APPENDIX A

Cover Letter and the Proposed Survey

Dear Sir/Madam,

Michigan Department of Transportation (MDOT) funded a research project aiming to develop methods to minimize reinforced concrete (RC) bridge deck early-age cracking and, in turn, increase the life span of future bridge decks. As a result of this research, the methods that are immediately applicable in Michigan will be recommended for action. As a part of this research project, a survey is prepared to collect information on your experience in increasing RC deck life in general and reducing cracking in particular. We would appreciate if you could fill out the survey that is linked below:
http://webpages.eng.wayne.edu/durabilitycenter/survey/decks.pdf
Please simply click on the link and fill out the blanks. When clicked, *Submit* button will take care of the data transfer.

Thanks for your time and effort.

Yours sincerely,

Roger D. Till, PE
Engineer of Structural Research
Michigan Department of Transportation
Construction and Technology Division
8885 Ricks Road
Lansing, Michigan 48909
Phone: 517-322-5682
Fax: 517-322-5664
E-mail : TILLR@michigan.gov

Multi-State Survey

Investigate Causes and Develop Methods to Minimize Early-Age Cracking on Bridge Decks

(Michigan Department of Transportation)

This simple survey containing nine questions is to collect information on reinforced concrete bridge deck life in general and to reduce deck cracking in particular. Please provide us the following information:

Your Name:_____ Position:_____

Address:_____

Phone:_____ E-mail:_____

If you cannot complete this survey, please provide the following information for people in your organization knowledgeable about your bridge decks and their condition. Thank you very much for your effort.

Name: _____ Position:_____

Address:_____

Phone:_____ E-mail:_____

Name:_____ Position:_____

Address:_____

Phone:_____ E-mail:_____

Name:_____ Position:_____

Address:_____

Phone:_____ E-mail:_____

Should you have any questions in this regard, please contact the project investigator given below:

Dr. Haluk Aktan, P.E. (313-577-3825) or haluk.aktan@wayne.edu
5050 Anthony Wayne Drive
Wayne State University
Department of Civil Engineering
Detroit, MI 48202
(Fax) 313-577-3881

Question 1

Has your Agency detected early-age cracking on your reinforced concrete bridge decks?

☐ Yes / ☐ No

When is the deck cracking first observed?

☐ During first few month of service

☐ During first year of service

☐ Beyond first year of service

What type of cracks is most prevalent?

☐ Transverse

☐ Longitudinal

☐ Diagonal

Question 2

Do you think concrete bridge deck service life meets your expectations?

☐ Yes / ☐ No

How long (in years) do you think your reinforced concrete decks last under average traffic? _____ years.

Question 3

Has your Agency felt the need to take any action(s) to improve the durability of reinforced concrete bridge decks? (Check all that apply)

☐ Increased thickness

☐ Changed reinforcement design

☐ Changed materials

☐ Changed restraint conditions

☐ Limited continuous spans

☐ Changed the mix design

☐ Changed curing and/or construction procedure

If any of the above is marked, please describe:

a) ☐ Are chemical and mineral admixtures commonly included in bridge deck concrete mix?

If marked, please describe the type and the amount:

Question 4

What is the typical thickness of reinforced concrete deck now in your jurisdiction, including the wearing surface? _____ inches.

If your Agency used a different thickness in the past, please provide that thickness and indicate approximately in what time period it was used. _____ inches. From ____ to ____.

Question 5

What type of reinforcement is commonly used in concrete bridge decks?

☐ Epoxy coated

☐ Black

☐ Stainless

Question 6

How is the bridge deck curing process upon concrete placement?

☐ Curing compound

☐ Burlap cover

☐ Air cured

Question 7

In your opinion, what are the probable causes of early-age bridge deck cracking in your jurisdiction?

☐ Deck design is insufficient

☐ Concrete mix is not appropriate

☐ Construction process including curing

☐ Other

If “Other” is marked, please describe:

Question 8

What is the cement content used for the bridge deck concrete?

☐ Add here

☐ Add here

☐ Add here

Question 9

If your Agency performed or participated in research related to this topic, please provide contact information for further inquiries:

Name: _____ Position: _____

Address: _____

Phone: _____ E-mail: _____

☐ Please check this box if you like to receive a copy of the final report.

Compiled Survey Data

Table A-1. Coding System

Codes used	Meaning of the codes
1	Yes
DN	Don’t know
NR	Not responded

Table A-2. Response to Question No. 1

	States	(a) Has your agency detected early age cracking on RC deck?		(b) When is the deck cracking first observed?			c) What type of cracking is most prevalent?		
		Yes	No	Few month	First year	Beyond first year	Transverse	Longitudinal	Diagonal
1.	Alabama	1		1			1		
2.	Arizona	1			1		1		
3.	Arkansas	1		1			1		
4.	California	1		1			1	1	
5.	Connecticut	1		1			1		
6.	Georgia	1		1			1		
7.	Hawaii		1						
8.	Idaho	1		1	1		1		
9.	Illinois	1		1			1		
10.	Kansas	1			1		1		
11.	Kentucky	1			1	1	1		
12.	Maryland	1			1		1	1	
13.	Massachusetts	1		1			1		
14.	Michigan	1		1			1		
15.	Minnesota	1		1			1		
16.	Montana	1		1			1		
17.	New Hampshire	1		1			1		
18.	New Jersey	1		1					1
19.	New Mexico	1		1	1	1	1	1	1
20.	New York	1		1			1		
21.	North Carolina	1		1			1		
22.	Oklahoma	1		1	1		1	1	
23.	Pennsylvania	1		1	1		1		
24.	Rhode Island	1		1			1		
25.	South Carolina	1		1			1	1	
26.	South Dakota	1		1			1		
27.	Tennessee	1		1			1		
28.	Texas	1		1	1		1	1	
29.	Virginia	1			1		1		
30	Washington	1		1			1		
31	Wisconsin	1		1	1		1		

Table A-3. Response to Question No. 2

	States	a) Do you believe RC bridge deck service life meets your expectations?		b) How long do you believe your RC decks last under average traffic? (yrs)
		Yes	No	
1.	Alabama	1		35
2.	Arizona	1		25
3.	Arkansas	1		30
4.	California	1		40
5.	Connecticut	1		50
6.	Georgia	1		50
7.	Hawaii	1		>50
8.	Idaho		1	30
9.	Illinois	1		50
10.	Kansas	1		25
11.	Kentucky		1	30
12.	Maryland	1		35
13.	Massachusetts	1		30
14.	Michigan		1	15
15.	Minnesota	1		40
16.	Montana	1		35
17.	New Hampshire		1	30
18.	New Jersey	1		25
19.	New Mexico	1		30
20.	New York		1	30
21.	North Carolina		1	40
22.	Oklahoma		1	50
23.	Pennsylvania		1	20
24.	Rhode Island	1		40
25.	South Carolina	1		50+
26.	South Dakota		1	50-60
27.	Tennessee	1		35
28.	Texas	1		60+
29.	Virginia	1		50
30.	Washington	1		40-50
31.	Wisconsin		1	35

Table A-4. Response to Question No. 3(a)

	States	Has your agency taken any actions to improve the durability of RC bridge decks?							
		Increased r/f cover	Changed material	Limited cont. span	Increased deck thickness	Changed rebar design	Changed restraint conditions	Changed mix design	Changed curing Procedure
1.	Alabama	1		1	1			1	1
2.	Arizona	1				1		1	1
3.	Arkansas				1			1	
4.	California	1							
5.	Connecticut	1			1	1		1	1
6.	Georgia	1						1	
7.	Hawaii	1						1	1
8.	Idaho							1	1
9.	Illinois		1					1	1
10.	Kansas	1						1	1
11.	Kentucky				1				1
12.	Maryland	1			1			1	1
13.	Massachusetts							1	1
14.	Michigan		1		1			1	
15.	Minnesota	1							1
16.	Montana		1					1	1
17.	New Hampshire	1				1		1	1
18.	New Jersey					1			1
19.	New Mexico		1					1	1
20.	New York	1	1		1	1		1	1
21	North Carolina		1						1
22.	Oklahoma	1	1	1		1			1
23.	Pennsylvania	1	1		1				1
24.	Rhode Island	1			1			1	1
25.	South Carolina	1	1		1				1
26.	South Dakota	1	1					1	1
27.	Tennessee	1	1					1	1
28.	Texas	1	1			1		1	1
29.	Virginia							1	1
30	Washington		1			1		1	1
31	Wisconsin							1	1

Table A-5. Response to Question No. 3 (b) & 3(c)

	States	Do you use mineral additives? What are the substitution rates?				Do you use chemical admixtures?				
		Fly ash	Silica fume	GGBS	Other	Set-control	Air-entrainment	Mid range water reducing	High range water reducing	c) Other
1.	Alabama	20%		50%			1		1	
2.	Arizona	ASTMC618								AASHTO MI94
3.	Arkansas	20%		25%		1	1			
4.	California	25%					1	1		
5.	Connecticut					1	1			
6.	Georgia	15%		50%		1	1		1	
7.	Hawaii					1	1	1		
8.	Idaho	20%					1			
9.	Illinois	Varies	Varies	25%			1			
10.	Kansas			50%		1	1	1	1	
11.	Kentucky	20%	6%			1	1		1	
12.	Maryland	15%	6%	25%			1		1	
13.	Massachusetts	1	1	1			1	1		
14.	Michigan	15%	5%				1			
15.	Minnesota	<20				1	1	1		
16.	Montana	1	1	1		1	1		1	
17.	New Hampshire	15%	7.50%	30%			1		1	
18.	New Jersey	25-30%				1	1			
19.	New Mexico	20%	10%				1			
20.	New York	20%	6%	20%		1	1	1		
21.	North Carolina	20%	5%	50%		1	1	1	1	
22.	Oklahoma	20%	10%				1			
23.	Pennsylvania	1	1	1			1	1		
24.	Rhode Island	20%	6.5%	20%		1	1	1	1	
25.	South Carolina	20%	7%	50%			1	1		
26.	South Dakota	25%					1	1		
27.	Tennessee	NR								
28.	Texas	<35%	<8%	<50%		1	1	1		
29.	Virginia	30%	10%	50%			1			
30.	Washington	3%					1			MI94 Type A
31.	Wisconsin	25%		50%		1	1	1		

Table A-6. Response to Question No. 4

	States	a) What is the typical top cover and total deck thickness of RC deck?		b) Has your agency used a different top cover and total deck thickness in the past?		
		Cover (in.)	Thickness (in.)	Yes & Cover (in.)	Yes & Thickness (in.)	No
1.	Alabama	2	7	1-1.5	6-7	
2.	Arizona	2.5	8	1.5	6.5	
3.	Arkansas	2	7.5-8	2.5	7.5-8	
4.	California	2		1.5		
5.	Connecticut	2.5	8.5	2	8	
6.	Georgia	2.5	8	1.5	6	
7.	Hawaii	2	Varies	11.5	Varies	
8.	Idaho	2.5	8	Varies		
9.	Illinois	2.5	7.5/ 8	1.5	7.5	
10.	Kansas	3	8	2.5	8	
11.	Kentucky	2.5	8	1		1
12.	Maryland	2.5	8.5-10.5	2.5	8 -10	
13.	Massachusetts	2	8	1.5	7.5	
14.	Michigan	3	9	2.5	7-8	
15.	Minnesota	3	9	1.5-2	6-7	
16.	Montana	2.5	7.25-9			1
17.	New Hampshire	2.50	8.0	2.25	7.75	
18.	New Jersey	2.5	8	1		1
19.	New Mexico	2	8	NR		
20.	New York	3	9.5	3.5	9.5	
21.	North Carolina	2.5	8-10			1
22.	Oklahoma	2.5	8	1	Varies	
23.	Pennsylvania	2.5	8			1
24.	Rhode Island	2	7.5	1.5	6.75	
25.	South Carolina	2.5	8	1.5-2	6.5-7.5	
26.	South Dakota	2.5	8-9	2.0	7.5	
27.	Tennessee	NR		NR		
28.	Texas	2	8	2	7.5	
29.	Virginia	2.5	8.5	2	8.5	
30.	Washington	2.5	8.5	1.5	7.0	
31.	Wisconsin	2.5	8	1		

Table A-7. Response to Question No. 5

	States	What type of reinforcement is commonly used?			
		Epoxy	Galvanized	Black	Stainless
1.	Alabama			1	
2.	Arizona	1		1	
3.	Arkansas	1		1	
4.	California	1		1	
5.	Connecticut	1			
6.	Georgia			1	
7.	Hawaii			1	
8.	Idaho	1			
9.	Illinois	1			
10.	Kansas	1			
11.	Kentucky	1			
12.	Maryland	1			
13.	Massachusetts	1			
14.	Michigan	1			
15.	Minnesota	1			
16.	Montana	1			
17.	New Hampshire	1			
18.	New Jersey	1	1		1
19.	New Mexico	1			
20.	New York	1	1	1	
21.	North Carolina	1		1	
22.	Oklahoma	1		1	
23.	Pennsylvania	1	1		
24.	Rhode Island	1			
25.	South Carolina		1	1	
26.	South Dakota	1			
27.	Tennessee	NR			
28.	Texas	1	1		
29.	Virginia	1			
30.	Washington	1			
31.	Wisconsin	1			

Table A-8. Response to Question No. 6

	States	What is your bridge deck curing process upon concrete placement?				
		Curing compound	Burlap cover	Air cured	Continuous wet cure	If CWC specify duration
1.	Alabama	1			1	7days
2.	Arizona	1				
3.	Arkansas	1	1		1	7days
4.	California	1			1	7days
5.	Connecticut		1		1	7days
6.	Georgia		1		1	5days
7.	Hawaii	1	1		1	7days
8.	Idaho				1	7days
9.	Illinois	1	1			
10.	Kansas				1	7days
11.	Kentucky	1	1		1	7days
12.	Maryland		1		1	7days
13.	Massachusetts				1	14days
14.	Michigan		1		1	7days
15.	Minnesota		1		1	5-7days
16.	Montana				1	14days
17.	New Hampshire		1		1	7days
18.	New Jersey		1		1	7days
19.	New Mexico	1	1		1	7days
20.	New York		1		1	14days
21.	North Carolina	1	1		1	7 days
22.	Oklahoma	1	1		1	7days
23.	Pennsylvania	1	1		1	
24.	Rhode Island		1		1	7days
25.	South Carolina	1	1		1	7days
26.	South Dakota	1	1		1	7 days
27.	Tennessee	NR				
28.	Texas	1			1	8-10 days
29.	Virginia				1	70%of f'_c
30.	Washington	1			1	14 days
31.	Wisconsin	1			1	7 days

Table A-9. Response to Question No. 7

	States	In your opinion what are the top three causes of early-age bridge deck cracking in your jurisdiction?									
		Substandard curing	Thermal Stress	Restraint	Mix design	Structural System	Epoxy rebar	Construction practice	Geometry	Load	Other
1.	Alabama	1	1					1			
2.	Arizona	1	1					1			
3.	Arkansas				1	1		1			
4.	California	1						1			
5.	Connecticut	1	1	1							
6.	Georgia	1									
7.	Hawaii	1									
8.	Idaho	1	1					1			
9.	Illinois			1	1			1			
10.	Kansas	1	1	1				1			
11.	Kentucky	1						1			1
12.	Maryland	1			1			1			1
13.	Massachusetts	1			1			1			
14.	Michigan	1						1			
15.	Minnesota	1						1	1		
16.	Montana	1	1				1				
17.	New Hampshire	1	1		1						
18.	New Jersey	1	1		1						
19.	New Mexico	1	1		1			1			1
20.	New York	1	1		1						
21.	North Carolina		1	1						1	1
22.	Oklahoma			1	1						1
23.	Pennsylvania	1		1	1						
24.	Rhode Island	1		1	1	1					
25.	South Carolina	1	1	1							
26.	South Dakota	1		1							1
27.	Tennessee	NR									
28.	Texas	1	1		1						
29.	Virginia	1				1		1			
30.	Washington			1	1			1			
31.	Wisconsin	1				1		1			

Table A-10. Response to Question No. 8

	States	What is the cement content used for the bridge deck concrete?				
		5 s/yd^3	6 s/yd^3	7 s/yd^3	8 s/yd^3	9 or more s/yd^3
1.	Alabama		1			
2.	Arizona		1			
3.	Arkansas			1		
4.	California			1		
5.	Connecticut		1			
6.	Georgia			1		
7.	Hawaii					w/c ratio 0.49
8.	Idaho			1		
9.	Illinois		1			
10.	Kansas			1		
11.	Kentucky			1		
12.	Maryland		1			
13.	Massachusetts		1			
14.	Michigan			1		
15.	Minnesota		1			
16.	Montana			1		
17.	New Hampshire					1
18.	New Jersey	1				
19.	New Mexico	1		1		
20.	New York			1		
21.	North Carolina		1			
22.	Oklahoma					
23.	Pennsylvania		1			
24.	Rhode Island	1				
25.	South Carolina		1	1		
26.	South Dakota			1		
27.	Tennessee	NR				
28.	Texas			1		
29.	Virginia			1		
30.	Washington			1		
31.	Wisconsin			1		

Table A-11. Final Comments Received with the Survey Response

	States	Final Comments
1.	Alabama	a) Top cover increased to 2 in & total deck thickness from 6 to 7 in as per AASHTO. b) Require moist cure bridge deck.
2.	Arizona	a) The specification describes the curing & construction procedure. b) Over 450 ft elevation, use epoxy coated r/ft.
3.	Arkansas	Gang vibration was used with wet curing process on a couple of experimental bridge deck. (Measure taken to improve durability)
4.	California	Increased cover in some cases by 1/2 in, increased average thickness by amount an inch
5.	Connecticut	Recently added thickness to provide a sacrificial layer to be lost during milling for resurfacing.
6.	Georgia	a) Banned limestone aggregate in 1972, changed rebar grade 60 in 1986 b) Added air entrainment admixture in 1972. c) Eliminated curing compounds in 1986.
7.	Hawaii	NR
8.	Idaho	a) Research project to evaluate silica fume intended to limit cement content.
9.	Illinois	a) HPC is used. b) Initial curing with membrane and then with wetted burlap or cotton materials.
10.	Kansas	a) Prevent moisture loss from concrete after placement. b) Fine grained cement is one of the reasons of early age cracking.
11.	Kentucky	NR
12.	Maryland	a) Use 2.5 in top cover to carry HS25 loading on all decks. b) Minimize time for finishing decks.
13.	Massachusetts	a) Use Continuous burlap curing for 14 days.
14.	Michigan	a) Type K cement is used b) Night time casting of bridge decks.
15.	Minnesota	a) Changes made in mid 1970's in deck thickness and top cover. b) Most decks have 2 in thick low slump concrete overlay.
16.	Montana	a) Wet cure procedure has been initiated. b) HPC research is currently undergoing.
17.	New Hampshire	a) HPC is used. b) Burlap cure for 7 days is effective.
18.	New Jersey	a) Stainless steel clad r/f is used. b) One of the causes of early age cracking is use of greater quantity of cement.
19.	New Mexico	To mitigate early age deck cracking, HMWM, epoxy sealers, latex modified & epoxy coated overlays are used.
20.	New York	a) HPC is used. b) Epoxy coated rebar on top, galvanized top & bottom, black in bottom.
21.	North Carolina	a) Added mineral additives to slow down hydration process& decrease permeability. b) Require extended wet cure.
22.	Oklahoma	a) CA to be complied with freeze and thaw test (ASTM C 666, Durability QC-QA Specifications).
23.	Pennsylvania	a) Now focusing on the restraint condition problem. b) Shrinkage & combination of all above (mentioned in the survey questionnaire) are causes of early age deck cracking.
24.	Rhode Island	NR
25.	South Carolina	NR
26.	South Dakota	NR
27.	Tennessee	a) Curing specifications require membrane spray immediately behind screening machine, application of wet burlap as soon as the deck can be trafficable by foot and continuous water cure for 120 hrs. b) Limit deck pours when the evaporation rate exceeds 0.2 $lb/ft^2/hr$.
28.	Texas	NR
29.	Virginia	a) Allow use of pozzolans/flyash. b) Use lower w/c ratio. c) Require moist curing.
30.	Washington	a) Added minimum of 75 lb/yd^3 of fly ash. b) Rebar spacing at bottom has been changed.
31.	Wisconsin	NR

APPENDIX B

Compiled Field Inspection Data

Table B-1. Bridge S19 of 82023 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	329	180
Lane-Span # 2	329	180
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	55	0.015
	37	0.005
	14	0.005
	73	0.005
	87	0.01
	329	0.015
	14	0.005
	25	0.055
	10	0.005
	27	0.015
	36	0.015
	33	0.015
	17	0.005
	50	0.01
	23	0.005
	22	0.005
	28	0.005
	7	0.005
	46	0.01
	15	0.01
	30	0.015
	21	0.005
	6	0.005
	40	0.005
	100	0.005
	10	0.005
	32	0.015
	44	0.015
	66	0.005
	42	0.01
	110	0.005
	19	0.005
	90	0.02
	176	0.005
	18	0.005

Table B-1. Bridge S19 of 82023 Cracking Inspection Data (contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 1	329	0.015
Longitudinal Cracks in Lane-Span# 2	37	0.005
	27	0.005
	21	0.005
	70	0.005
	34	0.005
	116	0.005
	12	0.005
	10	0.005
	27	0.005
	94	0.005
	12	0.005
	24	0.005
	22	0.005
	90	0.005
	64	0.005
	58	0.005
	20	0.005
	19	0.005
	104	0.01
	137	0.015
	38	0.005
	24	0.005
	33	0.005
	27	0.005
	41	0.005
	43	0.005
	64	0.005
	35	0.005
	47	0.005
	55	0.005
	12	0.005
	58	0.005
	13	0.005
	122	0.005
	160	0.005
	40	0.005
	94	0.005
	88	0.005
	36	0.005
	54	0.005

Table B-1. Bridge S19 of 82023 Cracking Inspection Data (contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 2	39	0.005
	25	0.005
	22	0.005
	21	0.005
	80	0.005
	70	0.005
	74	0.005
	23	0.005
	36	0.005
	65	0.005
	43	0.005
	31	0.005
	54	0.005
	70	0.005
	65	0.005
	329	0.005
	15	0.005
	15	0.005
	28	0.005
	100	0.005
	21	0.005
	125	0.005
	28	0.005
	23	0.005
	54	0.005
	9	0.005
	10	0.005
	58	0.005
	81	0.005
	31	0.005
	21	0.005
	9	0.005
	27	0.005
	27	0.005
	15	0.005
	12	0.005

Table B-1. Bridge S19 of 82023 Cracking Inspection Data (contd.)

Crack Geometry	Length (in)	Width (in)
Transverse Cracks In Lane-span# 1	40	0.015
Transverse Cracks In Lane-span# 2	18	0.005
Diagonal Cracks In Lane-span# 1	16	0.005
Diagonal Cracks In Lane-span# 2	17	0.005
Map Cracking In Lane-span# 1	0	0
Map Cracking In Lane-span# 2	39	27
	31	20
	48	26
	26	23
	26	23
	50	36
	38	30

Table B-2. Bridge S11 of 82025 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	462	144
Lane-Span # 2	454	142
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	44	0.005
	32	0.005
	17	0.005
	23	0.005
	18	0.005
	12	0.005
	42	0.005
	23	0.005
	10	0.005
	28	0.01
	30	0.01
	24	0.01
	51	0.02
	28	0.015
	20	0.005
	11	0.005
	15	0.005
	13	0.01
	19	0.02
	8	0.005
	12	0.005
	24	0.005
	43	0.005
	14	0.005
	28	0.005
	30	0.005
	30	0.005
	21	0.005
	16	0.005
	77	0.01
	27	0.01
	148	0.01
	67	0.015
	60	0.015
	115	0.025

Table B-2. Bridge S11 of 82025 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 1	15	0.01
	24	0.01
	129	0.01
	12	0.025
	8	0.005
	9	0.005
	6	0.005
	9	0.005
	60	0.005
	24	0.005
	23	0.005
	17	0.005
	22	0.015
	185	0.02
	114	0.01
Longitudinal Cracks in Lane-Span# 2	18	0.005
	16	0.005
	7	0.005
	30	0.005
	20	0.005
	7	0.005
	110	0.01
	45	0.005
	48	0.005
	36	0.005
	27	0.005
	15	0.005
	2	0.005
	4	0.005
Transverse Cracks In Lane-span# 1	0	0
Transverse Cracks In Lane-span# 2	0	0
Diagonal Cracks In Lane-span# 1	70	0.03
	74	0.02
	125	0.025
	14	0.01

Table B-2. Bridge S11 of 82025 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Diagonal Cracks In Lane-span# 1	72	0.03
	44	0.005
	40	0.01
	39	0.015
	61	0.015
	37	0.01
	15	0.005
Diagonal Cracks In Lane-span# 2	35	0.01
	32	0.01
	30	0.015
	54	0.015
	44	0.015
	84	0.005
	175	0.025
Map Cracking In Lane-span# 1	24	12
Map Cracking In Lane-span# 2	0	0

Table B-3. Bridge S01 of 82111 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	321	184
Lane-Span # 2	322	175
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	8	0.005
	16	0.005
	12	0.005
	202	0.02
	12	0.015
	26	0.015
	20	0.015
	28	0.01
	37	0.015
	81	0.02
	18	0.01
	16	0.01
	250	0.02
	126	0.015
	24	0.005
Longitudinal Cracks in Lane-Span# 2	30	0.01
	241	0.01
	28	0.01
	21	0.01
	14	0.015
	55	0.01
	30	0.02
	34	0.01
	62	0.015
	195	0.01
Transverse Cracks In Lane-span# 1	67	0.01
	112	0.025
	42	0.02
	40	0.005
	105	0.015
	11	0.01
Transverse Cracks In Lane-span# 2	45	0.015

Table B-3. Bridge S01 of 82111 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Transverse Cracks In Lane-span# 2	41	0.015
	15	0.01
	42	0.015
	39	0.02
Diagonal Cracks In Lane-span# 1	38	0.015
	24	0.005
	85	0.02
Diagonal Cracks In Lane-span# 2	31	0.01
	37	0.01
Map Cracking In Lane-span# 1	0	0
Map Cracking In Lane-span# 2	0	0

Table B-4. Bridge S09 of 82182 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	348	150
Lane-Span # 2	348	150
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	33	0.005
	60	0.01
	60	0.005
	19	0.005
	6	0.005
	41	0.005
	348	0.01
	17	0.005
	20	0.01
	21	0.005
	18	0.005
	81	0.005
	12	0.005
	10	0.005
	64	0.01
	46	0.015
	52	0.015
	28	0.015
	66	0.02
	22	0.005
	43	0.005
	48	0.005
	29	0.005
	28	0.005
	45	0.005
	101	0.01
	20	0.005
	18	0.005
	18	0.005
	11	0.005
	39	0.01
	14	0.005
Longitudinal Cracks in Lane-Span# 2	246	0.02
	161	0.01
	130	0.01

Table B-4. Bridge S09 of 82182 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 2	24	0.01
	52	0.01
	273	0.02
	17	0.005
	19	0.01
	22	0.005
	19	0.01
	94	0.005
	8	0.01
	15	0.005
	35	0.005
	65	0.01
Transverse Cracks In Lane-span# 1	34	0.005
	33	0.005
	20	0.015
Transverse Cracks In Lane-span# 2	21	0.015
	15	0.005
	34	0.01
	18	0.02
	54	0.015
	51	0.01
Diagonal Cracks In Lane-span# 1	164	0.015
	61	0.015
	20	0.015
Diagonal Cracks In Lane-span# 2	24	0.015
	22	0.015
Map Cracking In Lane-span# 1	32	20
	28	22
	36	24
	39	21
	24	14

Table B-4. Bridge S09 of 82182 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Map Cracking In Lane-span# 1	28	21
	25	21
	38	30
Map Cracking In Lane-span# 2	30	14
	27	21
	26	17
	30	27
	64	21
	40	26
	55	29

Table B-5. Bridge B01 of 06071 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	296	141
Lane-Span # 2	296	141
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	10	0.003
	35	0.003
	296	0.01
	15	0.003
	7	0.003
	12	0.003
	19	0.003
	11	0.003
	25	0.003
	22	0.003
	41	0.003
	20	0.003
	26	0.003
	28	0.003
	66	0.003
	40	0.003
	19	0.003
Longitudinal Cracks in Lane-Span# 2	14	0.003
	10	0.003
	15	0.003
	14	0.003
	25	0.003
	9	0.003
	54	0.003
	24	0.003
	29	0.01
Transverse Cracks In Lane-span# 1	0	0
Transverse Cracks In Lane-span# 2	0	0
Diagonal Cracks In Lane-span# 1	0	0
Diagonal Cracks In Lane-span# 2	0	0

Table B-5. Bridge B01 of 06071 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Map Cracking In Lane-span# 1	0	0
Map Cracking In Lane-span# 2	0	0

Table B-6. Bridge B02 of 06071 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	382	144
Lane-Span # 2	382	144
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	20	0.005
	12	0.005
	28	0.005
	108	0.005
	300	0.01
	14	0.005
	10	0.005
	8	0.005
	10	0.005
Longitudinal Cracks in Lane-Span# 2	94	0.002
	30	0.002
	37	0.002
	9	0.005
	40	0.005
	12	0.005
	21	0.002
	47	0.002
	25	0.005
	6	0.005
	8	0.005
	6	0.005
	19	0.005
	4	0.002
	3	0.002
	12	0.002
	9	0.005
	10	0.001
	22	0.005
	6	0.005
	5	0.005
	34	0.005
	64	0.01
	152	0.01
	21	0.005
	13	0.005

Table B-6. Bridge B02 of 06071 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 2	29	0.01
Transverse Cracks In Lane-span# 1	57	0.01
	15	0.01
	59	0.01
Transverse Cracks In Lane-span# 2	0	0
Diagonal Cracks In Lane-span# 1	0	0
Diagonal Cracks In Lane-span# 2	0	0
Map Cracking In Lane-span# 1	0	0
Map Cracking In Lane-span# 2	0	0

Table B-7. Bridge S27 of 41064 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	1566	142
Lane-Span # 2	1566	147
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	89	0.015
Longitudinal Cracks in Lane-Span# 2	28	0.005
	70	0.015
Transverse Cracks In Lane-span# 1	0	0
Transverse Cracks In Lane-span# 2	0	0
Diagonal Cracks In Lane-span# 1	0	0
Diagonal Cracks In Lane-span# 2	0	0
Map Cracking In Lane-span# 1	0	0
Map Cracking In Lane-span# 2	0	0

Table B-8. Bridge S28 of 41064 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	1572	754
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	717 805 140 92 24 87 310 33 24	0.005 0.01 0.01 0.015 0.005 0.01 0.01 0.01 0.005
Transverse Cracks In Lane-span# 1	86 77 73 125 90 84 47	0.01 0.005 0.01 0.005 0.01 0.01 0.005
Diagonal Cracks In Lane-span# 1	40 34 87 36 35 105 134 170 170	0.01 0.01 0.015 0.01 0.01 0.015 0.01 0.01 0.01
Map Cracking In Lane-span# 1	0	0

Table B-9. Bridge S06 of 82025 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	368	266
Lane-Span # 2	368	266
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	145	0.01
	301	0.01
	46	0.01
	18	0.01
	197	0.04
	51	0.01
	57	0.01
Longitudinal Cracks in Lane-Span# 2	24	0.01
	13	0.01
	36	0.01
	8	0.01
	7	0.01
	2.5	0.01
	12.5	0.01
	76	0.01
	29	0.01
Transverse Cracks In Lane-span# 1	0	0
Transverse Cracks In Lane-span# 2	0	0
Diagonal Cracks In Lane-span# 1	0	0
Diagonal Cracks In Lane-span# 2	171	0.02
Map Cracking In Lane-span# 1	0	0
Map Cracking In Lane-span# 2	8	6

Table B-10. Bridge S03 of 63022 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	1466	510
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	89	0.005
	48	0.005
	14	0.005
	50	0.005
	7	0.005
	9	0.005
	80	0.005
	58	0.005
	30	0.005
	21	0.005
	172	0.005
	107	0.005
	35	0.005
	6	0.005
	7	0.005
	118	0.005
	74	0.005
	267	0.005
	30	0.005
	36	0.005
	314	0.005
	1466	0.005
	1466	0.005
	1466	0.005
Transverse Cracks In Lane-span# 1	108	0.005
	62	0.005
	18	0.005
	12	0.005
	33	0.005
Diagonal Cracks In Lane-span# 1	0	0
Map Cracking In Lane-span# 1	0	0

Table B-11. Bridge S15 of 25032 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	368	139
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	10	0.005
	31	0.015
	43	0.02
	16	0.005
	25	0.015
	27	0.02
	121	0.02
	14	0.005
	23	0.005
	18	0.005
	51	0.015
	19	0.02
	13	0.02
	49	0.01
	21	0.005
	46	0.005
	16	0.005
	15	0.005
	15	0.005
	21	0.005
	8	0.005
	10	0.005
	10	0.005
	18	0.005
	32	0.015
	36	0.025
	26	0.005
	21	0.005
	8	0.005
	5	0.005
	8	0.005
	9	0.005
	9	0.005
	13	0.005
	6	0.005
	52	0.015

Table B-11. Bridge s15 of 25032 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 1	16	0.005
	6	0.005
	20	0.005
	15	0.005
	8	0.005
	14	0.005
	10	0.005
	31	0.02
	33	0.015
	21	0.005
	29	0.02
	32	0.01
	21	0.005
	20	0.005
	4	0.005
	6	0.005
	5	0.005
	65	0.005
	12	0.005
	16	0.005
	6	0.005
	12	0.005
	34	0.005
	16	0.005
	18	0.005
	13	0.005
	16	0.005
	17	0.015
	35	0.01
	35	0.02
	18	0.005
	5	0.005
	18	0.005
	5	0.005
	13	0.005
	9	0.005
	16	0.01
	8	0.005
	8	0.005
	12	0.005

Table B-11. Bridge s15 of 25032 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 1	12	0.005
	23	0.005
	16	0.005
	10	0.005
	31	0.005
	7	0.005
	11	0.005
	23	0.005
	8	0.005
	6	0.005
	6	0.005
	5	0.005
	13	0.005
	10	0.005
	12	0.005
	9	0.005
	9	0.005
	28	0.005
	6	0.005
	13	0.005
	24	0.005
	29	0.005
	6	0.005
	36	0.02
	12	0.005
	37	0.02
	21	0.02
	16	0.005
	24	0.005
	32	0.005
	38	0.01
	26	0.005
	6	0.005
	3	0.005
	7	0.005
	40	0.005
	39	0.02
	33	0.02
	30	0.005
	7	0.005
	36	0.005

Table B-11. Bridge s15 of 25032 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 1	14	0.005
	33	0.005
	25	0.005
	21	0.005
	34	0.02
	31	0.005
	44	0.015
	15	0.005
	19	0.005
	13	0.005
Transverse Cracks In Lane-span# 1	102	0.015
	45	0.02
	139	0.025
	139	0.005
	80	0.005
	139	0.005
	139	0.005
	139	0.005
	15	0.005
	22	0.005
	18	0.005
	10	0.005
	23	0.005
	10	0.005
	8	0.005
	139	0.005
	14	0.005
	6	0.005
	8	0.005
	6	0.005
Diagonal Cracks In Lane-span# 1	72	0.025
	26	0.02
	59	0.015
	21	0.005

Table B-11. Bridge s15 of 25032 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Diagonal Cracks In Lane-span# 1	36	0.005
	32	0.025
	16	0.005
	10	0.005
	33	0.005
	7	0.005
	7	0.005
	6	0.005
	11	0.005
	12	0.005
	10	0.005
	8	0.005
	12	0.005
	15	0.005
	14	0.005
	11	0.005
	5	0.005
	4	0.005
	9	0.005
	32	0.005
	28	0.005
	32	0.005
	28	0.005
	15	0.015
	31	0.005
	22	0.005
	14	0.015
	24	0.005
	30	0.02
	13	0.005
	24	0.005
Map Cracking In Lane-span# 1	0	0

Table B-12. Bridge B01 of 44012 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	788	118
Lane-Span # 2	788	143
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	80	0.005
	160	0.005
	23	0.005
	22	0.005
	8	0.005
	15	0.005
	21	0.005
	20	0.001
	4	0.005
	9	0.005
	7	0.005
	8	0.005
	8	0.005
	8	0.005
	10	0.001
	30	0.025
	140	0.015
Longitudinal Cracks in Lane-Span# 2	127	0.01
	305	0.01
	212	0.01
	55	0.02
Transverse Cracks In Lane-span# 1	118	0.01
	118	0.01
	38	0.01
	118	0.01
	48	0.01
	61	0.002
	9	0.005
Transverse Cracks In Lane-span# 2	143	0.015
	131	0.01
	50	0.01
	72	0.01

Table B-12. Bridge B01 of 44012 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Transverse Cracks In Lane-span# 2	18 15 72	0.005 0.005 0.025
Diagonal Cracks In Lane-span# 1 **Diagonal Cracks In Lane-span# 2**	11 18 92	0.005 0.005 0.005
Map Cracking In Lane-span# 1 **Map Cracking In Lane-span# 2**	0 0	0 0

Table B-13. Bridge B03 of 73031 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	595	174
Lane-Span # 2	595	177
Lane-Span # 3	595	129
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	35	0.01
	88	0.01
	24	0.01
	276	0.015
	77	0.015
	42	0.005
	11	0.005
Longitudinal Cracks in Lane-Span# 2	120	0.01
	13	0.001
Longitudinal Cracks in Lane-Span# 3	152	0.01
	24	0.005
	21	0.002
	11	0.005
	22	0.005
	28	0.005
Transverse Cracks In Lane-span# 1	6	0.015
	70	0.015
	62	0.02
	27	0.015
	174	0.01
	112	0.015
	64	0.005
	52	0.01
Transverse Cracks In Lane-span# 2	92	0.001
	63	0.001
	177	0.015
	177	0.015
	177	0.015
Transverse Cracks In Lane-span# 3	29	0.005
	88	0.005
	31	0.005

Table B-13. Bridge B03 of 73031 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Transverse Cracks In Lane-span# 3	30	0.01
	48	0.01
	82	0.015
	57	0.01
	64	0.01
	66	0.015
	92	0.01
	62	0.01
Diagonal Cracks In Lane-span# 1	0	0
Diagonal Cracks In Lane-span# 2	0	0
Diagonal Cracks In Lane-span# 3	56	0.005
	21	0.01
Map Cracking In Lane-span# 1	0	0
Map Cracking In Lane-span# 2	0	0
Map Cracking In Lane-span# 3	0	0

Table B-14. Bridge S17 of 82112 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	870	243
Lane-Span # 2	870	131
Lane-Span # 3	622	147
Lane-Span # 4	562	147
Lane-Span # 5	869	126
Lane-Span # 6	866	237
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	95	0.01
	86	0.01
Longitudinal Cracks in Lane-Span# 2	325	0.01
	13	0.005
Longitudinal Cracks in Lane-Span# 3	0	0
Longitudinal Cracks in Lane-Span# 4	0	0
Longitudinal Cracks in Lane-Span# 5	7	0.005
	16	0.005
	42	0.015
	20	0.015
	90	0.01
Longitudinal Cracks in Lane-Span# 6	350	0.015
	65	0.01
	44	0.01
	241	0.015
	68	0.01
Transverse Cracks In Lane-span# 1	92	0.01
	43	0.01
	194	0.01
	68	0.015
	100	0.015
	104	0.01
	268	0.01
	124	0.01
	11	0.01
	115	0.01
	78	0.015
	26	0.01

Table B-14. Bridge S17 of 82112 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Transverse Cracks In Lane-span# 1	263	0.015
Transverse Cracks In Lane-span# 2	58	0.01
	143	0.015
	149	0.01
	62	0.01
	28	0.005
	12	0.005
	33	0.01
	54	0.01
	33	0.01
	20	0.01
	14	0.005
	9	0.005
	14	0.005
	14	0.005
	14	0.01
	58	0.015
	20	0.015
	13	0.01
	85	0.015
Transverse Cracks In Lane-span# 3	153	0.02
	153	0.02
	151	0.02
	149	0.02
	27	0.01
	153	0.025
	147	0.015
Transverse Cracks In Lane-span# 4	150	0.02
	150	0.015
	150	0.01
	90	0.01
	103	0.02
Transverse Cracks In Lane-span# 5	124	0.015
	131	0.015
	64	0.01
	7	0.01
	46	0.015
	109	0.01
	74	0.015
	63	0.015
	125	0.01

Table B-14. Bridge S17 of 82112 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Transverse Cracks In Lane-span# 6	207	0.015
	148	0.015
	130	0.01
	75	0.01
	72	0.015
Diagonal Cracks In Lane-span# 1	77	0.01
	108	0.015
Diagonal Cracks In Lane-span# 2	16	0.005
	22	0.005
Diagonal Cracks In Lane-span# 3	114	0.02
	16	0.02
Diagonal Cracks In Lane-span# 4	95	0.015
	87	0.01
Diagonal Cracks In Lane-span# 5	7	0.01
Diagonal Cracks In Lane-span# 6	58	0.01
	42	0.015
	32	0.015
	34	0.02
Map Cracking In Lane-span# 1	0	0
Map Cracking In Lane-span# 2	0	0
Map Cracking In Lane-span# 3	0	0
Map Cracking In Lane-span# 4	0	0
Map Cracking In Lane-span# 5	0	0
Map Cracking In Lane-span# 6	0	0

Table B-15. Bridge S04 of 82062 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	912	246
Lane-Span # 2	906	273
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	42	0.015
	6	0.015
Longitudinal Cracks in Lane-Span# 2	19	0.005
	88	0.005
	35	0.01
	67	0.005
	12	0.005
	456	0.005
	62	0.015
	114	0.015
	17	0.005
	300	0.005
	14	0.01
	12	0.005
	72	0.02
	15	0.01
Transverse Cracks In Lane-span# 1	177	0.03
	250	0.035
	263	0.035
	260	0.03
	12	0.005
Transverse Cracks In Lane-span# 2	250	0.015
	250	0.005
	144	0.005
	26	0.005
	17	0.01
	76	0.003
	243	0.003
	23	0.005
	12	0.005
	20	0.005
	16	0.005

Table B-15. Bridge S04 of 82062 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Transverse Cracks In Lane-span# 2	16	0.015
Diagonal Cracks In Lane-span# 1	129	0.02
	220	0.02
	282	0.035
	117	0.025
	19	0.02
	41	0.01
Diagonal Cracks In Lane-span# 2	29	0.025
	85	0.015
	12	0.01
	71	0.01
Map Cracking In Lane-span# 1	0	0
Map Cracking In Lane-span# 2	24	13

Table B-16. Bridge S03 of 82024 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	746	135
Lane-Span # 2	754	135
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	61	0.01
	15	0.005
	94	0.015
	70	0.005
	82	0.01
	15	0.005
	6	0.005
	74	0.005
	58	0.005
	43	0.005
	68	0.005
	82	0.01
	23	0.015
	35	0.005
	12	0.005
	11	0.005
	14	0.005
	12	0.005
	160	0.01
	21	0.005
	16	0.005
	25	0.01
	25	0.005
	7	0.005
	14	0.005
	8	0.005
	16	0.005
	29	0.005
	60	0.005
	52	0.005
	28	0.005
	25	0.005
	20	0.005
	24	0.005
	9	0.01

Table B-16. Bridge S03 of 82024 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 1	58	0.005
	41	0.01
	15	0.005
	12	0.005
	5	0.005
	5	0.005
	61	0.007
	19	0.005
	127	0.005
	32	0.005
	33	0.005
	100	0.01
	32	0.005
	28	0.005
	16	0.005
	88	0.005
	34	0.005
	31	0.005
	14	0.005
	11	0.005
	39	0.005
	90	0.005
	21	0.005
	28	0.005
	20	0.005
	32	0.005
	17	0.005
	77	0.005
	71	0.005
	16	0.005
	22	0.005
	73	0.005
	17	0.005
	7	0.005
	8	0.005
	8	0.005
	38	0.005
	86	0.005
	50	0.01
	40	0.01

Table B-16. Bridge S03 of 82024 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 1	30	0.01
	16	0.005
	20	0.005
	10	0.005
	5	0.005
	4	0.005
	10	0.005
	44	0.005
	35	0.005
	51	0.005
	40	0.005
	28	0.005
	44	0.005
	60	0.005
	13	0.005
	24	0.005
	23	0.005
	20	0.005
	12	0.005
	12	0.005
	122	0.005
	10	0.005
	60	0.005
	20	0.01
	40	0.005
	10	0.005
	38	0.005
	27	0.005
	21	0.005
	19	0.005
	5	0.005
	6	0.005
	7	0.005
	22	0.005
	3	0.005
	9	0.005
	34	0.005
	5	0.005
	14	0.005
	31	0.005

Table B-16. Bridge S03 of 82024 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 1	200	0.01
	14	0.005
	14	0.005
	143	0.015
	30	0.005
	7	0.005
	15	0.005
	6	0.005
	65	0.005
	118	0.005
	23	0.005
	12	0.005
	7	0.005
	8	0.005
	106	0.005
	11	0.005
	8	0.005
	10	0.005
	31	0.005
	27	0.005
	85	0.005
	22	0.005
	30	0.005
	57	0.015
	40	0.01
	14	0.005
	12	0.01
	40	0.005
	27	0.005
	11	0.005
	21	0.005
	50	0.005
	54	0.005
	40	0.01
	13	0.005
	12	0.005
	24	0.005
	4	0.005
	9	0.005
	11	0.005

Table B-16. Bridge S03 of 82024 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 1	13	0.005
	8	0.005
	6	0.005
	20	0.005
Longitudinal Cracks in Lane-Span# 2	24	0.005
	26	0.005
	16	0.01
	52	0.005
	13	0.005
	39	0.005
	70	0.015
	36	0.015
	10	0.005
	32	0.005
	38	0.01
	20	0.005
	7	0.005
	25	0.01
	14	0.005
	32	0.005
	12	0.005
	11	0.005
	9	0.005
	4	0.005
	3	0.005
	3	0.005
	3	0.005
	3	0.005
	14	0.005
	5	0.005
	60	0.01
	39	0.005
	27	0.01
	19	0.005
	13	0.005
	9	0.005
	6	0.005
	9	0.005
	13	0.005
	80	0.005

Table B-16. Bridge S03 of 82024 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 2	19	0.005
	12	0.005
	36	0.005
	62	0.005
	41	0.015
	12	0.005
	11	0.005
	71	0.005
	26	0.005
	13	0.005
	58	0.015
	21	0.015
	17	0.01
	12	0.005
	8	0.005
	28	0.005
	14	0.01
	28	0.005
	154	0.005
	220	0.01
	167	0.01
	21	0.005
	27	0.01
	139	0.005
	170	0.01
	30	0.005
	49	0.015
	36	0.005
	53	0.015
	88	0.01
	16	0.005
	33	0.01
	32	0.01
	20	0.005
	12	0.005
	56	0.015
	84	0.01
	85	0.015
	193	0.025
	76	0.01

Table B-16. Bridge S03 of 82024 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 2	74	0.005
	22	0.005
	30	0.005
	40	0.005
	12	0.005
	30	0.005
	106	0.005
	26	0.01
	58	0.015
	37	0.01
	33	0.005
	8	0.005
	14	0.005
	11	0.005
	13	0.005
	25	0.005
	110	0.01
	34	0.01
	54	0.01
	11	0.005
	110	0.005
	20	0.005
	21	0.005
	23	0.005
	5	0.005
	4	0.005
	22	0.005
	38	0.005
	24	0.005
	14	0.005
	30	0.005
	20	0.005
	5	0.005
	3	0.005
	8	0.005
	25	0.005
	27	0.005
	65	0.005
	10	0.01
	4	0.005

Table B-16. Bridge S03 of 82024 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 2	37	0.01
	40	0.005
	82	0.01
	22	0.005
	182	0.015
	17	0.005
	25	0.01
	15	0.005
	6	0.005
	35	0.01
	22	0.005
	36	0.005
	104	0.02
	9	0.005
	30	0.01
	22	0.005
	26	0.01
	81	0.01
	24	0.005
	11	0.005
	38	0.015
Total Cracked Area		
Crack Density		
Transverse Cracks In Lane-span# 1	30	0.015
	8	0.005
	14	0.01
	19	0.005
	28	0.005
	24	0.005
	55	0.005
	40	0.005
	23	0.005
	17	0.005
	10	0.005
	20	0.005
	21	0.01
Transverse Cracks In Lane-span# 2	26	0.015
	14	0.005
	23	0.005

Table B-16. Bridge S03 of 82024 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Transverse Cracks In Lane-span# 2	22	0.005
	120	0.01
	17	0.003
	17	0.003
	24	0.005
	14	0.005
	27	0.005
	31	0.005
	120	0.015
	12	0.005
	63	0.005
	5	0.005
	44	0.005
Diagonal Cracks In Lane-span# 1	34	0.005
	26	0.005
	80	0.01
	34	0.005
	16	0.005
	11	0.005
	20	0.005
	18	0.005
	30	0.005
	33	0.005
	10	0.005
Diagonal Cracks In Lane-span# 2	16	0.005
	107	0.015
	50	0.005
	80	0.01
	38	0.005
	34	0.005
	8	0.005
	32	0.005
	20	0.005
	31	0.005
	14	0.005
	26	0.01
	37	0.005

Table B-16. Bridge S03 of 82024 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Diagonal Cracks In Lane-span# 2	8 42	0.005 0.01
Map Cracking In Lane-span# 1 **Map Cracking In Lane-span# 2**	0 0	0 0

Table B-17. Bridge S03 of 82192 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	475	257
Lane-Span # 2	476	264
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	18	0.005
	20	0.005
	5	0.005
	11	0.005
	6	0.005
	22	0.005
	12	0.005
	11	0.005
	11	0.005
	7	0.005
	15	0.005
	25	0.005
	4	0.01
	25	0.005
	49	0.005
	19	0.005
	23	0.005
	12	0.005
	13	0.005
	81	0.005
	56	0.015
	14	0.005
	7	0.005
	4	0.005
	41	0.005
	30	0.005
	26	0.005
	7	0.005
	14	0.005
	107	0.01
	12	0.005
	27	0.005
	4	0.005
	4	0.005
	47	0.005

Table B-17. Bridge S03 of 82192 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 1	11	0.005
	2	0.005
	5	0.005
	7	0.005
	10	0.005
	16	0.005
	22	0.005
	18	0.007
	29	0.005
	8	0.01
	10	0.01
	4	0.005
	14	0.005
	12	0.01
	10	0.005
	8	0.005
	17	0.005
	9	0.01
	8	0.01
	6	0.01
	7	0.01
	7	0.005
Longitudinal Cracks in Lane-Span# 2	17	0.005
	34	0.005
	46	0.005
	14	0.005
	21	0.005
	6	0.005
	8	0.005
	16	0.005
	10	0.005
	23	0.005
	57	0.01
	17	0.005
	2	0.005
	41	0.005
	27	0.005
	51	0.005
	31	0.005
	20	0.005
	8	0.005

Table B-17. Bridge S03 of 82192 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Longitudinal Cracks in Lane-Span# 2	13	0.005
	7	0.005
	8	0.005
	3	0.005
	6	0.005
	3	0.005
	2	0.005
	43	0.01
	16	0.005
	17	0.005
	21	0.005
	4	0.005
	7	0.005
	4	0.005
	2	0.005
	3	0.005
	10	0.005
	8	0.005
	3	0.005
Transverse Cracks In Lane-span# 1	0	0
Transverse Cracks In Lane-span# 2	0	0
Diagonal Cracks In Lane-span# 1	18	0.005
Diagonal Cracks In Lane-span# 2	0	0
Map Cracking In Lane-span# 1	0	0
Map Cracking In Lane-span# 2	0	0

Table B-18. Bridge S06 of 82192 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	372	276
Lane-Span # 2	372	278
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	4	0.005
	16	0.005
	6	0.005
	14	0.005
	7	0.005
	12	0.005
	5	0.005
	6	0.005
	15	0.01
	8	0.005
	6	0.005
	7	0.005
	4	0.005
	5	0.005
	31	0.005
Longitudinal Cracks in Lane-Span# 2	36	0.01
	8	0.003
	11	0.005
	7	0.005
	13	0.005
	7	0.005
	25	0.005
	20	0.005
	12	0.01
	16	0.02
	40	0.01
Transverse Cracks In Lane-span# 1	13	0.01
Transverse Cracks In Lane-span# 2	8	0.005

Table B-18. Bridge S06 of 82192 Cracking Inspection Data (Contd.)

Crack Geometry	Length (in)	Width (in)
Diagonal Cracks In Lane-span# 1	0	0
Diagonal Cracks In Lane-span# 2	0	0
Map Cracking In Lane-span# 1	0	0
Map Cracking In Lane-span# 2	39	15

Table B-19. Bridge B02 of 64012 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	574	150
Lane-Span # 2	569	125
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	96	0.01
	5	0.005
	6	0.005
	13	0.01
	4	0.005
	12	0.005
	16	0.005
	38	0.01
	154	0.01
	9	0.005
	27	0.015
	53	0.01
Longitudinal Cracks in Lane-Span# 2	81	0.01
	12	0.005
	14	0.005
Transverse Cracks In Lane-span# 1	0	0
Transverse Cracks In Lane-span# 2	128	0.01
Diagonal Cracks In Lane-span# 1	0	0
Diagonal Cracks In Lane-span# 2	0	0
Map Cracking In Lane-span# 1	0	0
Map Cracking In Lane-span# 2	0	0

Table B-20. Bridge B03 of 64012 Cracking Inspection Data

Deck Geometry	Length (in)	Width (in)
Lane-Span # 1	604	129
Lane-Span # 2	604	141
Crack Geometry	**Length (in)**	**Width (in)**
Longitudinal Cracks in Lane-Span# 1	114	0.01
Longitudinal Cracks in Lane-Span# 2	20	0.005
Transverse Cracks In Lane-span# 1	0	0
Transverse Cracks In Lane-span# 2	0	0
Diagonal Cracks In Lane-span# 1	0	0
Diagonal Cracks In Lane-span# 2	0	0
Map Cracking In Lane-span# 1	0	0
Map Cracking In Lane-span# 2	0	0

APPENDIX C

Construction Monitoring Data Sheets

Table C-1. Bridge S05 of 82025 Concrete Sampling Sheet

Concrete Sampling Sheet

Bridge Id	Conner ove I-94	**Number of Specimens**			
Date	Deck	**6 x 12**		**4 x 8**	
Inspectors					

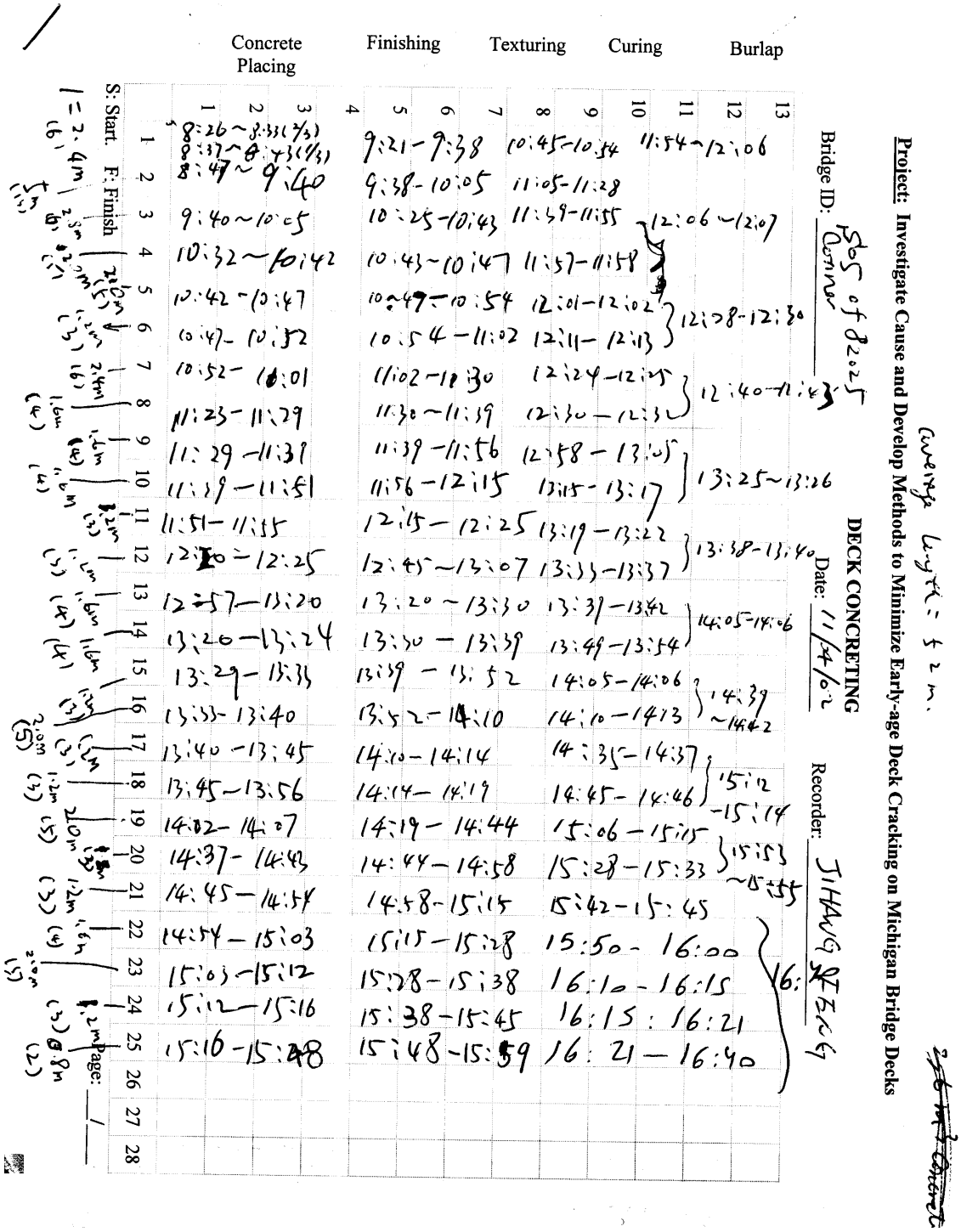
Ticket info			
Company Name			
Ticket #		**Photograph No:**	
Production time		**Transfer period**	
Arriving time		**Casting Time**	

Conducted Tests				
	1. Measure	**2. Measure**	**Average**	**Testing Consult**
Slump (inch)	4"			
Air Content	6.2%			
Unit Weight				
Temperature (°F)	68 °F			

Casting Data			
	Starting	**Finishing**	**Average**
Time of Casting			
Temperature (°F)			
Average Humidity			
Wind			

Notes :

Table C-2. Bridge S05 of 82025 Deck Construction



DECK CONCRETING

Project: Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks

Bridge ID: S05 of 82025 Date: 11/14/02 Recorder: JIHANG XIE

	Concrete Placing	Finishing	Texturing	Curing	Burlap
1	8:26 ~ 8:33 (7/31)	9:21 - 9:38	10:45 - 10:54	11:54 ~ 12:06	
2	8:37 ~ 8:43 (11/31)	9:38 - 10:05	11:05 - 11:28		
3	8:47 ~ 9:40	10:25 - 10:43	11:39 - 11:55	12:06 ~ 12:07	
4	9:40 ~ 10:05	10:43 - 10:47	11:57 - 11:58		
5	10:32 ~ 10:42	10:47 - 10:54	12:01 - 12:02	12:28 - 12:30	
6	10:42 - 10:47	10:54 - 11:02	12:11 - 12:13		
7	10:47 - 10:52	11:02 - 11:30	12:24 - 12:25	12:40 - 12:43	
8	10:52 - 11:01	11:30 ~ 11:39	12:30 - 12:32		
9	11:25 - 11:29	11:39 - 11:56	12:58 - 13:05		
10	11:29 - 11:31	11:56 - 12:15	13:15 - 13:17	13:25 ~ 13:26	
11	11:31 - 11:35	12:15 - 12:25	13:19 - 13:22		
12	12:20 ~ 12:25	12:45 ~ 13:07	13:33 - 13:37	13:38 - 13:40	
13	12:57 - 13:20	13:20 ~ 13:30	13:37 - 13:42		
14	13:20 - 13:24	13:30 - 13:39	13:49 - 13:54	14:05 - 14:06	
15	13:29 - 13:35	13:39 - 13:52	14:05 - 14:06		
16	13:33 - 13:40	13:52 - 14:10	14:10 - 14:13	14:39 ~ 14:42	
17	13:40 - 13:45	14:10 - 14:14	14:35 - 14:37		
18	13:45 - 13:56	14:14 - 14:19	14:45 - 14:46	15:12 - 15:14	
19	14:02 - 14:07	14:19 - 14:44	15:06 - 15:15		
20	14:37 - 14:43	14:44 - 14:58	15:28 - 15:33	15:53 ~ 15:55	
21	14:45 - 14:54	14:58 - 15:15	15:42 - 15:45		
22	14:54 - 15:03	15:15 - 15:28	15:50 - 16:00		
23	15:03 - 15:12	15:28 - 15:38	16:10 - 16:15		
24	15:12 - 15:16	15:38 - 15:45	16:15 : 16:21		
25	15:16 - 15:48	15:48 - 15:59	16:21 - 16:40		
26					
27					
28					

S: Start. F: Finish

1 = 2.4m

Page: 1

Table C-3. Bridge S05 of 82025 Ticket Information

Project: Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks

TICKET INFORMATION

Bridge ID: Conner over I94 Date: 11/04/03 Recorder: Reynolds

	Company Name	Truck #	Production Time (Concrete Plant)	Arrival Time (Casting Site)	Unloading Time		
					Start	Finish	
1	MICHIGAN	441	7.41	7.46	8.26	8.33	
2	FOUNDATION	443	8.13	8.21	8.32	8.43	
3	CONCRETE	385	8.21	8.35	8.43	8.52	
4		436	8.33	8.45	8.53	9.27	
5		386	8.56	9.01	9.26	9.39	
6		383	8.59	9.30	9.39	9.44	
7		441	9.14	9.39	9.43	9.49	
8		403	9.33	9.45	9.49	10.36	
9		385	9.47	9.53	10.36	10.44	
10		442	9.54	10.39	10.43	10.49	
11		386	10.03	10.45	10.48	10.54	
12		437	10.19	10.49	10.54	11.05	
13		385	11.16	11.17	11.18	11.29	
14		442	11.22	11.26	11.29	11.35	
15		283	11.24	11.33	11.35	11.44	
16		383	11.43	11.46	11.47	11.55	
17		385	11.54	11.56	12.19	12.26	* Repositioned the pump
18		441	12.46	12.49	12.50	12.58	
19		385	12.57	13.01	13.02	13.08	
20		402	13.14	13.16	13.17	13.23	
21		179	13.18	13.25	13.27	13.35	
22		441	13.25	13.28	13.35	13.39	
23		385	13.29	13.36	13.38	13.43	
24		402	13.49	13.50	13.51	13.56	
25		397	13.55	14.00	14.01	14.07	
26		434	14.27	14.35	14.36	14.42	
27		441	14.32	14.39	14.42	14.49	
28		395	14.38	14.48	14.56	15.02	
29		397	14.46	14.56	15.02	15.08	
30		283	12.53	15.05	15.08	15.17	Page: /
31		434	15.08	15.10	15.17	15.46	END
32		440	15.03	15.17			

Table C-4. Bridge S05 of 82025 Ambient Conditions

Project: **Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks**

Bridge ID: _____ Date: 11-04-02 Recorder: Iqbal Zafar

Time		Ambient Temperature	Ambient Moisture	Wind Speed
08:20	D	56	~~50~~ 35	
	A	50.6	57	
8:30	D	52	43	
	A	47.2	57	
8:40	D	50	48	
	A	44.6	61	
8:50	D	~~46~~ 49	51	
	A	46.8	59	
9:00	D	52	46	
	A	48.2	60	
9:10	D	53	50	
	A	48.2	67	
9:20	D	55	47	
	A	51.1	64	
9:30	D	57	39	
	A	52.2	57	
9:40	D	52	50	
	A	49.3	66	
9:50	D	51	53	
	A	48.4	69	
10:00	D	52	51	
	A	49.1	69	
10:10	D	54	45	
	A	49.5	63	
10:20	D	59	38	
	A	55.4	59	
10:30	D	65	35	
	A	63	40	
10:40	D	62	32	
	A	64.6	40	

D: Digital. A: Analog

Page: 1 / 4

Table C-4. Bridge S05 of 82025 Ambient Conditions (Contd.)

Project: **Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks**

Bridge ID: _____ Date: 11-04-02 Recorder: Iqbal Zafar

Time		Ambient Temperature	Ambient Moisture	Wind Speed
10:50	D	65	30	
	A	67.9	37	
11:00	D	69	26	
	A	72.4	34	
11:10	D	61	28	
	A	60.8	38	
11:20	D	56	35	
	A	55.6	43	
11:30	D	56	35	
	A	58	41	
11:40	D	56	36	
	A	54	44	
11:50	D	60	33	
	A	56	44	
12:00	D	60	31	
	A	55.6	44	
12:10	D	56	34	
	A	54.4	44	
12:20	D	56	35	
	A	54.4	45	
12:30	D	56	35	
	A	53.8	46	
12:40	D	57	35	
	A	55.6	46	
12:50	D	57	32	
	A	56.7	44	
13:00	D	58	32	
	A	55.4	44	
1310	D	57	33	
	A	54.7	46	

D: Digital. A: Analog

Page 8 /24

Table C-4. Bridge S05 of 82025 Ambient Conditions (Contd.)

Project: **Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks**

Bridge ID: _____ Date: 11-04-02 Recorder: Iqbal Zafar

Time		Ambient Temperature	Ambient Moisture	Wind Speed
13:20	D	67	28	
	A	62.1	41	
13:30	D	60	~~58.6~~ 29.4	
	A	~~30~~ 58.6	40	
13:40	D	59	30	
	A	56.9	41	
13:50	D	62	28	
	A	57.2	41	
14:00	D	64	27	
	A	59	41	
14:10	D	66	24	
	A	58.3	41	
14:20	D	74	19	
	A	63.4	38	
14:30	D	68	21	
	A	59.6	39	
14:40	D	67	22	
	A	59	38	
14:50	D	64	25	
	A	58.7	39	
15:00	D	62	24	
	A	56.9	38	
15:10	D	59	28	
	A	57.1	38	
15:20	D	59	29	
	A	57.6	39	
15:30	D	60	28	
	A	58.1	38	
1540	D	57	54.4	
	A	28	39	

D: Digital. A: Analog

Page: 3/3

Table C-4. Bridge S05 of 82025 Ambient Conditions (Contd.)

Project: **Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks**

Bridge ID: _____ Date: 11-04-02 Recorder: Iqbal Zafar

Time		Ambient Temperature	Ambient Moisture	Wind Speed
15:50	D	58	29	
	A	55.3	39	
16:00	D	55	31	
	A	52.4	40	
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			

D: Digital. A: Analog

Page: 4/4

Table C-5. Bridge S05 of 82191 Concrete Sampling Sheet

Deck

[redacted]

Concrete Sampling Sheet

Bridge Id	Vreeland ov	I 75	**Number of Specimens**		
Date	08/14/02	6 x 12	30	4 x 8	24
Inspectors R.B	O.D Y.K W.O. GF J.R K.M				

Ticket info

Company Name	Michigan Foundation Concrete		
Ticket # 7		**Photograph No:**	
Production time 9		**Transfer period**	
Arriving time		**Casting Time**	

Conducted Tests

	1. Measure	2. Measure	Average	Testing Consult
Slump (inch)	6 1/4	7 1/2		
Air Content Core was bag	6.8	7.2		
Unit Weight	~~20098 g~~	19925		
Temperature (°F)	89.2	89.2		

1st 20098 g

10+5+2+2

19 925

Casting Data

	Starting	Finishing	Average
Time of Casting			
Temperature (°F)			
Average Humidity			
Wind			

Notes : Windy specimens are taken from the pool. Pool is filled by pump
Cheap concrete with Mid range admixture
SEALER: LIN SEAL WHITE-MIC

COMPANY SEALIGHT
WORKABILITY LOOKS HIGH VIBRATION RARE

Table C-6. Bridge S05 of 82191 Deck Construction

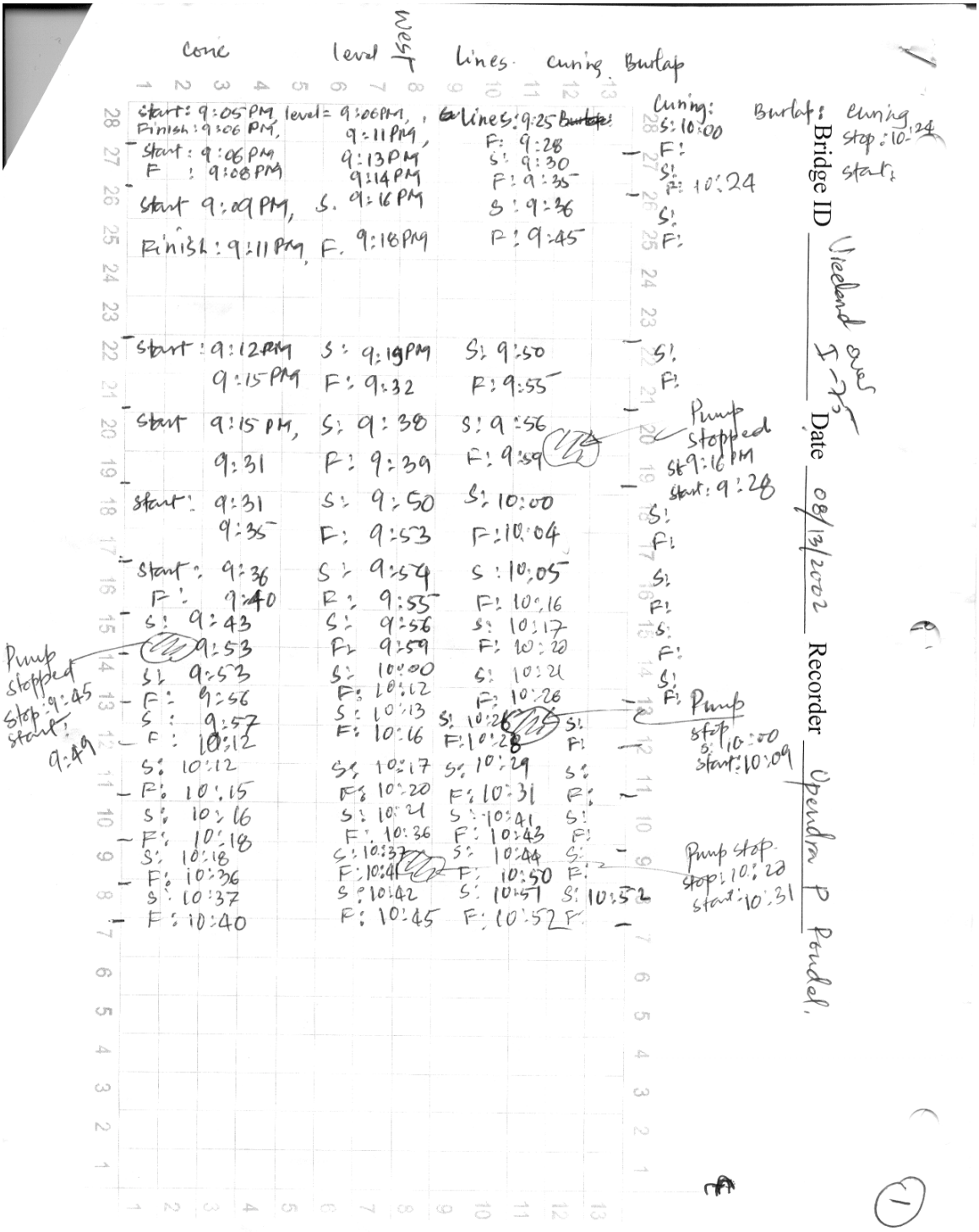


Table C-6. Bridge S05 of 82191 Deck Construction (Contd.)

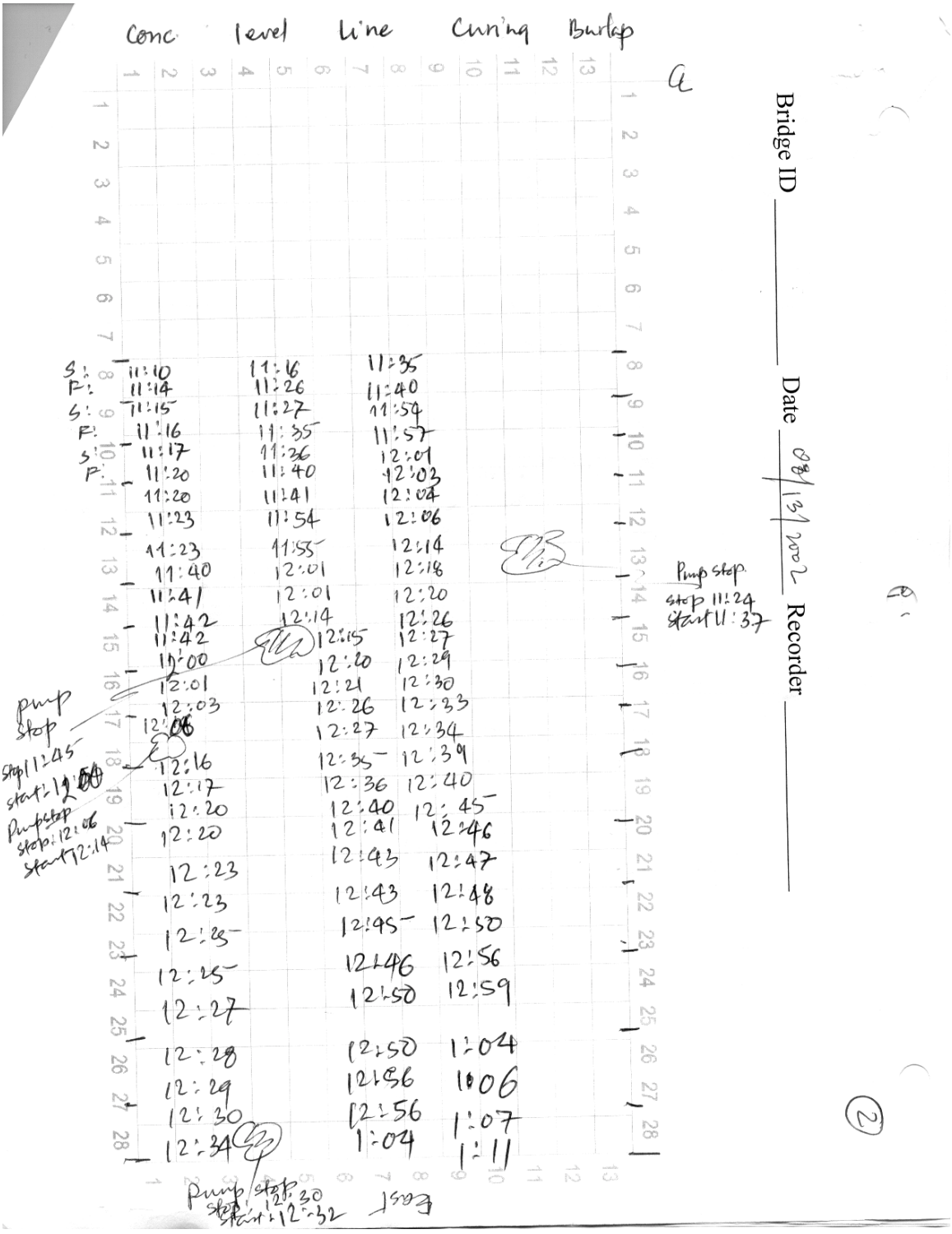


Table C-6. Bridge S05 of 82191 Deck Construction (Contd.)

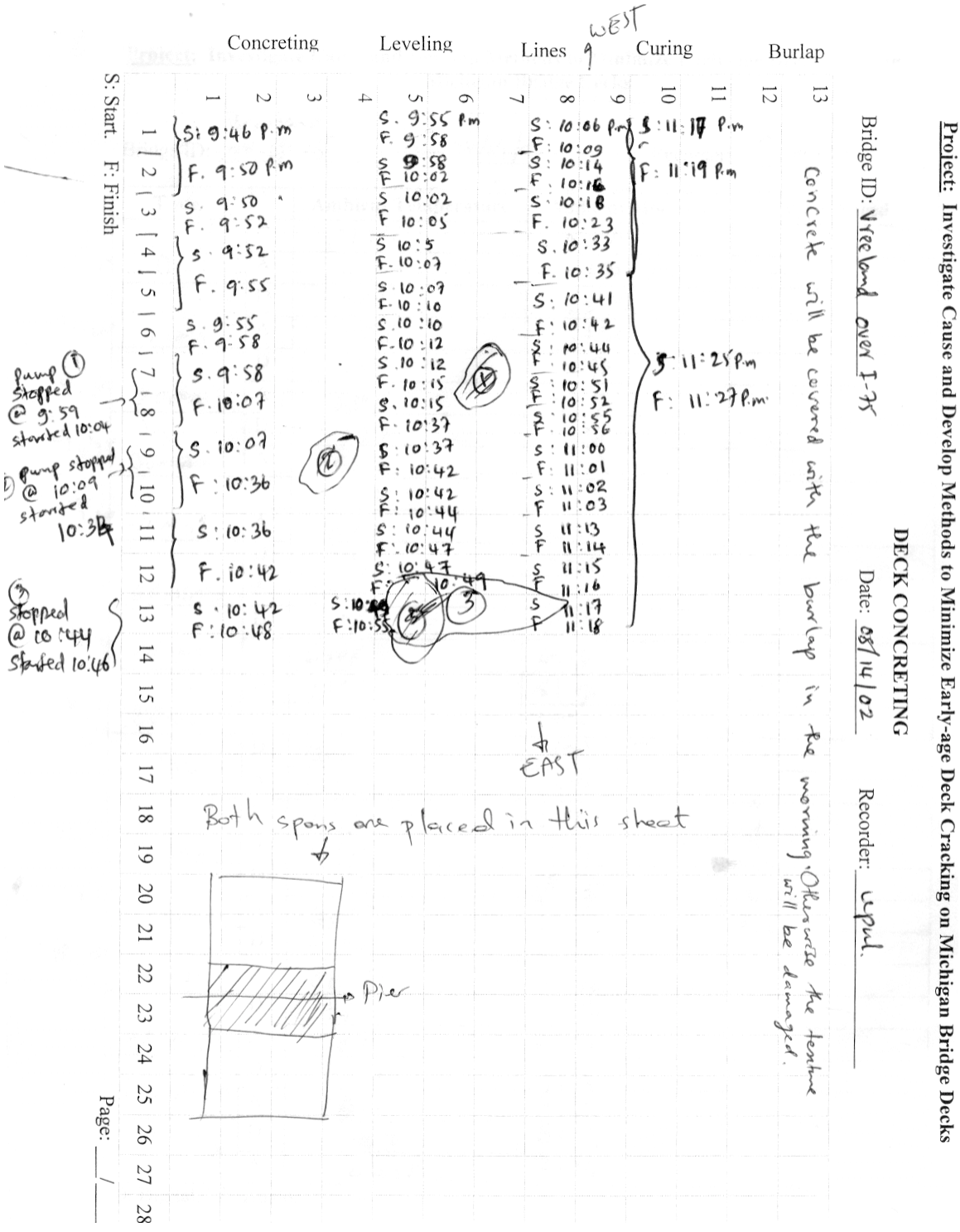


Table C-7. Bridge S05 of 82191 Ticket Information

Arrived at site : 8:34 PM Project: Early Age Deck Cracking ---

Batch time / Time leaving the plant

TICKET INFORMATION

BRIDGE ID : Veeland over I-75 RECORDER : Reynaldo DATE : 08/13/02

Cummulative Volume	Company Name	~~Ticket #~~ Truck #	Production Time (concrete plant)	Arrival Time (casting site)	Unloading Time	
					Start	Finish
11 yd³	Mich. Foudation Concr.	456	8:38 / 8:35	8:51 PM	8:55 PM	9:05
22 yd³	"	460	8:49 / 8:45	9:01	9:05	9:15
33	"	455	9:12 / 9:10	9:25	9:27	~~9:38~~ 9:38
44	"	463	9:22 / 9:15	9:32	9:35	9:45
55	"	462	9:36 / 9:32	9:48	9:50	9:59
65	~~2705?~~	410	9:57 / 8:50	~~10:12~~ 10:07	~~10:09~~ 10:11	10:19
76	~~Volvo~~ "	456	10:16 / 10:20	10:29	10:31	10:44 → Stop & pump trans to o side
87	"	460	10:25 / 10:30	11:00	11:15	11:34
97	"	433	11:19 / 11:15	11:35	11:36	11:45
~~107~~		408	11:36 / not written	11:55	11:57	12:06
~~118~~		456	~~11:58~~ / 11:55	12:10	12:12	12:20
~~129~~ 140		~~405~~ 463	12:06 / 12:05	12:17	12:19	12:32
		460	12:12 / 12:10	12:25	12:31	12:38

→ 11:10 (Start Pouring Other side) → 11:15

Table C-7. Bridge S05 of 82191 Ticket Information (Contd.)

Project: Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks

TICKET INFORMATION

Bridge ID: Veeland Over I-75 Date: 08/14/02 Recorder: REYNALDO PABLO JR.

approach casting

#	Company Name	Truck #	Production Time (Concrete Plant)	Arrival Time (Casting Site)	Unloading Time Start	Unloading Time Finish	Cumm. Volume, Yd
1	Michigan	456	8:39 / 8:40	9.00	9.07	9.12	8.41
2	Foundation	460	8:47 / 8:45	9.06	9.11	9.19	16.82
3	Concrete	409	8:56 / 8:50	9.13	9.18	9.34	24.47
4		461	9.03 / 8:55	9.20	9.33	9.46	32.88
5		424	9.11 / 9.06	9.35	9.46	9.53	40.52
6		432	9.20 / 9.15	9.47	9.58	10.05	48.17
7		456 *	10.18 / 10.15	10.30	10.30	10.43	56.58
8		456 *	cont'd.	cont'd	11.19	11:21	
9		460	10.25 / 10.25	11.05	11.21	11.28	64.22
10		409	11.42 /	11.42	11.43	11.51	71.87
		461	11.43 /	11.43	11.51	11.56	~~71.87~~ 79.51
			11.15 / 11.10				END.
			11.23 / 11.25				

moved to other side

same truck

approach

END OF FILE

74.60
64.22
10.38

72.32
26.46.

Note: Production Time Page: 1 / 1

8:39 / 8:40 means 8:39 = Batching Tim
8:40 = Truck depo

Table C-8. Bridge S05 of 82191 Ambient Conditions

Project: Early Age Deck Cracking. - - - ①

Ambient Temperature, Ambient Moisture, and Wind Speed

Bridge ID Vicksland over I-75 Date 08/13/2002 Recorder Upendra P Pandel.

Time	Temperature	Moisture	Wind Speed	
9:00 PM	80	57		D
	76	60		A
9:05	79	60		
	74	60		
9:10	78	61		
	74	61		
9:15	78	62		
	73	62		
9:20	78	62		
	74	62		
9:25	77	63		
	74	62		
9:30	77	63		
	74	62		
9:35	77	63		
	74	62		
9:40	78	61		
	74	60		
9:45	78	61		
	74	60		
9:50	78	61		
	74	60		
9:55	78	62		(Rain)
	72	62		
10:00	77	67		
	72	64		

D: Digital
A: Analarge.

Table C-8. Bridge S05 of 82191 Ambient Conditions (Contd.)

Ambient Temperature, Ambient Moisture, and Wind Speed

Bridge ID _____ Date _____ Recorder _____

Time	Temperature	Moisture	Wind Speed
10:05	77	70	
	72	65	
10:10	77	67	
	72	64	
10:15	77	67	
	73	64	
10:20	77	67	
	72	65	
10:25	77	67	
	72	65	
10:30	77	70	
	72	66	
10:35	77	69	
	72	66	
10:40	77	68	
	72	66	
10:45	77	67	
	74	66	
10:50	77	67	
	74	64	
10:55	77	73	
	73	70	
11:00	77	71	
	73	70	
11:05	80	69	
	74	70	

D
A

Table C-8. Bridge S05 of 82191 Ambient Conditions (Contd.)

Ambient Temperature, Ambient Moisture, and Wind Speed

Bridge ID _____ Date _____ Recorder _____

Time	Temperature	Moisture	Wind Speed
12:15	78	62	
	75	60	
12:20	78	62	
	75	60	
12:25	78	63	
	74	60	
12:30	78	64	
	75	60	
12:35	78	63	
	75	60	
12:40	78	62	
	74	60	
12:45	77	63	
	74	60	
12:50	77	63	
	75	60	
12:55	77	63	
	74	59	
1:00	78	62	
	74	58	
1:05	77	62	
	74	58	

Table C-8. Bridge S05 of 82191 Ambient Conditions (Contd.)

Project: **Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks**

Bridge ID: Vreeland over I-75 Date: 08/14/02 Recorder: Carissa

Time			Ambient Temperature	Ambient Moisture	Wind Speed
9:10	0	D	77°F	65%	
		A	72°F	71%	
9:20	10min	D	75°F	65%	
		A	70°F	71%	
9:30	20min	D	73°F	71%	
		A	68°F	71%	
9:40	30min	D	72°F	75%	
		A	68°F	70%	
9:50	40min	D	71°F	77%	
		A	67°F	72%	
10:00	60min	D	71°F	79%	
		A	67°F	71%	
10:10	70min	D	71°F	82%	
		A	67°F	69%	
10:20	80min	D	72°F	81%	Sunny
		A	68°F	74%	
10:30	90min	D	72°F	79%	
		A	68°F	74%	
10:40	100min	D	71°F	81%	
		A	68°F	72%	
10:50	120min	D	76°F	68%	
		A	70°F	72%	
11:00	130min	D	73°F	71%	
		A	68°F	71%	
	11:10 pm	D	75°F	67%	
		A	68°F	66%	
	11:20 pm	D	73°F	71%	
		A	69°F	70%	
	11:30 pm	D	70°F	80%	
		A	64°F	74%	

D: Digital. A: Analog

Page: 1 / 2

Table C-8. Bridge S05 of 82191 Ambient Conditions (Contd.)

Project: **Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks**

Bridge ID: Vreeland over I-75 Date: 08/14/02 Recorder: Recep

Time		Ambient Temperature	Ambient Moisture	Wind Speed
11:40 pm	D	69°F	86%	
	A	64°F	76%	
11:50 pm	D	68°F	92%	
	A	64°F	76%	
12:00	D	67°F	92%	
	A	60°F	74%	
	D	Concrete placement is completed		
	A			
	D	@ 11:57 p.m.		
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			

D: Digital. A: Analog

Page: 2 / 2

Table C-9. Bridge S06 of 82194 Concrete Sampling Sheet

Concrete Sampling Sheet

Bridge Id	I75 OV FORT ST	**Number of Specimens**			
Date	08/19/02	6 x 12	30	4 x 8	24
Inspectors	RB, O.D, UA, YK, KM, JR, W.D, R.P, JF				

Ticket info

Company Name	Michigan Foundation Concrete		
Ticket #		**Photograph No:**	
Production time		**Transfer period**	
Arriving time		**Casting Time**	

Truck #462

Conducted Tests

	1. Measure	2. Measure	Average	Testing Consult
Slump (inch)	5	5 1/2		
Air Content	6.6	6.5		
Unit Weight (including container)	20000g	20126		
Temperature (°F)	77.6	78		

Casting Data

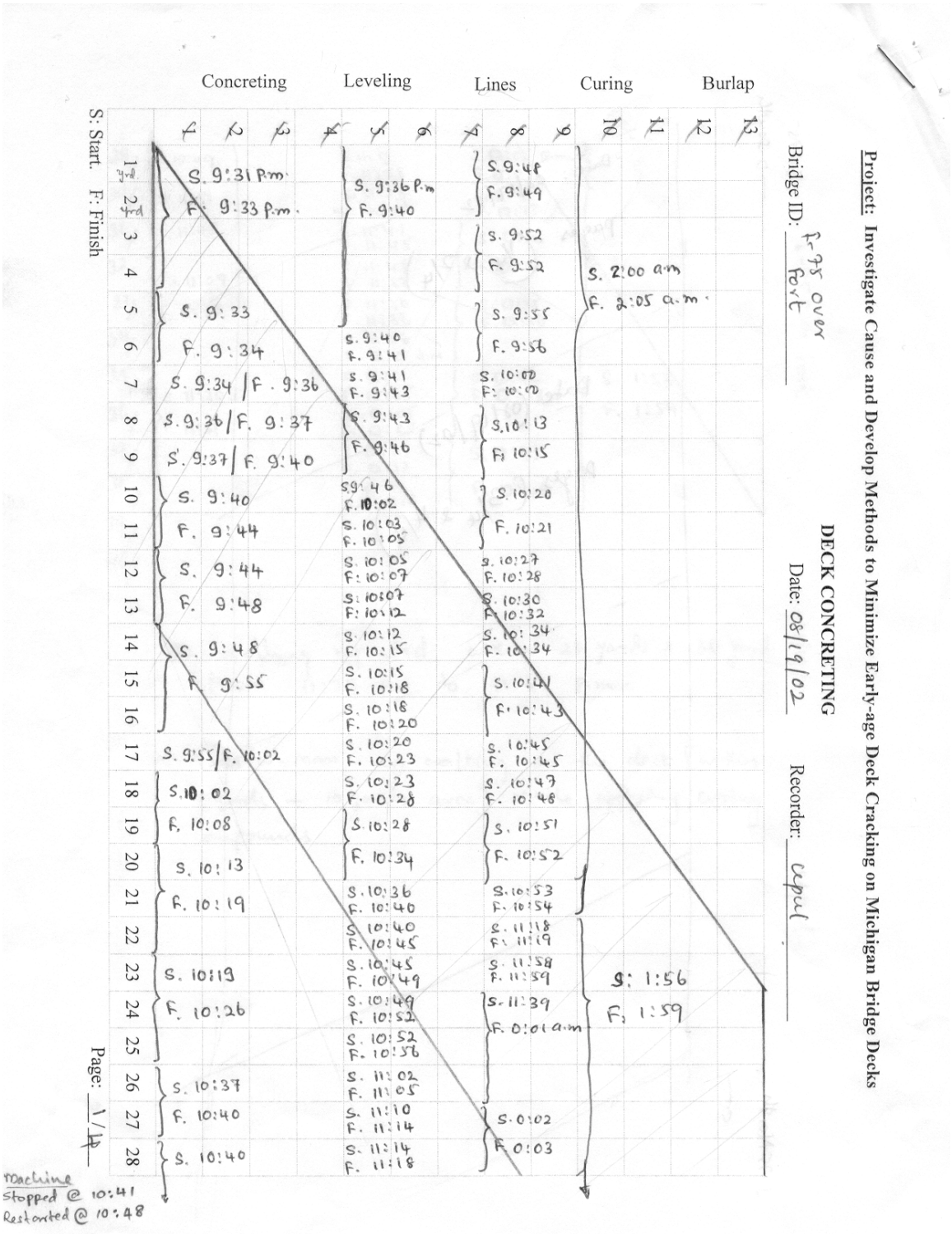
	Starting	Finishing	Average
Time of Casting			
Temperature (°F)			
Average Humidity			
Wind			

Notes :

Samples from the Truck # 462

Vibration 1 deep for each specimen

Table C-10. Bridge S06 of 82194 Deck Construction



Project: Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks

DECK CONCRETING

Bridge ID: I-75 over Fort Date: 08/19/02 Recorder: Lopez

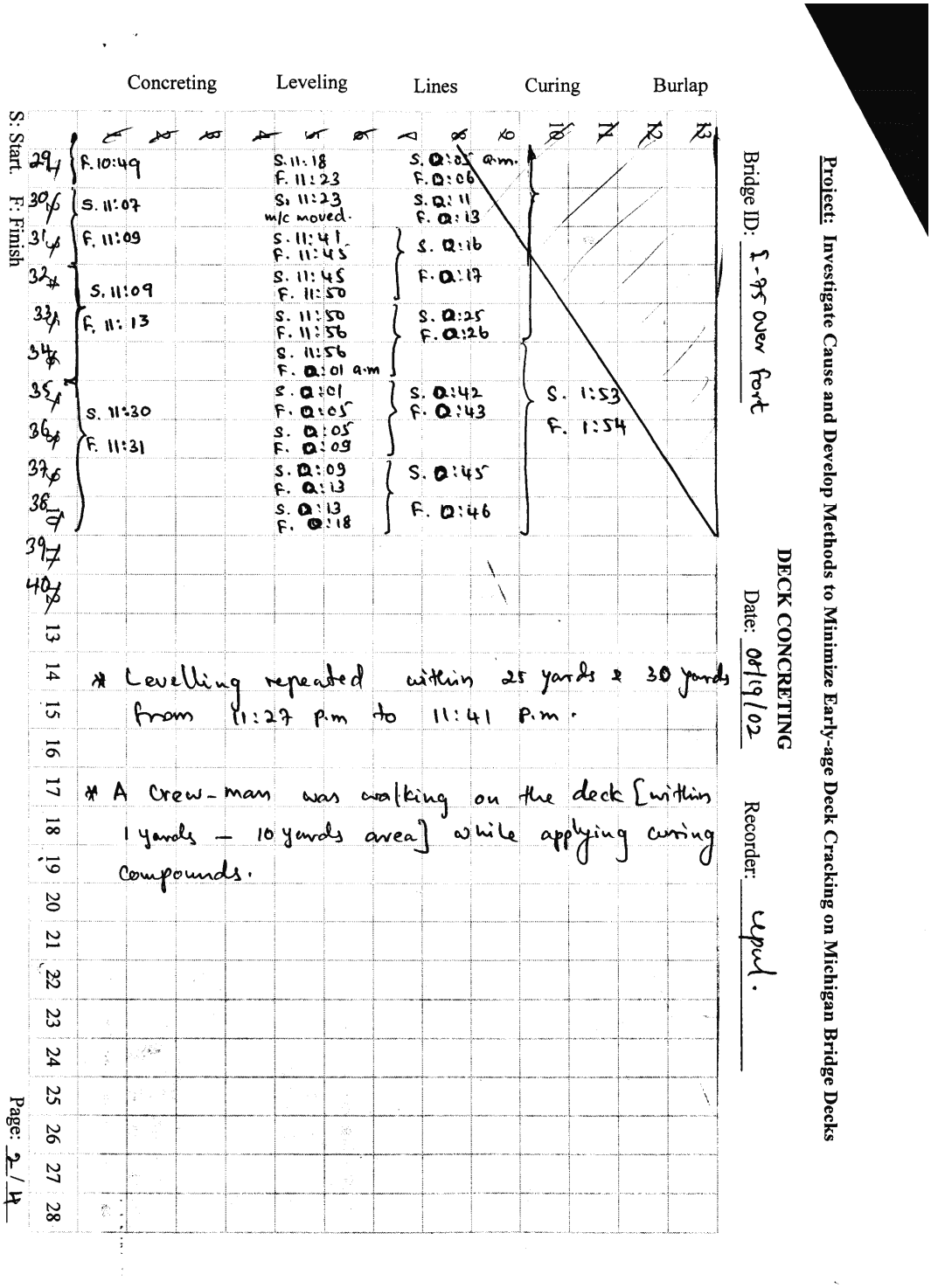
S: Start. F: Finish

Page: 1/1

	Concreting	Leveling	Lines	Curing	Burlap
1st	S. 9:31 P.m.	S. 9:36 P.m	S. 9:48		
2nd	F. 9:33 P.m.	F. 9:40	F. 9:49		
3			S. 9:52		
4			F. 9:52	S. 2:00 a.m	
5	S. 9:33		S. 9:55	F. 2:05 a.m.	
6	F. 9:34	S. 9:40 F. 9:41	F. 9:56		
7	S. 9:34 / F. 9:36	S. 9:41 F. 9:43	S. 10:07 F: 10:09		
8	S. 9:36 / F. 9:37	S. 9:43	S. 10:13		
9	S. 9:37 / F. 9:40	F. 9:46	F. 10:15		
10	S. 9:40	S. 9:46 F. 10:02	S. 10:20		
11	F. 9:44	S. 10:03 F. 10:05	F. 10:21		
12	S. 9:44	S. 10:05 F: 10:07	S. 10:27 F. 10:28		
13	F. 9:48	S. 10:07 F: 10:12	S. 10:30 F. 10:32		
14	S. 9:48	S. 10:12 F. 10:15	S. 10: 34 F. 10:34		
15	F. 9:55	S. 10:15 F. 10:18	S. 10:41		
16		S. 10:18 F. 10:20	F. 10:43		
17	S. 9:55 / F. 10:02	S. 10:20 F. 10:23	S. 10:45 F. 10:45		
18	S. 10:02	S. 10:23 F. 10:28	S. 10:47 F. 10:48		
19	F. 10:08	S. 10:28	S. 10:51		
20	S. 10:13	F. 10:34	F. 10:52		
21	F. 10:19	S. 10:36 F. 10:40	S. 10:53 F. 10:54		
22		S. 10:40 F. 10:45	S. 11:18 F: 11:19		
23	S. 10:19	S. 10:45 F. 10:49	S. 11:58 F. 11:59	S: 1:56	
24	F. 10:26	S. 10:49 F. 10:52	S. 11:39	F. 1:59	
25		S. 10:52 F. 10:56	F. 0:01 a.m		
26	S. 10:37	S. 11:02 F. 11:05			
27	F. 10:40	S. 11:10 F. 11:14	S. 0:02		
28	S. 10:40	S. 11:14 F. 11:18	F. 0:03		

machine stopped @ 10:41
Restarted @ 10:48

Table C-10. Bridge S06 of 82194 Deck Construction (Contd.)



Project: Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks

DECK CONCRETING

Bridge ID: I-95 over Fort

Date: 08/19/02 Recorder: Upul.

S: Start. F: Finish

Concreting Leveling Lines Curing Burlap

29 F. 10:49 — S. 11:18, F. 11:23 — S. 12:05 a.m., F. 12:06

30 S. 11:07 — S. 11:23 m/c moved. — S. 12:11, F. 12:13

31 F. 11:09 — S. 11:41, F. 11:45 — S. 12:16

32 S. 11:09 — S. 11:45, F. 11:50 — F. 12:17

33 F. 11:13 — S. 11:50, F. 11:56 — S. 12:25, F. 12:26

34 — S. 11:56, F. 12:01 a.m.

35 S. 11:30 — S. 12:01, F. 12:05 — S. 12:42, F. 12:43 — S. 1:53

36 F. 11:31 — S. 12:05, F. 12:09 — F. 1:54

37 — S. 12:09, F. 12:13 — S. 12:45

38 — S. 12:13, F. 12:18 — F. 12:46

39

40

* Levelling repeated within 25 yards & 30 yards from 1:27 p.m to 11:41 p.m.

* A Crew-man was walking on the deck [within 1 yards – 10 yards area] while applying curing compounds.

Page: 2/4

Table C-10. Bridge S06 of 82194 Deck Construction (Contd.)

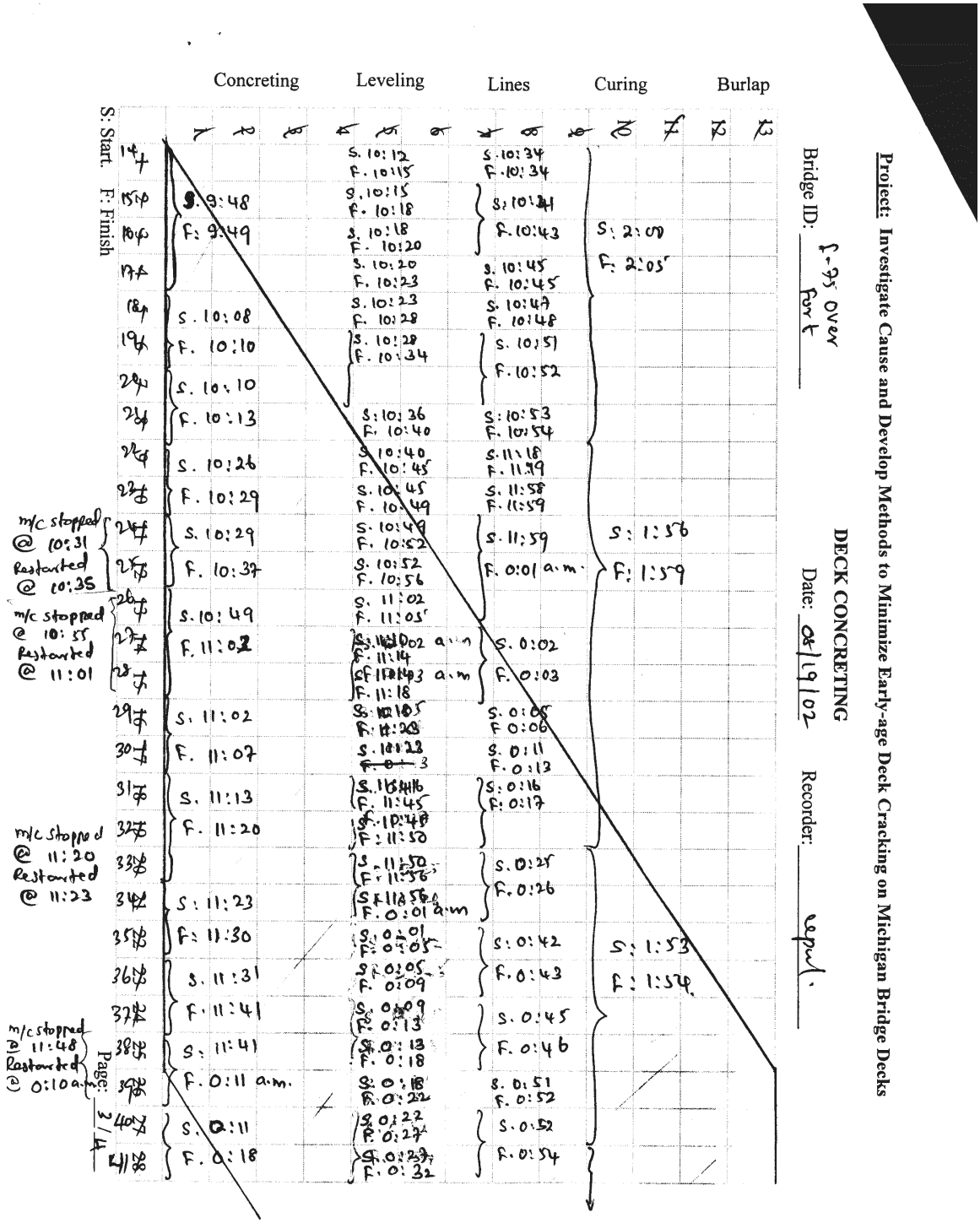


Table C-10. Bridge S06 of 82194 Deck Construction (Contd.)

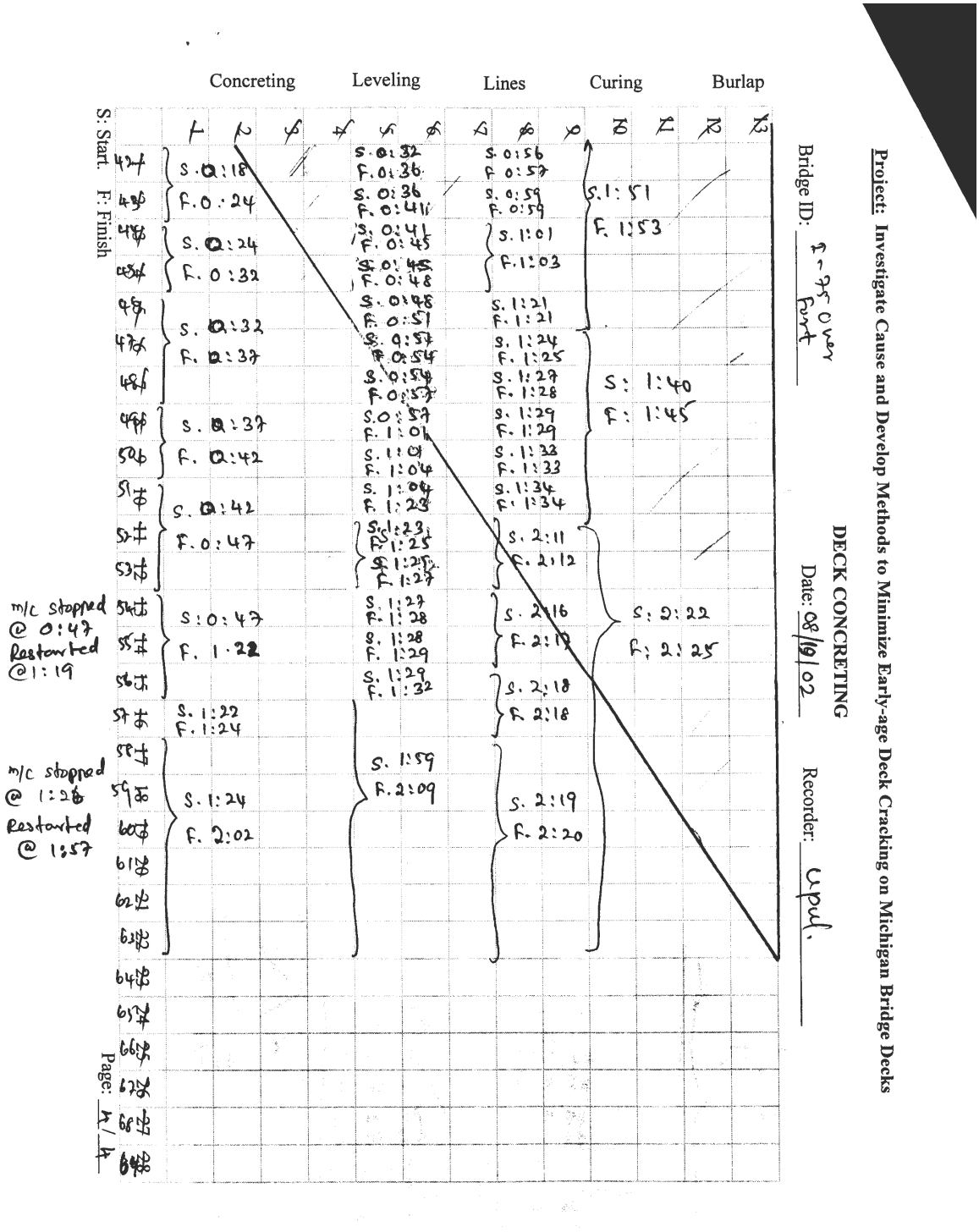


Table C-11. Bridge S06 of 82194 Ticket Information

Project: Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks

TICKET INFORMATION

Bridge ID: I75 Over Fort Date: 8/19/02 Recorder: REYNALDO PABLO JR.

	Company Name	Truck #	Production Time (Concrete Plant)	Arrival Time (Casting Site)	Unloading Time Start	Unloading Time Finish	Cummulative Qty (yards³)
1.	MICHIGAN	461	~~8~~8:56 / 8:50	9:12	9:25	9:39	8.41
2.	FOUNDATION	462	~~9~~9:05 / 9:05	9:20	9:29	9:39	16.82
3.	CONCRETE	424	9:13 / 9:05	9:33	9:38	9:45	24.47
4.		433	9:19 / 9:15	9:38	9:44	9:50	31.35
5.		414	9:28 / 9:25	9:39	9:49	9:57	38.99
6.		432	9:36 / 9:30	9:53	9:56	10:04	46.64
7.		460	9:46 / 9:43	10:01	10:04	10:11	55.05
8.		430	9:52 / 9:56	10:06	10:11	10:20	62.69
9.		409	~~10:05~~ 9:58 / 10:00	10:16	10:19	10:26	70.34
10.		461	10:13 / 10:10	10:29	10:30	10:37	78.75
11.		462	10:27 / 10:25	10:41	10:41	10:50	87.16
12.		424	10:35 / 10:36	10:54	10:55	11:01	94.80
13.		433	10:41 / 10:40	10:55	10:~~57~~	11:08	101.69
14		414	10:51 / 10:58	11:06	11:07	11:15	109.33
15		432	10:58 / 11:00	11:16	11:17	11:24	116.98
16		460	11:05 / 11:05	11:19	11:23	11:31	125.39
17		430	11:~~13~~ / 11:10	11:23	11:30	11:37	133.03
18		409	11:19 / 11:15	11:35	11:37	12:07	140.68
19		461	11:27 / 11:25	11:~~40~~	12:07	12:13	149.09
20		462	11:34 / 11:35	11:55	12:12	12:21	157.50
21		424	11:44 / 11:42	12:11	12:20	12:29	165.14
22	~~433~~	~~433~~ ~~12:05 / 12:10~~	12:11	12:29		~~172.60~~	
		~~414~~ 12:08 / 12:10	12:19			~~176.67~~	
22		433	11:56 / 11:55	12:11	12:29	12:34	172.02
23		414	12:08 / 12:10	12:19	12:34	12:43	179.67
24		432	12:58 / 12:53	01:10	01:10	01:19	~~187.65~~ 183.32
25		461	01:39 / 01:30	01:50	01:50	01:56	197.26

Page: 1 / 1

Note: Production Time:
8:56 / 8:50 means
8:56 is the production/batching time
8:50 is the departure from batching time

??? ∴ departure time is earlier than production time?
Ans: that is what is in the ticket

183.32
9.914
10x26

Table C-12. Bridge S06 of 82194 Ambient Conditions

Project: **Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks**

Bridge ID: I-75 over Fort Date: Aug 19-02 Recorder: Cerissa & Reep

Time		Ambient Temperature	Ambient Moisture	Wind Speed
9:10pm	D	66°F	66%	
	A	60°F	54%	
9:20	D	66°F	65%	
	A	60°F	56%	
9:30	D	67°F	66%	
	A	62°F	55%	
9:40	D	66°F	66%	
	A	61°F	54%	
9:50	D	66°F	66%	
	A	60°F	57%	
10:00	D	66°F	66%	
	A	60°F	60%	
10:10	D	65°F	68%	
	A	58°F	61%	
10:20	D	66°F	67%	
	A	62°F	54%	
10:30	D	68°F	61%	
	A	62°F	56%	
10:40	D	69°F	60%	
	A	60°F	54%	
10:50	D	69°F	62%	
	A	62°F	54%	
11:00	D	68°F	61%	
	A	60°F	53%	
11:10	D	65°F	68%	
	A	58°F	60%	
11:20	D	63°F	76%	
	A	56°F	62%	
11:30	D	66°F	76%	
	A	64°F	58%	

D: Digital. A: Analog

Page: 1/3

Table C-12. Bridge S06 of 82194 Ambient Conditions (Contd.)

Project: Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks

Michigan Foundation Concrete
~~(734) 722-82~~ (734) 282-9104 Jerry. mix design ask Jerry

Bridge ID: I-75 over Fort Date: Aug 19-02 Recorder: Reed

Time		Ambient Temperature	Ambient Moisture	Wind Speed
11:40	D	67 °F	68%	
	A	62 °F	~~68~~ 56%	
11:50	D	66 °F	70%	
	A	60 °F	48%	
12:00	D	63 °F	75%	
	A	56 °F	62%	
12:10	D	62 °F	80%	
	A	56 °F	64%	
12:20	D	61 °F	83%	
	A	56 °F	70%	
12:30	D	61 °F	85%	
	A	54 °F	~~68~~ 68%	
12:40	D	60 °F	85%	
	A	54 °F	70%	
12:50	D	60 °F	86%	
	A	54 °F	70%	
1:00	D	60 °F	86%	
	A	54 °F	70%	
1:10	D	60 °F	87%	
	A	54 °F	70%	
1:20	D	60 °F	88%	
	A	54 °F	70%	
1:30	D	60 °F	90%	
	A	54 °F	72%	
1:40	D	59 °F	92%	
	A	54 °F	72%	
1:50	D	59 °F	94%	
	A	54 °F	72%	
2:00	D	59 °F	93%	
	A	54 °F	72%	

D: Digital. A: Analog

Page: 2 / 3

Table C-12. Bridge S06 of 82194 Ambient Conditions (Contd.)

Project: Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks

Bridge ID: I-75 over Fort Date: July 20-22 Recorder: Reep

Time		Ambient Temperature	Ambient Moisture	Wind Speed
2:10 a.m	D	59°F	93%	
	A	54°F	72%	
2:20 a.m	D	59°F	94%	
	A	54°	72%	
2:30 a.m	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			
	D			
	A			

D: Digital. A: Analog

Page: 3 / 3

Table C-13. Bridge S26 of 50111 Deck Construction

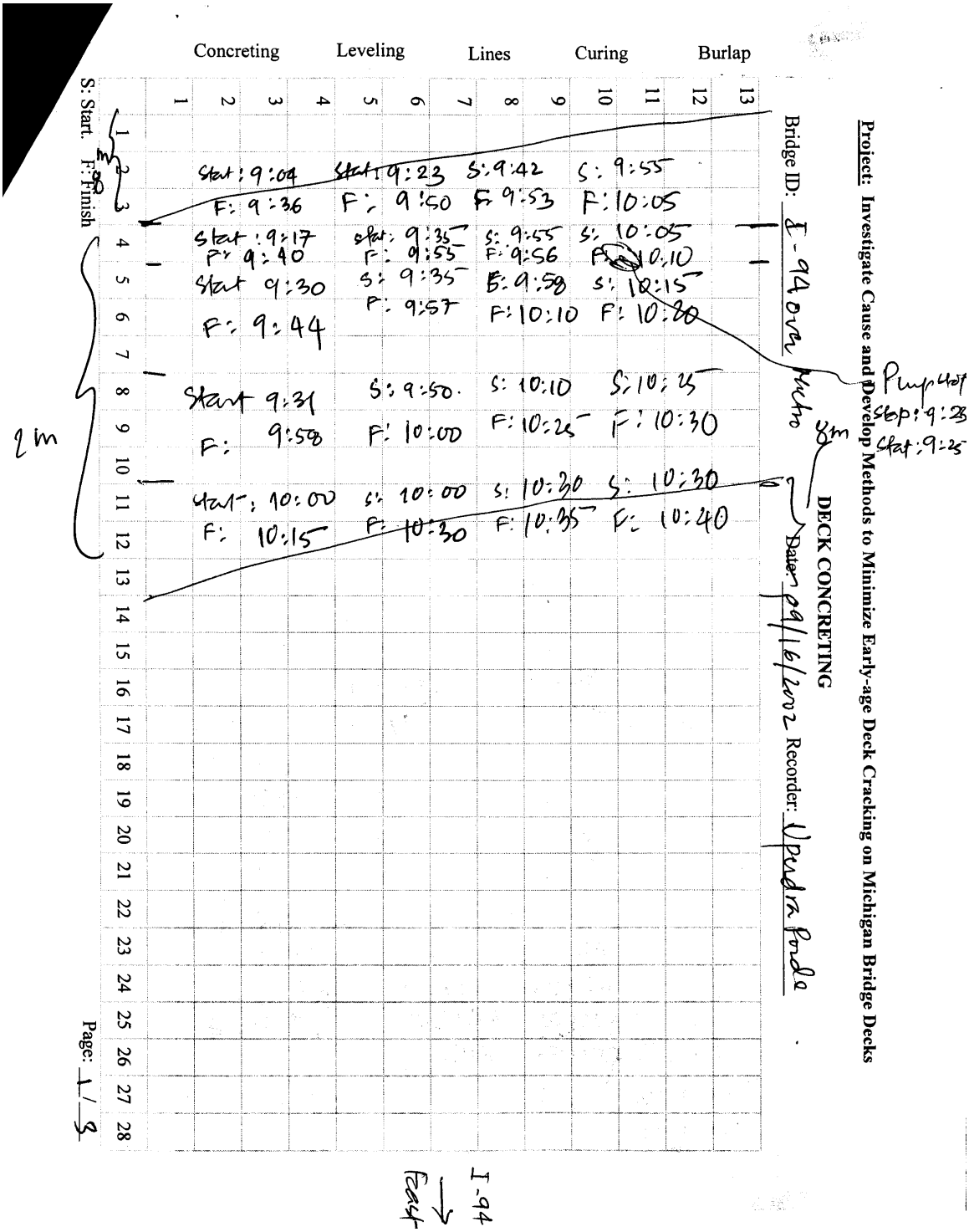


Table C-13. Bridge S26 of 50111 Deck Construction (Contd.)

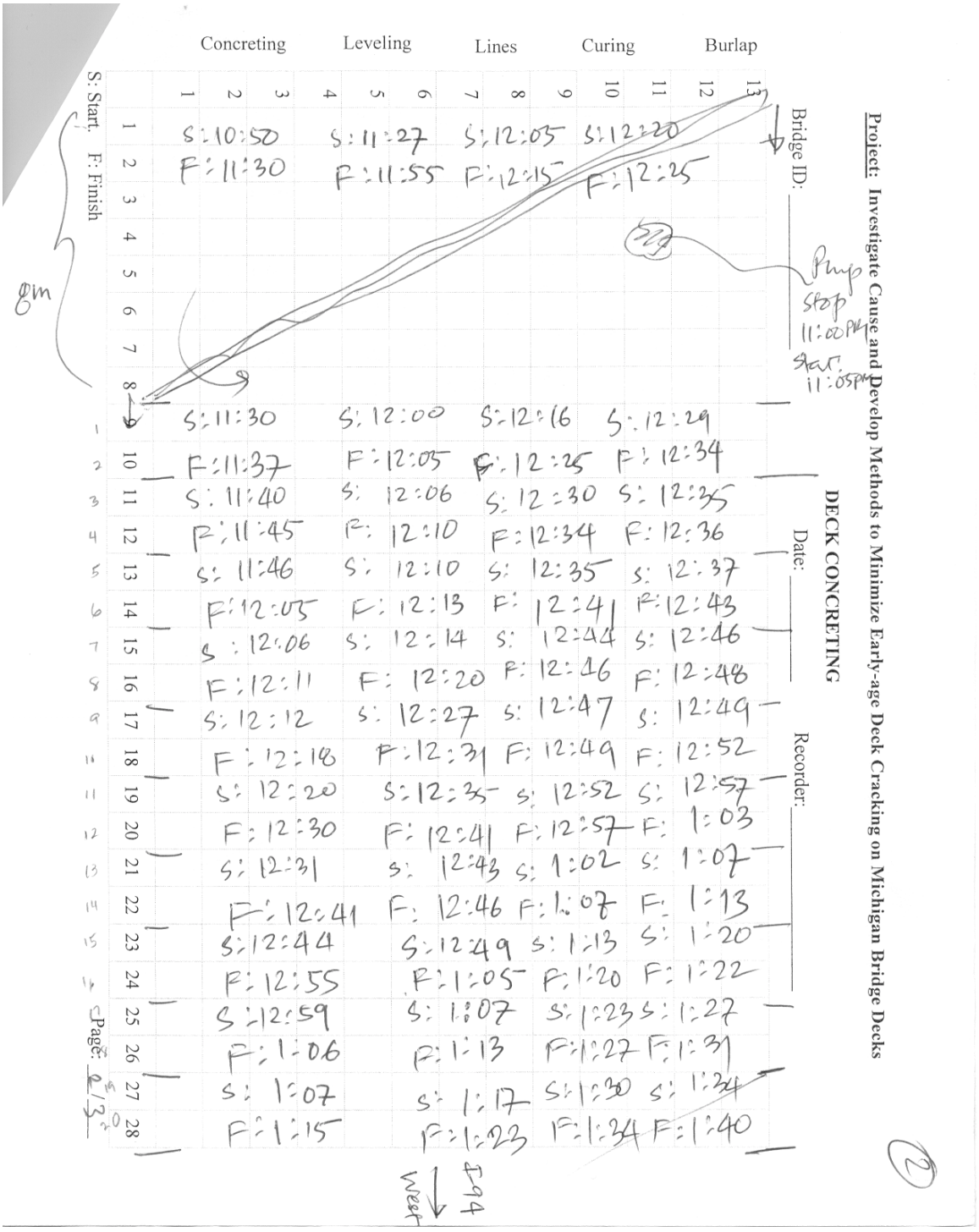


Table C-13. Bridge S26 of 50111 Deck Construction (Contd.)

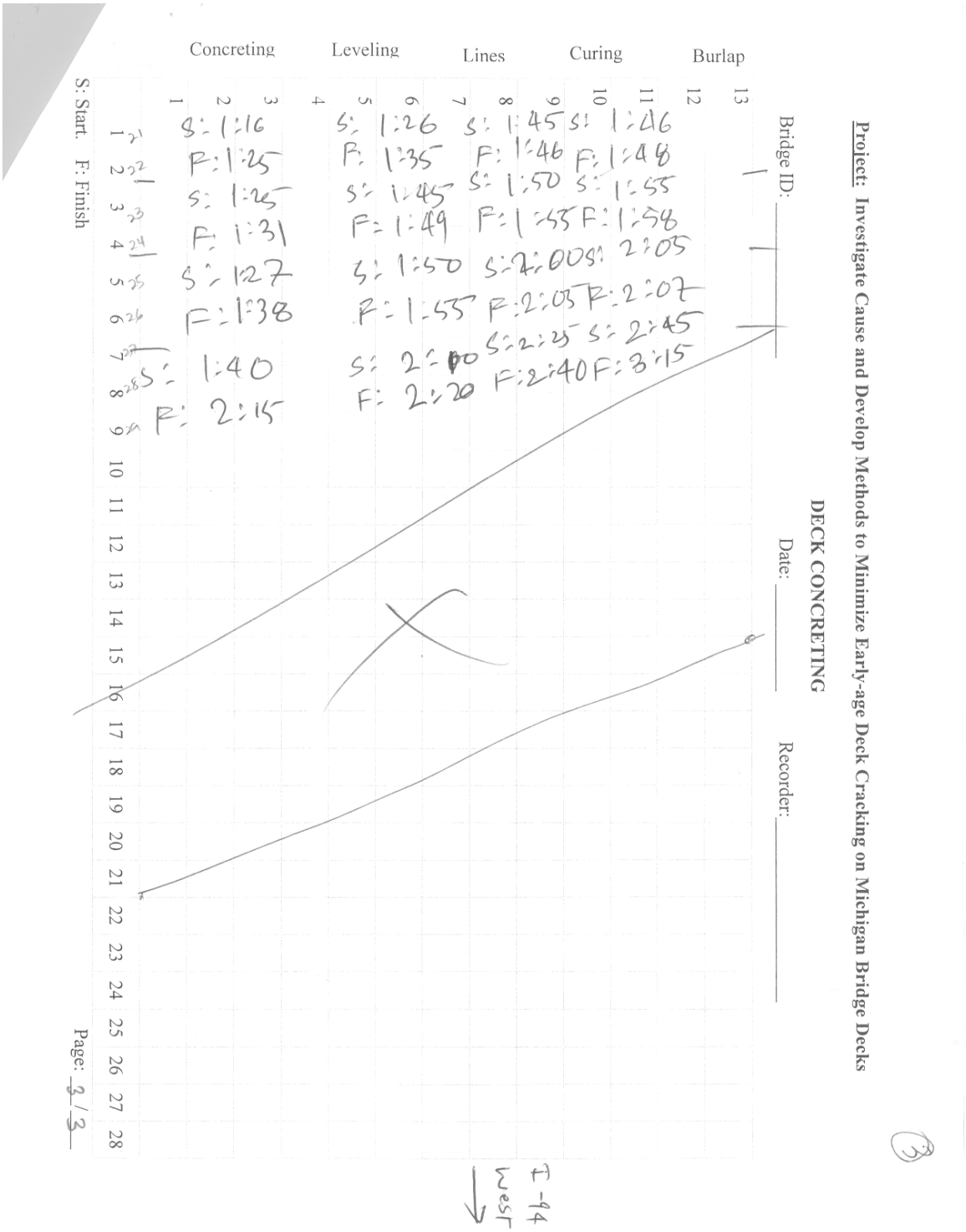


Table C-14. Bridge S26 of 50111 Ticket Information

Project: Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks

TICKET INFORMATION

Bridge ID: I-94 over Metro Date: 09/16/02 Recorder: Reynaldo

	Company Name	Truck #	Production Time (Concrete Plant)	Arrival Time (Casting Site)	Unloading Time	
					Start	Finish
1.	Metzen Concr.	82	20.45	8:59	9.05	9:11
2.		97	8.58	9.12	9.12	9.19
3		94	9.02	9.18	9.19	9.29
4		93	9.11	9.27	9.30	9.36
5		90	9.13	9.28	9.36	9.44
6		92	9.16	9.30	9.44	9.51
7		44	9.14	9.33	9.52	10.12
8		87	9.48	10.01	10.12	10.19
9			↳ transferred to other side of bridge		10.44	10.51
10		82	10.46	10.59	10.59	11.06
11		97	10.50	11.04	11.09	11.16
12		94	10.56	11.10	11.16	11.28
13		93	11.02	11.15	11.28	11.33
14		90	11.04	11.16	11.33	11.38
15		92~~88~~	11.11	11.25	11.38	11.44
16		44	11.20	11.37	11.44	12.01
17		87	11.31	11.45	12.00	12.12
18		82	11.47	12.01	12.02	12.08
19		97	11.53	12.08	12.08	12.15
20		94	12.01	12.16	12.17	12.26
21		93	12.13	12.20	12.26	12.33
22		90	12.15	12.27	12.33	12.38 12.47
23		92	12.24	12.39	12.39	12.45
24		44	12.38	12.53	~~01.05~~	12.55
25		87	12.41	~~01~~ 12.56	12.56	01.05
26		82	12.54	01.05	01.06	01.12
27		97	12.56	01.08	01.12	01.16
28		94	12.58	01.11	01.16	01.25
29		93	01.04	01.21	01.25	01.30

Page: 1/2

Table C-14. Bridge S26 of 50111 Ticket Information (Contd.)

Project: **Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks**

TICKET INFORMATION

Bridge ID: I-94 over Metro Date: 09/16/02 Recorder: Reynaldo

	Company Name	Truck #	Production Time (Concrete Plant)	Arrival Time (Casting Site)	Unloading Time	
					Start	Finish
30		90	01.15	01.30	01.31	01.37
31		92	01.18	01.32	01.37	01.44
32		44	01.28	01.44	01.45	01.56
33		82	02.00	02.12	02.12	02.16

Page: 2/2

Table C-15. Bridge S26 of 50111 Ambient Conditions

Project: Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks

Bridge ID: I-94 over Metropark way Date: 09/16 & 09/17 Recorder: Okan Icpul

Time		Ambient Temperature	Ambient Moisture	Wind Speed
20.45	D	62	61 %	
	A	59.6	71.%	
SAMPLING START 55	D	62	60 %	
	A	60.7	72 %	
21 05	D	62	63 %	{ Concrete
	A	60.3	76 %	{ Air 7%, 80°F, 4in slump
15	D	62	62 %	I. pump set up
	A	60.1	78 %	
25	D	63	61	
	A	59.9	78%	
SAMPLING FINISH 35	D	62	63	
	A	60.7	78	
45	D	62	64	
	A	60.5	76	
55	D	63	63	
	A	60.8	77	
22 05	D	63.0	64	
	A	62.1	71	
15	D	65	66	
	A	68.2	61	
25	D	67	64	
	A	71.5	62	
35	D	63	63	
	A	67	64	
45	D	59	66	
	A	57.4	75	
55	D	56	69	
	A	55	82	
23 05	D	56	78	
	A	55.6	84	

D: Digital. A: Analog

Page: 1 /

Table C-15. Bridge S26 of 50111 Ambient Conditions (Contd.)

Project: **Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks**

Bridge ID: I-94 over Metropark way Date: 09/16 & 09/17 Recorder: upul

Time		Ambient Temperature	Ambient Moisture	Wind Speed
23:15	D	55	78	
	A	54.2	88	
23:25	D	54	81	
	A	53.1	89	
:35	D	56	79	
	A	54	88	
:45	D	54	83	
	A	52.6	89	
:55	D	54	85	
	A	52.6	91	
24:05	D	53	87	
	A	52.2	91	
:15	D	53	89	
	A	52.2	92	
:25	D	53	88	
	A	51.8	93	
:35	D	53	88	
	A	52	94	
:45	D	53	92	
	A	51.7	99	
:55	D	53	94	
	A	52	99	
01:05	D	53	HH	
	A	53	99	
01:15	D	55	HH	
	A	54	99	
:25	D	55	HH	
	A	53.6	99	
:35	D	54	94	
	A	53.3	99	

D: Digital. A: Analog

Page: 2 /____

Table C-15. Bridge S26 of 50111 Ambient Conditions (Contd.)

Project: **Investigate Cause and Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks**

Bridge ID: f-94 over Metropolitan Parkway Date: 08/18 & 09/17 Recorder: upul

Time		Ambient Temperature	Ambient Moisture	Wind Speed
01:45	D	53	94	
	A	52.7	99	
:55	D	54	HH	
	A	54.5	99	
02:05	D	54	HH	
	A	54	99	
:15	D	54	HH	
	A	54.3	99	
:25	D	53	HH	
	A	54	99	
:35	D			
	A			
:45	D			
	A			
:55	D			
	A			
02:05	D			
	A			
:15	D			
	A			
:25	D			
	A			
:35	D			
	A			
:45	D			
	A			
:55	D			
	A			
03:05	D			
	A			

D: Digital. A: Analog

Page: 3 /

Cement Mill - Test Report

Table C-16. Cement Mill Report from May 1 to 31, 2003

LAFARGE NORTH AMERICA

Cement

CEMENT MILL TEST REPORT

CONSIGNEE:

Date:	Jun-03
Plant:	ALPENA
Cement Type:	I
Manufacture Period:	May 1 to 31

PHYSICAL DATA		CHEMICAL DATA (C-114)	Percent
Specific Surface (Blaine) (C-204)		Silicon Dioxide (SiO_2)	20.4
(sq. cm./gm.)	3630		
(sq. m./kg.)	363	Aluminum Oxide (Al_2O_3)	4.8
Percent Passing 325 Mesh (C-430)	95.8	Ferric Oxide (Fe_2O_3)	2.7
Compressive Strength (psi) (C-109)		Calcium Oxide (CaO)	65.5
Mortar Cubes		Magnesium Oxide (MgO)	2.2
1 day	2170		
3 day	3760	Sulphur Trioxide (SO_3)	2.5
7 day	4670		
28 day	5600	Loss on Ignition	1.4
Vicat Setting Time (C-191)		Insoluble Residue	0.42
Initial (min.)	110		
Final (min.)	220	Free Lime	1.42
Air Content (%) (C-185)	5.9	Tricalcium Silicate (C3S)	69
Autoclave Expansion (%) (C-151)	0.09	Tricalcium Aluminate (C3A)	8
		Total Alkali as Sodium Oxide	0.50

CERTIFIED BY: _____
Quality Coordinator – Alpena

We hereby certify that this cement complies with current ASTM C 150-02 and AASHTO M 85-00 specifications.

GREAT LAKES REGION – ALPENA PLANT
1435 Ford Avenue, PO Box 396, Alpena, MI 49707
OFFICE: (989) 354-4171 FAX: (989) 354-2223
Web: www.lafargenorthamerica.com

Table C-17. Cement Mill Report from June 1 to 30, 2003

LAFARGE NORTH AMERICA

Cement

CEMENT MILL TEST REPORT

CONSIGNEE:

Date: Jul-03
Plant: ALPENA
Cement Type: I
Manufacture Period: June 1 to 30

PHYSICAL DATA		CHEMICAL DATA (C-114)	Percent
Specific Surface (Blaine) (C-204)		Silicon Dioxide (SiO_2)	20.7
(sq. cm./gm.)	3690	Aluminum Oxide (Al_2O_3)	4.7
(sq. m./kg.)	369	Ferric Oxide (Fe_2O_3)	2.6
Percent Passing 325 Mesh (C-430)	96.1	Calcium Oxide (CaO)	65.7
Compressive Strength (psi) (C-109)		Magnesium Oxide (MgO)	2.2
Mortar Cubes		Sulphur Trioxide (SO_3)	2.5
1 day	2200	Loss on Ignition	1.4
3 day	3790	Insoluble Residue	0.26
7 day	4710	Free Lime	1.32
28 day	5690	Tricalcium Silicate (C3S)	68
Vicat Setting Time (C-191)		Tricalcium Aluminate (C3A)	8
Initial (min.)	115	Total Alkali as Sodium Oxide	0.48
Final (min.)	225		
Air Content (%) (C-185)	5.7		
Autoclave Expansion (%) (C-151)	0.02		

CERTIFIED BY: _____
Quality Coordinator – Alpena

We hereby certify that this cement complies with current ASTM C 150-02 and AASHTO M 85-00 specifications.

GREAT LAKES REGION – ALPENA PLANT
1435 Ford Avenue, PO Box 396, Alpena, MI 49707
OFFICE: (989) 354-4171 FAX: (989) 354-2223
Web: www.lafargenorthamerica.com

Table C-18. Cement Mill Report from July 1 to 31, 2003

LAFARGE NORTH AMERICA

Cement

CEMENT MILL TEST REPORT

CONSIGNEE:

Date: Aug-03
Plant: ALPENA
Cement Type: I
Manufacture Period: July 1 to 31

PHYSICAL DATA		CHEMICAL DATA (C-114)	Percent
Specific Surface (Blaine) (C-204)		Silicon Dioxide (SiO2)	20.7
(sq. cm./gm.)	3630		
(sq. m./kg.)	363	Aluminum Oxide (Al2O3)	4.7
Percent Passing 325 Mesh (C-430)	94.8	Ferric Oxide (Fe2O3)	2.6
Compressive Strength (psi) (C-109)		Calcium Oxide (CaO)	65.6
Mortar Cubes		Magnesium Oxide (MgO)	2.3
1 day	2130		
3 day	3670	Sulphur Trioxide (SO3)	2.6
7 day	4530		
28 day	5790	Loss on Ignition	1.6
Vicat Setting Time (C-191)		Insoluble Residue	0.31
Initial (min.)	115		
Final (min.)	225	Free Lime	1.30
Air Content (%) (C-185)	6.0	Tricalcium Silicate (C3S)	67
Autoclave Expansion (%) (C-151)	0.02	Tricalcium Aluminate (C3A)	8
		Total Alkali as Sodium Oxide	0.49

CERTIFIED BY: _____
Quality Coordinator – Alpena

We hereby certify that this cement complies with current ASTM C 150-02 and AASHTO M 85-00 specifications.

GREAT LAKES REGION – ALPENA PLANT
[illegible]

Printed on Recycled Paper

Table C-19. Cement Mill Report from August 1 to 31, 2003

LAFARGE NORTH AMERICA

CEMENT MILL TEST REPORT

Cement

CONSIGNEE:

Date: Sep-03
Plant: ALPENA
Cement Type: I
Manufacture Period: Aug 1 to 31

PHYSICAL DATA		CHEMICAL DATA (C-114)	Percent
Specific Surface (Blaine) (C-204)		Silicon Dioxide (SiO2)	20.6
(sq. cm./gm.)	3620		
(sq. m./kg.)	362	Aluminum Oxide (Al2O3)	4.7
Percent Passing 325 Mesh (C-430)	96.1	Ferric Oxide (Fe2O3)	2.6
Compressive Strength (psi) (C-109)		Calcium Oxide (CaO)	65.7
Mortar Cubes		Magnesium Oxide (MgO)	2.2
1 day	2140		
3 day	3650	Sulphur Trioxide (SO3)	2.5
7 day	4520		
28 day	5590	Loss on Ignition	1.4
Vicat Setting Time (C-191)		Insoluble Residue	0.28
Initial (min.)	115		
Final (min.)	225	Free Lime	1.39
Air Content (%) (C-185)	6.2	Tricalcium Silicate (C3S)	68
Autoclave Expansion (%) (C-151)	0.03	Tricalcium Aluminate (C3A)	8
		Total Alkali as Sodium Oxide	0.52

CERTIFIED BY: _____
Quality Coordinator – Alpena

We hereby certify that this cement complies with current ASTM C 150-02 and AASHTO M 85-00 specifications.

GREAT LAKES REGION – ALPENA PLANT
1435 Ford Avenue, PO Box 398, Alpena, MI 49707
OFFICE: (989) 354-4171 FAX: (989) 354-2223
Web: www.lafargenorthamerica.com

APPENDIX D

Schedule for Laboratory Testing

Activity ID	Activity Description	Early Start	Early Finish
DS 100	Deck Sampling-1 (30 6x12, 24 4x8)	AUG-14-02A	
DS 101	Removing Specimens And Curing	AUG-14-02A	AUG-17-02A
DS 103	Curing Specimens (7 Days)	AUG-14-02A	AUG-21-02A
DS 104	Sample Ends Cutting (26 6x12, 12 4x8)	AUG-14-02A	AUG-17-02A
DS 105	Curing Specimens (28 Days)	AUG-14-02A	SEP-11-02A
DS 110	3 Days Strength Testing	AUG-17-02A	AUG-17-02A
DS 111	3 Days Modulus of Elasticity Testing	AUG-17-02A	AUG-17-02A
DS 112	3 Days UPV testing	AUG-17-02A	AUG-17-02A
DS 200	Deck Sampling-1 (30 6x12, 24 4x8)	AUG-19-02A	
DS 201	Removing Specimens And Curing	AUG-19-02A	AUG-22-02A
DS 202	Sample Ends Cutting (4 6x12, 12 4x8)	AUG-19-02A	AUG-22-02A
DS 203	Curing Specimens (7 Days)	AUG-19-02A	AUG-26-02A
DS 204	Sample Ends Cutting (26 6x12, 12 4x8)	AUG-19-02A	AUG-22-02A
DS 205	Curing Specimens (28 Days)	AUG-19-02A	SEP-16-02A
DS 210	3 Days Strength Testing	AUG-19-02A	AUG-19-02A
DS 211	3 Days Modulus of Elasticity Testing	AUG-19-02A	AUG-19-02A
DS 212	3 Days UPV testing	AUG-19-02A	AUG-19-02A
DS 102	Sample Ends Cutting (4 6x12, 12 4x8)	AUG-21-02A	AUG-24-02A
DS 120	7 Days Strength Testing	AUG-21-02A	AUG-21-02A
DS 121	7 Days Modulus of Elasticity Testing	AUG-21-02A	AUG-21-02A
DS 122	7 Days UPV Testing	AUG-21-02A	AUG-21-02A
DS 220	7 Days Strength Testing	AUG-26-02A	AUG-26-02A
DS 221	7 Days Modulus of Elasticity Testing	AUG-26-02A	AUG-26-02A
DS 222	7 Days UPV Testing	AUG-26-02A	AUG-26-02A
DS 106	Ambient Laboratory Air (56 Days)	SEP-11-02A	OCT-08-02A
DS 107	Ambient Laboratory Air (90 Days)	SEP-11-02A	NOV-11-02A
DS 130	28 Days Strength Testing	SEP-11-02A	SEP-11-02A
DS 131	28 Days Modulus of Elasticity	SEP-11-02A	
DS 132	28 Days UPV Testing	SEP-11-02A	
DS 133	28 Days Permeability Testing	SEP-11-02A	
DS 134	28 Days RCPT Testing	SEP-11-02A	
DS 135	28 Days Absorption Testing	SEP-11-02A	
DS 302	Sample Ends Cutting (4 6x12, 12 4x8)	SEP-12-02A	SEP-15-02A
DS 300	Deck Sampling-1 (30 6x12, 24 4x8)	SEP-15-02A	
DS 301	Removing Specimens And Curing	SEP-15-02A	SEP-18-02A

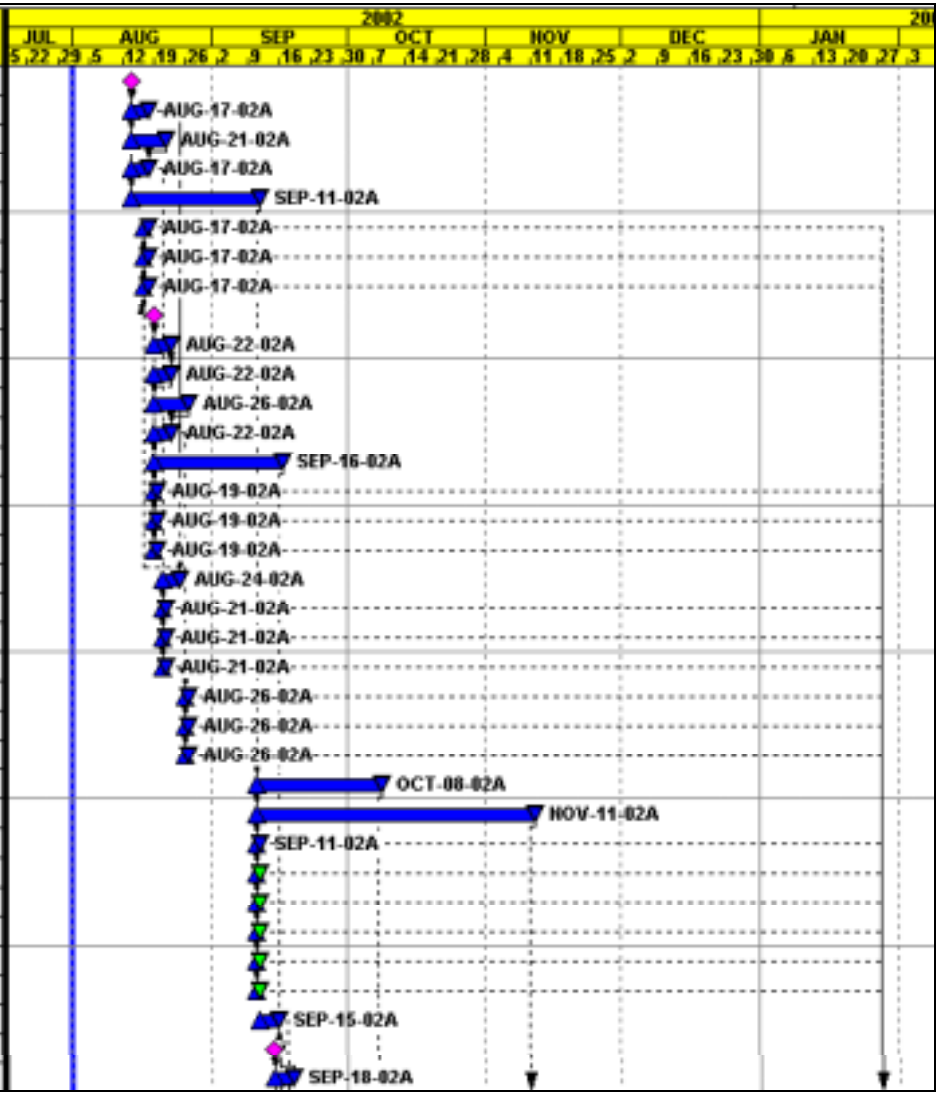


Figure D-1. Schedule for laboratory testing

Activity ID	Activity Description	Early Start	Early Finish
DS 303	Curing Specimens (7 Days)	SEP-15-02A	SEP-22-02A
DS 304	Sample Ends Cutting (26 6x12, 12 4x8)	SEP-15-02A	SEP-18-02A
DS 305	Curing Specimens (28 Days)	SEP-15-02A	OCT-13-02A
DS 206	Ambient Laboratory Air (56 Days)	SEP-16-02A	OCT-13-02A
DS 207	Ambient Laboratory Air (90 Days)	SEP-16-02A	NOV-16-02A
DS 230	28 Days Strength Testing	SEP-16-02A	SEP-16-02A
DS 231	28 Days Modulus of Elasticity	SEP-16-02A	
DS 232	28 Days UPV Testing	SEP-16-02A	
DS 233	28 Days Permeability Testing	SEP-16-02A	
DS 234	28 Days RCPT Testing	SEP-16-02A	
DS 235	28 Days Absorption Testing	SEP-16-02A	
DS 310	3 Days Strength Testing	SEP-18-02A	SEP-18-02A
DS 311	3 Days Modulus of Elasticity Testing	SEP-18-02A	SEP-18-02A
DS 312	3 Days UPV testing	SEP-18-02A	SEP-18-02A
DS 320	7 Days Strength Testing	SEP-22-02A	SEP-22-02A
DS 321	7 Days Modulus of Elasticity Testing	SEP-22-02A	SEP-22-02A
DS 322	7 Days UPV Testing	SEP-22-02A	SEP-22-02A
DS 400	Deck Sampling-1 (30 6x12, 24 4x8)	SEP-30-02A	
DS 401	Removing Specimens And Curing	SEP-30-02A	OCT-03-02A
DS 402	Sample Ends Cutting (4 6x12, 12 4x8)	SEP-30-02A	OCT-03-02A
DS 403	Curing Specimens (7 Days)	SEP-30-02A	OCT-07-02A
DS 404	Sample Ends Cutting (26 6x12, 12 4x8)	SEP-30-02A	OCT-03-02A
DS 405	Curing Specimens (28 Days)	SEP-30-02A	OCT-28-02A
DS 410	3 Days Strength Testing	OCT-03-02A	OCT-03-02A
DS 411	3 Days Modulus of Elasticity Testing	OCT-03-02A	OCT-03-02A
DS 412	3 Days UPV testing	OCT-03-02A	OCT-03-02A
DS 420	7 Days Strength Testing	OCT-07-02A	OCT-07-02A
DS 421	7 Days Modulus of Elasticity Testing	OCT-07-02A	OCT-07-02A
DS 422	7 Days UPV Testing	OCT-07-02A	OCT-07-02A
DS 140	56 Days Strength Testing	OCT-08-02A	OCT-08-02A
DS 141	56 Days Modulus of Elasticity Testing	OCT-08-02A	OCT-08-02A
DS 142	56 Days UPV Testing	OCT-08-02A	
DS 143	56 Days Permeability Testing	OCT-08-02A	
DS 144	56 Days RCPT Testing	OCT-08-02A	
DS 145	56 Days Absorption Testing	OCT-08-02A	

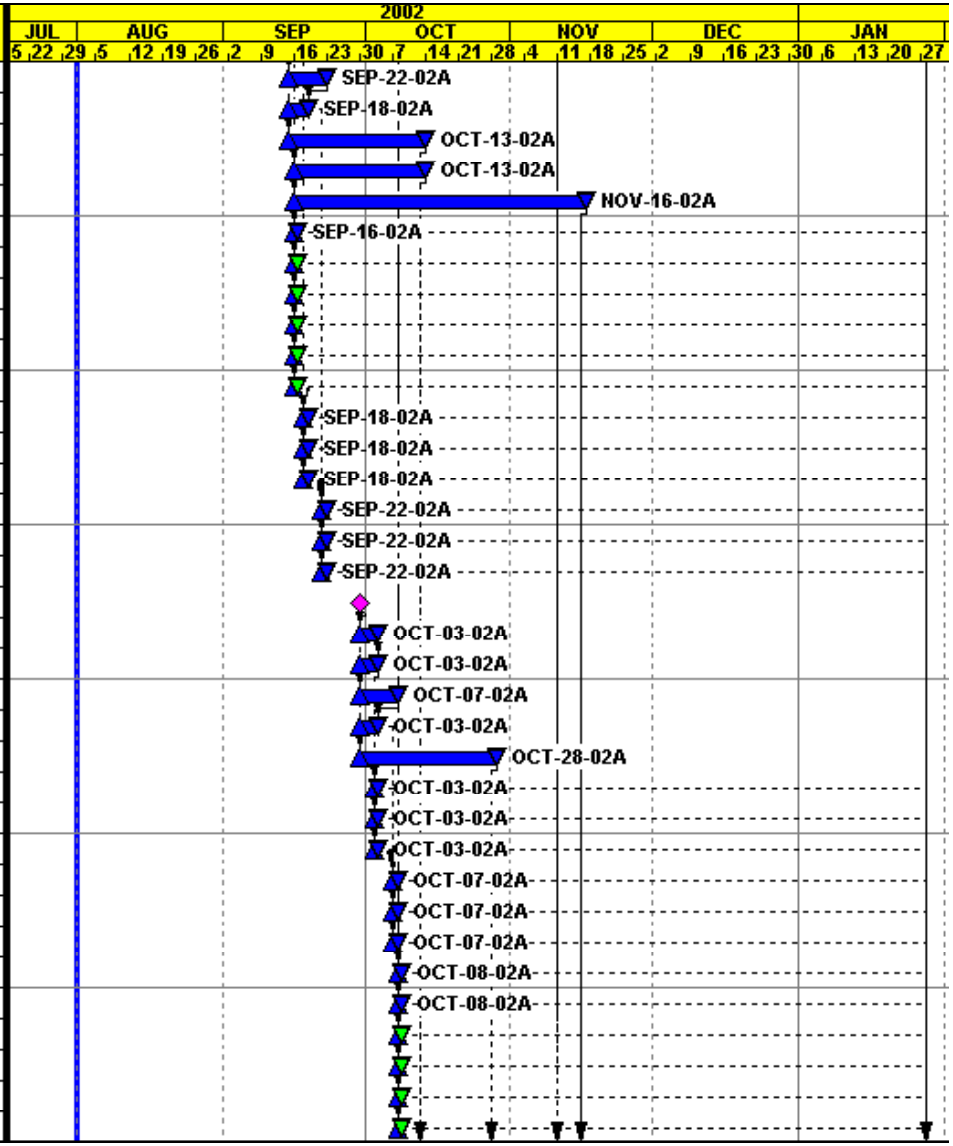


Figure D-1. Schedule for laboratory testing (contd.)

Activity ID	Activity Description	Early Start	Early Finish
DS 240	56 Days Strength Testing	OCT-13-02A	OCT-13-02A
DS 241	56 Days Modulus of Elasticity Testing	OCT-13-02A	
DS 242	56 Days UPV Testing	OCT-13-02A	
DS 243	56 Days Permeability Testing	OCT-13-02A	
DS 244	56 Days RCPT Testing	OCT-13-02A	
DS 245	56 Days Absorption Testing	OCT-13-02A	
DS 306	Ambient Laboratory Air (56 Days)	OCT-13-02A	NOV-09-02A
DS 307	Ambient Laboratory Air (90 Days)	OCT-13-02A	DEC-13-02A
DS 330	28 Days Strength Testing	OCT-13-02A	OCT-13-02A
DS 331	28 Days Modulus of Elasticity	OCT-13-02A	
DS 332	28 Days UPV Testing	OCT-13-02A	
DS 333	28 Days Permeability Testing	OCT-13-02A	
DS 334	28 Days RCPT Testing	OCT-13-02A	
DS 335	28 Days Absorption Testing	OCT-13-02A	
DS 500	Deck Sampling-1 (30 6x12, 24 4x8)	OCT-15-02A	
DS 501	Removing Specimens And Curing	OCT-15-02A	OCT-18-02A
DS 502	Sample Ends Cutting (4 6x12, 12 4x8)	OCT-15-02A	OCT-18-02A
DS 503	Curing Specimens (7 Days)	OCT-15-02A	OCT-22-02A
DS 504	Sample Ends Cutting (26 6x12, 12 4x8)	OCT-15-02A	OCT-18-02A
DS 505	Curing Specimens (28 Days)	OCT-15-02A	NOV-12-02A
DS 510	3 Days Strength Testing	OCT-18-02A	OCT-18-02A
DS 511	3 Days Modulus of Elasticity Testing	OCT-18-02A	OCT-18-02A
DS 512	3 Days UPV testing	OCT-18-02A	OCT-18-02A
DS 520	7 Days Strength Testing	OCT-22-02A	OCT-22-02A
DS 521	7 Days Modulus of Elasticity Testing	OCT-22-02A	OCT-22-02A
DS 522	7 Days UPV Testing	OCT-22-02A	OCT-22-02A
DS 406	Ambient Laboratory Air (56 Days)	OCT-28-02A	NOV-24-02A
DS 407	Ambient Laboratory Air (90 Days)	OCT-28-02A	DEC-28-02A
DS 430	28 Days Strength Testing	OCT-28-02A	OCT-28-02A
DS 431	28 Days Modulus of Elasticity	OCT-28-02A	
DS 432	28 Days UPV Testing	OCT-28-02A	
DS 433	28 Days Permeability Testing	OCT-28-02A	
DS 434	28 Days RCPT Testing	OCT-28-02A	
DS 435	28 Days Absorption Testing	OCT-28-02A	
DS 340	56 Days Strength Testing	NOV-09-02A	NOV-09-02A

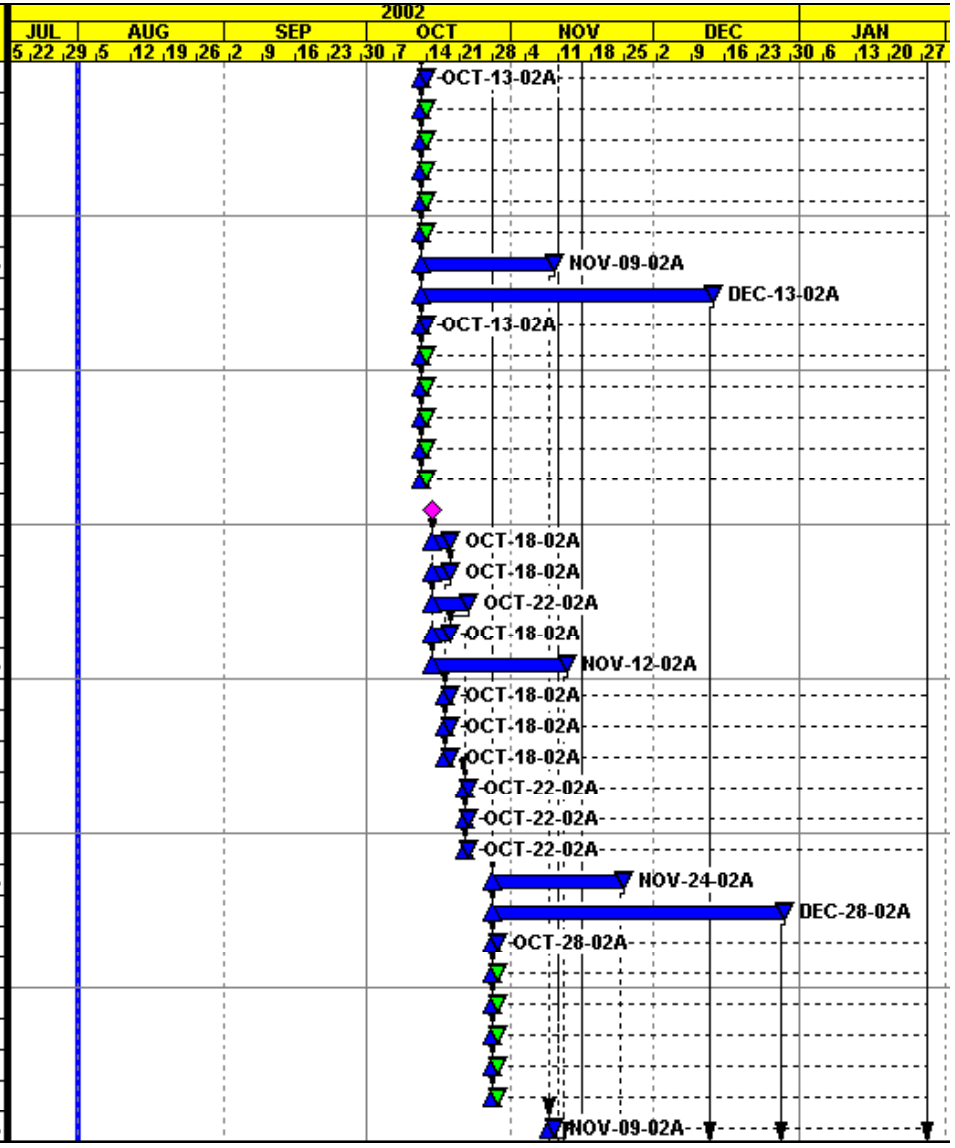


Figure D-1. Schedule for laboratory testing (contd.)

Activity ID	Activity Description	Early Start	Early Finish
DS 341	56 Days Modulus of Elasticity Testing	NOV-09-02A	
DS 342	56 Days UPV Testing	NOV-09-02A	
DS 343	56 Days Permeability Testing	NOV-09-02A	
DS 344	56 Days RCPT Testing	NOV-09-02A	
DS 345	056 Days Absorption Testing	NOV-09-02A	
DS 150	090 Days Strength Testing	NOV-11-02A	NOV-11-02A
DS 151	90 Days Modulus of Elasticity Testing	NOV-11-02A	
DS 152	90 Days UPV Testing	NOV-11-02A	
DS 153	90 Days Permeability Testing	NOV-11-02A	
DS 154	90 Days RCPT Testing	NOV-11-02A	
DS 155	90 Days Absorption Testing	NOV-11-02A	
DS 506	Ambient Laboratory Air (56 Days)	NOV-12-02A	DEC-09-02A
DS 507	Ambient Laboratory Air (90 Days)	NOV-12-02A	JAN-12-03A
DS 530	28 Days Strength Testing	NOV-12-02A	NOV-12-02A
DS 531	28 Days Modulus of Elasticity	NOV-12-02A	
DS 532	28 Days UPV Testing	NOV-12-02A	
DS 533	28 Days Permeability Testing	NOV-12-02A	
DS 534	28 Days RCPT Testing	NOV-12-02A	
DS 535	28 Days Absorption Testing	NOV-12-02A	
DS 250	90 Days Strength Testing	NOV-16-02A	NOV-16-02A
DS 251	90 Days Modulus of Elasticity Testing	NOV-16-02A	
DS 252	90 Days UPV Testing	NOV-16-02A	
DS 253	90 Days Permeability Testing	NOV-16-02A	
DS 254	90 Days RCPT Testing	NOV-16-02A	
DS 255	90 Days Absorption Testing	NOV-16-02A	
DS 440	56 Days Strength Testing	NOV-24-02A	NOV-24-02A
DS 441	56 Days Modulus of Elasticity Testing	NOV-24-02A	
DS 442	56 Days UPV Testing	NOV-24-02A	
DS 443	56 Days Permeability Testing	NOV-24-02A	
DS 444	56 Days RCPT Testing	NOV-24-02A	
DS 445	56 Days Absorption Testing	NOV-24-02A	
DS 540	56 Days Strength Testing	DEC-09-02A	DEC-09-02A
DS 541	56 Days Modulus of Elasticity Testing	DEC-09-02A	
DS 542	56 Days UPV Testing	DEC-09-02A	
DS 543	56 Days Permeability Testing	DEC-09-02A	

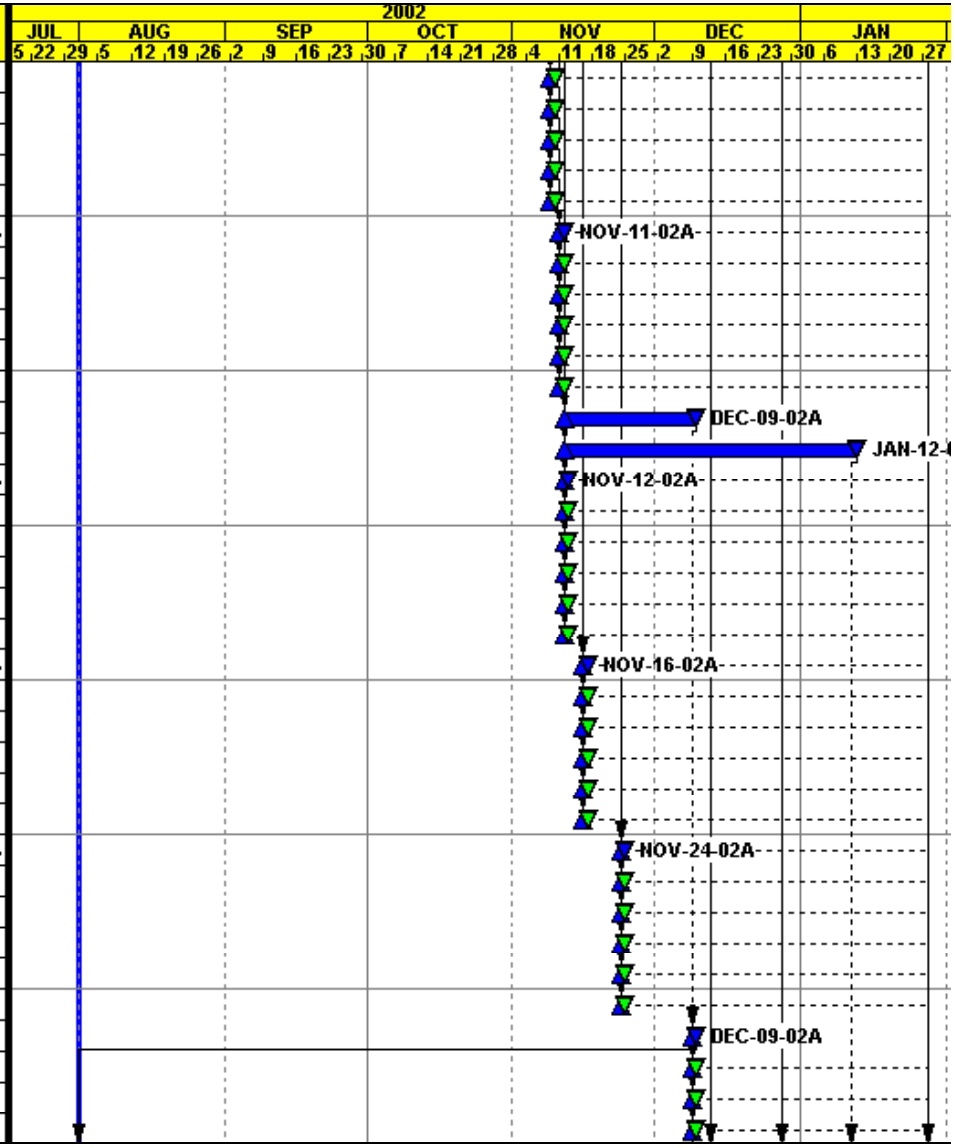


Figure D-1. Schedule for laboratory testing (contd.)

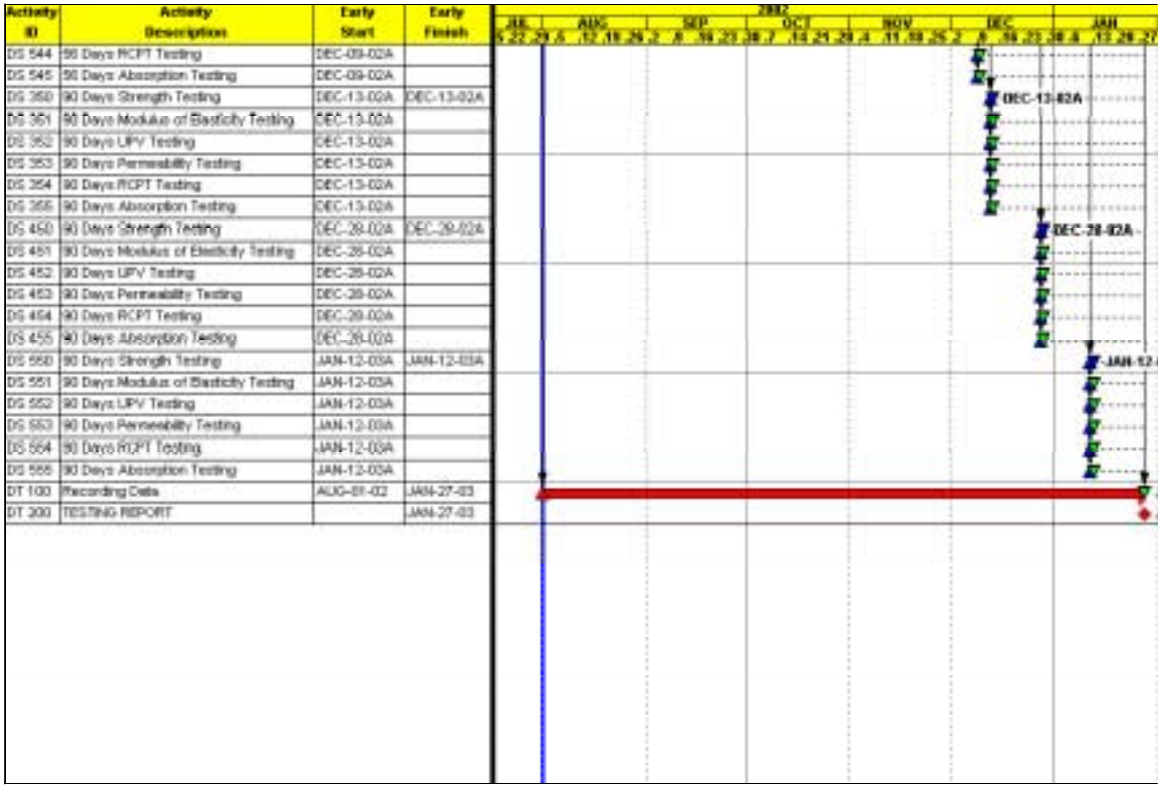


Figure D-1. Schedule for laboratory testing (contd.)

APPENDIX E

Laboratory Data Sheets

Project Name : Investigate Cause & Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks

Test Name :Determination of Air Content of Freshly Mixed Concrete by the Pressure Method

Related Code : (ASTM C231)

Conducted By : _____

Date : _____

Brief Description of Test

- Dampen the interior of measuring bowl and place it on a flat, level, firm surface. Place fresh concrete in three equal layers. Consolidate each layer by rodding (if slump>3 in), by either rodding or vibrating (if 1<slump<3 in), by vibrating (if slump<1 in).
- Strike-off the top surface of concrete and finish it smoothly with a flat strike-off plate using great care to leave the measuring bowl just level full.
- After strike-off clean all excess concrete from the exterior of the measuring bowl (base rim) and cover. Then clamp base rim and cover.
- Open petcocks. Inject water through one petcock until water is expelled from opposite petcock.
- Close air bleeder valve on air chamber. Close petcocks. Pump up air to the marked point on gauge. Wait a few seconds and tap gauge lightly. If necessary add or subtract air to attain reading at the marked point.
- Press needle valve lever to release air into base. Continue pressing lever and lightly tap gauge. Read direct percentage of air.
- Thoroughly clean base, cover and petcock openings with running water.

Measure

A (Air Content, %) = _____

Project Name: Investigate Cause & Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks

Test Name : RCPT Test

Related Code : (ASTM C 1202-91)

Conducted By : _____

Date : _____

_____

_____

Specimen No :_____
Cell No :_____
Diameter (in) :_____
Length (in) :_____
Vacuum Saturation Started :_____
Saturation Ended :_____
Initial Specimen Weight before Saturation (g) :_____
In-water Specimen Weight After Saturation (g) :_____
Surface Dry Specimen Weight After Saturation (g) :_____

Time	Voltage (mV)	Current (Amp)	Temp in NaCl (F)	Temp in NaOH (F)

Project Name: Investigate Cause & Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks

Test Name : Determination of Slump of Concrete

Related Code : (ASTM C143)

Conducted By : _____

Date : _____

_____

Brief Description of Test

- Fill the mold with concrete in three layers of equal volume, (one third of the volume of the mold fills it approximately to a depth of 6.7 cm; two thirds of the volume approximately fills it to a depth of 15.5 cm) each time rodding the layers with 25 strokes of tamping rod evenly distributed on the surface.
- Strike-off the top surface of concrete and finish it smoothly by rolling the damping rod.
- Remove the mold by raising it vertically and put the mold near the concrete.
- Measure the decrease in height to the nearest 6 mm.

_____

Measure

Slump = ____

_____

	Specimen Number	Length 1	Length 2	Length 3	Diameter 1	Diameter 2	Diameter 3
		(inch)					
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							

Project Name: Investigate Cause & Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks

Test Name : Determination of Unit Weight of Concrete

Related Code : (ASTM C138)

Conducted By : _____

Date : _____

Brief Description of Test

- Determine the volume of the measure. (V)
- Determine the mass of the measure. (T)
- Fill the measure with concrete in three layers each time rodding the layers with 25 strokes of tamping rod evenly distributed on the surface. After rodding each layer tap the sides of measure.
- Strike-off the top surface of concrete and finish it smoothly with a flat strike-off plate using great care to leave the measure just level full.
- After strike-off clean all excess concrete from the exterior of the measure.
- Determine the mass of the measure plus its contents. (M)

Measure

V (Volume of measure) = _____

G (Mass of conc. and measure) = _____

T (Mass of measure) = _____

Calculate

M (Unit weight of concrete) = (G-T)/V = ____

Project Name: Investigate Cause & Develop Methods to Minimize Early-age Deck Cracking on Michigan Bridge Decks

Test Name : Absorption Test

Related Code :

Conducted By : _____

Specimen No					
Weight 1 (gr)		**Date**		**Time**	
Weight 2 (gr)		**Date**		**Time**	
Weight 3 (gr)		**Date**		**Time**	
Weight 4 (gr)		**Date**		**Time**	
Dry Diameter (in)	**1**	**2**	**3**		
Dry Length (in)	**1**	**2**	**3**		

Saturation Starts

Weight 5 (gr)		**Date**		**Time**	
Weight 6 (gr)		**Date**		**Time**	
Weight 7 (gr)		**Date**		**Time**	
Weight 8 (gr)		**Date**		**Time**	

Start boiling for 5 hours

Weight after boiling (gr)		**Date**		**Time**	
Weight in water (gr)		**Date**		**Time**	
Saturated Diameter (in)	**1**	**2**	**3**		
Saturated Length (in)	**1**	**2**	**3**		