2016

Ministry of Transport
Republic of Tajikistan

PAVEMENT REPAIR GUIDELINE

Japan International Cooperation Agency

FOREWORD

Pavement Repair Guideline was prepared through *The Project for Improvement of Road Maintenance in the Republic of Tajikistan (October 2013 to November 2016)* implemented by Japan International Cooperation Agency (JICA), under collaborative works with Ministry of Transport (MOT), Republic of Tajikistan. This guideline provides a guidance on pavement repair recommended considering to the availability of materials and equipment in Tajikistan as well as important lessons and experience learnt through a series of pilot project conducted during the project. It aims to support MOT's policy of pavement repair by the hot mix asphalt concrete, while the guideline captures important use of cold mix asphalt concrete. This document is intended for road sector workers involved in the repair and maintenance as well as a comprehensive manual to assist in educational efforts pertaining to pavement maintenance.

October, 2016

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Introduction

JICA Experts Team for the Project for Improvement of Road Maintenance aims to improve repair skills of engineers/supervisors of Gissar SETM and Kurgan Tyube SETM to be applied on existing roads under their jurisdictions. New asphalt plant, aggregate plant and other paving equipment were supplied by JICA to support such improvement in October, 2014. In January 2016, JICA and the Ministry of Transport agreed to extend the project duration until November of 2016 and to include Sogd SETM and Kulyab SETM as an additional target group.

This Guideline serves as a textbook for engineers and supervisors to conduct pavement repairs and rehabilitation/improvement works applying hot asphalt mixture This Guideline annexes many of technical materials supplied to project participants during trainings provided under the project and other information which will be useful even for young and promising engineers and supervisors entering the profession without deep knowledge and skills of applying hot mix asphalt.

This Guideline applies to all pavement repairs and rehabilitation/improvement works applying hot asphalt mixture in MOT controlled roads in Gissar, Kurgan Tyube, Sogd and Kulyab regions. In case of works in other regions, additional checks must be considered from climatic conditions to ensure suitableness of materials used.

This Guideline consists of Introduction, Part-1: Material Requirement and Part-2: Construction Requirement which serves as a paving operation manual.

1. Application Area

Guideline is in general limiting its scope of particulars as follows:

1) Climatic Zone — Zone-V in GOST 9218
2) Road Category — R-III, R-IV and R-V in GOST 9218(National and Local Road) Nos. of Lane=2lanes, Width of lane=3~3.5m
3) Coarse Aggregate — Crushed river gravel / Maximum size 20mm
4) Fine Aggregate — Natural River sand or blended material with natural sand and screening
5) Bitumen — Viscous bitumen BND60/90 for hot mix asphalt; Liquid bitumen MG70/130 for cold mix asphalt
6) Mineral Filler (Powder) — Cement or Lime stone powder
7) Application of mixture — Surface course, Binder course and Levelling course
8) Type of mixture — Hot Mix Asphalt and Cold mix Asphalt

2. Standard Reference

Following standards are referred for the preparation of Guideline:

1) Japanese Road Association -2001: Guideline for Design and Construction of Pavement
2) Asphalt Institute USA: Manual Series No.2 (MS2); Mix Design Methods for Asphalt Concrete
3) GOST 3344-83: Specifications; Crushed stone and slag sand for road construction
4) GOST8267-93: Specifications; Crushed stone and gravel from dense rocks for construction works
5) GOST 8736-93: Specifications; Sand for construction works
6) GOST 16557-2005: Specifications; Powder for asphalt mixtures
7) GOST 22245-90: Specifications; Road viscous bitumen

3. Terms and Definitions

In Guideline following terms are used with corresponding definitions:

1) Asphalt Mixture: Mixture of mineral materials (crushed gravel and sand with mineral powder) with bitumen combined in certain proportions and mixed

2) Aggregate: Aggregate shall consist of crushed river gravel, sand and other inert finely divided mineral aggregate. The portion of mineral retained the No.4 (4.75mm) sieve is coarse aggregate. The portion passing No.4 sieve and retained the No.200 (0.075mm) sieve is fine aggregate and the portion passing the No.200 sieve is mineral powder (filler).
3) Hot Mix Asphalt (HMA): Asphalt mixture using viscous bitumen and applied immediately after production at temperature not below 120 o C
4) Cold Mix Asphalt: Asphalt mixture using liquid bitumen accepted for long–term storage
5) Surface Course: Asphalt mixture used for top layer as wearing course in overlaying operation
6) Binder Course: Asphalt mixture used for bottom layer when asphaltic paving structure consists of two layers
7) Leveling Course: Asphalt mixture placed underneath surface course for making the thickness of surface course even as much as possible
8) Base Course: Base layer beneath the surface& binder course made of crushed stone, soil or aggregate stabilized by cement or bituminous materials
9) Job Mix Formula (JMF): End result of recommended mix design which includes aggregate gradation and asphalt binder content based on the laboratory design mix and actual plant mix
10) AASHTO: American Association of State Highway and Transportation Officials
11) ASTM: American Society for Testing and Material

Part-1: Material Requirements

1. Asphalt Mixture

1-1 Classifications

1) Asphalt mixtures (hereinafter - mixtures) are divided into following types depending on the viscosity of bitumen and conditions of use:
   Hot Type - produced using viscous bitumen and applied immediately after production at temperature not below 120 ^{o} C
   Cold Type - produced using liquid bitumen accepted for long-term storage and applied at temperatures not below 5 ^{o} C
2) Mixtures shall be classified and divided into following types depending on the maximum size of the mineral materials(aggregate) and its usage:
   Dense Type - with maximum aggregate size of 20 mm & asphalt content 5~7%
   Dense type shall be used for surface course.
   Coarse Type - with maximum aggregate size of 20 mm& asphalt content 4.5~6%;
   Coarse type shall be used for binder course.
   Fine Type - with maximum aggregate size of 13 mm
   Fine type shall be used for leveling layer with thickness of 2～3cm in the course of overlaying

1-2 Characteristic

1) Properties and characteristics of mixtures shall meet the requirements of this guideline.
2) Gradation for each type of mixture shall meet the requirements in Table 1.

Table 1 Grading Requiremments

Type of Mixture	Passing Percentage by weight(%)							
Sieve Size(mm)	19	13.2	4.75	2.36	0.6	0.3	0.15	0.075
1. Dense type:								
	95-100	75-90	45-65	35-50	18-30	10-21	6-16	4-8
2. Coarse type:								
	95-100	70-90	35-55	20-35	11-23	5-16	4-12	2-7
3. Fine type for Levelling course								
	100	95-100	65-80	50-65	25-40	12-27	8-20	4-10

3) Recommended content of bitumen and requirement of Marshall Test properties for HMA are shown in Table 2.

Table 2 Content of Bitumen Recommended And Requirement for HMA

Type of mixture	Content of bitumen (%) by weight	Marshall Stability (KN)	Void (%)	Flow (1/100cm)	VMA (Voids in Mineral Aggregate) (%)
Dense type	5.0~7.0%	4.9	3~6%	20~40	14 ～19
Coarse type	4.5~6.0%	4.9	3~7%	20~40	14 ～19
Fine type	6.0~8.0%	4.9	3~6%	20~40	Less than 22

4) When determining the content of bitumen for cold mix asphalt, it is recommended that increase of bitumen content by 0.1% may be made compared with the percentage of HMA mix design.
5) Properties of cold mixture shall meet the Table 3.

Table 3 Properties of Cold Mix Asphalt

Description	Requirement	Remarks
Air Void (%)	6~10%	
VMA (%) less than	20%	
Index of strokes by testing of caking(less than)	10 times	In accordance with GOST 12801

6) Temperature of Mixture
   Temperature of mixture while production shall be 145～155 degrees o C for HMA and 80～100 degrees o C for cold mixture.
7) Asphalt mixtures shall withstand the adhesion of the bitumen with mineral part of mixtures.
8) Mixtures should be homogeneous. The absolute value of the deviation of bitumen content in the mixture shall not exceed ± 0.5% by weight.

2. Aggregate

2-1 Crushed Stone
Crushed stone of river gravel shall comply with the requirements of GOST 8267 and GOST 3344.

2-2 Production of Mixture
Production of mixture shall use crushed gravel with following fractions:
20 ~13mm, 13~ 5mm, 5~ 0mm

2-3 Flat or Elongated Particles
Percentage of containing flat or elongated particles in aggregate shall not exceed:
25% for mixture Dense and Coarse Type
35% for mixture Fine Type
Test shall be in accordance with ASTM D4791.

2-4 Fractured Face
Aggregate shall contain at least:
70% by weight of individual pieces having two (2) or three (3) fractured face and
85% by weight at least one (1) fractured face

2-5 Abrasion Loss
Abrasion loss shall be less than 40 percent in accordance with AASHOTO T96 ‘‘Resistance to Degradation of Small-size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine’’

2-6 Strength and Frost Resistance
Strength and frost resistance of crushed gravel for mixtures shall conform to Table 4.

Table 4 Property of Aggregate

Designation	Requirement	Remarks
Strength (kgf/cm2)	800	
Abrasion	Ab-2	Requirement of GOST
Characteristic on Frost Resistance	F25	

2-7 Natural Sand
Natural sand and screening products of rocks shall conform to GOST 8736.
Content of clay particles identified by swelling method shall be less than 0.5%.

2-8 Storage
Aggregates shall be stored in such a manner as to prevent segregation, contamination or intermixing of the different aggregate sizes.

3. Mineral Filler

3-1 General
Mineral filler of mixtures shall conform to GOST 16557 or ASTM D 242 ‘‘Mineral Filler for Bituminous Paving Mixtures’’.

3-2 Portland Cement and Lime
Portland cement and hydrated lime shall be properly stored to prevent moisture. Lime or cement that is partially hard and contains lumps shall not be used and removed from the plant site.

4. Bituminous Material

4-1 Bitumen
1) General
   For production of hot mixtures, the viscous bitumen is used according to GOST22245 or ASTM D 946 ‘‘Penetration Graded Asphalt Cement for Use in Pavement Construction’’.
2) Cold Mixture
   For production of cold mixtures, the liquid bitumen is used according to GOST 11955.
3) Bitumen for HMA
   Bitumen used for HMA shall be bitumen with penetration grades 60/90.
4) Bitumen for Cold Mixture
   Bitumen used for cold mixture shall be bitumen with penetration grades 70/130
5) Vendor's certified test reports for bitumen shipped to the project shall be furnished.

4-2 Tack Coat/Prime Coat
1) Tack coat and prime coat conform to Table 5.

Table 5 Properties of Tack Coat/Prime Coat

Designation	Type of material	Application temperature(℃)	Application(liter/m^2)	
			Tack Coat	Prime Coat
MC-70	Medium Curing cutback bitumen	50～85	0.1～0.3	0.8～1.2

2) Bitumen Diesel Proportion
3) Tack coat/prime coat shall be produced by mixing bitumen and diesel with the proportion of bitumen 60% and diesel 40%.
4) Cut-Back
5) Material shown above shall be in compliance with AASHTO M82 ‘‘Cut-Back Asphalt (Medium-Curing Type)".
6) Liquid Bitumen
7) Liquid bitumen MG70/130 may be applied as Tack/Prime Coat material confirming its viscosity for appropriate spraying.

Part-2: Construction Requirements (Asphalt Paving Manual)

1. Introduction

This manual outlines repair of pavement, coating, placing/spreading and compacting method suited to the use of asphalt mixture i.e. surface course, binder course and levelling course.

2. Repair of Defect

2-1 Cracks

Cracks wide enough to be treated shall be cleaned out with compressed air and filled with a bituminous material such as viscous bitumen or cutback bitumen having a viscosity low enough to enable it to be poured into the cracks. Care shall be taken to ensure that bituminous material does not bridge across the crack at the surface.

Light sanding shall be carried out on the treated area to prevent traffic picking/peeling surplus bitumen.

2-2 Pot Holes/Edge Breaks

All loose material in pot holes to be repaired shall be removed before reinstatement. Holes shall be tack-coated and reinstated with cold mix or hot mix. Compaction shall be made by vibratory plate compactor.

2-3 Large Depressions

The area to be treated shall be cleaned by compressed air blow prior to the application of a light tack coat. The depression shall be then be filled up with cold mix or hot mix and compacted.

3. Tack Coat

3-1 General

This work shall consist of furnishing and applying bituminous material to a previously prepared surface prior to the application of surface course.

3-2 Equipment

Bitumen distributor or asphalt sprayer shall be used for application.

3-3 Cleaning Surface

The full width of surface to be treated shall be cleaned with a power blower(compressor) to remove loose dirt, moisture and objectionable material.

3-4 Application of Bituminous Material

Tack coat is sprayed on the surface of existing surface course.

Specified application ratio shall be as follows:

Tack coat----0.1～0.3 liter per square meter

Immediately after cleaning the surface, bituminous material shall be applied at the specified rate and temperature.

The tack coat shall be applied only when the surface is dry.

Following the application, the surface shall be allowed to cure without being disturbed for such a period of time as may be necessary to permit drying out and setting of the tack coat. Until the surface course is placed, tack coat shall be protected from damage.

3-5 Trial Spray Test

Before the actual application of tack coat, a trial spraying test is carried out to determine the applicable spraying rate with proper vehicle speed of distributor and spraying pressure.

To check the ratio of bituminous material actually applied, a sheet of 30 x 30 cm paper or steel plate which is previously weighed shall be prepared and laid on the surface of existing surface, and then it shall be weighed again after application of the coat.

3-6 Procedure of Spraying Tack Coat

1**)** Distributer

Distributor with hot oil heating chamber (6,000 litter tank, Max. spraying width: 2.6~3.7m) is prepared and filled with tack coat material at the stock yard near asphalt plant.

The application temperature is controlled between 50 ~85℃.

2) Cleaning and sweeping

The surface to be coated is free from mud, loose dirt, segregated material and any other foreign material. The cleaning is carried out by the use of a compressor and brooms. Surface to be tacked is maintained in dry conditions.

3) Preparatory work

Building paper or other appropriate material is placed over the end of the previous applications in order not to spray in excess of specified volume of coating materials.

4) Spraying

After cleaning work is ready, tack coat shall be sprayed using the distributor or hand sprayer with the speed and spray-pressure determined at the trial spraying.

5) Curing

Coated surface is protected against damage.Traffic is not permitted on the coated surface untill the treatment has been cured sufficiently.

4. Basecourse Material

The material shall be clean and free from organic matter,lumps of clay,or other deleterious substances. The material shall be of such nature that it can be readily laid and compacted without seggregation.
When river gravel is used for basecourse material, it is preferable that gravel may be crushed by crushing plant and sieved.When river gravel is used without crushing,maximum size of particle may be 1/2 of the thickness of basecourse.Bigger size particle must be eliminated.
Completed base course shall be maintained in acceptable conditions at all times until prime coat is applied.

5. Prime Coat

5-1 General

This work shall consist of the preparation for and application of a bituminous prime material to a previous prepared base course. It is noted that prime coat shall not be applied for overlay works or remedial works.

5-2 Weather Limitation

Prime coat shall be applied only when the surface to be treated is dry and when the weather is not foggy or rainy.

5-3 Equipment

Bituminous material shall be sprayed by distributor or hand sprayer.
Nozzles shall be arranged to give a uniform spray and tested prior to spraying.

5-4 Application Ratio

Spraying shall be carried out not later than 12hours after the surface has been prepared.
Application rate shall be 0.8~1.2 liter per square meter.

5-5 Blotting Sand

Blotting material shall be of clean dry sand and spread in the amount required to absorb any excess bituminous material and to protect the primed surface. After blotting, proper curing time shall be required.

6. Hot Asphalt Mixture

6-1 Job Mix Formula

Before staring works, Job Mix Formula (JMF) shall be determined. During the preparation of the job mix design, adjustment of the cold bin feeder speed and revision of the proportion of aggregates based on hot bin sieve analysis shall be made in order to obtain the most suitable formula.

6-2 Equipment

1) Aggregate Crushing Plant

Aggregate crushing plant having capacity of 35ton/hour shall be utilized for the production of aggregates. Production sizes are 20-13mm, 13-5mm and 5-0mm respectively.

Opening of jaw crusher and cone crusher shall be adjusted and maintained to produce proper and consistent size of aggregates. Mesh opening of vibratory screen shall be maintained periodically to prevent from choking in order to provide appropriate gradation of aggregates.

2) Asphalt mixing Plant

Mixing plant shall be a batch type having sufficient capacity to provide a continuous supply of asphalt mixture to site. Cold aggregate feeder shall be adjusted being capable of delivering the maximum number of aggregate size required in their proper proportion.

3) Hauling equipment

Dump trucks used for hauling asphalt mixture have tight, clean and smooth metal beds. To prevent the mixture from adhering to them, the truck bed is lightly coated with a minimum amount of paraffin oil, soapy water, lime solution or other approved material. Each truck has a suitable cover to protect the mixture from adverse weather. To ensure that the mixture is delivered to the site at the specified temperature, covers must be securely fastened.

Total numbers of required dump truck is projected based on the target production rate for each day and hauling distance from asphalt plant to laying site. Speed limit of the trucks must be taken into consideration in terms of safety.

4) Asphalt Paver

Asphalt mixture is spread /placed by asphalt paver.

Wheel type Paver which has a paving width of 2~4.5m is used.

The paver has a receiving hopper of approximate 4 tons of mixture to permit a uniform spreading operation. The hopper is equipped with a distribution system to place the mixture uniformly in front of the screed without segregation.

The screed effectively produces a finished surface of the required evenness and texture without tearing, shoving or gouging the mixture.

Before starting the spreading operation, screed shall be pre-heated by propane gas burner heating system.

5) Compaction Equipment

Macadam roller shall weigh not less than 8tonnes.Pneumatic tire roller shall weigh not less than 12tonnes (gross mass) having not less than seven wheels. Each tire shall be kept inflated to the specified operating pressure such that the pressure difference between any two tires shall not exceed 0.3 bar.

6) Utility tools

Enough number of small utility tools such as rake, gas burner with torch, wheel barrow and shovel shall be provided and be ready for use at all times for the quality works to be performed.

6-3 Spreading/Placing

1) Paver Setting

Timber shall be set below screed taking account of shrinkage factor. Shrinkage Ratio (i.e. ratio of compacted thickness against loose thickness) shall be considered depending on the thickness of asphalt mixture placed.

2) Temperature at Spreading

The temperature of the mixture at the time of placement is within the temperature range of 130degree (℃) and 160 degree (℃).The temperature is monitored by inserting a dial type thermometer into the mixture.

3) Thickness and cross slope is controlled by an adjust-man using adjust- stick and level ruler.

On areas where irregularities or uneven or less thickness are appeared, the mixture is raked spreading additional material by skilled rake men in order to keep the specified thickness. Sieving men to sieve the material on the top of mixture immediately after finishing the rectification and before compaction is arranged.
4) The compacted thickness of asphalt layer in general shall not be less than 1.5 times the maximum size of aggregate.

6-4. Compaction
1) Compaction
After spreading, the mixture is thoroughly and uniformly compacted by rollers.
The surface is compacted as soon as possible when the mixture has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving.
The speed of roller is at all times sufficiently slow to avoid displacement of the hot mixture and effective in compaction. Any displacement occurring as a result of reversing the direction of the rollers or from any other cause is corrected at once.
To prevent adhesion of the mixture to the roller, the wheels is equipped with a scraper and kept properly moisture but excessive water is not allowed.
Rollers shall not be permitted to stand on the finished surface until compaction has been completed and the asphalt material has cooled to ambient temperature.
In areas not accessible to the roller, the mixture is thoroughly compacted with vibration plate compacters or hand driven/guided rollers.
Combination of macadam roller, pneumatic tire roller, tandem roller, if available, and vibratory plates shall be adopted for compaction operation.
2) Manner of Compaction
Compaction will be set up in three stages
Initial rolling is carried out with macadam roller and the second rolling with pneumatic tire roller.
Final/finished rolling is carried out in order to erase tire marks.
Initial rolling is carried out at temperature 110℃to140℃.
Final rolling is completed before the temperature of the mixture falls below 80 degree ℃.
Compaction is carried out from the lower edge of spread mixture in order to prevent the lateral movement of mixture.
In order to give a clean uniform edge, it is required that initial compaction is up to the edge via Macadam roller for initial (breakdown) rolling with paving staff on stand-by to correct any displacement or shortage of material thereof. Next, when the edge slope is confirmed by the lead rake man, the Pneumatic tire roller will compact up to the edge one time and subsequently come back for another pass with his most outside tire riding on the edge slope. Once complete, the Pneumatic tire roller will continue his normal compaction pattern and move onto the next section.
For areas adjacent to structures, a plate compactor is prepared for initial compaction.
Standard numbers of passes are shown in Table 6 below: however, actual suitable numbers of passes shall be determined based on the density obtained by core sampling when trial paving is conducted.

Table 6 Standard Numbers of Passes

Construction Procedures	Asphalt Mix Temperature (°C)	No. of Passes	Rolling Speed(km/h)
Initial Rolling (Macadam Roller)	140 ～ 110	2 passes	2～3km/h
Secondary Rolling (Tire Roller)	130 ～ 90	7 passes	4～5km/h
Finishing Rolling (Macadam Roller)	> 80	2 passes	5～6km/h

6-5 Joints
For overlay surface course, longitudinal joint is at the location of centerline.
Transverse joint is straightly cut off, cleaned and coated by tack coat, this work shall be completed before starting the spreading work.
Longitudinal and transverse joint shall be made in a careful manner so that well bonded and sealed joint are provided for the full depth of the layer. No asphalt material shall be placed against previously rolled material unless edge is vertical or has been cut back to a vertical face.

Cold joint portion shall be heated up using gas burner before hot mix asphalt is placed.

6-6 Leveling Course

In case depression of existing pavement has big area based on the level survey, leveling course may be placed in such area in order to average the thickness of surface course. Leveling course may be spread by hand or motor grader in case the area is wide enough.
It may be preferable to apply fine type mixture if the thickness is thin.

6-7 Weather Limitations

HMA is placed only when the surface is dry, when the weather is not rainy and ambient aerial temperature is above 5 degrees (℃)

6-8 Opening for Traffic

Section of newly overlay work is protected from traffic until the asphaltic mixture is cooled to 50 degrees (℃).

7. Cold Asphalt Mixture

7-1 General

Cold asphalt mixture may be in general applied for pothole repair works and leveling course. Cold mixture may be also utilized as surface course in the area where hot mix asphalt is not available due to the constraint of distance and transportation duration from the asphalt plant.

7-2 Storage

Cold mixture shall be stored in the open air in summer season, but in closed warehouses or under canopy in winter time.

7-3 Application

Cold mixture shall not be applied if the volume of heavy traffic may be more than 100 vehicle per day.

8. Quality Assurance

8-1 Quality Control

1) Laboratory

Field laboratory equipped with utilities shall be installed adjacent to asphalt plant for conducting routine quality controles where following equipment are furnished which were supplied by JICA in 2015 for Gissar and Kurgan Tyube and will be furnished in 217 for Sogd.
Marshall Stability test equipment(Test machine,compaction hammer,water bath,mould etc)
Sieve test equipment(sieves,digital balance)
Forced Air Convection Oven
Core Drilling machine with core bit.
Thermometer
Measuring devices
Laboratory technicians shall be stationed at laboratory for conducting routine quality controls.
Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition.

2) Sampling and Testing

Plant- produced asphaltic mixture shall be tested for stability, flow and air voids on a lot basis. Sampling shall be from material deposited into trucks at the asphalt plant or from trucks at the job site.

3) When delivering hot mixture, a lot consist of the weight of mixture of the same mix proportion produced at one plant during oneday.
4) Quality control is examined with following characteristics:
   - Temperature of produced mixture: on every dump truck
   - Gradation (Hot Bin sieve analysis):one time per day
   - Marshall test (Marshall Stability and Flow, VMA, Air Void):one time per day

5) The density of mixture after compaction shall be not less than 95% of the Marshall Density. Density shall be checked by φ100 core taken by core drill. Frequency of sampling shall be every 1,000m2.
6) Diagram showing the sequence of routine activities shall be indicated inFigure 1.
7) Quality nonconformance/defect

When observing quality nonconformance/defect, it shall be necessary to check whether problem arises from day– to- day basis QC test (sieve analysis, combined gradation, Marshall test) data at plant.
In case the quality of bitumen is concerned, it shall be necessary to check the quality by conducting properties test of penetration and softening point.
Laboratory technicians may identify the causes of nonconformance/defect from the results of each test.

8) Periodic monitoring shall be conducted at least once a month, also in each changing of materials used for production of mixtures.
9) When delivering of mixture to site, each vehicle shall be accompanied by the docket where mentioned:

-name of plant;
-address and name of site;
-date and time of production;
-temperature of mixture;
-type and quantity of mixtures.

8-2 Test Methods

Test shall be in accordance with following GOST or ASTM standards.

1) GOST standard
(1) Mixtures: tested according to GOST 12801
(2) Crushed stone of gravel and rocks: tested according to GOST 8269.0 and GOST 3344
(3) Natural sand and rock screenings: tested according to GOST 8735
(4) Mineral powders: tested according to GOST 16557
(5) Bitumen: tested according to GOST11501, 11503, 11505, 11506, 11507, 11508, 18180
(6) Marshall test: conducted in compliance with VSN93-73 paragraph 7.32

2) ASTM Standard
(1) Bulk Density (Unit Weight) and Voids in Aggregate: ASTM C29
(2) Materials Finer than 75μ (No.200) Sieve in Mineral Aggregate by Washing: ASTM C 117
(3) Specific Gravity and Absorption of Coarse Aggregate: ASTM C 127
(4) Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in Los Angeles Machine: ASTM C 131
(5) Sieve Analysis of Fine and Coarse Aggregate: ASTM C 136
(6) Total Evaporable Moisture Content of Aggregate by Drying: ASTM C 566
(7) Sampling Aggregate: ASTM D 75
(8) Sampling Bituminous Paving Mixtures: ASTM D 979
(9) Mixing Plants for Hot-Mixed Hot –Laid Bituminous Paving Mixtures: ASTM D 995
(10) Fine Aggregate for Bituminous Paving mixtures: ASTM D 1073
(11) Bulk Specific Gravity and Density of Compacted Bituminous Mixture Using Paraffin –Coated Specimens: ASTM D 1188
(12) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures: ASTM D 2041
(13) Bulk Specific Gravity and Density of Non-Absorptive Mixture: ASTM D 2726
(14) Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures: ASTM D 3203
(15) Liquid Limit, Plastic Limit and Plasticity Index of Soils: ASTM D 4318
(16) Preparation of Bituminous Specimens Using Marshall Apparatus: ASTM D 6926
(17) Marshall Stability and Flow of Bituminous Mixtures: ASTM D 6927

9. Safety Requirement

9-1 References

Below are the references with regard to safety:

GOST12.1.004-91: Standard system of labor safety& Fire safety: General requirements

GOST12.1.005-88: Standard system of labor safety: General sanitary-hygiene requirement to the air environment of working areas
GOST 12.1.007-76: Standard system of labor safety: Harmful substance. Classification and general safety requirement
GOST 12.3.002-75: Production process: General safety requirements
GOST17.2.3.02-78: Nature protection, Atmosphere: Rules of establishing permissible emissions of harmful substances by industrial enterprises

As for materials for the production of mixtures (crushed gravel, sand, mineral powder and bitumen), the nature of hazard and the degree of impact on the human body shall be of low-hazard substances according to GOST 12.1.007.

The environmental air in working area for production of mixture shall satisfy GOST 12.1.005.

For production and paving of mixtures, general safety requirement shall comply with relevant regulations.

Extreme care shall be taken during the heating process, since cutback bitumen is flammable.

9-2 Ttraffic Control

The nature of the works requires that public traffic pass over lengths of road while under repair. High standard of road safety for all road users during construction shall at all times be ensured. Regulation of traffic flow shall be necessary since overlay construction occupies one lane of carriageway.

Utmost caution shall be exercised to traffic control and collision of heavy equipment or public vehicles with workers during paving operation.

Traffic signs, safety facilities together with traffic control personnel shall be furnished when and where necessary.

Emergency lighting facilities shall be prepared in case night falls during paving works.

Part-3: Use of Reference Documents

1. Objectives of Reference Documents

The pavement repair works are consists of several stages such as planning, material / equipment procurement, mixing at asphalt plant, delivery, quality control and paving. The reference documents shown below are included in the guideline to facilitate such works as well as continuous training for the manual users.

2. List of Reference Documents

Table 7 List of Reference Documents

Reference Number	Objectives of documents	Name of Document	Standard Forms and Charts	Examples	Power points	Manual/ Reports
Reference -1	Training	1.Crushing Plant			○	
		2.MixDesign of AC			○	
		3.What is Asphalt mixing Plant			○	
		4.Manpower at AP			○	
		5.Quality Control			○	
		6.Material Control			○	
		7.Prectical Advice from experience			○	
		8.Maintenance of Machine			○	
		9.Construction Planning			○	
		10.Pavement Method			○	
		11.Maintenance and Repair of Pavement			○	
		12.Quality Control at site			○	
		13.Safety			○	
		14.Marshall Stability test			○	
		15.Mixing Design Part1			○	
		16.Asphalt mixing Design Part2			○	
		17.Sieve Analysis			○	
		18.Check Points of Daily Q.C		○		
Reference -2	Construction Management (Method Statements and Construction Data Sheet) See Figure 1	1. Method Statement	○	○		
		2. Tack/Prime coat check sheet	○	○		
		3. Delivery ticket	○	○		
		4. Asphalt Mixture Delivery Log Book	○			
		5. Diagram of Asphalt mixing plant	○			
		6. Reason of Bad Mixture	○			
		7. Flow of Quality control	○			
Reference -3	Quality control See Figure 1	1.Quality Control Manual				○
		2. Sieve Analysis(1,2bin)	○	○		
		3. Sieve Analysis(3bin))	○	○		
		4. Combined gradation		○		
		5. Marshall Stability Test	○	○		
		6.Core Density	○	○		
		7.Conbined Gradation	○	○		
		8.Density and Water Absorption Test(Coarse aggregate)	○	○		
		9.Density and Water Absorption Test(Fine aggregate)	○	○		
		10.Theoretical Density	○	○		
Reference -4	Pilot Project Reports	1.Report on Pilot Project#1(2014)				○
		2.Report on Pilot Project#2(2015)				○
						○

3. How to use the Reference Documents

The objectives of the reference documents are shown in Table 8.

Table 8 Objectives of reference documents

	Name of Documents	Objectives of the Documents
Reference -1 Power point for Training	1.Crushing Plant	To transfer the important knowledge to new engineer
	2.MixDesign of AC	
	3.What is Asphalt mixing Plant	
	4.Manpower at AP	
	5.Quality Control	
	6.Material Control	
	7.Advice from my experience	
	8.Maintenance of Machine	
	9.Planing of construction in Japan	
	10.Pavement Method	
	11.Maintenance and Repair of Pavement	
	12.Quality Control at site	
	13.Safety	
	14.Marshall Stability test(Revised)	
	15.Mixing Design Part1	
	16.Asphalt mixing Design Part-2	
	17.Sieve Analysis	
	18.Check points of Daily Q.C	
Reference -2 Construction Management	1.Method Statement	To plan and carryout the job successfully.
	2. Tack/Prime coat check sheet	To ensure the application rate of Tack or Prime coat
	3.Delivery ticket	Can be used for yourself to Know Quality and others
	4.Asphalt Mixture Delivery Log Book	Can be used for yourself to Know Quality and others
	5. Diagram of Asphalt mixing plant	To explain the flow of aggregate, filler and bitumen at AP for new engineers.
	6. Reason of Bad Mixture	To find out the reason of bad mixture
	7.Flow of Quality control	To explain the flow of daily Quality Control for new engineers
Reference -3 Quality control	1. Quality Control Manual	Format for Asphalt mixing design and/or daily quality control
	2. Sieve Analysis(1,2bin)	
	3. Sieve Analysis(3bin))	
	4.Combinned gradation	
	5.Marshall Stability Test	
	6.Core Density	
	7.Conbined Gradation	
	8.Density and Water Absorption Test(Coarse aggregate)	
	9.Density and Water Absorption Test(Fine aggregate)	
	10.Theoretical Density	
Reference -4 Report	Report on Pilot Project#1	Record of the pilot project and lessons learnt
	Report on Pilot Project#2	

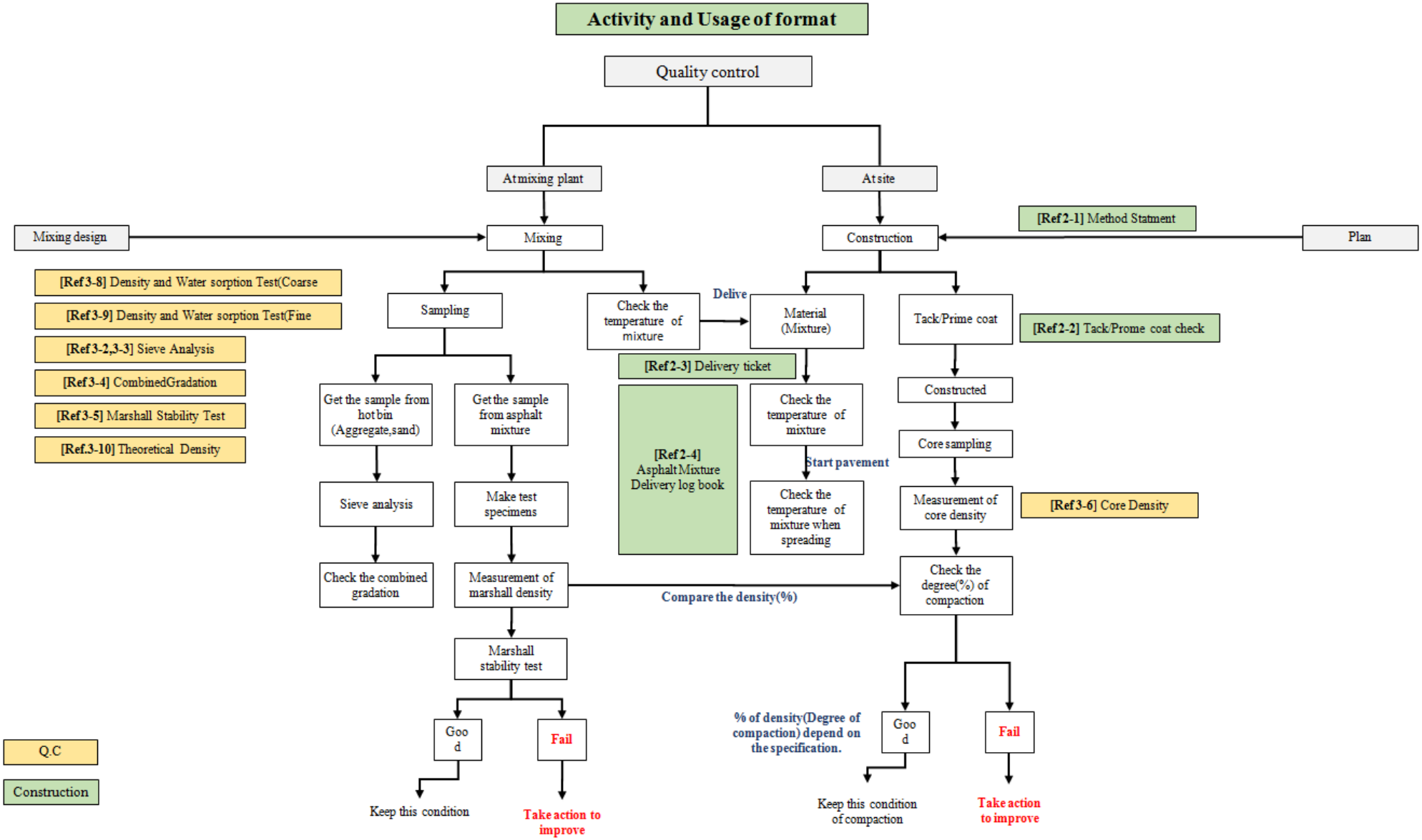


Figure 1 Work Flow and Choise of Forms to Use

Reference Document 1

Training

Training Materials for Asphalt Production, Work Managment and Quality Control

Training program for pavement and pavement repair

a. Management of Asphalt Mixing Plant

1. Crushing Plant	How aggregates are produced.
2. Asphalt Mixing Design	procedure –From the sampling of materials to the Job mix design.
3. Asphalt Mixing Plant	Components and Procedure.
4. Manpower planning for Asphalt Mixing Plant	What is the duty?
5. Quality Control	What kind of tests and document are required.
6. Material Control	Balance and Order
7. Advice from my experience.	What is important for producing.

b. Maintenance of machine

1. Daily Inspection and Maintenance	Greasing ,Check before starting.
2. Periodic Maintenance	Replacement of filters, Oil change, Operation manual.

c. Pavement construction and repair

1. Construction planning	Typical contents in plan.
2. Pavement method	Material order, Machinery and procedure.
3. Maintenance and Repair of pavement	Type of maintenance and Repair.
4. Quality control at site	What is required to keep good quality.

d. Safety

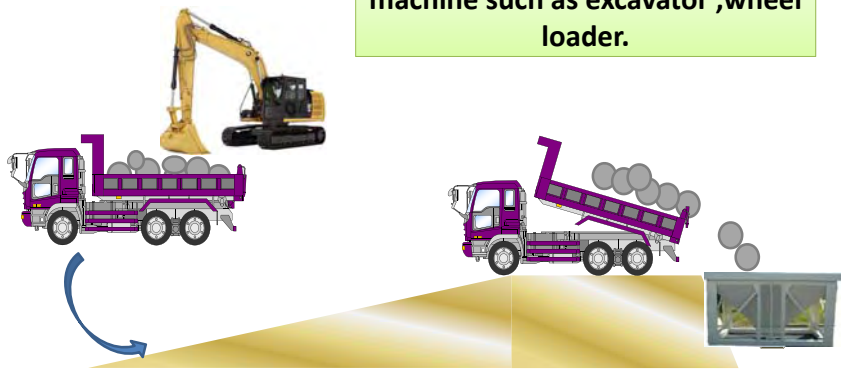
e. Evaluation of training

1.CRUSHING PLANT

Produce base material and aggregate for Bituminous mixture and/or Cement concrete

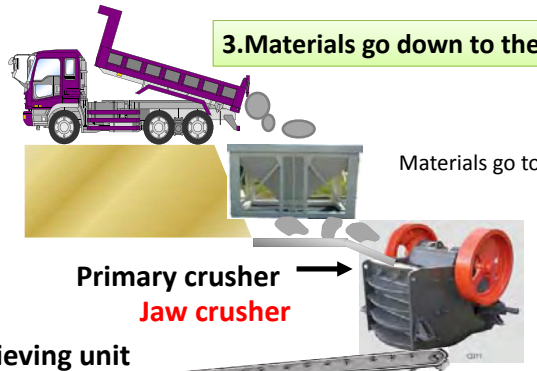
FLOW1,2

1.Load the materials by loading machine such as excavator ,wheel loader.



2.Feed the material to the hopper

FLOW3,4



3.Materials go down to the Jaw crusher.

Materials go to the sieving unit

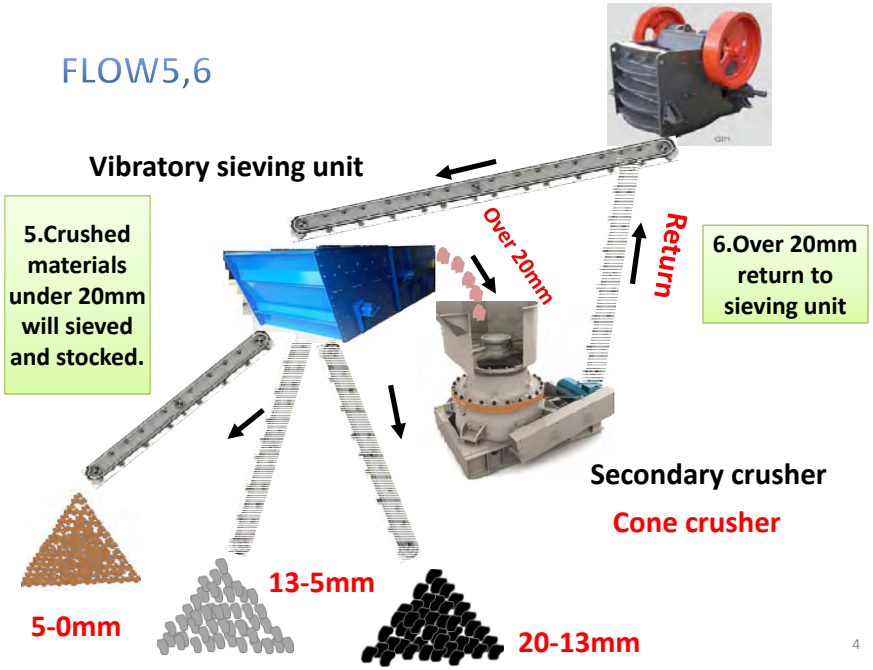
Primary crusher

Jaw crusher

Vibratory sieving unit

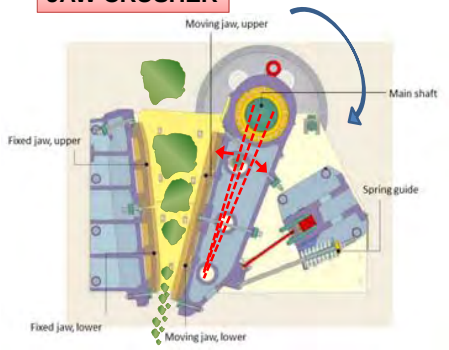
4.Crushed materials go to sieving unit.

FLOW5,6



TYPE OF CRUSHER

JAW CRUSHER

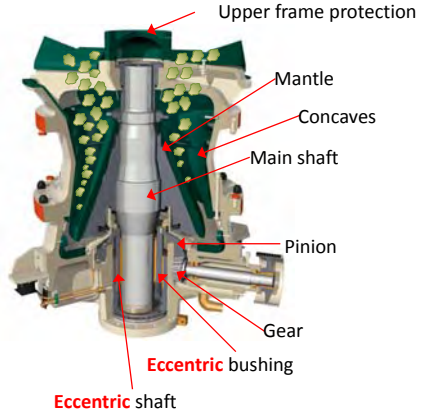


JAW CRUSHER consist of two jaws. One fixed and the other reciprocating. The opening between them is largest at the top and decreases towards the bottom. The pitman moves on an eccentric shaft and swing lever swings on center pin. The rock is thrown between two jaws and crushed by mechanical pressure.

Jaw crushers are classified on the basis of the position of the pivoting of the swing jaw

- **The swing jaw is fixed at the upper position**
- **The swing jaw is fixed at the lower position**
- **The swing jaw is fixed at an intermediate position**

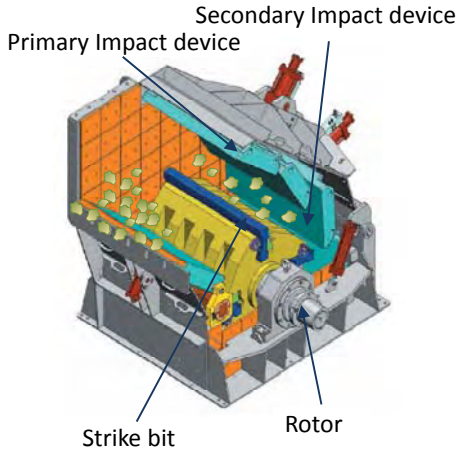
CONE CRUSHER



A cone crusher breaks rock by squeezing the rock between an **eccentrically gyrating spindle**, which is covered by a wear resistant mantle, and the enclosing concave hopper. As rock enters the top of the cone crusher, it becomes **wedged and squeezed** between the **mantle** and the **concave**. Large pieces of rock are broken once, and then fall to a lower position (because they are now smaller) where they are broken again. This process continues until the pieces are small enough to fall through the narrow opening at the bottom of the crusher.

Hopper attached on a corn crusher to receive the material to be crushed.

IMPACT CRUSHER



When the **IMPACT CRUSHER** works, the motor drives the **rotor** of the impact crusher rotate with a high speed. When the materials get into the area which the hammers effect, under the impact function of the hammer at a high speed, materials are thrown to the **impact device** above the rotor continuously. And then the materials are rebounded from the impact liner to the area where the hammers effects for re-crushing, then discharged from the discharge port. Users can adjust the space between Impact Rack and Rotor Support to get the expected size.

Ref 1-1

SCREEN(SIEVING UNUIT)

Horizontal Screens

- Vertical and horizontal amplitudes.

- Horizontal vibration conveys aggregate along screens, vertical vibration ensures fast and accurate sieving.

2. (ASPHALT)BITUMINOUS MIXING DESIGN

Uses OF ASPHALT HOT MIXTURE

- Highways
- Airfield
- Port facilities
- Parking lot
- Recreational facilities
- Hydraulic structure
- Recycled material

FLOW CHART OF MIXING DESIGN

STEP 1

1. Mixing design in laboratory.

STEP 2

2. Determination of Job mix design

3

1. Mixing design in laboratory.

a. Select the Materials

b. Characteristic Test of Materials

O.K

NO

c. Sieve test of aggregate and sand

d. Determination of combined grading

e. Determination of asphalt content

a. Select the Materials

Components of Asphalt Hot Mixtures

- 2 or 3 size of aggregates — 20-10, 10-05, 05-00
- Sand — Coarse sand /Fine sand.
- Filler — Cement or lime powder
- Asphalt(Bitumen) — Specified penetration
- Additive(if required)

b. Characteristic Test of Materials

Required test in Specification-1

- Aggregate
  - Water absorption test
  - Specific gravity
  - Los Angeles abrasion test
  - Test for soundness of aggregates by use of sodium sulfate
  - Flakiness Index
- Sand
  - Water absorption test
  - Specific gravity
- Filler
  - Specific gravity

Required test in Specification-2

- Asphalt(Bitumen)
  - Penetration (25℃)
  - Softening point℃
  - Ductility (15℃)
  - Solubility in Trichloroethylene(% by weight)
  - Flashing point℃
  - Thin Film Oven Test (% mass change)
  - Penetration of Residue (%)
  - Viscosity (60 ℃)
  - Specific gravity(Density) (15℃)g/cm3
  - Kinematic Viscosity（120℃,150 ℃,180℃)

ASPHALT（BITUMINOUS）MIXING DESIGN

Materials have to meet all requirements of SPECIFICATIONS!!

Materials which do not meet the requirements will be REJECTED

⇩

Find another material and carryout all tests again.

c. Sieve test of aggregate, sand and filler

This test can be done after the characteristic test, because selected materials(aggregates) may be rejected if they do not meet the requirements of specifications.

d. Determination of combined grading

Specification covers the grading range(upper and lower limit) for each types of mixtures.

⇩

Determine the mixing proportion of each aggregate, sand and filler to get the near center grading of the grading range. Combined grading can be calculated as below.

Calculate as below.

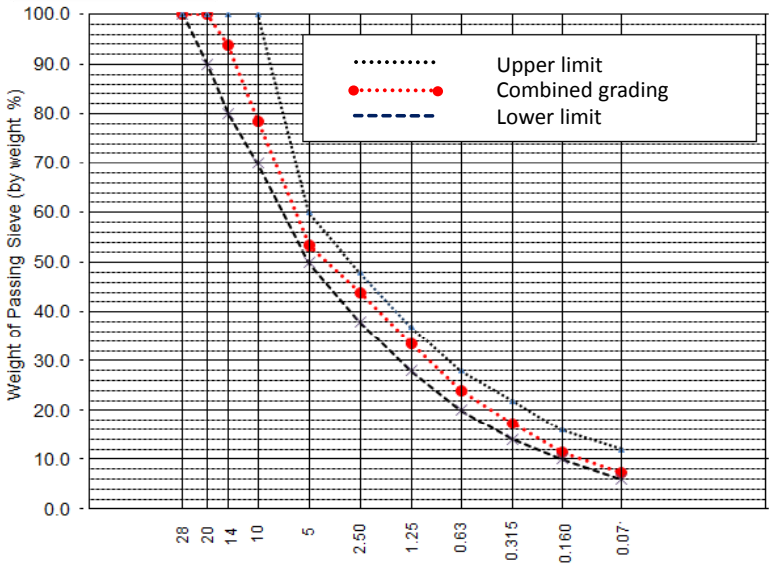
Sieve Analysis

Material		28	20	15	10	5	2.5	1.25	0.63	0.315	0.16	0.071
(20-10)		100.0	100	76.3	23.2	4.8	2.1	1.8	1.2	0.8	0.5	0.4
(10-5)		100.0	100	100	93.9	18.3	5.8	3.3	2.8	2.1	1.2	0.5
(5-0)		100.0	100	100	100	93.4	78.3	58.7	38.9	28.4	18.7	12.3
sand		100.0	100	100	100	100	94.3	68.3	47.2	26.9	12.6	0.5
Filler		100.0	100	100	100	100	100	100	99	94.1	81	72.9

Calculation of combined grading

Material	Proportion		28	20	15	10	5	2.5	1.25	0.63	0.315	0.16	0.071
(20-10)	26		26.0	26.0	19.8	6.0	1.2	0.5	0.5	0.3	0.2	0.1	0.1
(10-5)	24		24.0	24.0	24.0	22.5	4.4	1.4	0.8	0.7	0.5	0.3	0.1
(5-0)	34		34.0	34.0	34.0	34.0	31.8	26.6	20.0	13.2	9.7	6.4	4.2
sand	12		12.0	12.0	12.0	12.0	12.0	11.3	8.2	5.7	3.2	1.5	0.1
Filler	4		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.8	3.2	2.9
	100												
Combined grading			100.0	100.0	93.8	78.5	53.4	43.8	33.5	23.9	17.4	11.5	7.4
Range of grading			100 ~ 100	90 ~ 100	80 ~ 100	70 ~ 100	50 ~ 60	38 ~ 48	28 ~ 37	20 ~ 28	14 ~ 22	10 ~ 16	6 ~ 12
Target passing			100.0	100.0	90.0	85.0	55.0	43.0	32.5	24.0	18.0	13.0	9.0

Grading curve



e. Determination of asphalt content

- 15* pieces of Marshall test specimens are made to determine proper asphalt content.

*5 deferent asphalt content with same proportion of aggregate/sand/filler x 3peace for each=15

These specimens are tested to obtain the followings.

1. Density (Bulk density.)
2. Marshall stability
3. V.M.A: Voids in the Mineral Aggregate
4. V.F.A: Voids Filled with Asphalt
5. Air Void
6. Flow value

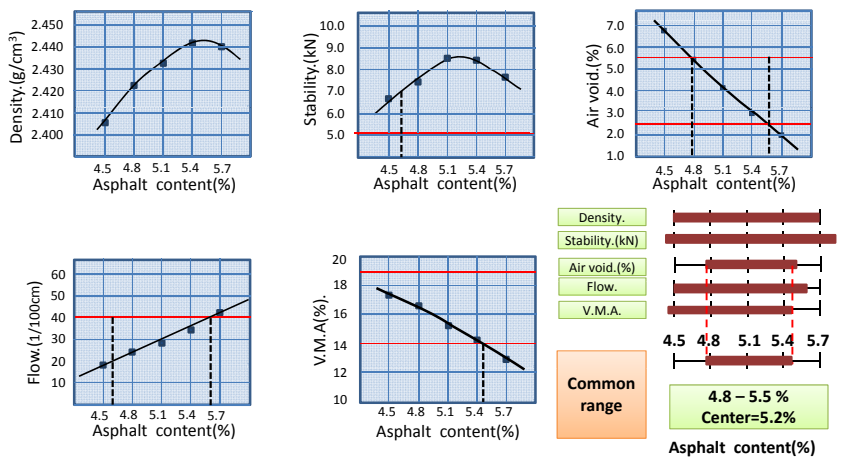
To be Continued

From the result above, optimum asphalt content(%) is derived based on the following method.(Example)

The summery of the Marshal test result (example)

Asphalt content(%)	Density	Air void(%)	V.M.A	Stability	Flow
4.5	2.406	5.3	17.5	6.7	18.0
4.8	2.422	4.2	16.4	7.3	24.0
5.1	2.432	3.3	15.2	8.5	29.0
5.4	2.442	2.5	14.1	8.4	34.0
5.7	2.440	1.8	12.7	7.6	42.0
Requirment		2.5-5.0	14-19	more than 5	Less than40

From the table above, optimum asphalt content(%) is derived.
(Example: Dense type, continues graded, Type-B, class-Ⅱ)



Mixing design in laboratory is completed.

2. Determination of Job mix design.

a. Determine the speed of the each cold bin feeder.

b. Take samples from hot bin

c. Sieve test of the materials from hot bin.

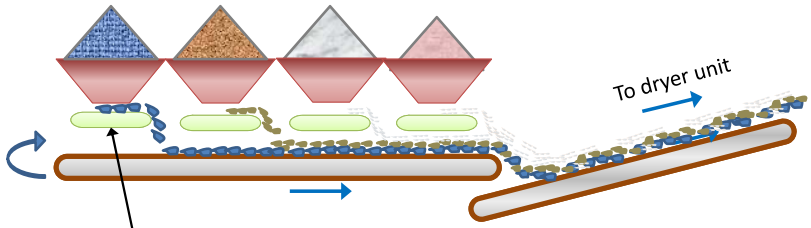
d. Determine the proportion of the aggregate in hot bin.

e. Product the mixture and take sample.

f. Check the Stability, air void and others.

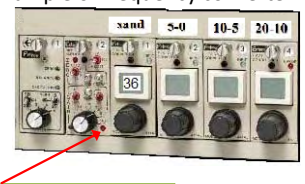
g. Trial construction. → Construction

a. Determine the speed of the each cold bin feeder.



FEEDER : Speed can be controlled by frequency converters.
By changing the frequency, feeder speed changes **Steplessly**.

Example of frequency converter.



Adjust the frequency by this knob.

Continue.

Find out the proper frequency of each feeder.

Maximum Production volume per hour of your Plant → 600kg/batch x 3600sec/60sec = 36.0t/hour

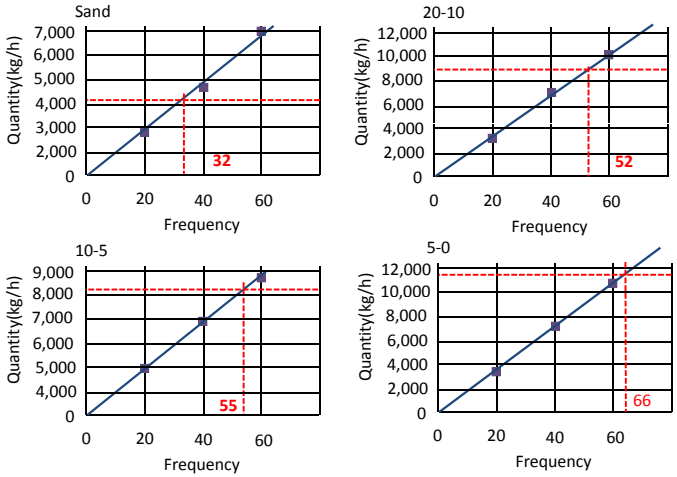
Example of grading is as follow.

Material	Mix proportion(%)
20-10	26
10-5	24
5-0	34
sand	12
Filler	4
Asphalt	5.2
Total	105.2

Required volume in weight.

- 36t x 0.26x100/105.2= 8.9 t
- 36t x 0.24x100/105.2= 8.21 t
- 36t x 0.34x100/105.2= 11.63 t
- 36t x 0.12x100/105.2= 4.11 t
- Is not from hot bin
- Is not from hot bin

Find out the proper frequency of each feeder.



b. Take samples from hot bin

Adjust the frequency by knob according to the result .

Example of frequency converter.

Adjust the frequency by this knob.

Start feeding of aggregate and sand.

Heat the materials.

Stock the materials in hot bin.

Take samples from all hot bin.

c. Sieve test of the materials from hot bin.

Calculation of combined grading

BIN No.	Sieve size	28	20	15	10	5	2.5	1.25	0.63	0.315	0.16	0.071
BIN.1	5-0	100	100	100	100	94.9	73.5	53.8	38.1	26.3	18.7	11.8
BIN.2	10-5	100	100	100	96.1	12.7	5.4	2.2	0.3	0.1		
BIN.3	20-10	100	98.5	78.3	9.8	4.2	2.1	1.2	0.8			
BIN.4	-	-	-	-	-	-	-	-	-	-	-	-
Filler		100	100	100	100	100	100	100	99	94.1	81	72.9
Material	Proportion	28	20	15	10	5	2.5	1.25	0.63	0.315	0.16	0.071
BIN.1	50.0	50.0	50.0	50.0	50.0	47.5	36.8	26.9	19.1	13.2	9.4	5.9
BIN.2	25.0	25.0	25.0	25.0	24.0	3.2	1.4	0.6	0.1	0.0	0.0	0.0
BIN.3	21.0	21.0	20.7	16.4	2.1	0.9	0.4	0.3	0.2	0.0	0.0	0.0
BIN.4	-	-	-	-	-	-	-	-	-	-	-	-
Filler	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.8	3.2	2.9
	100.0											
Combined grading		100.0	99.7	95.4	80.1	55.5	42.5	31.7	23.3	16.9	12.6	8.8
Range of grading		100 ~ 100	90 ~ 100	80 ~ 100	70 ~ 100	50 ~ 60	38 ~ 48	28 ~ 37	20 ~ 28	14 ~ 22	10 ~ 16	6 ~ 12
Target passing		100	95	90	85	55	43	32.5	24	18	13	9

d. Determine the proportion of the aggregate in hot bin.

Proportion of each bin has decided in the table above .

Weight of materials of each bin ,filler and bitumen.

Material	Proportion(%)	Conv.proportion	Weight(KG)
BIN.1	50.0	47.53	285
BIN.2	25.0	23.76	142
BIN.3	21.0	19.96	120
BIN.4			
Filler	4.0	3.80	23
Asphalt	5.2	4.95	30
Total	105.2	100.0	600

Input the weight in the system.

e. Product the mixture and take sample.

Product 3 batch

1.Design asphalt - 0.1%
2.Design asphalt
3.Design asphalt + 0.1%

Check the appearance, Luster and mixing condition.

Take samples for stability test.

f. Check the Stability, air void and others.

Choose one of 3. → Trial construction

g. Trial construction.

Purpose

1.Determine the No. of compaction.
2.Find out compaction ratio.
3.Check the surface condition.
4.Find out the defect.

Start construction

3.ASPHALT MIXING PLANT

Asphalt (Bituminous)hot mixtures are composed with

- Coarse aggregate
- Fine aggregate
- Bitumen
- Filler
- Additives if required

Asphalt mixing plant can mix these materials in designated proportion with proper temperature according to the mix design.

ASPHALT MIXING PLANT ARE MADE UP with MANY EQUIPMENTS AND OTHERS BELOW.

1.STOCK YARD: Stock pile for each size of aggregates

Stock yard should have roof if possible to keep all aggregates in dry condition.

Stock yard should have concrete floor to minimize the loss of aggregate and to minimize the contamination with foreign materials.

2.COLD BIN: STOCK BIN FOR EACH SIZE OF AGGREGATE

COLD BIN should have roof if possible or be covered by any water proof sheets especially in the rainy season.

This property is composed with:

1. 4 or 5 storage bins for each size of aggregates and sand.

2. Belt feeder below each bin with motors. Each bin has its individual feeder belt. Material flow is controlled by a combination of belt speed and gate opening.
Independent feed control is done by frequency converters.

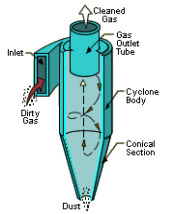
3. One continuous belt conveyer for all bins with motor.

3.DRUM DRYER: Dry up and heat the aggregates by burner.

Oil burner is equipped to Drum dryer.

About 7-12 litter of Fuel is required to dry up and heat 1 ton of aggregate.(in Japan)

4. DUST COLLECTION SYSTEM: Collect the dust to minimize the dust for environment protection.



Primary:Cyclone separators

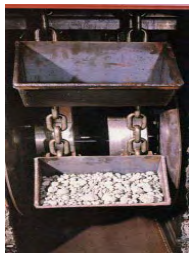
Reclaimed dust can be used as filler.

Secondary : Bag filter

Bag filtering system purify the exhaust gases from its plants for environmental protection by collecting/catching the dust in this unit.

5.HOT ELEVATER: Vertical hot elevator transfers heated aggregate from the dryer to the sieving unit.

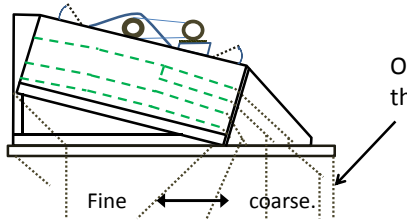
This system is composed with gears, Single or double row chain with buckets which feed the hot aggregate into the sieving device.



Bucket in the hot elevator

6. SIEVING UNIT: Sort out the aggregate which conveyed by hot elevator to required grading

SIEVING UNIT are equipped with vibration motors to create vertical and horizontal amplitudes. While horizontal vibration conveys aggregate along screens, vertical vibration ensures fast and accurate sieving.



Over size materials go out from the unit through the pipe.

7. HOT BIN : Stock the hot aggregate come from SIEVING UNIT.

This unit is composed with:

1. 4 or 5 stock bins for classified aggregate.

2. Gate with pneumatic cylinder to open /close the gate to the weighing unit for each bins.

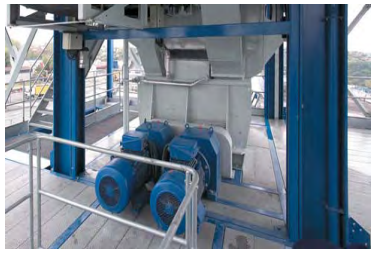
3. Sensor to alarm when the level of material come up to the limit capacity of each bin.

8.AggregateWeighingUnit: Accumulative weighing by electronic loadcells.

9.Pneumatically controlled discharge gate of aggregate to batch mixer .

10.Asphalt(Bitumen) Weighing Unit: Weighing by electronic loadcells.
With hot oil or electrical heating system.
Discharge the bitumen into the mixing unit by special pump.

11.BATCH MIXER : Device that uniformly mix the aggregate, asphalt(bitumen) and filler which was weighed and discharged from weighing units.



Mixing unit with 2 motors.

Inside of mixer with twin shaft

12. FILLER SUPPLY SYSTEM: System to supply the filler into the mixing unit.

Filler Supply System is composed with :

1.Filler silo

2.Screw conveyer

3.Filler elevator.

4.Filler weighing unit with pneumatic controlled gate.

13.ASPHALT(BITUMEN)TANK: Storage tank of hot asphalt(bitumen).

Horizontal tanks

1.Outer surface of the tank is Covered with thermal insulation.

2.Tank is Equipped with heating system.

Vertical tanks

3. Gear pump, thermostat, thermometer, thermal insulated pipe up to the asphalt weighing unit and other devices are connected.

14.ASPHALT (BITUMEN) MELTING KETTLE:

Asphalt melting kettle with oil burner, pump, hoist crane and Plumbing.

15.POWER GENERATOR:

Power generator:
200 to 350 KVA Is required for asphalt mixing plant.

16-1. Other main equipment.

Fuel tank and Plumbing

Air compressor with casing for pneumatic control device and for other purpose.

16-2. Other main equipment

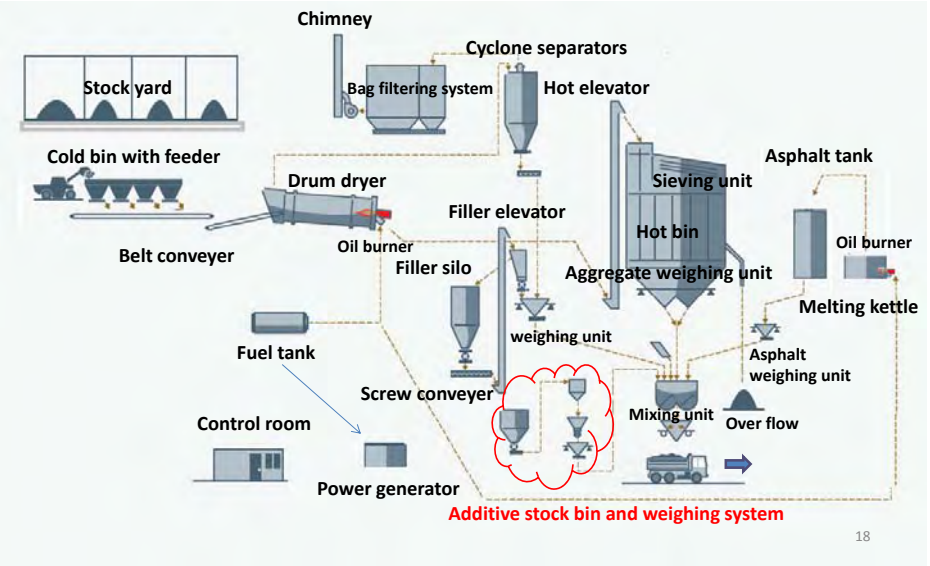
chimney

Control system

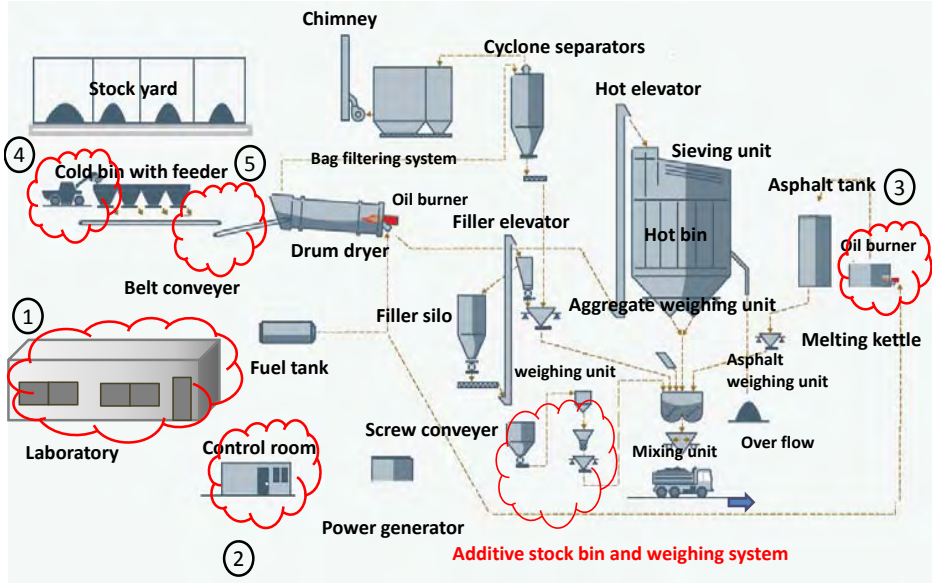
17. Laboratory

Assure the quality of the Mixture

DIAGRAM OF ASPHALT MIXING PLANT



4. Manpower planning for Asphalt Mixing Plant



Management Plant Manager 1 Assistant 1

- Total Management of Asphalt Mixing Plant
- Management of Staffs
- Coordination with all the related offices
- Production scheduling → Supply schedule to SEHM
- Material order → Shortage of Materials cause the delay of construction.
- Document control
- All others inclusive safety → Sum up all the report and analyze.

1.Laboratory Lab. Engineer 1 Lab. technician 1 Helper 3-4

- Quality control of Asphalt Mixture
- Quality check of Materials.
- Aggregate, asphalt and other → Does all Material meet with the requirement s of Specs?
- Test of Hot mixture
- Sampling of mixture and test → Temperature check, Sampling, marshal test and other required test.
- Assist the Quality control at site. → Density, thickness and other

2.Control room

Plant operator 1 Assistant 1

Plant operation

Production of Asphalt mixture.

Check the balance and consumption of materials and report.

Aggregates and sand.

Asphalt.

Asphalt in tank.

Filler.

Fuel.

3.Melting kettle

Helper 4-5

Shift the drum asphalt.

Cut the cover.

Heat the drum to melt down.

4.Wheel loader operator

Operator 1 Assistant 1

Check the machine before start and report the record.

Charge the materials into the cold bin.

5.Conveyer belt and cleaning

Worker 1-2

Check the material on conveyer, cleaning around the mixing plant and work as helper of the Plant operator.

Loader operator may charge foreign materials at quarry or stockyard. If it is big size of rock or cobblestone, it cause serious damage to the mixing plant.

→ It is necessary to make a trap to catch the foreign materials.

6. Mechanic and Electrician.

Periodical check and maintenance of machine and plant.

Repairing of machine and plant when necessary.

* 7. Workers to supply filler.

Worker 4-5

*If filler silo is not include in Asphalt mixing plant unit.

5. Quality Control at asphalt mixing plant

Components of Asphalt Hot Mixtures

- Aggregates
- Sand
- Filler
- Asphalt(Bitumen)
- Additive(if required)

→ Mix design

→ Keep samples in clear container at A.P ★

↓

Visually compare with delivered materials

Aggregate

- Water absorption test
- Specific gravity
- Los Angeles abrasion test
- Test for soundness of aggregates by use of sodium sulfate
- Flakiness Index
- Grading

Sand

- Water absorption test
- Specific gravity
- Grading

Filler

- Specific gravity
- Grading

Asphalt(Bitumen)

- Penetration (25℃)
- Softening point℃
- Ductility (15℃)
- Solubility in Trichloroethylene(% by weight)
- Flashing point℃
- Thin Film Oven Test (% mass change)
- Penetration of Residue (%)
- Viscosity (60 ℃)
- Specific gravity(Density) (15℃)g/cm3
- Kinematic Viscosity（120℃ ,150 ℃ ,180℃)

Mix design has done

AP → Assure the quality

a. Periodical check of materials

↳ Whether materials are same quality with the materials which was used in design.

b. Daily quality control

↳ Every production days

to be continued

What should be done in every production days?

1.Check the temperature of mixture

↳ Every dump track before leave

2.Take samples from mixture

↳ Make specimen for Marshall test

↳ Marshall test

Grading

Asphalt content

→ Asphalt extraction

3. Assist/cooperate construction site

Check the mixture at site

- Temperature
- Grading, Luster, Foreign material etc.
- Appearance

Core sampling

- Density → Inform the result to site
- Thickness

↓ If not meet requirement

Site have to improve there procedure of compaction

6. Material Control

Stock of the materials

Materials to be used

- Coarse aggregate
- Fine aggregate
- Bitumen
- Filler
- Additives if required

+

Fuel

All of these materials must not be stockout

Stock control

You must grasp:

a. Stock

b. Consumption

c. Planning use

↓

Calculate the stock in at least next **?** days.

→ Order/Purchase.

?: Depend on number of the day from ordering to arrival

Matters to be attention to

a. Stock

1.Aggregates	Some of them can not be used Contaminated at the bottom
2.Asphalt in tank	2 or 3 tons of dead stock
3.Asphalt in melter	1 or 2 tons of dead stock

4.Calculation and actual survey result is differ

5.Keep the stock with **sufficient** margin

Ref 1-6

b. Consumption

1.Loss

Some of aggregate go out as dust

Some of aggregate go out as over size

* Some of aggregate go into the ground

Loss of aggregate for cleaning of mixer

Some of filler will have moisture

c. Planning use

Additional order because of loss at site

7.Advice from my experience

a. At asphalt mixing plant

- Increase the capacity of AP

Adjust the mixing time

Trial mixing is required to do this.

60 second → 54 second → 48 second

↓ ↓ ↓

36t/hour → 41.5t/hour → 45t/hour

- Stock the mixture on the dump track

Use the dump track as HOT SILO.

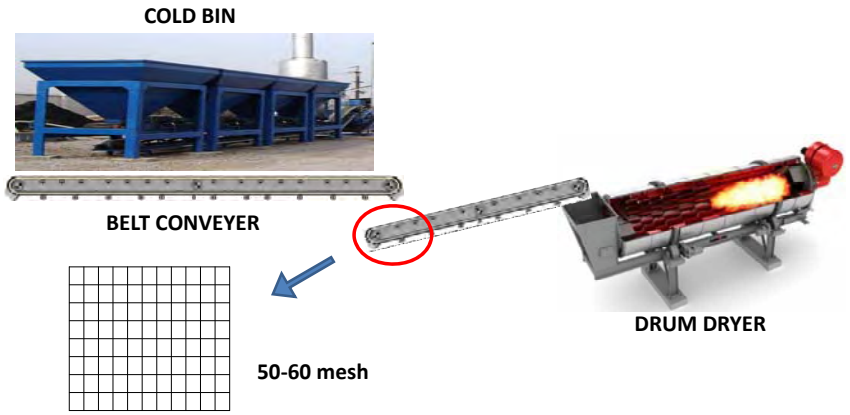
At hot season only

You can start mixing(production) early in the morning

↳ Increase daily production of AP

↳ Increase the productivity at site

- Make a trap to catch the foreign materials



This can decrease the so many trouble

b. At site

- Adjust the speed of Paver

Operator check the number of standby dump track!

Slow down the Paver speed if 1 stand by dump track!

1 or 2 dump truck stand by is better

Slow down the speed if 1

- Do not close hopper for every dump track

It makes segregation on the surface

- Dump track should stop at 50-60cm in front of paver

Paver will approach and push the dump track .

- Make slope bridge for hand guide roller

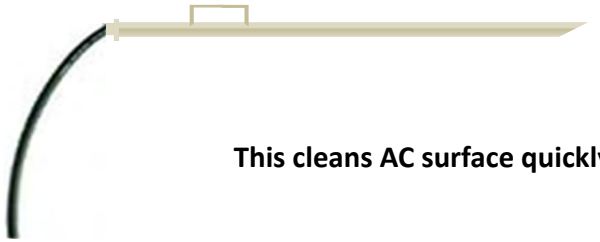
2 piece with hook

You do not need Crane track

Ref 1-7

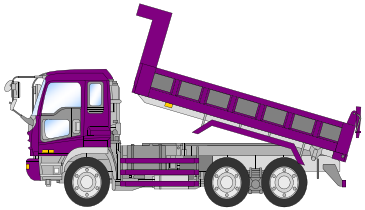
- Make Proper tool to clean the AC surface

For compressor



This cleans AC surface quickly

8.Maintenance of Machine



Inspection and maintenance

- Commencement inspection (inspection before starting work)
- Periodic inspection and maintenance
- Occasional inspection and maintenance

No periodic inspection and maintenance

⇩

Machine failure

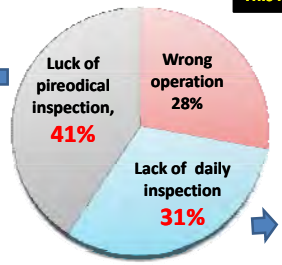
⇩

- Injure/Kill persons by accident. ★
- Decrease the productivity at site.
- Increase the cost of constriction.
- Increase the cost of maintenance.

Cause of machine troubles.

This is the Data from KOMATSU

- Neglect the element Replacement
- Neglect the adjustment
- Neglect the oil replacement and etc.



- Water drain from fuel
- Cleaning of element
- Shortage of cooling water
- Shortage of oil and etc.

More than **70%** of the machine troubles are caused from **shortage/failure/lack** of daily inspection and periodical maintenance.

In order to prevent the trouble of the machine and to maintain the performance same as new machine, a reliable **inspections and maintenance** are quite essential.

Daily inspection and maintenance based on the **instruction manual of the manufacturers** is important.

Each machine has its own instruction manual of the manufacturers.

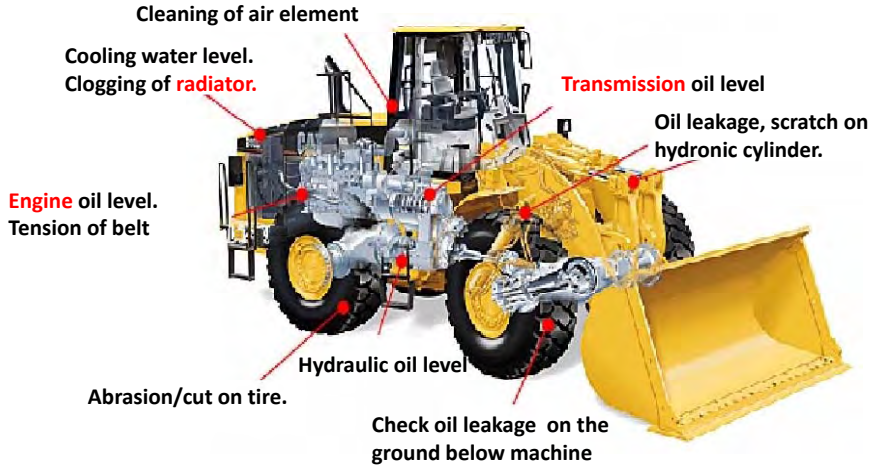
Example of Inspection before starting work

Following figure is **just one example** of this machine of this makers.

Required checking point is different by the type of machine and manufacturers instruction.

Follow the Maintenance Manual of each machine.

Example



*This is not include function check for safety.

Periodical maintenance

Replacement of filters	Replacement of oil
Engine oil filter	Engine oil
Hydraulic oil filter	Hydraulic oil
Fuel filter	Pump mission oil
Air filter	Traveling mission oil
	Turning mission oil

Interval of this replacement is noted in each Maintenance Manual.

Preventive inspection and maintenance

"Preventive maintenance" ensures your production plan

In a general machine maintenance is performed only "after" a machine comes to a sudden stop or fails and cannot restart production until inspection and repair of the machine is completed. On the other hand, "preventive maintenance" prevents sudden machine stoppage by means of periodic inspection

9. Construction Planning

What kinds of the information you need to start and complete the project?

Example in japan

Documents of construction plan must contain the followings.

1. Outline of the project

- Name of the project
- Route name
- project location
- Period of the project
- Contract Amount
- Client name
- Contractor name
- Bill of quantities
- Location map
- plan view
- Typical section and others

2. Construction schedule

- Bar chart or Network scheduling

3. Site organization

- Organization
- Person in charge
- Duty of each person

4. Specified machineries

- Name of machine
- Maker
- Capacity
- Usage

Construction machine may cause the noise and vibration. Where it should be limited, client specify the type of machine to minimize the noise and vibration.

5. Main machineries list

- Same with 4.

6. Main materials list

- Name of materials
- Maker
- Standard/Quality
- Quantity
- Usage
- * Does it meet to spec?

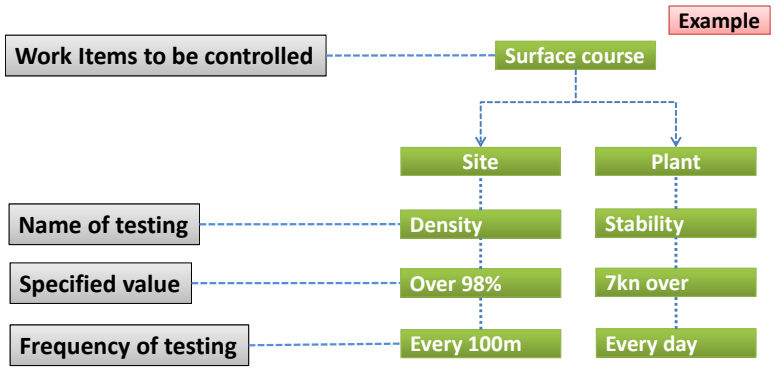
7. Construction procedure

- Construction order of the work item
- Description of the each work items
  - How to
  - Points of concern
  - Machine to be used
- * Does it meet to spec?

8. Construction management plan-1

Quality control plan

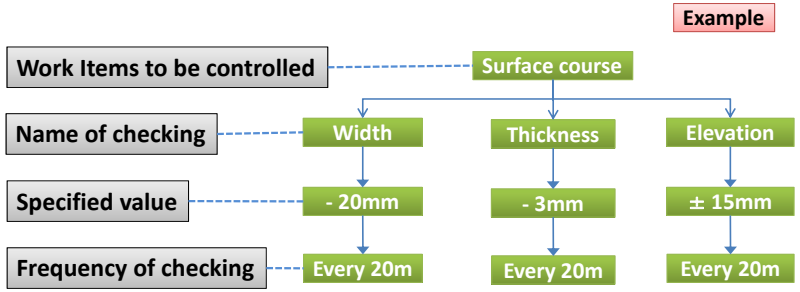
Check the required quality to confirm construction/production procedures are stable or not.



8. Construction management plan-2

Shape and elevation control plan

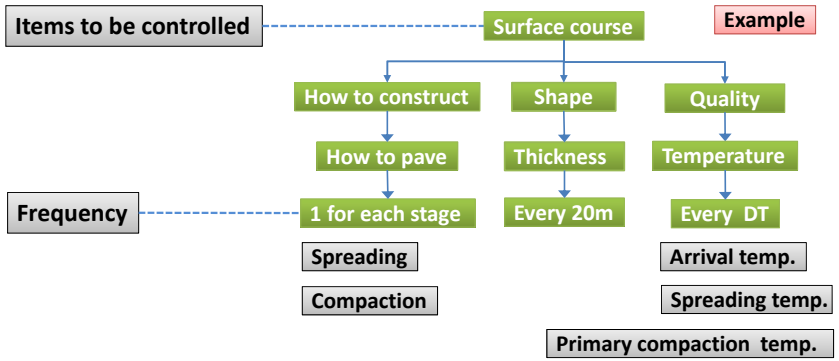
Check all dimension and others to confirm that construction procedures are stable or not.



8. Construction management plan-3

Picture control plan

Take pictures to prove that the dimension, quality and procedure of construction are meet to specifications.



9. Safety control

- Safety organization
- Prevention plan of Disasters.
- Safety training plan.
- Safety patrol plan.

10. Correspondence in emergency

- Contact diagram in accident.
- Disaster prevention plans in Unusual weather.

11. Traffic control plan

- Temporal Traffic control plan.
- Temporal traffic sign.
- Traffic Safety facility plan.

12. Environmental measures

- Air Pollution measures.
- Water pollution measures.
- Noise and vibration measures.

10. Pavement method

Types of Pavements

Flexible Pavements ➡ **Asphalt concrete** ★

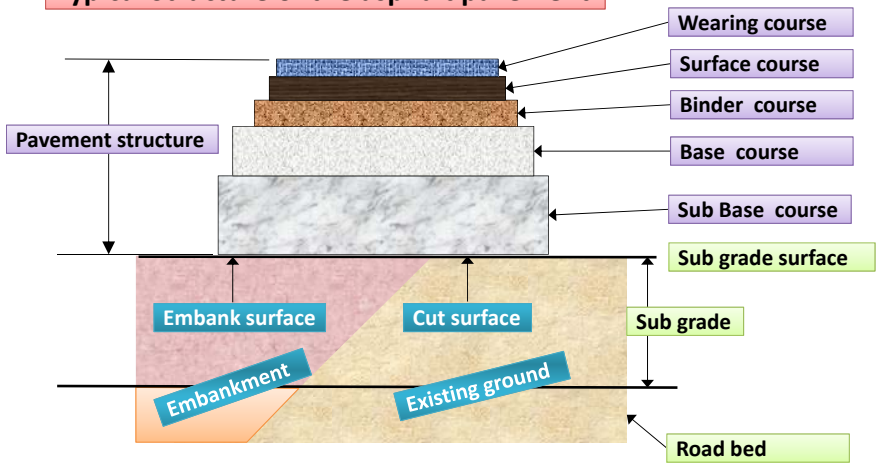
1. Deformation in the sub grade is transferred to the upper layers
2. Low construction cost but high repairing cost
3. Have low life span (High Maintenance Cost)
4. Expansion joints are not needed
5. Road can be used for traffic within 24 hours after pave
6. Damaged by Oils and Certain Chemicals

Rigid Pavements ➡ **Cement concrete**

1. Deformation in the subgrade is not transferred to subsequent layers
2. Low repairing cost but construction cost is high
3. Life span is more as compare to flexible (Low Maintenance Cost) X
4. expansion joints are needed
5. Road cannot be used until 14 days of curing after pave
6. No Damage by Oils and Greases

Asphalt concrete pavement

Typical Structure of the asphalt pavement



Machine to be used.


Asphalt Paver


Water truck


Hand guide roller


Steel roller


Plate compactor


Pneumatic roller

Procedure of Asphalt pavement

1.Preparations of the base surface
↓
2.Prime coat/Tack coat
↓
3.Curing
↓
4.Paving Lane marking And Form setting
↓
5.Machine setting
↓
6.Start paving
↓
7.Compaction
↓
8.Open for traffic

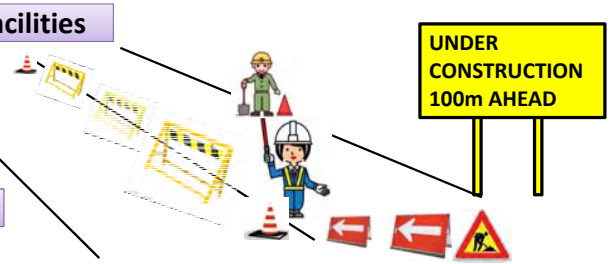
- Material order — Damp truck
- Date — How many
- Starting time
- How many tons or final delivery time
- Machine transport
- Delivery of Material

Procedure

Tool box meeting everyday in the morning

- Today's schedule — How many tons, How many meter and etc.
- Work sequence — Start point, order, End point and etc.
- Duties of each personal
- Safety — Pre- see and how to prevent accident.

Setting of safety facilities



Start daily works

1.Preparations of the base surface

- Enough compaction with watering.
- Enough grading.
- Density test.
- Check the thickness, width and elevation.
- Clearing of foreign matter and debris on the base.

2.Prime coat/Tack coat

- Check the application ratio.
- Sand spreading (Prime coat)

3.Curing

- Water in the emulsified asphalt should be evaporated.
- Penetration in the base course

4.Paving Lane marking And Form setting

- Determine the paving sequence in advance
- All workers have to know the order to pave

The day before pave is better

Include all corners and widening area

5.Machine setting

→ Inspection before transport

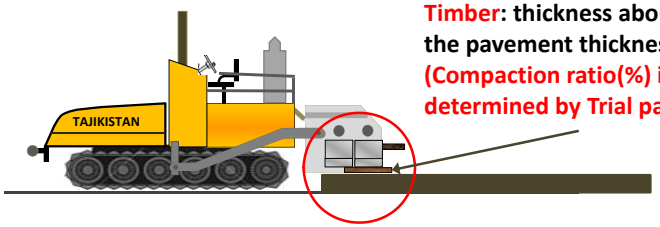
Start Heating of Screed at least 1hour before pave.

Daily inspection before Start the work

Set the paver on the line.

Especially water supply system of rollers

Set the screed.



Timber: thickness about 20% of the pavement thickness (Compaction ratio(%) is determined by Trial pavement)

6.Start paving 1

The followings should be carried out at regular intervals during paving operations:

a. Check the temperature of the mixture before unloading.

- Material which temperature is low should be rejected
- Inform it to asphalt plant immediately

b. Visual inspection of the mixture(appearance, quality)

- Does all aggregate covered by bitumen?
- Does appearance is same with previous one?
  - Grading, Luster, Foreign material etc.

2

c. Amount of mixture being placed and layer thickness

- Check the laying thickness by thickness gage.
- How many tons are paved to the placed area.
  - Smaller than design. → Thin → thickness problem
  - Bigger than design. → Thick → Cost problem

Adjust the laying thickness

3

d. Visual inspection regarding to uniform surface condition of the placed layer.

- Treat the rough surface manually by using sieve and other.
- No spot bleeding because of mixing problem?

e. Alignment of edges. (correct location and true alignment)

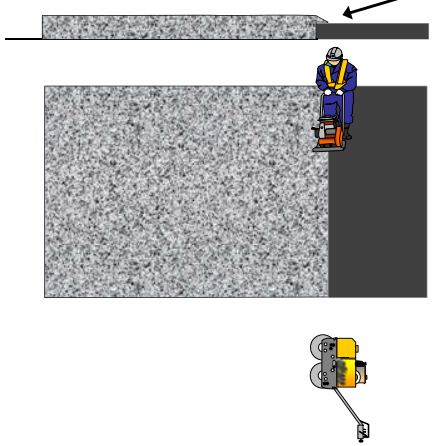
f. Quality/condition of longitudinal and transverse joint.

- difference in level
- Rough joint

g. Inform the final tonnage to Asphalt plant.

7.Compaction

a. At first treat the transverse joint.



Treat the joint

↓

*Compact the joint first by small compacter.

Plate compactor.

Hand guide roller.

↓

Check the joint surface condition and repair if necessary

If new surface is flat with existing, it will get low by compaction by roller.

↓

Start compaction

b. Start the primary compaction by Steel roller as soon as possible.

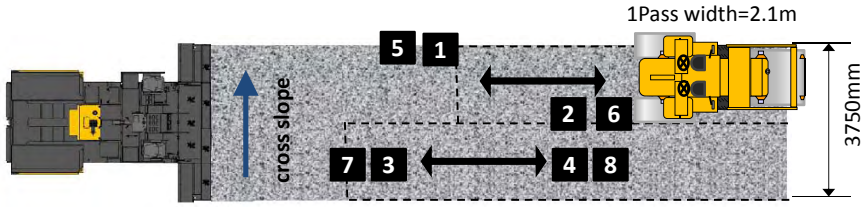
Speed : 2～3km/h(almost same speed with human slowly walk)

★ Minimum temperature 110℃

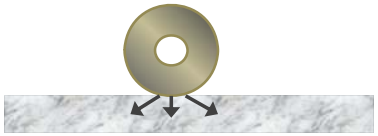
1.Longitudinal joint

2.Lower area of cross slope.

3.Go up the cross slope.



Number of compaction is determined by trial pavement.

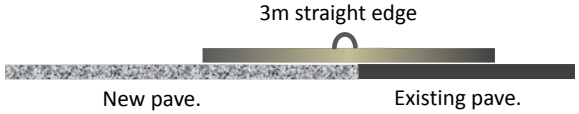


← longitudinal direction

Primary compaction mainly effect to longitudinal direction.

Primary compaction push down the large particles.

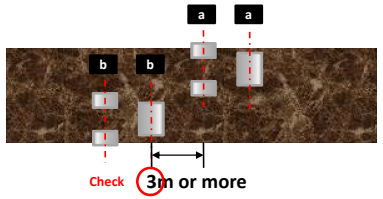
Check the joint condition by 3m straight edge



★ Just little higher than existing is better, because additional secondary compaction will come.

Correct the gap immediately by using sieve and other if there are Irregular gap.

Do not stop the roller at the same position with previous compaction.

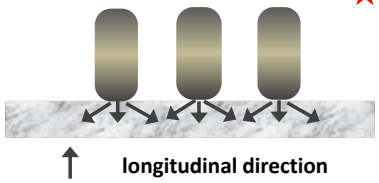


Stoppage at same position makes bigger unevenness after compaction finish!!

c. Secondary compaction by pneumatic roller

Speed : 6～10km/h(Faster than human walk)

★ Enter from the drive wheels.



↑ longitudinal direction

Secondary compaction mainly effect to transverse direction.

Secondary compaction push the fine particles into the void and gap in the mixture. And it makes dense surface.

d. Finishing compaction by pneumatic roller or steel roller.

- Correct the unevenness.
- Remove the roller marks*

*indentations on the surface caused by rolling operations

- Additional roller is required if paving area/unit hour is large.

8. Open for traffic

Traffic release at higher temperatures cause a rutting.

↳ Open the traffic at About 50 ˚C.

Capacity of pavement by your AP

AP Capacity — 600kg /batch/min. X 60min. = 36t/hour

How many Square meter you can pave per hour?

5cm thick Density = 2.45t/m³

36t/hour ÷ 2.45t/m³ ÷ 0.05m

$$= \frac{36\text{t/hour}}{2.45\text{t/m}^3 \times 0.05\text{m}} = 294\text{m}^2\text{/hour}$$

By no loss

3% loss	5% loss	10%loss
285m²/hour	280m²/hour	267m²/hour
	△	X

Thank you.

11. Maintenance and Repair of pavement

1.Types of maintenance

a. Preventive Maintenance:

Purpose
- Extend the functional life of a pavement.
- Retard progressive failures.
- Reduce the routine maintenance and service activities.

Typical Activities
- Crack sealing.
- Rut filling.
- Thin overlay.

b. Corrective Maintenance:

Purpose
- After a deficiency occurs in the pavement .
  - Severe friction(wearing).
  - Rutting of moderate to severe.
  - Extensive cracking.

Typical Activities
- Milling and overlay.
- Structural repair.
- Patching.
- Pothole repair.

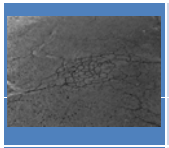
c. Emergency Maintenance: (temporal maintenance)

Purpose
- To avoid accident.
- Temporal treatment to keep traffic path.

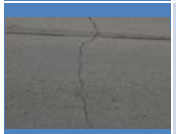
⬇

more permanent repairs will be done.

Type of Damages -1

TYPE OF DAMAGE		POSSIBLE CAUSE	MAINTENANCE SUGGESTIONS
	Alligator Cracking	1.Excessive loading 2.Weak surface, base, or subgrade 3.Thin surface or base 4.Poor drainage 5.Any combination of 1-4	·Full-depth replacement
	Block Cracking	1.Old and dried out mix 2.mix with low penetration asphalt & absorptive aggregates 3. Deterioration by low traffic volume	·Any surface treatment or thin overlay
	Edge Cracks	1.Lack of lateral support 2.Settlement of underlying material 3.Shrinkage of drying out soil 4.Weak base or subgrade layer 5.Poor drainage 6.Heavy traffic pass	·Improve drainage. ·Fill cracks with asphalt emulsion slurry or emulsified asphalt ·Crack seal/fill

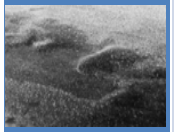
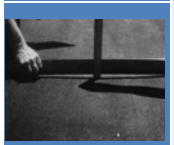
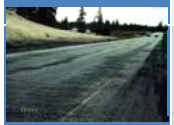
Type of Damages -2

TYPE OF DISTRESS		POSSIBLE CAUSE	MAINTENANCE SUGGESTIONS
	Longitudinal (Linear) Cracking-1	1.Shrinkage of the asphalt layer 2.Cracks in an underlying layer reflect up through the pavement 3.Repeated stress by wheel	·Seal crack or fill with asphalt emulsion slurry or light grade of asphalt mixed with fine sand. ·Crack seal/fill
	Longitudinal (Linear) Cracking-2	1. Poor longitudinal joint construction. 2. No tack coat on the joint.	
	Transverse Cracking	1.Shurinkage by cold temperature 2.Daily temperature cycling 3.Poor transverse joint construction 4.No tack coat on the joint	

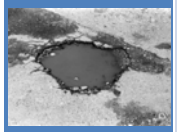
Type of Damages -3

TYPE OF DISTRESS		POSSIBLE CAUSE	MAINTENANCE SUGGESTIONS
	Reflection Cracking	1.Differential movement between the asphalt and concrete layers (Joint of PCC)	·Crack seal/fill
	Slippage Cracks	1.Lack of a good bondage between surface layer and the base below due to dust, oil, dirt, water and other non-adhesive material 2.Tack coat has not been used 3.Mixture has a high sand content 4.Vehicular turning or stopping movements on pavements with a low-strength surface mix	·Partial or full-depth patch

Type of Damages -4

TYPE OF DISTRESS		POSSIBLE CAUSE	MAINTENANCE SUGGESTIONS
	Corrugations & Shoving	1.Mixtures too high in asphalt 2.Low air voids 3.Fine aggregate content too high 4.Excessive moisture or contamination in the granular base 5.Smooth or rounded aggregate Incorrect asphalt grade	·Full-depth patch · Removal/Cold mill and overlay
	Rutting	1.Consolidation or lateral movement of any of the pavement layers or the subgrade under traffic 2.Lack of compaction 3.Weak asphalt mixtures 4. Physical loss due to wearing by studded tire	·Removal/Cold mill /leveling and overlay or thin surface patch
	Raveling	1.Inadequate compaction during construction. 2.Mechanical dislodging by certain types of traffic (studded tires, snowplow blades	· Remove or cold mill and overlay

Type of Damages -5

TYPE OF DISTRESS		POSSIBLE CAUSE	MAINTENANCE SUGGESTIONS
	Pot Hole	1.Continued deterioration of another type of distress, such as thawing of a frozen subgrade, cracking, raveling, or a failed patch after pieces of the original pavement surface have been dislodged 2.Poor surface mixtures 3.Weak spots in the base or subgrade 4.Severity of the surrounding distress and traffic action accelerate potholes	・Partial, full-depth patching
	Settlement/ Grade Depressions	1.Settlement or failure in the lower pavement layers 2.Improper construction techniques	・Cold mill and overlay ・Thin surface patch

3.Types of repairing

a. Crack Seal/Fill

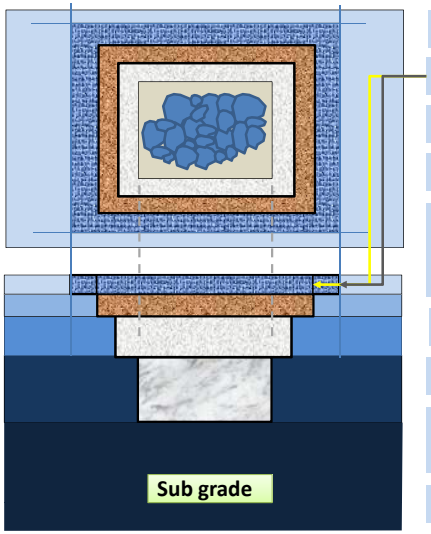
Cracks that are sealed are typically less than 3/4-inch wide.

Object	**Early stage** longitudinal cracks, transverse cracks, reflection cracks and block cracks.
Purpose	To prevent entering of water, sand, dirt, rocks or weeds
Material	Heated liquid asphalt / Rubberized asphalt / Sand or rock dust
Note	Crack sealing is best done in moderate temperatures (spring or fall)
	Cracks need to be routed out
	Cracks need to be cleaned
	Performed immediately after cracks occurs.

b.Full-depth replacement 1

Object	Alligator Cracking
Purpose	To improve pavement structure
Material	Subgrade material* / Sub base material* / Base course material*
	*Depend on the investigation result of the cause on damage.
	Cutback asphalt or emulsified asphalt / Asphalt hot mixture
Machine	Asphalt cutter / Excavator* / Dump truck* / Tamping compactor
	Plate compactor / Hand guide roller / Heavy roller*
	Asphalt distributer* or hand sprayer* / Asphalt paver*
	*Depend on the volume of works.
	Water tank truck*
Note	Each layer have to keep a gap at least **15**cm at all 4 sides.
	Clean/wash AC cut surface!!

b.Full-depth replacement 2



- Decide the damaged area
- Cut the AC pavement(2 line)
- Remove the AC
- Remove the base, sub base
- Fill the new acceptable sub base and base materials for each layer and compact until get the specified density for each layer
- Remove the AC surface course.
- Clean the base surface and AC cut surface
- Apply prime coat and tack coat on AC cut surface
- Construct AC layer after curing of coating

AC : Asphalt Concrete

c. Removal/Cold mill and overlay 1

- Object: Rutting, Raveling, Bleeding, Shoving, Settlement
- Purpose: To improve pavement surface condition
- Material: Cutback asphalt or emulsified asphalt, Asphalt hot mixture
- Machine: Milling machine*or excavator, Dump truck, Compressor, Asphalt distributer, Motor grader**, Asphalt paver, Pneumatic tired roller, Steel roller, Water tank truck, Hand guide roller, Plate compactor

*This machine is not include in Machine-donating from Japan

**In case of removal

- Limitation in use: Under layers should not have any distress/damage
- ***Milled surface should be bituminous or rigid one

***In case of milling

c.Removal/Cold mill and overlay 2

a. Cold milling

Purpose

1.Recycling of the road surface

Milled surface will receive new layer

→ Get Comfortable drive

2.Remove damages from the surface

Raveling　Bleeding

Rutting　Shoving:

Swells　Bumps

Depressions

Milling thickness can be controlled

b. Overlay

Start the paving after enough cleaning and tack coat

Please follow to the pavement procedure of
『PAVEMENT METHOD』

▪In case of only 1 layer of Asphalt pavement

→ **Removal of asphalt layer and AC pavement**

12. Quality control at site

For asphalt pavement

How to keep the requirement of specification?

1.Check the temperature of asphalt mixture

- **Every tracks**

2.Check the appearance of asphalt mixture

- **Mixing is enough or not?**
  - **All particles are covered with asphalt?**
  - **Asphalt is not biased?**
  - **Particles are not segregated?**
  - **No spot breeding?**(After spreading)

3. Reject the material if bad quality

- **Inform it to asphalt mixing plant**
  - **Which dump track?**
  - **Reason** (Low temp, segregation)

AP will take action to improve

4.To get the required density

- **Proper preparation to start paving**
  - **Long time stand-by cause Temperature drop**

Check the temperature of primary compaction

Start primary compaction as soon as possible

Keep the number of compaction which determined by trial construction

5. Take core sample to check density

- **Check density everyday when pave**
  - **Judge work procedure was good or not**

13.Safety

Anybody who get accident will cry, but also the person who make the accident will also cry.

Please think about their family

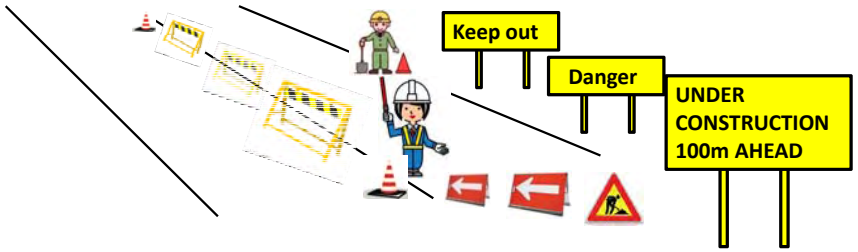
Never make accident!!!!!

1.For pedestrian and vehicle traffic

a. Set the barricades and others to prevent entering of them.

b. Set the signboards

c. Assign a traffic guide



2.For Workers

a. Tool box meeting in the morning

- Today's schedule
- Work sequence
- Duties of each personal

Safety

- What kind of accident may happen
- How to prevent it
- What you have to do

What kind of accident may happen

a. Worker working on the ground was injured/killed by roller

Do not enter in dead angle!

Operator must check around!

Assign a person who take care of safety!

b. Worker taking rest in the shade of roller was injured/killed by roller.

Do not take rest in the shade of machine!

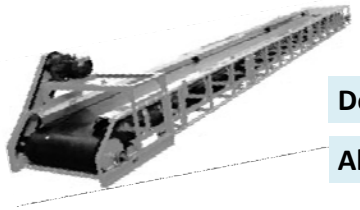
Operator must check around the roller before get on!

c. Wheel loader hit the person near by at asphalt plant

Close the working area when working!

Operator must check his surroundings!

d. Belt conveyer roll up workers at asphalt plant and crushing plant



Do not start without notice!

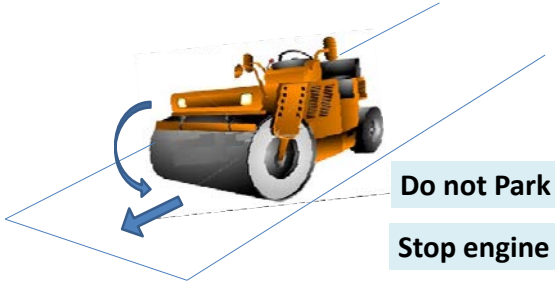
Always check the emergency rope*!

Workers who work near there

- **Wear should not have rope**
- **Hem of jacket should put in the trousers**

*** Every belt conveyer has emergency rope to stop it**

e. Machine go down without operator at slope area

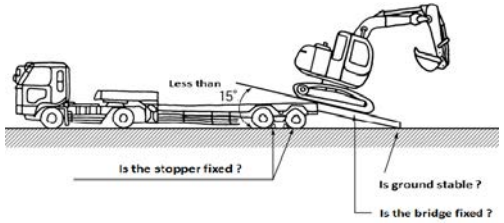


Do not Park without stopper!

Stop engine when leave the seat!

Brake when leave the seat!

f. Fail at loading/unloading and travelling



Work at flat and stable area!

Fix the stopper under the wheel!

Check the bridge!

Steel roller is easy to slip down!

Tight the machine by proper tools !

g. Machine hit track/another machine

Assign a person who guide machine and tracks!

These are only a few examples on many kinds of accidents

Safety meeting before start your job!!

Thank you

14. How to make Stability test specimen.

Stability test.

At Asphalt plant

1.Take samples from dump track.

Tray

or

Wheel borrow

Laboratory

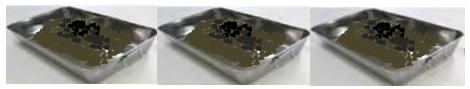
2.Weigh the sample.

1200g

*1. This mass is depend on the HMA design.

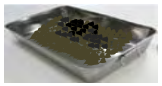
*2

1200g 1200g 1200g



+1

1200g



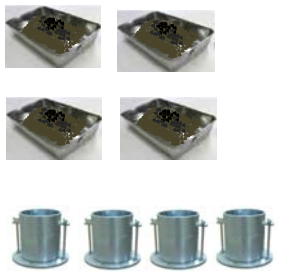
*1. We do not have any design In case of this project because we do not have test equipment.

*2. Thickness of specimen shall be near to 63.5mm.
By this mass, you can 63.5mm ±thick specimen.

3. Keep the mixture in the oven.

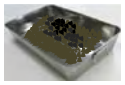
Mixture and Mold

At 145℃±5



4. Make specimen.

Take one sample and mold from the oven.



Put the paper in the mold.

Put the material in the mold.

Shape .the top of material and put the paper on the top.

5. Compaction.-(Page1)

Set the mold to the compaction machine or hand tamper.

Compact both side.

or

5. Compaction.-(Page2)

Compact both side. Number of blows are depends on specification.(**50**,65, 75both side)

We apply 50 blows both side.

How to revers?

a. Remove the top.(Collar)

b. Upside down the mold

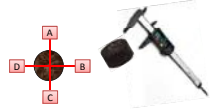
c. Attach the collar again.

6. Preparation for Marshall Test-(Page1)

Remove the specimen from mold.

Remove the edge before check the thickness.

Check the thickness. 4 section.



Weigh the surface dry specimens in the water.

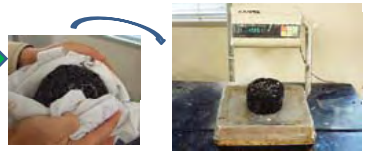
Immerse the specimens in water about 1 minute or more.

Weigh the mass of dry condition.

6. Preparation for Marshall Test-(Page2)

Take sample from water bath. Then, remove the water from surface.

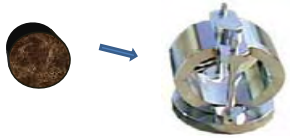
Weigh the mass of surface dry condition.



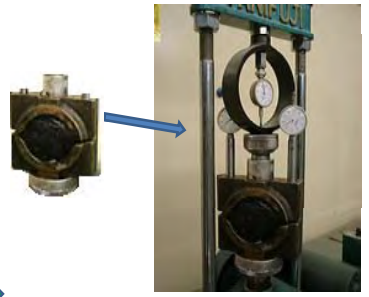
7. Marshall Test-Page1

Immerse the specimens in the thermostatic bath at 60℃±1 for 30 to 40 minutes.

Set a **test specimen** on the testing head.

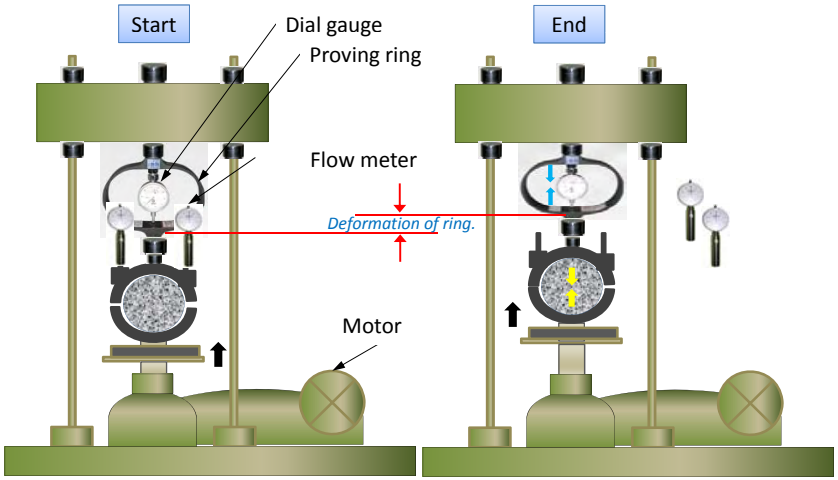


Set the **testing head** to testing machine. And set the flow meter(s)



Start the test.

7.Marshall Test-Page2



Marshall Test

1. Push the button to Start the equipment.

Cylinder of jack will constantly raise at 50±5 mm per minute.

2. Stop the equipment just when specimen has broken.

Needle of Dial gauge in ring will suddenly come down.

3-1. **Memory** the max. deformation of proving ring.(Dial gauge shows)

3-2. Remove flow meter just same timing of 2.

Flow meter should be kept by hand.

All proving ring has calibrated. All proving ring has it's own **conversion facter** and graph.

4. Read the deformation of specimen.(Flow meter shows)

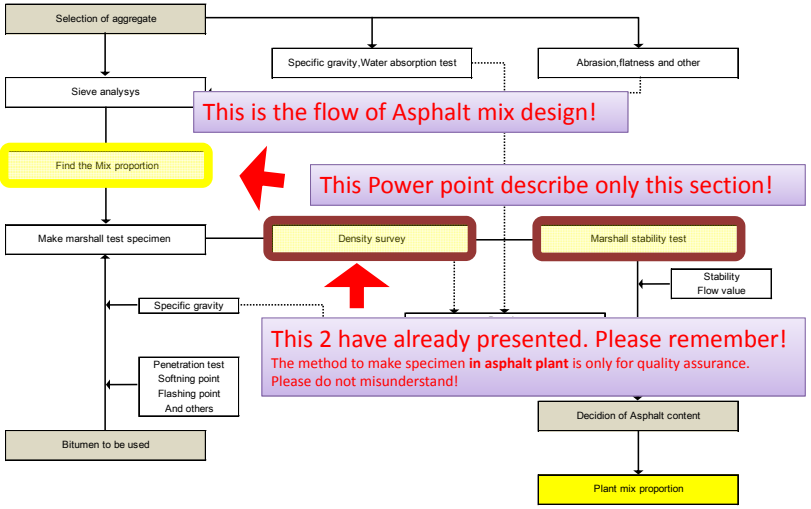
5. Record the all value in the form.

6. Calculation.

15. How to get mixing proportion

Example

FLOW OF ASPHALT MIX DESIGN



Explanation will be presented
according to the following materials

Table 5-1 Example of Sieve Result

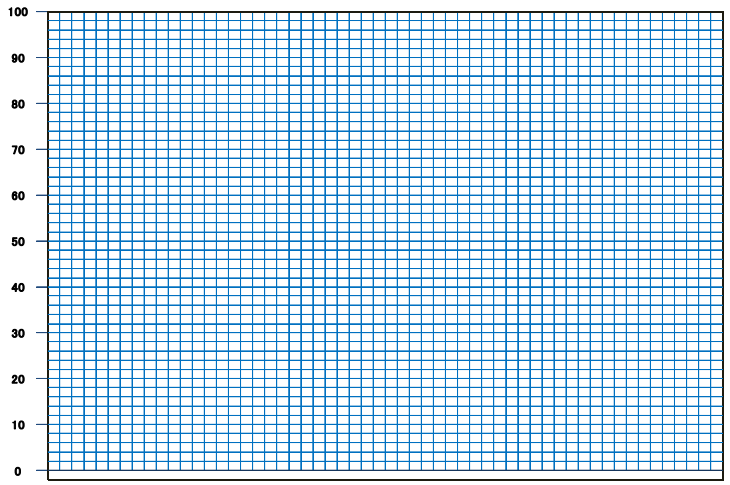
Material	Sieve size								
	25	20	13	5	2.5	0.63	0.315	0.16	0.075
20-13mm	100.0	93.5	8.0	1.4	0.3	0	0	0	0
13-5mm	100.0	100	97.2	8.6	2.1	0.8	0	0	0
5-2.5mm									
5-0mm	100.0	100	100	98.3	77.3	45.9	31.2	19.5	10.8
sand	100.0	100.0	100.0	95.1	91	76	21	10.1	2.3
Filler	100.0	100	100	100	100	99	94.1	89.5	80.3

Table 5-2 expected grading

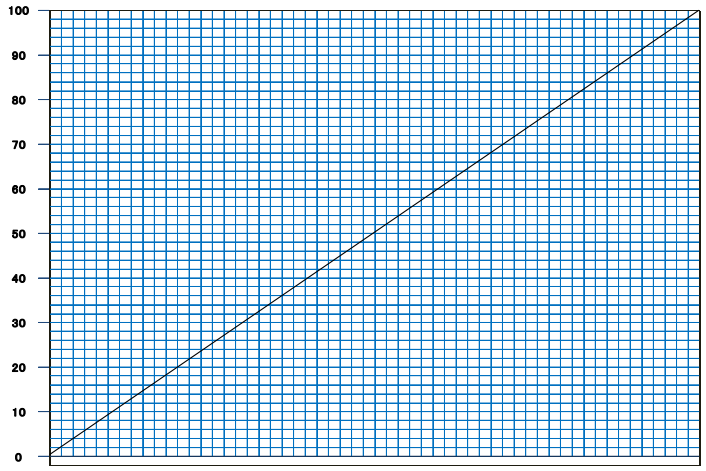
Sieve size	25	20	13	5	2.5	0.63	0.315	0.16	0.075
Combined grading	100	97.5	82.5	55	42.5	24	15.5	11	6

1 Draw the graph

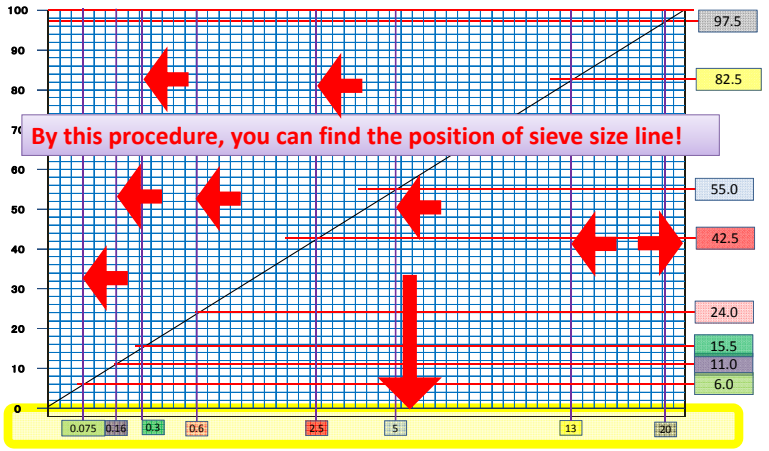
1. Draw the square on the Graph paper



2. Draw the Diagonal Line from upper light to lower left.

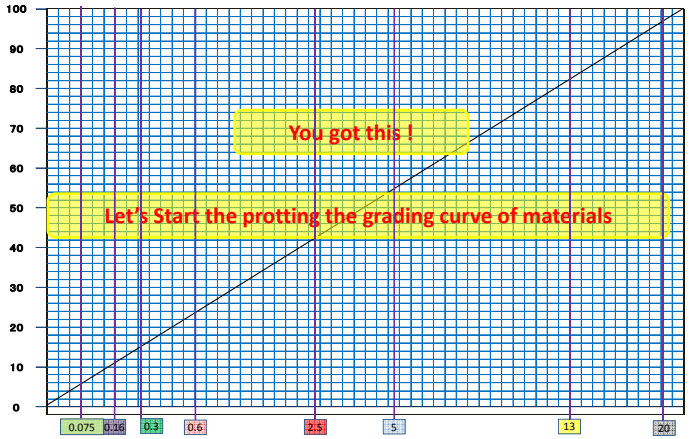


3. Find the Position of sieve size



Sieve size	25	20	13	5	2.5	0.63	0.315	0.16	0.075
Combined grading	100	97.5	82.5	55	42.5	24	15.5	11	6

4. Plot the Grading curve of aggregate, sand and filler.-1



4. Plot the Grading curve of aggregate, sand and filler.-2

This is the Sieve Result

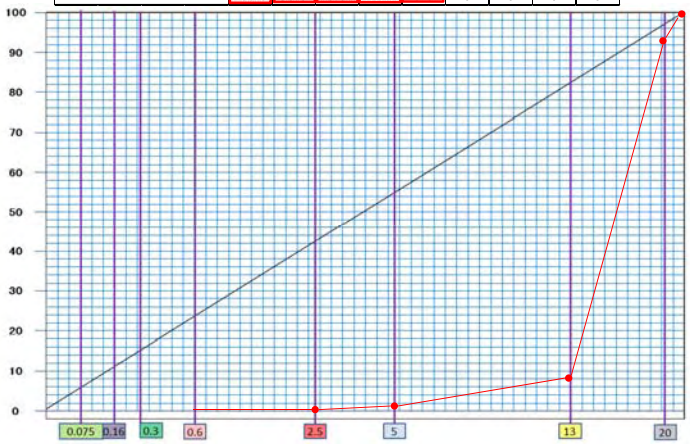
Let's start the plotting.

Material	Sieve size								
	25	20	13	5	2.5	0.63	0.315	0.16	0.075
20-13mm	100.0	93.5	8.0	1.4	0.3	0	0	0	0
13-5mm	100.0	100	97.2	8.6	2.1	0.8	0	0	0
5-2.5mm									
5-0mm	100.0	100	100	98.3	77.3	45.9	31.2	19.5	10.8
sand	100.0	100.0	100.0	95.1	91	76	21	10.1	2.3
Filler	100.0	100	100	100	100	99	94.1	89.5	80.3

4. Draw the Grading curve of aggregate, sand and filler.-3

This is the Sieve Result of 20-13mm

Material	Sieve size								
	25	20	13	5	2.5	0.63	0.315	0.16	0.075
20-13mm	100.0	93.5	8.0	1.4	0.3	0	0	0	0



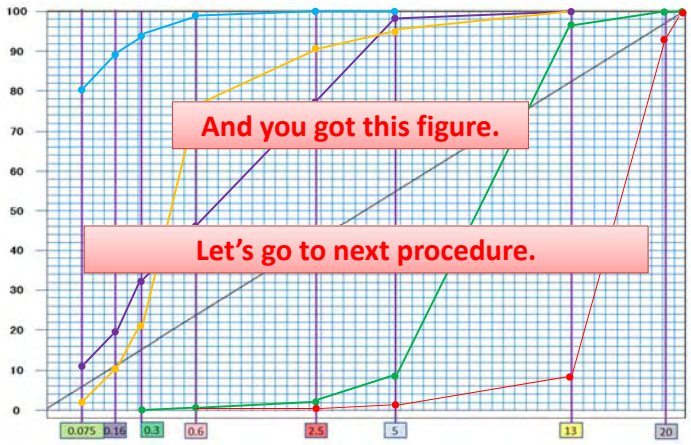
4. Draw the Grading curve of aggregate, sand and filler.-4

This is the Sieve Result of 13-05mm

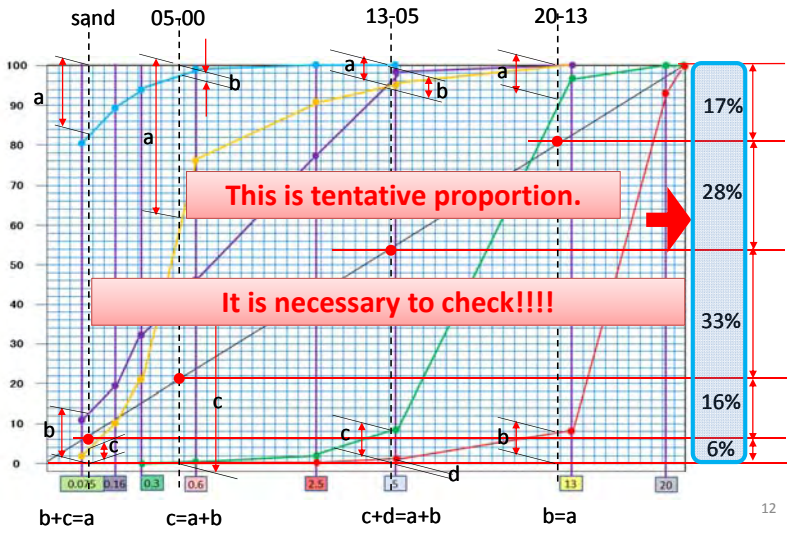
Material	Sieve size								
	25	20	13	5	2.5	0.63	0.315	0.16	0.075
13-5mm	100.0	100	97.2	8.6	2.1	0.8	0	0	0

4. Draw the Grading curve of aggregate, sand and filler.-5

Please repeat same procedure for another materials.



5. Find out the mix proportion!



6. Check the Grading.

This is the Grading of each materials!

Material	Sieve size								
	25	20	13	5	2.5	0.63	0.315	0.16	0.075
20-13mm	100.0	93.5	8.0	1.4	0.3	0	0	0	0
13-5mm	100.0	100	97.2	8.6	2.1	0.8	0	0	0
5-0mm	100.0	10							
sand	100.0	100.0	100.0	95.1	91	51.8	21	10.1	2.3
Filler	100.0	100	100	100	100	96.1	94.1	89.5	80.3

Do you remember? How to get this table?

This is the Combined grading with the proportion from plotting!

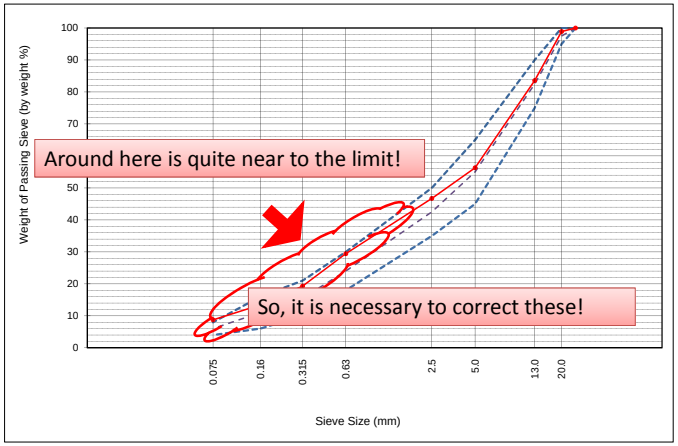
Calculating of combined grading (Center Grading)

Material	Proportion	25	20	13	5	2.5	0.63	0.315	0.16	0.075
20-13mm	17	17.0								
13-5mm	28	28.0								
5-0mm	33	33.0	33.0	33.0	32.4	25.5	15.1		.4	3.6
sand	16	16.0	16.0	16.0	15.2	14.6	8.3	3	1.6	0.4
Filler	6	6.0	6.0	6.0	6.0	6.0	5.8	5	5.4	4.8
Total	100									
Combined grading		100.0	98.9	83.6	56.3	46.7	29.4	19.3	13.4	8.8
Range of grading		100	95	75	45	35	18	10	6	4
		~	~	~	~	~	~	~	~	~
		100	100	90	65	50	30	21	16	8
Target passing		100.0	97.5	82.5	55.0	42.5	24.0	15.5	11.0	6.0

You shall see the grading curve of this!

No good!!

This is the combined Grading curve come from plotting mathod!



7. Adjust the proportion.

Calculating of combined grading (Center Grading)

Material	Proportion	25	20	13	5	2.5	0.63	0.315	0.16	0.075
20-13mm	17	17.0	15.9	1.4	0.2	0.1	0.0	0.0	0.0	0.0
13-5mm	28	28.0	28.0	27.2	2.4	0.6	0.2	0.0	0.0	0.0
5-0mm	33	33	33							
sand	16	16.0	16.0							
Filler	6	6.0	6.0	6.0	6.0	6.0	5.8	5.6	5.4	4.8
Total	100									
Combined grading		100.0	98.9	83.6	56.3	46.7	29.4	19.3	13.4	8.8
Range of grading		100	95	75	45	35	18	10	6	4
		~	~	~	~	~	~	~	~	~
		100	100	90	65	50	30	21	16	8
Target passing		100.0	97.5	82.5	55.0	42.5	24.0	15.5	11.0	6.0

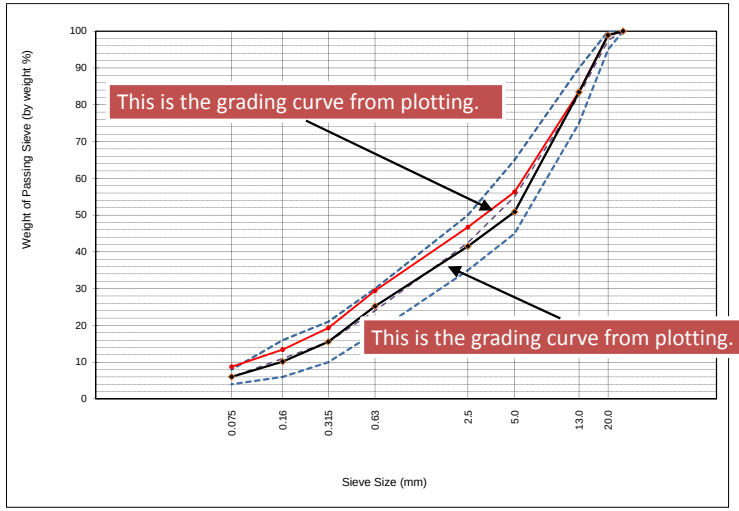
This is the proportion from plotting.

Calculating of combined grading (Corrected)

Material	Proportion	25	20	13	5	2.5	0.63	0.315	0.16	0.075
20-13mm	17	17.0	15.9	1.4	0.2	0.1	0.0	0.0	0.0	0.0
13-5mm	34	34.0	34.0	33.0	2.9	0.7	0.3	0.0	0.0	0.0
0										
5-0mm	30	30	30							
sand	16	16.0	16.0							
Filler	3	3.0	3.0	3.0	3.0	3.0	2.9	2.8	2.7	2.4
Total	100									
Combined grading		100.0	98.9	83.4	50.9	41.5	25.2	15.5	10.2	6.0
Range of grading		100	95	75	45	35	18	10	6	4
		~	~	~	~	~	~	~	~	~
		100	100	90	65	50	30	21	16	8
Target passing		100.0	97.5	82.5	55.0	42.5	24.0	15.5	11.0	6.0

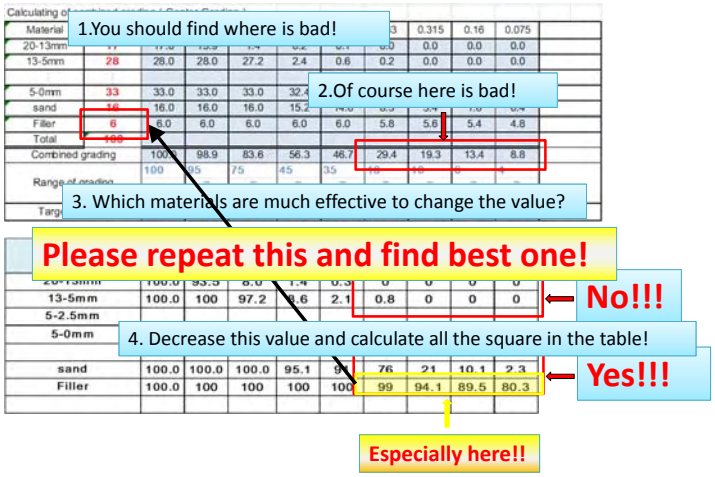
This is the proportion adjusted.

8. Check the adjusted grading.



9. How Adjust the proportion?

At first, which portion do you want to change?



10. How Adjust the proportion?

This is the final proportion!

Calculating of combined grading (Corrected)

Material	Proportion	25	20	13	5	2.5	0.63	0.315	0.16	0.075
20-13mm	17	17.0	15.9	1.4	0.2	0.1	0.0	0.0	0.0	0.0
13-5mm	34	34.0	34.0	33.0	2.9	0.7	0.3	0.0	0.0	0.0
0										
5-0mm	30	30.0	30.0	30.0	29.5	23.2	13.8	9.4	5.9	3.2
sand	16	16.0	16.0	16.0	15.2	14.6	8.3	3.4	1.6	0.4
Filler	3	3.0	3.0	3.0	3.0	3.0	2.9	2.8	2.7	2.4
Total	100									
Combined grading		100.0	98.9	83.4	50.9	41.5	25.2	15.5	10.2	6.0
Range of grading		100 ~ 100	95 ~ 100	75 ~ 90	45 ~ 65	35 ~ 50	18 ~ 30	10 ~ 21	6 ~ 16	4 ~ 8
Target passing		100.0	97.5	82.5	55.0	42.5	24.0	15.5	11.0	6.0

Please go to next step.

Is presented

16. Asphalt Mix design part-2

Find the optimum asphalt content

Proceed under the following condition.

1.Material's Characteristics are satisfactory.

2.Material's specific gravity is the following.

Material	Proportion
20-13mm	2.730
13-5mm	2.740
5-0mm	2.732
sand	2.670
Filler	2.710
Asphalt	1.030

Find the optimum asphalt content

1.Trial compaction.-1

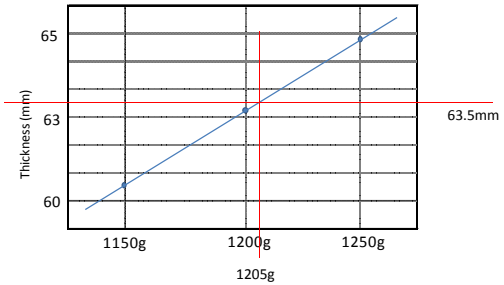
We know that about 1200g of mixture will give us the specimen which have the thickness of 63mm by experience.

Make of 3specimen by the mass of the following table.

Material	Proportion	Weight of 3 specimen		
20-13mm	17	185.7	193.8	201.9
13-5mm	34	371.5	387.6	403.8
5-0mm	30	327.8	342.0	356.3
sand	16	174.8	182.4	190.0
Filler	3	32.8	34.2	35.6
Total	100	1,092.5	1,140.0	1,187.5
Asphalt		57.5	60.0	62.5
Total		1,150.0	1,200.0	1,250.0

1.Trial compaction.-2

By the trial compaction. You can get the graph as below.



This graph shows **1205g** of materials mix will give us 63.5mm specimen.

2. Preparation of materials -1

1205g X(100-5)/100 = 1145g of aggregates, sand and filler are required for 1 specimen.

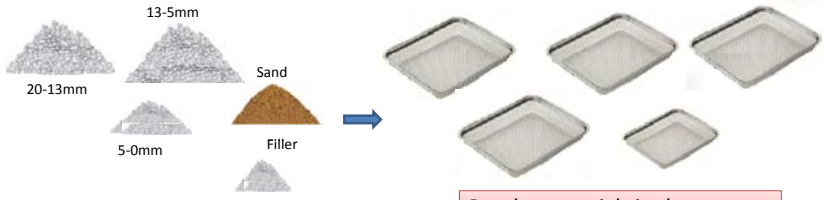
Material	Proportion	Asphalt content(%)				
		4.00%	4.50%	5.00%	5.50%	6.00%
20-13mm	17	185.4	185.4	185.4	185.4	185.4
13-5mm	34	370.8	370.8	370.8	370.8	370.8
5-0mm	30	327.1	327.1	327.1	327.1	327.1
sand	16	174.5	174.5	174.5	174.5	174.5
Filler	3	32.7	32.7	32.7	32.7	32.7
Total	100	1145	1145	1145	1145	1145
Asphalt		47.7	54.0	60.3	66.6	73.1
Total		1,192.7	1,199.0	1,205.3	1,211.6	1,218.1

This table is the required mass for 5 types of specimen which have different asphalt content.

Each type should be 3 piece to take average .

2. Preparation of materials - 2

Please prepare enough mass of each material.



Put the materials in the tray.

Put the Tray in the convection oven for through night at 110℃±.

2. Preparation of materials - 3

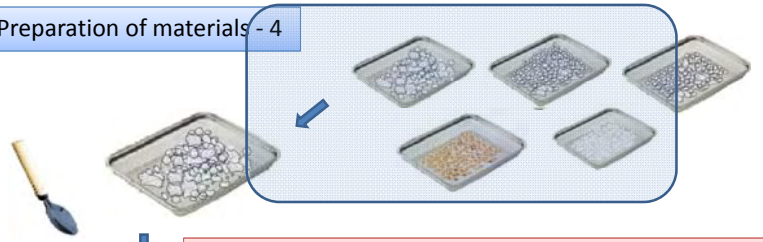
a. Take out all materials from oven.

b. Put the tray on the digital balance.

c. Adjust the reading to zero.

d. Then, start the weighing according to the weight on the table.

2. Preparation of materials - 4



a. Shift the 20-13 materials according to the mass in the table .

b. Cumulatively shift all materials in the tray.

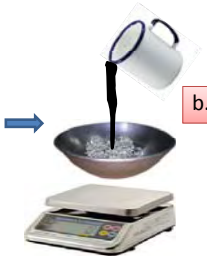
c. Total 3 x 5 As.content =15 trays will be prepared.

2. Preparation of materials - 5

d. Heat up all of these in the oven.

3. Mixing and compaction.-1

a. Shift the weighed materials in the mixing pan.



b. Add the heated asphalt according to the table.

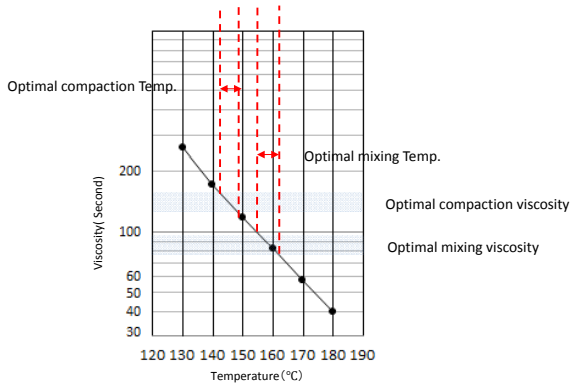
3. Mixing and compaction.-2

c. Mix the materials and asphalt enough until it get to the expected temperature.

d. Immediately after mixing, compact this mixture by the blow specified.

e. Repeat it and get 3peaces x 5 types = 15 pieces of specimen.

Mixing and compaction temperature can be obtained from “temperature – viscosity figure” like below.



Asphalt temperature-Viscosity - relation graph

3. Mixing and compaction.-3

Please open the another Power point titled Marshall Stability Test. And start from page 5 named (4.Make specimen.)

4. Optimum asphalt content

By the result of this, you can get the optimum asphalt content.

Please open another Power point named “Mix design of AC” and present from the page no.14. (Value and others are different but procedure is same)

17. Sieve Analysis

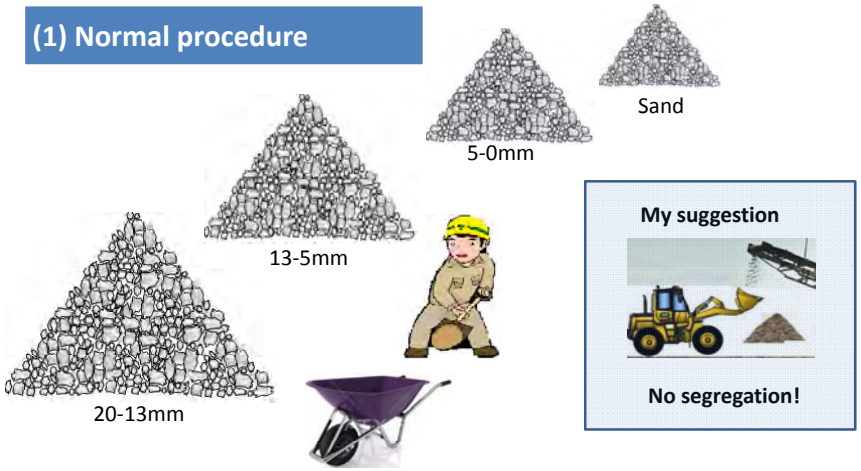
1.Sampling. -Page1

Minimum weight of the sample

Nominal Maximum Aggregate Size, mm	Minimum Weight for Test Sample, kg
9.5	1
12.5	2
19	5
25	10
37.5	15

1.Sampling.-Page2

(1) Normal procedure



My suggestion

No segregation!

2.Preparations.-Page1

Samples

Quartering device

Sieve sets

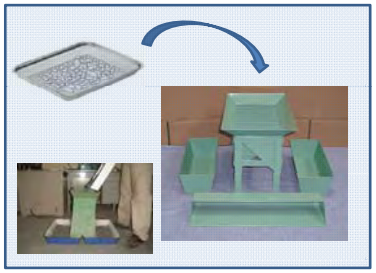
Tray

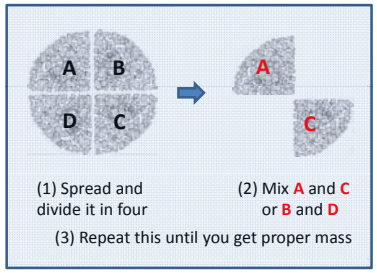
Electric balance

2.Preparations.-Page2

(1) Get the proper weight of sample

Quartering by quartering device or Quartering by manual





(2) Put the sample in the oven to dry it up(110℃±)

2.Preparations.-Page2

(3).After drying, measure and record the mass of the sample

(4).Start sieving by manual for sufficient time. **We do not have sieving machine**

(5). Continue sieve until the particles fall down to next sieve decrease in less than 1%.

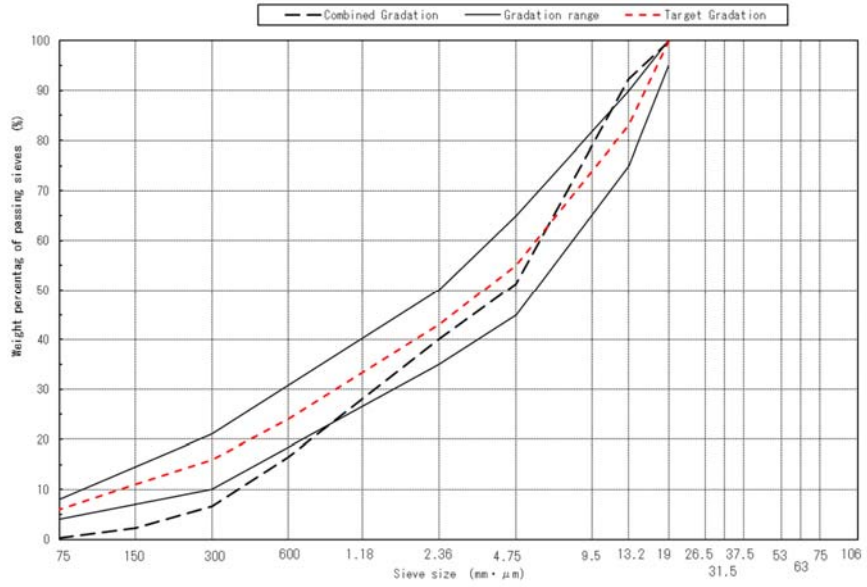
(6).Weigh each size of particle.

(7). Record the weighing data.

18. Quality Control of Asphalt Mixture By Daily Data

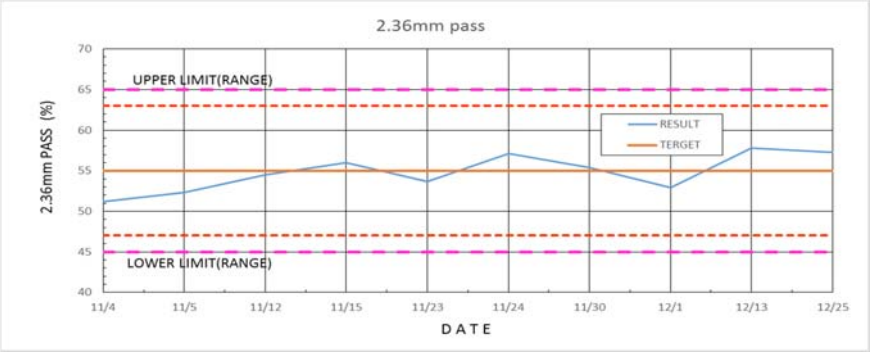
RESULT OF TEST

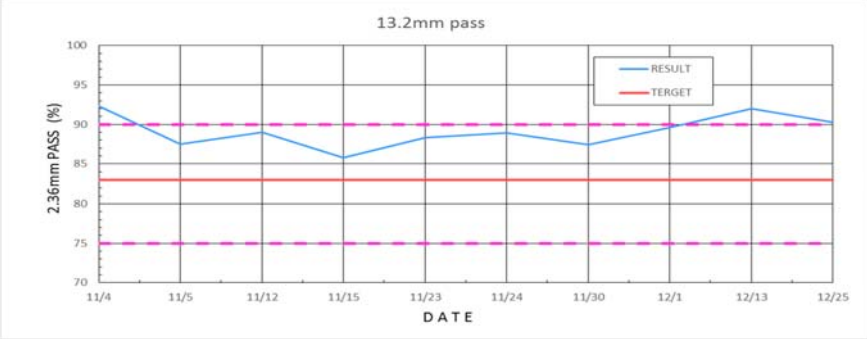
Type of material		1 1bin	2 2bin	3 3bin	4	5	6	Calculation of Combined Gradation 1 1bin	2bin	3bin	4	5	6	Combined Gradation	Target gradation	Gradation range
Mix proportion (%)		46.5	40.9	12.6												
Weight percentage of passing sieves (%)	Sieve size															
	53															
	37.5															
	31.5															
	26.5			100.0						12.6				100.0		
	19.0		100.0	98.8					40.9	12.4				99.8	100.0	95～100
	13.2	100.0	92.8	61.7				46.5	38.0	7.8				92.3	**83.0**	75～90
	9.5	99.7	62.5	3.3				46.4	25.6	0.4				72.4		
	4.75	98.6	13.2	0.1				45.8	5.4	0.0				51.2	**55.0**	45～65
	2.36	85.9	0.4					39.9	0.2					40.1	43.0	35～50
	1.18	65.9						30.6						30.6		
	600μm	35.5						16.5						16.5	24.0	18～30
	300	14.3						6.6						6.6	16.0	10～21
	150	4.9						2.3						2.3	11.0	6～16
	75	0.7						0.3						0.3	6.0	4～8

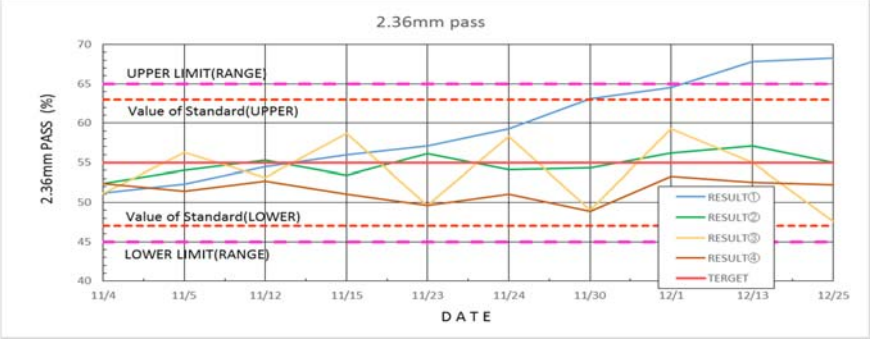


Line graph analysis

DATE	11/4	11/5	11/12	11/15	11/23	11/24	11/30	12/1	12/13	12/25
RESULT(2.36mm)	51.2	52.3	54.5	56.0	53.7	57.1	55.4	52.9	57.8	57.3
RESULT(13.2mm)	92.3	87.5	89.0	85.8	88.3	88.9	87.4	89.6	92.0	90.3

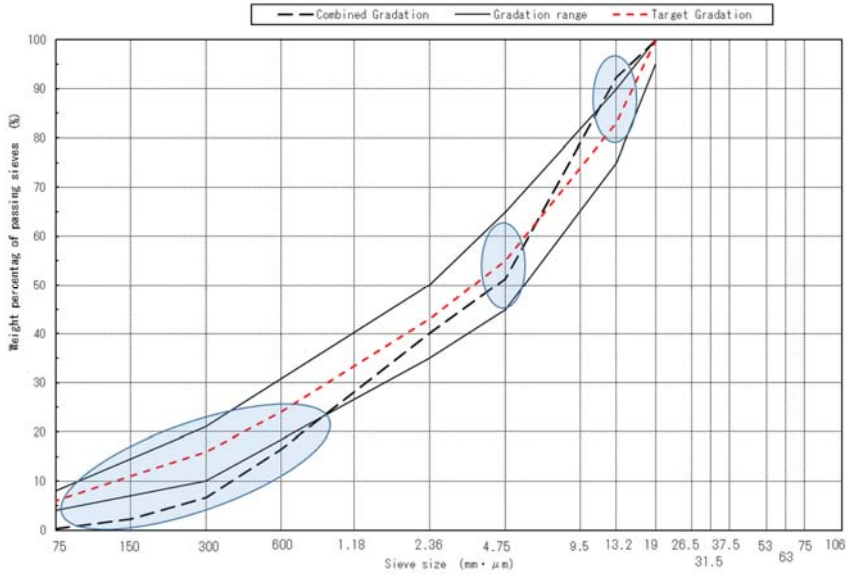






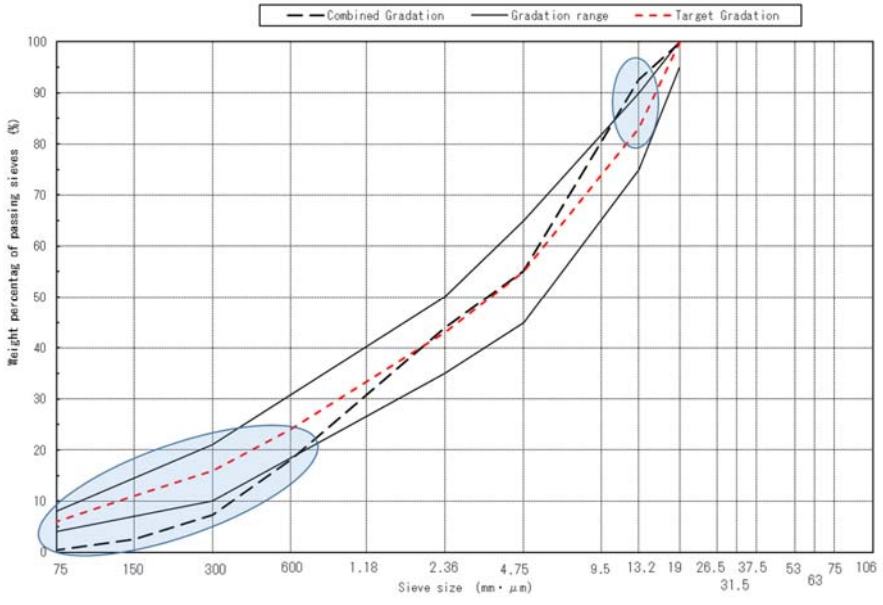
RESULT OF TEST

Type of material		1 1bin 0~5	2 2bin 5~13	3 3bin 13~20	4	5	6	Calculation of Combined Gradation 1 1bin	1 2bin	1 3bin	1 4	1 5	1 6	1 Combined Gradation	Target gradation	Gradation range
Mix proportion (%)		46.5	40.9	12.6												
Weight percentage of passing sieves (%)	Sieve size															
	53															
	37.5															
	31.5															
	26.5			100.0						12.6				100.0		
	19.0		100.0	98.8					40.9	12.4				99.8	100.0	95~100
	13.2	100.0	92.8	61.7				46.5	38.0	7.8				92.3	**83.0**	75~90
	9.5	99.7	62.5	3.3				46.4	25.6	0.4				72.4		
	4.75	98.6	13.2	0.1				45.8	5.4	0.0				51.2	**55.0**	45~65
	2.36	85.9	0.4					39.9	0.2					40.1	43.0	35~50
	1.18	65.9						30.6						30.6		
	600μm	35.5						16.5						16.5	24.0	18~30
	300	14.3						6.6						6.6	16.0	10~21
	150	4.9						2.3						2.3	11.0	6~16
	75	0.7						0.3						0.3	6.0	4~8



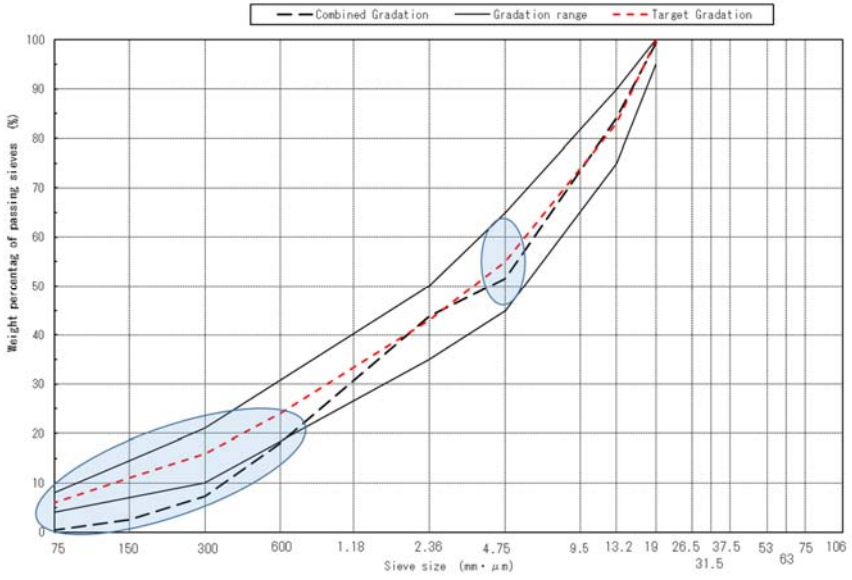
STEP1 FOR CORRECTION

Type of material		1	2	3	4	5	6	Calculation of Combined Gradation							Target gradation	Gradation range
		1bin	2bin	3bin				1								
Mix proportion (%)		51.0	36.4	12.6		100.0		1bin	2bin	3bin	4	5	6	Combined Gradation		
Weight percentage of passing sieves (%)	Sieve size															
	53															
	37.5															
	31.5															
	26.5			100.0						12.6				100.0		
	19.0		100.0	98.8					36.4	12.4				99.8	100.0	95～100
	13.2	100.0	92.8	61.7				51.0	33.8	7.8				92.6	83.0	75～90
	9.5	99.7	62.5	3.3				50.8	22.8	0.4				74.0		
	4.75	98.6	13.2	0.1				50.3	4.8	0.0				55.1	55.0	45～65
	2.36	85.9	0.4					43.8	0.1					43.9	43.0	35～50
	1.18	65.9						33.6						33.6		
	600μm	35.5						18.1						18.1	24.0	18～30
	300	14.3						7.3						7.3	16.0	10～21
	150	4.9						2.5						2.5	11.0	6～16
	75	0.7						0.4						0.4	6.0	4～8



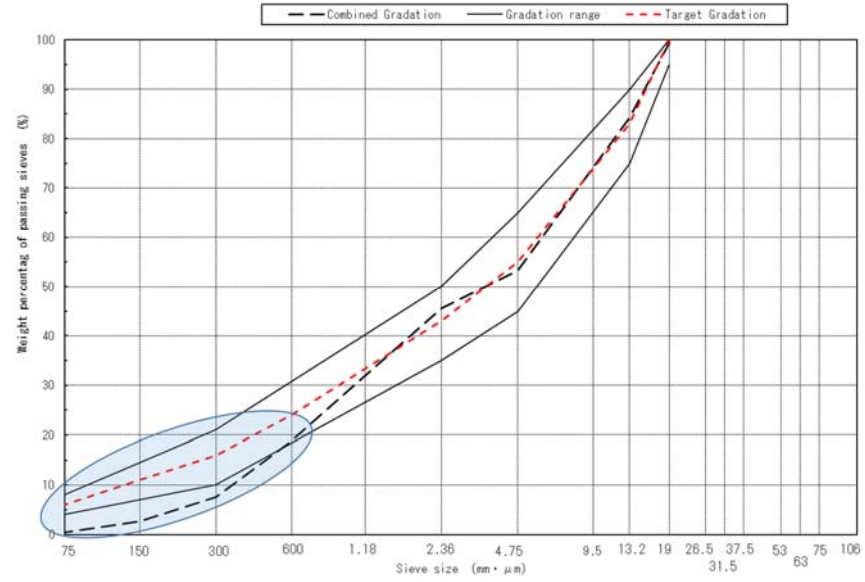
STEP2 FOR CORRECTION

Type of material		1	2	3	4	5	6	Calculation of Combined Gradation							Target gradation	Gradation range
		1bin	2bin	3bin				1								
Mix proportion (%)		51.0	9.0	40.0		100.0		1bin	2bin	3bin	4	5	6	Combined Gradation		
Weight percentage of passing sieves (%)	Sieve size															
	53															
	37.5															
	31.5															
	26.5			100.0						40.0				100.0		
	19.0		100.0	98.8					9.0	39.5				99.5	100.0	95～100
	13.2	100.0	92.8	61.7				51.0	8.4	24.7				84.1	83.0	75～90
	9.5	99.7	62.5	3.3				50.8	5.6	1.3				57.7		
	4.75	98.6	13.2	0.1				50.3	1.2	0.0				51.5	55.0	45～65
	2.36	85.9	0.4					43.8	0.0					43.8	43.0	35～50
	1.18	65.9						33.6						33.6		
	600μm	35.5						18.1						18.1	24.0	18～30
	300	14.3						7.3						7.3	16.0	10～21
	150	4.9						2.5						2.5	11.0	6～16
	75	0.7						0.4						0.4	6.0	4～8



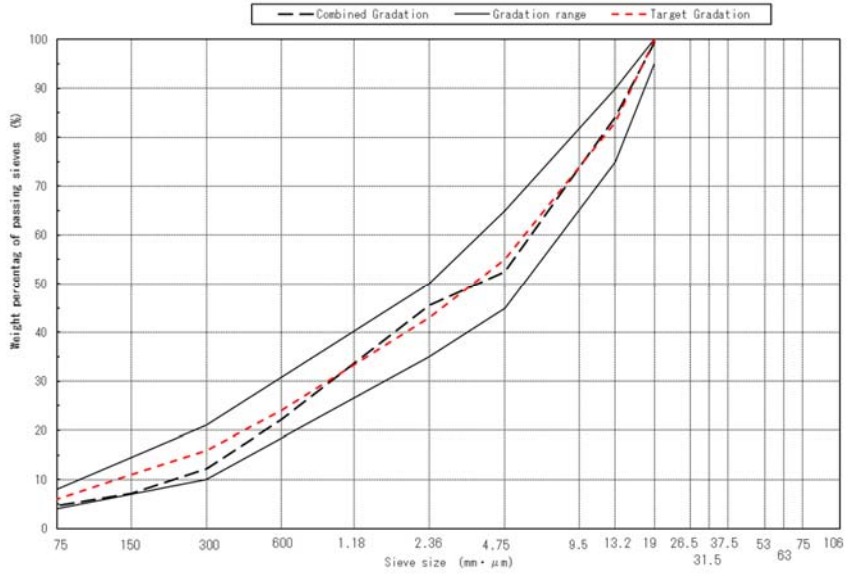
STEP3 FOR CORRECTION

Type of material		1 1bin	2 2bin	3 3bin	4	5	6	Calculation of Combined Gradation 1 1bin	2bin	3bin	4	5	6	Combined Gradation	Target gradation	Gradation range
Mix proportion (%)		53.0	7.0	40.0		100.0										
Weight percentage of passing sieves (%)	Sieve size															
	53															
	37.5															
	31.5															
	26.5			100.0						40.0				100.0		
	19.0		100.0	98.8					7.0	39.5				99.5	100.0	95～100
	13.2	100.0	92.8	61.7				53.0	6.5	24.7				84.2	83.0	75～90
	9.5	99.7	62.5	3.3				52.8	4.4	1.3				58.5		
	4.75	98.6	13.2	0.1				52.3	0.9	0.0				53.2	55.0	45～65
	2.36	85.9	0.4					45.5	0.0					45.5	43.0	35～50
	1.18	65.9						34.9						34.9		
	600μm	35.5						18.8						18.8	24.0	18～30
	300	14.3						7.6						7.6	16.0	10～21
	150	4.9						2.6						2.6	11.0	6～16
	75	0.7						0.4						0.4	6.0	4～8



(STEP4 FOR CORRECTION)

Type of material		1 1bin	2 2bin	3 3bin	4 Filler	5	6	Calculation of Combined Gradation 1 1bin	2bin	3bin	4	5	6	Combined Gradation	Target gradation	Gradation range
Mix proportion (%)		46.0	8.0	40.0	6.0	100.0										
Weight percentage of passing sieves (%)	Sieve size															
	53															
	37.5															
	31.5															
	26.5			100.0						40.0				100.0		
	19.0		100.0	98.8					8.0	39.5				99.5	100.0	95～100
	13.2	100.0	92.8	61.7	100.0			46.0	7.4	24.7	6.0			84.1	83.0	75～90
	9.5	99.7	62.5	3.3				45.9	5.0	1.3	6.0			58.2		
	4.75	98.6	13.2	0.1	100.0			45.4	1.1	0.0	6.0			52.5	55.0	45～65
	2.36	85.9	0.4					39.5	0.0		6.0			45.5	43.0	35～50
	1.18	65.9			100.0			30.3			6.0			36.3		
	600μm	35.5			99.0			16.3			5.9			22.2	24.0	18～30
	300	14.3			94.1			6.6			5.6			12.2	16.0	10～21
	150	4.9			81.0			2.3			4.9			7.2	11.0	6～16
	75	0.7			72.9			0.3			4.4			4.7	6.0	4～8



Reference Document 2

Construction Management

Forms and Chart to be used for the construction Management

[Blank Forms]

1. Method Statement
2. Tack/Prime coat check sheet
3. Delivery ticket
4. Asphalt Mixture Delivery Log Book
5. Diagram of Asphalt mixing plant
6. Reason of Bad Mixture
7. Flow of Quality control

[Samples]

1. Method Statement
2. Tack/Prime coat check sheet
3. Delivery ticket

[Blank Forms]

To _____ Submission date _____

METHOD STATEMENT

Name of project: _____

SEHM

Contents

1 WorkOverview

(1) Name of project：

(2) Construction area：

(3) Construction period：

(4) Budget：

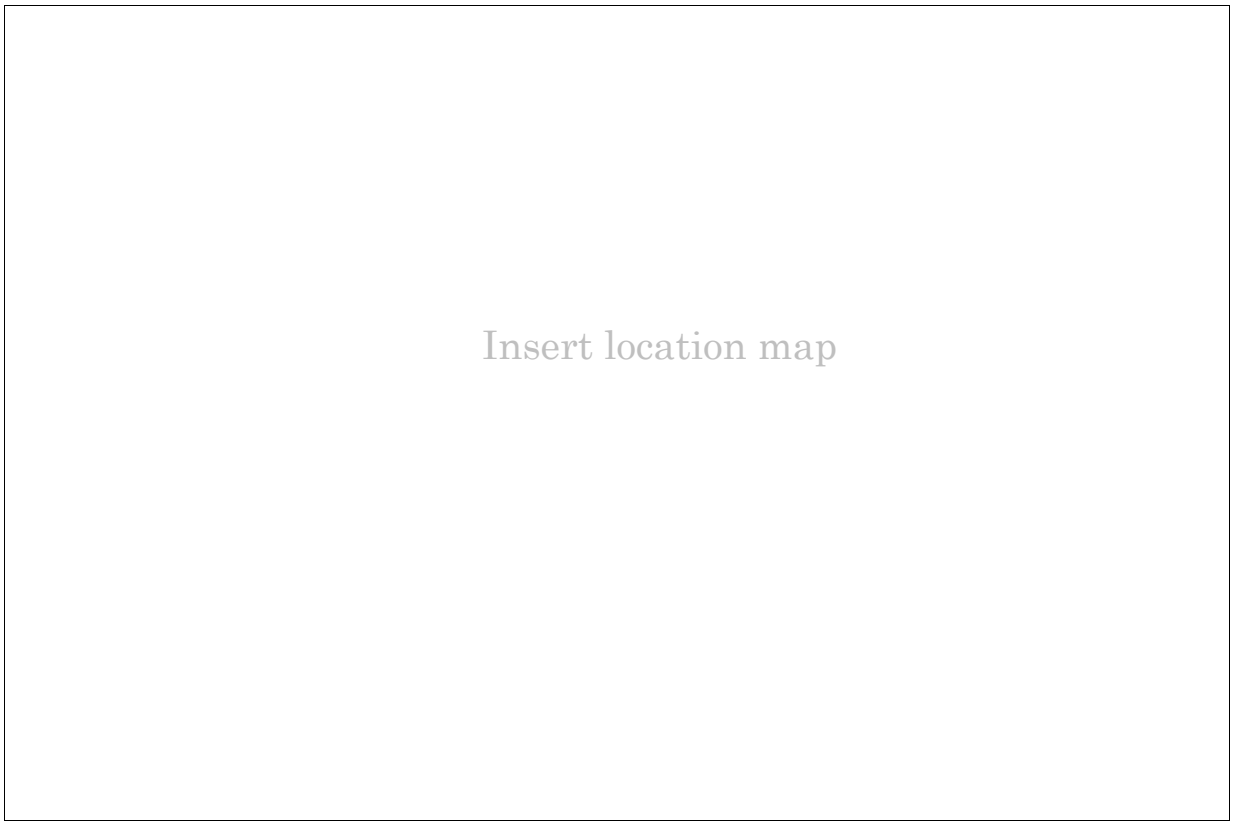
(5) Client

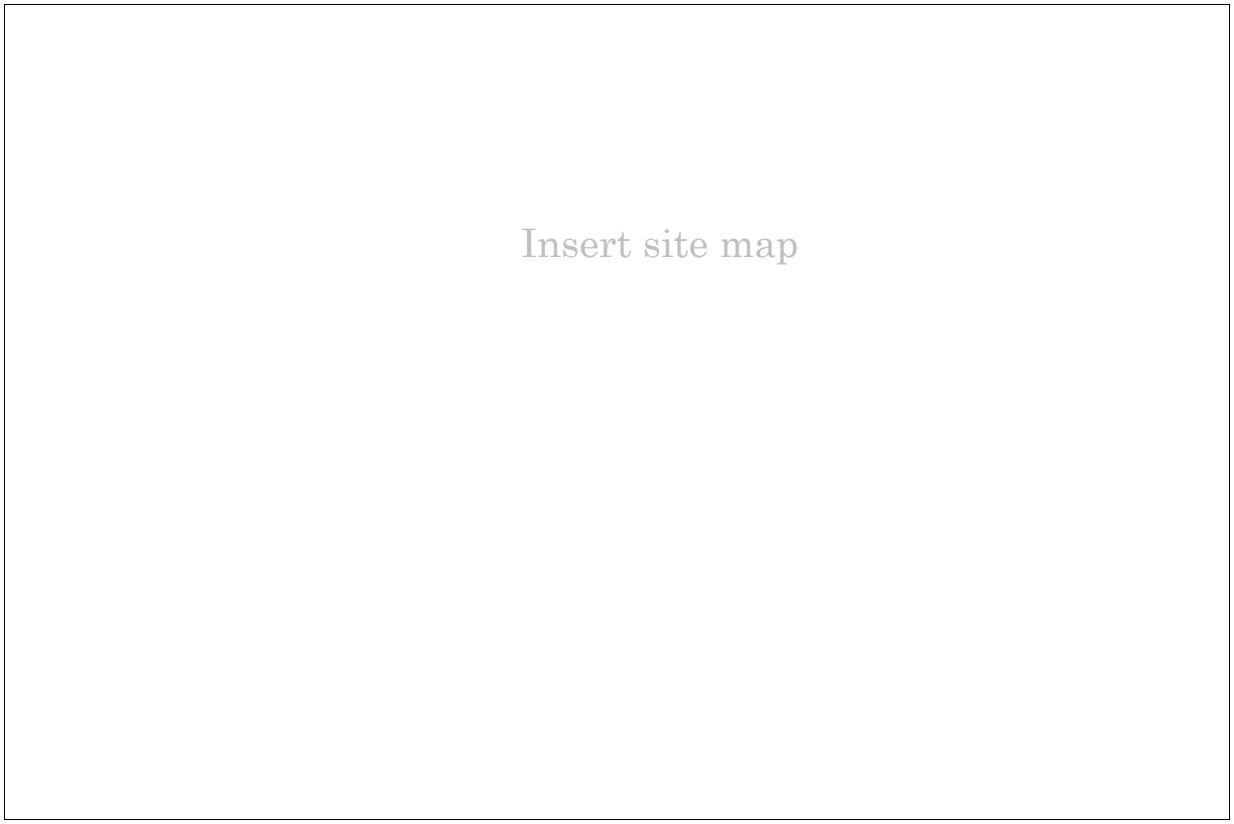
(6) Constructor

(7) Description of work Pavement

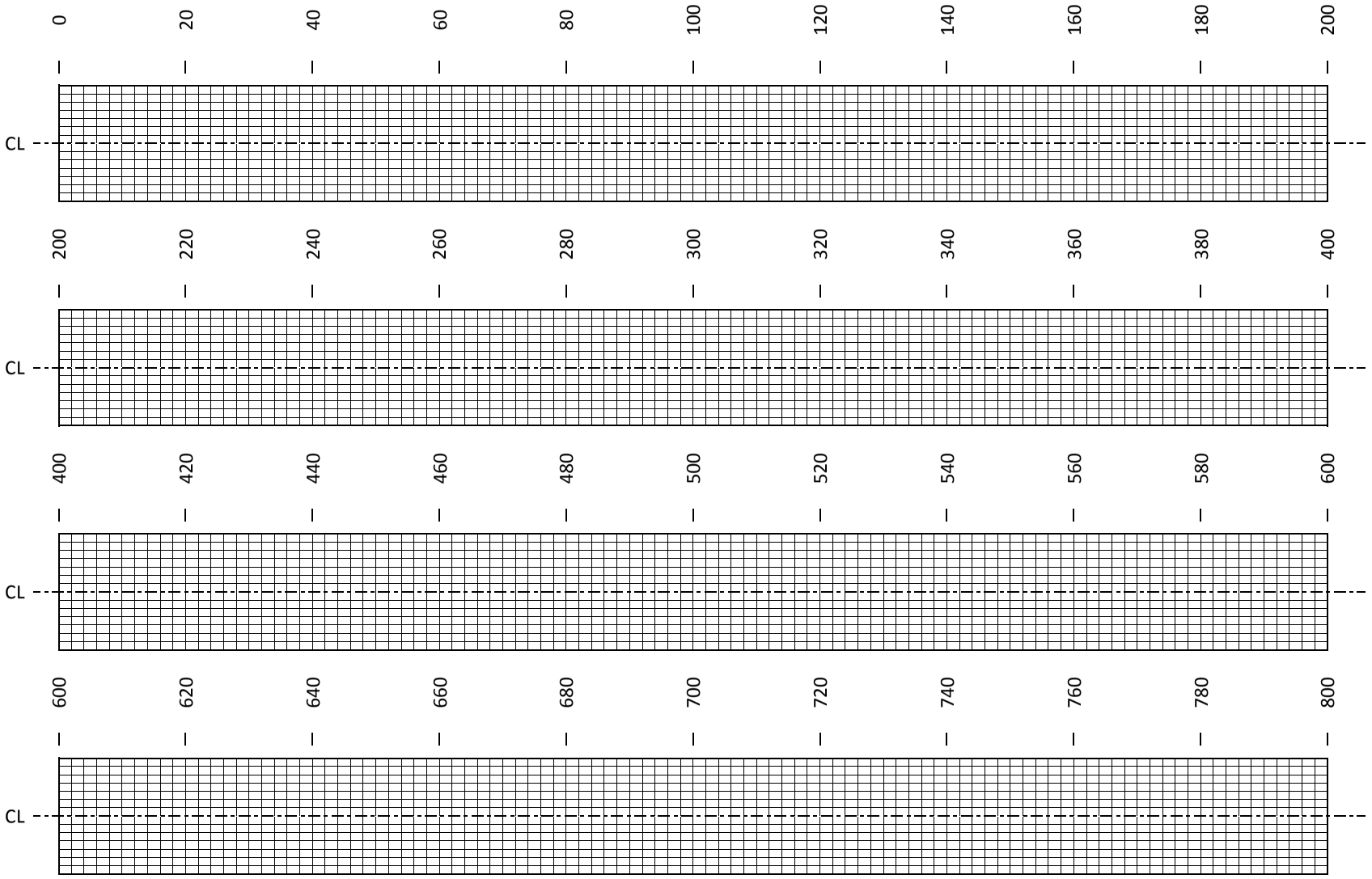
	Type of works	Specification	Unit	Quantity	Remarks
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

(8) Site map

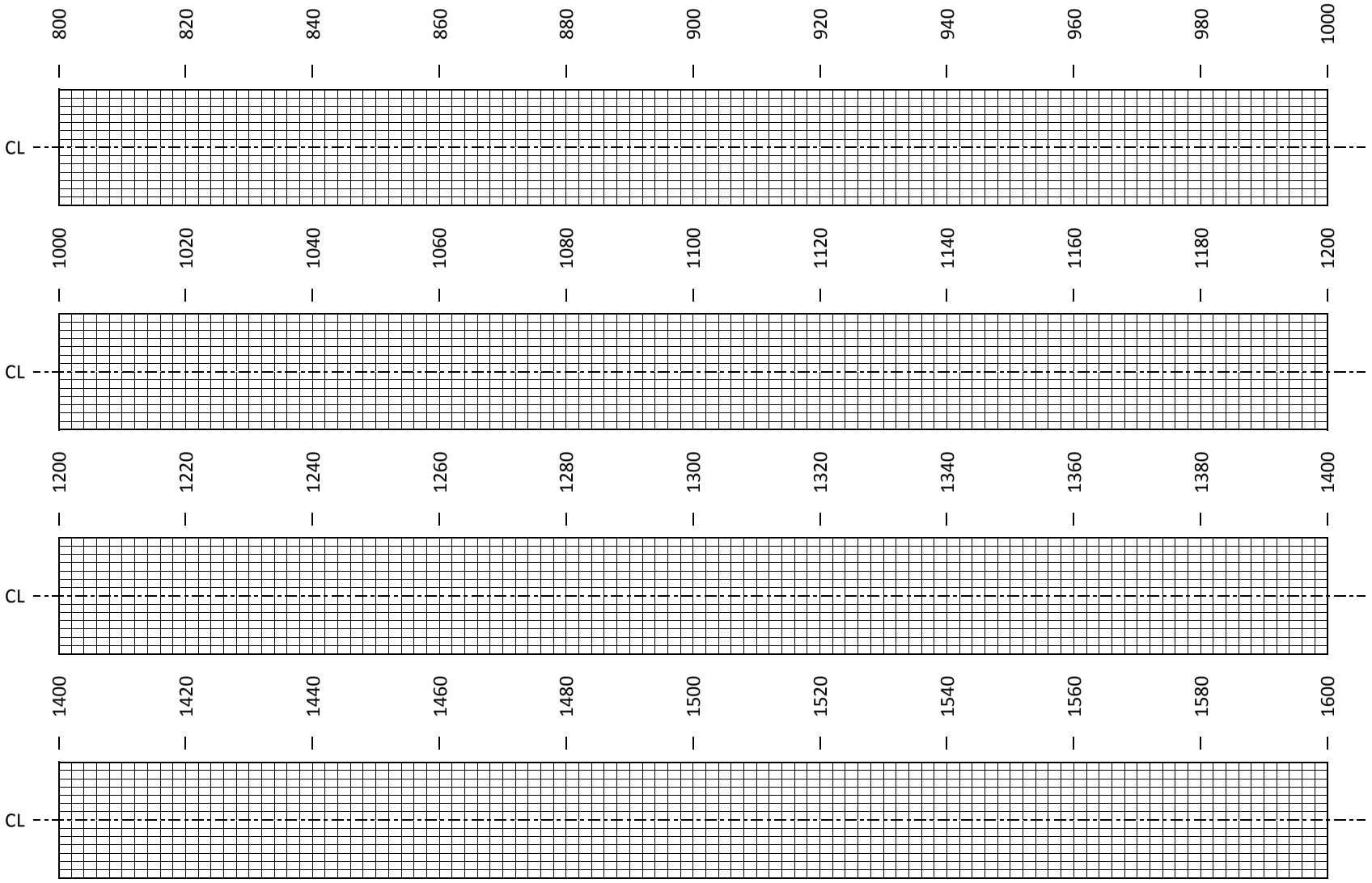




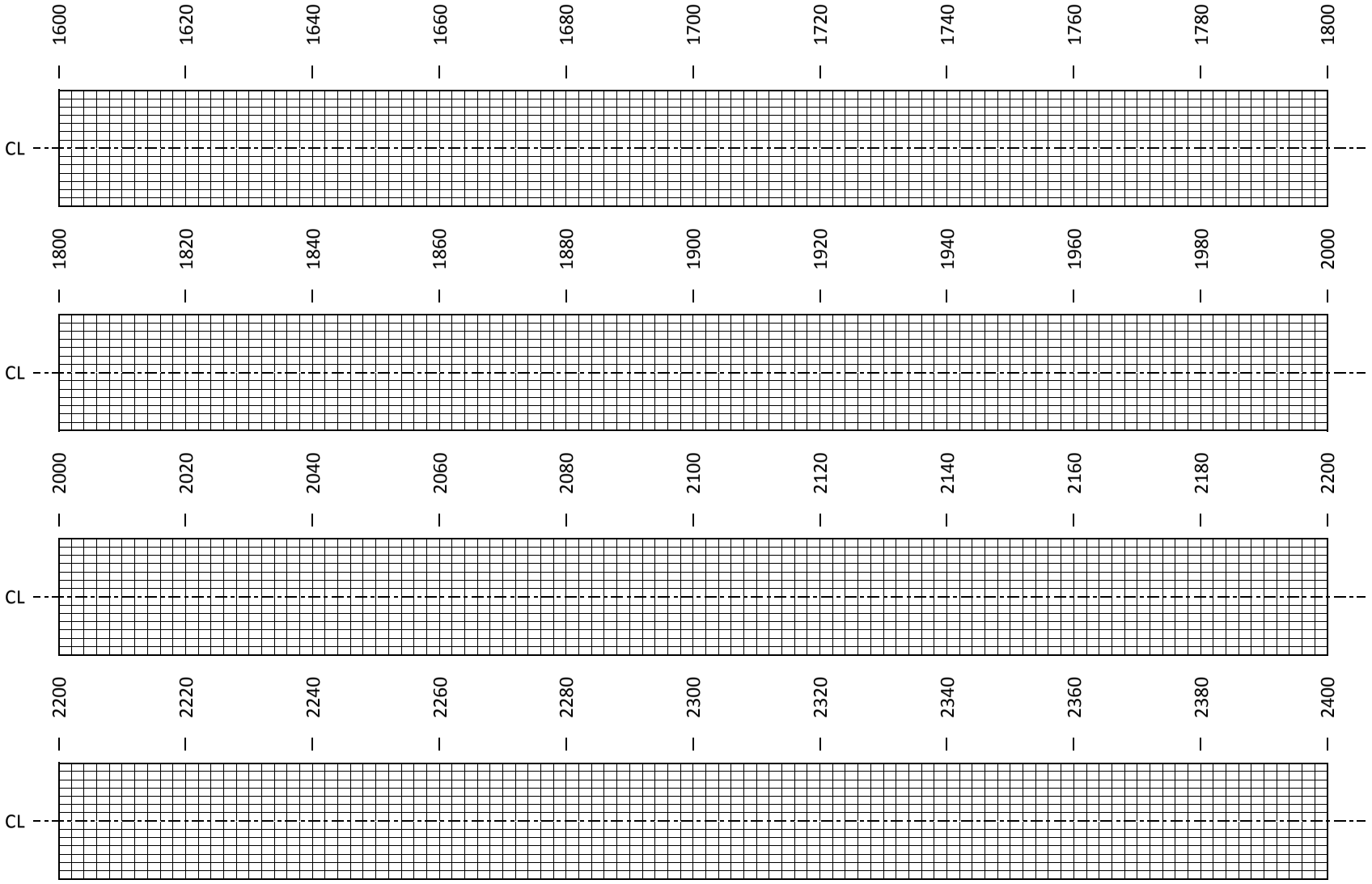
Name of project : 0 (9) PLAN VIEW-1



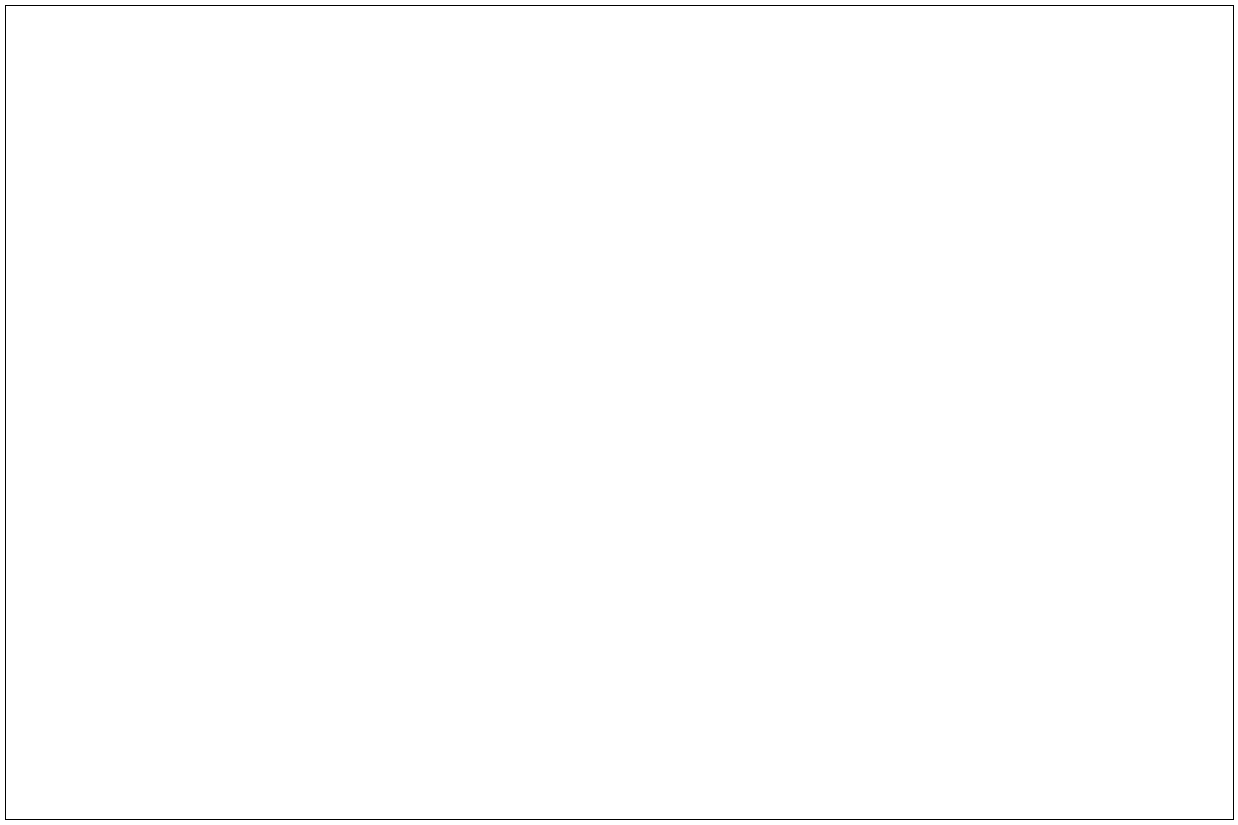
Name of project : 0 (9) PLAN VIEW-2

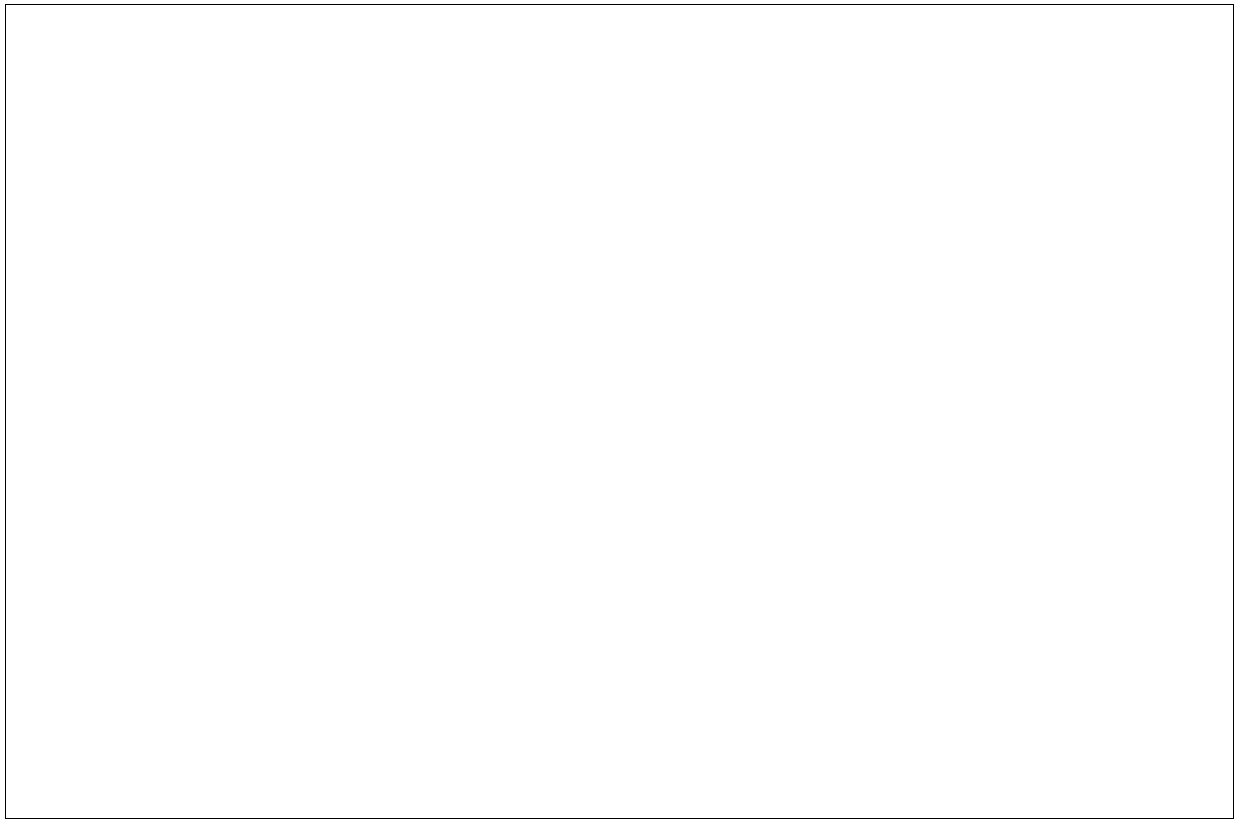


Name of project : 0 (9) PLAN VIEW-3



(9) Design drawingg





PROJECT for IMPROVEMENT of ROAD MAINTENACE

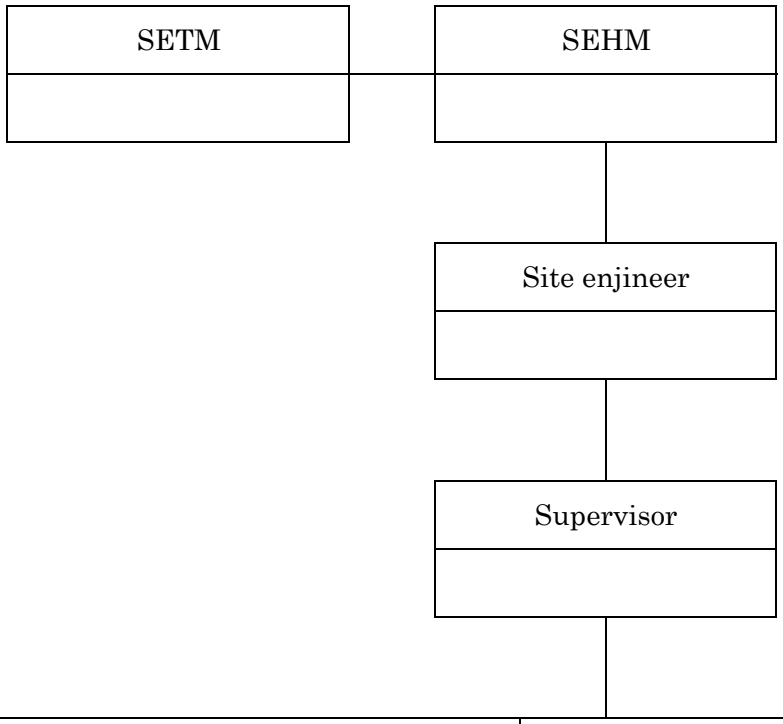
2 Planned progress schedule　　Name of project :　　0

Start date		In charge		Date	
Completion date		Made by		Reviewed by	

	Work Description	Unit	Quantity	Daily progress	Year / Month / Day	Remarks
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						

Approved by		Date	
Approved by		Date	

3 Site organization chart



	Type of works	Who is in charge	Remarks
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

4 Machine to be used

	Machinary	No	Type/Spec.	Use for	Remarks
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					

5 Materials to be used

	Material	Unit	Type/Quality	Quantity	Remarks
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

6 Construction methods

6-1 Construction flow (Flow of each types of work)

7　Construction control plan

7-1　Quality control plan

Check item	Detail	Frequency	Standard value	Remarks

7-2　Shape and elevation control plan

Check item	Detail	Frequency	Standard value	Remarks

8 Safety management plan

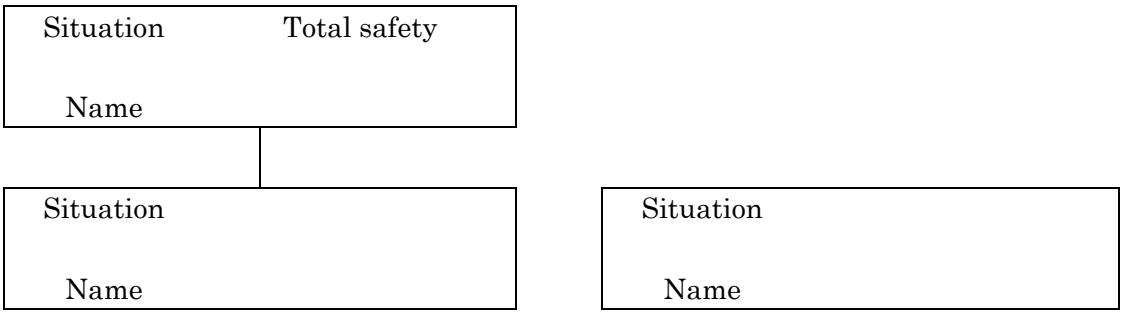
8-1 Who is in charge? Ostonaev Khurshed

8-2 Activity plan to keep safety

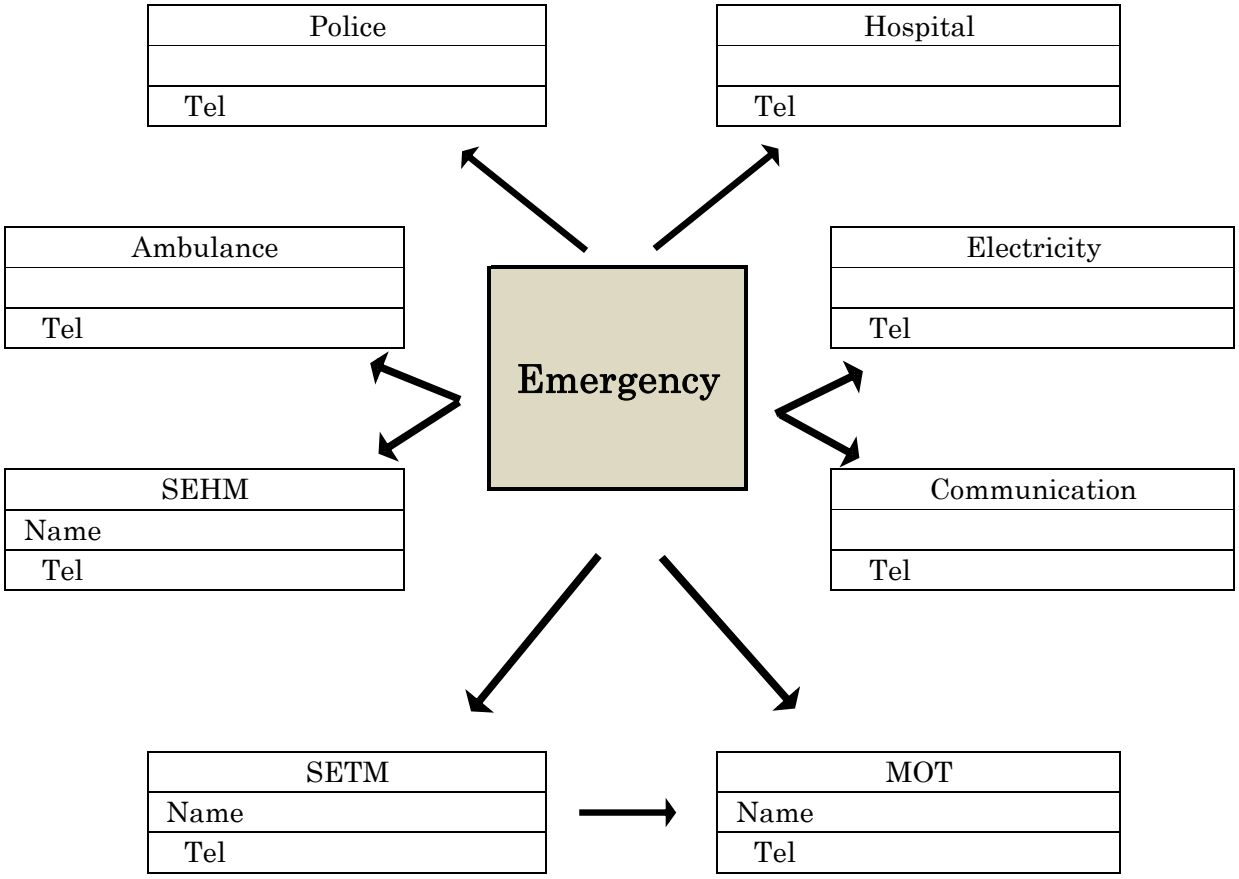
Activity		Who?	What you do?	Time
Daily activity				
Weekly activity				
Monthly activity				
When required				

9 Emergency control plan

9-1 Organization for safety



9-2 Emergency call



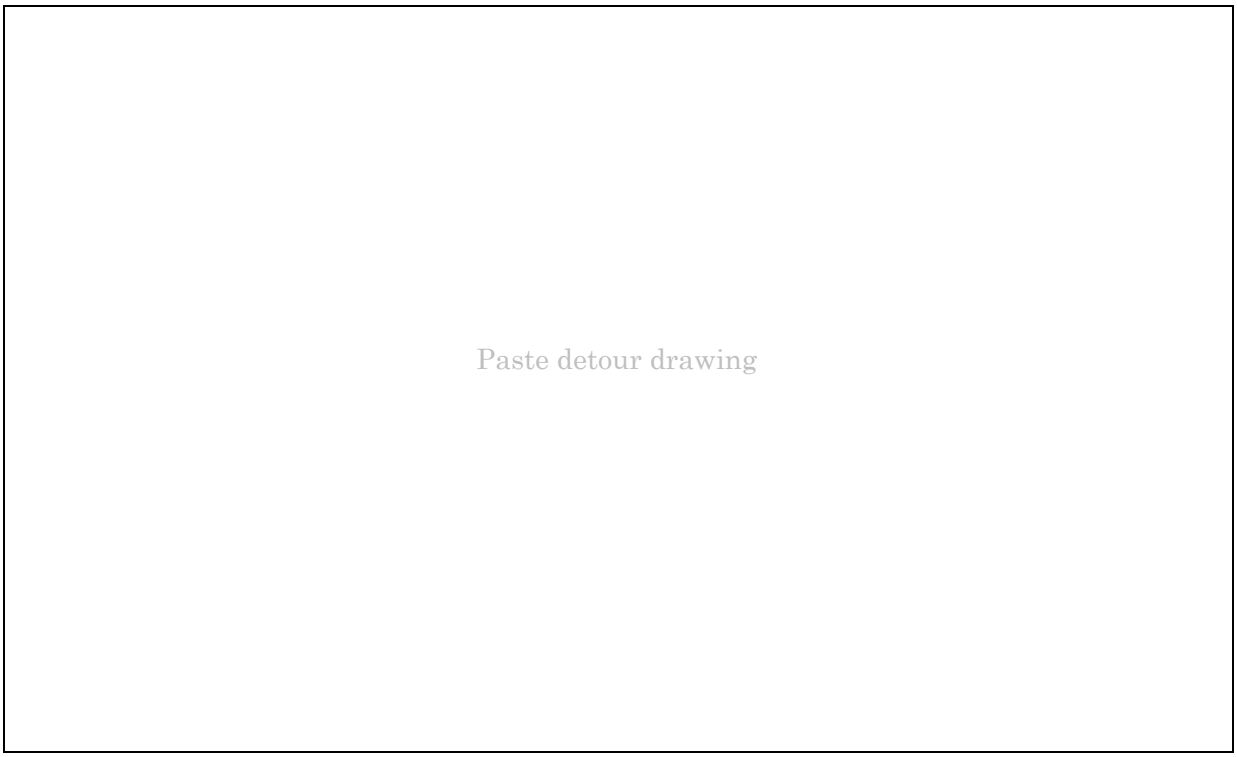
10 Traffic control

10-1 How to keep construction area?

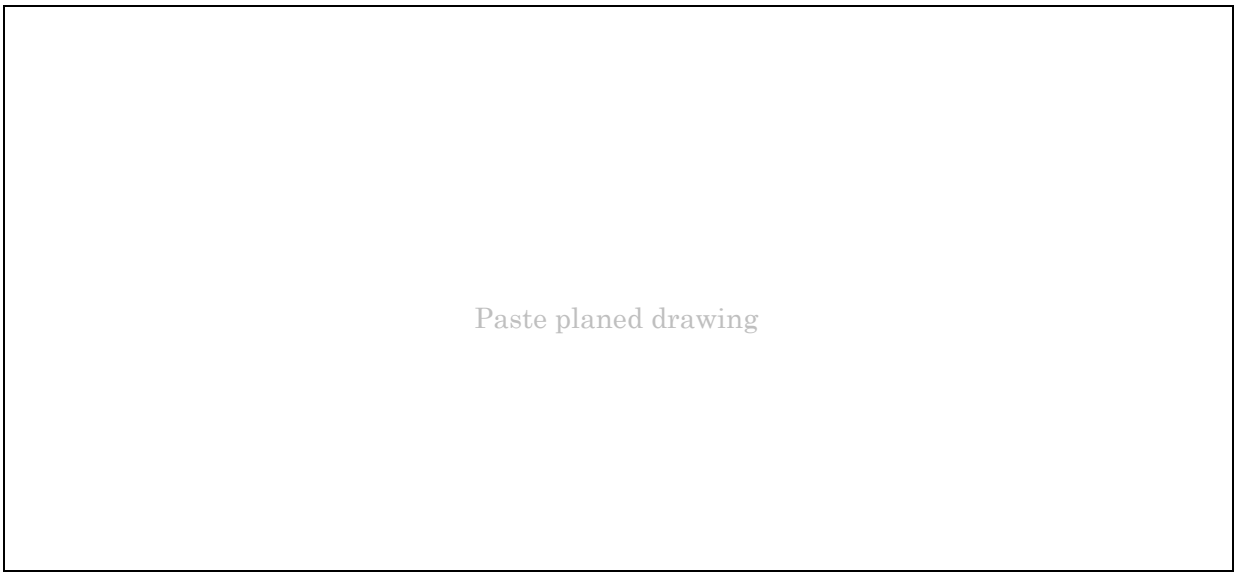
A. Full Close

B. Half close (Alternating traffic)

10-2 Detour plan (If you choose A)



10-3 Safty property setting plan



11 Environmental measures

11-1 Air pollution countermeasures

A
B
C
D
E
F

11-2 Water pollution countermeasures

A
B
C
D
E
F

11-3 Others

A

B
C
D
E
F

12 Others

We sincerely want that current project successfully and timely will implemented and completed

Measurement of application volume

Prime coat	Tack coat

Name of Project

Location

Mesuring date

Measured by

Measuring point	Wieight of mat(g)		Wieight of cut back(g)	SG of cut back	Volume of cut back (mL)	Area of Mat(m2)	Application volume (L/m2)
	A	B	C	D	E	F	G
	Before apply	After apply	B-A	1.001	E=C/D		$G=\frac{E}{F*1000}$
Example	28	45	17	1.001	16.98	0.0625	0.27
Average							

Remarks

Delivery chicket

1. For mixing Plant

Production Date		
Day	Month	year

No.

To	

Type of mixture	Time	
1. Dense type	Depart AP	:
2. Coase type	Arrive Site	:
3. Sandy type	Temperature	
4	Deparet	℃
5	Arrive	℃
6	Quantity	
Plate No. of Vehicle	On this truck	t
	Cummulative	t

Memo

Sent by
Received by

Plant Name:

Ref 2-3

Delivery chicket

2. Foe Driver

Production Date		
Day	Month	year

No.

To	

Type of mixture	Time	
1. Dense type	Depart AP	:
2. Coase type	Arrive Site	:
3. Sandy type	Temperature	
4	Deparet	℃
5	Arrive	℃
6	Quantity	
Plate No. of Vehicle	On this truck	t
	Cummulative	t

Memo

Sent by
Received by

Plant Name:

Delivery chicket

3. For Reciever

Production Date		
Day	Month	year

No.

To	

Type of mixture	Time	
1. Dense type	Depart AP	:
2. Coase type	Arrive Site	:
3. Sandy type	Temperature	
4	Deparet	℃
5	Arrive	℃
6	Quantity	
Plate No. of Vehicle	On this truck	t
	Cummulative	t

Memo

Sent by
Received by

Plant Name:

Asphalt Mixture Delivery Record

Date :

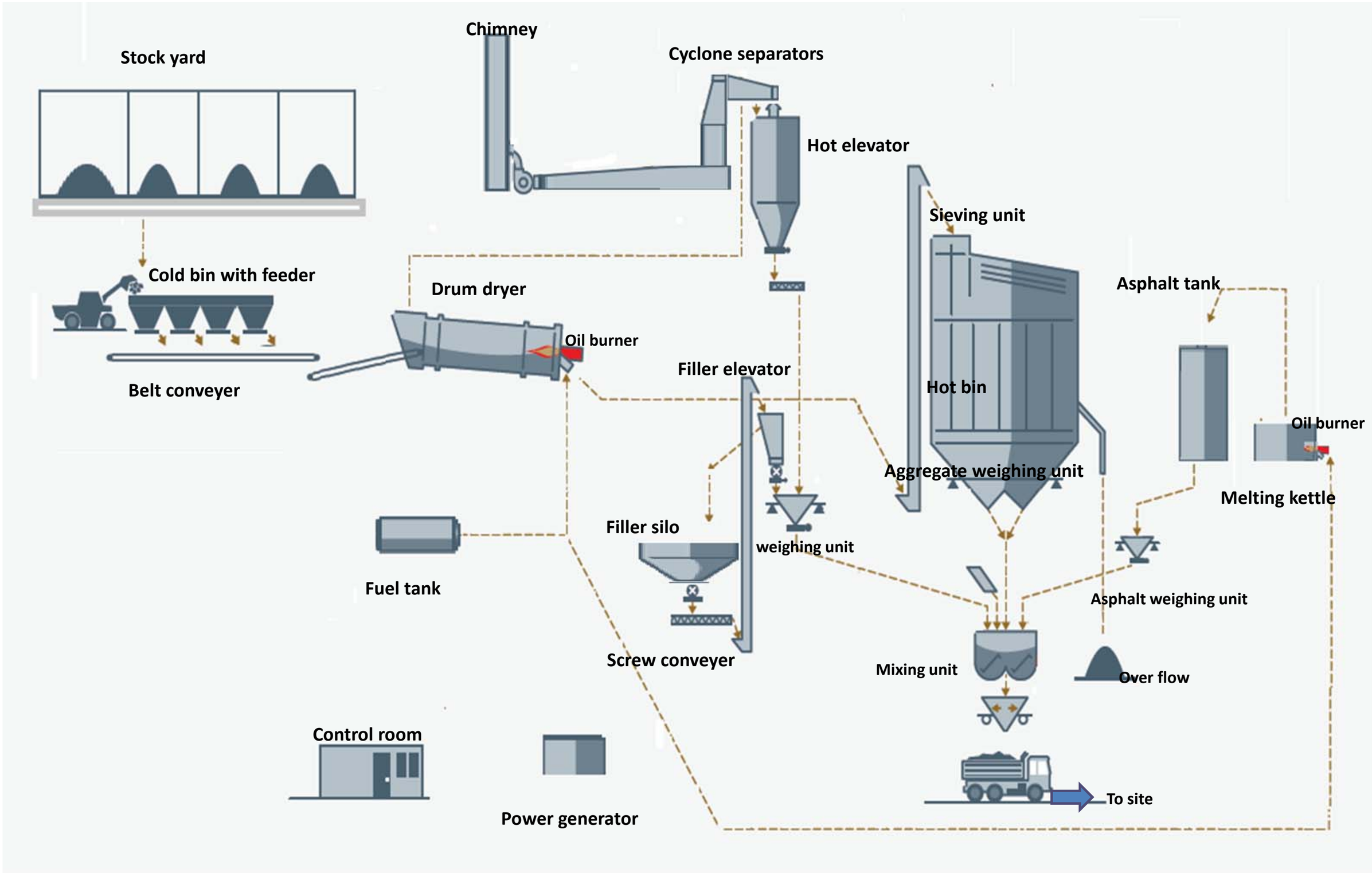
Asphalt Plant : Jilkuhl Bahdad

Report by :

Type of mixture										
Truck No.	Number plate	Start at plant		Arrival		Temperature		Deliery		Remarks
		time	℃	time	℃	Spreading (℃)	Initial Comp. (℃)	Weight (t)	Cumulative(t)	
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
The most suitable mixing temperature						℃	to			℃
Initial Compaction Temperature				More than					℃	

Remarks:

DIAGRAM OF ASPHALT PLANT



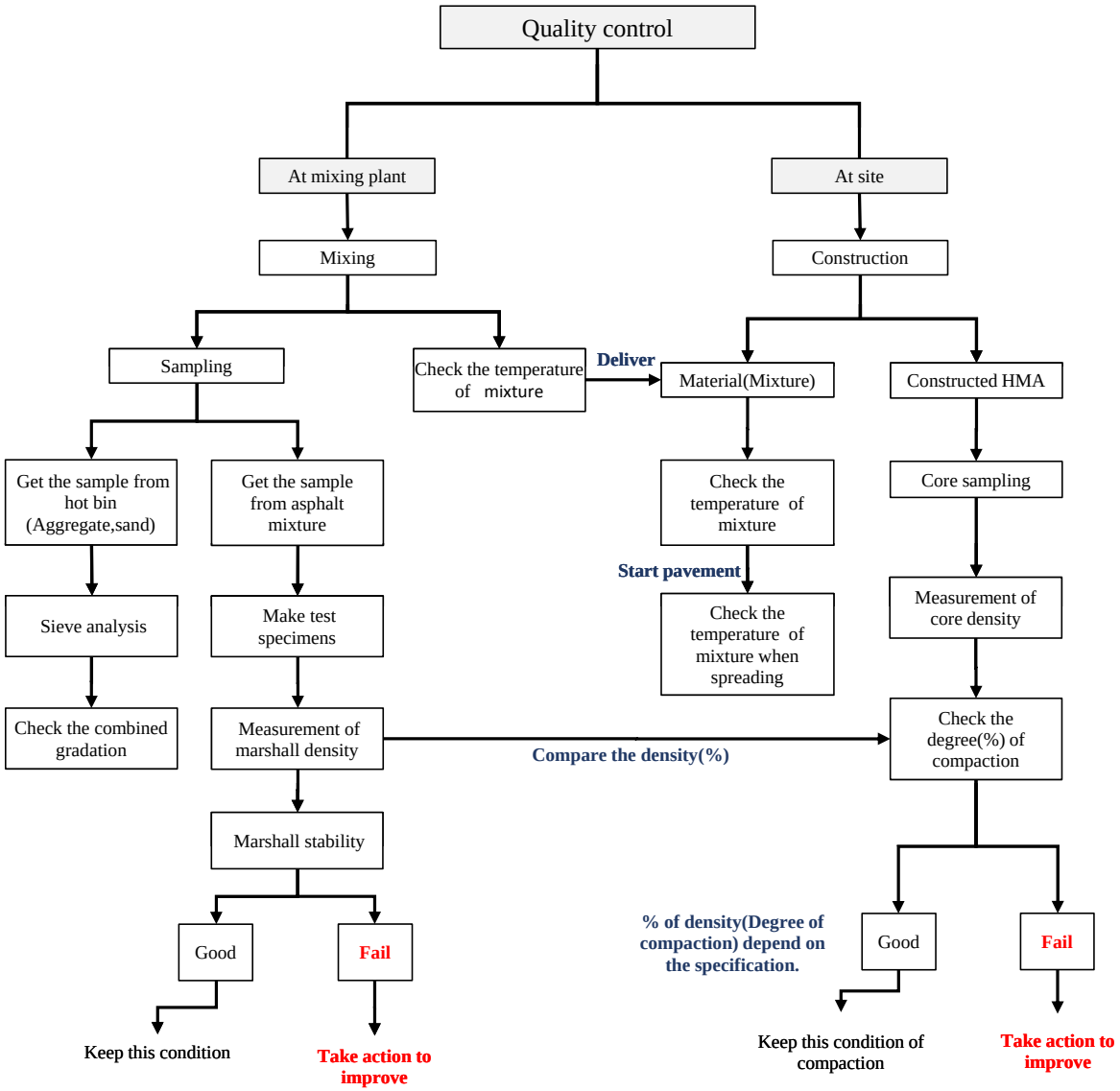
Bad Mixture and the reason

Reason of bad condition \ Bad Cundition of Mixture		:Mixture on the truck flow like hot chocolate	:Steam / small babble from mixture	:Mixture do not have enough stickiness	:Yellow smoke from mixtuer	:Mixture is not uniform for each batch	:Aggregate is not coverd by bitumen	:Fine materials are separated in the mixture	:Bitumen in mixture is separated	:Can not keep constant temperature	:Fine particles are too much in mixture	:Grading is bad	:Asphalt content is bad		
Stock	aggregate quality is bad		○				○								
	grading have big change					○				○		○			
	Water content is too high		●				○			○					
Aggregate feeding system	Stock yard control		○	○						○	○	○			
	Feeding speed is bad			○						●	○	○			
Dryer system	Over feeding		●												
	slope of dryer is too big		○												
	operating condition	○	○		●					●					
	Termometer problem	○	○		○					○					
	aggregate temperature is too high	●			●										
Sieving unit and Hot bin	Siebing is not enough			○		●					●	●			
	Seggregation of aggregate in hot bin			○							○	○			
	Shortage of aggregate in hot bin											○			
	Filler supply is not stable	○				○					○	○			
Weighing unit	Un-proper weighing	○		●		●			○		●	●	○		
	Asphalt content is too low			●			●						○		
	Asphalt content is too high	●							●				○		
	Problem on asphalt weighing unit	○		○		○	○		○				●		
	Problem on aggregatet weighing unit			○		○	○		○		○				
Mixing device	Shortage of mixing time			○			●				○				
	Wearing of mixing paddle			○			○	●	○						
	Problem on emission gate							○							

● = main reason ○=possibility

Ref 2-7

Flow of Quality Control



[Samples]

To | Submission date

METHOD STATEMENT

Name of project: Pavement repair of Rudaki-03Road-4

Rudaki SEHM

Contents

1 WorkOverview

(1) Name of project : Pavement repair of Rudaki-03Road-4

(2) Construction area : Rudaki-03_4

(3) Construction period : 30 days

(4) Budget : Nil

(5) Client Ministry of transport

(6) Constructor Rudaki SEHM

(7) Description of work Over lay

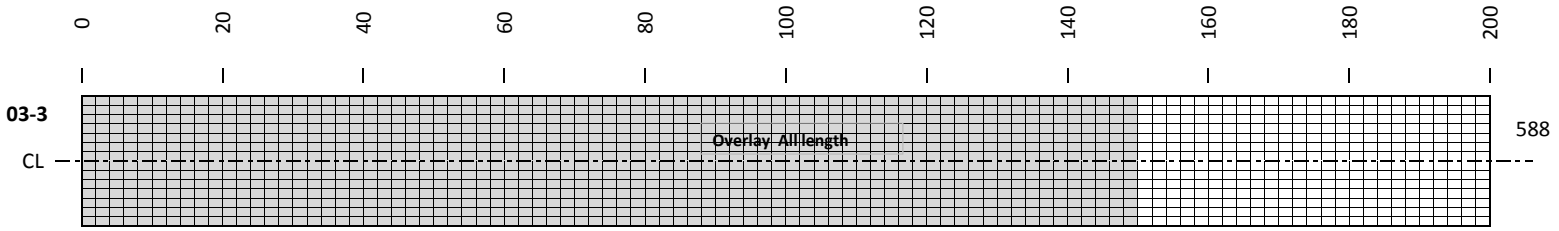
Type of works		Specification	Unit	Quantity	Remarks
1	Preparation		Location	1	
2	Shoulder Clearing		m	300	
3	Surface clearing		m2	1050	Crack
4	Tack coat	0.3L/м2	м2	1050	Over lay
5	Over lay	Ave. T=4cm	м2	1050	
6	Shoulder treatment		m	300	w=1.0m
7	Cleaning site		Location	1	
8					
9					
10					
11					
12					
13					

(8) Site map


Rohati
Khojikatagan
Vahdat
Tezgar
Karasu
Dushanbe
Rudaki-02
Rudaki-03-2
Rudaki-03-1
Rudaki-03-3
Sukanabad
Balkhi
Rudaki
Image © 2016 DigitalGlobe
© 2016 Google
Google earth
画像取得日: 2016/6/18 38° 28'26.51" N 68° 51'32.73" E 標高 1039 m 高度 15.84 km


150m
© 2016 Google
Image © 2016 DigitalGlobe
2005
Google earth
画像取得日: 2016/7/24 38° 25'19.72" N 68° 57'04.85" E 標高 1166 m 高度 1.70 km

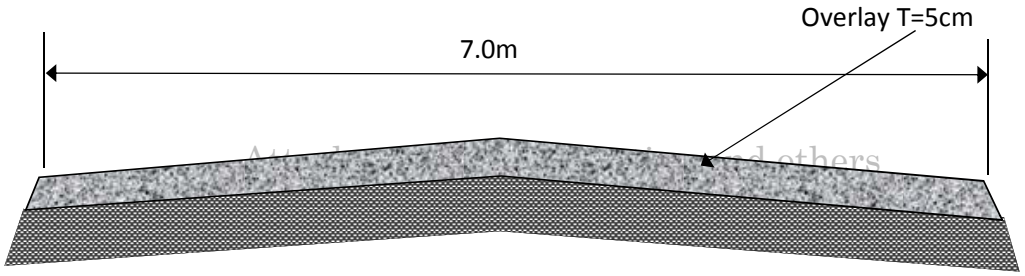
Name of project : Pavement repair of Rudaki-03Road-3 (9) PLAN VIEW-1



	Overlay T=5cm	m2	1050

(9) Design drawingg

Overlay and Leveling



Attach typical cross section and others

PROJECT for IMPROVEMENT of ROAD MAINTENACE

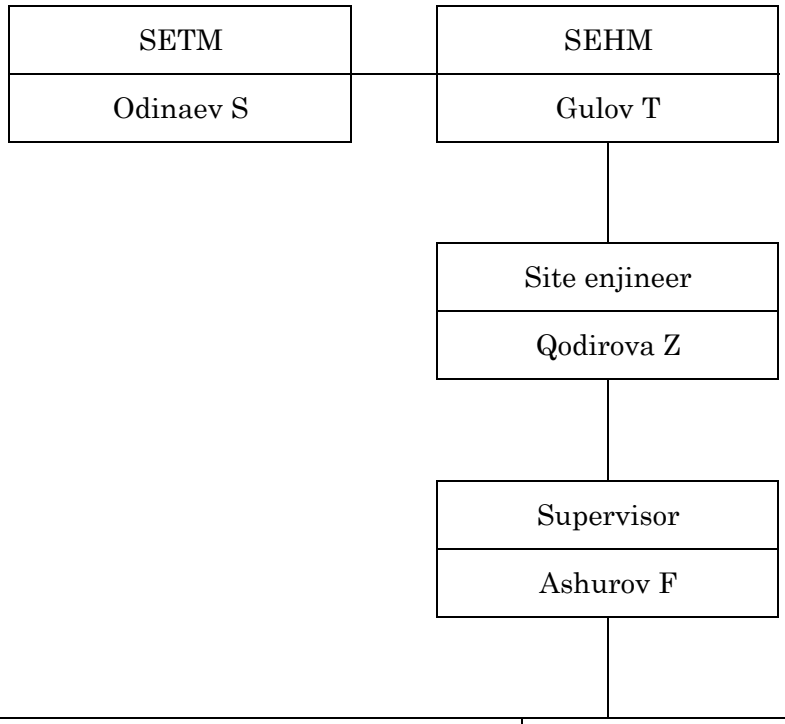
2 Planned progress schedule　　Name of project :　　Pavement repair of Rudaki-03Road-4

Start date		In charge		Date	
Completion date		Made by		Reviewed by	

	Work Description	Year			2016		Remarks
		Month			Aug.	September	Oct.
		Day			10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	1 2 3 40 5 6 7 8
		Unit	Quantity	Daily progress			
1	Preparation	Location	1				
2	Shoulder Clearing	m	300				
3	Surface clearing	m2	1050				
4	Tack coat	м2	1050				
5	Over lay	м2	1050				
6	Shoulder treatment	m	300				
7	Cleaning site	Location	1				
8							
9							
10							
11							
12							
13		m	223				

Approved by		Date	
Approved by		Date	

3 Site organization chart



	Type of works	Who is in charge	Remarks
1	Preparation	Nosirov I	
2	Shoulder Clearing	Astanaqulov U	
3	Surface clearing	Khatamov S	
4	Tack coat	Yusupov E	
5	Over lay	Mirzosaidov M	
6	Shoulder treatment	Astanaqulov U	
7	Cleaning site	Mirzosaidov M	
8		Samadov K	
9		Davlatov O	
10		Samadov K	
11		Astanaqulov U	
12		Astanaqulov U	
13		Khasanov Kh	

4 Machine to be used

Machinary		No	Type/Spec.	Use for	Remarks
1	Motor Grader	1	3.7	Planning	
2	Hand guide bitumen sprayer	1	400/L	Prime coat	
3	Distributor	1	6/t	Prime coat	
4	Pnemautic roller	1	8/t	Compaction	
5	Tire roller	1	8-12/t	Compaction	
6	Hand guide roller	1	700/kg	Compaction	
7	Plate compactor	1	60/kg	Compaction	
8	Compressor	1		Cleaning	
9	Paver machine	1	2-4,5m	Paving asphalt	
10	Asphalt plant	1	36t/h	Production of hot mixture	
11	Dump truck	6	14/t	Delivery	
12	Water truck	1	8/t	Spray water	
13	Line marker	1		Line marking	
14	Fuel truck	1	2/t	Diesel supply	
15	Trailer	1		Transportation machineries	
16					

5 Materials to be used

Material		Unit	Type/Quality	Quantity	Remarks
1	Bitumen	ton		1.2	Tackcoat
2	Asphalt	ton	Densty coarse	154	Over lay
3	Shoulder treatment	м3		90	Shoulder
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

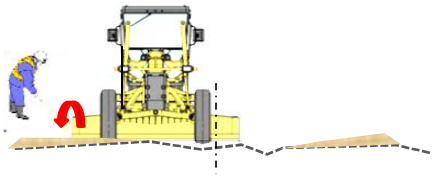
6 Construction method

6-1 Construction flow (The flow each type of work)

1.Shoulder treatment

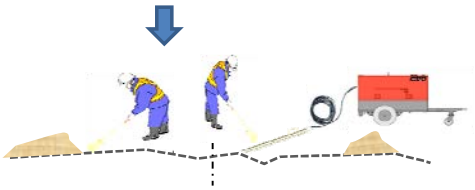
1-1)

Clean out the sand and garbage from the edge of road



1-2)

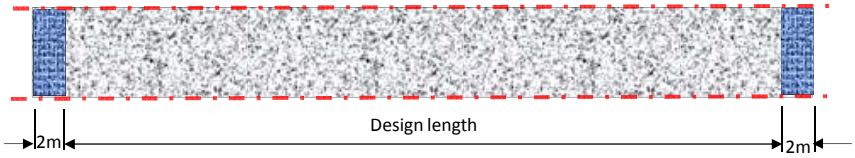
Manually(with compresser) clean the pavement surface



2 Bituminous pavement(Over lay)

2-1

Mark the center and edge line

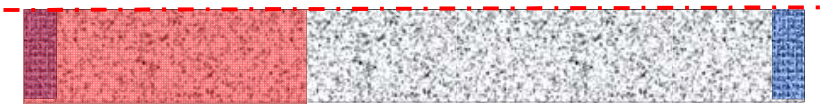


2-2

Apply tack coat

*Handy type sprayer also acceptable.

*Check the apply rate (once a day)

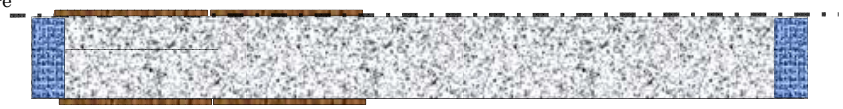


4-3

Set timber along the cener line and edge line

*the length of pavement for one time should be less than 200m for traffic control.

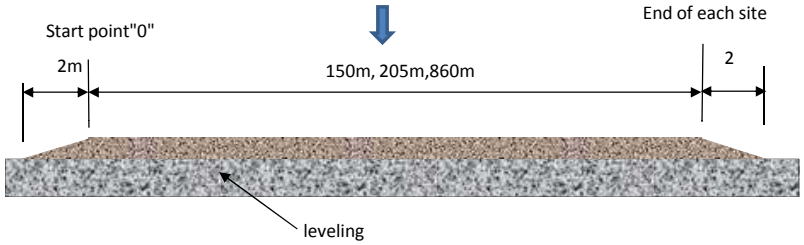
*Apply tack coat for joint again to enshure the stickness before pavement works



4-4

Start bituminous pavement (Over lay)

*Final firgure



4-4-1

Set timber up with 6cm thickness

4-4-2

Set paver machine on the imber

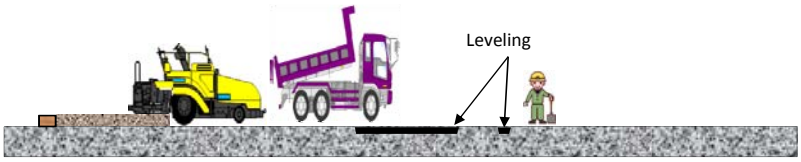
*Heat scread up one houre before pavement operation start

4-4-3

Start pavement

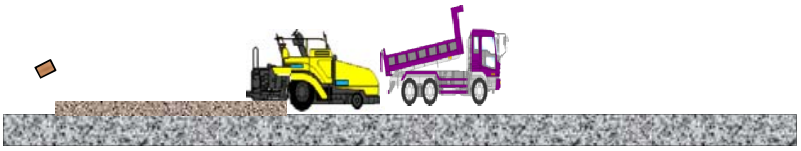
Check the hot mixture tempreture before unloading!

Filling up and compaction the small poth holls in front of paver machine before spread over lay



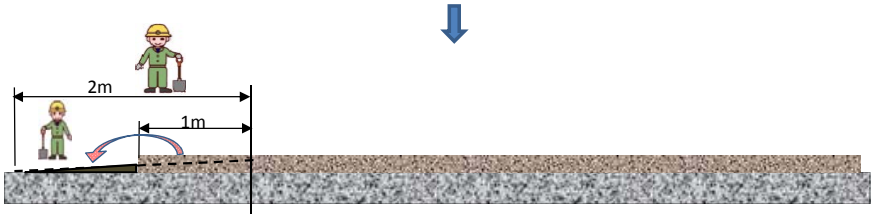
4-4-4

Take out the timber



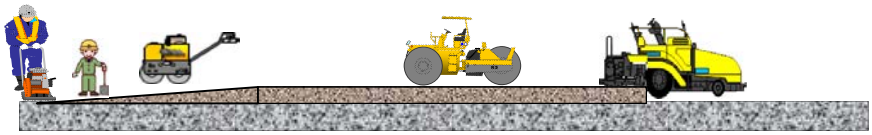
4-4-5

Make slope properly



4-4-6

Treat and complete the joint promptly and properly



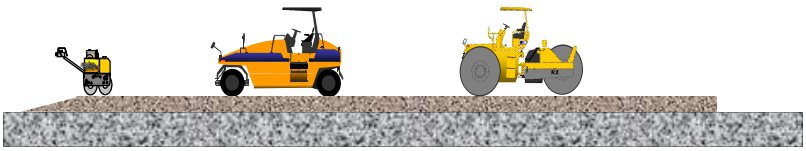
4-4-7

Start initial compaction

4-4-8

Start second compaction

*Continously compact until the hot mixture get sufficient density and the surface get enough flatness (Final compaction)



4-4-7

Open for traffic

*The tempreture of pavement must be get down up to 50 C

7　Construction control plan

7-1　Quality control plan

Check item	Detail	Frequency	Standard value	Remarks
Tempreture of AHM	Arrival	Each dump truck	more then 150	
Tempreture of AHM	Spreading	Each dump truck	more then 120	
Density		Every1000m2	more than96%	

7-2　Shape and elevation control plan

Check item	Detail	Frequency	Standard value	Remarks
Width		each 20 meters		
Thickness		each 1000m2	Max'-3mm	

8 Safety management plan

8-1 Who is in charge? Qodirova Zulkhumor

8-2 Activity plan to keep safety

Activity		Who?	What you do?	Time
Daily activity	Meeting	everyday		7:00
	Setting road sign boards	Khasanov Kh		7:30
	Involve traffic control police	Qodirova Z		7:40
	Check the machineries condition	Mechanic		7:45:00
	med.control	Qodirova Z		7:50
Weekly activity	Check the site condition	Qodirova Z		
	Cleaning site	Labours		sartuday. 17:00
	Share opinion	Road specialists		sartuday. 18:00
Monthly activity	Check the machineries condition	Mechanic		
	Appearance of defects	Manager level		
When required	Reporting	Qodirova Z		

9 Emergency control plan

9-1 Organization for safety

Situation	Total safety
Name	Kodirova Z

Situation	
Name	-------

Situation	
Name	-------

9-2 Emergency call

Police	
Tel	O2

Hospital	
Tel	O3

Ambulance	
Tel	O3

Electricity
Tel

Emergency

SEHM	
Name	Kodirova Z
Tel	918874057

Communication
Tel

SETM	
Name	Odinaev S
Tel	933559104

MOT	
Name	Anoyatshoev A
Tel	5555577

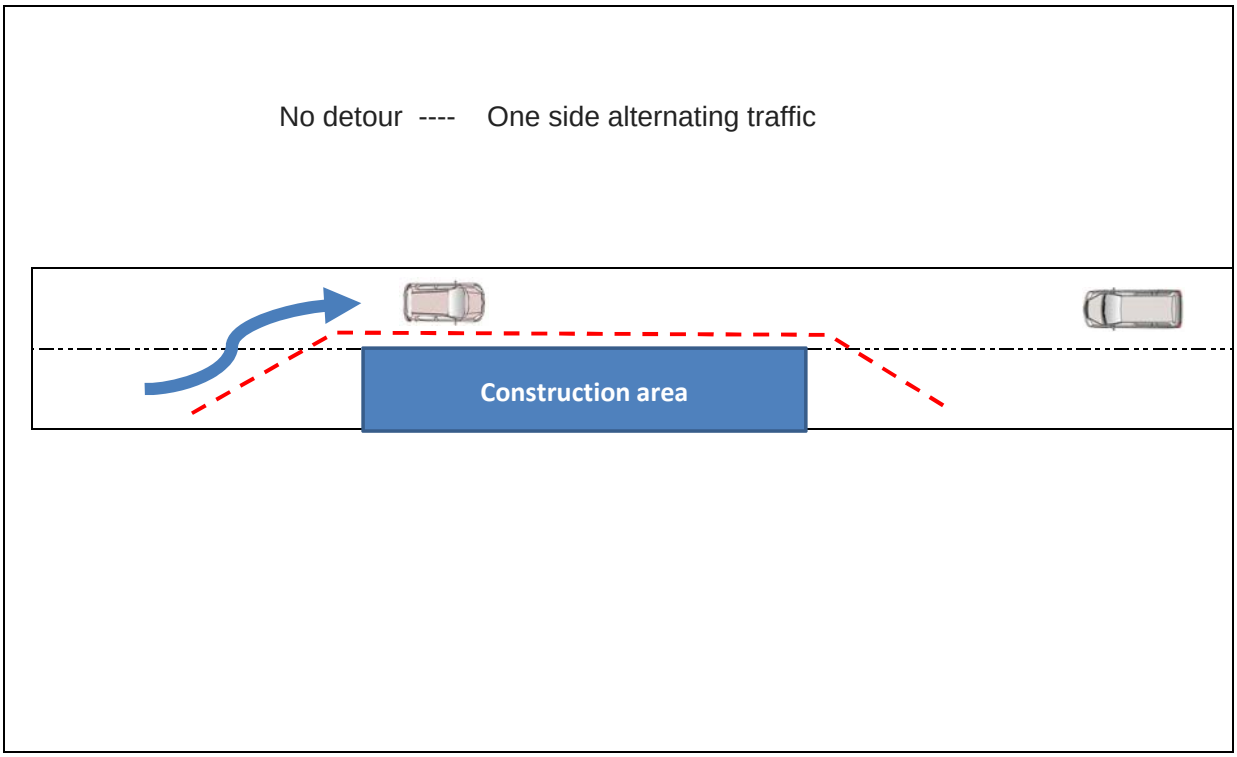
10 Traffic control

10-1 How to keep construction area?

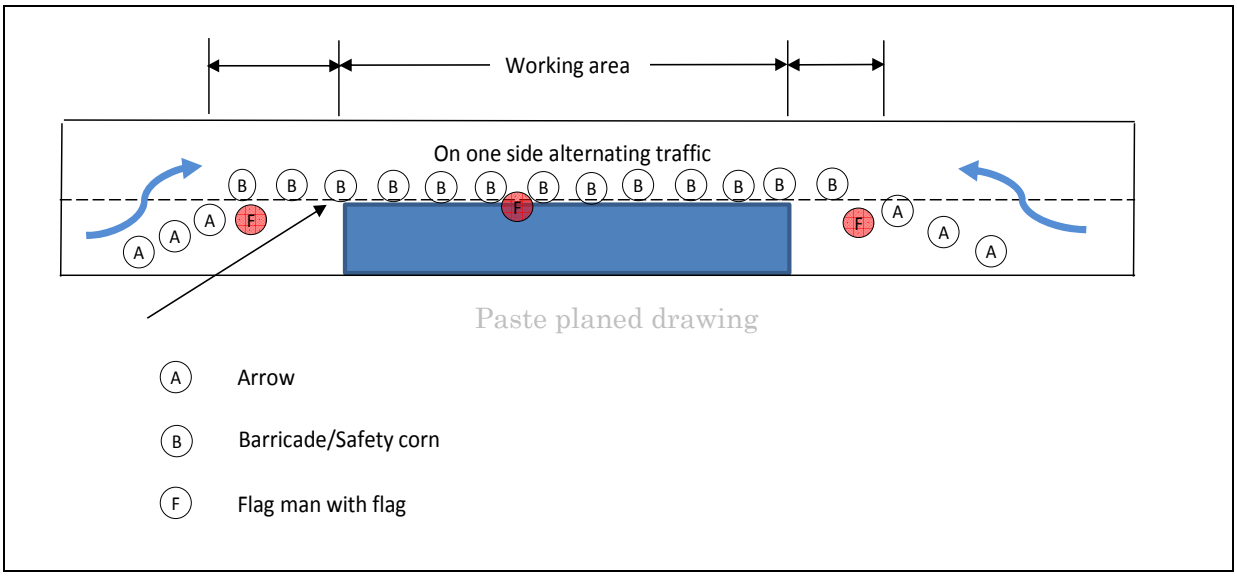
A. Full Close

B. Half close (Alternating traffic)

10-2 Detour plan (If you choose A)



10-3 Safty property setting plan



11 Environmental measures

11-1 Air pollution countermeasures

A Take care not to fire the bituminous material
B Distribute water on the road surface every day at least 2/t
C
D
E
F

11-2 Water pollution countermeasures

A Do not throw away bituminous material into the water
B Do not apply prime coat/tack coat in ranny days
C Do not throw away remained diesel
D Do not throw away garbage into the water
E Clean the site after then work
F

11-3 Others

A Do not use vibrating at near houses as much as possible
B Do not use fraquently signal of constrcution machineries
C Supply and Spray water at the dusty sections as much as possible
D
E
F

12 Others

Measurement of application volume

~~Prime coat~~ | Tack coat

Name of Project | Mesuring date

Location | Measured by

Measuring point	Wieight of mat(g)		Wieight of cut back(g)	SG of cut back	Volume of cut back (mL)	Area of Mat(m2)	Application volume (L/m2)
	A	B	C	D	E	F	G
	Before apply	After apply	B-A	1.001	E=C/D		$G=\frac{E}{F*1000}$
Example	28	45	17	1.001	16.98	0.0625	0.27
No4(L)	31	51	20	1.001	19.98	0.0625	0.31
No.10®	31	52	21	1.001	20.98	0.0625	0.33
Average							

Remarks

Delivery chicket

1. For mixing Plant

Production Date		
Day	Month	year

No.
2

To	Rudaki 06 road

Type of mixture	Time	
(1.) Dense type	Depart AP	7:20
2. Coase type	Arrive Site	9:10
3. Sandy type	Temperature	
4	Deparet	158℃
5	Arrive	148℃
6	Quantity	
Plate No. of Vehicle	On this truck	18t
	Cummulative	36t

Memo

Sent by	Sign
Received by	Sign

Kurgan-tube SETM, Jilkule Bituminous Mixing Plant

Ref 2-3

Delivery chicket

2. For Driver

Production Date		
Day	Month	year

No.

To	

Type of mixture	Time	
1. Dense type	Depart AP	:
2. Coase type	Arrive Site	:
3. Sandy type	Temperature	
4	Deparet	℃
5	Arrive	℃
6	Quantity	
Plate No. of Vehicle	On this truck	t
	Cummulative	t

Memo

Sent by
Received by

Kurgan-tube SETM, Jilkule Bituminous Mixing Plant

Delivery chicket

3. For Reciever

Production Date		
Day	Month	year

No.

To	

Type of mixture	Time	
1. Dense type	Depart AP	:
2. Coase type	Arrive Site	:
3. Sandy type	Temperature	
4	Deparet	℃
5	Arrive	℃
6	Quantity	
Plate No. of Vehicle	On this truck	t
	Cummulative	t

Memo

Sent by
Received by

Kurgan-tube SETM, Jilkule Bituminous Mixing Plant

Reference Document 3

Quality Control

Forms and Chart to be used for the Quality Control

1. Quality Control Manual

[Blank and Sample Forms]

2. Sieve Analysis (1,2bin)
3. Sieve Analysis (3bin))
4. Combined gradation
5. Marshall Stability Test
6. Core Density
7. Combined Gradation (*Sample Only)
8. Density and Water Absorption Test (Coarse aggregate)
9. Density and Water Absorption Test (Fine aggregate)
10. Theoretical Density

QUALITY CONTROL MANUAL

1. Introduction

This manual outlines day to day quality control works at asphalt, Sampling, Sieve analysis Test, Marshall and core density Test, Marshall stability test, etc.

2. Purpose

- Confirm whether a produced mixture complies with the mix design.
- Confirm whether frequent mixture variation dose not occurs, when producing mixture.
- Reduce variation in quality of the produced mixture.
- It is a technical basis for certifying the pavement quality.
- It provides a technical clue when investigating the cause of irregularity.

3. Quality Control

3.1 Laboratory

Field laboratory equipped with utilities shall be installed adjacent to asphalt plant for conducting routine quality controles where following equipment are furnished which were supplied by JICA in 2015:

Marshall Stability test equipment(Test machine,compaction hammer,water bath,mould etc)
Sieve test equipment(sieves,digital balance)
Forced Air Convection Oven
Core Drilling machine with core bit.
Thermometer
Measuring devices

Laboratory technicians shall be stationed at laboratory for conducting routine quality controls.
Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition.

3.2 Sampling and Testing

Plant- produced asphaltic mixture shall be tested for stability, flow and air voids on a lot basis. Sampling shall be from material deposited into trucks at the asphalt plant or from trucks at the job site.

3.3 When delivering hot mixture, a lot consist of the weight of mixture of the same mix proportion produced at one plant during oneday.

3.4 Quality control is examined with following characteristics:

- Temperature of produced mixture: on every dump truck
- Gradation (Hot Bin sieve analysis):one time per day
- Marshall test (Marshall Stability and Flow, VMA, Air Void):one time per day

3.5 Density

The density of mixture after compaction shall be not less than 95% of the Marshall Density.
Density shall be checked by ϕ 100 core taken by core drill. Frequency of sampling shall be every 1,000m^2.

3.6 Diagram showing the sequence of routine activities shall be indicated in Table-5hereinafter.

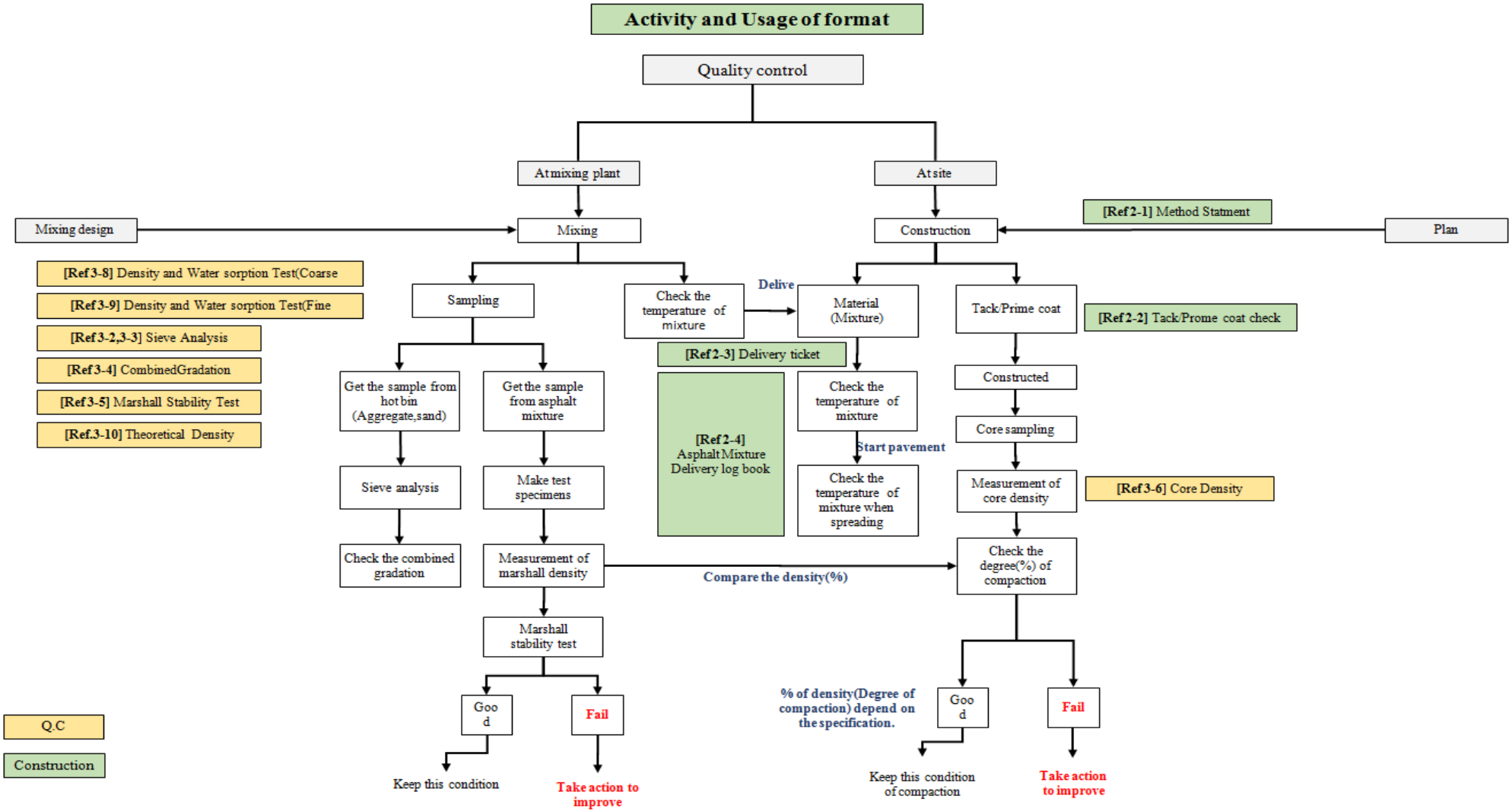


Table-5: Diagram of Quality Control Procedure

3.7 Quality nonconformance/defect
When observing quality nonconformance/defect, it shall be necessary to check whether problem arises from day– to- day basis QC test (sieve analysis, combined gradation, Marshall test) data at plant.
In case the quality of bitumen is concerned, it shall be necessary to check the quality by conducting properties test of penetration and softening point.
Laboratory technicians may identify the causes of nonconformance/defect from the results of each test.
3.8 Periodic monitoring shall be conducted at least once a month, also in each changing of materials used for production of mixtures.

3.9 When delivering of mixture to site, each vehicle shall be accompanied by the docket where mentioned:

- name of plant;
- address and name of site;
- date and time of production;
- temperature of mixture;
- type and quantity of mixtures.

4. Test methods
Test shall be in accordance with following GOST or ASTM.

4.1 GOST
1) Mixtures: tested according to GOST 12801
2) Crushed stone of gravel and rocks: tested according to GOST 8269.0 and GOST 3344
3) Natural sand and rock screenings: tested according to GOST 8735
4) Mineral powders: tested according to GOST 16557
5) Bitumen: tested according to GOST11501, 11503,11505, 11506, 11507, 11508, 18180
6) Marshall test: conducted in compliance with VSN93-73 paragraph 7.32

4.2 ASTM
1) Bulk Density (Unit Weight) and Voids in Aggregate: ASTM C29
2) Materials Finer than 75 μ (No.200) Sieve in Mineral Aggregate by Washing: ASTM C 117
3) Specific Gravity and Absorption of Coarse Aggregate: ASTM C 127
4) Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in Los Angeles Machine: ASTM C 131
5) Sieve Analysis of Fine and Coarse Aggregate: ASTM C 136
6) Total Evaporable Moisture Content of Aggregate by Drying: ASTM C 566
7) Sampling Aggregate: ASTM D 75
8) Sampling Bituminous Paving Mixtures: ASTM D 979
9) Mixing Plants for Hot-Mixed Hot –Laid Bituminous Paving Mixtures: ASTM D 995
10) Fine Aggregate for Bituminous Paving mixtures: ASTM D 1073
11) Bulk Specific Gravity and Density of Compacted Bituminous Mixture Using Paraffin –Coated Specimens: ASTM D 1188
12) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures: ASTM D 2041
13) Bulk Specific Gravity and Density of Non-Absorptive Mixture: ASTM D 2726
14) Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures: ASTM D 3203
15) Liquid Limit, Plastic Limit and Plasticity Index of Soils: ASTM D 4318
16) Preparation of Bituminous Specimens Using Marshall Apparatus: ASTM D 692617) Marshall Stability and Flow of Bituminous Mixtures: ASTM D 6927

[Blank Forms]

JIS A 1102

Test for Sieve Analysis of Aggregate

Investigation name ..... Test date .....

Use ..... Test place .....

Sampling person ..... 1Test person .....

Locality, Kind 2bin .....

Sieve size (mm)	1bin ① weight of aggregate (g)	1bin ② Residual weight of aggregate (g)	1bin ③ Residual rate (%) ②/⑥*100	1bin ④ Weight percentage of passing sieves (%) 100-③	2bin ① weight of aggregate (g)	2bin ② Residual weight of aggregate (g)	2bin ③ Residual rate (%) ②/⑥*100	2bin ④ Weight percentage of passing sieves (%) 100-③	Average ⑤ Weight percentage of passing sieves (%)
53 mm									
37.5									
31.5									
26.5									
19.0									
13.2									
9.5									
4.75									
2.36									
1.18									
600 μm									
300									
150									
75									
⑥Total Weight of aggregate (g)									

Remarks

JIS A 1102

Test for Sieve Analysis of Aggregate

Investigation name ..... Test date .....

Use ..... Test place .....

Sampling person ..... Test person .....

Locality, Kind 2bin .....

Sieve size (mm)	3bin ① weight of aggregate (g)	3bin ② Residual weight of aggregate (g)	3bin ③ Residual rate (%) ②/⑥*100	3bin ④ Weight percentage of passing sieves (%) 100-③	① weight of aggregate (g)	② Residual weight of aggregate (g)	③ Residual rate (%) ②/⑥*100	④ Weight percentage of passing sieves (%) 100-③	Average ⑤ Weight percentage of passing sieves (%)
53 mm									
37.5									
31.5									
26.5									
19.0									
13.2									
9.5									
4.75									
2.36									
1.18									
600 μm									
300									
150									
75									
⑥Total Weight of aggregate (g)									

Remarks

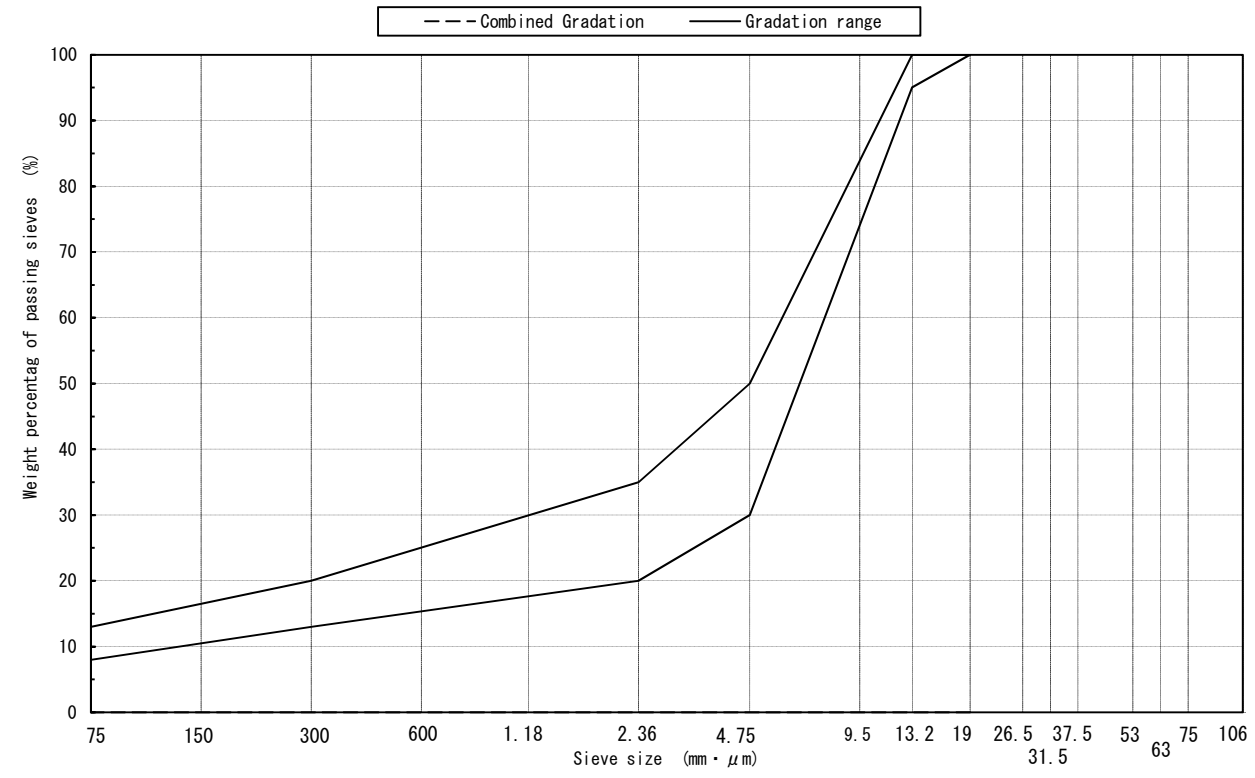
JHS－202

Calculation Sheet of Combined Gradation

Material Weight at Plant (kg)	1bin	2bin	3bin	As(4.9%)	Total
					600.0

Type of material		1	2	3	4	5	6	Calculation of Combined Gradation							Target gradation	Gradation range
		1bin	2bin	3bin				1								
Mix proportion (%)		48.3	39.3	12.4				1bin	2bin	3bin	4	5	6	Combined Gradation		
Weight percentage of passing sieves (%)	Sieve size															
	53															
	37.5															
	31.5															
	26.5															
	19.0															100
	13.2															95～100
	9.5															－
	4.75															30～50
	2.36															20～35
	1.18															
	600μm															－
	300															13～20
	150															－
	75															8～13

Combined Gradation Curve



ＪＨＳ－２０２

Data Sheet of Marshall Stability Test (Standard・Immersed)

Construction name ..... Use ..... Mix design .....

Number of blows ..... For each 50 times of both sides .....

Mixture name ..... Temp. of asphalt ..... Mixing temp. .....

Temp. of mold ..... Blowing temp. .....

Density of Asphalt= ..... g/cm^3 Temp. of aggregate ..... Immersion temperature ..... Test place .....

Type of density ..... Test date .....

Immersion time ..... Test person .....

Test specimen No.	1	2					3	4	5	6	7	8	9	10	11	12	13	14	Remarks
	Asphalt content (%)	Thickness (cm) h１	h２	h３	h４	Average	Aerial weight (g)	Underwater weight (g)	Saturated surface-dry weight (g)	Volume (cm^3)	Density (Bulk) (g/cm^3)	Maximum Thoretical Density (g/cm^3)	Asphalt volume (%)	Air voids (%)	Voids of aggregate (%)	Degree of saturation (%)	Stability (kN)	Flow value (1/100cm)	
										5-4	3/6		1x7/A	(1-7/8) x(100)	9+10	9/11 x(100)			
1																			
2																			
3																			
Average																			
4																			
5																			
6																			
Average																			
7																			
8																			
9																			
Average																			
10																			
11																			
12																			
Average																			
13																			
14																			
15																			
Average																			

Data Sheet of Density Test (Core Specimen)

Construction name .....

Mixture name .....

Test person .....

Boring Point		Thickness							Density						
		Measurements (cm)					Design	Difference	Weight (g)			Volume (cm^3) V=③-②	Bulk Density (g/cm^3) ①/V	基準密度 g/cm^3	Compaction Ratio (%)
Survey Point	Place	1	2	3	4	Ave.	(cm)	(cm)	Aeria ①	Underwater ②	Saturated surface-dry ③				
Average															

ＪＩＳ　Ａ　１１１０	Test for Density and Water Absorption of Coarse Aggregate

Construction name ..... Test date .....

Use ..... Test place .....

Sampling person ..... Test person .....

Locality, Kind .....

Aggregate size					
Number of tests		1	2		
1. Weight of Material in Saturated Surface-dry＋Vat (g)					
2. Weight of Vat (g)					
3. Weight of Material in Saturated Surface-dry (g)	1-2				
4. (Mesh Basket＋Material) Underwater Weight (g)					
5. Underwater Weight of Mesh Basket (g)					
6. Underwater Weight of Material (g)	4-5				
7. Density of Material in Saturated Surface-dry (g/cm^3)	3/(3-6)				
Average					
8. Weight of Material in Dry ＋Vat (g)					
9. Weight of Material in Dry (g)	8-2				
１０. Bulk Density (g/cm^3)	9/(3-6)				
Average					
１１. Apparent Density (g/cm^3)	9/(8-6)				
Average					
１２. Water Absorption (%)	(3-9)/9x100				
Average					

Remarks

Ref 3-9

JIS A 1109 Test for Density and Water Absorption of Fine Aggregate

Construction Name ..... Test Date .....

Use ..... Test Place .....

Sampling Person .....

Locality, Kind ..... Test Person .....

Water Temp. 20 ° C

測　定　番　号		1	2	1	2
Flask No.		1	2		
Volume of Flask （A） (cm^3)					
1. (Flask+Material) Weight (g)					
2. Weight of Flask (g)					
3. Weight of Material in Saturated Surface-dry (g)	1-2				
4. (Flask+Material+Water) Weight (g)					
5. Additional Water Weight (g)	4-1				
6. Density of Material in Saturated Surface-dry (g/cm^3)	3/(A-5)				
Average					
7. Weight of Vat (g)					
8. (Vat+Dry Material) Weight (g)					
9. Weight of Material in Dry (g)	8-7				
10. Bulk Density (g/cm^3)	9/(A-5)				
Average					
11. Water Content (g)	3-9				
12. Apparent Density	9/(A-5-11)				
Average					
13. Water Absorption (%	11/9x100				
Average					

Remarks

ＪＨＳ－２０２	Calculation Sheet of Maximum Thoretical Density	

Construction Name ..... Test Person .....

Use ..... Test Place .....

Mixture Name ..... Test Date .....

Type of Aggregate ..... Type of Filler .....

Type of Fine Aggregate ..... Type of Density .....

Type of Material	① Mix Proportion (%)	Density (g/cm^3)			②Density for Calculation	③＝①／②
		Apparent	Saturated Surface-dry	Bulk		
13-5						
5-2.5						
SC						
Fine sand						
Filler			—	—		
					④＝Total of ③	0.000

⑤ Asphalt Content (%)	⑥ Density of Asphalt (g/cm３)	⑦＝⑤／⑥	⑧＝④（１－⑤／100）		⑩＝⑦＋⑧	⑪ Maximum Thoretical Density =100／⑩

Remarks

[Samples]

JIS A 1102

Test for Sieve Analysis of Aggregate

Investigation name ..... Test date .....

Use ..... Test place .....

Sampling person ..... Test person .....

Locality, Kind 2bin .....

Sieve size (mm)	1bin ① weight of aggregate (g)	1bin ② Residual weight of aggregate (g)	1bin ③ Residual rate (%) ②/⑥*100	1bin ④ Weight percentage of passing sieves (%) 100-③	2bin ① weight of aggregate (g)	2bin ② Residual weight of aggregate (g)	2bin ③ Residual rate (%) ②/⑥*100	2bin ④ Weight percentage of passing sieves (%) 100-③	Average ⑤ Weight percentage of passing sieves (%)
53 mm									
37.5									
31.5									
26.5									
19.0					0.0	0.0	0.0	100.0	
13.2					103.0	103.0	3.6	96.4	
9.5	0.0	0.0	0.0	100.0	906.2	1009.2	35.4	64.6	
4.75	2.9	2.9	0.1	99.9	1688.3	2697.5	94.7	5.3	
2.36	253.4	256.3	13.7	86.3	124.9	2822.4	99.1	0.9	
1.18	432.4	688.7	36.8	63.2	25.5	2847.9	100.0	0.0	
600 μm	450.2	1138.9	60.8	39.2					
300	333.8	1472.7	78.6	21.4					
150	174.6	1647.3	87.9	12.1					
75	76.3	1723.6	91.9	8.1					
⑥Total Weight of aggregate (g)	1873.5				2847.9				

Remarks

JIS A 1102

Test for Sieve Analysis of Aggregate

Investigation

name ..... Test date .....

Use ..... Test place .....

Sampling person ..... Test person .....

Locality, Kind 2bin .....

Sieve size (mm)	3bin ① weight of aggregate (g)	3bin ② Residual weight of aggregate (g)	3bin ③ Residual rate (%) ②/⑥*100	3bin ④ Weight percentage of passing sieves (%) 100-③	① weight of aggregate (g)	② Residual weight of aggregate (g)	③ Residual rate (%) ②/⑥*100	④ Weight percentage of passing sieves (%) 100-③	Average ⑤ Weight percentage of passing sieves (%)
53 mm									
37.5									
31.5									
26.5	0.0	0.0	0.0	100.0					
19.0	23.5	23.5	1.3	98.7					
13.2	1343.0	1366.5	76.3	23.7					
9.5	411.6	1778.1	99.3	0.7					
4.75	7.6	1785.7	99.7	0.3					
2.36	5.4	1791.1	100.0	0.0					
1.18									
600 μm									
300									
150									
75									
⑥Total Weight of aggregate (g)	1791.1								

Remarks

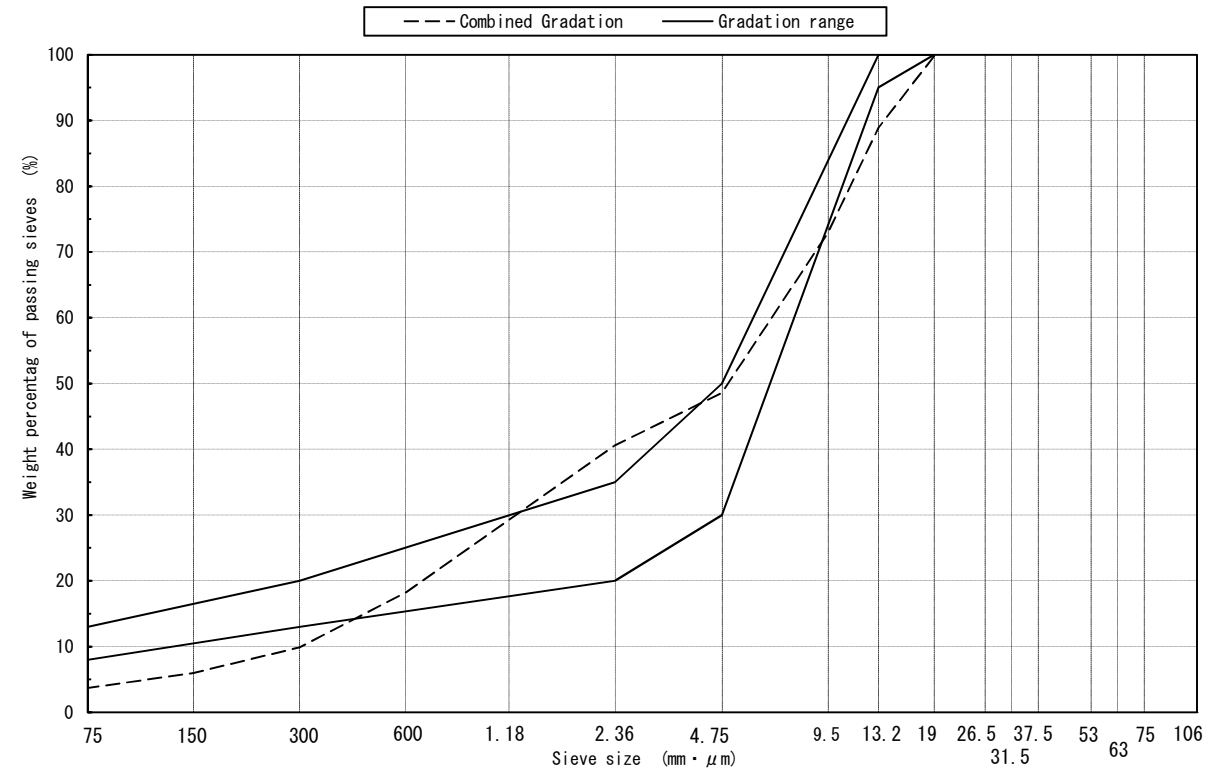
JHS－202

Calculation Sheet of Combined Gradation

Material Weight at Plant (kg)	1bin	2bin	3bin	As	Total
	265.8kg	234.0kg	72.0kg	28.2kg	600.0

Type of material		1	2	3	4	5	6	Calculation of Combined Gradation							Target gradation	Gradation range
		1bin	2bin	3bin				1								
Mix proportion (%)		46.5	40.9	12.6				1bin	2bin	3bin	4	5	6	Combined Gradation		
Weight percentage of passing sieves (%)	Sieve size															
	53															
	37.5															
	31.5															
	26.5			100.0						12.6				100.0		
	19.0		100.0	98.8					40.9	12.4				99.8		100
	13.2		96.3	23.5					39.4	3.0				88.9		95～100
	9.5	100.0	64.3	0.5				46.5	26.3	0.1				72.9		－
	4.75	99.9	5.2	0.3				46.5	2.1	0.0				48.6		30～50
	2.36	86.5	0.9					40.2	0.4					40.6		20～35
	1.18	63.3						29.4						29.4		
	600μm	39.2						18.2						18.2		－
	300	21.2						9.9						9.9		13～20
	150	12.8						6.0						6.0		－
	75	8.0						3.7						3.7		8～13

Combined Gradation Curve



ＪＨＳ－２０２

Data Sheet of Marshall Stability Test (Standard・Immersed)

Construction name ..... Use ..... Mix design .....

Number of blows ..... For each 50 times of both sides .....

Mixture name ..... Temp. of asphalt ..... Mixing temp. .....

Temp. of mold ..... Blowing temp. .....

Density of Asphalt= ..... g/cm^3 Temp. of aggregate ..... Immersion temperature ..... Test place .....

Type of density ..... Test date .....

Immersion time ..... Test person .....

Test specimen No.	1	2					3	4	5	6	7	8	9	10	11	12	13	14	Remarks
	Asphalt content (%)	Thickness (cm) h１	h２	h３	h４	Average	Aerial weight (g)	Underwater weight (g)	Saturated surface-dry weight (g)	Volume (cm^3)	Density (Bulk) (g/cm^3)	Maximum Thoretical Density (g/cm^3)	Asphalt volume (%)	Air voids (%)	Voids of aggregate (%)	Degree of saturation (%)	Stability (kN)	Flow value (1/100cm)	
										5-4	3/6		1x7/A	(1-7/8) x(100)	9+10	9/11 x(100)			
1							1143.7	658.1	1148.6	490.5	2.332								
2							1156.3	664.9	1160.6	495.7	2.333								
3							1167.0	684.5	1171.1	486.6	2.398								
Average											2.354								
4																			
5																			
6																			
Average																			
7																			
8																			
9																			
Average																			
10																			
11																			
12																			
Average																			
13																			
14																			
15																			
Average																			

Ref 3-6

Data Sheet of Density Test (Core Specimen)

Construction name .....

Mixture name ..... Test person .....

Boring Point		Thickness							Density						
		Measurements (cm)					Design	Difference	Weight (g)			Volume (cm^3) V=③-②	Bulk Density (g/cm^3) ①/V	基準密度 g/cm^3	Compaction Ratio (%)
Survey Point	Place	1	2	3	4	Ave.	(cm)	(cm)	Aeria ①	Underwater ②	Saturated surface-dry ③				
		5.3	5.4	5.2	5.3	5.3	5.0	0.3	920.6	523.0	925.1	402.1	2.289	2.354	97.2
		5.2	5.0	5.1	4.9	5.0	5.0	0.0	934.1	533.1	938.3	405.2	2.305	2.354	97.9
		4.9	4.8	5.0	4.7	4.9	5.0	-0.1	911.7	517.9	916.6	398.7	2.287	2.354	97.2
Average						5.1							2.294	2.354	97.4

Ref 3-7

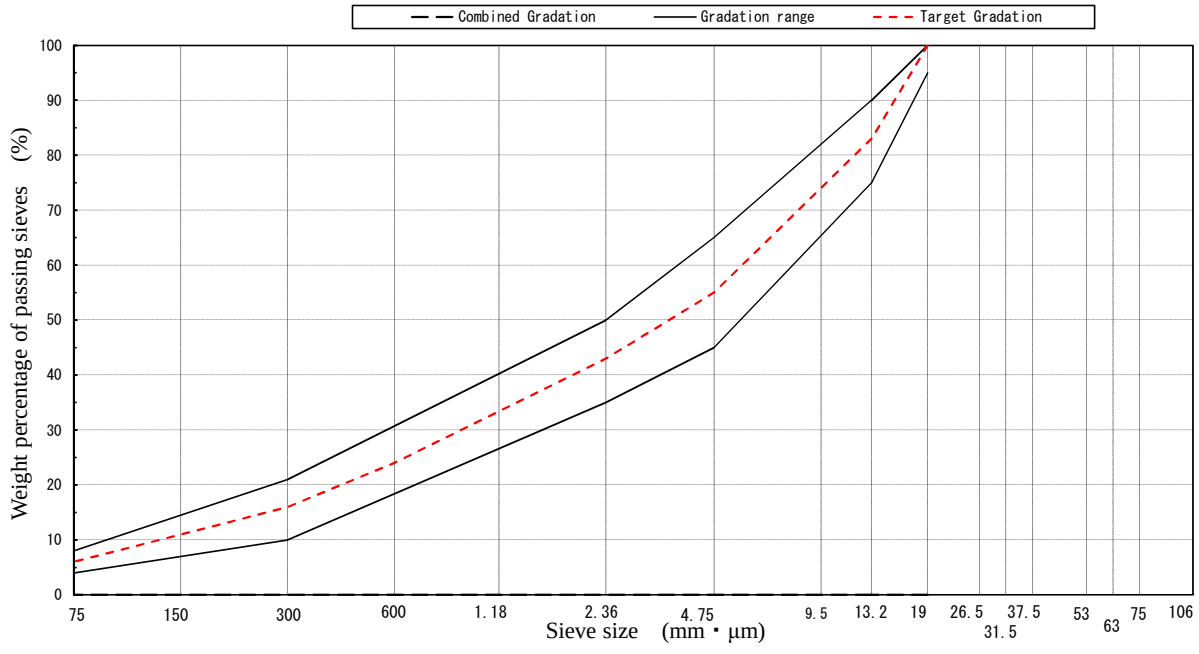
JHS－２０２

Calculation Sheet of Combined Gradation (Correction)

Material Weight at Plant	1bin	2bin	3bin	As	TOTAL
				28.0kg	600.0kg

Type of material		1 1bin	2 2bin	3 3bin	4	5	6	Calculation of Combined Gradation 1							Target gradation	Gradation range
Mix proportion (%)								1bin	2bin	3bin	4	5	6	Combined Gradation		
Weight percentage of passing sieves (%)																
	Sieve size															
	53															
	37.5															
	31.5															
	26.5			100.0												
	19.0		100.0	94.4											100.0	95～100
	13.2	100.0	96.8	31.0											83.0	75～90
	9.5	98.5	77.8	2.2												
	4.75	95.0	11.1	0.3											55.0	45～65
	2.36	83.8	0.8												43.0	35～50
	1.18	68.5														
	600μm	43.4													24.0	18～30
	300	18.7													16.0	10～21
	150	6.4													11.0	6～16
	75	2.2													6.0	4～8

Combined Gradation Curve



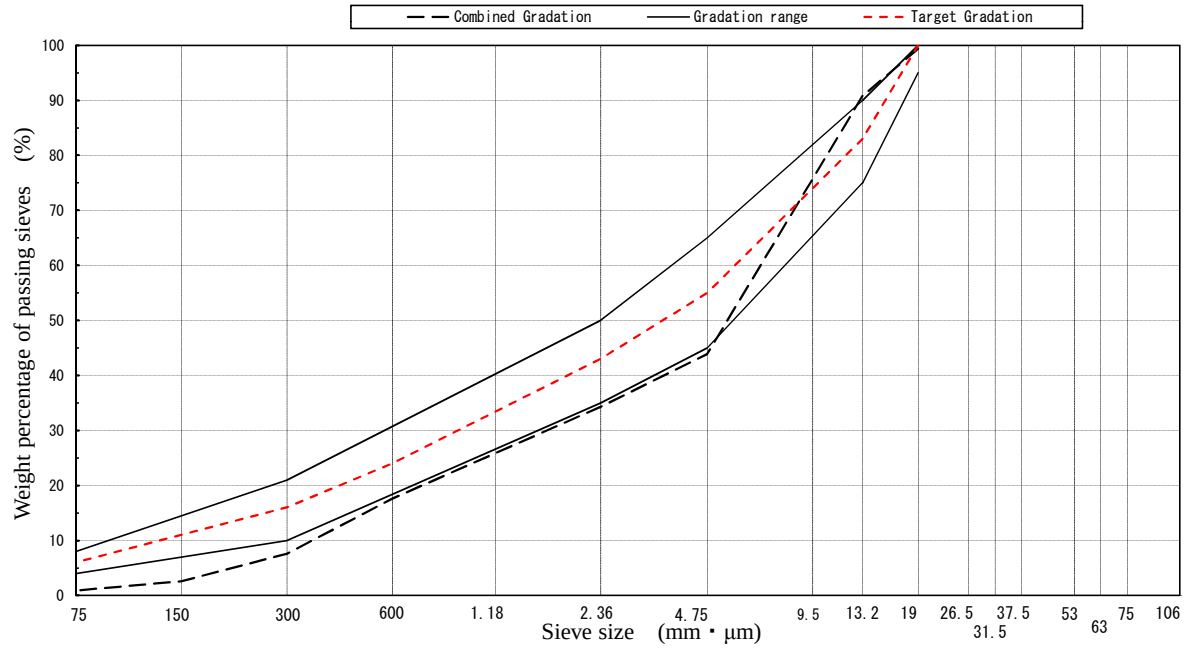
JHS－２０２

Calculation Sheet of Combined Gradation (Result)

Material Weight at Plant	1bin	2bin	3bin	As	TOTAL
	231.7kg	277.4kg	62.9kg	28.0kg	600.0kg

Type of material		1	2	3	4	5	6	Calculation of Combined Gradation							Target gradation	Gradation range
		1bin	2bin	3bin				1								
Mix proportion (%)		40.5	48.5	11.0				1bin	2bin	3bin	4	5	6	Combined Gradation		
Weight percentage of passing sieves (%)	Sieve size															
	53															
	37.5															
	31.5															
	26.5			100.0						11.0				100.0		
	19.0		100.0	94.4					48.5	10.4				99.4	100.0	95～100
	13.2	100.0	96.8	31.0				40.5	46.9	3.4				90.8	83.0	75～90
	9.5	98.5	77.8	2.2				39.9	37.7	0.2				77.8		
	4.75	95.0	11.1	0.3				38.5	5.4	0.0				43.9	55.0	45～65
	2.36	83.8	0.8					33.9	0.4					34.3	43.0	35～50
	1.18	68.5						27.7						27.7		
	600μm	43.4						17.6						17.6	24.0	18～30
	300	18.7						7.6						7.6	16.0	10～21
	150	6.4						2.6						2.6	11.0	6～16
	75	2.2						0.9						0.9	6.0	4～8

Combined Gradation Curve



〈 Answer 〉

Ref 3-7

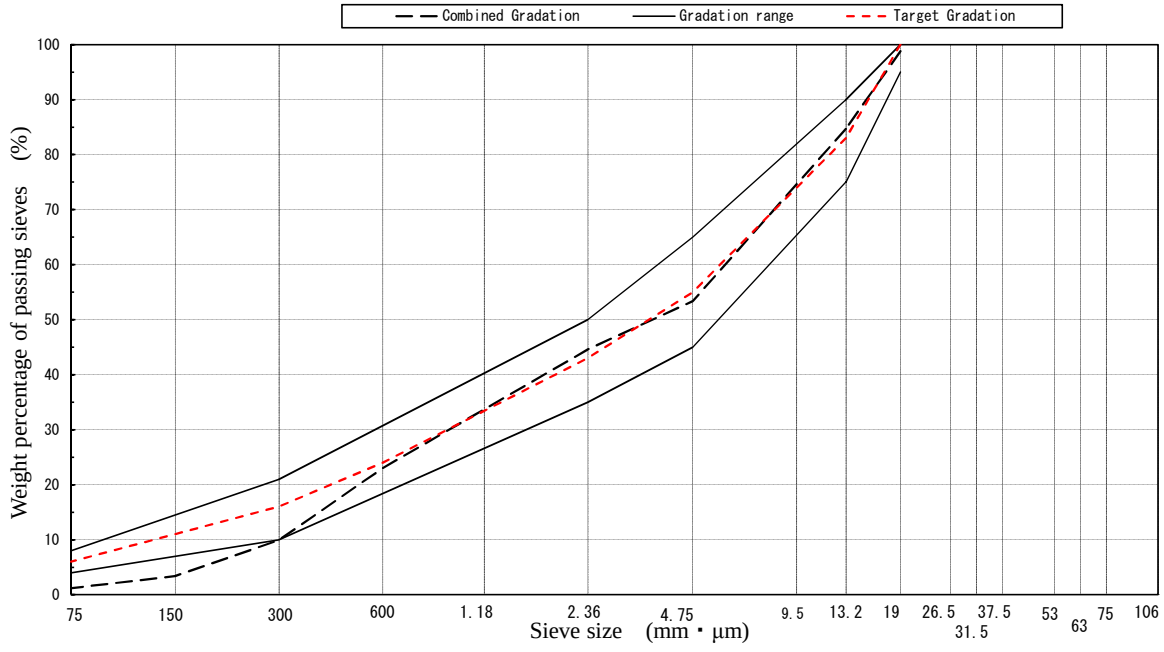
JHS－202

Calculation Sheet of Combined Gradation (Correction)

Material Weight at Plant	1bin	2bin	3bin	As	TOTAL
	303.1kg	148.8kg	120.1kg	28.0kg	600.0kg

Type of material		1	2	3	4	5	6	Calculation of Combined Gradation							Target gradation	Gradation range
		1bin	2bin	3bin				1								
Mix proportion (%)		53.0	26.0	21.0				1bin	2bin	3bin	4	5	6	Combined Gradation		
Weight percentage of passing sieves (%)	Sieve size															
	53															
	37.5															
	31.5															
	26.5			100.0						21.0				100.0		
	19.0		100.0	94.4					26.0	19.8				98.8	100.0	95～100
	13.2	100.0	96.8	31.0				53.0	25.2	6.5				84.7	83.0	75～90
	9.5	98.5	77.8	2.2				52.2	20.2	0.5				72.9		
	4.75	95.0	11.1	0.3				50.4	2.9	0.1				53.4	55.0	45～65
	2.36	83.8	0.8					44.4	0.2					44.6	43.0	35～50
	1.18	68.5						36.3						36.3		
	600μm	43.4						23.0						23.0	24.0	18～30
	300	18.7						9.9						9.9	16.0	10～21
	150	6.4						3.4						3.4	11.0	6～16
	75	2.2						1.2						1.2	6.0	4～8

Combined Gradation Curve



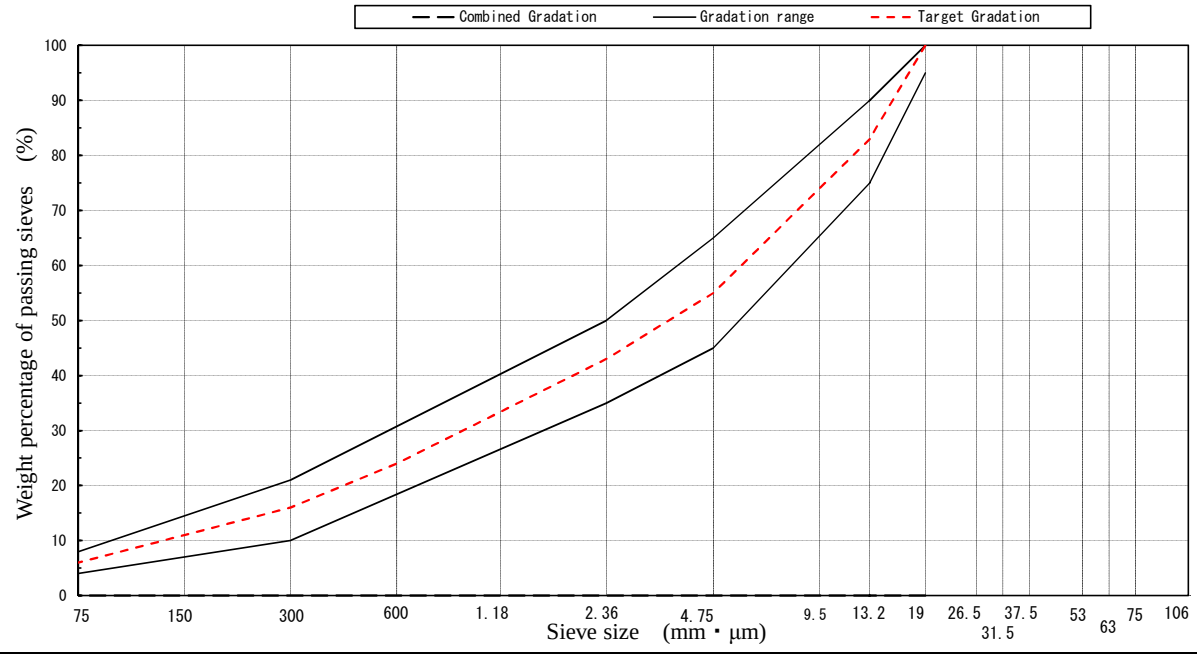
Ref 3-7

JHS－２０２	Calculation Sheet of Combined Gradation (Correction)

Material Weight at Plant	1bin	2bin	3bin	Filler	As	TOTAL
					28.0kg	600.0kg

Type of material		1	2	3	4	5	6	Calculation of Combined Gradation							Target gradation	Gradation range
		1bin	2bin	3bin	Filler			1								
Mix proportion (%)								1bin	2bin	3bin	Filler	5	6	Combined Gradation		
Weight percentage of passing sieves (%)	Sieve size															
	53															
	37.5															
	31.5															
	26.5			100.0												
	19.0		100.0	94.4											100.0	95～100
	13.2	100.0	96.8	31.0											83.0	75～90
	9.5	98.5	77.8	2.2												
	4.75	95.0	11.1	0.3											55.0	45～65
	2.36	83.8	0.8												43.0	35～50
	1.18	68.5			100.0											
	600μm	43.4			99.0										24.0	18～30
	300	18.7			94.1										16.0	10～21
	150	6.4			81.0										11.0	6～16
	75	2.2			72.9										6.0	4～8

Combined Gradation Curve



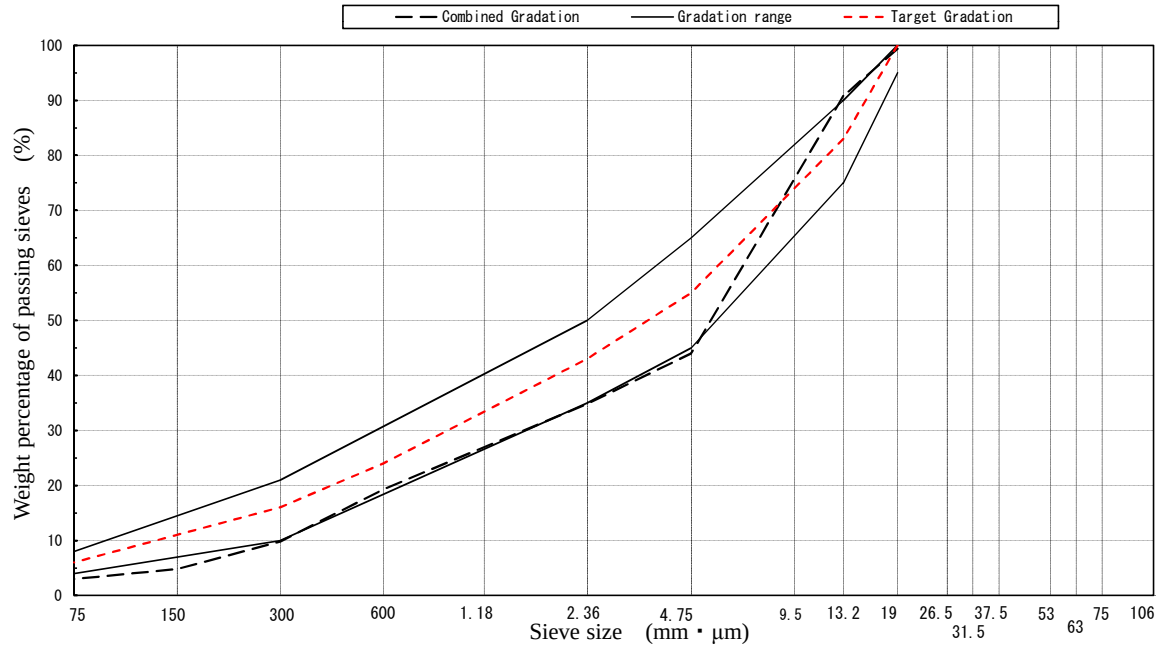
JHS－２０２

Calculation Sheet of Combined Gradation (Result)

Material Weight at Plant	1bin	2bin	3bin	Filler	As	TOTAL
	214.5kg	277.4kg	62.9kg	17.2kg	28.0kg	600.0kg

Type of material		1 1bin	2 2bin	3 3bin	4 Filler	5	6	Calculation of Combined Gradation 1							Target gradation	Gradation range
Mix proportion (%)		37.5	48.5	11.0	3.0			1bin	2bin	3bin	Filler	5	6	Combined Gradation		
Weight percentage of passing sieves (%)	Sieve size															
	53															
	37.5															
	31.5															
	26.5			100.0						11.0				100.0		
	19.0		100.0	94.4					48.5	10.4				99.4	100.0	95～100
	13.2	100.0	96.8	31.0				37.5	46.9	3.4				90.8	83.0	75～90
	9.5	98.5	77.8	2.2				36.9	37.7	0.2				77.8		
	4.75	95.0	11.1	0.3				35.6	5.4	0.0				44.0	55.0	45～65
	2.36	83.8	0.8					31.4	0.4					34.8	43.0	35～50
	1.18	68.5			100.0			25.7			3.0			28.7		
	600μm	43.4			99.0			16.3			3.0			19.3	24.0	18～30
	300	18.7			94.1			7.0			2.8			9.8	16.0	10～21
	150	6.4			81.0			2.4			2.4			4.8	11.0	6～16
	75	2.2			72.9			0.8			2.2			3.0	6.0	4～8

Combined Gradation Curve



< Answer >

Ref 3-7

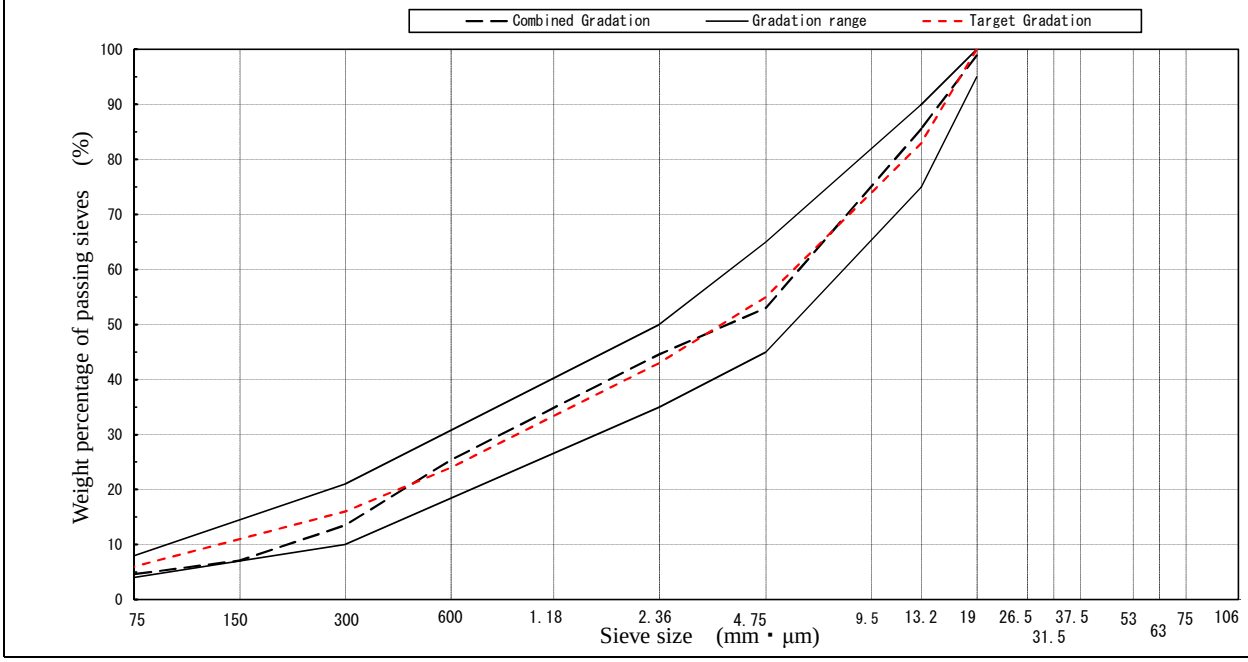
JHS－２０２

Calculation Sheet of Combined Gradation (Correction)

Material Weight at Plant	1bin	2bin	3bin	Filler	As	TOTAL
	268.9kg	163.0kg	111.5kg	28.6kg	28.0kg	600.0kg

Type of material		1 1bin	2 2bin	3 3bin	4 Filler	5	6	Calculation of Combined Gradation 1							Target gradation	Gradation range
Mix proportion (%)		47.0	28.5	19.5	5.0			1bin	2bin	3bin	Filler	5	6	Combined Gradation		
Weight percentage of passing sieves (%)	Sieve size															
	53															
	37.5															
	31.5															
	26.5			100.0						19.5				100.0		
	19.0		100.0	94.4					28.5	18.4				98.9	100.0	95～100
	13.2	100.0	96.8	31.0				47.0	27.6	6.0				85.6	83.0	75～90
	9.5	98.5	77.8	2.2				46.3	22.2	0.4				73.9		
	4.75	95.0	11.1	0.3				44.7	3.2	0.1				53.0	55.0	45～65
	2.36	83.8	0.8					39.4	0.2					44.6	43.0	35～50
	1.18	68.5			100.0			32.2			5.0			37.2		
	600μm	43.4			99.0			20.4			5.0			25.4	24.0	18～30
	300	18.7			94.1			8.8			4.7			13.5	16.0	10～21
	150	6.4			81.0			3.0			4.1			7.1	11.0	6～16
	75	2.2			72.9			1.0			3.6			4.6	6.0	4～8

Combined Gradation Curve



Ref 3-9

JIS A 1109 Test for Density and Water Absorption of Fine Aggregate

Construction Name ..... Test Date .....

Use ..... Test Place .....

Sampling Person .....

Locality, Kind ..... Test Person .....

Water Temp. 20 ° C

測　定　番　号		1	2	1	2
Flask No.		1	2		
Volume of Flask （A） (cm^3)		498.8	498.8		
1. (Flask+Material) Weight (g)		683.6	680.3		
2. Weight of Flask (g)		180.2	178.7		
3. Weight of Material in Saturated Surface-dry (g)	1-2	503.4	501.6		
4. (Flask+Material+Water) Weight (g)		993.4	990.9		
5. Additional Water Weight (g)	4-1	309.8	310.6		
6. Density of Material in Saturated Surface-dry (g/cm^3)	3/(A-5)	2.663	2.665		
Average		2.664			
7. Weight of Vat (g)		489.4	484.8		
8. (Vat+Dry Material) Weight (g)		981.7	975.5		
9. Weight of Material in Dry (g)	8-7	492.3	490.7		
10. Bulk Density (g/cm^3)	9/(A-5)	2.605	2.607		
Average		2.606			
11. Water Content (g)	3-9	11.1	10.9		
12. Apparent Density	9/(A-5-11)	2.767	2.768		
Average		2.768			
13. Water Absorption (%	11/9x100	2.25	2.22		
Average		2.24			

Remarks

JIS A 1110	Test for Density and Water Absorption of Coarse Aggregate

Construction name ..... Test date .....

Use ..... Test place .....

Sampling person ..... Test person .....

Locality, Kind .....

Aggregate size					
Number of tests		1	2		
1. Weight of Material in Saturated Surface-dry＋Vat (g)		2699.8	2755.8		
2. Weight of Vat (g)		391.9	429.1		
3. Weight of Material in Saturated Surface-dry (g)	1-2	2307.9	2326.7		
4. (Mesh Basket＋Material) Underwater Weight (g)					
5. Underwater Weight of Mesh Basket (g)					
6. Underwater Weight of Material (g)	4-5	1442.0	1454.0		
7. Density of Material in Saturated Surface-dry (g/cm^3)	3/(3-6)	2.665	2.666		
Average		2.666			
8. Weight of Material in Dry ＋Vat (g)		2654.2	2708.5		
9. Weight of Material in Dry (g)	8-2	2262.3	2279.4		
10. Bulk Density (g/cm^3)	9/(3-6)	2.613	2.612		
Average		2.613			
11. Apparent Density (g/cm^3)	9/(9-6)	2.758	2.762		
Average		2.760			
12. Water Absorption (%)	(3-9)/9x100	2.02	2.08		
Average		2.05			

Remarks

ＪＨＳ－２０２	Calculation Sheet of Maximum Thoretical Density	

Construction Name ..... Test Person .....

Use ..... Test Place .....

Mixture Name ..... Test Date .....

Type of Aggregate ..... Type of Filler .....

Type of Fine Aggregate ..... Type of Density .....

Type of Material	① Mix Proportion (%)	Density (g/cm^3)			②Density for Calculation	③＝①／②
		Apparent	Saturated Surface-dry	Bulk		
13-5	62.0	2.757	2.677	2.631	2.694	23.014
5-2.5	7.0	2.753	2.670	2.623	2.688	2.604
SC	14.0	2.759	2.647	2.584	2.759	5.074
Fine sand	7.0	2.706	2.585	2.513	2.706	2.587
Filler	10.0	2.734	—	—	2.734	3.658
					④＝Total of ③	36.937

⑤ Asphalt Content (%)	⑥ Density of Asphalt (g/cm３)	⑦＝⑤／⑥	⑧＝④（１－⑤／100）		⑩＝⑦＋⑧	⑪ Maximum Thoretical Density =100／⑩
5.5	1.030	5.340	34.905		40.245	2.485
6.0	1.030	5.825	34.721		40.546	2.466
6.5	1.030	6.311	34.536		40.847	2.448
7.0	1.030	6.796	34.351		41.147	2.430
7.5	1.030	7.282	34.167		41.449	2.413

Remarks

Reference Document 4

Pilot Project Reports

Record of the Pilot Projects and Lessons Learnt

1. Report on Pilot Project#1 (2014)
2. Report on Pilot Project#2 (2015)

The Project for Improvement of Road Maintenance

REPORT on PILOT PROJECT No.1

November, 2014

1 Preface

JICA Expert Team for ‘‘Project for Improvement of Road Maintenance’’ is aiming to improve road repair skills of existing roads under jurisdiction of Gissar SETM and Kurgan-Tyube SETM. Pilot Project is inter-related with the other Project ‘‘Improvement of Equipment for Road and Maintenance in Khatlon Region and Districts of Republican Subordination’’ contracted between Ministry of Transport and JICA.

Main target of Pilot Project #1 is to overlay existing pavement as practical performance utilizing plants and equipment provided by JICA.

This report describes the record of Pilot Project #1 executed from 4 November to 14 November, 2014 both in Gissar SETM and Kurgan-Tyube SETM inclusive of examination of the works done as well.

2. Chronology

Following activities were conducted in chronological order before the actual paving works in November, 2014:

- ＊3--10 Jun : Road Repair Training for Gissar SETM by Experts
- ＊17--20 Jun : Road Repair Training for Kurgan Tyube SETM by Experts
- ＊Mid Jun—Aug : Installation of Crushing plant and Asphalt plant
- ＊End Jul-- Mid Sep : Training for equipment and plant
- ＊4&5 Aug : Mini Workshop on Planning and Method Statement for Pilot Project by Experts (papers on ‘Planning and Method Statement’ was submitted to MOT on 13 August,2014)
- ＊3&11 Nov: Lecture on Outline of Pilot Project #1 for Gissar and Kurgan Tyube SETM respectively by Experts (papers on ‘Outline for Pilot Project #1’is attached in appendix-1.)

3 Preparatory Works

Prior to the paving activities at site, following preparatory works as necessary actions to be taken were discussed between each SETM and Expert team:

1) Confirmation of Location (one week prior)
   Length/width/thickness of road repaired.
   Quantity calculation on paving works
   Quantity of material procurement (bitumen, mineral powder)
2) Survey works
   Depending on road configuration, it is to be decided whether leveling course is required or not.
   Level (topographic) survey shall be conducted prior to paving (4~5 days prior)
3) Crack Repair

Sealing of crack or removal of existing pavement shall be carried out one day before Pilot Project if necessary.

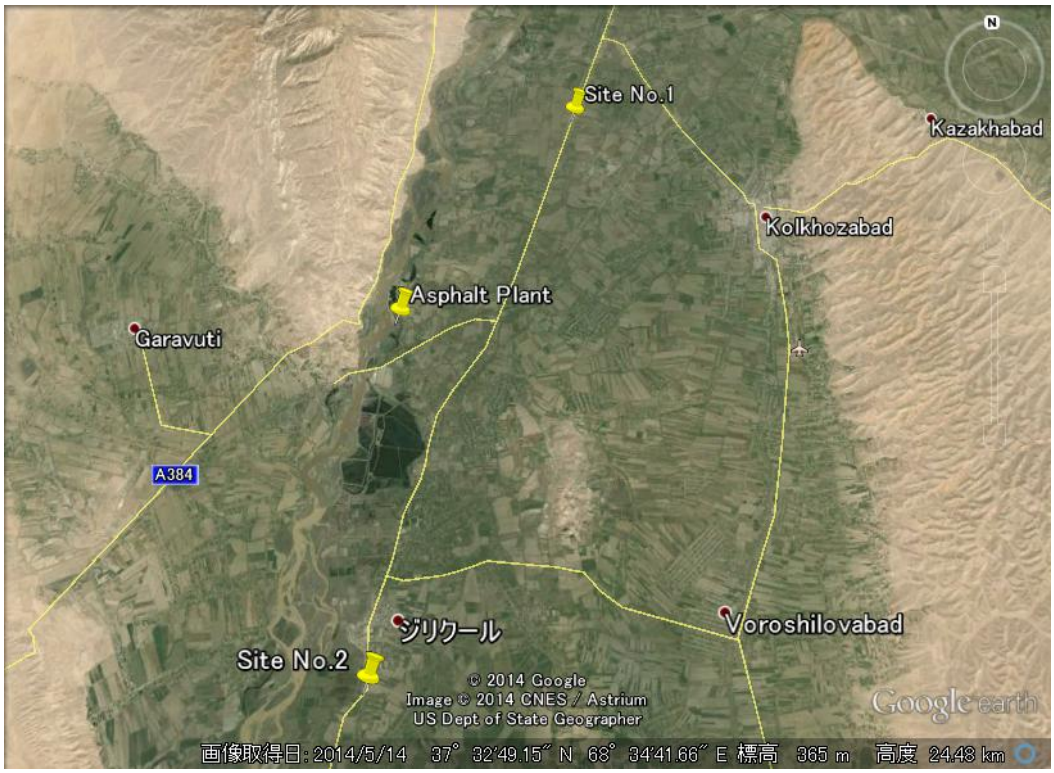
4) Preparation of Tack coat material
   Trial spray test shall be carried out in prior.
5) Trial Mix of asphalt mixture(2~3days prior),if possible
6) Arrangement of manpower(1day prior)
   Rake-man /traffic security
7) Confirmation of paving tools/equipment(1 day prior)
   Rake/Shovel/Burner/Wheel barrow/Burner/Plate compactor/compressor
   Traffic control facilities/Personal Protective Equipment
   Transportation trucks for above
8) Training for operators (1 day prior)
   Compaction Sequence/Number of passes/Temperature control
   Communication between As. plant and site
   Participants from other SEHM staff should be arranged
9) Tool Box Meeting before paving start

3.1 Confirmation of Location

Selection of location paved was made by SETM and confirmed between SETM and Expert team based on observation at site. Location map are shown below:

Gissar SETM (Vakhdat SEHM)

(Locations of Site & As plant are pinpointed.)



Kurgan Tyube SETM (Rumi SEHM & Jilikul SEHM)
(Locations of Site & As plant are pinpointed.)

(1)Gissar SETM (Vakhdat SEHM)

Site No.1 (Site G-1) Rohati Road (Vakhdat SEHM)

Hot mix Asphalt (HMA) is on existing base course

Site No.2 (Site G-2) Jarboshi Road (Vakhdat SEHM)

HMA is on existing surface course: Overlay

(2)Kurgan Tyube SETM

Site No.1 (Site KT-1) Uzun-Jilikul Road Kilo-post 3km (Runi SEHM)

HMA is on existing surface course: Overlay

Site No.2 (Site KT-2) Uzun-Jilikul Road Kilo-post 21km (Jilikul SEHM)

HMA is on existing base course

3.2 Survey works

Topographic survey was conducted at Kurgan Tyube Site KT-.1 where leveling course may be required.

3.3 Crack Repair

Crack repair was carried out in the following manner:

(1) Gissar SETM(Vakhadat) Site G-2:Filling up of cracks and pot holes are carried out by motor grader using hot mix asphalt

(2) Kurgan Tyube SETM(Rumi)Site KT- 1 :Filling up of cracks and pot holes are carried out by motor grader using cold mix asphalt

3.4 Tack Coat

Due to shortage of preparation, material of tack coat was not ready, consequently, test spray was

not executed at both SETM.

3.5 Hot Mix Asphalt

Job Mix Formula (JMF) was determined based on the aggregate sampling carried out on 19 Aug and 10 Oct 2014 at Vakhdat Crushing plant. Modification on mix design was made based on hot bin sampling at asphalt plant conducted on 29 Oct 2014.

On the contrary sampling at Jilikul plant was carried out on 21 Aug and 21 Oct 2014 for determining JMF. (Hot bin sampling was conducted on 11 Nov for future amendment of design mix)

JMF (Design Mix) for Pilot Project #1are determined as follows:

Vakhdat Asphalt plant

Material	No.1	No.2	No.3	No.4	No.5	
	20～13	13～5	5～0	Filler	Bitumen	
Proportion (%)	12.3	35.1	45.6	2.0	5.0	
Weight per Batch(Kg)	74	211	273	12	30	Total 600kg
Accumulative Weight	74	285	558	570	600	

Jilikul Asphalt Plant

Material	No.1	No.2	No.3	No.4	No.5	
	20～13	13～5	5～0	Filler	Bitumen	
Proportion (%)	9.5	45.6	36.1	3.8	5.0	
Weight per Batch(Kg)	57	274	217	22	30	Total 600kg
Accumulative Weight	57	331	548	570	600	

3.6 Arrangement of manpower and Equipment/tools

Importance of proper arrangement of manpower and equipment was reminded of at the lecture on 3 & 11 Nov 2014

3.7 Tool Box Meeting

Tool Box Meeting (safety meeting) was held in the morning when the pavement work was performed and importance of traffic control and prevention of collision of machine/cars with workers were emphasized.

4 Hot Mix Paving Operation

4.1 Profile of works

Actual dimensions of pavement executed are as follows:

(1) Gissar SETM

1. Site G-1(Vakhdat) on 4 Nov,2014 at Rohati Road
   L=147m Wave= 4.4m newly laid hot mix
   Transportation distance of HMA: 7km
2. Site G-2(Vakhdat) on 5 Nov,2014 at Jarboshi Road
   L=231m Wave=6.4m: Overlay
   Transportation distance of HMA: 12km

(2)Kurgan-Tyube SETM

1. Site KT-1(Rumi) on 13 Nov,2014 at Uzun-Jikilul Road KP 3km
   L=150m, W=7.45m : Overlay
   Transportation distance of HMA: 15 km
2. Site KT-2(Jilikul) on 14 Nov,2014 at Uzun-Jikilul Road KP 21km
   L=130m, W=6.5m newly laid hot mix
   Transportation distance of HMA: 18 km

As-Built plan is attached in Appendix-2

4.2 Tack Coat

Tack coat material was produced at site. Melting of solid bitumen and mixing with diesel was carried out in the kettle of hand sprayer. Due to the lack of preparation it took long time to produce cutback bitumen causing delay in hot mix laying.

4.3 Equipment utilized

Equipment mobilized at site is shown in the table below in comparison with the quantity envisaged.

	Description	Specification	Q'ty envisaged	Q'ty in Gissar		Q'ty in Kurgan Tyube		Remarks
				Site 1	Site 2	Site 1	Site "2	
1	Sprayer		1	1	1	1	1	
2	Asphalt paver		1	1	1	1	1	
3	Macadam roller		1	1	1	1	1	
4	Pneumatic tire roller		1	1	1	1	1	
5	Hand Guide Roller		1	1	nil	nil	nil	
6	Vib. Plate compactor	ZV-60PF	2	nil	nil	nil	nil	
7	Dump truck	ISUZU 14ton	3	3	3	3	3	
8	Water Tanker	8kl tank	1	nil	nil	nil	nil	
9	Pickup truck	double cabin	1	1	1	1	1	
10	Semi. Trailer	25ton	1	nil	nil	1	1	
11	Asphalt cutter		1	nil	nil	1	nil	
12	Compressor	POS-175S	1	nil	nil	1	nil	
1	Rake		5	3	3	4	4	
2	Square scoop		10	4	4	5	5	
3	Sieve		2	nil	nil	nil	nil	
4	Wheel Barrow		2	nil	nil	1	1	
5	Gas Burner		1	nil	nil	nil	nil	

4.4 Joint

Transverse joint at the starting point of Site KT-1 was cut by asphalt cutter and adjacent existing surface course was removed approximate 50cm wide longitudinally to provide smooth transition.

4.5 Spreading/placing of Hot Mix Asphalt(HMA)

Control of thickness was conducted by Expert and paver operator. However, due to the lack of experience and shortage of rake-man rectification work for irregularities or uneven were not well done.

4.6Temperature and Compaction Control

Measurement of temperature at each stage of placing Hot Mix Asphalt (HMA) was taken by Expert in cooperation with SEHM staff. Timing when rolling starts and number of passes by macadam roller and tire roller were controlled by Expert.

5. Lessons Learnt from Pilot Project

5.1 Observation and Examination

Followings are the examination made in view of the actual performance of works in terms of production of aggregate and asphalt mixture and paving operation:

(1)Crushing Plant

(i)Vakhdat Cr. plant

＊Experts observed on many occasion that screen net mesh is choked with wet sand especially 5-0mm mesh causing dis-gradation of aggregate size (i.e. 5-0mm fine aggregate is mixed up with 13-5mm aggregate)

＊Daily maintenance to prevent from choking by compressor or jet water washing using compressor is proposed.

＊Gravel is from river quarry, therefore stock of river gravel which is drained off at stock pile must be charged into feed hopper.

(ii) Jilikul Cr.plant

＊Jilikul crushing plant is equipped with aggregate washing facility, consequently, no choking at screen ne mesh is observed. However, materials produced are too wet to use for asphalt plant because it takes long time to dry up aggregates in dryer.

＊Drain-off the water of aggregate is required by digging trenches surrounding stock piles for example. When delivering aggregates from stock piles to cold bin at asphalt plant, it is required that wheel loader should scoop the aggregate from the top side of stock piles.

＊It is observed that asphalt mixture contains many un-crushed gravel . Care shall be taken by wheel loader operators.

(2) Asphalt plant

(i)Vakhdat As. Plant

Screw conveyor for filler had a trouble because filler may absorb the moisture causing choking/clogging.

(ii) Jilikul As. plant

＊It takes two minutes to mix one batch of asphalt mixture. It is 1.5~2 times longer than usual operation. This is because of wet aggregate as mentioned in above. Immediate counter-measures are required.

＊ Procurement of materials such as bitumen and diesel should be arranged timely and properly.

＊Print-out of control panel should be kept as a record for quality control and quantity survey.

(2) Paving Operation

(i)Tack Coat

＊It is understandable that hand sprayer is utilized instead of distributor taking account of small volume of tack coat sprayed. However, usage of distributor is recommended in order to be accustomed to the equipment for future use.

＊Production of cutback asphalt at site takes long time affecting systematic cycle time of paving operation. Preparation of cutback asphalt prior to spraying at site is required.

(ii)Spreading

＊Heating of screed is one of the important preparation for paver operation.

In Kurgan Tyube sites, propane gas was not available.

＊Rake is a fundamental tool for good quality pavement. Total number of 3-4 rakes is insufficient.

＊Wheel barrow is also useful tool for small delivery of asphalt mixture .In Site G-1&2 wheel barrow was not available.

＊Number of manpower both at Gissar and Kurgan Tyube are insufficient. Taking the opportunity of Pilot Project, many labors must be trained and get accustomed to spreading works.

(iii)Joint

＊Smooth transition between existing pavement and newly laid pavement is required for riding quality of vehicles. Plate compactor is a necessity for creating smooth joints.

＊Construction of quality longitudinal joint is one of the difficult activity in terms of compaction and spreading. More chance of construction may improve the quality of the joint.

(iv) Establishment of paving organization

＊It seems that arrangement of equipment and manpower is not well organized. SETM should take initiative of arranging necessary number of equipment/tools and manpower in coordination with individual SEHM.

5.2 Test carried out by the Experts

Marshall Stability test for the specimen taken is conducted at Avtostrada laboratory in the absence of lab equipment for the project at present. Results of test are shown in Appendix-3

5.3 Conclusion

Pilot Project is a sort of practice pavement not only for placing hot asphalt but producing hot mixture since both SETM has no experience of handling hot mix asphalt for the last 20-25 years.

It needs more time to perform good quality works and every staff in SETM/SEHM must be accustomed to the hot mix asphalt works through further training before Pilot Project#2 commence in 2015

Appendix-1:

OUTLINE for PILOT PROJECT #1 at SETM Kurgan -Tyube Nov, 2014

1 MAJOR WORK PROFILE:

1.1 Location

(1) Uzun-Jilikul Road Kilo-post 3km L=150m

Wearing course : W=7 m, t= ave. 40mm

(2) Uzun-Jilikul Road Kilo-post 22km L=150m

Wearing course : W= 6.5m, t= ave. 40mm

1.2 Duration of Construction

12 November~13 November, 2014

1.3 Major Quantities estimated:

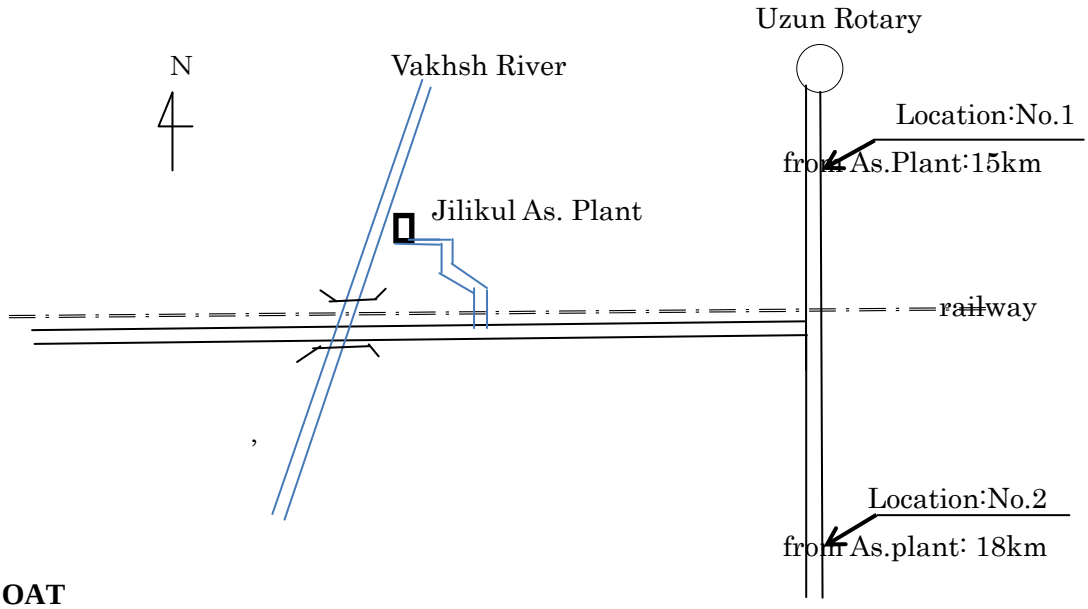
(1) Uzun-Jilikul Road Kilo-post 3km L=150m

Asphalt mixture:0.04m x 7m x 2.5ton/m3x150m=105 ton

(2) Uzun-Jilikul Road Kilo-post 22km L=150m

Asphalt mixture:0.04m x 6.5m x 2.5ton/m3x150m=98 ton

1.4 Location Map



2. TACK COAT

2.1 Material

Tack coat material used is Medium Curing cutback bitumen MC-70 produced by mixing bitumen and diesel in the distributor.

Mixing ratio is: Straight Asphalt (Bitumen): 60%

Diesel 40%

2.2 Application of tack coat : 0.2 ～0.6 liter per square meter

The application temperature is controlled between 50 ~85℃.

2.3 Spraying

Distributor with hot oil heating chamber (6,000 litter tank, Max. spraying width: 2.6~3.7m) is used for spray.

3 HOT MIX ASPHALT CONCRETE WORKS

3.1 Material

1) Bitumen is of straight asphalt with BND60/90 grade.

2) Fine aggregate and coarse aggregate is produced at crushing plant

3) Mineral powder(lime powder or cement) is used as filler.

3-2. Asphalt plant

Model: Nikko: Capacity: 36 ton/hour one batch: 600kg

3-3 Job Mix Formula (tentative)

Material	No.1	No.2	No.3	No.4	No.5	
	20～13	13～5	5～0	Filler	Bitumen	
Proportion (%)	9.5	45.6	36.1	3.8	5.0	
Weight per Batch(Kg)	57	274	217	22	30	Total 600kg
Accumulative Weight	57	331	548	570	600	

4 PAVING OPERATION

1. Survey works

Survey on length, width and actual elevation of existing surface course is surveyed in order to achieve good performance of overlay works. Based on the survey result, area where leveling course is required is estimated in advance

2. Remedial works

All large cracks are filled with a crack filler or sealer prior to tack coat application.

Pot holes are filled with cold mix or hot mix prior to over- laying.

3. Cleaning and sweeping

Existing surface course is thoroughly cleaned by the use of compressor and brooms to remove all mud, dust and other loose foreign material.

4. Leveling Course

Leveling course is generally laid by hand or motor grader.

5. Tack Coat (Refer to Section 2 hereinbefore)

6. Hauling

To prevent the mixture from adhering to them, the truck bed is lightly coated with a minimum amount of paraffin oil, soapy water, lime solution or other approved material. Each truck has a suitable cover to protect the mixture from adverse weather.

7. Spreading.

a) Asphalt Paver:

Asphalt mixture is spread /placed by asphalt paver:

HANTA wheel type Paver F2045W3 which has a paving width of 2~4.5m.

The paver has a receiving hopper of approximate 4 tons of mixture to permit a uniform spreading operation.

Before starting spreading operation, screed is pre-heated by propane gas burner heating system.

b) Temperature at spreading

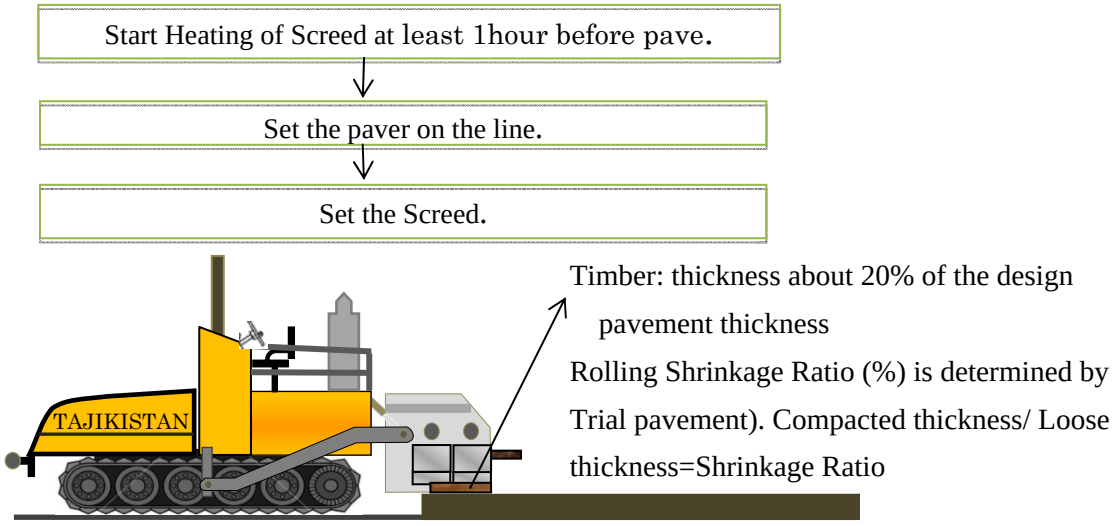
The temperature of the mixture at the time of placement is within the temperature range of 130degree(℃) and 160 degree (℃).The temperature is monitored by inserting a dial type thermometer

into the mixture.

c) Thickness and cross slope is controlled by an adjust-man using adjust- stick and level ruler.

On areas where irregularities or uneven or less thickness are appeared, the mixture is raked spreading additional material by skilled rake men in order to keep the specified thickness. Sieving men to sieve the material on the top of mixture immediately after finishing the rectification and before compaction is arranged.

d) Paver setting



8. Compaction

a) Compaction equipment

After spreading the mixture is thoroughly and uniformly compacted by rollers.

The surface is compacted as soon as possible when the mixture has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving.

The speed of roller is at all times sufficiently slow to avoid displacement of the hot mixture and effective in compaction. Any displacement occurring as a result of reversing the direction of the rollers or from any other cause is corrected at once.

To prevent adhesion of the mixture to the roller, the wheels is equipped with a scraper and kept properly moisture but excessive water is not allowed.

In areas not accessible to the roller, the mixture is thoroughly compacted with power driven tampers/compacters or hand driven rollers.

Combination of macadam roller, pneumatic tire roller, tandem roller and vibratory roller is adopted for compaction operation.

b) Manner of Compaction

Compaction will be set up in three stages

Initial rolling is carried out with macadam roller and the second rolling with pneumatic tire roller.

Final/finished rolling is carried out with Macadam roller or tandem roller.

Initial rolling is carried out at temperature 110℃to140℃

Final rolling is completed before the temperature of the mixture falls below 80 degree ℃.

Compaction is carried out from the lower edge of spread mixture in order to prevent the lateral

movement of mixture

In order to give a clean uniform edge, the Contractor will initially compact up to the edge via Macadam roller for initial (breakdown) rolling with paving staff on stand-by to correct any displacement or shortage of material thereof. Next, when the edge slope is confirmed by the lead rake man, the Pneumatic tire roller will compact up to the edge one time and subsequently come back for another pass with his most outside tire riding on the edge slope. Once complete, the Pneumatic tire roller will continue his normal compaction pattern and move onto the next section.

For areas adjacent to structures, a plate compactor is prepared for initial compaction.

9. Temperature and Compaction Control

Typical temperature control is as follows;

Construction Procedures	Asphalt Mix Temperature (°C)	No. of Passes	Rolling Speed(km/h)
Mixing Temperature	below 170	-	-
Discharging mix into Truck	More than 140	-	-
Delivery to Paver	160 – 130	-	-
Initial Rolling (Macadam Roller)	140 – 110	2 passes	2～3km/h
Secondary Rolling (Tire Roller)	130 – 90	7 passes	4～5km/h
Finishing Rolling (Macadam Roller)	> 80	2 passes	5～6km/h

10 Joints

For overlay wearing course: the longitudinal joint is at the centerline

Transverse joint is straightly cut off, cleaned and coated by tack coat, this work is completed before starting the spreading work.

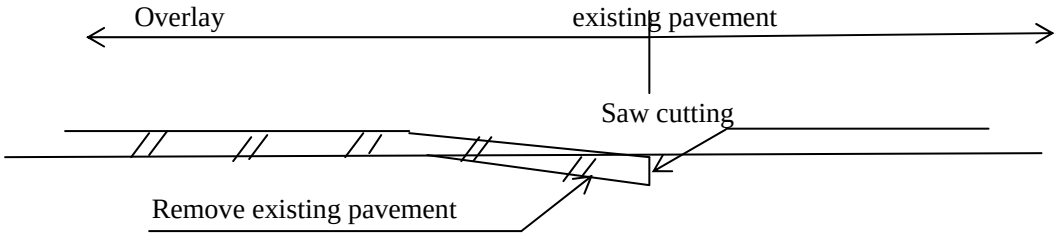


Fig. 4-3 Transverse joint

Burner unit to heat up the cold joint for better adhesion and joint making is prepared**.**

During paving of the side adjacent to the joint, exposed vertical face is lightly coated, so as to allow good adhesion when the joint is made.

11. **Weather Limitations**

Bituminous mixture is placed only when the surface is dry, when the weather is not rainy and ambient aerial temperature is above 5 degrees℃

12. **Opening for traffic**

Section of newly overlay work is protected from traffic until the asphaltic mixture is cooled to 50degree℃

13. Equipment and Manpower

: Line up of Equipment &Tool

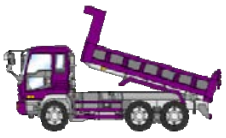
Paver

Macadam Roller

Tire Roller

Distributor

Water tanker



Dump Truck

Compressor

Hand Guide Roller

Plate Compactor

Cutter

Burner

Rake

Scoop

Wheel Barrow

Sieve

13-1. List of Equipment and plant

No	Description	Standard/Specification	Qty	Note
Paving Works				
Tack coat				
1	Distributor	HANTA 6,000 litter tank	1	Max 3.7m wide
Laying and Compaction				
1	Asphalt paver	HANTA Wheel type W=7.5ton	1	
2	Macadam roller	SAKAI R2H 10 tons	1	
3	Pneumatic tire roller	SAKAI TS-200 13 tons	1	
5	Hand Guide Roller	Hitachi Kenki ZV-650W (600 kg)	1	
6	Vibration Plate compactor	Hitachi Kenki ZV-60PF (80kg)	2	Jilikul/Boktar
7	Dump truck	ISUZU 14ton	3	3 in SETM
Common use				
1	Gas Burner		1	
2	Water Tanker	Shinmaywa 8,000 litter tank	1	
3	Pickup truck	Isuzu double cabin	1	
4	Semi Trailer	Max load 25ton	1	For mobilization
5	Asphalt cutter	Cutter blade 450mm	1	
6	Compressor	Hokuetsu POS-175S(5.0m3/min)	1	

Miscellaneous Tools				
1	Rake		5	
2	Sieve		2	
3	Wheel Barrow		2	
4	Square point(flat) scoop		10	

13-2. List of Manpower

Standard labor force for bituminous pavement work consists of the following manpower.

Paver operator	1 persons
Roller operator	3
Distributor operator	1
Dump truck driver	3 (depend on hauling distance)
Adjuster	1
Rake man	4
Skilled labor	5
Unskilled labor	7
Traffic control	4

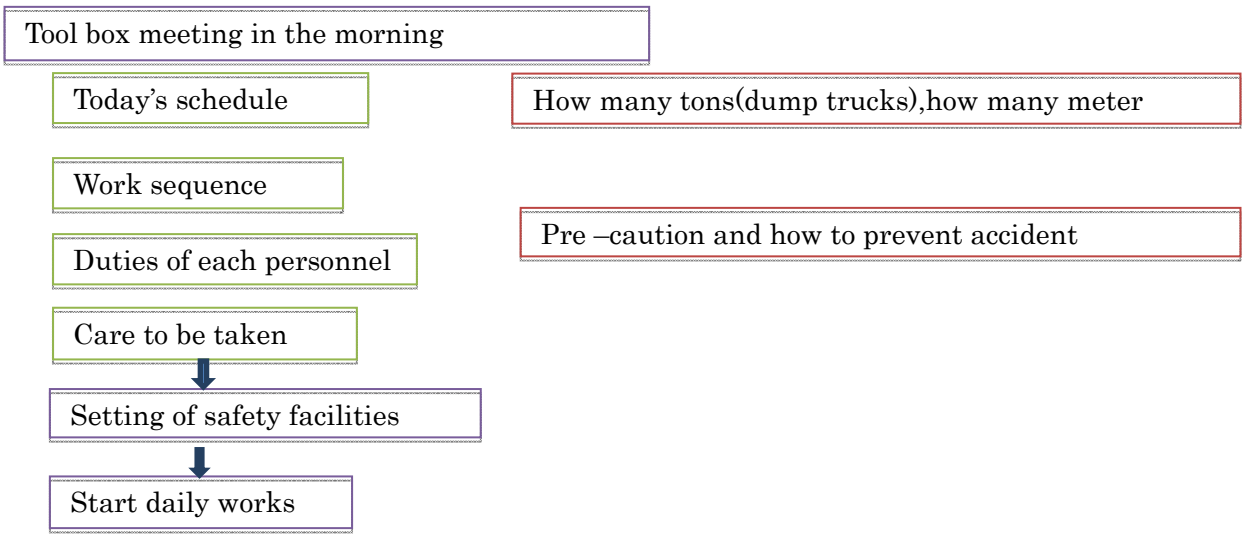
14. Quality Control

1. Check temperature of mixture: refer to attached sheet

4. SAFETY CONTROL

1. Tool Box Meeting

Tool Box Meeting is held before start of the works



2. Traffic Control

The nature of the Project requires that public traffic will pass over lengths of road while under construction. The highest standard of road safety for all road users during construction is at all times ensured

The road improvement works is mostly overlaying the existing road. Overlaying will be achieved by keeping the same road center-line.

Regulation of traffic flow is necessary since overlay construction operation occupies one lane of carriageway.

During this road overlaying the traffic will be restricted to alternating single direction flow on the road lane not under construction.

Set-up barricades and sign board and assign traffic control men

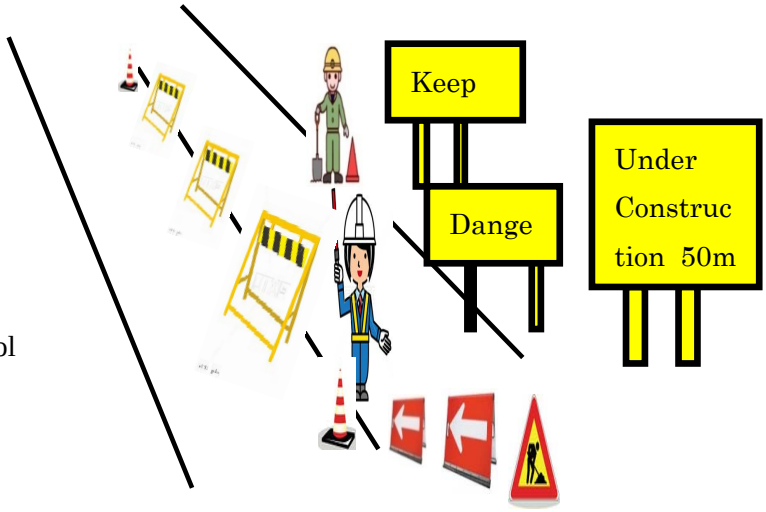
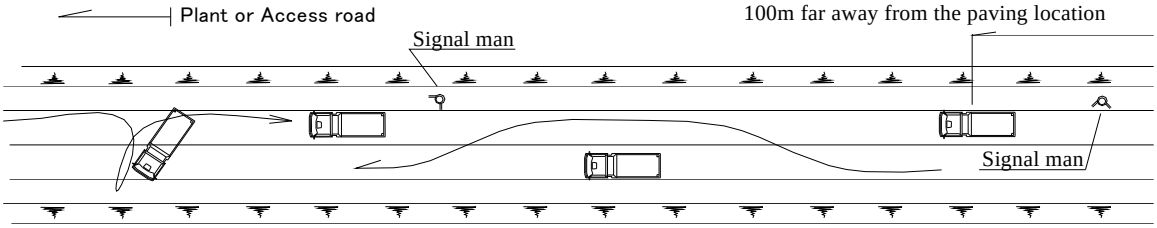


Fig.4-4 Traffic Control

Always take into account of stand-by location for dump truck loaded



Dump truck never turn at the same location,
that is, the Loction will be shifting .
Dump truck must follow the instruction of Signal-man.

Dump truck waits to keep the centor space for
dump truck going back to the plant at the point
100m far away from paving

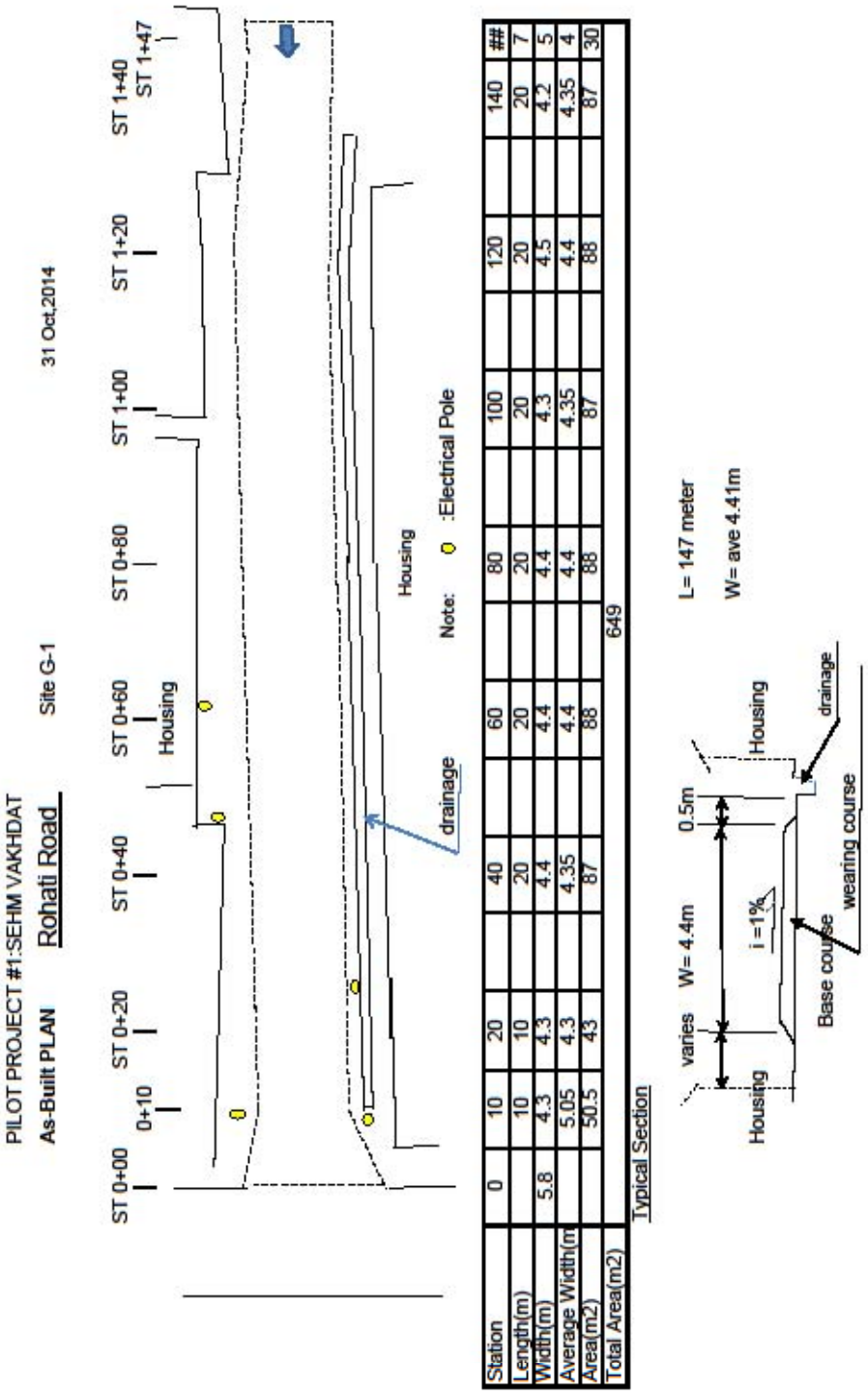
3. Safety during Paving construction

*Accident caused by roller when reversing back

Do not enter into blind corner of operator

Operator must always look around the surrounding

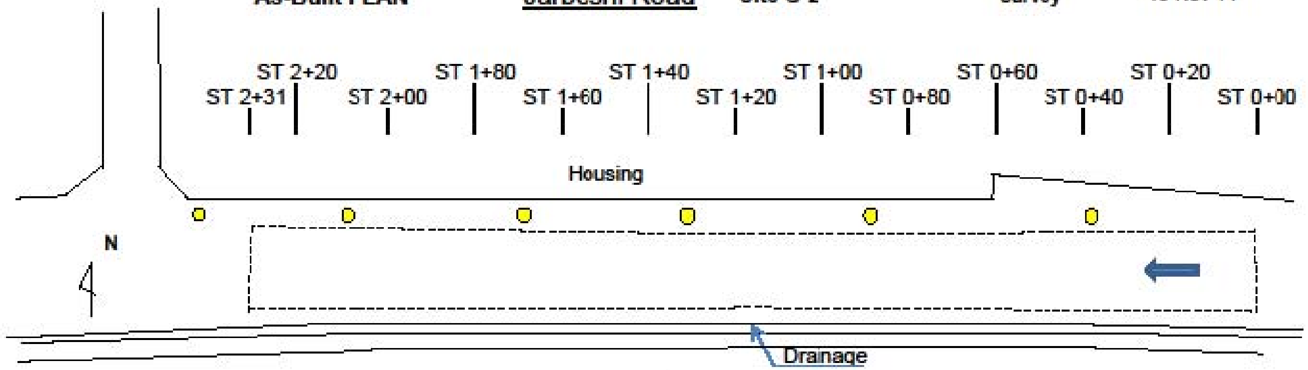
Appendix-2



Station	0	10	20		40		60		80		100		120		140	##
Length(m)		10	10		20		20		20		20		20		20	7
Width(m)	5.8	4.3	4.3		4.4		4.4		4.4		4.3		4.5		4.2	5
Average Width(m		5.05	4.3		4.35		4.4		4.4		4.35		4.4		4.35	4
Area(m2)		50.5	43		87		88		88		87		88		87	30
Total Area(m2)	649															

PILOT PROJECT #1:SEHM VAKHDAT

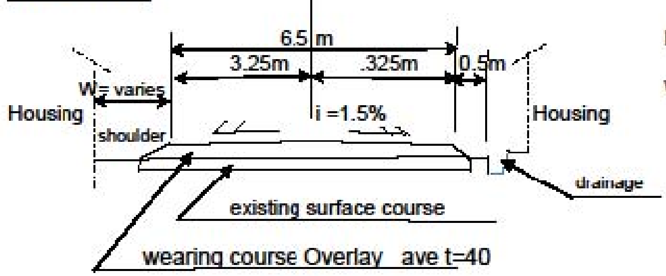
As-Built PLAN <u>Jarbcshi Road</u> **Site G-2** survey 19-Nov-14



Note: ○ : electrical pole

Station	231	220	200	180	160	140	120	100	80	60	40	20	0
Lemgth (m)	11	20	20	20	20	20	20	20	20	20	20	20	
Width(m)	6.5	6.5	6.4	6.5	6.5	6.3	6.0	6.1	6.3	6.3	6.3	6.5	6.5
Average Width(m)	6.5	6.45	6.45	6.5	6.4	6.15	6.05	6.2	6.3	6.3	6.4	6.5	
Area (m2)	71.5	129	129	130	128	123	121	124	126	126	128	130	
Area Total (m2)	1,466												

<u>Typical Section</u>



L=231 m

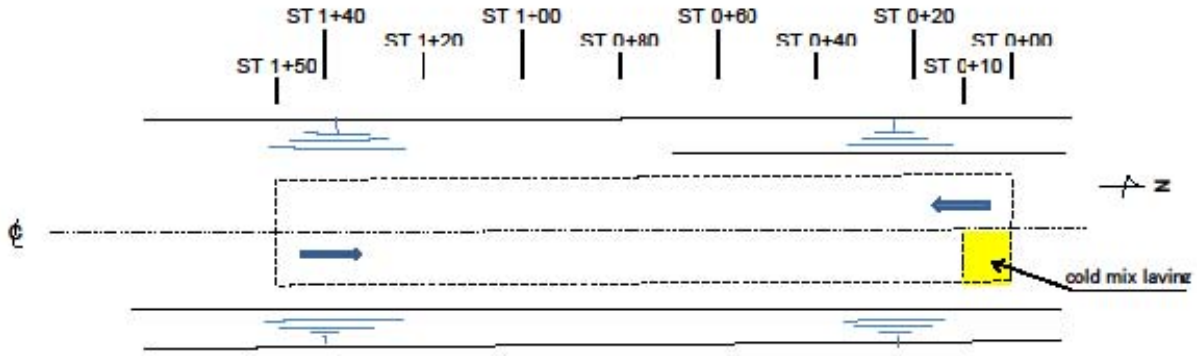
W= ave 6.35m

Ref 4-1

As-Built PLAN

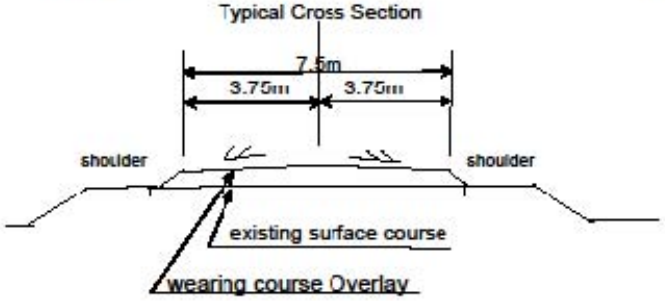
PILOT PROJECT #1 Kurgan Tyube SETM (Rumi)

Uzun-Jilikul Road :Kilo-Post 3km **Site KT-1** survey 27 Nov 14



Station	150	140	120	100	80	60	40	20	0
Length (m)	10	20	20	20	20	20	20	20	
Width(m)	7.5	7.5	7.4	7.5	7.5	7.4	7.4	7.4	7.5
Average Width(m)	7.5	7.45	7.45	7.5	7.45	7.4	7.4	7.45	
Area (m2)	75	149	149	150	149	148	148	149	
Area Total (m2)	1,117								

Typical Cross Section



L=150 m

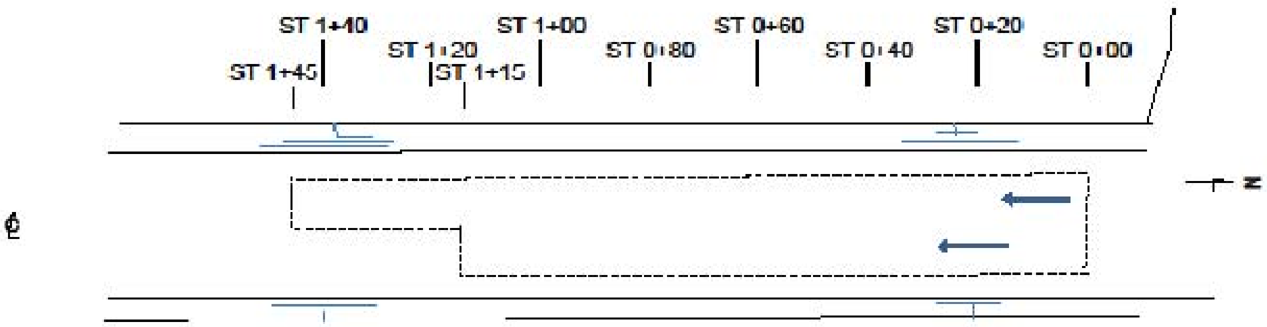
W= 7.45m

19

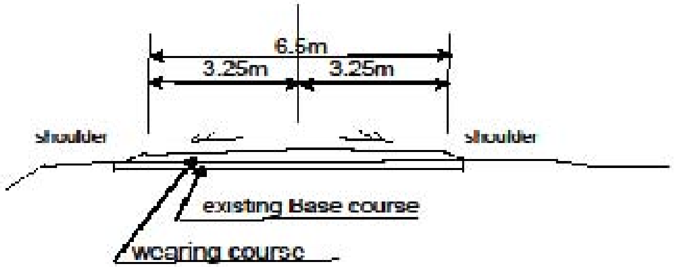
As-Built PLAN

PILOT PROJECT #1 Kurgan Tyube SETM (Jilikul)

Uzun-Jilikul Road Kilo-Post 21km Site KT-2 survey 27-Nov-14



Station	145	140	120	115	100	80	60	40	20	0
Lemgth (m)	5	20	5	15	20	20	20	20	20	
Width(m)	3.2	3.2	3.2	6.5	6.5	6.5	6.5	6.6	6.9	6.3
Average Width(m)	3.2	3.2	3.2	6.5	6.5	6.5	6.55	6.75	6.6	
Area (m2)	16	64	16	90	130	130	131	135	132	
Area Total (m2)	852									



L=150 m

W= 6.5m

Ref 4-1

Appendix-3

Marshall Stability Test For Pilot Project #1 VAKHDAT and JILIKUL

Sample number: Total 10 Specimens — Test date: 18 Nov, 2014

Project name: The Project for Improvement of Road Maintenance

Type of asphalt mixture: Hot mixture and Cold Mixture

Tested by: AVTOSTRADA

Binder type: BND 60/90 — Binder gravity: — Binder temperature: —

Aggregate temperature: 150℃ — Compaction temperature: 150℃ — Number of blow: 50

Sample No.	①specimen thickness	②specimen thickness	③specimen thickness	④specimen thickness	Average specimen thickness	Mass in air	Mass in water	Mass of saturated surface-dry	Apparent density	Bulk density	Stability	Flow Value	Remarks :Date taken (asphalt contents)
						(A)	(C)	(B)	A/(A-C)	A/(B-C)			
	cm	cm	cm	cm	cm	g	g	g	g/cm^3	g/cm^3	KN	1/100cm	
V-1	7.0	7.0	7.0	7.0	7.00	1251.5	702.700	1255	2.280	2.266	9.70	20.9	04 Nov, 2014 (5.2%)
V-2	6.7	6.7	6.7	6.7	6.70	1190.8	668.100	1195.8	2.278	2.257	7.83	32.5	
V-3	6.8	6.7	6.6	6.7	6.70	1190.4	669.800	1194	2.287	2.271	7.81	33.7	
Average					6.80	1210.9	680.200	1214.9	2.282	2.264	8.45	29.0	
V-1	6.8	6.7	6.7	6.7	6.73	1210.0	689.300	1213.5	2.324	2.308	10.43	19.8	04 Nov, 2014 (5.0%)
Average					6.73	1210.0	689.30	1213.5	2.324	0.769	10.43	19.80	
J-1	7.1	7.2	7.3	7.1	7.18	1288.9	722.600	1291.0	2.276	2.268	2.12	19.50	13 Nov, 2014 (5.0%)
J-2	6.6	6.6	6.7	6.7	6.65	1198.9	676.300	1201.3	2.294	2.284	2.15	64.00	
J-3	6.6	6.6	6.6	6.5	6.58	1203.7	683.700	1206.3	2.315	2.303	4.07	36.50	
Average					6.80	1230.5	694.200	1232.9	2.295	2.285	2.78	40.00	
C-1	6.6	6.6	6.7	6.7	6.65	1190.8	684.700	1198.8	2.353	2.316	1.03	9.4	11 Nov, 2014 (4.7%) Cold Mix
C-2	6.8	6.7	6.7	7.0	6.80	1193.9	678.300	1203.5	2.316	2.273	0.61	10.4	
C-3	6.4	6.4	6.4	6.4	6.40	1146.2	657.000	1154.4	2.343	2.304	0.57	1.63	
Average					6.62	1177.0	673.333	1185.6	2.337	2.298	0.74	7.14	

The Project for Improvement of Road Maintenance

REPORT ON PILOT PROJECT No.2

July.2015

Table of Contents

1. Introduction

Pilot Project #2 is conducted in continuation from activities conducted in 2014 and places importance on understanding the Plan-Do-Check-Action management cycle in road maintenance introduced by the JICA Experts Team since the start of the project.

Pavement Inspection Guideline Version 0 and Pavement Repair Guideline Version 0 were issued respectively in 2014 and which then were revised as Version 1 on 1 December 2014 and 5 February 2015 considering various realistic situations including implementation of Pilot Project 1 in November 2014.

In accordance with procedures introduced in Pavement Inspection Guideline Version 1, the following procedures for identifying priority sections for Pilot Project #2 were conducted by Counterparts

a. Counter parts carried out road inspection by using DRIMS
b. Necessary information including IRI measurement data was recorded using Forms-1, -2 and -3.
c. Priority sections were shortlisted for pavement repair under Pilot Project #2 by both Gissar and Kurgan Tyube SETMs.
d. Final selection was made based on consultations with MOT.

As a part of road maintenance PDCA cycle, Pilot Project #2 was implemented. Pilot Project #2 together with the result of Pilot Project #1 in 2014 was aimed at achieving one of the verifiable indicators for assessing the Project Purpose 'Implementation capacity for road maintenance is improved'. The verifiable indicator is '*At least 5km length of road repairing is implemented by the target SEHMs according to the revised guidelines by the end of the project*'.

Please be advised that since April 2015, the JICA Experts Team was unable to access into the southern regions of the district under Kurgan Tyube SETM including Jilikul Asphalt Plant other than by the national staff following the instruction from JICA Tokyo. This restriction is still in force. A similar restriction in the district under Gissar SETM including Vakhdat Asphalt Plant was enforced in the district under GIssar SETM from 4 September until 30 September following the Gissar police office attack by a few extreme activists on 4 September 2015. Now, the restriction has been lifted.

2. Preparatory Activities since Pilot Project #1

Repeat Training on Pavement Repair

A repeat training on pavement repair was performed in between 10th.Feb - 20th.Feb. 2015 following the program indicated in the next page.

Training schedule of Road repair(Gissar & Kurgan-tube)

Date / Time		10th Feb.Gissar 17th FebKurgan-tube 1st day	11th Feb.Gissar 18th Feb.Kurgan-tube 2nd day	12th Feb.Gissar 19th Feb.Kurgan-tube 3rd day	13th Feb.Gissar 20h Feb.Kurgan-tube 4th day
10:00	10:45	C.Plant &A.Plant Site Visit and study	・ Ashalt mixing design-2	・ Pavement method-2	・ **Evaluation examination-2**
10:45	11:00		Rest	Rest	
11:00	12:00		・ Question-and-Answer Sessions for Mix gesign and other	・ Maintenance and Repair of pavement	
12:00	13:00	Lunch time	Lunch time	Lunch time	
13:00	13:45	・ Crushing plant ・Asphalt Mixing Plant -1	・ Manpower for Asphalt Mixing Plant ・ Quality Control at Asphalt Plant ・ Material Control	・ Quality control at site ・ safety	No.class
13:45	14:00	Rest	Rest	Rest	
14:00	14:45	・ Asphalt Mixing Plant -2	・ Maintenance of Machine ・ Planning of construction	・ **Evaluation examination-1**	
14:45	15:00	Rest	Rest		
15:00	16:00	・ Ashalt mixing design-1	・ Pavement method-1		

Other Preparatory Activities

Jan..2015 – Mar.2015 Counterparts collected all data of DRIMS from all SEHM and completed Forms -1, -2 and -3.

15th.May – 23rd.May.2015. Finalization of Pilot Project #2 locations.

The following considerations were also necessary for proper implementation of Pilot Project #2.

1) Although the strength of aggregates is stipulated in Pavement Repair Guideline, there is no equipment available for checking the quality. Therefore, reliance on past experience as well as visual inspection had to be accepted.

2) Although other technical requirements for hot mix asphalt are also stipulated in Pavement Repair Guideline, quality control testing equipment necessary for such procured under additional JICA equipment supply arrived in Tajikistan early May 2015 only and any use of such testing equipment can only commence from August 2015 at

earliest.

As such, the current hot mix asphalt mix proportion was used as was the case for Pilot Project #1 in 2014.

3. Method Statements

The JICA Experts Team collaborated with Counterparts to produce method statements.
(For the complete method statements, see attachment-1 and -2, for Gissar and Kurgan Tyube SETMs respectively)

(Gissar SETM)
The JICA Experts Team discussed the method statement with Counterparts.
A topic in which the JICA Experts Team and Counterparts had difference of the opinion was on the repaired pavement structure. The JICA Experts Team insisted on use of the repaired pavement structure as shown in the attachment-3). However, this was overruled by Counterparts on the basis of effective utilization of the budget available. Although the JICA Experts Team felt this effective utilization was shortsighted and the shortcomings were inevitable, it was finally left to the option of Counterparts to select the repaired pavement structure. Evaluation conducted by the JICA Experts Team is made on the basis of how Counterparts performed the pavement surface course work.

(Kurgan Tyube SETM)
The JICA Experts Team discussed with Counterparts and conducted Pilot Project #2 based on the agreed method statement.

4. Locations and Work Volume

a. (Gissar SETM)

PP#2-1 Location Rudaki road-06

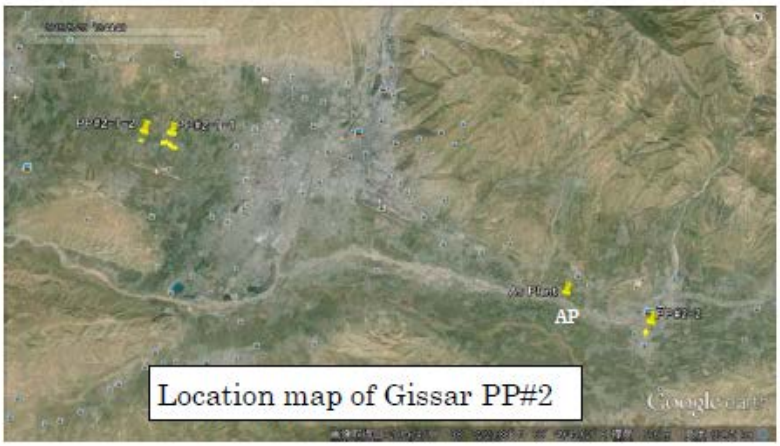
L =1,250m+250m

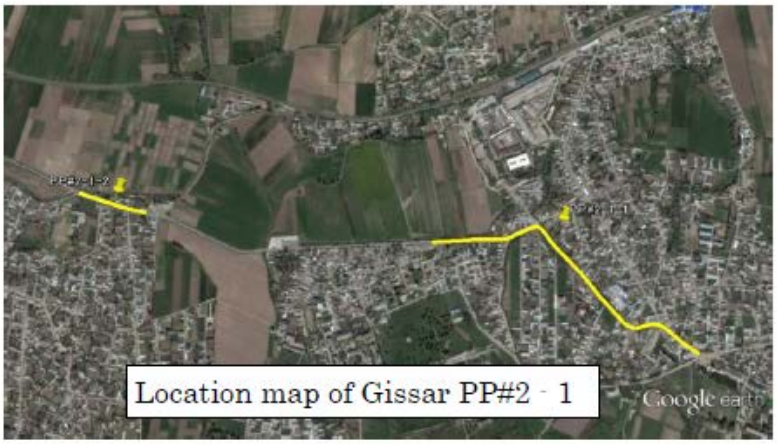
W= 7.0m A=10,500m2

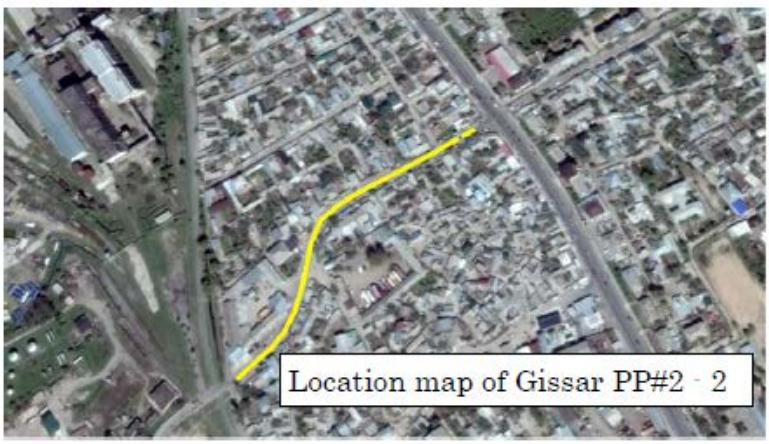
PP#2-2 Location Bahadad road-05

L=400m

W=7.0m A=2,800m2







b.Kurgan Tyube

PP#2-1 Location Holoson Road-01

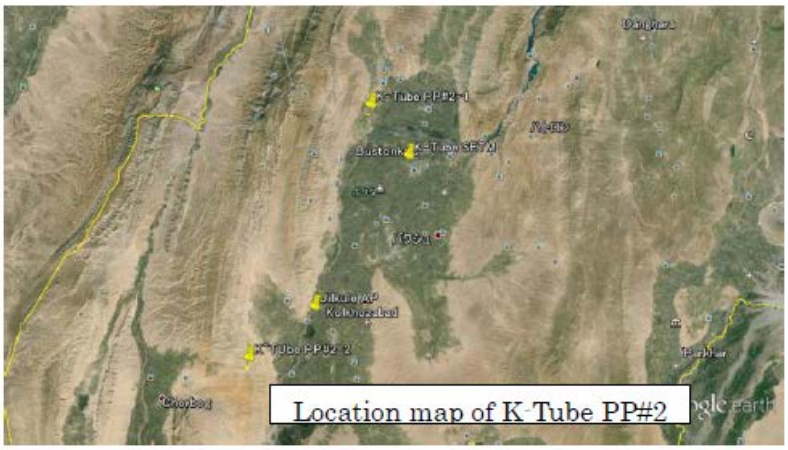
L =420m

W=8.0m A=3,360m2

PP#2-2 Location Jilkul Road-01

L =1,080m

W=7.0m A=7,560m2



5. Pilot Project #2 Result

5.1 Overall Result

Although, implementation of Pilot Project #2 together with the result of Pilot Project #1 aimed at achieving *At least 5km length of road repairing is implemented by the target SEHMs according to the revised guidelines by the end of the project*' and necessary budget for procuring required bitumen and fuel was approved in the 2015 National Budget, an unforeseen event of major flooding of Vaksh River in July caused the allocated fund to be used for recovery programs from such flooding in the extensive area of Tajikistan. Thus, implementation of Pilot Project #2 was suspended since July and the result of such had a major impact on the numerical achievement.

At the end of October 2015, it is assessed by the JICA Experts Team that only *2.9km length of road repairing is implemented by the target SEHMs according to the revised guidelines. There is a shortfall of 2.1km length.*

Progress Status on Pilot Project		at the end of Oct 2015			
Locations		Length (m)	Width (m)	Thickness (cm)	Area (m2)
1 Gissar SETM					
1) Pilot Project #1 in 2014					
1	Rohatii St. (new construction)	160	4.3	4	688
2	Jarboshi Road (overlay)	210	7.0	4	1,470
2) Pilot Project #2 in 2015 Completed					
1	Rudaki 06 (overlay)	1,203	6.0	5	7,391
3) Pilot Project #2 in 2015 Planned					
1	Vahdad 052				
2	Sharinav 03				
3	Sharinav 043				
4	Varzob 03				
5	Varzob 044				
6	Tursunzade 02				
Total Completed		1,570			9,549
Converted Length		1,364			
2 Kurgan Tyube SETM					
1) Pilot Project #1 in 2014					
1	Uzun Jilikul Road 1 (overlay)	150	7.0	5	1,050
2	Uzun Jilikul Road 2 (new construction)	140	6.0	3	840
2) Pilot Project #2 in 2015 Completed					
1	Khuroson 01 (overlay)	428	8.0	5	3,597
3) Pilot Project #2 in 2015 Completed					
1	Jilikul 01	510	7.0	5	3,570
2	Jilikul 01 Section 2	261	7.0	5	1,827
4) Pilot Project #2 in 2015 Planned					
1	Julikul 01 Section 3				
2	Khuroson 022				
3	Vakhsh 013				
4	Jomi 024				
5	Kabadiyan 01				
Total Completed/Underway		1,790			10,884
Converted Length		1,555			
3 Combined					
Total Completed/Underway		3,360			
Converted Length		2,919			

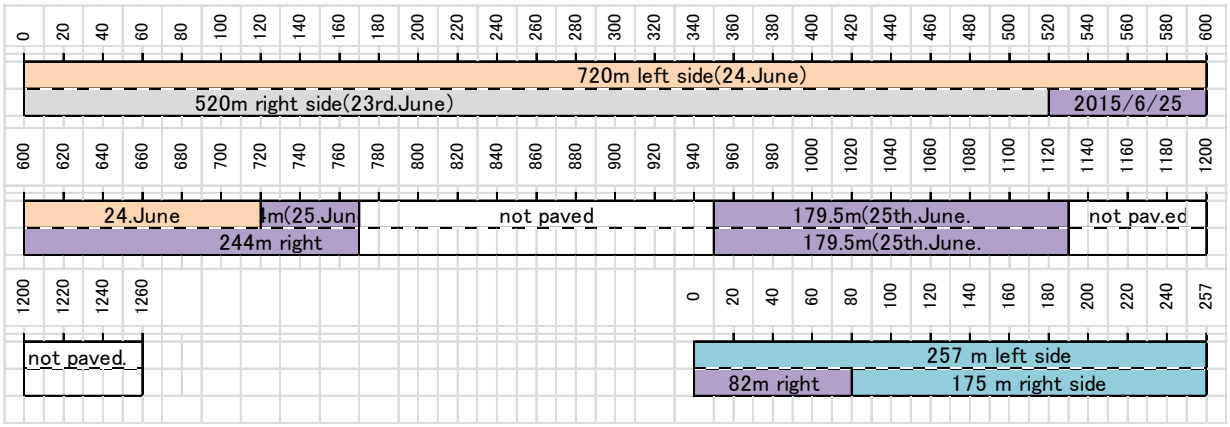
5.2 Section by Section Result

Gissar SETM- PP#2-1 Location Rudaki Road-06

25th .May—21st.June Preparation and Emergency work.

1st day (22nd.Jun.) Cleaning,patching and leveling..
2nd.day (23rd.Jun.) Leveling,patching and Overlay
3rd.day (24th.Jun.) Leveling,patching and Overlay
4th.day (25th.Jun.) Leveling,patching and Overlay
5th.day(26th.Jun) Leveling,patching and Overlay

Daily Progress



Total Paved Area (Gissar)PP#2-1

Rudaki-06(1)

Station. No	Width(m)	Ave. width(m)	Area(m2)
0	7.00		
20	6.90	6.95	139.00
40	6.20	6.55	131.00
60	6.20	6.20	124.00
80	5.90	6.05	121.00
100	5.90	5.90	118.00
120	6.00	5.95	119.00
140	6.00	6.00	120.00
160	6.40	6.20	124.00
180	7.00	6.70	134.00
200	6.30	6.65	133.00
220	5.70	6.00	120.00
240	5.70	5.70	114.00
260	6.10	5.90	118.00
280	5.80	5.95	119.00
300	6.00	5.90	118.00
320	6.00	6.00	120.00
340	6.00	6.00	120.00
360	6.00	6.00	120.00
380	6.00	6.00	120.00
400	6.00	6.00	120.00
420	6.00	6.00	120.00
440	5.90	5.95	119.00
460	6.00	5.95	119.00
480	6.00	6.00	120.00
500	6.00	6.00	120.00
520	6.00	6.00	120.00
540	5.90	5.95	119.00
560	6.00	5.95	119.00
580	6.00	6.00	120.00
600	6.00	6.00	120.00
620	6.10	6.05	121.00
640	6.10	6.10	122.00
660	6.00	6.05	121.00
680	6.00	6.00	120.00
700	6.30	6.15	123.00
720	8.20	7.25	145.00
740	7.60	7.90	158.00
760	7.60	7.60	152.00
764	7.60	7.60	30.40

Station. No	Width(m)	Ave. width(m)	Area(m2)
764	Not Paved		
951.8			
951.8	6.05		
960	6.00	6.03	49.41
980	6.00	6.00	120.00
1000	5.95	5.98	119.50
1020	6.00	5.98	119.50
1040	5.75	5.88	117.50
1060	6.05	5.90	118.00
1080	6.00	6.03	120.50
1100	6.00	6.00	120.00
1120	6.10	6.05	121.00
1133.3	6.20	6.15	81.79
1133.3	Not Paved		
1260			
Total			5,827.60

Rudaki-06(2)

Station. No	Width(m)	Ave. width(m)	Area(m2)
0	5.80		
20	6.00	5.90	118.00
40	6.00	6.00	120.00
60	6.05	6.03	120.50
80	6.10	6.08	121.50
100	6.10	6.10	122.00
120	6.15	6.13	122.50
140	6.10	6.13	122.50
160	6.15	6.13	122.50
180	6.10	6.13	122.50
200	6.20	6.15	123.00
220	6.10	6.15	123.00
240	6.10	6.10	122.00
257	6.05	6.08	103.28
Total			1,563.28

Total 7,390.88 m2

Bituminous mixture use: Plan – 850t (This amount has decided by MOT, not calculated by the area to be paved.)

Actural – 861t (905t-44t:44t was used for other area.)

Average paved thickness 861t / 7391m2 /2.5t/m3 = 0.046 =**4.6cm**

6. Lessons Learnt from Pilot Project #2

Issues observed on site

1. Hot mix asphalt was not used for leveling and patching.
   Procedure in the method statement was not followed.
2. Working days were disrupted, due to internal control issue. This led to disrupted preparations and (consequently poor quality).
   Procedure in the method statement was not followed.
3. Praparation and pavement work were performed in the same day.
   Procedure in the method statement was not followed.
4. Understanding of prime/tack coat is not understood by workers.
5. Too much emphasis was placed on utilzing materials and equipment for pavement repair without due considerations for quality and the time required for planning and proper equipment and material handling. This might have occurred owing to too many requests from both community and governmental senior officials for pavement repair. The JICA Experts Team believes at least drawbacks from such action should be fully considered prior to action and continual monitoring of the road must be performed to understand the consequence of such action.
   Procedure in the method statement was not followed.

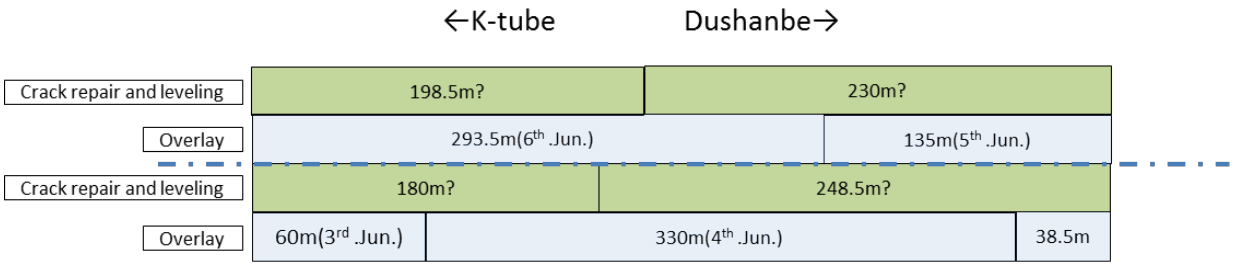
Before repair (Gissar, PP#2-1)

After repair

Kurgan Tyube SETM-PP#2-1 Location Khuroson Road 01

1st day (2nd.Jun.) Clearing of shoulder by moter grader.
2nd.day (3rd.Jun.) Crack repair, leveling and overlay (60m of 1 lane.).
3rd.day (4th.Jun.) Crack repair, leveling and overlay (330m of 1 lane.)
4th.day (5th.Jun.) Crack repair, leveling and overlay (30m of 1 lane+163m of other lane.)
5th.day(6th.Jun) Crack repair, leveling and overlay (remaining of other lane.)

Daily Progress



Total Paved Area (K-Tube)PP#2-1

Station. No	Width(m)	Ave. width(m)	Area(m2)
0	8		
20	8.3	8.15	163
40	8.25	8.275	165.5
60	8.3	8.275	165.5
80	8.4	8.35	167
100	8.5	8.45	169
120	8.35	8.425	168.5
140	8.4	8.375	167.5
160	8.4	8.4	168
180	8.5	8.45	169
200	8.6	8.55	171
220	8.4	8.5	170
240	8.45	8.425	168.5
260	8.25	8.35	167
280	8.35	8.3	166
300	8.35	8.35	167
320	8.35	8.35	167
340	8.5	8.425	168.5
360	8.55	8.525	170.5
380	8.35	8.45	169
400	8.4	8.375	167.5
420	8.6	8.5	170
428.45	8.4	8.5	71.8
Total			**3596.8m2**

Bituminous mixture use: Plan – 433t (Leveling 30t, Overlay 403t)
Actural – 544t (Leveling 116t, Overlay 428t)
111t excess.

Average paved thickness 428t / 3597m2 /2.5t/m3 =0.048m =**4.8cm**

Issues obeserved on site

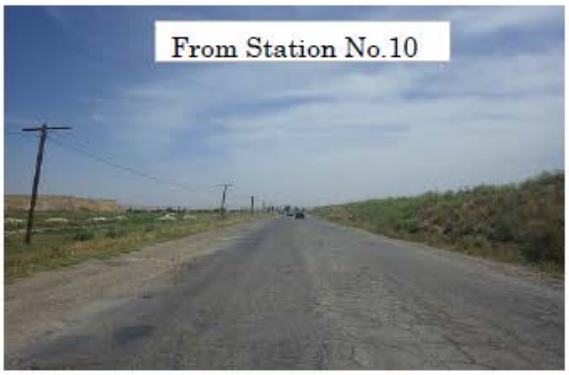
1. Bitumen 60/90 was mixed with Kumsangir cold mix bitumen.
   - Basic understanding on the asphalt mixure must be understood by all.
     (Such basic mistakes should never occur.)
   - Surface course will likely to have wave in the near future.
2. Since Kurgan Tyube SETM has the policy of operaters and workers combining together from various regions, it was still difficult to control operators and workers as a team. The JICA Experts Team conducted small meeting before starting the work. It is necessary for everyone to understand that all works as one team under one team leader.
3. Procedure in the method statement was not followed.
4. Bad mixed batch was delivered on 2 occasions. The first batch was removed from pavement work, but the second one was used. The section using this batch will likely to have flashing in the near future.
5. It is strongly reccomended that bitumen mixture still in the bitumen tank which has Kumsangir cold mix bitumen be used for non pavement activities.

Evaluation

The JICA Exerts Team judges the Pilot Project #2 on Khuroson Road -1 acceptable with the score of 73 out of 100. For details, see attched evaluation result.(Attachment-5).

The result and evaluation for Jilikul 01 sections are not performed as access by the Experts were not permitted by JICA Tokyo instruction.

Before repair (K-Tube, PP#2-1)



After repair

Minor Defects after Pavement on KurganTyube PP#2-1

After less than 18 days from pave,rutting was came out.
This phenomenon has not occurred in linear. This might occurred because of the under layer cold mixture.

Flashing has occurred on the new pave. Mixture has too much bitumen when paved. And also mixture has not fine materials, just looks like pea gravel.

We could take only broken core sample because of problem of bitumen.

Kurgan Tyube PP#2-2 Location Khurson -1

The area was not accessible by the JICA Experts.

Sta: 0+000


Sta: 0+200


Sta: 0+400


0+600


Sta: 0+770

Sta: 0+900

From Sta: 0+770 onward,
Pilot Project #2 is suspended

Sta: 1+000

Sta: 1+080