

15+700

COMMENT	Volume of crackle: medium Width of crackle: 05-30mm 369 / 2800 x 100 = 13.18%	Volume of crackle: medium Width of crackle: 05-30mm 314 / 2800 x 100 = 11.21%	Volume of crackle: most Width of crackle: 05-40mm 428 / 2800 x 100 = 15.29%	Volume of crackle: medium Width of crackle: 05-50mm 419 / 2800 x 100 = 14.96%
SUBJECTIVE EVALUATION	3	3	3	3
OBJECTIVE EVALUATION	b, d	b, d	b, d	b, d
TYPE OF PAVEMENT REHABILITATION	C	C	C	C



DSC01259



DSC01260



DSC01261



DSC01262





15+800

COMMENT	Volume of crackle: medium Width of crackle: 05-30mm 350 / 2800 x 100 = 12.50%	Volume of crackle: medium Width of crackle: 05-30mm 499 / 2800 x 100 = 17.82%	Volume of crackle: most Width of crackle: 05-40mm 506 / 2800 x 100 = 18.07%	Volume of crackle: medium Width of crackle: 05-20mm 357 / 2800 x 100 = 12.75%
SUBJECTIVE EVALUATION	4	4	3	3
OBJECTIVE EVALUATION	b, d	b, d	b, d	b, d
TYPE OF PAVEMENT REHABILITATION	C	C	C	C



DSC01263



DSC01264



DSC01265



DSC01266

THE BASIC DESIGN STUDY ON CONSTRUCTION OF EASTERN ARTERIAL ROAD IN MONGOLIA

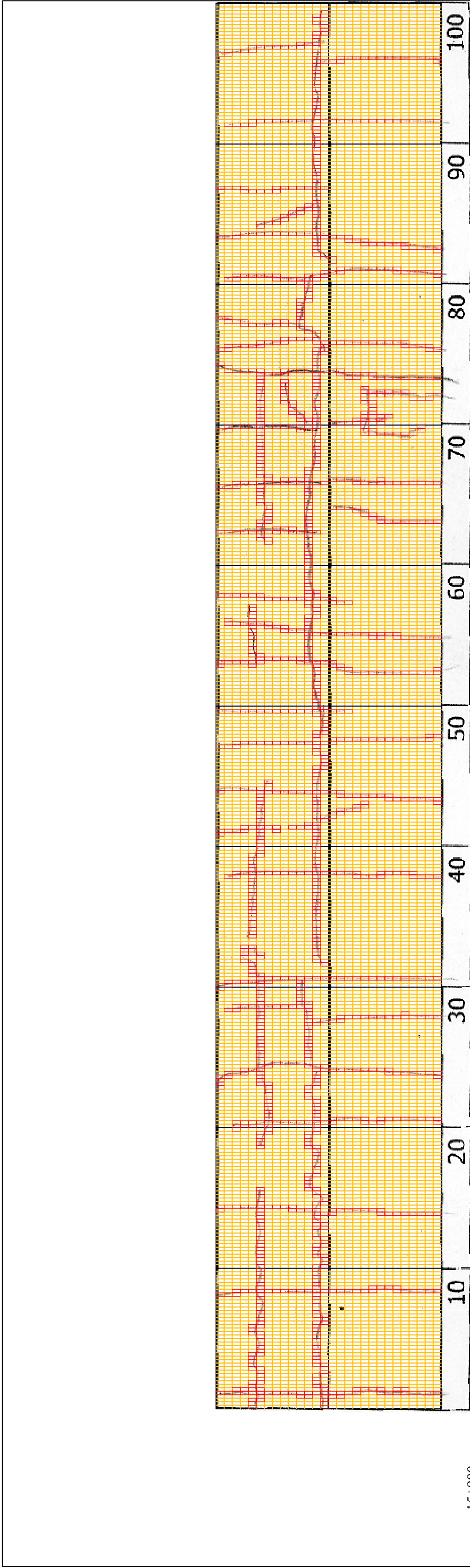
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
MINISTRY OF INFRASTRUCTURE,  
THE GOVERNMENT OF MONGOLIA

PACIFIC CONSULTANTS INTERNATIONAL  
JAPAN OVERSEAS CONSULTANTS

Scale  
1:5900=1:6000

No.  
D-157





15+900

COMMENT	Volume of cracle: medium Width of cracle: 05-30mm 379 / 2800 x 100 = 13.54%	Volume of cracle: medium Width of cracle: 05-20mm 378 / 2800 x 100 = 13.50%	Volume of cracle: medium Width of cracle: 05-40mm 436 / 2800 x 100 = 15.57%	Volume of cracle: most Width of cracle: 05-15mm 306 / 2800 x 100 = 10.93%
SUBJECTIVE EVALUATION	3	3	3	3
OBJECTIVE EVALUATION	b	b	b	b
TYPE OF PAVEMENT REHABILITATION	B	B	B	B



DSC01267



DSC01268



DSC01269



DSC01270

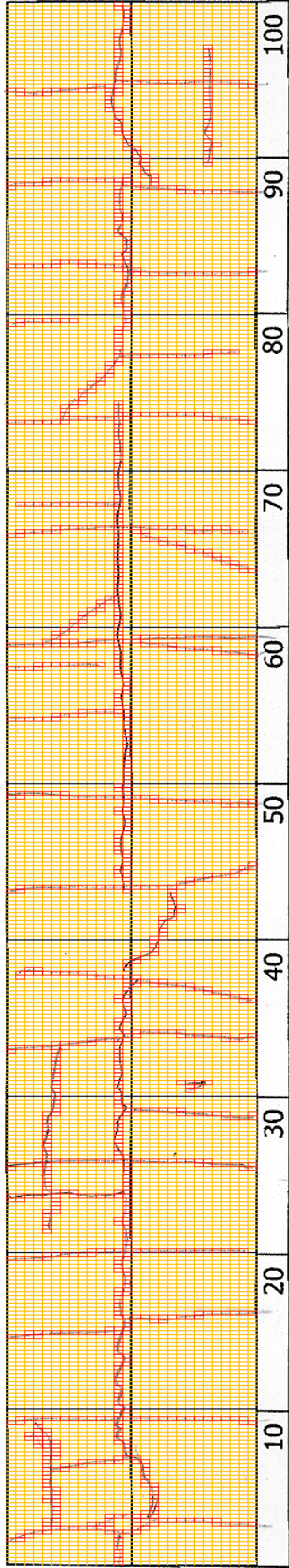
THE BASIC DESIGN STUDY ON CONSTRUCTION OF EASTERN ARTERIAL ROAD IN MONGOLIA

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
MINISTRY OF INFRASTRUCTURE,  
THE GOVERNMENT OF MONGOLIA

PACIFIC CONSULTANTS INTERNATIONAL  
JAPAN OVERSEAS CONSULTANTS

Scale  
1:6000-1:6100

No.  
D-158



16+000

COMMENT	Volume of crackle: most Width of crackle: 05-50mm 339 / 2800 x 100 = 12.11%	Volume of crackle: most Width of crackle: 05-30mm 352 / 2800 x 100 = 12.57%	Volume of crackle: medium Width of crackle: 05-20mm 301 / 2800 x 100 = 10.75%	Volume of crackle: medium Width of crackle: 05-30mm 275 / 2800 x 100 = 9.82%
SUBJECTIVE EVALUATION	3	3	3	3
OBJECTIVE EVALUATION	b	b	b	b
TYPE OF PAVEMENT REHABILITATION	B	B	B	B



DSC01271



DSC01272



DSC01273



DSC01274

THE BASIC DESIGN STUDY ON CONSTRUCTION OF EASTERN ARTERIAL ROAD IN MONGOLIA

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEPARTMENT OF ROADS,  
MINISTRY OF INFRASTRUCTURE,  
THE GOVERNMENT OF MONGOLIA

PACIFIC CONSULTANTS INTERNATIONAL  
JAPAN OVERSEAS CONSULTANTS

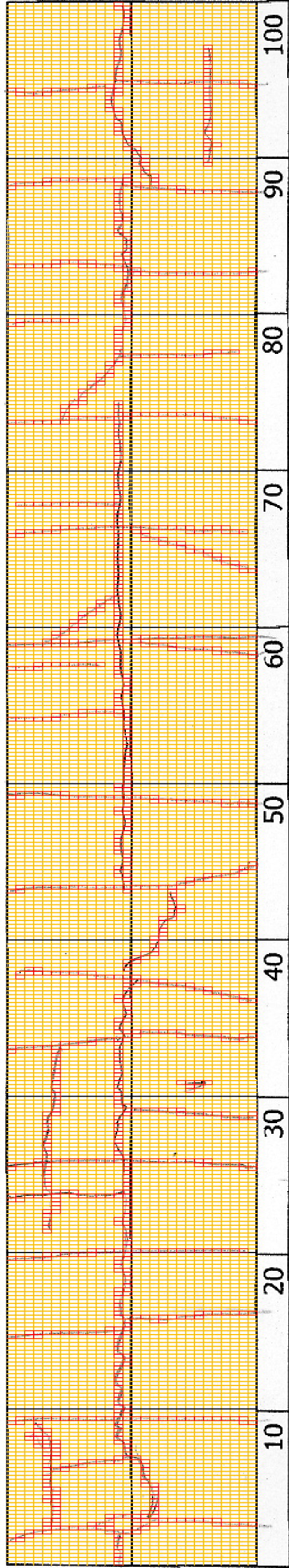
Drawing title

16100-16200

No.

D-159





16+000

COMMENT	Volume of crackle: most Width of crackle: 05-50mm 339 / 2800 x 100 = 12.11%	Volume of crackle: most Width of crackle: 05-30mm 352 / 2800 x 100 = 12.57%	Volume of crackle: medium Width of crackle: 05-20mm 301 / 2800 x 100 = 10.75%	Volume of crackle: medium Width of crackle: 05-30mm 275 / 2800 x 100 = 9.82%
SUBJECTIVE EVALUATION	3	3	3	3
OBJECTIVE EVALUATION	b	b	b	b
TYPE OF PAVEMENT REHABILITATION	B	B	B	B



DSC01271



DSC01272



DSC01273



DSC01274

THE BASIC DESIGN STUDY ON CONSTRUCTION OF EASTERN ARTERIAL ROAD IN MONGOLIA

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEPARTMENT OF ROADS,  
MINISTRY OF INFRASTRUCTURE,  
THE GOVERNMENT OF MONGOLIA

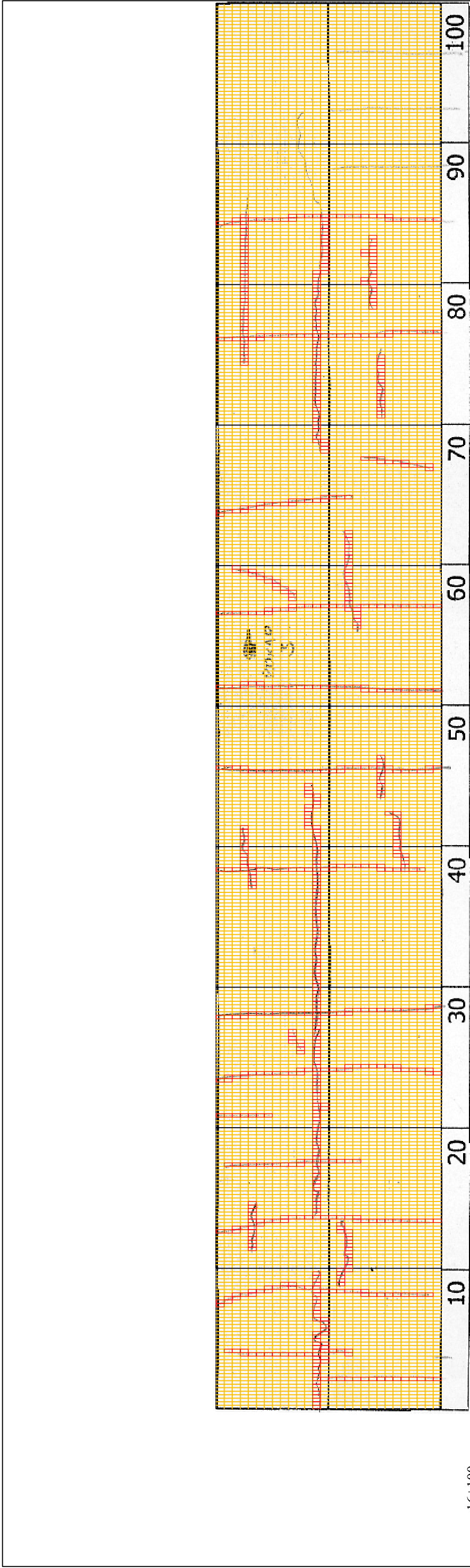
PACIFIC CONSULTANTS INTERNATIONAL  
JAPAN OVERSEAS CONSULTANTS

Drawing title

16100-16200

No.

D-159



16+100

COMMENT	Volume of crackle: most Width of crackle: 05-50mm 280 / 2800 * 100 = 10.00%	Volume of crackle: medium Width of crackle: 05-80mm 225 / 2800 * 100 = 8.04%	Volume of crackle: less Width of crackle: 05-30mm There is a pothole in + 16255 metre. (200*100*30mm) 190 / 2800 * 100 = 6.79 %	Volume of crackle: medium Width of crackle: 05mm 163 / 2800 * 100 = 5.82%
SUBJECTIVE EVALUATION	3	3	3	3
OBJECTIVE EVALUATION	b	b	b, c	b
TYPE OF PAVEMENT REHABILITATION	B	B	B	B



DSC01275



DSC01276



DSC01277



DSC01278

THE BASIC DESIGN STUDY ON CONSTRUCTION OF EASTERN ARTERIAL ROAD IN MONGOLIA	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DEPARTMENT OF ROADS,
PACIFIC CONSULTANTS INTERNATIONAL JAPAN OVERSEAS CONSULTANTS	MINISTRY OF INFRASTRUCTURE, THE GOVERNMENT OF MONGOLIA
Drawing title	Scale
16200-16300	
No.	D-160

## 9. 舗装構成の算出

【資料9. 舗装構成の算出】

1. Section new construction

$$\log_{10}W_{18} = Z_R * S_0 + 9.36 * \log_{10}(SN+1) - 0.20 + \log_{10} \left( \frac{PSI}{(4.2-1.5)} \right) / \left( (0.40+1094/(SN+1)^{5.19}) \right) + 2.32 * \log_{10}M_R - 8.07$$

- \* Effective Resilient Modulus of Subgrade (psi)  $M_R = 1500 * CBR$
- \* Reliability: 90%  $Z_R = -1.282$
- \* Standard Deviation  $S_0 = 0.35$
- \* Initial Pavement Serviceability Index for the Asphalt Pavement  $P_0 = 4.2$
- \* Terminal Serviceability Index  $P_t = 2.5$
- \* PSI  $PSI = 1.7$
- \* Cumulative Traffic (ESAL) for 7 year  $W_{18} = 629,400$

Input Data for SN

$W_{18}$	$Z_R$	$S_0$	PSI	CBR	$M_R$
629,400	-1.282	0.35	1.7	8	12,000
				10	15,000
				12	18,000

Computed SN

	CBR=8	CBR=10	CBR=12
SN	2.56	2.35	2.19

$$SN = a_1 D_1 + a_2 D_2 m_2 + a_3 D_3 m_3$$

Pavement Layer	a	CBR=8			CBR=10			CBR=12			m
		D		SN	D		SN	D		SN	
		in	cm		in	cm		in	cm		
Asphalt Concrete Surface	0.45	2.1	5	0.95	2.1	5	0.95	2.1	5	0.95	-
Granular Base Course	0.14	5.8	15	0.81	5.8	15	0.81	4.0	10	0.56	1
Granular Subbase	0.08	10.2	26	0.82	7.7	20	0.62	8.7	22	0.70	1
Total	-	18.1	46	2.57	15.6	40	2.37	14.8	37	2.20	-



2. Section new construction

$$\log_{10}W_{18} = Z_R * S_0 + 9.36 * \log_{10}(SN+1) - 0.20 + \log_{10} \left( \frac{PSI}{(4.2-1.5)} \right) / \left( \frac{0.40+1094}{(SN+1)^{5.19}} \right) + 2.32 * \log_{10}M_R - 8.07$$

- \* Effective Resilient Modulus of Subgrade (psi) M<sub>R</sub> = 1500 \* CBR
- \* Reliability: 90% Z<sub>R</sub> = -1.282
- \* Standard Deviation S<sub>0</sub> = 0.35
- \* Initial Pavement Serviceability Index for the Asphalt Pavement P<sub>0</sub> = 4.2
- \* Terminal Serviceability Index P<sub>t</sub> = 2.5
- \* PSI PSI = 1.7
- \* Cumulative Traffic (ESAL) for 7 year W<sub>18</sub> = 247,600

Input Data for SN

W <sub>18</sub>	Z <sub>R</sub>	S <sub>0</sub>	PSI	CBR	M <sub>R</sub>
247,600	-1.282	0.35	1.7	8	12,000
				10	15,000
				12	18,000

Computed SN

	CBR=8	CBR=10	CBR=12
SN	2.19	2.01	1.87

$$SN = a_1D_1 + a_2D_2m_2 + a_3D_3m_3$$

Pavement Layer	a	CBR=8			CBR=10			CBR=12			m
		D		SN	D		SN	D		SN	
		in	cm		in	cm		in	cm		
Asphalt Concrete Surface	0.45	2.1	5	0.95	2.1	5	0.95	2.1	5	0.95	-
Granular Base Course	0.14	4.0	10	0.56	4.0	10	0.56	4.0	10	0.56	1
Granular Subbase	0.08	8.5	22	0.68	8.0	20	0.64	8.0	20	0.64	1
Total	-	14.6	37	2.19	14.1	35	2.15	14.1	35	2.15	-

**3. Section rehabilitation**

$$\log_{10}W_{18} = Z_R * S_0 + 9.36 * \log_{10}(SN+1) - 0.20 + \log_{10} \left( \frac{PSI}{(4.2-1.5)} \right) / \left( \frac{0.40+1094}{(SN+1)^{5.19}} \right) + 2.32 * \log_{10}M_R - 8.07$$

- \* Effective Resilient Modulus of Subgrade (psi) M<sub>R</sub> = 1500 \* CBR
- \* Reliability: 90% Z<sub>R</sub> = -1.282
- \* Standard Deviation S<sub>0</sub> = 0.35
- \* Initial Pavement Serviceability Index for the Asphalt Pavement P<sub>0</sub> = 4.2
- \* Terminal Serviceability Index P<sub>t</sub> = 2.5
- \* PSI PSI = 1.7
- \* Cumulative Traffic (ESAL) for 7 year W<sub>18</sub> = 681,700

**Input Data for SN**

W <sub>18</sub>	Z <sub>R</sub>	S <sub>0</sub>	PSI	CBR	M <sub>R</sub>
681,700	-1.282	0.35	1.7	8	12,000
				10	15,000
				12	18,000

**Computed SN**

	CBR=8	CBR=10	CBR=12
SN	2.59	2.38	2.22

CBR=10	
SN <sub>0</sub>	SN <sub>f</sub>
2.04	2.38

SN<sub>0</sub> Asphalt Surface 4.72 in \* 0.45 / 4 = 0.53  
 Base Course 7.87 in \* 0.10 = 0.79  
 Subbase 12 in \* 0.06 = 0.72  
 2.04

W <sub>18</sub> (N)	Z <sub>R</sub>	S <sub>0</sub>	PSI	CBR	M <sub>R</sub>	log <sub>10</sub> W <sub>18</sub>	Z <sub>R</sub> *S <sub>0</sub>	log <sub>10</sub> ( P <sub>t</sub> - P <sub>0</sub> ) / ( 4.2 - 1.5 )	log <sub>10</sub> M <sub>R</sub>
681,700	-1.282	0.35	2.2	10	15,000	5.834	-0.449	-0.089	4.176

$$SN_{OL} = SN_f - F_{RL} * S_{neff}$$

- SN<sub>OL</sub> : Required Overlay Structure Number
- SN<sub>f</sub> : Structure Number Required for Future Traffic
- F<sub>RL</sub> : Remaining Life Percentage
- S<sub>neff</sub> : Effective Structure Number of Existing Pavement

CBR	SN <sub>f</sub>	log <sub>10</sub> W <sub>18</sub>	W18 (Nfy)	R <sub>LY</sub> = ( N <sub>fy</sub> - N ) / N <sub>fy</sub>	F <sub>RL</sub>	C <sub>x</sub> by estimate	S <sub>neff</sub> = C <sub>x</sub> * SN <sub>0</sub>	SN <sub>OL</sub> =SN <sub>f</sub> -
10	2.38	5.881	759,933.032	10.3%	0.80	0.87	1.773	0.960

D <sub>OL</sub> =SN <sub>OL</sub> /a <sub>l</sub>	
in	cm
2.1	5



## 10. ソフトコンポーネント要請レター



DEPARTMENT OF ROADS  
IMPLEMENTARY AGENCY  
OF THE GOVERNMENT OF MONGOLIA

210628 Chingisiin orgon cholo 11  
Sukhbaatar duureg, Ulaanbaatar, MONGOLIA  
Tel/Fax: (976-11) 31-05-03, E-mail: roads@mongol.net

Date 7 September 2004  
Ref. 2/988

To: Study team of Japanese Grant aid

Subject: Implementation of improvement measures of the operation level of road maintenance equipment procured under Grant aid.

Dear Sirs, .

With the purpose to advance equipment operation level, to implement appropriate road maintenance system and to improve its quality and efficacy, we are requesting you to accept our proposal to implement following issues within the project.

1. Elementary training

Training will be a part of equipment procurement contract, and the procuring company will teach the methods to operate the equipment, and the knowledge how to use instruction manual and how to carry out technical inspection for the equipment will be endowed. The trainings will be organized group by group.

2. Technology transfer training

Road maintenance technology will be learnt within the training. As learnt this technology, trainers will have an eventuality to make appropriate road maintenance work.

Short and long-term appointment of Japanese experts to Mongolia is needed.

3. Within the project, at least three road engineers and three mechanic engineers will be involved in the training under JICA.

With best regards,

B.ENKHTUR  
DEPUTY DIRECTOR