets should be allowed to operate freely, wherever competitive markets exist; economic regulation should be limited to mitigating market failures. This is the best way to protect consumers and promote efficient, innovative transport.
- Safety of rail operations must be preserved through the enforcement of sound standards for operator qualifications, infrastructure and rolling stock.
- Cost of regulation—including the cost of DGR technical regulation, economic oversight and the economic costs of its regulatory processes to infrastructure managers and railway operators—should be minimised.
- Financial sustainability of proposed rail sector investments should be an important criterion in the licensing of railway enterprises

Rail sector institutional capacity improvements in the NRMP are intended to allow MoT and DGR to address new issues created by the restructuring of the railway industry in Indonesia, not to supersede established legal structures and processes. In particular, DGR authority will not preempt established labour law and the collective bargaining process in establishing terms and conditions of employment. Similarly, the DGR's environmental responsibilities will be performed within the framework of the national standards set by the National Spatial Plan and responsible environmental

authorities, while its occupational health and safety responsibilities must be carried out in the context of existing national standards.

5.7 CAPACITY REQUIREMENTS FOR TECHNICAL REGULATION

DGR is the logical government entity to perform the numerous tasks associated with the technical regulation needed to support a more robust rail sector. DGR, however, needs to strengthen its capacity to perform these tasks in at least three areas:

- Infrastructure and equipment standards
- Safety
- Licensing

5.7.1 Infrastructure and Equipment Standards

Current DGR infrastructure and equipment standards naturally draw heavily from existing PTKA standards and practices. These standards, especially technical specifications for railway equipment, parts and supplies, are in turn based largely on an infrastructure network and rolling stock fleet that reflects outdated technology. If the objectives of the NRMP are to be met, DGR will need to modify standards, particularly operating standards, to reflect a new industry structure with multiple participants.

In some respects, Indonesia will benefit in setting standards from the fact that the Indonesian railway network does not interconnect with any other rail system and is not obligated to harmonise standards. (Moreover, the Indonesian rail system is likely not to develop international connections within the NRMP time period and, if ever, will do so only in a limited way – possibly on Borneo or via rail ferry with mainland Malaysia). Nonetheless, DGR may benefit greatly by exchanges with the Association of American Railroads (AAR), the International Union of Railways (UIC), the International Association of Public Transport (UITP), the American Public Transportation Association (APTA), and other railway associations, and with regional and global rail systems with more advanced technologies in place than are presently in effect in Indonesia. DGR should actively promote such exchanges and seek to acquire Indonesia-relevant information from the vast array of standards documentation available from such sources. DGR should weigh these international standards and practices carefully against Indonesian transport requirements, as many countries' standards are responsive to particular conditions in the economies in which they were developed or reflect a parochial adherence to national practices.

As noted in prior sections, the current directorate structure within the DGR offers an obvious framework for establishing standards. The Directorate for Infrastructure should be the source for infrastructure standards, in addition to its infrastructure development responsibilities. (The Infrastructure Directorate will be responsible for computing TAC and IMO requirements, subject to higher level approval by the Director General and the Minister.)The Directorate for Safety and Rolling Stock will issue rolling stock standards, although DGR may separate rolling stock and safety functions if the combined burden proves excessive.

5.7.2 Safety

Under the NRMP, DGR will have the responsibility to ensure safe operations in the railway sector. With the increasing commercial and operational independence of PTKA and the prospect of

additional infrastructure managers and operators, however, safety regulations must be explicitly defined and must share safety responsibility with these independent managers/operators. In this regard, DGR will require, review and audit safety programs put in place by the actual operators.

➢ Operator Safety Programs

The DGR will require each rail service provider to have a formal, explicit system-safety program in place. While DGR review of these programs is an important proactive measure for promoting safety, design and implementation of the safety program will be the responsibility of the rail service provider. The DGR also will have the authority to audit safety programs. If suitable auditing firms can be found in Indonesia, the DGR may consider outsourcing this function (and the cost associated with it).

Despite DGR review, each rail service provider will have primary responsibility for the safety of its own operations. Thus, in addition to having its own system-safety program in place, the infrastructure provider(s) will be expected to require any train operators using its infrastructure to have acceptable safety programs. Similarly, train operators will be expected to require safety programs of any rolling stock service providers they use.

➢ Procedures for Setting Safety Standards

While DGR has the power to set necessary safety standards (including technical standards for equipment and supplies) independently, by the second phase of the NRMP, DGR plans to implement a transparent rulemaking process in which concerned parties are invited to participate in commenting on proposed modifications of safety rules and standards. The process will draw on the knowledge and experience of all affected parties and should be cooperative, rather than confrontational, in nature.

➢ Modernisation of Standards

“Best practice” safety standards for the railway industry emphasise performance measures—standards that allow different participants in the industry to achieve a specified level of safety with significant discretion to determine the most efficient and cost effective means. While the DGR may require minimum physical or design specifications that must be met or exceeded, merely codifying PTKA standards for the evolving industry would potentially stifle innovation and impose unnecessary costs on the industry. New rail service providers will be given the flexibility to set their own internal safety standards and rules. They are likely to be more detailed than the DGR’s rules, and detail the range of safe practices approved by DGR, that the service provider will employ.

DGR modifications of safety standards will include a cost-benefit analysis of the proposed modified standard. Such an analysis need not be complicated and may employ non-financial measures of impacts that are difficult to quantify. Nonetheless, it will focus all the involved parties on finding cost efficient ways of achieving safety.

- *Accident Investigations.* The DGR will be responsible for ensuring that appropriate accident investigations are conducted, but should not necessarily directly investigate each minor incident. Rather, as part of its power to set standards and to require reporting, the DGR should establish

standards for accident investigation and reporting and delegate responsibilities to the infrastructure provider and/or train operator to review specific types of incidents. For very serious accidents (those involving serious injury, loss of life or significant property damage), the DGR would, upon request of the affected parties or on its own initiative, convene and direct a Board of Inquiry. The Board of Inquiry's function would be limited to determining the cause of the accident. Any compensation issues arising out of the accident should be determined by the applicable laws and contracts, interpreted as necessary through arbitration or by the courts.

- *Safety Investigations.* If the DGR has reason to believe that safety is being compromised and a rail service provider is operating in violation of safety standards, it may conduct an investigation. An investigation should only be initiated for cause. Reasonable cause for initiating an investigation would include:
  - Frequent accidents;
  - Frequent safety complaints; or
  - Very severe accident.
- If the investigation reveals safety violations, the DGR may take appropriate remedial action, as allowed in the enforcing powers.
- *Safety Reporting.* To monitor safety performance, the DGR may define standard safety reports to be provided by all railway industry participants or groups of railway industry participants (e.g., train operators). It may require this reporting and use its enforcing powers to ensure compliance with it. The DGR will be able to specify reporting requirements at its discretion and may elect to hold public hearings or otherwise solicit comments prior to issuing decisions on reporting requirements.
- *Safety Complaints*. Any affected party (e.g., employee, customer, community) may bring a complaint about violation of safety standards to the attention of the DGR. The DGR can then judge the validity of the complaint and take appropriate action, which action may include conducting a safety investigation.
- *Imposing Fines and Conditions or Revoking Licenses.* As enforcement mechanisms, the DGR will have the power to set fines and conditions or revoke licenses. The circumstances under which these powers can be exercised will be established in rulemakings, and not determined on a case-by-case basis.
- *Jurisdictional Consistency*. In establishing standards, the DGR will recognise the jurisdiction of other governmental bodies in, for example, the realm of worker's compensation, occupational health and safety, and employment benefits. To the degree that the DGR sets occupation health and safety rules for the railway industry, it will "interpret" these national rules in the context of the rail industry. Similarly, any DGR standards in environmental areas must be consistent with national rules.

Safety administration will be conducted by the present Safety and Rolling Stock Directorate, or a separate Safety Directorate, should the DGR elect to separate the two functions.

5.7.3 Licensing

Technical regulation entails not only the establishment of infrastructure, equipment and safety standards, but also the licensing of infrastructure providers, train operators and rolling stock service providers. Participants in the rail industry in Indonesia should be licensed for their fitness to operate/provide service. Parties that will be licensed include (1) managers of rail infrastructure for internal or external use, (2) operators of trains, (3) operators of rolling stock maintenance facilities and other parties that lease or provide rolling stock to train operators and that undertake activities

that would be encompassed within a train operator's license. (As a group, these entities are referred to as "rail service providers.")

- The licensing review will be conducted to determine the fitness of the rail service provider. The licensing review must not be used to accomplish other economic or policy objectives. However, for new railway projects, the fitness assessment will include not only an assessment of the applicant's ability to finance the construction of infrastructure or acquisition of equipment, but also a due diligence review of the sustainability of proposed railway operations. It is important that the finances of the provider be strong. Experience argues that a major cause of accidents and other problems is the deferral of maintenance. Maintenance is often deferred when finances are weak, or when predicted profits fail to materialise.
- The licensee will be required to provide detailed information about the operation to be licensed and to demonstrate fitness to operate, including specifically evidence that:
- Licensee has an appropriate System-Safety Program. This program would include inspections, training, adherence to technical standards, and enforcement of operating practices necessary to function in a safe manner.
- Licensee has an appropriate Environmental Program. This program would include inspections, training and enforcement of environmentally safe operating practices, as defined by the appropriate national and sub-national environmental authorities.
- Licensee has insurance of an amount and coverage appropriate to the licensed activities.
- Licensee is technically fit to provide the services to be licensed. That is, the licensee's employees have adequate railway knowledge, training and experience in the specific services to be licensed that licensee can perform them safely.
- Licensee is financially fit to provide the services to be licensed. Through provision of a bankers' statement, audited financial statements or other means, the licensee will be required to demonstrate that it is financially capable of operating the services to be licensed in a safe and sustainable fashion.
- Licensee will be required to disclose of litigation, judgments and enforcement orders against licensee, its directors, company officers, or major shareholders. This would allow the DGR to determine whether the litigation, judgments or enforcement orders indicate that the licensee would be likely to provide service in an unsafe fashion.
- Other rail licenses in Indonesia in which the license applicant participates should be identified along with other rail operations conducted by the licensee or its affiliates in jurisdictions other than Indonesia.
- Operations to be undertaken must be described in detail together with a description of any service, time or geographic limitation on the license.

These issues will be weighed together to determine whether a prospective licensee is fit to operate safely in Indonesia. For example, if the applicant seeks to operate a passenger service, special attention would be given to the experience of its employees in operating passenger services. If an applicant plans to use subcontractors, it will be held responsible for assuring the fitness of those subcontractors. In making its safety case, the applicant will be required to also make the safety case for its subcontractors. If a licensee later makes a significant change in its subcontractors, as defined by the DGR in its licensing rules, it may be required to amend its license to provide the safety case for the new subcontractors.

DGR will designate a Directorate to be responsible for issuing licenses. While infrastructure, rolling stock and safety units all provide important inputs to the licensing process, operator licensing will not be housed with any of the specialised units. After thorough review, DGR will decide whether to create a new Directorate or a staff office as part of the central DGR function, or to locate the function within planning or traffic.

5.7.4 Summary of Technical Regulation Responsibilities

Technical regulation contains many separate aspects as detailed above and can result in an unwieldy bureaucracy that inhibits industry development and private sector participation unless those responsibilities are shared with railway industry components. In many cases, the infrastructure manager and/or train operator will take primary responsibility, allowing DGR to focus on monitoring, review and approval. In addition, DGR and rail service providers should encourage inputs from rail labour on matters impacting their working conditions and safety.

An indicative list of major technical regulation components and sharing of functional responsibilities is contained in the following table:

Function	DGR	Rail Service Providers	Rail Labour
Establishment of Interoperable Infrastructure Standards and for testing of designs	Primary	Advisory (Infrastructure Manager, Train Operators)	
Establishment of Interoperable Rolling Stock Standards and for testing of designs	Primary	Advisory (Infrastructure Manager, Train Operators)	
Fitness licensing of rail service providers	Primary		
Publish safety standards	Primary	Advisory	Advisory
Safety programs of rail infrastructure managers	Review and approval	Design and Report (Infrastructure Manager)	
Safety programs of train operators	Review and approval	Design and Report (Facility Train Operator)	
Safety programs of rolling stock maintenance facility operators	Review and approval	Design and Report (Facility Operators)	
Set performance standards for safety of rolling stock	Primary	Advisory	Advisory
Set performance standards for safety of infrastructure	Primary	Advisory	Advisory
Set performance standards for safe operating practices	Primary	Advisory	Advisory
Set detailed operating rules; publish network statement describing requirements	Approval	Primary (Infrastructure Manager)	
Set access charges	Approve and Publish	Propose	
Set performance standards for safe handling of hazardous materials handling	Primary	Advisory	Advisory
Set detailed operating rules for handling of hazardous materials	Review and approval	Primary (Infrastructure Manager, Train Operators)	

Function	DGR	Rail Service Providers	Rail Labour
Ensure appropriate accident investigation and reporting	Primary	Advisory	
Accident investigation and reporting	Primary, Serious accidents. NTSC may determine cause in serious cases	Primary, All accidents	
Conduct safety investigations for cause	Primary		
Define and require routine safety reporting	Primary	Advisory	Advisory
Hear safety complaints	Primary		

5.8 CAPACITY REQUIREMENTS FOR DISPUTE RESOLUTION/ECONOMIC REGULATION

In specifying recommendations for the economic powers and responsibilities of economic regulation in Indonesia, the NRMP takes careful note of structure of the transport sector in Indonesia and the likely structure of the rail industry and its markets after restructuring. These have strong prospects for being competitive and/or contestable markets. In rail transport-user markets, where rail shares are well under 10 percent:

- Competition from intercity bus, private automobiles and other personal transport is intense for urban, commuter and intercity transport of passengers.
- Truck competition is overwhelming for transport of manufactured products (general goods, containerised cargo, petroleum products, cement etc.), lumber and agricultural products (general produce, plantation products).
- Waterborne competition (inland barge and coastal shipping) is strong for much mineral resources and agricultural and lumber traffic.

To foster development of a vibrant and efficient rail industry, the regulatory authority needs—first and foremost—to allow competition to work. In many cases this is accomplished by refraining from interference in the marketplace. In circumstances where incumbency or other factors give one party market power, it is accomplished by DGR enforcement of Law no. 23/2007 article preventing the market power from being used to exclude competitors. Thus, economic regulation of railways will be limited to ensuring that the rail transport marketplace can operate without anti-competitive barriers created by industry participants, allowing economically efficient pricing and investment in rail infrastructure, rolling stock and operations.

The NRMP supports the circumscribed powers described below for carrying out this responsibility. The powers have been defined to provide necessary protections, while allowing markets to operate as freely as possible. The users of rail services and consumers would be protected by fostering competition among rail industry participants, not by direct government intervention in rail freight tariffs and passenger fares.

5.8.1 Entry and Exit

Entry and exit constraints are a form of economic regulation as well as technical regulation, as they impact the extent of competition in the rail sector as well, ensuring that rail operators are technically qualified to provide service and that rail transport is safe.

Entry: Law no. 23/2007 calls for a permissive approach to entry in terms of the economic objectives of encouraging competition, developing rail initiatives of sub-national governments and attaining investment interest from the private sector. This policy guidance should be reflected in the NRMP treatment of licensing. As described in the preceding section, licensing will be focused on financial and technical fitness to provide rail service and that licenses should not be denied to protect the incumbent carrier, PTKA. As stated elsewhere in this NRMP, any threat of "destructive competition" will be addressed adequately by non-discriminatory access terms and charges.

Licensing of railways that are part of minerals concession projects or similar undertakings require government approval of the overall project in terms of its potential contribution to the national welfare. This involves issues such as determining policy for export of mineral resources versus reserving such resources for domestic use. These matters are not DGR's concern and DGR licensing should address only the transport related requirements for approval of the applicant's license.

5.8.2 Infrastructure Access

Section 5.4 addressed the relationship of infrastructure charges (TAC) to IMO and PSO arrangements, focusing on means to increase the transparency and clarity of Government policy. Access charges must also be addressed as part of economic regulation and in terms of their impact on competition. Under the railway industry restructuring approach adopted in Indonesia, an important element of protecting competition is ensuring that multiple train operators have access to the infrastructure. This access must be on reasonable terms. The DGR should share responsibility with the infrastructure manager(s) and a dispute resolution body for this important element.

The infrastructure manager has the primary responsibility to ensure that terms of access do not pose a safety hazard to the public, rail labour or other operators and also do not undermine operating efficiency or result in unjustified costs. DGR, however, must ensure that terms of access and, particularly, access charges, are equitable. The DGR will have the final decision on TAC.

Finally, disputes may arise access when the decisions on the infrastructure manager, the DGR or of both, are challenged by an actual or potential operator (or an interested third party, such as a municipal government). Such disputes should be resolved by a body not subordinate to DGR, as discussed elsewhere in the NRMP.

Access terms should be different for operations over the network now operated by PTKA and railways operated by mining enterprises or other industrial firms. For such railways, the government is likely to concession both the infrastructure and the operating rights over that infrastructure as monopolies. In fact, current Indonesian law may prohibit third party traffic on a line built specifically to serve a single enterprise, such as a coal mine. DGR will report to the Minister any issues that may arise with respect to such railways for current legal terms and recommend to the Minister any proposed changes to regulations or laws that perhaps should be considered.

If this apparent constraint is overcome, rates and conditions under which train operators gain access to a special rail line would likely be set as part of the concession agreement, rather than by the DGR. However, it is possible that if third party traffic is allowed on a special railway, the concession might allow DGR to establish a TAC tariff and require the parties to use it for some period of time (or until

they negotiate a contract and establish a replacement tariff). Such a tariff should be designed to offer the infrastructure manager/primary rail operator the opportunity to operate profitably and provide incentives for efficient railway investment and service to any third parties. Again, a body outside of the GDR should be responsible for resolving disputes.

Access charges applicable to the network now operated by PTKA (and any extensions to that network) should meet several criteria:

The NRMP considers that access charges (TAC) should reflect the different situations and services that result in different costs for infrastructure use. Among the elements included in the charges are likely to be (1) geographic terrain, (2) volume of traffic on the subject line segments, (3) train characteristics including speed, weight, and wagon type, (4) power source (electrification or diesel), (5) gauge, (6) time slot desired, (7) dispatch priority desired, (6) other traffic type distinctions that impact infrastructure usage or maintenance costs. That is, to avoid major distortions that can have the impact of discriminating among operators, cost-based TAC calculations need to be made on a detailed level, not system-wide averages.

Once established, charges should be escalated on an equivalent basis for the principal train operator and any third party users that compete for the same traffic.

If an established access charge does not meet the needs of the infrastructure manager, principal train operator and any additional train operator (other than the principal train operator), all impacted parties should be encouraged to negotiate a comprehensive agreement. This comprehensive agreement might differ from the initial access terms approved by DGR. These negotiations might occur in cases where the operator sought to use a capacity-restricted part of the network or where complex operator-specific investments were required. In such cases, DGR should defer to industry expertise, subject to its final review and approval, after affirming that the arrangement would not have adverse impact on IMO or PSO obligations.

Thus, for the general rail network, DGR should require the infrastructure manager to publish access terms and conditions and propose access charges. DGR would have the power to approve or disapprove the charges. DGR, however, should adopt the position that its regulatory oversight is to ensure competitive access, not to substitute the DGR's judgment for market outcomes. Consequently, the DGR's judgment would be based solely on whether the charges and terms of access fairly reflected the terms of the contract between the infrastructure provider, principal train operator and any third parties. The DGR should not have the power to modify access charges to subsidise any third party operators that have made unwise commercial decisions. This includes rail services initiated by sub-national public bodies that prove to be unsustainable. Such situations should be addressed by explicit modifications of subsidies or PSO agreements, or by allowing the service to fail. Such situations should not be addressed by manipulation of access charges.

NRMP policy is to encourage private sector development and investment. Investment is especially important. Encouraging private sector investment requires permitting the investors to make the best use of the investment as they determine. Investors will not want to invest in Indonesia's rail sector if the investors believe that their judgment is being replaced by the DGR's judgment. Of course, the investors' projects must be financially viable, safe, interoperable in the future, and comply with environmental laws. But, once these are established, then market and pricing decisions should be left up to the investors as much as is practical to encourage investment.[39]

[39] Investors include local governments

5.8.3 Discrimination in Rates and Services

Apart from its function in determining TAC charges, the NRMP does not foresee the need for the development of anti-discrimination regulation over the 20-year plan period.

5.8.4 Complaints Regarding Alleged Anti-competitive Actions

Indonesia does not have a well-developed body of general competition law that applies to railway industry participants. While Indonesia established a Commission for Business Supervision (KPPU) in 1999, the powers of the commission and its relationship to other commissions, courts and State agencies are still being sorted out. Consequently, a Dispute Resolution Authority (DRA), with a status similar to that of the NTSC, will be established within MoT to address competitive issues. This DRA should have the power to hear complaints and protect against certain anti-competitive acts, when they occur within the railway industry.

To bring a complaint about an anti-competitive action before the DRA, the complainant should be a participant in the rail industry: an infrastructure provider, a rolling stock or rolling stock maintenance provider, a train operator or a rail customer. For the DRA to take any action on the complaint, the complainant would be required to show compelling evidence that (1) the anti-competitive action took place; (2) it had the result of reducing competition; and (3) the complainant was harmed by the action.

Typically prohibited anti-competitive actions are listed below:

- *Price collusion:* Agreement by competitors to set price levels for purposes of raising, lowering, pegging or stabilising prices. Example: for negotiated freight contracts, agreement by two train operators to bid the same price for a customer's business, rather than submit competitive bids. The same issue could arise between rail industry suppliers.
- *Non-compete agreements:* Agreements by competitors to not compete for certain markets or customers. Example: an agreement by two train operators to divide customers between them, with each party agreeing to not compete for the customers assigned to the other.
- *Predatory pricing:* Setting prices below incremental cost to drive (or keep) a competitor out of the market. Example: an established train operator bids below its costs for a customer's business in order to keep a new train operator from winning that business and becoming established in the market.
- *Refusal to deal:* Monopsony seller keeps competitors out of the market by refusing to negotiate reasonable terms for use of essential asset. Example: An infrastructure manager refuses to negotiate terms of access with a new entrant train operator.
- *Tying restrictions:* A sale or lease imposing, on one of the parties, an obligation extending beyond the good or service that is the subject to the sale or lease of other goods or services. Example: An equipment lessor requires a train operator to lease wagons from it in order to be able to lease its locomotives.

Overall, the above types of competitive issues appear much more likely to occur in the railway supply industry, rather than among train operators and infrastructure managers. If the DRA finds that anti-competitive conduct has occurred and that the complainant was harmed, it should first require arbitration. Only if arbitration fails, should DRA take further steps, such as recommending DGR suspend licenses or referring the matter to KPPU with a recommendation that sanctions under general competition law be imposed.

Economic/Dispute Resolution Functions			
Function	**Directorate General Railways**	**Infrastructure Manager(s)**	**Dispute Resolution Authority**
Oversee terms of infrastructure access through tariff review.	Primary		
Negotiate infrastructure access terms and conditions with train operators.	Oversight	Primary	
Approve TAC	Primary		
Resolve disputes over proper TAC application.			Primary
Hear complaints on anti-competitive actions within the rail industry in Indonesia.			Primary
Require reports of financial, economic and operating information.	Primary		Supplemental

5.9 TIME PHASING OF INSTITUTIONAL REFORMS

5.9.1 Rail Master Plan Phase I: 2010-2014

Regulatory Legal Framework Reforms

Technical Regulation: Numerous new and revised major railway regulations will need to be drafted by DGR and approved at various governmental levels over the 20 year period of the NRMP. (There are about two dozen railway-related government regulations, ministerial decrees, regulations and instructions, and presidential decrees and instructions were issued over the last decade).

However, the first phase of the NRMP is a critical period for solidifying the basic technical regulation function for railways. In the second half of 2009, DGR completed drafting two major sets of regulations. One is Regulation no. 56/2009 issued in September 2009 and dealing principally with railway organisation and infrastructure. The other is draft Regulation no. 72/2009 issued in December 2009 and dealing principally with traffic and train operations issues. Additional regulations may need to be issued in the 2010-2014 period. Modifications of those already completed will likely be required to be fine-tuned to effectively respond to the now-restructured industry. For example, the DGR Directorate of Safety and Rolling Stock is expecting to complete a draft regulation dealing with those matters for government approval in 2010. DGR should endeavour to fill any gaps in the legal basis for its technical regulation activities, including a clear definition of enforcement powers and in procedures to be followed by industry during the 2010-2014 period.

As noted in Section 5.4, under Law no. 23/2007, within the next few months of 2010, the government is obligated to resolve the legal and policy standards for PSOs, IMO and TAC. As indicated earlier, a PSO is a compensation provided by the government to the railway service provider, the basic price of which is defined by the difference between the production cost and non commercial tariffs specified by the government. An IMO is compensation to the infrastructure manager for the cost of maintaining and operating the main infrastructure on behalf of the government. TAC represents the costs charged to the railway service provider for the use of track owned by the government and operated by an infrastructure manager.

In the past, application of these financial transfers was obscurely defined. The application was also complicated by the fact that the railway's service provider and its infrastructure manager were part of the same corporatised entity; furthermore, the governmental and industry roles in the rail sector were still being sorted out. Under the law, the basic principles for these functions must be determined immediately and initial guidelines developed. However, detailed, definitive procedures are likely to require modification throughout much of the 2010-2014 period, much as these policies have taken considerable time in EU countries. It is critical, however, that clear policies are defined in detail and implemented in this initial phase of the NRMP.

DGR has indicated that it is considering restructuring its directorates and sub-directorates under the General Directorate to better respond to its new obligations under Law no. 23/2006. This internal reorganisation should be accomplished within the initial phase of the NRMP. One specific change under consideration is separating responsibility for safety enforcement from rolling stock oversight. This potential change is worthy of consideration, since establishment of standards for rolling stock involves numerous issues other than safety. At the same time, there are numerous overlaps between safety issues, rolling stock issues and other functions. For example, licensing encompasses a wide range of financial fitness, technical fitness and safety considerations. Responsibility for administration of PSO, IMO and TAC also needs to be accommodated in the internal reorganisation of DGR.

DGR is moving forward under the new law to issue licenses; for example, licenses are being issued for the new rail line to be constructed for the coal mining development at Bukit Asam, Sumatra. However, in the 2010-2014 period, DGR will move from issuing licenses on an *ad hoc* basis to developing a transparent model framework for the requirements needed to obtain a valid railway operating license. The specific content of models is likely to, and should vary by type of license. As one measure to ease private sector risk perceptions in Indonesian railway investments, the DGR will develop a set of model licenses for distinct railway activities during the 2010-2014 NRMP phase.

Economic Regulation/Dispute Resolution: As indicated earlier, given the extensive competition to the rail sector in Indonesia, extensive economic regulation is unnecessary and undesirable. In addition to modal competition, the dependence of rail passenger service on public financing and PPP type arrangements also minimises the potential for rail service providers exercising market power. Consequently, economic oversight (apart from that inherent in the licensing process) can be exercised sufficiently through dispute resolution procedures established by a quasi-independent unit within MoT, which would supplement options available under Indonesia's emerging general competition law, and with the railway industry expertise to take proper account of rail sector costing and pricing issues. Because additional entrants to the rail sector are expected to emerge somewhat slowly, in the 2010-2014 phase, MoT initially will establish an administrative unit for dispute resolution that will report directly to the Minister. It would have no powers to directly apply sanctions to resolve a dispute, but could recommend arbitration procedures, refer matters to the competition board or recommend that DGR be instructed to suspend licenses or take other actions available under existing statutes and regulations.

5.9.2 Rail Industry Structural Reforms

Vertical Separation Measures: Based on international experience, any structural breakup of PTKA is to proceed carefully and deliberately, so as not to disrupt the main objective of the NRMP of enhancing the rail sector role in the national economy. For that reason, the 2010-2014 stage of the NRMP will focus on the accounting requirements within PTKA needed to clearly separate infrastructure costs from above-rail operating costs and on implementation of improved computerised costing (and revenue accounting) systems within PTKA to produce definitive

infrastructure cost data. Prior to 2014, PTKA accounting will be required to generate definitive TAC amounts for each major line segment on the network and each major traffic type based on specific cost causality computations rather than system averages. These developments should permit TAC to be applied in a methodologically sound, quantifiably verifiable and transparent manner and would set the stage for further infrastructure and train operations separation in the next PMP phase.

Horizontal Separation Issues: During the 2010-2014 period, a definitive decision should be made and implemented concerning the extent of separation of Jabodetabek commuter rail operations from PTKA inter-city operations. As of 2008, the PTKA Jabodetabek operations (KCJ) moved from the status of a wholly integrated division of PTKA to a subsidiary. KCJ could remain in this status or be wholly separated. Since KCJ accounts for about two-thirds of all PTKA passengers, the outcome is of substantial importance to PTKA as a corporate entity. International experience may not provide a definitive recommendation on this issue, as there are numerous examples of both commuter services that are affiliated with intercity railways and those that are not. Early resolution of KCJ status, however, will support efforts to seek external investment for both commuter and intercity services.

PTKA involvement in special purpose railways is another policy matter to be resolved in the 2010-2014 period. For the proposed Bukit Asam new rail line development, PTKA is involved, which is a logical outcome because PTKA currently does serve Bukit Asam coal traffic. The same rationale does not exist, however, for proposed coal rail lines in Kalimantan. PTKA will be allowed to negotiate for participation in these prospective franchises, but that PTKA participation will not be required nor special preferences granted for PTKA. Instead, coal concessions and their associated transport development should be evaluated based on their contribution to the Indonesian economy.

5.9.3 Rail Master Plan Phase II: 2015-2019

Regulatory Legal Framework Reforms

Technical Regulation: Technical regulation procedures should be generally well established by this phase. However, DGR may undertake further adjustment in TAC, IMO and TAC as circumstances warrant. When infrastructure management functions are definitively separated from PTKA train operations, DGR should progressively shift responsibilities for defining access terms and conditions from its internal Directorates to the infrastructure manager, eventually adopting a Network Statement format on the EU model.

Economic Regulation: During this period, the MoT should seek to formalise the role on the economic regulation/dispute resolution entity as a legal body with clear authorities defined in statutes.

5.9.4 Rail Industry Structural Reforms

If not achieved in the prior period, PTKA infrastructure management activities should be organisationally separated as a PTKA subsidiary from above-rail services by the 2015-2019 NRMP phase.

5.9.5 Rail Master Plan Phase III: 2020-2024

Regulatory Legal Framework Reforms

Once infrastructure is formally and legally separated from railway operations, BUMN should relieve PTKA or its successor, as railway service operator of its status as a Persero. PTKA should be allowed to operate as an ordinary limited liability company (PT). While this might possibly occur earlier, this should take place by the 2020-2024 period.

Concurrently with the above action, the government should offer shares in PTKA (or its successor), reducing its current 100 percent ownership. While the government may wish to retain majority control through this period, it should allow private investors to approach 50 percent ownership by the end of the period. During this period, the infrastructure manager (referenced as PTKI), could remain a 100 percent state-owned Persero, but the government should consider reducing its ownership toward 51 percent if it can find interested private sector investors.

Rail Industry Structural Reforms

If not achieved during 2015-2019, infrastructure management activities should be organisationally separated from PTKA as an independent corporate entity by the 2020-2024 NRMP phase. The new entity, referenced here as PTKI, should then fully take on the formal role of issuing an annual Network Statement as in Europe (see Appendix B example) setting forth the terms and conditions of access to the railway infrastructure that it manages. This statement would be a public document and would apply to any uses of PTKI infrastructure by PTKA, KCJ, other municipal commuter lines using PKI track, special railways (such as Bukit Asam) using segments of PTKI as well as their own traffic and any other railway service operators. PTKA would assume the task of formally proposing TAC for approval by DGR.

Urban/Commuter rail developments may be developed in this period as joint products of national and sub-national NRMP initiatives.

5.9.6 Rail Master Plan Phase IV: 2025-2029

Regulatory Legal Framework Reforms

Adjust as necessary to accommodate any major structural changes in the industry, such as the introduction of world class high speed rail service.

Rail Industry Structural Reforms

By 2025, private sector participation should be sufficiently established to permit the government share in PTKA (or successor) to be reduced below 51 percent, as permitted by removing Persero status in the prior period. To maximise private sector investment, new rail service providers (such as specialised high speed rail service provider) should be organised as ordinary limited liability companies, regardless of the nature of any PPP arrangements.

By this phase of the NRMP, if not earlier, the government should reduce its ownership in PTKI, the infrastructure manager to 51 percent or below. Alternatively, the government should consider a long-term concession for management of intercity railway infrastructure.

Expand general purpose rail capacity in Kalimantan and Sulawesi and initial rail developments in Papua where economically warranted. If publically funded, determine whether such developments should be affiliated with PTKA train operations or independently established.

CHAPTER 6: NRMP RAIL SECTOR INVESTMENT STRATEGY

Chapter three reviewed the condition of Indonesia's existing rail network. It evaluated the condition of Indonesia's railway infrastructure and concluded that for the most part, it is in reasonable condition for current operations and operating practices. It also concluded, however, that Indonesia's railway infrastructure was built to standards seen in prior periods of railway history, not modern standards. That observation does not refer to Indonesia's 3'6" gauge itself (which international comparisons show can be operated at modern performance standards) but rather to its axle loading, speed limits, signal systems, and maintenance and operating practices. In some aspects the railway might well be viewed as a well preserved antique among modern railways. Nonetheless, the infrastructure is in adequate condition to accommodate current traffic and moderate traffic growth under safe operating conditions.

In this chapter, the NRMP addresses how Indonesia's railways can be brought to a more modern state, and highlights a number of investments that make sense in the near term. In addition, it reviews other major projects that are in the planning stages and will be supported by MoT and DGR over the 20 year period of the NRMP and it also identifies national investments for new lines projected to be needed beyond into the next several decades.

Chapter six thus constitutes an investment strategy for revitalising Indonesia's railway systems. The need to revitalise the national railway is reviewed briefly in Section 6.1; in Section 6.2 an infrastructure revitalisation program is outlined. Section 6.3 evaluates Indonesia's current railway rolling stock fleet and identifies replacement needs over the 20-year NRMP period. Section 6.4 summarises the investments needed to revitalise the existing railway infrastructure. Section 6.5 summarises the basis for the spending estimates for infrastructure and Section 6.6, the investments needed for high speed passenger rail services between Jakarta and Surabaya.

6.1 REVITALIZING THE NATIONAL RAILWAY

The NRMP is devoted to upgrading and expanding the Indonesian railway network. Indonesia currently has an island-wide interconnected rail network only on Java. There are three separate and not interconnected railways on Sumatra. In total, some 4,675 kilometers of railway lines are operated on a regular basis (see the map below) while the total network, including sections of track that are not operated, includes some 6,797 kilometers, as shown in Table 5.

Figure 5: Indonesia's Major Islands

6.1.1 Infrastructure

Indonesia's railways are all built to a "Cape Gauge" (1,067 mm or 3'6") standard.[40] Generally, the network on both islands is single-track with sections of double-track (mostly on Java) and multiple tracks at stations for train passing and station events. Maximum train operating speeds on main-lines range from 60 to 100 kph.

Table 5: Indonesian Railway Network (kms)

Location	Active	Inactive	Total
Java	3,327	1,480	4,807
Madura	0	130	130
Sub-total	3,327	1,610	4,937
Sumatra			
North	516	428	944
West	169	80	249
South	663	4	667
Sub-total	1,348	512	1,860
Total	**4,657**	**2,122**	**6,797**

Source: DGR-Draft Railway Master Plan

The existing Indonesian network is built to a very light standard with relatively low axle loadings – between nine and 18 tons; and relatively small physical size. These factors together – axle loads and physical size (commonly called *loading* gauge) – limit the capability and capacity of Indonesia's rail infrastructure. Rail weights are R 54 (54-kg/m), R 50, and R 40 with some R 33 still in the main-lines. Analysis undertaken in support of the NRMP estimate that Indonesia's active railway infrastructure would cost about USD 7,000 million to

[40] Gauge in this case means the distance between the inside faces of the rail. Cape Gauge is so named because of the early widespread use of the 3'6" standard in the Cape Region of South Africa. Other typical railway gauges are the meter gauge (1,000 mm); standard gauge (1,435 mm); Russian gauge (1,525 mm); and Indian gauge (1,676 mm).

replace, based on typical replacement cost estimates for light density lines.[41] This estimate does not consider any cost of land acquisition, but does include typical costs for bridges and drainage structures, for signaling and control systems, or for building and station replacement or modernisation.

Given the low axle loads that are characteristic of Indonesia's railways, particularly where there is only limited freight traffic; the typical life of most infrastructure components is long – in the range of 40 to 50 years. The NRMP estimates that current investments required for renewal and replacement alone are between USD 150 million and USD 175 million per year. Given increasing demands on the railway and the need to increase speed and capacity, renewal investments to upgrade infrastructure standards over time will be higher. Priority will be given to maintaining surface and alignment on segments that are operated at higher speeds and to extend rail life on highly curved track that is characteristic of some parts of the network. Additional maintenance will be required where there are soil stability problems, especially on lines that run near the coast. Attention will be given to extending the life of track components – fastenings, welds, switches, and the depth and characteristics of the ballast section.

This NRMP notes that Indonesia's geography is often demanding for railways with significant portions of mountainous territory and many bridges, culverts and drainage structures. Bridges are mostly steel and concrete with concrete spans replacing steel spans as bridges are replaced at the end of their useful life. The NRMP also recognises that, while the current light track structure is adequate for relatively lower speed passenger services, it is inadequate for higher-speed operations and for commercial freight services. These are some of the limitations that are addressed in the following sections.

6.1.2 Rolling Stock

An extensive set of rolling stock assets operates over Indonesia's rail infrastructure, supporting both passenger and commercial freight operations. Assessments supporting the NRMP indicate that Indonesia's entire rolling stock assets would cost approximately USD 5,133 million to replace. Of this, some USD 1,650 million worth of railway rolling stock is currently operating beyond its economic life. Moreover, during the next 25 years, additional rolling stock with a replacement cost of about USD 2,730 million will reach the end of its economic life. Altogether, this constitutes more than 85 percent of all existing railway rolling stock.

A large proportion of the locomotive and DMU fleet is already operating beyond its economic life.[42] About 35 percent of freight wagons should now be retired; many more are likely to be economically obsolete in the current road transport competitive market. The only fleet that is reasonably young is the EMU fleet. Therefore, most of Indonesia's railway rolling stock will be needed to be replaced over the next 25 years. The cost to replace the existing fleet is estimated to be approximately USD 175 million per year. Much more investment will be needed to accommodate projected and expected growth in passenger and freight markets. In an environment where there is only one railway rolling stock owner or operator, or even one owner or operator of a particular type of equipment, private financing of railway rolling stock will be difficult to arrange without a government guarantee. In the following sections, the NRMP addresses how existing rolling stock will be replaced and how new rolling stock will be acquired and by whom.

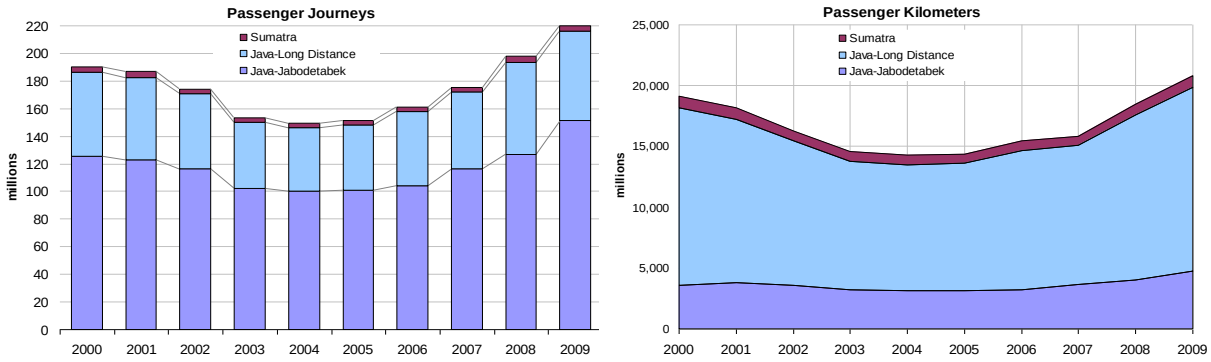
[41] The World Bank estimates that typical railway line costs are about USD 1.8 million/kilometer for standard gauge track; about USD 1.4 million is used here, reflecting Indonesia's Cape Gauge standard.

[42] Economic life of locomotives of the type used in Indonesia is estimated at 25 years; passenger coaches are estimated to have an economic life of 40 years; EMUs, 30 years; DMUs, 25 years; and freight wagons 30 years.

6.1.3 Rail Passenger Market Issues

Indonesia's railway serves both passenger and freight customers. There are currently three markets receiving rail passenger services in Indonesia. Commuter services in Jakarta represent the largest segment of the rail passenger market as measured by journeys or trips; but long distance travel on Java is the largest market segment by passenger kilometers. Rail passenger services in Sumatra are a small proportion of overall rail passenger services in Indonesia by either passenger-journey or passenger-kilometer measures. Overall rail passenger journeys in Indonesia grew about 15 percent over the decade 2000-2009; passenger-kilometers grew about 9 percent despite the fact that passenger services declined from 2000 to a low point in 2004. Since that time, both measures of rail passenger service have grown significantly. Jakarta commuter passenger journeys and passenger kilometers have increased by more than 50 percent, an average annual rate of growth of about 9 percent. Java long-distance services are up about 40 percent from 2004, an average annual rate of growth of about 7.5 percent. On Sumatra, both measures of passenger service are lower in 2009 than a decade earlier. Even so, rail passenger services on Sumatra have increased about 20 percent since 2004, an average annual rate of growth of about 3.5 percent.

Figure 6: Indonesia's Rail Passenger Markets



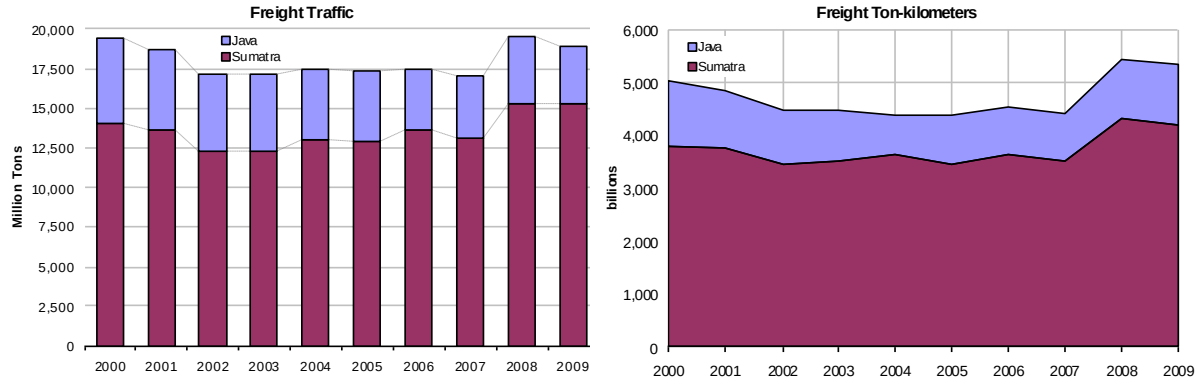
Despite recent railway passenger growth, rail market shares have stagnated or declined due to significant structural changes taking place in the rest of the transport sector, including the growth of low cost airlines, increased automobile ownership, construction of toll roads, and increasing size and effectiveness of commercial passenger road transport companies. Rail passenger services must compete with different modes in different markets. In urban areas, rail competes with bus, mini-bus, motorbike, and auto alternatives; in long distance services it must compete with air, and multiple road transport modes (private automobiles, commercial buses). In recent years, air competition has stiffened and toll roads have increased road transport speeds, making highway alternative modes more competitive – although increasing highway congestion is beginning increasingly to erode the competitive advantage of road transport.

In Jakarta, rail services are often overcrowded and uncomfortable, but inexpensive. For intercity transport, rail is more expensive than bus and typically slower than other competing modes. Rail retains a share of the market because it is considered safer and more comfortable than alternative modes, and because congestion is increasing transit times and causing greater uncertainties in travel times by road. Infrastructure investments that will be important to rail passenger services are investments in speed, capacity in urban areas, and in increased reliability and comfort.

6.1.4 Rail Freight Market Issues

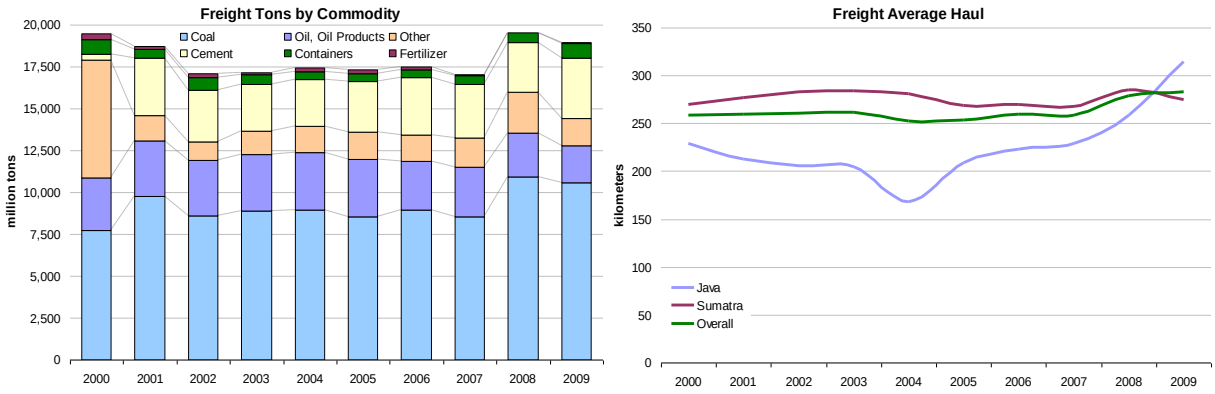
Commercial rail freight services in Indonesia are disadvantageous because of short lengths of haul (250 to 300 kilometers are typical haul lengths), very low axle loadings that limit the amount of freight that can be carried and provide poor net:tare ratio (the weight of the freight versus the weight of the empty freight wagon). With higher axle loads, net:tare ratios in modern railways are typically higher than 3.0 but the low axle loadings in Indonesia typically provide net:tare ratios of 2.0 or less. With this relatively low rail axle loading, road transport commonly has the same or greater haul capacity. It is common for road transport to have greater haul capacity per vehicle, especially on the main highway network, where truck overloading is a common phenomenon.

Figure 7: Indonesia's Rail Freight Business



Rail freight traffic is concentrated on Sumatra, and growth mostly involves growth in coal traffic on Sumatra. Freight traffic on Java declined slowly until the last few years. As can be seen in the chart below, one reason for the recently increased freight traffic volume on Java has been a significant increase in the length of haul for freight traffic – increasing from about 200 kilometers in the early 2000s to more than 300 kilometers in 2009.

Figure 8: Rail Freight Commodities & Haul Lengths



Coal traffic has increased and there appears to have been a significant commodity reclassification after 2000 from "other" to cement and construction materials. While still a small portion of freight tonnage, container traffic increased substantially in the last few years.

Railways are particularly well suited for the high-volume movement of bulk commodities. For volume movements between single origin-destination pairs, rail can compete even over relatively short

distances. Except in certain circumstances, rail cannot offer the customised door-to-door service that is available from road transport. To capture non-bulk traffic, rail must compete on price to overcome the advantages of road transport in short-haul movements. Thus, railways must be as efficient and convenient as possible to overcome the service advantage of customised road transport services.

Given the short haul lengths and the need to maximise volume, rail freight services must focus on concentrated movements between single origin-destination pairs by providing a means to concentrate traffic at specialised terminal areas. Some traffic is naturally concentrated (e.g., mining); the rail economics of other freight traffic can be improved by developing specialised concentrating terminals for commodities like cement, automobiles, multi-product bulk distribution terminals (e.g., for flour, grains, sugar, chemicals). Other possibilities include developing logistics centers including warehousing and distribution facilities with rail services between factories, ports and the logistics centers or inland ports.

Even in these cases, rail transport must be as inexpensive as possible – costs can be reduced by improving efficiency (e.g., improving net:tare for freight equipment, running heavier trains, reducing operating costs), by achieving high utilisation of equipment and other assets, and by streamlining customer interfaces. Even with warehousing, and other concentrating terminals, it will be very difficult for rail to become competitive for small shipments or even wagon load movements from factory to store.

Investments which help optimise the design of infrastructure, rolling stock and operating practices to reduce costs and provide a platform for the introduction of competitive freight businesses will help railway market shares and are a necessary part of the RMP. Terminal facilities may be part of the master plan or may be financed and operated by the private sector.

6.1.5 Market Implications for NRMP

Competitive pressures for both passenger and freight rail services require the introduction of more efficient designs and technologies as a part of the development of the railway over the next several years. In particular, for suburban and freight services, higher clearance heights are needed to permit the use of bi-level suburban equipment where called for – mostly around Jakarta at first, but in other major cities as well. Higher passenger train speeds can be achieved on many lines using conventional locomotive-hauled rolling stock. However, attaining those higher speeds will require more robust infrastructure, improved signal systems, new rolling stock, and better maintenance practices. For both passenger and freight services, infrastructure with higher axle loads is needed – for passenger trains to permit the use of 4-axle high-horsepower locomotives that can comfortably attain high speed operation when properly geared; for freight to permit the use of freight wagons with larger loading capability and improved net:tare ratios. The move to higher axle loads and to a larger loading gauge will require heavier and more substantial track components and a heavier-duty infrastructure. This shift will increase the track modulus significantly and result in the more robust infrastructure needed to achieve higher passenger train speeds using conventional Cape Gauge equipment.

When Indonesia elects to move to very high-speed train services (e.g., Shinkansen or TGV type trains [43]capable of speeds in excess of 250 kph), an entirely new infrastructure will be required. The

[43] Shinkasen means "bullet train" in Japanese. It refers to an approach of massive cicle works to create a flat, straight "bullet" path through mountainous terrain. The TGV, or Train à Grande Vitesse, is the French approach of using existing tracks in and out of cities, and then using very powerful locomotives to move trains quickly over less ambitious civil works than the Japanese typically construct.

infrastructure will have to be separate from existing lines, be electrified, and much straighter than many existing lines. An analysis of this option is considered in a subsequent section of this chapter.

6.2 RAILWAY INFRASTRUCTURE INVESTMENT STRATEGY

This NRMP concludes that to increase both rail passenger and freight traffic, Indonesia needs to increase the capacity and capability of its railway infrastructure. The current *loading* gauge (including height and width clearances as well as axle load bearing strength) of the existing infrastructure is not a sufficient base on which to build a resurgent rail sector. Investments are needed to strengthen infrastructure and to increase its capacity. Ways to do that are addressed below.

6.2.1 Infrastructure Renewal

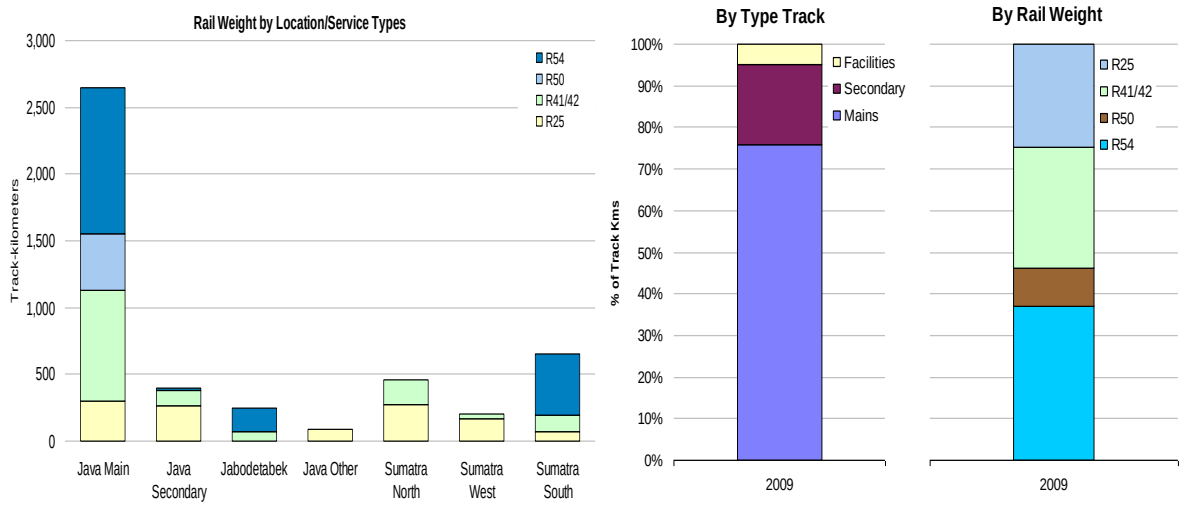
The load bearing strength of infrastructure is usually measured by the track modulus – a measure of stiffness or resistance to vertical deflection under loads. Higher track modulus values mean greater stiffness, generally higher axle-load capacities, and lower infrastructure wear rates. Track modulus is determined by many factors –gauge, rail weight, type and spacing of sleepers, type and thickness of ballast and by the quality of the sub-grade. Some sample values are shown in the table below. Higher values denote greater track stiffness and more stable infrastructure conditions.

Table 6: Typical Track Modulus Values[44]

Rail Weight	Sleeper Spacing	Ballast type and depth	Track Modulus[45]
R42	1,800 / kilometer	150 mm cinder ballast on clay sub-grade	375
R42	1,800 / kilometer	150 mm limestone on clay sub-grade	760
R42	1,800 / kilometer	300 mm limestone on clay sub-grade	780
R42	1,800 / kilometer	600 mm limestone on clay sub-grade	850
R50	1,800 / kilometer	600 mm limestone on compacted clay sub-grade	2,000
R65	1,660 / kilometer	600 mm limestone on compacted clay sub-grade	2,100
R60	1,660 / kilometer	600 mm limestone ballast on crushed stone compacted limestone sub-grade	3,600

[44] Talbot et al, Report of the Special Committee on Stresses in Railroad Track:, *AREA Bulletin, Sixth Progress Report*
[45] Track modulus measurements converted to grams/mm/mm from lb/in/in

Figure 9: Rail Weight by Type and Location



Indonesia's railway lines are built to a light standard – one with a relatively low track modulus. The first chart in Figure 6.5 shows the percent of active track-kilometers by type of track – main lines, secondary lines, and tracks in stations, marshalling yards and other facilities. The second chart shows the percent of track-kilometers laid with various weights of rail. Railways use heavier rail weights on lines that need higher track modulus values – main lines first. Based on the assumption that larger rail is used in main lines, the charts show that about half the main lines are laid with rail that is less than R50 (50 kg/meter).

About 43 percent of the Java main lines have rail sections less than R50. Only about 5 percent of Java's secondary lines have rail sections of R50 or more. About 75 percent of the Jabodetabek lines are R50 or greater. In Sumatra, only the Sumatra-South lines have rail sections of R50 or greater. While Jakarta's Jabodetabek service operates largely on R54 rail, rail lines carrying only moderate-speed passenger services do not need to be built for heavy axle loads, but even these lines benefit from a higher track modulus – the ride is better, maintenance costs are lower, and fewer maintenance inputs are needed (an important consideration in high-density service).

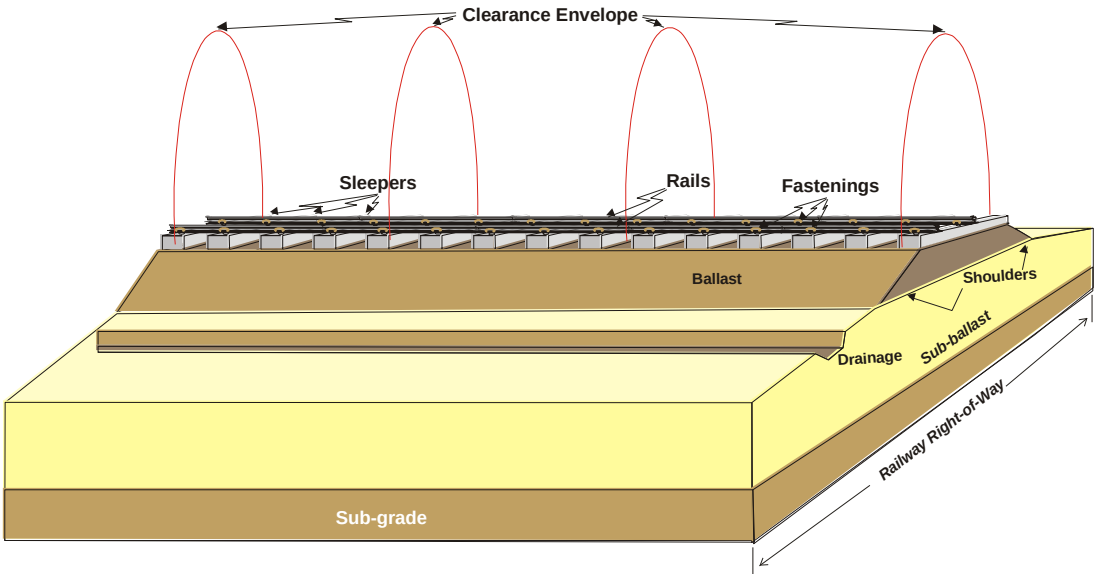
Limitations of the existing loading gauge, particularly axle loads, prohibit the use of heavier and more powerful locomotives and of more efficient freight wagons with greater capacity and a higher net:tare ratio. While it is often thought that heavy axle loads are not needed in passenger services, Indonesia's current low limits do not permit the use of four-axle locomotives with sufficient power to pull loaded passenger trains at higher speeds. Even using six-axle locomotives, which are not well suited for high-speed operations, current axle-load limitations mean that Indonesia's railways must use smaller and lighter diesel-engines to ensure that locomotive weight does not exceed the axle load limits imposed by the current infrastructure. The NRMP plans to increase infrastructure axle load design limits to allow the use of higher horsepower diesel-electric locomotives in passenger service. Higher axle load limits will also permit locomotive-borne train power generation systems, eliminating the need for a separate power car on passenger trains, increasing passenger capacity and reducing maintenance expenses.

For freight services, heavier axle-load limits will allow the use of higher-power six-axle locomotives in freight service (in singles or in pairs). Higher axle-loads will also permit modern wagon designs with higher net:tare ratios and greater payloads, reducing the amount of unproductive tonnage that must be hauled to produce a tonne-kilometer of freight transport. Modern wagons also promise to be cheaper to maintain and will increase the productivity of freight services substantially.

This NRMP has determined that axle load limit of 25 tonnes should become the new standard for new lines in Indonesia. While many railways are shifting to 27 and 30-tonne axle loading limits, these railways are typically standard gauge or larger. For new railway lines that are built for mineral transport where interoperability with existing systems is not a consideration (e.g. on Kalimantan), DGR will permit a higher limit to be proposed and used. Increasing the track modulus for Indonesian railways means increasing the weight of rail to an R60 standard, using concrete sleepers designed for higher axle loads, on a spacing of about 1,660 per kilometer (current standard), and increasing the standard ballast section on main lines. An important element of higher track modulus is the use of high quality ballast that is properly compacted. The resulting higher track modulus will support heavier axle loadings and higher speed train operations.

In addition to a heavier axle loading (and a higher track modulus), railway loading gauge is also a measure of the physical clearances of the railway line. The diagram in Figure-6.6 shows the major elements of a simple rail track system. The red arcs show the dimensions of the largest rolling stock that can move over the railway. Typically, physical clearances are determined by platform widths, the height of any platform roof, and the height and width of bridge openings. Physical clearances determine the maximum physical dimensions of the rolling stock that can pass over the railway line.

Figure 10: Elements of Railway Infrastructure and Loading Gauge



In keeping with its relatively light infrastructure standards, Indonesia's current loading gauge is quite small. Besides axle loadings, vertical clearances are limited, mostly by bridge openings, but also by tunnel sizes, highway overpasses, and other structures. Some of Indonesia's main railway lines can benefit from increases in the loading gauge. Higher clearances will permit the use of bi-level suburban coaches, multi-level automobile carriers, and perhaps double-stack containers in well-cars.[46]

[46] Chinese, Russian, and Indian Railways have shown that higher clearances can be operated in electrified territory. These examples, however, all use larger track gauge (standard, broad, and Russian gauge). It may be more difficult to operate high clearances on Cape Gauge lines and such operation will undoubtedly require higher maintenance inputs. For this reason, it is suggested that high clearances be developed first in non-electrified territories, and only on lines where projected traffic requires it. In most cases, this should be a market based decision – where the revenue gains outweigh the cost increases.

6.2.2 Railway Bridge Replacements

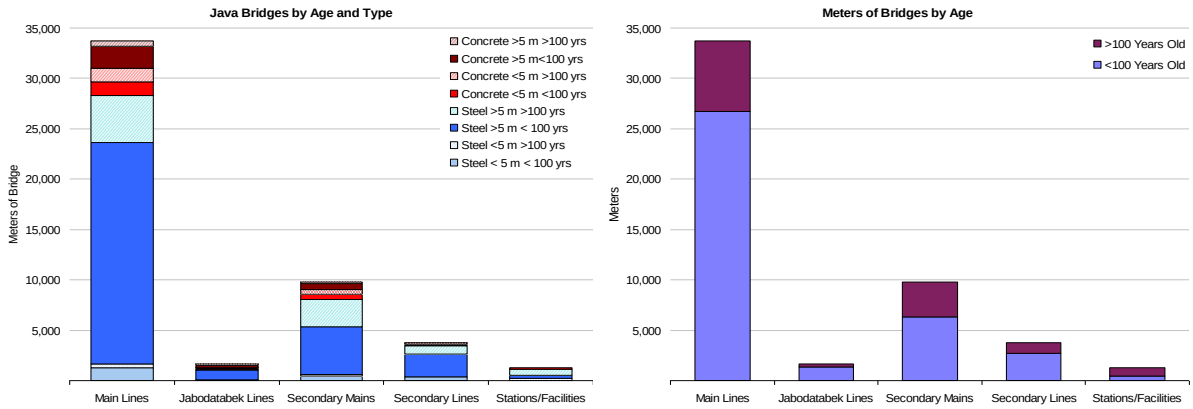
Indonesia is mountainous and the railway in many places traverses difficult terrain and numerous water courses and valleys. Indonesia's railway has many bridges. Java has about 4,500 bridges with a total length of 50,000 meters. Bridges are either steel or concrete; some steel bridges are of thru-truss design, some under-truss. Concrete bridges and some steel bridges are of ballasted deck design.

The pictures in Figure 11 show a steel, thru truss bridge on the left and a concrete open deck bridge on the right.

Figure 11: Bridges on Java's Main Line

Of all of Java's 4,500 bridges, nearly one-third are greater than 100 years old and will need to be replaced in the near future. Figure 6.8 below shows the type and age distribution of bridges across several types of track. Java's main lines have about 2,900 bridges totaling some 34,000 meters. Of these, 39 percent of the structures and 21 percent of the total bridge length are greater than 100 years old. Jabodetabek lines have only 157 bridges with a total length of about 1,600 meters. Of these bridges, 28 percent of the structures and 18 percent of the bridge length are more than 100 years old.

Figure 12: Java's Railway Bridges by Type and Age



On line segments where axle loads will be increased, DGR will review bridge conditions with the expectation that many will likely require strengthening. Bridge strengthening does not always require complete replacements, but the NRMP anticipates that many bridges on Java will have to be replaced over the course of the next 25 years.

In the analysis supporting this NRMP, a cost of USD 100,000/meter for shorter spans (less than five meters) and USD 200,000 per meter for longer spans (greater than five meters) for bridge strengthening and replacement was assumed. On this basis, bridge replacement to accommodate increased axle loadings and higher speed operations is estimated to be about USD 1,300 million over the next 25 years.

6.2.3 Infrastructure Maintenance Practices and New Track Standard

Higher speeds and larger loading gauge (both heavier axle-loads and higher clearances) will require more precision in track maintenance standards to ensure that irregularities in cross level and alignment are minimised. This will require the use of modern mechanised tamping machines with computerised, laser-based alignment and leveling capabilities. Frequency of maintenance may also need to be increased, but labour inputs will be reduced using mechanised track maintenance methods.

Under this NRMP, a new track standard will be adopted for Indonesia's higher-speed main lines. This standard will require use of R60 rail, heavy-duty concrete sleepers, modern rail fastening systems, continuous welded rail, and a deeper ballast section, with track maintained to a higher level of precision. Work will be required to improve sub-grade conditions on some lines to permit 125-kph passenger train speeds and 25 tonne axle-loadings.

6.2.4 Signaling and Train Control Renewal

Indonesia's railways have both electronic and mechanical signaling and train control systems. Indonesia's main lines have many kilometers of mechanical semaphore signals.[47]

Figure 13: Sémaphore Signals on Java

[47] Mechanical semaphore signals like that pictured above (*photo by Ian Antono*) are controlled from the nearest station using a system of levers, wires and pulleys that may extend several kilometers from the station in both directions. Such systems operate slowly (it takes some time to change signal indications, at least relative to electronic signals), and require substantial maintenance inputs. Further, these systems do not permit centralised control or allow for managing train movements across multiple stations. Modern railways abandoned mechanical semaphore signals many decades ago because of cost, reliability, and safety concerns.

In the future, to accommodate both higher speeds and more freight and passenger traffic, it will be necessary to modernise railway signal systems. Mechanical signal systems throughout Indonesia will be phased out in a systematic manner. Mechanical systems have slow reaction times and limit line capacity in areas were train densities are high. Mechanical systems also require substantial maintenance inputs and are less reliable. There are a number of different electronic signaling systems available worldwide. Some rely on way-side signals; some bring signal indications inside the locomotive. Probably the most traditional signal system upgrade for Indonesia would be a track circuit-based electro-mechanical system using way-side signals. The technology has advanced considerably in the last decade and communications based systems may have similar costs. European systems based on the ERTMS specification or an ATCS system specification based system (North America, Japan, Scandanavia). Either of these systems can be communications based (GSM-R, fiber-optic). Under the NRMP, modern computer based systems will start out as basic systems and advanced safety features, such as speed control and automatic stop, will be added as these features are needed to cope with increasing train volumes and speeds.

Any of the systems (traditional way-side signals or advanced cab-based systems) permit centralised control of train operations and the NRMP incorporates a phasing in of central train operations control. Some of Java's mail lines are already equipped with centralised electronic signals. In the future, all the main lines and all lines supporting high-speed passenger movements will be required to be signaled for increased safety, lower operating costs, and as a means to increase line capacity before double tracking is required. This NRMP estimates that electronic signal systems will cost about USD 1 million per control point (two control points are required for each track for a passing loop or station siding). Where the distance between stations is large (say more than 10 kilometers), line capacity will be increased by providing intermediate signals, allowing trains to be advanced into the next block. Intermediate signals will cost about USD 700,000 each (bi-directional). In double track areas, signaled crossovers can permit fast trains to over-take slower trains and contribute to greater capacity. Signaled crossovers cost about USD 4 million each (including the cost of the crossover switches) in high-speed territory.

On lighter density lines, a radio-based train signaling system is recommended where electronic signals are not warranted. Radio-based signal systems are available from many manufacturers.[48] They provide a solid mechanism to control train movements from a central location and to improve safety of operations as well. These radio based train control systems require that each locomotive be equipped with digital radio systems which can be used for voice and data communications.

Associated with these train control system updates, new investments in crossing protection systems are also recommended. Indonesia's railways have many level crossings protected by crossing watchmen and others with nothing but signs. Signaled crossing protection systems are recommended to augment level crossings protected only by signage. Signaled crossings depend on a track circuit to trigger flashing lights and bells. More advanced designs also include electronically controlled gates. An economic analysis will be required to determine whether to replace manned crossings with electrically activated gates but all crossings, including those with crossing watchmen should have track circuit based signaling systems if only to activate lights and bells.

These measures will improve safety, permit centralising the control of train operations in logical zones and allow for the control of multiple operators, should that come about. Overall, it is estimated that replacing mechanical signal systems, and re-engineering existing signal systems on the main lines, installing radio based train control systems for lighter density lines not requiring

[48] GE Transportation provides its ITCS radio-based vital train control system; Siemens provides a similar RETB system. Radio based signal systems are available from other manufacturers in Europe, Japan, and South Korea.

signals, and upgrading level crossing protection systems will cost about USD 900 million (at 2010 prices) over the period covered by the master plan (25 years).

6.2.5 Changes in Planning Methods

A review of both DGR and PTKA planning methods indicates that there has been inadequate attention in the past to market, operational, economic and financial analysis. The modernisation projects discussed in this chapter will have good returns based on the market forecasts and market share increases expected from Indonesia's railway network. Even so, the NRMP will require both the railway operator(s) and DGR to institute more rigorous analysis for each major planning component so that improvement projects can be staged and managed for the greatest early returns. Pre-investment market surveys should be conducted to assess prospective customer responses to both service and price improvements contemplated in the proposed network investment programs. This analysis should be jointly planned by DGR and the train operators and could be executed by either entity, or separately contracted to qualified consulting firms where the necessary expertise is not available on the staff of either DGR or the train operators.

Prior to making DGR investment commitments, the NRMP will require operational models to be used to evaluate alternatives to double tracking investments – for example improvements to signaling systems, extension of existing station tracks to provide double track approaches that allow cross-over movements so that trains can meet and pass in stations. Other alternatives include construction of passing loops or sections of double track that, over time, can be connected to provide incremental capacity increases. Further, the proposed speed increases will themselves increase line capacity of mains where higher-speed trains can operate.[49] Signal improvements will also contribute significant capacity increases.

To evaluate these alternatives and determine when to implement which improvements, the NRMP recommends that an operational dispatch simulation model be used. There are a number of such models available in the market – most now operate on inexpensive work-stations and even modern laptop computers. The use of such models requires a great deal of preparation (to document track layouts, grades, signal capabilities, locomotive, EMU and DMU performance under various load conditions). Most railways have developed such databases and keep them updated for regular use in analysing railway investment alternatives and the NRMP expects such databases to be developed by PTKA in partnership with DGR, and ultimately any independent infrastructure manager-operator that emerges.

A thorough analysis of the alternative investments should be included in project evaluations. These should include the alternative of not making an investment as well as an evaluation of alternative means to achieve the same or similar benefits – for example, improved signal systems versus investments in physical track improvements or changes in operating practices. The Indian Railway has conducted a thorough analysis of its losses from passenger services and adopted a program to increase the total revenue per passenger train through various means.[50] PTKA should review this process as a possible model for use in Indonesia. Means to increase capacity and total revenue other

[49] Note that all Java main-lines on Java are not likely to be able to permit 125 kph train operations due to extensive curvature, higher grades, and other speed impediments. Even so, the strengthened infrastructure should permit larger and heavier trains to be operated and higher speeds in straight sections.

[50] These means included lengthening trains by adding coaches, increasing the density of seating on economy coaches, adopting hardware improvements (such as air conditioning) that allowed them to charge higher prices, adopting a "frequent traveler" program that upgraded passengers to higher classes and allowed them to fill economy seats to ensure that all seats were filled and that the maximum amount of revenue possible was on any given train.

than through investment should be part of railway strategies and master plans. Such considerations will ensure that Indonesia's railway assets are fully utilised at the highest possible levels.

In addition to detailed market analysis, operating and line capacity computer modeling, improved planning techniques for infrastructure must include financial and risk analysis of proposed projects. Each project or investment program (a program is a collection of projects that together achieve an objective). It is not necessary to evaluate each element of such programs; they can be grouped in logical sets. The financial analysis should consider both short term costs and benefits but also should consider long-term impacts. To the extent possible, these impacts should be quantified monetarily and long term costs and benefits discounted at a rate used by Government to evaluate such projects.

For many rail projects, both costs and benefits from a project may extend beyond those which will be seen on an income statement or balance sheet of the sponsoring organisation. The analysis of major projects should extend to evaluate economic impacts not only on the rail sector but on society in general. For example, most road transport projects include an evaluation of the costs and benefits of increased travel including the cost of congestion that may be alleviated (reduced waiting times, faster trip times, for example), the safety impacts (such as the cost of accidents), the environmental impacts, including changes in emissions of green house gases, and other social and environmental impacts. These analyses should be part of any major investment program evaluation.

6.2.6 Infrastructure Investments for Revitalisation

The NRMP has concluded that it will be difficult to increase rail market shares or to extend the capability of railway operations in Indonesia without addressing its very light infrastructure. As discussed previously, higher speed passenger train operations and more efficient and effective freight operations depend on increasing the track modulus and strength. For this reason a program to enhance existing main-line infrastructure is an essential part of the first decade of an infrastructure investment program. Investments should be stepped-up from the normal track renewals program to accomplish five major objectives:

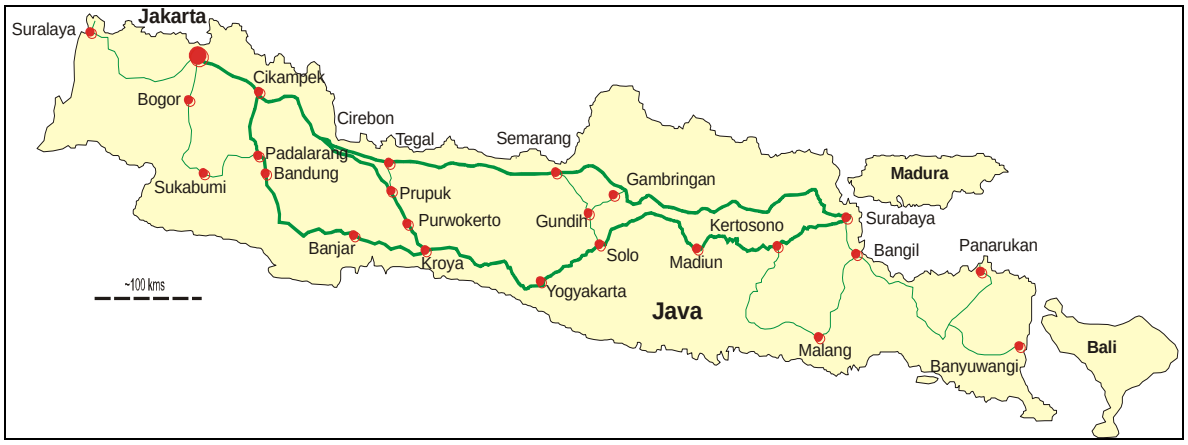
1) To achieve at least 22.5 ton axle loadings on all main-line track and to move to a new 25 ton axle load standard for new track.
2) To strengthen bridges on all main-lines to accept the new higher axle load standard and to permit locomotives to operate with axle loads of 25 tons.
3) To increase loading gauge to permit the operation of bi-level coaches in major cities and along high-intensity routes; to permit the operation of multi-level auto carriers on lines where that can contribute significant traffic potential (near ports that receive/export automobiles, and lines serving auto manufacturing facilities).
4) To increase loading gauge further on main-lines where double-stack well-cars can contribute to increased use of rail for intermodal transport (first and most especially from ports to inland container terminals, between inland container terminals).
5) To improve signaling on all lines were passenger trains operate at speeds in excess of 90-kph and to eliminate mechanical-semaphore signal systems – either with electrically operated signals or with radio controlled train protection.

These major objectives form the basis of the enhancement spending in the railway master plan for infrastructure. Principal elements are described below.

6.2.7 Infrastructure Enhancement on Java

The diagram below shows the principal rail lines on Java for which significant upgrading is planned. The lines total about 1,680 route kilometers and a little over 2,030 track-kilometers.

Figure 14: Java Main Lines for Enhancement



The 2,032 track-kilometers currently operated are largely built with R50/R54 rail and concrete sleepers, but about 876 track-kilometers have rail less than R50 or have wood or steel sleepers. First priority will be to upgrade the 876 track-kilometers to at least R50 rail and concrete sleepers spaced at 1666 sleepers per kilometer with sound ballast formation and modern track fastening systems. It is estimated that this upgrading will cost about USD 650,000 per track-kilometer or about USD 569 million.

Second priority is to improve track strength by ensuring an adequate depth of ballast under all 2,030 track-kilometers so that the track modulus is at least 3,000 kg/cm. It is anticipated that this will require a new investment of approximately USD 300,000 per track kilometer on the remaining 1,156 kilometers of designated railway main-lines, or about USD 347 million.

To achieve greater speeds, main-line switches must also be replaced with high-speed switches (#20 equilateral switches have been assumed, all electrically operated). Replacing all 289 turnouts that are built from less than R50 rail is estimated to cost about USD 81 million. Over time, the remaining 866 turnouts will also be replaced with heavier duty turnouts with higher speed ratings, though these enhancements will be considered in replacement programs rather than as an urgent enhancement.

The next priority is to improve bridges and structures on these lines to support heavier axle loads and larger loading gauges. This improvement effort will be directed first on the North Coast main line where it is anticipated that with stronger track and limited amount of curvature, passenger train speeds of 150-kph can be obtained with new rolling stock.[51] The bridge improvements are designed to strengthen the bridges for these higher speeds and for the use of 25-ton axle loads needed to operate higher speed trains; where there are prospects for bi-level trains and a potential need for greater vertical clearances, bridge clearances will be increased. Bridge improvements on the North Coast main-line are expected to cost about USD 2,300 million.

[51] Note that Queensland Railway in Australia has been running a high-speed train on Cape gauge track at scheduled speeds of 160-kph since 1997. Both EMU and diesel-hauled tilt trains operate at these speeds on a regularly scheduled basis. The QR EMU tilt-train holds the Cape gauge speed record of 215-kph on this route.

In addition, North Coast main-line signals will be enhanced with electronic signaling and some form of automatic train control to permit higher train speeds and heavier, faster trains. While some portions of the North Coast line are already converted and fiber-optic cable has been laid along the right of way, much of the existing way-side signaling will be replaced with in-cab signaling that will support train control features. Signal enhancements are estimated to cost about USD 560 million (see estimate in Section 6.5).

The railway has many level crossings, crossings of highway and railway line at grade. Many of the main road crossings are protected by manually operated crossing gates and flashing lights. For higher speed train movements, many level crossings on the North Coast main line will be closed, others will be upgraded with improved protection systems. In some areas, railway right-of-way has been encroached by housing and commercial buildings too near tracks. It is estimated that some USD 122 million will be needed to improve level crossings and ensure a safe right-of-way.

Under this NRMP, DGR will conduct a marketing study to define the potential market for dedicated high-speed container services between Jakarta and inland points to determine shipper demand, revenue potential, and likely costs. This analysis is expected to determine whether clearances can and should be opened to 6.14 meters to permit well-car based double stack services or if other capacity enhancements (e.g., double track) have a greater return. The Box below describes the potential for container movements on Java.

Prospects for Container Transport in Java

Container Terminals, some at ports or on-dock, others inland "Dry" terminals can be a a significant rail business. Fast and reliable container transport can permit shipping companies to serve only one port on Java, saving steaming time, port fees, and ship delays. Containers can be distributed from dry-terminals to local businesses, saving truck time traversing congested urban areas. A deep water port (proposed near Suralaya or Bojonegara) in western Java could permit super container ships (12,000 +TEU) to call in Java.

Dry terminals can serve as a concentration point for both inbound and outbound containers. Local shippers can dray containers from factory to the local dry terminal concentration point. From here, containers can be railed to ports for loading for onward movement.

The concentration offered minimises road transport costs. But involves two additional lifts for each container – rail transport pricing would have to accommodate the additional costs. In many places, economies of scale offered by double stack rail movements off-sets the additional terminal costs. In Java, until double stacking is possible, low cost movements using a single locomotive and frequent fast service may make it possible for rail to be competitive.

There is significant opportunity for increased freight service in the more industrial heartland from Jakarta through Bandung to Kroya and Yogyakarta. Infrastructure investments were discussed at the beginning of this section. Bridges must be strengthened for increasing axle-loads and loading gauge

clearances need to be increased at least enough to permit bi-level coaches and automobile carriers. The improved infrastructure will permit the use of tilt-train technology and higher operating speeds on some portions of these lines.

As with the North Coast line, these main lines will be strengthened to provide an axle-load capacity of at least 22.5 tons and, when bridges and infrastructure are replaced, replacements will be built to a 25-ton axle load capacity. The increased infrastructure capacity will permit expansion of rail freight services to these critical areas. Some rail freight traffic will be more competitive with road transport because of the increased load carrying capacity. For example, the maximum payload for most 4-axle freight wagons in Indonesia is about 30 tons; an increase of axle load limits to 22.5 tons will permit an increase in payload to 66 tons – a substantial increase by any measure – 220 percent. When axle loadings are increased to 25 tons, payloads can be increased to as much as 76 tons – a 250 percent increase. While not all wagons will be fully loaded or make use of the full payload capability of new wagons, the loading capacity, both in weight and in volume, available to shippers will help railways become an important freight transport mode in Java. The box below describes the potential local industrial developments that improved rail infrastructure will support.

Prospects for Industrial Freight Terminals and Flows On Java

Increased rail axle loads provides the opportunity to develop specialised terminals to concentrate traffic for movement throughout Java and to/from principal ports for import/export markets. Examples include:

Autos and Manufacturing Business: Movement of steel and parts from ports to an industry logistics center where parts can be distributed to factories, other parts suppliers. Auto loading terminals for completion of manufacturing processes, and temporary storage. Then loading assembled autos on multi-level (say bi-level) car containers for transport to markets. A common terminal could assemble autos from several manufacturers on trains for transport to area markets. Road transport would be limited to movement from destination terminal area.

Oil, Chemical and Fertiliser Terminals: Bulk distribution terminals can allow bulk transport of chemicals and fertilisers from ports and manufacturing centers to inland distribution centers. Road transport would be limited to movement from the distribution center to end users.

Warehousing Logistics and Distribution Centers (WLDCs): WLDCs can be developed similar to Chemical and Fertiliser Terminals, goods would move in containers or high-capacity box wagons from ports and manufacturing centers (or from other WLDCs) to a distribution center where goods can be warehoused and custom orders assembled for local distribution to end users.

The southern Java main lines traverse much more difficult terrain and involve more bridges and structures than other Java lines. The more difficult terrain will not permit the same kinds of speeds

that can be achieved on the North Coast main line. However, using tilt-train technologies and judicious air-lining,[52] speeds will be increased, passenger capacities will be increased through the use of bi-level coaches (gallery cars) on some trains, and freight volumes and competitiveness will be improved at the same time. It is estimated that bridge enhancements to 22.5 ton axle loads can be made for approximately USD 1,000 million[53] and that bridge strengthening and loading gauge improvements could cost as much as USD 3,700 million.[54]

Signal and train control improvements will also be required on southern lines (the 950 route kilometers between Jakarta and Surabaya via Bandung and Kroya, including the line Cirebon to Kroya). The NRMP calls for a modern signal system to be installed on these lines, replacing all mechanical semaphore systems, for approximately US$436 million (see **Annexe 1** for table of estimate). These investments will be second in priority to the North Coast investments but should be completed within the first five year planning period (2010-2014).

For physical improvements to track structures, the initial strengthening (to 22.5 tons/axle) will take place in the first five year period (2010-2014), and enhancements to loading gauge and additional strengthening (to 25 ton/axle) will be staged in subsequent periods based on determined need and potential for improved rail competitiveness.

6.2.8 Terminal and Capacity Enhancements

Increasing freight market shares will necessarily require expansion of or improvements to specialised terminal facilities discussed above. Specialised terminals are likely to be financed or paid for by commercial interests – either by the companies who will operate them, by PTKA in its normal course of making commercial investment decisions, or by other railway operators, permitted under the new railway law. However, some rail infrastructure investments may properly be made by the DGR or other units of the GoI in the interest of expanding rail freight services and as alternatives to further investment in road transport capacity. Specialised terminals may also be sponsored or proposed by LGs at many levels. The contribution from government may include land, connections and associated signaling to the main-line rail network, and even railway infrastructure within specialised terminals themselves.

The NRMP expects investment in specialised terminals should be led and proposed by private sector investors but the DGR will also conduct cost/benefit and financial feasibility analysis so that it can rate those proposed investments along with others in what is inevitably a limited budget allocation. Investments for inland “dry-ports” for container consolidation may be good investment alternatives to spending for increased highway capacity and the cost/benefit analysis will include a review of avoided investments, benefits from reduction of congestion, and the disparate environmental impacts of rail vs. road investments.

The maps in the text boxes above show some of the potential terminal investments that may arise over the next few years – about 11 were identified, some already exist but may require expansion funding; others will require new construction and connections to an increasingly sophisticated main-line infrastructure. Over time, more special terminal ideas will be developed and put forward. For the NRMP, a total of 10 new specialised terminals are assumed. The cost to develop a new rail terminal vary widely depending upon location and land costs, the size and complexity of the terminal, and on

[52] Air-lining is straightening lines by easing curves, and trading off distance, curvature, and additional grading.
[53] Estimate based on an investment of USD 100,000 per meter for all bridges that are 100 years old or more.
[54] Estimate based on an investment of USD 200,000 per meter for all bridges on the lines in question. This is likely to be an over estimate for Indonesia but covers a mix of urban, suburban and rural structures.

the facilities needed to operate it. For the purposes of the RMP, a cost of USD 25 million per terminal is assumed. This estimate is based on: connections to the main line (USD 3 million); five kilometers of track construction (USD 10 million); rail related buildings and support structures (USD 2 million); and land acquisition and environmental remediation (USD 10 million). The cost of pavement, loading and unloading facilities, special handling equipment, cranes, lighting, and other related costs are assumed to be borne by commercial investors. Based on these estimates, specialised freight terminals will cost approximately USD 250 million over the first 10 years of the investment plan.

6.2.9 Infrastructure Enhancement on Sumatra

Sumatra contains some 1,300-track kilometers of railway line; about 660 track-kilometers of this are main lines. On Sumatra, only South Sumatra has a substantial amount of heavier duty track (with about 400 kilometers of R54 railway line using concrete sleepers); North and West Sumatra railways have mostly R33/38 rail and very low axle loads. The lines proposed for strengthening are shown in the map below.

Figure 15: Infrastructure Enhancements on Sumatra

It is estimated that track strengthening in Sumatra will require an investment of about USD 288 million. Signal improvements to all main lines (resulting in electronic signals on all 660 track kilometers of railway line and elimination of mechanical semaphore signal systems) is expected to cost about USD 293 million. Enhancements to main-line turnouts (those on less than 50kg rail) are expected to cost about USD 24 million; level crossing improvements on the main-lines are expected to cost an additional USD 20 million. For details on the proposed enhancement costs, see Section 6.5.

The main lines on North and East Sumatra will be enhanced, similar to the enhancements described above on Java, with the most important lines moving to 22.5 ton axle loads, and the rest of the main lines upgraded over time as demand requires. South Sumatra main lines carrying coal volumes will be enhanced to a 25-tons/axle loading standard on a priority basis in the initial phase of the NRMP (2010-2014). Should a mineral development require earlier development on any of the lines, infrastructure enhancements will be advanced. Eventually, the target for Sumatra will be the same as for Java – 25 ton axle loads and sufficient loading gauge clearance for at least bi-level commuter equipment. Expansion of each of the three regional Sumatra systems will take place during the first three phases of the NRMP. In phase four of the NRMP (2025-2029), DGR will support interconnection of the three regional systems into a Trans-Sumatra Railway, should feasibility studies conducted in the third NRMP justify such system integration.

6.2.10 Summary of Infrastructure Enhancements

The aim of the RMP is to provide Indonesia with a rail system that can contribute to economic growth, compete in the market place for both passenger and freight traffic, and enhance the development of the economy of the country. Indonesia's railways have been losing market share and have not contributed significantly to economic development. Indeed, some argue that the deficiencies of the railway system have hindered economic growth and development. A top priority for investments included in the RMP is to enhance the infrastructure so that the railway can contribute to economic development in the future. The NRMP therefore mandates that Indonesia adopt a new standard for railway developments in the country – a standard that will provide the country with a relatively heavy duty infrastructure suitable for higher speeds and much greater freight productivity:

Rail:	R60, continuously welded, heat treated or head hardened in curves with radius less than 500 meters.
Sleeper:	Heavy standard steel reinforced concrete sleepers on a spacing of at least 1,660/kilometer.
Fastenings:	Single piece fastening auto tensioning, elastomeric pad.
Ballast:	300 mm hard rock ballast (granite) to an AAR specification
Sub-ballast	250 mm compacted crushed-stone ballast.
Axle Loading:	25 tons per axle.
Loading Gauge:	6.1 meter, flat roof-profile (AAR Plate H or approximate).
Signaling:	ETRMS level 2 or AAR-CTC signaling with broken rail protection for main lines.
	Radio based, GPS monitored block train control for branches.
Bridges:	Sufficient for 25 ton axle loading.
Electrification:	25-kVAC/50/60 Hz.

The investments discussed in this section upgrade the existing network to a standard such that main lines have a minimum of 22.5 ton continuous axle load capability with the ability to handle locomotive loads of 25 tons/axle and provide an infrastructure that will support 150-kph train services on the Java North Coast main line. The plan also allows for the construction of 12 new special purpose freight terminals. As rail renewals are carried out on the principal main lines, rail should be a minimum of R60 and the lines will have a 25 ton/axle capacity. These proposed investments, totaling about USD 7,500 million, are summarised in Table 7 below. Of this investment, approximately USD 5 billion would be spent in the first five year period, and the entire infrastructure enhancement would be completed by the end of the second five year period.

Table 7: Infrastructure Enhancement Investments

Investment Category	Java	Sumatra	Total (USD million)
Track, Turnouts, Level Crossings	$ 1,119	$ 332	$ 1,451
Bridges *(Sumatra estimated)*	$ 3,700	$ 1,000	$ 4,700
Signals	$ 996	$ 293	$ 1,289
Special Terminals	$ 250	$ 50	$ 300
Total	**$ 6,065**	**$ 1,675**	**$ 7,740**

In addition to the spending discussed above, some of the Jabodetabek lines will not support bi-level equipment and heavier locomotives. This may not be an issue as the EMU and DMU equipment is replaced over time. However, some 70-kilometers of existing Jabodetabek lines are currently constructed with rail that is less than R50 or with wood sleepers. The NRMP also mandates that these lines be enhanced as well – this enhancement is estimated to cost about USD 31 million. Enhancing all Jabodetabek lines to a 22.5/25 ton axle load for bi-levels is estimated to cost about USD 84 million. The cost of expanding loading gauge to permit bi-level EMU/DMU equipment will be estimated in the first phase of the NRMP (2010-2014).

The enhancement program discussed above is oriented to the main lines, shown in the maps in Figures 12 and 13. Eventually, many of Indonesia's secondary lines must be upgraded to the same standards. The cost to upgrade the infrastructure (track, turnouts, level crossings) on all secondary lines is estimated to be an additional USD 1,000 million.

The need for new track maintenance equipment was discussed in a preceding section. The acquisition of new equipment (tampers, ballast regulation and compaction equipment, in particular) will be needed to meet the higher track geometry standards to permit high-speed train operations, particularly on the North Coast main-line where some passenger trains are expected to operate at 150-kph. This equipment may be provided by track maintenance contractors (including PTKA) or purchased by/for the DGR. It is anticipated that initially new track maintenance equipment will cost approximately USD 30 million. Older equipment will be cascaded to secondary mains, where train speeds and geometry standards will not be so significant.

6.2.11 New Infrastructure Investments

While the infrastructure enhancements described above will increase rail system capacity substantially, projected passenger traffic demand and the desire to increase rail freight transport requires the construction of new infrastructure throughout Indonesia. Many single-track lines will need to be double tracked, some lines will require double double-tracking to handle projected increases in both passenger and freight traffic. Over time, a substantial amount of capacity expansion will be required, especially if the infrastructure and service enhancements result in increasing market shares as anticipated.

In the initial five year period of the NRMP (2010-2014), the DGR will develop an investment program that includes the main line enhancements discussed above for the North Coast main line and blends traditional enhancements for double-track, workshops, and related investments. In the second five

year period (2015-2019), the main-line enhancements will be completed, in order to maximise the value of new rolling stock investments valuable, and to significantly increase capacity with limited further double tracking needed. As the planning process proceeds, the DGR and PTKA should begin using the capacity models discussed earlier to make more targeted investment decisions.

There has been a great deal of discussion of additional investments to expand Indonesia's railway infrastructure. These include the introduction of VHST, for example, France's TGV technology, Germany's ICE trains, Japan's Shinkansen services, or most recently in China, where passenger trains are capable of speeds of 260-kph or more. An analysis of the potential gains and expenses for such an investment were carefully considered. Section 6.6 contains a summary of the analysis and the impact on rail market shares that might result from the introduction of HST services in Indonesia. This analysis indicates that the introduction of VHST trains on the North Coast route between Jakarta and Surabaya would require a completely new right-of-way with grade separation and fencing along the entire route. This alternative is estimated, on most favorable assumptions, to cost approximately USD 29-billion at current prices and require substantial land taking with significant social impacts. The investment would be expected to increase rail market share by about 1 percent over the far less costly enhanced 150-kph service described here. Quite likely the actual costs would be higher.

Given Indonesia's high population density, and if rapid economic growth can be sustained over the years, a VHST route may be warranted in the more distant future. However, it is expected that the need for such a service will be substantially later in the planning period, i.e. in the 2025-2029 period or beyond. This NRMP projects that DGR will begin planning for an eventual VHST and develop a route plan and land acquisition strategy for the route to be implemented in the 2020-2024 period, after other more urgent needs have been met.

This NRMP concludes that more important and more urgent series of investments in urban rail transport systems must be dealt with before the need for a dedicated VHST system. These include expansion of Jabodetabek services to additional areas further from central Jakarta and expansion of suburban services in other major cities, including those on islands currently without rail service. Each of these expansions will require detailed analysis during the first NRMP planning period (2010-2014). However, each is likely to depend on the enhanced rail infrastructure discussed above or on expensive new line construction. Additional spending will be required – perhaps to open now closed lines, to build new commuter service lines, to construct lines serving concentrated areas of demand like airports and suburban population centers. More than a decade of sustained rapid economic growth will be required before sufficient resources become available to develop VHST and before per capita incomes rise sufficiently to support a sustainable fare structure.

The most immediate needs include airport links and expanded commuter services in Jakarta and Surabaya, and expanded commuter services in other major cities. In this area, the DGR plans for expansion and construction are reasonable for planning purposes and are adopted as part of this final NRMP. The plans for metro systems in Jakarta are also advanced in this NRMP – there is no doubt that such systems are needed, given the rapid growth in automobile ownership, increasing congestion, and growing environmental impacts associated with road transport. Urban commuter services and metro construction must find a means of financing for the vast expenditures required. The best sources of financing for these local investments are local taxes and developers who can gain value in land developments from improved transport. The DGR and GoI will develop regulations and programs that permit local investors and local government contributions to be a part of the planning and approval process. These issues are further addressed in chapter 7 of this NRMP.

6.3 ROLLING STOCK INVESTMENT STRATEGY

Railway rolling stock is essential to the delivery of rail services. Traditionally, rolling stock has been held (owned) by railways. Today, in many parts of the world, rolling stock is often owned by private companies and, in other cases, by government units who wish to subsidise some particular rail service. For example, many shippers own freight wagons they use; leasing companies buy wagons and lease them to users on a variable time basis – sometimes for a single trip, sometimes for as long as seven years. In Canada, the Agriculture Ministry owns some grain wagons to help grain farmers. In Russia, more than 40 percent of the wagon fleet is now owned by private companies – shippers, leasing companies, and private railway operators. In China, some shippers own their own freight equipment, some is owned by industry groups.

Passenger equipment is less widely owned by private entities. Generally this is because the services provided with passenger rolling stock are government subsidised and there is only one service provider who can use the equipment – thus there is not really a market in passenger rolling stock in which private investors could participate. An exception is the UK where most passenger rolling stock is owned by private leasing companies. The passenger equipment market is different in the UK because service providers are private companies who have a concession (a contract right and obligation) to provide certain services for a term that is much less than the life of passenger rolling stock. Rail passenger equipment in the UK is generally standardised such that it can be moved to a different concessionaire or the lease transferred to the next concessionaire when the concession for a particular group of services ends. As a result of this feature of relatively standardised equipment and multiple potential customers, UK passenger equipment is owned by equipment leasing companies.

Locomotives are most often owned and operated by railways, less often by private or other entities. Of course, there are exceptions – in North America there is a vibrant locomotive leasing market and a number of private leasing companies own and lease locomotives to rail carriers and others who have a need for locomotives, if only periodically. In Russia, most locomotives are owned by RZD, the state-owned railway company which also owns and operates the infrastructure. RZD provides trained drivers and mechanical repair services. Some locomotives are owned by private railway operators and shippers. Shippers own locomotives used in their own services and occasionally on the RZD maintained infrastructure. Privately owned railway operators (those who own freight wagons, too) also own some locomotives that are used to haul their trains on RZD main-lines. As of yet, there is not a private market in locomotives for short term lease in Russia. In the UK, passenger locomotives are usually owned by private equipment leasing companies but freight locomotives are owned by railway operating companies providing freight services.

Generally, one of the easiest ways for private investors to participate in the rail sector is through ownership of rolling stock. Of course, special purpose railways will buy railway rolling stock fit for their purpose. Other than that, freight wagon ownership is easiest for major shippers handling large volumes of bulk commodities, those for whom freight wagon storage is cheap warehousing (e.g., chemical companies), or those who can arrange high-utilisation services between a few points (e.g., a shipper moving containers from an inland terminal to a port, or between terminals in major cities). Other private entities interested in rolling stock ownership may be private rail operators – companies who provide rail services using Indonesia's rail infrastructure. These might be contract operators or concessionaires providing a subsidised passenger service (as in the UK) or specialised freight operators servicing specific origins and destinations. Development of private leasing companies depends on having multiple potential customers and relatively standardised equipment specifications.

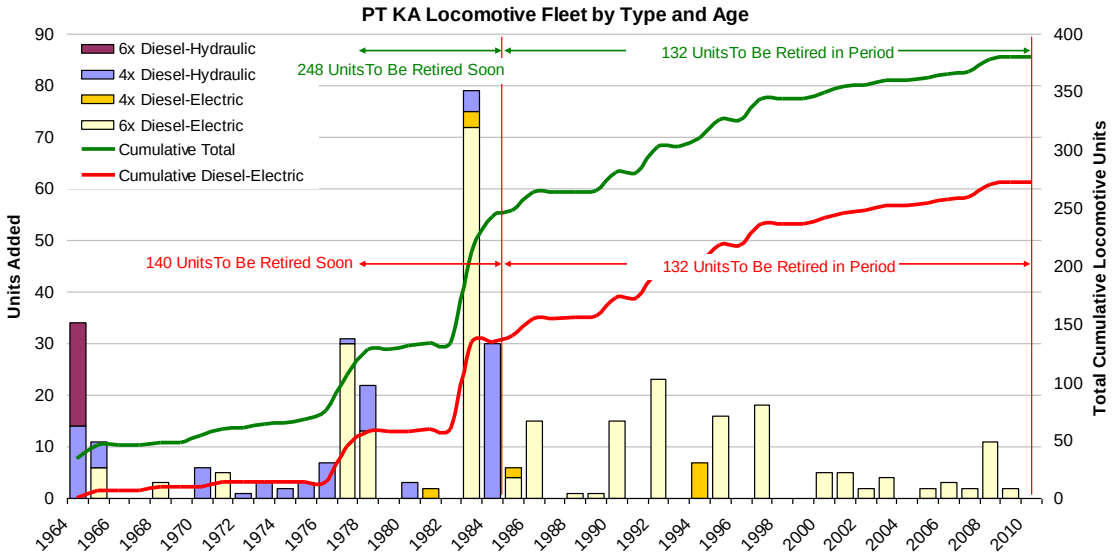
As equipment fleet replacement needs are reviewed, it is clear that a large proportion of the Indonesian fleet of railway rolling stock needs to be replaced now, and that nearly all of it will require

replacement over the next 25 years. This is a good thing. It means that legacy equipment investments need not prohibit significant changes in infrastructure standards. It also means that as infrastructure standards are upgraded, required replacement equipment and new equipment can begin generating benefits as quickly as infrastructure upgrades are completed. Rolling stock purchased for replacement as well as for new traffic should meet new infrastructure standards – not perpetuate old standards. Since the infrastructure upgrade discussed above will take some time to implement, new equipment should be used on lines where the upgrades have taken place, or, in the case of increased axle-load rolling stock, only partly loaded when used on non-upgraded lines.

6.3.1 Locomotives

The average age of the Indonesian locomotive fleet at the end of 2010 was 26.4 years. Some 41 locomotives are scheduled to be retired in 2010, at which time the average age of the fleet will still be about 25 years old – about the typical life of a locomotive before retirement or a major rebuild.

Figure 16: Locomotive Fleet Ownership and Age Distribution



Based on the fleet age profile, DGR expects PTKA to retire some 248 locomotive units in the near future – these are units that are already 25 years old (and include the 41 units that are currently scheduled to be retired). Some of these locomotives may be rebuilt rather than retired. Railways often keep locomotives beyond their useful life, but maintenance costs escalate rapidly as locomotive units age without a major rebuild. The total replacement value of the 248 locomotives to be retired soon is about USD 620 million (assuming replacement locomotives cost about USD 2.5 million each). Over the next 25 years, an additional 132 locomotives will need to be retired or rebuilt – a current replacement cost of an additional USD 330 million.

Diesel-electric locomotives are the workhorses of the existing Indonesian railway fleet. In this category, PTKA had 272 diesel-electric locomotives in its fleet at the end of 2009. Of these, 140 are already 25 or more years old. There are an additional 132 diesel-electric locomotives that will be retired or rebuilt over the next 25 years. The decision to rebuild a locomotive is usually a complex one. Rebuilding is less expensive – around USD 1 million – and can result in a locomotive with a decade or more of additional useful life. But, new locomotives have the benefit of technology

advances that have been made in the last 25 years, generally have much lower maintenance requirements, greater reliability, better fuel economy, and a longer life.

Decisions about whether to rebuild, or buy new, will involve an analysis of the differences in the cost of rebuilding an old locomotive with a shorter life versus the cost of a new locomotive with a longer life based on the time-value of money. A full analysis also will consider the impact of the changes in operating practices and costs that new locomotives allow. The NRMP considers that technology advances will allow Indonesian railways to replace old locomotives with fewer more advanced new units – the new units have greater power, better reliability, or both. This kind of substitution will reduce the total number of locomotive units needed to provide a given level of service and will reduce maintenance inputs due to both; a smaller fleet size and to reduced maintenance inputs needed for each individual locomotive. In Indonesia, additional analysis will be required in the NRMP initial phase to project the replacement ratio. Because train sizes are relatively small and only two locomotives are typically used on a typical train, it is not likely that new locomotives will have a 2:1 replacement ratio so that most trains could be dispatched with only one locomotive. Efficiency benefits must thus be calculated in accordance with actual locomotive utilisation. The replacement ratio also will need further computations for light but faster passenger trains.

New locomotive technology and increased permitted axle loads will change several cost related features that will be considered prior to DGR investment decisions. First, only one locomotive might be sufficient for some trains; each would have to be evaluated. Second, some trains can haul larger loads – more or heavier passenger equipment (see the discussion of bi-level passenger coaches below), more tons in freight trains (see the discussion of freight wagon replacements, below). Third, trains might be run faster, improving equipment utilisation, impacting rolling stock maintenance costs, and potentially increasing patronage or prices that can be charged. Fourth, new four-axle locomotives reduce infrastructure maintenance requirements since they reduce rail wear and can operate faster on more difficult terrain. Finally, faster train movements increase the throughput capacity of track infrastructure.

All of these factors are part of the rebuild versus new locomotive decision-making process that will take place in the 2010-2014 phase of the NRMP. An additional factor that will be considered is the ability to afford the investment – either directly or through various financing mechanisms. In recent years, because of the great technical developments in the last 25 years, most railways have decided to replace old locomotives with new units if they had the financing capacity. Older locomotives are rebuilt to satisfy lower service demands – for non-main-line service – for use in shunting services, or on branch lines where newer locomotives may not be able to operate because of axle-load limitations. DGR will encourage PTKA to implement this type of evaluation process in order to avoid unnecessary investments.

In Indonesia, the NRMP anticipates that some locomotives will be rebuilt at the end of their useful life (here assumed to be about 25 years), but that most will be scrapped. The introduction of new technology diesel-electric locomotives will be paced by improvements in infrastructure such that new, higher capacity locomotives can be used on an increasing proportion of main-line services.

6.3.2 EMU and DMU Passenger Equipment

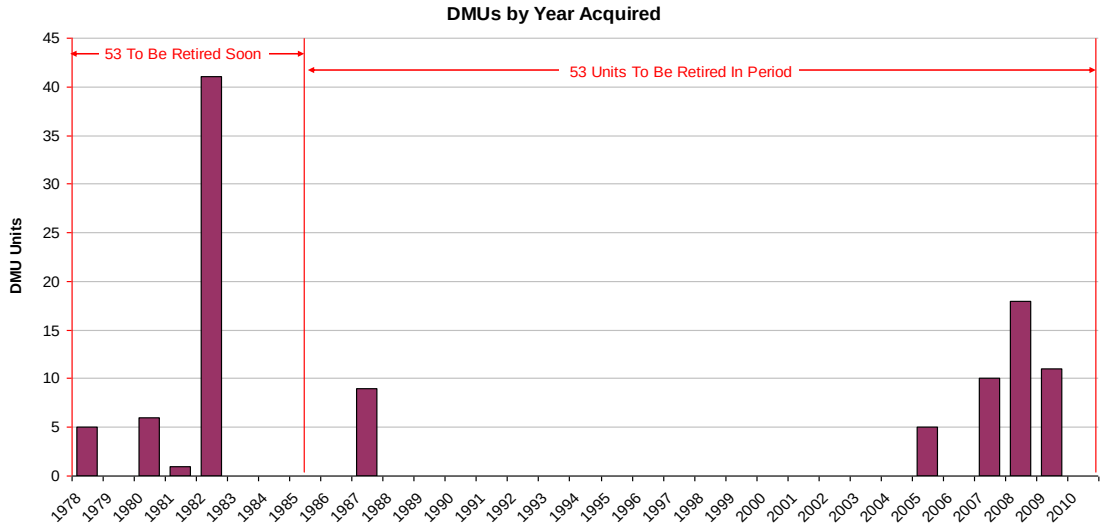
Many passenger services are provided via self-propelled passenger coaches that operate in train sets that can vary in length. Such equipment is called multiple-unit rolling stock because the coaches can be coupled in multiple-units and, when coupled together, be operated with one set of drivers. Multiple unit rolling stock has power for traction distributed among the various coaches. This kind of equipment gives rail passenger services operators a great deal of flexibility since the capacity of passenger services can be adjusted by adding or subtracting coaches. Multiple-unit equipment also

saves station capacity since all equipment in the train can carry passengers. Multiple-unit passenger equipment that is powered by diesel-electric traction systems are called DMUs; equipment that relies on electric traction are called EMUs. Indonesia uses both DMUs and EMUS. Each of them is discussed below.

Diesel Multiple-Units

At the end of 2009, Indonesia operated some 106 pieces of DMU equipment. Replacement cost for a DMU car is about USD 2.5 million, thus Indonesia's DMU equipment has a replacement cost value of about USD 265 million. The equipment had an average age of about 17 years, but the age distribution is bi-modal. Half of Indonesia's DMUs (53 units) are old with an average age of almost 29 years; the other half (also 53 units) is relatively new with an average age of less than 3 years. A DMU set can be expected to have a life of about 25 years, though this life can be extended by rebuilding or overhauling equipment. Based on averages, it is expected that about 53 DMU units should be retired in the near future. Over the master plan horizon, the other half of the fleet will be ready for retirement or overhaul. The chart below shows the distribution of DMU unit acquisitions.

Figure 17: DMU Fleet Age Distribution



Most DMUs are used in Java, with only three sets used on Sumatra – and these are the newest ones, acquired in 2009. The age profile provides an opportunity for the DMU fleet to be replaced with more productive units using better prime movers, improved transmissions, and greater capacity. Some of these units might be replaced with locomotive hauled bi-level passenger rolling stock to provide greater capacity and lower maintenance costs. The same issues surround rebuilding DMU equipment as locomotives.

Another issue that must be faced when replacing DMU equipment is whether to extend electrification into areas now served by DMU operations. This is likely to involve a complex set of decisions in Indonesia's major cities as electrification is expensive to construct, requires higher clearances, and may interfere with decisions regarding increasing the loading gauge (physical clearance envelope) that can make freight services moving through Jakarta to ports and inland terminal areas more useful. So, the total number of DMUs that must be acquired depends on an analysis of the demand for commuter services in non-electric territory – most of Indonesia.

DMUs are an excellent way to begin suburban or commuter services in a city – they are relatively inexpensive, provide flexible capacity, and can be used on a number of routes with minimum expense. An alternative to the use of DMU equipment is using locomotive hauled coaches. This

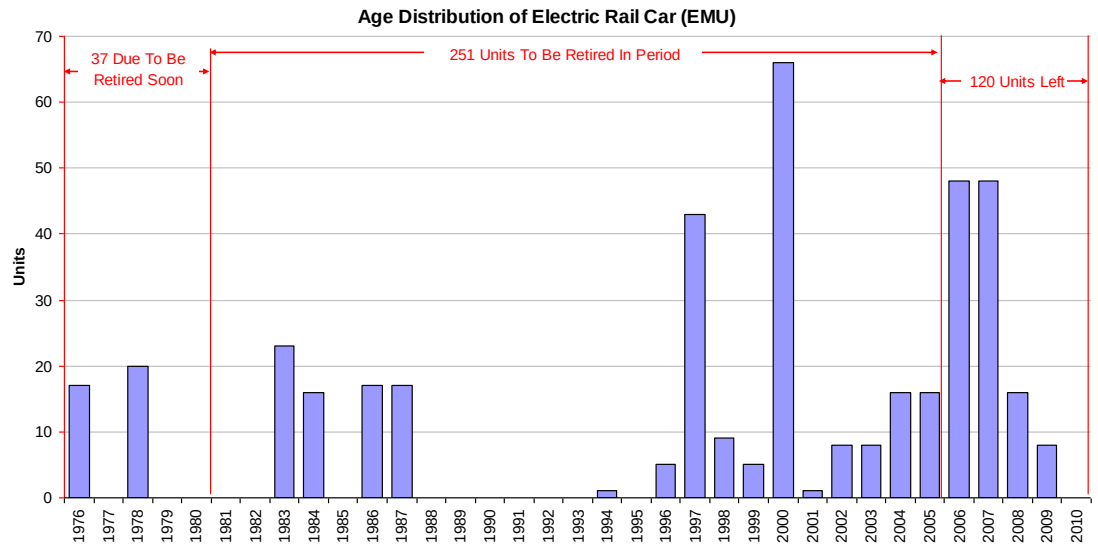
option can require a lower rolling stock investment, depending upon the size of trains and the availability of coaches and locomotives versus suitable DMU equipment.

Either DMU units or, more likely, push-pull train sets (passenger coaches with a locomotive at either end of the train) will be considered for 150-kph high speed services between Jakarta and Surabaya.

Electric Multiple-Units

At the end of 2009, Indonesia's EMU fleet totalled some 524 EMUs. According to data received for this report, 82 EMU units were scheduled for retirement in 2009. For the purposes of this report, the fleet has been assumed to total 408 units with a replacement cost estimated at about USD 900 million (using an average cost of about USD 2.2 million per EMU car, using modern materials and self contained toilet facilities).

Figure 18: EMU Fleet Ownership and Age Distribution



These 408 units have an average age of about 13 years. Many EMUs have been acquired in recent years, so the age distribution is not quite as skewed as for the DMU fleet. EMUs have a typical life of about 30 years. Based on that life estimate, an additional 37 units should be retired soon and some 251 units will be retired over the course of the master plan period. A total of 288 EMU units will require replacement to keep the same services – at an estimated cost of USD 630 million. The high level of retirements provides a great deal of flexibility to replace aging EMU equipment over time with bi-level units and with units with greater capacity and other benefits of modern technology.

In addition to the replacement of 288 EMUs, the degree and intensity of rail passenger services is expected to increase significantly over the next 25 years as existing services expand and new services added. It is likely that most cities to gain new commuter services will first be served by locomotive hauled coaches or by DMU services. Some new lines may be built as electrified services from start-up. EMU services require a significant investment in power distribution systems, substations, higher clearances and more sophisticated signal and train control systems. The advantage is that EMU operations are often less expensive, and are generally quieter and more environmentally friendly in urban areas.

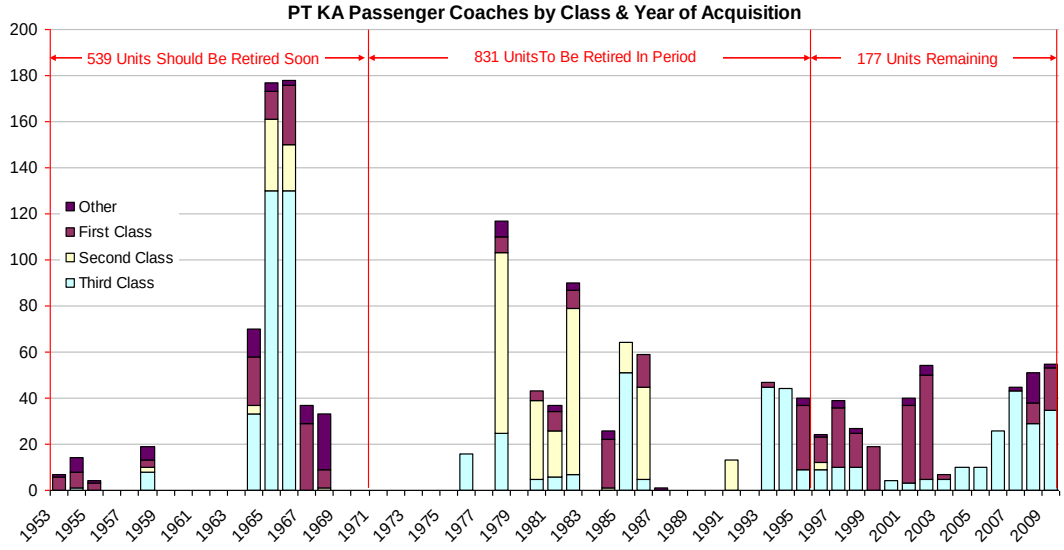
One of the issues that arise with expansion of electrification and the acquisition of more EMU equipment concerns electrification standards that should be used. Current EMU services use a 1,500-

kVDC standard; a relatively common standard used in a number of countries. Chapter 7 addresses this issue more completely. It is recommended that Indonesia adopt two electric railway standards – 750-VDC for metros, light rail and trams; 25-kVAC for main line electrification. New EMU equipment would be capable of handling both 25-kVAC and 1.5-kVDC. New electrified main-line track would be built to a 25-kVAC standard. Dual voltage EMU equipment is common and about the same cost as single voltage equipment.

6.3.3 Long Distance Passenger Equipment

Indonesia has extensive intercity rail passenger services, primarily on Java. These operate with some 1,550 pieces of locomotive-hauled passenger rolling stock with a current replacement cost of USD 2,800 million. Indonesia's intercity passenger equipment has an average age of about 27 years. Generally, locomotive hauled rail passenger equipment can have a long life – usually on the order of 40 years – in part because such equipment does not typically contain complex mechanical systems integral to the coach, as is the case with locomotives and DMU/EMU equipment.

Figure 19: Passenger Coaches by Year of Acquisition



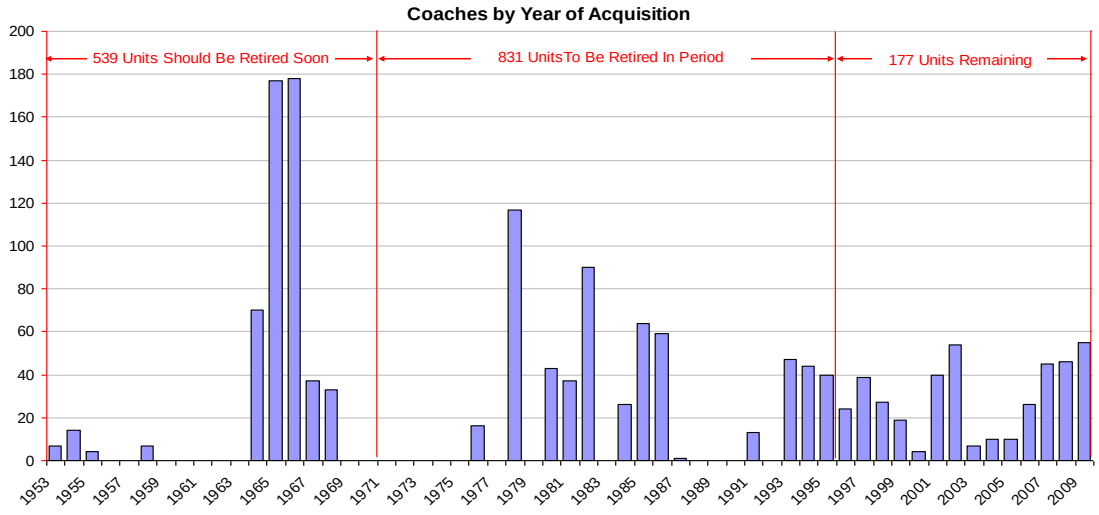
Locomotive hauled passenger coaches used in Indonesia are relatively simple in construction[55] and can be overhauled or re-purposed relatively easily. Given these factors, some 539 units of intercity passenger equipment (worth almost USD 1,000 million) are now over 40 years old and should soon be retired. Over the next 25 years an additional 830 passenger coaches (with a current replacement cost of about USD 1,500 million) will need to be replaced. The age distribution of the coach fleet is shown in Figure 16.

The age distribution of rail passenger equipment varies somewhat by class of service. The average age of first class passenger rolling stock is 23.4 years; for second class coaches it is 31.1 years; and for third class equipment it is 27.1 years. It is typical for higher class equipment to be newer as

[55] Compared to freight equipment, locomotive-hauled passenger equipment is quite complex. Some passenger coaches are equipped with air conditioning systems, electrical outlets, entertainment systems and internal furnishings that are quite elaborate; dining cars contain complex heating and cooling systems; power cars contain diesel generators. However, most of this complex equipment is replaceable in the normal course of maintenance and upgrades while the basic car-body, suspension systems, and bogies remain the same.

passenger rolling stock is usually cascaded into less demanding service classes as it ages. Passenger coach age distribution by class of service is shown in Figure 20.

Figure 20: Passenger Coaches by Class and Age



As passenger equipment is replaced, it should be replaced with equipment that meets modern passenger transport standards, environmentally and in terms of comfort, capacity, and maintainability. A modern passenger coach with toilet facilities, soft coach seating, and air conditioning costs about USD 1.6 million, a modern dining coach is about USD 2.5 million; power cars should cost about USD 1.5 million (power cars will be needed unless locomotives with "head end"-power supply capabilities are used to provide power to the coaches).

Overhaul of passenger coaches is common and relatively frequent because of the high-use characteristics of the equipment. As Indonesia's passenger equipment is replaced, some of it might be rebuilt for use in less intensive service or as a starter set of equipment for commuter services in a new community. Overhaul costs can run about half the cost of new equipment so a commuter train-set of a locomotive and five passenger coaches could be rebuilt for about USD 6 million, including toilets and air-conditioning. The use of rebuilt equipment can provide a means to expand lower intensity services while new equipment is put into high-intensity services.

6.3.4 Freight Wagons

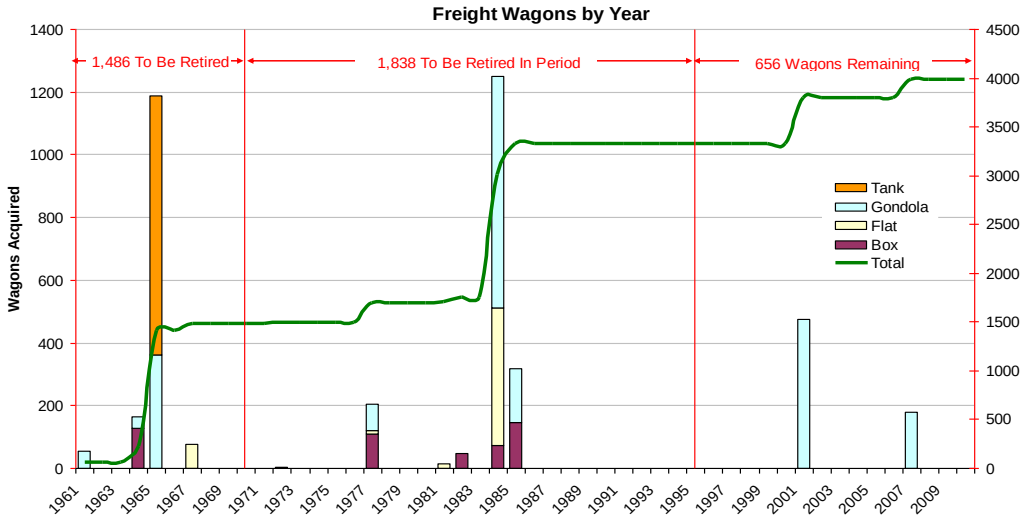
Indonesia's railway owns and operates nearly 4,000 freight wagons; about 3,500 are 4-axle freight wagons with air-brakes. The replacement cost of the 4-axle fleet is about USD 260 million. While there are some relatively new wagons, none are high-capacity due to the axle load limitations imposed by Indonesia's rail infrastructure. The average age of the fleet is about 30 years; freight wagons can have a life of as much as 40 years, sometimes more if they are not in demanding service. A more typical life among freight hauling railways is 30 years – after that the economics of repair and maintenance, and the utility of the older wagons for most shippers turns unfavourable.

Indonesia's 4-axle box wagon fleet totals about 500 wagons and has an average age of 32.5 years; its flat wagon fleet totals about 540 wagons with an average age of 28.6 years; its gondola fleet totals about 2,100 wagons with an average age of 24.6 years; and its 830 tank wagon fleet has an average age of 45 years. The age distribution of the 4-axle freight fleet is shown in Figure 21. Based on an average life of 40 years, some 1,480 wagons should be retired in the near future. Over the planning horizon, an additional 1,840 wagons will be retired. If axle-loads are increased, retirements of the

existing fleet could be higher since the economics of wagons built to higher-axle loading limits have proven compelling everywhere in the world.

The high average age of Indonesia's wagon fleet provides an opportunity (as well as a challenge) to replace the existing wagon fleet with newer, more capable, modern design wagons that can take advantage of improvements in the infrastructure and generate better net:tare ratios. Such changes will reduce maintenance costs, reduce fuel consumption (because more energy is spent on delivering net-ton-kilometers than tare-ton-kilometers), and make rail services more attractive to freight shippers. It will also reduce the total number of wagons that must be acquired by as much as 50 percent. The existing wagon fleet has an average capacity of about 30 net-tons per wagon. With increased axle-load capabilities, wagon capacity can be increased to between 65 and 75 tons per wagon. While the larger wagons will be somewhat more expensive, the net difference in wagon cost is less than 15 percent.

Figure 21: Freight Wagon Age Profile



Replacement cost of existing wagons is estimated at about USD 75,000 each to replace in 2010; high-capacity wagons should cost no more than USD 85,000 each (typical world prices for standard gauge 100-ton freight wagons are currently about USD 70,000). Given the capacity increases, only about 2,500 wagons should be needed to provide similar carrying capacity to the existing fleet. While not all shippers would use the full tonnage capacity, loading gauge increases would allow an increase in the volumetric capacity of replacement wagons. In addition, the enhanced infrastructure will support higher train speeds; development of load concentrating terminals (bulk distribution terminals, warehousing logistics and distribution centers, intermodal terminals, etc.) will also contribute to improved freight wagon utilisation. Thus, replacement of the existing wagon fleet over the period is estimated to cost about USD 212.5 million.

Additional traffic that is projected is likely to require an additional 5,000 wagons, or an investment of an additional USD 425 million. This does not include wagons used on special purpose and special railways – these wagons are assumed to be part of the development of the new lines.

It is not clear at this stage what entity or entities will put up the investment for new railway wagons. Some wagons may be acquired by new rail service operators providing specialised service between distribution centers; some may be acquired by shippers, some by PTKA. Should a market with multiple equipment owners develop over the period, it is likely that equipment leasing companies may evolve. This will require the development of a set of Indonesian standards for Cape Gauge equipment that permits investors to acquire relatively standardised or universal wagon types that

can be moved between services or customers. This NRMP anticipates that Indonesian standards will be drawn from rolling stock standards used in other Cape or narrow gauge railways (particularly Queensland, South Africa, Brazil) where heavier haul and higher speed standards are currently already well developed. This will permit suppliers from these countries to compete for rolling stock investments; it will also permit acquisition of used equipment in these markets for use in Indonesia as its standards and the capacity of its infrastructure evolves over time. The NRMP endorses the use of relatively common standards with similar railways, as this will also enhance the ability of Indonesian suppliers to service those markets as well.

6.3.5 Summary Rolling Stock Replacement

Indonesia's railway rolling stock fleet is aging and a substantial portion of it should be retired soon, another significant investment will be required to replace equipment that will reach the end of its useful life over the planning period. In total, rolling stock with a replacement value of more than $USD 4,700 million will reach the end of its useful life over the planning period. Equipment with a current replacement cost of $USD 1,945 million should be retired soon. The table below summarises the investment needed simply for replacement of equipment that has already reached the end of its useful life, and an estimate for the equipment that will need to be replaced over the planning period.

Table 8: Summary of Rolling Stock Investments

Rolling Stock Type	Average Age (years)	USD (million) for Equipment to be Replaced Now	USD (million) for Additional Replacements by end of Period
Locomotives	26.4	$ 620	$ 330
DMUs	17.2	$ 133	$ 133
EMUs	12.8	$ 81	$ 660
Coaches and other loco-hauled	27.4	$ 1,000	$ 1,500
Freight Wagons	34.6	$ 111	$ 138
Total		**$ 1,945**	**$ 2,761**

The NRMP anticipates that investments designed to enhance the capacity, speed, and axle load of the existing railway infrastructure will mitigate replacement costs somewhat. For example, enhanced infrastructure standards will permit replacing existing locomotives with fewer but more powerful locomotive units. More powerful locomotives may be somewhat more expensive but the substitution effects will be substantially greater. Similarly, bi-level coaches can be used to replace single coaches in locomotive hauled services – either increasing the passenger capacity (and revenue potential) or decreasing the number of units that must be replaced. Similarly, higher axle loads will permit replacing the existing fleet with about half as many wagons while retaining the existing capacity of the fleet.

As the NRMP is intended to increase rail passenger and freight market shares, substantially more rolling stock capacity will be needed. The replacement costs discussed above simply retain the current capacity. If capacity is to be doubled in any area, substantial additional investments – at least

as much as shown in the table above – will be required. Rolling stock investments are likely to reach USD 9,400 million for new and replacement rolling stock. One way to minimise the capital cost of new and replacement equipment is to increase speed (thereby utilisation) and to increase capacity. The speed and capacity increases require the substantial investments in infrastructure discussed in the preceding section.

6.3.6 Rail Equipment Markets

Private finance of rolling stock is either a means to finance ownership or a lease. There will be no leasing market in Indonesia unless there are multiple owners – if there is only one owner, then equipment financing is just a mortgage. Even this kind of financing will be hard to obtain unless it is guaranteed by the government or the assets are not unique to Indonesia.

This NRMP advocates adoption of universal standards, so that Indonesian government units and private investors can buy what is good, efficient, and reliable; and have some assurance that they are paying a fair price. Setting unique standards and specifications for Indonesian railway equipment and components would make it difficult to attract private financing, either from leasing companies or from manufacturers and therefore is rejected by this NRMP. Developing standards that will preclude foreign companies from selling in Indonesia does not make economic sense. Railway equipment is already specialised and unique; Indonesia's Cape Gauge makes it even somewhat more specialised. The lack of a market for standard railway equipment in Indonesia would make it even more difficult to attract private investors (except for those making a larger investment in mineral development).

Suppliers will develop manufacturing capabilities in Indonesia when it makes sense – the government should make it easy for them to form partnerships and operate in Indonesia, so that private investors will be more willing to invest here. Rolling stock standards that are used at other places in the world will be chosen so that Indonesian manufacturers can more readily compete for that business as well. Having open and common standards will enable investors to ensure that they pay a fair price and will permit Indonesian industry to develop the capabilities and technologies needed to compete in other markets.

As the GoI wants rail to compete with other modes, it will avoid handicapping the mode by requiring buyers to be subject to a captive manufacturer – that way leads to corruption, poor design, and more expensive equipment. Once the EU broke down the barriers for equipment manufacturers from other countries to sell into all EU markets – prices dropped, quality increased, and there was a huge consolidation in the industry that has helped improve efficiency and reduce the cost of rolling stock.

There may be possibilities for private sector investment in specialised terminals, logistics centers, and bulk distribution facilities. If such private sector investment can be attracted, it will reduce the amount of finance that must be provided by the government, either directly, through development banks, or direct borrowings.

6.4 SUMMARY OF NRMP INVESTMENT POLICY

Indonesia's railways are at a turning point. Government policy, as exemplified in Law no. 23/2007, is to expand and enhance the role of the railway sector in transportation with the objective of substantially increasing the rail market share. The aims of these policies are to reduce offsetting road transport investments, increase mobility, improve environmental standards, and reduce the cost of transport; so that Indonesia's economic growth is not constrained by transport shortages or congestion.

One way to accomplish that task might be to replicate the existing railway using existing standards and techniques. Already many parts of the existing infrastructure network are at capacity – to increase rail market share substantially in a growing economy would require duplicating, triplicating, or double duplicating existing infrastructure. Investment needed for rolling stock would also require duplicating or more, the existing investment. Another alternative might be to build new rail infrastructure at standard gauge to provide the additional capacity. Such an effort, however, would have significant transition expenses – it would take years to standard gauge primary infrastructure, but much of Indonesia's railway rolling stock needs replacement now. The cost to convert to standard gauge in the near term would be substantial and would include not only new duplicate lines, one standard gauge, one Cape Gauge, but would not solve current capacity problems for many years.

This NRMP supports a different alternative. In the investment program endorsed herein, existing lines are retained but enhanced for larger clearances and heavier axle loads. These enhancements permit increased train speeds and heavier trains. They also permit the use of larger locomotives with greater speed or tractive effort capabilities and are likely to allow three new more capable locomotives to replace two existing locomotives. Freight wagons will be able to carry more than double the load; passenger coaches and equipment can utilise bi-level equipment to increase passenger capacity. Increased speed (to as much as 150-kph on portions of the Java North Coast main-line), larger loading gauge and higher axle loads, improved signal systems, better road crossing protection systems all contribute to a significant enhancement of Indonesia's railway assets.

The NRMP's **infrastructure investment plan** is to upgrade the existing main lines to a minimum 22.5 ton continuous axle load capability and provide an infrastructure that will support 150-kph train services on the Java North Coast main line (but exclude the costs of proposed new urban railways) are shown in the table below.

Table 9: Infrastructure Enhancement Investments

Investment Category	Java	Sumatra	Total (USD million)
Track, Turnouts, Level Crossings	$ 1,119	$ 332	$ 1,451
Bridges *(Sumatra estimated)*	$ 3,700	$ 1,000	$ 4,700
Signals	$ 996	$ 293	$ 1,289
Special Terminals	$ 250	$ 50	$ 300
Total	**$ 6,065**	**$ 1,675**	**$ 7,740**

Of this investment, approximately USD 4 billion would be spent in the first five year period (2010-2014), and the entire infrastructure enhancement would be completed by the end of the second five year period (20150-2019). The infrastructure enhancement investments are described in Section 6.2.

Under the NRMP railway revitalisation plan, clearances are increased to permit bi-level passenger equipment. On some lines, if the demand justifies it, clearances can be increased sufficiently to permit bi-level auto carriers, high-cube appliance wagons, or double-stack container trains in well cars. Over time, axle loads should be increased to at least 22.5 tons, and on some lines, to 25 tons. Bridges on main lines should be enhanced to sustain loads from locomotives of 25 tons/axle and from wagons and coaches of at least 22.5 ton per axle.

The NRMP investments will be staged over time so that existing assets are not diminished in value but enhanced. Investments can be directed so that benefits are realised early and incrementally.

Over time, the enhanced infrastructure will reduce investments needed for new and replacement equipment. While the proposed infrastructure investment plan is substantial, it is less than the investment needed to build a TGV style train between Java's major cities.

Indonesia's railway **rolling stock** fleet is aging and a substantial portion of it is already operating beyond its economic useful life and should be retired soon. In addition, most of the remaining **rolling stock** will need to be replaced over the planning period.

Table 10: Summary of Rolling Stock Investments

Rolling Stock Type	Average Age (years)	USD (million) for Equipment to be Replaced Now	USD (million) for Additional Replacements by end of Period	Total Rolling Stock Investments USD (million)
Locomotives	26.4	$ 620	$ 330	$ 950
DMUs	17.2	$ 133	$ 133	$ 266
EMUs	12.8	$ 81	$ 660	$ 741
Coaches & other	27.4	$ 1,000	$ 1,500	$ 2,500
Freight Wagons	34.6	$ 111	$ 138	$ 249
Total		**$ 1,945**	**$ 2,761**	**$ 4,706**

In total, approximately USD 4,700 million will be required to simply replace existing rolling stock, nearly USD 2,000 million is needed in the short term, another USD 2,700 million in the longer term. Rolling stock investments are described in Section 6.3.

If rail market shares are to increase, additional investment will be required to accommodate new services and volumes of traffic – new rolling stock investment needs could easily equal investments for replacement – totaling USD 9,400 million or more. One way to minimise the capital cost of new and replacement equipment is to increase speed (thereby utilisation) and to increase capacity of the equipment. Such speed and capacity increases require the substantial investments in infrastructure discussed in Chapter 3. With these enhancements, the capacity of passenger equipment can be increased substantially using bi-level rolling stock and faster services. Freight wagon capacity can be more than doubled, reducing investments needed for equivalent capacity by half.

The investment needed to revitalise Indonesia's existing railways and provide enhanced capacity to existing assets will require substantial investment – on the order of USD 15,000 million over the next 20 to 25 years. Investment for high-speed railway lines, new special purpose railways, urban metro systems will be additional to those described in this chapter.

6.5 INFRASTRUCTURE ENHANCEMENT COST ESTIMATE DETAILS

Table 11: Infrastructure Enhancement Estimates

Java	Track Kilometers			Switches		
Item	<50kg **or** Steel/Wood	>50kg **and** Concrete	Total	<50kg	>50kg	Total
Trunk Routes						
North Coast Main Line	395.3	576.3	971.6	99	445	544
South Main Line	436.8	465.6	902.3	172	356	528
Cirebon-Kroya	43.5	114.5	158.0	18	65	83
Surabaya-Bangil	0.6	38.5	39.2	6	16	22
Subtotal, Trunk Routes	876.2	1,194.8	2,071.0	295	882	1,177
Jabodetabek Lines	69.5	175.0	244.5	42	93	135
Secondary Main Lines	570.5	6.6	577.1	221	42	263
Total	1,516.2	1,376.4	4,963.6	558	1,017	1,575
Trunk Mains Only	875.5	1,156.3	4,924.5	289	866	1,155

Cost to Enhance	Cost/Km ($000)		Total ($000)	Cost per Turnout ($000)		Total ($000)
Mains	$650	$300		$280	$280	
Secondary Lines	$400	$100		$180	$100	
Jabodetabek Lines	$450	$300		$180	$150	
Total	$829,010	$411,605	$1,240,616	$129,940	$265,110	$395,050
Trunk Mains Only	$569,104	$346,893	$915,997	$80,920	$242,480	$323,400
Jabodetabek Cost	$31,291	$52,495	$83,786	$7,560	$13,950	$21,510

Level Crossings	
Crossing interval (in km)	5.0
No of Crossings for Protection-Trunk Mains Only	984.9
Cost per Crossing (000)	$300
Estimated Cost for Level Crossings/Mains	$295,469

Total Cost to Upgrade All Java Main Lines	$1,931,134

Sumatra	Track Kilometers			Switches		
Item	<50kg **or** Steel/Wood	>50kg **and** Concrete	Total	<50kg	>50kg	Total
Trunk Routes						
North Sumatra	153.7	0.0	153.7	56		56
West Sumatra	12.6	0.0	12.6	7		7
South Sumatra	93.1	398.1	491.2	25	115	140
Subtotal, Trunk Routes	259.4	398.1	657.5	88	115	203
Secondary Main Lines	468.7	49.2	517.9	119	22	141
Total	728.1	447.3	1,832.9	207	137	344
Trunk Mains Only	259.4	398.1	657.5	88	115	203

Cost to Enhance	Cost/Km ($000)		Total ($000)	Cost per Turnout ($000)		Total ($000)
Mains	$650	$300		$280	$280	
Secondary Lines	$400	$100		$180	$100	
Total	$356,116	$124,344	$480,461	$46,054	$34,403	$80,457
Trunk Mains Only	$168,642	$119,426	$288,068	$24,640	$32,200	$56,840

Level Crossings	
Crossing interval (in km)	10.0
No of Crossings for Protection-Trunk Mains Only	65.8
Cost per Crossing (000)	$300
Estimated Cost for Level Crossings/Mains	$19,726

Total Cost to Upgrade All Sumatra Main Lines	$580,644

Table 12: Signal Improvement Estimates Java and Sumatra

Signal Improvement Estimate

Jakarta - Surabaya	Kms	Block Length	Cost/ Block	No of Blocks	$ m
Kilometers single track	492.0	5.0	4.0	99.0	396.0
Kilometers, double track	239.8	10.0	6.0	24.0	144.0
Coms Drops			0.1	123.0	12.3
Station Drops		20.0	0.3	37.0	9.3
Total	731.8				$561.6

Signal Improvement Estimate

Jakarta - Bandung - Surabaya	Kms	Block Length	Cost/ Block	No of Blocks	$ m
Kilometers single track	676.3	10.0	4.0	68.0	272.0
Kilometers, double track	113.0	10.0	6.0	12.0	72.0
Coms Drops			0.1	80.0	8.0
Station Drops		20.0	0.3	40.0	10.0
Total	789.3				$362.0

Signal Improvement Estimate

Cirebon - Kroya	Kms	Block Length	Cost/ Block	No of Blocks	$ m
Kilometers single track	158.0	10.0	4.0	16.0	64.0
Kilometers, double track		10.0	6.0	1.0	6.0
Coms Drops			0.1	17.0	1.7
Station Drops		20.0	0.3	8.0	2.0
Total	158.0				$73.7

Signal Improvement Estimate

Sumarta Main Lines	Kms	Block Length	Cost/ Block	No Blocks	$ m
Kilometers single track	657.5	10.0	4.0	66.0	264.0
Kilometers, double track		10.0	6.0	1.0	6.0
Sig Coms Drops			0.1	67.0	6.7
Station Drops		10.0	0.3	66.0	16.5
Total	657.5				$293.2

6.6 HIGH SPEED PASSENGER ALTERNATIVES

6.6.1 Capital Implications of Growth in Passenger Modal Share

During the past several years, several drafts and completed planning exercises in Indonesia projected major gains in rail passenger market shares. As shown in chapter 4, these planning exercises reflect the fact that populous nations in Asia use railways to move inhabitants far more than Indonesia. Because Indonesia is growing in population, economic activity, and GDP per capita, these assessments conclude that railways ought to capture a larger modal share of passenger movements. Some set targets for the railway network to have a 25 percent market share within two decades. While previous sections indicate that these rail *demand* projections may be over-optimistic, the focus here is to examine the potentials for *supply* of railway services in Indonesia which could potentially attract and service such demands and at what costs.

Specifically, this section of chapter six reviews four concrete alternatives for increasing the market share of railways, assessed by consultant research supporting the NRMP. Each alternative was formulated as an incremental investment. Each increment upgraded the service on a long, major Java route. The route is the roughly 800-kilometer corridor along the North Coast, and is connected with a

network of other enhanced passenger services that will be put in place under the development plan contained herein. All North Coast rail route alternatives envisaged an increase in the number of trains, purchase of new rolling stock, and reduction in travel times with successively larger, more costly improvements in track, signals and bridges. The final alternative evaluated the construction on a new high-speed railway. The effect on rail market-share was estimated for each alternative.

The analysis of investment alternatives did not concern sub-national commuter railroad lines, such as Jabodetabek. It concerned the national network, hence a long route that connects many provinces and many cities was analysed. The high-speed alternative assumed an enhanced network of modern connecting trains would be scheduled to coordinate with the initial high-speed train line. (Sub-national railways and special purpose railways will be discussed in chapter 7).

6.6.2 Capacity and Service Quality Alternatives to Increase Railway Passenger Shares

As noted above, the consultant analysis supporting this NRMP estimated the capacity increases and gains in service quality for each increment of investment level in each of the four scenarios. Capacity was measured in available passenger-kilometers per year. The scenarios represented different ideas about how to increase capacity. Each option was based on the assumption that increased investment results in a more attractive railway passenger service. Better service results in more demand for service, given a constant ticket price. Better service was defined as new and attractive rolling stock; improved stations; less time to wait between arrivals and the departure of the next train; and faster travel times. Safety was also assumed to be generally improved because both, faster trains and trains that operate closer together require better track and better signals. Under more ambitious scenarios, double-track lines and stronger, new bridges are required, which also improves safety. Each investment scenario, or increment of investment, represents what economists traditionally call a “production function”. Each production function has different marginal costs at different levels of utilisation. Because marginal costs are different at different levels of utilisation, average cost per available-seat-km also changes. Average costs decline until a production function reaches a level where tracks and stations are congested; then average and marginal costs will increase. All of this reasoning follows well-established theory and observed reality.

The different production functions, or investment scenarios, were applied to one of the busiest routes: from Jakarta to Surabaya, a rail distance of about 800-kilometers. The route analysed included the currently double track line Jakarta to Cirebon, and then single track through Semarang, through to Surabaya, where some sections are being doubled. This focused the analysis on a discrete opportunity to develop the railway sector along a natural corridor between major cities, in a geographic environment that is not difficult and where there is natural demand, and likely considerable un-met demand.

Four production functions, or service designs, were estimated. The estimates were only approximate, but showed the approximate level of initial capital needed to upgrade the railway to carry a larger share of the existing passenger travel market for this major route. Each design incrementally improved the capacity and speed of this route, finally ending with the technical leap of a very-high speed train, such as those found in Japan, China, Taiwan, and the western EU.

The four production function programs are shown in the table below. The alternatives reflected the *maximum* speed of the trains. In all cases, schedules were one train in each direction every hour from early in the morning to late in the evening. However, the two fastest alternatives offered a train every 30 minutes during the busiest hours of the day.

Table 13: Characteristics of HSR Alternatives

Major Characteristics	Speed			
Maximum Speed, km/our	**100**	**125**	**150**	**260**
Average Speed, km/hour	81	99	115	196
One-way Travel Time, hours	9.0	7.4	6.4	3.7
Units of Rolling Stock Required, Fleet	197	178	185	140
Turns per Train-set	1.6	1.9	2.2	3.8
Minimum Hectares of Land Required	0	12	32	3700
Revenue Trains per day: One Way	30.8	33.0	38.5	41.5

The dynamics of modeling major upgrades is complex. Judgment was used in developing likely schedules. The judgment originated in the consultant's extensive, direct experience with passenger trains. Examples of this complexity include:

- As speeds increase, demand is likely to increase during selected business-office hours. This increased demand results in operating trains every half-hour during parts of the day for the two fastest alternatives.
- Average speeds are not the maximum speeds. Raising maximum speeds by 30 kilometers per hour on straight sections does not raise maximum speeds on 100 percent of a route that has hills and curves and goes through urban areas. Speeds are assumed to be lower in urban areas (although still quite high for the high-speed train alternative – trains are expected to be able to average 130 kph through urban areas (not including station stopping time).
- The 260 kilometer per hour alternative has a bit shorter route because the high-speed train requires a 100 percent new route (though much of it may be alongside the existing right-of-way).
- Revenue trains in the above table are "fractions" because some trains are required to operate almost empty to place the trains in position along the route at the right time in the morning to meet market demands.

The modeling required making assumptions and simplifications. When comparing alternatives, assumptions, prices, costs, and simplifications were usually chosen to favour the high-speed, 260-kilometer per hour new route. The "favorable number" for prices, construction difficulty, resettling people in the path of the new route, etc. was usually chosen. The reason the favourable number and favourable assumption was chosen for 260 kilometer hour trains was to show what the most-favourable case might be for a new, high-speed railway.[56] The details of four alternatives are described below:

[56] 260 km per hour is the UIC minimum speed to be considered a truly high-speed train. Construction costs escalate as speeds increase, as do operating costs for electricity. Therefore, 260 km per hour was chosen to obtain most favorable construction costs; further increases in design speed would push costs much higher.

6.6.3 100 Kilometers per hour Alternative: Continue with Present Technology

This alternative was the base case. Maximum speeds remained what they are at the present. Axle gauge remained at 18 tonnes after any renovation to tracks. The route was assumed to be double tracked over the period. This alternative adds trains to the timetable to provide a train each hour during the day and early evening.

All the rolling stock would require replacing before 2015. This is because of the rolling stock's age and because of corrosion of the carbon-steel coach bodies.

This alternative continued with the existing investment plans for adding double-track and for replacing obsolete bridges. Some manual or mechanical signals would be replaced. Traffic control would use the same block length and number of control points. Locomotives would be newer models of the 2,250 HP, eight-cylinder, six-axle locomotives now used. Coaches would be gradually replaced with new ones. All the rolling stock would require replacing before 2015. This is because of the existing rolling stock's age and because of corrosion of the carbon-steel coach bodies. Axle-gauge would become 18 tonnes. No new land would need to be purchased. Maximum speeds would be the same as today: 105-kph in rural areas and about 60-kph in urban areas.

In reviewing this option DGR concluded that the improvements would likely be insufficient to achieve the market share improvements envisioned under the NRMP.

6.6.4 125 Kilometers per Hour: Economical Upgrades

This alternative recognised that simply adding more trains would not necessarily add more market share. Some increase in train speeds is required (a maximum speed of 125 kilometers per hour). The additional trains and shorter trip time would make the passenger trains more attractive. The improvements could be worth a higher price for a ticket. PTKA has been successful in attracting commercial class revenue by improving commercial class service. The 125-kph maximum speed continues this effort (average speed in urban areas is expected to be about 70-kph as track is improved and more crossings are protected or eliminated).

Increasing train speeds increases effective train and track capacity. The increased speed would permit some trains to be better utilised; that is, to make more than one trip a day if a "push-pull" cabin is used to permit rapid turns of trains. The increased speed would generate a better load-factor; that is, an improved utilisation of the seats on each train. Infrastructure investment is increased from Alternative #1 – track modulus is increased, line and surface are improved, the line is double tracked more quickly, all bridges more than 100 years old are replaced. Mechanical signals are replaced with electronic signal systems and all turnouts less than 50-kg rail are replaced. New maintenance yards and depots would be required (requiring some land acquisition).

End-to-end travel time for the 800-kilometer route would be reduced from 9 hours to almost 7:25 hours, about a 20 percent reduction. The times would still be too long for substantial increases in end-to-end travel (except perhaps for some night-train services). However, the reduced time would make some intermediate trips attractive for more travellers.

DGR assesses this level of improvement to be achievable within the second phase of the NRMP (2015-2019). It is adopted herein as a target to be achieved by 2016.

6.6.5 150 Kilometers per Hour Alternative: Major Upgrades

This alternative increases passenger train speeds to 150 kilometers per hour (urban speeds are expected to average about 80-kph). Increasing train speeds to 150 kilometers per hour requires a major investment. Attaining higher speeds requires more powerful locomotives coupled together. These locomotives require improved axle load limits, probably of 23 tonnes. As a result, track strengthening investments are increased; the route is fully double tracked earlier in the period.

Speeds of 150 kilometers per hour require replacing the majority of bridges to support the larger dynamic clearances and higher axle loads. Many signal blocks, perhaps one half of the existing control points, would be divided into two blocks to permit closer train spacing at faster speeds. Major stations would be upgraded to "high platforms" to reduce time spent in stations.

The result would be a modern railway. The modern railway would permit Indonesia to operate more than an attractive intercity railway that could compete with many airline and bus services. The modern railway would have the capacity to operate commuter trains and cargo trains. Container services and express cargo would become more attractive. The heavier axle loads would also permit some bulk commodities competitive with truck and water. Some additional passing sidings would be required to support the multi-use aspect of the rail network.

End-to-end travel time decreases to 6:20 hours. This is about 30 percent below present schedules. The time is still too long to compete with airlines for long-distance travel other than for potential overnight sleeper services (similar to the offerings of China Railways in the busy Beijing-Shanghai corridor), but travel mode would shift to rail from air and highway for many intermediate stations.

It is at this point that it becomes difficult to predict what would happen to modal shares. An attractive, efficient train service can induce travel demand. Travel demand is not solely determined by the ticket price. It is also a function of the utility of the service. The utility of the railway service includes speed, reliability, comfort, frequency, and, also, how much status attaches to the choice of mode. A premium overnight sleeper train in the Java-Surabaya segment could become highly competitive with air service.

W*hile the response to service improvements of this scenario cannot be definitively determined at this time (and depends on developments in air and road transport as well as railway passenger service), the DGR concludes that this level of upgrade will be essential if the goals for improvement in railway market share on Java are to be realised over the 20-year period of the NRMP. Consequently, the NRMP adopts this scenario as the minimum objective for inter-city rail capacity and service improvements on Java during the master plan period.*

6.6.6 260 Kilometers Per Hour: Expensive and "World Class"

Two hundred sixty kilometers-per-hour speeds requires a new right-of-way from end to end. *The consultant's analysis demonstrated that this is enormously expensive.* It requires an order-of-magnitude more investment. An entirely new 800 kilometer long, high-speed railway requires the relocation of large number of people and of some major business to build new lines into cities. The new line requires relocating other infrastructure, such as major and minor roads, as well as small parts of toll road highways.

In considering various models, the consultant concluded that the most appropriate VHST alternative for Indonesia would be somewhat similar to the TGV in France and use existing or adjacent right-of-way in approaches to urban areas and existing stations (with some modifications). This would avoid the tremendous expense and disruption that would be caused by building new high-speed lines into

urban centers. It also would allow easy connection with enhanced passenger services on other routes (these are part of the recommended programs for the RMP effort) and will provide for the development of a higher-speed train network in Indonesia over time. This assumption maybe difficult to implement in Jakarta, but may be achievable under most favourable assumptions. Indonesia has dense cities. A very fast route out of city will require relocating many people. An average urban train speed of about 130-kph will require grade separations, increased land acquisitions, and a protected (fenced) route.

The expense of constructing an entirely new standard gauge, electrified, high-speed railway, is partly off-set by:

- New bridges would not need to be built to a heavy axle gauge. TGV technologies use approximately 18-tonne axle gauge.[57] The Model 700T Japanese equipment for Taiwan is only 14 tonnes per axle.
- Grades could be steeper. Steeper grades reduce total length of the route. Steeper grades also reduce construction costs and the need for tunnels. 1.5% is the working maximum for 125-kph conventional diesel-electric trains. 58K-VAC electric TGV-style trains permit 3.5 percent to 4 percent maximum grades.
- Rolling stock initial investment costs would not be substantially higher than for conventional equipment, despite the advanced level of technology, because fewer train-sets are needed. The much-faster trains can sometimes make almost twice as many round-trips as slower, more conventional trains can make.

Against these investment-cost advantages are the huge costs to build the catenary, the need to build power substations and electric transmission lines, and the need to build bridges and tunnels to eliminate all level crossings.

The consultant assumed land prices to be about USD 300,000 per hectare, averaging urban, agricultural, and industrial land along the right-of-way. It is estimated that about 3,700 hectares of property must be acquired for the new line, expanded stations, and maintenance and storage facilities at each end of the line – an estimated cost of more than USD 1 billion in total.

This NRMP concludes that the viability of a 260 kilometer per hour high speed line cannot definitively be determined at this time. It will require further analysis in the first two phases of the NRMP and a definitive commitment to the construction of such a line should not be made until the third NRMP phase (2020-2024) at the earliest. An important determinant of feasibility will be sustained rapid growth in Indonesian GDP and GDP per capita. It is important to note that, because a true VHST will require new, dedicated right-of-way, existing railway lines would largely remain for local, commuter, and freight services. The vision of VHST should not compete with upgrading the existing railway in the early periods of the RMP – for about the infrastructure sums estimated for the 125-kph service level.

6.6.7 Investment Results

The results of the investment are measured in the (a) investment cost per available passenger-kilometer and the (b) increase in available passenger-kilometers that would result from each investment alternative. The first measure, investment per available passenger-kilometer, is indicative of the economic efficiency of the investment. The second measure, increase in available passenger-

[57] However, the track uses 60 kg/meter UIC rail and the cant is 1:40 instead of 1:20.
[58] This takes into account compensating for curve friction on mountain gradients.

kilometers, is indicative of the effectiveness of the investment. The below table presents the results of the consultant study.

Table 14: HST Rail Investments

Effectiveness & Efficiency	Speed			
Maximum Speed, km/hour	**100**	**125**	**150**	**260**
Available psgr-km, annual, millions	1,650	1,980	2,610	2,840
Per cent Increase in available psgr-km	Base	20%	58%	72%
Total Investment, in USD million	$ 2,050	$ 3,070	$ 7,050	$ 28,390
Rolling Stock Investment/psgr-km	$ 0.49	$ 0.37	$ 0.27	$ 0.28
Infrastructure Investment/psgr-km	$ 0.76	$ 1.18	$ 2.70	$ 9.72
Total Investment/annual psgr-km	$ 1.25	$ 1.55	$ 2.70	$ 10.00
Annual Seat-km per loco and coach	**8,357,000**	**11,111,000**	**14,102,000**	**20,280,000**

6.6.8 The Role of VHST in the RMP

Six primary conclusions emerge from the consultant's assessment regarding the place of VHST in the NRMP.

1. Investment in rail lines below VHST standards will increase rail's market share of passenger transportation in congested corridors.
2. Investment required to capture additional market share through increasing train speeds rises very fast. The first USD 2.0 billion "buys" one a 2.5 percent increase in national market share. The next incremental investment of USD 1 billion "buys" another 1 percent. The next 1 percent requires an incremental investment of USD 4 billion. The final 1 percent increase in modal share requires an increment of not less than USD 22 billion under most favourable assumptions, and quite possibly substantially more.
3. Building a new very high-speed line does not solve the problems of an obsolete cargo railroad and of limited commuter and local railway capacity. Upgrading the existing routes solves these problems*. International experience shows that very high-speed railway service moves passengers from airplanes to trains. It does not solve the problem of local highway congestion.*
4. *A VHST does not solve the mobility problem for Indonesia's cities.* The problem of the obsolete commuter, local, and cargo PTKA remain and must receive priority attention in the near term.
5. Most of the improvement in the market-share for passenger trains happens when the existing slow lines are greatly improved. The incremental improvement in railway market share is not a result of VHSTs.
6. High-Speed Trains recover their costs when the national economy has a per-capita income several times that of Indonesia currently. Consequently, while definitive financial feasibility and engineering studies might begin as early as phase three of the NRMP (2020-2024), VHST should not be initiated prematurely when income levels are unlikely to support the service through ticket prices or government subsidies.

The NRMP supports the eventual institution of VHST service in Indonesia, but on a schedule that is commensurate with financial sustainability and consistent with other urgent investment requirements in the railway sector.

CHAPTER 7: GUIDELINES FOR SUB-NATIONAL RAILWAY MASTER PLANS

7.1 INTRODUCTION AND PURPOSE OF SUB-NATIONAL GUIDELINES.

Chapter *7, Development of Sub-National Railway Master Plans,* contributes to the NRMP by defining specific guidelines for preparing provincial/district/city railway master plans. Law no. 23 of 2007 requires the national RMP to provide guidance and coordination for the development of sub-national RMPs. Sub-national RMPs are separately developed by the sub-national authorities; however, the MoT/DGR will provide oversight to ensure that sub-national RMPs and specific sub-national projects are consistent with the national RMP and the national laws discussed in section 1.4. This oversight will:

- comply with the NRMP national network plans, spatial plans, and capital-investment plans;
- provide "due diligence" guidelines on core issues to avoid major financial and regulatory mistakes;
- provide conformance with the financial and technical options that will be licensed by DGR at sub-national government levels;
- communicate the importance of well-developed, economically and financially sound sub-national RMPs to the achievement of national goals in the rail sector; and
- ensure that any sub-national railway does not inhibit the development of other sub-national railways.

Consistent with Law no. 23 of 2007, the DGR must regard any rail line that will be connected to the core rail network originally operated by PTKA, as a development project to be incorporated into the national RMP. This inclusion is because of the potential impact on the core network. In addition, any separate railway or special-purpose railway of national importance must be incorporated into the national RMP using guidelines consistent with this chapter.

The scope of chapter 7 is found in Law no. 23 of 2007 which requires a RMP for sub-national governmental entities, such as provinces, districts, regions, and cities. Articles 7 through 12 require the MoT, supported by its DGR to develop a NRMP that includes virtually all fixed guideway systems as well as the PTKA and Jabodetabek rail lines. Fixed guideways include all designs from conventional, standard-gauge coal mining railways to fundamentally new technologies to move people at high speeds.

Sub-national railway RMPs and projects must be consistent with the *2010-2014 Strategic Plan for the Railways Sector.* This *Strategic Plan* assumes that 75 percent of the capital expenditure is to be funded by sources other than the state budget. These sources may include LGs, BUMN, and the private sector[59]. Therefore, one purpose of the NRMP must be to ensure that sub-national efforts expend funds to maximise economic efficiency and effectiveness.

The scope of chapter 7 may be summarised as this:

> *How does Indonesia's DGR use the NRMP to insure that this 75 percent investment provided by the local and private sub-national investment is invested intelligently?*

[59] P. 67, Section E. Also p, 70 of a translation into English of the January, 2010 edition.

Chapter 7 does not select which specific sub-national projects should be executed. The DGR only sets out the criteria for (i) approving sub-national projects, (ii) adding national funds to approved plans, and (iii) for eventually licensing a sub-national project if the project is financially and operationally sustainable. Therefore, this chapter's scope does not prioritise development projects. The development of mineral resources, cities' mass transit, or of ports are decisions that depend upon interagency coordination and the principal of devolution.

The NRMP does not specify or favour any specific technology or project. The NMRP will propose specific technical criteria for interoperability, for financial due-diligence, for ease of leasing, and for ease of "step-in" by another operator or owner should the initial operator or owner fail.

7.2 OUTLINES OF PROCEDURES AND RESPONSIBILITIES BETWEEN LEVELS OF GOVERNMENT

The relationships and responsibilities of each level of government are outlined below. This division of responsibilities follows the written text and the intent of Law no. 23 of 2007, as well as following the devolution principles in the spatial planning laws. The NRMP requires the national government to advise the sub-national governmental units of what the NRMP plans are, and what the NRMP intends to accomplish. The sub-national governments, such as provinces and cities, are to develop their own RMPs based on the next higher level of government plans and regulations.

7.2.1 Provincial Railway Master Plan

A Provincial RMP is a plan to be realised for provincial railway for at least the next 25 years. This Provincial RMP shall include, at a minimum:

Directions and roles of provincial railway policies in entire transportation modes discussing how the following policies and roles are connected:

- Direction of policies and roles of inter-city railway that connect centers of national activity to centers of regional activity in a province;
- Directions and policies on inter-city railway that connects centers of regional activity to other centers of regional activity in a province;
- Direction of policies related to roles of urban railway whose network lies in a province.

Estimates of human and/or goods movement according to trip origin and destination in a province, so that the provincial and lower levels of government may plan realistically:

- Estimates of volume of passenger and/or goods movement to and from provincial activity centers;
- Estimate of volume of passenger and/or goods movement between provincial and national activity centers;
- Estimate of passenger and/or goods movement from and to nodes of other transportation modes to be served by provincial railway;
- Estimate of passenger movement in urban areas, whose scope is provincial; and
- Estimate of volume of passenger and goods movement in urban areas, whose scope is cross-provincial.

Plan of provincial railway infrastructure demand

- Plan of railway tracks and capacities, which continuously connect regional activity centers, and to national and other regional activity centers;
- Plan of station classes and facilities in centers of regional activity; and
- Plan of need for railway operation facilities in provincial railway track.

Plan of need for provincial railway facility

- Plan of need for railway facilities to serve inter-city transportation in a province;
- Plan of need for railway infrastructure to serve transportation to and from nodes of other transportation nodes that are served by provincial railway;
- Plan of need for railway infrastructure to serve cross-provincial urban areas.

Plan of need for railway human resources

- Human resources for operating provincial railway;
- Plan of need for facilities to support human resources, which includes:
  - manpower for testing railway infrastructure;
  - manpower for testing railway facility;
  - manpower for inspecting railway infrastructure;
  - manpower for inspecting railway facility;
  - manpower for maintaining railway infrastructure; and
  - manpower for maintaining railway facility.

These human resources are to match the quantities of plan of national RMP for infrastructure and facilities.

- The provincial plans will consider and include:
  - Master Plan of Provincial Railway shall be prepared by observing:
    - National Spatial Plan;
    - Provincial Spatial Plan;
    - Master Plan of National Railway;
    - Provincial Master Plan of Other Network of Transportation Modes

Procedure and mechanism to determine

Master Plan of Provincial Railway is determined through provincial regulations. Master Plan of Provincial Railway, as decided by the Governor, shall consider views of district heads/mayors and comply with the guidelines for Preparing RMP stipulated by Minister.

7.2.2 Master Plan of District/City Railway

A Master Plan of district/city Railway is a plan to be realised for district/city in at least the next 25 years. Master Plan of district/city shall at least contain:

Directions and roles of provincial railway policies in entire transportation modes

- Direction of policies and roles of inter-city railway that connect centers of local activity in a district/city;
- Directions and policies on inter-city railway that connects centers of local activity to other centers of national activity and/or regional activity in a district/city;
- Direction of policies related to roles of urban railway whose network lies in a district/city territory.

Estimates of passenger and/or goods movement according to points of trip origin and destination in a district/city

- Estimates of volume of passenger and/or goods movement to and from local activity centers in a district/city;
- Estimates of volume of passenger and/or goods movement from local to provincial and national activity centers;
- Estimates of passenger and/or goods movement from and to nodes of other transportation modes to be served by district/city railway;

A Plan of Needed facilities for district/city railway, which shall comprise:

- Plans of railway tracks and their capacities, which continuously connect local activity centers to national and regional activity centers;
- Plans of station classes, terminals, and facilities in centers of local activity; and
- Plans of needs for railway operation facilities in district/city railway track.

These plans shall estimate the required investment, required land, and shall include a time-line or schedule for construction and for financing.

A Plan of needs for district/city railway facility

- Plan of need for railway facilities to serve inter-city transportation in a district;
- Plan of need for railway infrastructure to serve transportation to and from nodes of other transportation nodes that are served by district/city railway;
- Plan of need for railway infrastructure to serve urban areas in a district/city.

These plans shall estimate the required investment, required land, and shall include a time-line or schedule for construction and for financing.

A Plan for railway human resource needs

Human resources for operating district/city railway must be included in this plan. The plan must include facilities to support human resources. These human resources are to match the quantities planned in national railway infrastructure and facility investment planning. The plans should include total employees required and also include what regional and local technical schools and training will be provided. The schools and training may be integral to the specified project and provided by that project to meet the specific project's needs.

Factors to consider

Each Master Plan of a district/city railway shall be prepared by considering:

- National Spatial Plan;
- Provincial Spatial Plan;
- District/City Spatial Plan;
- Master Plan of National Railway;
- Master Plan of Provincial Railway;
- Provincial Master Plan of Other Network of Transportation Modes.

Procedure and mechanism to determine

The Master Plan of district/city railway is determined through district/city regulations, subject to review by the DGR and other government agencies for compliance, with national planning objectives and technology/safety requirements. A Master Plan of a district/city railway, as decided by District Head/Mayor, shall consider the views of district heads/mayors and comply with the guidelines for preparing RMP stipulated by Minister.

7.2.3 Supervision in Preparation of Provincial/District/City Railway Master Plan

Preparation of a provincial/district/city RMP for developing railway is the initial, basic step in realising the railway's vision of the future. By preparing Master Plans of provincial/district/city railway can be drawn a picture of provincial, district and city railway to be realised for at least the next 25 years. Based on this premise, preparation of the master plans through the following approach:

Process

Topics of the supervision include material and inputs to be used in preparing RMPs, and the method or model to be used to analyse and process inputs into output in the form of RMPs. Supervision related to the inputs is done to ensure that types of employed inputs shall at least be similar to those stipulated by prevailing regulations. Supervision related to procedure and method is intended to ensure academic accountability of procedure, method or model that is used to prepare RMP.

Output

The object of this supervision is the result of scientific review in the form of provincial/district/city RMP. Supervision of this result of RMP is focused on two things. These are:

- to ensure that content of the master plan does not contradict the stipulations in laws and regulations.
- The essentials of the master plans content shall be accountable in various aspects, be it political or academic.

7.2.4 Allocation of Authority for Railway Development

Government authority to develop railway includes:

Determining directions and targets of policies for national, provincial and district/city railway developments, which include:

- Determining strategy to achieve the targets of policies for medium and long-term national, provincial and district/city railway developments;
- Determining annual performance goals of national railways subject to financial limitations.

Determining guidelines, standards and procedures of railway organisations and their development, which include:

- Determining guidelines, standards and procedures of general railway organisations;
- Determining guidelines, standards and procedures of specific railway organisations

Determining minimum competence of officials who are to perform functions in the area of railway, which include:

- Officials performing governmental tasks related to railway;
- Officials performing governmental tasks related to railway organisation.

Providing direction, guidance, training and technical assistance for regional government, and railway service organiser and user, which includes:

- Providing direction, guidance, training and technical assistance for regional government, which may be in the form of financing and specific activity;
- Providing direction, guidance, training and technical assistance for a railway organiser, which may be in the form of financing and specific activity;
- Providing direction, guidance, training and technical assistance for a railway user, which may be in the form of railway policy socialisation.

Oversight on accomplishing of railway system development

- Oversight on preparation of national, provincial and district/city RMPs;
- Oversight on organisation of national railway, including construction;
- Oversight on implementation of provincial and district/city railway development.

7.2.5 Authority of Provincial Government

Authorities of provincial government for railway development include:

Determining directions and targets of policies for district/city railway development, which include:

- Determining strategies to achieve policy targets of development of medium term provincial and district/city railways;
- Determining annual performance of provincial railway.

Providing direction, guidance, training and technical assistance for district/city government, railway service organiser and user, which includes:

- Providing direction, guidance, training and technical assistance for district/city government, which may be in the form of financing and specific activity;
- Providing direction, guidance, training and technical assistance for railway organiser, which may be in the form of financing and specific activity;
- Providing direction, guidance, training and technical assistance for service users as defined in Article 43b, which may be in the form of socialisation of railway policy.

Oversight on implementation of provincial railway, which includes:

- Oversight on planning and development of provincial and district/city railway;
- Oversight on organisation of provincial railway;
- Oversight on implementation of district/city railway development.

7.2.6 Authority of District/City Government

The scope of authority of district/city government for railway development includes:

Determining directions and targets of policies for district/city railway development, which includes:

- Determining strategies to achieve policy targets of medium term district/city railway development;
- Determining annual performance goals and objectives of district/city railways.

Providing direction, guidance, training and technical assistance for railway service organiser and user in district/city territory, which includes:

- Providing direction, guidance, training and technical assistance for railway service organiser, which may be in the form of financing and specific activity;
- Providing direction, guidance, training and technical assistance for service users as defined in [open], which may be in the form of financing and specific activity.

Oversight on implementation of district/city railway organisation, which includes:

- Oversight on planning and development of district/city railway; and
- Oversight on organisation of district/city railway.

7.2.7 Working Relationships in between National and Sub-National Governments

The National Government, in relation to provincial and district/city governments, is obligated to:

- Provide information and inputs related to preparation of NRMP and plans of development implementation to be done by the government;

- Socialise enforcement of NRMP, and determine policy, guidelines, standards and procedure for the development implementation;
- Request provincial and district/city governments for special and routine reports on implementation of decentralisation, assisting with the decentralised tasks performed by provincial and district/city governments;
- Provide direction, guidance, training and technical assistance for provincial and district/city governments within the framework of preparing and determining master plans of provincial and district/city railways, and implementing railway development done by provincial and district/city governments.

Provincial governments, in relation to the National Government, are obligated to:

- Provide inputs related to preparation of NRMP;
- Provide information and request for inputs related to preparation of Master Plan of Provincial Railway and plans of railway development implementation performed by provincial governments;
- Socialise enforcement of NRMP, and determine policy, guidelines, standards and procedures for district/city governments and communities in their territories;
- Report on implementation of provincial railways' development.

District/City governments, in relation to Government, are obligated to:

- Provide inputs, via provincial government, related to preparation of NRMP;
- Provide information and request for inputs related to preparation of the Master Plan of district/city railways and plans of railway development implementation performed by district/city government, via provincial governments;
- Socialise enforcement of NRMP, and determine policy, guidelines, standards and procedures for communities in its territory;
- report on implementation of district/city railway development, via provincial governments.

7.2.8 Working Relationship between Provincial and District/City Governments

Provincial governments, in relation to district/city government, are obligated to:

- Provide information and have inputs related to preparation of NRMP and plans of development implementation to be done by provincial government;
- Socialise enforcement of Master Plan of Provincial Railway and provincial plans of railway development implementation;
- Request district/city government for routine reports on implementation of assisting and decentralised tasks done by provincial and district/city governments, such reports being consistent with the development goals of the NRMP and not being burdensome;
- Provide limited direction, guidance, training and technical assistance for district/city governments within the framework of preparing and determining master plans of provincial and district/city railways, and implementing railway development done by district/city governments.

Provincial governments, in relation to the National Government, are obligated to:

- Provide inputs related to preparation of Master Plan of National and Provincial Railways;
- Provide information and request for inputs related to preparation of Master Plan of district/city railway and plans of railway development implementation done by district/city government;
- Socialise enforcement of NRMP, and determine limited policies, guidelines, standards and procedures for communities in its territory;
- report on implementation of district/city railway development, via provincial government.

7.3 POTENTIAL CONFLICT AREAS FOR SUB-NATIONAL RMPS

Sub-national RMPs must be consistent with the NRMP. However, there are several areas in which conflicts may arise. Therefore, this NRMP provides specific guidance to sub-national/private sector development efforts. The specific guidance specifies the areas of potential conflicts in which MoT/DGR will review sub-national efforts.

The following section describes several of these topics as core issues which shall be continuously managed by the DGR. These topics and their potential conflicts will guide (i) the specific design criteria given below and (ii) the due-diligence recommendations described below.

7.3.1 Four Critical Objectives: Interoperability, Network Benefits, Sound Financing, Safety

The four objectives of (i) interoperability, (ii) network benefits, (iii) sound financing, and (iv) safety are fundamental to the MoT/DGR's evaluation of sub-national RMPs and projects. These four objectives must be addressed in the elucidation of sub-national RMPs and projects.

> *The NRMP will oppose implementation of any sub-national RMP or project that undermines the four national objectives of (i) interoperability, (ii) network benefits, (iii) sound financing, and (iv) safety. The DGR will review sub-national RMPs and individual projects to determine if the proposed project would undermine these key objectives of the NRMP to a significant degree, and, if so, will issue instructions as to how the adverse impacts may be mitigated.*

The issues that are likely to cause a potential conflict with national objectives are more fully described in Sections 7.3.2 through 7.3.8.

7.3.2 Definition of Potential Conflict Topics

A potential conflict topic is an issue that any and all sub-national RMPs and projects must resolve before they proceed. In large part, these issues are generated by the tension between the need for good regulations and the need to have freedom to innovate quickly.

These issues include:

#1 Growth of the Sub-National Economies versus Unsustainable Finances

#2 Safety versus Technological Innovation

#3 Innovation versus Private Sector Investment

#4 Integration into National Plan: Interoperability versus Specialisation

#5 Regulation versus Over-Regulation

7.3.3 Issue #1: Growth versus Unsustainable Finances

Finance is the most important sub-national regulatory issue in the NRMP. No sub-national RMP or project is acceptable if its finances present a threat to the general economy of Indonesia or to a province, regions, district, or city. Finances include both capital to construct and commission, and operating income and subsidies once operations commence. Financial issues include special-purpose railways as well as urban mass transit railways, mainline and other conventional railways.

The DGR shall determine the cumulative effect on national economy of sub-national actions. For passenger railways, the determination will take into account if the sub-national government has put into effect regulations to create land-use patterns that increase transit-friendly development. In general, a due-diligence review shall be the method of performing this review.

7.3.4 Issue #2: Innovation versus Safety

The potential conflict between technical and management innovations versus safety will always be considered by the DGR. The basic issue is that there are clear needs for safety and also, at the same time, clear needs for innovation. The DGR will consider if the proposed sub-national technology conflicts with current designs with regards to traffic control, collision behaviour, providing for proper maintenance, and safety systems. The DGR will review if the proposed new assets may be required to be interoperable with DGR and other standards.

When reasons are compelling, the NRMP will require the DGR to, in the future, draft detailed technical regulations to be approved with the status of Peraturan Pemerintah (PP). The detailed PP regulations may include either performance specifications or detailed design drawings.

7.3.5 Issue #3: Innovation versus Standardisation

The DGR will evaluate sub-national RMPs and projects according to the potential conflict between innovation and standardisation. The basic issue which will be evaluated is the advantages to standardisation when compared to the advantages of innovations. The review will compare the potential savings new technologies offer, against the losses of interoperability; and whether the new technology significantly enhances or reduces the network benefit to Indonesia. In general, the DGR will not require standardisation if detailed technical guidelines and regulations have not been previously published to describe the standard. The DGR will only publish detailed guidelines and draft PP regulations when the benefits of national standardisation are clear and compelling.

The NRMP will take advantage of Indonesia's unique opportunity to exploit the benefits available from networks because Indonesia does not have a legacy collection of different trams and different commuter trains.

7.3.6 Issue #4: Integration into National Plan: Interoperability versus Specialisation

Local RMPs and sub-national projects will be evaluated to see if their designs and operations, including tariffs and fares, are consistent with the advantages available from interoperability. Interoperability is a major policy issue for sub-national RMPs and it is the MoT's goal to maximise interoperability of projects to benefit Indonesia's transport sector.

In general: Local plans to develop local industries by requiring or by assisting manufacturers and developers to supply unique, specialised, non-interoperable assets to a province, district, regional, or city, or to a special-purpose railway, will be not acceptable for national funding or DGR approvals. Sub-national RMPs and railway projects shall not have the goal of locating suppliers in their districts by awarding these suppliers contracts or concessions to supply the sub-national entity or special-purpose railway.

Sub-national entities shall not plan to accept, or accept, low-interest loans or grants from donors if it appears that the donor seeks to establish a "sole source" or monopoly position within Indonesia.

Interoperable standards published by the DGR and potentially incorporated into PP regulations shall reflect the technology and efficiency standards of the foreseeable future, typically 25 years from the date of publication.

7.3.7 Issue #5: Innovation versus Private Sector Financing

The NMRP recognises that a benefit of standardisation is that standardisation may assist to attract private capital. This benefit primarily applies to rolling stock, but may also apply to passenger stations and cargo/mineral railways. Rolling stock should be constructed for high capacities and with standard designs permitting rolling stock to be moved at the end of leases. Rolling stock will be designed so that it may be taken back by a lessor and leased again if the first lessee financially defaults.

Leasing provides a mass transit system a method of obtaining private capital. It is more risky to lease rolling stock that is completely unique to one city or one coal mine in Asia that it is to lease rolling stock that has wide use. Standardisation facilitates leasing. It may also facilitate other private sector financing by reducing technology risk.

- Sub-national RMPs and specific projects will avoid future regulations that inhibit interoperability and portability for leased or other privately financed equipment.

Regulations that promote interoperability and portability improve a sub-national organisation's opportunity to attract efficient capital. The NRMP affirms that it is important to use "efficient capital". A donor, development bank, or private developer offer to finance assets is not consistent with an acceptable sub-national RMP if the specific assets financed are inefficient capital.

Private capital will be considered as having two parts. One part is the design engineering and project management the private sector can provide for projects it specifically sponsors. This is the institutional capital. The other part is the actual funds. This is the financial capital. Both parts must be efficient capital; that is, both parts must promote interoperability and portability of the assets.

7.3.8 Issue #6: Regulation versus Over-Regulation

Economic regulation increases the chances of social problems. One social problem is that over-regulation makes it difficult to conduct business and research. Therefore, unless there is a clear, compelling need for economic oversight, sub-national RMPs shall avoid the publication of economic regulations.

Excessive technical regulation can also undermine business innovation and substantially increase the cost of doing business. In general, regulations shall be specific-enough to permit standardisation, and performance specifications shall be avoided wherever possible. Performance specifications are not a

solution to bureaucratic delays because performance specifications often require the user to undergo extensive and expensive testing processes. To minimise problems caused by over-regulations, this NRMP provides the following guidelines for national DRG and sub-national regulations:

- A specific product, brand, or manufacturer will not be specified and sole-source will be avoided, except for safety-related replacement parts, training, and software.
- Regulations and specifications will use broad-based technical standards that apply to the globalised marketplace. These include the UIC, the AAR, American Railway Engineering and Management Association (AREMA), and China's version of the AAR published by China's Ministries. The use of narrow national market standards, e.g. DIN, BS, or JIS standards, is not appropriate.
- Regulations and specifications will avoid the requirement for several ministries to approve of the exact same item or project element.
- Regulations and specifications should, whenever possible, incorporate the terms of existing regulations by reference and should avoid publishing locally applicable versions that may be subject to conflicting interpretations unless there is strong evidence that local conditions call for different regulatory policies.

The DGR will consider protests by parties that claim that sub-national regulations that contravene the foregoing principles.

7.4 TECHNICAL GUIDELINES FOR SUB-NATIONAL RMPS

The NRMP's technical guidelines constitute a specific plan of how Indonesia's network of sub-national designs will be configured to minimise the engineering and social conflicts discussed in the Section 7.3.

7.4.1 Financial Safeguards Require Some Technical Safeguards.

The sub-national RMPs and projects shall emphasise good economic and technical design criteria in the NRMP. The basic physical design of a sub-national project or network will meet basic design criteria to comply with Law no. 23 of 2007's goal of national planning and national benefit.

The specific design criteria in these guidelines include:

- Electrification
- Gauges: Track, Loading, and Axle
- Maximum gradients and minimum speeds
- Signs and wagon identification
- Automatic Equipment Identification ("AEI")
- Signals and automated traffic control
- Station lengths
- Rolling stock collision requirements and interoperability

The list of design criteria is restricted to the list above to observe the principle of "avoiding regulating whenever there is doubt that regulations are needed".

7.4.2 Electrification

The first requirement for electrification is for any sub-national project to demonstrate that it has secured electrical generating capacity to supply its needs. The supply analysis should include high-voltage transmission lines. The analysis should include actual contractual options to purchase electricity on a long-term basis for at least 15 years from existing generating capacity.

The major design criteria are the voltage and frequency of catenary and third rail power. Indonesia has only one electrified part of its railway network. In this regard, Indonesia is fortunate because it does not have a legacy of obsolete designs. The one present system uses 1.5 kilovolt continuous current ("1.5 kV DC"), which is an older design. New construction will embody current global standards:

- The widely used catenary for new main line railways throughout the world is 25 kV AC power at 50 Hertz.
- The most popular catenary and third rail power for new metros and light rail and trams is 750 V DC.

This recommendation also applies to any major expansion of Jabodetabek. The existing catenary, power supply substations, and rolling stock may remain at 1.5 kV DC, until these are finally retired. New lines shall be required to operate on at least the following voltages and currents:

- Metros, light rail, trams, and similar systems that do not connect to the general system of railways, shall be 750 V DC.
- Mainline railways, special-purpose railways for minerals, general cargo and mixed use shall be 25 kV at 50 Hertz. Used locomotives may have capability to use other voltages and frequencies if these are part of the original equipment.
- Special purpose railway that use unconventional guideways, such as, but not limited to, monorails, Mag-Lev, and rubber-tyred automated people-movers, shall make use of commercial grid alternating current power, or 25 kV at 50 Hertz, or 750 V DC power
- New main-line EMU's should be built to operate on both 1.5 kV DC and 25 kV at 50 Hertz until the year 2020.

Electric locomotives may only be 25 kV AC because the 1.5 kV catenary in Jabodetabek may not be able to supply large electric locomotives and rush-hour EMU's in the same power section at the same time.

Special-purpose railways shall not be allowed to acquire and utilise second-hand power sub-stations, cargo locomotives, or EMU's if the equipment is not 25 kV AC or 750 V DC, unless the equipment is modified to meet the above standards, or the equipment is solely used on Jabodetabek's 1.5 kV DC lines.

7.4.3 Gauges

The NRMP considers three gauges: (i) the loading gauge, which is the maximum width, height, and length of wagons and their contents (ii) the axle gauge, which is the maximum weight on each axle on rolling stock and (iii) the track gauge.

The basic principle that governs Indonesia's gauge is that when lines are built, or when existing track is rebuilt, or when double track is added, Indonesia should build for its future. This future is best decided on commercial reasons to permit economic and social development. Loading gauge, track

gauge, and axle gauge should handle the speeds and clearances required for modern, high-capacity passenger and cargo trains.

Loading Gage:

Loading gauges are discussed by considering passenger trains and cargo trains together. In summary, main lines for cargo, local lines for commuter trains and all lines that might be electrified, require high clearances. This clearance is the distance from the "top of rail" to the top of a coach, wagon, or pantograph. The loading gauge also describes the width of wagons and the distances from a station platform to the lower edges of wagons.

The physics of a loading gauge are complex. Loading gauge should provide clearances for high-capacity passenger coaches. Modern intercity and commuter railways use multi-level coaches to achieve high-capacity.

UIC railway clearances use a rounded ceiling profile whereas AAR clearances are typically square at the top. The AAR clearances are more expensive to build. However, the AAR clearances facilitate the use of "double stack" container wagons. The AAR pattern also facilitates the use of highly-efficient wagons for containers, highway trailers, new automobiles, and bulky freight.

The following design criteria will be required of sub-national railway projects:

- For longer main lines that might move containers and for lines connecting to dry ports, the AAR "Plate H" dimensions shall be adopted for new construction and for bridge and tunnel reconstruction. This shall also apply to new "special-purpose" mineral lines and to double-tracking of selected commuter lines.
- For conventional lines that will not ever carry containers or frequent, large passenger trains, either the AAR Plate C-1 or UIC Diagram 6 in UIC Code 505-1 may be adopted instead of AAR Plate H.

Axle Gauge

The NRMP requires that Indonesia's railways compete effectively in global markets and that Indonesia be able to employ the most economical and effective motive power designs in the future. Indonesia will construct new lines that permit the use of globally-supplied rolling stock so as to enhance the ability of Indonesia to attract private-sector financing.

Therefore, the minimum axle gauge for new and reconstructed mainlines and special purpose cargo and passenger railways shall be as follows:

- All new and rebuilt mainline and special-purpose railways shall be constructed with an axle gauge of not less than 25 tonnes, and shall support the live loadings of six-axle locomotives at this axle gauge.
- All bridges and similar structures shall be built to an AREMA loading standard of a Coopers E-72 for steel and Coopers E-80 for concrete. The useful life for these structures will be 100 years for new construction, and not less than 25 years for reconstruction of an existing bridge or structure.
- Tram, light rail, and metro line bridges and similar structures may be constructed to lighter standards that are suitable for the technology chosen, and for useful lives of not less than 50 years.
- True high-speed lines that will only carry true high-speed trains may be constructed to a 15 tonne axle gauge, and for useful lives of not less than 50 years.

Track Gauge

The governing principle for determining track gauge is interoperability and the benefits of a network.

- The track gauge for any line that is, or can be, part of the mainline network shall be built to Cape Gauge, except for existing 1435 mm gauge lines on Sumatra. This requirement includes financed privately, special-purpose mineral railways.

Tram and metro lines are a different case, and may have a different gauge from Cape Gauge. Trams and metro lines typically are incompatible with mainline railways, and will not be expected to become part of a national network.

Metro and trams are generally built differently enough so that a collision between a metro or a tram and a mainline locomotive will have disastrous consequences. Therefore, running gear, traffic control, and brake controls should be different and incompatible between mainline railroads and metros. Therefore, mainline railways and metros should be built with each using a different track gauge.

- New metros, trams, light rail and other mass transit projects shall be built to track gauge of 1435 mm.

The use of 1435 mm gauge for metro lines, light rail, trams, and other mass transit shall be encouraged so as to reduce the safety risks from collisions or incompatible traffic control systems.

- Truly high-speed lines, where the top speed is 200 kilometers per hour or greater, will employ either cape gauge or 1435 mm gauge. In no instances will dual-gauge track be permitted. Both gauges may share parallel alignments.
- Concrete and rubber-tired guideways and unconventional fixed-guideways, such as Maglev, airport Automated Guideway Transit (AGT), or monorail, should only be licensed if built within the confines of the owners' land development. Unconventional fixed-guideways may be any track gauge or other gauge, the owner chooses to use if, and only if, the other due-diligence requirements are also satisfied. However, the use of sole-source unconventional guideways shall not be approved unless a due-diligence study demonstrates the financial sustainability of the unconventional guideway is clearly superior to Cape gauge or 1435 mm gauge conventional track.

7.4.4 Maximum Gradient and Minimum Speed

The NRMP considers maximum gradient is an important design criterion in financially sustainable sub-national railways. However, the maximum gradient cannot be specified as a single, specific, requirement for all designs. The maximum gradient depends on the terrain and the dominating direction of cargo movement (uphill versus downhill). There is also a trade-off between axle gauge and maximum gradient. High axle loads permit the use of powerful, efficient locomotives that can move trains up steeper grades. The maximum gradient must take into account the local terrain and the predominant type of service a line is expected to provide.

Therefore, the NMRP will establish no precise requirement for this design criterion. The economics depend too much upon local conditions. In general, maximum grades in excess of 2 percent in mountainous areas will be cause for further review by the DRG. For commuter and regional passenger trains on flat plains, more than 1 percent will be reviewed by the DRG.

The NMRP considers that, although the minimum speed is an important design criterion in sustainable sub-national railways, the minimum speed must be chosen to reflect local conditions. The minimum speed for mineral railways should not be regulated because of construction costs must be traded against operating costs on a case-by-case basis so as not to inhibit economic development.

However, sub-national passenger and high-value cargo railway criteria are recommended, and designs that fall below these minimums will be reviewed by the DRG. The following minimums are suggested, based upon experience in passenger systems and high-value cargo railways. These minimums are for new or rebuilt track and signals:

- Passenger trains shall operate at speeds of not less than 75 kilometers per hour on existing alignments through dense urban areas.
- Passenger trains shall operate at speeds of not less than 90 kilometers per hour in mountainous regions.
- Passenger trains shall operate at speeds of not less than 120 kilometers per hour in relatively flat regions.
- Maximum speeds for metros, tram lines, and light rail systems should depend on the specifics of the project, and should not be regulated or reviewed expect for safety considerations.
- Speeds for unconventional guideway technologies should depend on the project, and should not be regulated or reviewed except for safety considerations.
- Speeds for true high-speed should meet the current UIC and EU concept of 260 kilometers or greater for 1435 mm gauge and 200 kilometers per hour for cape gauge.
- Speeds for high-value cargo railways shall not be less than 80 kilometers per hour, although trains may consistently operate at lower speeds. High value cargo railways are railways that primarily are intended to carry manufactured goods in wagons or containers or specialty commodities such as manufactured chemicals or hazardous/toxic materials.

7.4.5 Signs and Marking

Signs and markings on local and private railway stations, level crossings, and rolling stock shall be arranged to obtain the widest national benefit. The goal is to permit tourists, international cargo shippers, human resources, and other parties to quickly and correctly identify information that these parties may require. Signs and markings relating to safety shall always be uniform throughout Indonesia. Local railways shall not develop their own brands and marketing that is inconsistent with the concept of a national network.

Passenger Coaches and Stations

UIC standards shall be used for passenger stations, ticketing, and passenger rolling stock, including ancillary facilities such as automobile parking. The governing document shall be *RIC: The Accord for the Exchange and Use of Coaches in International Traffic*, most recent edition.

Cargo Wagons

AAR standards shall be used for cargo rolling stock and cargo containers. The governing document is Section L of the AAR's *Manual of Standards and Recommended Procedures*, the most recent edition.

Trams Operating in Streets

Light rail cars and trams operating in streets and that do not multiple-unit trainline controls, will use the automotive-industry symbols for crew controls, found in 49 CFR 571.101.

7.4.6 Electronic Automatic Vehicle Identification: "AEI"

The NRMP intends for Indonesia to develop modern logistics and modern cargo wagon fleet management. Modern fleet management requires a method of identifying wagons without the use of cumbersome paperwork. The method shall be service-proven on over a million wagons, capable of withstanding the shocks and vibration of mineral trains, especially coal and ore trains, and inexpensive to apply. The general name for an electronic vehicle identifying tag is "Automatic Electronic Identification (AEI). The most successful AEI system in wide use today is that used by the AAR nations.

- All cargo wagons, passenger coaches, EMUs, DMUs, and self-propelled track maintenance machines that could operate on the general railway network at some point in the future, be equipped with and use an AEI RF tag complying with AAR Standard S-918.
- All special-purpose railway rolling stock for passenger trains that cannot safely operate on the general railway network may use an AEI design of the initial buyers', lessees', or lessors' choice, including no AEI equipment at all.
- Owners or operators of rolling stock, track maintenance and cargo containers may at their option and cost, add supplemental electronic vehicle identification, control, locating, and monitoring devices in so far as these additional devices are consistent with safety requirements.
- No owner or operator of a general-purpose or special purpose railway shall employ an AEI or similar system if using this design precludes or inhibits other parties from operating trains or rolling stock upon railways, other than urban mass transit metro lines, trams, light rail, and specialised technologies such as monorails or airport AGT systems.

7.4.7 Signals and ATC/ATO/PTC

Although signal systems should be standardised at least for each island for the mainline railway network, there is insufficient research to make a recommendation at this point for the national and sub-national RMPs.

- Because signal, SCADA, and other traffic control suppliers tend towards unique, sole source designs, the DGR recommends that PTKA and its successors standardise on no more than two different suppliers, and that each island network's new and replacement traffic control should be all of one kind for future installations for cape gauge lines.
- Metros, tram lines, light rail lines, and all unconventional guideways should choose the traffic control system that provides it with the best economics, and should not be regulated expect for safety and "step-in" matters.
- No owner or operator of a general-purpose, special-purpose, or mass transit railway shall install a new or replacement signal, Automatic Train Control/Automatic Train Operation/Positive Train Control (ATC/ATO/PTC), SCADA or similar system if using this design precludes or inhibits other parties from operating trains or rolling stock upon railways, or from "stepping-in" to operate a financially or technically failed railway. In general, the software and hardware shall use an "open architecture." The owner or operator of such a system shall make available the hardware, software, and firmware of the system to other users of the same tracks on the same commercial terms and prices that the owner or operator is using, except for assets used solely to monitor

rolling stock or to monitor fare/net weight/passenger count/ accounting/ lading information that is of a commercial type.

7.4.8 Station Lengths

Because station length limits the possible economies of scale of railway operations, sub-national projects and RMPs will specify minimum station lengths to improve financial sustainability and "step-in" provisions. These requirements apply to urban metros as well as cargo trains and conventional passenger trains.

Cargo

For cargo trains, the word "station" includes "passing loop", "passing sidings" and similar tracks. The distance between stations shall depend on local conditions. As overall guidance, and unless the proposed builder makes a convincing case otherwise, the NRMP will require all new and reconstructed special-purpose and general single-track railways, other than metros and tram lines, to be designed and then built to the following financially sustainable standard:

- New and rebuilt sidings for single-track mainline railways should be not less than 2000 meters long if the spacing between stations is greater than 10 kilometers, and/or the maximum gradient on this section of route is greater than 1.5 percent. Turnouts and crossovers should use not less than AREMA #15 switches for new or completely rebuilt construction on mainlines. Lines that are primarily for passenger trains shall, however, use AREMA #20.
- New and rebuilt sidings for single-track mainline railways should be not less than 1500 meters long if the spacing between stations is less than 10 kilometers, and/or the maximum gradient on this section of route is less than 1.6 percent. Turnouts and crossovers should use not less than AREMA #15 switches for new or completely rebuilt construction on mainlines. Lines that are primarily for passenger trains shall, however, use AREMA #20.
- The above requirements shall be reviewed and modified by the MoT or its successor in the third phase, from 2021-2025.
- Passenger-only commuter railways shall construct three-purpose sidings that comply with the above regulations. These sidings shall have these purposes: (i) To permit the eventual use by cargo trains; (ii) to permit "short turn-backs" of commuter trains to encourage economical operations, and (iii) to be used as pocket-tracks for spare passenger trains to improve reliable service.
- Existing PTKA routes that have much shorter passing stations may be exempt for this requirement upon application and approval by the DGR when these stations are reconstructed.

Metros and Commuter Trains

The length of a metro and commuter trains determines its eventual financial sustainability and its technical/social success. The NRMP should only approve and support designs that include stabling and station designs that facilitate financial sustainability and social/technical success. Therefore, it is recommended that sub-national RMPs and projects require, for metros and new commuter train routes:

- Stations and stabling shall require the use of EMU, DMU and commuter cars and coaches that are at least 20 meters in length.

- Stations and stabling shall require the use of EMU and commuter trains that are at least eight cars and/or coaches in length, not including locomotives.
- DMU stations and stabling on routes that are not commuter lines, shall require the use of DMU trains up to three DMU cars in length.

These regulations are not the same as requiring the initial line to commence operation with eight-car long EMU or commuter trains. It is only to require that designs permit such trains in the future.

7.4.9 Rolling Stock Collision Requirements and Interoperability

The safe design of mechanical and electrical components requires a specific study to determine the structural requirements of passenger and cargo rolling stock. This also applies to brake systems, trainline controls, platform heights, electromagnetic interference, current collectors, and couplers.

This section of this chapter does not constitute a definitive set of DGR regulations, but provides only basic policy guidance and recommendations on major design criteria issues that will be elaborated subsequently by DGR or by a special committee to choose these requirements.

However, the following regulations should immediately apply to any sub-national project:

- Any metro, light rail, tram, or advanced technology Automated Guideway Technology ("AGT") or other fixed-guideway approach under the scope of Law no. 23 of 2007, shall have a mechanical coupler and a collision strength that is equal among all rolling stock used in that system, except that maintenance equipment may have lesser strengths. Exceptions may be granted by the DGR for new assets that represent a transition to a more stringent standard.
- All railway passenger rolling stock of any kind that operates at level crossings and/or in streets shall have an elementary ability to withstand collisions with highway motor vehicles in front, side, rollover, and rear collisions. The protection provided to passengers shall be at least equal to those found in the US Department of Transportation's regulations found Title 49 of the Consolidated Federal Register in Parts 571.217, .220 through .222, .224, .301, .302, .305 and related regulations.
- The analysis for collision protection provided to the DGR, for collisions between railway vehicles shall not be acceptable to the DGR if the analysis is restricted to front-end and rear-end collisions between similar railway vehicles only. Instead, all analysis must include (i) collisions between dissimilar vehicles commonly used on the same line, (ii) the results of roll-over of the vehicle caused by derailments and collisions, and (iii) collisions that occur between the corners of two vehicles.
- The DGR will favour development projects using compatible rolling stock, fare and ticket systems, AEI, ATO/ATC/PTC and other assets commonly in use by other Indonesia national or sub-national railways, including special-purpose railways.

The DGR reserves the right to publish future rolling stock regulations for safety and interoperability and would seek formal PP legal status for these regulations. These regulations include draft gear capacity; handholds, ladders, steps, and other safety-related crew appliances; platform and door heights, collision and derailment strength, emergency exits; trainline emergency circuits for public address/intercom, door operations, emergency lighting, and related multiple-unit control circuits; trainline battery power and earthing; and fire/smoke/toxicity requirements.

7.5 FINANCIAL GUIDELINES FOR SUB-NATIONAL RMPS AND PROJECTS: DUE DILIGENCE

7.5.1 Financial Guidelines: Introduction

A purpose of the NRMP is to increase the financial stability of the rail transport sector without excessive regulations and without interfering with the principles of devolution. Achieving this purpose requires insuring that sub-national development is financial self-sustaining. Financial guidelines are criteria to assess whether or not a sub-national project is likely to be financially self-sustaining. The NRMP will have provisions to establish whether or not sub-national projects are self-sustaining to avoid the necessity of the GOI having to "step-in" to finish a project. Therefore, the MoT/DGR will publish procedures and standards to permit evaluation of projects on a consistent and accurate basis. The requirements include realistic cash flow projections, income statements, and selected technical/management tests that indicate whether a project has a reasonable likelihood of success.

The financial guidelines, or criteria, are elementary requirements for financial planning. Because these are elementary requirements, sub-national projects may also conduct additional planning exercises.

Approving the development of financially sustainable and social/technical successful projects is one part of the DGR's role in executing the NRMP. This role requires sub-national RMPs and projects to perform sound, diligent analysis of their projects' financial futures. The DGR emphasis will be on (i) passenger projects and (ii) plans relying on public funding and governmental loans. However, private special-purpose railways must also demonstrate financial sustainability and social/technical success factors.

There are two general financial due-diligence requirements. One requirement is comprehensive due-diligence analysis that applies to many infrastructure and industrial development projects. The other requirements are specific, but informal, tests that are focused predictors of a project's or plan's success or failure. The specific, informal tests shall be performed by the DGR prior to the comprehensive due-diligence analysis.

Financial due-diligence analysis will not be the same as a conventional cost-benefit analysis. A financial due-diligence is not intended to calculate the over-all costs and benefits to a society. Conventional cost-benefit calculations are the responsibility of BAPPENAS. The MoT financial due-diligence shall, instead, focus on the cash-flow sustainability of the project under different economic scenarios. The financial due-diligence shall determine if there is an *adequate* mechanism providing a sufficient flow of cash in each and every time period. The due-diligence shall report if the cash-flow is adequate to pay for construction costs, to pay for working capital requirements, including commissioning, and then to pay continuing operating costs.

Externalities shall only be included in the financial due-diligence to the extent that externalities may impose regulations or delays that impact cash-flows. The financial due-diligence shall determine if the riders, shippers, miners, real-estate developers, LGs, and other beneficiaries have a regular, prompt method of paying cash to the sub-national railroad for the benefits received. The regular, prompt payment may be through cargo tariffs, TAC, PSO, passenger tickets, and special real-estate tax assessments near a project's stations, ports, or terminals. The routine payment may be indirect; for example, the payment may be in the form of granting monopoly privileges to the project's sponsors.

Financial sustainability requires that, in every case and for every project, the routine payments are to be directly linked from specific, sub-national beneficiaries to the operators and owners of the sub-

national project. The national and sub-national RMPs shall require that all sub-national projects be funded, in large part, through these direct links.

These links between payments and services shall be such as to motivate a project to perform its transportation services in a manner that is directly valued by its users. Therefore, taxes, subsidies, and PSO payments shall not be structured for future sub-national projects that do not link the payments for services with the users of the services.

7.5.2 Recommended Format of a Comprehensive Due-Diligence Analysis

Performing a financial due-diligence requires a consistent, complete effort to be applied to all projects. A general purpose Terms of Reference ("TOR") that will provide a consistent, complete due-diligence has been prepared as a template for both special-purpose, mass transit, and general railways. However, the RMP recognises that financial conclusions may need to be proprietary to private-sector investors. Therefore, the RMP's requirements for a comprehensive due-diligence include these specific elements and requirements to protect private-sector investors:

- If purely private capital is involved, then the independent firm performing the due-diligence shall not be Indonesian, and the office of the firm directing the work, and the team leader, shall be off-shore. This requirement shall facilitate confidentiality of the analysis details.
- If purely private capital is involved, then the results of the due-diligence furnished to the DGR shall exclude commercially sensitive and proprietary information. The results should be confined to statements of adequacy of cash-flows; of financing methods, of technical risks, of technical and safety compliance, and of areas of concern requiring risk-mitigation.
- If significant amounts of public funding are involved, including PSO or other subsidies, grants of land, creation of special tax districts, granting of tax and customs abatements, granting of monopolies, then the DGR may require fuller disclosure proportionate with the degree of public funding.

In general, "significant amounts of public funding" may be defined to be funds whose Net Present Value amounts to more than 10 percent of a project's Net Present Value.

- The DGR will not retroactively require fuller disclosure than the level of disclosure required initially; that is, the NRMP regulations will not allow a developer to expend significant cash and then, afterwards, be required to reveal its proprietary commercial information, unless there has been a material change in the project's scope or costs.
- All comprehensive due-diligence and cost-benefit analysis shall be performed to avoid conflicts of interests. Therefore, the NRMP will normally require that:
  - The work shall be paid for by the project's sponsors. If the project's sponsors' cannot afford to pay for their due-diligence, then it is prima facie clear that the first test of financial sustainability was failed.
  - The analysis shall be performed by an independent, qualified firm to be selected by the DGR under competitive tendering procedures.
  - The independent firm shall not have any national or sub-national ties to the sponsor's interests that present a real and present likelihood of bias or conflict of interest.
  - The independent firm shall have demonstrated its clear and extensive qualifications in the specific transport mode proposed for development.

The NRMP provides this further guidance for the due-diligence analysis to ensure that it protects Indonesia from sub-national failures:

- The due-diligence shall include the period-by-period cash-flow requirements required to service interest, principal, and eventual dividends.
- The due-diligence shall include working capital requirements for inventories of consumable material and for accounts-receivable. Accounts-receivable analysis shall conservatively reflect delays in collections where there are land-tax, TAC, and PSO income that are paid to the sub-national project only quarterly or yearly, or where there is a lag in monthly payments.
- The due-diligence shall also model what happens when problems occur. These problems should include:
  - Construction and commissioning cost overruns of up to 100 percent for passenger railways and up to 50 percent for cargo railways. Special passenger railways and metros tend to employ more experimental technologies.
  - Delays in commencing operations of up to 24 months.
  - A major recession that affects demand for this transport service, e.g. the demand for coal, containers, airplane passengers at an airport line, or employee commuting.

Problems revealed by modeling will not be interpreted to be the same as predicting the actual results upon which decisions should be made to license or not withhold licensing. The results of modeling problems are only to advise the risks facing the parties and the Government.

7.6 FACILITATING ACCESS TO PRIVATE CAPITAL FOR SUB-NATIONAL PRIVATE & PUBLIC EFFORTS

Law no. 23/2007 and the MoT/DGR capital planning work require the NRMP to facilitate the use of private capital to carry out development at levels of up to 75 percent of capital expenditures for the five-year plan ending in 2014. Guidelines to facilitate the use of private capital to invest in sub-national projects are provided below. These guidelines shall be incorporated into sub-national RMPs to encourage the investment of responsible, patient, private capital.

7.6.1 Minimum Term of Projects

The minimum terms of railway infrastructure and related assets shall be such as to encourage investment by responsible, patient, private capital.

- No Build-Operate-Transfer (BOT) contracts, leases, easements, or other reversion of property contract for less than 35 years may be imposed by regional governments or LGs. Contractual arrangements of less than 35 years may be mutually negotiated with the specific approval of the MoT/DGR.
- Depreciation shall be accounted for based on the expected commercial life of the assets, rather than the assets' historical physical life.

Land shall be an exception to the depreciation requirement. Otherwise, rolling stock, buildings, information systems, bridges, grading, and similar fixed assets should be depreciated over a short-enough period to permit the investors to recover their investment in a prudent period of time.

7.6.2 Financial Transparency Requirement: Management Accounting

The NRMP requires sub-national projects to provide adequate financial transparency. This financial transparency shall be sufficient to accurately calculate subsidies, TAC, PSO, and tariffs without

disputes and without implicit cross-subsidisation. The financial transparency requirements of sub-national RMPs require projects to obtain approval of a management and cost accounting system by the DGR before final approvals and licenses are granted.

- Sub-national RMPs shall require accounting systems that permit costs to be calculated so that operators' can be efficiently-managed, and so that tariffs, subsidies, TAC, PSO, taxes, and other income streams can match costs to income.
- The NRMP will not require cost and management accounting to conform as financial accounting standards because financial accounting and managerial accounting are different.

The RMP recognises that management accounting and financial accounting are different types of accounting. The latter provides a basis for comparing the financial performance of an entity to similar entities, so that financial and economic decisions may be made on a fair, consistent basis. The former permits management to make internal decisions concerning pricing, internal allocation of scarce resources ("budgeting"), and performance of managers and of product lines.

The NRMP will not require a uniform chart of accounts to be applied to all sub-national projects. The NMRP will adopt the policy that different railway entities have different management needs. However, all accounting systems shall employ the principles below:

- Accounting systems employed by a sub-national railway shall contain accrual accounts and processes to match expense and income events occurring at different times. These events include, but shall not be limited to, matching income with receipts and expenses with expenditures.
- All accounting systems must account for maintenance of rolling stock and infrastructure on an accrual basis. Actual expenditures must not be confused with actual expenses, and expenses shall be accrued to accurately capture cyclical maintenance activities and the effect of warranties on expenditures.
- The financial accounting for passenger operations must account for income on the basis of rides taken rather than on receipts for advance ticket and fare sales.
- The NRMP shall require sub-national railways to report to the DGR on the basis of International Financial Reporting Standards (IFRS) except as noted about.

7.6.3 Redundant Sub-National Approvals

The NRMP encourages the use of private-sector capital to facilitate the rapid development of the rail sector of the economy. Rapid development using private-sector capital requires investors knowing what approvals are required for a project, and what the specific regulations are. Furthermore, both private and public projects for railways will cross two or more local jurisdictions by the very nature of transport.

Therefore, the NRMP will establish that approvals at the local level shall not be arranged so as to be redundant. Sub-national regulations and RMPs shall not conflict with the NRMP, and shall not be contradictory. In general, the NRMP establishes the principle that if approvals and licenses have been granted by a superior level of government, then developers may assert that these approvals and licenses apply to lower levels of government under a principle called the "preemptive effect" of the superior level of government.

- Any MoT regulation preempts any provincial, regional, district, or city law, regulation, approval, or order covering the same subject matter, except an addition or more stringent law, regulation or order that (i) is necessary to eliminate or reduce an essentially local safety hazard; (ii) is not

incompatible with a law, regulation, or order of the GOI; and (iii) that does not impose an unreasonable burden on the national transport sector.

7.7 RISK MANAGEMENT: THE SUB-NATIONAL STRATEGIES

The NRMP will mitigate financial risks to Indonesia by requiring sub-national railway enterprises to undertake specific financial and technical risk mitigation strategies. The NMRP sets forth these specific planning guidelines for the NRMP to employ in approving and licensing sub-national projects. These projects may be public, private, or a combination of both. The combination may take the form of a PPP, BOT, Design – Build – Operate – Maintain (DBOM), or any other combination of owners, operators, grantors, or lenders.

7.7.1 Insolvency Risk Mitigation

The financial risk at the Indonesian national level is that a sub-national project becomes insolvent. Because Law no. 23/2007 emphasises that all railways – even monorails and cable trams – are the property of the State, it is possible the GOI may need to undertake a financial and even operational "rescue" of a failing sub-national railway enterprise. Therefore, the NRMP requires sub-national projects to mitigate the risk of insolvency so as to protect the national and the other sub-national railway enterprises.

"Step-In Provisions and Contractors' Sureties"

Although contractors' sureties may not be sufficient to provide for future operating losses, sureties must be obtained for passenger and general-purpose cargo railways. The NRMP policy is that sureties are prudent for sub-national projects that are difficult for the GOI to allow to be abandoned once the projects are started. Therefore, the NRMP includes criteria for sureties. These sureties may be performance bonds, Irrevocable Letters of Credit, and other forms of guarantees.

Minimum requirements for sureties are as follows:

- A surety shall be sufficient to cover likely cost-overruns. The amount of a surety shall be not less than 120 percent or more than 200 percent of original budget. This amount shall be increased for change orders, variations, and additions to the original project.
- Sureties shall always be required for passenger railways' prime contractors, whether the railways is publicly or privately funded, and for any railway relying on a specific, advanced technology that has not been successfully and repeatedly employed before.
- As a policy, sureties shall not be required of all cargo railway projects unless (i) an advanced technology is employed and/or (b) the contractor receives milestone payments or advance payments. Sureties shall not be required of special-purpose, sub-national cargo railroads constructed primarily for transport of minerals and related cargo if, and only if, no public funds other than land grants, are involved in the project.
- Only Irrevocable Letters of Credit shall be acceptable sureties for advance and milestone payments. Raw material, advances to other parties, and work-in-process shall not be accounted as earned-value when calculating the net value of advance payments, and only substantially complete and commissionable assets shall be counted.

- Sureties are not acceptable when issued by banks or other institutions headquartered or based in the same nation as the party purchasing the surety, and shall be obtained from a firm or other entity that is clearly independent of the party required to purchase the surety.
- Sureties should be payable to the national government only. Sureties should not be payable to sub-national governments. (The reason is that sub-national governments are too often the "driver", or ultimate cause, of the insolvency.)
- Sureties shall contain a provision that the surety shall "step-in" and finish the project, then, operate it and/or sell it, and that title and all other rights belong to the surety in the form of a lease or lease-hold, until the project is commissioned and licensed to operate.
- The DGR shall have the preemptive right of first refusal for any sale of the insolvent enterprise, including the sale of operating contracts and long-term leases, and the sale price receipts to the surety shall be limited to the surety's actual loss. The loss should include the legal and other direct corporate costs incurred by the surety.

Passenger Railways: Farebox Recovery Ratio

Farebox recovery requirements are an important form of providing an indirect step-in or financial surety for passenger railways. The farebox recovery ratio is the percent of operating costs that are paid by a combination of passenger fares, routine income from rental of real estate, the taking-in contracts for maintenance and construction activities, and by advertising income.

Routine income does not include subsidies or dedicated taxes. Routine income is income that depends on how many passengers are using the railway or metro. The RMP policy is to have management of a mass transit or other passenger railway focus on carrying passengers, collecting revenue, safety, and controlling costs. Management should not focus on obtaining subsidies or collecting unrelated taxes.

Operating costs include periodic, routine overhauls and renewals of assets. Operating expenses includes current interest and principal payments on loans, short-term leases and other short-term cash payment obligations of a railway. Operating costs do not include allocation of general overheads of parent corporations.

The RMP target for farebox recovery ratios for mass transit is equal to or greater than 100 percent. This is a target. Individual development targets may not reach this target and may require subsidies or supporting taxes. However, sub-national RMPs must take into account that South Asia rail mass transit lines can achieve 100 percent or better farebox recovery ratios. Therefore, sub-national projects and RMPs shall plan for:

- Farebox recovery ratios that shall exceed 100 percent after three years of operation on a full accrual basis. Jabodetabek's existing operations may be exempted from this requirement.
- Mass transit projects shall demonstrate that they have sufficient physical capacity to reach a break-even volume; that is 100 percent farebox recovery of operating expenses can be recovered before physical capacity is reached at the fares and tariffs contemplated for the project.

Working Capital for Parts and Material

A simple test to estimate if a passenger operation or an advanced technology railway will sustain itself is whether or not it has acquired routine spare parts and material. This is a DGR test of whether or not an operating license should be granted: If there are not enough routine parts and material for routine maintenance and routine repairs, then there will be safety problems. The RMPs will require

that up to 2020, licenses cannot be granted to operate a railway unless there is sufficient working capital inventory to commence safe, financially sustainable operations.

- As a general rule, routine parts and material shall amount to not less than four percent of the total price of the assets at the time of commissioning. Assets include track, signals and SCADA, catenary and power sub-stations and transmission, ticket vending and canceling equipment, building equipment such as lighting and passenger furniture, rolling stock, and maintenance machines used for repairing track, catenary, and rolling stock.
- Major capital spares should not be included in the four percent of routine parts and material: nonetheless, these assets must be owned and available to the entity performing routine maintenance.
- Routine parts and material shall include long-term service contracts to update software and perform systems maintenance on SCADA and other software-driven assets.
- Service contracts replacing hard-assets, consignment material, and "Just In Time" contracts should not be accepted as substitutes for actual inventories of hard assets. The service contractor inventories of routine repair and maintenance material not physically located in the provinces in which the parts and material will be used, may not be included in the sum of the inventories' values.
- Licenses to commence actual operations should not be granted unless a physical inventory routine parts and material verifies that the material and parts are actually available and also organised for use at the time of start-up. This inventory shall be conducted in a manner acceptable to the DGR.

7.7.2 Tourists on a Commuter Railway

An indicator that a sub-national RMP or a specific project will have major problems is if the RMP or specific project assumes that tourists and similar visitors will be a major source of passengers. The problem lies within the demonstrated unwillingness of tourists to adapt themselves to a very short term use of mass transit. Therefore, sub-national RMPs and specific projects that are based on tourist use, shall demonstrate how and why the projects will overcome this inherent problem. This demonstration shall be to the DGR's satisfaction.

Airport AGT projects that operate wholly within an airport and tourist excursion trains shall be exempt from this requirement.

7.7.3 Unconventional Technologies

An indicator that a sub-national RMP or a specific project will have major problems is the projected use of an advanced technology. Therefore, projected uses of an advanced technology shall be approved by the DGR. In general, the DGR will not approve any proposal where the proposed technology has not:

(a) built a working commercial model, and the model is "scalable" upwards in size and capacity according to engineering calculations and engineering modeling; or

(b) has not successfully commissioned at least three systems for operation in other cities that use similar technologies; and also

(c) established that it is only a transport project, and is not a project to develop a manufacturing industry and then capture global markets, unless funded and approved by BAPPENAS.

DGR verification of points (a) and (b) mentioned above shall require on-site visits by DGR Indonesian engineering staff. Representations by sub-national and private parties as to (a) and (b) are not acceptable substitutions for on-site verification by DGR engineering staff.

Projects based upon advanced technologies shall include (i) an adequate budget to transfer sufficient technology to Indonesian nationals to permit routine operation, routine light and periodic maintenance, and also routine modification and upgrades and (ii) a detailed plan and timetable to do so. These plans shall be subject to DGR staff approvals.

7.8 SUB-NATIONAL PLANS TO 2029

This section addresses the potential scope of projected sub-national rail projects out to 2029.

As noted in Chapter 2, sub-national rail projects currently proposed in Indonesia may be grouped into three broad classes:

- Urban and suburban commuter railways, including city center-airport link railways for the major cities,
- Provincial and local feeder ('short-line') railways linking specific areas to the national railway mainline network, and
- New 'Special' or 'Special Purpose' railways being planned primarily to facilitate large scale expansion of coal mining on Sumatra and Kalimantan.

Of these, the first group is overwhelmingly the most important in terms of the scale of investments, and particularly the impact on government finances. The second group – short-line feeders— will be of much smaller impact, particularly, if, as recommended here, the financing for such developments is left entirely to those closest to the markets that would employ such investments. The third group may involve more substantial investments, but these investments are expected to be financed mainly by mining interests from the private sector, so the impact on government funding requirements should be limited. So chapter 7 is concerned primarily with the scope and scale of urban and suburban railways, including city-center to airport rail links.

7.8.1 Urban railway developments planned In Indonesia

Law no. 23 of 2007 mandates that urban railway development planning be addressed in the NRMP. Current thinking in Indonesia is reported to be that urban railways systems should be constructed (i) where there is serious urban congestion and (ii) where the inter-city movements require mass transportation in the form of an urban railway. The inter-urban railway may take the form of a commuter or corridor mainline train.

It is the first and primary recommendation of the present study that the NRMP require that all urban and inter-urban railway plans be integrated with a comprehensive metropolitan area land use development plan, including road transport networks.

7.8.2 Priority Cities for Urban Rail

Urban rail development plans in Indonesia currently focus on the seven major cities of Jakarta (Greater Jakarta), Bandung, Surabaya, Medan, Semarang, Yogyakarta and Palembang. In addition, the potential development of urban railways is also mooted for several other cities. These cities

include Denpasar, Malang, Makassar, Pekanbaru, Padang, and Lampung. Most of these are developing to be a metropolitan city with development expanding into the surrounding area.

The table below shows that the first seven cities targeted for urban rail have a large population whose per-capita incomes make the use of mass transit economically rational because automobiles and even motorcycles may be too expensive. Income ranges from a high of USD 1,380 per year to a low of USD 300 per year. The low end of per-capita incomes suggests that revenues from the farebox are unlikely to provide a financially sustainable basis for some rail mass transit projects.

Table 15: Characteristics of Priority Cities of Indonesia

A	Jakarta	Bandung	Surabaya	Medan	Semarang	Yogyakarta	Palembang
Population (in 2009}	25,612,000	8,924,000	8,829,000	3,949,000	3,586,000	3,505,000	1,323,000
GRDP (Rp. Billion)	333,000	25,000	68,000	29,000	18,000	18,000	15,000
Per-capita Income* (Rp. Million)	13.0	2.8	7.7	7.4	5.1	5.2	11.3

Notes: * Constant Price year 2007

7.8.3 Evaluating Current Sub-National Plans and projects: Metro Construction Costs

The cost to construct a railway, such as a full metro, depends on many parameters. A single track freight line with a few locomotives and simple signaling, running across a flat, geologically sound, sparsely populated landscape in a developing country, might be built for less than USD 2 million per kilometer if diesel-electric locomotives are used. A double track underground metro line in a densely populated city with difficult geological conditions, requiring anti-earthquake construction techniques, electric traction, immunity from typhoons and high humidity, high technology specifications, and high passenger capacity trains could cost USD 200 million per kilometer. One of the most expensive railways ever built was the Jubilee Line extension in London. This cost USD 330 million per kilometer because of difficult civil engineering, its large and finely built stations, and its additional safety equipment and its financing costs.

Asian railway construction costs, as illustrated in the table below, appear to vary widely from country to country, and, of course, between urban railways and inter-city railways largely on rural alignments. Surprisingly, the usual key determinant of cost per kilometer –the proportion of the route that is underground – does not appear to dominate costs. Hong Kong's KCR West Rail route was the most expensive, so much so that the KCR was absorbed by the Hong Kong MTR because of the KCR's impending insolvency.

Table 16: Passenger Railway Cost Development in Asian Countries

Railway	Type of System	Cost per km(USD)	Distance	Notes
Kuala Lumpur, Malaysia	Airport/suburban link	$ 14 million	57 kms	100 % surface

Railway	Type of System	Cost per km(USD)	Distance	Notes
Manila Line 3 Extension	Light Metro	$ 50 million	5.2 kms	Elevated
Bangkok, Thailand	Metro	$ 74 million	23.1 kms	100 % elevated
Bangkok, Thailand	Metro	$ 139 million	20 kms	100 % tunnel
Seoul-Pusan, Korea	High Speed Passenger	$ 37 million	412 kms	46 % tunnel, 26 % viaducts
West Rail - Hong Kong	Heavy Metro	$ 220 million	30.5 kms	38 % tunnel
Taiwan High Speed	High Speed Passenger	$ 49 million	345 kms	Mostly surface
Singapore North East Line	Heavy Metro	$ 150 million	20 kms	100 % tunnel
Shanghai China	Heavy Metro	$ 91 million	16.5 kms	100 % tunnel
Kaoshiung, Taiwan	Heavy Metro	$ 140 million	43 kms	85 % tunnel

Judging from the costs of metros developed in other Asian cities, financing the development of railway systems for Indonesian cities will present a formidable challenge. Success is likely to hinge on whether measures that capture the increased land values (or rents) created by well located railway developments can be incorporated into the funding mechanisms for the railway developments.

There is still no planning about the legal permission to tax the value of the private land near the metro. The DGR's RMP can begin to solve this problem. It is recommended that:

- The NRMP require sub-national governments to include a requirement that sub-national RMPs and sub-national passenger station projects institute legal zoning that is "transit friendly". Each project should include an analysis of special real estate taxes to be paid if "transit friendly" zoning gives developers of the land near transit special rights, e.g. exclusive rights to construct high-rise buildings. This analysis should be a requirement of all future feasibility studies.

According to Law no. 34/2005, a local/regional authority LG may apply a real-estate tax upon the value of land and buildings that directly benefit from their proximity to a station. This is simply called a Land and Building Tax (in bahasa: *Pajak Bumi dan Bangunan*). This tax is collected by the LG, but must be remitted directly to the railway.

- Alternatively, feasibility studies may replace real-estate taxes with contributions; include ownership or operating subsidies, paid directly by real-estate developers who use land and air-rights benefiting from an urban railway. Contributions must be such that they reduce the operating cost of the railway, or reduce the need of the railway to service debt.

The contributions may be in-kind. Examples of contributions include land, the construction and maintenance of a station or construction of a stabling yard. The form of this in-kind support may take the form employed by the BPJT (Toll Road Authority) of the MPW. In one toll highway arrangement, the BPJT acted as the facilitator for land acquisition because it lacked funds to acquire the land outright. The land will be purchased by the private operator and the operator will receive an extension of the concession period as a contribution of capital.

Planning for major cities to accommodate passenger movement for urban traffic can be divided into two categories:

1. Cities which have existing rights-of-way and do not need to acquire all the necessary land. These are in Sumatra and Jawa islands. Some of the plans for Medan, Jabodetabek, Bandung, Semarang, and Surabaya, intend to utilise inactive railway rights-of-way. The right-of-way obstacle is not obtaining the land, but clearing illegal users off the land.
2. Cities which have no rights-of-way from abandoned railways. These are primarily on Sulawesi and Kalimantan islands. However, most of the development for these islands focuses on coal railways. Planning for urban railways has not progressed to the point of identifying alignments, and so remains speculative.

Using existing rights-of-way in urban areas may be a good solution in many cases. These existing rights of way may align themselves with areas of dense populations. The alignment needs to be reviewed to determine what additional land may be required for double-track and for modern stations. Existing rights-of-way are good choices for light rail and pre-metro operations up to 20,000 peak passengers per hour, one direction, if there are not many level-crossings. This capacity can drop to half of this figure if there are many level crossings.

In rural areas, however, existing rights-of-way from abandoned lines may be a mistake. These old railways have difficult gradients and curves. Some were built for only 24” track gauge.

It is recommended the final NRMP contain language challenging:

- A sub-national urban passenger railway or port/terminal railway plan that does not identify a specific alignment.
- A provincial or district RMP that appears to use abandoned rights-of-way simply because these are available.

CHAPTER 8: A VISION FOR THE RAIL SECTOR

As noted in earlier chapters, the railway sector in Indonesia has not contributed substantially to the growth of the Indonesian economy. It is of great concern that a continuation of the past structures and performance in the rail sector could constrain economic development, require vast investments in alternative transport modes, and contribute to worsening environmental conditions. Rail sector limitations and uncertainties in the regulatory environment have constrained growth in both rail passenger and freight transport and have also hindered the development of other rail-based transport modes, including metros, airport links and suburban services, even for the Greater Jakarta region; which is approximately the world's sixth largest metropolis with current population in excess of 25 million. These pressures led to the passage of railway Law no. 23/2007. This law provides the basis to restructure the rail sector. In addition to the legal structure, the Government put into place a number of other structures, including those within the Director General Rail's office, other planning structures, and the inter-ministerial Technical Committee for the Revitalisation of the National Railway.

The law allows a wide range of rail sector developments. Regulation can encourage some developments and constrain others. This chapter addresses the strategic future of Indonesian railways with particular attention to the implications of the new railway law and how it might be implemented. It considers the alternative developments and sets out an action plan for the NRMP, proposing specific measures intended to guide public policy to enable that future to be realised.

8.1 ASSET OWNERSHIP

The law is clear: the infrastructure of the national railway (PTKA) is owned, accounted on the books of, and maintained by, the MoT. All other PTKA assets are owed and controlled by PTKA. Currently PTKA is a state-owned enterprise and all its stock is owned by the GoI, represented by the Ministry of State Enterprises (BUMN).

The ownership disposition of prospective new railways' lines is unclear at this time – many possibilities are permitted by the new law but clarifying regulations are needed to define how the structure of the industry will evolve over time. It is possible that private enterprises or local governmental units proposing new railway lines will hold ownership of the infrastructure assets they build using their own funds (or funds they may raise from various sources). It is possible that new lines could be:

- Built and owned as a special purpose railway where the infrastructure is an asset of the building company, remains on its books until fully written off and may be transferred or sold to other entities. In this case, the enterprise is responsible for the operation, maintenance and renewal of the infrastructure to fit its needs and special requirements.
- Formed as a BOT project where the entity building the new line will have possession and responsibility for maintaining the infrastructure over some concession period (e.g., 40 years).
- Built and owned by a governmental agency (national, provincial, or LG). It remains to be determined how new infrastructure will be treated – whether it become part of the national rail network (controlled by the DGR), or remain the responsibility of the unit of government or agency who built it.
- Infrastructure built by PTKA, if financed by the national government, would become part of the national rail infrastructure and be owned by the DGR. Infrastructure built by PTKA from its own finances would remain on the books of PTKA.

- Since the DGR is responsible for issuing charters and licenses, it could require that all infrastructure for which it issues a License becomes part of the national rail infrastructure and falls under its ownership and responsibility. This would make any new rail lines, even special purpose lines, eventually part of the national rail network and the responsibility of the DGR (all new railway lines would become BOT type projects).

Asset ownership rights can be a critical part of infrastructure financing arrangements, so these considerations are important in establishing the basis for rail infrastructure development in Indonesia. Policy with respect to new infrastructure development should be finalised in the first phase of the NRMP (2010-2014).

In addition to ownership issues, several other factors critically affect the ability to finance and develop rail infrastructure. These include Access Rights, Technical Regulation, and Economic Regulation. Each is discussed below.

8.2 ACCESS RIGHTS

Property owners usually control who uses their property and how it is used. In the case of property owned by national governments, the national government usually determines how assets are used. Where the property is common use, governments usually define the conditions of use and who has usage rights in the form of regulations. For roads, conditions of use typically include speed limits and physical characteristics of vehicles, while who has usage rights are controlled by licensing regulation. Governments also often regulate the conditions of use for private assets, especially those of national significance.

The right of access to railway infrastructure is covered in Law no. 23/2007. It remains to be determined how access rights may be limited by ownership (as discussed above, ownership rights can take many forms). Railway infrastructure owned by DGR will have access rights and track access charges (TAC) defined by a formal regulation of PP legal status, so that it may be used by a number of different entities. As noted in chapter 5, TAC are expected to be based on a straightforward gross ton-kilometer formula that would be defined uniformly for all railway service providers at a level that an efficient service provider can afford to pay while earning a normal return on investment. Services that require subsidy in the public interest should be supported through PSO payments, not reduced TAC. Infrastructure development required in the public interest, including rehabilitation of neglected or under-maintained lines should be supported through infrastructure maintenance and operations (IMO) payments, not increased TAC. Adherence to these principles is considered desirable in order to ensure adequate funding for essential maintenance and periodic capital renewal, minimise market distortions, reduce confusion and increase the transparency of public policy in the rail sector. During the initial phase of the NRMP (2010-2014), DGR should undertake a public rulemaking to determine the extent DGR should exercise similar controls over railway infrastructure under different ownership structures; private investors will be reluctant to invest in rail infrastructure if rights of ownership are not clearly delineated.

Typically, the national government controls access rights on new railway whether built by the government or PPPs. If the government invests and builds the infrastructure on its own financing, access rights are usually the same as with other nationally owned infrastructure. For PPP concessions, access rights are made a condition of railway charters or licenses to build the railway. Access rights may be limited by conditions of the license or the form of the concession contract, (e.g., BOT, DFBOT, DFBOOT). Law no. 23/2007, however, is not entirely clear on the public interest or the powers of the government to mandate access rights in the case of Special Railways which are funded 100 percent by private investors and their lenders where no government guarantees or other

contributions are involved. The NRMP considers, however, that it is often useful to limit access rights for Special Purpose Railways, since the exclusive right to operate over railway infrastructure can be valuable and thus can often help raise private finance. It therefore anticipates that the terms of access rights will be expanded and further defined as a part of the licensing and permitting procedures.[60]

8.3 TECHNICAL REGULATION

Responsibility for technical Rail Regulation issues and negotiation for national infrastructure projects that will be financed by the government is the responsibility of the DGR. This includes:

- Safety Inspection and Standards
- Chartering of Railway Infrastructure
- Licensing of Railway Operators
- National Planning and Rail Infrastructure Strategy

The DGR sets performance and safety specifications for infrastructure, rolling stock, and oversees railway operating standards. These standards and specifications apply to all railway activities in the country, including those built privately and by provincial, local, or other agencies or authorities.

A governmental agency, perhaps the DGR, or another ministry or government agency, should be responsible for chartering new railway infrastructure. The charter defines the nature of the business, whether there are any special purpose conditions, access requirements, limitations, and the term of the Charter – usually for a long period. Since all railway infrastructure in Indonesia should be governed by the same set of technical (and perhaps economic) regulations, one of the conditions of the Charter to build a railway should stipulate that DGR technical and safety standards will apply under the terms of the Charter. The Charter is a special agreement that can provide alternative standards, to be developed by the DGR, that would permit, for example, standard gauge, different axle loadings, or other conditions that may apply for the type of operation envisaged.

An operating license typically applies to those who operate rail services, whether over their own or other infrastructure. Licenses are issued to enterprises who want access to the national infrastructure to provide some train operating service. An enterprise that wishes to buy rolling stock and arrange rail services according to its needs (for whatever market) would be licensed by a licensing authority. The license defines the applicable standards that apply (usually the technical and safety standards defined by the DGR), and may include financial and moral standards (to eliminate those with a criminal background), the form of economic regulation, dispute resolution procedures, and terms of license renewal.

National rail policy, planning for new rail infrastructure, and development of government investment strategies for rail capacity enhancement are the responsibility of the Ministry of Communications through the offices of the DGR.

[60] Even in the case of a purely private Special Railway -- entirely designed, financed, built, operated, and owned in perpetuity by private investors (DFBOO) solely for their internal-to-their-firm transportation requirements, with no right to offer for-hire transportation services outside the parent company— it appears the Government of Indonesia, through the MoT's Director General of Railways, may nonetheless have the authority to condition the award of licenses to construct and operate that private railway infrastructure and the right of access of third parties to the use of the infrastructure. The public policy issues involved in the rights and conditionalities to be attached to the award of licenses for Special Railways are currently being further evaluated in a separate policy study.

In many countries, enterprises participating in the rail sector form associations which often have a voluntary technical regulatory role. Examples include the UIC, CIS Council of Railways, the AAR, and AREMA (setting standards for infrastructure and mechanical systems). This type of regulation ensures commonality among major suppliers, ensures that equipment can be used across multiple rail operators, and provides manufacturers with a set of technical specifications that are acceptable to all industry participants. The detailed technical standards provided by these industry organisations must meet the more generalised performance standards issued by the DGR but do not have the heavy hand of a state institution and are more flexible since industry entities set and modify them.

8.4 ECONOMIC REGULATION

Economic regulation in the rail sector generally refers to regulation of railway tariffs and controls the adjudication process where there are disputes regarding railway pricing issues. In the case of Indonesia, the railway law defines an access arrangement as well as railway transportation services. So, in the case of the Indonesian rail sector, price regulation is defined as access price regulation and may include final transport price regulation. While there may be limited regulation of final tariffs, in cases where a railway service provider (either an infrastructure entity or a rail operator) enjoys a monopoly, some price regulation generally is provided.

As defined by the new law, the NRMP will dictate regulation of access prices – the price that operators over the national network are charged for use of the network. Currently, the equivalent of TAC paid by PTKA are generally set equal to the cost to operate and maintain the infrastructure (IMO). This approach will be replaced by a computation of TAC based on the ability of an efficient user of rail infrastructure to fully pay for infrastructure services while maintaining a normal return on investment. Where this cannot be accomplished due to infrastructure development or line rehabilitation costs, IMO payments may be authorised to fill the gap. In addition to PTKA, other operators (PTKA Commuter Jabodetabek – KCJ, should be considered an operator) would pay TAC on the same basis as PTKA– with charges for each line segment cost category generally allocated on the basis of gross ton-kilometers, and perhaps train-kilometers for certain categories of expenses. [61]

The NRMP supports DGR negotiation of end-user tariffs/ticket prices as a condition to providing PSO support to rail services. The NRMP supports similar negotiations governing tariff rates/ticket prices where sub-national governments provide PSO funding. Where PSO support is not provided, the NRMP considers that regulatory oversight should be restricted to resolution of disputes between railway service providers and their customers and suppliers and DGR should not set rates. Arbitration will be required and mandated tariff rates will be considered only following the failure of arbitration to reach a mutually satisfactory resolution.

As discussed in Chapter 5, economic regulation is the responsibility of a different part of government from charters, licensing, and safety and technical regulation. Economic regulation is usually the responsibility of an independent agency. The NRMP considers an agency independent of DGR, but located within MoT (similar to the status of the NTSC) to be the most practical solution.

[61] On electrified lines such as KCJ, train-kilometers are sometimes considered a more accurate measure of power charges than gross ton-kilometers.

8.5 FUTURE ROLES OF GOVERNMENT INSTITUTIONS

Indonesia has many government institutions involved in the rail sector. For the purposes of this discussion, three major influences will be discussed below:

8.5.1 Director General Railways

The DGR has custodial responsibility for the current national railway infrastructure (that is operated by PTKA). It is also responsible for setting standards, and regulating safety. It executes its responsibility for maintaining existing infrastructure by tendering for operation, maintenance and renewal work needed to maintain the condition of the infrastructure and to operate it.

In this case, operations include train planning, dispatching, crossing protection, and day-to-day maintenance of the track. In the initial period of the transition from PTKA control of the infrastructure, the contract for maintenance and operation would be let to PTKA in a closed bidding process. Over time, DGR should open the bidding process for various portions of the railway.

For Special Purpose Railways, especially railways where the infrastructure is an integral part of the railway system and where no other access based operators are likely to arise (for example, subway, metro, or tram services), the DGR should be able to transfer ownership and maintenance responsibility for infrastructure maintenance to a special purpose body.

8.5.2 Service Contracting

A government agency, probably a unit of the DGR's office, should be formed to contract for services that may be loss-making in their own right but provide valuable public services. This unit would tender for the provision of rail services not provided in the public market place. The unit would also develop model contracts and contracting procedures for use by regional and local officials. It would also provide oversight to any national level subsidy directed at supporting local rail transport contracts. LGs receiving national assistance for local transport services would be required to use model contracts and contracting procedures and contractors would be required to meet standards (safety, licensing, and financial reporting) set by the service contracting unit.

8.5.3 Chartering

It is not clear now who would be responsible for Chartering new railways. The Chartering agency would be required to work with the Planning Agency, the Ministry of Communications, and, if government funds are involved, with the MoF. The Charter would cover infrastructure and equipment standards for a fixed life-time (may be limited to a number of years) and would require that the Charter owner continuously comply with Charter requirements. A Railway Charter might provide some form of subsidy or special permission – for example it might provide some "eminent domain" rights covering the planned railway's route, to allow property taking where that may be needed. A Charter may provide the holder with development rights for properties surrounding the charter.

8.5.4 Licensing

Operators' licenses could be issued by the DGR or by another governmental agency involved in transport issues. Licenses would specify safety, training, financial, and experience requirements. Licensing would require a time-based renewal process and license holders would be required to be continuously in compliance with the terms of the license. Licenses should not be withheld without cause.

8.5.5 Economic Regulation

Most likely a new agency will be required for economic regulation. The agency should be separate from Ministries involved in rail transport and should be empowered to impose economic decisions. It would also develop accounting standards for cost and revenue reporting for railways.

8.6 INSTITUTIONAL STRUCTURES: RAILWAY OPERATORS

8.6.1 PTKA

The largest railway operator is PTKA. It owns rolling stock, has a marketing organisation, and an extensive and specially trained staff with many skills (engineers, drivers, mechanics, station managers, etc). These capabilities provide PTKA with a number of strategies for growth within the provisions of the NRMP. However, over a transition period, PTKA must develop a new operating organisation structure which includes an infrastructure business unit, and at least one rail operations business unit. It may also want to create a separate infrastructure design, construction and maintenance business unit to sell these services to other private railways. The PTKA infrastructure business unit would be contracted by DGR, at least initially, to maintain and operate the national railway infrastructure. Infrastructure operations services would include dispatching and train control; level crossing protection; day-to-day track, structures, and train control systems maintenance; and infrastructure inspection. This unit would also supervise schedules and other activities that require occupation and use of the railway line. A separate unit should provide design, construction services, heavy or capital maintenance, and related engineering and technical services. Operating unit(s)[62] would include train operations management (drivers, scheduling, loading and unloading), rolling stock, rolling stock maintenance services, and station operations staff. Initially, the operations unit(s) would be integrated but eventually, as other rail operators arise, the infrastructure operations unit could be further separated into separate businesses.

In addition to providing train operations services for its own account the NRMP encourages PTKA to provide services tendered by other governmental units. It can also provide train operations services for other operators, form joint-ventures with rail operators who want to provide themselves or others with specialised train services using specialised rolling stock or between specific origins and destinations. It can provide operating services for new railway lines, and even provide operating services in other countries. In addition to its skilled staff, PTKA has many assets with which it can compete in this marketplace – locomotives, universal rolling stock, workshops, depots, stations, etc. It also has unique capabilities to train specialised employees needed to obtain rail operations licenses, and to perform maintenance and repair services on that rolling stock.

[62] Operating units might be set up for freight, long distance passenger, and include the current Jabodetabek unit, while other units might be established for commuter services in other cities.

8.6.2 Other Rail Operators

Other entities may wish to form operating companies to provide specialised services. Examples may include container services between water ports and dry ports or other locations, local communities may wish to provide specialised suburban train services, mineral companies may wish to form licensed railway operating companies to more tightly integrate train services over specialised railways. Such operating companies are envisaged in the NRMP but they will be required to obtain licenses to provide these services, or to contract with already licensed operators for such services.

A rail operating entity would acquire rolling stock, market its services (find customers), negotiate with the operator of rail infrastructure for train paths and for track access fees, and then either provide its own operating services or contract with another licensed operator to provide transport services.

8.6.3 Equipment Leasing Companies

Equipment leasing companies may find the new, more open market for rail equipment attractive. Leasing companies may not require any special licenses if they buy rolling stock that meets government and industry association standards and use a licensed operator to provide maintenance and repair services. It may be desirable to require that a licensed equipment maintenance entity provide maintenance and examination services for some safety critical rolling stock (examples include locomotives, passenger rolling stock, perhaps any wagon hauling hazardous materials).

8.6.4 Single Purpose Private Railways

The law permits private railways in Indonesia. Private railways may propose to build a railway to serve a single shipper operation, most are likely to be a mine or mineral extraction enterprise. Two types of private railways are possible. One type is designed for a particular commercial operation and built solely to meet its needs to move products from one point to another. Most typically, such a railway will move coal or some other mineral from a mine to a port. Under these specialised conditions, the railway line becomes a part of the production system – like a conveyor belt or a pipeline – and can be engineered and sized to suit a specific purpose. The production process, railway and port facilities can be designed and built to optimise production while minimising capital costs.

These railways have no obligation to serve the public or other shippers, and in fact, seem to be prohibited from serving any other shippers. The primary example of this is a rail line built by a coal operator to move coal from a mine to a port. Under the NRMP, such railways would have to receive a charter and the operator of the single-purpose private railway would have to have an operating license.

Given the single purpose nature of these railways, the degree to which they must meet DGR infrastructure standards could be a matter of negotiation. If they do not connect to the national network and are built specifically for a single purpose – the builders may wish to use different standards. For example, to save capital costs, single purpose railways might be built to a different gauge than other railways. They may be built to exceptionally higher, or lower, axle load standards, and could even be built to be fully automated. Developers of single purpose railways should have wide latitude to build a railway that meets the special needs of the production process.

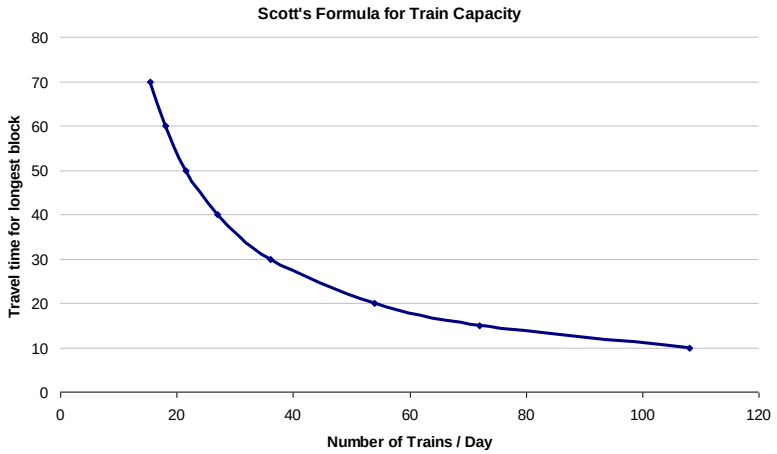
8.6.5 Multi-Purpose Private Railways

Many such rail operations would welcome additional freight traffic, to help defray construction and other fixed costs. In practice, railways have economies of scale – more traffic allows fixed costs to be

distributed over more volume. If that volume is from multiple shippers, all the better – others are helping pay for the costs for the initial investment. This characteristic defines the other type of private railway – a multi-purpose railway.

The utility of multiple traffics over common infrastructure depends greatly upon the capacity of the railway infrastructure. However, the cost to add capacity to an existing railway operation is not linear with volume. Capacity of a single track railway line can be increased by adding places for trains to pass (passing loops), stations and, as the number of trains increases, train signaling and control systems to minimise delays associated with telling train drivers where and when to pass opposing trains (trains travelling in the opposite direction). Such investments are less expensive than the cost to build an entire new line.

Figure 22: Line Capacity Calculation



Typically, the cost to build the initial capacity – the right-of-way and track structure – is a significant investment. In simple terms, say a 100 kilometer railway costs USD 2 million a kilometer to build – requiring an initial investment of USD 200 million. Capacity can be added for a small fraction of this investment. Using Scott's Formula[63] as an approximation of capacity, the initial line would have an average long term capacity of about 18 trains a day, assuming the same number of trains is run in each direction. Capacity can be doubled by building a passing loop or siding in the middle of the line – at a cost of only around USD 2 to 3 million, it can be doubled again by building a few more sidings in appropriate places – at a cost of another USD 6 to 8-million (see diagram above). Scott's Formula is only an approximation and as train densities increase, more sophisticated interventions will be needed so trains do not lose too much time waiting in sidings – eventually requiring signal systems, and then by linking the passing loops into longer sections of double track. The high initial cost and the relatively low investment needed to add capacity makes higher volumes desirable.

In general, railways become more economical as traffic volumes increase up to a point. Of course – like highways, railways can become congested and require even more investments in capacity. At higher volumes, investment increases dramatically – double tracking and automated electronic train control systems add substantially to the initial cost – more than doubling it, but capacity can be increased by a factor of 10 or more. Because railway capacity is generally relatively easy to expand, a

[63] Scott's Formula is a simple approximation of line capacity where the number of trains a day that can be carried (N) is a function of the longest time between places where trains can pass (T, in minutes) such that: N= E*24*(60/T); where E is an efficiency factor related to the time required to notify meeting trains and to change train paths, typically between 0.7 and 0.85 with higher efficiency factors related to more advanced signal and control systems. With electronic CTC, this factor is basically related to the ability of the train driver to notice a speed request change and to act on it.

more common situation for a private railway is one where the primary purpose of the private railway may be to move minerals or coal from mine to port, but excess capacity is available for other shipments and other users.

Often this may be another mine, or other producers, or for passenger services. The private railway can offer transportation services using its own locomotives, drivers, and infrastructure assets; or it can offer its excess infrastructure capacity to others to operate such services. In either case, someone must manage the infrastructure, dispatch trains, and ensure safe practices. The railway owner/builder usually wants to manage the infrastructure to ensure that it serves its original purpose in the logistics processes of the mining operation. It also usually wants to operate its own train services, for the same reason.

The owner/builder is interested in selling its infrastructure and perhaps rail operations services on a commercial basis. Other users will be expected to pay for the cost of their services, make a contribution to help pay for the fixed cost of building and maintaining the line, and provide the owner/builder and operator an opportunity to earn a profit from the services.

Adding users to the infrastructure can spread the fixed cost of the infrastructure over a greater volume and actually reduce fixed cost for the owner/builder. Taking the example above – a 100-kilometer private railway from mine to port – base level infrastructure costs are USD 200 million for the railway capacity needed for the mine (say eight loaded trains a day and eight empty trains a day, with 4,000 net-ton trains, that amounts to about 11 million tons a year). Assuming a 30 year financing transaction at, say 8 percent, fixed charges for the owner/builder are about USD 1.62 per ton. For an additional investment of about USD 25 million, capacity can be doubled and another operator can also ship 11 million tons a year; fixed charges for both shippers amount to about USD 0.89 per ton. The original owner/builders annual fixed costs drop from about USD 18-million to about USD 9-million. This is a compelling case for serving more than one customer, even with a railway built for a special purpose. If a private owner/builder is to provide services for other customers, it must be able to do so without losing money on the additional services. If there is another mine or major producer, the two producers may wish to join together to share the risks and initial capital costs. The opportunity to add other shippers as original investors is just as financially attractive. If multiple users are to be serviced, general rail operations experience will be needed. Someone must invest in the additional rolling stock – the owner/builders would be expected to acquire their own rolling stock but additional equipment would be needed if rail services were to be offered to others. Rolling stock could be purchased or leased by other shippers, by other operators, or by the owner/builder in some cases.

An important set of issues that must be resolved is how such enterprises are structured and how the primary investors can be assured that they have sufficient control of the railway enterprise to ensure that service meets their requirements and that costs don't escalate. Many forms are possible – a) a company structure with investors represented on the board of directors in proportion to their investment where the larger company builds and operates the railway, or the larger company builds the railway and a rail operator is contracted to run the services; b) a joint venture company formed with share capital from the major users, one of whom is a railway operating company.

The investors will want to decide the structure of such companies. However, an important factor, and perhaps the controlling factor in building a railway for multiple users, is how the enterprise will be licensed and regulated. What are the interests of the state in the development of a railway that can provide service to multiple users? One would think that it might be harder to get a license as a special railway serving only the interests of the owner/builder; certainly it should not be harder to get a license for a private-multi-use railway than it is for a private single-use railway.

Government must also determine whether and how to assist in the formation of such companies. There are a number of ways to encourage formation of private sector railways:

1. Clear and transparent application and licensing processes
2. Speedy approval of licenses and applications
3. Clear and BRIEF regulations covering private railways – limiting regulatory oversight to basic technology standards, safety requirements, and licensing practices.

Government can provide further assistance in the formation of private railways in a number of other ways. For example, either national or LG units can help the private railway acquire land for right-of-way, stations and facilities. They can also enter into long term contracts with private entities for services that may be loss making but are socially desirable – such as passenger commuter services. LG might also purchase rolling stock for passenger services, and either contract for the operation of passenger services or form a local railway operating unit (which would have to be licensed) to provide those services.

8.7 SUMMARY AND PROJECTED FUTURE ENVIRONMENT

The strategic future of Indonesia's railways, as envisaged in the NRMP, includes a number of national government units to charter new railway lines. Within MoT, the DGR must have units to license railway operators, define and enforce technical standards regarding safety, specifications that must be met by railway lines that become part of the national network, to develop general technical standards for both single-purpose and multi-purpose railways, and to develop and promulgate national railway policy and plans. A separate governmental unit would be required for economic regulation, but could be placed within MoT outside DGR, as indicated in Section 5.1 of Chapter 5 above. LGs may need to form units to operate or contract for railway services under their jurisdiction. These units should not be involved in regulating technical or safety standards but would be designed to develop specification for local services and to manage the financial contribution of LGs to railway development and operation.

The rail infrastructure and operations segment of Indonesia's rail sector is likely to have a number of different entities. The largest (at least initially and probably for the foreseeable future) will be PTKA with at least three business units: Railway Infrastructure Operations, performing contract services to the DGR and perhaps to other private railway entities; a railway engineering and technical unit; and at least one railway operations unit managing drivers and operating staff and scheduling train services, in cooperation with the railway infrastructure operations unit.

The vision of the future, embodied in this Chapter, assumes that a number of private and semi-private railway entities have been established. One may be a single purpose railway for natural resources exploitation (say on Sumatra). Another may be a multi-purpose railway designed to provide rail services for one or more natural resources companies as well as providing passenger and other freight services (say on Kalimantan). In addition, several private sector rail operators will likely have emerged to provide rail operating services for mineral railways, commuter services, and specialised train services over the national railway infrastructure including, e.g. container trains. If there are a sufficient number of operators, equipment leasing businesses may also have been developed. A number of technical enterprises may also be active – for heavy track maintenance services, rolling stock maintenance services, and for the design and manufacture of railway products of all types (e.g., rolling stock, special track-work, signal system components, load restraint devices, railway wheels, rails, etc.).

Finally, a number of enterprises which provide services to railway customers will also be in place. These may include billing and information services, tour companies, food service companies, loading and unloading specialists, load aggregators, warehousing and logistics services.

Based on this evolving structure, the next sections define the strategic future of Indonesia's railways.

8.8 FUTURE RAILWAY DEVELOPMENT

Chapter 6 has described a medium term investment strategy for Indonesia's railways in general terms. Over the planning horizon of the NRMP, Indonesia's railways are likely to develop further. In this chapter, near and medium term developments are described, then longer-term developments are discussed. Railway development depends upon the regulatory environment, and the industry structure that is promoted by that regulatory structure.

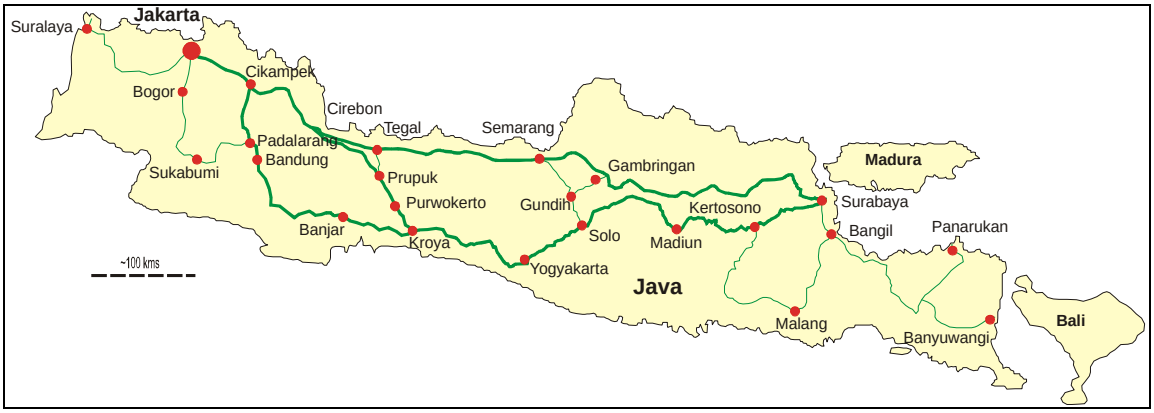
Railway Law no. 23/2007 mandates far reaching reforms in the structure of the rail sector. Experience in many countries indicates that rail sector reform requires a lengthy period to implement. Indonesia has the opportunity to move its rail sector reforms more quickly because of both, the new law, and also because of significant current interest in building new railways by private investors and developers. In addition, many potential new rail projects are in advanced stages of development (e.g., in Jakarta, the airport link line and the MRT lines).

Rapid progress in rail sector reform and development will require the adoption and implementation of a number of regulatory reforms and institutions. Here a transparent regulatory environment is assumed with relatively simple charter and licensing regulations. The DGR has promulgated a set of performance based safety standards, and regulations regarding infrastructure standards for both the national railway and for other railways that come under its purview (certainly multi-purpose private railways, other railways of national importance built with national funding sources), and a set of flexible regulations regarding infrastructure and safety standards for single-purpose railways.

8.8.1 Developments on Java

The initial National Railway Development Plan is based on upgrading the railway infrastructure on Java to higher-speed and axle-load standards. The map below, from Working Paper 4, shows the initial extent of this heavier duty network – marked by a thicker green line.

Figure 223: Java Enhanced Main Line Network



While it may take some years for this network to be fully enhanced, it is expected that over the next seven to ten years, the main lines will carry higher speed passenger trains. The Jakarta to Surabaya route will be served by trains that operate at 150-kph on straight segments. Passenger trains on this

line will operate with new rolling stock that is modern, comfortable, and is designed to maximise revenue-per-train. (This means that some trains that stop often may have dense seating, other trains, particularly those designed for longer distances, will have lower density seating but higher ticket prices.) Trains will operate hourly from Jakarta; during the peak periods they may operate at half-hour increments.

The main line to Bandung and on to Yogyakarta is capable of running at similar speeds on straight segments but since much of this line is in mountainous territory, average running speeds are lower overall. New rolling stock will be acquired for these services and, like the North Coast services, the equipment used on the train is designed to maximise revenue. Peak-hour trains from Jakarta to Bandung return have higher density seating more fitting suburban services. The higher speeds will make the trip to Bandung more comfortable and much more competitive with either automobiles or buses – although the fares will still be pitched to make money. The equipment will most likely employ tilting technology to achieve higher speeds even on the difficult terrain between the two cities.[64] Some trains operating beyond Bandung to Yogyakarta will be similar to the North Coast trains, though they, too, may employ tilting technology. While this type of rolling stock technology is more expensive to acquire and maintain, the additional speed (as much as 10-kph in curved territory) and reduced travel times may make it worthwhile.

New commuter services, some using new bi-level rolling stock will be developed in Jakarta, Surabaya, and Bandung. The new rolling stock used for these services will have been financed from both national and local funds. The selected rolling stock will, for the most part, have been designed to a common standard so that maintenance and parts' costs can be minimised and so that the rolling stock can be moved between cities to provide additional capacity for special events and to accommodate differing traffic growth rates.

Within the time frame of the NRMP, LGs in and around Jakarta will form a joint venture to specify and acquire new rolling stock (as in Sweden[65]) that can be commonly used across various jurisdictions and so that differing usage across the jurisdictions can be reflected in the rolling stock funding. This joint venture company will also provide maintenance facilities and services. Using this vehicle, improved commuter and suburban services will operate in Depok, Bekasi and Tangerang. Even Bandung could join the joint venture company to enhance the commuter services operating between Jakarta and Bandung.

The rail link from the airport will be operational, connected to the local commuter services, having been constructed by a private enterprise financed through several sources – LGs provided development rights for land parcels surrounding some of the stations served by the line; airport authorities provided partial financing from funds that were originally dedicated to providing parking facilities and to improving road access; by local developers eager to develop some of the land parcels surrounding the station complexes; and some financing from the national government. The utility of the airport line has been enhanced by the growing commuter services network serving Jakarta and by direct connections to intercity trains for onward travel to other major cities.

Surabaya will learn from Jakarta's experience and will probably form a local authority to build an airport link and to operate expanded commuter and suburban services to serve its growing population.

[64] Subject to an economic and feasibility analysis of similar technologies in other locations

[65] Reflecting experience from Storstockholms Lokaltrafik, a transit authority in Stockholm that provides rolling stock acquisition and maintenance services for a number of communities surrounding Stockholm. The equipment is common enough that it is interchangeable and commuter services can serve the commuting and suburban service needs of a number of communities surrounding Stockholm.

This enhanced network will facilitate the operation of a set of freight services – container trains, special purpose services carrying assembled automobiles between factory and final distribution yards in major cities, oil and bulk materials trains operating between ports and specialised terminals. While rail freight traffic on Java will grow during the time frame of the NRMP, it will still not have a significant market share. Even so, many thousands of trucks will have been removed from Indonesia's highways by the growing container and specialised freight services.

A new freight operator will have been created specialising in warehousing and logistics services. It will have acquired new high-capacity freight rolling stock that permits it to compete better with road transport and will have lined up contracts with major manufactures for logistics services operated from its larger rail-road logistics and warehousing centers. The freight operator started out building the logistics and warehousing centers and contracted with PTKA for freight services. LGs helped the effort by providing land and development rights for the warehousing and distribution centers. They also improved road access to the distribution centers to reduce congestion for local pick-up and delivery services.

After the logistics/freight operator acquired new freight rolling stock more suitable to the needs of its customers, it began acquiring locomotives designed for its needs – four-axle high-horsepower locomotives geared to move its freight trains at near passenger train speeds between warehousing/logistics centers.

The logistics/freight operator will continue to contract with PTKA-Infrastructure Services business for access rights to the rail network and for dispatching services, and will contract with PTKA-Freight Services for drivers, wagon inspection and other services. PTKA-Freight Services Unit will also continue to provide local pick-up and delivery services for some customers with freight sidings.

In the longer term DGR will commence planning for the development of a very-high-speed train network. This network will require a new railway line. A decision will have to be taken to build a standard gauge line to capitalise on the growing capability of and competition between manufacturers in China, Europe, and Japan for 250-kph train services. A preliminary long-term development plan will be laid out and DGR will slowly begin acquiring land for the new railway lines. It is expected that the line may be profitably built by 2030, as Indonesia's economy continues to grow rapidly.

8.8.2 Developments on Sumatra

Developments on Sumatra will be equally dramatic but driven more by private sector investment. After the main lines were enhanced and the infrastructure became more capable, private investors built a multi-user railway in Southern Sumatra that opened other mineral producing areas for development.

The regional government will work with the South Sumatra Railway unit of PTKA to develop air-lining plans – a review of the most difficult railway alignments to reduce grades and improve capacities. Based on this review, the government will help acquire the land needed to make the necessary improvements while the DGR arranges funding to construct the new lines and build bridges capable of higher axle-loads and larger loading gauges (physical size of wagons).

It is expected that a private company will build a single purpose railway for the movement of coal from mine to port. Part of this movement will be made over the upgraded national railway network. For these movements, the single purpose railway will assemble trains designed to move over the national railway network and deliver them to a siding where PTKA locomotives and drivers will pick them up and move the trains to the existing coal port. To enable this movement, the private investor will have to contribute some funding for the upgrading of national railway lines. These funds as well

as contributions from the regional government (some in the form of land), and specific funds for upgrading bridges and other infrastructure from the DGR must be sufficient to economically justify a significant investment in the national railway infrastructure operated by PTKA's Infrastructure Services Business unit.

Figure 24: Sumatra's Enhanced Infrastructure Rail Network

Initially, the privately built single purpose railway operator will deliver trains for onward movement by PTKA but later it may decide to invest in improved port facilities and integrate its mine-railway-port operations, buying additional locomotives and operating its trains directly from mine to port, using rolling stock that can be rotary dumped. PTKA's Operations Business unit can provide the drivers and manage operating activities for the single purpose railway.

For longer term development, the DGR will survey a new north-south railway alignment connecting South Sumatra Railway with the North Sumatra Railway lines. The regional governments, eager for the new line, will facilitate land acquisition and prepare to make contributions to the construction of the new railway line. A cape gauge line with 22.5 ton axle loads should be preferred as market research has shown that the railway will be passenger oriented. While the line is in planning, the DGR and LG units on Sumatra will plan how passenger services will be subsidised. Prior to letting any contracts, the DGR must conduct extensive feasibility studies, contract with outside firms to conduct the due diligence for the new line, determine how it will be financed and how its operating expenses will be subsidised. Agreements will have to be worked out between the various regional and national government units who form the authority which contracts for rail operations services. A contract should be negotiated with PTKA Operations Services unit for the operation of train services. While the initial equipment for the operation of new services will be financed by the Authority and will be government owned, PTKA's Operations Unit will contract for the acquisition of some new higher-speed rolling stock to provide commercial services.

The new railway line will become part of the national rail network and the infrastructure will be operated and maintained under an expanded agreement with PTKA's Infrastructure Services Unit.

Also, in the longer term, the DGR will start planning for the development of a connecting line between West Sumatra Railway and the new north-south railway line. However, difficult terrain makes this connection an expensive proposition and all parties must agree to wait to see how the new north-south line develops.

At the same time, LGs will be proceeding with the development of commuter and urban transport systems in Medan and Palembang. The commuter services will be integrated with the new north-south railway line and with the passenger services on those lines. Initially, much of the passenger patronage on the new line will be suburban and commuter services but intercity services are also to be offered. Some freight services may evolve as warehousing and logistics centers are developed.

8.8.3 Developments on Kalimantan and Sulawesi

In the time frame of the NRMP, Kalimantan may have both single-purpose railways and a joint venture multi-purpose railway. The single purpose railway would be a standard gauge line serving a specific mining development and connecting to a new port for coal exports. The multi-purpose railway joint venture might serve several mining developments and also provide freight and passenger services to communities on Kalimantan. Since there was no historic sunk investment, new railways on Kalimantan will likely be standard gauge. Railway lines extending from mining developments and ports to serve larger communities seeking suburban services may be built to a bit lighter standard.

The DGR should develop prospects for a railway on Sulawesi to reach mining deposits and serve local community developing around Makassar.

Figure 25: Kalimantan and Sulawesi

8.9 RAILWAY ENTERPRISES

During the period of the NRMP, it is expected that a number of new railway enterprises will be developed as the rail sector revival takes hold. The largest will still be the state-owned PTKA Railway, but PTKA will itself establish a number of business units to service growing railway developments.

8.9.1 PTKA Railway

The Infrastructure Services Unit will operate most of the national main-line railways. It will provide maintenance services, operate the signaling and dispatching centers, provide train scheduling and planning services and work closely with the DGR on developing specifications for new lines and for contractors performing capital repairs and major engineering services. Since the Infrastructure Services unit will be responsible for managing dispatching and train operations, as well as providing day-to-day infrastructure maintenance services, it will also be charged with developing renewal plans and for contracting for heavy maintenance and renewal works. PTKA's Infrastructure Services unit will be responsible for maintaining stations and other national railway assets. Some stations may be developed in conjunction with land developers who hold the development rights to land and buildings around some major city stations. In these cases, the PTKA Infrastructure Services unit will be responsible for specifying and maintaining passenger station portions of what are otherwise commercial buildings. It will do this in conjunction with developers who are responsible for developing the buildings – some of which include office towers, hotels, and other commercial establishments. The PTKA Infrastructure Services Unit will publish a Network Statement and maintain the information for ready public access. The Network Statement will describe the national railway network, the loading gauge of each segment, and establish access prices for the use of the infrastructure, with the approval and concurrence of the DGR. The network statement will also describe the conditions and procedures for receiving access and for developing train schedules over the network. The Statement will also have links to the PTKA Railway Operations Unit for access to locomotives, drivers, and other operating services and to other railway operators for ready access to the services they provide on a non-discriminatory basis.

PTKA's Railway Operations Unit will operate passenger and freight services over the national rail network. Some will be operated under PSO contracts with the DGR – these will include both passenger services and freight services that are in the public interest but not commercially self-sustaining. The PTKA Operations unit will provide operating services and staffing for stations as well as train inspections, wagon and locomotive inspections and repair services for day-to-day operations. The PTKA Operations unit will work with local communities to develop and operate commuter and suburban services and with the community authorities and its Rolling Stock Unit to specify and operate equipment appropriate to the services needed.

PTKA will also develop a Rolling Stock unit to provide rolling stock and equipment maintenance services to customers – both passenger and freight. EMU and DMU equipment for commuter and suburban services may be owned by local community authorities but some will lease the equipment from PTKA who can also provide maintenance services, including overhauls and renewal maintenance. The Rolling Stock unit will also own or lease freight wagons for freight customers who need railway equipment. In this activity, it must work closely with the Freight Division of PTKA's Railway Operations Unit which markets and prices the services. Customers can provide their own rolling stock and many who have long term well defined needs for rolling stock will do so (e.g., commuter service authorities, mining railways, perhaps oil companies among others). PTKA Rolling Stock Unit will be more than an equipment leasing company, it will also own and operate PTKA's workshops and perform maintenance services for other railway operators and commuter authorities through short and long-term contracts.

8.9.2 Private Railway Operators

A number of other railway operators will have developed as the rail sector becomes more competitive and service innovations evolve in the market place. Each rail operator must receive a License from the DGR and be certified as capable of operating railway services.

Some of these operators will be passenger services operators – providing operating services to local communities and for suburban services. The largest of these will be Jabodetabek, which will have separated from PTKA and become the responsibility of the Jakarta Area Commuter Services Agency, a multi-governmental authority set up to provide commuter services to Jakarta and its surrounding communities. Jabodetabek will operate commuter and suburban services trains in the Jakarta area, with services extending as far as Bandung, Tangerang, Depok and Bekasi. Jabodetabek will work with the PTKA Infrastructure Unit to develop the infrastructure needed to provide the required services. It may own some rolling stock, with financing for new equipment provided by the Jakarta Area Commuter Services Agency, with assistance from the MoT through the DGR's office. Other rolling stock will be leased, some from the PTKA Rolling Stock unit. In Jakarta, the Airport Link, a PPP, will be operated under contract by Jabodetabek – a contract it will have won in a competition with PTKA's Railway Operations Unit as well as other international rail service providers. The equipment for the Airport Link will have been provided by the Airport Link enterprise as a part of the development of that service. The rail infrastructure for the Airport Link will have become part of the national railway, maintained under contract by PTKA's Infrastructure Services Unit.

Other commuter authorities will have developed in Surabaya and in Bandung. In these cases, the authority will have gone to tender for railway operations services and maybe an international railway operator enterprise will win the tender to provide commuter services under fixed period contract arrangement. The local commuter authorities will remain responsible for the development and maintenance of some station properties (those which are not part of the national network, or were developed specifically for commuter services). Here, the local authorities may contract the maintenance of those stations to PTKA's Infrastructure Unit or the maintenance services may be part of the commuter services tender. The local commuter authorities can provide their own rolling stock, or lease it from the PTKA Rolling Stock Unit, or even from Jabodetabek (though this is not the business they are in, they may find it useful to rent out older equipment to supplement the fleet of growing commuter authorities.

In addition to rail passenger operators, several freight operators will be licensed. Some of these will have their own rolling stock and specialised equipment for the specialised services they are designed to render. Rail Operators may also lease rolling stock from PTKA or from railway equipment leasing companies which are evolving as the market develops.

The Single Purpose Railways on Sumatra and Kalimantan will own and maintain their own rolling stock. These companies must also be licensed as operators and their rolling stock maintenance practices must conform to the standards set by the DGR. Under their charter and licenses, Single Purpose Railways must also maintain their infrastructure to standards as determined by the DGR and remain responsible for operating safety. Like other rail operating companies, their operations, infrastructure, and equipment remain subject to inspection by the DGR's Inspectorate unit and must submit reports as established by the DGR and required of all railway operators, infrastructure and equipment ownership companies.

8.9.3 Rail Services Companies

In addition to railway operators, commuter authorities, and rolling stock leasing companies, a number of other railway services enterprises are likely to evolve over time. These include railway infrastructure maintenance enterprises – companies specialising in renewals, bridge strengthening,

soils stabilisation, and infrastructure contracting work. Indonesia already has a number of very competent civil engineering and construction companies; it is a small step to performing contract maintenance, renewals and other railway infrastructure work.

As the number of rolling stock owners and users expands, and as the DGR publishes rolling stock standards, the number of companies providing rolling stock leasing services is also expected to expand. There are a number of equipment financing services that will evolve as the private sector is permitted to enter the market for railway rolling stock. Investment banking and specialist investment companies may provide finance-leases for railway rolling stock, to permit railway operators and commuter authorities to acquire equipment as needed and then pay for it over time, like a home mortgage. Under finance-leases, title to the rolling stock passes from the financing company to the operating company when the final payment is made.

Operating lease companies are also likely to evolve. Operating leasing companies purchase railway rolling stock that is relatively universal (can be used in many places) and then lease it out to customers who use the equipment. Operating leases are very common with freight rolling stock since there are generally many potential customers; longer term leases are also somewhat common with passenger rolling stock in locations where there are a number of potential users of the equipment. Where there is only one user, leasing companies generally do not develop. The single user (usually a national railway) can often purchase equipment with a finance-lease but this is simply another version of debt financing and is typically provided by an investment bank. In Indonesia, as the number of independent railway operators increase, leasing companies will evolve to finance railway rolling stock. If equipment standards encourage a number of commuter and suburban authorities to specify and use similar equipment, it is possible that private companies may evolve to provide operating leases for this equipment. Similarly, if there are a number of locomotive users and locomotive specifications are relatively common, a locomotive leasing market may evolve as well.

Manufacturers of railway rolling stock will also enter a market that has a number of customers and a transparent bidding process. So, even though the market is relatively small at present, rolling stock manufacturers will evolve to produce rolling stock locally for a growing market. Should rail operators, leasing companies, and private rolling stock ownership develop, we would expect a growing market in rolling stock maintenance services. Such services may be provided by manufacturers initially; as the market grows a number of companies are expected to provide rolling stock maintenance services.

Station and back-office service companies are also likely to evolve. These are companies that will clean and operate stations, provide security services, sell and collect tickets, provide ticket vending equipment and so on.

As the rail market evolves and the number and variety of services increases, a number of new companies will be attracted to the market to provide the myriad of services associated with a vibrant and growing rail market.

8.10 SUMMARY STRATEGIC FUTURE OF THE INDONESIAN RAIL SECTOR

The key elements of the RMP are composed of several different features – some of them hard investments, other soft changes necessary to implement the railway Law no. 23/2007 and encourage growth in the industry.

The soft changes include issuance of regulations on railway charters, licenses, and technical specifications for infrastructure and rolling stock. They also include regulations regarding how the

national infrastructure is to be accessed and how it will be priced and controlled. Railways are expensive and the development of competing railway operators in existing national railway territory will initially be quite slow. New operators must sense the opportunity, feel relatively certain about the conditions under which they will operate, and then develop services they can market to customers. Only when they have some sense that the market exists and is interested will they make the investments necessary to develop a new transport business.

The first developments in opening the railway sector are likely to be via private single and multi-purpose railways were none currently exist. These will be adjunct services to mining or other production services that are the real focus of these developments. Once these railways have developed and there is some sense of the regulatory and commercial environment, other railway operators will test the market and begin to make the investments needed to revitalise the rail sector.

PTKA, Indonesia's state-owned national railway need not see these developments as a dreadful evolution of the market. The new private participants in the rail sector will be investors, bringing private investment to help revitalise the sector. A multitude of private enterprises seeking to provide specialised services and investments should be welcomed by PTKA as new partners in the development of Indonesian rail transport. PTKA will be responsible for operating and maintaining the nation's only integrated rail service, it will get investment help from private investors dedicated to using the infrastructure and needing operating and rail services expertise. A growing market will help PTKA more than any other factor or set of circumstances. The clarity from transparent and open standards, contracts, and agreements between PTKA and the DGR will make railways operate more efficiently and the competition, while affecting some of PTKA's services, will do nothing but expand the market if successful.

The physical side of the RMP is composed of a series of investments in the national railway infrastructure that will help modernise and increase the capacity of the existing network while also expanding it. The DGR's draft RMP laid out a number of investments for capacity improvements, the opening of closed lines, and for increasing commuter and suburban services in many local communities. Most of these investments should and will move ahead.

But, the focus of the NRMP in the near future should be on modernising and upgrading the major main lines of the existing railway network. The investment programs discussed in Working Paper 4 describe a major effort to improve the standard of principal main lines to increase axle loads, raise train speeds, increase loading gauge, and replace aging rolling stock with modern equipment that can take advantage these improvements. This includes higher-speed passenger equipment, capable of speeds of 150 kph or more on the North Island main line, new rolling stock designed for the relatively difficult terrain of the southern main lines that will permit increased speeds and improved passenger services once infrastructure standards have been raised. While the southern main line may not be capable of the same kinds of average speeds, improved infrastructure and more specialised rolling stock can improve average speeds significantly and make rail passenger services competitive over a wider area.

Indonesia needs to replace much of its rolling stock over the next 15 to 20 years, these investments might be shared with private investors if track standards can be improved and an encouraging regulatory environment put in place.

In addition to these investments, new railway developments should be encouraged on other islands. The same upgrading of standards will help develop the existing infrastructure in Sumatra but, given the separate nature of these railway lines, additional investment will be needed to fully develop rail transport. Here, Indonesia is already discussing a number of private single purpose railways. These developments should be advanced to enhance the growth of private multi-purpose railways where none now exist. The interconnection of the national network with these multi-purpose railways (and

the single purpose ones as well) should be encouraged – the value of networks increases with their extent and interconnectedness.

Government investment in the Indonesian rail network should be focused on adding capacity – both through the development of more double track segments as well as through enhancing and modernising the network. Network enhancements should provide greater axle loads, bi-level coaches, freight wagons with greater carrying capacity (such as bi-level auto carriers and perhaps, if the demand develops, double-stacked container services). It should also include modernising the train control and signaling systems to permit higher speeds, greater control of train movements and the elimination of mechanically operated signals and interlockings. Modern signal systems will also enhance the safety of operations. Along with these investments, greater public safety can be ensured by improving level-crossing protection, and by increasing the clearances afforded railway operations in urban areas – either through fencing or simply by moving urban developments farther from the railway right-of-way.

In the long term, Government investment will be needed to provide VHST passenger services. Here, a new infrastructure will be needed – separated from urban developments by elevation or by more permanent fences and fewer level crossings, closure of streets and highways, or the development of overpasses and underpasses to permit unimpeded rail operations. New rolling stock will also be needed for these new services. These investments are so large as to require some time to plan, develop and for the economy to grow sufficiently that more of the operating costs can be borne from passenger revenue.

The development of a connection between the railways in Sumatra should also be in the longer-term plans of the government; as should investments in commuter services developed in conjunction with local and regional governmental agencies.

These investment needs are so large that private investment is likely to be the force behind rail developments on Indonesian islands that do not currently have rail services. The DGR should make every effort to have private rail investments serve multiple purposes – mineral developments, freight services for other customers, and passenger services where these are in demand. The government may wish to joint venture with some private investors to extend a special purpose railway to urban areas to provide community services. The regulatory environment should encourage such development.