



Elevated Mass Rapid Transit System
through
Public Private Partnership

MANUAL
OF
SPECIFICATIONS AND STANDARDS

Government of Andhra Pradesh

HMR: SS: 01-2008

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Readers are advised to seek independent technical advice before embarking upon development of any Metro rail system whether based on any of the specifications and standards contained in this publication or otherwise. Contents of this book should not be construed as technical or legal advice.

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Foreword

The Government of Andhra Pradesh is to be complimented for undertaking the Hyderabad Metro Rail Project through Public Private Partnership (PPP). Besides attracting private capital in a public infrastructure project of fairly large dimensions, this would help in improving efficiencies to world-class standards and thereby reducing costs. It would be a path-breaking effort, by any standards, and its success would open up similar opportunities in India and abroad.

For awarding the Hyderabad Metro Rail Project within a competitive, efficient and economic framework based on international best practices, the Planning Commission had provided a Model Concession Agreement (MCA) for adoption by the State Government. The MCA is based on the Design, Build, Finance and Operate (DBFO) approach that requires the concessionaire to bear the responsibility for detailed design and engineering. However, the accountability for providing a safe and reliable rail system ultimately rests with the Government and the MCA, therefore, mandates a Manual of Standards and Specifications that the concessionaire must conform to.

Consistent with the DBFO approach, the MCA specifies the performance standards that would have a direct bearing on users of the rail system. The focus is on 'what' rather than 'how' in relation to the delivery of services by the concessionaire. This implies a shift from input specifications to output-based specifications that would provide the private sector with a greater opportunity to add value and reduce costs by innovating and optimising on designs in a way normally denied to it under conventional input-based procurement specifications. Nevertheless, a public infrastructure asset must conform with specifications and standards that provide the requisite assurance relating to its quality, reliability and safety. Hence, the need for this Manual.

The State Government had engaged reputed international consultants for developing the Manual of Specifications and Standards, which was reviewed by the Delhi Metro Rail Corporation that has a successful track record in building and operating urban rail systems. These efforts were supplemented by extensive consultations with experts and stakeholders. The Manual thus evolved would, by reference, form an integral part of the Concession Agreement for the Hyderabad Metro Rail Project and shall be binding on the concessionaire. Its provisions would be enforceable and any breach would expose the concessionaire to penalties, including termination of the concession. In that sense, the Manual would be a key document in safeguarding user interests.

The Manual reflects a delicate balance that would enable development of a world-class metro system while at the same time improving on its financial viability by optimising on costs and obligations. The objective is to provide a safe and reliable urban rail system through PPP, with least cost to the users and to the public exchequer. This Manual would also be useful for other States that wish to take up similar projects.

The project team for the Hyderabad Metro Rail Project, ably led by Mr. N.V.S. Reddy, is to be congratulated for producing this volume with the assistance of eminent experts. Having written the Model Concession Agreement on which the Concession Agreement for the Hyderabad Metro Rail System is based, I am particularly delighted with this excellent piece of work that will form an integral part of the contractual framework. I have no doubt that this Manual would go a long way in development of metro rail systems through PPPs – a modality that has become inevitable for attracting ever larger volumes of investment to this sector.



(Gajendra Haldea)
Adviser to Deputy Chairman,
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July 02, 2008

Preface

In the 'service' sector dominant post-industrial era, Indian cities have an excellent opportunity to be global "back office" hubs and to benefit from the resultant economic gains. However, the infrastructural facilities in Indian cities are grossly inadequate to make our cities globally competitive. An important factor that has to be kept in mind while building/strengthening the urban infrastructural facilities is that presently India is only at 30% urbanization level, but already the infrastructural facilities are under severe strain. As urbanization picks up a fast pace, improvement of these facilities would be a daunting task and the resources required would be of immense magnitude. Public Private Partnership (PPP) approach has been identified by Government of India (GoI) as an important mechanism to bridge the wide resource gap in this context and many of the state governments are also increasingly following this approach in tandem.

One of the main areas of urban infrastructural development is creation of a robust and efficient Public Transportation System. Building of rail-based Mass Rapid Transit Systems (MRTS) is a key component in this endeavour. However, development of modern Metro Rail Systems in India is a relatively new phenomenon and developing them in PPP mode is being attempted for the first time.

Development of Elevated Metro Rail System in some of the high density traffic corridors of Hyderabad city, the capital of Andhra Pradesh, in PPP mode has been undertaken by Government of Andhra Pradesh (GoAP) with partial financial assistance from GoI under the Viability Gap Funding (VGF) scheme. The scheme envisages a transparent and competitive bidding process based on international best practices, with a Model Concession Agreement (MCA) and Manual of Specifications and Standards (MSS) as the key documents. Both these documents are legally binding and the Concessionaire will have to conform to the provisions and specifications incorporated in them. Thus, while offering the Financial Bids, the bidders will have to keep the provisos of the specifications and standards indicated in the MSS in mind. The basic philosophy behind these key documents of the Design, Build, Finance, Operate and Transfer (DBFOT) format is that while the Concessionaire is responsible for all these DBFOT functions, the primary responsibility of ensuring a world class mass transit system which conforms to the performance criteria, technical specifications and safety standards squarely lies with the Government, which is the Concessions Authority.

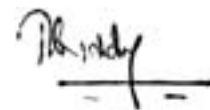
Metro Rail Systems are highly complex and intricately interdependent on a whole spectrum of technologies ranging from structural stability in civil engineering to the latest computerized signaling systems. While it is difficult to draw up and indicate Specifications and Standards to be relevant for a time span of over three decades in a fast changing technology scenario, it must nevertheless be stated that our team of dedicated technically-knowledgeable senior officers and technical experts, after several rounds of brainstorming sessions and deliberations, have evolved a reliable, implementable and pragmatic MSS. The Manual underwent several revisions and each revised draft was circulated to all the pre-qualified bidders of the Hyderabad project to accommodate their views, address their concerns and make the Manual technology-neutral.

The Manual has to be used in conjunction with Schedule-D of the MCA. However, to address project-specific requirements, the said schedule allows deviations, which are to be stated upfront. Such an enlisting of deviations would enable the bidders to appreciate the financial implications more accurately and offer competitive bids. Since the specifications and standards incorporated in the Manual are contractually binding on the Concessionaire, care has been taken to ensure that the Manual is consistent with the provisions of MCA.

With emphasis on “performance-based outputs” rather than the conventional “input” oriented specifications, the Manual allows scope for design innovation to optimize life cycle costs and reflects a fine balance between the interests of the Users of the system and those of the Concessionaire. This Manual can be used as a good technical document for building and operating a sophisticated elevated Metro Rail System in a sustainable manner.

While a large number of technical experts with varied and vast experience in rail technologies and operations have contributed to this volume, the contribution made by Mr. S.P. Iyer, Former Chief Engineer, Indian Railways, Mr. Satish Kumar, an eminent electrical engineer and Director, Delhi Metro Rail Corporation (DMRC), Mr. Mangu Singh, an expert civil engineer and Director, DMRC, Mr. R. Sivaramakrishna, Former Chief Signalling and Telecommunications Engineer, Indian Railways, Mr. S.K. Saha, Director (PPP), Planning Commission and Mr. G.P. Garg, Former Chief Commissioner of Railway Safety, GoI deserves special mention. I am also grateful to Mr. T. Stanley Babu, Former General Manager, Indian Railways and Adviser to Government and Dr. C.V.S.K. Sarma, Chairman, Hyderabad Metro Rail Limited and Ex-Officio Principal Secretary to Government of Andhra Pradesh for their active role and guidance in preparation of this Manual.

On behalf of Government of Andhra Pradesh (GoAP), I would like to express my gratitude to Dr. D. Subba Rao, Secretary, Ministry of Finance, Government of India (GoI), and Dr. M. Ramachandran, Secretary, Ministry of Urban Development, GoI, for encouraging us to undertake development of an elevated Metro Rail System spanning over 71 km in Hyderabad city in PPP mode. I would also like to thank Mr. Gajendra Haldea, Adviser to Deputy Chairman, Planning Commission for ably guiding us in preparation of this comprehensive Manual, which is a pioneering one for a PPP Metro rail project in this country. Finally, I am extremely grateful to Padmavibhushan Dr. E. Sreedharan, the legendary Metro rail veteran of India and Mr. P. Ramakanth Reddy, Chief Secretary, GoAP, for their constant encouragement and support.



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MANUAL OF SPECIFICATIONS AND STANDARDS

The Manual of Specifications and Standards is a comprehensive technical manual for Elevated Metro Rail Systems, published by Government of Andhra Pradesh.

Some of the independent technology experts who have gone through the Manual feel that this is perhaps one of the very few global attempts to prepare a technology neutral MSS for Metro Rail PPP Projects, which can allow design innovation and benefit from the resultant life-cycle cost competitiveness.

The Manual (a 260 page document) can be purchased from HMR office for Rs.500/-.

EXTRACT OF MSS ENVIRONMENTAL PROTECTION

2.6 Environmental Noise Standards

The following noise standards shall be followed:

2.6.1 Stationary Trains

- (a) **Noise level inside the car and cab**
The noise level inside the car and the cab shall not exceed 68 dB (A) with all Auxiliary Equipment operating at its greatest noise out put. The noise level shall be measured in the car along the center line between 1200 mm and 1600 mm above the floor and at a distance over 600 mm from the end of the car. The measurement shall be done as per ISO 3381.
- (b) **Noise level outside the Train**
The noise level outside the Train shall not exceed 68 dB (A) with all Auxiliary Equipment operating. The noise level shall be measured at a point 7.5 m from the Train centerline at a point between 1200 mm and 1500 mm above the rail level. The measurement shall be done as per ISO 3095.

2.6.2 Moving trains

- (a) **Noise level inside the car and cab**
The noise level when running at the scheduled maximum speed shall not exceed 72 dB (A). The noise level shall be measured in the car along the center line between 1200 mm and 1600 mm above the floor and at a distance over 600 mm from the end of the car. The measurement shall be done as per ISO 3381.
- (b) **Noise level outside the Train**
The noise level when it is moving at the scheduled maximum speed shall not exceed 85 dB (A) with all auxiliary systems operating. The noise level shall be measured at a point 7.5 m from the Train centerline at a point between 1200 mm and 1500 mm above the rail level. The measurement shall be done as per ISO 3095.

- 2.6.3 All noise levels listed above are in decibels referred to 20 micro Pascals as measured with “A’ weighting network of standard Type 1 sound level meter with time weighting F.

10.15 Environmental Protection Requirements

10.15.1 General

The Concessionaire shall implement the environmental protection requirements applicable to the Works.

10.15.2 Noise

10.15.2.1 The design of permanent works shall comply fully with following requirements:

- (i) All parts, including non-structural parts, of the structures shall minimize as far as practicable the radiation of noise due to vibration caused by the passage of Trains. Particular attention shall be paid to the minimization of noise at the low end of the acoustic frequency spectrum; and
- (ii) walls and slabs intended to contain airborne noise from the Trains shall be concrete of 200mm minimum thickness and shall be purpose-made, non-combustible and vibration absorbing / dampening, and shall utilise GRC panels or similar construction.

10.15.2.2 Allowable Range of Noise levels:

The allowable range of noise levels for different land uses are:

Residential	:	50-70 dbA
Business and Commercial	:	75 dbA
Hospitals	:	60 dbA
Rural	:	45-50 dbA

10.15.2.3 Provision of Noise barriers:

Noise shall be reduced to locally acceptable levels by provision of low vibration track forms, resilient base plates, design of parapet walls and treatment of their track side surface. They shall be supplemented by providing sound absorption material on sides of the viaduct superstructures. Additional noise barriers shall be provided in lengths of viaducts and bridges passing through sensitive residential or hospital zones. The choice of barrier type and their disposition along the parapet / railing shall be closely related to aesthetics of the structures.