

CONTECComissão de Normalização
Técnica**SC-04**

Civil Construction

Roadway and Pavement Design**1st Amendment**

This is the 1st Amendment to PETROBRAS N-2724 REV. B and it is used to alter the text of the Standard in the parts indicated below:

NOTE 1 The news pages with the performed amendments are placed in its corresponding positions.

NOTE 2 The amended pages, indicated the date of the amendment, are placed at the end of this standard, in chronological order, and shall not be used.

CONTENTS OF THE 1st AMENDMENT - 04/2014

- Section 2:

Exclusion of ABNT NBR 9780.

- Subsection 6.2.2:

Exclusion of ABNT NBR 9780.

Roadway and Pavement Design

Procedure

This Standard replaces and cancels its previous revision.

The CONTEC - Authoring Subcommittee provides guidance on the interpretation of this Standard when questions arise regarding its contents. The Department of PETROBRAS that uses this Standard is responsible for adopting and applying the sections, subsections and enumerates thereof.

Technical Requirement: A provision established as the most adequate and which shall be used strictly in accordance with this Standard. If a decision is taken not to follow the requirement ("non-conformity" to this Standard) it shall be based on well-founded economic and management reasons, and be approved and registered by the Department of PETROBRAS that uses this Standard. It is characterized by imperative nature.

Recommended Practice: A provision that may be adopted under the conditions of this Standard, but which admits (and draws attention to) the possibility of there being a more adequate alternative (not written in this Standard) to the particular application. The alternative adopted shall be approved and registered by the Department of PETROBRAS that uses this Standard. It is characterized by verbs of a nonmandatory nature. It is indicated by the expression: **[Recommended Practice]**.

Copies of the registered "non-conformities" to this Standard that may contribute to the improvement thereof shall be submitted to the CONTEC - Authoring Subcommittee.

Proposed revisions to this Standard shall be submitted to the CONTEC - Authoring Subcommittee, indicating the alphanumeric identification and revision of the Standard, the section, subsection and enumerate to be revised, the proposed text, and technical/economic justification for revision. The proposals are evaluated during the work for alteration of this Standard.

"This Standard is exclusive property of Petróleo Brasileiro S. A. - PETROBRAS, internal application and PETROBRAS Subsidiaries and shall be used by its suppliers of goods and services under contracts or similar under the conditions established in Bidding, Contract, Agreement or similar.

The use of this Standard by other companies / organizations / government agencies and individuals is the sole responsibility of the users.."

CONTEC

Comissão de Normalização
Técnica

SC - 04

Civil Construction

Introduction

PETROBRAS Technical Standards are prepared by Working Groups - WG (consisting specialized of Technical Collaborators from Company and its Subsidiaries), are commented by Company Units and its Subsidiaries, are approved by the Authoring Subcommittees - SCs (consisting of technicians from the same specialty, representing the various Company Units and its Subsidiaries), and ratified by the Executive Nucleus (consisting of representatives of the Company Units and its Subsidiaries). A PETROBRAS Technical Standard is subject to revision at any time by its Authoring Subcommittee and shall be reviewed every 5 years to be revalidated, revised or cancelled. PETROBRAS Technical Standards are prepared in accordance with PETROBRAS Technical Standard [N-1](#). For complete information about PETROBRAS Technical Standards see PETROBRAS Technical Standards Catalog.

Summary

Foreword.....	4
1 Scope.....	4
2 Normative References.....	4
3 Terms and Definitions.....	6
4 General Conditions.....	6
5 Specific Conditions.....	7
5.1 Road Accesses	8
5.2 Avenues and Roads.....	8
5.3 Parking, Loading and Unloading Areas	9
5.3.1 Parking for Passenger Cars.....	9
5.3.2 Parking for Tank Trucks.....	9
5.3.3 Tank Truck Loading and Unloading Areas.....	9
5.4 Administrative Areas	10
5.5 Storage Yards	10
5.6 Sphere Areas	10
5.7 Pipeways and Pipeline Rights-of-Way	10
5.8 Heliports and Helipads	10
5.9 Areas of Process Units.....	11
5.10 Scraper Areas	11
6 Sizing.....	11
6.1 Geotechnical Data and Traffic Estimate of Avenues and Roads.....	11
6.1.1 Avenues and Roads.....	11
6.1.2 Parking, Loading and Unloading Areas	11
6.1.3 Storage Yards	11
6.1.4 Heliports and Helipads.....	11
6.1.5 Area of Process Units	11
6.2 Flexible and Rigid Pavements.....	12
7 Signaling.....	12
8 Design Presentation	



8.1 Design Premises	12
8.1.1 Basic Design Data.....	12
8.1.2 Material Specification	13
8.1.3 Design Methodology	13
8.2 Calculation Notes	13
8.3 Drawings	13
8.4 Technical Specification	15
8.4.1 Description of Services	15
8.4.2 Material Specification	15
8.4.3 Execution and Control Procedures	15
8.5 Service Quantity Sheet	16
8.6 Service Notes	16
Annex A - Figures.....	17

Figures

Figure A.1 - Parking Area of Passenger Cars - Transverse.....	17
Figure A.2 - Parking Area of Passenger Cars - Oblique	18
Figure A.3 - Parking Area of Tank Trucks - Transverse.....	19
Figure A.4 - Parking Area of Tank Trucks - Oblique	20
Figure A.5 - Parking Area of Tank Trucks - Oblique	21

Table

Table 1 - Type of Pavement for Each Type of Stored Material	10
---	----

Foreword

This Standard is the English version (issued in 08/2013) of PETROBRAS N-2724 REV. B 11/2012. In case of doubt, the Portuguese version, which is the valid document for all intents and purposes, shall be used.

1 Scope

1.1 This Standard establishes the premises to be followed for the road and pavement designs of:

- a) road accesses;
- b) avenues and roads;
- c) parking, loading and unloading areas;
- d) administrative areas;
- e) storage yards;
- f) sphere areas;
- g) pipeways and pipeline rights-of-way;
- h) heliports and helipads;
- i) areas of process units;
- j) scraper areas.

1.2 This Standard applies to procedures beginning from its issue date.

1.3 This Standard contains Technical Requirements and Recommended Practices.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document applies.

Portaria [COMAER N° 256/GC5](#), de 13 de maio de 2011 - Dispõe sobre as Restrições Relativas às Implantações que Possam Afetar Adversamente a Segurança e a Regularidade das Operações Aéreas, e dá Outras Providências;

Portaria [COMAER N° 271/GC5](#), de 06 de junho de 2012 - Dispõe sobre as Restrições Relativas às Implantações que Possam Afetar Adversamente a Segurança e a Regularidade das Operações Aéreas, e dá Outras Providências;

Portaria [DNC N° 44](#) de 29 de Setembro de 1997 - Estabelece para os Aditivos Asfálticos de Reciclagem para Misturas à Quente o Regulamento Técnico DNC n° 04/97 e a Tabela que Acompanham à Portaria;

Resolução [ANP n° 30](#) de 09/10/2007 - Especificações de Asfaltos Diluídos de Cura Rápida e Cura Média - Regulamento Técnico N° 02/2007;

DNER [EM-364/97](#) - Alcatrões para Pavimentação;

DNIT [022/2006-ES](#) - Drenagem - Dissipadores de Energia;

DNIT [029/2004-ES](#) - Drenagem - Restauração de Dispositivos de Drenagem Danificada;

DNIT [031/2006-ES](#) - Pavimentos Flexíveis - Concreto Asfáltico;

DNIT [032/2005-ES](#) - Pavimentos Flexíveis - Areia-Asfalto a Quente;

DNIT [047/2004-ES](#) - Pavimento Rígido - Execução de Pavimento Rígido com Equipamento de Pequeno Porte;

DNIT [048/2004-ES](#) - Pavimento Rígido - Execução de Pavimento Rígido com Equipamento de Fôrma-Trilho;

DNIT [049/2009-ES](#) - Pavimento Rígido - Execução de Pavimento Rígido com Equipamento de Fôrma-Deslizante;

DNIT [137/2010-ES](#) - Pavimentação - Regularização do Subleito;

DNIT [138/2010-ES](#) - Pavimentação - Reforço do Subleito;

DNIT [139/2010-ES](#) - Pavimentação - Sub-Base Estabilizada Granulometricamente;

DNIT [140/2010-ES](#) - Pavimentação - Sub-Base de Solo Melhorado com Cimento;

DNIT [141/2010-ES](#) - Pavimentação - Base Estabilizada Granulometricamente;

DNIT [142/2010-ES](#) - Pavimentação - Base de Solo Melhorado com Cimento;

DNIT [143/2010-ES](#) - Pavimentação - Base de Solo-Cimento;

DNIT [144/2010-ES](#) - Pavimentação Asfáltica - Imprimação com Ligante Asfáltico Convencional;

DNIT [145/2010-ES](#) - Pavimentação - Pintura de Ligação com Ligante Asfáltico Convencional;

DNIT [146/2010-ES](#) - Pavimentação - Tratamento Superficial Simples com Ligante Asfáltico Convencional;

DNIT [147/2010-ES](#) - Pavimentação Asfáltica - Tratamento Superficial Duplo com Ligante Asfáltico Convencional;

DNIT [148/2010-ES](#) - Pavimentação Asfáltica - Tratamento Superficial Triplo com Ligante Asfáltico Convencional;

DNIT [149/2010-ES](#) - Pavimentação Asfáltica - Macadame Betuminoso com Ligante Asfáltico Convencional por Penetração;

DNIT [150/2010-ES](#) - Pavimentação Asfáltica - Lama Asfáltica;

DNIT [151/2010-ES](#) - Pavimentação - Acostamento;

DNIT [152/2010-ES](#) - Pavimentação - Macadame Hidráulico;

PETROBRAS [N-38](#) - Critérios para Projetos de Drenagem, Segregação, Escoamento e Tratamento Preliminar de Efluentes Líquidos de Instalações Terrestres;

PETROBRAS [N-381](#) - Execução de Desenhos e Outros Documentos Técnicos em Geral;

PETROBRAS [N-1602](#) - Construção de Pavimentos;

PETROBRAS [N-1645](#) - Critérios de Segurança para Projeto de Instalações Fixas de Armazenamento de Gás Liquefeito de Petróleo;

PETROBRAS [N-1674](#) - Projeto de Arranjo de Instalações Industriais Terrestres de Petróleo, Derivados, Gás Natural e Alcool;

ABNT [NBR 7207](#) - Terminologia e Classificação de Pavimentação;

ABNT [NBR 9781](#) - Peças de Concreto para Pavimentação.



NOTE For documents referred in this Standard and for which only the Portuguese version is available, the PETROBRAS department that uses this Standard should be consulted for any information required for the specific application.

3 Terms and Definitions

For the purposes of this document, the terms and definitions of contained in PETROBRAS [N-381](#), [N-1602](#), [N-1674](#) and ABNT [NBR 7207](#) are applicable, complemented by the definitions indicated in 3.1 to 3.7.

3.1

avenues

access and circulation roads for vehicles that cross the industrial facility entirely or almost entirely, whether North-South or East-West, with considerable traffic of vehicles. Roads placed beside main pipeways or pipe-racks are also deemed as avenues

3.2

roadway design

geometric design of avenues and roads intended for interconnecting and providing access to the various areas of an industrial unit or complex of industrial units, so as to ensure long-lasting stability for the safe and comfortable circulation of vehicles

3.3

pavement design

design of structure of the various layers of pavements of avenues and roads defined in the roadway design, so as to ensure long-lasting stability for the safe and comfortable circulation of vehicles

3.4

limited access roads

access roads where the normal traffic of motor vehicles is forbidden, being its use limited to situations in which safety measures are met. They shall be fitted with gates, rising barriers or chains

3.5

unit internal roads

internal access roads to process and utility units, intended to make the maintenance and firefighting easy

3.6

main roads

access and circulation roads for vehicles interconnecting various areas or units and which traffic of vehicles is moderate. Access roads that shall allow the passage of cargo handling equipment and access roads to product loading are also considered main roads

3.7

secondary roads

access and circulation roads for vehicles which surround process units, utility areas, tank basins, scraper areas, sphere parks, and which traffic of vehicles is limited to maintenance and emergency response exclusively for those areas

4 General Conditions

The provisions established below shall be complied with, complemented by the description of PETROBRAS [N-1674](#) Section 6.



4.1 The pavement of roads and areas shall be defined by types of use, containing minimum recommendations for avenues, main roads, secondary roads, parking areas, loading and unloading areas, industrial areas, accesses and intersections.

4.2 The roadway design shall consider the levels obtained in the earthwork design.

4.3 When choosing the type of pavement and its sizing, the local weather conditions shall be considered.

4.4 The design shall consider the materials available in the region and their technical and economic characteristics in order to be used.

4.5 The purpose of the facility for which the design is intended shall be considered.

4.6 The roadway design shall consider the indications provided by the layout plan or master plan, such as: location and destination of roads, yards and other areas to be paved.

4.7 The reservoirs of paving materials shall be defined according to the characteristics obtained in geotechnical investigations and shall be compatible with the design.

4.8 The description of all documents generated in the design shall be presented, as well as the reason for the adopted solutions.

4.9 The design shall consider traffic estimates based on the types of vehicles, axle load and frequency, and cover at least 2 alternatives for the traffic of heavy loads inside industrial units.

4.10 The pavement sizing shall consider the information obtained in geotechnical investigations.

4.11 Drainage devices in accesses and roads outside the limits of PETROBRAS shall be defined respecting the recommendations of the agencies responsible for maintenance of the sections.

4.12 Bridges, level crossings, viaducts, tunnels and trenches for passage of industrial piping shall be deemed to be special structures.

5 Specific Conditions

The following design criteria shall be adopted:

- a) compatibility among the various designs involved
- b) use of materials and constructive methods compatible with the regional characteristics and other parts of the job;
- c) ease of maintenance and possibility of expansion of paved areas;
- d) prevision of passage and movement of large equipment parts during the construction and assembly phase;
- e) desired quality standard and service life.