ASPHALT MIX DESIGN MANUAL

QUALITY CONTROL QUALITY ASSURANCE AND ACCEPTANCE

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CURRENT ASPHALT MIX, PRODUCTION & PAVING APPROACH

IT IS PRACTICE IN SA THAT AFTER SUCCESSFUL LABORATORY DESIGN OF A NEW MIX

- TRIAL PLANT MIXES ARE PRODUCED TO ASSESS THE PROPERTIES AT THE PROPOSED GRADING & BINDER CONTENTS
- PAVING TRIALS ARE DONE TO ASSESS THE WORKABILITY OF THE MIX AND ITS COMPARISON WITH THE PROPERTIES OF THE LAB & TRIAL PLANT MIXES

FINAL PLANT PRODUCTION & PAVING OF THE MIX COMMENCES ONLY AFTER SUCCESSFUL PLANT & PAVING TRIALS HAVE BEEN COMPLETED

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QUALITY MANAGEMENT PROCESS FOR ASPHALT MIXES

- **A COMPLETE QUALITY MANAGEMENT PROCESS IS REQUIRED FROM THE MIX DESIGN STAGE TO THE PAVING OF THE MIX**
  - TO ENSURE THAT THE VARIOUS STAGES TAKES PLACE IN A PRESCRIBED MANNER WHICH COULD GUARANTEE THAT THE SPECIFIED REQUIREMENTS ARE MET

- **A WELL DESIGNED MIX COULD BE CONSTRUCTED TO INFERIOR QUALITY SHOULD QUALITY MANAGEMENT PROCEDURES BE NEGLECTED OR OMITTED**

- **AN APPROPIATE QC/QA & ACCEPTANCE PROCESS IS OF UTMOST IMPORTANCE IN THE QUALITY MANAGEMENT PROCESS**

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LEVELS OF ASPHALT MIX DESIGN

3 ASPHALT MIX DESIGN LEVELS

- **LEVEL I: LOW TO MEDIUM VOLUME ROADS (<3 MIL E80's)**
  - VOLUMETRIC DESIGN WITH RECOMMENDED CONTROL POINTS FOR AGGREGATE GRADING AND TESTING OF MECHANICAL PROPERTIES
- **LEVEL II: MEDIUM TO HIGH VOLUME ROADS (3 – 30 MIL E80's)**
  - LEVEL I VOLUMETRIC DESIGN & PERFORMANCE-RELATED LAB TESTING TO SELECT OPTIMUM MIX DESIGN
- **LEVEL III: VERY HIGH VOLUME ROADS (>30 MIL E80's)**
  - LEVEL I VOLUMETRIC DESIGN & FULL SCALE LAB TESTING FOR ADVANCED PAVEMENT DESIGN & ANALYSIS

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PERFORMANCE-RELATED APPROACH

- **PERFORMANCE-RELATED APPROACH IS NEW IN SOUTH AFRICA**
  - INVOLVES RELATIVELY LENGTHLY PERFORMANCE-RELATED LABORATORY TESTING
  - NOT PRACTICAL TO REPEAT ON CONTRACT BASIS

- **ASPHALT MIX SUPPLIERS SHOULD HAVE A NUMBER OF CERTIFIED PERFORMANCE-RELATED MIXES**
  - MIXES SHOULD BE CERTIFIED FOR SPECIFIC APPLICATIONS & PERFORMANCE CHARACTERISTICS
  - CERTIFICATION WOULD BE VALID FOR 2 YEARS
- **PERFORMANCE-RELATED MIXES NOT CERTIFIED (PURPOSE-DESIGNED MIX)**
  - "CERTIFICATION-TYPE" TESTING PROCEDURE SHOULD PROCEDES THE QUALITY CONTROL PROCESS
  - SAME QUALITY CONTROL APPROACH SHOULD STILL BE FOLLOWED

APPROACH TO QUALITY MANAGEMENT

APPROACH TO QUALITY MANAGEMENT (QC/QA & A) DURING THE MIX DESIGN, PRODUCTION & PAVING PROCESSES DEPENDS ON THE LEVEL OF MIX DESIGN APPROACH FOLLOWED

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QUALITY MANAGEMENT PROCESSES FOR DIFFERENT LEVELS OF MIX DESIGNS

LEVEL I	LEVEL II & III
Laboratory stage Contract based mix design	Laboratory stage Certified mixes or purposed design mixes
	
Plant trial mix & trial paving	Trial paving
	
Field/site stage	Field/site stage

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QUALITY MANAGEMENT FOR LEVEL I MIX DESIGN

- **The approach followed during these mix designs are contract based**
- **Quality management process consist of:**
  - Laboratory mix design
  - Plant trial mix
  - Trial paving
  - Site paving

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QUALITY MANAGEMENT FOR LEVEL I MIX DESIGN

Laboratory mix design

- Selection & proportioning of binder, aggregate & filler to obtain the desired mix properties
- Mix design procedures
  - Chapter 5
- Final optimum mix defined in terms of the following parameters
  - BC, VIM, VMA, VFB, ITS, Dynamic creep, Semi-circular bending, air permeability & Modified Lottman

QUALITY MANAGEMENT FOR LEVEL I MIX DESIGN

Plant trial mix

- Optimum laboratory mix is manufactured in asphalt plant
- Mix parameters of the plant mix are assessed to verify laboratory mix design
  - Grading, BC, VIM, VMA, VFB, ITS, Dynamic creep, Semi-circular bending, permeability & Modified Lottman

QUALITY MANAGEMENT FOR LEVEL I MIX DESIGN

Trial paving is undertaken to assess field performance of mix

- Assess constructability of mix
- Test the properties of field samples
- Establish required compaction effort
- Establish production mix parameters
- Set tolerances for acceptance control

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QUALITY MANAGEMENT FOR LEVEL I MIX DESIGN

Field/site quality control

- The project mix is finalised after successful evaluation of the trial plant mix & trial paving
- The following mix parameters are monitored to assess compliance of the production mix with project mix during paving
  - Grading, BC, VIM, Density, layer thickness & levels

QUALITY MANAGEMENT FOR LEVEL II & III MIX DESIGN

- **The performance-related approach followed during these mix designs are closely associated with the concept of certified mixes**
- **Quality management process consist of following stages**
  - Mix certification
  - Trial paving section
  - Site/field paving

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QUALITY MANAGEMENT FOR LEVEL II & III MIX DESIGN

Mix certification

Performance-related parameters that will be certified

- Dynamic modules @ field voids
- Fatigue @ design voids
- Permanent deformation @ field voids
- Workability value
- Durability (TSR) (Mod Lottman)@ field voids

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QUALITY MANAGEMENT FOR LEVEL II & III MIX DESIGN

Note:

The quality procedures proposed for a certified mix is based on the assumption that if the material properties (binder & aggregate/filler) and mix characteristics (binder content & grading) do not change, then the performance-related parameters set for the mix should not differ significantly from the certified properties

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QUALITY MANAGEMENT FOR LEVEL II & III MIX DESIGN

Trial paving

- Evaluation of performance-related parameters will not be repeated during this stage
- The following parameters will be assessed and strictly controlled during trial paving
  - Grading, binder content, density & voids
- Permissible deviations of trial mix properties are shown in Table 37

QUALITY MANAGEMENT FOR LEVEL II & III MIX DESIGN

Site/field paving

- Parameters that should be monitored during production mix paving to ensure that performance-related properties are met
  - Grading, Binder content, Density & Voids
- Permissible deviations of production mix from the certified mix and required test frequencies are shown in Table 38

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TEST FREQUENCIES

PROPERTY	LEVEL I	LEVEL II & III
Binder content	6 per lot	6 per lot
Grading	6 per lot	6 per lot
Voids in mix (VIM)	2 per lot	
Density	4 per lot	4 per lot
Layer thickness	One days work	One days work

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TEST METHODS

Test methods to be used for evaluation of material properties, mix characteristics and performance-related parameters are shown in Table 39

- Different standards (BS, SANS, ASTM, EN, AASHTO & CSIR)

FACTORS AFFECTING QUALITY

Compaction

Most important factor to ensure performance-related properties are achieved.

Factors affecting compaction

- Material properties
- Environmental variables
- Site conditions
- Type of compaction equipment

FACTORS AFFECTING QUALITY

Compaction (2)

Best practices required

- Equipment selection
- Sequence of compaction
- Rolling patterns & speed
- Correct roller operation
- Timing from batching to paving
- Avoid over-compaction

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FACTORS AFFECTING QUALITY

Temperature

Temperature control is important

- Difficulty in achieving density
- Water permeability of mat
- Ageing of binder is affected

Temperature measurements to be taken on each load at plant & on site

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FACTORS AFFECTING QUALITY

Segregation

Avoid segregation of mix

- Variability in mix composition
- Finer fraction higher binder content
- Variation in density & voids
- Worse with large aggregate mixes

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FACTORS AFFECTING QUALITY

Functional mix acceptability

Functional performance indicators

- Surface texture
- Riding Quality
- Appearance
- Noise generation

Consult relevant documents/guidelines which cover the above aspects

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THANK YOU

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