

# Table of Contents – Asphalt

<b>Section 1 – Introduction to Asphalts</b> .....	Section 1-1
Asphalt Characteristics .....	Section 1-3
Asphalt Sources .....	Section 1-4
Petroleum Asphalt Production .....	Section 1-5
Typical Refining Process .....	Section 1-6
Asphalt Types .....	Section 1-7
Asphalt Uses. ....	Section 1-8
Asphalt Properties .....	Section 1-10
Physical Properties .....	Section 1-12
Handling and Storage .....	Section 1-13
Temperature/Volume .....	Section 1-15
Asphalt Volume Correction Table – 1 .....	Section 1-16
Asphalt Volume Correction Table – 2 .....	Section 1-17
Asphalt Volume Correction Table – 3 .....	Section 1-18
Asphalt Volume Correction Table – 4 .....	Section 1-19
Asphalt Volume Correction Table – 5 .....	Section 1-20
Asphalt Volume Correction Table – 6 .....	Section 1-21
Temperature/Volume Example .....	Section 1-22
Partially Filled Tank .....	Section 1-24
% Volume Table .....	Section 1-26
Partially Filled Tank Example .....	Section 1-27
<b>Section 2 – Asphalt Performance Grading</b> .....	Section 2-1
Grading of Asphalt Binder .....	Section 2-2
Old Asphalt Testing Equipment .....	Section 2-3
Performance Grading (PG) Asphalt Testing Equipment .....	Section 2-8
Asphalt Performance Grading (PG) .....	Section 2-9
PG Asphalt Tests .....	Section 2-10
PG Asphalt Testing Equipment .....	Section 2-11
Asphalt Performance Grading .....	Section 2-24
Performance Grade Table .....	Section 2-29
Table: Asphalt Binder Grades and Reliability for Selected Cities .....	Section 2-32
Example: Frontier PG64-22 .....	Section 2-34
Asphalt Performance Grading (Example) .....	Section 2-35
PG Asphalt Grade Adjustment .....	Section 2-36
Performance Grading (Example). ....	Section 2-37
Changing Grade of Binder. ....	Section 2-38
<b>Section 3 – Aggregates For PMP</b> .....	Section 3-1
Physical Properties. ....	Section 3-2
Texture .....	Section 3-3

Gradation -----	Section 3-4
Particle Size -----	Section 3-5
Aggregate Gradation -----	Section 3-6
Gradation -----	Section 3-7
Absorption -----	Section 3-8
Aggregate Tests -----	Section 3-9
ASTM D 5821 -----	Section 3-10
AASHTO T 304 -----	Section 3-11
ASTM D4791 -----	Section 3-12
Measuring Flat & Elongate Particles -----	Section 3-13
AASHTO T 176 -----	Section 3-14
Sand Equivalent Test -----	Section 3-15
AASHTO T 96 -----	Section 3-16
AASHTO T 104 -----	Section 3-17
AASHTO T 112 -----	Section 3-18
Crushing and Stockpiling -----	Section 3-19
Specifications -----	Section 3-20
Table 803.5.5-1 -----	Section 3-22
Table 803.5.5-2 -----	Section 3-23
Table 803.6.1-1 -----	Section 3-25
Table 803.6.2-1 -----	Section 3-26
Table 803.7-1 -----	Section 3-28
<b>Section 4 – Mix Design -----</b>	<b>Section 4-1</b>
Mix Design -----	Section 4-2
Mixture Characteristics -----	Section 4-3
Density -----	Section 4-4
Maximum Density -----	Section 4-5
Air Voids -----	Section 4-6
Voids in the Mineral Aggregate -----	Section 4-7
Asphalt Content -----	Section 4-9
Performance Properties -----	Section 4-10
Stability -----	Section 4-11
Durability -----	Section 4-13
Impermeability -----	Section 4-14
Workability -----	Section 4-15
Flexibility -----	Section 4-16
Fatigue Resistance -----	Section 4-17
Skid Resistance -----	Section 4-18
Mix Design -----	Section 4-19
<b>Section 5 – Marshall Mix Design -----</b>	<b>Section 5-1</b>
Mix Design – Marshall Method -----	Section 5-2
Procedure -----	Section 5-3
Marshall Graphs -----	Section 5-13

Marshall Mix-Design Criteria -----	Section 5-14
Percent Voids in Mineral Aggregate -----	Section 5-15
Mix Design- Moisture Resistance-----	Section 5-16
<b>Section 6 – Superpave -----</b>	<b>Section 6-1</b>
Superpave -----	Section 6-2
Gradation Requirements, Marshall and Superpave Mixes .... -----	Section 6-4
Aggregate Properties, Flexible Pavements -----	Section 6-5
Table 401.4.1-2 -----	Section 6-15
Table 401.4.1-3 -----	Section 6-16
Superpave Graphs -----	Section 6-20
<b>Section 7 – Mix Design Variables and effects -----</b>	<b>Section 7-1</b>
Mix Design Variable and Their Effects-----	Section 7-2
Aggregates -----	Section 7-3
Gradation -----	Section 7-4
VMA -----	Section 7-7
Crushed Faces -----	Section 7-8
Summary -----	Section 7-9
Adverse Effects -----	Section 7-10
Asphalt -----	Section 7-11
Excess Asphalt -----	Section 7-12
Insufficient Asphalt -----	Section 7-13
Temp. / Visc.-----	Section 7-14
High Temp. -----	Section 7-15
Low Temp -----	Section 7-16
Density -----	Section 7-17
<b>Section 8 – Production and Construction -----</b>	<b>Section 8-1</b>
Production-----	Section 8-2
Asphalt Mixing Plants -----	Section 8-3
Mixing & Compaction Temperatures -----	Section 8-8
Weather Limits -----	Section 8-10
Hauling -----	Section 8-13
Rollers -----	Section 8-16
Burner Fuels -----	Section 8-19
Spreading and Finishing -----	Section 8-20
Test Strips -----	Section 8-22
Compaction-----	Section 8-25
PMWC -----	Section 8-27
<b>Section 9 – QC / QA Specifications -----</b>	<b>Section 9-1</b>
Description -----	Section 9-2
Personnel Requirements -----	Section 9-3
Level of Control -----	Section 9-5
Table 401.4.23-1 -----	Section 9-6

Table 401.4.23-2 -----	Section 9-7
Job Mix Formula -----	Section 9-8
Mix Design -----	Section 9-10
Department Furnished Sources -----	Section 9-11
Table 401.4.1-2 Marshall and Superpave Plant Mix Properties -----	Section 9-13
Table 401.4.1-3 Percent Voids in Mineral Aggregate -----	Section 9-14
Gradation Requirements -----	Section 9-15
Testing Technicians Correlations -----	Section 9-16
Dispute Resolution -----	Section 9-20
Mix Design Correlation -----	Section 9-22
Mix Design Dispute Resolution -----	Section 9-24
Quality Acceptance -----	Section 9-26
Verification Testing -----	Section 9-27
Table MTM417.0 -----	Section 9-29
Table MTM 529 -----	Section 9-30
Definition of Lo -----	Section 9-31
Sampling -----	Section 9-33
Asphalt Sampling -----	Section 9-36
Pay Factor -----	Section 9-38
Table 401.5.3-3 -----	Section 9-40
Table 401.5.3-2. -----	Section 9-43
Basis of Payment -----	Section 9-44
Table 401.5.3-1. -----	Section 9-45
Pay Adjustments -----	Section 9-46
<b>Section 10 – Random Sampling Density -----</b>	<b>Section 10-1</b>
Random Sampling Density -----	Section 10-2
Density Random Number Selection Worksheet -----	Section 10-7
<b>Section 11 – Correlation of Testing Technicians for Core Densities-----</b>	<b>Section 11-1</b>
Correlation of Testing Technicians for Core Densities -----	Section 11-2
Procedure -----	Section 11-4
Correlation of Core Densities -----	Section 11-6
Cost Analysis -----	Section 11-8
<b>Section 12 – Bulk Specific Gravity of Compacted Bituminous Material</b>	<b>Section 12-1</b>
Bulk Specific Gravity T 166 -----	Section 12-2
Bulk Specific Gravity of Compacted Bituminous Material -----	Section 12-3
<b>Section 13 – Accuracy Verification of Electronic Balance -----</b>	<b>Section 13-1</b>
Verification of Accuracy of Electronic General-Purpose Balance -----	Section 13-2
Procedure -----	Section 13-3
Scales -----	Section 13-6
Balance Verification Worksheet -----	Section 13-7
<b>Section 14 – WYDOT Forms: E-45, E-46 -----</b>	<b>Section 14-1</b>

E-45----- Section 14-2  
E-46M ----- Section 14-3

**Section 15 – Practice Problems.** ----- Section 15-1  
Practice Problems ----- Section 15-2  
Compaction Pay Factors ----- Section 15-3  
Cost Analysis ----- Section 15-4  
Verification Testing (Aggregate Gradation) ----- Section 15-6  
Verification Testing (Density) ----- Section 15-9

**Section 16 – Seminar Tutorial** ----- Section 16-1  
Asphalt Seminar Tutorial ----- Section 16-2  
Density Random Number Selection Worksheet----- Section 16-8