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16. Abstract CRCP-2 is an ex	tension a	and revis	ion of the CR	CP-1 computer	solution for
the analysis of continuou	sly rein	forced co	ncrete paveme	nt (reported :	n Research
Report NCHRP 1-15). It i	mproves	the profi	ciency and ex	tends the capa	bility of the
original model. Small er	rors in (CRCP-1 fo	r extreme val	ues of variab	e combinations,
such as a high-friction v	alue and	a high s	teel percenta	ge, were remed	ied by extend-
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under the influence of hi	gh frict	ional res	istance might	exceed half	he crack
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the maximum concrete stre	ss under	minimum	temperature i	s compared wit	h the concrete
strength at the time of m	inimum t	emperatur	e occurrence,	thus allowing	for additional
strength gain in the conc	rete. W	heel load	and wheel-lo	ad stress are	included in
CRCP-1 as new design vari	ables for	r when th	e combined ef	fect of the be	nding stress
under wheel load and the	in-plane	stress u	nder environm	ental load are	considered.
Some minor changes were m	ade in t	ne comput	er program.	In order to be	compatible
with the mathematical mod	el. which	n require	s at least on	e increment be	contained in
the bond slip zone, the i	nitial s	lab lengt	h was adjusted	d inside the t	rogram to en-
sure that the increment 1	ength is	within t	olerance limi	ts while main	aining the
dimensional array for the	slab lei	ngth to o	ne hundred in	crements. Thu	s, the computa-
tion time was substantial	ly reduce	ed, and A	rrors at high	-level studies	were elimin-
ated. The revision of th	e CRCP-1	model an	d the inclusion	on of wheel 1	ad, provide
better predictions of the	behavior	r of CRC	pavement. Ho	wever, to full	v portrav the
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CRCP-2, AN IMPROVED COMPUTER PROGRAM FOR THE ANALYSIS OF CONTINUOUSLY REINFORCED CONCRETE PAVEMENTS

by

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James Ma B. Frank McCullough

Research Report Number 177-9

Development and Implementation of the Design, Construction and Rehabilitation of Rigid Pavements

Research Project 3-8-75-177

conducted for

Texas State Department of Highways and Public Transportation

> in cooperation with the U. S. Department of Transportation Federal Highway Administration

> > by the

CENTER FOR HIGHWAY RESEARCH THE UNIVERSITY OF TEXAS AT AUSTIN August 1977

The contents of this report reflect the view of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

PREFACE

This is the ninth report in the series of reports that describes the work done in the project entitled, "Development and Implementation of the Design, Construction, and Rehabilitation of Rigid Pavements," The project is conducted at the Center for Highway Research, The University of Texas at Austin as part of the Cooperative Highway Research Program sponsored by the State Department of Highways and Public Transportation and the Federal Highway Administration.

This report presents the results of an analytical study undertaken to improve the method, CRCP-1, for the computer solution of continuously reinforced concrete pavement.

Our thanks are extended to Dr. W. R. Hudson, member of my graduate supervising committee, who reviewed this report. Special thanks to Mrs. Patricia Henninger for typing the drafts of the manuscript, Charlie Copeland and Randy Wallin concerning the analysis of the computer program. Thanks are also due to Mrs. Marie Fisher and Mr. Art Frakes for their efforts in editing and coordinating the reports preparation.

> James C. M. Ma B. Frank McCullough

August 1977

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LIST OF REPORTS

Report No. 177-1, "Drying Shrinkage and Temperature Drop Stresses in Jointed Reinforced Concrete Pavement," by Felipe R. Vallejo, B. Frank McCullough, and W. Ronald Hudson, describes the development of a computerized system capable of analysis and design of a concrete pavement slab for drying shrinkage and temperature drop. August 1975.

Report No. 177-2, "A Sensitivity Analysis of Continuously Reinforced Concrete Pavement Model CRCP-1 for Highways," by Chypin Chiang, B. Frank McCullough, and W. Ronald Hudson, describes the overall importance of this model, the relative importance of the input variables of the model, and recommendations for efficient use of the computer system. August 1975.

Report No. 177-3, "A Study of the Performance of the Mays Ride Meter," by Yi Chin Hu, Hugh J. Williamson, B. Frank McCullough, and W. Ronald Hudson, discusses the accuracy of measurements made by the Mays Ride Meter and their relationship to roughness measurements made with the Surface Dynamics Profilometer. January 1977.

Report No. 177-4, "Laboratory Study of the Effect of Non-Uniform Foundation Support on CRC Pavements," by Enrique Jimenez, W. Ronald Hudson, and B. Frank McCullough, describes the laboratory tests of CRC slab models with voids beneath them. Deflection, crack width, load transfer, spalling, and cracking are considered. Also used is the SLAB 49 computer program that models the CRC laboratory slab as a theoretical approach. The physical laboratory results and the theoretical solutions are compared and analyzed and the accuracy is determined. (Being prepared for submission)

Report No. 177-5, "A Comparison of Two Inertial Reference Profilometers Used to Evaluate Airfield and Highway Pavements," by Chris Edward Doepke, B. Frank McCullough, and W. Ronald Hudson, describes a United States Air Force owned profilometer developed for measuring airfield runway roughness and compares it with the Surface Dynamics Profilometer using plotted profiles and mean roughness amplitude data from each profilometer. Preliminary, March 1976.

Report No. 177-6, "Sixteenth Year Progress Report on Experimental Continuously Reinforced Concrete Pavement in Walker County," by Thomas P. Chesney and B. Frank McCullough, presents a summary of data collection and analysis over a 16-year period. During that period, numerous findings resulted in changes in specifications and design standards. These data will be valuable for shaping guidelines for future construction. April 1976.

Report No. 177-7, "Continuously Reinforced Concrete Pavement: Structural Performance and Design/Construction Variables," by Pieter J. Strauss, B. Frank McCullough, and W. Ronald Hudson, describes a detailed analysis of design, construction, and environmental variables that may have an effect on the structural performance of a CRCP. May 1977. Report No. 177-8, "Continuously Reinforced Concrete Pavement: Prediction of Distress Quantities," by John P. Machado, B. Frank McCullough, and Hugh J. Williamson, presents a general analysis of environmental, design, construction and historic pavement behavior conditions and their effects on future performance. (Being prepared for submission)

Report No. 177-9, "CRCP-2, An Improved Computer Program for the Analysis of Continuously Reinforced Concrete Pavements," by James Ma and B. Frank McCullough, describes the modification of a computerized system capable of analysis of a continuously reinforced concrete pavement based on drying shrinkage and temperature drop. Preliminary, August 1977.

ABSTRACT

CRCP-2 is an extension and revision of the CRCP-1 computer solution for the analysis of continuously reinforced concrete pavement (reported in Research Report NCHP 1-15). It improves the proficiency and extends the capability of the original model. Small errors in CRCP-1 for extreme values of variable combinations, such as a high-friction value and a high steel percentage, were remedied by extending the original steel stress model to cover situations where development length under the influence of high frictional resistance might exceed half the crack spacing. The stress-strength interaction model in CRCP-1 has been revised such that the maximum concrete stress under minimum temperature is compared with the concrete strength at the time of minimum temperature occurrence, thus allowing for additional strength gain in the concrete. Wheel load and wheel-load stress are included in CRCP-1 as new design variables for when the combined effect of the bending stress under wheel load and the in-plane stress under environmental load are considered.

Some minor changes were made in the computer program. In order to be compatible with the mathematical model, which requires at least one increment be contained in the bond slip zone, the initial slab length was adjusted inside the program to ensure that the increment length is within tolerance limits while maintaining the dimensional array for the slab length to one hundred increments. Thus, the computation time was substantially reduced, and errors at high-level studies were eliminated.

The revision of the CRCP-1 model and the inclusion of wheel load, provide better predictions of the behavior of CRC pavement. However, to fully portray the state-of-stress in a slab, fatigue due to repetitions of load and warping stress due to temperature differential need to be considered.

KEY WORDS: continuously reinforced concrete pavement, external load, internal load, CRCP-1 program, CRCP-2 program, development length, steel stress model

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SUMMARY

The CRCP-1 method, developed in Ref 5, provides a useful tool for the analysis of temperature and shrinkage effects on continuously reinforced concrete pavements. Certain modifications of the CRCP-1 method were made in this study to increase the proficiency and to extend the capability of this method. The age-tensile strength model was extended to cover conditions in which the drop to minimum temperature was delayed. For high frictional subbase, the steel stress model was extended to cover conditions in which the bond length exceeds one-half the crack spacing. The wheel-load stress was combined with the internal load caused by temperature drop and drying shrinkage to obtain a better prediction of crack spacing in field conditions.

The inclusion of wheel-load stress with internal stress was accomplished by superimposing the tensile stress at the bottom fibre, computed by the Westergaard equation for a single-concentrated vertical load, an the airplane tensile stress across the depth of the slab, computed by the CRCP-1 method. \$ ÷

IMPLEMENTATION STATEMENT

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The CRCP-2 computer program developed in this study can be used to determine the combined effect of external loads and internal loads on a continuously reinforced concrete pavement. In addition, the modification of the mathematical model, as well as the computer program, makes it possible to analyze a CRC slab under the influence of high-level parameters; the new program should be used in lieu of the original CRCP-1 program for extreme values of variable combinations. For instance, the analysis of a CRC pavement laid over a treated base with high frictional resistance, the analysis of high percentage steel, the analysis of high temperature drop, or any combination of the above conditions can be made only by the revised, CRCP-2, program. L . ٠

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NOMENCLATURE

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Symbol	Units	Definition
а	inch	Radius of the tire contact area
Ac	in ²	Area of concrete
As	in ²	Area of steel
Ъ	in	Development length
D	in	Slab thickness
Ec	psi	Modulus of elasticity of concrete
Es	psi	Modulus of elasticity of steel
Fcm	lbs	Concrete force between cracks
F _i	1b/in ²	Friction force for a dx element
Fsc	lbs	Steel force at the crack
F sm	lbs	Steel force between cracks
f' _{cx}	psi	Compressive strength of concrete at x days
f'28th day	psi	Compressive strength of concrete at 28th day
f' _{tx}	psi	Tensile strength of concrete at x days
k	lb/in ² /in	Modulus of subgrade
l	in	Radius of relative stiffness
L	in	Half the slab length
p	percent	Percentage steel
Р	lbs	Applied wheel load
μ	1b/in ²	Nominal bond stress
U	lb/in	Bond force per unit length

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Symbol	Units	Definition
x	days	Number of days in between from the time when pavement was built to the time when minimum temperature was reached
Z	in/in	Total shrinkage strain
α _c	in/in/°F	Thermal coefficient of concrete
α _s	in/in/°F	Thermal coefficient of steel
Y	in	Movement of concrete slab
$\Delta \mathbf{T}$	°F	Change in temperature
Δx	in	Crack width
Ø	in	Steel bar diameter
εcz	in/in	Shrinkage strain of concrete due to restraint of steel
[€] c∆t	in/in	Concrete strain due to temperature drop
ິ <mark>sz</mark>	in/in	Shrinkage strain of steel due to contraction of concrete
[€] s∆t	in/in	Steel strain due to temperature drop
ε _o	in	Steel bar perimeter
σ _{cm}	psi	Concrete stress between the cracks
σ _{cz}	psi	Shrinkage stress of concrete
σ _{cst}	psi	Concrete stress due to temperature drop
σ_{i}	psi	Interior wheel-load stress
σ sc	psi	Steel stress at the crack
σ sm	psi	Steel stress between the crack
σ sz	psi	Shrinkage stress of steel
σ s∆t	psi	Steel stress due to temperature drop
u		Poissons ratio

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CHAPTER 1. INTRODUCTION

BACKGROUND

The rational approach to pavement design is based on the use of the mechanics of the materials and the structural equilibrium of the system to predict the behavior of the pavement. The rational approaches developed for rigid pavements can be categorized into three groups: first, the theory that deals with the stress in the slab under wheel load; second, the stress in the slab induced by environmental factors; and, third, fatigue or repeated load effects.

Stress in the Slab Under Wheel Load

The earliest attempt to predict the behavior of rigid pavement was made in 1920. By assuming zero support near the corner, Goldbeck approximated the stress in the slab under wheel load in his corner formula (Ref 1). In 1926, H. M. Westergaard (Ref 2) used Timoshenko's plate equations to develop a slab on foundation solution for edge, interior, and corner loading conditions. In 1956, Turner et al introduced the finite element method and started a new trend in structural analysis which is characterized by its heavy reliance on high-speed computers (Ref 3). Most recently, Hudson and Matlock introduced the discrete element method, which is a very powerful method for the analysis of stress on rigid pavements (Ref 4). The slab in the discrete element model was beams, to represent bending stiffness, and torsional bars, to represent torsional stiffness. The support media was represented by the spring constant k equal to the modulus of subgrade described in Westergaard's equations.

Stress Induced by Environmental Factors

In the area of environmental design, a continuously reinforced concrete pavement (CRCP) model was developed which can be used to predict the in-plane stress in the slab caused by drying shrinkage and temperature drop (Ref 5).

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In that model, CRCP-1, the movement, or the summation of concrete strains along the slab, is fitted to a friction-movement curve of a particular type of supporting soil to determine the frictional force acting on the pavement. The concrete stress then is the equilibrium force needed to balance the frictional resistance of the soil, plus the steel restraint of the reinforcement. One unique feature in the CRCP design method is that the age-strength function of the concrete slab is used in the model to follow-through the formation of cracks each time the internal stress exceeds the tensile strength of the concrete.

In addition to the change in average temperature along the slab, the warping stress cuased by the temperature differential across the depth of the slab should also be considered. In 1940, Thomlinson extended Westergaard's equation to predict the warping stress of rigid pavements (Ref 6). Both Westergaard and Thomlinson assumed full support beneath each slab, and their analysis was later modified by Teller and Sutherland (Ref 7) to account for the loss in support along the edges. Also, computer programs to compute stress, deflection, and loss in support caused by this warping effect were written by Harr and Leonards (Ref 8).

Repeated Load Effects

In fatigue design, the progressive structural damage in the concrete slab caused by repeated loads is emphasized. Due to the difference in material behavior between the slab and the subgrade, where one may be elastic while the other may be plastic under repeated load, the rational approach to fatigue design is quite complex. Very limited research has been done in this area, and fatigue design still has to rely heavily on other empirical solutions.

THE PROBLEM AND THE STUDY OBJECTIVES

There are two major advantages to the development of rational theories. Different modes of failures and different types of pavement behavior can be studied more closely with these theories. Second, due to tremendous cost involved, only limited road tests can be performed. To cover other environments and other conditions, rational analysis can be used to extend the findings indicated in these road test for pavement design.

2

In earlier discussions, several rational techniques, each dealing with specific problems, were briefly reviewed. Although the severity of distress due to any particular cause can be analyzed using these theories, pavement behavior under the combined effect of all factors is not known.

The objectives in this study were three-fold:

- (1) To extend the CRCP-1 design method, which considered only the effect of temperature drop and drying shrinkage, to include wheel-load stress at the mid-slab, which will lead to better prediction of the stress development and crack spacing of continuously reinforced concrete payment under field conditions.
- (2) To modify the steel-stress model used in CRCP-1 to cover conditions in which the development length of the steel bar exceeds one-half the crack spacing. When high friction values are used in the analysis, the crack spacings may be reduced to such short lengths that the distance required for the bond between steel and concrete to fully develop may exceed them. When such a case arises, computer program CRCP-1 and the theoretical models are no longer valid. To cover such conditions, a new set of equations must be developed and added to the CRCP-1 program.
- (3) To compare the stress caused by the minimum temperature drop with the tensile strength of the concrete at the time when the minimum temperature occurs and not with the earlier 28th day strength, since concrete strength continues to increase after it reaches its early strength. This is particularly significant when the pavement is built in summer and the temperature will not reach the minimum until a few months later. The CRCP-1 program needs to be revised to account for this increase in tensile strength before the occurrence of a severe cold temperature.

The inclusion of external load and the modifications of the mathematical models as well as the computer program resulted in a revised version of CRCP-1, which is designated as CRCP-2.

SCOPE OF THE STUDY

This study expands and modifies computer solution CRCP-1. The addition of new equations to acheive the objectives resulted in the addition of several new variables to the CRCP-1 design method. The variables used in the CRCP-1 program and the additional variables used in the CRCP-2 are listed in Tables 1.1 and 1.2, respectively.

The report covers the development of the equations for inclusion in the design method. Chapter 2 discusses the theoretical model used in CRCP-1 design method and the wheel-load stress and the combined effect of external and internal loads. Chapter 3 discusses the modification of the age-concrete

Symbol	Definition	Units
ITPYER	Types of reinforcement either deformed bar or deformed wire fabric	
. P	Percent reinforcement	percent
Ø	Bar diameter	inches
fy	Steel yield stress	lb/in ²
E	Steel modulus	lb/in ²
a	Thermal coefficient for steel	in/in/°F
BHIGH	Transverse wire spacing	inches
D	Slab thickness	inches
ac	Thermal coefficient for concrete	in/in/°F
Z	Drying shrinkage strain	in/in
UNWT	Unit weight of concrete	lb/in ³
FPC	28th day compressive strength	lb/in ²
F(I), Y(I)	Friction-movement relation- ship between the slab and the subbase	lb/in ² , in
CURT	Curing temperature	°F
TD	Minimum daily temperature	°F
DTMAX	Minimum temperature expected after concrete gain full strength	°F
MAXITE	Maximum number of interactions	
TOL	Relative closure tolerance	percent

TABLE 1.1. DESIGN VARIABLES USED IN CRCP-1 PROGRAM

 Symbol	Definition	Units
WHLSTR	Wheel load stress	lb/in ²
WHLOAD	Wheel load	1b
WHBASE	Wheel base radius	inches
SOILK	Modulus of subgrade	lb/in ² /ir
TMLOD	Number of days after concrete is set before wheel load is applied	days
COLDTM	Number of days after concrete is set before minimum temper- ature occurs	days
COLDSTN	Concrete strength at the time when minimum temperature occurs	psi

TABLE 1.2. ADDITIONAL VARIABLES IN CRCP-2 PROGRAM

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. • strength model in CRCP-1 to account for the gain in strength between the 28th day and the occurrence of the minimum temperature. Modification of the steel-stress model to cover the condition in which development length exceeds one-half the crack spacing is discussed in Chapter 4. Chapter 5 describes sample problems used to demonstrate the application of the new design variables in CRCP-2. Chapter 6 summarizes the report and presents recommendations for implementation and additional development.

CHAPTER 2. DRYING SHRINKAGE, TEMPERATURE DROP, AND WHEEL-LOAD STRESS IN CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

BACKGROUND

The dimensional changes in a continuously reinforced concrete pavement caused by drying shrinkage of the concrete and temperature variation after curing were investigated and design method CRCP-1 was developed in the study described in Ref 5. The theoretical model was based on the material properties, stress, strain interaction between steel, concrete, subgrade, and the internal forces caused by the temperature drop and shrinkage of the slab.

Figures 2.1 and 2.2 show the geometric model used to develop the basic equations for the CRCP-1 design method. Due to the accumulated friction and the terminal treatments used in the construction, the slab model assumes an anchorage at each end so that the pavement within the anchorages will maintain a fixed length.

The difference in the thermal coefficients of steel and concrete together with the drying shrinkage of concrete enable us to determine the internal stress in the reinforced slab. With the friction movement characteristic of the slab and the soil, the degree of restraint of the supporting medium can be estimated. By establishing equilibrium in the system, the stress of one material can be correlated to the stress of the adjacent materials. Finally, the crack spacing is determined by comparing concrete stress with concrete strength at each time interval.

In the development of the model, the following assumptions were made:

- (1) A crack occurs when the concrete stress exceeds the concrete strength, and, after cracking, the concrete stress at the location of the crack is zero.
- (2) The concrete and steel properties are linearly elastic.
- (3) In the fully bonded sections of the concrete slab, there is no relative movement between the steel and the concrete.
- (4) The force displacement curve which characterizes the frictional resistance between the concrete slab and the underlying base is elastic.

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(b) Section AA

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Fig 2.1. Full length of a continuously reinforced concrete pavement (Ref 5).

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- (5) Temperature variations and shrinkage due to drying are uniformly distributed throughout the slab, and hence, a one-dimensional axial structural model is adopted for the analysis of the problem.
- (6) Material properties are independent of space.
- (7) The effect of creep of concrete and slab warping are neglected.

PRIMARY CONCEPTS

The mechanistic behavior of the CRCP-1 can be summarized briefly in the following paragraphs...

Steel and Concrete Interaction

In the fully bonded section of a continuously reinforced concrete pavement, the total change in length in the concrete will be the same as the change in length of the steel. Thus, the difference in the thermal coefficients of expansion and contraction for the steel and the concrete plus the drying shrinkage of the concrete results in a steel and concrete strain history that may be modeled by a mathematical relationship. By converting strains into stress based on their individual modulus of elasticity, the stress history of the concrete can be written as the function of the stress history of the steel.

Steel Boundary Conditions

The total length of the pavement within the fictitious anchorages is fixed, which implies that the integrals of the steel strains along the slab or the sume of the area under the steel strain diagram will equal the pavements shortening. The steel stress at any point can be written as a function of the steel stress at any other location along the slab.

Equilibrium

Figures 2.3 and 2.4 show a free-body diagram for the CRCP-1 model. By summing all the forces, the steel and the concrete stresses between the cracks will be balanced by the sum of the steel stresses at the crack and the frictional resistance between the slab and the base.



Fig 2.3. Forces in CRCP free-body diagram (Ref 1).



Fig 2.4. Free-body diagram of an element in CRCP-1 model (Ref 5).

By converting the concrete stresses between the cracks into functions of steel stress as described earlier, the steel stress and subsequently the concrete stress and slab movement can be readily calculated, provided that the frictional resistance is known. The frictional resistance, however, is not a constant force because it depends on the magnitude of the movement of the slab, and the larger the movement, the larger the resulting frictional force. Since the movement of the slab is its length times the total strain, and the stress of the concrete and steel must be solved in order for the strain to be known, an interactive process that involves the following steps (Fig 2.5) is therefore needed to solve the friction force and stresses in the slab:

- Assume zero friction and solve for the strain of concrete along the slab.
- (2) Sum the strains and solve for the movement of the slab, Y_1 .
- (3) Use a friction-movement curve, obtained through laboratory experiments, to locate the frictional force, F_2 , that corresponds to the movement found in step 2.
- (4) Reenter the frictional force from step 3, F_2 , into the basic equations and solve for movement, Y_2 .
- (5) Reenter Y_2 into the F-M curve and solve for F_3 .
- (6) Use F_4 , the average of F_2 and F_3 , to solve for Y_{4c} with the basic equations and Y_{4e} by using the F-M curve.
- (7) If Y_{4c} is greater than Y_{4e} , F_5 will be equal to $(F_2 + F_4)/2$, and if Y_{4c} is smaller than Y_{4e} , F_5 will be equal to $(F_3 + F_4)/2$.
- (8) Returning to step 6, use the new frictional force until the movement solved from the equations falls within the tolerance range of the movement obtained from the F-M curve.
- (9) Use the final frictional force to solve for the steel stress at the crack and the concrete stress at the mid-slab.

INCLUSION OF WHEEL-LOAD STRESS

When a crack occurs, the tension that was carried by the concrete will be taken up by the steel. The concrete stress will, therefore, be zero at the crack and increase to its maximum in tension at the mid-slab. This high tension stress at the mid-slab is the result of the accumulated frictional resistance of the base plus the restraint on concrete contraction by the steel.



Fig 2.5. Binary search technique as applied to frictional resistance-movement curve (Ref 5).

If the warping effect due to the temperature variance is set aside, the tensile stress due to the internal forces will be uniformly distributed across the depth of the slab (Fig 2.6b). Maximum of this tensile stress will, theoretically, be near the mid-point between a pair of cracks where the highest frictional resistance is accumulated. The stress due to external force on the other hand will be in compression on the top fibre and in tension on the bottom fibre (Fig 2.6c). The highest combined stress due to both external and internal forces will then be at the bottom fibre of the slab and at the mid-point between two cracks. Figure 2.6d shows the stress diagram for the wheel load stress superimposed with the tensile stress at mid-slab caused by drying shrinkage and temperature drop, in which

$$\sigma_{\text{TOT}} = \sigma_{\text{INT}} + \sigma_{\text{EXT}}$$

where

σ _{TOT}	=	combined external and internal stresses,
σINT	-	tensile stress caused by drying shrinkage and temperature drop, and
σ _{EXT}	=	tensile stress at the bottom fibre of the slab under wheel load.

New cracks will form when $\sigma_{\rm TOT}$ exceeds the tensile strength of the concrete. After new cracks have developed, the external load will be moved to a new position, the mid-point between the newly developed crack and an adjacent crack. This process continues until equilibrium is established.

The inclusion of wheel-load stress in the CRCP-2 computer program is briefly summarized in the flow diagram in Fig 2.7.

The tensile stress due to the external load will be solved in the CRCP-2 computer program, using Westergaard's equation for interior loading. The user may choose, however, to solve the wheel-load stress by some other means. An option is available in the program in which either the wheel load in pounds or the wheel load stress in pound per square inch can be inputted.



(a) Side view of CRCP geometric model.

drop and shrinkage.



shrinkage, temperature and wheel-load stress.

Fig 2.6. Stress diagram of concrete at the center of the slab due to wheel loads and volume changes.


Fig 2.7. Flow diagram for CRCP-2.

STRESS IN SLAB DUE TO WHEEL LOAD

Steel reinforcement in continuous pavements is not designed to carry tensile stress at the bottom when wheel load is applied. In fact, most steel bars in the existing rigid pavements are placed at the mid-depth of the slab to keep cracks tightly closed so that the time for the water to seep through is greater than the surface runoff time, thus preventing passage of water from the surface to the subgrade. When steel bars are placed at the neutral surface or mid-depth, the compression on the top fibre and the tension on the bottom fibre of a reinforced slab will be the same as for the nonreinforced slab. Several methods available for the analysis of a concrete slab under wheel load are discussed in the following sections.

Westergaard Interior Equation

The Westergaard equation for interior loading may be used here to predict the tensile stress at the bottom fibre of the slab (Ref 2). The resistance to deformation of the slab under wheel load depends upon the relative stiffness of the supporting media and the slab; the stiffer the slab and the weaker the subgrade, the greater is the stress. Westergaard defined the relative properties of these two materials as radius of relative stiffness, in which

$$\ell = \frac{4}{\frac{E_c D^3}{12(1-\mu^2)k}}$$

where

- E_{c} = modulus of elasticity of the concrete slab (lb/in²),
- D = thickness of the slab (inches),
- μ = Poissons ratio, and
- k = modulus of subgrade reaction $(lb/in^2/in)$;

and tensile stress at the bottom of the slab for interior loading, in which

$$\sigma_i = 0.3162 \frac{P}{D^2} [\log_{10}(D^3) - 4 \log_{10} a - \log_{10} k + 6.478]$$

where

- a = radius of the tire contact area (inches) and
- P = applied load (pounds).

If the assumption is made that plane cross-sections remain plane and perpendicular to the neutral surface during loading, the theory of elasticity leads to the conclusion that the peak moment and, thus, the peak tensile stress at the bottom of the slab, are infinite. However, if we take into account the deformation due to local stress in the immediate neighborhood of a concentrated load, the above assumption cannot be made and the tensile stress at the bottom fibre of the slab will be rounded off. Computation according to Nadai's analysis (Ref 9), shows that the stress can be found using the special theory which considers local stress at the point of loading if the radius, a , of the above equation is replaced by an equivalent radius, b , in which

$$b = \sqrt{1.6a^2 + D^2} - 0.675D$$

for a < 1.724D

and

$$b = a$$

for $a \ge 1.724D$

The tensile stress at the bottom for interior loading when a is less than 1.724D becomes

$$\sigma_{i} = 0.3162 \frac{P}{D^{2}} [\log_{10} (D^{3}) - 4 \log_{10} (\sqrt{1.6a^{2} + D^{2}} - 0.675D) - \log_{10}k + 6.478]$$

Discrete Element

Several computer programs were developed to solve the wheel-load stress of the slab. The discrete-element method developed by Hudson and Matlock is a very powerful analytical tool for prediction of stresses in concrete slab (Refs 4 and 11). This method was based on the biharmonic equation (Ref 12), which states that the fourth order differential of deflection times the stiffness is equal to the load applied. This fourth order differential was solved by the central-differential approximation in which the differential of deflection is the change of deflection between adjacent stations divided by the distance between those stations. To obtain the stiffness of the system, the slab was replaced by x-bars and y-bars to simulate bending stiffness, torsional bars to simulate torsional stiffnesses, and elastic joints to connect the whole system together. Due to the large number of simultaneous equations that relate the relative forces which acted on each element, a direct matrix manipulation technique (Ref 10) was employed to obtain the deflection at each joint.

Two approaches are recommenced to compute the wheel-load stress for the CRCP-2 computer program. First, to solve the wheel-load stress internally using Westergaard's equation for interior loading, the user needs only to input the magnitude of the wheel load, in pounds, wheel base radius, and modulus of subgrade. The selection of Westergaard's equation was made for the following reasons: (1) it is easy to apply, the solution obtained will be the tensile stress directly under the wheel load, (2) the computational time required is minimal, and (3) it is the most reliable closed form solution available. Tests were run on concrete slabs in the laboratory, and it was concluded that the values derived from Westergaard's theoretical formula correlate closely with the actual test values (Refs 15 and 16).

The second approach is to solve the wheel-load stress externally and input the maximum concrete tensile stress obtained into the CRCP-2 program. For edge loads, the tensile stress can be obtained using Westergaard's equation for edge loadings. For pavements that have nonuniform slab thicknesses or nonuniform soil supports, the tensile stress under wheel load can be solved by the discrete element method. This open form solution allows us to consider voids underneath the pavement. Also, cracks can be modeled by reducing bending stiffness along the crack (Ref 13). To use this method, it is necessary to investigate the load transfer between cracks, which includes (1) aggregate interlock, (2) shear resistance by steel reinforcement, and (3) moment transfer if the crack width is small enough for the slab on each side to make contact. Concepts for modeling the load transfer at the crack are still being developed and it is recommended they be considered for future studies (Chapter 6).

Note that neither approach mentioned above considered the fatigue of the concrete slab due to repetitive loadings. A safety factor is needed in these approaches when they are used for design.

EFFECT OF EXTERNAL LOAD

A series of problems with input parameters, listed in Table 2.1, was solved using the CRCP-2 program to investigate the combined effect of both the external and the internal forces on the performance of continuously reinforced concrete pavement. A series was developed to study the effect of wheel load stress on the crack spacings of a CRC pavement. The results are plotted in Fig 2.8. In the B series, the effects of wheel-load stress on crack width, crack spacing, and steel and concrete stress are examined and illustrated in Fig 2.9. With different steel percentages, the C series allows for individual examination of the crack spacing, the crack width, and the steel and the concrete stresses, with and without wheel-load stress. The results are plotted in Figs 2.10 to 2.13. The D series shows the effect of wheel load applied on slab with different thicknesses. The E series gives an indication of the effect of wheel load on CRC pavement applied at various ages after the placement of the slab.

Figure 2.8 shows the change of crack spacing with time for four different magnitudes of external loads. The loads were applied on the 28th day, and there is no effect on the behavior of the pavement before that time. The addition of bending stress in the slab under external load to the existing internal force from restrained pavement volume changes leads to higher tensile stress and cause new cracks to form. As shown in the figure, the final crack spacing decreases as the magnitude of the external load increases. The decrease in the final crack spacing will cause other variables in a CRC pavement to change, as is illustrated in the following problem series.

Figure 2.9 is a composite figure to show the effect of wheel-load stress on the behavior of various variables in a CRC pavement. As shown in the figure, the final crack spacing decreases when heavier external loads were applied. The reduction in crack spacing lessens the amount of frictional resistance between the slab and the subgrade because the contact area is reduced. Subsequently, the crack width and the forces transmitted to the

		Problem Series				
Steel Properties	1A 2A 3A 4A	1B 2B 3B 4B 5B 6B	1C 2C 3C 4C 5C 6C 7C 8C	1D 2D 3D 4D 1E 2E 3E		
P (percent)	1.0	0.5	0.5 0.7 0.9 1.2 0.5 0.7 0.9 1.2	0.7 1.0		
ø (in)	0.5	0.6	0.6	0.6 0.5		
fy x 10 ⁴ (рві)	6.0	6.0	6.0	6.0 6.0		
Е _д x 10 ⁷ (рві)	E _a x 10 ⁷ (psi) 2.9		2.9	2.9 2.9		
$\alpha_{c} \times 10^{-6} (in/in/F)$	5.0	5.0	5.0	5.0 5.0		
Concrete Properties						
D (in)	10.0	10.0	10.0	6.0 8.0 10.0 12.0 10.0		
$\alpha \times 10^{-6} (in/in/{}^{\circ}F)$	5.0	5.0	5.0	5.0 5.0		
$z^{c} \times 10^{-4}$ (in/in)	4.0	4.0	4.0	4.0 4.0		
Y x 10 ² (pcf)	1.5	1.5	1.5	1.5 1.5		
fc x 10 ³ (psi)	6.0	6.0	6.0	5.0 6.0		
Temperature Data						
Curing Temp (°F)	75.0°	75.0°	75.0°	70.0° 75.0°		
Minimum 1st - 10th	Minimum 1st - 10th 65.0°		50.0°	65.0° 65.0°		
Daily 11th - 16th	50.0°	50.0°	50.0 [°]	6 5 .0° 65.0°		
Temp (^o F) 17th - 28th	Temp (°F) 17th - 28th 50.0°		50.0°	55.0° 65.0°		
Minimum Temp (°F) 40.0°		40.0°	40.0°	30.0° 40.0°		
COLDTM (Days)	90.0	90.0	90.0°	90.0 90.0		
Friction						
Fi (psi)	1.0	1.0	1.0	1.0 1.0		
Y (in)	-0.1	-0.1	-0.1	-0.1 -0.1		
External Load						
Wheel Load x 10 ³ (1bs)	* * * *	* * * * * *	0 0 0 0 * * * *	9.0 9.0 9.0 9.0 * *		
Wheel Load Stress (psi)	0 50 150 200	0 50 100 150 200 250	0 0 0 0 100 100 100 100	287.6 179.2 121.9 88.01 200 200 20		
Time Applied (Days)	28 28 28	28 28 28 28 28 28 28	28 28 28 28 28 28 28 28 28	28 28 28 28 7 15 28		

TABLE 2.1. INPUT PARAMETERS FOR TESTING THE COMBINED EFFECT OF EXTERNAL LOAD AND ENVIRONMENTAL STRESSES

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*Option of inputting stress due to wheel load used. 1 inch = 2.54 cm 1 psi = .070454 kg/cm 1 pcf = .00001605 kg/cm 1°F = $(9/5) \times °C + 32°$

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Fig 2.8. A-Series crack spacing under different wheel load stresses applied on 28th day versus time solved by CRCP-2 program.

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Fig 2.9. B-Series external load versus crack spacing, crack width, steel stress and maximum concrete stress at the end of analysis period, solved by CRCP-2 program.



Fig 2.10. C-Series percent steel versus final crack spacing with and without external load solved by CRCP-2 program.



Fig 2.11. C-Series percent steel versus final crack width with and without external load solved by CRCP-2 program.



Fig 2.12. C-Series percent steel versus final concrete stress with and without external load solved by CRCP-2 program.



Fig 2.13. C-Series percent steel versus final steel stress with and without external load solved by CRCP-2 program.

steel from the reduced restraint also decrease. The final concrete stress is more or less a straight line for different magnitudes of external loads. This phenomenon will be disucssed further later on.

Results from this problem series show that the addition of external load reduces both the steel stress and the crack width in CRC pavement by forcing more cracks to develop. The reduction of these two variables can be favorable for the design as long as the crack spacing is maintained at an acceptable level.

The steel reinforcement in a continuously reinforced concrete pavmeent does not prevent cracking. On the contrary, it induces cracks because the volume change in the concrete is restrained by the steel bars and because of the subgrade friction. However, steel in the slab also keeps the cracks tightly closed. In Fig 2.10, increase in steel percentages in the slab was associated with decrease in crack spacing and with even smaller crack spacing when external load was applied. The reduction of crack spacing in turn caused the crack width and the steel stress to decrease, as shown in Fig 2.11 and 2.13.

The final concrete stresses plotted in Fig 2.12 do not show a trend. Increase in steel percentage caused the concrete stress to increase and then decrease. The difference in concrete stress between the slab that had wheel load applied to it and the slab without wheel load is large at one point and small at the other. This shows that the concrete stress does not depend solely on the steel percentage or the magnitude of wheel load. The final concrete stress is primarily controlled by the final state of stress in the slab and the crack spacing that the CRC pavement eventually stabilized with. If, for instance, before any external load is applied the internal forces caused by drying shrinkage and temperature drop alone have created enough tension in the slab for the concrete to be on the point of breaking, the addition of external load will result in an even larger tensile stress in the concrete and cause new cracks to form. On the other hand, as new cracks develop, the crack spacing will be one half the length as before, which relieves some of the internal tensile stress present when the crack spacing was larger. The final concrete stress, therefore, may actually be the same as before any external load was applied.

The effect of slab thickness on the performance of CRC pavement under 9000-pound (4091-kg) wheel load is plotted in Fig 2.14. Since a greater slab thickness is accompanied by an increase in the slab's cross-sectional area the concrete stress per unit area due to external load decreases as slab thickness increases. For the external loads, the increase in slab thickness increases the stiffness of the slab, thus reducing the bending stress in the concrete. Consequently, in order to achieve equilibrium, the net reduction of concrete stress permits the crack spacing to be kept greater for thicker slabs. The increase in crack spacing causes both the steel stress and the crack width to increase, as shown in Fig 2.14.

The results of an application of external loads at various ages after the placement of the slab are plotted in Fig 2.15; note that cracks start to develop immediately when 200 psi of external load is applied. The final crack spacings however are not affected by the time of load application.

The input data for the above analysis are shown in Appendix 3.

SUMMARY

A series of problems are solved using CRCP-2 to test the effect of wheel load on continuously reinforced concrete pavement. Either the wheel loads are input in pounds and the stresses solved by Westergaard's equation within the program or the wheel-load stress is solved externally and input directly into the program.

The results from this study show that

- Increase in wheel-load stress will reduce crack width, crack spacing, and steel stress.
- (2) Increase in steel percentage will reduce crack width, crack spacing, and steel stress with or without wheelload stress.
- (3) An increase in slab thickness will increase the crack width, the crack spacing, and the steel stress. This shows that the design for the slab thickness and the steel reinforcement as indicated in (2) counteract with each other, therefore must be balanced properly to ensure that the limiting criterias for the crack width, the crack spacing and the steel stress are satisfied.
- (4) Cracks developed earlier when wheel loads were applied earlier, but developed into the same crack spacing at the end of the analytical period regardless to the time when the load was applied.



D-Series thickness of a slab under 4091 kg. external load versus crack spacing, crack width, steel stress and maximum concrete stress at the end of analysis period.

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Fig 2.15. E-Series time of external load application solved by CRCP-2 program.

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CHAPTER 3. AGE, STRENGTH-STRESS INTERACTION

BACKGROUND

The rate at which concrete gains strength depends on many factors, such as

- the concrete materials, the type of cement, and the size of aggregates,
- (2) the proportions mix, the water/cement ratio, and the gel/ space ratio, and
- (3) the curing time, the temperature, and so on.

All these factors affect the time required for the concrete slab to develop adequate strength. In the past, the 28th day strength was used as a standard measure for the strength of concrete, although the 28th day strength is considerably lower than the long-term strength. This gain in strength after the 28th day was used by structural designers as an extra contribution to the safety factor.

In pavement design, the safety factor required is minimal because failure in pavement is not really a failure but a distress limit, such as Serviceability Index (SI), which poses no real danger to the safety of the users. Also, the fact that the maximum internal stress occurs when temperature drop is highest means that the ultimate strength of the slab, therefore, should be measured when the temperature is the lowest and not necessarily on the 28th day.

In the model in Ref 5, an interactive process was used to compare stress caused by shrinkage and daily temperature drop with the tensile strength of the slab at each time interval. Use of the strength-stress interaction model in CRCP-1 is illustrated by Fig 3.1a. The solid line in the figure represents the age-strength curve of the concrete, the dash line represents the concrete stress in the slab, and points 1 to 7 represent the steps in the interactive process. At point 1, the stress is higher than the strength, which causes cracks to form. The reduction of crack spacing relieve some of the internal forces in the slab and causes the concrete stress to drop to point 2. A further decrease in temperature or a higher shrinkage factor causes the



Fig 3.1b. Variation of concrete strength and maximum concrete stress with time accounting for the increase in strength after the 28th day in the GRCP-2 model.

concrete stress to increase again, which forces other cracks to develop. This interactive process continues until the concrete reaches the 28th-day strength. From then on, the strength of the concrete no longer increases with time and this is treated as the ultimate strength of the slab. The maximum concrete stress generated by the maximum temperature drop and maximum shrinkage factor is represented by point 3 in the figure. Since the stress is higher than the strength, the crack spacing is further reduced, which causes the concrete stress to drop to point 4 and then point 5, until the stress is insufficient to induce another crack. The final crack spacing is then adjusted higher or lower until the stress in the concrete is within the limit of tolerance, with the strength at point 7.

Comparing the maximum concrete stress in the CRCP-1 model to the 28th-day strength may be underestimating the actual strength in the concrete at that time. This underestimation, however, does not provide any safety factor in the design. On the contrary, the lower crack spacing predicted from this underestimation may mislead the designer into decreasing the steel reinforcement in the slab in seeking for an optimum crack spacing and crack width.

INCREASE IN STRENGTH AFTER 28TH DAY

Figure 3.1b shows the strength-stress interaction model in CRCP-2 program. This model projects the strength gain in the concrete beyond the 28th day. The age-strength curve represented by the solid line shows a further increase in concrete strength after the 28th-day strength. The initial steps in the strength-stress interaction in CRCP-2 are identical to the original model. However, after the 28th day, the maximum concrete stress at point 3 is compared to the strength of the concrete at the time minimum temperature occurs and not with the 28th-day strength. Since the stress will drop to point 4 and then point 5. Once the concrete stress falls below the strength, the crack spacing is adjusted until the final concrete stress matches the ultimate concrete strength at the point 7. This higher tensile strength is now generated by the computer program, which is based on the age-strength curve from Ref 14. The equations used to predict the increase in tensile strength after 28th day are as follows:

compressive strength, f'

$$f'_{x} = f'_{28th day} \left[1 + 0.1972 \log \left(\frac{x}{28} \right) \right] psi$$
 (3.1)

tensile strength, f',

$$f't_{x} = \frac{3000}{3 + \frac{12000}{f'_{cx}}} X \text{ constant psi}$$
 (3.2)

where

x = number of days from the time the pavement was built to the time the minimum temperature was reached.

An option is provided in the computer program in which users can input the strength at the time of the minimum temperature drop. For users who specify neither the time nor the ultimate strength the program defaults to a 28-day concrete strength.

EFFECTS DUE TO THE STRENGTH INCREASE

A series of test problems, for which the input parameters are listed in Table 3.1, have been solved with the CRCP-2 program. By allowing various time periods for the concrete strength to build up before applying the minimum temperature, different final crack spacings are found. As shown in Fig 3.2, the final crack spacing increases with an increase of time before the occurrence of the minimum temperature. The solid line in the figure represents the final tensile strength in the concrete. The higher tensile strength sets a higher limit for the concrete stress to reach before cracks can be developed, which inturn increase the crack width and the steel stress in the slab, as shown in the figure.

The input data for the above analysis are printed in Appendix 3.

SUMMARY

A new strength-stress interaction model in the CRCP-2 program has replaced the original model in the CRCP-1 program to account for the concrete strength gain beyond the 28th day. If the lowest temperature is to occur after

	1F 2F 3F 4F 5F
Steel Properties	
P (percent)	0.5
φ (in)	0.6
fy x 10^4 (psi)	6.0
$E_s \times 10^7$ (psi)	2.9
$\alpha_c \times 10^{-6} \text{ (in/in/°F)}$	5.0
Concrete Properties	
D (in)	10.0
$\alpha_{o} \times 10^{-6} $ (in/in/°F)	5.0
$Z \times 10^{-4}$ (in/in)	4.0
$\gamma \times 10^2$ (pcf)	1.5
fc x 10 ³ (psi)	6.0
Temperature Data	
Curing Temp (°F)	75.0°
Minimum 1st - 10th	65.0°
Daily 11th - 16th	65.0°
Temp (°F) 17th - 28th	50.0°
Minimum Temp (°F)	0.0°
COLDTM (Days)	28.0 60.0 90.0 120 150
Friction	
Fi (psi)	2.0
Y (in)	-0.1
External Load	
Wheel Load x 10^3 (lbs)	0
Wheel Load Stress (psi)	0
Time Applied (Days)	7

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TABLE 3.1. INPUT PARAMETERS FOR TESTING THE NEW STRENGTH-STRESS INTERACTION MODEL.



Fig 3.2. Number of days after curing before minimum temperature occurs versus crack spacing, crack width, concrete stress and steel stress.

a prolonged period of time after the pavement was built, it is important to consider the strength gain in the concrete during that time. The results obtained from a test problem solved with the CRCP-2 program indicate that, by considering certain strength gain after the 28th day, a higher crack spacing is predicted. This increase in crack spacing will affect other variables in the CRC pavement and possibly change the percentage steel needed for the design.

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CHAPTER 4. MODIFICATION OF STEEL STRESS MODEL FOR DEVELOPMENT LENGTH EXCEEDS CRACK SPACING

BACKGROUND

When high friction values are used in the analysis, the crack spacing may become so small that the distance required for the bond between the steel and its surrounding concrete to fully develop, is greater than the spacing. When this happens, computer program CRCP-1 and the theoretical models are not applicable. To cover such conditions, a new set of equations has been developed and added to the CRCP-1 program. The change in the steel stress model after the development length exceeds half the crack spacing is shown in Fig 4.1.

DERIVATIONS OF BASIC EQUATIONS

For a fully bonded section, the basic equations are similar to the original equations. At the partially bonded zone, the average bond stress will determine the development length as well as the rate of stress transfer from the steel to the concrete. The mechanics of composite materials which lead to the derivation of basic equations are described below.

Interactions Between Steel and Concrete at Fully Bonded Zone

The interactions between steel and concrete caused by drying shrinkage and temperature drop are as follows:

<u>Stress Caused by Shrinkage</u>. As shown in Fig 4.2, the total concrete shrinkage strain, Z, is equal to the summation of the strain in concrete caused by the restraint of the fully bonded steel bar, ε_{cz} , and the strain in steel caused by the shortening of the concrete due to shrinkage, ε_{sz} , or

 $Z = \varepsilon_{cz} + \varepsilon_{sz}$.



Fig 4.1. Change of steel stress model after development length exceeds half the crack spacing.



(a) Steel and concrete not bonded.



(b) Steel and concrete fully bonded.



Replacing the above equation with stress and using a negative value to represent compression results in

$$Z = \frac{\sigma_{cz}}{E_{c}} + \left(-\frac{\sigma_{sz}}{E_{s}}\right)$$

or

$$\sigma_{cz} = ZE_{c} + \frac{\sigma_{sz}}{n}$$
(4.1)

where

σsz	=	steel stress due to shrinkage of concrete at fully bonded section,
σcz	=	concrete stress due to restraint of steel at fully bonded section, and
n	22	^E s/ _E c.

Stress Caused by Temperature Drop. From Fig 4.3,

$$\varepsilon - \varepsilon = \varepsilon + \varepsilon_{s\Delta t}$$

where

 ε_{c} = concrete strain due to temperature drop with no restraint, ε_{s} = steel strain due to temperature drop with no restraint, $\varepsilon_{s\Delta t}$ = steel strain caused by shortening of concrete during temperature drop at fully bonded section, $\varepsilon_{c\Delta t}$ = concrete strain in tension caused by the restraint of steel bars at fully bonded section.

Replacing the above equation with stress and using a negative value for compression gives

$$\alpha_{c} \Delta T + \alpha_{s} \Delta T = \frac{\sigma_{c\Delta t}}{E_{c}} + \left(-\frac{\sigma_{s\Delta t}}{E_{s}}\right)$$



(a) Steel and concrete not bonded.



(b) Steel and concrete fully bonded.



$$\sigma_{c\Delta t} = E_c \Delta T \left(\alpha_c - \alpha_s \right) + \frac{\sigma_s \Delta t}{n}$$
(4.2)

where

 $\sigma_{c \Delta t}, \sigma_{s \Delta t}$ = stresses due to temperature drop at fully bonded section, and α_{s}, α_{c} = thermal coefficients of steel and concrete.

Combining stress due to drying shrinkage and temperature drop. Combining Eqs 4.1 and 4.2,

$$\sigma_{\rm cm} = \sigma_{\rm cz} + \sigma_{\rm c\Delta t}$$

$$= (ZE_{\rm c} + \frac{\alpha_{\rm SZ}}{n}) + \{E_{\rm c}\Delta T(\alpha_{\rm c} - \alpha_{\rm s}) + \frac{\sigma_{\rm S\Delta t}}{n}\}$$

$$= E_{\rm c} \{Z + \Delta T(\alpha_{\rm c} - \alpha_{\rm s})\} + \frac{1}{n} (\sigma_{\rm SZ} + \sigma_{\rm S\Delta t})$$

$$\sigma_{\rm cm} = E_{\rm c} \{Z + \Delta T(\alpha_{\rm c} - \alpha_{\rm s})\} + \frac{1}{n} (\sigma_{\rm sm}) \qquad (4.3)$$

where

σ_{sm} = total steel stress due to temperture drop and drying shrinkage of concrete at fully bonded region.

Overall Equilibrium

From Fig 2.3, the summation of all forces is

$$F_{sm} + F_{cm} = F_{sc} + \int_{0}^{x} F_{i} dx$$

where

F = force of steel at mid-slab,
F = force of concrete at mid-slab,

 F_{sc} = force of steel at the crack, and F_{i} = friction force between slab and support.

Converting the above equation into stresses

$$A_{s}\sigma_{sm} + A_{c}\sigma_{cm} = A_{s}\sigma_{sc} + \int_{0}^{x} F_{i}dx$$
$$\sigma_{sc} = \sigma_{sm} + \frac{\sigma_{cm}}{A_{s}} - \frac{\int_{0}^{x} F_{i}dx}{A_{s}}$$

where

$$A_s = area of steel and A_c = area of concrete,$$

and, for a one-foot strip,

$$A_{c} = D X 1 = D$$
$$A_{s} = pA_{c} = pD$$

where

gives

$$\sigma_{sc} = \sigma_{sm} + \frac{\sigma_{cm}}{p} - \frac{\sigma_{t}^{s} F_{t} dx}{pD} . \qquad (4.4)$$

Movement of the Slab

The total movement of the slab will be the sum of the movement caused by temperature drop plus the movement caused by shrinkage. From Figs 4.2 and 4.3 we have

$$\frac{dY_{cz}}{dx} = \varepsilon_{cz} - Z$$

and

$$\frac{dY_{c\Delta t}}{dx} = \frac{\varepsilon}{c\Delta t} - \alpha_c \Delta T$$

where

 Y_{cz} = slab movement caused by shrinkage and $Y_{c\Delta T}$ = slab movement caused by temperature drop.

The total movement of the slab, $\begin{array}{c} \mathbf{Y} \\ \mathbf{c} \end{array}$, will be

$$Y_{c} = \int_{0}^{L} \varepsilon_{cz} dx + \int_{0}^{L} \varepsilon_{c\Delta t} - (Z + \alpha_{c} \Delta T)L$$

=
$$\int_{0}^{L} \varepsilon_{c} dx - (Z + \alpha_{c} \Delta T)L \qquad (4.5)$$

where

 ε_{c} = total strain of concrete and L = slab length.

Crack Width

Crack width is simply the summation of the concrete movement from both sides of the crack:

$$\Delta \mathbf{x} = 2 \mathbf{Y}_{c}$$

$$\mathbf{L}$$

$$= 2 \int_{O} \varepsilon_{c} d\mathbf{x} - 2(\mathbf{Z} + \alpha_{c} \Delta \mathbf{T}) \mathbf{L}$$

where

$$\Delta x = crack width.$$

Bond Stress and Bond Length

Bond stress can be considered as the chemical adhesion and the bearing of projections between concrete paste and the steel surface. It is the unit shear force acting parallel to the bar on the interface between bar and concrete. When cracks form, shrinkage and temperature decrease will shorten the adjacent concrete slabs, thus pulling on the steel bars at the crack and resulting in an increase in high-tension. This increase of tensile steel stress will transfer back to the concrete at a rate which is controlled by the bond stress. The real mechanism of stress transfer with deformed bars is quite complex; it involves three basic elements, which progress in the following sequence: first, the shearing resistance of the adhesion itself; then, the frictional resistance to sliding after adhesion is broken; and, finally, the bearing against the lugs. In Ref 5, the model, an average bond stress U was used in which

 $U = \mu \varepsilon_{0}$

where

$$\mu = \frac{9.5\sqrt{f'c}}{\emptyset} \le 800 \text{ lb/in}^2$$

$$\varepsilon_0 = \text{ perimeter of steel bar, and}$$

$$\emptyset = \text{ bar diameter.}$$

As stated above, the high tensile stress of the steel bars at the crack was transferred to the nearby concrete at a rate which is controlled by the shear resistance of the bond between steel and concrete. And, since this shear resistance was assumed to be an average value (bond stress) evenly spread along the bar from the crack to the fully bonded region, the change of steel stress is a linear curve sloping downward at the bond slip zone. Summing all the forces acting on the steel bar alone, shown in Fig 4.4b, we have

> $F_s + dF_s = F_s + Udx$ $A_s d\sigma_s = (\mu \epsilon_o) dx$



Fig 4.4. Free-body diagram to illustrate forces in the steel bar at bond-slip zone.

$$d\sigma_{g} = \frac{\mu \pi \phi}{\frac{\pi \phi^{2}}{4}} dx$$
$$= \frac{4\mu}{\phi} dx \qquad (4.6)$$

By integration, the development length, b, required will be

$$\int_{0}^{b} d\sigma_{s} = \frac{4\mu}{\emptyset} \int_{0}^{b} dx$$

$$\sigma_{sc} - \sigma_{sm} = \frac{4\mu}{\emptyset} (b)$$

$$b = \frac{\emptyset}{4\mu} (\sigma_{sc} - \sigma_{sm})$$
(4.7)

Steel Boundary Condition

Since the total length of the steel bar is fixed, the strain caused by the drying shrinkage and the temperature drop of the concrete minus the strain of steel due to thermal contraction should equal zero; therefore

$$\int_{0}^{L} \varepsilon_{s} dx - \alpha_{s} L\Delta T = 0$$

$$\frac{1}{E_{s}} \int_{0}^{L} \sigma_{s} dx - \alpha_{s} L\Delta T = 0$$

Integrating the steel stress from the crack to the mid-slab gives the area under the steel stress diagram, shown in Fig 4.5b, and yields

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$$\frac{L}{2} (\sigma_{sm} + \sigma_{sc}) = E_s \sigma_s \Delta T L$$
(4.8)

where

 σ_{sm} = steel stress at the mid-slab for partially bonded condition which is higher than the steel stress σ_{sm} in fully bonded section.






(b) Steel stress diagram.

Fig 4.5. Steel stress diagram showing development length exceeding half the crack spacing.

The slope for the steel stress diagram in Fig 4.5b, which can be obtained if the development length b is known,

$$s = \frac{\sigma - \sigma_{sm}}{b}$$

and the steel stress $\sigma_{\rm sm}^{},\,$ will be

$$\sigma_{sm}' = \sigma_{sm} + s(b-L)$$
$$= \sigma_{sm} + \left(\frac{\sigma_{sc} - \sigma_{sm}}{b}\right) (b - L)$$
$$= \sigma_{sc} - \frac{L}{b} \sigma_{sc} + \frac{L}{b} \sigma_{sm}$$

Substituting the above equation into Eq 4.8,

$$\frac{L}{2} \left[\sigma_{sc} + (\sigma_{sc} - \frac{L}{b} \sigma_{sc} + \frac{L}{b} \sigma_{sm}) \right] = E_s \alpha_s L \Delta T$$

$$\sigma_{sc} - \frac{L}{2b} \sigma_{sc} + \frac{L}{2b} \sigma_{sm} = E_s \alpha_s \Delta T \qquad (4.9)$$

Summary of Equations

$$\sigma_{\rm cm} = E_{\rm c} \{ Z + \Delta T (\alpha_{\rm c} - \alpha_{\rm s}) \} + \frac{1}{n} (\sigma_{\rm sm})$$
(4.3)

$$\sigma_{\rm sc} = \sigma_{\rm sm} + \frac{\sigma_{\rm cm}}{p} - \frac{\int_{\rm i}^{\rm F} f \, dx}{p D}$$
(4.4)

$$E_{s}\alpha_{s}\Delta T = \sigma_{sc} - \frac{L}{2b}\sigma_{sc} + \frac{L}{2b}\sigma_{sm}$$
(4.9)

where:

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$$b = \frac{\phi}{4\mu} (\sigma_{sc} - \sigma_{sm}). \qquad (4.7)$$

From the above, we have four unknowns $(\sigma_{sc}, \sigma_{sm}, \sigma_{cm}, F_i)$, but only three equations. To solve these equations, a binary search technique was used. By assuming zero friction, an estimate of slab movement can be made. By plotting this movement on the friction-movement curve provided by the user, an estimate of friction-force can be obtained. The slab will be analyzed again, but this time with the estimated frictional resistance. The interaction will continue until the friction obtained from the analytical procedure coincides with the friction obtained through the friction-movement curve. The interaction technique was shown in Chapter 6 of Ref 5.

Two models are needed, one without friction and the other with friction. They are as follows:

Frictionless Model. From Eq 4.4, $\sigma_{sc} = \sigma_{sm} + \frac{\sigma_{cm}}{p} - \frac{\sigma_{p}}{p}$ $\sigma_{cm} = p\sigma_{sc} - p\sigma_{sm}$

Substituting into Eq 4.3,

$$\sigma_{sc} - \sigma_{sm} = E_{c} \left[Z + \Delta T (\alpha_{c} - \alpha_{s}) \right] + \frac{1}{n} (\sigma_{sm})$$

$$\sigma_{sc} - \sigma_{sm} = \frac{E_{c}}{p} \left[Z + \Delta T (\alpha_{c} - \alpha_{s}) \right] + \frac{1}{pn} (\sigma_{sm})$$

$$\sigma_{sm} (1 + \frac{1}{pn}) = \sigma_{sc} - \frac{E_{c}}{p} \left[Z + \Delta T (\alpha_{c} - \alpha_{s}) \right]$$

or

$$C_{1} \quad sm = \sigma_{sc} - C_{2} \tag{4.10}$$

where

$$C_1 = 1 + \frac{1}{n}$$

$$C_{2} = \frac{E_{c}}{p} \left[2 + \Delta T(\alpha_{c} - \alpha_{s})\right]$$

By combining terms in Eq 4.9 and substituting b from Eq 4.7;

$$\sigma_{sc} - \frac{L}{2b} \sigma_{sc} + \frac{L}{2b} \sigma_{sm} = E_s \alpha_s \Delta T$$

$$\sigma_{sc} - \frac{L}{2b} (\sigma_{sc} - \sigma_{sm}) = E_s \alpha_s \Delta T$$

$$\sigma_{sc} - \frac{L(\sigma_{sc} - \sigma_{sm})}{2\{\frac{\varphi}{4\mu}(\sigma_{sc} - \sigma_{sm})\}} = E_s \alpha_s \Delta T$$

$$\sigma_{sc} = \frac{L}{2k} + E_s \alpha_s \Delta T \qquad (4.11)$$

where

$$k = \frac{\phi}{4\mu} .$$

Equation 4.11 indicates that the concrete stress is no longer a function of the steel-stress at the crack in the frictionless model. This is obvious, because the theory assumes an average bond-stress which will dominate the rate of stress-transfer from steel to concrete at the bond-slip zone. Summing all the forces acting on the concrete element at the bond-slip zone in Fig 4.6 gives

$$F_{c} = F_{i}dx + Udx + F_{c} + dFc$$
$$A_{c}d\sigma_{c} = -F_{i}dx - Udx$$



Fig 4.6. Free-body diagram to illustrate forces acting in the concrete at bond-slip zone.

For a one-foot strip,

$$d\sigma_{c} = -\frac{F_{i}dx}{D} - \frac{\mu\pi\phi}{\frac{\pi\phi^{2}}{4p}}dx$$
$$= -\frac{F_{i}}{D}dx - \frac{4\mu p}{\phi}dx \qquad (4.12)$$

By integration, the maximum concrete stress at the middle for a frictionless slab is

$$\int_{0}^{L} d\sigma_{c} = -\frac{\int_{0}^{L} F dx}{D} - \frac{4\mu p}{\theta} \int_{0}^{L} dx$$

$$\sigma_{cm} = -\frac{4\mu p}{\theta} L$$
(4.13)

Combining Eqs 4.10 and 4.11 gives

$$\sigma_{\rm sm} = \frac{1}{C_1} \left(\frac{L}{2K} + E_{\rm s} \alpha_{\rm s} \Delta T \right) - \frac{C_2}{C_1}$$
(4.14)

Friction Model.

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Combining Eqs 4.3 and 4.4,

$$p\sigma_{sc} - p\sigma_{sm} + p \frac{\int_{0}^{x} F_{i} dx}{pD} = E_{c} \{ z + \Delta T (\alpha_{c} - \alpha_{s}) \} + \frac{1}{n} \sigma_{sm}$$

$$\sigma_{sc} - \sigma_{sm} + \frac{\int_{0}^{x} F_{i} dx}{pD} = \frac{E_{c}}{p} \{ z + \Delta T (\alpha_{c} - \alpha_{s}) \} + \frac{1}{np} \sigma_{sm}$$

$$\sigma_{sm} (1 + \frac{1}{np}) = \sigma_{sc} - C_{2} + C_{3}$$

$$\sigma_{sm} C_{1} = \sigma_{sc} - C_{2} + C_{3} \qquad (4.15)$$

Where

$$C_{1} = 1 + \frac{1}{np}$$

$$C_{2} = \frac{E_{c}}{p} \{ z + \Delta T(\alpha_{c} - \alpha_{s}) \}$$

$$C_{3} = \frac{\int_{0}^{L} F_{i} dx}{pD}$$

By substituting b into Eq 4.9, the steel stress at the crack is

$$\sigma_{sc} = \frac{L}{2k} + E_s \alpha_s \Delta T$$

From Eq 4.12, the maximum concrete stress will be

$$\sigma_{\rm cm} = -\frac{\delta^{\rm L} \mathbf{F}_{\rm i} d\mathbf{x}}{D} - \frac{4\mu p \mathbf{L}}{\mathbf{\Phi}} . \qquad (4.16)$$

SUMMARY

The basic equations derived in this chapter are an extension of the equations developed in the CRCP-1 model to cover conditions in which development length exceeds half the crack spacing and, thus, extend its capability for solving problems with more extreme parameters, such as higher friction value, abrupt temperature changes, heavy wheel-load stress, and so on.

While the mechanism of the load transfer in the bond-slip zone is quite complex and the state of art is still being developed an average bond strength value was used in this study to predict the rate of load transfer from steel bars to concrete.

CHAPTER 5. EXAMPLE PROBLEMS AND OBSERVATIONS

A series of example problems are presented in this chapter to demonstrate the application of the CRCP-2 program with the added design variables discussed in the previous chaters. Observations of the predicted behavior of CRC pavement with these new variables are also made.

Problem A - Development Length Exceeds Crack Spacing

Two analysis are made of a continuously reinforced concrete pavement placed over two different kinds of subbases. The first problem, A-1, is a control problem with input data that can be solved by the original steel stress model in CRCP-1. The second problem, A-2, has exactly the same input data as Problem A-1, except that the steel reinforcement and the subbase friction are higher to force the crack spacing to fall below the development length in the slab. The CRCP-2 program with the revised steel stress model is used to solve this problem.

Problem A-1, deals with a 0.7 percent reinforced concrete pavement placed over a smooth subbase with maximum frictional resistance of 1.0 psi (70.45 gm/cm^2) per 0.1-inch (0.254-cm) movement. The concrete properties, the steel properties, and the daily temperature variations are tabulated in the computer output in Appendix 2.

The final crack spacing obtained from this analysis is 8.2 feet (2.499 m). The maximum steel stress found was 52,580 psi (3704.5 Kg/cm^2), which is slightly below the yeilding stress for steel. The difference between the maximum concrete stress and the maximum tensile strength for the concrete is within 1.0 percent, which is the closure tolerance assigned to this problem.

The changes in steel and concrete stresses are plotted along the horizontal stations of the slab in Fig 5.1. Station 1 is at the mid-slab and station 101 is at the crack. In Figs 5.1b and 5.1c, the steel stress is the highest, while concrete carries no load at the crack. From station 101 towards the mid-slab, the steel stress decreases as it transfers its load to concrete along the bond-slip zone. The total development length required for the load transfer in this problem is 9.84 inches (24.99 cm).

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In Problem A-2, the steel percentage and the bar diameters are higher, and a maximum frictional resistance of 7.5 psi $(.528 \text{ kg/cm}^2)$ per 0.2-inch (0.508-cm) movement was used. The increase in frictional resistance reduces the crack spacing further, while the increase in steel percentage and bar diameter increase the devleopment length. The result will be such that the development length exceeds one half the crack spacing an the problem can no longer be solved using the CRCP-1 program. The solutions obtained by the CRCP-2 program are plotted in Fig 5.2. The final crack spacing is shorter than the result obtained from Problem A-1 and the new development length for the load transfer occupies the entire slab. The steel stress diagram in Fig 5.2c is consistant with the steel stress model developed in Chapter 4.

Problem B - Increase in Tensile Strength Before Minimum Temperature Occurs

For this comparison it is assumed that a continuously reinforced concete pavement is built in midsummer, and the minimum, winter, temperature is not anticipated for at least 3 months. The daily temperature variations recorded during the first 28 days are tabulated in the computer output in Appendix 2.

Two analyses were made on this pavement. Problem B-1 considered the strength increase of concrete only up to the 28th day, as was done in the CRCP-1 program. In Problem B-2, all input parameters remained the same, except that an allowance of 90 days was given for the concrete to gain additional strength before the occurrence of the minimum winter temperatures.

The variations of concrete strength, concrete stress, and the changes of crack spacing with time are plotted in Figs 5.3 and 5.4 for the alternative solutions. Figure 5.3 represents the original CRCP-1 model, where increase in tensile strength after the 28th day is not accounted for. Figure 5.4 shows an increase in tensile strength after the 28th date the 28th day and an increase in the crack spacing is found when it is compared to Problem B-1.

Problem C - Environmental Stresses as Combined with External Load Stresses

To demonstrate the combined effect of environmental and wheel-load stresses, a 12-inch (30.48-cm) thick pavement with 1.2 percent steel reinforcement is placed over a polyethylene sheeting with maximum frictional resistance 1.0 psi with 0.1 inch (0.254 cm) of movement at sliding. The subgrade modulus



(a) Half the final crack spacing.



Fig 5.2. Variation of steel stress and concrete stress along the CRCP-2 model.



Note: 1 inch = 2.54 centimeters; 1 psi = 0.0704 kg/cm^2 .

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Fig 5.3. Variation of concrete strength and maximum concrete stress with time for CRCP-1 model.



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Note: 1 inch = 2.54 centimeters; 1 psi = 0.0704 kg/cm².

Fig 5.4. Variation of concrete strength and maximum concrete stress with time for CRCP-2 model.

is estimated to be 150 pci (4.157 kg/cc). The steel and concrete properties are tabulated in the computer output in Appendix 2.

In Problem C-1, the slab described above was analyzed with only the internal stress caused by the change in temperature and drying shrinkage. In Problem C-2, in addition to the environmental stresses, an 18-kip (8182.0-kg) external load was applied to the slab on the seventh day after the placement of the slab. The results from both analyses are plotted in Figs 5.5 and 5.6.

In Fig 5.5, the effect on crack spacings of CRC pavement due to the external load is demonstrated by the sudden drop in the crack spacing, where the combined external and internal stresses exceeded the tensile strength of concrete. At the end of the analysis period, the final crack spacing for the loaded pavement was less than one-half the value for the unloaded pavement.

Figure 5.6 shows the change in steel stress with time for both Problems C-1 and C-2. Arrows are used in the figure to indicate the time cracks occurred.

For a given slab length and for a nearly constant drop in temperature, the stress in concrete will increase with time. However, each time a crack occurs, the slab length will be reduced. The cumulative frictional resistance for that shorter slab will be lessened, which in turn lowers the stress in the concrete as well as the steel stress. For the concrete strength, which increases steadily with time, the maximum concrete stress required for the crack to form increases with time also. Notice that, in Fig 5.6, the general trend for the steel stress curves is to increase with time but plunge downward everytime a crack occurs.

When an external load is applied to the pavement, the combination of both the external load and the internal load stresses induces more cracks in the CRC pavement, which explains the decrease in steel stress for the loaded curve in Fig 5.6. 65



Fig 5.5. Change in crack spacing with time; with and without external load solved by CRCP-2 program.



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Fig 5.6. Change in steel stress with time; with and without external load solved by CRCP-2 program.

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CHAPTER 6. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

SUMMARY

The CRCP-1 method, developed in Ref 5, provides a useful tool for the analysis of temperature and shrinkage effects on cintinuously reinforced concrete pavements. Certain modifications of the CRCP-1 method were made in this study to increase the proficiency and to extend the capability of this method. The age-tensile strength model was extended to cover conditions in which the drop to minimum temperature was delayed. For high frictional subbase, the steel stress model was extended to cover conditions in which the bond length exceeds one-half the crack spacing. The wheel-load stress was combined with the internal load caused by temperature drop and drying shrinkage to obtain a better prediction of crack spacing in field conditions.

The inclusion of wheel-load stress with internal stress was accomplished by superimposing the tensile stress at the bottom fibre, computed by the Westergaard equation for a single-concentrated vertical load, an the inplane tensile stress across the depth of the slab, computed by the CRCP-1 method.

The computer program was written in FORTRAN IV computer language for the Control Data Corporation 6600 digital computer. The program can be adapted for use with the IBM 360/370 computer by some minor changes.

CONCLUSIONS

Based on this study, the following conclusions are made.

(1) The forces acting on the continuously reinforced concrete pavement can be modeled more realistically using the CRCP-2 computer program, which allows for analysis of a CRC pavement under both wheel-load stress and environmental stress. The inclusion of wheel load helps to gain more insights into the real behavior of CRC pavmeent. Warping effect and the fatigue in the slab under repetitive loadings, however, are not considered.

- (2) From a limited number of test problems, it was found that the addition of wheel load on continuously reinforced concrete pavement has the same effect as increasing the steel percentage in the pavement; they both force more cracks to develop. Variation in crack spacing changes the magnitudes of other variables in the pavement, such as steel stress and crack width; lower crack spacing results in lower steel stress and lower crack width. Decrease in slab thickness, on the other hand has an adverse effect on the behavior of CRC pavement. Increasing the slab thickness, can prevent excessive cracking. For the design of CRC pavement it is important to have a proper correlation on the steel percentage and the slab thickness. The final crack spacing should be adjusted to keep cracks at an optimum width.
- (3) Comparing the concrete stress under the minimum temperature with the 28th-day strength will sometimes cause underestimation of the crack spacing and, thus, the steel stress in the CRC pavement and mislead the designer in to decreasing the steel reinforcement in the slab. The strength-stress interaction model used in the CRCP-2 program enables us to project the strength gain in the concrete beyond the 28th day and predict the final crack spacing more accurately.
- (4) The modified steel stress model in the CRCP-2 program can cover conditions where development length exceeds half the crack spacing, thus extending its capability for solving problems with more extreme parameters, such as high friction values, abrupt temperature changes, heavy wheel load, and so on.
- (5) Computer program CRCP-2 can be used to develop charts or nomographs for the design of continuously reinforced concrete pavement.

RECOMMENDATIONS

Stress induced by different types of loadings have been treated in the past separately by various methods. To realistically analyze the complete state-of-stress, further research is needed to combine these theories and models into a more complete design. In addition, more effort should be directed toward better understanding of various design variables, such as the frictional resistance of treated base, the air of concrete temperature of the slab, and the load transfer at cracks. Recommendation for future research are listed as follows.

Environmental Load Plus Traffic Loads

The environmental influence on rigid pavements can be seperated into two categories. The first is the difference in temperature throughout the depth of the slab, which, in accordance with the thermal conductivity of the concrete, has a slab-surface temperature different from the mid-depth temperature. The strain differential due to this temperature variation causes the slab to curl up and at the same time, the weight of the slab adds pressure in the opposite direction. The loss of support near the crack due to this warping effect poses a serious problem when the wheel load is added. Either Teller's closed form solution or Leonard's computer program (Refs 7 and 8) can be used here to solve for the tensile stress on the top fibre of the slab near the crack. The second category of environmental influence is the change of temperature after curing, which, in accordance with the thermal coefficient of contraction, will build up a magnitude of in-plane stress when the temperature reduces to below curing temperature. The CRCP-1 method was developed to solve this tensile stress along the slab.

The bending of a slab due to traffic load contributes another type of stress on the pavement. Although the values derived from Westergaard's equation correlate closely with the laboratory results and have been widely used for the prediction of wheel-load stress (Refs 15 and 16), the method is limited to uniform slab thickness, uniform foundation support, and a single, concentrated loading. The discrete-element method on the other hand allows considerable freedom for the configuration of the pavement, the loading patterns patterns, the flexural stiffness of the slab and various combinations of support median. The finite approximation method not only offers major advantages over the Westergaard equation, but since the slab in the discrete-element model was decided into discrete elements, such as beams, torsional rods, and springs, it can be suited to couple various types of loading into a more complete analytical tool for the design of rigid pavements. Valuable research would be to include the environmental stress into the discrete element model as a uniaxial thrust acting longitudinally on the beams. In a similar manner, the strain differential across the depth due to the temperature gradient also can be included with additional efforts.

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Load Transfer at the Crack

To fully portray a continuously reinforced concrete pavement, the slab as well as the transverse cracks that occur every few feet need to be considered. Work done by Abou-Ayyash (Ref 13) suggested a reduced stiffness at the crack to account for the moment transfer when each end of the slab at the crack come in contact with each other. The amount of stiffness needs to be reduced and the length of hte slab under influence can be determined by using the basic-moment curvature relationship. A study done by Strauss found that, unless the crack width is very narrow, as in the case of early-age, the probability of slabs' coming in contact at the crack is very small (Ref 17). Other forms of load transfer are aggregate interlock and dowel action of the steel bars. By simulating aggregates as circular particles and by simple geometry, the shear stress carried by the bearing of the aggregate particles can be obtained if the crack width is known. By using the pile theory (Ref 17), the amount of shear load acting on the concrete due to the dowel action of the steel bars can be found. It would be highly desirable to model the cracks as related to these three types of load transfer and incorporate them into other analytical models mentioned in previous paragraphs.

Frictional-Resistance of Treated Base

In the CRCP-1 design method, the friction-movement relationship between the slab and its support must be known before the amount of frictional force acting on the slab can be estimated. Past studies were made to determine the friction-movement relationship between the slab and the granular materials; however, little was known about the frictional force developed on the slab for treated base. Therefore, a study to determine the friction-movement curve for cement-stabilized, asphalt-stabilized, and lime-stabilized bases is highly desirable.

Air and Concrete Temperature

Assessment of pavement temperature at mid-depth for the input data in the CRCP-1 design method, as well as the temperature variation across the depth of the slab, for the prediction of strain differential requires a correlation to link air temperature with pavement temperature at any time and depth.

A pavement temperature simulation model was developed for simulating bituminous pavement temperatures, as related to air temperature, wind velocity, solar radiation, and the thermal properties of the concrete (Ref 18), and based on the same conception, the temperature simulation model for rigid pavement can be developed. Future research should be conducted to incorporate this model into other non-traffic-associated slab design models for the prediction of environmental stresses.

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APPENDIX 1

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LISTING OF COMPUTER PROGRAM CRCP-2

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C CONCRETE PROPERTIES	C TWICK COLS, 11-20 I CONCRETE BLAB THICKNESS	C ALPHAC COLS, 21-30 I THORAAL COEFFICIENT OF CONCRETE C 2107 COLS, 31-48 I DRYING SHRINKAGE STRAIN	C UNHT COLS, 41+50 JUNT MEIGHT OF CONCRETE	C FPC COLS, S1+60 1 28+0AY COMPRESSIVE STRENGTH	C (DHI IF USER PROVIDES AGE-TENSILE DATA, C (DHI IF USER AT 0) C 5,6,1F NSTRN GT 0) C 5,72000 AGE ATEN AT 0 GENERATE THE C 5,72000 AGE-TENSILE RELATIONSHIP, C (DHIT IF USER PROVIDES AGE-TENSILE DATA, C (DHIT IF USER PROVIDES AGE-TENSILE DATA,	C EGG, IF NBTAN GT D) (57RNVL HUBT BE LE 1,0) (67RNVL TVALUE 18,10) (06FALUT VALUE 18,10) C NSTRN COLS, 65-66 1 NUMBER OF POINTS IN THE AGE-TENBILE RELAT, C NSTRN LE 20) C IFY COLS, 69-78 1 NUMBER OF POINTS IN 3LAB-ABASE FRICTION CURVE	C C C C C C C C C C C C C C C C C C C	C C C C C C C C C C C C C C C C C C C	C C C C C C C C C C C C C C C C C C C	C ENVIRONMENTAL INPUTS	C CURTEMP COLS, 1-10 1 CURING TEMPERATURE (decrees famerneit) C wtemp cols, 11-15 1 Number of days before concrete gaing full C temp court ageu(nstrn) if	C NSTRN > 0, OTHERWIGE NTENP = 20, C Oltatm Cols, 21-30 Minimu tenperture Expected After Concrete C Oeltatm Cols, 21-30 Minimu tenperture Expected After Concrete C Gains Full Strength	C COLDIM COLS, 36-40 INUMBER OF DAYS AFTER CONCRETE IS SET C Coldim Cols, 36-40 I Number of Days After Concrete is set C set of the thinth temperature of tatm occurs C f5.0.First Cold Season)	C (OMIT IF RUN IS PROGROM CRCP1) C (COLOTICEC-20.0) C (COLOTICEC-20.0)	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	C D7 CULS, 1+5,6+18,11+15,ETC, 1 (DEGREES FAMRENMEIT)
PROGRAM CRCP2(INPUT,OUTPUT,TAPES#INPUT)		α. υ υ	C • VERSION Z.1 •	C C C C C C C C C C C C C C C C C C C	СС С. С	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	C C DESCRIPTION OF RUN	C ANI ANY COMBINATION OF LETTERS AND/OR NUMBERS. C (2 cards are reguired)	C TYPE 2 DESCRIPTION OF PROBLEM	C NPROB COLS. 1-5 I PROBLEM NUMBER (ANY COMSINATION OF LETTERS AND/OR NUMBERS) (AN2 Cols. 11-80 I description of problem (AN2 Cols. 11-80 I description of problem)	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	C ITYPER COLA 5 I TYPE OF REINFORCEMENT C ITYPER COLA 5 I TYPE OF REINFORCEMENT C == 2 FOR DEFORMED BARB	C P COLS, 11-20 ; PERCENT STEEL REINFORCEMENT C DIA COLS, 21-30 ; REINFORCING BAR DIAMETER C Y COLS, 11-40 ; YEIGB ; YERAR	C ES COLS. 41-50 I ELASTIC MODULUS	C ALPHAS COLS, 51-60 (741) C ALPHAS COLS, 51-60 (741) C BHIGH COLS, 51-70 I TRANSVERSE WIRE 8PACING C BHIGH COLS, 51-70 I TRANSVERSE WIRE 8PACING C C BHIGH COLS, 51-70 I TRANSVERSE WIRE 8PACING C C C C C C C C C C C C C C C C C C C	C TYPE 4

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	C FEXP COLS, 1+10,21-30,ETC. I FRICTIONAL FORCE PER UNIT LENGTH
1vD\$ 7	C VEYR COLS. 11-20-31-40-ETC. & SLAB MOVEMENT
EXTERNAL LOAD OR STRESS	C (INCHES)
(OMIT THIS CARD IF RUN IS PROGRAM CRCP1)	¢
THIND COLS. 6+10 1 NUMBER OF DAYS AFTER CONCRETE IS SET	
BEFORE WHEEL LOAD TR APPLITED	
(DEFAULT VALUE IS 0.0)	Ê Î
AHLOAD COLS.11-20 I WHEEL LOAD (LBS)	COMMON /8LOCK1/ RATIO, THICK, P, FF, STRAINC, ES, NTP1, U, DIA, UNHT
(BLANK IF USER SUPPLIES WHLSTR)	COMMON /BLOCK2/ SS(101),AAA,WS(101),LONGPR,NPRINT,MAXITE,CRACKH
(DEFAULT VALUE IS 0.0)	COMMON /BLOCK3/ XBAR, STRSC, STRSB, STRC, IBABY, ITEB, NEHBAR
WHBASE COLS, 21-50 I WHEEL BASE RADIUS (IN.)	COMMON /BLOCK4/ AL(101), STRAIN(101), LUNSTR(101), STRESS(101)
(BLANK IF USER SUPPLES HHLSIR)	COMMON /BLOCKS/ FERF(19); FERF(19); FERFOL; FIFFOL; FI
8011 K COLR.31-40 C MODULUS OF SUBGRADE (PST)	COMMON / BLOCKA/ Y(101), REFE(101), YP(101), H. ICLOSEB, YPITE(101)
(BLANK IF USER SUPPLIES WHLATR)	COMMON /BLOCK9/ STX, STY, PSX, PSY, ITE
WHLSTR COLS_41+50 & HHEEL LOAD STRESS (PSI)	COMMON /BLOCK18/ NSTRN, VOS, AGEU(28), TENSION(28), STRNMUL
(BLANK IF USER SUPPLIES WHLOAD)	COMMON /BLOCK12/ DT (50), NTEMP, NTIFLAG, UPINC, DOWNINC
	COMMON /BLOCK13/ AGE(8), PERCENT(8), COLDTH, ANTEMP, IBXBAR, COLDSTN
	COMMON /BLDCK14/ F(101),BDNDL,Z,DELTAT,STRMAX,WHLSTR,THLDD,IBECK
TYPE 5	C OTHERETON BUILDED ANICIAL AND/TA
PRINT AND PLUT OPTIONS	DIMENSION BUMILIDIJAMILIDIJAMILIJA
TOL COLA. 3-5 1 RELATIVE CLOBURE TOLERANCE	DATA PERCENT/0, 15, 18, 18, 63, 63, 94, 100,/
(PERCENT)	DATA EP/ 1.8E-89 /.NTP1/ 101 /.VD8/ 4.8 /.MAXITE/ 30 /
(DEFAULT VALUE IS 5.8)	INTEGER AAA
LONGPR COLS, 8-10 I FLAG TO PRINT RESULTS FROM EACH ITERATION	c
P YES IF DESIRED	C PROGRAM AND PROBLEM IDENTIFICATION
B BLANK IF NOT DESIRED	
NAKINI COCS' IIAIJ I KUIC OL GOBZANDTUNG OSED IN AKINIING KERCIS	NEAU 318, (ANI(N)/NH/1/10) 10 DELA 520, NDONG,(AN2/N).NE1.7)
FUR EACH LICRAILUM (F.C., 141 POTNYA ARF CALCULATED IN FACH	15 KEND 320, APRODUCTIVE (K), (CT) (CT)
ITERATION, IF NPRINT # 20 AND LONGPR # YES THEN	11 PRINT SIG
FOR EACH ITERATION VALUES AT POINTS 1, 21, 41,	PRINT 548, (AN1(N),N=1,16)
61, 81, AND 101 WILL BE PRINTED)	PRINT 550, NPROB,(AN2(N),N=1,7)
(DEFAULT VALUE IS 20)	C C
IPLOT CULS, 10-20 I PLAG PUR PLUT UP FEMPERIURE DROP VS, TIME	C INPUT STEEL PROPERTIES
B TED IF FLOT ID DEDIRED B RIANK TE NOT DEDIRED	C READ 569, ITYPER.P.DIA.FY.ES.ALPHAS.BHIGH
THACALE COLA, 21-35 & NUMBER OF INCHEA PER DAY TO BE PLOTTED	PRINT SEO
FINAL COLS. 34-40 : NUMBER OF DAYS TO BE PLOTTED	PRINT 570
	PRINT 580
	IF (ITYPER.EQ.1) PRINT 540
	IF (ITYPER.EU.2) PRINT 000 Tr (ITYPER.EU.2) PRINT 000
AGE IENGILETGINENGIN RELATIONGNIP (Tute faor wiet de omitten te nêton - an	IF (ITTPERSLIGIONGITTPERSGISE) 60 10 430 DOTAT ATM, D.DTA.FYJRFA.AIPHAN
(TENSTRE SAL HER ADITIONAL CARDS ADE DEQUTED)	
	C INPUT CONCRETE PROPERTIES
AGEU COLS. 1=5,11=15,21=25,ETC. : AGE OF THE CONCRETE	Č
(DAYS)	READ 628, THICK, ALPHAC, ZTOT, UNHT, FPC, STRNMUL, NSTRN, IFY
TENSION COLS. 6-10,16-20,26,30,ETC. : TENSILE STRENGTM	PRINT 580
(PSI)	PRINT 630
	PRINT 200 05107 - 400 - 70707 - 10040 - 7707 - 10047 - 500
TYPE LA	EKINI GADI INICKIMELMETITIDUMITELE
SLABABASE FRICTION PELATIONSHIP	C INPUT ENVIROMENTAL FACTORS
(FORCE+DISPLACEMENT)	
(IF IFY > 4 ADDITIONAL CARDS ARE REQUIRED)	READ 650, CURTEMP, NTEMP, DELTATH, COLDTM, COLDSTN
	c

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READ 655, (DT(I),I=1,NTEMP)
C
C
      INPUT EXTERNAL LOAD
С
      READ 660,TMLOO,WHLOAD,WHBASE,SOILK,WHLSTR
      READ 665, TOL, LONGPR, NPRINT, IPLOT, TH&CALE, FINAL
C
        MAKE DEFAULT SETTINGS
C
          IF (LONGPR.EQ. 3HYES. AND. NPRINT.LE. 8) NPRINT = 20
          IF(IFY,LE.0) IFY # 2
          IF(TOL, LE. 0. 0) TOL = 5.0
          IF (ITYPER.E0.2. AND. BHIGH.LE.0.0) BHIGH = 18.0
          IF (STRNMUL, E0, 0, 0) STRNMUL = 1.0
          IF (COLDTM.LT.NTENP) COLDTH . NTEMP
          IF (THLOD.GE.NTEMP) THLOD & NTEMP
С
         IF (NSTRN_EQ.8) GO TO 38
С
C
      INPUT AGE-TENSILE STRENGTH RELATIONSHIP
C
      READ 668, (AGEU(I), TENSION(I), I#1, NSTRN)
                TENS#TENSION(NSTRN)
      PRINT 670, ((AGEU(I), TENSION(I)), IS1, NSTRN)
         GO TO 68
   30 PRINT 688
      PRINT 698
      DO 50 Ia1,8
                DUMDUM#FPC*PERCENT(I)+0.81
         IF (DUMDUM,EQ.0.) GO TO 40
               DUMDUM#STRNMUL#3080./(3.+12000./DUMDUM)
   48 PRINT 700, AGE(I), DUMDUM
   50 CONTINUE
                TENS#STRNMUL+3000,/(3,+12000,/FPC)
C
      INPUT SLAB-BASE FRICTION RELATIONSHIP **(FORCE-DISPLACEMENT**)
C
C
   68 PRINT 718
      READ 730, (FEXP(I), YEXP(I), I=1, IFY)
         IF (IFY,EQ.2) GO TO 80
         IF (IFY,GT.2) GO TO 98
                FRICHUL#FEXP(1)/YEXP(1)
                FUEFEXP(1)
         PRINT 740, FEXP(1), YEXP(1)
         GO TO 100
   89
                FRICHUL=SQRT(A88(1/YEXP(1)))*FEXP(1)
                FU=FEXP(1)
         PRINT 750, FEXP(1), YEXP(1)
         GO TO 180
           IF (FEXP(1),NE.0,OR,YEXP(1),NE.0.) GO TO 440
   99
         PRINT 760, ((FEXP(I), YEXP(I)), I=1, IFY)
  100 PRINT 800
      PRINT 790, CURTEMP
      PRINT 810
      00 110 I=1,NTEMP
               TEMPT=DT(I)
               DT(I)=CURTEMP=DT(I)
```

C

C

INPUT MINIMUM DAILY TEMPERTURE

IF (OT(I).LT.0) DT(I)=0.

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PRINT 820, I,TEMPT,DT(I)
110 CONTINUE
     PRINT 840, DELTATH, COLDTH
              DELTATM#CURTEMP=DELTATM
        CALCULATE WHEEL STRESS
     IF (NSTRN, EQ. 0) GO TO 111
        DUMASTENS/STRNMUL
        DUMB=(12000,+0UMA)/(3000,-3,+DUMA)
        ECON=33.*(UNHT**1.5)*SQRT(DUMB)
     60 TO 112
       ECON=33.+(UNHT++1.5)+SQRT(FPC)
 111
 112 IF (WHLOAD, EQ. 0.) GO TO 116
     Q1=1.724+THICK
     IF (WHBASE.GE.Q1) GO TO 113
     B=8QRT(1,6*(HHBA8E*#2,)+(THICK##2,))=(,675#THICK)
     GO TO 114
 113 BEWHBASE
 114 Q2=ECON*(THICK**3.)
     Q3=11,73+801LK
     8TIF=(Q2/Q3)++,25
     Q4=(.316+WHLOAD)/(THICK++2.)
     Q5=ALOG10(STIF/B)
     #HLSTR=04+(4+05+1,069)
 116 CONTINUE
     PRINT 845
     PRINT 850
     PRINT 846
     IF (WHLOAD, EQ. 0,0) GO TO 852
     PRINT 851, WHLOAD, WHBASE, SOILK, ECON, THLOD, WHLSTR
     Go TO 854
 852 PRINT 853, WHLSTR, TMLOD
 854 PRINT 860
     PRINT 870, MAXITE, TOL
         IF (IPLOT.EQ. 3HYES) CALL PLOTEMP (TM8CALE, FINAL)
     *********************************
         INITIALIZE PARAMETERS
     *****************************
       IF(LONGPR, EQ, 3HYE8) PRINT 500
              XBAR # 4800.0
               IFINISH=0
              TOL=0,01+TOL
              P=0.01+P
 130
             IF (ITYPER,E0,2) ICLOSEB=1
              NEWBAR = Ø
               ANTENPENTEMP
               IBABY=0
               IBECK=0
               IBXBAR=0
               IENDONE=Ø
              ITEB=0
               NTENTP1=1
               HEXBAR/(2.0+NT)
              IB=1
              AAA=1
              BLOWES, S*BHIGH
 140
               NTIFLAG=1
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TIME=0.

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DOWNINC=2. UPINC=10. DELTATES. Z#8. С ****** THIS SECTION OF THE PROGRAM HAS THE ALGORITHIUM FOR THE С INCREMENTAL APPROACH BEFORE THE TENSILE STRENGTH REACHES ĉ С A HAXIMUM CONSTANT LEVEL. c IF (ITYPER, EQ.2.) BONDL=BLOW+(BHIGH=BLOW)+RANB(0.) 158 ITTIMENØ CALL DELTEMP (TIME, DELTAT) 160 IF (TIME, GE, ANTEMP) GO TO 268 CALL FORWARD (TENSTRN, ZTOT, Z) CALL PACKAGE (SUM, INDEX) IF (NEWBAR,ED,1) GD TD 130 IF (STRMAX.LT.TENSTRN) GO TO 178 NTIFLAG==1 ITTINEBITTIME+1 IF (ITTINE, GT, MAXITE) GO TO 418 60 TO 168 178 CONTINUE IF (ABS(STRMAX),LT,0,801) GO TO 150 PFLSHTENBTRN PSTRMAX#STRMAX NTIFLAG#1 IF (IFINISH, EQ.1) PRINT 490, TIME, DELTAT, Z, TENSTRN, XBAR, CRACKW, STRMAX, STRESSS(NTP1) 1 С LOCATE PDINT 2 С C ITERI 180 CALL DELTEMP (TIME, DELTAT) IF (TIME.GE.ANTEMP) GO TO 268 CALL FORWARD (TENSTRN, ZTOT, Z) CALL PACKAGE (SUM, INDEX) IF (NENBAR,EQ.1) GO TO 138 DUMMY=(BTRMAX=TENSTRN)/TENSTRN IF (ABS(DUMMY), LT, TOL) GD TO 228 IF ((STRMAX+TENSTRN),GE,8,) GO TO 200 PFLSHTENSTRN PSTRHAX#STRHAX IF (IFINISH.EG.1) PRINT 490, TIME, DELTAT, Z, TENSTRN, XBAR, CRACKH, STRMAX, STRESSS(NTP1) 1 GO TO 188 280 CONTINUE IBXBAR=1 218 CONTINUE ITE=ITE+1 IF (ITE,GT,MAXITE) GD TO 468 CALL GETHE (PFL8, PSTRMAX, TENSTRN, STRMAX, FOUT) TENSTRNEFOUT NTIFLAGED CALL BACKWAR (FOUT, ZTOT, Z) CALL DELTEMP (TIME, DELTAT) CALL PACKAGE (BUH, INDEX) IF (NEWBAR.EG.1) GO TO 130 DUMMY#(STRMAX+TENSTRN)/TENSTRN IF (ABS(OUMMY), GE, TOL) GO TO 210 220 CONTINUE

.

IBX8AR#1 ICRLOC=0 RESPONSETIME IF (IENDONE,EQ.1) GO TO 230 XBAR=0.5+XBAR HEXBAR/(2.+NT) 60 TO 240 230 CONTINUE BDUNDU=XBAR XBAR=(BOUNDL+BOUNDU)+0.5 HEXBAR/(2.+NT) 240 TRY1=2.+XBAR 241 CONTINUE IF (ITYPER,EQ.2.) BONDL=BLON+(BHIGH=BLON)+RANB(0.) CALL PACKAGE (SUM, INDEX) IF (NEWBAR, EG. 1) GO TO 138 IF (IBABY,EG.0) GO TO 250 CALL BABY (IENDONE, BOUNDL, BOUNDU) TRY2=ABS(TRY1=XBAR) IF (TRY2_LT_1_8) GO TO 258 GO TO 241 250 CONTINUE IF (IFINISH.EG.1) PRINT 490, TIME, DELTAT, Z, TENSTRN, XBAR, CRACKH, 1 STRMAX,STRESSS(NTP1) PFLSETENSTRN PSTRMAX#STRMAX NTIFLAGR1 GO TO 188 С THIS SECTION OF PROGRAM HAS THE ALGORITHM FOR THE INCREMENTAL C APPROACH AFTER THE TENSILE STRENGTH REACHED MAXIMUM VALUE. C ******* C 268 TIMERANTEMP CALL FORWARD (TENSTRN, ZTOT, Z) DELTAT=DELTATH IF (ITYPER.EG.2.) BONDL=BLOW+(BHIGH-BLOW)+RANB(8.) 278 ZEZTOT CALL PACKAGE (BUH, INDEX) IF (NEWBAR,EG.1) GO TO 130 298 CONTINUE DUMMY=(STRMAX=TENSTRN)/TENSTRN IF (ABS(DUHHY), LT, TOL) GO TO 360 IF (STRMAX, LT, TENSTRN) GO TO 320 IBXBAR=1 ICALDC=1 IF (IENDONE,EG.1) GO TO 380 XBARBO. S+XBAR HEXBAR/(2.+NT) GO TO 278 300 CONTINUE BOUNDUEXBAR XBAR=(BOUNDL+BOUNDU)+0.5 HEXBAR/(2,+NT) GO TO 278 320 CONTINUE IF (ICRLOC.EG.Ø.AND.IFINISH.EG.1) GO TO 370 NTIFLAG#1 IF (IENDONE.NE.1) BOUNDU # 2.8 + XBAR BOUNDL=XBAR XBAR=(BOUNDU+BOUNDL)+0.5

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HEXBAR/(2.+NT) IF (IBXBAR,EQ.0) GO TO 140 IENDONE=1 DUMHY#(BOUNDU+SOUNDL)/BOUNDU IF (DUMNY_LT.#) GO TO 428 IF (DUMMY, LT, TOL) GO TO 368 IF (ICRLOC,NE.0) GO TO 270 TIME#RESPONS **IBECK#Ø** GO TO 150 368 CONTINUE IF (IFINISH,EQ.0) GD TO 380 370 CONTINUE CALL PACKAGE (SUM, INDEX) XBAR#XBAR/12. PRINT 860, XBAR, CRACKW, STRMAX, STRESSS(NTP1), TENSTRN PRINT AGA PRINT 988, (I,AL(I),Y(I),F(I),CONSTR(I),STRESSS(I),I#1,NTP1) 380 CONTINUE IF (IFINISH,EQ.1) GO TO 10 TEMXBAR#XBAR X848#4898.4 IFINISH#1 PRINT 530 PRINT 540, (AN1(N),N=1,16) PRINT 550, NPROB, (AN2(N), N=1,7) PRINT 488 GO TO 130 C 410 PRINT 910 GO TO 18 420 CONTINUE PRINT 928 60 10 478 448 CONTINUE PRINT 940 GO TO 478 445 CONTINUE PRINT A75, STRMAX, TENSTRN, BOUNDU, BOUNDL GO TO 10 450 CONTINUE PRINT 950, ITYPER GO TO 470 460 CONTINUE PRINT 968, ITE 470 CONTINUE C 475 FDRMAT (//,10X,*ERROR IS DETECTED*,/,10X,*STRMAX #+,E10.3,/, 10X, *TENSTRN #*, E10, 3, /, 10X, *800NOU #*, E10, 3, /, 1 2 10X, +BOUNDL =+, E10.3) 480 FORMAT (62X, 9H MAXIHUM ,/, 2X, 23H TIME TEMP DRVING , CONCRETE STRESS IN ,/, 53H TENBILE CRACK CRACK 1X,51H (DAY8) DROP SHRINKAGE STRETH SPACING WIDTH , - 3 4X,22H STRESS THE STEEL ./) 498 FORMAT (2X,F5,2,2X,F5,1,2X,E10,3,2X,F5,1,3X,F6,1, 1 1X,E10,3,2(2X,E10,3)) 500 FORMAT (1H1) 518 FORMAT (8410) 520 FORMAT (A5,5X,7A10) 538 FORMAT (5H1 ,76X,18HI++++TRIM)

550 FORMAT (//, SH PROB, /, 45, 5%, 7410, //) 560 FORMAT (15,5X,6(E10,3)) 570 FORMAT (10%,1H+,46%,1H+,/, STEEL PROPERTIES *./. 10X,48H+ 1 10X,1H+,46X,1H+) 2 580 FORMAT (10X,48(1H+)) 590 FORMAT (//,15X,39H TYPE OF LONGITUDINAL REINFORCEMENT IS ,/, 26X,14H DEFORMED BARS) 608 FORMAT (//,15X,39H TYPE OF LONGITUDINAL REINFORCEMENT IS ./. 23X,21H DEFORMED WIRE FABRIC) 1 610 FORMAT (//, 15x, 24H PERCENT REINFORCEMENT =, E10.3, /, 15X,24H BAR DIAMETER =,E10.3,/, 15X,24H YIELD STRESS *,E10,3,/, 15X,24H ELASTIC MODULUS =,E10.3,/, 15x,24H THERHAL COEFFICIENT =,E10,3,///) 628 FORMAT (18X, 5E18, 3, F4, 1, 12, 2X, 12) 638 FORMAT (18X, 1H+, 46X, 1H+, /, CONCRETE PROPERTIES * . / . 10X,48H# 1 10X,1H#,46X,1H#) 648 FORMAT (//, 15X, 22H SLAB THICKNESS #,E10.3./. 15X,22H THERMAL COEFFICIENT =,E10,3,/, 15X,22H TOTAL SHRINKAGE =,E10,3,/, 15X,22H UNIT WEIGHT CONCRETE=,E18,3,/, ٦. 15X,22H COMPRESSIVE STRENGTHE,E10.3,//) 650 FORMAT (E10,3,15,5X,E10,3,5X,F5,1,F10,1) 655 FORMAT ((16F5,1)) 660 FORMAT (5E10,2) 665 FORMAT (#5,1,2X,43,15,2X,43,F15,10,F5,0) 668 FORMAT ((16F5,8)) 678 FORMAT (//,15X,48H TENSILE STRENGTH DATA AS INPUT BY USER ,//, 14X,16H AGE, TENSILE ,/, 13X,18H (DAY8) STRENGTH ,/, . (15X,F5,1,2X,F5,1)) 688 FORMAT (14X, 22H TENBILE STRENGTH DATA, /, 15X, 21(1++)) 698 FORMAT (/, 15X, 43H NO TENSILE STRENGTH DATA IS INPUT BY USER ;/, 15x,49H THE FOLLOWING AGE-TENSILE STRENGTH RELATIONSHIP ,/ 1 15X,46H IS USED WHICH IS BASED ON THE RECOMMENDATION #/# 2. 15%,37H GIVEN BY U.S. BUREAU OF RECLAMATION ,//, 3 15X,15H AGE, TENSILE ,/, 14X,17H (DAY8) STRENGTH ,/) 788 FORMAT (13x, 2(2x,F5,1)) FORMAT (/,10X,48(1H+),/,10X,1H+,46X,1H+,/, 710 10X, 1H+, 5X, 35H BLAB+BASE FRICTION CHARACTERISTICS, 6X, 1H+, /, 10X,1H+,14X,17H F-Y RELATIONSHIP,15X,1H+,/,10X,1H+,46X,1H+,/, 10X,48(1H+),//) 730 FORMAT ((8F10,4)) 740 FORMAT (15X,41HTYPE OF FRICTION CURVE IS A STRAIGHT LINE,//, 15x,24H HAXIMUM FRICTION FORCE#, F10,4,7, 15x,24H HOVEMENT AT SLIDING =,F10,4) 750 FORMAT (15%, 36HTYPE OF FRICTION CURVE 18 & PARABOLA, //, 15X,24H MAXIMUM FRICTION FORCE#,F18,4,/, 15X,24H HOVEHENT AT SLIDING #,F10,4) 760 FORMAT (11X,43HTYPE OF FRICTION CURVE IS A MULTILINEAR CURVE,//, 17x,5H F(1),5X,5H Y(1),//,(13x,2F18,4),//) 1 790 FORMAT (14X, 20H CURING TEMPERATURE#, F5, 1, //) FORMAT (///,10X,30(1H+),/, 800 10×,1H+,26×,1H+,/, 1 TEMPERATURE DATA

540 FORMAT (1X,8410)

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2 10X,30H+ TEMPERATURE DATA +,/,10X,1H+,28X,1H+,/, 3 10X,30(1H+),//) BIG FORMAT (20X, THMINIMUM, 6X, THOROP IN, /, 10X, 3HDAY, 5X, 11HTEMPERATURE, 2X, 11HTEMPERATURE, /) 1 828 FORMAT (10X, (13,8X,F5,1,8X,F5,1)) 840 FORMAT (/,12X,36H MINIMUM TEMPERATURE EXPECTED AFTER ./. 12X, 37H CONCRETE GAINS FULL STRENGTH =,F5.1, 22H DEGREES FAMRENHEIT ,/,13X,+DAYS BEFORE+ A REACHING MIN. TEMP. ##F5,1,X,+0AY8+) 845 FORMAT (1H1,//,10X,48(1H+)) 846 FORMAT (18X,48(1H+)) 850 FORMAT (10X, 1H+, 46X, 1H+, /, EXTERNAL LOAD 1 10X,48H+ *,/, 10x,1H*,46X,1H*) 851 FORMAT (//, 15X, 25H WHEEL LOAD (LBB) *,E10,3,/; 15X,25H WHEEL BASE RADIUS (IN) =,E10,3,/, 15X,25H SUBGRADE MODULUS (PSI) .E10,3,// 15X,25H CONCRETE MODULUS (PSI) .E10,3,// 15X.25H LOAD APPLIED AT #,X,F2,0,* TH DAY+,/, 15x,25H CALC,LOAD STRESS (PSI) #,E10,3,///) 853 FORMAT (//.15X,25H WHEEL LOAD STRESS (PSI)=,E10.3./. 15X,25H LOAD APPLIED AT 868 FORMAT (//,18X,48(1H+),/,18X,1H+,46X,1H+,/,18X,1H+,6X, 33H ITERATION AND TOLERANCE CONTROL ,7X,1H+,/, 1 10X, 1H+, 46X, 1H+, /, 10X, 48(1H+), ///) 2 878 FORMAT (10%,40H MAXIMUM ALLOWABLE NUMBER OF ITERATIONS=,15 ,// 10x,28H RELATIVE CLOSURE TOLERANCE=,F5,1, 8H PERCENT,//) 880 FORMAT (1H1,18X,34H AT THE END OF THE ANALYSIS PERIOD,/, /,10X,21H CRACK SPACING *, E10, 3, 6H FEET /,10x,21H CRACK WIDTH =,E10,3,8H INCHES , /,10X,21H MAX CONCRETE STRESS=,E10,3,5H PSI . /,10x,21H HAX STEEL STRESS =,E10,3,5H PSI, /,10x,21H CONC. TENS. STRENGTH =,E18.3,5H PSI) 5 890 FORMAT (//,10X,48H STA- DIS- CONCRETE FRICTION CONCRETE 1, 4X,7H STEEL ,/,10X,24H TIDH TANCE HOVEMENT , 4X,31H FORCE STRESS STRESS ./) 2 988 FORMAT (10X, 15, 2X, F5, 1, 2X, 4(E18, 3, 2X,)) 910 FORMAT (//,10%,37H FOR ALLOWABLE NUMBER OF ITERATIONS, ,/, 18X.36H THE SOLUTION DOES NOT CLOSE ON THE . 18X,24H STRESS STRENGTH CURVE, ./. 13X,29HCURRENT PROBLEM IS TERMINATED,/, 19X,18H PROGRAM CONTINUES) 920 FORMAT (//,10%,41H ERROR IS DETECTED BY ITERATING ON CRACK ,/, 18X,41H SPACING, PROGRAM IS TERMINATED. 938 FORMAT (//,15X,3H++ ,+CURRENT PROBLEM IS TERMINATED+3H ++,//, 15X, THE BOND LENGTH IS GREATER THAN THE +, /, 15X, +CRCP HODEL, UNFORTUNATELY, FOR THIS+,/, 15%, +CONDITION, THE THEORETICAL EQUATION8+,/, 3 15X,+DO NOT HOLD TRUE,+,/,23X,+PROGRAM CONTINUES+) 948 FORMAT (//,10X,* ERROR IS DETECTED *,/, 10X, * FRICTION-MOVEMENT CURVE INPUT IS WRONG *,/, 10X.+ F(1) AND Y(1) SHOULD BE ZEROS +./. 10X, * PROGRAM IS TERMINATED *) 950 FORMAT (//,10X,* ERROR IS DETECTED *./. 1 10X, *TYPE OF PERCENT REINFORCEMENT OPTION IS NOT RIGHT*, /, 2 10x,*ITYPER=*,IS) 960 FORMAT (//,10X,* PROGRAM IS TERMINATED , ITE # +,15) END

SUBROUTINE PACKAGE (SUM, INDEX)

23 COMMON /BLOCK1/ RATIO, THICK, P, FF, STRAINC, ES, NTP1, U, DIA, UNNT COMMON /BLOCK2/ SS(101), AAA, WS(101), LONGPR, NPRINT, MAXITE, CRACKW COMMON /BLOCK3/ XBAR, STRSC, STRSB, STRC, IBABY, ITEB, NEWBAR COMMON /BLOCK4/ AL(101), STRAIN(101), CONSTR(101), STRESSS(101) COMMON /BLOCK5/ FEXP(10), YEXP(10), FRICHUL, NT, FU, IFY COMMON /BLOCKS/ ALPHAC, ALPHAS, EC, FPC, TIME, EP, TOL, ITYPER COMMON /BLOCK8/ Y(101), REFF(101), YP(101), H, ICLOSEB, YPITE(101) COMMON /BLOCK9/ STX, STY, PSX, PSY, ITE COMMON /BLOCK14/ F(101),BONDL,Z,DELTAT,STRMAX,WHLSTR,THLOD,IBECK OIMENSION SUM(101) REAL L INTEGER AAA ۴ L=0.5+XBAR 00 10 I=1,NTP1 Y(I)=REFF(I)=YP(I)=AL(I)=F(I)=0. 88(I)=STRAIN(I)=CONSTR(I)=STRE5SS(I)=#. CONTINUE 10 IF (ITYPER.EQ.1) CALL DFBAR(THLOD,WHLSTR) IF (NEHBAR.EQ.1) RETURN IF (ITYPER, EQ. 2) CALL DEWIRE IF (BONDL.GT.L) IBABY#1 IF (BONDL LE.L) IBABY=0 STRAINC=STRMAX/EC CALL STRGENE (BONOL) CALL SIMPSPE (STRAIN, NTP1, H, SUM) CALL CONHOV (SUM, Z, DELTAT) CALL FRIC (F) DO 20 J=1,NTP1 REFF(J)#F(J) 28 IF (ITYPER, EQ. 1) CALL DEBARE (THLOD, WHLSTR) IF (ITYPER, EQ.2) CALL DFWIREF CALL SIMPSPE (STRAIN, NTP1, H, SUM) CALL CONHOV (SUM, Z, OELTAT) CALL FRIC (F) 00 30 J#1,NTP1 F(J)=(REFF(J)+F(J))+0.5 39 Ĉ 40 CALL SIMPSPE (F,NTP1,H,SUM) FFESUMENTPIN IF (AAA, LT. MAXITE) GO TO 50 PRINT 98, AAA PRINT 100 PRINT 118. (I.AL(I), REFF(I), YP(I), Y(I), F(I), I#1, NTP1) S& IF(FRICHUL, NE, 8, 8) CALL BAKFRIC(F) IF (ITYPER.EG.1) CALL DEBARE(THLOD, WHLSTR) IF (ITYPER, EG. 2) CALL DFHIREF IF (LONGPR.NE. 3HYES) GD TO 60 PRINT 128 PRINT 148, TIME, Z, DELTAT PRINT 130. STRMAX 60 CALL SIMPSPE (STRAIN, NTP1, H, SUM) CALL CONHOV (SUM, Z, OELTAT) CALL CLOSE (NTP1, INDEX, F) IF (INDEX, EQ. 1, AND, ICLOSEB, EQ. 1) RETURN DO 200 1=1,NTP1 IF (YP(I), GT, Y(I)) GD TO 250 TEMP=REFF(I)

REFF(I)=F(I) F(1)=(3.0*F(1)=TEMP)+8.5 cc GO TO 280 C 250 CONTINUE ċ F(1)#(REFF(1)+F(1))+8.5 Ċ 200 CONTINUE ē DIFFERENTIAL EQUATION . 60 TO 48 ř C c FORMAT (//,10X,*RESULTS FOR ITERATION *, 15./) 98 188 FORMAT (/, 12X, * I +, 7X, * AL(I) +, 7X, * REFF+, 9X, * YP+, 11X, * Y+, 11X, * F+, /) 110 FORMAT (10X,15,5(2X,E10.3)) 120 FORMAT (//,20X,+IN THE PACKAGE ROUTINE+,/) 130 FORMAT (19X,* 5TRMAX **,E10,3) 140 FORMAT (19X,* FOR TIME OF * ,E10.3,/, 1 20X, + SHRINKAGE=+, E10, 3, /, 2 28X,+OELTAT =+,E18,3) DIMENSION SUM(101)

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END
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SUBROUTINE CONMON (SUM. Z. DEL TAT)

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*************
   THIS SUBROUTINE COMPUTES THE NOVEMENT OF THE CONCRETE AT
Every station . The movement is computed from the developped
**********
COMMON /BLOCK1/ RATIO, THICK, P, FF, BTRAINC, ES, NTP1, U, DIA, UNWY
COMMON /BLOCK2/ SS(181), AAA, H8(181), LONGPR, NPRINT, MAXITE, CRACKH
COMMON /BLOCK3/ XBAR, STRSC, STRSB, STRC, IBABY, ITEB, NEWBAR
COMMON /BLOCK4/ AL(101), STRAIN(101), CONSTR(101), STRESSS(101)
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CONHON /BLOCK5/ FEXP(10), YEXP(10), FRICHUL, NT, FU, IFY COMMON /BLOCK6/ ALPHAC, ALPHAS, EC, FPC, TIME, EP, TOL, ITYPER COMMON /8LOCK8/ Y(101), REFF(101), YP(101), H, ICLOSEB, YPITE(101) INTEGER AAA

```
00 10 I=1.NTP1
            Y(I)#BUM(I)#AL(I)*(ALPHAC*DELTAT+Z)*Y(1)
    IF (AB8(Y(1)).GT.1.) GO TO 20
18
           CRACKNEABS(Y(NTP1))+2.
     IF (LONGPR.EG. 3HYES) PRINT 30, ((I.AL(I), STRAIN(I), SUM(I), Y(I)),
                           IN1,NTP1,NPRINT)
 1
  RETURN
28 PRINT 58, (Y(I), I=1, NTP1)
30 FORMATE //.25X,*IN SUBROUTINE CONMOV*.
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//,10X,* INDEX DISTANCE
1
                                    CON STR
                                                 SUM
                                                           CO.
2N HOV *.//. (10X.15.4(2X.E10.3)))
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58 FORMAT (/,10X,47H MOVEMENTS GREATER THAN 1 INCH ARE ENCOUNTERED ./
   1, 10X,8(2X,E10,3))
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END
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SUBROUTINE CLOSE (N, INDEX, F)
CC.
C.
     THIS SUBROUTINE IS USED WITH THE BINARY TECHNIQUE
C
C
         OF MOVEMENT CLOSURE
С
     С
     COMMON /BLOCK2/ 85(101), AAA, WS(101), LONGPR, NPRINT, MAXITE, CRACKW
     COMMON /BLOCK4/ AL(181), STRAIN(181), CONSTR(181), STRESSS(181)
     COMMON /BLOCK6/ ALPHAC, ALPHAS, EC, FPC, TIME, EP, TOL, ITYPER
     COMMON /BLOCK8/ V(101), REFF(101), YP(101), H, ICLOSE8, YPITE(101)
     DIMENSION DIF(101), F(101)
     INTEGER AAA
C
              INDEX=8
              BAD=1,
      IF (LONGPR.EQ. 3HYE8) PRINT 148
        IF (AAA,EQ.1) GO TO SO
      00 20 I=2,N
        IF (Y(I)_EQ.0.) GO TO 20
        IF (AB8(Y(I))+LT+1+E=06) GO TO 20
              DIF(I)=(Y(I)=YPITE(I))/Y(I)
          IF (A88(DIF(I)).GT.TOL) BAD=BAD+1.
 20 CONTINUE
        IF (LONGPR.NE. 3HYES) GO TO 30
     PRINT 80
     PRINT 90, ((I,Y(I),YPITE(I),DIF(I)),I=1,N,NPRINT)
 30
    CONTINUE
        IF (BAD.GT.1.) GO TO 50
          INDEX = 1
          AAA = 1
        IF (LONGPR.EQ. 3HYES) PRINT 108
      RETURN
 50
     CONTINUE
              AAABAAA+1
        IF (AAA, GT. MAXITE) GO TO 70
              MA1=AAA=1
      DO 60 I=1,N
   60
              YPITE(I)=Y(I)
          IF (LONGPR.EG. 3HYES) PRINT 110, MA1, BAD, AAA
      RETURN
C
 70 CONTINUE
     PRINT 120
     PRINT 110, MA1, BAD, AAA
     PRINT 80
     PRINT 130, ((I,Y(I),YPITE(I),DIF(I),88(I),STRESSS(I),STRAIN(I),
     1
           CONSTR(I),F(I)),I=1,N)
C.
 80 FORMAT ( 28X,*
                                  YPITE
                                             DIF
                                                    *,/)
    FORMAT ( 20X, 15, 3(2X, E10, 3))
 90
 100 FORMAT (10X, 3H++ , +SOLUTION CLOSES WITHIN THE SPECIFIED NUMBER OF
     1ITERATIONS +,2H++,6/ )
 110 FORMAT ( /, 10X, * SOLUTION DID NOT CLOSE FOR ITERATION*, 15, /,
         10X, *THE NUMBER OF POINTS THAT DID NOT CLOSE ARE*, F10, 0, /,
     1
          1H1,//,10X,* RESULTS FOR ITERATION *, 15,//)
     2
 120 FORMAT (//,10X,* BAD LUCK, SOLUTION DID NOT CLOSE *,//)
 130 FORMAT ( 20x, 15,8(2x, E10,3))
 140 FORMAT(//,30X,+IN SUBROUTINE CLOSE+,/)
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END

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SUBROUTINE BAKFRIC (F) 22 COMMON /BLOCK1/ RATIO, THICK, P, FF, STRAINC, ES, NTP1, U, DIA, UNHT COMMON /BLOCK2/ SS(101), AAA, WS(101), LONGPR, NPRINT, MAXITE, CRACKW COMMON /BLOCK3/ XBAR, STRSC, STRSB, STRC, IBABY, ITEB, NEWBAR COHMON /BLOCK4/ AL(181), STRAIN(181), CONSTR(181), STRESSS(181) COMMON /BLOCK5/ FEXP(10), YEXP(10), FRICHUL, NT, FU, IFY COMMON /BLOCK6/ ALPHAC, ALPHAS, EC, FPC, TIME, EP, TOL, ITYPER COMMON /BLOCK8/ Y(101), REFF(101), YP(101), H, ICLOSEB, YPITE(101) DIMENSION F(101) INTEGER AAA C IF (IFY_EQ.1) GO TO 40 IF (IFY.EQ.2) GO TO 60 DO 30 I=1,NTP1 00 10 J=1, IFY IF (ABS(F(I)), LT, ABS(FEXP(J))) GO TO 20 10 CONTINUE YP(I)=YEXP(IFY) GO TO 30 28 CONTINUE DUMDUM=(FEXP(J)=FEXP(J=1))/(ABS(YEXP(J))=ABS(YEXP(J=1))) YP(I)=ABS(YEXP(J=1))+(ABS(F(I))=FEXP(J=1))/DUMDUM IF (F(I),GT,0) YP(I)==YP(I) CONTINUE 30 RETURN 40 CONTINUE DO 50 I=1,NTP1 YP(I)=F(I)/FRICHUL IF (AB8(F(I)),GE,FU) YP(I)*YEXP(1) 50 CONTINUE RETURN 60 CONTINUE 00 70 I=1,NTP1 YP(I)=(F(I)/FRICHUL)++2 IF (AB8(F(I)).GE.FU) YP(I)=YEXP(1) IF (F(I),GT,0) YP(I)=-YP(I)

70 CONTINUE

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RETURN

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SUBROUTINE BABY (IENDONE, BOUNDL, BOUNDU)
                                                                                        SUBROUTINE DEBARE
CC
                                                                                  CC
      COMMON /BLOCK3/ XBAR,STRSC,STRSB,STRC,IBABY,ITEB,NEWBAR
                                                                                  С
      COMMON /BLOCK4/ AL(101), STRAIN(101), CONSTR(101), STRESSS(101)
                                                                                  Ĉ
      COMMON /BLOCK5/ FEXP(10), YEXP(10), FRICHUL, NT, FU, IFY
                                                                                  C
      COMMON /BLOCK6/ ALPHAC, ALPHAB, EC, FPC, TIME, EP, TOL, ITYPER
                                                                                  Ĉ
      COHMON /BLOCK8/ Y(181), REFF(181), YP(181), H, SCLOSEB, YPITE(181)
                                                                                  ċ
C
                                                                                  С
                                                                                  C
           18A8Y = 0
                BOUNDLEXBAR
          IF (IENDONE,EG,1) GO TO 10
                BOUNDU=2. +XBAR
                XBAR=(BOUNDL+BOUNDU)+0.5
                H#XBAR/(2,+NT)
                IENDONE#1
      RETURN
                XBAR=(BOUNDL+BOUNDU)+9.5
   10
                HEXBAR/(2,+NT)
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RETURN
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************ THIS SUBROUTINE SOLVES FOR THE STRESS IN THE STEEL AT THE CRAC AND BETWEEN CRACKS. IT IS USED IN THE CASE OF DEFORMED BARS S THE DEVELOPMENT LENGTH CRITERIA OR BOUNDARY CONDITION IS IMPOS IN THE SOLUTION OF THE BASIC EQUATIONS. **** COMMON /BLOCK1/ RATIO, THICK, P, FF, STRAINC, ES, NTP1, U, DIA, UNWT COMMON /BLOCK2/ SS(101), AAA, WS(101), LONGPR, NPRINT, MAXITE, CRACKW COMMON /BLOCK3/ XBAR, STRSC, STRSB, STRC, IBABY, ITEB, NEWBAR COMMON /8LOCK4/ AL(101),STRAIN(101),CONSTR(101),STRESSS(101) COMMON /BLOCK5/ FEXP(10), YEXP(10), FRICMUL, NT, FU, IFY COMMON /BLOCK6/ ALPHAC, ALPHAS, EC, FPC, TIME, EP, TOL, ITYPER COMMON /BLOCK7/ SIGMASC, SIGMASB, NA, NAP1, E, A, S, DEND, NAP2 CDHMON /BLOCK8/ Y(101), REFF(101), YP(101), H, ICLOSEB, YPITE(101) COMMON /BLOCK14/ F(101), BONDL, Z, DELTAT, STRMAX, WHLSTR, THLOD, IBECK DIMENSION SUM(101) INTEGER AAA C ICL08E8#0 ABAL (NTP1)-BONDL IF (A.LE.S.) GO TO 15 NABA/H+1+EP . EEA#AL(NA) IF (NA.GT.NT) GD TO 50 NAP1=NA+1 NAP2ENA+2 NAM1=NA=1 DENDETHICK+(P+1./RATIO) 3UM1=0. SUM2=0. 00 18 Im1, NAM1 SUM1=SUM1+(2+NA=(2,*I+1))+(=F(1)/DENO) 8UH2=8UH2+(=F(1)/DENO) 10 C С DEFINE CONSTANTS ¢ S==F(NAP1)/DEND ANA#NA 15 CONTINUE BONDCON=DIA/(4.+U) Ci=1.+1./(RATIO*P) C2=EC+(Z+DELTAT+(ALPHAC=ALPHAS))/P C3=FF/(P+THICK) IF (A.LE. @. AND, IBECK, EQ. 1) GO TO 16 C4=C2=C3 CS#H#SUH2+8+E C6=H+H+SUM1+0.5 C7#(ANA=1,)+H C8#H+SUM2+E+S+E+E+8.5 C9==C4/C1+C5 C С DEFINE QUADRATIC EQUATION CONSTANTS С AA=BONDCON+(1,+1,/(C1+C1))+0.5 BB=(C7+E)/C1=BONDCON+C9/C1 CC==ALPHA8+AL(NTP1)+DELTAT+ES=C4+(C7+E) 1 /C1+C6+C8=80N0C0N+C9+C9+0.5

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С DELTA#88#88=4. +AA+CC IF (DELTA, LT. D.) GO TO 60 С RDOT1=(=BB+8GRT(DELTA))/(2,+AA) ROOT2= (+88-SORT (DELTA))/(2.+AA) IF (ROOT2.GT.8.) GO TO 48 SIGMASC#ROOT1 SIGHASB#(BIGHASC=C4)/C1 BONDLC=(\$IGMASC=(\$IGMABB+C5))+BONDCON IF (A.GT.B.AND.IBECK.EQ.B) GO TO 17 16 SIGMASCEAL (NTP1)/(2, +BONDCON)+ES+ALPHAS+DELTAT SIGHABB=(SIGHASC=C2+C3)/C1 BONDLC=(SIGMASC=SIGMASB) +BONDCON DUN=(BONDLC-BONDL)/BONDLC 17 IF (ABS(OUM).LE.TOL) ICLOSES=1 IF (ICLOSEB,EG.1) ITEB=0 ITEB#ITE8+1 IF (ITEB.GT. MAXITE) GO TO 20 BONDL=BONDLC C CONFUTE AREAS FOR SUMMATION CHECK C A1=H+((2,#ANA=2,)#8IQHA85+H+8UH1)+8,5 A2=8IGHA88+E+H+8UH2+E+8+E+8.5 A3=(SIGHASB+C5+SIGHASC)+BONDL+0.5 ************** IF (IBECK.EQ.1) AAAA=AL(NTP1)*(8IGHA8C+(AL(NTP1)+ (SIGMASC=SIGMASB))/(2,+BONDL)) 1 C DUM2#ALPHAS#AL(NTP1)+DELTAT*ES IF (ABS(AAAA-DUH2),GT,1,E-5) GO TO 78 CALL POIRES (LOCMAX) RETURN ¢ 20 CONTINUE PRINT 90, ITEB GO TO BE 30 CONTINUE PRINT 100, A GO TO 88 40 CONTINUE PRINT 118, DELTA, ROOT1, ROOT2 GO TO 88 CONTINUE 50 PRINT 128, NA, NT, BONDL, AL (NTP1), H, A GO TO 80 68 CONTINUE PRINT 138, DELTA GO TO 80 70 CONTINUE PRINT 148, DUM2, AAAA 88 CONTINUE С FORMAT (//,10%,+ SOLUTION DID NOT CLOSE BY ITERATING ON BOND *, 90 *LENGTH IN SUBROUTINE DFBARF*,/,10X,*PROGRAM IS TERMINATED*, 1 /,10X,* ITE8=*,15) 2 100 FORMAT (//, 10X, *ERROR IS DETECTED IN DEBARF*,/, 10X,+A IS NEGATIVE AND=+,E10,3) 1

110 FORMAT (//,10X,=DELTA=+,E10,3,/,

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10X, +ROOT1=+, E10, 3,/, 1 2 10x, +RODT2=+, E10, 3, /, 3 18X,* ERROR IS DETECTED IN SUBROUTINE DEBARF, ROOT2 IS POS. *) 128 Format (/,20X,* ERROR IS DETECTED *,/, 10x,+ NA = +,15,10x,+ NT = +,15,/, 10x,+ B = +,F10,3,5x,+ AL = +,F10,5,/, 10x,+ H = +,F10,3,5x,+ A = +,F10,5) 2 3 130 FORMAT (/, 18X, *ERROR IS DETECTED*, /, 18X,* DELTA IS NEGATIVE AND#*, E18, 3) 1 148 FORMAT (/, 10x, * ERROR 18 DETECTED IN SUBROUTINE DEBARF*,/, 1 10X, * DUM2 IS NOT EQUAL TO AAAA*,/, 2 18X,* DUM2#*,E15,7,2X,* AAAA#*,E15,7) END

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RETURN

END

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FUNCTION RANB (ARG)
                                                                                SUBROUTINE DEBAR
                                                                          CC
DATA PY.RANB/3.0576752..379845342/
                                                                                THIS SUBROUTINE COMPUTES THE STRESSES AND STRAINS IN THE CONCRETE
                                                                         Ĉ
                                                                         ĉ
                                                                                STEEL DUE TO A TEMPERATURE DROP AND/OR SHRINKAGE .
    IF (ARG.LT.0.0) RETURN
                                                                                THE EQUATIONS ARE WRITTEN FOR A FRICTIONLESS SYSTEM
                                                                         Ċ
    IF (ARG.GT.0.0) GD TO 20
                                                                          C
         TENDERANA
                                                                                COMMON /BLOCK1/ RATID, THICK, P, FF, STRAINC, ES, NTP1, U, DIA, UNWT
          RANB#RANB+PY+1.2357863E+5
                                                                                COMMON /BLOCK2/ SS(101), AAA, WS(101), LONGPR, NPRINT, MAXITE, CRACKH
         NEDANR
                                                                                COMMON /BLOCK3/ XHAR, STRSC, STRSB, STRC, IBABY, ITEB, NEWBAR
         RANS=ABS (RANB=N)
                                                                                COMMON /BLOCK4/ AL(101),STRAIN(101),CONSTR(101),STRESSS(101)
                                                                                COMMON /BLOCK5/ FEXP(10), YEXP(10), FRICMUL, NT, FU, IFY
         PYETEMP
                                                                                COMMON /BLOCK6/ ALPHAC, ALPHAS, EC, PPC, TIME, EP, TOL, ITYPER
                                                                                COMMON /BLOCK8/ Y(101), REFF(101), YP(101), H, ICLOSEB, YPITE(101)
          NEARG
         PY#ABS(ARG+N)+6.0585548
                                                                                COMMON /BLOCK14/ F(101),BONDL,Z,OELTAT,STRMAX,WHLSTR,THLOD,IBECK
   GO TO 10
                                                                                INTEGER AAA
                                                                         С
                                                                                  HXBAR # 0.5 # XBAR
                                                                                   IF (Z.LT. 0. OR. DELTAT.LT. 0.) GO TO 40
                                                                                   IF (INECK.EQ.1) GO TO 20
                                                                          С
                                                                          č
                                                                                    COMPUTE CONSTANTS
                                                                         č
                                                                                         CI#(RATIO=P)/(I_+RATIO=P)
                                                                                         C2#(E8+Z)/(1,+RATIO*P)
                                                                                         C3=(1.=C1)=DIA/(4.=U)
                                                                                         C4=C2+DIA/(4.+U)
                                                                                         AA=C3=C1+C3
                                                                                         BR#184R+C1+C1+C4+C2+C3+C4
                                                                                         DD==E8+XBAR+DELTAT+ALPHAS=XBAR+C2+C2+C4
                                                                                         DELTA=88+88=4.+AA+00
                                                                                   IF (DELTA, LT. 0.) GO TO 98
                                                                         C
                                                                                  STRSC STRESS IN THE STEEL AT THE CRACK
                                                                         С
                                                                                  STRSS# STRESS IN THE STEEL BETWEEN CRACKS
                                                                          С
                                                                          č
                                                                                  STRCE STRESS IN CONCRETE
                                                                          ċ
                                                                                         STRSC=(+88+(DELTA++8,5))/(2,+AA)
                                                                                         STRSB=C1+STRSC=C2
                                                                                         STRC#STR8B/RATIO+EC=Z
                                                                                         B=(STRSC=STRSB)=0IA/(4.0+U)
                                                                                   IF (B,LE.0.) GO TO 38
                                                                                   IF (B.GT.H) GO TO 18
                                                                                   X84R#180.+8
                                                                                   NEWBARES
                                                                                   RETURN
                                                                             16
                                                                                  IF (B.GE.HXBAR) GO TO 20
                                                                                CRAH#(ALPHAC+DELTAT+Z)+HXBAR=(8TRC+(HXBAR=B))/EC=STRC+B/(EC+2.)
                                                                                         CHE=(XBAR=2.+8)+STRSB+(STRSC+STRSB)+8
                                                                                         CHECK=CHE=ES+XBAR+DELTAT+ALPHAB
                                                                                   IF (A88(CHECK).GT.1.E=2) GO TO 70
                                                                         C
                                                                          ē
                                                                                * CHECKING THE SOLUTION BY SOLVING FOR CONCRETE STRESS FIRST
                                                                                         C11=DIA/(4,+U+P+P)
                                                                                         C12=XBAR+RATIO
                                                                                         C13#XBAR+ES#Z
                                                                                         C14#ALPHAS*XBAR*ES*DELTAT
                                                                                         DEL=C12+C12+4.+C11+(C13+C14)
                                                                                         CONCRES=(=C12+SQRT(DEL))/(2,=C11)
                                                                                         R2=(-BB-SQRT(DELTA))/(2,+AA)
                                                                                         R4=C1+R2=C2
```

RABR4/RATIO+EC+Z IF (R6.GT_0) GO TO 50 IF (R2.GT.0) GO TO 50 IF (LONGPR.EQ. 3HYES) PRINT 130, C1.C2.C3.C4.AA.88.DD. DELTA DEL CONCRES 1 TF (ABB(STRC=CONCRES).GT.1.E=7) GO TO 80 С END OF AROVE CHECK C ٠ ē GD TO 25 20 TRECK#1 C1=1.+(1./RATID) C2# (EC/P) + (DELTAT+ (ALPHAC+ALPHAS)+Z) STRS8=(1./C1)+((HXBAR+4.+U)/(2.+DIA)+E8+ALPHA8+DELTAT)+(C2/C1) STRSC=(HXBAR+4,+U)/(2,+OIA)+ES+ALPHAS+DELTAT STRC=(4.+U+HXBAR+P)/DIA B=(STRSC=STRSB)+DIA/(4.+U) IF (B.LT.HXBAR) GD TO 105 CRAW# (ALPHAC+DELTAT+Z)+HXBAR+(STRC+HXBAR)/(2.+EC) STRAREANHXBAR+ (2.+STRSC= (HXBAR+STRSC) /B+ (HXBAR+STRSB) /B)/ (2.+ES) 1 IF (ABS(STRAREA+ALPHAS+DELTAT+HXBAR).GT.1.E+7) GO TO 180 STRMAX#STRC STRAINC#STRC/EC BONDL#B IF (LONGPR.EQ. 3HYES) PRINT 128, P. DELTAT. Z. XBAR. STRSC. STRSB 25 .STRC. EC. B. CRAN 1 TF(TAFCK.ED.1) GO TO 28 C COMPUTE AREA UNDER STEEL STRAIN DIAGRAM FOR THE ASSUMED C FRICTIONLESS SYSTEM c c. DUHISHXAAR-B STRAREAMDUH1+STRSB/ES+ (STRSB+STRSC)+B/(2++ES) IF (ABS(STRAREA-ALPHAS+DELTAT+HXBAR),GT.1.E-7) GO TO 100 STRMAX#STRC C ATRAINC#STRC/EC BONDL#B С COMPUTE CRACK WIDTH BY USING D.E. CONCEPT C ċ CRWIDTHEZ*BONDL+((STRSC+STRSB)/ES+STRAINC)+BONDL+8.5 DUNIE(CRAN-CRHIDTH)/CRAH IF (ARS(DUM1)_GT.0.01) GD TO 60 CONTINUE 28 RETURN C 30 CONTINUE PRINT 140. B GO TO 110 CONTINUE 44 PRINT 158, Z, DELTAT GO TO 110 50 CONTINUE PRINT 168, R2,R4,R6 GO TO 110 CONTINUE 60 PRINT 170, CRAW, CRWIDTH

GO TO 110

v (1 CONTINUE PRINT 120, P.DELTAT.Z.XBAR.STRSC.STRSB.STRC.EC.B.CRAW PRINT 180, CHECK CO TO 110 6 .A CONTINUE DRINT 120. P.DELTAT.7. YAAR.STRSC.STRSB.STRC.EC.B.CRAW PRINT 198 GO TO 118 64 CONTINUE PRINT 200 c 100 CONTINUE PRINT 210 PRINT 220, STRAREA 146 CONTINUE PRINT 115 PRINT 116,8,HXBAR 118 CONTINUE ſ. 115 FORMAT (//,18X,+IN SUBROUTINE DEBAR, BOND LENGTTH IS+/. 10X. * NOT GREATER THAN HALF THE CRACK SPCING *) 116 FORMAT (//.10X.+BONDL ##.E10.3./. 10X.+HALF XBAR =+.E10.3.//) 1 ##.E10.3,/, 120 FORMAT (//, 10X, * PERCENT REINFORCEMENT 19X. . TENPERATURE DROP ##.E10.3./. 10X.+ BHRINKAGE ##.E10.3./. 10X.+ CRACK SPACING #*.E10.3./. 10X,+ STEEL STRESS AT CRACK #*.E18.3./. 10X .* STEEL STRESS BETHEEN CRACKS **,E10.3./. 10X.+ CONCRETE STRESS ##.E10.3./. 10X.+ CONCRETE HODULUS #*,E10.3,/, 10X.+ DEVELOPMENT LENGTH #*.E10.3./. 10X. * CRACK WIDTH #*,E10.3,//) 138 FORMATE //.20X.+IN SUBPOUTINE OFBAR+, //,10X, * C1 * *,E10.3 , * C2 * *.E10.3 . 2 * C3 # *,E10,3 , 1 + C4 = +,E18.3 ./.10%. + AA # +,E10,3 , . . BB # #,E10.3 + DD = +, E10.3 ,//, 10X, * DELTA# *, E10.3 , DEL # #,E10.3 , . * CONCRES **, E10.3,) 140 FORMAT (//, 10X, *ERROR IS DETECTED IN SUBROUTINE DEBAR*, /, 18X, +BOND LENGTH IS NEGATIVE AND#+, E18, 3, /, 18%, *PRDGRAM IS TERMINATED*) FORMAT (//, 10X, * ERROR IS DETECTED IN SUBROUTINE TEMPSHR *. 150 10X.* Z = +,E10.3,/, 10X.+ DELTAT = +,E10,3) 168 FORMAT (//, 18X, *ERROR IS DETECTED IN SUBROUTINE TEMPSHR * 10X.+ STEEL STRESS AT CRACK ##,E10.3./. 1 14X,* STEEL STRESS BETWEEN CRACK #*,E10.3,/, 19X.+ CONCRETE STRESS #*,E10.3) 170 FORMAT (//.10X.+ERROR IS DETECTED IN THE COMPUTATION OF CRACK+,/, 1 10X,* WIDTH FOR THE FRICTIONLESS SYSTEM*, 2(5X,E10.3)) 180 FORMAT (///, 10X, * ROOTS DO NOT SATISFY EQUATION 1 *,/, 10X,

1 * CHECKE *, E10.3) 190 FORMAT (//,10X,* SOLUTION ONE DOES NOT MATCH SOLUTION THD *)

200 FORMAT (///, 30%, +DELTA IS NEGATIVE+)

210 FORMAT (/,10%,+SOMETHING IS WRONG, THE AREA UNDER STEEL STRAIN DI 1AGRAM IS NOT EQUAL TO ALPHAS *,1H*,* DELTAT *,1H*,* XBAR / 2*,/) 220 FORMAT (/,10%,* AREA UNDER STEEL STRAIN DIAGRAM FOR FRICTIONLESS 18LAO * +,E10,3//)

END

```
SUBROUTINE FRIC (F)
CC
      COMMON /BLOCK1/ RATIO, THICK, P, FF, STRAINC, ES, NTP1, U, DIA, UNHT
      COMMON /BLOCK2/ $5(101), AAA, WS(101), LONGPR, NPRINT, MAXITE, CRACKW
      COMMON /BLOCK3/ XBAR, STRSC, STR88, STRC, IBABY, ITEB, NEWBAR
      COMMON /8LOCK4/ AL(101), STRAIN(101), CONSTR(101), STRESSS(101)
      COMMON /BLOCKS/ FEXP(10), YEXP(10), FRICHUL, NT, FU, IFY
      COMMON /BLOCK6/ ALPHAC, ALPHAS, EC, FPC, TIME, EP, TOL, ITYPER
      COMMON /BLOCK8/ Y(101), REFF(101), YP(101), H, ICLOSEB, YPITE(101)
      DIMENSION F(101)
      INTEGER AAA
C
               BEYOND . 0.0
      IF (LONGPR.ED. 3HYES) PRINT 168
         IF (IFY, E9, 2) GO TO 40
         IF (IFY,GT.2) GO TO 90
               SLOPESFRICHUL
Ċ
C
      COMPUTE FRICTION FORCES FROM STRAIGHT LINE GRAPH
Ċ
      00 30 I#1,NTP1
               F(1)=Y(1)+8LOPE
         IF (ABS(F(I)).LE.FU) GO TO 30
          IF (F(I),GT,0,0) F(I)#FU
          IF (F(I)_LT,0,0) F(I)==FU
      CONTINUE
 30
         GO TO 135
C
      COMPUTE FRICTION FORCES FROM PARABOLA
C
С
   40 DO 80 I=1.NTP1
C
         IF (Y(I),GT,0,) 60 TO 50
               #(I)=FRICHUL*SQRT(ABS(Y(I)))
         GO TO 60
 50
    CONTINUE
               F(I)==FRICHUL+SQRT(Y(I))
      CONTINUE
 60
         IF (ABS(F(I)), LE, FU) GO TO 80
          IF (F(I)_GT_0,0) F(I)#FU
          IF (F(I),LT.0,0) F(I)=FU
   80 CONTINUE
         IF (LONGPR.EQ. 3HYES) PRINT 180
         GO TO 135
С
 98
     CONTINUE
      COMPUTE FRICTION FORCES FROM INPUT POINT CURVE
C
      00 130 Is1,NTP1
      00 100 J=1, IFY
         IF (ABS(Y(I)), LT. ABS(YEXP(J))) GO TO 110
 100 CONTINUE
               BEYOND=BEYOND+1.
               F(I)=FEXP(IFY)
         GO TO 120
 110 CONTINUE
               DUMDUM=(FEXP(J)=FEXP(J=1))/(AUS(YEXP(J))+ABS(YEXP(J=1)))
               F(I)=FEXP(J=1)+DUHDUM+(ABS(Y(I))=ABS(YEXP(J=1)))
 128 CONTINUE
          IF (Y(I)_GT_0.0) F(I)==F(I)
 130 CONTINUE
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SUBROUTINE DEWIREF
 135 IF(LONGPR_E0.3HYES) PRINT 170,(I,AL(I),Y(I),F(I),I=1,NTP1,NPRINT)
                                                                                 CC
C
                                                                                       COMMON /BLOCK1/ RATID, THICK, P, FF, STRAINC, ES, NTP1, U, OIA, UNWT
Ĉ
          COMPUTE THE TOTAL FRICTION FORCE
                                                                                       COMMON /BLOCK2/ SS(101), AAA, WS(101), LONGPR, NPRINT, MAXITE, CRACKW
С
                                                                                       COMMON /ALOCK3/ XBAR, STRSC, STRSB, STRC, IBABY, ITEB, NEWBAR
         IF (BEYOND.GT.Ø.) PRINT 190, BEYOND
                                                                                       COMMON /BLOCK4/ AL(101),STRAIN(101),CONSTR(101),STRESSS(101)
             FF = 0.0
                                                                                       COMMON /BLOCK5/ FEXP(10), YEXP(10), FRICMUL, NT, FU, IFY
      DO 150 I#1,NT,2
                                                                                       COMMON /BLOCK&/ ALPHAC, ALPHAS, EC, FPC, TIME, EP, TOL, ITYPER
               FFRFF+(F(1)+4,*F(1+1)+F(1+2))*H/3.
                                                                                       COMMON /BLOCK7/ SIGHABC, SIGMASB, NA, NAP1, E, A, S, OENO, NAP2
 150 CONTINUE
                                                                                       COMMON /BLOCK8/ Y(101), REFF(101), YP(101), H, ICLOSE8, YPITE(101)
          IF (LONGPR.EQ. 3HYES) PRINT 200, FF
                                                                                       COMMON /BLOCK14/ F(101), BONDL, Z, OELTAT, STRMAX, WHLSTR, THLOO, IBECK
      RETURN
                                                                                       DIMENSION SUM(101)
C
                                                                                       INTEGER AAA
  160 FORMAT( //,20X,+IN SUBROUTINE FRIC+,/)
 178 FORMAY ( 11X,+I+,6X,+AL(I)+,7X,+Y(I)+,8X,+F(I)+,//.
                                                                                 Ċ
              (8X,15,3(2X,E10,3)))
                                                                                 Ĉ
    1
 188 FORMAT ( /, 18X, *FRICTION MOVEMENT CURVE IS & PARABOLA*, /)
                                                                                           COMPUTE THE STRAINS DUE TO FRICTION FORCES DEVELOPED
                                                                                 ¢
 190 FORMAT (//, 10X, +IN COMPUTING THE FRICTION FORCES FROM MOVEMENTS+,/
                                                                                           DUE TO SLAB HOVEMENT
                                                                                 Ĉ
     1, 18X,F5,8,* POINTS EXCEEDED THE MAX MOV ON F-Y CURVE*)
                                                                                 C
 200 FORMAT (/, 10X, * TOTAL FRICTION FORCE ##, E10.3)
                                                                                                ABAL (NTP1)=BONOL
                                                                                          IF (A.LE.0.) GO TO 50
      END
                                                                                                 NABA/H+1+EP
                                                                                                EBA-AL(NA)
                                                                                           IF (NA.GT.NT) GO TO 60
                                                                                          IF (LONGPR, EQ. 3HYES) PRINT 90, H, BONDL, A, NA, E
                                                                                                NAP1=NA+1
                                                                                                NAP2#NA+2
                                                                                                 NAM1=NA=1
                                                                                                 NAM2#NA+2
                                                                                                DENOSTHICK+(P+1,/RATIO)
                                                                                           COMPUTE THE SLOPE TO THE STEEL STRAIN DISTRIBUTION CURVE BY
                                                                                 C
                                                                                 ¢
                                                                                           DIVIDING THE FRICTION FORCE BY DEND AND CONSIDERING THE
                                                                                 C
                                                                                           SIGN CONVENTION ADOPTED IN THIS STUDY
                                                                                 Ĉ
                                                                                 Ĉ.
                                                                                                            SLOPE(I) . F(I) / DEND
                                                                                 Ĉ
                                                                                                 SUH140.
                                                                                                SUH2=0,
                                                                                       DO 20 INI,NAMI
                                                                                                SUH1#SUH1+(2+NA=(2,+I+1))+(=F(I)/DENO)
                                                                                                84H2=80H2+(=F(I)/DENO)
                                                                                       CONTINUE
                                                                                  2ø
                                                                                          IF (LONGPR.NE. 3HYES) GO TO 30
                                                                                       PRINT 100
                                                                                       PRINT 110, SUM1, SUM2
                                                                                  30
                                                                                       CONTINUE
                                                                                 ¢
                                                                                           DEFINE CONSTANTS FOR SOLUTION OF EQUATIONS
                                                                                 C
                                                                                 Ć.
                                                                                                C1=1.+1./(P*RATIO)
                                                                                                C2#((Z+DELTAT*(ALPHAC=ALPHAS))*EC)/P
                                                                                                C3#FF/(P+THICK)
                                                                                                S==F(NAP1)/DEND
                                                                                 С
                                                                                 C
                                                                                            SOLVE FOR STRESS IN STEEL BETWEEN CRACKS AND AT CRACK
                                                                                 C
                                                                                       DUM1=ALPHA8+AL(NTP1)+DELTAT+ES=H+H+SUM1+0,5=E+H+SUM2=
                                                                                             $*E*E*P.5+(H*SUM2+8*E+C2=C3)*BONDL*0.5
                                                                                      1
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ANA#NA
DUM2#H+{2,*ANA#2,}*0,5+E+((1,+C1)*BONDL)*0,5
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SIGMASB=DUH1/DUH2
               SIGMASC#C1+SIGMASB+C2+C3
c
          CHECK FOR THE SUMMATION OF STEEL STRESSES UNDER THE
C
          STEEL DIAGRAM
C
¢
               A1=(((2.*ANA=2.)*81GHA88+H*8UM1)*H)*0.5
               A2=(2.+SIGHAS8+2.+H+SUM2+S+E)+E+0.5
               A3=(SIGHASB+H+SUH2+S*E+SIGHASC)*BONDL*8.5
               DIIM1#41+42+43
               DUM2#ALPHA8#AL(NTP1)*DELTAT*E8
               DUH3=DUH1=DUH2
         IF (AB8(DUM3),GT.1,E-4) GO TO 78
С
C
          COMPUTE THE STEEL AND CONCRETE STRAIN AT EVERY INCREMENT
C
          THE STRAIN IS COMPUTED IN THE BONDED AND UNBONDED SECTIONS
C
С
      CALL POIRES (LOCMAX)
         IF (LONGPR, EQ. SHYES) PRINT 120, SIGMASD, SIGMASC, STRMAX, LOCMAX
      RETURN
C
 50
      CONTINUE
      PRINT 138, A
         GO TO BØ
 60
      CONTINUE
      PRINT 148, NA.NT
         GO TO 80
 70
      CONTINUE
      PRINT 150, SIGMASC, SIGMASB, DUM1, DUM2, DUM3
 88
      CONTINUE
C
   90 FORMATE //,20X, +IN SUBROUTINE DEWIREE+,
                //,10X,* INCREMENT LENGTH
                                              #*,E14.7,/,
      .
                                              =*,E14,7,/,
                   10x,* BOND LENGTH
                   18X,* NO SLIPPAGE LENGTH =*,E14,7,/,
     2
                   10X.* NO OF INCREMENTS ,NA =+,IS ,/,
      ٦.
                   18X.+ E
                                                =*,E14.7,//)
                                SLOPE
                                                        SUH2 +,/)
 100 FORMAT (//,10X,* INDEX
                                             SUM1
 110 FORMAT (/,10X,* SUH1 #*,E10,3,10X,* SUM2 #*,E10,3,/)
      FORMAT (//, 10X, * STEEL STRESS AT MIDSPAN #+, E18, 3,/,
 150
                  10X,* STEEL STRESS AT CRACK
                                                   ##,E18,3,/,
      1
                  10X,* MAXIMUM CONCRETE STRESS
                                                   ##,E18.3,/,
      2
                  10X,*STATION OF HAXIMUN STRESS IS *, I5,/)
      3
 130 FORMAT (//, 18X, *ERROR IS DETECTED IN DEWIREF*,/,
             10x,*A IS NEGATIVE AND #*,E18,3)
     1
 140 FORMAT (/, 20X, * ERROR IS DETECTED *,/,
     1
                 10x,* NA = *, I5, 10x,* NT = *, I5)
  150
      FORMAT (//,20%, * ERROR IS DETECTED * ,/,
                                                     #*,E10,3,/,
                  18X, * STEEL STRESS AT CRACK
      2
                  10X, * STEEL STRESS BETWEEN CRACKS #*,E10,3,/,
                  10X, * SUMMATION OF A1, A2, AND A3 =*, E18.3,/,
      3
                  18X, * ALPHA L DELTAT ES
                                                     #*,E10,3,/,
                  10X, * ABSOLUTE DIFFERENCE
                                                     #*,E10,3)
      κ,
      END
```

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SUBROUTINE DEWIRE
CC
С
      ********
C
         THIS SUBROUTINE SOLVES FOR THE STRESS IN THE STEEL AND
          CONCRETE FOR DEFORMED WIRE FABRIC -NO FRICTION FORCES
С
          ARE CONSIDERED IN THE SOLUTION
      **********
      COMMON /BLOCK1/ RATIO, THICK, P, FF, STRAINC, ES, NTP1, U, DIA, UNHT
      COMMON /BLOCK2/ $$(101),AAA,WS(101),LONGPR,NPRINT,MAXITE,CRACKW
      COMMON /BLOCK3/ XBAR, STRSC, STRSB, STRC, IBABY, ITEB, NEWBAR
      COMMON /BLOCK4/ AL(181),STRAIN(101),CONSTR(101),STRESSS(101)
      COMMON /BLOCK5/ FEXP(10), YEXP(10), FRICMUL, NT, FU, IFY
      COMMON /BLOCK6/ ALPHAC, ALPHAS, EC, FPC, TIME, EP, TOL, ITYPER
      COMMON /BLOCK7/ SIGMASC, SIGMASB, NA, NAP1, E, A, B, DENG, NAP2
      COMMON /BLOCK8/ Y(101), REFF(101), YP(101), H, ICLOSEB, YPITE(101)
      COMMON /BLOCK14/ F(101),BONDL,Z,DELTAT,STRMAX,WHLSTR,TMLOD,IBECK
      REAL L
Ċ
      DEFINE CONSTANTS
С
              L=0.5+XBAR
              C1=EC+Z+EC+DELTAT+(ALPHAC+ALPHA8)
              C2=ALPHAS+L+DELTAT+ES
              C3=BONDL/(2.*RATIO)+P+L
С
C
              SOLVE FOR STRESSES
              STRC=(C1*P*L+C2*P/RATIO)/C3
              8TRSB= (=C1+BONDL/2,+P+C2)/C3
              STR8C=(C2/RATIO+C1*(L=BONDL/2,)+P+C2)/C3
              STRMAXESTRC
      CHECK EQUILIBRIUM - EQUATION 1
C
C
              DUM1=STRC+P+STRS8
              DUM2=P+STRSC
         IF (A88(DUH1=DUH2).GT.1.E=5) GO TO 19
              SRAINC#STRC/EC
      RETURN
С
   10 PRINT 20, STRC, STRSB, STRSC, DUM1, DUM2
    FORMAT (//, 10X, * ERROR IS DETECTED *,/,
 20
    1
               10X,* EQUILIBRIUM IS NOT SATISFIED *,/,
               10x.+ STRC = +,E10,3,5x,+ STRS8 = +,E10,3,5x,+ STRSC #+,
    2
    3
               E10,3,/,10X,* DUM1 = *,E10,3,5X,* DUM2 = *,E10,3)
     END
```

.

```
SUBROUTINE FORWARD (TENSTRN, ZTOT, Z)
CC
C
      *********************
          THIS SUBROUTINE CALCULATES THE TIME DEPENDENT VARIABLES FROM
C
          WHICH THE SLAB RESPONSES ARE COMPUTED, LINEAR INTERPOLATION
C
          IS USED TO GET FLEXURAL STRENGTH FROM AGE OF CONCRETE .
C
C
      *********************
C
      COMMON /BLOCK1/ RATIO, THICK, P, FF, STRAINC, ES, NTP1, U, DIA, UNWT
      COMMON /BLOCK2/ 8S(101), AAA, WB(101), LONGPR, NPRINT, MAXITE, CRACKW
      COMMON /BLOCK3/ XBAR, STRSC, STRSB, STRC, IBABY, ITEB, NEWBAR
      COMMON /BLOCK4/ AL(101),STRAIN(101),CONSTR(101),STRESSS(101)
      COMMON /BLOCK5/ FEXP(18), YEXP(10), FRICHUL, NT, FU, IFY
      CONHON /BLOCK6/ ALPHAC, ALPHAS, EC, FPC, TIME, EP, TOL, ITYPER
      COMMON /BLOCKB/ Y(101), REFF(101), YP(101), H, ICLOSEB, YPITE(101)
      COMMON /BLOCK10/ NSTRN, VDS, AGEU(20), TENSION(20), STRNMUL
      COMMON /BLOCK13/ AGE(8), PERCENT(8), COLDTH, ANTEMP, IBXBAR, COLDSTN
      INTEGER AAA
С
         IF (N&TRN.GT.0.) GO TO 30
      00 18 I=1.8
               Jui
   10
         IF (TIME.LE.AGE(I)) GO TO 20
         GO TO 70
   28
         IF (TIME, EQ, ANTEMP, AND, IBXBAR, EQ. 1) GO TO 21
              PERCOM=(PERCENT(J)=PERCENT(J=1))/(AGE(J)=AGE(J=1))
               PERCOM=PERCENT(J=1)+PERCOM+(TIME=AGE(J=1))
               CONSTR = PERCOM + FPC/100
               FLESTRN=3000,/(3.+12000,/CONSTR)
               TENSTRN=FLESTRN+STRNHUL
         GO TO 68
         IF (COLDSTN.LE.8) GO TO 22
   21
               TENSTRN=COLDSTN
               FLESTRNETENSTRN/STRNMUL
               COMSTR=(12000,*FLESTRN)/(3000,-3,*FLESTRN)
         60 TO 68
               COMSTR=FPC+(1.+0.1972+(ALOG10(COLDTM/ANTEMP)))
   22
               FLESTRN=3000,/(3,+12000,/COHSTR)
               TENSTRN=FLESTRN*STRNMUL
         GD TO 60
 30
      CONTINUE
      DO 48 I#1,NSTRN
               JEI
         IF (TIME, LE, AGEU(I)) GO TO 50
 40
      CONTINUE
         GO TO 70
 50
         IF (TIME, EQ. ANTEMP, AND, IBXBAR, EQ. 1) GO TO 23
      COMPUTE SLOPE BY LINEAR INTERPOLATION
C
C
               SLOPE=(TENSION(J)+TENSION(J+1))/(AGEU(J)-AGEU(J-1))
               TENSTRN=TENSION(J=1)+SLOPE+(TIME=AGEU(J=1))
               FLESTRN=TENSTRN/STRNMUL
               COMSTR=(12000,*FLESTRN)/(3000,+3,*FLESTRN)
           GO TO 60
   23 IF (COLDSTN.LE.0) GO TO 24
        TENSTRNECOLDSTN
           GO TO 25
```

24 TENSTRNETENSION(NSTRN)*(1,+0,1972*(ALOG10(COLDTM/ANTEMP))) 25 FLESTRNETENSTRN/STRNMUL COMSTR=(12000,*FLESTRN)/(3000,=3,*FLESTRN) Continue

С

C

C

60

```
EC=33.*(UNWT**1.5)*SQRT(COMSTR)
              RATIO=ES/EC
              U=9.5+SQRT(COMSTR)/DIA
         IF (U.GT.800.) U=800.
              SHRN=26, *EXP(0,36+VD8)
              Z=(TIME/(SHRN+TIME))+ZTOT
         IF (LONGPR, NE, 3HYES) RETURN
     PRINT 100, TIME, Z, FLESTRN, COMSTR, EC, RATIO, U
     PRINT 90, J, PERCENT(J), AGE(J), PERCOM, PERCENT(J=1), AGE(J=1), FPC
     RETURN
70
    PRINT 80, TIME
    FORMAT (//,10%,*ERROR IS DETECTED IN SUBROUTINE FORWARD*,/,10%,
80
    1 *TIME ENCOUNTERED IS GREATER THAN MAXIMUM AGE PROVIDED BY THE USE
               10X, *TIME =*,E10.3,/,
    2R*/,
    3
               10x, *PROGRAM IS TERMINATED*)
    FORMAT( 40X,+J =+12,/10X,+PERCENT(J) =+F5,1,7X,
 90
           *AGE(J) =*F5,1,7X,*PERCOM =*F10,3,/10X,
           *PERCENT(J=1) =*F5,1,5X,*AGE(J=1) =*F5,1,5X,
    2
           *FPC =*F14,3)
100 FORMAT ( //,15%,*IN SUBROUTINE FORWARD*,//,
                10X, * TIME
                                        *, E10.3./.
                10X * SHRINKAGE
                                        *,E10.3,/,
    2
                10X,* FLEXURAL STRENGTH*, E10, 3, /,
    3
                10X,* COMPRESSIVE STRN *,E10.3,/,
                10X. + CON MODULUS
   5
                                        *,€10.3,/,
                10X,* RATIO
                                        *,E10.3,/,
                10X .* BOND STRENTH
   7
                                        *,E10.3,/)
               END
```

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.

```
cc
c
      ******
С
         THIS SUBROUTINE CALCULATES THE TIME DEPENDENT VARIABLES FROM
С
          THE COMPUTED STRENGTH ON THE LINE OF EQUALITY OF STRESS -
Ĉ
         STRENGTH CURVE .
С
      **********************
Ċ
      COMMON /BLOCK1/ RATIO,THICK,P;FF,STRAINC,ES;NTP1,U,DIA,UNWT
      COHMON /BLOCK2/ 85(101), AAA, NS(101), LONGPR, NPRINT, MAXITE, CRACKW
      COMMON /BLOCK3/ XBAR, STRSC, STRSB, STRC, IBABY, ITEB, NEWBAR
      COMMON /BLOCK4/ AL(101),STRAIN(101),CONSTR(101),STRESSS(101)
      COMMON /BLOCK5/ FEXP(10), YEXP(10), FRICMUL, NT, FU, IFY
      COMMON /BLOCK6/ ALPHAC, ALPHAS, EC, FPC, TIME, EP, TOL, ITYPER
      COMMON /BLOCK8/ Y(181), REFF(181), YP(181), H, ICLOSEB, YPITE(181)
      COMMON /BLOCK10/ NSTRN, VD8, AGEU(20), TENSION(20), STRNMUL
      COMMON /BLOCK13/ AGE(8), PERCENT(8), COLDTM, ANTEMP, IBXBAR, COLDSTN
      INTEGER AAA
C
      IF (NSTRN.GT.D.) GO TO 30
               FLESTRN#TENSTRN/STRNMUL
               COMSTR=(12000, *FLESTRN)/(3000, =3, *FLESTRN)
               PERCOM#(COMSTR/FPC)+100.
               EC#33, + (UNHT++1,5)+80RT(COMSTR)
               RATIO#E8/EC
               U=9.5+8GRT(COMSTR)/DIA
          IF (U.GT.800.) U=800.
      00 10 I=1,8
               Jai
   10
         IF (PERCON, LE, PERCENT(I)) GO TO 20
      PRINT 80, PERCOM
         60 TO 70
   28
               TIME=(PERCENT(J)+PERCENT(J=1))/(AGE(J)=AGE(J=1))
               TIME#AGE(J=1)+(PERCOM=PERCENT(J=1))/TIME
         GO TO 60
C
      COMPUTE THE TIME CORRESPONDING
¢
Ċ
      TO TENSILE STRENGTH
Ċ
   30 DO 40 1=1,N$TRN
               127
   40
        IF (TENSTRN, LE. TENSION(1)) GO TO 50
      PRINT 90, TENSTRN
         GO TO 70
С
      COMPUTE SLOPE BY LINEAR INTERPOLATION
С
C
   50
               TIME=(TENSION(J)=TENSION(J=1))/(AGEU(J)=AGEU(J=1))
               TIME=AGEU(J=1)+(TENSTRN=TENSIDN(J=1))/TIME
C
               SHRN#26.*EXP(0.36+V05)
   60
               Z=(TIME/(8HRN+TIME))+2TOT
          IF
             (LONGPR, EQ. 3HYES) PRINT 100, FLESTRN, COMSTR, EC, TIME, Z
      RETURN
      CONTINUE
 70
C
 80
      FORMAT (//,10%,*ERROR IS DETECTED IN SUBROUTINE BACKWARD*./.
                18X,*THE COMPUTED PERCENT COMPRESSION IS GREATER THAN TH
     1
     2E MAXIMUM PERCENT AVAILABLE*,/,
     3
                10X, *PERCOM #*E10.3./.
```

```
10x, +PROGRAM IS TERMINATED+)
    FORMAT (//,10%,*ERROR IS DETECTED IN SUBROUTINE BACKWARD*,/,
90
               10x, *THE COMPUTED TENSILE STRENGTH IS GREATER THAN THE M
    1
    2AXIMUM STRENGTH PROVIDED BY THE USER*, /,
               10x, *TENSTRN=*, E10,3,/,
    x
               10x, *PROGRAM IS TERMINATED*)
    4
 100 FORMAT( //,15X,+IN SUBROUTINE BACKWAR+,
                 //,10X,* FLESTRN
                                            *,E10,3,/,
                10X,* COMPRESSIVE STR *,E10,3,/ ,
                10X,* CON MODULUS
                                        *,E10.3,/,
                18X. TIME
    х
                                        *,E10,3,/,
    4
                 18x, + SHRINKAGE
                                         *,E10.3,//)
```

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```
END
```

```
SUBROUTINE DELTEMP (TIME, DELTAT)
CC.
      **********************
C
         THIS SUBROUTINE CONTAINS THE INCREMENTAL TECHNIQUE
C
         FOR TEMPERATURE TIME DATA. A SINE WAVE IS FIT
Through Each day, the routine has three options.
C
Ċ
C
          DELTEMP INCREMENTS UP BY UPING IF NTIFLAG = 1
C
          INCREMENTS DOWN BY DOWNING IF NTIFLAG = -1
C
          IT GIVES THE TEMPERATURE DROP AT TIME IF NTIFLAG = B
Ĉ
      ***********
Ĉ
C
      COMMON /BLOCK2/ $$(101),AAA,WS(101),LONGPR,NPRINT,MAXITE,CRACKW
      COMMON /BLOCK12/ OT(50), NTEHP, NTIFLAG, UPINC, DOWNINC
      DATA PI / 3.14159265359 /
C
      DO 10 ITIME#1,NTEMP
               REALTI=FLOAT(ITIME)
         IF (REALTI, GT. TIME) GO TO 20
   10
      PRINT 130, DELTAT, TIME
      STOP 66
     CONTINUE
 29
         IF (TIME, GT, REALTI+, 75, A, TIME, LT, REALTI-, 25) GO TO 38
               DELTATED.
      IF(NTIFLAG) 120,80,50
      CONTINUE
 30
                DELTATEDT(ITIME)+SIN((TIME+REALTI+.75)+2.+PI)
         IF (NTIFLAG) 120,80,50
     CONTINUE
 50
               DELTAT=DELTAT+UPINC
         IF (TIME, GT, REALTI-, 5) GO TO 90
         IF (DELTAT, GE, DT(ITIME)+UPINC-1, E-7) GO TO 98
         IF (DELTAT.LE.DT(ITIME)) GO TO 100
 60
      CONTINUE
                DELTATEDT(ITIME)
      CONTINUE
 70
                TIME#REALTI=.5
      CONTINUE
  89
       RETURN
    98
                REALTI=REALTI+1.
                ITINE=ITIME+1
                DELTATOELTAT-UPINC
          IF (ITIME, GT. NTEMP) GO TO 78
          IF (DELTAT.GE.DT(ITIME)) GO TO 60
  100 CONTINUE
                TPLUS#ABS(ASTN(OELTAT/DT(ITIHE))/(2.+PI)+.25)
           IF (TIME, LE, REALTI., 5) TPLUS= TPLUS
                TIME =REALTI+TPLUS = .5
       RETURN
  120 CONTINUE
                DELTAT=DELTAT=DOWNINC
          IF (DELTAT. GT. 8,8) GO TO 108
                DELTATED.
           IF (TIME, LE, REALTI-, 5) TIME#REALTI-, 75
           IF (TIME, GT, REALTI., 5) TIMERREALTI+, 25
       RETURN
  130 FORMAT (* END DF TEMPERATURE ARRAY ENCOUNTERED*./.* DELTAT #*. #6.3
      1.* TIME =*. F6.3)
        END
```

```
SUBROUTINE PLOTEMP (THSCALE, FINAL)
CC
      *********
       THIS SUBROUTINE IS CALLED AT THE USERS OPTION TO PLOT
       TEMPERTURE DROP VS. TIME (DAYS).
      ******
     COMMON /BLOCK12/ DT(50),NTEMP,NTIFLAG,UPINC,DOWNINC
     CALL BGNPLT (4LPLOT,FINAL*THSCALE+10,,28,1)
     CALL PLT (2.,.75,-3)
              TEMPES.
     DO 10 INI.NTEMP
         IF (DT(I).GT.TEMP) TEMP=DT(I)
 1.8
     CONTINUE
              TEMPSTEMP+10, -AMOD (TEMP, 10.)
              YSCALE=0,1+TEMP
         IF (TH&CALE, GT. 5, D. TH&CALE, LE, 0) TH&CALE=2.
     CALL PLT (0.,10,,2)
     CONTINUE
 20
     CALL PLT (=,15,TEMP/Y8CALE,2)
     CALL NUMBER (-, 6, TEMP/YSCALE-, 1, , 15, TEMP, 0, ,-1)
              TEMP#TEMP#YSCALE
     CALL PLT (0., TEMP/YSCALE, 3)
        IF (TEMP.GE.0) GO TO 20
     CALL PLT (0.,0.,3)
TIMESFINAL=AMOD(FINAL,1.)
     CALL PLT (TIME*TH8CALE, 0.,2)
     CONTINUE
 30
     CALL PLT (TIME*THSCALE,=_15,2)
        IF (AHOD(TIME, 1, ), GT, 1, E-6) GO TO 40
      CALL NUMBER (TIMENTMSCALE. 1, ... 3, 15, TIME, 0., -1)
 60
     CONTINUE
              TIHE=TIME+,5
     CALL PLT (TIME*TH&CALE,0,,3)
        IF (TIME.GE.0) GO TO 38
      CALL SYMBOL (5.,6.,.3.33HPLOT OF TEMPERATURE DROP VS. TIME,0.,33)
     CALL SYMBOL (6.15,5.,.3,23HAS USED IN CRCP PROGRAM, 0.,23)
     CALL SYMBOL (5., -. 6, 2, 15HTIME (IN DAYS), 0, 15)
     CALL SYMBOL (-1.,1.,2,36HTEMPERATURE DROP (DEGREES FAHRENHEIT),
     90,,38)
CALL PLT (0,,0.,3)
     1
              TIME#0.
              NTIFLAGES
     CALL PLT ((TIME+.25) +THSCALE,0.,2)
              TIME#TIME+,275
 K (1
     CONTINUE
     CALL DELTEMP (TIME,D)
     CALL PLT (TIME*THSCALE,D/YSCALE,2)
              TIME=TIME+.025
        IF (AMOD(TIME,1.).LT.,75) GO TO 50
         IF (TIME.GE.FINAL=AMOD(FINAL,1.)=,25) TIME=TIME=,2476
      CALL PLT ((TIME+,475)+TMSCALE,0,,2)
              TIMESTINE+.475
        IF (TIME, LT. FINAL-AMOD(FINAL, 1.)) GO TO SU
      CALL ENDPLT
     RETURN
```

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END
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SUBROUTINE POIRES (LOCHAX) CC COMMON /BLOCK1/ RATIO, THICK, P, FF, STRAINC, ES, NTP1, U, DIA, UNWT COMMON /BLOCK2/ SS(101), AAA, WS(101), LONGPR, NPRINT, MAXITE, CRACKW COMMON /BLOCK3/ XBAR, STRSC, STRSD, STRC, IBABY, ITEB, NEWBAR COMMON /BLOCK4/ AL(101),STRAIN(101),CONSTR(101),STRESSS(101) COMMON /BLOCKS/ FEXP(10), YEXP(10), FRICHUL, NT, FU, IFY COMMON /BLOCK6/ ALPHAC, ALPHAS, EC, FPC, TIME, EP, TOL, ITYPER COMMON /BLOCK7/ SIGMASC, SIGMASB, NA, NAP1, E, A, S, DEND, NAP2 COMMON /BLOCK8/ Y(101), REFF(101), YP(101), H, ICLOSE8, YPITE(101) COMMON /BLOCK14/ F(101), BONDL, Z, DELTAT, STRMAX, NHLSTR, THLOD, IBECK DIMENSION SUM(101) INTEGER AAA С HH = 0.5 + H II=NAP2 SUM3=0. SUM4=0, IF (IBECK.EQ.1) GO TO 55 STRESSS(1)=SIGMASB 88(1)#STRESSS(1)/E8 STRAIN(1)=SS(1)+Z+DELTAT*(ALPHAC+ALPHAS) CONSTR(1)=STRAIN(1)+EC LOCHAX=1 STRMAX=CONSTR(1) DD 20 1=2, NA STRESSS(I)=STRESSS(I=1)+H+(=F(I)/DENO) \$\$(I)=\$TRE\$8\$(I)/E8 STRAIN(I)=SS(I)+Z+DELTAT*(ALPHAC=ALPHAS) CONSTR(I)=STRAIN(I)*EC IF (CONSTR(I), LT, STRMAX) GD TO 10 STRMAX=CONSTR(I) LOCMAXEI 10 CONTINUE 8UH3=8UH3+(SS(I)+8S(I+1))+HH SUM4=SUM4+(STRESSS(I)+STRESSS(I=1))+HH CONTINUE 28 ADOI=STRESSS(NA)+S*E ADDIAR=(STRESSS(NA)+ADDI)+E+0,5 SUM3=SUM3+(ADDIAR)/ES SUM4=SUM4+ADDIAR SLOPE2=(SIGMASC=ADDI)/BONDL ADDIC=ADDI/ES+Z+OELTAT+(ALPHAC+ALPHAS) ¢ SLOPECC==AODI/BONDL STRESSS(NAP1)=ADOI+(AL(NAP1)=A)+SLOPE2 C SS(NAP1)=STRESSS(NAP1)/ES STRAIN(NAP1)=ADDIC=F(NAP1)+H/(THICK+EC)=(STRESSS(NAP1)=ADDI)+P/EC CONSTR(NAP1)=STRAIN(NAP1)*EC IF (CONSTRINAPI).LT.STRMAX) GO TO 30 STRHAX=CONSTR(NAP1) LOCMAX=NAP1 C CONTINUE 3.6 SUM4=SUM4+(STRESSS(NAP1)+ADDI)+(AL(NAP1)=A)+0.5 SUM3=SUM3+(STRESSS(NAP1)+ADD1)+(AL(NAP1)-A)/(2.*ES) IF (NA,EQ.NT) II=NAP1 DO 50 I=II,NTP1 STRESSS(I)=ADDI+(AL(I)=A)+SLOPE2 SS(I)=STRES8S(I)/ES STRAIN(I)=STRAIN(I+1)+F(I)+H/(THICK+EC)+(STRESSS(I)=STRESSS(I=1))+

1

P/FC

CONSTR(I)=STRAIN(I)+EC IF (CONSTR(1).LT.STRMAX) GO TO 40 STRMAX=CONSTR(I) LOCHAX=I CONTINUE 40 SUM3=SUM3+(SS(I)+SS(I+1))*HH SUM4=SUM4+(STRESSS(I)+STRESSS(I=1))*HH CONTINUE 50 GO TO 58 SBPIN#SIGMASC=(AL(NTP1)*(SIGMASC=SIGMASB))/BONDL 55 SLOP=(SIGHASC-SIGHASB)/BONDL SLOPK=(SIGMASC=SBPIN)/AL(NTP1) OUMP=ABS(SLOPK=SLOP) IF (DUHP,GT,1,E=5) GO TO 65 STRESSS(1)=SBPIN \$\$(1)=8TRESS\$(1)/ES SIGHACH#FF/THICK+(4,*AL(NTP1)+U+P)/DIA CONSTR(1)=SIGMACM STRAIN(1)=CONSTR(1)/EC LOCHAX#1 STRMAX=CONSTR(1) DO 57 1=2,NTP1 STRESSS(I)=AL(I)*SLOP+STRESSS(1) 88(I)=8TRE888(I)/E8 STRAIN(I)=STRAIN(1)*(1,=AL(I)/AL(NTP1)) CONSTR(I)=STRAIN(I)+EC IF (CONSTR(I).LT.STRMAX) GO TO 56 STRMAX=CONSTR(I) LOCMAXEI 56 CONTINUE SUH3=SUH3+(SS(I)+SS(I=1))+HH SUM4=SUM4+(STRESSS(I)+STRESSS(I=1))+HH 57 CONTINUE 58 IF(ICLOSEB.ED.1.AND.TIME.GE.TMLOD) STRMAX=STRMAX+WHLSTR IF (LONGPR, NE, 3HYES) RETURN PRINT 70, ADDI, ADDIC PRINT 80 PRINT 98, ((I,AL(I),STRESSS(I),SS(I),CONSTR(I),STRAIN(I)),I#1, NTP1, NPRINT) RIGHTG#ALPHAS*DELTAT*AL(NTP1)*ES PRINT 100, SUM3, SUM4, RIGHTO PRINT 110 CALL SIMPSPE (SS, NTP1, H, SUM) DO 60 I=1,NTP1 WS(I)=SUH(1)+(ALPHAS+DELTAT)+AL(I) 60 CONTINUE PRINT 120, ((I,AL(I),SS(I),SUM(I),WS(I)),I=1,NTP1,NPRINT) RETURN 65 PRINT 68,DUMP 67 CONTINUE 68 FORMAT(//,10%,*ERROR IN POIRES,DUMP#*,E10.3) 70 FORHAT(//, 30X, +IN SUBROUTINE POIRES*, //,20X,*ADDI =*,E10,3,10X,*ADDIC =*,E10,3) 1 FORMAT (//,10%, * INDEX DISTANCE STEEL STRESS STEEL STRAIN CON 80 1 STRESS CON STRAIN *,/)

- 90 FORMAT (10%, 15 ,5(2%,E10,3))
- 190 FORHAT (//,10%,+SUM OF AREA UNDER STEEL STRAIN DIAGRAM ##,E10.3,/,

76

- 10X,*SUM OF AREA UNDER STEEL STRESS DIAGRAM #*,E10.3,// 10X,*RIGHT QUANTITY #*,E10.3//) 1 2 110 FORMAT (///,15%,* MOVEMENT OF STEEL BEFORE CONCRETE CRACKS *//, 1 10%,* INDEX DISTANCE STE,STRAIN SUM STEEL MOVE*/ STEEL HOVE #/ 2)
- 120 FORMAT (10X, 15, 4(2X, E10, 3)) END

- SUBROUTINE SIMPSPE (Y,N,H,SUM)
- THIS SUBROUTINE COMPUTES THE AREA UNDER A DISTRIBUTION USING SIMPSONS RULE WITH A SPECIAL MODIFICATION
- DIMENSION Y(N), SUM(N)
- С DO 10 I=1.N

 - 10 SUM(I) = 0,0 A1=(Y(I)+Y(2))*H+0,5 AOLD#A1 SUM(2)=AOLD NM1=N=1
- С

23

с с

С

- 00 28 I=2,NH1 AS#(Y(I+1)+4,+Y(I)+Y(I+1))+H/3 ABAS-AOLD BUM(I+1)=SUM(I)+A ADLDEA
- CONTINUE 20
 - RETURN

 - END

```
SUBROUTINE GETHE (X1, Y1, X2, Y2, FOUT)
                                                                               SUBROUTINE STRGENE (BONDL)
cc
                                                                         CC
č
      ****
                                                                         C
                                                                               C.
         THIS SUBROUTINE SOLVES FOR THE POINT OF INTERSECTION OF THO
                                                                                   THIS SUBROUTINE GENERATES THE STRAIN IN THE CONCRETE AT
                                                                         C
č
         STRAIGHT LINES , WHERE ONE OF THE LINES IS Y=X .
                                                                                   EVERY STATION IN THE FRICTIONLESS SLAB .
                                                                         C.
         THIS VERSION OF THE PROGRAM JOINS THE NEW POINT TO THE POINT
С
                                                                                   RESULTS OF SUBROUTINE TEMPSHE ARE USED +( NO FRICTION )
                                                                         ē
         ON THE OTHER SIDE OF THE YEX LINE .
ĉ
                                                                         r
                                                                               ******
      ******************
C
                                                                         ć
C
                                                                               COMMON /BLOCK1/ RATID, THICK, P.FF, STRAINC, ES, NTP1, U. DIA, UNHT
с
         PSX AND PSY ARE STORED VALUES
                                                                               COMMON /BLOCK2/ SS(101), AAA, WS(101), LONGPR, NPRINT, MAXITE, CRACKW
         BELON THE EQUALITY LINE
ĉ.
                                                                               COMMON /BLOCK3/ XBAR, STRSC, STRSB, STRC, IBABY, ITEB, NEWBAR
C.
         STX AND STY ARE STORED VALUES
                                                                               COMMON /ALOCK4/ AL(101), STRAIN(101), CONSTR(101), STRESSS(101)
e.
         ABOVE THE EQUALITY LINE
                                                                               COMMON /BLOCK5/ FEXP(10), YEXP(10), FRICMUL, NT, FU, IFY
C
                                                                               COMMON /BLOCK6/ ALPHAC, ALPHAS, EC, FPC, TIME, EP, TOL, ITYPER
     COMMON /BLOCK2/ $$(101),AAA,W$(101),LONGPR,NPRINT,MAXITE.CRACKW
                                                                               COMMON /BLOCK8/ Y(101), REFF(101), YP(101), H, ICLOSEB, YPITE(101)
     COMMON /BLOCK9/ STX, STY, PSX, PSY, ITE
                                                                               INTEGER AAA
c
                                                                         C
        IF (ITE.E0.2) GO TO 10
                                                                                       A=0.5+XBAR+BONDL
        IF (X2+Y2) 20,20,40
                                                                                       HHE-H
10
     CONTINUE
                                                                               DO 20 1=1.NTP1
              DUHX2#PSX=X1
                                                                                       STRAIN(I)=STRAINC
              DUMY2=PSY=Y1
                                                                                       AL (T) #HH+H
        GO TO 30
                                                                                       HH#AL(1)
28
     CONTINUE
                                                                                 IF (AL(I),GT,A) STRAIN(I)=STRAINC = STRAINC+(AL(I)=A)/BONDL
              OUHX2=PSX
                                                                                 IF (A.LE.G.) STRAIN(I)=STRAINC+(STRAINC+AL(I)+2.)/XBAR
              DUMY2#PSY
                                                                                       CONSTR(I)=STRAIN(I)+EC
30
     CONTINUE
                                                                          28
                                                                             CONTINUE
              DUHX1=STX=X2
                                                                                  IF (LONGPR.NE. 3HYES) RETURN
              DUMY1=STY=Y2
                                                                               PRINT 30
        60 TO 50
                                                                               PRINT 48, ((I,AL(I),STRAIN(I),CONSTR(I)),I#1,NTP1,NPRINT)
 ЦA
     CONTINUE
                                                                               PRINT 50, NTP1, A, H
              DUMYIBSTY
                                                                               RETURN
              DUNY1#STY
                                                                         С
              DUMX2=PSX=X2
                                                                            30 FORMAT( //,20X, *IN SUBROUTINE STRGENE*,
              DUMY2=PSY=Y2
                                                                                      //,10X,* INDEX DISTANCE CON STRAIN CON STRESS *,/)
                                                                              1
     CONTINUE
 $9
                                                                              FORMAT (10X, 15 , 3(2X, E10, 3))
                                                                          40
      FOUT=(DUHX2+DUHY1=DUHX1+DUHY2)/((DUHX2=DUHX1)=(DUHY2=DUHY1))
                                                                              FORMAT (/,28X,* NO, OF POINTS *,15,/,28X,* BONDED LENGTH **,
                                                                          50
        IF (LONGPR, EQ. 3HYES) PRINT 68, ITE, DUHX1, DUHY1, DUHX2, DUHY2, FOUT
                                                                                      E18,3,/,20%,* INCREMENT LENGTH #*,E18,3)
                                                                              .
     RETURN
                                                                               END
C
     FORMAT (//,10%,* IN SUBROUTINE GETME *,/,
 60
                10X,* ITE =+,15,/,
                10X,* DUMX1 #*,E10,3,10X,* DUMY1 #*,E10,3,/,
    2
                10X,* DUMX2 #*,E10.3,10X,* DUMY2 #*,E10.3,/,
    3
                10X.* FOUT =*,E10.3./)
     €ND
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APPENDIX 2

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EXAMPLE PROBLEMS

۰. • . • CRCP-2 TESTING EXAMPLE PROBLEM FOR CRCP-2 TESTING

PROB A-1 BOND LENGTH > 1/2 XBAR. FIRST WITH LOW F-M CURVE *** æ ð STEEL PROPERTIES 8 . 4 æ *** TYPE OF LONGITUDINAL REINFORCEMENT IS DEFORMED BARS PERCENT REINFORCEMENT = 7.000E-01 BAR DIAMETER = 6.000E-01YIELD STRESS $= 6 \cdot 000E + 04$ ELASTIC MODULUS = 9.000E+06 THERMAL COEFFICIENT = 5.000E-06 *** ø 8 CONCRETE PROPERTIES ð ø * 4 **** SLAB THICKNESS = 1.000F+01THERMAL COEFFICIENT = 5.000E-06 TUTAL SHRINKAGE = 4.000E-04 UNIT WEIGHT CONCRETE= 1.500E+02 COMPRESSIVE STRENGTH= 2.500E+03 TENSILE STRENGTH DATA *** NO TENSILE STRENGTH DATA IS INPUT BY USER THE FOLLOWING AGE-TENSILE STRENGTH RELATIONSHIP IS USED WHICH IS BASED ON THE RECOMMENDATION GIVEN BY U.S. BUREAU OF RECLAMATION AGE, TENSILE (DAYS) STRENGTH

> 0.0 0.0 85.7 1.0 191.9 3.0 5.0 248.8 7.0 282.5 14.0 338.8 21.0 370.1 28.0 384.6

* -85 SLAB-RASE FRICTION CHARACTERISTICS ¢ ø 4 F-Y RELATIONSHIP ø # 4 ************ TYPE OF FRICTION CURVE IS A STRAIGHT LINE MAXIMUM FRICTION FORCE= 1.0000 MOVEMENT AT SLIDING 2 -.1000 *** ø 4 # TEMPERATURE DATA # # ø ***** CURING TEMPERATURE= 75.0 MINIMUM DROP IN DAY TEMPERATURE TEMPERATURE 1 72.0 3.0 2 69.0 6.0 3 53.0 22.0 4 53.0 22.0 5 60.0 15.0 6 65.0 10.0 7 54.0 21.0 8 15.0 60.0 9 59.0 16.0 55.0 10 20.0 25.0 11 50.0 25.0 12 50.0 13 15.0 60.0 14 54.0 21.0 15 45.0 30.0 16 59.0 16.0 17 15.0 69.0 18 54.0 21.0 19 53.0 25.0 20 54.0 21.0 21 69.0 6.0 22 53.0 22.0 23 56.0 19.0 45.0 24 30.0 25 32.0 43.0 26 43.0 32.0 19.0 27 56.0 18.0 28 57.0 MINIMUM TEMPERATURE EXPECTED AFTER = Q.O DEGREES FAHRENHEIT CONCRETE GAINS FULL STRENGTH DAYS BEFORE REACHING MIN. TEMP. = 28.0 DAYS

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***********	*****	*******	******
*			4
4	EXTERNAL	LOAD	4
4			4
******	*******	*******	***
WHEEL LO	AD STRESS (PSI)= n.	
LOAD APP	LIED AT	= 28	TH DAY

***	****	***
4		
4	ITERATION AND TOLERANCE CONTROL	
4		4
***	*****	***

MAXIMUM ALLOWABLE NUMBER OF ITERATIONS= 30 RELATIVE CLOSURE TOLEPANCE= 1.0 PERCENT

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CRCP-> TESTING EXAMPLE PROBLEM FOR CRCP-> TESTING

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Prob A-1

BOND LENGTH > 1/2 XBAR+ FIRST WITH LOW F-M CURVE

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TIME TEMP DRYING TENSILE CRACK CRACK CONCETE STRESS THE 50 3.0 1.8145-06 44.8 800.0 9.727E-04 1.394E-01 2.108E-03 1.50 6.0 5.394F-06 105.3 4800.0 9.727E-03 4.853E-01 3.799F+03 2.29 6.0 R.190F-06 161.7 4800.0 9.727E-03 4.853E-01 7.059E+03 2.38 16.0 R.4490E-06 161.7 4800.0 1.754E-02 1.571E+02 2.2346F+04 2.440 R+2 R.575E-06 165.9 600.0 1.764E-02 1.572E+02 2.2175F+04 2.450 7.235F+06 165.9 600.0 1.438E+02 2.175F+04 3.50 22.0 1.235F+05 277.5 600.0 4.75E-03 1.332E+02 1.897F+02 3.50 22.0 1.235F+05 277.5 600.0 4.75E-03 1.332E+02 2.038E+02 2.038F+04 4.50 15.0 1.576F+05 273.4							MAXI	MUM
(DAYS) DROP SHRINKAGE STRGTH SPACING WINTH STRESS THE STEEL .50 3.0 1.8146-06 44.8 4800.0 9.747E-04 1.394E+01 2.108E+03 1.33 3.0 4.802E-06 105.3 4800.0 9.747E-04 2.595E+01 3.799E+03 2.29 6.0 R.190E-06 157.4 4800.0 3.754E-07 3.638E+02 2.051E+04 7.40 18.2 R.576E-06 163.6 2400.0 1.848E-02 1.571E+02 2.246F+04 7.442 19.753E-06 165.5 600.0 1.748E-02 1.543E+02 2.211E+04 7.50 22.0 R.910F+06 167.4 600.0 1.748E+02 1.543E+02 2.585E+04 4.50 15.0 1.576F+05 235.4 600.0 7.58E+03 1.33EE+02 1.478E+04 2.535E+02 2.135E+04 4.53 10.0 1.909F+05 257.5 600.0 2.53E+02 3.15E+04 4.501 2.231E+04 3.131E+04 4.502	TIME	TEMP	DRYING	TENSILE	CRACK	CRACK	CONCRETE	STRESS IN
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	(DAYS)	DROP	SHRINKAGE	STRGTH	SPACING	WIDTH	STRESS	THESTEEL
-50 3.0 1.014Er06 44.8 4800.0 5.77Er04 1.394Er01 2.108Er03 1.53 3.0 4.802Fr06 114.8 4800.0 7.74FF04 2.595Er01 3.795F03 2.29 6.0 8.190Fr06 157.4 4800.0 7.74FF04 2.551Er01 7.059Er03 2.40 18.2 8.576Er06 163.7 4800.0 1.644Er02 1.458Er02 2.051Er04 2.442 19.0 8.61Fr06 163.6 2400.0 1.644Er02 1.571Er02 2.2466Fr04 2.452 1.1 8.576Er06 163.6 2400.0 1.644Er02 1.571Er02 2.2466Fr04 2.442 19.0 8.61Fr06 167.8 600.0 1.719Er02 1.436Er02 2.271Fr44 3.50 22.0 1.910Fr05 257.5 600.0 7.45Er03 1.235Er02 1.774Er04 4.530 10.0 2.231Fr57 273.6 600.0 2.215Er03 1.333E+02 1.897Fr46 4.530 10.0 2.231Fr57 273.6 600.0 2.231Er02 2.034Er02 3.009Er04 7.331								
	•50	3.0	1.814E-06	44.8	4800.0	5.727E-04	1.394E+01	2.108E+03
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	ī.33	3.0	4.802E-06	105+3	4800.0	9.747E-04	2.595E+01	3.799F+03
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	ĩ•50	6.0	5.394E-06	114•8	4800.0	2.720E-03	4-853E+01	7.059F+03
2.38 16.0 A.490E-06 161.7 4800.0 1.448E-02 1.458E-02 2.05EF-04 2.40 18.2 8.576E-06 163.0 2400.0 1.861E-02 1.572E+02 2.246F+04 2.45 21.1 8.576E-06 163.6 1200.0 1.784E-02 1.572E+02 2.211E+04 2.45 21.1 8.575E-06 165.5 600.0 1.784E-02 1.543E+02 2.175F+04 3.50 22.0 8.910E-06 165.5 600.0 1.438E-02 2.135F+04 2.556E+02 4.50 15.0 1.576F-05 235.4 600.0 1.44E-02 2.014E+02 2.546F+04 4.50 15.0 1.576F-05 235.4 600.0 9.271E+02 2.014E+02 2.91E+04 6.450 21.0 2.21F=05 273.6 600.0 7.421E+02 2.014E+02 2.91E+04 7.31 21.0 2.407E+05 285.4 600.0 2.53E+02 2.014E+02 3.009E+04 7.34 31.0 2.50F=05 285.4 600.0 2.63F+02 2.69F+02 3.06F+04 7.34	2.29	6• U	8.190E-06	157•4	4800.0	3.584F=03	6.266E+01	9-016E+03
2.40 18.2 8.576F=16 163.0 2400.0 1.861E=02 1.571E=02 2.246F+04 2.42 19.0 8.617F=06 163.6 1200.0 1.784E=02 1.571E=02 2.246F+04 2.45 21.1 8.753E=06 165.5 600.0 1.784E=02 1.458E+02 2.275F+04 3.50 22.0 8.910F=05 257.5 600.0 1.838E=02 1.749E+02 2.355E+04 4.50 15.0 1.576F=05 235.4 600.0 1.346E=02 1.335E+02 1.837E+04 6.33 11.0 7.181F=05 271.6 600.0 9.758E=03 1.335E+02 1.807F+04 6.450 21.0 7.221Fe=05 273.6 600.0 9.421E=02 2.088E+02 3.0196+04 7.31 21.0 7.497E=05 285.4 600.0 2.431E=02 2.308E+02 3.152F+04 7.434 31.0 7.507E=05 285.8 300.0 7.91E=02 2.308F+02 3.907F+04 7.434 31.0 2.526F=05 286.5 150.0 3.408E=02 2.11E+04 7.434 31.0<	2.38	16.0	8.490F-06	161.7	4800.0	1.644F=02	1.458F+02	2.051E+04
2.42 19.0 R.617F-06 163.6 1200.0 1.78E=02 1.522E.02 2.211E+04 2.45 21.1 R.753E-06 167.6 600.0 1.719E-02 1.466E-02 2.175F+04 3.50 22.0 1.236F+05 206.9 600.0 2.065E-02 1.532E+02 2.552E+04 4.50 15.0 1.576F+05 235.4 600.0 R.456E-03 1.235E+02 1.777F+04 6.33 10.0 1.909F=05 257.5 600.0 R.456E-03 1.235E+02 1.897F+04 6.450 21.0 7.237E+05 273.6 600.0 7.271E+02 2.014E+02 2.911E+04 6.445 21.0 7.237E+05 274.4 600.0 7.421E+02 2.014E+02 3.009F+04 7.31 21.0 7.407E+05 285.4 600.0 7.419E+02 2.508E+02 3.009F+04 7.34 32.9 7.502F+05 285.4 600.0 7.915E+02 3.009F+04 7.34 32.9 7.502F+05 285.4 600.0 7.915E+02 3.075F+02 3.097F+04 7.34 32.9 <td>2.40</td> <td>18.2</td> <td>8.576F-06</td> <td>163.0</td> <td>2400.0</td> <td>1.861E=02</td> <td>1.571E+02</td> <td>2.246E+04</td>	2.40	18.2	8.576F-06	163.0	2400.0	1.861E=02	1.571E+02	2.246E+04
7.45 21:1 8.753E-06 165:5 600:0 1.719E-02 1.486E+02 2.175F+04 7.50 72:0 8.910F-06 167:F 600:0 1.438E+02 2.258E+04 4.50 15:0 1.576F-05 235:4 600:0 1.348E+02 2.135E+04 6.33 10:0 1.909F-05 257:5 600:0 9.35E=03 1.235E+02 2.35E+04 6.33 10:0 2.231F=05 271:6 600:0 9.758E=03 1.313E+02 1.897F+04 6.450 21:0 2.231F=05 273:6 600:0 9.421E=02 2.083E+02 3.009E+04 7.34 31:0 2.507E=05 285:7 600:0 7.421E=02 2.083E+02 3.099E+04 7.34 31:0 2.507E=05 285:8 300:0 7.911E=02 7.308F+02 3.466E+04 7.434 32:9 2.509E=05 285:8 300:0 7.911E=02 2.014E+02 3.909F+04 7.44 46:0 7.5576=05 286:5 150:0 3.407E=02 2.564E+02 3.57F+04 7.450 68:0 2.559E=05	2.42	19.0	8.617E-06	163.6	1200-0	1.7845-02	1.522E+02	2.2115+04
2.50 22.0 R.010F.06 167.2 600.0 1.038F.02 1.538F.02 2.258F.04 3.50 22.0 J.236F.05 206.9 600.0 2.066FE.02 1.543F.02 2.258F.04 4.50 15.0 1.576F.05 235.4 600.0 R.056E.03 1.235F.02 1.3576F.04 6.33 10.0 2.018F.05 273.6 600.0 R.056E.03 1.235F.02 1.897F.04 6.455 21.0 2.221F.05 273.6 600.0 2.421F.02 2.0144.02 3.097F.04 6.450 21.0 2.237F.05 285.4 600.0 2.421F.02 2.083E.02 3.0097F.04 7.31 21.0 2.407F.05 285.4 600.0 2.451F.02 3.9097F.04 7.34 31.0 2.509F.05 285.4 300.0 2.011E.02 3.046F.02 3.46F.04 7.40 48.0 2.566F.05 286.0 150.0 3.407F.02 3.157F.04 7.40 7.50 60.0 2.566F.05 286.4 150.0 3.407F.02 2.11FF.04 7.507F.05 7.50 60.0	2.45	21.1	8.7535-06	165.5	600.0	1.7195-02	1.484E+02	2 1755+04
3.50 22.0 1.236F(5) 206.0 600.0 7.065F-02 1.749F+02 2.546F+n4 4.50 15.0 1.576F+05 235.4 600.0 1.4346E+02 1.470F+02 2.135F+04 6.50 10.0 1.909E+05 271.6 600.0 9.456E+03 1.235E+02 1.747F+n4 6.450 21.0 2.221F+05 273.6 600.0 9.457E+02 2.014E+02 2.911E+04 6.450 21.0 2.427F+05 273.6 600.0 9.421E+02 2.0087e+02 3.155E+04 7.31 21.0 2.407F+05 285.2 600.0 2.421E+02 2.008F+02 3.976F+04 7.33 32.9 2.509E+05 285.5 300.0 3.665E+02 2.607F+02 3.976F+04 7.40 48.0 2.526E+05 286.5 150.0 3.300F+02 2.11F+04 3.45E+04 7.40 48.0 2.566E+05 286.5 150.0 3.30E+02 2.21F+04 3.567E+04 7.50 60.0 2.566E+05 286.5 150.0 3.406E+02 3.637E+04 4.56.5 7.50 <td>2.50</td> <td>22.0</td> <td>8.910F-06</td> <td>167.8</td> <td>600.0</td> <td>1.838E=02</td> <td>1.5425+02</td> <td>2.2585+04</td>	2.50	22.0	8.910F-06	167.8	600.0	1.838E=02	1.5425+02	2.2585+04
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3.50	22.0	1.236F=05	206.9	600.0	2.065E=02	1.749E+02	2.5465+04
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4.50	15.0	1.5765-05	235.4	600.0	1.3445-02	1.4705+02	2.1255+04
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5.50	10.0	1.909E=05	257.5	600.0	9.056F=03	1 235F+02	1 7975+04
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6.33	10.0	2.1815-05	271.6	600.0	0.758E=03	1.3136+02	1 8075+04
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6.45	20.0	2.2215-05	273.6	600.0	2.2715=02	2 016E+02	2 0115+04
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6.50	21.0	2.2276-05	274.4	600.0	2.4215=02	2 0825+02	2 0005+04
7.3431.00 $2.507-05$ 285.4 500.00 $7.5351-02$ $7.5361-02$ $2.758E+02$ $3.976E+04$ 7.34 32.9 $2.509E-05$ 285.8 300.0 $2.991E-02$ $2.308F+02$ $3.346E+04$ 7.40 48.0 $2.526E-05$ 286.0 150.0 $2.681E-02$ $2.211E+02$ $3.211E+04$ 7.46 58.0 $2.554E-05$ 286.5 150.0 $3.300E-02$ $2.456E+02$ $3.547E+04$ 7.50 61.0 $2.559E-05$ 286.5 150.0 $3.472E-02$ $2.456E+02$ $3.637E+04$ 8.50 16.0 $2.876F-05$ 295.4 150.0 $3.479E-02$ $1.847E+04$ 9.30 16.0 $3.124E-05$ 302.0 150.0 $9.103E-02$ $2.456E+02$ $1.847E+04$ 9.36 36.0 $3.145E-05$ 302.0 150.0 $9.103E-02$ $1.973E+02$ $1.847E+04$ 9.36 36.0 $3.145E-05$ 302.6 150.0 $2.055E-02$ $1.667E+02$ $2.409E+04$ 9.36 36.0 $3.145E-05$ 302.6 150.0 $2.055E-02$ $1.667E+02$ $2.409E+04$ 9.36 36.0 $3.145E-05$ 302.6 150.0 $2.2747E+02$ $3.255E+04$ 9.36 36.0 $3.145E-05$ 302.6 150.0 $2.2747E+02$ $3.255E+04$ 9.35 35.0 $3.147E-05$ 302.6 150.0 $3.216E-02$ $2.247E+02$ $3.255E+04$ 1.50 25.0 $3.493E-05$ $31.98E-02$ $1.72E+02$ $3.75E-04$	7.31	21.0	2.4975-45	285.2	600.0	2.5325=02	2 1505+02	3 1155+04
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7.34	21.0	2.5075-05	285.4	600+0	A 102E= 02	7 7595+02	3 9745+04
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7.34	32.0	2.5095-05	205+4	300 0	4 • 107C ()C	2 3495+42	3 344 5404
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7.38	52 • 7 47 0	2 507E 05	20.14.1	300+0	2 0455 - 2 2	2+3V0E+02	
7.467.467.467.467.211E-023.211E-017.4658.02.546E+052.86+5150.03.300E-022.456E+023.637E+048.5016.02.556E+05295.4150.03.427E-022.504E+023.637E+049.3016.03.124E+05302.0150.09.103E-031.280E+021.847E+049.3326.03.134F-05302.4150.09.403E-021.667E+022.409E+049.3326.03.145E-05302.4150.02.656E-021.667E+022.865E+049.4146.03.158E-05302.4150.02.656E-022.247E+023.587E+049.5055.03.187E-05303.7150.03.216E-022.476E+023.588E+041.5025.03.493E-05310.8150.01.457E-022.477E+023.588E+041.5125.03.493E-05310.8150.01.457E-021.753E+022.523E+041.7325.03.493E-05326.4150.01.431E-021.753E+022.523E+041.7335.04.046F-05327.6150.03.455E-022.600E+023.756E+041.23845.04.057E-05326.4150.01.334E-021.662E+023.934E+041.24331.04.619E-05327.5150.03.455E-022.706E+023.756E+041.43321.04.619E-05340.4150.01.348E-021.662E+023.934E+041.4.3321.04.619E-05<	7.40	42.07	2 5265-05	297.0	300+0	3+9075 ()<	2+07/6+02	3.7095 104
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7.46	E8.0	2.0202-00	294.5	150+0	2.0010-112		
$n \cdot 50$ $10 \cdot 0$ $2 \cdot 53 \cdot 2 \cdot 15$ $10 \cdot 10$ $10 \cdot 10 \cdot 12 \cdot 10 \cdot 10$ $2 \cdot 50 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10$	7.50	50.0	2.5402-05	286.0		3€300E 0C	2.4000702	3+34/5+04
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0.50	16.0	2.9745=05	206 . 4	150+0	104215 ()C		300375104
0.33 $26+0$ $3\cdot124\pm103$ $302\cdot0$ $150\cdot0$ $10\cdot102$ $11\cdot312\cdot02$ $12\cdot72\pm104$ $0\cdot36$ $36\cdot0$ $3\cdot134\pm0.05$ $302\cdot0$ $150\cdot0$ $2\cdot05n\pm0.02$ $1\cdot667\pm0.22$ $2\cdot409\pm104$ $9\cdot41$ $46\cdot0$ $3\cdot158\pm0.5$ $302\cdot0$ $150\cdot0$ $2\cdot05n\pm0.22$ $1\cdot973\pm10.22$ $2\cdot856\pm104$ $9\cdot50$ $55\cdot0$ $3\cdot187\pm0.55$ $302\cdot0$ $150\cdot0$ $2\cdot656\pm0.22$ $2\cdot247\pm10.22$ $3\cdot255\pm10.44$ $9\cdot50$ $55\cdot0$ $3\cdot187\pm0.55$ $311\cdot8$ $150\cdot0$ $2\cdot656\pm0.22$ $2\cdot247\pm10.22$ $3\cdot558\pm10.44$ $11\cdot50$ $25\cdot0$ $3\cdot493\pm0.55$ $311\cdot8$ $150\cdot0$ $1\cdot498\pm0.22$ $1\cdot721\pm0.22$ $2\cdot425\pm10.44$ $12\cdot50$ $25\cdot0$ $3\cdot493\pm0.55$ $311\cdot8$ $150\cdot0$ $1\cdot498\pm0.22$ $1\cdot721\pm0.22$ $2\cdot479\pm10.44$ $12\cdot32$ $25\cdot0$ $4\cdot037\pm0.55$ $326\cdot1$ $150\cdot0$ $2\cdot121\pm0.22$ $2\cdot065\pm10.22$ $2\cdot573\pm10.44$ $12\cdot38$ $45\cdot0$ $4\cdot037\pm0.55$ $326\cdot6$ $150\cdot0$ $2\cdot121\pm0.22$ $2\cdot600\pm12$ $3\cdot756\pm10.44$ $12\cdot38$ $45\cdot0$ $4\cdot071\pm0.55$ $327\cdot5$ $150\cdot0$ $3\cdot673\pm0.22$ $2\cdot600\pm12$ $3\cdot756\pm10.44$ $12\cdot50$ $60\cdot0$ $4\cdot090\pm0.55$ $327\cdot5$ $150\cdot0$ $3\cdot673\pm0.22$ $2\cdot600\pm12$ $3\cdot756\pm10.44$ $12\cdot50$ $60\cdot0$ $4\cdot619\pm-0.55$ $340\cdot6$ $150\cdot0$ $1\cdot378\pm0.22$ $2\cdot328\pm10.22$ $3\cdot94\pm10.44$ $14\cdot33$ $21\cdot0$ $4\cdot632\pm0.55$ $340\cdot6$ $150\cdot0$ $1\cdot378\pm0.22$ $2\cdot320\pm12\times23$ $3\cdot30\pm10.44$ $14\cdot37$	8.30	16.0	2.1246-05	302.0	150+0	0.102E=03	1.3135+02	1 9025+04
0.36 36.00 3.1345 ± 0.5 302.03 150.00 2.050 ± 0.2 1.973 ± 0.2 2.860 ± 0.4 9.41 46.00 3.158 ± 0.5 302.9 150.00 2.050 ± 0.2 1.973 ± 0.2 2.856 ± 0.4 9.50 55.00 3.187 ± 0.5 302.9 150.00 2.656 ± 0.2 2.247 ± 0.2 3.255 ± 0.4 $1.50.00$ $2.550.00$ 3.493 ± 0.5 303.7 150.00 3.216 ± 0.2 2.476 ± 0.2 3.588 ± 0.4 $1.50.00$ $2.550.00$ 3.493 ± 0.5 319.8 150.00 1.457 ± 0.2 2.476 ± 0.2 3.588 ± 0.4 $1.50.00$ $2.550.00$ 3.493 ± 0.5 319.8 150.00 1.457 ± 0.2 2.476 ± 0.2 3.588 ± 0.4 $1.50.00$ $2.50.00$ 3.493 ± 0.5 319.8 150.00 1.457 ± 0.2 2.573 ± 0.2 2.479 ± 0.4 12.35 35.00 4.0467 ± 0.5 326.4 150.00 2.121 ± 0.2 2.065 ± 0.2 2.977 ± 0.4 12.38 45.00 4.037 ± 0.5 327.00 150.00 2.731 ± 0.2 2.344 ± 0.2 3.344 ± 0.4 12.43 55.00 4.0467 ± 0.5 327.00 150.00 2.731 ± 0.2 2.722 ± 0.2 3.934 ± 0.4 12.50 21.00 4.090 ± 0.5 327.5 150.00 3.673 ± 0.2 2.722 ± 0.2 3.934 ± 0.4 13.50 21.00 4.632 ± 0.5 340.4 150.00 1.378 ± 0.2 2.3312 ± 0.2 3.306 ± 0.4 14.33 21.00 4.632 ± 0.5 340.6 <	9.33	26.0	3.1345-05	302.3	150.0	1.4655=02	1.4475+02	
9.41 46.0 $3.158E-05$ 302.9 150.0 $2.656E-02$ $2.247E+02$ $3.255E+04$ 9.50 55.0 $3.187E-05$ 303.7 150.0 $3.656E-02$ $2.247E+02$ $3.255E+04$ 11.50 25.0 $3.493E-05$ 311.8 150.0 $3.476E-02$ $2.476E+02$ $3.588E+04$ 11.50 25.0 $3.493E-05$ 311.8 150.0 $1.457E-02$ $1.681E+02$ $2.425E+04$ 11.50 25.0 $3.794E-05$ 319.8 150.0 $1.457E-02$ $1.753E+02$ $2.479E+04$ 12.32 25.0 $4.037E-05$ 326.4 150.0 $1.531E-02$ $1.753E+02$ $2.523E+04$ 12.38 45.0 $4.037E-05$ 326.4 150.0 $2.121E-02$ $2.065E+02$ $2.977E+04$ 12.38 45.0 $4.067E-05$ 326.4 150.0 $2.121E-02$ $2.065E+02$ $2.977E+04$ 12.43 55.0 $4.071E-05$ 327.0 150.0 $3.673E-02$ $2.722E+02$ $3.934E+04$ 13.50 21.0 $4.382E-05$ 340.4 150.0 $1.378E-02$ $1.662E+02$ $2.386E+04$ 14.43 21.0 $4.632E-05$ 340.6 150.0 $1.965E-02$ $2.020E+02$ $2.9242E+04$ 14.43 41.0 $4.649E-05$ 340.6 150.0 $2.872E-02$ $2.423E+02$ $3.330E+04$ 14.43 41.0 $4.649E-05$ 340.6 150.0 $2.872E-02$ $2.423E+02$ $3.201E+04$ 14.43 41.0 $4.649E-05$ 34	9.36	20.0	3+1346 05	302.4	150.0	1 405t (12	1 0735+02	2 9545404
9.514.605.13.00.51.013.0150.07.150.07.150.07.216E 027.476E 023.53.88 E 0416.5025.03.493E 05311.8150.01.457E n21.681E 022.425E 0417.5025.03.794E 05319.8150.01.457E n21.681E 022.425E 0417.5025.03.794E 05326.1150.01.457E n21.753E 022.523E 0417.3225.04.037E 05326.1150.02.121E 022.065E 1022.977E 0417.3845.04.066F 05326.4150.02.731E n22.344E 1023.384E 10417.4355.04.071F 05327.0150.03.673E n22.600E 1023.756E 10417.5021.04.382E n5335.1150.01.348E 021.662E 1022.386E 10413.5021.04.632E n5340.4150.01.378E n21.691E 1022.994E 10414.4321.04.632E n5340.4150.01.378E n22.020E 1022.904E 10414.4341.04.632E n5340.4150.01.965E n22.020E 1022.904E 10414.4341.04.649E n5340.9150.02.573E n22.312E 1023.491E 10415.5016.04.668E n5340.9150.01.137E n21.545E 1022.209E 10416.3226.05.179E n5345.8150.01.137E n21.545E 1022.209E 10416.3536.05.198E n5349.515	9.41	46.0	3.1585-05	302.0	150.0	2.656E=02	2.247E+02	2.050.104
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9.50	55.0	3.1975-05	303.7	150.0	2.214E=02	2.4745+02	3.5085+04
11.5025.0 $3.794F-05$ $319.R$ 150.0 $1.498E-02$ $1.721E+02$ $2.479E+04$ 12.3225.0 $4.037F-05$ 326.1 150.0 $1.498E-02$ $1.753E+02$ $2.573F+04$ 12.35 35.0 $4.046F-05$ 326.4 150.0 $2.121E-02$ $2.065E+02$ $2.977E+04$ 12.38 45.0 $4.057F-05$ 326.4 150.0 $2.121E-02$ $2.065E+02$ $2.977E+04$ 12.38 45.0 $4.057F-05$ 326.6 150.0 $2.731E-02$ $2.344E+02$ $3.384E+04$ 12.43 55.0 $4.071F-05$ 327.0 150.0 $3.457E-02$ $2.600E+02$ $3.756E+04$ 12.50 60.0 $4.090E-05$ 327.5 150.0 $3.673E-02$ $2.600E+02$ $3.756E+04$ 13.50 21.0 $4.382E-05$ 340.4 150.0 $1.348E-02$ $1.662E+02$ $2.386E+04$ 14.33 21.0 $4.619E-05$ 340.4 150.0 $1.378E-02$ $2.020E+02$ $2.904E+04$ 14.33 21.0 $4.669E-05$ 340.6 150.0 $1.965E-02$ $2.020E+02$ $2.904E+04$ 14.50 45.0 $4.668E-05$ 341.7 150.0 $2.822E-02$ $2.423E+02$ $3.491E+04$ 14.50 45.0 $4.668E-05$ 341.7 150.0 $2.822E-02$ $2.423E+02$ $3.201E+04$ 16.52 16.0 $5.179E-05$ 349.4 150.0 $1.137E-02$ $1.545E+02$ $2.209E+04$ 16.32 26.0 $5.179E-05$ 349.4 150.0 1	12.50	25.0	3.4036-65	311.8	150.0	1.4575-42	1.6815+02	2.4755+A4
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	11.50	25.0	3.7945-05	310.8	150.0	1.498E=A2	1.721E+02	2.4705+04
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	12.32	25.0	4.0375-05	326.1	150.0	1.5315-02	1 7525+02	2.5335+04
12.3845.04.040F 05326.4150.0 $2.721E 02$ $2.034E 102$ $2.771E 04$ 12.3845.04.057E 05326.6150.0 $2.731E 02$ $2.344E + 02$ $3.384E + 04$ 12.5060.04.071E 05327.5150.0 $3.673E 02$ $2.722E + 02$ $3.934E + 04$ 13.5021.04.619E 05335.1150.0 $3.673E 02$ $2.722E + 02$ $3.934E + 04$ 14.3321.04.619E 05340.4150.0 $1.348E - 02$ $1.662E + 02$ $2.386E + 04$ 14.3731.04.632E 05340.4150.0 $1.378E - 02$ $2.020E + 02$ $2.904E + 04$ 14.4341.04.649E 05340.4150.0 $1.966E - 02$ $2.020E + 02$ $2.904E + 04$ 14.4341.04.668E 05340.9150.0 $2.573E - 02$ $2.312E + 02$ $3.330E + 04$ 14.5045.04.668E 05341.2150.0 $2.822E - 02$ $2.423E + 02$ $3.491E + 04$ 15.5016.04.951E - 05345.8150.0 $1.137E - 02$ $1.545E + 02$ $2.209E + 04$ 16.2216.0 $5.171E - 05$ 349.4150.0 $1.164E - 02$ $1.569E + 02$ $2.242E + 04$ 16.3226.0 $5.179E - 05$ 349.5150.0 $1.741E - 02$ $1.920E + 02$ $2.753E + 04$ 16.3336.0 $5.188E - 05$ 349.6150.0 $2.959E - 02$ $2.550E + 02$ $3.605E + 04$ 16.3456.0 $5.228E - 05$ 350.3150.0 $3.846E - 02$ $2.$	12.35	25.0	4.0465-05	326.4	150.0	2.1215=02	0 065F+02	2 9775+04
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	12.38	45.0	4-0575-05	326.6	150.0	2.731F=02	2.344E+02	3.3045+04
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	12.43	55.0	4.0715-05	327.0	150.0	2.355E=A2	2.6005+02	3.7565+04
13.5021.0 $4.382E-05$ 335.1150.0 $1.348E-02$ $1.662E+02$ $2.386E+04$ 14.3321.0 $4.619E-05$ 340.4 150.0 $1.378E-02$ $1.662E+02$ $2.425E+04$ 14.3731.0 $4.632E-05$ 340.6 150.0 $1.965E-02$ $2.020E+02$ $2.904E+04$ 14.4341.0 $4.649E-05$ 340.9 150.0 $2.573E-02$ $2.312E+02$ $3.330E+04$ 14.4341.0 $4.6649E-05$ 341.9 150.0 $2.822E-02$ $2.423E+02$ $3.330E+04$ 14.50 45.0 $4.668E-05$ 341.7 150.0 $2.822E-02$ $2.423E+02$ $3.491E+04$ 15.5016.0 $4.951E-05$ 345.8 150.0 $1.137E-02$ $1.545E+02$ $2.209E+04$ 16.2916.0 $5.171E-05$ 349.4 150.0 $1.164E-02$ $1.569E+02$ $2.242E+04$ 16.3226.0 $5.179E-05$ 349.5 150.0 $1.741E-02$ $1.920E+02$ $2.753E+04$ 16.35 36.0 $5.188E-05$ 349.7 150.0 $2.959E-02$ $2.228E+02$ $3.201E+04$ 16.39 46.0 $5.198E-05$ 349.8 150.0 $2.959E-02$ $2.761E+02$ $3.976E+04$ 16.44 56.0 $5.212E-05$ 350.1 150.0 $3.846E-02$ $2.859E+02$ $4.119E+04$ 16.50 60.0 $5.228E-05$ 350.3 150.0 $3.846E-02$ $2.859E+02$ $4.119E+04$ 16.50 21.0 $5.501E-05$ 354.8 150.0 $1.49nE-02$ $1.787E+02$ <td>12.50</td> <td>60.0</td> <td>4.0905-05</td> <td>327.5</td> <td>150.0</td> <td>3.6738=02</td> <td>2.722F+02</td> <td>3.9345+04</td>	12.50	60.0	4.0905-05	327.5	150.0	3.6738=02	2.722F+02	3.9345+04
14.3321.04.619E- (5) 340.4150.01.378E- (2) 1.601E+ (2) 2.425E+ (0) 14.3731.04.632E- (0) 340.6150.01.965E- (0) 2.020E+ (0) 2.904E+ (0) 14.4341.04.649E- (0) 340.9150.01.965E- (0) 2.020E+ (0) 2.904E+ (0) 14.4341.04.649E- (0) 340.9150.02.573E- (0) 2.312E+ (0) 3.30E+ (0) 14.5045.04.668E- (0) 341.2150.02.822E- (0) 2.423E+ (0) 3.491E+ (0) 15.5016.04.951E- (0) 345.8150.01.137E- (0) 1.545E+ (0) 2.209E+ (0) 16.2916.05.171E- (0) 349.4150.01.164E- (0) 1.569E+ (0) 2.242E+ (0) 16.3226.05.171E- (0) 349.5150.01.741E- (0) 1.920E+ (0) 2.753E+ (0) 16.3536.05.188E- (0) 349.7150.02.342E- (0) 2.288E+ (0) 3.201E+ (0) 16.3946.05.198E- (0) 349.8150.02.959E- (0) 2.505E+ (0) 3.605E+ (0) 16.4456.05.212E- (0) 350.1150.03.846E- (0) 2.859E+ (0) 3.976E+ (0) 16.5060.05.228E- (0) 350.3150.03.846E- (0) 2.859E+ (0) 4.119E+ (0) 16.5021.05.501E- (0) 354.8150.01.499E- (0) 1.787E+ (0) 2.556E+ (0) 17.5021.05.501E- (0) 359.1150.01.499E- (0) 1.815E+ $($	12.50	21.0	4.3825-05	335.1	150.0	1.348E=02	1.662E+02	2.396E+04
14.37 31.0 $4.632E-05$ 340.6 150.0 $1.965E-02$ $2.020E+02$ $2.904E+04$ 14.43 41.0 $4.632E-05$ 340.9 150.0 $2.573E-02$ $2.312E+02$ $3.330E+04$ 14.50 45.0 $4.668E-05$ 341.7 150.0 $2.573E-02$ $2.423E+02$ $3.491E+04$ 15.50 16.0 $4.951E-05$ 345.8 150.0 $1.137E-02$ $1.545E+02$ $2.209E+04$ 16.29 16.0 $5.171E-05$ 349.4 150.0 $1.164E-02$ $1.569E+02$ $2.242E+04$ 16.32 26.0 $5.179E-05$ 349.4 150.0 $1.741E-02$ $1.920E+02$ $2.753E+04$ 16.35 36.0 $5.188E-05$ 349.7 150.0 $2.342E-02$ $2.228E+02$ $3.201E+04$ 16.39 46.0 $5.198E-05$ 349.6 150.0 $2.959E-02$ $2.505E+02$ $3.201E+04$ 16.44 56.0 $5.212E-05$ 350.1 150.0 $3.590E-02$ $2.761E+02$ $3.976E+04$ 16.50 60.0 $5.228E-05$ 350.3 150.0 $3.846E-02$ $2.859E+02$ $4.119E+04$ 17.50 21.0 $5.501E-05$ 354.8 150.0 $1.49nE-02$ $1.787E+02$ $2.556E+04$ 18.45 21.0 $5.758E-05$ 359.1 150.0 $1.49nE-02$ $1.815E+02$ $2.594E+04$	14.33	21.0	4 502 (-5	340.4	150.0	1.3785-02	1 691E+02	2 4255+04
14.51 31.60 $4.63E$ 0.53 340.9 150.0 $2.573E-02$ $2.312E+02$ $3.330E+04$ 14.50 45.0 $4.668E-05$ 341.7 150.0 $2.573E-02$ $2.312E+02$ $3.491E+04$ 15.50 16.0 $4.951E-05$ 345.8 150.0 $2.822E-02$ $2.423E+02$ $3.491E+04$ 16.29 16.0 $5.171E-05$ 345.8 150.0 $1.137E-02$ $1.545E+02$ $2.209E+04$ 16.29 16.0 $5.171E-05$ 349.4 150.0 $1.164E-02$ $1.569E+02$ $2.242E+04$ 16.32 26.0 $5.179E-05$ 349.5 150.0 $1.741E-02$ $1.920E+02$ $2.753E+04$ 16.35 36.0 $5.188E-05$ 349.7 150.0 $2.342E-02$ $2.228E+02$ $3.201E+04$ 16.39 46.0 $5.198E-05$ 349.8 150.0 $2.959E-02$ $2.505E+02$ $3.605E+04$ 16.44 56.0 $5.212E-05$ 350.1 150.0 $3.846E-02$ $2.859E+02$ $4.119E+04$ 16.50 60.0 $5.228E-05$ 350.3 150.0 $3.846E-02$ $2.859E+02$ $4.119E+04$ 17.50 21.0 $5.501E-05$ 359.1 150.0 $1.49nE-02$ $1.787E+02$ $2.556E+04$ 18.45 21.0 $5.758E-05$ 359.1 150.0 $1.49nE-02$ $1.815E+02$ $2.594E+04$	14.37	31.0	4.6325-05	340.6	150.0	1.9655-02	2.0205+02	2.9045+04
14.50 45.0 4.668E-05 341.2 150.0 2.822E-02 2.423E+02 3.491E+04 15.50 16.0 4.951E-05 345.8 150.0 1.137E-02 1.545E+02 2.209E+04 16.29 16.0 5.171E-05 349.4 150.0 1.137E-02 1.545E+02 2.209E+04 16.32 26.0 5.179E-05 349.4 150.0 1.164E-02 1.569E+02 2.242E+04 16.32 26.0 5.179E-05 349.5 150.0 1.741E-02 1.920E+02 2.753E+04 16.35 36.0 5.188E-05 349.7 150.0 2.959E-02 2.228E+02 3.201E+04 16.39 46.0 5.198E-05 349.8 150.0 2.959E-02 2.505E+02 3.605E+04 16.44 56.0 5.212E-05 350.1 150.0 3.590E-02 2.761E+02 3.976E+04 16.50 60.0 5.228E-05 350.3 150.0 3.846E-02 2.859E+02 4.119E+04 17.50 21.0 5.501E-05 354.8 150.0 1.49nE-02 1.787E+02 2.556E+04	14.57	41.0	4 6495-05	340.9	150.0	2.573E=02	2.312E+02	3 3305+04
14.50 45.00 4.0664.05 541.7 150.0 7.61220 7.4250.02 54712.02 15.50 16.0 4.951E-05 345.8 150.0 1.137E-02 1.545E+02 2.209E+04 16.29 16.0 5.171E-05 349.4 150.0 1.164E-02 1.569E+02 2.242E+04 16.32 26.0 5.179E-05 349.5 150.0 1.741E-02 1.920E+02 2.753E+04 16.35 36.0 5.188E-05 349.7 150.0 2.342E-02 2.228E+02 3.201E+04 16.39 46.0 5.198E-05 349.8 150.0 2.959E-02 2.505E+02 3.605E+04 16.44 56.0 5.212E-05 350.1 150.0 3.590E-02 2.761E+02 3.976E+04 16.50 60.0 5.228E-05 350.3 150.0 3.846E-02 2.859E+02 4.119E+04 17.50 21.0 5.501E-05 354.8 150.0 1.49nE-02 1.787E+02 2.556E+04 18.45 21.0 5.758E-05 359.1 150.0 1.523E-02 1.815E+02 2.594E+04 <td>14.45</td> <td>41.0</td> <td>4 6685-05</td> <td>341.2</td> <td>150.0</td> <td>2 822F-A2</td> <td>2 423E+02</td> <td>3 401 5+04</td>	14.45	41.0	4 6685-05	341.2	150.0	2 822F-A2	2 423E+02	3 401 5+04
16.29 16.0 5.171E-05 349.4 150.0 1.164E-02 1.569E+02 2.242E+04 16.32 26.0 5.179E-05 349.5 150.0 1.164E-02 1.920E+02 2.753E+04 16.32 26.0 5.179E-05 349.5 150.0 1.741E-02 1.920E+02 2.753E+04 16.35 36.0 5.188E-05 349.7 150.0 2.342E-02 2.228E+02 3.201E+04 16.39 46.0 5.198E-05 349.8 150.0 2.959E-02 2.505E+02 3.605E+04 16.44 56.0 5.212E-05 350.1 150.0 3.590E-02 2.761E+02 3.976E+04 16.50 60.0 5.228E-05 350.3 150.0 3.846E-02 2.859E+02 4.119E+04 17.50 21.0 5.501E-05 354.8 150.0 1.49nE-02 1.787E+02 2.556E+04 18.45 21.0 5.758E-05 359.1 150.0 1.523E-02 1.815E+02 2.594E+04	16 50	16.0	4 9515-05	345.8	150 0	1 137E=02	1 545F+02	2 200F+04
16.32 26.0 5.179E-05 349.5 150.0 1.741E-02 1.920E+02 2.753E+04 16.35 36.0 5.188E-05 349.7 150.0 1.741E-02 1.920E+02 2.753E+04 16.35 36.0 5.188E-05 349.7 150.0 2.342E-02 2.228E+02 3.201E+04 16.39 46.0 5.198E-05 349.8 150.0 2.959E-02 2.505E+02 3.605E+04 16.44 56.0 5.212E-05 350.1 150.0 3.590E-02 2.761E+02 3.976E+04 16.50 60.0 5.228E-05 350.3 150.0 3.846E-02 2.859E+02 4.119E+04 17.50 21.0 5.501E-05 354.8 150.0 1.49nE-02 1.787E+02 2.556E+04 18.45 21.0 5.758E-05 359.1 150.0 1.523E-02 1.815E+02 2.594E+04	16.29	16-0	5,1715=n5	349.4	150.0	1.164F=02	1.569E+02	2.2425+04
16.35 36.0 5.188E=05 349.7 150.0 2.342E=02 2.228E+02 3.201E+04 16.39 46.0 5.198E=05 349.8 150.0 2.959E=02 2.505E+02 3.605E+04 16.44 56.0 5.212E=05 350.1 150.0 3.590E=02 2.761E+02 3.976E+04 16.50 60.0 5.228E=05 350.3 150.0 3.846E=02 2.859E+02 4.119E+04 17.50 21.0 5.501E=05 354.8 150.0 1.49nE=02 1.787E+02 2.556E+04 18.45 21.0 5.758E=05 359.1 150.0 1.523E=02 1.815E+02 2.594E+04	14.32	26.0	5,1795-05	349.5	150.0	1.741F=n2	1.9205+02	2.753E+04
16.39 46.0 5.198E-05 349.8 150.0 2.959E-02 2.505E+02 3.605E+04 16.44 56.0 5.212E-05 350.1 150.0 3.590E-02 2.761E+02 3.976E+04 16.50 60.0 5.228E-05 350.3 150.0 3.846E-02 2.859E+02 4.119E+04 17.50 21.0 5.501E-05 354.8 150.0 1.49nE-02 1.787E+02 2.556E+04 18.45 21.0 5.758E-05 359.1 150.0 1.523E-02 1.815E+02 2.594E+04	10.02	26.0	5,1095-05	340.7	150.0	2.342F=A2	2.2285+02	3.201 F+04
16.44 56.0 5.212E-05 350.1 150.0 3.590E-02 2.761E+02 3.976E+04 16.50 60.0 5.228E-05 350.3 150.0 3.846E-02 2.859E+02 4.119E+04 17.50 21.0 5.501E-05 354.8 150.0 1.49nE-02 1.787E+02 2.556E+04 18.45 21.0 5.758E-05 359.1 150.0 1.523E-02 1.815E+02 2.594E+04	14-30	46-0	5.10ÅF=05	349.8	150-0	2.959F= A2	2.505E+02	3.6055+04
16.50 60.0 5.228E-05 350.3 150.0 3.846E-02 2.859E+02 4.119E+04 17.50 21.0 5.501E-05 354.8 150.0 1.49nE-02 1.787E+02 2.556E+04 18.45 21.0 5.758E-05 359.1 150.0 1.523E-02 1.815E+02 2.594E+04	16.44	56-0	5.2125-05	350-1	150.0	3.590F=02	2.761F+02	3.976F+n4
17.50 21.0 5.501E=05 354.8 150.0 1.499E=02 1.787E+02 2.556E+04 18.45 21.0 5.758E=05 359.1 150.0 1.523E=02 1.815E+02 2.594E+04	16.50	60-0	5.2285-05	350-3	150-0	3-846F=02	2.859F+02	4.119F+04
18-45 21-0 5-758F=05 359-1 150-0 1-523E=02 1-815E+02 2-594E+04	17.50	21-0	5.5015-05	354-8	150-0	1.49nF-02	1.787E+02	2.556F+04
	18.45	21.0	5.758F-05	359.1	150.0	1.523E-02	1.815E+02	2.594E+04

18.50	22.0	5.7716+05	359.3	150.0	1.5835=02	1.851E+02	2.646E+04
	22.00			1.70.04			
19.50	51+0	6.035E=05	303+0	150.0	1.5545-02	1.845C+02	2.035E+04
20.50	6.0	6.296E-05	367.9	150.0	7.50°E-03	1.286E+02	1.819E+04
21.27	6.0	6.494E-05	370.6	150.0	7.730E-03	1.309E+02	1.850E+04
21.30	16.0	6.502E-05	370.7	150.0	1.3295-02	1.717E+02	2.443E+04
21.33	26.0	6.510F-05	370.8	150.0	1.916E-02	2.063E+02	2.946E+04
21.37	36.0	6.520F-05	370.9	150.0	2.5258-02	2.368E+02	3.390E+04
21.42	46.0	6.532E-05	371.0	150.0	3.149E-02	2.646E+02	3.793E+04
21.50	53.0	6.553E-05	371•1	150.0	3.594E-02	2.828E+02	4.058E+04
22.50	19.0	6.806F-05	373.3	150.0	1.539E-02	1.853E+02	2.638E+04
23.32	19.0	7.010E-05	375+0	150.0	1.564E-02	1.872E+02	2.663E+04
23.36	29.0	7.021E-05	375-1	150.0	2.162E=02	2.201E+02	3.143E+04
23.42	39.0	7.034E-05	375.2	150.0	2.778E-02	2.496E+02	3.571E+04
23.50	45.0	7.055E-05	375.3	150.0	3.157E-02	2.662E+02	3.8116+04
24.50	43.0	7.300E-05	377.4	150.0	3.064E-02	2.628E+02	3.760E+04
25.50	32.0	7.542E-05	379.5	150.0	2.413E-02	2.337E+02	3.334E+04
26.50	19.0	7.780E-05	381.6	150.0	1.659E-02	1.942E+02	2.758E+04
27.50	18.0	8.015E-05	383.6	150.0	1.629E-02	1.928E+02	2.736E+04

.

CRACK SPACING =	8-503E+00	FFFT
CRACK WIDTH =	6.509E-02	INCHES
MAX CONCRETE STRESS=	3-860E+02	PST
MAX STEEL STRESS =	5-258E+04	PST,
CONC.TENS.STRENGTH =	3.846E+02	PST

$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	STA- TION	DIS- TANCE	CONCRETE	FRICTION	CONCRETE STRESS	STEEL
2 -5 $-3.188E-0.3$ $3.188E-0.3$ $3.860E+0.2$ -2.454 ± 0.3 3 $1\cdot0$ $-6.375E-0.4$ $6.376E-0.3$ $3.860E+0.2$ -2.454 ± 0.3 5 $2\cdot0$ $-1.275E-0.3$ $1.275E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 5 $2\cdot0$ $-1.275E-0.3$ $1.275E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 6 $2\cdot5$ $-1.594E-0.3$ $1.913E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 8 $3\cdot4$ $-2.231E-0.3$ $2.232E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 8 $3\cdot4$ $-2.231E-0.3$ $2.550E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 8 $3\cdot4$ $-2.231E-0.3$ $2.550E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 10 $4\cdot4$ $-2.869E-0.3$ $3.507E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 11 $4\cdot9$ $-3.88E-0.3$ $3.82E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 12 $5\cdot4$ $-3.506E-0.3$ $3.507E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 13 $5\cdot9$ $-3.825E-0.3$ $3.82E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 14 $6\cdot4$ $-4.144E-0.3$ $4.144E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 15 $6\cdot9$ $-4.63E-0.3$ $4.63E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 16 7.4 $-4.782E-0.3$ $4.782E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 16 7.4 $-4.782E-0.3$ $4.782E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 16 7.4 $-4.782E-0.3$ $4.782E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 17 7.9 $-5.100E-0.3$ $5.420E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 19 8.9 $-5.738E-0.3$ $5.738E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 21 9.8 $-6.375E-0.3$ $6.057E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 22 10.3 $-6.694E-0.3$ $6.695E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 23 10.6 $-7.13E-0.3$ $7.014E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 24 11.3 $-7.332E-0.3$ $7.970E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 25 11.8 $-7.651E-0.3$ $6.02E-0.2$ $3.860E+0.2$ -2.454 ± 0.3 26 12.3 $-7.663E-0.3$ $8.289E-0.2$ $3.850E+0.2$ -2.454 ± 0.3 26 12.3 $-7.663E-0.3$ $8.289E-0.2$ $3.850E+0.2$ -2.454 ± 0.3 30 14.3 $-9.244E-0.3$ $9.245E-0.2$ $3.850E+0.2$ -2.454 ± 0.3 31 1.48 $-9.563E-0.3$ $9.265E-0.2$ $3.850E+0.2$ -2.454 ± 0.3 33 15.7 $-1.8026-0.3$ $9.265E-0.2$ $3.859E+0.2$ -2.454 ± 0.3	١	0.0	0.	0 -	3.0605402	-2 4545400
$ \begin{array}{c} 1.0 & -6.375E-04 & 5.186E-03 & 3.8800E+02 & -2.454E+03 \\ 4 & 1.5 & -9.563E-04 & 9.564E-03 & 3.860E+02 & -2.454E+03 \\ 5 & 2.0 & -1.275E-03 & 1.594E-02 & 3.860E+02 & -2.454E+03 \\ 6 & 2.5 & -1.594E-03 & 1.594E-02 & 3.860E+02 & -2.454E+03 \\ 7 & 3.0 & -1.913E-03 & 1.913E-02 & 3.860E+02 & -2.454E+03 \\ 8 & 3.4 & -2.231E-03 & 2.530E-02 & 3.860E+02 & -2.454E+03 \\ 10 & 4.4 & -2.869E-03 & 2.869E-02 & 3.860E+02 & -2.454E+03 \\ 11 & 4.9 & -3.188E-03 & 3.188E-02 & 3.860E+02 & -2.454E+03 \\ 12 & 5.4 & -3.506E-03 & 3.507E-02 & 3.860E+02 & -2.454E+03 \\ 12 & 5.4 & -3.506E-03 & 3.507E-02 & 3.860E+02 & -2.454E+03 \\ 13 & 5.9 & -3.825E-03 & 3.826E-02 & 3.860E+02 & -2.454E+03 \\ 14 & 6.4 & -4.144E-03 & 4.144E-02 & 3.860E+02 & -2.454E+03 \\ 15 & 6.9 & -4.463E-03 & 4.542E-02 & 3.860E+02 & -2.454E+03 \\ 15 & 6.9 & -4.463E-03 & 4.542E-02 & 3.860E+02 & -2.454E+03 \\ 16 & 7.4 & -4.782E-03 & 5.420E-02 & 3.860E+02 & -2.454E+03 \\ 18 & 8.4 & -5.419E-03 & 5.420E-02 & 3.860E+02 & -2.454E+03 \\ 19 & 8.9 & -5.738E-03 & 5.4738E-02 & 3.860E+02 & -2.454E+03 \\ 21 & 9.8 & -6.375E-03 & 6.376E-02 & 3.860E+02 & -2.454E+03 \\ 22 & 10.3 & -6.694E-03 & 6.695E-02 & 3.860E+02 & -2.454E+03 \\ 23 & 10.8 & -7.013E-03 & 7.014E-02 & 3.860E+02 & -2.454E+03 \\ 24 & 11.3 & -7.332E-03 & -860F+02 & -2.454E+03 \\ 25 & 11.8 & -7.651E-03 & 7.032E-02 & 3.860E+02 & -2.454E+03 \\ 26 & 12.3 & -7.969E-03 & 7.970E-02 & 3.860E+02 & -2.454E+03 \\ 26 & 12.3 & -7.969E-03 & 7.970E-02 & 3.860E+02 & -2.454E+03 \\ 26 & 13.3 & -8.607E-03 & 7.970E-02 & 3.860E+02 & -2.454E+03 \\ 30 & 14.3 & -9.244E-03 & 9.245E-02 & 3.859E+02 & -2.454E+03 \\ 31 & 14.8 & -9.563E-03 & 9.265E-02 & 3.859E+02 & -2.454E+03 \\ 32 & 15.3 & -9.842E-03 & 9.842E-02 & 3.859E+02 & -2.454E+03 \\ 33 & 15.7 & -1.020E-02 & 1.052E-10 & 3.859E+02 & -2.454E+03 \\ 33 & 15.7 & -1.020E-02 & 1.027E-10 & 3.859E+02 & -2.454E+03 \\ 34 & 19.2 & -1.271E-02 & 1.168E-01 & 3.859E+02 & -2.454E+03 \\ 34 & 19.2 & -1.243E-02 & 1.243E-01 & 3.859E+02 & -2.454E+03 \\ 34 & 20.2 & -1.307E-02 & 1.307E-01 & 3.859E+02 & -2.454E+03 \\ 34 & 20.2 & -1.307E-02 & 1.302E$	2	5	-3.1885-04	V. 2 1085-42	3+8000+02	-2.404L+()3
$ \begin{array}{c} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 $	้า	1.0	-6.3755-04	5+1000-03	3+8006+02	-2.434L+03
$\begin{array}{c} 2 \cdot 0 & -1 \cdot 275 \pm 03 & 1 \cdot 375 \pm 02 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 6 & 2 \cdot 5 & -1 \cdot 594 \pm 03 & 1 \cdot 913 \pm 02 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 7 & 3 \cdot 0 & -1 \cdot 913 \pm 03 & 1 \cdot 913 \pm 02 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 8 & 3 \cdot 4 & -2 \cdot 231 \pm 03 & 2 \cdot 232 \pm 02 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 10 & 4 \cdot 4 & -2 \cdot 669 \pm 03 & 2 \cdot 869 \pm 102 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 11 & 4 \cdot 9 & -3 \cdot 188 \pm 03 & 3 \cdot 188 \pm 02 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 12 & 5 \cdot 4 & -3 \cdot 506 \pm 03 & 3 \cdot 507 \pm 02 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 13 & 5 \cdot 9 & -3 \cdot 2550 \pm 03 & 3 \cdot 866 \pm 02 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 14 & 6 \cdot 4 & -4 \cdot 144 \pm 03 & 4 \cdot 144 \pm 102 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 15 & 6 \cdot 9 & -4 \cdot 463 \pm 03 & 4 \cdot 637 \pm 02 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 15 & 6 \cdot 9 & -4 \cdot 463 \pm 03 & 4 \cdot 782 \pm 102 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 16 & 7 \cdot 4 & -4 \cdot 782 \pm 103 & 5 \cdot 738 \pm 102 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 17 & 7 \cdot 9 & -5 \cdot 100 \pm 03 & 5 \cdot 101 \pm 102 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 18 & 8 \cdot 4 & -5 \cdot 419 \pm 03 & 5 \cdot 738 \pm 102 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 21 & 9 \cdot 8 & -6 \cdot 375 \pm 103 & 5 \cdot 738 \pm 102 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 22 & 10 \cdot 3 & -6 \cdot 694 \pm 103 & 5 \cdot 738 \pm 102 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 22 & 10 \cdot 3 & -6 \cdot 694 \pm 103 & 7 \cdot 014 \pm 102 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 22 & 10 \cdot 3 & -6 \cdot 694 \pm 103 & 7 \cdot 014 \pm 102 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 23 & 10 \cdot 8 & -7 \cdot 138 \pm 103 & 7 \cdot 014 \pm 102 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 24 & 11 \cdot 3 & -7 \cdot 322 \pm 103 & 7 \cdot 051 \pm 103 & 7 \cdot 051 \pm 102 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 25 & 11 \cdot 8 & -6 \cdot 551 \pm 103 & 7 \cdot 651 \pm 103 & 7 \cdot 651 \pm 102 & 3 \cdot 860 \pm 102 & -2 \cdot 454 \pm 103 \\ 26 & 12 \cdot 3 & -7 \cdot 659 \pm 103 & 7 \cdot 651 \pm 103 & 859 \pm 102 & -2 \cdot 454 \pm 103 \\ 26 & 12 \cdot 3 - 2 \cdot 454 \pm 103 & 8 \cdot 926 \pm 102 & 3 \cdot 859 \pm 102 & -2 \cdot 454 \pm 103 \\ 26 & 12 \cdot 3 - 1 \cdot 178 \pm 103 & 9 \cdot 924 \pm$	4	1.5	-9.563E-04	9.564F=03	3+8000+02	-2 4545+03
$ \begin{array}{c} 6 & 2.5 & -1.594E-03 & 1.594E-02 & 3.660E+02 & -2.454E+03 \\ 7 & 3.0 & -1.913E-03 & 1.913E-02 & 3.660E+02 & -2.454E+03 \\ 8 & 3.4 & -2.231E-03 & 2.550E-02 & 3.660E+02 & -2.454E+03 \\ 10 & 4.4 & -2.869E-03 & 2.869E-02 & 3.860E+02 & -2.454E+03 \\ 11 & 4.9 & -3.188E-03 & 3.188E-02 & 3.860E+02 & -2.454E+03 \\ 12 & 5.4 & -3.506F-03 & 3.507E-02 & 3.860E+02 & -2.454E+03 \\ 13 & 5.9 & -3.825E-03 & 3.826E-02 & 3.860E+02 & -2.454E+03 \\ 13 & 5.9 & -3.825E-03 & 3.826E-02 & 3.860E+02 & -2.454E+03 \\ 14 & 6.4 & -4.144E-03 & 4.144E-02 & 3.860E+02 & -2.454E+03 \\ 15 & 6.9 & -4.463E-03 & 4.463F-02 & 3.860E+02 & -2.454E+03 \\ 15 & 6.9 & -4.463E-03 & 4.463F-02 & 3.860E+02 & -2.454E+03 \\ 16 & 7.4 & -4.782E+03 & 4.463F-02 & 3.860E+02 & -2.454E+03 \\ 16 & 7.4 & -4.782E+03 & 5.420E+02 & 3.860E+02 & -2.454E+03 \\ 17 & 7.9 & -5.100F-03 & 5.101E-02 & 3.860E+02 & -2.454E+03 \\ 19 & 8.9 & -5.738E-03 & 5.738E-02 & 3.860E+02 & -2.454E+03 \\ 20 & 4 & -6.57E-03 & 6.057E-02 & 3.860E+02 & -2.454E+03 \\ 21 & 9.8 & -6.375E-03 & 6.057E-02 & 3.860E+02 & -2.454E+03 \\ 22 & 10.3 & -6.694E+03 & -7.014E+02 & 3.860E+02 & -2.454E+03 \\ 23 & 10.8 & -7.913E+03 & 7.014E+02 & 3.860E+02 & -2.454E+03 \\ 24 & 11.3 & -7.322E+03 & 7.332F+02 & 3.860E+02 & -2.454E+03 \\ 26 & 12.3 & -7.969F+03 & 7.970E+02 & 3.860E+02 & -2.454E+03 \\ 26 & 12.3 & -7.969F+03 & 7.970E+02 & 3.860E+02 & -2.454E+03 \\ 27 & 12.8 & -8.288E+03 & 8.289E+02 & 3.859F+02 & -2.454E+03 \\ 30 & 14.3 & -9.244F+03 & 9.246F+02 & 3.859F+02 & -2.454E+03 \\ 31 & 14.8 & -9.563E+03 & 9.564E+02 & 3.859F+02 & -2.454E+03 \\ 32 & 13.3 & -9.882E+03 & 9.883E+02 & 3.859F+02 & -2.454E+03 \\ 33 & 15.3 & -9.882E+03 & 9.26EF+02 & 3.859F+02 & -2.454E+03 \\ 34 & 16.2 & -1.025E+02 & 1.052E+01 & 3.859E+02 & -2.454E+03 \\ 35 & 16.7 & -1.026E+02 & 1.068F+01 & 3.859E+02 & -2.454E+03 \\ 36 & 17.2 & -1.168F+02 & 1.39F+01 & 3.859E+02 & -2.454E+03 \\ 37 & 17.7 & -1.148E+02 & 1.39F+01 & 3.859E+02 & -2.454E+03 \\ 38 & 18.2 & -1.179E+02 & 1.371E+01 & 3.859E+02 & -2.454E+03 \\ 34 & 20.2 & -1.307E+02 & 1.337E+01 & 3.859E+02 & -2.454E+03 \\ 34 & 20.2 & -1.3$	5	2.0	-1.275E-03	1.2755=02	3-9605+02	-2 4545+03
$3 \cdot 0 = 1 \cdot 913E - 03$ $3 \cdot 60E \cdot 02 = 2 \cdot 454E \cdot 03$ $7 \cdot 3 \cdot 0 = 1 \cdot 913E - 03$ $3 \cdot 60E \cdot 02 = 2 \cdot 454E \cdot 03$ $8 \cdot 3 \cdot 4 = 2 \cdot 231E - 03$ $2 \cdot 232E - 02$ $3 \cdot 60E \cdot 02 = 2 \cdot 454E \cdot 03$ $9 \cdot 3 \cdot 9 = 2 \cdot 550E - 03$ $2 \cdot 550E - 02$ $3 \cdot 60E \cdot 02 = 2 \cdot 454E \cdot 03$ $10 \cdot 4 \cdot 4 = 2 \cdot 669E - 03$ $2 \cdot 869E - 02$ $3 \cdot 660E \cdot 02 = 2 \cdot 454E \cdot 03$ $11 \cdot 4 \cdot 9 = 3 \cdot 188E - 03$ $3 \cdot 188E - 02$ $3 \cdot 660E \cdot 02 = 2 \cdot 454E \cdot 03$ $12 \cdot 5 \cdot 4 = 3 \cdot 506E - 03$ $3 \cdot 60E + 02 = 2 \cdot 454E \cdot 03$ $13 \cdot 5 \cdot 9 = 3 \cdot 825E - 03$ $3 \cdot 826E - 02$ $3 \cdot 860E \cdot 02 = 2 \cdot 454E \cdot 03$ $14 \cdot 6 \cdot 4 - 4 \cdot 144E - 03$ $4 \cdot 144E - 02$ $3 \cdot 660E \cdot 02 = 2 \cdot 454E \cdot 03$ $15 \cdot 6 \cdot 9 - 4 \cdot 463E - 03$ $4 \cdot 646 - 02$ $3 \cdot 660E \cdot 02 = 2 \cdot 454E \cdot 03$ $16 \cdot 7 \cdot 4 - 4 \cdot 782E - 03$ $4 \cdot 782E - 02$ $3 \cdot 660E \cdot 02 = 2 \cdot 454E \cdot 03$ $16 \cdot 7 \cdot 4 - 4 \cdot 782E - 03$ $5 \cdot 738E - n2$ $3 \cdot 660E \cdot 02 = 2 \cdot 454E \cdot 03$ $16 \cdot 7 \cdot 4 - 4 \cdot 782E - 03$ $5 \cdot 738E - n2$ $3 \cdot 660E \cdot 02 = 2 \cdot 454E \cdot 03$ $18 \cdot 8 \cdot 4 - 5 \cdot 419E - 03$ $5 \cdot 738E - n2$ $3 \cdot 660E \cdot 02 = 2 \cdot 454E \cdot 03$ $21 \cdot 9 \cdot 8 - 6 \cdot 375E - 03$ $5 \cdot 738E - n2$ $3 \cdot 860E \cdot n2 = 2 \cdot 454E \cdot 03$ $21 \cdot 9 \cdot 8 - 6 \cdot 6375E - 03$ $7 \cdot 651E - 02$ $3 \cdot 660E \cdot 102 = 2 \cdot 454E \cdot 03$ $22 \cdot 10 \cdot 3 - 6 \cdot 694E - 03$ $7 \cdot 651E - 02$ $3 \cdot 660E \cdot 102 = 2 \cdot 454E \cdot 103$ $22 \cdot 10 \cdot 3 - 6 \cdot 694E - 03$ $7 \cdot 970E - 02$ $3 \cdot 600E \cdot 102 = -2 \cdot 454E \cdot 103$ $22 \cdot 10 \cdot 3 - 6 \cdot 694E - 03$ $7 \cdot 970E - 02$ $3 \cdot 650E \cdot 102 = -2 \cdot 454E \cdot 103$ $23 \cdot 11 \cdot 8$	6	2.5	-1.594F-03	1.5945-02	3.0605.02	-2.4545403
R 3.4 $-2.231E-03$ $2.232E-02$ $3.860E+02$ $-2.454E+03$ 9 3.9 $-2.550E-03$ $2.860E+02$ $-2.454E+03$ 10 4.4 $-2.869E-03$ $2.860E+02$ $-2.454E+03$ 11 4.9 $-3.188E-03$ $3.168E-02$ $3.860E+02$ $-2.454E+03$ 12 5.4 $-3.506F-03$ $3.507E-02$ $3.860E+02$ $-2.454E+03$ 13 5.9 $-3.825E-03$ $3.826E-02$ $3.860E+02$ $-2.454E+03$ 14 6.4 $-4.144E-03$ $4.144E-02$ $3.860E+02$ $-2.454E+03$ 15 6.9 $-4.463E-03$ $4.463F-02$ $3.860E+02$ $-2.454E+03$ 16 7.4 $-4.782E+03$ $4.463F-02$ $3.860E+02$ $-2.454E+03$ 16 7.4 $-4.782E+03$ $4.463F-02$ $3.860E+02$ $-2.454E+03$ 17 7.9 $5.100E+03$ $5.101E-02$ $3.860E+02$ $-2.454E+03$ 18 8.4 $-5.419E+03$ $5.420E+02$ $3.860E+02$ $-2.454E+03$ 18 8.4 $-5.419E+03$ $5.6420E+02$ $3.860E+02$ $-2.454E+03$ 20 9.4 $-6.57E+03$ $6.69E+02$ $3.860E+02$ $-2.454E+03$ 21 9.8 $-6.375E+03$ $6.69E+02$ $3.860E+02$ $-2.454E+03$ 22 10.3 $-7.032E+03$ $7.07E+02$ $3.860E+02$ $-2.454E+03$ 23 10.8 $-7.332E+03$ $7.07E+02$ $3.860E+02$ $-2.454E+03$ 24 11.3 $-7.332E+03$ $7.07E+02$ $3.860E+02$ $-2.454E+03$ <td>7</td> <td>3.0</td> <td>-1.9135-03</td> <td>1.0135-02</td> <td>3+8000+02</td> <td>-2.4345103</td>	7	3.0	-1.9135-03	1.0135-02	3+8000+02	-2.4345103
9 3.9 $-2.550E-03$ 2.55 $DE-02$ 3.86 $DE-02$ 2.45 $AE+03$ 10 4.4 $-2.669E-03$ 2.86 $9E-02$ 3.86 $0E+02$ $-2.45AE+03$ 11 4.9 $-3.188E-03$ 3.18 $BE-02$ 3.86 $0E+02$ $-2.45AE+03$ 12 5.4 $-3.506F-03$ 3.5 $07E-02$ 3.86 $0E+02$ $-2.45AE+03$ 13 5.9 $-3.825E-03$ 3.82 $6E-02$ 3.86 $0E+02$ $-2.45AE+03$ 14 6.4 $-4.144E-03$ $4.144E-02$ $3.860E+02$ $-2.45AE+03$ 15 6.9 $-4.463E-03$ $4.463F-02$ $3.860E+02$ $-2.45AE+03$ 16 7.4 $-4.782E-03$ $4.782E-02$ $3.860E+02$ $-2.45AE+03$ 16 7.4 $-4.782E-03$ $4.782E-02$ $3.860E+02$ $-2.45AE+03$ 17 7.9 $-5.100E-03$ $5.101E-02$ $3.860E+02$ $-2.45AE+03$ 18 8.4 $-5.419E-03$ $5.420E-02$ $3.860E+02$ $-2.45AE+03$ 19 8.9 $-5.738E-03$ $5.738E-02$ $3.860E+02$ $-2.45AE+03$ 19 8.9 $-5.738E-03$ $5.738E-02$ $3.860E+02$ $-2.45AE+03$ 21 9.8 $-6.375E-03$ $6.057E-02$ $3.860E+02$ $-2.45AE+03$ 22 10.3 $-6.694E-03$ $6.057E-02$ $3.860E+02$ $-2.45AE+03$ 23 10.8 $-7.913E-03$ $7.014E-02$ $3.860E+02$ $-2.45AE+03$ 24 11.3 $-7.651E-03$ $7.651E-02$ $3.860E+02$ $-2.45AE+03$ 25 11.8 $-7.651E-03$ $7.651E-02$ $3.860E+02$ $-2.45AE+03$ 26 12.3 $-7.969E-03$ $7.970E-02$ $3.860E+02$ $-2.45AE+03$ 26 12.3 $-7.969E-03$ $7.970E-02$ $3.860E+02$ $-2.45AE+03$ 26 12.3 $-7.969E-03$ $7.970E-02$ $3.860E+02$ $-2.45AE+03$ 27 12.8 $-8.288E-03$ $8.289E-02$ $3.859E+02$ $-2.45AE+03$ 26 12.3 $-7.969E-03$ $9.824E-02$ $3.859E+02$ $-2.45AE+03$ 27 13.8 $-8.926E-03$ $9.9245E-02$ $3.859E+02$ $-2.45AE+03$ 30 14.3 $-9.244F-03$ $9.245E-02$ $3.859E+02$ $-2.45AE+03$ 31 14.8 $-9.563E-03$ $-9.564E-02$ $3.859E+02$ $-2.45AE+03$ 33 15.7 $-1.020E-02$ $1.020E-01$ $3.859E+02$ $-2.45AE+03$ 34 15.7 $-1.020E-02$ $1.020E-01$ $3.859E+02$ $-2.45AE+03$ 35 16.7 $-1.072E-02$ $1.805E-01$ $-3.859E+02$ $-2.45AE+03$ 36 17.2 $-1.116E-02$ $1.148E-01$ $3.859E+02$ $-2.45AE+03$ 37 17.7 $-1.148E-02$ $1.211E-01$ $3.859E+02$ $-2.45AE+03$ 36 17.2 $-1.307E-02$ $1.338E-01$ $3.859E+02$ $-2.45AE+03$ 37 12.7 $-1.231E-02$ $1.337E-01$ $3.859E+02$ $-2.454E+03$ 36 17.2 $-1.307E-02$ $1.3859E+02$ $-2.454E+03$ 37 10.7 -1.2	Ŕ	3.4	-2.231E-03	2.2325-02	3+4000-02	-2 4541403
10 4.4 -2.869E.03 2.869E.02 3.860E.02 -2.454E.03 11 4.9 -3.188E.03 3.168E.02 3.860E.02 -2.454E.03 12 5.4 -3.506E.03 3.507E.02 3.860E.02 -2.454E.03 13 5.9 -3.825E.03 3.826E.02 3.860E.02 -2.454E.03 14 6.4 -4.144E.03 4.144E.02 3.860E.02 -2.454E.03 15 6.9 -4.463E.03 4.463F.02 3.860E.02 -2.454E.03 16 7.4 -4.782E.03 4.782E.02 3.860E.02 -2.454E.03 17 7.9 -5.100E.03 5.101E.02 3.860E.02 -2.454E.03 18 8.4 -5.419E.03 5.420E.02 3.860E.02 -2.454E.03 19 8.9 -5.738E.03 5.420E.02 3.860E.02 -2.454E.03 20 9.4 -6.057E.03 6.057E.02 3.860E.02 -2.454E.03 21 9.8 -6.375E.03 6.057E.02 3.860E.02 -2.454E.03 22 10.3 -6.694E.03 6.057E.02 3.860E.02 -2.454E.03 23 10.8 -7.013E.03 7.014E.02 3.860E.02 -2.454E.03 24 11.3 -7.332E.03 7.332E.02 3.860E.02 -2.454E.03 25 11.8 -7.651E.03 7.61F.02 3.860F.02 -2.454E.03 26 12.3 -7.969E.03 7.970E.02 3.860F.02 -2.454E.03 26 12.3 -7.969E.03 7.970E.02 3.860F.02 -2.454E.03 26 12.3 -7.969E.03 7.970E.02 3.860E.02 -2.454E.03 26 12.3 -7.969E.03 7.970E.02 3.860E.02 -2.454E.03 27 12.8 -6.288E.03 8.289E.02 3.860E.02 -2.454E.03 26 12.3 -7.969E.03 7.970E.02 3.860E.02 -2.454E.03 27 12.8 -6.288E.03 8.926E.02 3.860E.02 -2.454E.03 28 13.3 -8.607E.03 8.608E.02 3.860E.02 -2.454E.03 30 14.3 -9.244F.03 9.245E.02 3.859F.02 -2.454E.03 31 14.8 -9.563E.03 9.564E.02 3.859F.02 -2.454E.03 33 15.7 -1.020E.02 1.020F.01 3.859F.02 -2.454E.03 34 16.2 -1.052E.01 3.652E.01 3.859F.02 -2.454E.03 35 16.7 -1.084E.02 1.020F.01 3.859F.02 -2.454E.03 36 17.2 -1.116E.02 1.106F.01 3.859F.02 -2.454E.03 37 17.7 -1.148E.00 1.3.859F.02 -2.454E.03 39 18.7 -1.21E.02 1.21F.01 3.859F.02 -2.454E.03 40 19.2 -1.243E.02 1.39FE.01 3.859F.02 -2.454E.03 41 19.7 -1.2275E.02 1.275E.01 3.859F.02 -2.454E.03 42 20.2 -1.307E.02 1.307E.01 3.859F.02 -2.454E.03 43 20.7 -1.339E.02 1.339E.01 3.859F.02 -2.454E.03 44 21.2 -1.371E.01 3.859F.02 -2.454	ģ	3.9	-2.5508-03	2.5505-02	3-0605+02	-2 4546403
11 4.9 -3.188E-03 3.188E-02 3.860E+n2 -2.454E+n3 12 5.4 -3.506E-n3 3.507E-02 3.860E+n2 -2.454E+n3 13 5.9 -3.825E-03 3.826E-02 3.860E+n2 -2.454E+n3 14 6.4 -4.144E-03 4.144E-n2 3.860E+n2 -2.454E+n3 15 6.9 -4.463E-03 4.463F-02 3.860E+n2 -2.454E+n3 16 7.4 -4.782E-03 4.782E-02 3.860E+n2 -2.454E+n3 17 7.9 -5.100E-03 5.101E-n2 3.860E+n2 -2.454E+n3 18 8.4 -5.419E-03 5.420E-n2 3.860E+n2 -2.454E+n3 19 8.9 -5.738E-n3 5.738E-n2 3.860E+n2 -2.454E+n3 20 9.4 -6.657E-03 6.057E-n2 3.860E+n2 -2.454E+n3 21 9.8 -6.375E-n3 6.376E-n2 3.860E+n2 -2.454E+n3 22 10.3 -6.694E-n3 6.695E-n2 3.860E+n2 -2.454E+n3 23 10.8 -7.913E-n3 7.014E-02 3.860E+n2 -2.454E+n3 24 11.3 -7.651E-03 7.651F-02 3.860F+n2 -2.454E+n3 25 11.8 -7.651E-03 7.651F-02 3.860F+n2 -2.454E+n3 26 12.3 -7.969E-03 7.970E-02 3.860E+n2 -2.454E+n3 26 12.3 -7.969E-03 7.970E-02 3.860E+n2 -2.454E+n3 26 12.3 -7.969E-03 7.970E-02 3.860E+n2 -2.454E+n3 26 12.3 -7.969E-03 8.926E-02 3.850E+n2 -2.454E+n3 27 12.8 -6.288E-n3 8.926E-02 3.850E+n2 -2.454E+n3 26 12.3 -7.969E-03 7.970E-02 3.860E+n2 -2.454E+n3 27 13.8 -8.607E-03 8.926E-02 3.859E+n2 -2.454E+n3 28 13.3 -8.607E-03 8.926E-02 3.859E+n2 -2.454E+n3 29 13.8 -8.926E-03 8.926E-02 3.859E+n2 -2.454E+n3 30 14.3 -9.244F-03 9.845E-n2 3.859E+n2 -2.454E+n3 31 14.8 -9.563E-03 9.564E-n2 3.859E+n2 -2.454E+n3 32 15.3 -9.882E-03 9.883E-n2 3.859E+n2 -2.454E+n3 33 15.7 -1.020E-02 1.027E-n1 3.859E+n2 -2.454E+n3 34 16.2 -1.052E-02 1.052E-n1 3.859E+n2 -2.454E+n3 35 16.7 -1.084E-02 1.084E-01 3.859E+n2 -2.454E+n3 36 17.2 -1.116E-02 1.180E-01 3.859E+n2 -2.454E+n3 36 17.2 -1.116E-02 1.180E-01 3.859E+n2 -2.454E+n3 37 18.7 -1.243E-01 1.859E+n2 -2.454E+n3 38 18.2 -1.179E-02 1.307E-n1 3.859E+n2 -2.454E+n3 34 16.2 -1.032E-02 1.927E-01 3.859E+n2 -2.454E+n3 34 16.2 -1.032E-02 1.937E-01 3.859E+n2 -2.454E+n3 34 20.7 -1.339E-02 1.337E-01 3.859E+n2 -2.454E+n3 34 20.7 -1.339E-02 1.337E-01 3.859E+n2 -2.454E+n3 34 20.7 -1.339E-02 1.337E-01 3.859E+n2 -2.454E+n3 34 20.7 -1.339E-02 1.937E-01 3.859E+n2 -2.454E+n3 34 20.2 -1.307E-02 1.930E-	10	4.4	-2.869E-03	2.8695+02	3+9605+02	-2 4545+03
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14 6.4 $-4.144E-03$ $4.144E-02$ $3.860E+02$ $2.2.454E+03$ 15 6.9 $-4.463E-03$ $4.463F-02$ $3.860E+02$ $-2.454E+03$ 16 7.4 $-4.782E-03$ $4.782E-02$ $3.860E+02$ $-2.454E+03$ 17 7.9 $5.100E-03$ $5.101E-02$ $3.860E+02$ $-2.454E+03$ 18 8.4 $-5.419E-03$ $5.420E-02$ $3.860E+02$ $-2.454E+03$ 19 8.9 $-5.738E-03$ $5.738E-02$ $3.860E+02$ $-2.454E+03$ 20 9.4 $-6.057E-03$ $6.057E-02$ $3.860E+02$ $-2.454E+03$ 21 9.8 $-6.375E-03$ $6.057E-02$ $3.860E+02$ $-2.454E+03$ 22 10.3 $-6.694E-03$ $6.695E-02$ $3.860E+02$ $-2.454E+03$ 23 10.8 $-7.913E-03$ $7.014E-02$ $3.860E+02$ $-2.454E+03$ 24 11.3 $-7.332E-03$ $7.332F-02$ $3.860E+02$ $-2.454E+03$ 25 11.8 $-7.651E-03$ $7.660E+02$ $3.860E+02$ $-2.454E+03$ 26 12.3 $-7.969E-03$ $8.289E-02$ $3.860E+02$ $-2.454E+03$ 27 12.8 $-8.288E-03$ $8.926E-02$ $3.859E+02$ $-2.454E+03$ 30 14.3 $-9.244F-03$ $9.245E-02$ $3.859E+02$ $-2.454E+03$ 31 14.8 $-9.563E-03$ $9.564E-02$ $3.859E+02$ $-2.454E+03$ 33 15.7 $-1.020E-02$ $1.020E-01$ $3.859E+02$ $-2.454E+03$ 33 16.7 $-1.084E-02$	13	5.9	-3.825E-03	3-826F-02	3+860E+02	-2.454E+03
15 6.9 $-4.463E-03$ $4.463F-02$ $3.860E+02$ $-2.454E+03$ 16 7.4 $-4.782E+03$ $4.782E-02$ $3.860E+02$ $-2.454E+03$ 17 7.9 $-5.100E-03$ $5.101E-02$ $3.860E+02$ $-2.454E+03$ 18 8.4 $-5.419E+03$ $5.420E+02$ $3.860E+02$ $-2.454E+03$ 19 8.9 $-5.738E+03$ $5.738E+02$ $3.860E+02$ $-2.454E+03$ 20 9.4 $-6.057E+03$ $6.057E+02$ $3.860E+02$ $-2.454E+03$ 21 9.8 $-6.375E+03$ $6.376E+02$ $3.860E+02$ $-2.454E+03$ 22 10.3 $-6.698E+03$ $6.957E+02$ $3.860E+02$ $-2.454E+03$ 23 10.8 $-7.013E+03$ $7.014E+02$ $3.860E+02$ $-2.454E+03$ 23 10.8 $-7.013E+03$ $7.014E+02$ $3.860E+02$ $-2.454E+03$ 24 11.3 $-7.332E+03$ $7.332E+02$ $3.860E+02$ $-2.454E+03$ 25 11.8 $-7.651E+03$ $7.651E+02$ $3.860E+02$ $-2.454E+03$ 26 12.3 $-7.969E+03$ $7.970E+02$ $3.860E+02$ $-2.454E+03$ 26 12.3 $-7.969E+03$ $7.970E+02$ $3.860E+02$ $-2.454E+03$ 27 12.8 $-8.288E+03$ $8.289E+02$ $3.860E+02$ $-2.454E+03$ 28 13.3 $-8.607E+03$ $8.289E+02$ $3.859E+02$ $-2.454E+03$ 30 14.3 $-9.244E+03$ $9.26E+02$ $3.859E+02$ $-2.454E+03$ 31 14.8 $-9.563E+03$ $9.564E+02$ $3.859E+02$ $-2.454E+03$ 33 15.7 $-1.020E+02$ $1.020E+01$ $3.859E+02$ $-2.454E+03$ 34 16.2 $-1.052E+02$ $1.020E+01$ $3.859E+02$ $-2.454E+03$ 35 16.7 $-1.084E+02$ $1.088E+01$ $3.859E+02$ $-2.454E+03$ 36 17.2 $-1.116E+02$ $1.116E+01$ $3.859E+02$ $-2.454E+03$ 36 17.2 $-1.116E+02$ $1.116E+01$ $3.859E+02$ $-2.454E+03$ 36 17.2 $-1.121E+02$ $1.211E+01$ $3.859E+02$ $-2.454E+03$ 36 17.2 $-1.1339E+02$ $1.275E+01$ $3.859E+02$ $-2.454E+03$ 36 17.2 $-1.1339E+02$ $1.275E+01$ $3.859E+02$ $-2.454E+03$ 37 17.7 $-1.243E+02$ $1.275E+01$ $3.859E+02$ $-2.454E+03$ 36 12.2 $-1.307E+02$ $1.337E+01$ $3.859E+02$ $-2.454E+03$ 36 12.2 $-1.307E+02$ $1.337E+01$ $3.859E+02$ $-2.454E+03$ 37 17.7 $-1.403E+02$ $1.337E+01$ $3.859E+02$ $-2.454E+03$ 36 22.1 $-1.498E+02$ $1.243E+01$ $3.859E+02$ $-2.454E+03$ 36 22.1 $-1.498E+02$ $1.243E+01$ $3.859E+02$ $-2.454E+03$ 37 $12.21E+01$ $3.859E+02$ $-2.454E+03$ 38 23.6 $-1.530E+02$ $1.498E+01$ $3.858E+02$ $-2.454E+03$ 39	14	6.4	-4.144F-03	4-144F-02	3+860E+02	-2.454E+03
167.4-4.782E-034.782E-02 $3.660E+02$ -2.454E+03177.9-5.100E-035.101E-02 $3.860E+02$ -2.454E+03188.4-5.419E+03 $5.420E-02$ $3.860E+02$ -2.454E+03198.9-5.738E-03 $5.738E-02$ $3.860E+02$ -2.454E+03209.4-6.057E+03 $6.057E-02$ $3.860E+02$ -2.454E+03219.8-6.375E+03 $6.057E-02$ $3.860E+02$ -2.454E+032210.3-6.694E+03 $6.695E+02$ $3.860E+02$ -2.454E+032310.8-7.913E+03 $7.014E=02$ $3.860E+02$ -2.454E+032310.8-7.9551E+03 $7.651F=02$ $3.860E+02$ -2.454E+032411.3-7.956E+03 $7.970E=02$ $3.860E+02$ -2.454E+032612.3-7.969F+03 $7.970E=02$ $3.860E+02$ -2.454E+032612.3-7.969F+03 $8.289E=02$ $3.859E+02$ -2.454E+032712.8-6.638E+03 $8.289E=02$ $3.859F+02$ -2.454E+033014.3-9.244F+03 $9.245E=02$ $3.859F+02$ -2.454E+033114.8-9.563E=03 $9.564E=02$ $3.859F+02$ -2.454E+033215.3-9.882E=03 $9.883E=02$ $3.859E+02$ -2.454E+033315.7-1.020E=02 $1.020F=01$ $3.859E+02$ -2.454E+033416.2-1.652E=02 $1.020F=01$ $3.859E+02$ -2.454E+033516.7-1.684E=02<	15	6.9	-4.463F-03	4-463E-02	3.960E+02	-2.4541+03
17 7.9 $-5.100E-03$ $5.101E-02$ $3.60E+02$ $-2.454E+03$ 18 8.4 $-5.419E+03$ $5.420E+02$ $3.60E+02$ $-2.454E+03$ 19 8.9 $-5.738E-03$ $5.738E-02$ $3.860E+02$ $-2.454E+03$ 20 9.4 $-6.057E+03$ $6.057E+02$ $3.860E+02$ $-2.454E+03$ 21 9.8 $-6.375E+03$ $6.376E+02$ $3.860E+02$ $-2.454E+03$ 22 10.3 $-6.694E+03$ $6.695E+02$ $3.860E+02$ $-2.454E+03$ 23 10.8 $-7.013E+03$ $7.014E+02$ $3.860E+02$ $-2.454E+03$ 24 11.3 $-7.332E+03$ $7.651E+02$ $3.860E+02$ $-2.454E+03$ 25 11.8 $-7.651E+03$ $7.651F+02$ $3.860E+02$ $-2.454E+03$ 26 12.3 $-7.969E+03$ $7.970E+02$ $3.860E+02$ $-2.454E+03$ 27 12.8 $-8.288E+03$ $8.289E+02$ $3.860E+02$ $-2.454E+03$ 28 13.3 $-8.607E+03$ $8.926E+02$ $3.860E+02$ $-2.454E+03$ 29 13.8 $-8.926E+03$ $8.926E+02$ $3.859E+02$ $-2.454E+03$ 30 14.3 $-9.244F+03$ $9.245E+02$ $3.859E+02$ $-2.454E+03$ 31 14.8 $-9.563E+03$ $9.564E+02$ $3.859E+02$ $-2.454E+03$ 33 15.7 $-1.020E+02$ $1.020E+01$ $3.859E+02$ $-2.454E+03$ 34 16.2 $-1.052E+02$ $1.052E+01$ $3.859E+02$ $-2.454E+03$ 35 16.7 $-1.084E+02$ $1.084E+01$ $3.859E+02$ $-2.454E+03$ 36 17.2 $-1.116E+02$ $1.16E+01$ $3.859E+02$ $-2.454E+03$ 37 17.7 $-1.148E+02$ $1.188E+01$ $3.859E+02$ $-2.454E+03$ 38 18.2 $-1.179E+02$ $1.180E+01$ $3.859E+02$ $-2.454E+03$ 39 18.7 $-1.211E+02$ $1.211E+01$ $3.859E+02$ $-2.454E+03$ 40 19.2 $-1.243E+02$ $1.275E+01$ $3.859E+02$ $-2.454E+03$ 41 19.7 $-1.275E+02$ $1.371E+01$ $3.859E+02$ $-2.454E+03$ 42 20.2 $-1.307E+02$ $1.339E+01$ $3.859E+02$ $-2.454E+03$ 44 21.2 $-1.371E+02$ $1.371E+01$ $3.859E+02$ $-2.454E+03$ 45 21.7 $-1.403E+02$ $1.403E+01$ $3.859E+02$ $-2.454E+03$ 46 22.1 $-1.434E+02$ $1.449E+01$ $3.859E+02$ $-2.454E+03$ 47 22.6 $-1.466E+02$ $1.449E+01$ $3.859E+02$ $-2.454E+03$ 48 23.1 $-1.498E+02$ $1.498E+01$ $3.858E+02$ $-2.454E+03$ 49 23.6 $-1.530E+02$ $1.498E+01$ $3.858E+02$ $-2.454E+03$ 49 23.6 $-1.530E+02$ $1.530E+01$ $3.858E+02$ $-2.454E+03$ 49 23.6 $-1.530E+02$ $1.530E+01$ $3.858E+02$ $-2.454E+03$	16	7.4	-4.782E-03	4.782F-02	3+860E+02	-2.454E+03
188.4 $-5.419E-03$ $5.420E-02$ $3.860E+02$ $-2.454E+03$ 198.9 $-5.738E-03$ $5.738E-02$ $3.860E+02$ $-2.454E+03$ 209.4 $-6.057E-03$ $6.057E-02$ $3.860E+02$ $-2.454E+03$ 219.8 $-6.375E-03$ $6.057E-02$ $3.860E+02$ $-2.454E+03$ 2210.3 $-6.694E^{-}03$ $6.695E-02$ $3.860E+02$ $-2.454E+03$ 2310.8 $-7.913E-03$ $7.014E-02$ $3.860E+02$ $-2.454E+03$ 2411.3 $-7.332E^{-}03$ $7.332E-02$ $3.860E+02$ $-2.454E+03$ 2511.8 $-7.651E-03$ $7.651F-02$ $3.860E+02$ $-2.454E+03$ 2612.3 $-7.969E^{-}03$ $7.970E-02$ $3.860E+02$ $-2.454E+03$ 2712.8 $-8.288E^{-}03$ $8.289E^{-}02$ $3.860E^{+}02$ $-2.454E^{+}03$ 2813.3 $-8.607E^{-}03$ $8.926E^{-}02$ $3.859F^{+}02$ $-2.454E^{+}03$ 2913.8 $-8.926E^{-}03$ $9.245E^{-}02$ $3.859F^{+}02$ $-2.454E^{+}03$ 3014.3 $-9.244F^{-}03$ $9.245E^{-}02$ $3.859F^{+}02$ $-2.454E^{+}03$ 3114.8 $-9.563E^{-}03$ $9.564E^{-}02$ $3.859F^{+}02$ $-2.454E^{+}03$ 3315.7 $-1.020E^{-}02$ $1.052E^{-}01$ $3.859E^{+}02$ $-2.454E^{+}03$ 3416.2 $-1.052E^{-}02$ $1.052E^{-}01$ $3.859E^{+}02$ $-2.454E^{+}03$ 3516.7 $-1.084E^{-}02$ $1.084E^{-}01$ $3.859E^{+}02$ -2.45	17	7.9	-5.100E-03	5.101F-02	3.860F+02	-2.454L+03
198.9 $-5.738E-n3$ $5.738E-n2$ $3.860E+n2$ $-2.454E+n3$ 209.4 $-6.057E-n3$ $6.057E-n2$ $3.860E+n2$ $-2.454E+n3$ 219.8 $-6.375E-n3$ $6.376E-n2$ $3.860E+n2$ $-2.454E+n3$ 22 10.3 $-6.694E-n3$ $6.695E-n2$ $3.860E+n2$ $-2.454E+n3$ 23 10.8 $-7.913E-n3$ $7.014E-n2$ $3.860E+n2$ $-2.454E+n3$ 24 11.3 $-7.332E-n3$ $7.014E-n2$ $3.860E+n2$ $-2.454E+n3$ 25 11.8 $-7.651E-n3$ $7.651F-n2$ $3.860E+n2$ $-2.454E+n3$ 26 12.3 $-7.969F-n3$ $8.289E-n2$ $3.860E+n2$ $-2.454E+n3$ 26 12.3 $-7.969F-n3$ $8.289E-n2$ $3.860E+n2$ $-2.454E+n3$ 26 12.3 $-7.969F-n3$ $8.608E-n2$ $3.860E+n2$ $-2.454E+n3$ 27 12.8 $-8.288E-n3$ $8.289E-n2$ $3.860E+n2$ $-2.454E+n3$ 28 13.3 $-8.607E-n3$ $8.608E-n2$ $3.860E+n2$ $-2.454E+n3$ 29 13.8 $-8.926E-n3$ $8.926E-n2$ $3.859E+n2$ $-2.454E+n3$ 30 14.3 $-9.244F-n3$ $9.245E-n2$ $3.859E+n2$ $-2.454E+n3$ 31 14.8 $-9.563E-n3$ $9.564E-n2$ $3.859E+n2$ $-2.454E+n3$ 33 15.7 $-1.020E-n2$ $1.020E-n1$ $3.859E+n2$ $-2.454E+n3$ 34 16.2 $-1.052E-n2$ $1.052E-n1$ $3.859E+n2$ $-2.454E+n3$ 35 16.7 $-1.684E-n2$ 1	18	8.4	-5+419E-03	5.420E-02	3+860F+02	-2.454E+03
20 9.4 $-6.057E-03$ $6.057E-02$ $3.860E+n2$ $-2.454E+03$ 21 9.8 $-6.375E-n3$ $6.376E-n2$ $3.860E+n2$ $-2.454E+n3$ 22 10.3 $-6.694E+n3$ $6.695E-n2$ $3.860E+n2$ $-2.454E+n3$ 23 10.8 $-7.913E-n3$ $7.014E-n2$ $3.860E+n2$ $-2.454E+n3$ 24 11.3 $-7.332E+n2$ $3.860E+n2$ $-2.454E+n3$ 25 11.8 $-7.651E-n3$ $7.651F-n2$ $3.860E+n2$ $-2.454E+n3$ 26 12.3 $-7.969E+n3$ $8.69E+n2$ $-2.454E+n3$ 26 12.3 $-7.969E+n3$ $8.608E+n2$ $-2.454E+n3$ 26 12.3 $-7.969E+n3$ $8.608E+n2$ $-2.454E+n3$ 26 12.3 $-7.969E+n3$ $8.608E+n2$ $-2.454E+n3$ 28 13.3 $-8.607E+n3$ $8.608E+n2$ $-2.454E+n3$ 29 13.8 $-8.926E-n3$ $8.926E-n2$ $3.860E+n2$ $-2.454E+n3$ 30 14.3 $-9.244E+n3$ $9.245E+n2$ $3.859E+n2$ $-2.454E+n3$ 31 14.8 $-9.563E-n3$ $9.564E-n2$ $3.859E+n2$ $-2.454E+n3$ 32 15.7 $-1.020E-n2$ $1.020E-n1$ $3.859E+n2$ $-2.454E+n3$ 34 16.2 $-1.052E-n2$ $1.052E-n1$ $3.859E+n2$ $-2.454E+n3$ 34 16.2 $-1.052E-n2$ $1.020E-n1$ $3.859E+n2$ $-2.454E+n3$ 36 17.2 $-1.116E+n2$ $1.168E-n1$ $3.859E+n2$ $-2.454E+n3$ 36 <	19	8.9	-5.738E-03	5.738F-02	3+860F+02	-2.454L+03
21 9.8 $-6.375E-03$ 6.376E-02 3.860F.02 $-2.454E+03$ 22 10.3 $-6.694E-03$ 6.695E-02 3.860F.02 $-2.454E+03$ 23 10.8 $-7.013E-03$ 7.014E-02 3.860F.02 $-2.454E+03$ 24 11.3 $-7.032E-03$ 7.332F-02 3.860F.02 $-2.454E+03$ 25 11.8 $-7.051E-03$ 7.651F-02 3.860F.02 $-2.454E+03$ 26 12.3 $-7.969F-03$ 7.970E-02 3.860E.02 $-2.454E+03$ 27 12.8 $-8.288E-03$ 8.289E-02 3.860E.02 $-2.454E+03$ 28 13.3 $-8.607E-03$ 8.608E-02 $3.860E+02 -2.454E+03$ 29 13.8 $-8.926E-03$ 8.926E-02 $3.859F+02 -2.454E+03$ 30 14.3 $-9.244F-03$ 9.564E-02 $3.859F+02 -2.454E+03$ 31 14.8 $-9.563E-03$ 9.564E-02 $3.859F+02 -2.454E+03$ 32 15.3 $-9.882E-03$ 9.564E-02 $3.859F+02 -2.454E+03$ 33 15.7 $-1.020E-02$ 1.020E-01 $3.859E+02 -2.454E+03$ 34 16.2 $-1.052E-02$ 1.052E-01 $3.859E+02 -2.454E+03$ 35 16.7 $-1.084E-02$ 1.084E-01 $3.859E+02 -2.454E+03$ 36 17.2 $-1.116E-02$ 1.16E-01 $3.859E+02 -2.454E+03$ 37 17.7 $-1.148E-02$ 1.180E-01 $3.859E+02 -2.454E+03$ 38 18.2 $-1.179E-02$ 1.180E-01 $3.859E+02 -2.454E+03$ 39 18.7 $-1.211E+02$ 1.211E-01 $3.859E+02 -2.454E+03$ 34 19.2 $-1.243E-02$ 1.211E-01 $3.859E+02 -2.454E+03$ 35 16.7 $-1.084E-02$ 1.211E-01 $3.859E+02 -2.454E+03$ 36 17.2 $-1.116E-02$ 1.211E-01 $3.859E+02 -2.454E+03$ 37 17.7 $-1.243E-02$ 1.221E-01 $3.859E+02 -2.454E+03$ 39 18.7 $-1.211E+02$ 1.211E-01 $3.859E+02 -2.454E+03$ 40 19.2 $-1.243E-02$ 1.237E-01 $3.859E+02 -2.454E+03$ 41 19.7 $-1.275E-02$ 1.307E-01 $3.859E+02 -2.454E+03$ 42 20.2 $-1.307E-02$ 1.307E-01 $3.859E+02 -2.454E+03$ 44 21.2 $-1.371E-02$ 1.307E-01 $3.859E+02 -2.454E+03$ 45 21.7 $-1.403E-02$ 1.403E-01 $3.859E+02 -2.454E+03$ 46 22.1 $-1.434E-02$ 1.403E-01 $3.859E+02 -2.454E+03$ 47 22.6 $-1.460E-02$ 1.403E-01 $3.859E+02 -2.454E+03$ 48 23.1 $-1.498E-02$ 1.403E-01 $3.859E+02 -2.454E+03$ 48 23.1 $-1.498E-02$ 1.403E-01 $3.858E+02 -2.454E+03$ 49 23.6 $-1.530E-02$ 1.502E-01 $3.858E+02 -2.454E+03$ 49 23.6 $-1.530E-02$ 1.502E-01 $3.858E+02 -2.454E+03$ 49 23.6 $-1.530E-02$ 1.502E-01 $3.858E+02 -2.454E+03$	Že.	9.4	-6.057E-03	6+057F-02	3+860F+n2	-2.454L+03
22 10.3 $-6.694E-03$ $6.695E-02$ $3.860E+02$ $-2.454E+03$ 23 10.8 $-7.013E-03$ $7.014E-02$ $3.860E+02$ $-2.454E+03$ 24 11.3 $-7.332E+03$ $7.332E-02$ $3.860E+02$ $-2.454E+03$ 25 11.8 $-7.651E-03$ $7.651F+02$ $3.860E+02$ $-2.454E+03$ 26 12.3 $-7.969E+03$ $7.970E-02$ $3.860E+02$ $-2.454E+03$ 27 12.8 $-8.288E-03$ $8.289E-02$ $3.860E+02$ $-2.454E+03$ 28 13.3 $-8.607E+03$ $8.289E-02$ $3.860E+02$ $-2.454E+03$ 29 13.8 $-8.926E+03$ $8.926E+02$ $3.859E+02$ $-2.454E+03$ 30 14.3 $-9.244F+03$ $9.245E+02$ $3.859F+02$ $-2.454E+03$ 31 14.8 $-9.563E+03$ $9.564E+02$ $3.859F+02$ $-2.454E+03$ 32 15.3 $-9.882E+03$ $9.564E+02$ $3.859F+02$ $-2.454E+03$ 33 15.7 $-1.020E+02$ $1.020E+01$ $3.859E+02$ $-2.454E+03$ 34 16.2 $-1.052E+02$ $1.052E+01$ $3.859E+02$ $-2.454E+03$ 35 16.7 $-1.084E+02$ $1.084E+01$ $3.859E+02$ $-2.454E+03$ 36 17.2 $-1.116E+02$ $1.16E+01$ $3.859E+02$ $-2.454E+03$ 38 18.2 $-1.179E+02$ $1.180E+01$ $3.859E+02$ $-2.454E+03$ 39 18.7 $-1.211E+02$ $1.211E+01$ $3.859E+02$ $-2.454E+03$ 40 19.2 $-1.243E+02$ $1.275E+01$ $3.859E+02$ $-2.454E+03$ 41 19.7 $-1.275E+02$ $1.275E+01$ $3.859E+02$ $-2.454E+03$ 42 20.2 $-1.307E+02$ $1.307E+01$ $3.859E+02$ $-2.454E+03$ 44 21.2 $-1.371E+02$ $1.37E+01$ $3.859E+02$ $-2.454E+03$ 45 21.7 $-1.403E+02$ $1.339E+01$ $3.859E+02$ $-2.454E+03$ 46 22.1 $-1.434E+02$ $1.435E+01$ $3.859E+02$ $-2.454E+03$ 47 22.6 $-1.443E=02$ $1.435E+01$ $3.859E+02$ $-2.454E+03$ 48 23.1 $-1.498E+02$ $1.435E+01$ $3.858E+02$ $-2.454E+03$ 49 23.6 $-1.530E+02$ $1.435E+01$ $3.858E+02$ $-2.454E+03$ 47 22.6 $-1.446E+02$ $1.438E+01$ $3.858E+02$ $-2.454E+03$ 48 23.1 $-1.498E+02$ $1.498E+01$ $3.858E+02$ $-2.454E+03$ 49 23.6 $-1.530E+02$ $1.530E+01$ $3.858E+02$ $-2.454E+03$ 49 23.6 $-1.530E+02$ $1.562E+01$ $3.858E+02$ $-2.454E+03$	21	9.8	-6.375F-03	6.376F-02	3+860E+02	-2.454L+03
2310.8 $-7.913E-03$ $7.014E-02$ $3.860F+n2$ $-2.454E+n3$ 2411.3 $-7.332E-03$ $7.332F-n2$ $3.860F+n2$ $-2.454E+n3$ 2511.8 $-7.651E-03$ $7.651F-02$ $3.860F+n2$ $-2.454E+n3$ 2612.3 $-7.969F-03$ $7.970E-02$ $3.860F+n2$ $-2.454E+n3$ 2712.8 $-8.288E-n3$ $8.289E-n2$ $3.860E+n2$ $-2.454E+n3$ 2813.3 $-8.607E-n3$ $8.289E-n2$ $3.860E+n2$ $-2.454E+n3$ 2913.8 $-8.926E-n3$ $8.926E-n2$ $3.859F+n2$ $-2.454E+n3$ 3014.3 $-9.244F-n3$ $9.245E-n2$ $3.859F+n2$ $-2.454E+n3$ 3114.8 $-9.563E-n3$ $9.564E-n2$ $3.859F+n2$ $-2.454E+n3$ 3315.7 $-1.020E-n2$ $1.020E-n1$ $3.859E+n2$ $-2.454E+n3$ 3416.2 $-1.052E-n2$ $1.052E-n1$ $3.859E+n2$ $-2.454E+n3$ 3516.7 $-1.084E-n2$ $1.084E-n1$ $3.859E+n2$ $-2.454E+n3$ 3617.2 $-1.116E-n2$ $1.148E-n1$ $3.859E+n2$ $-2.454E+n3$ 3617.2 $-1.116E-n2$ $1.148E-n1$ $3.859E+n2$ $-2.454E+n3$ 3617.2 $-1.116E-n2$ $1.148E-n1$ $3.859E+n2$ $-2.454E+n3$ 37 17.7 $-1.423E-n2$ $1.275E-n1$ $3.859E+n2$ $-2.454E+n3$ 3818.2 $-1.179E-n2$ $1.275E-n1$ $3.859E+n2$ $-2.454E+n3$ 4019.2 $-1.243E-n2$ $1.339E-n1$ $3.859E$	22	10.3	-6.694F-03	6+695F=02	3+860F+02	-2.454L+03
2411.3 $-7.332E+03$ $7.332E+02$ $3.860F+n2$ $-2.454E+n3$ 25 11.8 $-7.651E+03$ $7.651F+02$ $3.860F+n2$ $-2.454E+n3$ 26 12.3 $-7.969F+03$ $7.970E+02$ $3.860E+n2$ $-2.454E+n3$ 27 12.8 $-8.288E+n3$ $8.289E+n2$ $3.860E+n2$ $-2.454E+n3$ 28 13.3 $-8.607E+n3$ $8.608E+02$ $3.860E+n2$ $-2.454E+n3$ 29 13.8 $-8.926E+n3$ $8.926E+n2$ $3.859F+n2$ $-2.454E+n3$ 30 14.3 $-9.244F+03$ $9.245E+n2$ $3.859F+n2$ $-2.454E+n3$ 31 14.8 $-9.563E+03$ $9.564E+n2$ $3.859F+n2$ $-2.454E+n3$ 32 15.3 $-9.882E+03$ $9.883E+n2$ $3.859F+n2$ $-2.454E+n3$ 33 15.7 $-1.020E+02$ $1.020F+n1$ $3.859E+n2$ $-2.454E+n3$ 34 16.2 $-1.052E+02$ $1.052E+n1$ $3.859E+n2$ $-2.454E+n3$ 35 16.7 $-1.084E+02$ $1.084E+01$ $3.859E+n2$ $-2.454E+n3$ 36 17.2 $-1.116E+02$ $1.116E+n1$ $3.859E+n2$ $-2.454E+n3$ 36 18.2 $-1.179E+02$ $1.80E+01$ $3.859E+n2$ $-2.454E+n3$ 39 18.7 $-1.211E+02$ $1.211E+01$ $3.859E+n2$ $-2.454E+n3$ 40 19.2 $-1.243E+02$ $1.243E+01$ $3.859E+n2$ $-2.454E+n3$ 41 19.7 $-1.213E+02$ $1.275E+01$ $3.859E+n2$ $-2.454E+n3$ 42 20.2 $-1.307E+02$	23	10.8	-7.013E-03	7.014E-02	3+860E+02	-2.454L+03
25 11.8 -7.651E-03 7.651F-02 $3.860F+02 -2.454E+03$ 26 12.3 -7.969F-03 7.970E-02 $3.860E+02 -2.454E+03$ 27 12.8 -8.288E-03 8.289E-02 $3.860E+02 -2.454E+03$ 28 13.3 -8.607E-03 8.608E-02 $3.860E+02 -2.454E+03$ 29 13.8 -8.926E-03 8.926E-02 $3.859F+02 -2.454E+03$ 30 14.3 -9.244F-03 9.245E-02 $3.859F+02 -2.454E+03$ 31 14.8 -9.563E-03 9.564E-02 $3.859F+02 -2.454E+03$ 32 15.3 -9.882E-03 9.564E-02 $3.859F+02 -2.454E+03$ 33 15.7 -1.020E-02 1.020E-01 $3.859F+02 -2.454E+03$ 34 16.2 -1.052E-02 1.020E-01 $3.859E+02 -2.454E+03$ 35 16.7 -1.084E-02 1.052E-01 $3.859E+02 -2.454E+03$ 36 17.2 -1.116E-02 1.062E-01 $3.859E+02 -2.454E+03$ 37 17.7 -1.148E-02 1.084E-01 $3.859E+02 -2.454E+03$ 38 18.2 -1.179E-02 1.180E-01 $3.859E+02 -2.454E+03$ 39 18.7 -1.211E-02 1.211E-01 $3.859E+02 -2.454E+03$ 40 19.2 -1.243E-02 1.243E-01 $3.859E+02 -2.454E+03$ 41 19.7 -1.275E-02 1.275E-01 $3.859E+02 -2.454E+03$ 42 20.2 -1.307E-02 1.307E-01 $3.859E+02 -2.454E+03$ 44 21.2 -1.371E-02 1.371E-01 $3.859E+02 -2.454E+03$ 45 21.7 -1.443E-02 1.435E-01 $3.859E+02 -2.454E+03$ 46 22.1 -1.434E-02 1.435E-01 $3.859E+02 -2.454E+03$ 47 22.6 -1.466E-02 1.435E-01 $3.859E+02 -2.454E+03$ 48 23.1 -1.498E-02 1.371E-01 $3.859E+02 -2.454E+03$ 48 23.1 -1.498E-02 1.371E-01 $3.859E+02 -2.454E+03$ 49 23.6 -1.530E-02 1.330E-01 $3.858E+02 -2.454E+03$ 49 23.6 -1.530E-02 1.350E-01 $3.858E+02 -2.454E+03$ 49 23.6 -1.530E-02 1.530E-01 $3.858E+02 -2.454E+03$ 49 23.6 -1.530E-02 1.562E-01 $3.858E+02 -2.454E+03$	24	11.3	-7.332E-03	7.332F-02	3+860F+02	-2.454E+03
26 12.3 $-7.969F-03$ $7.970E-02$ $3.860E+02$ $-2.454E+03$ 27 12.8 $-8.288E-03$ $8.289E-02$ $3.860E+02$ $-2.454E+03$ 28 13.3 $-8.607E-03$ $8.608E-02$ $3.860E+02$ $-2.454E+03$ 29 13.8 $-8.926E-03$ $8.926E-02$ $3.859F+02$ $-2.454E+03$ 30 14.3 $-9.244F-03$ $9.245E-02$ $3.859F+02$ $-2.454E+03$ 31 14.8 $-9.563E-03$ $9.564E-02$ $3.859F+02$ $-2.454E+03$ 32 15.7 $-1.020E-02$ $1.020F-01$ $3.859F+02$ $-2.454E+03$ 33 15.7 $-1.020E-02$ $1.020F-01$ $3.859F+02$ $-2.454E+03$ 34 16.2 $-1.052E-02$ $1.052E-01$ $3.859F+02$ $-2.454E+03$ 35 16.7 $-1.084E-02$ $1.084E-01$ $3.859F+02$ $-2.454E+03$ 36 17.2 $-1.116F-02$ $1.116F-01$ $3.859F+02$ $-2.454E+03$ 37 17.7 $-1.128E-02$ $1.243E-01$ $3.859F+02$ $-2.454E+03$ 39 18.7 $-1.221E-02$ $1.275E-01$ $3.859F+02$ $-2.454E+03$ 40 19.2 $-1.243E-02$ $1.275E-01$ $3.859F+02$ $-2.454E+03$ 41 19.7 $-1.275E-02$ $1.275E-01$ $3.859F+02$ $-2.454E+03$ 42 20.2 $-1.307E-02$ $1.339E-01$ $3.859F+02$ $-2.454E+03$ 43 20.7 $-1.339F-02$ $1.339E-01$ $3.859F+02$ $-2.454E+03$ 44 21.2 $-1.371E-02$ </td <td>25</td> <td>11.8</td> <td>-7.651E-03</td> <td>7+651F-02</td> <td>3+860F+02</td> <td>-2.454E+03</td>	25	11.8	-7.651E-03	7+651F-02	3+860F+02	-2.454E+03
27 12.8 $-8.288E-03$ $8.289E-02$ $3.860E+02$ $-2.454E+03$ 28 13.3 $-8.607E-03$ $8.608E-02$ $3.860E+02$ $-2.454E+03$ 29 13.8 $-8.926E-03$ $8.926E-02$ $3.859F+02$ $-2.454E+03$ 30 14.3 $-9.244F-03$ $9.245E-02$ $3.859F+02$ $-2.454E+03$ 31 14.8 $-9.563E-03$ $9.245E-02$ $3.859F+02$ $-2.454E+03$ 32 15.3 $-9.882E-03$ $9.863E-02$ $3.859F+02$ $-2.454E+03$ 33 15.7 $-1.020E-02$ $1.020F-01$ $3.859F+02$ $-2.454E+03$ 34 16.2 $-1.052E-02$ $1.052E-01$ $3.859F+02$ $-2.454E+03$ 35 16.7 $-1.084E-02$ $1.084E-01$ $3.859F+02$ $-2.454E+03$ 36 17.2 $-1.116F-02$ $1.116F-01$ $3.859F+02$ $-2.454E+03$ 37 17.7 $-1.148E-02$ $1.480F-01$ $3.859F+02$ $-2.454E+03$ 38 18.2 $-1.179F-02$ $1.180E-01$ $3.859F+02$ $-2.454E+03$ 39 18.7 $-1.211E+02$ $1.211E-01$ $3.859F+02$ $-2.454E+03$ 40 19.2 $-1.275E-02$ $1.275E-01$ $3.859F+02$ $-2.454E+03$ 41 19.7 $-1.275E-02$ $1.307E-01$ $3.859F+02$ $-2.454E+03$ 42 20.2 $-1.307E-02$ $1.339E-01$ $3.859F+02$ $-2.454E+03$ 43 20.7 $-1.339F-02$ $1.339E-01$ $3.859F+02$ $-2.454E+03$ 44 21.2 $-1.371E-02$ </td <td>26</td> <td>12.3</td> <td>-7.969E-03</td> <td>7.970E-02</td> <td>3+860E+02</td> <td>-2.454E+03</td>	26	12.3	-7.969E-03	7.970E-02	3+860E+02	-2.454E+03
28 13.3 $-8.607E-03$ $8.608E-02$ $3.860E+02$ $-2.454E+03$ 29 13.8 $-8.926E-03$ $8.926E-02$ $3.859F+02$ $-2.454E+03$ 30 14.3 $-9.244F-03$ $9.245E-02$ $3.859F+02$ $-2.454E+03$ 31 14.8 $-9.63E-03$ $9.664E-02$ $3.859F+02$ $-2.454E+03$ 32 15.3 $-9.882E-03$ $9.863E-02$ $3.859F+02$ $-2.454E+03$ 33 15.7 $-1.020E-02$ $1.020F-01$ $3.859F+02$ $-2.454E+03$ 34 16.2 $-1.052E-02$ $1.020F-01$ $3.859F+02$ $-2.454E+03$ 35 16.7 $-1.084E-02$ $1.084F-01$ $3.859F+02$ $-2.454E+03$ 36 17.2 $-1.116F-02$ $1.116F-01$ $3.859F+02$ $-2.454E+03$ 37 17.7 $-1.211E-02$ $1.211E-01$ $3.859E+02$ $-2.454E+03$ 39 18.7 $-1.211E-02$ $1.211E-01$ $3.859E+02$ $-2.454E+03$ 40 19.2 $-1.243E-02$ $1.275E-01$ $3.859E+02$ $-2.454E+03$ 41 19.7 $-1.275E-02$ $1.275E-01$ $3.859E+02$ $-2.454E+03$ 42 20.2 $-1.307E-02$ $1.307E-01$ $3.859E+02$ $-2.454E+03$ 43 20.7 $-1.339E-02$ $1.339E-01$ $3.859E+02$ $-2.454E+03$ 44 21.2 $-1.371E-02$ $1.371E-01$ $3.859E+02$ $-2.454E+03$ 45 21.7 $-1.403E-02$ $1.403E-01$ $3.859E+02$ $-2.454E+03$ 46 22.1 $-1.434E-02$ <td>27</td> <td>12.8</td> <td>-8.288E-03</td> <td>8+289E-02</td> <td>3+860E+02</td> <td>-2.454E+03</td>	27	12.8	-8.288E-03	8+289E-02	3+860E+02	-2.454E+03
29 13.8 $-8.926E-03$ $8.926E-02$ $3.859F+02$ $-2.454E+03$ 30 14.3 $-9.244F-03$ $9.245E-02$ $3.859E+02$ $-2.454E+03$ 31 14.8 $-9.563E-03$ $9.564F-02$ $3.859F+02$ $-2.454E+03$ 32 15.3 $-9.882E-03$ $9.883E-02$ $3.859F+02$ $-2.454E+03$ 33 15.7 $-1.020E-02$ $1.020F-01$ $3.859F+02$ $-2.454E+03$ 34 16.2 $-1.052E-02$ $1.052E-01$ $3.859E+02$ $-2.454E+03$ 35 16.7 $-1.084E-02$ $1.084E-01$ $3.859E+02$ $-2.454E+03$ 36 17.2 $-1.116F-02$ $1.116F-01$ $3.859E+02$ $-2.454E+03$ 37 17.7 $-1.148E-02$ $1.148E-01$ $3.859E+02$ $-2.454E+03$ 38 18.2 $-1.179E-02$ $1.180E-01$ $3.859E+02$ $-2.454E+03$ 39 18.7 $-1.211E-02$ $1.211E-01$ $3.859E+02$ $-2.454E+03$ 41 19.7 $-1.275E-02$ $1.275E-01$ $3.859E+02$ $-2.454E+03$ 42 20.2 $-1.307E-02$ $1.307E-01$ $3.859E+02$ $-2.454E+03$ 43 20.7 $-1.339E-02$ $1.339E-01$ $3.859E+02$ $-2.454E+03$ 44 21.2 $-1.371E-02$ $1.339E-01$ $3.859E+02$ $-2.454E+03$ 45 21.7 $-1.466E-02$ $1.463E-01$ $3.859E+02$ $-2.454E+03$ 46 22.1 $-1.466E-02$ $1.463E-01$ $3.858E+02$ $-2.454E+03$ 47 22.6 $-1.466E-02$ </td <td>28</td> <td>13.3</td> <td>-8.607E-03</td> <td>8•608E-02</td> <td>3•860E+02</td> <td>-2.454E+03</td>	28	13.3	-8.607E-03	8•608E-02	3•860E+02	-2.454E+03
30 14.3 $-9.244E-03$ $9.245E-02$ $3.859E+02$ $-2.454E+03$ 31 14.8 $-9.563E-03$ $9.564E-02$ $3.859E+02$ $-2.454E+03$ 32 15.3 $-9.882E-03$ $9.883E-02$ $3.859E+02$ $-2.454E+03$ 33 15.7 $-1.020E-02$ $1.020E-01$ $3.859E+02$ $-2.454E+03$ 34 16.2 $-1.052E-02$ $1.020E-01$ $3.859E+02$ $-2.454E+03$ 35 16.7 $-1.084E-02$ $1.084E-01$ $3.859E+02$ $-2.454E+03$ 36 17.2 $-1.116E-02$ $1.116E-01$ $3.859E+02$ $-2.454E+03$ 37 17.7 $-1.448E-02$ $1.148E-01$ $3.859E+02$ $-2.454E+03$ 38 18.2 $-1.179E-02$ $1.211E-01$ $3.859E+02$ $-2.454E+03$ 39 18.7 $-1.211E+02$ $1.211E-01$ $3.859E+02$ $-2.454E+03$ 41 19.7 $-1.275E-02$ $1.307E-01$ $3.859E+02$ $-2.454E+03$ 42 20.2 $-1.307E-02$ $1.339E-01$ $3.859E+02$ $-2.454E+03$ 43 20.7 $-1.339E-02$ $1.339E-01$ $3.859E+02$ $-2.454E+03$ 44 21.2 $-1.371E-02$ $1.435E-01$ $3.859E+02$ $-2.454E+03$ 45 21.7 $-1.433E-02$ $1.435E-01$ $3.859E+02$ $-2.454E+03$ 45 21.7 $-1.433E-02$ $1.435E-01$ $3.859E+02$ $-2.454E+03$ 45 21.7 $-1.439E-02$ $1.435E-01$ $3.858E+02$ $-2.454E+03$ 46 </td <td>29</td> <td>13.8</td> <td>-8.9265-03</td> <td>8.•926E-02</td> <td>3•859F+02</td> <td>-2.454E+03</td>	29	13.8	-8.9265-03	8.•926E-02	3•859F+02	-2.454E+03
31 $14 \cdot 8$ $-9 \cdot 563E = 03$ $9 \cdot 564E = 62$ $3 \cdot 859E + 62$ $-2 \cdot 454E + 63$ 32 $15 \cdot 3$ $-9 \cdot 882E = 03$ $9 \cdot 883E = 62$ $3 \cdot 859E + 62$ $-2 \cdot 454E + 63$ 33 $15 \cdot 7$ $-1 \cdot 020E = 62$ $1 \cdot 020E = 61$ $3 \cdot 859E + 62$ $-2 \cdot 454E + 63$ 34 $16 \cdot 2$ $-1 \cdot 052E = 62$ $1 \cdot 052E = 61$ $3 \cdot 859E + 62$ $-2 \cdot 454E + 63$ 35 $16 \cdot 7$ $-1 \cdot 084E = 62$ $1 \cdot 084E = 61$ $3 \cdot 859E + 62$ $-2 \cdot 454E + 63$ 36 $17 \cdot 2$ $-1 \cdot 116E = 62$ $1 \cdot 116E = 61$ $3 \cdot 859E + 62$ $-2 \cdot 454E + 63$ 37 $17 \cdot 7$ $-1 \cdot 148E = 62$ $1 \cdot 148E = 61$ $3 \cdot 859E + 62$ $-2 \cdot 454E + 63$ 38 $18 \cdot 2$ $-1 \cdot 179E = 62$ $1 \cdot 180E = 61$ $3 \cdot 859E + 62$ $-2 \cdot 454E + 63$ 39 $18 \cdot 7$ $-1 \cdot 211E = 62$ $1 \cdot 211E = 61$ $3 \cdot 859E + 62$ $-2 \cdot 454E + 63$ 40 $19 \cdot 2$ $-1 \cdot 243E = 62$ $1 \cdot 243E = 61$ $3 \cdot 859E + 62$ $-2 \cdot 454E + 63$ 41 $19 \cdot 7$ $-1 \cdot 275E = 62$ $1 \cdot 275E = 61$ $3 \cdot 859E + 62$ $-2 \cdot 454E + 63$ 42 $20 \cdot 2$ $-1 \cdot 307E = 62$ $1 \cdot 307E = 61$ $3 \cdot 859E + 62$ $-2 \cdot 454E + 63$ 43 $20 \cdot 7$ $-1 \cdot 339E = 62$ $1 \cdot 339E = 61$ $3 \cdot 859E + 62$ $-2 \cdot 454E + 63$ 44 $21 \cdot 2$ $-1 \cdot 371E = 62$ $1 \cdot 339E = 61$ $3 \cdot 859E + 62$ $-2 \cdot 454E + 63$ 45 $21 \cdot 7$ $-1 \cdot 463E = 62$ $1 \cdot 467E = 61$ $3 \cdot 858E + 62$ $-2 \cdot 45$	30	14.3	-9.244E-03	9.245E-n2	3+859E+02	-2.454L+03
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	31	14.8	-9.563E-03	9+564E=02	3+859E+n2	-2.454L+03
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	32	15•3	-9+882E-03	9+883E-02	3+859E+n2	-2.454L+03
34 16.2 $-1.052E-02$ $1.052E-01$ $3.859E+02$ $-2.454E+03$ 35 16.7 $-1.084E-02$ $1.084E-01$ $3.859E+02$ $-2.454E+03$ 36 17.2 $-1.116E-02$ $1.116E-01$ $3.859E+02$ $-2.454E+03$ 37 17.7 $-1.148E-02$ $1.148E-01$ $3.859E+02$ $-2.454E+03$ 38 18.2 $-1.179E-02$ $1.180E-01$ $3.859E+02$ $-2.454E+03$ 39 18.7 $-1.211E-02$ $1.211E-01$ $3.859E+02$ $-2.454E+03$ 40 19.2 $-1.243E-02$ $1.243E-01$ $3.859E+02$ $-2.454E+03$ 41 19.7 $-1.275E-02$ $1.275E-01$ $3.859E+02$ $-2.454E+03$ 41 19.7 $-1.275E-02$ $1.307E-01$ $3.859E+02$ $-2.454E+03$ 42 20.2 $-1.307E-02$ $1.339E-01$ $3.859E+02$ $-2.454E+03$ 43 20.7 $-1.339E-02$ $1.3371E-01$ $3.859E+02$ $-2.454E+03$ 44 21.2 $-1.403E-02$ $1.403E-01$ $3.859E+02$ $-2.454E+03$ 45 21.7 $-1.403E-02$ $1.435E-01$ $3.859E+02$ $-2.454E+03$ 46 22.1 $-1.466E-02$ $1.467E-01$ $3.858E+02$ $-2.454E+03$ 48 23.1 $-1.466E-02$ $1.498E-01$ $3.858E+02$ $-2.454E+03$ 49 23.6 $-1.530E-02$ $1.530E-01$ $3.858E+02$ $-2.454E+03$ 50 24.1 $-1.562E-02$ $1.562E-01$ $3.858E+02$ $-2.454E+03$	33	15.7	-1.020E-02	1.020E-01	3+859E+n2	-2.454L+03
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	34	16.2	-1.052E-02	1.052E-01	3+8596+02	-2.454L+03
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	35		-1.1165-02	1.0841-01	3+8596+02	-2.4545+03
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	30	1/+2	-1.1495-02	1+1105-01	3+8595+02	-2.4545+03
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	21		-1 1795-02	1.1005-01	3+8375+02	-2.45454503
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	20	10.2	-1.2115-02	1.000-01	3.8375+()2	-2 4545+03
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	37	10.7	-1 2425-02	1.2425.01	3+8575+02	-2.4345403
41 $19 \cdot 1$ $-1 \cdot 27 \cdot 5 = 02$ $1 \cdot 27 \cdot 5 = 01$ $3 \cdot 83 \cdot 59 = 102$ $-2 \cdot 45 \cdot 45 \cdot 103$ 42 $20 \cdot 2$ $-1 \cdot 307 = 02$ $1 \cdot 307 = 01$ $3 \cdot 859 = 102$ $-2 \cdot 454 = 103$ 43 $20 \cdot 7$ $-1 \cdot 339 = 02$ $1 \cdot 339 = 01$ $3 \cdot 859 = 102$ $-2 \cdot 454 = 103$ 44 $21 \cdot 2$ $-1 \cdot 371 = 02$ $1 \cdot 371 = 01$ $3 \cdot 859 = 102$ $-2 \cdot 454 = 103$ 45 $21 \cdot 7$ $-1 \cdot 403 = 02$ $1 \cdot 403 = 01$ $3 \cdot 859 = 102$ $-2 \cdot 454 = 103$ 46 $22 \cdot 1$ $-1 \cdot 434 = 02$ $1 \cdot 403 = 01$ $3 \cdot 858 = 102$ $-2 \cdot 454 = 103$ 47 $22 \cdot 6$ $-1 \cdot 466 = 02$ $1 \cdot 435 = 01$ $3 \cdot 858 = 102$ $-2 \cdot 454 = 103$ 48 $23 \cdot 1$ $-1 \cdot 498 = 02$ $1 \cdot 498 = 01$ $3 \cdot 858 = 102$ $-2 \cdot 454 = 103$ 49 $23 \cdot 6$ $-1 \cdot 530 = 02$ $1 \cdot 530 = 01$ $3 \cdot 858 = 102$ $-2 \cdot 454 = 103$ 50 $24 \cdot 1$ $-1 \cdot 562 = 02$ $1 \cdot 562 = -01$ $3 \cdot 858 = 102$ $-2 \cdot 454 = 103$	4()	19.2	-1.2755-02	1 + 24 3 2 - 01	3+8375+02	-2.404LTU3
42 20.2 $-1.307E-02$ $1.307E-01$ $3.839E+02$ $-2.454E+03$ 43 20.7 $-1.339E-02$ $1.339E-01$ $3.859E+02$ $-2.454E+03$ 44 21.2 $-1.371E-02$ $1.371E-01$ $3.859E+02$ $-2.454E+03$ 45 21.7 $-1.403E-02$ $1.403E-01$ $3.859E+02$ $-2.454E+03$ 46 22.1 $-1.434E-02$ $1.435E-01$ $3.858E+02$ $-2.454E+03$ 47 22.6 $-1.466E-02$ $1.467E-01$ $3.858E+02$ $-2.454E+03$ 48 23.1 $-1.498E-02$ $1.498E-01$ $3.858E+02$ $-2.454E+03$ 49 23.6 $-1.530E-02$ $1.530E-01$ $3.858E+02$ $-2.454E+03$ 50 24.1 $-1.562E-02$ $1.562E-01$ $3.858E+02$ $-2.454E+03$	40	20.2	-1 2075-02	1.2075-01	3 0595402	-2,45454513
432001 -103350 02 103350 10350 1020 10350 1020 10350 1020 10350 1020 10350 1020 10350 1020 10350 1020 10350 1020 10350 1020 10350 1020 10350 1020 10350 1020 10350 1020 10350 1020 10350 1020 10350 10350 1020 10350 10350 1020 10350 10350 1020 103500 103500 103500 103500 103500 103500 103500 103500 103500 103500 103500 103500 103500 103500 103500 103500 103500 10350	42	20.2	-1 3395-02	1.3395-01	3+8375+92	-2 4545+03
45 21.7 $-1.403E-02$ $1.403E-01$ $3.859E+02$ $-2.454E+03$ 46 22.1 $-1.434E-02$ $1.435E-01$ $3.859E+02$ $-2.454E+03$ 47 22.6 $-1.466E-02$ $1.467E-01$ $3.858E+02$ $-2.454E+03$ 48 23.1 $-1.498E-02$ $1.498E-01$ $3.858E+02$ $-2.454E+03$ 49 23.6 $-1.530E-02$ $1.530E-01$ $3.858E+02$ $-2.454E+03$ 50 24.1 $-1.562E-02$ $1.562E-01$ $3.858E+02$ $-2.454E+03$		21 2	-1.3716-02	1.3715-01	3.05954.02	-2.454F+03
46 22.1 -1.434E-02 1.435E-01 3.858E+02 -2.454E+03 47 22.6 -1.466E-02 1.467E-01 3.858E+02 -2.454E+03 48 23.1 -1.498E-02 1.498E-01 3.858E+02 -2.454E+03 49 23.6 -1.530E-02 1.530E-01 3.858E+02 -2.454E+03 50 24.1 -1.562E-02 1.562E-01 3.858E+02 -2.454E+03	44 45	21 T	-1.4035-02	1.4035-01	3.05954402	-2.454F+03
47 22.6 -1.466E-02 1.467E-01 3.858E+02 -2.454E+03 48 23.1 -1.498E-02 1.498E-01 3.858E+02 -2.454E+03 49 23.6 -1.530E-02 1.530E-01 3.858E+02 -2.454E+03 50 24.1 -1.562E-02 1.562E-01 3.858E+02 -2.454E+03	45	22.1	-1.4345-02	1.4355-01	3.858F+02	-2.454L+07
48 23.1 -1.498E-02 1.498E-01 3.858E+02 -2.454E+03 49 23.6 -1.530E-02 1.530E-01 3.858E+02 -2.454E+03 50 24.1 -1.562E-02 1.562E-01 3.858E+02 -2.454E+03	40	22.6	-1.466F-02	1.4676-01	3.858F+h2	-2.454E+03
49 23.6 -1.530E-02 1.530E-01 3.858E+02 -2.454E+03 50 24.1 -1.562E-02 1.562E-01 3.858E+02 -2.454E+03	48	23.1	-1.498F-02	1.498F=01	3+858F+A2	-2.454E+03
50 24.1 -1.562E-02 1.562E-01 3.858E+02 -2.454E+03	49	23.6	-1.530F-02	1.530E-01	3+858E+02	-2.454E+03
	50	24.1	-1.562E-02	1.562E-01	3+858E+n2	-2.454L+03

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E 1	24 4	1 5045-00	1 COLE -1		0 4 C 4 K 4 4 4
21	24.0	-1.594E=02	1.594E=01	3+858E+02	-2.4545703
52	25.1	-1.626E-02	1.626E-01	3+858E+02	-2.455E+03
53	25.6	-1.658E-02	1.658E-01	3+858E+n2	-2.455L+03
54	26.1	-1.690E-02	1.690E-01	3•858E+n2	-2.455E+03
55	26 .6	-1.721E-02	1.722E-01	3+858E+n2	-2.455L+03
56	27.1	-1.753E-02	1.753E-01	3.858E+02	-2.455E+03
57	27.6	-1.785E-02	1.785E-01	3.858E+02	-2.455L+03
58	28.1	-1-817E-02	1-817E-01	3-858E+02	-2.455E+03
59	28.5	-1-8495-02	1.849E=01	3-857E+02	-2.455L+03
60	29.0	-1-881E-02	1.8815-01	3-857E+02	-2.4551+03
61	20 5	-1.913E-02	1.0135-01	3.9575+62	-2 455E+03
62	30 0	-1 9455-42	1 0455-61	3.0575+02	-2 4551+03
43	30.0		10775 41	308376472	2 4554403
03	30.5	-1.970E-02	1.9772-01	3+H3/E+12	-2,4554703
64	31.0	-2.008E-02	2.009E-01	3+857E+02	-2,455E+03
65	31.5	-2.040E-02	2.040E-01	3.85/E+02	-2,455E+03
66	32.0	-2.072E-02	2.072E-01	3+857E+02	-2,455L+03
67	32,5	-2.104E-02	2.104E-01	3+857E+02	-2.4554+03
68	33.0	-2.136E-02	2.136E-01	3.857E+02	-2.455E+03
69	33.5	-2.168E-02	2.168E-01	3.856E+n2	-2.455E+03
70	34.0	-2.200E-02	2.200E-01	3.856E+n2	-2.455L+03
71	34.5	-2.232E-02	2.232E-01	3.856E+02	-2.455E+03
72	34.9	-2.263E-02	2.264E-01	3+856E+02	-2.455L+h3
73	35.4	-2.2955-02	2.295E-01	3.856E+n2	-2,455±+03
74	35.9	-2.327E-02	2.3275-01	3.856E+02	-2.455Ê+03
75	36.4	-2.359E-02	2.3595-01	3.856E+02	-2.455L+03
76	36.9	-2.391E-02	2.3915-01	3.856E+02	-2.455E+03
77	37.4	-2.423F-02	2.423F-01	3.856F+n2	-2.455L+03
78	37.9	-2.455E-02	2.455F-01	3.855F+n2	-2.455E+03
79	38.4	-2.487F-02	2.487F-01	3+855E+02	-2.455E+03
8 n	38.9	-2.518E-02	2-519E-01	3-821E+02	-1.973E+03
81	39.4	-2.551F-02	2.5515-01	3.6395+02	6.247±+02
82	30.0	-2.583E-02	2.5836-01	3-4575+02	3 2228+03
83	40 4	-2.6165-02	2.6165-01	3.2755+02	5 8201+03
84	40.9	-2.649E=02	2.6495-01	3.0945.02	8 4181+03
95	40.9	-2.6825-02	2 6025-01	2.0125+02	1 1021+04
92	41.0	-2 7155-42	2.0025-01	2 7305+02	1 2616404
00	41.0	-2 7495-02	2.7495-41	2 - 7 3 05 + 102	1 4016+04
01	42.3	-2.7075-02	2.7475-01	2.5400.402	
88	42.0	-2.1835-02	2.7846-01	2.3001.402	
89	43.3	-2.8185-02	2.8105-01	2+J84 <u>5</u> +02	
98	43.8	-2.8531-02	2.853E-01	2.0021.+02	2.4000-104
91	44.3	-2.888E-02	2.888E-01	1+82UE+02	2.0005-04
92	44.8	-2.923F-02	2.923E=01	1+6385+02	2.9205+04
93	45.3	-2.959E-02	2.959E-01	1.4501+02	3.1805+04
94	45.8	-2.9951-02	2.9955-01	1+2/45+02	3.4395+14
95	46.3	-3.0315-02	3.031E-01	1+0726+02	3.0995+04
76	40.8	-3.10/E-02	3.0685-01	9+078E+01	5,9395+04
91	41.2	-3.141E -02	5+104E-01	1.2/0E+01	
98	4/./	-J.1411-02	3.141E-01	5+430L+01	4.4/857()4
39	48.4	-3-1/95-02	3-1/96-01	3+6386+01	4.1585704
100	48.1	= 3.2101=02	3.23/F-01	1.4101+01	4,9985704
101	49.2	-3.2546-02	3.2558-01	-1.8205-02	5.2586+04

CRCP-2 TESTING EXAMPLE PROBLEM FOR CRCP-2 TESTING

ROND LENGTH > 1/2 XBAR, WITH HIGH F-M CURVE ****** * * STEEL PROPERTIES 4 * * ø ***** ** TYPE OF LONGITUDINAL REINFORCEMENT IS DEFORMED BARS PERCENT REINFORCEMENT = 1.200E+00 BAR DIAMETER = 1+000E+00 YIELD STRESS = 6+000E+04 ELASTIC MODULUS = 2+900E+07 THERMAL COEFFICIENT = 5.000E-06 ***** ÷ ð 4 CONCRETE PROPERTIES ø 4 8 ** SLAB THICKNESS = 1.000F+01 THERMAL COEFFICIENT = 5.000F-06 TOTAL SHPINKAGE = 4.000E-04 UNIT WFIGHT CONCRETE= 1.500F+02 COMPRESSIVE STRENGTH= 2.500F+03 TENSILE STRENGTH DATA *** NO TENSILE STRENGTH DATA IS INPUT BY USEP THE FOLLOWING AGE-TENSILE STRENGTH RELATIONSHIP IS USED WHICH IS BASED ON THE RECOMMENDATION GIVEN BY U.S. BUREAU OF RECLAMATION AGE, TENSILE (DAYS) STRENGTH 0.0 0.0 85.7 1.0 191.9 3.0 5.0 248.8 7.0 282.5 338.8 14.0 21.0 370.1 384.6 28.0

PROB A-2 TYPE OF FRICTION CURVE IS A PARABOLA

MAXIMUM	FRIC	TION	FORCE	=	7.5000
MOVEMENT	AT	SLIDI	[NG	=	2000

*****	***	***
#		
4	TEMPERATURE DATA	*
4		4
*****	****	***

CURING TEMPERATURE= 75.0

	•	MINIMUM	DROP IN	
DV,	Y TE	MPERATURE 1	EMPERATUR	Ε
1	l	72.0	3.0	
2	2	69.0	6.0	
:	3	53.0	22.0	
4	4	53.0	22.0	
ç	5	60.0	15.0	
. (5	65.0	10.0	
-	7	54.0	21.0	
	3	15.0	60.0	
ç	9	59.0	16.0	
1(D	20.0	55.0	
11	1	50.0	25.0	
12	2	50.0	25.0	
13	3	15.0	60.0	
14	4	54.0	21.0	
15	5	30.0	45.0	
-16	5	59.0	16.0	
17	7	15.0	60.0	
18	R .	54.0	21.0	
- 19	9	53.0	55+0	
50)	54.0	21+0	
S1	1	69.0	6.0	
22	2	22.0	53.0	
23	3	56.0	19+0	
24	•	30.0	45.0	
55	5	32.0	43.0	
56	5	43•0	32.0	
21	7	56.0	19.0	
- Ž8	3	57.0	18.0	
	MINIMUM	TEMPERATURE	EXPECTED	AFTER

MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH = 0.0 DEGREES FAHHENHEIT DAYS BEFORE REACHING MIN. TEMP. = 28.0 DAYS

***	****	***	****	***	****
*					4
4	ITERATION	AND	TOLERANCE	CONTROL	4
*					4
****	****	***	********	****	***

MAXIMUM ALLOWABLE NUMBER OF ITERATIONS= 30 RFLATIVE CLOSURE TOLERANCE= 1.00 PERCENT

CRCP-2 TESTING EXAMPLE PROBLEM FOR CRCP-2 TESTING

PR08 A-2

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ROND LENGTH > 1/2 XBAR. WITH HIGH F-M CURVE

						MAX	LMUM
TIME	TEMP	DRYING	TENSILE	CRACK	CRACK	CONCRETE	STRESS IN
(DAYS)	DROP	SHRINKAGE	STRGTH	SPACING	WIDTH	STRESS	THE STEEL
		-					
•50	3.0	1.814E-06	44.R	4800.0	3.776E-n4	1.417E+01	1.4175+03
ī•33	3.0	4.802E-06	105+3	4800•0	5.321E-04	2.634E+01	2.3682+03
ī•50	6.0	5.394F-06	114•8	4800.0	1.25"E=03	5.013E+01	4.480E+03
2.29	6.0	8.190F-06	157•4	4800.0	1.474E-03	6.345E+01	5.600E+03
2.38	16.0	8-490F-06	161.7	4800.0	5-621E-03	1.500F+02	1.297E+04
2.40	17.5	8.548F-06	162.6	2400-0	5.585ET03	1.625E+02	1-416F+04
2.40	17.5	8.549F=06	162.6	1200.0	5.741E-03	1.617E+02	1.415F+04
2.40	17.7	8.5575-06	162.7	600-0	5.657ET03	1.557E+02	1-4175+04
2.41	18.7	8-604F-06	163.4	300-0	5.581E=03	1-498E+02	1.4135+04
2.46	21.1	8.7535-06	165.5	150.0	5-4315-03	1.454E+02	1.4005+04
2.50	22.0	8-9105-06	167.8	150-0	5.7915-03	1.5085+02	1-450E+04
3.50	22.0	1.2365-05	206.9	150-0	6.379F=03	1.704E+02	1.600F+04
4.50	15.0	1.5765-05	235.4	150-0	4-141E-03	1.4386+02	1.319E+04
5.50	10.0	1.9096-05	257.5	150.0	2.7495-03	1.212E+02	1.086E+04
4.33	10.0	2.1915-05	271.6	150-0	2.980F=03	1.287E+02	1.143E+04
6.45	20.0	2.221F=05	273.6	150-0	6-844E=03	1.9566+02	1.7695+04
6.50	21.0	2.2375-05	274.4	150-0	7.2875-03	2-021F+02	1-829E+04
7.31	21.0	2.4975-05	285.2	150-0	7.587E-03	2.094F+02	1.882E+04
7.34	31.0	2.5078-05	285.4	150.0	1.222E-02	2.658E+02	2.410F+04
7.35	35.1	2.5116-05	285.5	75.0	9-168E=03	2-280E+02	2.077F+04
7.39	45.1	2.5225-05	285.9	75.0	1.2225-02	2.634E+02	2.411F+04
7.42	52.7	2.533F=05	286+2	37.5	R-518F-03	2.188E+02	2.000E+04
7.50	60.0	2.5595-05	286.9	37.5	9.82 F-n3	2.352E+02	2.154E+04
8.50	16.0	2.876F=05	295+4	37.5	2.562F=03	1.215E+02	1.065E+04
0.30	16.0	3-1245-05	302.0	37.5	2.645E=03	1.245E+02	1.084F+04
9.33	26.0	3.134F=05	302.3	37.5	4.227F-03	1.575E+02	1.395F+04
9.36	36.0	3+145F-05	302+6	37.5	5.887E-03	1+859E+02	1.663E+04
9.41	46.0	3+158F=05	302.9	37.5	7.600E=03	2.114E+02	1.902E+04
9.50	55+0	3+187F=05	303+7	37.5	9.18°E-03	2.326E+02	2.101E+04
1:.50	25+0	3.493F-05	311+8	37.5	4.193E=03	1.588E+02	1.393E+04
11.50	25+0	3.794E-05	319+8	37.5	4.300E-03	1.625E+02	1.416E+04
12.32	25.0	4.037E-05	326•1	37.5	4.386E-03	1.655E+02	1.4345+04
ĩ2•35	35+0	4.0468-05	326•4	37.5	6.052E-03	1.944E+02	1.705E+04
12.38	45.0	4.057E-05	326+6	37.5	7.767E-03	2.203E+02	1.9475+04
12.43	55+0	4.071E-05	327.0	37•5	9.519E-03	2.440E+02	2.169E+04
12.50	60.0	4.090E-05	327+5	37•5	1.041E-02	2.554E+02	2•274E+04
13.50	21.0	4.382E-05	335+1	37•5	3.861E-03	1.570E+02	1•341E+04
14.33	21•0	4•619E=05	340•4	37.5	3.942E-03	1+597E+02	1.3576+04
14.37	31.0	4.632E-05	34()•6	37.5	5.593E=03	1+902E+02	1.6425+04
14+43	41•0	4+649E-05	340•9	37.5	7.298E-03	2.174E+02	1.895E+04
ĩ4•50	45.0	4.668F-05	341•2	37.5	7.996E-03	2.276E+02	1.990E+04
15+50	16.0	4.951E-05	345+8	37.5	3.257E-03	1•461E+02]•219E+04
16.29	16.0	5.171E-05	349•4	37.5	3.330E-03	1.484E+02	1.233E+04
16.32	26.0	5.179E-05	349.5	37.5	4.9538-03	1.810E+02	1.536E+04
16.35	36.0	5.188E-05	349 • 7	37.5	6.637E-03	2.096E+02	1.802F+04
16.39	46.0	5.198E-05	349 • 8	37•5	R.364F-03	2+353E+02	2.0425+04
16.44	56+0	5+2128-05	350+1	37.5	1.0125-02	2.590E+02	2.2625+04
16+50	60.0	5+2286-05	350+3	37•5	1.084E-02	2.681E+02	2.346E+04
17.50	21.0	5.501F=65	354• <i>B</i>	37.5	4.244E-03	1.686E+02	1•410E+04

18.45	21.0	5.758F-05	359•1	37.5	4.332E-n3	1.712E+02	1.425E+04
18.50	22.0	5.771E-05	359.3	37.5	4.50CE-03	1.746E+02	1.456E+04
19.50	21.0	6.035F-05	363.6	37.5	4.428E-03	1.741E+02	1.442E+04
21.50	6.0	6.296E-05	367.9	37.5	2.154E-n3	1.220F+02	9.497E+03
21.27	6.0	6.494F-05	370.6	37.5	2.216E-03	1.241E+02	9.630E+03
21.30	16.0	6.502E-05	370.7	37.5	3.776E-ñ3	1.621E+02	1.315E+04
2ī•33	56.0	6.510E-05	370.8	37.5	5.42 ⁻ E-03	1.942E+02	1.612E+04
21.37	36.0	6.520E-05	370.9	37.5	7.117E-03	2.226E+02	1.875E+04
21.42	46.0	6.532E-05	371.0	37.5	8.854E-03	2.483E+02	2.113E+04
21.50	53.0	6.553E-05	371+1	37.5	1.009E-02	2.651E+02	2.269E+04
22.50	19.0	6.806E-05	373•3	37.5	4.363E-03	1.748E+02	1.422E+04
23.32	19.0	7.010E-05	375+0	37.5	4.432E-03	1.765E+02	1.432E+04
23.36	29.0	7.021E-05	375.1	37.5	6.101E-03	2.071E+02	1.715E+04
23+42	39.0	7.034E-05	375.2	37.5	7.817E-03	2.344E+02	1.968E+04
23.50	45.0	7.055E-05	375+3	37.5	8.867E-03	2.498E+02	2.109E+04
24.50	43.0	7.300E-05	377.4	37.5	8.606E-03	2.467E+02	2.072E+04
25.50	32.0	7.542E-05	379.5	37.5	6.793E-03	2.197E+02	1.814E+04
26.50	19.0	7.780E-05	381.6	37.5	4.692E-03	1.830E+02	1.467E+04
27.50	18.0	8.015E-05	383•6	37.5	4.607E-03	1.818E+02	1.448E+04

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CRACK SPACING =	2.783E+00	FFFT
CRACK WIDTH =	2.378E-02	INCHES
MAX CONCRETE STRESS=	3+827E+02	PST
MAX STEEL STRESS =	2.674E+04	PSI,
CONC.TENS.STRENGTH =	3.846E+02	PST

STA- TION	DIS- TANCE	CONCRETE	FRICTION FORCE	CONCRETE STRESS	STELL STRESS
1	0.0	0.	0•	3.827E+n2	-4.989E+n3
2	•2	-1.084E-04	1.747E-01	3.789E+02	-4.672L+03
3	•3	-2.171E-04	2.471E-01	3•751E+ñ2	-4.355t+03
4	•5	-3.259E-04	3.028E-01	3.713E+02	-4.037E+03
5	•7	-4.350E-04	3.498E-01	3+674E+02	-3.7204+03
6	•8	-5.443E-04	3.913E-01	3+636E+n2	-3.403E+03
7	1.0	-6.538E-04	4•289E-01	3+598E+02	-3.086±+03
8	1.2	-7.635E-04	4•635E-01	3+559E+82	-2.768E+n3
9	1.3	-8.734E-04	4.957E-01	3+521E+n2	-2.451E+03
1 e	1.5	-9.835E-04	5.260E-01	3•483E+ñ2	-2.134L+03
11	1.7	-1.094E-03	5•547E-01	3•445E+02	-1.816±+13
12	1.8	-1.204E-03	5+821E-01	3•406E+02	-1.499E+03
13	2.0	-1.315E-03	6•083E-01	3•368E+n2	-1.182L+03
14	2.2	-1.426E-03	6+334E-01	3•330E+n2	-8.646E+02
15	2.3	-1.537E-03	6•576E-01	3+292E+n2	-5.473E+02
16	2.5	-1•649E-03	6+810E-01	3+253E+02	-2.300L+02
17	2.7	-1•760Ē-03	7•037E-01	3•212E+02	8.7304+01
18	2.8	-1.872E-03	7.257E-01	3+177E+02	4.046E+02
19	3.0	-1.984E-03	7•471E-01	3•138E+02	7.219±+02
20	3.2	-2.096 <u>E</u> -03	7•679 <u>E</u> -01	3•100E+02	1.0392+03
51	3•3	-2.209E-03	7.883E-01	3.062E+02	1.356E+03
22	3.5	-2.321E-03	8•081E-01	3+024E+02	1.674±+03
23	3•7	-2.434E-03	8.275E-01	2•985E+12	1.991E+03
24	3.8	-2•547E-03	8.4655-01	2•947E+02	2.308L+03
25	4.0	-2.661E-03	8.652E-01	2•909E+n2	2.626L+03
26	4.2	-2.774E-03	8-834E-01	2.871E+02	2.943E+03
27	4.3	-2.888E-03	9.013E-01	2. R32E+ 02	3.2601+03
28	4.5	-3.002E-03	9+189E-01	2.794E+02	3.5772+03
29	4.7	-3.116E-03	9•362E-01	2+756E+02	3.8955-03
34	4.8	-3.230E-03	9.533E-01	2.717E+02	4.2125-03
31	5.0	-3.345E-03	9.700E-01	2+6/95+02	4.5295103
32	5.4	-3.400t-03	9.8675-01	2+6415+02	- ++04/L'()3 E 1/46+00
33	5+3	-3.5/5E-03	1.0036+00	2.6035.702	D+1044-03
34	5.5		1.0175700	2+5046+02	5 790F+03
35		-3.00000-03		2+5205-02	6.116F+03
30	5.0	-4.037F=03	1.0665+00	2+4502+02	6.4335+03
38	6.2	-4.1536-03	1.0815+00	2+430E+02	6.750E+03
30	6.3	-4.269E-03	1.0965+00	2.3735+02	7.0685+03
40	6.5	-4.385E-03	1.11]E+00	2.335E+02	7.385E+03
41	6.7	-4.502F-03	1+125E+00	2+296E+02	7.7024+03
42	6.8	-4.619F-03	1.140F+00	2+258E+02	8.019E+03
43	7.0	-4.736F-03	1+154E+00	2+220E+02	8.337L+03
44	7.2	-4.853F-03	1+168E+00	2.182E+02	8.654E+03
45	7.3	-4.971E-03	1.182E+00	2.143E+02	8.971E+03
46	7.5	-5.089E-03	1.196E+00	2 • 1 05E + 02	9.289E+03
47	7.7	-5.206E-03	J.210E+00	2.067E+02	9.606L+03
48	7 . 8	-5.325E-03	1.224E+00	2+029E+02	9.923E+03
49	8.0	-5.443E-03	1.237E+00	1•990E+02	1.024Ê+04
50	8.2	-5.561E-03	1.251E+00	1+952E+n2	1.056E+04

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51	8,3	-5.680E-03	1.264E+00	1.914E+n2	1.088E+04
52	8.5	-5.799E-03	1.277E+00	1.875E+02	1.119E+04
53	8.7	-5.918E-03	1.290E+00	1+837E+02	1,151E+04
54	8.9	-6.038E-03	1.303E+00	1.799E+02	1,183E+04
55	9.0	-6.157E-03	1.316E+00	1.761E+02	1.214E+n4
56	9.2	-6.277E-03	1.329E+00	1+722E+02	1.246E+04
57	9.4	-6.397E-03	1.341E+00	1.684E+02	1.278++04
58	9.5	-6.518E-03	1.354E+00	1.646E+02	1.310E+04
59	9.7	-6.638F-03	1.3665+00	1-608E+02	1.3416+04
60	0.0	-6.759F-03	1.3795+00	1.6605+62	1 3726+04
61	10.0	-6.880F-03	1.3015+00	1+9072+02	1 4055+04
62	10.2	-7-0015-03	1.4035+00	1.4935462	1 4036104
63	10.4	-7.1225-02	1.4155400	1+4/32+02	1 4495404
6A		-7 2425-03	1.4975.00	1+4040+02	1.400-104
65	10.7	-7.2655-03	1+42/2400	1+4100+02	
66	10.0	-7.4875-03	1.4576+00	1.3/05+02	1.5325-04
67	11 0	-7.6095-02	1.44716700	1+3+VE+92	1.5055404
69	11.0	-7 7225-62	1+4032+00	1.3015-02	1.5755404
60	11.62	-7 9545-03	1.4945.40	1.2036+02	1.02/5+04
78	11.º*	-7.0775-03	1+400E+00	1.265402	
7)	11.5	-1.71/2-03	1.4402+00	1+1002+02	1.0900-04
71	11.1	-0.1VUE-03	1.509E+00	1+140E+02	1.7220+04
72	11.9	-0.2231-03	1+521E+00	1+110E+02	1,7545+04
4.5	12.0	=0+34/E=03	1+534E+00	1+0/2E+02	1.7865-04
74	12.2	-8.470E-03	1+544E+00	1.033E+n2	1.817E+04
75	12.4	-8.5946-03	1+555E+00	9+951E+01	1.849E+64
16	12.5	-8.718E-03	1+566E+00	9+569E+01	1,881E+04
17	12.7	-8.842E-03	1.577E+00	9+186E+n1	1.912E+04
78	12.9	-8.967E-03	1.588E+00	8+803E+01	1.944E+04
79	13.0	-9.091E-03	1.+599E+00	8+420E+01	1,976±+04
80	13.2	-9.216E=03	1+610E+00	8+038E+01	2.008±+04
81	13.4	-9.341E-03	1.621E+00	7+655E+01	2.039E+04
82	13.5	-9.467E-03	1.632E+00	7+272E+01	2.0716+04
83	13.7	-9.592E-03	1.643E+00	6+889E+01	2.103E+04
84	13.9	-9.718E-03	1+653E+00	6•507E+01	2.1355+04
85	14.0	-9.844E-03	1.664E+00	6+124E+01	2.166±+04
86	14.2	-9.970E-03	1+675E+00	5•741E+01	2.198L+04
87	14.4	-1.010E-02	1-685E+00	5+358E+n1	2.230E+04
88	14.5	-1.022E-02	1.696E+00	4•976E+n1	2.261E+04
89	14.7	-1.035E-02	1.706E+00	4+593E+01	2.293L+04
90	14.9	-1.048E-02	1+717E+00	4+210E+01	2.325E+04
91	15.0	-1.060E-02	1+727E+00	3+827E+01	2.357E+04
92	15.2	-1.073E-02	1.737E+00	3.445E+01	2.388L+14
93	15.4	-1.086E-02	1.748E+00	3.062E+01	2.420L+04
94	15.5	-1.099E-02	1.758E+00	2+679E+01	2.452E+04
95	15.7	-1.111E-02	1.768E+00	2+296E+01	2.484t+04
96	15.9	-1.124E-02	1.778E+00	1.914E+01	2.5156+04
97	16.0	-1.137E-02	1.788E+00	1•531E+01	2.547E+04
98	16.2	-1.150E-02	1.799E+00	1.148E+01	2.579E+04
99	16.4	-1.163E-02	1.809E+00	7+655E+00	2.610E+04
100	16.5	-1.176E-02	1.8192+00	3.827E+00	2.642E+04
101	16.7	-1.189E-02	1+829E+00	0•	2.674E+04
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CRCP-2 TESTING EXAMPLE PROBLEM FOR CRCP-2 TESTING

PRUB

B-1

NO INCREASE IN TENSILE STRENGTH AFTER 28 TH DAY *** 4 4 # STEEL PROPERTIES 8 44 *** TYPE OF LONGITUDINAL REINFORCEMENT IS DEFORMED BARS PERCENT REINFORCEMENT = 1.200E+00 BAR DIAMETER = 1.000E+00YIELD STRESS = 6.000E+04ELASTIC MODULUS = 2.900E+07THERMAL COEFFICIENT = 5.000E-06 *** * -**#** CONCRETE PROPERTJES # ø 8 SLAB THICKNESS = 1.000E+01 THERMAL COEFFICIENT = 5.000E-06 TOTAL SHRINKAGE = 4.000E-04UNIT WEIGHT CONCRETE= 1.500E+02 COMPRESSIVE STRENGTH= 3.500E+03 TENSILE STRENGTH DATA ****** NO TENSILE STRENGTH DATA IS INPUT BY USER THE FOLLOWING AGE-TENSILE STRENGTH RELATIONSHIP IS USED WHICH IS HASED ON THE RECOMMENDATION GIVEN BY U.S. BUREAU OF RECLAMATION AGE, TENSILE (DAYS) STRENGTH 0.0 0.0 116.0 1.0 3.0 249.5 5.0 316.8 7.0 355.4 14.0 417.8 21.0 451.3

28.0

466.7

종 성 쮸 SLAB-BASE FRICTION CHARACTERISTICS 4 F-Y RELATIONSHIP 4 *** *** TYPE OF FRICTION CURVE IS A STRAIGHT LINE MAXIMUM FRICTION FORCES 3.0000 MOVEMENT AT SLIDING = -.1000 *** 4 **#** TEMPERATURE DATA * # *** *** CURING TEMPERATURE= 75.0 DROP IN MINIMUM DAY TEMPERATURE TEMPERATURE 1 72.0 3.0 2 69.0 6.0 3 53.0 22.0 51.0 4 24.0 5 60.0 15.0 65.0 6 10.0 54.0 7 21.0 15.0 8 60.0 9 59.0 16.0 10 20.0 55.0 25.0 11 50.0 12 50.0 25.0 13 15.0 60.0 54.0 21.0 14 30.0 15 45.0 59.0 16 16.0 15.0 17 60.0 54.0 18 21.0 19 53.0 22.0 54.0 21.0 20 69.0 21 6.0 22.0 53.0 22 56.0 19.0 23 30.0 45.0 24 32.0 25 43.0 43.0 26 32.0 56.0 19.0 27 57.0 28 18.0

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46

-8

MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH = 0.0 DEGREES FAHRENHEIT DAYS BEFORE REACHING MIN. TEMP. = 28.0 DAYS

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*	*
* EXTERNAL	LOAD *
*	*
***	*****

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WHEEL LOAD STRESS (PSI) = 0. LOAD APPLIED AT = 28 TH DAY

****	***	***
#		4
#	ITERATION AND TOLERANCE CONTROL	*
*		#
****	***	***

MAXIMUM ALLOWABLE NUMBER OF ITERATIONS= 30 RELATIVE CLOSURE TOLERANCE= 1.0 PERCENT

CRCP-2 TESTING EXAMPLE PROBLEM FOR CRCP-2 TESTING

PRUB B-1

NO INCREASE IN TENSILE STRENGTH AFTER 28 TH DAY

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						MAXI	MUM
TIME	TEMP	DRYING	TENSILE	CRACK	CRACK	CONCRETE	STRESS IN
(DAYS)	DROP	SHRINKAGE	STRGTH	SPACING	WIDTH	STRESS	THE STEEL
.50	3.0	1.814E-06	61.6	4800.0	3.764F-04	1.651E+01	1-802E+03
1.33	3.0	4-802F-06	141.5	4800.0	5.5045-04	3.0005.01	2 9805-03
1.50	6.0	5.3945-06	153.7	4800.0	3405-03	5.7745+01	5 6005+03
2.20	6 0	8 1905-06	207 3	4900.00	1.5405-03	24/74ETV1	
2 39	14 0	8 490E-00	217.6	4000.0	1.0042-03	7.4728401	0.9902+03
	10.0	0.4702-00	212.0	4800+0	7+031E-03	1+/55E+U2	1.0382+04
2 44	20.0	0.007E-00	215.8	2400.0	9.480E-03	2.130E+02	2+003E+04
6.44	20.3	8.680E-00	216.2	1200+0	9.492E-03	2.091E+02	1.988E+04
2.40	21.2	8.759E-00	217.4	600.0	9.258E-03	2.058E+02	1.970E+04
2.50	22.0	8,910E-06	220.1	600+0	9.911E-03	2.140E+02	2.046E+U4
3,43	22.0	1.214E-05	265.3	600.0	1.124E-02	2.445E+02	2.2926+04
3,50	24.0	1.236E-05	267.6	600.0	1.296E-02	2.639E+02	2.472E+04
4.50	15.0	1.576E-05	301.2	600.0	7.038E-03	2.029E+02	1.868E+04
5,50	10.0	1,909E-05	326.9	600.0	4.474E-03	1.672E+02	1.512E+04
6.33	10.0	2.181E-05	342.9	600+0	4.917E-03	1.790E+02	1.608E+04
6.4 5	20.0	2.221E-05	345.2	600.0	1.268E-02	2.887E+02	2.621E+04
6.50	21.0	2.237E-05	346.1	600.0	1.362F-02	2.998F+02	2.722E+04
7.31	21.0	2.497E-05	358.4	600.0	1.433E=02	3.122E+02	2-821F+04
7.32	25.7	2.502F-05	358.5	300.0	1.4755-02	3,1555+02	2.8635+04
7.34	31.5	2.507E-05	358.7	150.0	1.325E=02	2.9845+02	2.711E+04
7.37	41.5	2.5185-05	359.0	150.0	1.8505=02	3.5295+02	3.2175+04
7.38	43.0	2.5205-05	369.1	75.0	1.1905=02	2.8265+02	2.5655104
7.42	53.0	2.5345-05	359.5	75.0	1.5085=02	3.1045402	2.9095+84
7.50	60.0	2 5595-05	360 3	75.0	1 7395-02	3+10+6+02	3 1195-04
8 50	16 0	2 9765-05	340 8	75.0	4 2445-02	3.7005+02	1 5005.04
9 20	10.0	3 1245-05	377 3	75.0	4 2045-03	1 7545402	1.5415.04
7.37	10+U	3-1272-05	377 5	75.0	7 2005-02	2 2495+02	1.0005.04
7.33	20.0	3+1346-05	37783	75+1	1.0010-00	2+240E+V2	2 2075,04
7.30	30.0	3.1400-05	371.7	75+0	1.0216-02	2.0112+02	2.37/2+04
9.41	40.0	3.1302-03	378.3	/5+0	1.333E=V2	3.001E+02	2.1032+04
7.50	35.0	3.10/2-05	3/9.1	/5+0	1.0246-02	3.3822+02	3.0302+04
10.50	25.0	3.4932-03	388.1	/5+0	7.158E-03	2.268E+02	2.003E+04
11,50	25.0	3.794E-05	396.9	75+0	7.361E=03	2.323E+02	2.041E+04
12.32	25.0	4.037E-05	403.9	75.0	7.524E-03	2.368E+02	2.072E+04
12,35	35.0	4.040E-05	404.2	75+0	1.055E-02	2.805E+02	2.475E+04
12,38	45.0	4.057E-05	404,5	75.0	1.369E-02	3.197E+02	2.837E+04
12.43	55.0	4.071E-05	404.9	75.0	1.692E-02	3.557E+02	3.168E+04
12.50	60.0	4.090E-05	405.4	75+0	1.8586-02	3.729E+02	3.326E+04
13.50	21.0	4.382E-05	413.7	75.0	6.588E-03	2.240E+02	1.940E+04
14.33	21.0	4.619E-05	419.4	75.0	6.741E-03	2.281E+02	1.968E+04
14.37	31.0	4.632E-05	419.6	75.0	9.732E-03	2.742E+02	2.392E+04
14.43	41.0	4.649E-05	419.9	75.0	1.286E-02	3.153E+02	2.770E+04
14.50	45.0	4.668E-05	420.3	75.0	1.414E-02	3.308E+02	2.912E+04
15.50	16.0	4.951E-05	425.3	75.0	5.518E-03	2+077E+02	1.769E+04
16.29	16.0	5.171E-05	429.2	75.0	5.652E-03	2.111E+02	1.793E+04
16.32	26.0	5.179E-05	429.3	75.0	8.580E-03	2.602E+02	2.243E+04
16.35	36.0	5.188E-05	429.5	75.0	1.166E-02	3+034E+02	2.640E+04
16.39	46-0	5.198F-05	429.7	75.0	1.484E-02	3.424E+02	2.998E+04
16.44	56.0	5.212F+05	429.9	75.0	1.810E-02	3.784E+02	3.328E+04
16.50	60.0	5.2285-05	430.2	75-0	1.9435+02	3.9225+02	3.454F+04
17.50	21 0	5.5015-05	435 0	75.0	7.3025-02	2.4165+02	2.060F+04
T1+20	CI+U	1*20TE-01	, - 3 - , e V	1000	· • JUEL	F TAC . AF	

21.0	5.758E-05	439.5	75.0	7.466F-03	2.455E+02	2.087E+04
55.0	5.771E-05	439.8	75.0	7.770E-03	2.505E+02	2.133E+04
21.0	6.035E-05	444.4	75.0	7.645E-03	2.498E+02	2.116E+04
6.0	6.296E-05	449.0	75.0	3.579E-03	1.717E+02	1.392E+04
6.0	6.494E-05	451.9	75.0	3.689E-03	1.749E+02	1.414E+04
16.0	6.502E-05	452.0	75.0	6.474E-03	2.318E+02	1.934E+04
26.0	6.510E-05	452.1	75.0	9.459E-03	2.802E+02	2.378E+04
36.0	6.520E-05	452.1	75.0	1.258E-02	3.232E+02	2.770E+04
46.0	6.532E-05	452.2	75.0	1.579E-02	3.622E+02	3.127E+04
53.0	6.553E-05	452.4	75.0	1.809E-02	3.878E+02	3.360E+04
19.0	6.806E-05	454.7	75.0	7.538E-03	2.509E+02	2.099E+04
19.0	7.010E-05	456.5	75.0	7.665E-03	2.535E+02	2.116E+04
29.0	7.021E-05	456.6	75.0	1.071E-02	2+997E+02	2.539E+04
39.0	7.034E-05	456.7	75.0	1.387E-02	3.412E+02	2.918E+04
45.0	7.055E-05	456.9	75.0	1.582E-02	3.644E+02	3.129E+04
43.0	7.300E-05	459.1	75.0	1.534E-02	3.597E+02	3.078E+04
32.0	7.542E-05	461.3	75.0	1.1996-02	3.188E+02	2.696E+04
19.0	7.780E-05	463.4	75.0	8.145E-03	2.633E+02	2.181E+04
18.0	8.015E-05	465.6	75.0	7.993E-03	2.614E+02	2.156E+04
	$\begin{array}{c} 21.0\\ 22.0\\ 21.0\\ 6.0\\ 16.0\\ 26.0\\ 36.0\\ 45.0\\ 19.0\\ 19.0\\ 39.0\\ 45.0\\ 43.0\\ 32.0\\ 19.0\\ 19.0\\ 18.0 \end{array}$	21.0 5.758E-05 22.0 5.771E-05 21.0 6.035E-05 6.0 6.296E-05 6.0 6.494E-05 16.0 6.502E-05 26.0 6.510E-05 36.0 6.520E-05 36.0 6.532E-05 39.0 7.010E-05 29.0 7.021E-03 39.0 7.034E-05 45.0 7.542E-05 19.0 7.780E-05 19.0 7.055E-05	21.0 $5.758E-05$ 439.5 22.0 $5.771E-05$ 439.8 21.0 $6.035E-05$ 444.4 6.0 $6.296E-05$ 449.0 6.0 $6.494E-05$ 451.9 16.0 $6.502E-05$ 452.0 26.0 $6.510E-05$ 452.1 36.0 $6.520E-05$ 452.1 36.0 $6.532E-05$ 452.2 53.0 $6.553E-05$ 452.4 19.0 $7.010E-05$ 456.5 29.0 $7.021E-03$ 456.6 39.0 $7.034E-05$ 456.9 43.0 $7.300E-05$ 459.1 32.0 $7.542E-05$ 461.3 19.0 $7.780E-05$ 463.4 18.0 $8.015E-05$ 465.6	21.0 $5.758E-05$ 439.5 75.0 22.0 $5.771E-05$ 439.8 75.0 21.0 $6.035E-05$ 444.4 75.0 6.0 $6.296E-05$ 449.0 75.0 6.0 $6.296E-05$ 449.0 75.0 6.0 $6.494E-05$ 451.9 75.0 16.0 $6.502E-05$ 452.0 75.0 26.0 $6.510E-05$ 452.1 75.0 36.0 $6.520E-05$ 452.2 75.0 36.0 $6.532E-05$ 452.2 75.0 53.0 $6.553E-05$ 452.4 75.0 19.0 $7.010E-05$ 456.5 75.0 29.0 $7.021E-03$ 456.6 75.0 39.0 $7.034E-05$ 456.7 75.0 43.0 $7.300E-05$ 456.9 75.0 43.0 $7.300E-05$ 456.7 75.0 32.0 $7.542E-05$ 461.3 75.0 19.0 $7.780E-05$ 463.4 75.0 18.0 $8.015E-05$ 465.6 75.0	21.0 $5.758E-05$ 439.5 75.0 $7.466E-03$ 22.0 $5.771E-05$ 439.8 75.0 $7.770E-03$ 21.0 $6.035E-05$ 444.4 75.0 $7.645E-03$ 6.0 $6.296E-05$ 449.0 75.0 $3.579E-03$ 6.0 $6.296E-05$ 449.0 75.0 $3.689E-03$ 16.0 $6.502E-05$ 451.9 75.0 $3.689E-03$ 16.0 $6.502E-05$ 452.1 75.0 $9.459E-03$ 36.0 $6.520E-05$ 452.1 75.0 $1.258E-02$ 46.0 $6.532E-05$ 452.2 75.0 $1.579E-02$ 53.0 $6.553E-05$ 452.4 75.0 $1.809E-02$ 19.0 $6.806E-05$ 454.7 75.0 $1.809E-02$ 19.0 $7.010E-05$ 456.5 75.0 $1.665E-03$ 29.0 $7.021E-03$ 456.6 75.0 $1.071E-02$ 39.0 $7.034E-05$ 456.7 75.0 $1.582E-02$ 43.0 $7.300E-05$ 456.7 75.0 $1.582E-02$ 43.0 $7.300E-05$ 456.7 75.0 $1.534E-02$ 32.0 $7.542E-05$ 461.3 75.0 $1.199E-02$ 19.0 $7.780E-05$ 463.4 75.0 $8.145E-03$ 18.0 $8.015E-05$ 465.6 75.0 $7.993E-03$	21.0 $5.758E-05$ 439.5 75.0 $7.466E-03$ $2.455E+02$ 22.0 $5.771E-05$ 439.8 75.0 $7.770E-03$ $2.505E+02$ 21.0 $6.035E-05$ 444.4 75.0 $7.645E-03$ $2.498E+02$ 6.0 $6.296E-05$ 449.0 75.0 $3.579E-03$ $1.717E+02$ 6.0 $6.494E-05$ 451.9 75.0 $3.689E-03$ $1.749E+02$ 16.0 $6.502E-05$ 452.0 75.0 $3.689E-03$ $2.802E+02$ 26.0 $6.510E-05$ 452.1 75.0 $9.459E-03$ $2.802E+02$ 36.0 $6.520E-05$ 452.1 75.0 $1.258E-02$ $3.232E+02$ 36.0 $6.532E-05$ 452.2 75.0 $1.579E-02$ $3.622E+02$ 33.0 $6.553E-05$ 452.4 75.0 $1.809E-02$ $3.878E+02$ 19.0 $6.806E-05$ 454.7 75.0 $1.809E-02$ $3.878E+02$ 19.0 $7.010E-05$ 456.5 75.0 $1.6552E-03$ $2.509E+02$ 29.0 $7.021E-03$ 456.6 75.0 $1.071E-02$ $2.997E+02$ 39.0 $7.034E-05$ 456.7 75.0 $1.387E-02$ $3.412E+02$ 45.0 $7.300E-05$ 456.9 75.0 $1.534E-02$ $3.644E+02$ 43.0 $7.300E-05$ 456.7 75.0 $1.534E-02$ $3.644E+02$ 43.0 $7.300E-05$ 456.6 75.0 $1.993E-03$ $2.633E+02$ 19.0 $7.780E-05$ 463.4 75.0 $8.145E-0$

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AT THE END OF THE ANALYSIS PERIOD

CRACK SPACING =	2.881E+00	FEET
CRACK WIDTH =	2.454E-02	INCHES
MAX CONCRETE STRESS=	4.666E+02	PSI
MAX STEEL STRESS =	3.030E+04	PSI,
CONC.TENS.STRENGTH =	4.667E+02	PSI
MAX CONCRETE STRESS= MAX STEEL STRESS = CONC.TENS.STRENGTH =	4.666E+02 3.030E+04 4.667E+02	PSI PSI, PSI

STA-	DIS-	CONCRETE	FRICTION	CONCRETE	STEEL
TION	TANCE	MOVEMENT	FORCE	STRESS	STRESS
1	0.0	0.	0.	4.666E+02	-8.554E+03
2	.2	-1.116E-04	3.348E-03	4.619E+02	-8.166E+03
3	.3	-2-234E-04	6.702E-03	4.573E+02	-7.777E+03
4	•2	-3.354E-04	1.006E-02	4.526E+02	-7.389E+03
5	.7	-4.477E-04	1.343E-02	4.480E+02	-7.000E+03
6	.9	-5.602E-04	1.681E-02	4.433E+02	-6.612E+03
71	1.0	-6.729E-04	2.019E-02	4.386E+02	-6.223E+03
8	1.2	-7.858E-04	2.358E-02	4.340E+02	-5.834E+03
9	T+4	-8.990E-04	2.697E-02	4.293E+02	-5.446E+03
10	1.6	-1.012E-03	3.037E-02	4.246E+02	-5+057E+03
11	1.7	-1.126E-03	3.378E-02	4.200E+02	-4.669E+03
12	1.9	-1.240E-03	3.720E-02	4.153E+02	-4.280E+03
13	2.1	-1.354E-03	4.062E-02	4.106E+02	-3.891E+03
14	2.2	-1.468E-03	4.405E-02	4.060E+02	-3.503E+03
15	2.4	-1.583E=03	4.748E-02	4.013E+02	-3.114E+03
16	5.6	-1.697E-03	5.092E-02	3.966E+02	-2.726E+03
17	2.8	-1.812E-03	5.437E-02	3.920E+02	-2.337E+03
18	2.9	-1.928E-03	5.783E-02	3.873E+02	-1.948E+03
19	3.1	-2.043E-03	6.129E-02	3.826E+02	-1.560E+03
20	3.3	-2.159E-03	6.476E-02	3.780E+02	-1+171E+03
21	3.5	-2.274E-03	6.823E-02	3.733E+02	-7.827E+02
22	3.6	-2.341E-03	7.172E-02	3.686E+02	-3.941E+02
23	3.8	-2.507E-03	7.521E-02	3.640E+02	-5.503E+00
24	4.0	-2.623E-03	7.870E-02	3.593E+04	3.831E+02
25	4.1	-2.740E-03	8.221E-02	3.546E+02	7.717E+02
26	4.3	-2.857E-03	8.571E-02	3.500E+02	1.160E+03
27	4.5	-2.974E+03	8.923E-02	3.453E+02	1+549E+03
28	4.7	-3.092E-03	9.2756-02	3.406E+02	1.937E+03
29	4.8	-3.209E-03	9.628E-02	3.360E+02	2.326E+03
30	5.0	-3.327E-03	9.982E-02	3+313E+05	2.715E+03
31	5.2	-3.445E-03	1.034E-01	3.266E+02	3.103E+03
32	5.4	-3.564E-03	1.069E-01	3+220E+02	3.492E+03
33	5.5	-3.682E-03	1.105E-01	3+173E+02	3.880E+03
34	5+1	-J.801E-0J	1.140E-01	3.1202+02	4.269E+03
35	5.9	-3.920E-03	1.176E-01	3.080E+02	4.058E+03
30	6.0	-4.039E-03	1.212E-01	3.033E+02	5.046E+03
31	0.4	-4.139E-03	1.248E+01	2.9802+02	5.435E+03
38	6.4	-4.2/8E+03	1.2042-01	2.7402+04	5.8232+03
39	0.0	-4.398E=U3	1.320E-01	2.0932+02	6.2120+03
40	6.1	-4.518E-03	1.356E-01	2.0401+02	6.601E+03
41	6.7	-4.039E-03	1.392E=01	2.0000000	6.989E+03
42	7.1	-4./592-03	1.42HE-01	2.1532+02	7.3/82+03
45	7.3	-9.000E-03	1.4042-01	2.1002+02	1.100E+U3
44 21	1 6 ⁻¹⁴		1.5006-01	2.0002+02	0+100C+U3
40	7 0	-3+122E-03	1.537E=01	2.0136+02	0.0005.00
40	/.0	-3.2448-03	1.5/3L=01	2.000000	8+732C+03
41	8.V	-3.JO6E-03	1.0105-01	2.0200+02	9.JC1C+V3
40	5 + 1 7 - 7	-3.4081-03	1.0055-01	2.47/36+02	9.109C+03
47	8.3	-3.010E+03	1.603E-V1	2.705+02	1.0405.04
50	8.5	-3.(J2E+03	1.720E-01	2.380F+05	1.0492+04

51	8.6	-5.855E-03	1.756E-01	2.333E+02	1.087E+04
52	8.8	-5.978E-03	1.793E-01	2.286E+02	1.126E+04
53	9.0	-6.101E-03	1.830E-01	2.240E+02	1.165E+04
54	9.2	-6.224E-03	1-867E-01	2.193E+02	1.204E+04
55	9.3	-6.347E-03	1.904E-01	2.146E+02	1.243E+04
56	9.5	-6.471E-03	1.941E-01	2.100E+02	1.282E+04
57	9.7	-6.595E-03	1.979E-01	2.053E+02	1.321E+04
58	9.9	-6.719E-03	2.016E-01	5.009E+05	1.360E+04
59	10.0	-6.844E-03	2.053E-01	1.960E+02	1.398E+04
60	10.2	-6.968E-03	2.091E-01	1.913E+02	1.437E+04
61	10.4	-7.093E-03	2.128E-01	1 .866E+0 2	1.476E+04
62	10.5	-7.218E-03	2.166E-01	1.820E+02	1.515E+04
63	10.7	-7.343E-03	2.203E-01	1.773E+02	1.554E+04
64	10.9	-7.469E-03	2.241E-01	1.726E+02	1.593E+04
65	11.1	-7.595E-03	2.27AE-01	1.680E+02	1.632E+04
66	11.2	-7.721E-03	2.316E-01	1.633E+02	1.670E+04
67	11.4	-7.847E-03	2.354E-01	1.586E+02	1.709E+04
68	11.6	-7.973E-03	2.392E-01	1.540E+02	1.748E+04
69	11.8	-8.100E-03	2.430E-01	1.493E+02	1.787E+04
70	11.9	-8.227E-03	2.468E-01	1.447E+02	1.826E+04
71	12.1	-8.354E-03	2.506E-01	1.400E+02	1.865E+04
72	12.3	-8.481E-03	2.544E-01	1.353E+02	1+904E+04
73	12.4	-8.609E-03	2.583E-01	1.307E+02	1.942E+04
74	12.6	-8.737E-03	2.621E-01	1.260E+02	1.981E+04
75	12.8	-8.865E-03	2.659E-01	1.213E+02	2.020E+04
76	13.0	-8.993E-03	2.698E-01	1.167E+02	2.059E+04
77	13.1	-9.121E-03	2.736E-01	1.120E+02	2.098E+04
78	13.3	-9.250E-03	2.775E-01	1.073E+02	2.137E+04
79	13.5	-9.379E-03	2.814E-01	1.027E+02	2+176E+04
80	13.7	-9.508E-03	2.852E-01	9.799E+01	2+214E+04
81	13.8	-9.637E-03	2.891E-01	9.332E+01	2+253E+04
82	14.0	-9.767E-03	2.930E-01	8.866E+01	2.292E+04
83	14.2	-9.897E-03	2.969E=01	8+399E+01	2.3312+04
84	14.5	-1.003E-02	3.00AE-01	7.932E+01	2.3/0E+04
85	14.5	-1.016E-02	3.047E-01	7.4652+01	2.4090+04
80	14.7	-1.029E-02	3.086E-01	6.9995+01	2.4400+04
01	14.7	-1.042t-02	3.126E-01	6.333E+01	2.4000.404
80	15.0	-1.0555-02	3,1055401	5 509E+01	2.5252+04
07	13+6	-1.0005-02	3.2040-01	5.3976.01	2.0040404
90	15+4	-1.001E=02	3+244E=01	5-1336+01	2.6003C+04
71	15.0	-1 1/05-02	3.2036-01	4.000E+01	2 6915+04
72	12.10	-1.1215-02	3 3635-01	3.733E+01	2.720F+04
93	12.7	-1.1345-02	3.402E=01	3.266F+01	2.758F+04
95	16.2	-1.147F-02	3.4425-01	2.800E+01	2.797E+04
96	16.4	=1.160F=02	3.4815-01	2.333E+01	2.836E+04
97	1616	-1.174F-02	3.521F-01	1.866E+01	2.875E+04
98	16.8	-1.187F-02	3.561E=01	1.400E+01	2.914E+04
99	16.9	-1.200E-02	3.601E-01	9.332E+00	2.953E+04
100	17.1	-1.214E-02	3.641E-01	4.666E+0U	2.992E+04
TOT	17.3	-1-227E-02	3.682E-01	0.	3.030E+04

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CRCP-2 TESTING EXAMPLE PROBLEM FOR CRCP-2 TESTING

PROB

B-2 ALLOW STRENGTH BUILD UP FOR 90 DAYS

28.0

466.7

****** * * STEEL PROPERTIES æ ***** TYPE OF LONGITUDINAL REINFORCEMENT IS DEFORMED BARS PERCENT REINFORCEMENT = 1.200E+00 BAR DIAMETER = 1.000E+00YIELD STRESS = 6.000E+04ELASTIC MODULUS = 2.900E+07 THERMAL COEFFICIENT = 5.000E+06 ****** 8 44 CONCRETE PROPERTIES 8 4 45 **** SLAB THICKNESS = 1.000E+01 THERMAL COEFFICIENT = 5.000E-06 TOTAL SHRINKAGE = 4.000E-04UNIT WEIGHT CONCRETE= 1.500E+02 COMPRESSIVE STRENGTH= 3.500E+03 TENSILE STRENGTH DATA *** NO TENSILE STRENGTH DATA IS INPUT BY USER THE FOLLOWING AGE-TENSILE STRENGTH RELATIONSHIP IS USED WHICH IS BASED ON THE RECOMMENDATION GIVEN BY U.S. BUREAU OF RECLAMATION AGE, TENSILE (DAYS) STRENGTH 0.0 0.0 1.0 116.0 3.0 249.5 5.0 316.8 7.0 355+4 14.0 417.8 21.0 451.3

124

SLAB-BASE FRICTION CHARACTERISTICS F-Y RELATIONSHIP TYPE OF FRICTION CURVE IS A STRAIGHT LINE MAXIMUM FRICTION FORCE= 3.0000 MOVEMENT AT SLIDING = TEMPERATURE DATA CURING TEMPERATURE= 1 72.0 3 3.0 2 60.0 1 72.0 3 3.0 22.0 4 5.0 1 72.0 3 3.0 22.0 4 5.0 0.0 2 60.0 3 3.0 22.0 5.0 11 50.0 12 50.0 13 15.0 14 54.0 21.0 25.0 11 50.0 26.0 27.0 28.0 29.0 21.0	***	*****	*****
SLADBASE FRICTION CHARACTERISTICS F-Y RELATIONSHIP ************************************	*	STAD-DACE FORSTYCH OUR	AATERICINE A
Image: Concept of the second decided de	*	SLAB-BASE FRICTION CHAP	RACIERISTICS *
TYPE OF FRICTION CURVE IS A STRAIGHT LINE MAXIMUM FRICTION FORCE= 3.0000 MOVEMENT AT SLIDING =1000 ***********************************	*	FT RELATIONS	
TYPE OF FRICTION CURVE IS A STRAIGHT LINE MAXIMUM FRICTION FORCE= 3.0000 MOVEMENT AT SLIDING =1000 ************************************	-	*********	r Könöörööröörööröörööröörööröörööröörööröö
TYPE OF FRICTION CURVE IS A STRAIGHT LINE MAXIMUM FRICTION FORCE= 3.0000 MOVEMENT AT SLIDING = 1000 ************************************			*******************
TYPE OF FRICTION CURVE IS A STRAIGHT LINE MAXIMUM FRICTION FORCE= 3.0000 MOVEMENT AT SLIDING =1000 **********************************			
MAXIMUM FRICTION FORCE: 3.0000 MOVEMENT AT SLIDING =1000 		TYPE OF FRICTION CURVE I	S & STRAIGHT LINE
MAXIMUM FRICTION FORCE= 3.0000 MOVEMENT AT SLIDING =1000 **********************************			
MOVEMENT AT SLIDING =1000 **********************************		MAXIMUM FRICTION FORCE=	3.0000
**************************************		MOVEMENT AT SLIDING =	1000

* TEMPERATURE DATA * TEMPERATURE DATA * * * CURING TEMPERATURE 75.0 MINIMUM DROP IN DAY TEMPERATURE TEMPERATURF 1 72.0 3.0 2 66.0 6.0 3 53.0 22.0 4 51.0 24.0 5 60.0 15.0 6 65.0 10.0 7 54.0 21.0 8 15.0 00.0 9 59.0 16.0 10 20.0 55.0 12 50.0 25.0 13 15.0 60.0 14 54.0 21.0 15 30.0 45.0 16 55.0 10.0 17 15.0 60.0 18 54.0 21.0 19 53.0 22.0 20 54.0 21.0 19 53.0 22.0 20 54.0 21.0 19 53.0 22.0 20 54.0 21.0 19 53.0 22.0 20 54.0 21.0 21 69.0 60.0 22 22.0 53.0 23 56.7 19.0 24 30.0 45.0 25 32.0 43.0 26 43.0 32.0 27 56.0 19.0 28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH = 0.0 DEGREES FAHRENHEIT DAVS BEFORE BEACHING HILW STRENGTH = 0.0 DEGREES FAHRENHEIT			_
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13 15.0 60.0 14 54.0 21.0 15 30.0 45.0 16 59.0 16.0 17 15.0 60.0 18 54.0 21.0 19 53.0 22.0 20 54.0 21.0 21 69.0 6.0 22 22.0 53.0 23 56.0 19.0 24 30.0 45.0 25 32.0 43.0 26 43.0 32.0 27 56.0 19.0 28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH = 0.0 DEGREES FAHRENHEIT DAYS DEFODE PEODE MEN TEMPER = 0.0 DEGREES FAHRENHEIT	12		
14 34.0 45.0 15 30.0 45.0 16 59.0 16.0 17 15.0 60.0 18 54.0 21.0 19 53.0 22.0 20 54.0 21.0 21 69.0 6.0 22 22.0 53.0 23 56.0 19.0 24 30.0 45.0 25 32.0 43.0 26 43.0 32.0 27 56.0 19.0 28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH = 0.0 DEGREES FAHRENHEIT DAYS REFORE REACHING MIN TEMPER = 90.0 DAYS	13	54 0 21 0	
16 59.0 16.0 17 15.0 60.0 18 54.0 21.0 19 53.0 22.0 20 54.0 21.0 21 69.0 6.0 22 22.0 53.0 23 56.0 19.0 24 30.0 45.0 25 32.0 43.0 26 43.0 32.0 27 56.0 19.0 28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH = 0.0 DEGREES FAHRENHEIT DAYS REFORE REACHING MIN TEMP = 90.0 DAYS	14		
17 15.0 60.0 18 54.0 21.0 19 53.0 22.0 20 54.0 21.0 21 69.0 6.0 22 22.0 53.0 23 56.0 19.0 24 30.0 45.0 25 32.0 43.0 26 43.0 32.0 27 56.0 19.0 28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH = 0.0 DEGREES FAHRENHEIT DAYS REFORE REACHING MIN TEMP = 80.0 DAYS	16	· 59.0 · 16.0	
18 54.0 21.0 19 53.0 22.0 20 54.0 21.0 21 69.0 6.0 22 22.0 53.0 23 56.0 19.0 24 30.0 45.0 25 32.0 43.0 26 43.0 32.0 27 56.0 19.0 28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH = 0.0 DEGREES FAHRENHEIT DAYS REFORE REACHING MIN TEMP = 80.0 DAYS	17	15.0 60.0	
19 53.0 22.0 20 54.0 21.0 21 69.0 6.0 22 22.0 53.0 23 56.0 19.0 24 30.0 45.0 25 32.0 43.0 26 43.0 32.0 27 56.0 19.0 28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH 0.0 DEGREES FAHRENHEIT DAYS REFORE REACHING MIN TEMP	18	54.0 21.0	
20 54.0 21.0 21 69.0 6.0 22 22.0 53.0 23 56.0 19.0 24 30.0 45.0 25 32.0 43.0 26 43.0 32.0 27 56.0 19.0 28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH 0.0 DEGREES FAHRENHEIT DAYS REFORE REACHING MIN TEMP	19	53.0 22.0	
21 69.0 6.0 22 22.0 53.0 23 56.0 19.0 24 30.0 45.0 25 32.0 43.0 26 43.0 32.0 27 56.0 19.0 28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH 0.0 DEGREES FAHRENHEIT DAYS REFORE REACHING MIN TEMP	20	54.0 21.0	
22 22.0 53.0 23 56.0 19.0 24 30.0 45.0 25 32.0 43.0 26 43.0 32.0 27 56.0 19.0 28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH 0.0 DEGREES FAHRENHEIT DAYS REFORE REACHING MIN TEMP	21	69.0 6.0	
23 56.0 19.0 24 30.0 45.0 25 32.0 43.0 26 43.0 32.0 27 56.0 19.0 28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH 0.0 DEGREES FAHRENHEIT DAYS REFORE REACHING MIN. TEMP.	22	22.0 53.0	
24 30.0 45.0 25 32.0 43.0 26 43.0 32.0 27 56.0 19.0 28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH = 0.0 DEGREES FAHRENHEIT DAYS REFORE REACHING MIN. TEMP.	23	56.0 19.0	
25 32.0 43.0 26 43.0 32.0 27 56.0 19.0 28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH = 0.0 DEGREES FAHRENHEIT DAYS REFORE REACHING MIN. TEMP.	24	30.0 45.0	
26 43.0 32.0 27 56.0 19.0 28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH = 0.0 DEGREES FAHRENHEIT DAXS REFORE REACHING MIN. TEMP. - 80.0 DEGREES FAHRENHEIT	25	32.0 43.0	
27 56.0 19.0 28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH = 0.0 DEGREES FAHRENHEIT DAYS REFORE REACHING MIN TEMP 80.0 DAYS	26	43.0 32.0	
28 57.0 18.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH = 0.0 DEGREES FAHRENHEIT	27	56.0 19.0	
MINIMUM TEMPERATURE EXPECTED AFTER Concrete Gains Full Strength = 0.0 dégrees fahrenheit Days refore reachtne Min Temp 80.0 days	28	57.0 18.0	
CONCRETE GAINS FULL STRENGTH = 0.0 DEGREES FAHRENHEIT		THITHIN TRUNCHATINE FYRE	
CONCRETE DAINS FULL STRENDIN = 0.0 DEVELS FARKENHELT	M	INIMUM LEMPERATURE EAPECT	10 AFIEK A A Déguere Fillerurit
	C	AVS DEFODE DEACHTAG MIN	= 0.0 DAYS

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WHEEL LOAD STRESS (PSI) = 0.
LOAD APPLIED AT = 28 TH DAY
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MAXIMUM ALLOWABLE NUMBER OF ITERATIONS= 30 RELATIVE CLOSURE TOLERANCE= 1.0 PERCENT

CRCP-2 TESTING EXAMPLE PROBLEM FOR CRCP-2 TESTING

PROB B-2

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ALLOW STRENGTH BUILD UP FOR 90 DAYS

						MAX	[MUM
TIME	TEMP	DRYING	TENSILE	CRACK	CRACK	CONCRETE	STRESS IN
(UAYS)	DROP	SHRINKAGE	STRGTH	SPACING	WIDTH	STRESS	THE STEEL
50	.	1 0145 06	<i>(</i>) <i>(</i>)	4000 •	2 7// - 0/	1 6515.01	1 0005 / 13
.50	3.0	1.814E-00	61.0	4800.0	3.764E-04	1.0516+01	1.8020+03
1.33	3.0	4.802E-00		4800.0	5.504E-04	3.080E+01	2.980E+03
1.50	6.0	5.394E=00	153.7	4800.0	1.340E-03	5./74E+01	5.609E+03
2.29	6.0	8.190E-00	207.3	4800.0	1.684E-03	7.472E+01	6.990E+03
2.38	16.0	8.490E-06	212.6	4800•0	7.031E-03	1 • /55E+02	1.638E+04
2.43	20.0	8.669E-06	215.8	2400.0	9.480E-03	2.130E+02	2.003E+04
2.44	20.3	8.688E-06	216.2	1200.0	9.492E-03	2.091E+02	1.988E+04
2.46	2ĩ.Ž	8.759E-06	217.4	600.0	9.258E-03	2.058E+02	1.970E+04
2.50	22.0	8.910E-06	220.1	600.0	9.911E-03	2.140E+02	2.046E+U4
3.43	22.0	1.214E-05	265.3	600•0	1.124E-02	2.445E+02	2.292E+04
3.50	24.0	1.236E-05	267.6	600.0	1.296E-02	2•639E+02	2.472E+U4
4.50	15.0	1.576E-05	301.2	600.0	7.038E-03	2.029E+02	1.868E+04
5,50	10.0	1.909E-05	326.9	600.0	4.474E-03	1.672E+02	1.512E+04
6.33	10.0	Z.181E-05	342.9	600.0	4.917E-03	1.790E+02	1.608E+04
6.45	20.0	2.221E-05	345.2	600.0	1.268E-02	2.887E+02	2.621E+04
6.50	21.0	2.237E-05	346.1	600.0	1.362E-02	2.998E+02	2.722E+04
7.31	21.0	2.497E-05	358.4	600.0	1.433E-02	3.122E+02	2.821E+04
7.32	25.7	2.502E-05	358.5	300.0	1.475E-02	3.155E+02	2.863E+04
7.34	31.5	2.507E-05	358.7	150.0	1.325E-02	2.984E+02	2.711E+04
7.37	41.5	2.518E-05	359.0	150.0	1.85nE-02	3.529E+02	3.217E+04
7.38	43.0	2.520F-05	359.1	75.0	1.190F-02	2.826F+02	2.565E+04
7.42	53.0	2.534E-05	359.5	75.0	1.508E-02	3.184E+02	2.898E+04
7.50	60.0	2.559E-05	360.3	75.0	1.738E-02	3.421E+02	3.118E+04
8.50	16.0	2.876F-05	369.8	75.0	4.244F-03	1.709F+02	1.509E+04
9.30	16.0	3.124E-05	377.3	75.0	4.394E-03	1.754E+02	1.541E+04
9.33	26.0	3.134E-05	377.5	75.0	7.208E-03	2.248E+02	1.999E+04
9.36	36.0	3.145E-05	377.9	75.0	1.021E-02	2.677E+02	2.397E+04
9.41	46.0	3.158E-05	378.3	75.0	1.333E-02	3.061E+02	2.753E+04
9.50	55.0	3.187E-05	379.1	75.0	1.624E-02	3.382E+02	3.050E+04
10.50	25.0	3.493E-05	388.1	75.0	7.158E-03	2.268E+02	2.003E+04
11.50	25.0	3.794E-05	396.9	75.0	7.361E-03	2.323E+02	2.041E+04
12.32	25.0	4.037E-05	403.9	75.0	7.524E-03	2.368E+02	2.072E+04
12.35	35.0	4.046E-05	404.2	75+0	1.055E-02	2.805E+02	2.475E+04
12.38	45.0	4.057E-05	404.5	75.0	1.369E-02	3.197E+02	2.837E+04
12.43	55.0	4.071E-05	404.9	75.0	1.692E-02	3.557E+02	3.168E+04
12.50	60.0	4.090E-05	405.4	75.0	1.858E-02	3•729E+02	3.326E+04
13.50	21.0	4.382E-05	413.7	75.0	6.588E-03	2.240E+02	1.940E+04
14-33	21.0	4.619E-05	419.4	75.0	6.741E-03	2.281E+02	1.968E+04
14.37	31.0	4.632E-05	419.6	75.0	9.732E-03	2.742E+02	2.392E+04
14.43	41.0	4.649E-05	419.9	75.0	1.286E-02	3.153E+02	2.770E+04
14.50	45.0	4.668E-05	420.3	75.0	1.414E-02	3.308E+02	2.912E+04
15.50	16.0	4.951E-05	425.3	75.0	5.518E-03	2+077E+02	1.769E+04
16.29	16.0	5.171E-05	429.2	75.0	5.652E-03	2.111E+02	1.793E+04
16.32	26.0	5-179E-05	429.3	75.0	8.580E-03	2.602E+02	2.243E+04
10.35	36.0	5.188E-05	429.5	75.0	1.166E-02	3.034E+02	2.640E+04
16.39	46.0	5.198E-05	429.7	75.0	1.484E=02	3.424E+02	2.998E+04
16.44	56.0	5.212E-05	429.9	75+0	1.810E-02	3.784E+02	3.328E+04
16,50	60.0	5.228E-05	430.2	75.0	1.943E-02	3.922E+02	3.454E+04
17.50	21.0	5.501E-05	435.0	75.0	7.302E=03	2.416E+02	2.060E+04

18.45	21.0	5.758E-05	439.5	75.0	7.466F-03	2.4555+02	2.087F+U4
18.50	22.0	5.771E-05	439.8	75.0	7.7705-03	2.5055402	
19.50	21.0	6.0355-05	444 4	75.0	7 4455-00		201336704
	-1-0			1300	1.045E-03	2.4982+02	2.110C+V4
20.50	6.0	0.240E-02	449.0	75.0	3.579E-03	1.717E+02	1.392E+04
21.27	6.0	6.494E-05	451.9	75.0	3.689E-03	1.749E+02	1.414E+04
21.30	16.0	6.502E-05	452.0	75.0	6.474E-03	2+318E+02	1.934E+04
21.33	26.0	6.510E-05	452.1	75.0	9.459E-03	2.802E+02	2.378E+04
21.37	36.0	6.520E-05	452.1	75.0	1.258E-02	3.232E+02	2.770E+04
21.42	46.0	6.532E-05	452.2	75.0	1.579E-02	3.622E+02	3.127E+04
21.50	53.0	6.553E-05	452.4	75.0	1.809E-02	3.878E+02	3.360E+04
22.50	19.0	6.806E-05	454.7	75+0	7.5386-03	2.509E+02	2.099E+04
23.32	19.0	7.010E-05	456.5	75.0	7.665E-03	2.535E+02	2.116E+04
23.36	29.0	7.021E-05	456.6	75 . n	1.0715-02	2.997E+02	2.539E+04
23.42	39.0	7.034E-05	456.7	75.0	1.387E-02	3.412E+02	2.918E+04
23.50	45.0	7.055E-05	456.9	75.0	1.5826-02	3.6448+02	3.129E+04
24.50	43.0	7.300E-05	459.1	75.0	1.534E-02	3.597E+02	3.078E+04
25.50	35.0	7.5428-05	461.3	75.0	1.199E-02	3.188E+02	2.696E+04
26.50	19.0	7.780E-05	463.4	75.0	8.145E-03	2.633E+02	2.181E+04
27.50	18.0	8.015F-05	465.6	75.0	7.993E-03	2.614E+02	2.156F+04

AT THE END OF THE ANALYSIS PERIOD

8.1 -5.364E-03

8.3 -5.494E-03

8.4 -5.625E-03

8.6 -5.755E-03

8.8 -5.887E-03

9.0 -6.018E-03

9.2 -6.150E-03

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CRACK CRACK MAX CO MAX SI CONC.	SPACIN WIDTH DNCRETE FEEL ST TENS.ST	G = 3.12 = 2.64 STRESS= 4.88 RESS = 3.28 RENGTH = 4.90	25E+00 FEET 3E-02 INCHES 34E+02 PSI 34E+04 PSI 34E+02 PSI		
STA- TION	DIS- TANCE	CONCRETE MOVEMENT	FRICTION FORCE	CONCRETE STRESS	STEEL STRESS
1 2 3 4 5 6 7 8 9 10 11 23 4 5 6 7 8 9 10 11 23 4 5 6 7 8 9 10 11 23 14 5 6 7 8 9 10 11 23 14 5 6 7 8 9 10 11 23 14 5 6 7 8 9 10 11 23 14 5 6 7 8 9 10 11 23 14 5 6 7 8 9 10 11 23 14 5 6 7 8 9 10 11 23 14 5 6 7 8 9 10 11 23 14 5 6 7 8 9 10 11 23 14 5 6 7 8 9 10 11 2 3 14 5 6 7 8 9 10 11 2 3 14 5 6 7 8 9 10 11 2 3 14 5 6 7 8 9 10 11 2 3 14 5 6 7 8 9 10 11 2 3 14 5 6 7 8 9 10 11 2 3 14 5 15 1 12 13 14 5 15 1 12 13 14 5 15 11 2 11 2 2 11 2 2 2 2 2 2 2 2 2 2	ANCE 0.02 .4 .8 .9 1.1 1.5 1.7 1.9 2.3 4.6 8.9 1.1 2.3 2.6 8.0 2.4 6.8 9.1 1.5 7.9 1.3 2.4 6.8 9.2 3.4 6.8 9.1 1.5 7.9 1.3 3.4 6.8 9.1 3.5 7.9 1.3 3.4 6.8 9.2 3.4 6.8 9.1 3.5 7.9 1.3 5.5 7.9 1.5 7.5 7.5 7.5 7.5 7.5 7.5 7.5 7	0. -1.210E-04 -2.419E-04 -3.629E-04 -4.839E-04 -6.048E-04 -7.258E-04 -8.468E-04 -9.677E-04 -1.089E-03 -1.210E-03 -1.332E-03 -1.454E-03 -1.576E-03 -1.698E-03 -1.821E-03 -2.944E-03 -2.563E-03 -2.563E-03 -2.687E-03 -2.687E-03 -2.812E-03 -2.937E-03	0. 3.629E-03 7.258E-03 1.089E-02 1.452E-02 1.452E-02 2.177E-02 2.540E-02 3.266E-02 3.266E-02 3.631E-02 3.996E-02 4.361E-02 4.361E-02 5.463E-02 5.463E-02 5.463E-02 5.463E-02 5.463E-02 5.463E-02 5.463E-02 5.463E-02 5.463E-02 5.463E-02 5.465E-02 5.455E-	4.884E+02 4.884E+02 4.884E+02 4.884E+02 4.884E+02 4.884E+02 4.884E+02 4.884E+02 4.884E+02 4.884E+02 4.884E+02 4.884E+02 4.884E+02 4.884E+02 4.831E+02 4.778E+02 4.672E+02 4.672E+02 4.619E+02 4.566E+02 4.513E+02 4.301E+02 4.301E+02 4.248E+02 4.141E+02 4.088E+02 4.035E+02	-7.835E+03 -7.835E+03 -7.835E+03 -7.835E+03 -7.835E+03 -7.835E+03 -7.835E+03 -7.835E+03 -7.835E+03 -7.835E+03 -7.834E+03 -7.392E+03 -6.950E+03 -6.950E+03 -6.950E+03 -5.182E+03 -5.182E+03 -3.855E+03 -3.855E+03 -3.413E+03 -2.971E+03 -2.971E+03 -2.087E+03 -1.645E+03 -1.645E+03 -1.608E+02
25 26 27 28 29	4.5 4.7 4.9 5.1 5.3	-2.937E-03 -3.062E-03 -3.188E-03 -3.314E-03 -3.440E-03	8.812E-02 9.187E-02 9.564E-02 9.942E-02 1.032E-01	4.035E+02 3.982E+02 3.929E+02 3.876E+02 3.823E+02	-7.608E+02 -3.187E+02 1.234E+02 5.655E+02 1.008E+03
30 31 32 33 34	5.4 5.6 5.8 6.0	-3.566E-03 -3.693E-03 -3.820E-03 -3.947E-03 -4.075E-03	1.070E-01 1.108E-01 1.146E-01 1.184E-01 1.222E-01	3.770E+02 3.717E+02 3.664E+02 3.611E+02 3.558E+02	1.450E+03 1.892E+03 2.334E+03 2.776E+03 3.218E+03
39 36 37 38 39	6.6 6.8 6.9 7.1	-4.202E-03 -4.330E-03 -4.458E-03 -4.587E-03 -4.716E-03	1.261E-01 1.299E-01 1.338E-01 1.376E-01 1.415E-01	3.505E+02 3.451E+02 3.398E+02 3.345E+02 3.292E+02	3.660E+03 4.102E+03 4.544E+03 4.986E+03 5.429E+03
40 41 42 43	7.3 7.5 7.7 7.9	-4.845E-03 -4.974E-03 -5.104E-03 -5.233E-03	1.453E-01 1.492E-01 1.531E-01 1.570E-01	3.239E+02 3.186E+02 3.133E+02 3.080E+02	5.871E+03 6.313E+03 6.755E+03 7.197E+03

1.609E-01

1.648E-01

1.687E-01

1.727E-01

1.766E-01

1.805E-01

1.845E-01

3.027E+02

2.974E+02

2.921E+02

2.868E+02

2.815E+02

2.761E+02

2.708E+02 1.029E+04

7.639E+03

8.523E+03

8.081E+03

8.965E+03

9.407E+03

9.849E+03

51	9.4	-6.282F-03	1.8855-01	2.655E+02	1.0736.04
52	9.6	-6.414E-03	1.924F=01	2.602E+02	1.118F.04
53	g B	-6-5465-03	1.9645-01		1 1625.04
54	6 9	-6 6705-03	2 0045-01	2.3475+02	1.1020+04
55	303	-0.0/9E-03	2.0040-01	2.44900+02	1.2000+04
55	10.1	-0.012E-03	2.044E-01	2.443E+02	1.250E+04
20	10.3	-0.945E=03	2.084E-01	2.390E+02	1.294E+04
57	10.5	=7.079E=03	2.124E-01	2.337E+02	1.339E+04
58	10.7	-7.213E-03	2.164E-01	2.284E+02	1.383E+04
59	10.9	-7.347E-03	2.204E-01	2.231E+02	1.427E+04
60	11.1	-7.481E-03	2.244E-01	2.177E+02	1.471E+04
61	11.3	-7.616F-03	2.285F-01	2.124E+02	1.515F+04
62	11.4	-7.750E-03	2.325E=01	2.0715+02	1.5605.04
63	11.6	-7.886E-03	2.3648=01	2.0185.02	1.6045.04
64	11 8	-8.0215-03	2.3066-01	2.0100402	1.0040404
46	11.0	-0.021E-03	204005-01	1+7000+02	1.0400+04
65	12.0	-0.15/E-UJ	2.4472-01	1+7120+02	1.0922+04
00	12.4	-0.2932-03	2.488E-01	1.059E+02	1.737E+04
67	12.4	-8.429E-03	2.529E-01	1+806E+02	1.781E+04
68	12.6	-8.565E-03	2.570E-01	1.753E+02	1.825E+04
69	12.7	-8.702E-03	2.611E-01	1.700E+02	1.869E+04
70	12.9	-8.839E-03	2.652E-01	1.646E+02	1.913E+04
71	13.1	-8.976E-03	2.693E-01	1.593E+02	1.958E+04
72	13.3	-9.114E-03	2.734E-01	1.540E+02	2.002E+04
73	13.5	-9.251F-03	2.776E=01	1-487E+02	2.046F+04
74	13.7	-9.389F-03	2.9175-01	1.4345+02	2.090F+04
75	12.9	-9.5205-03	2 0505-01	1 3015.02	2 1365.04
75	1307	-3.520E-03	2.00000-01	1.3015-02	2+1340+04
10	14+1	-7.000E-03	2.9002-01	1.3286+02	2+1/90+04
11	14.4	-9.805E-03	2.942E=01	1.2752+02	2.2232+04
78	14•4	-9.944E-03	2.983E-01	1+222E+02	2.267E+04
79	14.6	-1.008E-02	3.025E-01	1+169E+02	2.311E+04
80	14.8	-1.022E-02	3.067E-01	1+115E+02	2.355E+04
81	15.0	-1.036E-02	3.109E-01	1.062E+02	2.400E+04
82	15.2	-1.050E-02	3.151E-01	1+009E+02	2.444E+04
83	15.4	-1.064E-02	3.193E-01	9.561E+01	2.488E+04
84	15.6	-1.078F-02	3.235E-01	9.030E+01	2.532E+04
85	15.7	-1.093E-02	3.278E=01	8.499E+01	2.576F+04
86	15.9	-1.1075-02	3.3205-01	7.967E+01	2.621E+04
87	16.1	-1.121E-02	3.3625-01	7.4365+01	2.665E+04
98	14 3	-1.1366-05	3 4055-01	4. 905F+01	2.709E+04
00	10.5	-1 1405-02	3 44950-01	6 70JL+01	2 7525.04
07	10+-7	-1+1495-02	3.4485-01	C+3/4C+01	2 7095.04
90	16.7	-1+103E=02	3.490E-01	5.0432+01	2.1986+04
AT	10.7	-1+1/8E-02	3.533E-01	5+3120+01	2.0420+04
92	17+1	-1.192E-02	3.5/6E-01	4./80E+01	2.886E+04
93	17.2	-1.206E-02	3.619E-01	4.249E+01	2+930E+04
94	17.4	-1.221E-02	3.662E-01	3.718E+01	2.974E+04
95	17.6	-1.235E-02	3.705E-01	3.187E+01	3.019E+04
96	17.8	-1.249E-02	3.748E-01	2.656E+01	3.063E+04
97	18.0	-1.264E+02	3.791E-01	2.124E+01	3.107E+04
98	18.2	-1.278E-02	3.835E-01	1.593E+01	3.151E+04
99	18.4	-1.293E-02	3.878E-01	1.062E+01	3+195E+04
100	18.6	-1.307F-02	3.921E-01	5+307E+00	3.24nE+n4
100	18.7	-1.323F=62	3.9655-01	-6-037E-03	3.284E+04
101	TOAL	******		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	

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CRCP=2 TESTING EFFECT OF EXTERNAL LOAD

PROB C-1

ZERO EXTERNAL LOAD

********* × STEEL PROPERTIES Ħ ÷ * ***** TYPE OF LONGITUDINAL REINFORCEMENT IS DEFORMED BARS PERCENT REINFORCEMENT # 1,200E+00 = 1,000E+00 BAR DIAMETER YIELD STRESS = 6,000E+04 ELASTIC MODULUS = 2,900E+07 THERMAL COEFFICIENT = 5.000E=06 *************** × * CONCRETE PROPERTIES × * * * ****** SLAB THICKNESS = 1.200E+01 THERMAL COEFFICIENT = 5.000E-06 TOTAL SHRINKAGE = 4.000E=04 UNIT WEIGHT CONCRETE 1.500E+02 COMPRESSIVE STRENGTH= 5.000E+03 TENSILE STRENGTH DATA ****** NO TENSILE STRENGTH DATA IS INPUT BY USER THE FOLLOWING AGE-TENSILE STRENGTH RELATIONSHIP IS USED WHICH IS BASED ON THE RECOMMENDATION GIVEN BY U.S. BUREAU OF RECLAMATION AGE, TENSILE (DAYS) STRENGTH 0,0 0.0 1.0 157.9 3,0 322.0 5,0 398.5 7.8 440.6 14,0 506,2 21.0 540.2 28.0 555.6

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× SLAB-BASE FRICTION CHARACTERISTICS * * × F-Y RELATIONSHIP * * *************** TYPE OF FRICTION CURVE IS A STRAIGHT LINE MAXIMUM FRICTION FORCES 1,0000 HOVEMENT AT SLIDING # -.1000 ********** ٠ * * TEMPERATURE DATA ÷ * * ****** CURING TEMPERATURE# 75.0 MINIMUM DROP IN DAY TEMPERATURE TEMPERATURE 65,0 10.0 1 65.0 10.0 2 3 65.0 18.0 65.0 4 10.0 65.0 5 10.0 65.8 6 10.0 65.0 7 10.0 65,0 8 10.0 9 10.0 65.0 10 65.9 10,0 11 65,0 10.0 65.0 12 10.0 65.0 13 10.0 14 65.0 10.0 15 65,0 10.0 16 65.0 10,0 55,0 17 20.0 55.0 18 20.0 19 55.0 20.0 20 55.0 20.0 55.0 21 20.0 22 55,0 20,0 23 55,8 20,0 55,0 24 20.0 55.0 25 20.0 26 55,0 20,0 55,0 27 20.0 28 55.0 20.0 MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH = 30.0 DEGREES FAHRENHEIT DAYS BEFORE REACHING MIN. TEMP, = 90.0 DAYS

******	*****************
* EXTERNI	AL LOAD
*******	***************
WHEEL LOAD STRESS Load applied at	(PSI)= 0. = 28 TH DAY

*					1
*	ITERATION	AND	TOLERANCE	CONTROL	1
*					1

MAXIMUM ALLOWABLE NUMBER OF ITERATIONS# 30 Relative closure tolerance# 1.0 percent

CRCP-2 TESTING EFFECT OF EXTERNAL LOAD

PROB C-1

ZERO EXTERNAL LOAD

	_					MAX	Емим
TIME	TEMP	DRYING	TENSILE	CRACK	CRACK	CONCRETE	STRESS IN
(DAYS)	DROP	SHRINKAGE	STRGTH	SPACING	WIDTH	STRESS	THE STEEL
,50	18.0	1,814E-06	85.7	4800.0	2.019E-03	6,065E+01	6.46ØE+03
1,50	10.0	5,394E=06	206,0	4800.0	3.121E-03	1.075E+02	1.032E+04
2,50	10,0	8,910E-06	287.3	4800,0	4 070E-03	1.4226+02	1.317E+04
3,50	10,0	1,2366-05	342.9	4800.0	4,962E=03	1,709E+02	1.553E+04
4,50	10.0	1,576E-05	381.0	4800.0	5.815E-03	1.954E+02	1.753E+04
5,50	10,0	1,909E-05	409.6	4800.0	6.663E=03	2.177E+02	1.935E+04
6,50	10.0	2.237E=05	430.6	4800 0	7.499E-03	2.3778+02	2.0998+04
7,50	10,0	2,559E-05	445.8	4800.0	8.319E=03	2,558E+02	2.246E+04
8,50	10,0	2 876E-05	456.0	4800.0	9.114E-03	2.718E+02	2.376E+04
9,50	10,0	3.187E-05	465,9	4800.0	9.940E-03	2.879E+02	2.507E+04
10,50	10,0	3,493E-05	475.4	4800.0	1.079E-02	3,041E+02	2.637E+04
11,50	10,0	3,794E-05	484.6	4800.0	1,168E=02	3,2046+02	2.769E+04
12,50	10.0	4,090E-05	493.4	4800.0	1.259E-02	3,367E+02	2.982E+04
13,50	10,0	4,382E-05	502,0	4800.0	1.353E-02	3,532E+02	3.034E+04
14,50	10.0	4,668E-05	508.8	4800.0	1.446E-02	3,685E+02	3.159E+04
15,50	10,0	4.9518-05	513,9	4800.0	1,537E-02	3,829E+02	3.274E+04
16,33	10,0	5,1826-05	518,1	4800.0	1.614E-02	3,948E+02	3.370E+04
16,41	16,7	5,203E-05	518,4	2400.0	2.578E-02	5,016E+02	4.346E+04
16,42	17.7	5.207E-05	518,5	1200.0	2.442E-02	4,862E+02	4,231E+04
16,50	20.0	5,228E-05	518,9	600,0	2,273E=02	4.680E+02	4.079E+04
17,50	20,0	5,501E-05	523.8	600.0	2.352E=02	4,787E+02	4.163E+04
18,50	20,0	5,771E-05	528,6	600,0	2.4326-02	4.892E+02	4.247E+04
19,50	20,0	6 035E-05	533.3	600,0	2.511E=02	4,996E+02	4.330E+04
20,50	20.0	6,296E=05	538,0	600.0	2.5 90E=02	5.100E+02	4.412E+04
21,50	20.0	6.553E=05	541.4	600.0	2. 666E=02	5,193E+02	4.486E+Ø4
22,50	20.0	6,806E-05	543.6	600.0	2 . 738E=02	5,275E+02	4.551E+04
23,50	20,0	7,055E=05	545.8	600.0	2,809E=02	5 . 357E+02	4 . 615E+04
24,50	20,0	7,300E-05	548.0	300,0	2,075E-02	4 . 608E+02	3 . 940E+04
25,50	20.0	7,542E-05	550.2	300.0	2.121E-02	4 . 670E+02	3 .987E+ Ø4
26,50	20,0	7,780E=05	552.4	300.0	2.167E-02	4 . 731E+02	4.034E+04
27,50	20.0	8,015E-05	554.5	300.0	2,212E-02	4 . 792E+02	4 . 080E+04

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AT THE END OF THE ANALYSIS PERIOD

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CRACK	SPACING		4.6882+00	FEET
CRACK	WIDTH	8	3.014E-02	INCHE8
MAX CO	NCRETE	STRESS#	5.7408+02	PSI
MAX ST	EEL STR	E88 #	3.9922+04	PSI,
CONC.T	ENS.STR	ENGTH #	5,789E+02	PSI

STA-	DIS-	CONCRETE	FRICTION	CONCRETE	STEEL
TION	TANCE	MOVEMENT	FORCE	STRESS	STRESS
				0.000	UTALOU
	. .	•	-		
1	N N	Ø.	и. •	5,740E+02	=7.898E+03
2	.3	=1 . 399E=04	1 . 399E-03	5,740E+02	=7.898E+03
3		-2.798E-04	2.798E=03	5.7402+02	-7.898E+03
Δ	Å	-4.196F-04	4.1965-03	5.740F+02	-7.898F+01
Ē		-E COSE-0/	5 5055_01	5 7005-63	-7 8088.01
3	4 . 1			E TAGELOS	-7.0000000
	1.4	-0.444E-04	0,9945483	3.1402+02	-1.0405+03
7	1.7	=8,393E=04	8,343E=03	5.740E+02	=7.898E+93
8	2.0	=9,791E=0 4	9,7928+03	5,740E+02	=7,898E+Ø3
9	2.3	=1,119E=03	1.119E=02	5,740E+02	=7.898E+03
10	2.5	=1.259E=03	1.2598-02	5.740E+02	-7.898E+03
11	2 8	-1.3995-01	1 3995-82	5.7495+02	-7 AGAF-DI
4.2	1 1	-1 \$105-01	1 5105-00	5 7/0E+02	-7 8086+03
14	2 1	-1,3372-03	1,3375-02	5.7402402	=/,0702+03
13	3,4	=1.0/YE=03	1.0798-02	5.740E+02	•7.898E+03
14	3,7	=1,818E=03	1 .8 18 E=02	5 . 740E+02	₹7,898E+03
15	3.9	■1,958E=03	1,958E-02	5.740E+02	=7.898E+03
16	4.2	-2.098E-03	2.0985-02	5.740E+02	-7.898E+03
17	4 5	-2.21AE-01	2.2385-02	5.740F+02	-7. 898F+93
	4 9	-2 1785-01	3 1785-03	5 7405+02	-7 8085191
10			2,3/02002	5 7405402	-7 00000103
19	5,1	-2,5105-05	C. 2105-06	3.7402+02	-/.0702+03
20	5,3	₩Z,658E=03	2,658E=02	5,740E+02	=7,898E+03
21	5.6	-2,7982-03	2,798E-02	5,740E+02	=7.898E+03
22	5,9	-2.937E-03	2.937E=02	5,7408+82	-7.898E+03
21	6.2	-3.077#-03	3.0778-02	5.739E+02	-7.898E+03
24	A E	-1 2175-01	1 2175-02	5.719F+02	-7 .8985-01
55	4 9	-1 1876-41	3,2175-03	5 710E+02	-7 AGRE-41
<27	b , 0	-3,33/2-03	3,33/2-02	5,1372402	-/.0402+03
26	7.0	=3,497E=03	3.4976=02	5.734E+02	=7.898E+03
27	7,3	=3,637 <u>E</u> =03	3,637E=02	5,739E+02	-7.898E+03
28	7.6	-3,777E-03	3,777E=02	5.739E+02	-7,898E+03
29	7.9	-3.917E-03	3.917E-02	5,7398+02	-7.898E+03
30	8.2	-4.056E-03	4.057E-02	5.739E+02	=7.898E+03
11	A 4	-4.196F-03	4.1965-92	5.739F+82	T. AGAF+HI
12	ě • 7	-4 3346-03	/ IIAE_GD	5 7105-42	-7 AOAEL01
36	0,1	- 0 0365-03	4,3305-02	5 7705.00	-7 8085+03
22	4.0	-4,4/02-03	4,4/02-02	2,1372+02	-1.0405403
34	9,3	=4,0102=03	4.0102-02	3,7346+02	•7.898E+03
35	9.6	-4,756E-03	4,756E-02	5,739E+02	=7.898E+03
36	9.8	=4,896E=Ø3	4 . 896E-02	5,739E+02	◆7,898E+03
37	10.1	-5.036E-03	5.0368-02	5.739E+02	-7.898E+03
14	10 4	-5.175F-03	5.1765-82	5.739F+82	-7.898F+03
10	40.7	-5 1155-01	5 1155-02	5.7105-02	-7 A08F101
37	10.7		5,5155-02	5 9705-05	-7 0702703
40	11.0	-2,4325-03	3,4772+#Z	3,134E+02	*/.0702+03
41	11,3	■5,595E=03	5,5952-02	5,708E+02	=7,639E+03
42	11.5	-5,736E-03	5,736E=02	5,613E+02	=6,846E+03
43	11.8	=5.877E=Ø3	5.877E=02	5,518E+02	•6,053E+03
44	12 1	-6.018F-01	6.018F-02	5,4238+02	-5.261F+03
Ц Ш	12 /	-6 1402-01	A 160E-00	5. 1DAFLAS	HAAFAAT
43 47	15.44	-6 1000-03	4 1000-0K	2 311E-44	
40	12.7	-0,3035-03	0.3035-05	3,6336982	4340/25403
47	12,9	=0,446E=Ø3	6.446E=02	3,137E+02	=2,863E+03
48	13.2	-6,590E-03	6,590E-02	5,042E+02	=2,090E+03
49	13.5	-6,735E-03	6.735E=02	4.947E+82	=1.298E+03
50	13.8	-6.880E-01	6.880E-02	4.8522+02	-5.051E+02
			wyverw rb	· · · · · · · · · · · · · · · · · · ·	******

		3 03/8 03		" 	
21	14#1	-1.0000-03	7,020E-02	4.7578+02	2.875E+02
52	14.3	-7.172E-03	7.172E-02	4,662E+02	1.0805+03
41	4 4	-7. 319F-03	7 1105-03	1 5475+03	
	1490		TETE	4.30/E+02	1.0/35+03
54	14,9	#/,400E-03	7,467E=02	4.4718+02	2,665E+03
55	15.2	=7.615E=Ø3	7.615E-02	4.376F+Ø2	3.4585101
64	15 5	-7 7638-01	7 7615-03	// 3645.63	
30	13.3		1.103E-02	4.2012+02	4,2016+03
57	15,7	=7.913E=03	7,913E-02	4 . 186E+02	5,043E+03
58	16.0	-8,062E-03	8.063F-02	4.091F+02	5.8365.01
KO	14 7	-8 2138-01	8 3176-03	7 0045 00	
37	10+2	-0.2132-03	0.2136-02	3.4405405	0,0205+43
60	16,6	=0,304E=03	8,364E-02	3,901E+02	7,421E+03
61	16.9	-8.516E-03	8.516E-02	3.806F+02	8.214F+03
62	17 2	-8.6685-03	A 6685-02	1 7195-03	O DOAELON
				3.1102.402	7,0002403
05	17.4	-0.041E-03	5,8<11-02	3,015E+02	9,799E+03
64	17.7	-8,9742-03	8.974E-02	3.520E+02	1.059E+04
85	18.0	-9.12AE-03	0.120F-02	3.425F+02	1.138F+04
11	48.4	-9 2818-01	9 3816-03		
	10.3		7.203E-02	3,3302402	1.2102404
67	10,6	=9.438E=03	9,438E-02	3,2352+02	1, 297E+ 04
68	18.8	-9.594E-03	9.594E-02	3.140E+02	1.376E+04
40	101	-9 7515-01	0 7615-02	1 0/85+03	1 1555.00
	1701	-0.0010.03	7.7316402	3.0432702	1,4332404
70	19,4		9,908E=02	2,949E+02	1,535E+04
71	19.7	-1.0075-02	1.007E-01	2.854E+Ø2	1.614E+04
72	20 0	-1 0225-02	1 0228-01	2 7595+02	1 4035484
					1. 3336-04
13	20,2	-1.030E-02	1,0305-01	2,0042+02	1.//22+04
74	20,5	-1.054E-02	1.054E-01	2,569E+02	1,852E+04
75	20.8	-1,070E-02	1.070E=01	2.474E+Ø2	1.931E+Ø4
74	31 1	-1 9845-93	1 0845-01	2 1705+02	3 010E+04
10	E1.1	-1.0000-02	1.0005-01	2,3/72702	2.0102404
77	21.4	-1.102E-02	1,102E=01	2,283E+02	2,090E+04
78	21.7	-1.119E-02	1.1192-01	2.188E+02	2.169E+04
79	21.0	-1,135F-02	1.135F-01	2.0935402	2. 2485+04
		-1 1518-03	1 1515-01	1 0085.00	3 7376.04
99	66,6	-1,1516-02	1.1315-01	1.4405405	C. 36/2404
81	22,5	=1,167E=02	1.107E=01	1,903E+02	2,407E+04
82	22.8	=1.184€=02	1.184E=01	1.808E+02	2.486E+Ø4
AT	21 1	-1 2005-02	1 2005-01	1 7135-02	3 6455404
03	23.1			1 (1 9 7 . 2 5	
84	23,3	-1.21/E-02	1,21/E=01	1.01/2+02	2.0445+04
85	23.6	=1.233E=02	1,233E=01	1.522E+02	2.724E+04
86	23.9	-1.250F-02	1.250F+01	1.4275+02	2.803F+04
87		-1 2478-43	1 2478-01	1 1125-03	2 8825+04
0/	64.6			1.3325402	E O O E T B 4
88	24,5	=1,284E=02	1.284E=01	1.2372+02	2,961E+04
89	24.7	-1 . 300E-02	1 . 300E-01	1 . 142E+02	3.041E+04
98	25.0	=1.317F=02	1.317#=01	1.047F+02	3.120F+04
04		-1 3345-03	1 1145-01	0 51/16+01	1 1005.04
71	C2+ 3				
4 S	25.6	+1,351E=02	1.3216-01	0,3032+01	3,278E+04
93	25.9	■1,368E=02	1,368E=01	7.611E+01	3.358E+04
94	26.2	+1.385F+02	1.386F=01	6.660F+01	3.437F+04
ÓE		-1 //015-01	1 //016_01	5 7085.01	7 8168104
77	KO • N		1 40 35-01	3.100LT01	3,3102+04
76	26,7	-1,4Z0E-02	1 . 420 2-01	4 . 757E+01	3,595E+04
97	27.0	=1.437E=02	1.437E-01	3.806E+01	3.675E+04
QA	27 1	-1.4558-02	1 4585-01	2.8545401	3.7548×04
00			4 // 7 7 8 - 4 4	1 007E+01	
77	¢/,0	-1.4/25-02	1.4/22-01	1,4035401	3.0335+64
100	27.8	=1 . 490E=02	1,490E-81	9 . 512E+00	3,913E+04
101	38.1	-1.507F-02	1 5075-01	-1,217F-A1	1.002ET04

CRCP-7 TESTING EFFECT OF EXTERNAL LOAD

PROB C-2

EXTERNAL LOAD = 18000.0 LB.

44 # # STEEL PROPERTIES **#** # * ¢. **** *** TYPE OF LONGITUDINAL REINFORCEMENT IS DEFORMED BARS PERCENT REINFORCEMENT = 1.200E+00 BAR DIAMETER = 1.000E+00YIELD STRESS $= 6 \cdot 000E + 04$ ELASTIC MODULUS = 2.900E+07 THERMAL COEFFICIENT = 5.000E-06 *** # 24 CONCRETE PROPERTIES # 8 8 # **** SLAB THICKNESS = 1.200E+01 THERMAL COEFFICIENT = 5.000E-06TOTAL SHRINKAGE = 4.000E - 04UNIT WEIGHT CONCRETE= 1.500E+02 COMPRESSIVE STRENGTH= 5.000E+03 TENSILE STRENGTH DATA **** NO TENSILE STRENGTH DATA IS INPUT BY USEP THE FOLLOWING AGE-TENSILE STRENGTH RELATIONSHIP IS USED WHICH IS BASED ON THE RECOMMENDATION GIVEN BY U.S. BUREAU OF RECLAMATION AGE, TENSILE (DAYS) STRENGTH 0.0 0.0 1.0 157.9 3.0 322.0 5.0 398+5 440.6 7.0 14.0 506.2 21.0 540.2 28.0 555+6

*********** 8 ø SLAB-RASE FRICTION CHARACTERISTICS # **#** 4 F-Y RELATIONSHIP ø ð ******* TYPE OF FRICTION CURVE IS A STRAIGHT LINE MAXIMUM FRICTION FORCE= 1.0000 MOVEMENT AT SLIDING z -.1000 ****** ** 8 ø TEMPERATURE DATA # ø 4 æ ***** CURING TEMPERATURE= 75.0 MINIMUM DROP IN DAY TEMPERATURE TEMPERATURE 1 65.0 10.0 2 65.0 10.0 3 65.0 10.0 4 65.0 10.0 5 65.0 10.0 65.0 6 10.0 7 65.0 10.0 8 65.0 10.0 9 65.0 10.0 10 65.0 10.0 11 65.0 10.0 12 65.0 10.0 13 65.0 10.0 14 65.0 10.0 15 65.0 10.0 65.0 16 10.0 55.0 17 20.0 55.0 18 20.0 19 55.0 20.0 55.0 20 20.0 55.0 21 20.0 22 55.0 20.0 23 55.0 20.0 24 55.0 20.0 25 55.0 20.0 55.0 20.0 26 20.0 27 55+0 55.0 20.0 28

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MINIMUM TEMPERATURE EXPECTED AFTER CONCRETE GAINS FULL STRENGTH = 30.0 DEGREES FAHMENHEIT DAYS BEFORE REACHING MIN. TEMP. = 90.0 DAYS *** 4 EXTERNAL LOAD # 4 \$ ð *** ****** WHEEL LOAD (LBS) = 1.800E+04WHEEL BASE RADIUS (IN) = 6.500E+00 SUBGRADE MODULUS (PSI) = 1.500E+02 CONCRETE MODULUS (PSI) = 4.287E+06 LOAD APPLIED AT = 7 TH DAY CALC.LOAD STRESS (PSI) = 1.760E+02*** # ITERATION AND TOLERANCE CONTROL # 4 ø *** ***

MAXIMUM ALLOWABLE NUMBER OF ITERATIONS= 30 RELATIVE CLOSURE TOLERANCE= 1.0 PERCENT CRCP-2 TESTING EFFECT OF EXTERNAL LOAD

PROB C-2

EXTERNAL LOAD = 18000.0 LB.

						MAX.	LMUM
TIME	TEMP	DRYING	TENSILE	CRACK	CRACK	CONCRETE	STRESS IN
(DAYS)	DROP	SHRINKAGE	STRGTH	SPACING	WIDTH	STRESS	THE STEEL
•50	10.0	1.814E-06	85•7	4800+0	2.019E-03	6.065E+01	6.460E+03
i•50	10+0	5+394E-06	206+0	4800+0	3+121E-03	1.075E+02	1+032E+04
2+50	10+0	8.910E-06	287•3	4800+0	4.070E-03	1+422E+02	1.317E+04
3+50	10•0	1.2365-05	342+9	4800+0	4.962E-03	1.709E+02	1+553E+04
4+50	10.0	1+576E-05	381+0	4800.0	5+8158-03	1.954E+02	1.753E+04
5•50	10+0	1+909E-05	409+6	4800•0	6+663E=03	2.177E+02	1.935E+04
6+50	10+0	2+237E-05	430+6	4800•0	7-499E-03	2.377E+02	2.099E+04
7.50	10.0	2.559E-05	445+8	4800.0	8.319E-03	4.318E+02	2.2462+04
8.50	10.0	2.876E-05	456.0	4800.0	9.114E-03	4.478E+02	2.376E+04
9.50	10.0	3.187E-05	465.9	2400.0	8.970E-03	4.574E+02	2.463E+04
10.50	10.0	3.493E-05	475•4	1200.0	9.261E-03	4.607E+02	2.489E+04
11.50	10.0	3.794E-05	484+6	1200.0	1.001E-02	4.750E+02	2.606E+04
12.50	10.0	4.090E-05	493•4	600+0	9+280E-03	4+666E+02	2+521E+04
13+50	10.0	4+382E-05	502+0	600+0	9.910E-03	4.791E+02	2+622E+04
14.50	10.0	4.668E-05	508.8	600.0	1.053E-02	4.907E+02	2.715E+04
15.50	10.0	4.951E-05	513.9	600.0	1.113E-02	5.013E+02	2.801E+04
16.33	10.0	5.182E-05	518.1	600.0	1.163E-02	5.102E+02	2.873E+04
16+34	10.6	5+184E-05	518•1	300.0	9.457E-03	4.771E+02	2.576E+04
16.38	14.6	5.195E-05	518.3	150.0	8.630E-03	4.636E+02	2.454E+04
16.50	20.0	5+228E-05	518+9	150.0	1+133E-02	5+058E+02	2+835E+04
17.50	20.0	5.501E-05	523+8	150.0	1.165E-02	5+121E+02	2.882E+04
18.50	20.0	5.771E-05	528.6	150.0	1.1965-02	5.183E+02	2.928E+04
19.50	20.0	6.035E-05	533.3	150.0	1.226E-02	5.244E+02	2.974E+04
20.50	20.0	6.296E-05	538+0	150.0	1.257E-02	5.305E+02	3.019E+04
21.50	20.0	6.553E-05	541.4	75.0	7.938E-03	4.587E+02	2.362E+04
22.50	20.0	6.806E-05	543+6	75.0	8.097E-03	4+655E+05	2.385E+04
23.50	20.0	7.055E-05	545+8	75.0	R.254E-03	4.657E+02	2.409E+04
24.50	20.0	7.300E-05	548.0	75.0	8.410E-03	4.691E+02	2+431E+04
25+50	20.0	7+542E-05	550+2	75.0	8-563E-03	4.725E+02	2+454E+04
26+50	20.0	7.780E-05	552+4	75+0	8.715E-03	4.758E+02	2+476E+04
27.50	20.0	8.0156-05	554+5	75+0	8.865E-03	4.791E+02	Z.498E+04

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AT THE END OF THE ANALYSIS PERIOD

CRACK	SPACIN	G = 2.00)2E+00 FFFT		
CRACK	WIDTH	= 1.39	3E-02 INCHES		
MAX CO	DNCRETE	STRESS= 5.82	23E+02 PS1		
MAX SI	FEEL ST	RESS = 2.34	5E+04 PSI+		
CONC.1	ENS.ST	RENGTH = 5.78	39E+02 PSI		
STA-	DIS-	CONCRETE	FRICTION	CONCRETE	STEEL
TION	TANCE	MOVEMENT	FORCE	STRESS	STRESS
		_			
1	0.0	0.	0.	4.062E+02	-1.0401+04
2	•1	-6.427E-05	6.427E-04	4 • 022E + 02	-1.006L+04
3	•2	-1.287E-04	1.287E-03	3.981E+02	-9.723L+0
4	• •	-1.931E-04	1.931E-03	3+941E+02	-9.385L+0
5	•5	-2.577E-04	2.577E-03	3.900E+02	-9.0461+0
6	• 6	-3.225E-04	3.225E-03	3+859E+02	-8,708L+0.
1	• /	=3.873E=04	3.873E-03	3+819E+02	-8,3692+0
8	.8	-4.522E-04	4.522E-03	3.778E+02	-8,0312+0
	1.0	-5+1/2E-04	5.172E-03	3+737E+02	-1.6925+03
10	1.1	-5.8242-04	5.824E-03	3.697E+02	-/-JJ4E+0.
11	1.2	-0.4/02-04	6.4/0E=03	3.6501+02	=/.015E+U.
12	1.3	-7.130E-04	7.130E-03	3+616E+02	-6.67/E+0
13	1.4	-/./85E-04	7.7852-03	3+5/5E+02	=0.338E+0.
14	1.6	-8+440E-04	8.440E-03	3+534E+02	-6.000L+0.
15	1.7	-9.09/E-04	9.09/E-03	3+494E+02	-5.0615-0
10	1.8	-9+/33E-04	90/57E-03	3+4532+02	-5.323C+0.
17	1.9	-1.041E-03	1.041E-02	3+412E+02	-4.9842+0
18	2.0	-1.10/E-03	1.10/E-02	3+3/2E+02	
19	2.2	-1.1/4E-03	1.1/4E-02	3+3312+02	-4.30/E+0.
20	2.3	-1.24UE-03	1.24VE-02	3+2712+02	
21	2.4	-1.300E-03	1.300E-02	3.250E+02	-3.030E+0
22	2.5	-1+3/3E-03	1+373E-02	3+209E+02	-3.2925*0.
23	2.0	-1.439E-03	1.4376-02	3.13854.02	-2 415F+0
24	2.0	-1-5000-03	1.5735-02	3.0875402	-2 276FtA
25	2.17	-1.6395#03	1.4295-02	3.0475+02	-1 9385+0
20	2.1	-1.039E-03	1.7065-02	3+0412+02	-1.5091+0
29	3.2	-1.7735-03	1.7745-62	2.966F+02	-1.2612+0
20	3.4	-1.841F=03	1.9415-02	2.9255+02	-9.222£+02
30	3.5	-1.9086-03	1.9085-02	2.884F+02	-5.837E+02
31	3.6	-1.975F-03	1.9755-02	2.844F+02	-2.4521+02
32	3.7	-2-043F-03	2.043E=02	2.803E+02	9.334E+01
33	3.8	-2.111E-03	2.111F=02	2.762E+02	4.318L+0
34	4.0	-2.178E-03	2.178E-02	2.722E+02	7.704L+0
35	4.1	-2.246E-03	2.246E-02	2.681E+02	1.109±+0
36	4.2	-2.314E-03	2.314E-02	2+641E+02	1.447E+0
37	4.3	-2.382E-03	2.382E-02	2.600E+02	1.786E+0
38	4.4	-2.450E-03	2.450E-02	2+559E+02	2.1246+0
39	4.6	-2.519E-03	2.519E-02	2•519E+02	2.463E+0:
40	4.7	-2.587E-03	2.587E-02	2.478E+02	2.801E+0
41	4.8	-2.656E-03	2.656E-02	2.437E+02	3.1402+0
42	4.9	-2.724E-03	2.724E-02	2.397E+02	3.4782+0
43	5.0	-2.793E-03	2.793E-02	2.356E+02	3.817L+0
44	5.2	-2.862E-03	2.862E-02	2•316E+n2	4.1551+03
45	5.3	-2.931E-03	2.931E-02	2.275E+02	4.494L+03
46	5.4	-3.000E-03	3•000E-02	2+234E+02	4.8326+0
47	5.5	-3.069E-03	3.069E-02	2.194E+02	5.1714+03
48	5.6	-3.138E-03	3.138E-02	2+153E+02	5.5092+03
49	5.8	-3.208E-03	3.208E-02	2.112E+02	5.848L+0
Б Λ	E Q	-3.2776-03	3.2775-02	2.072F+02	6.186 2+ 03

51	6.0	-3.347E-03	3.347E-02	2•031E+02	6.525E+03
52	6.1	-3.416E-03	3.416E-02	1+991E+02	6-864E+03
53	6.2	-3.486E-03	3.486F-02	1.950E+02	7.2024+03
54	6.4	-3.556F-03	3-556F-02	1.909F+02	7.5416+03
55	6.5	-3.626E-03	3.626F-02	1.869E+02	7.8795+03
56	6.6	-7.6965-07	3.6965-02	1.0285402	9 31 8E+A3
57	6.7	-3.7665-03	3.7475-02	1.7875440	0.210-103
EQ	۰. ۲	-3 9375-03	3.1012-02	1.7072+02	0.00000000
50	7.0		3.03/2-02	1 • / 4 / E + 02	8.8952-03
37	7.0	-3.90/E-03	3.90/E-02	1.706E+02	9.233E-03
00	<u>/ • 1</u>	-3.9/8E-03	3.978E-02	1+666E+02	9.572L+03
01	1.2	-4.0496-03	4.049E-02	1.625E+02	9.910E+03
50	1.3	-4.119E-03	4.119E-02	1.584E+02	1.0254+04
63	7.4	-4.190E-03	4.190E-02	1•544E+02	1.059E+04
64	7.6	-4.261E-03	4.2618-02	1•503E+02	1.093E+04
65	7.7	-4.332E-03	4.332E-02	1.462E+02	1.126±+04
66	7.8	-4.404E-03	4.404E-02	1•422E+02	1.160±+04
67	7.9	-4.475E-03	4.475E-02	1.381E+02	1.194±+04
68	8.0	-4.546E-03	4.546E-02	1.341E+n2	1.228E+04
69	8.2	-4.618E-03	4.618E-02	1.300E+02	1.262E+04
70	8.3	-4.690E-03	4.690E-02	1+259E+02	1-296E+04
71	8.4	-4.761E-03	4.761F-02	1.219E+02	1.330E+04
72	8.5	-4.833E-03	4-833F-02	1.178F+02	1.3634+04
73	8.6	-4.905F-03	4-905F-02	1.137E+02	1.3971+04
74	8. Ř	-4.977E-03	4.977E-02	1.0975+02	1 4316+04
75	8.9	-5.0495-03	5.0495-02	1.0565+02	1 4454+04
76	0.0	-5.1225-03	5 1325-02	1.0165.02	1 4005+04
77	7 •0	-5.1945-03	5.1045-02		1 6776104
70	7 • 1	-5-1946-03	5+1940-02	9 7 5 0 E + 01	
70	7. 2	-5.20/2-03	5+20/2-02	9•3•4E*n1	1.000-104
17 00	7,4	-5-5376-03	5.3375-02	0.9372+01	
00	7.5	-3.412E-03	5+412t=02	0.5312-01	1.0346+04
01	9.0	-3.4030-03	5.4071-02	0+1C0C+01	1.0005-04
02	9.1	-2.2201-03	5+55PE=02	7+719E+01	1.7020+04
83	9.8	-5+031E-03	5+631E-02	7.312E+01	1.736-04
84	10.0	-5.704E-03	5./04E-02	6+900E+01	1.7702+04
85	10.1	-5.///E-03	5.77/E-02	6+500F+01	1.8034+04
86	10.2	-5•851E≠03	5.851E-02	6+094E+01	1.837E+04
87	10.3	-5.924E-03	5.924E-02	5+687E+01	1.8716+04
88	10.5	-5•998E-03	5.998E-02	5+281E+01	1.9056+04
89	10.6	-6.072E-03	6.072E-02	4+875E+01	1.9395+04
90	10.7	-6.145E-03	6.145E-02	4•4692+01	1.973L+04
91	10.8	-6.219E-03	6.219E-02	4•062E+01	2.007±+04
92	10.9	-6.293E-03	6.293E-02	3.656E+01	2.040E+04
93	11.1	-6.368E-03	6.368E-02	3.250E+01	2.074±+04
94	11.2	-6.442E-03	6-4425-02	2•844E+01	2.1086+04
95	11.3	-6.516E-03	6.516E-02	2+437E+01	2.142±+04
96	11.4	-6•591E-03	6.591E-02	2.031E+01	2.176E+04
97	11.5	-6.665E-03	6+665E-02	1+625E+01	2.210±+04
98	11.7	-6.740E-03	6.740E-02	1•219E+01	2.243E+04
99	11.8	-6.815E-03	6.815E-02	8+125E+00	2.277L+04
100	11.9	-6.890E-03	6.890F-02	4.062E+00	2.311E+04
101	12.0	-6.965E-03	6.965F-02	0.	2.345E+04

APPENDIX 3

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INPUT VARIABLES FOR SOLUTIONS IN CHAPTER 2 AND CHAPTER 3

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CRCP-2 TESTING EXTERNAL LOAD VS. STL STRESS, CK SPCING, CK WIDTH EXTERNAL LOAD = 0.0 LR. 1 A 1 1.0 0.5 60000.02900000.6 .000005 5.00 10. .0004 .000005 159.7 6000.0 1. 1 90. 75. 28 40. 65. 65. 65. 50. 5**0**. 65. 65. 65. 65. 65. 65. 65. 50. 50. 50. 51. 50. 50. 50. 50. 0.0n 5ō, 50. 50. 50. 50. 50. Sē. 50. 6.5 28.0 0.0 150.00 ۱. 1 1.0 -.1 EXTERNAL LOAD = 50.0 18. 2A 0.5 60000.029000000.6 1 1.0 .000005 0.0 .0004 .000005 150.5 10. 6000.0 1. 1 40. 75. 28 90. 65. 65. 50. 50. 65. 6<u>5</u>. 59. 50. 50. 50. 65. 65. 65. 65. 65. 65. 50. 5ñ. 50. SÚ. 50. 50. 5ñ. 50. 50. 50. 28.0 0.0 6.5 150.00 50.0 1. 1 1.0 -.1 3A EXTERNAL LOAD = 150. 18. 60000.0290,0000.0 1 1.0 0.5 .0000r5 0.00 .000005 .0004 10. 150.0 6000.0 1. 90. 40. 28 75. 65. 65. 50. 50. 54. 50. 50. 50. 65. 65. 65. 65. 65. 65. 65. 65. 50. 57. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 28.0 6.5 155. 0.0 1. 1 1.0 -.1 EXTERNAL LOAD = 200.0 LB. **4**A 60000-02900000. .000005 1 1.0 0.5 ñ.ôo 1. 10. .000005 -0004 150.0 6000.0 1 90. 28 75. 40. 65. 65. 65. 65. 65. 65. 65. 65. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 5ñ. 50. 50. 65. 65. 65. 50. 50. 50. 50. 50. 200. 28.0 0.0 6.5 150.00 1. 1 1.0 -.1

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EXTERNAL LOAD = 0.0 LR. 1B 0.5 0.6 60000.02900000.ñ .0000ñ5 10. .000005 .0004 150.n 6000.ñ 1. 1 A.00] 50. 50 50. 50. 50. 50. 50. 50. 50. 5<u>0</u> 50. 50. 0.00 1. 1 1.0 -.1 EXTERNAL LOAD = 50.0 18. 28 0.5 0.6 60000.02900000.8 1 .000005 6000.0 1. · . ño 1ō. .000005 .0004 150.n 1 40. 28 90 75. 50. 50. 50. 50. 50. 50. 28.0 1. 1 1.0 -.1 3B EXTERNAL LOAD = IOD.0 LB. .ñ000ñ5 6000.n 1. 1 0.5 0.6 60000.029000000.ñ 0.00 150 · ñ .000005 .0004 10. 1 75. 28 40. 90. 50. 50. 50. 50. 50. 50. 100. 28.0 1. 1 1.0 -.1 EXTERNAL LOAD = 150.0 LB. 4B 1 0.5 0.6 60000.02900000.0 •000005 6000.0 1• Ā.Õŋ .000005 •0004 15ປ.ກໍ 10. 1 41. 90. 75. 28 50 · 50 · 50 · 50. 50. 50. 50. 28.0 0.0 ۱. 1 1.0 -.1 EXTERNAL LOAD = 200.0 LB. 58 .ñ000ñ5 600ñ.ñ 1. ñ.ñn 0.5 0.6 60000.029000000.n 1 .0004 15. .000005 150.5 1

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CRCP-2 TESTING EXTERNAL VS. PERCENTAGE STEEL 10 PERCENTAGE STEEL = 5.5 60000-02900000.5 •00000es 0.00 1 0.5 0.6 150.0 10. .000005 .0004 6000.0 1. 1 28 90. 75. 43. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 57. 50. 50. 50. 50. 5ŵ. 50. 50. 50. 50. 50. 50. 28.0 6.5 150.0* 0.00 0.0 1. 1 -.1 1.0 PERCENTAGE STEEL = 0.7 0.7 0.6 60000.02900000.0 2C •000<u>0</u>05 5.00 1 .0004 150.0 6000.0 1. 10. .000005 1 90. 75. 28 40. 50. 50. 57. 50. 50. 50. 50. 50. 50. 6.5 150.00 0.01 28.0 0.0 1. 1 1.0 -.1 ЗC PERCENTAGE STEEL = 0.9 0.6 60000.02900000.0 •000<u>0</u>05 0.9 5.00 1 .000005 150.0 6000.0 1. 10. .0004 1 90. 75. 28 49.
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CRCP-2 TESTING EFFECT OF EXTERNAL LOAD AND SLAB THICKNESS SLAB THICKNESS = 6. TN. 10 60000.029000000.0 0.7 1 •0000005 5.60 0.6 6.0 .000005 •00<u>0</u>4 155.5 5000.0 1. 2 28 70. 90. 30. 65. 65. 65. 65. 65. 65. 55. 55. 55. 55. 55. 55. 150.00 0.02 65. 65. 65. 65. 55. 55. 65. 65. 65, 65, 65, 65, 55. 55. 55. 55. 9000.0 6.5 28. 1. 1 1.0 -.1 SLAB THICKNESS = 8.0 TN. 2D 60000-02900000.5 Ú.6 .000ĝn5 5.00 1 0.7 8.0 .000005 .0004 150.ñ 5000.0 1. 2 39. 90. 70. 28 65. 65. 55. 55. 150.0 65. 65. 65. 65. 65. 5⁵. 55. 55. 55. 65. 65. 65. 65. 65. 65. 65. 65. 65. 55. 55. 55. 55. 55. 55. 28. 9000.0 6.5 0.00 1. 1 -.1 1.0 SLAB THICKNESS = 11.0 IN. ЗD .000075 0.7 60000-029000000.7 1 0.6 5.60 .000005 .0004 1. 10. 150.n 5000.0 30. 90. 7<u>0</u>. 28 65. 65. 65. 65. 65. 65. 55. 55. 55. 55. 55. 55. 150.00 0.00 65. 65. 65. 65. 65. 55. 55. 65. 65. 65. 65. 65. 55. 55. 55. 55. 28. 9000.0 6.5 1. 1 -.1 1.0 SLAB THICKNESS = 12.0 IN. **4**D 0.7 60000:02900000.n ·000075 5.00 1 0.6 .0004 .000005 15**.**.ñ 12. 5000.0 1. 2 76. 36. 28 90. 65, 65, 65, 65, 55, 55, 55, 55, 55 65, 65, 55, 55, 65. 65+ 65. 65. 55. 55. 65. 65. 55. 55. 65. 65. 65. 65. 55. 55. 150.0* 6.5 9000.0 0.08 28. 1. 1 1.0 -.1

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CRCP-2 TESTING TIME OF MIN. TEMP. VS. STL. STRESS, CK. WIDTH, CK. SPCING 1F COLDTM = 28.0 1 0.5 60000-029000000.n .000005 ñ.ñ0 0.6 6000.0 1. .000005 15:0.0 10. .0004 1 28. 75. 28 0.0 0.0 65. 65. 65. 50. 59. 50. 65. 65. 65. 65. 65. 65. 65. 65. 65. 65. 65. 65. 65. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 28.0 0.0 6.5 150.0 1. 1 2.0 -.1 2F COLDTM = 60.060000.029000000.0 .000005 ñ. ñù 1 0.5 0.6 .0004 .000005 15ú.ň 6000.0 1. 10. 1 75. 28 0.0 60. 65. 65. 65. 65. 65. 65. 65. 65. 65. 50. 50. 50. 50. 50. 50. 50. 50. 65. 65. 65. 65. 65. 65. 65. 65. 50. 50. 50. 50. 28.0 150.00 0.0 6.5 ۱. 1 2.0 -.1 3F COLDTM = 90.060000.029000000.0 .000005 0.00 0.6 1 0.5 .0004 .000005 6000.0 1. 10. 150.5 1 75. 28 0.0 90. 65. 65. 65. 05. 50. 50. 50. 50. 150.00 0.0 6.5 28.0 1. 1 2.0 -.1 $COLDTM = 120 \cdot \bar{0}$ 4F 60000.02900000.5 .000005 5.00 1 0.5 0.6 .0004 150.5 .000005 6000.0 1. 1ç. 1 0.0 120. 65. 65. 65. 65. 65. 65. 65. 50. 50. 50. 50. 50. 50. 50. 50. 28 75. 65. 65. 65. 65. 65. 65. 65. 65. 65. 50. 50. 50+ 5č. 28.0 0.0 6.5 150.0 1. 1 2.0 -.1 5F $COLDTM = 150 \cdot 0$ 60000-029000000. .000005 0.6 1 0.5 0.00 .0004 .000005 150.5 6000.0 1. 10. 1 150. 65. 65. 50. 50. 75. 28 0.0 65. 65. 65. 65. 57. 50. 50. 50. 65. 65. 65. 65. 65. 65. 65. 65. 65. 65. 50. 50. 50. 50. 50. 50. 6.5 150.00 28.0 0.0 1. 1 2.0 -.1

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