1982

Further parametric studies on the overloading of highway bridges, August 1980, 110p.; final revised ed., October 1982

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-PA-RD-77-2-1		

4. Title and Subtitle	5. Report Date / 6. Performing Organization Code
FURTHER PARAMETRIC STUDIES ON THE OVERLOADING OF HIGHWAY BRIDGES	5. Report Date: August 1980 6. Performing Organization Code:
7. Author(s): Celal N. Kostem	8. Performing Organization Report No.: Fritz Engineering Laboratory Report No. 434.2
9. Performing Organization Name and Address: Fritz Engineering Laboratory, 13 Lehigh University Bethlehem, Pennsylvania 18015	10. Work Unit No. (TRAIS) 11. Contract or Grant No.: PennDOT Project 77-2
12. Sponsoring Agency Name and Address: Pennsylvania Department of Transportation Harrisburg, Pennsylvania 17120	13. Type of Report and Period Covered: Interim Report 14. Sponsoring Agency Code

15. Supplementary Notes

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

16. Abstract

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The study was designed to quantify the effects of (1) spacing of bridge beams, (2) use of inside versus outside lanes, and (3) bridge deck deterioration on the overload response of the bridge superstructure.

By using Program BOVA (Bridge OVerloading Analysis) the response of the superstructures when subjected to the vehicles is determined. For various load levels the damage that the superstructure will sustain, and the maximum tensile and compressive stresses in the beam and slab concrete, were tabulated.

17. Key Words	18. Distribution Statement
Overloading of Bridges, Bridge Rating, Overload Permit Operations, Beam-Slab Highway Bridges, Deck Deterioration, Parametric Study	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	116	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

COMMONWEALTH OF PENNSYLVANIA

Department of Transportation

Office of Research and Special Studies

Wade L. Gramling - Chief
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Project 77-2: Implementation of Program BOVA

FURTHER PARAMETRIC STUDIES ON THE OVERLOADING OF HIGHWAY BRIDGES

by

Celal N. Kostem

This work was sponsored by the Pennsylvania Department of Transportation and the U. S. Department of Transportation, Federal Highway Administration.

LEHIGH UNIVERSITY

Office of Research

Bethlehem, Pennsylvania

August 1980

Fritz Engineering Laboratory Report No. 434.2

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ABSTRACT

This report presents the results of a parametric study on the overloading response of simple span beam-slab bridges with reinforced concrete deck and prestressed concrete I-beams. Six bridges with span lengths of 40 and 70 feet having 6 and 7 beams were designed in accordance with current specifications. These bridges were subjected to three different overload vehicles. Each bridge was loaded by a vehicle on predefined traffic lanes in order to produce maximum flexural response at the midspan of the bridge superstructure.

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1. INTRODUCTION

1.1 Problem Statement

Most bridges are occasionally loaded beyond the load levels for which they were designed. Since the gross weight of the overloaded vehicles and wheel and axle arrangements can not be predicted during the design phase, the load carrying capacity of bridge superstructures needs to be evaluated, when the new vehicular configurations are known.

A method was developed to predict the inelastic behavior of simple span bridge superstructures with reinforced concrete slab and prestressed concrete I-beams (Refs. 4 and 7). A parametric investigation was conducted using the developed method (Ref. 2). The investigation had 45 case studies. Bridges with three different span lengths were considered (40', 70' and 100'). Five different overload vehicles were used in the analyses. The pilot studies in this completed investigation had indicated that the structural properties of the deck slab may have noticeable effect on the load level which corresponds to the initiation of the deck damage (Refs. 3 and 4). Furthermore, it was noted that additional information is necessary to determine the effects of placement of the vehicle at the inner lane or the outer lane of the bridge (Ref. 3). The research reported herein is aimed at answering the following issues: (a) effects of bridge deck deterioration on the overload carrying capacity of bridges, (b) effects of traverse of the overloaded vehicle on various lanes, and (c) effects of beam spacing on slab damage.

1.2 Simulation Technique

The reported investigation is a computer based analytical research. Presentation of the details of the employed analytical method and comparative studies verifying the accuracy of the method do not belong in this report. Extensive presentation of the methodology can be found in Reference 5 for the beam behavior, in Reference 6 for slab behavior and in Reference 7 for the overall bridge behavior. The only reference that the user of this report should have an access to is Reference 2, "Overloading of Highway Bridges-A Parametric Study." The reported research forms an extension of the previously conducted parametric study.

For better visualization of the results, two specific concepts that deal with the mathematical modeling of the bridge superstructure need to be explained. As shown in Figure 1, the bridge superstructure is divided into a series of beam and slab elements, which is the basis of the finite element method employed in the reported research. Aggregation of the beams results in the simulation of the beams. Similarly, the aggregation of the slab elements will result in the bridge deck. As compared to many other methods, and especially the component-by-component design of the bridge, the employed research considers the full interaction between the slab and the beams. This corresponds to the actual behavior of the superstructure. Thus, the results obtained by this method are far superior to any other method.

Increased overload levels may push the stresses at certain regions of the bridge superstructure into nonlinear portions of the stress-strain relations of the ingredient materials. If the load levels are further increased, then in some regions of the superstructure damage may initiate and then propagate. This damage is in the form of cracking, or crushing, of concrete, and yielding of reinforcement bars or prestressing strands. To monitor the stress levels, and the damage, at various depths of the slab and the beams layering is employed. Figure 2 shows the layering of a part of the bridge. In the conduct of the overload simulation of the bridge structure stresses, strains and damage were continually monitored for every layer of every beam and slab element for every load level. The computer printout for each case study results in an extensive compilation of information on the behavior of the superstructure. In the computer printout form the data is too extensive to be easily deployed by practicing engineers. The key information from each printout has been extracted, and included in this report. This tabulated data is referred to as Overload Directories.

2. PARAMETRIC STUDY

2.1 Bridges

In the design of the experiment the reported research was considered as a continuation of the previously completed parametric investigation on the overloading of prestressed concrete bridges (Ref. 2). The numbering employed in this research reflects this continuation, having bridges numbered 10 through 15. The study considered two span lengths, 40 ft. and 70 ft. The bridges were designed in accordance with the current AASHTO specifications (Ref. 1) and Bridge Design Aids of the Pennsylvania Department of Transportation, BD-201 (Ref. 9). All beams were assumed to have straight strands. Prestress losses were computed according to the formula provided in BD-201 (Ref. 9). Beam concrete was considered to have a compressive cylinder strength of 5,250 psi for bridges 10, 12, and 13 and 5,500 psi for bridges 11, 14 and 15. Prestressing was provided by grade-270 prestressing strands.

A brief description of the bridges can be seen in the following table:

Bridge No.	Span Length (ft)	No. of Beams	Slab Thickness (in)	Beam Spacing
10	40	6	8	7'-6"
11	70	6	8	7'-6"
12	40	8	7½	6'-6"
13	40	7	8	7'-6"
14	70	8	7½	6'-6"
15	70	7	8	7'-6"

Cross sections, plan views of the bridges, and the axis of traverse for the overloaded vehicles are shown in Figures 3-5.

Slab concrete for all bridges without deck damage was taken as 3,500 psi. The reinforcement details for the bridges and concrete covers- for bridges without deck damage- are shown in Figures 6 and 7.

2.2 Overload Vehicles

In the previously completed parametric investigation on the overloading of highway bridges 5 different vehicles were considered (Ref. 5). The results of the completed investigation had indicated that only two of those vehicles could be employed in future investigations, if the interest of the research is aimed at the determination of the overload response of the bridges, rather than development of the data base for overload permit operations. Consequently, this investigation employed the vehicles shown in Figure 9 (Overload Vehicle No. 3) and in Figure 10 (Overload Vehicle No. 4). Both vehicles correspond to the dollies of large vehicular configurations. The loading of the bridge by these dollies was simulated by equivalent area loads as shown in Figures 9 and 10.

In addition to the above vehicles, a new vehicle shown in Fig. 11 was employed for limited case studies. This vehicle corresponds to a configuration that is not uncommon in heavy industry and especially in the construction industry. The specific interest in this vehicle was the determination of damage, if any, that it may cause to the bridge superstructure.

2.3 Loading of Bridges

The previous investigations had indicated that the worst damage to the superstructure would be sustained if the vehicle is placed in such a manner that it will induce the largest bending moments in the bridge slab in the transverse direction. This corresponds to the placement of the load at the midspan of the bridge (Refs. 2, 3 and 4). Initial concern for the adverse loading conditions that may correspond to the shear loading was resolved at the completion of a previous parametric investigation (Ref. 2). Possible adverse effects of the shear loading were determined to be as follows:

1. In bridges more than 45 ft.-50 ft. span range placement of the vehicle near the midspan of the bridge causes cracking at the deck slab. After substantial damage to the deck slab, the damage in the bridge beams starts. This damage is in the form of cracking of the concrete cover of the strands.
2. If the same vehicle is placed to produce maximum shear near the supports the damage mechanism is still similar to the one described above. However, the overload level far exceeds the level for the previously described loading. It can be concluded that during the traverse of a given vehicle, the damage to the bridge superstructure will be worst when the vehicle is near the midspan.
3. For bridges having span lengths 40 ft. or less, the damage due to overload vehicles, if placed for maximum flexural moment configurations, will follow a pattern similar to that described above. However, for certain loading arrangements, if adverse shear near the supports can be generated then the damage initiation and propagation will follow the pattern of: (i) flexural cracking of the deck slab, (ii) extensive spread of the deck cracking,

(iii) interface shear failure between the slab and the beams near the supports, (iv) spread of loss of composite action between the beam and the slab, and cracking of the concrete cover of the prestressing strands of the beams.

The above described damage initiation and spread mechanisms have confirmed the previous assumption regarding the placement of the vehicle near the span as being the worst loading. In the reported research, all loadings have followed this guideline.

2.4 Damage to the Superstructure

Program BOVA, which is used in the conduct of the reported investigation, analyzes the bridge superstructure as a whole. Thus, the redistribution of the stresses and the loads throughout the loading history is continually taken into account. It should be emphasized that because of the analysis technique employed the beams and slab segments are not treated separately, but are investigated as a whole with the capability of isolating one segment at a time for closer inspection. The employed analysis scheme also required the use of finite element discretization and layering of the beams and the slab as indicated in Figs. 1 and 2. The assumption of the plane stress state at each layer of each element introduces some approximations since the state of stress at each layer is taken to be constant throughout the layer. In the actual structure the stresses will be of a continually varying nature rather than having step by step increments (due to the constant stress layers). This approximation can be, and has been, improved by having a large number of elements (see

Fig. 1) for the bridge superstructure. Furthermore, the monitoring of the penetration of material nonlinearity, such as cracking and crushing, can also be more accurately predicted by increasing the number of layers depicted in Fig. 2. To provide an accurate, but reasonable analysis as far as the computational effort is concerned, each bridge was discretized for different loading conditions. Detailed drawings, corresponding to these discretizations, that will be analogous in looks to Fig. 1, are not included in the report.

Both the bridge deck and the beams, regardless of the bridge or the loading condition in question, were divided into a fixed number of equal thickness layers. The bridge deck employed six equal thickness layers to simulate the concrete and four steel layers to simulate the top and bottom reinforcement in longitudinal and transverse directions. For any given load level Program BOVA provided the information about the extent of damage to the slab. Due to the approximation in the layering it is possible to predict the depth of the cracks in the deck to within 1/12 of the slab thickness. For example, if the bridge deck is eight inches thick and if the damage is reported as one layer is cracked, with the specification of top or bottom, then the penetration of the crack is denoted as 8"/6 = 1.33 in. However, in view of the approximation concerned, the actual depth of the crack will be 8"/6 ± 8"/24 (1.67 in. - 1.00 in.). In view of the unpredictability of the state of the actual bridge superstructure, an accuracy as such should be sufficient. Similarly, the beams are divided into ten layers. Thus, the damage to the beam can be predicted to within 1/20 the depth of the beam.

Program BOVA has the capability of analyzing a given bridge for a given loading and load positioning from zero external load, i.e. dead weight only, up to the collapse of the bridge superstructure. Since the collapse of the bridge superstructure is a rather theoretical concept, as far as the issuance of the permit is concerned, analysis with BOVA for each load case was terminated when the damage occurred had reached the "serviceability limits" of the structure. These limits can and should not be considered as the absolute values to be used in the issuance of the permit. It is believed that these values normally correspond to substantial damage, thus if the importance of the bridge or the state of deterioration of the bridge is in question it will be highly advisable that the permit officer take a more conservative approach and not permit the widespread occurrence of the damage. Since these are policy issues, rather then the technical one to which the report addresses itself, the overload directories in the report should be used by bridge engineers and permit officers with maximum possible engineering judgment and common sense.

The analysis for each case study was terminated with the occurrence of any one of the damages listed below:

1. One layer of the beam concrete crushed (1/10 the depth of the beam).
2. One layer of the beam concrete cracked (1/10 the depth of the beam).
3. Stresses in the strands reached "yield point."

Inspection of the case studies indicated that these limits are rather conservative as far as the overall bridge superstructure is concerned. Prior to the attainment of any one of the damages to the beam listed above, the deck slab undergoes substantial deformations and damage. Therefore, it can be said that, at least as far as the reported parametric study indicates, the performance and serviceability of the bridge superstructure are governed by the strength of the slab.

If "serviceability limits" had been imposed on the damage to the slab, as had been done for the beams, the load levels to which the analysis was conducted would have been substantially lower. It should also be realized that Program BOVA has the capability of accepting various serviceability limits to terminate the analysis. However, for the reported study the slab serviceability criteria were not activated. Consequently, in the overload directories included in the report some of the high load levels should not be permitted since damage to the slab will be substantial, even though the beams may not have been distressed.

2.5 Deck Deterioration

One of the main concerns in the reported research has been the determination of the deck deterioration on the overload performance of highway bridges. It has been widely accepted that due to various factors deterioration of the bridge deck is much faster than that of the beams. Furthermore, in general the quality of beam concrete tends to be much better than the specified f_c', whereas the quality of the slab concrete tends to be comparable, with some exceptions, to the f_c' specified. This report will not attempt to explain the sources of the faster deck deterioration. In the parametric study, deck deteriorations have been preset to certain amounts in the determination of the overload response of deteriorated bridges. In actuality, it can be assumed that the deck deterioration is not uniform throughout the deck. Rather then taking the variation of the deterioration as an additional parameter, it was assumed that the deterioration is constant for the full deck. This assumption does not necessarily lead to overly conservative results. Weakened parts of the deck tend to loose their stiffness, thus "drawing" less load; whereas, the undeteriorated parts of the bridge tend to maintain their stiffness, thus resulting in carrying a larger share of the loads. Consequently, even though at this time a numerical proof is not available, the assumptions that have been made regarding the uniformity of the deck deterioration seems to be a reasonable one. Thus, the obtained results should be applicable to the bridges with localized deterioration. It should, however, be noted that if the deterioration of the bridge is in the form of a few spalled locations on the deck, then the results for the deteriorated decks presented in this report will be conservative. The question of "How much must the deterioration spread, in order to assume that the deck has deteriorated?" can best be answered by the bridge engineer, based on past experience with the bridges.

In the research three types of "deterioration" were considered, and the overload analyses were carried out for these three, as well as for the undamaged bridge to provide the "control bridge." Bridges with the suffix of "A," e.g. Bridge-10A, correspond to the bridge without any deterioration. This is the control bridge.

If the bridge number has the suffix of "B," e.g. Bridge-10B, this bridge is deteriorated in such a manner that all the concrete cover above the top slab reinforcement is "lost." For example, in Bridge-10A the total deck slab thickness is 8 inches, however, for Bridge-10B the thickness is 6 inches; the reduction in the thickness occurs at the top of the slab only.

Bridge numbers with the suffix "C," e.g. Bridge-10C, correspond to the assumptions that the (i) slab thickness is the same as it was designed, but (ii) concrete cylinder strength is reduced by 500 psi. Since the original slab was designed for 3,500 psi concrete, this corresponds to a 14% reduction in concrete strength.

Bridge numbers with suffix "D," e.g. Bridge-10D, correspond to the following assumptions: (i) as in type-B deterioration, the top concrete cover is removed, <u>and</u> (ii) as in type-C deterioration, the concrete strength is reduced by 500 psi.

It should be noted that only the bridges with a suffix-A were designed. Types -B, -C, and -D were obtained by making the appropriate changes in the dimensions and/or properties of the bridge deck slab of Type-A. Types -B, -C, and -D do not correspond to the redesign of the slab with reduced concrete strength or reduced thickness.

2.6 Keys to the Parametric Study

The parametric study reported herein is considered as a continuation of the previously completed investigation (Ref. 2). Thus, the case studies corresponding to the placement of a given vehicle on a given bridge start with Case Study No. 46. Twenty-eight case studies have been conducted and reported, as can be seen in the overload directories included in this report. Even though the user can extract the pattern in the case studies, the following key would be of assistance:

Effects of Slab Deterioration:

Comparison of case studies 46, 47, 48 and 49 (Vehicle 3, Bridges 10A, 10B, 10C, 10D)

Comparison of case studies 50, 51, 52 and 53 (Vehicle 3, Bridges 11A, 11B, 11C, 11D)

Comparison of case studies 54, 55, 56 and 57 (Vehicle 5, Bridges 10A, 10B, 10C, 10D)

Comparison of case studies 58, 59, 60 and 61 (Vehicle 5, Bridges 11A, 11B, 11C, 11D)

Comparison of case studies 62 and 63 (Vehicle 5, Bridges 12A, 12C)

Comparison of case studies 64 and 65 (Vehicle 5, Bridges 13A, 13C)

Comparison of case studies 66 and 67 (Vehicle 5, Bridges 14A, 14C)

Comparison of case studies 68 and 69 (Vehicle 5, Bridges 15A, 15C)

Comparison of case studies 70, 71, 72 and 73 (Vehicle 6, Bridges 10A, 10B, 10C, 10D)

Effects of Beam Spacing (Vehicle 5 type loading)

Comparison of case studies 62 and 63 (Bridges 12A, 12C) vs 64 and 65 (Bridges 13A, 13C)

Comparison of case studies 66 and 67 (Bridges 14A, 14C) vs 68 and 69 (Bridges 15A, 15C)

Effects of the Placement of the Vehicle, Inner vs Outer Lane (Vehicle 5 type loading)

Comparison of case studies 54 and 56 (Bridges 10A, 10C) vs 64 and 65 (Bridges 13A, 13C)

Comparison of case studies 58 and 60 (Bridges 11A, 11C) vs 68 and 69 (Bridges 15A, 15C)

Effects of Span Length of the Bridge

Comparison of case studies 46, 47, 48 and 49 (Vehicle 3, Bridges 10A, 10B, 10C, 10D) vs 50, 51, 52, and 53 (Vehicle 3, Bridges 11A, 11B, 11C, 11D)

Comparison of case studies 54, 55, 56 and 57 (Vehicle 5, Bridges 10A, 10B, 10C, 10D) vs 58, 59, 60 and 61 (Vehicle 5, Bridges 11A, 11B, 11C, 11D)

Comparison of case studies 64 and 65 (Vehicle 5, Bridges 13A, 13C) vs 68 and 69 (Vehicle 5, Bridges 15A, 15C)

Comparison of case studies 62 and 63 (Vehicle 5, Bridges 12A, 12C) vs 66 and 67 (Vehicle 5, Bridges 14A, 14C)

3. RESULTS

3.1 General Comments

The parametric study reported herein included 28 basic case studies, resulting in computer printouts of approximately 9 feet high. Reduction of all the data would correspond to an extremely thick report, which would be as intractable to use as the massive computer printouts. This report, therefore, contains only the averaged final results, wherever possible, and a set of Overload Directories. These directories should be considered as a companion set to the previously compiled set (Ref. 2). In Reference 2, "Overloading of Highway Bridges - A Parametric Study," observations and comments were provided. Rather than repeating these observations, which would be approximately 24 report pages long, it is sufficient to state that all the observations that were made for the previous parametric investigation are also made for the parametric investigation reported herein.

This report also contains a set of Overload Directories. The use of these directories was explained in detail in Reference 2, therefore it will not be repeated.

The results that are pertinent to the goals of the research project will be presented. Specifically, the goals are determining (1) the effects of deck deterioration on the overloading response of bridge superstructures, (2) the effects of load placement on the overload response, and (3) the effects of beam spacing on the overload response.

3.2 Threshold Load Levels

The Overload Directories given in Tables 1 through 28 are not conducive to drawing conclusions. The key results from the Overload Directories have been summarized in Table 29. For each case study (vehicle and bridge arrangement) five different gross vehicular weights are given. These values correspond to the overload level at which no damage was observed (GVW_1), overload levels at which the cracks in the deck slab were about 1/6 the thickness of the slab - in the case of deteriorated slabs this crack depth corresponds to about 1/5 the reduced slab thickness, or about 1/6 the undamaged slab - (GVW_2), overload levels at which the slab crack is two times the crack depth corresponding to that for GVW_2 (GVW_3), overload levels at which the slab crack depths are about three times the crack depths of those at load level GVW_2 (GVW_4), and overload levels at which the cracks at beams have penetrated to the bottom-most prestressing strands (GVW_5). Table 29 could be nondimensionalized by dividing each line by the load level at which no damage to the bridge superstructure was observed. Table 30 gives the nondimensionalized values. "No-damage load percentage" is taken as 100%. The statistical averages are shown at the bottom of Table 30. If the load level, at which no damage was observed, is increased by 21%, than the slab will develop cracks about 1/6 the depth of the slab deep. However, if the load level is increased, again as compared to the no-damage load, by 76%, than the cracks will be twice the depth of the previous observation. The statistical averages and standard deviation of various columns of Table 30 indicate that as the extent of the damage is more pronounced, than its prediction becomes less reliable. The increase in the standard deviations from 7% to 146% attests to this observation. The standard deviation for the load percentage for P_1 is 6% of the mean; however, the standard deviation for beam cracking is 30% of the mean.

It can be concluded that if load levels where no damage was observed (near limit of the working stress design computations) are increased by about 20% then the cracks will penetrate half the distance between the outer surface of the slab and half the depth of the concrete cover. This guideline has about 5% error.

If the load levels where no damage was observed (near limit of the working stress design computations) are increased by about 75%, the cracks in the deck slab will penetrate to the reinforcement. This guideline has about 10% error.

Spread of the cracking can be observed by the nondimensionalization that can be obtained assuming the load levels at which the cracks have penetrated about 1/6 the depth of the slab are 100% (Table 31). If this load is increased about 46%, then the cracks will double in depth. This rule contains about 5% error. In order to increase the crack depths from 1/6 to half the slab depth the load needs to be increased about 130%. This rule contains about 15% error.

3.3 Effects of Deterioration

3.3.1 Loss of Top Concrete Cover

Table 32 was developed by using Table 29, which indicates the threshold damages. This table shows the reduction of the limiting threshold load levels for the cases at which the top concrete cover of the deck slab reinforcement is lost. This Table provides the effects of Type-B deck deterioration. No damage load levels for bridges with Type-B deterioration is 21% less than as built bridges. Thus, if no damage is permitted in the deteriorated bridge that has lost the concrete cover, the loads that can be allowed are about 79% of the loads that would have been permitted for intact bridges.

Two of the extremely interesting aspects of the Type-B deck deterioration that correspond to beam cracking and cracking of the slab through half the slab thickness can be seen in Table 32. As far as extensive deck damage due to the overload is concerned, the slab with deterioration is more tolerant than the slab without any damage (note the negative sign in % changes in loads). This is due to the fact that if the deck slab is more flexible because of the loss of the concrete cover, it draws less transverse moments, thus they are less prone to damage. Similar phenomenon could be observed in the case of beam cracking. Beams of bridges with Type-B deck deterioration will crack at 90% of the load level at which the undeteriorated bridge beams were cracking. This shows that bridge beams are fairly insensitive, as far as their strength is concerned, to the deterioration in the bridge deck.

3.3.2 Reduction in Slab Concrete Strength

The results of the reduction in slab concrete is illustrated in the nondimensionalized Table 33. At the bottom of the table the statistical averages and standard deviations are shown. The statistical results indicate that the results obtained do not show a large scatter, thus the conclusions can be drawn with little errors.

A 14% reduction in the cylinder strength of deck concrete lowers the load levels at which various forms of slab damages would have initiated and spread by about 11-12%. Furthermore, this reduces the level of damage to the beams by only 2%.

3.3.3 Reduction in Slab Concrete Strength and Loss of Top Concrete Cover

The effects of Type-D deterioration, i.e. reduction of deck slab concrete strength by 14% and the loss of the top cover of slab concrete, are shown in Table 34. On the average, this type of deterioration reduces the threshold load level for slab damage initiation by about 29%. However, the loss of strength, as far as the possible damage to the beam, is about 12%.

3.3.4 Effects of Beam Spacing

The effects of beam spacing on the change of the damage threshold load levels can be seen in Table 35. 15% change in the beam spacing does not have a discernible effect on the load levels at which the damage to the deck starts and propagates. In general, in a bridge with widely spaced beams, as compared to a slightly closer spaced situation, the deck damage starts a few percent prematurely. However, this number is so small that it can be ignored. The only difference comes in the beam damage initiation. In the cases where beam spacing is larger, the beam damage can initiate about 10% prematurely. The reason behind the consistency of the slab damage initiation for differently spaced beams has been due to the use of different percentages of reinforcement steel in the slab. Thus, it can be concluded that if the deck slab is properly designed, there will not be major changes in the load levels that can induce damage to the deck slab, provided that the variation in beam spacing is within practical limits.

3.3.5 Effects of the Placement of the Overloaded Vehicle

The effects of the placement of the overloaded vehicle at the center of the bridge versus the exterior lane can be seen in Table 36. The results of this table are disturbing as far as the overload permit operations are concerned. As a prudent safety measure, as far as the traffic operations are concerned, it is recommended that overloaded vehicles traverse the bridges on slow lanes, i.e. outside lanes. Table 36 shows that the damage to the bridge deck can happen prematurely, by about 6%, if the load traverses the outside lane, as opposed to inside lane. This may be a small percentage to be concerned with so long as the bridge engineers are cognizant of this effect.

In the case of initiation of the damage in the beams, outside lanes are about 15% less strong than the inside lanes. Thus, for very heavy loads, at which the limited recoverable damage to the bridge deck is expected, the use of inside lanes is highly recommended.

4. CONCLUSIONS

The research reported herein could not be separated from the previously completed research on the overloading of similar types of bridges (Ref. 2). To prevent misunderstanding, the conclusions that will be presented herein will be based only on those that are unique to this research. The observations that are common for both this research and the previously completed ones will be presented in the final report of this project (Ref.3). The following observations and conclusions can be drawn from the reported research:

1. If the overload level is such that it does not cause any damage to the bridge, but if increased by a small amount may start some damage, but if increased by about 20% deck slab concrete will crack. The depth of these cracks will be about half the distance between the concrete surface and the reinforcement bars.

   The above defined load, the one that does not cause any damage to the bridge, is the limiting value of the analysis by the working stress design approach, without considering the factors of safety.
2. If the no damage overload load level is increased by about 75%, concrete cover of the deck reinforcement will be exposed by the cracking of the slab concrete.
3. If it is estimated that the flexural cracks of the deck concrete are about half the depth of the concrete cover of the reinforcement

bars, about 45% increase of this load level will double the depth of the cracks.

4. If the concrete cover above the top reinforcement of the bridge deck can be assumed to be "lost" due to wear, the strength of this bridge deck is reduced by about 21% that of a bridge without any noticeable damage.

5. If the concrete cover above the top reinforcement of the bridge deck can be assumed to be ineffective due to wear, strength of the bridge beams is reduced by about 10%.

6. If the strength of the bridge deck concrete is about 14% less than originally envisioned (500 psi reduction in the cylinder strength) the strength of the bridge deck is reduced, as compared to the original bridge, without any imperfections, by about 10%. The corresponding loss of strength of the beams is about 2%.

7. If the strength of the bridge deck concrete is about 14% less than originally envisioned (500 psi reduction in the cylinder strength) and if the concrete cover above the top of the reinforcing bars are lost due to wear, the deck strength is reduced by about 30%.

8. Reduction in the beam strength for above deterioration (#7) is about 12%.

9. Changes in the spacing of the beams do not change the strength of the bridge by any noticeable amount. This assumption is valid, if the beam spacings are within practical limits and if the design of the deck slab had properly taken into account the changes in

the beam spacing.

10. If an overloaded vehicle is traversing the bridge on the inside lane, the load level that the bridge can carry is about 6% more than that if the load should have been traversing the outside lane.

11. If limited damage to the deck slab is permitted, inside lane can carry 15% more load than the outside lane.

12. All the deck slab damages referred to above are recoverable, if the bridge beams are not subjected to any form of damage.

13. Bridge beams are less susceptible to damage than the bridge deck slab, regardless of the placement of the loads, spacing of the beams, and any type of deterioration that the bridge deck may be subjected to.

14. Heavy construction, and other similar vehicles, with large diameter low pressure tires, but minimum number of wheels, cause the premature cracking of the deck slab concrete. The gross vehicular weight that causes extensive damage to the deck slab and the beams for these types of vehicles are substantially less than those of the vehicular configuratins with large number of axles and more than four wheels per axle.

TABLES

TABLE 1
Overload Directory for Vehicle #3 on B10A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
36.	0.02/1.86	0.23/0.21	0.019	None
46.	0.02/1.86	0.29/0.26	0.024	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM.
60.	0.03/1.86	0.29/0.29	0.026	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
66.	0.03/1.87	0.30/0.40	0.035	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 3½ ft. to 7 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
69.	0.03/1.87	0.30/0.43	0.037	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 7 ft. to 10½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
101.	0.04/1.87	0.31/0.68	0.056	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 7 ft. to 10½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
127.	0.06/1.87	0.31/0.88	0.074	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 10½ ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 10½ ft. to 15 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
155.	0.08/1.88	0.30/1.08	0.091	Same as above; additional cracks at the top of the slab are 1.25 in. deep in the regions S of BM3 and N of BM4, and 3½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.

TABLE 1 (continued)
Overload Directory for Vehicle #3 on B10A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
182.	0.09/1.88	0.31/1.29	0.107	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 15 ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 15 ft. to support lines on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are: (1) 2.50 in. deep in the regions S of BM3 and N of BM4, and 3½ ft. long on BSM, (2) 1.25 in. deep in the regions S of BM3 and N of BM4, and from 3½ to 7 ft. away on BSM. Beam cracks of BM3 & BM4 are 2. in. deep throughout 3½ ft. long regions on BSM.

TABLE 2
Overload Directory for Vehicle #3 on B10B

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
28.	0.02/1.86	0.23/0.20	0.016	None
35.	0.02/1.86	0.29/0.25	0.020	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM.
39.	0.02/1.86	0.30/0.28	0.022	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
56.	0.03/1.87	0.31/0.43	0.032	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 3½ to 10½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
79.	0.04/1.87	0.31/0.65	0.048	Bottom cracks of the slab are 2.40 in. deep in the region between BM3 & BM4, and 10½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
93.	0.05/1.87	0.31/0.77	0.057	Bottom cracks of the slab are 2.40 in. deep in the region between BM3 & BM4, and 15 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
100.	0.05/1.87	0.30/0.83	0.062	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 3½ ft. to 10½ ft. away on BSM, (3) 1.20 in. deep in the region between BM3 & BM4, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are 1.20 in. deep in the regions S of BM3 and N of BM4, and 7 ft. long on BSM.
121.	0.06/1.87	0.31/1.02	0.076	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 10½ ft. long on BSM, (2) 2.40 in. deep in the region between

TABLE 2 (continued)
Overload Directory for Vehicle #3 on B 10B

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				BM3 & BM4, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are 1.20 in. deep in the regions S of BM3 and N of BM4, and 7 ft. long on BSM.
128.	0.07/1.87	0.30/1.08	0.081	Same as above. Additional cracks at the top of the slab are 2.40 in. deep in the regions S of BM3 and N of BM4, and 7 ft. long on BSM.
156.	0.09/1.88	0.31/1.36	0.100	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 15 ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 15 ft. to the support lines on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are 2.40 in. deep in the regions S of BM3 and N of BM4, and 7 ft. long on BSM.
161.	0.09/1.88	0.30/1.40	0.102	Same as above. Bottom cracks of the beams are 2 in. deep on BM3 & BM4 throughout 3½ ft. long regions on BSM.

TABLE 3
Overload Directory for Vehicle #3 on B10C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
32.	0.01/1.86	0.20/0.18	0.017	None
40.	0.02/1.86	0.26/0.22	0.021	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM.
44.	0.02/1.86	0.26/0.25	0.023	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
57.	0.03/1.86	0.26/0.34	0.031	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 3½ ft. to 7 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
60.	0.03/1.86	0.26/0.37	0.032	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 7 ft. to 10½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
87.	0.04/1.87	0.26/0.56	0.049	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 3½ ft. to 10½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
110.	0.04/1.87	0.27/0.74	0.063	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 10½ ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
119.	0.05/1.87	0.27/0.80	0.069	Same as above. Additional cracks at the top of the slab are 1.25 in. deep in the region S of BM3 and N of BM4, and 7 ft. long on BSM.

TABLE 3 (continued)
Overload Directory for Vehicle # 3 on B 10C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
146.	0.06/1.88	0.26/1.01	0.086	Same as above. Additional cracks at the top of the slab are 2.5 in. deep in the region S of BM3 and N of BM4, and 3½ ft. long on BSM.
158.	0.06/1.88	0.26/1.11	0.093	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 15 ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 15 ft. to the support lines on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are 2.50 in. deep in the regions S of BM3 and N of BM4, and 7 ft. long on BSM.
178.	0.09/1.88	0.26/1.28	0.105	Bottom cracks of the slab are: (1) 5.00 in. deep in the region between BM3 & BM4, and 15 ft. on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 15 ft. to the support lines on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are: (1) 2.50 in. deep in the regions S of BM3 and N of BM4, and 7 ft. long on BSM, (2) 1.25 in. deep in the regions N of BM2 and S of BM5, and 15 ft. long on BSM. Bottom cracks of BM3 & BM4 are 2. in. deep throughout 3½ ft. long regions on BSM.

TABLE 4
Overload Directory for Vehicle #3 on B10D

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
25.	0.02/1.86	0.20/0.17	0.014	None
31.	0.02/1.86	0.25/0.21	0.018	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM.
34.	0.02/1.86	0.26/0.24	0.019	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
48.	0.03/1.87	0.26/0.36	0.028	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 3½ ft. to 10½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
51.	0.03/1.87	0.26/0.38	0.029	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 7 ft. to 10½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
82.	0.04/1.87	0.27/0.65	0.050	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 10½ ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are 1.20 in. deep in the regions S of BM3 and N of BM4, and 7 ft. long on BSM.
88.	0.04/1.87	0.26/0.70	0.054	Same as above. Additional cracks at the bottom of the slab are 3.60 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM.
104.	0.05/1.87	0.26/0.84	0.065	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 10½ ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are

TABLE 4 (continued)
Overload Directory for Vehicle #3 on B10D

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				expected at the top of the slab in the same regions on BM3 & BM4.
110.	0.05/1.87	0.25/0.89	0.069	Same as above. Additional cracks at the top of the slab are 2.40 in. deep in the region S of BM3 and N of BM4, and 7 ft. long on BSM.
159.	0.09/1.88	0.26/1.38	0.100	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 15 ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 15 ft. to the support lines on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are: (1) 3.60 in. deep in the regions S of BM3 and N of BM4, and 7 ft. long on BSM, (2) 1.20 in. deep in the regions S of BM3 and N of BM4, and from 7 ft. to 10½ ft. away on BSM, (3) 1.20 in. deep in the regions N of BM2 and S of BM5, and 10½ ft. long on BSM. Bottom cracks on beams are 2. in. deep on BM3 & BM4 throughout 3½ ft. long regions on BSM.

TABLE 5

Overload Directory for Vehicle #3 on B11A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
37.	0.02/1.86	0.23/0.21	0.010	None
46.	0.02/1.86	0.28/0.26	0.012	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM.
51.	0.03/1.86	0.30/0.29	0.014	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
60.	0.03/1.86	0.30/0.33	0.016	Same as above.
69.	0.03/1.86	0.31/0.42	0.019	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 7 ft. to 11½ ft. away on BSM. Similar cracks at the top of the slab are in the same regions on BM3, BM4 & BM5.
78.	0.03/1.86	0.31/0.50	0.020	Same as above.
88.	0.03/1.86	0.31/0.57	0.024	Same as above.
91.	0.04/1.86	0.30/0.59	0.025	Bottom cracks of the slab are 2.50 in. deep in the region between BM3 & BM4, and 11½ ft. on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3, BM4 & BM5.
100.	0.04/1.86	0.30/0.67	0.028	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 3½ ft. to 17 ft. long on BSM. Similar cracks at the top of the slab are in the same regions on BM3, BM4 & BM5.
106.	0.04/1.86	0.30/0.71	0.030	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 7 ft. to 17 ft. long on BSM. Similar cracks are expected

TABLE 5 (continued)
Overload Directory for Vehicle #3 on B 11A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				at the top of the slab in the same regions on BM3, BM4 & BM5.
115.	0.04/1.86	0.30/0.78	0.032	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 7 ft. to 11½ ft. away on BSM, (3) 1.25 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM. Similar cracks at the top of the slab are in the same regions on BM3, BM4 & BM5.
124.	0.04/1.86	0.29/0.84	0.035	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM. Similar cracks at the top of the slab are in the same regions on BM3, BM4 & BM5.
134.	0.05/1.86	0.30/0.91	0.039	Same as above; additional cracks at the bottom of the slab are 1.25 in. deep in the region S of BM3 and N of BM5 and 11½ ft. long on BSM.
137.	0.05/1.86	0.29/0.93	0.040	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM, (3) 1.25 in. deep in the region S of BM3 and N of BM5, and 11½ ft. long on BSM. Similar cracks at the top of the slab are in the same regions on BM3, BM4 & BM5. Additional cracks at the top of the slab are 1.25 in. deep in the region S of BM3 and N of BM5, and 3½ ft. long on BSM.
142.	0.05/1.86	0.31/0.96	0.041	Same as above; additional bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM.
152.	0.05/1.86	0.31/1.03	0.044	Similar to above except additional cracks at the bottom of the slab have developed 1.25 in. deep in the region S of BM3 and N of BM5 and from 11½ ft. to 17 ft. long on BSM.

TABLE 5 (continued)
Overload Directory for Vehicle #3 on B 11A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
161.	0.06/1.86	0.31/1.10	0.047	Same as above.
166.	0.06/1.86	0.30/1.14	0.048	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 17 ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM, (3) 1.25 in. deep in the region S of BM3 and N of BM5, and 25 ft. long on BSM. Similar cracks at the top of the slab are in the same regions on BM3, BM4 & BM5. Additional cracks at the top of the slab are 1.25 in. deep in the region S of BM3 and N of BM5, and 3½ ft. long on BSM.
175.	0.06/1.86	0.30/1.21	0.051	Same as above; additional cracks at the top of the slab are 2.50 in. deep in the region S of BM3 and N of BM5, and 3½ ft. long on BSM.
184.	0.06/1.86	0.30/1.28	0.054	Same as above; additional cracks at the top of the slab are 1.25 in. deep in the region S of BM3 and N of BM5, and from 3½ ft. to 7 ft. away on BSM.
194.	0.07/1.86	0.31/1.36	0.057	Same as above.
203.	0.07/1.86	0.30/1.43	0.060	Bottom cracks of the slab are: (1) 5.0 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 3.75 in. deep in the region between BM3 & BM4, and from 11½ ft. to 25 ft. away on BSM, (3) 1.25 in. deep in the region S of BM3 and N of BM5, and 25 ft. long on BSM. Similar cracks at the top of the slab are in the same regions on BM3, BM4 & BM5. Additional cracks at the top of the slab are (1) 2.5 in. deep in the region S of BM3 and N of BM5, and 3½ ft. long on BSM, (2) 1.25 in. deep in the region S of BM3 & N of BM5, and from 3½ ft. to 11½ ft. away on BSM, and (3) 1.25 in. deep in the region N of BM3 & S of BM5 and 25 ft. long on BSM.
212.	0.07/1.86	0.31/1.51	0.062	Same as above.

TABLE 5 (continued)
Overload Directory for Vehicle #3 on B11A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
222.	0.08/1.86	0.31/1.51	0.065	Same as above; additional cracks at the bottom of the slab are 5.00 in. deep in the region between BM3 & BM4, and 17 ft. long on BSM.
231.	0.08/1.87	0.31/1.66	0.068	Same as above; additional cracks at the top of the slab are 1.20 in. deep in the region S of BM2 and N of BM5, and 25 ft. long on BSM.
240.	0.09/1.88	0.30/1.74	0.071	Bottom cracks of the slab are: (1) 5.0 in. deep in the region between BM3 & BM4, and 17 ft. long on BSM, (2) 3.75 in. deep in the region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM, (3) 2.50 in. deep in the region between BM3 & BM4, and from 25 ft. to the support lines away on BSM, (4) 1.25 in. deep in the region S of BM3 and N of BM4, and 25 ft. long on BSM. Similar cracks at the top of the slab are in the same regions on BM3, BM4 & BM5. Additional cracks at the top of the slab are: (1) 3.75 in. deep in the region S of BM3 and N of BM4, and 3½ ft. long on BSM, (2) 2.50 in. deep in the region S of BM3 and N of BM4, and from 3½ ft. to 7 ft. away on BSM, (3) 1.25 in. deep in the region S & N of BM2 & BM4, and 17 ft. long on BSM. Bottom cracks of BM3 & BM4 are 2 in. deep throughout 3½ ft. long regions on BSM.

TABLE 6

Overload Directory for Vehicle #3 on B11B

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
15.	0.02/1.87	0.23/0.20	0.008	None
36.	0.02/1.87	0.29/0.25	0.010	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM.
40.	0.02/1.87	0.30/0.28	0.011	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
47.	0.02/1.87	0.30/0.35	0.013	Same as above.
54.	0.03/1.87	0.29/0.41	0.015	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM.
57.	0.03/1.88	0.30/0.44	0.016	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 3½ ft. to 11½ ft. away on BSM.
60.	0.03/1.88	0.30/0.46	0.017	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 7 ft. to 11½ ft. away on BSM.
67.	0.03/1.88	0.30/0.53	0.019	Same as above.
74.	0.03/1.88	0.30/0.59	0.021	Same as above.
78.	0.04/1.88	0.30/0.62	0.022	Bottom cracks of the slab are 2.40 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
85.	0.03/1.88	0.30/0.68	0.025	Same as above.

TABLE 6 (continued)
Overload Directory for Vehicle #3 on B 11B

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
92.	0.03/1.88	0.30/0.75	0.027	Same as above.
99.	0.04/1.88	0.30/0.81	0.029	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are 1.20 in. in the region S of BM3 and N of BM4, and 7 ft. long on BSM.
106.	0.04/1.88	0.29/0.88	0.031	Same as above; additional cracks at the bottom of the slab are 3.60 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM.
110.	0.04/1.88	0.30/0.91	0.033	Same as above.
118.	0.05/1.88	0.31/0.97	0.035	Same as above.
122.	0.05/1.88	0.30/1.01	0.036	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are 1.20 in. deep in the region S of BM3 and N of BM4, 11½ ft. long on BSM.
129.	0.05/1.88	0.30/1.07	0.038	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM, (3) 1.20 in. deep in the region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are: (1) 2.40 in. deep in

TABLE 6 (continued)
Overload Directory for Vehicle # 3 on B 11B

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				the region S of BM3 and N of BM4, and 7 ft. long on BSM, (2) 1.20 in. deep in the region S of BM3 and N of BM4, and from 7 ft. to 11½ ft. away on BSM.
136.	0.05/1.88	0.31/1.14	0.041	Same as above; additional cracks at the bottom of the slab are 1.20 in. deep in the regions S of BM3 and N of BM4, and 25 ft. long on BSM.
144.	0.06/1.88	0.30/1.21	0.043	Same as above; additional cracks at the top of the crack are 1.20 in. deep in the regions N of BM2 and S of BM5, and 3½ ft. long on BSM.
151.	0.06/1.88	0.30/1.28	0.045	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 17 ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM, (3) 1.20 in. deep in the regions S of BM3 and N of BM4, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are: (1) 2.40 in. deep in the region S of BM3 and N of BM4, and 7 ft. long on BSM, (2) 1.20 in. deep in the region N of BM2, and S of BM5, and 3½ ft. long on BSM.
158.	0.06/1.88	0.30/1.35	0.048	Same as above; additional cracks at the top of the slab are 1.20 in. deep in the regions N of BM2 and S of BM5, and 25 ft. long on BSM.
165.	0.06/1.88	0.30/1.42	0.050	Same as above.
172.	0.06/1.89	0.31/1.50	0.052	Same as above.
180.	0.07/1.89	0.31/1.57	0.054	Same as above.
187.	0.07/1.89	0.30/1.64	0.056	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 25 ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 25 ft. to the support lines on BSM, (3) 1.20 in. deep in the regions S of BM3 and N of BM4 and 25 ft. long on BSM. Similar cracks

TABLE 6 (continued)
Overload Directory for Vehicle #3 on B11B

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are (1) 3.60 in. deep in the region S of BM3 and N of BM4, and 7 ft. long on BSM, (2) 1.20 in. deep in the regions N of BM2 and S of BM5, and 25 ft. long on BSM.
195.	0.08/1.89	0.30/1.72	0.058	Same as above; additional cracks at the top of the slab are 1.20 in. deep in the region S of BM2 and N of BM5, and 25 ft. long on BSM.
201	0.08/1.89	0.31/1.79	0.061	Same as above.
209.	0.08/1.89	0.30/1.86	0.063	Same as above; additional cracks at the bottom of the slab are 4.80 in. deep in the region between BM3 & BM4, and 17 ft. long on BSM.
216.	0.09/1.89	0.31/1.93	0.065	Same as above. Bottom cracks of BM3 and BM4 are 2 in. deep throughout 3½ ft. long regions on BSM.

TABLE 7

Overload Directory for Vehicle # 3 on B 11C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
32.	0.02/1.88	0.20/0.18	0.009	None
41.	0.02/1.88	0.24/0.22	0.011	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM.
44.	0.02/1.88	0.25/0.25	0.012	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
52.	0.02/1.88	0.26/0.31	0.014	Same as above.
60.	0.02/1.88	0.26/0.36	0.016	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 7 ft. to 11½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
68.	0.02/1.88	0.27/0.43	0.019	Same as above.
76.	0.03/1.88	0.27/0.49	0.021	Same as above.
79.	0.03/1.88	0.26/0.51	0.022	Bottom cracks of the slab are 2.50 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
88.	0.04/1.88	0.26/0.57	0.024	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 3½ ft. to 11½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
92.	0.04/1.88	0.26/0.60	0.026	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 7 ft. to 11½ ft. away on BSM. Similar cracks are expected

TABLE 7 (continued)

Overload Directory for Vehicle #3 on B 11C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				at the top of the slab in the same regions on BM3 & BM4.
100.	0.04/1.88	0.26/0.66	0.028	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 7 ft. to 17 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
108.	0.04/1.88	0.25/0.72	0.031	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
116.	0.04/1.88	0.24/0.77	0.033	Same as above; additional cracks at the top of the slab are 1.25 in. deep in the regions S of BM3 and N of BM4, and 3½ ft. long on BSM.
120.	0.04/1.88	0.26/0.79	0.034	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 2.50 in. deep in the region from 11½ ft. to 17 ft. away on BSM, (3) 1.25 in. deep in the region S of BM3 and N of BM4, and 11½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
128.	0.04/1.88	0.26/0.85	0.037	Same as above.
136.	0.04/1.88	0.26/0.91	0.039	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM, (3) 1.25 in. deep in the region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM, (4) 1.25 in. deep in the regions S of BM3 and N of BM4, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are 1.25 in. deep in the region S of BM3 and N of BM4, and 3½ ft. long on BSM.

TABLE 7 (continued)
Overload Directory for Vehicle #3 on B 11C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
144.	0.05/1.88	0.26/0.97	0.042	Same as above; additional cracks at the top of the slab are 2.50 in. deep in the region S of BM3 and N of BM4, and 3½ ft. long on BSM.
149.	0.05/1.88	0.27/1.00	0.043	Same as above.
156.	0.05/1.88	0.26/1.06	0.046	Same as above; additional cracks at the top of the slab are in the regions S of BM3 and N of BM5, and from 3½ ft. to 7 ft. away on BSM.
164.	0.05/1.88	0.27/1.13	0.048	Same as above.
174.	0.05/1.88	0.27/1.19	0.050	Same as above.
182.	0.06/1.89	0.26/1.26	0.053	Bottom cracks of the slab are: (1) 5.00 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 3.75 in. deep in the region between BM3 & BM4, and from 11½ ft. to 25 ft. away on BSM, (3) 1.25 in. deep in the regions between BM2 & BM3 and BM4 & BM5, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are (1) 2.5 in. deep in the regions S of BM3 and N of BM4, and 3½ ft. long on BSM, (2) 1.25 in. deep in the regions S of BM3 and N of BM4, and from 3½ ft. to 25 ft. away on BSM.
190.	0.07/1.89	0.26/1.32	0.055	Same as above.
198.	0.07/1.89	0.26/1.39	0.058	Same as above; additional cracks at the top of the slab are 1.25 in. deep in the regions S of BM2 and N of BM5, and 25 ft. long on BSM.
206.	0.07/1.89	0.26/1.45	0.060	Bottom cracks of the slab are: (1) 5.00 in. deep in the region between BM3 & BM4, and 17 ft. long on BSM, (2) 3.75 in. deep in the region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM, (3) 1.25 in deep in the region between BM3 & BM4, and from 25 ft. to the support lines on BSM, (4) 1.25 in. deep in the regions S of BM3 and N of BM4, and 25 ft. long on BSM.

TABLE 7 (continued)

Overload Directory for Vehicle #3 on B11C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are: (1) 3.75 in. deep in the regions S of BM3 and N of BM4, and 3½ ft. long on BSM, (2) 2.5 in. deep in the regions S of BM3 and N of BM4, and from 3½ ft. to 7 ft. away on BSM, (3) 1.25 in. deep in the regions S of BM3 and N of BM4, and from 7 ft. to 25 ft. away on BSM, (4) 1.25 in. deep in the regions N of BM2 and S of BM5, and 25 ft. long on BSM.
214.	0.07/1.89	0.26/1.52	0.062	Same as above.
222.	0.08/1.89	0.26/1.59	0.065	Same as above; additional cracks at the top of the slab are 1.25 in. deep in the regions S of BM2 and N of BM5, and 25 ft. long on BSM.
230.	0.08/1.89	0.26/1.67	0.067	Slab cracks are similar to above. Bottom cracks at BM3 and BM4 are 2 in. deep throughout 3½ ft. long regions on BSM.

TABLE 8

Overload Directory for Vehicle #3 on B 11D

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
26.	0.02/1.88	0.20/0.17	0.007	None
32.	0.02/1.88	0.23/0.22	0.009	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM.
35.	0.02/1.88	0.26/0.24	0.010	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
41.	0.03/1.88	0.26/0.29	0.011	Same as above.
48.	0.03/1.88	0.26/0.35	0.013	Same as above.
50.	0.03/1.88	0.26/0.37	0.014	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 3½ ft. to 11½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
52.	0.03/1.88	0.26/0.39	0.015	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 7 ft. to 11½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
59.	0.03/1.88	0.26/0.45	0.016	Same as above.
64.	0.03/1.88	0.26/0.50	0.018	Same as above.
68.	0.03/1.88	0.26/0.53	0.020	Bottom cracks of the slab are 2.40 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
75.	0.03/1.88	0.26/0.58	0.021	Same as above.

TABLE 8 (continued)
Overload Directory for Vehicle #3 on B11D

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
84.	0.03/1.88	0.26/0.66	0.024	Same as above; additional cracks are 1.20 in. deep in the region S of BM3 and N of BM4, and 7 ft. long on BSM.
91.	0.04/1.88	0.26/0.72	0.026	Same as above.
94.	0.04/1.88	0.25/0.74	0.027	Same as above; additional cracks at the bottom of the slab are 3.60 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
100.	0.04/1.88	0.26/0.80	0.029	Same as above.
106.	0.04/1.88	0.25/0.85	0.031	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM, (3) 1.20 in. deep in the regions S of BM3 and N of BM4, and 11½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are 1.20 in. deep in the region S of BM3 and N of BM4, and 7 ft. long on BSM.
112.	0.05/1.88	0.25/0.90	0.033	Same as above; additional cracks at the top of the slab are 2.40 in. deep in the region S of BM3 and N of BM4, and 7 ft. long on BSM.
125.	0.05/1.88	0.25/1.02	0.037	Same as above; additional cracks at the top of the slab are 1.20 in. deep in the regions N of BM2 and S of BM5, and 3½ ft. long on BSM.
135.	0.05/1.88	0.25/1.11	0.040	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 17 ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM, (3) 1.20 in. deep in the regions S of BM3 and N of BM4, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are (1) 2.40 in. deep in the regions S of BM3 and N of BM4, and 7 ft. long on BSM, (2) 1.20 in. deep in the

TABLE 8 (continued)
Overload Directory for Vehicle #3 on B11D

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				regions N of BM2 and S of BM5, and 25 ft. long on BSM.
154.	0.06/1.89	0.25/1.30	0.045	Same as above.
160.	0.06/1.89	0.25/1.36	0.047	Same as above; additional cracks at the top of the slab are 3.60 in. deep in the regions S of BM3 and N of BM4, and 7 ft. long on BSM.
172.	0.06/1.89	0.25/1.48	0.051	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 25 ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 25 ft. to the support lines on BSM, (3) 1.20 in. deep in the regions S of BM3 and N of BM4, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are: (1) 3.60 in. deep in the regions S of BM3 and N of BM4, and 7 ft. long on BSM, (2) 1.20 in. deep in the regions on BM2 and BM5, and 25 ft. long.
192.	0.08/1.89	0.25/1.65	0.057	Same as above; additional cracks at the bottom of the slab are 4.80 in. deep in the region between BM3 & BM4, and 17 ft. long on BSM.
204.	0.08/1.89	0.26/1.76	0.061	Same as above; additional cracks at the top of the slab are 2.40 in. deep in the regions N of BM2 and S of BM5, and 17 ft. long on BSM.
211.	0.08/1.89	0.26/1.81	0.063	Slab cracks are same as above. Bottom cracks of BM3 & BM4 are 2 in. deep throughout 3½ ft. long regions on BSM.

TABLE 9

Overload Directory for Vehicle #5 on B10A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
67.	0.03/1.86	0.28/0.24	0.033	None
74.	0.03/1.86	0.30/0.26	0.036	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
101.	0.03/1.86	0.29/0.38	0.050	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 3½ ft. to 10½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
104.	0.04/1.87	0.30/0.40	0.052	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 7 ft. to 10½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
137.	0.04/1.87	0.31/0.56	0.070	Bottom cracks of the slab are 2.50 in. deep in the region between BM3 & BM4, and 10½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
149.	0.06/1.87	0.31/0.62	0.076	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 3½ ft. to 10½ ft. away on BSM, (3) 1.25 in. deep in the region between BM3 & BM4, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
175.	0.08/1.87	0.30/0.74	0.091	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 7 ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.

TABLE 9 (continued)

Overload Directory for Vehicle #5 on B10A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
181.	0.08/1.87	0.30/0.76	0.095	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 10½ ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
203.	0.09/1.87	0.31/0.86	0.107	Slab cracks are similar to above. Beam cracks of BM3 & BM4 are 2. in. deep throughout 3½ ft. long regions on BSM.

TABLE 10

Overload Directory for Vehicle # 5 on B 10B

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
50.	0.02/1.86	0.25/0.21	0.026	None
59.	0.02/1.86	0.30/0.25	0.031	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
88.	0.04/1.87	0.30/0.41	0.047	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 7 ft. to 10½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
128.	0.04/1.87	0.30/0.62	0.070	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 10½ ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 7 ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
153.	0.06/1.87	0.30/0.75	0.086	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 7 ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
182.	0.09/1.87	0.30/0.86	0.103	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 10½ ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 10½ ft. to 15 ft. away on BSM, (3) 1.20 in. deep in the region between BM3 & BM4, and from 15 ft. to support lines on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4. Bottom cracks of BM3 & BM4 are 2 in. deep throughout 3½ ft. long regions on BSM.

TABLE 11

Overload Directory for Vehicle #5 on B10C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
55.	0.02/1.86	0.22/0.19	0.027	None
66.	0.02/1.86	0.25/0.23	0.033	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
88.	0.03/1.86	0.26/0.32	0.044	Bottom cracks of the slab are: (1) 2.5 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 3½ ft. to 7 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
92.	0.03/1.86	0.26/0.34	0.046	Bottom cracks of the slab are: (1) 2.5 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 7 ft. to 10½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
119.	0.03/1.87	0.26/0.47	0.060	Bottom cracks of the slab are 2.50 in. deep in the region between BM3 & BM4, and 10½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
130.	0.05/1.87	0.26/0.52	0.066	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 3½ ft. to 10½ ft. away on BSM, (3) 1.25 in. deep in the region between BM3 & BM4, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
157.	0.07/1.87	0.22/0.64	0.082	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 10½ ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.

TABLE 11 (continued)
Overload Directory for Vehicle #5 on B10C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
201.	0.10/1.87	0.26/0.82	0.107	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 15 ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 15 ft. to the support lines on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4. Bottom cracks of BM3 & BM4 are 2 in. deep throughout 3½ ft. long regions on BSM.

TABLE 12
Overload Directory for Vehicle #5 on B10D

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
49.	0.02/1.86	0.24/0.20	0.026	None
52.	0.02/1.86	0.26/0.21	0.027	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, 7 ft. long on BSM.
76.	0.03/1.87	0.26/0.33	0.040	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 3½ ft. to 10½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
104.	0.03/1.87	0.26/0.48	0.056	Bottom cracks of the slab are 2.40 in. deep in the region between BM3 & BM4, and 10½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
133.	0.06/1.87	0.25/0.63	0.073	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 3½ ft. to 10½ ft. away on BSM, (3) 1.20 in. deep in the region between BM3 & BM4, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
156.	0.08/1.87	0.26/0.73	0.088	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 10½ ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
176.	0.09/1.88	0.25/0.82	0.099	Slab cracks are similar to above. Bottom cracks of BM3 & BM4 are 2 in. deep throughout 3½ ft. long regions on BSM.

TABLE 13

Overload Directory for Vehicle # 5 on B11A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
58.	0.03/1.87	0.23/0.20	0.014	None
72.	0.03/1.87	0.29/0.25	0.018	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM.
78.	0.03/1.87	0.29/0.27	0.019	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
106.	0.04/1.88	0.31/0.40	0.026	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 7 ft. to 11½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
135.	0.04/1.88	0.30/0.54	0.034	Bottom cracks of the slab are 2.50 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
150.	0.05/1.88	0.30/0.61	0.038	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
155.	0.05/1.88	0.30/0.63	0.039	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 7 ft. to 11½ ft. away on BSM, (3) 1.25 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
169.	0.05/1.88	0.31/0.70	0.043	Same as above; additional cracks at the bottom of the slab are 1.25 in. deep in the regions S of BM3 and N of BM4, and 11½ ft. long on BSM.

TABLE 13 (continued)
Overload Directory for Vehicle #5 on B 11A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
191.	0.06/1.88	0.31/0.79	0.049	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM, (3) 1.25 in. deep in the region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4. Additional cracks at the bottom of the slab are 1.25 in. deep in the regions S of BM3 and N of BM4, and 25 ft. long on BSM.
220.	0.07/1.88	0.31/0.91	0.058	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 17 ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM, (3) 1.25 in. deep in the regions S of BM3 and N of BM4, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
263.	0.09/1.88	0.31/1.09	0.070	Slab damage is similar to above. Bottom cracks of BM3 & BM4 are 2 in. deep throughout 3½ ft. long regions on BSM.

TABLE 14

Overload Directory for Vehicle #5 on B11B

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
47.	0.03/1.88	0.23/0.19	0.012	None
59.	0.03/1.88	0.29/0.24	0.015	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM.
63.	0.03/1.88	0.29/0.26	0.016	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
86.	0.03/1.88	0.30/0.39	0.022	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM.
91.	0.04/1.88	0.30/0.41	0.023	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 7 ft. to 11½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
130.	0.05/1.88	0.30/0.62	0.034	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
160.	0.06/1.88	0.30/0.77	0.042	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 7 ft. to 17 ft. away on BSM, (3) 1.20 in. deep in the region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM, (4) 1.20 in. deep in the region S of BM3 and N of BM4, and 17 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
183.	0.06/1.88	0.31/0.87	0.049	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM, (3) 1.20 in. deep

TABLE 14 (continued)
Overload Directory for Vehicle #5 on B11B

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				in the region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM, (4) 1.20 in. deep in the region S of BM3 and N of BM4, and 17 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
230.	0.08/1.89	0.30/1.05	0.062	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 17 ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 17 ft. to 25 ft. on BSM, (3) 1.20 in. deep in the regions S of BM3 and N of BM4, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4. Additional cracks at the top of the slab are 1.20 in. deep in the regions N of BM2 and S of BM5, and 25 ft. long on BSM.
241.	0.09/1.89	0.31/1.10	0.065	Slab cracks are similar to above. Bottom cracks of BM3 & BM4 are 2. in. deep throughout 3½ ft. long regions on BSM.

TABLE 15
Overload Directory for Vehicle #5 on B 11C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
51.	0.03/1.87	0.20/0.17	0.013	None
63.	0.03/1.87	0.25/0.22	0.016	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM.
67.	0.03/1.87	0.26/0.23	0.017	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
93.	0.04/1.88	0.27/0.34	0.022	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 7 ft. to 11½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
131.	0.04/1.88	0.26/0.52	0.032	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
135.	0.05/1.88	0.26/0.54	0.034	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 7 ft. to 11½ ft. away on BSM, (3) 1.25 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
147.	0.05/1.88	0.26/0.59	0.037	Same as above; additional cracks at the bottom of the slab are 1.25 in. deep in the regions S of BM3 and N of BM4, and 17 ft. long on BSM.
167.	0.05/1.88	0.26/0.67	0.043	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 2.50 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM, (3) 1.25 in. deep in the

TABLE 15 (continued)
Overload Directory for Vehicle #5 on B 11C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM, (4) 1.25 in. deep in the regions S of BM3 and N of BM4, 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
235.	0.06/1.88	0.26/0.95	0.061	Bottom cracks of the slab are: (1)5.00 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 3.75 in. deep in the region between BM3 & BM4, and from 11½ ft. to 25 ft. away on BSM, (3) 1.25 in. deep in the region between BM3 & BM4, and from 25 ft. to the support lines on BSM, (4) 1.25 in. deep in the regions S of BM3 and N of BM4, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
260.	0.09/1.89	0.26/1.05	0.064	Bottom cracks of the slab are: (1) 5.0 in. deep in the region between BM3 & BM4, and 17 ft. long on BSM, (2) 3.75 in. deep in the region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM, (3) 1.25 in. deep in the region between BM3 & BM4, and from 25 ft. to the support lines, (4) 1.25 in. deep in the regions S of BM3 and N of BM4, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are 1.25 in. deep in the regions N of BM2 and S of BM5, and 25 ft. long on BSM. Bottom cracks at BM3 and BM4 are 2 in. deep throughout 3½ ft. long regions on BSM.

TABLE 16

Overload Directory for Vehicle #5 on B11D

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
41.	0.03/1.88	0.20/0.17	0.010	None
54.	0.03/1.88	0.25/0.21	0.013	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 3½ ft. long on BSM.
55.	0.03/1.88	0.25/0.22	0.013	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
75.	0.03/1.88	0.25/0.33	0.019	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM.
80.	0.03/1.88	0.25/0.35	0.020	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 7 ft. to 11½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
114.	0.04/1.88	0.26/0.53	0.029	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
140.	0.05/1.88	0.26/0.65	0.036	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 7 ft. to 17 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
155.	0.05/1.88	0.26/0.72	0.041	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 11½ ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 11½ ft. to 17 ft. away on BSM, (3) 1.20 in. deep in the region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM, (4) 1.20 in. deep in the regions S of BM3 and N of BM4, and 25 ft. long on BSM.

TABLE 16 (continued)
Overload Directory for Vehicle #5 on B11D

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
202.	0.07/1.88	0.25/0.90	0.054	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 17 ft. long on BSM, (2) 2.40 in. deep in the region between BM3 & BM4, and from 17 ft. to 25 ft. away on BSM, (3) 1.20 in. deep in the regions S of BM3 and N of BM4, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are 1.20 in. deep in the regions N of BM2 and S of BM5 and 25 ft. long on BSM.
232.	0.08/1.89	0.26/1.03	0.062	Bottom cracks of the slab are: (1) 3.60 in. deep in the region between BM3 & BM4, and 25 ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 25 ft. to the support lines away, (3) 1.20 in. deep in the regions S of BM3 and N of BM4, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Additional cracks at the top of the slab are 1.20 in. deep in the regions N of BM2 and S of BM5, and 25 ft. long on BSM. Bottom cracks at BM3 & BM4 are 2 in. deep throughout 3½ ft. long regions on BSM.

TABLE 17
Overload Directory for Vehicle # 5 on B12A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
60.	0.04/1.94	0.24/0.22	0.033	None
70.	0.04/1.94	0.28/0.25	0.039	Bottom cracks of the slab are 1.17 in. deep in the region between BM2 & BM3, and 3½ ft. long on BSM.
75.	0.04/1.94	0.28/0.28	0.042	Bottom cracks of the slab are 1.17 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM.
85.	0.05/1.94	0.30/0.32	0.047	Same as above.
95.	0.05/1.94	0.30/0.37	0.053	Same as above.
99.	0.06/1.94	0.30/0.39	0.055	Bottom cracks of the slab are: (1) 2.33 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 1.17 in. deep in the region between BM2 & BM3, and from 7 ft. to 10½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
109.	0.07/1.94	0.30/0.44	0.061	Same as above.
119.	0.07/1.94	0.30/0.49	0.067	Same as above.
129.	0.08/1.94	0.30/0.54	0.073	Bottom cracks of the slab are 2.33 in. deep in the region between BM2 & BM3, and 10½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
140.	0.09/1.94	0.30/0.59	0.080	Bottom cracks of the slab are: (1) 3.50 in. deep in the region N of BM2 and 3½ ft. long on BSM, (2) 2.33 in. deep in the region S of BM3, and 3½ ft. long on BSM, (3) 2.33 ft. long in the region between BM2 & BM3, and from 3½ ft. to 10½ ft. away on BSM, (4) 1.17 in deep in the region between BM2 & BM3, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.

TABLE 17 (continued)
Overload Directory for Vehicle #5 on B 12A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
145.	0.09/1.94	0.30/0.62	0.082	Bottom cracks of the slab are: (1) 3.50 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 2.33 in. deep in the region between BM2 & BM3, and from 7 ft. to 10½ ft. away on BSM, (3) 1.17 in. deep in the region between BM2 & BM3 and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
155.	0.10/1.94	0.30/0.67	0.090	Same as above.
165.	0.11/1.94	0.30/0.72	0.096	Bottom cracks of the slab are: (1) 3.50 in. deep in the region between BM2 & BM3, and 10½ ft. long on BSM, (2) 2.33 in. deep in the region between BM2 & BM3, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
175.	0.12/1.94	0.30/0.76	0.103	Same as above.
181.	0.13/1.94	0.29/0.79	0.108	Bottom cracks of the slab are: (1) 3.50 in. deep in the region between BM2 & BM3, and 10½ ft. long on BSM, (2) 3.50 in. deep in the region N of BM2, and from 10½ ft. to 15 ft. away on BSM, (3) 2.33 in. deep in the region S of BM3, and from 10½ ft. to 15 ft. away on BSM, (4) 1.17 in. deep in the region N of BM2, and from 15 ft. to the support lines on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
191.	0.14/1.94	0.31/0.84	0.114	Same as above.
201.	0.14/1.94	0.31/0.88	0.121	Slab cracks are similar to above. Bottom cracks of BM2 are 2 in. deep throughout a 3½ ft. long region on BSM.

TABLE 18

Overload Directory for Vehicle #5 on B 12C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
60.	0.04/1.94	0.23/0.16	0.033	None
64.	0.04/1.94	0.26/0.23	0.036	Bottom cracks of the slab are 1.17 in. deep in the region between BM2 & BM3, and 3½ ft. long on BSM.
74.	0.05/1.94	0.26/0.27	0.041	Same as above.
84.	0.05/1.94	0.27/0.32	0.047	Same as above.
88.	0.05/1.94	0.26/0.33	0.049	Bottom cracks of the slab are: (1) 2.33 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 1.17 in. deep in the region between BM2 & BM3, and from 7 ft. to 10½ ft. away on BSM. Similar cracks at the top of the slab are expected in the same regions on BM2 & BM3.
98.	0.06/1.94	0.26/0.38	0.055	Same as above.
108.	0.07/1.94	0.26/0.43	0.060	Same as above.
113.	0.07/1.94	0.25/0.45	0.065	Bottom cracks of the slab are: (1) 2.33 in. deep in the region between BM2 & BM3, and 10½ ft. long on BSM, (2) 1.17 in. deep in the region N of BM2, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
123.	0.08/1.94	0.26/0.50	0.071	Bottom cracks of the slab are: (1) 3.50 in. deep in the region N of BM2, and 3½ ft. long on BSM, (2) 2.33 in. deep in the region S of BM3, and 3½ ft. long on BSM, (3) 2.33 in. deep in the region between BM2 & BM3, and from 3½ ft. to 10½ ft. away on BSM, (4) 1.17 in. deep in the region between BM2 & BM3, and from 10½ ft. to 15 ft. on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.

TABLE 18 (continued)
Overload Directory for Vehicle #5 on B 12C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
128.	0.08/1.94	0.26/0.52	0.074	Bottom cracks of the slab are: (1) 3.50 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 2.33 in. deep in the region between BM2 & BM3, and from 7 ft. to 10½ ft. away on BSM, (3) 1.17 in. deep in the region between BM2 & BM3, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
137.	0.09/1.94	0.26/0.57	0.080	Same as above.
148.	0.10/1.94	0.26/0.62	0.086	Bottom cracks of the slab are: (1) 3.50 in. deep in the region between BM2 & BM3, and 10½ ft. long on BSM, (2) 2.33 in. deep in the region between BM2 & BM3, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
154.	0.10/1.94	0.27/0.65	0.091	Same as above.
162.	0.11/1.94	0.27/0.70	0.098	Same as above. Additional cracks at the bottom of the slab are 1.17 in. deep in the region between BM2 & BM3, and from 15 ft. to the support lines away on BSM.
174.	0.12/1.94	0.27/0.74	0.104	Same as above.
183.	0.13/1.94	0.27/0.77	0.110	Same as above.
187.	0.14/1.94	0.26/0.79	0.113	Bottom cracks of the slab are: (1) 3.50 in. deep in the region between BM2 & BM3, and 15 ft. long on BSM, (2) 2.33 in. deep in the region between BM2 & BM3, and from 15 ft. to the support lines on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3. Additional cracks at the top of the slabs are 1.17 in. deep in the region S of BM4, and 7 ft. long on BSM.

TABLE 18 (continued)
Overload Directory for Vehicle #5 on B 12C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
200.	0.15/1.94	0.24/0.83	0.119	Slab cracks are same as above. Bottom cracks of BM2 are 2 in. deep throughout a 7 ft. long region on BSM.

TABLE 19

Overload Directory for Vehicle # 5 on B13A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
58.	0.03/1.85	0.24/0.21	0.034	None
66.	0.03/1.85	0.28/0.26	0.039	Bottom cracks of the slab are 1.25 in. deep in the region N of BM2, and 3½ ft. long on BSM.
72.	0.03/1.85	0.30/0.28	0.043	Bottom cracks of the slab are 1.25 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM.
82.	0.03/1.85	0.30/0.33	0.048	Same as above.
91.	0.04/1.85	0.30/0.37	0.054	Bottom cracks of the slab are: (1) 2.50 in. deep in the region N of BM2, and 3½ ft. long on BSM, (2) 1.25 in. deep in the region S of BM3, and 3½ ft. long on BSM, (3) 1.25 in. deep in the region between BM2 & BM3, and from 3½ ft. to 7 ft. away on BSM.
100.	0.05/1.85	0.31/0.43	0.060	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 1.25 in. deep in the region between BM2 & BM3, and from 7 ft. to 10½ ft. away on BSM. Similar cracks at the top of the slab are expected in the same regions on BM2 & BM3.
105.	0.05/1.85	0.31/0.46	0.063	Same as above.
114.	0.05/1.85	0.31/0.51	0.069	Same as above.
124.	0.06/1.85	0.30/0.54	0.075	Bottom cracks of the slab are: (1) 2.5 in. deep in the region between BM2 & BM3, and 10½ ft. long on BSM, (2) 1.25 in. deep in the region N of BM2, and from 10½ ft. to 15 ft. away on BSM, (3) 1.25 in. deep in the region S of BM2, and 7 ft. long on BSM. Similar cracks at the top of the slab are expected in the same regions on BM2 & BM3.

TABLE 19 (continued)
Overload Directory for Vehicle #5 on B 13A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
134.	0.06/1.85	0.30/0.62	0.081	Similar to above; additional cracks at the bottom of the slab are 3.75 in. deep in the region N of BM2, and 3½ ft. long on BSM.
138.	0.07/1.85	0.31/0.64	0.084	Similar to above; additional cracks at the bottom of the slab are 3.75 in. deep in the region N of BM2, and 7 ft. long on BSM.
148.	0.07/1.85	0.31/0.70	0.090	Bottom cracks of the slab are: (1) 3.75 in. deep in the region N of BM2, and 10½ ft. long on BSM, (2) 2.5 in. deep in the region N of BM2, and from 10½ ft. to 15 ft. away on BSM, (3) 2.5 in. deep in the region S of BM3, and 10½ ft. long on BSM, (4) 1.25 in.deep in the region S of BM2, and 15 ft. long on BSM. Similar cracks at the top of the slab are expected in the same regions on BM2 & BM3.
157.	0.08/1.85	0.31/0.76	0.097	Same as above.
166.	0.08/1.85	0.30/0.82	0.103	Bottom cracks of the slab are: (1) 3.75 in. deep in the region N of BM2, and 10½ ft. long on BSM, (2) 3.75 in. deep in the region S of BM3, and 3½ ft. long on BSM, (3) 2.50 in. deep in the region S of BM3, and from 3½ ft. to 10½ ft. away on BSM, (4) 2.50 in. deep in the region N of BM2, from 10½ ft. to 15 ft. away on BSM, (5) 1.25 in. deep in the region N of BM2, and from 15 ft. to support lines on BSM, (6) 1.25 in. deep in the region S of BM2, and 15 ft. long on BSM. Similar cracks at the top of the slab are expected in the same regions on BM2 & BM3.
176.	0.10/1.85	0.31/0.88	0.111	Slab cracks are same as above. Bottom cracks of BM2 are 2 in. deep throughout a 3½ ft. long region on BSM.

TABLE 20
Overload Directory for Vehicle #5 on B 13C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
56.	0.02/1.85	0.23/0.21	0.033	None
61.	0.02/1.85	0.25/0.24	0.036	Bottom cracks of the slab are 1.25 in. deep in the region between BM2 & BM3 and 7 ft. long on BSM.
65.	0.02/1.85	0.26/0.25	0.039	Same as above.
74.	0.02/1.85	0.27/0.30	0.044	Same as above.
82.	0.03/1.85	0.25/0.35	0.050	Bottom cracks of the slab are: (1) 2.5 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 1.25 in. deep in the region between BM2 & BM3 and from 7 ft. to 10½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
93.	0.04/1.85	0.26/0.40	0.056	Same as above.
102.	0.04/1.85	0.27/0.45	0.062	Same as above.
107.	0.05/1.85	0.26/0.47	0.065	Bottom cracks of the slab are: (1) 2.5 in. deep in the region N of BM2, and 10½ ft. long on BSM, (2) 2.5 in. deep in the region S of BM3, and 7 ft. long on BSM, (3) 1.25 in. deep in the region N of BM2, and from 10½ ft. to 15 ft. away on BSM, (4) 1.25 in. deep in the region S of BM2, and 7 ft. long on BSM, (5) 1.25 in. deep in the region S of BM3, and from 7 ft. to 10½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
117.	0.06/1.85	0.27/0.52	0.071	Same as above.
120.	0.06/1.85	0.26/0.54	0.074	Bottom cracks of the slab are: (1) 3.75 in. deep in the region N of BM2, and 7 ft. long on BSM, (2) 2.5 in. deep in the region N of BM2, and from 7 ft. to 10½ ft. away on BSM, (3) 2.5 in. deep in the region S of BM3,

TABLE 20 (continued)

Overload Directory for Vehicle # 5 on B 13C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				and 10½ ft. long on BSM, (4) 1.25 in. deep in the region S of BM2, and 7 ft. long on BSM, (5) 1.25 in. deep in the region N of BM2, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
130.	0.06/1.85	0.27/0.59	0.080	Same as above.
140.	0.06/1.85	0.26/0.63	0.086	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 3.75 in. deep in the region N of BM2 and from 10½ ft. to 15 ft. away on BSM, (3) 2.5 in. deep in the region N of BM2, and from 10½ ft. to 15 ft. away on BSM, (4) 2.5 in. deep in the region S of BM3, and from 7 ft. to 10½ ft. away on BSM, (5) 1.25 in. deep in the region S of BM2, and 15 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
148.	0.08/1.85	0.27/0.68	0.093	Same as above.
158.	0.09/1.85	0.26/0.74	0.100	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 3.75 in. deep in the region N of BM2, and from 7 ft. to 15 ft. away on BSM, (3) 2.5 in. deep in the region N of BM2, and from 25 ft. to support lines on BSM, (4) 2.5 in. deep in the region S of BM3, and from 7 ft. to 10½ ft. away on BSM, (5) 1.25 in. deep in the region S of BM2, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3. Additional cracks at the top of the slab are 1.25 in. deep in the region N of BM3, and 7 ft. long on BSM.
162.	0.09/1.85	0.27/0.76	0.104	Same as above.
169.	0.10/1.85	0.28/0.79	0.108	Slab cracks are same as above. Bottom cracks of BM2 are 2 in. deep throughout a 3½ ft. long region on BSM.

TABLE 21
Overload Directory for Vehicle #5 on B14A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
58.	0.02/1.91	0.23/0.24	0.014	None
72.	0.02/1.91	0.27/0.28	0.017	Bottom cracks of the slab are 1.17 in. deep in the region between BM2 & BM3, and 3½ ft. long on BSM.
76.	0.02/1.91	0.28/0.28	0.018	Bottom cracks of the slab are 1.17 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM.
90.	0.03/1.91	0.28/0.35	0.022	Same as above.
100.	0.03/1.91	0.28/0.39	0.024	Bottom cracks of the slab are: (1) 2.42 in. deep in the region between BM2 & BM3, and 3½ ft. long on BSM, (2) 1.17 in. deep in the region between BM2 & BM3, and from 3½ ft. to 10½ ft. away from BSM. Similar cracks at the top of the slab are expected in the same region on BM2 & BM3.
104.	0.03/1.91	0.28/0.41	0.025	Bottom cracks of the slab are: (1) 2.42 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 1.17 in. deep in the region between BM2 & BM3, and from 7 ft. to 11½ ft. away from BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
119.	0.03/1.91	0.30/0.48	0.029	Same as above.
129.	0.04/1.91	0.30/0.54	0.031	Bottom cracks of the slab are 2.42 in. deep in the region between BM2 & BM3, and 11½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
140.	0.04/1.91	0.30/0.57	0.033	Bottom cracks of the slab are: (1) 2.42 in. deep in the region between BM2 & BM3, and 11½ ft. long on BSM, (2) 1.17 in. deep in the region between BM2 & BM3, and from 11½ ft. to 17 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.

TABLE 21 (continued)
Overload Directory for Vehicle #5 on B 14A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
150.	0.04/1.91	0.30/0.64	0.037	Bottom cracks of the slab are: (1) 3.58 in. deep in the region between BM2 & BM3, and 3½ ft. on BSM, (2) 3.58 in. deep in the region N of BM2, and from 3½ ft. to 7 ft. away on BSM, (3) 2.42 in. deep in the region S of BM3, and from 3½ ft. to 7 ft. away on BSM, (3) 1.17 in. deep in the region between BM2 & BM3, and from 11½ ft. to 17 ft. away on BSM, (4) 1.17 in. deep in the region S of BM2, and 17 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions.
154.	0.04/1.91	0.30/0.66	0.038	Same as above.
160.	0.04/1.91	0.29/0.69	0.040	Bottom cracks of the slab are: (1) 3.58 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 2.42 in. deep in the region between BM2 & BM3, and from 7 ft. to 17 ft. away on BSM, (3) 1.17 in deep in the region N of BM3, and 17 ft. long on BSM, (4) 1.17 in. long in the region S of BM2, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
166.	0.05/1.91	0.31/0.71	0.042	Same as above; additional bottom cracks are 1.17 in. deep in the region between BM2 & BM3, and from 17 ft. to 25 ft. long on BSM.
174.	0.05/1.91	0.31/0.76	0.044	Same as above.
189.	0.05/1.91	0.30/0.81	0.048	Bottom cracks of the slab are: (1) 3.58 in. deep in the region between BM2 & BM3, and 17 ft. long on BSM, (2) 2.42 in. deep in the region between BM2 & BM3, and from 17 ft. to 25 ft. away on BSM, (3) 1.17 in. deep in the regions N of BM3 and S of BM3, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
204.	0.05/1.91	0.31/0.89	0.052	Same as above.

TABLE 21 (continued)
Overload Directory for Vehicle #5 on B14A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
210.	0.05/1.91	0.31/0.92	0.054	Same as above, additional bottom cracks of the slab are 1.17 in. deep in the region N of BM2, and from 25 ft. to the support lines.
216.	0.06/1.91	0.31/0.94	0.056	Same as above.
230.	0.06/1.91	0.29/1.01	0.060	Bottom cracks of the slab are: (1) 4.75 in. deep in the region N of BM2, and 11½ ft. long on BSM, (2) 3.58 in. deep in the region N of BM2, and from 17 ft. to 25 ft. away on BSM, (3) 3.58 in. deep in the region S of BM3, and 17 ft. long on BSM, (4) 2.42 in. deep in the region S of BM3, and from 17 ft. to 25 ft. away on BSM, (5) 1.17 in. deep in the region S of BM2, and throughout the length of the bridge, (6) 1.17 in. deep in the region N of BM3, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
239.	0.07/1.91	0.31/1.04	0.063	Slab cracking is similar to above. Bottom cracks of BM2 are 2 in. deep throughout a 3½ ft. long region on BSM.

TABLE 22

Overload Directory for Vehicle #5 on B 14C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
50.	0.02/1.91	0.20/0.18	0.012	None
63.	0.02/1.91	0.25/0.23	0.015	Bottom cracks of the slab are 1.17 in. deep in the region between BM2 & BM3, and 3½ ft. long on BSM.
66.	0.02/1.91	0.26/0.24	0.016	Bottom cracks of the slab are 1.17 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM.
79.	0.03/1.91	0.27/0.30	0.019	Same as above.
88.	0.03/1.91	0.26/0.34	0.021	Bottom cracks of the slab are: (1) 2.42 in. deep in the region between BM2 & BM3, and 3½ ft. long on BSM, (2) 1.17 in. deep in the region between BM2 & BM3, and from 3½ ft. to 11½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
91.	0.03/1.91	0.26/0.35	0.022	Bottom cracks of the slab are: (1) 2.42 in. deep in the region between BM2 & BM3 and 7 ft. long on BSM, (2) 1.17 in. deep in the region between BM2 & BM3, and from 7 ft. to 11½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
104.	0.03/1.91	0.26/0.42	0.025	Same as above.
117.	0.04/1.91	0.27/0.48	0.028	Bottom cracks of the slab are: (1) 2.42 in. deep in the region between BM2 & BM3, and 11½ ft. long on BSM, (2) 1.17 in. deep in the region N of BM2, and from 11½ ft. to 17 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
120.	0.04/1.91	0.27/0.50	0.029	Same as above.
128.	0.04/1.91	0.26/0.54	0.031	Bottom cracks of the slab are: (1) 3.58 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 2.42 in. deep in the region between

TABLE 22 (continued)
Overload Directory for Vehicle #5 on B 14C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				BM2 & BM3, and from 7 ft. to 11½ ft. away on BSM, (3) 1.17 in. deep in the region between BM2 & BM3, and from 11½ ft. to 17 ft. away on BSM, (4) 1.17 in. deep in the region S of BM2, and 17 ft. long on BSM. Similar cracks are expected at the top of the slab in similar regions on BM2 & BM3.
134.	0.04/1.91	0.27/0.56	0.033	Same as above.
140.	0.04/1.91	0.26/0.58	0.035	Bottom cracks of the slab are: (1) 3.58 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 2.42 in. deep in the region between BM2 & BM3, and from 7 ft. to 17 ft. away on BSM, (3) 1.17 in. deep in the region S of BM2, and 25 ft. long on BSM, (4) 1.17 in. deep in the region N of BM3 and 17 ft. long on BSM. Similar cracks are expected in the same regions over BM2 & BM3.
146.	0.04/1.91	0.27/0.61	0.036	Same as above.
160.	0.05/1.91	0.27/0.67	0.040	Bottom cracks of the slab are: (1) 3.58 in. deep in the region between BM2 & BM3, and 11½ ft. long on BSM, (2) 2.42 in. deep in the region between BM2 & BM3, and from 11½ ft. to 17 ft. away on BSM, (3) 1.17 in. deep in the region between BM2 & BM3, and from 17 ft. to 25 ft. away on BSM, (4) 1.17 in. deep in the regions N of BM3 and S of BM2, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions over BM2 & BM3.
170.	0.05/1.91	0.27/0.72	0.043	Same as above.
183.	0.05/1.91	0.28/0.78	0.047	Same as above.
196.	0.06/1.91	0.26/0.83	0.050	Bottom cracks of the slab are: (1) 3.58 in. deep in the region between BM2 & BM3, and 17 ft. long on BSM, (2) 2.42 in. deep in the region between BM2 & BM3, and from 17 ft. to 25 ft. away on BSM, (3) 1.17 in deep in the

TABLE 22 (continued)
Overload Directory for Vehicle #5 on B14C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				region S of BM2 from support line to support line, (4) 1.17 in. deep in the region N of BM3, and 25 ft. long on BSM, (5) 1.17 in. deep in the region N of BM2, and from 25 ft. to the support lines on BSM. Similar cracks are expected at the top of the slab in the same regions on BM2 & BM3.
197.	0.06/1.91	0.26/0.83	0.050	Same as above except the bottom cracks in the region N of BM2 are 4.75 in. deep and extend 11½ ft. on BSM.
208.	0.06/1.91	0.25/0.87	0.054	Bottom cracks of the slab are: (1) 4.75 in. deep in the region N of BM2, and 17 ft. long on BSM, (2) 3.58 in. deep in the region between BM2 & BM3 and from 17 ft. to 25 ft. away on BSM, (3) 1.17 in. deep in the region S of BM2, and throughout the length of the bridge, (4) 1.17 in. deep in the region between BM2 & BM3, and from 25 ft. to support lines away on BSM, (5) 1.17 in. deep in the region N of BM3, and 25 ft. long on BSM. Similar cracks are expected in the same regions at the top of the slab on BM2 & BM3.
216.	0.07/1.91	0.27/0.90	0.056	Same as above.
229.	0.07/1.91	0.27/0.97	0.059	Similar to above. Additional cracks at the top of the slab are 1.17 in. deep in the region S of BM4, and 25 ft. long on BSM.
235.	0.07/1.91	0.27/0.99	0.061	Slab cracks are same as above. Bottom cracks in BM2 are 2 in. deep throughout a 3½ ft. long region on BSM.

TABLE 23

Overload Directory for Vehicle #5 on B15A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
56.	0.03/1.86	0.23/0.21	0.016	None
70.	0.03/1.86	0.28/0.27	0.020	Bottom cracks of the slab are 1.25 in. deep in the region N of BM2 & 3½ ft. long on BSM. Similar cracks at the top of the slab are expected in the same region over BM3.
74.	0.03/1.86	0.30/0.29	0.021	Bottom cracks of the slab are 1.25 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM. Similar cracks are expected at the top of the slab in the same region over BM2 & BM3.
88.	0.04/1.86	0.30/0.35	0.026	Same as above.
102.	0.04/1.86	0.30/0.40	0.030	Bottom cracks of the slab are: (1) 2.5 in. deep in the region between BM2 & BM3 and 3½ ft. long on BSM, (2) 2.5 in. deep in the region N of BM2 and from 3½ ft. to 7 ft. away on BSM, (3) 1.25 in. deep in the region between BM2 & BM3 and from 7 ft. to 11½ ft. on BSM, (4) 1.25 in deep in the region S of BM3 and from 3½ ft. to 7 ft. on BSM. Similar cracks at the top of the slab are expected in the same regions N of BM2 and S of BM3.
108.	0.04/1.86	0.30/0.46	0.031	Bottom cracks of the slab are: (1) 2.5 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 1.25 in. deep in the region between BM2 & BM3, and from 7 ft. to 11½ ft. away on BSM. Similar cracks at the top of the slab are expected in the same region N of BM2 and S of BM3.
122.	0.04/1.86	0.30/0.51	0.035	Same cracks as above, in addition, bottom cracks of the slab are 1.25 in. deep in the region N of BM2, and from 11½ ft. to 17 ft. away on BSM.
130.	0.04/1.86	0.29/0.58	0.038	Bottom cracks of the slab are: (1) 2.5 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 2.5 in. deep in the region N of BM2 and 7 ft. to 11½ ft. long on BSM, (3) 1.25 in. deep in the region S of BM3, and from 7 ft. to 11½ ft. long on BSM, (4) 1.25 in. deep in the region N of BM2 and

TABLE 23 (continued)
Overload Directory for Vehicle #5 on B15A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				from 11½ ft. to 17 ft. long on BSM, (5) 1.25 in. deep in the region S of BM2 and 17 ft. long on BSM. Similar cracks are expected at the top of the slab on BM2 and S of BM3.
137.	0.05/1.86	0.30/0.61	0.040	Bottom cracks of the slab are: (1) 2.5 in. deep in the region between BM2 & BM3, and 11½ ft. long on BSM, (2) 1.25 in. deep in the region S of BM2 and 17 ft. long on BSM, (3) 1.25 in. deep in the region N of BM2, and from 11½ ft. to 17 ft. away on BSM. Similar cracks at the top of the slab are expected in the same regions S of BM3 and on BM2.
151.	0.05/1.86	0.31/0.69	0.045	Bottom cracks of the slab are: (1) 3.75 in. deep in the region N of BM2, and 7 ft. long on BSM, (2) 2.5 in. deep in the region S of BM3 and 11½ ft. long on BSM, (3) 2.5 in. deep in the region N of BM3, and from 7 ft. to 17 ft. away on BSM, (4) 1.25 in. deep in the region N of BM2, and from 17 ft. to 25 ft. away on BSM, and (5) 1.25 in. deep in the region S of BM2, and 25 ft. long on BSM. Similar cracks are expected at the top of the slab on BM2 and S of BM3.
165.	0.06/1.86	0.31/0.75	0.049	Same as above.
172.	0.06/1.86	0.29/0.80	0.052	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 3.75 in. deep in the region N of BM2, and from 7 ft. to 11½ ft. away on BSM, (3) 2.5 in. deep in the region S of BM3, and from 7 ft. to 11½ ft. away on BSM, (4) 2.5 in. deep in the region N of BM2, and from 11½ ft. to 17 ft. away on BSM, (5) 1.25 in. deep in the region S of BSM, and from 11½ ft. to 17 ft. away on BSM, (6) 1.25 in. deep in the region N of BM2 and from 17 ft. to 25 ft. away on BSM, (7) 1.25 in. deep in the region S of BM2 in a region 25 ft. long on BSM. Similar cracks at the top of the slabs are expected on BM2 and BM3.
186.	0.06/1.84	0.29/0.83	0.056	Same as above.

TABLE 23 (continued)
Overload Directory for Vehicle #5 on B15A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
189.	0.07/1.80	0.32/0.85	0.057	Bottom cracks of the slab are: (1) 3.75 in. deep in the region S of BM3, and 7 ft. long on BSM, (2) 3.75 in. deep in the region N of BM3, and 17 ft. long on BSM, (3) 2.5 in. deep in the region S of BM3, and from 7 ft. to 11½ ft. away from BSM, (4) 2.5 in. deep in the region N of BM3, and from 17 ft. to 25 ft. long on BSM, (5) 1.25 in deep in the region S of BM2 and 25 ft. long on BMS. Similar cracks are expected at the top of the slab in the same regions on BM2 and BM3.
199.	0.07/1.78	0.30/0.92	0.061	Same as above; and 1.25 in. deep cracks at the top of the slab in the region N of BM3, and 7 ft. long on BSM.
205.	0.07/1.76	0.31/0.98	0.063	Same as above; and 1.25 in. deep cracks at the bottom of the slab in the region N & S of BM2 and from 25 ft. to support line on BSM.
206.	0.07/1.75	0.31/0.99	0.063	Same as above.
219.	0.08/1.75	0.31/1.04	0.067	Bottom cracks of the slab are: (1) 3.75 in. deep in the region of BM2 & BM3, and 17 ft. long on BSM, (2) 2.5 in. deep in the region S of BM2, and 25 ft. long on BSM, (3) 1.25 in. deep in the region N of BM2, and from 25 ft. to support line on BSM. Similar cracks at the top of the slab are expected in the same regions over BM2 & BM3. Additional cracks at the top of the slab are 1.25 in. deep in the region N of BM3, and 7 ft. long on BSM.
227.	0.09/1.75	0.30/1.08	0.070	Slab cracks are same as above. Bottom cracks at BM2 are 2 in. deep throughout a 3½ ft. long region on BSM.

TABLE 24
Overload Directory for Vehicle # 5 on B15C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
50.	0.03/1.86	0.20/0.18	0.014	None
61.	0.03/1.86	0.25/0.23	0.017	Bottom cracks of the slab are 1.25 in. deep in the region N of BM2, and 3½ ft. long on BSM.
65.	0.03/1.86	0.26/0.25	0.019	Bottom cracks of the slab are 1.25 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM. Similar cracks are expected at the top of the slab in the same region over BM2 & BM3.
77.	0.03/1.86	0.26/0.29	0.022	Same as above.
89.	0.04/1.86	0.27/0.36	0.026	Bottom cracks of the slab are: (1) 2.5 in. deep in the region between BM2 & BM3, and 7 ft. long on BSM, (2) 1.25 in. deep in the region between BM2 & BM3, and from 7 ft. to 11½ ft. away on BSM. Similar cracks are expected at the top of the slab in the same region over BM2 & BM3.
94.	0.04/1.86	0.28/0.39	0.027	Same as above.
106.	0.04/1.86	0.24/0.45	0.031	Same as above; additional bottom cracks of the slab are 1.25 in. deep in the region N of BM2, and from 11½ ft. to 17 ft. away on BSM.
114.	0.04/1.86	0.26/0.49	0.033	Bottom cracks of the slab are: (1) 2.5 in. deep in the region between BM2 & BM3, and 11½ ft. long on BSM, (2) 1.25 in. deep in the region S of BM2, and 17 ft. long on BSM. Similar cracks are expected at the top of the slab on the same regions over N of BM2 and S of BM3.
120.	0.04/1.86	0.26/0.52	0.035	Same as above.
132.	0.04/1.86	0.26/0.52	0.039	Bottom cracks of the slab are: (1) 3.75 in. deep in the region N of BM2, and 7 ft. long on BSM, (2) 2.5 in. deep in the region S of BM3, and 11½ ft. long

TABLE 24 (continued)
Overload Directory for Vehicle #5 on B15C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				on BSM, (3) 1.25 in. deep in the region N&S of BM2, and 25 ft. long on BSM. Similar cracks at the top of the slab are expected in the same regions.
144.	0.05/1.86	0.26/0.65	0.043	Similar to above; except the cracks S of BM3 are 3.75 in. deep in a region 7 ft. long on BSM.
148.	0.05/1.86	0.26/0.66	0.045	Same as above.
161.	0.06/1.86	0.26/0.74	0.049	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM2 & BM3, and 11½ ft. long on BSM, (2) 2.5 in deep in the region between BM2 & BM3, and from 17 ft. to 25 ft. away on BSM, (3) 1.25 in. deep in the region S of BM2, and 25 ft. long on BSM. Similar cracks at the top of the slab are expected in the same regions S of BM3 and over BM2.
172.	0.06/1.86	0.26/0.80	0.053	Same as above; additional cracks at the top of the slab are 1.25 in. deep in the region N of BM3 and 7 ft. long on BSM.
180.	0.07/1.86	0.26/0.83	0.055	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM2 & BM3, and 17 ft. long on BSM, (2) 2.5 in. deep in the region S of BM2, and 7 ft. long on BSM, (3) 1.25 in. deep in the region S of BM2, and from 7 ft. to the support line on BSM, (4) 1.25 in deep in the region N of BM2, and from 25 ft. to the support line N of BM2. Similar cracks at the top of the slab are expected in the same regions. Additionally, there are 1.25 in. deep cracks at the top of the slab in the region N of BM3, and 7 ft. long on BSM.
181.	0.07/1.86	0.27/0.82	0.055	Bottom cracks of the slab are: (1) 3.75 in. deep in the region between BM2 & BM3, and 11½ ft. long on BSM, (2) 3.75 in. deep in the region N of BM2, and from 11½ ft. to 25 ft. away on BSM, (3) 2.5 in. deep in the region S of BM2, and 7 ft. long on BSM, (4) 1.25 in. deep in the region S of BM2, and from 7 ft. away to the support lines on BSM, (5) 1.25 in. deep in the region N

TABLE 24 (continued)
Overload Directory for Vehicle #5 on B 15C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
				of BM2, and from 25 ft. away to the support lines on BSM, (6) 1.25 in. deep in the region S of BM3, and from 11½ ft. to 17 ft. away on BSM. Similar cracks at the top of the slab are expected in the same regions. Additional cracks at the top of the slab are 1.25 in. deep in the region N of BM3, and 7 ft. BSM.
192.	0.07/1.86	0.28/0.88	0.059	Same as above.
204.	0.08/1.86	0.26/0.93	0.063	Bottom cracks of the slab are: (1) 5 in. deep in the region N of BM2, and 17 ft. long on BSM, (2) 3.75 in. deep in the region S of BM3, and 11½ ft. long on BSM, (3) 3.75 in. deep in the region N of BM2, and from 17 ft. to up to the support lines on BSM, (4) 2.5 in. deep in the region S of BM2, 7 ft. long on BSM, (5) 1.25 in. deep in the region S of BM2, and from 7 ft. up to the support lines on BSM. Similar cracks at the top of the slab are expected in the same region over BM2 & BM3. Additional cracks at the top of the slab are expected 2.5 in. deep in the region N of BM3, and 7 ft. long on BSM.
216.	0.08/1.86	0.24/0.99	0.067	Same as above. Additional cracks at the top of the slab are 1.25 in. deep S of BM4, and 25 ft. long on BSM.
221.	0.09/1.86	0.25/1.02	0.068	Same as above. Bottom cracks of BM2 are 2 in. deep throughout a 3½ ft. long region on BSM.

TABLE 25

Overload Directory for Vehicle #6 on B10A

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
124.	0.03/1.87	0.28/0.22	0.064	Bottom cracks of the slab are 1.25 in. deep in the regions N & S of BM3 and N & S of BM4, and 3½ ft. long on BSM.
144.	0.05/1.87	0.30/0.25	0.071	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, N of BM4 and S of BM3, and 7 ft. long on BSM.
167.	0.06/1.87	0.30/0.30	0.086	Bottom cracks of the slab are 1.25 in. deep in the region between BM3 & BM4, N of BM4 and S of BM3, and 10½ ft. long on BSM.
181.	0.07/1.87	0.30/0.65	0.097	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM3 & BM4, S of BM3, N of BM4, and 7 ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, N of BM4, S of BM3, and from 7 ft. to 10½ ft. long on BSM, (3) 1.25 in. deep in the region between BM3 & BM4, and from 10½ ft. to 15 ft. away on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
191.	0.08/1.87	0.30/0.68	0.099	Slab cracks are same as above. Bottom cracks of the beams are 2 in. deep on BM3 & BM4 throughout 3½ ft. long regions on BSM.

TABLE 26

Overload Directory for Vehicle #6 on B10B

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
116.	0.06/1.87	0.28/0.47	0.064	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
125.	0.06/1.87	0.29/0.51	0.069	Bottom cracks of the slab are: (1) 1.20 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.20 in. deep in the regions S of BM3 and N of BM4, and 7 ft. long on BSM.
151.	0.07/1.87	0.29/0.62	0.083	Bottom cracks of the slab are: (1) 1.20 in. deep in the region between BM3 & BM4, and 10½ ft. long on BSM, (2) 1.20 in. deep in the regions S of BM3 and N of BM4, and 10½ ft. long on BSM.
168.	0.08/1.87	0.28/0.69	0.092	Bottom cracks of the slab are: (1) 2.40 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.20 in. deep in the region between BM3 & BM4, and from 7 ft. to 15 ft. away on BSM, (3) 1.20 in. deep in the regions S of BM3 and N of BM4, and 10½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4. Bottom cracks of beams are 2 in. deep on BM3 & BM4 throughout 3½ ft. long regions on BSM.

TABLE 27

Overload Directory for Vehicle #6 on B10C

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
110.	0.04/1.87	0.24/0.39	0.058	Bottom cracks of the slab are 1.25 in. deep in the regions between BM3 & BM4, S of BM3 and N of BM4, and 3½ ft. long on BSM.
120.	0.05/1.87	0.26/0.41	0.063	Bottom cracks of the slab are 1.25 in. deep in the regions between BM3 & BM4, S of BM3 and N of BM4, and 7 ft. long on BSM.
148.	0.06/1.87	0.25/0.52	0.078	Bottom cracks of the slab are 1.25 in. deep in the regions between BM3 & BM4, S of BM3 and N of BM4, and 10½ ft. long on BSM.
158.	0.06/1.87	0.25/0.56	0.083	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 7 ft. to 15 ft. on BSM, (3) 1.25 in. deep in the regions S of BM3 and N of BM4, and 10½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
167.	0.07/1.87	0.26/0.59	0.088	Bottom cracks of the slab are: (1) 2.50 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM, (2) 1.25 in. deep in the region between BM3 & BM4, and from 7 ft. to 15 ft. on BSM, (3) 2.50 in. deep in the regions S of BM3 and N of BM4, and 10½ ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 & BM4.
186.	0.08/1.87	0.25/0.66	0.098	Slab cracks are same as above. Bottom cracks of beams are 2. in. deep on BM3 & BM4 throughout 3½ ft. long regions on BSM.

TABLE 28

Overload Directory for Vehicle #6 on B10D

P (kips)	S_b^t/S_b^c (ksi)	S_s^t/S_s^c (ksi)	T (ksi)	Damage
104.	0.04/1.87	0.24/0.41	0.056	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM.
112.	0.05/1.87	0.24/0.45	0.061	Bottom cracks of the slab are 1.20 in. deep in the region between BM3 & BM4, S of BM3 and N of BM4, and 7 ft. long on BSM.
146.	0.06/1.87	0.24/0.59	0.079	Bottom cracks of the slab are: (1) 1.20 in. deep in the region between BM3 & BM4, and 15 ft. long on BSM, (2) 1.20 in. deep in the regions S of BM3 and N of BM4, and 10½ ft. long on BSM.
154.	0.07/1.87	0.24/0.62	0.083	Same as above. Additional cracks at the bottom of the slab are 2.40 in. deep in the region between BM3 & BM4, and 7 ft. long on BSM. Similar cracks are expected at the top of the slab in the same regions on BM3 and BM4.
166.	0.09/1.87	0.25/0.67	0.090	Same as above; additional cracks at the top of the slab are 1.20 in. deep in the region N of BM2 and S of BM5. Bottom cracks of the beam are 2 in. deep on BM3 & BM4 throughout 3½ ft. long regions on BSM.

TABLE 29

GROSS VEHICULAR WEIGHTS (GVW) FOR
THRESHOLD DAMAGE (kips)

CASE	VEHICLE NO.	BRIDGE NO.	GVW_1*	GVW_2*	GVW_3*	GVW_4*	GVW_5*
46	3	10A	36	46	66	101	182
47	3	10B	28	35	56	100	161
48	3	10C	32	40	57	87	178
49	3	10D	25	31	48	88	159
50	3	11A	37	46	69	100	240
51	3	11B	30	36	57	106	216
52	3	11C	32	41	60	88	230
53	3	11D	26	32	50	94	211
54	5	10A	67	74	101	149	203
55	5	10B	50	59	88	153	182
56	5	10C	55	66	88	130	201
57	5	10D	49	52	76	133	176
58	5	11A	58	72	106	155	263
59	5	11B	47	59	91	160	241
60	5	11C	51	63	93	135	260
61	5	11D	41	54	80	140	232
62	5	12A	60	70	99	140	201
63	5	12C	60	64	88	123	200
64	5	13A	58	66	91	134	176
65	5	13C	56	61	82	120	169
66	5	14A	58	72	100	150	239
67	5	14C	50	63	88	128	235

TABLE 29 (continued)

CASE	VEHICLE NO.	BRIDGE NO.	GVW_1*	GVW_2*	GVW_3*	GVW_4*	GVW_5*
68	5	15A	56	70	102	151	227
69	5	15C	50	61	89	132	221
70	6	10A		124	181		191
71	6	10B		116	168		168
72	6	10C		110	158		186
73	6	10D		104	154		166

* GVW_1 = Limit of no-damage (kips)

GVW_2 = Load level that causes cracking of the deck slab concrete, 1/6 the slab thickness deep (1/5 in Type-B and -D deck deterioration) (kips)

GVW_3 = Load that causes cracking of the deck slab concrete, twice the depth of crack corresponds to load level GVW_2 (kips)

GVW_4 = Load that causes cracking of the deck slab concrete, three times the depth of cracks corresponds to load level GVW_2 (kips)

GVW_5 = Load that causes cracking of the concrete cover at the bottom of prestressing strands (kips)

TABLE 30

NONDIMENSIONALIZED THRESHOLD LOAD LEVELS (%)

CASE	VEHICLE NO.	BRIDGE NO.	P_1^*	P_2^*	P_3^*	P_4^*	P_5^*
46	3	10A	100	128	183	281	506
47	3	10B	100	125	200	357	575
48	3	10C	100	125	178	272	556
49	3	10D	100	124	192	352	636
50	3	11A	100	124	186	270	649
51	3	11B	100	120	190	353	720
52	3	11C	100	128	188	275	719
53	3	11D	100	123	192	362	812
54	5	10A	100	110	151	222	303
55	5	10B	100	118	176	306	364
56	5	10C	100	120	160	236	365
57	5	10D	100	106	155	271	359
58	5	11A	100	124	183	267	453
59	5	11B	100	126	194	340	513
60	5	11C	100	124	182	265	510
61	5	11D	100	132	195	341	566
62	5	12A	100	117	165	233	335
63	5	12C	100	107	147	205	333
64	5	13A	100	114	157	231	303
65	5	13C	100	109	146	214	302
66	5	14A	100	124	172	259	412
67	5	14C	100	126	176	256	470

TABLE 30 (continued)

CASE	VEHICLE NO.	BRIDGE NO.	P_1*	P_2*	P_3*	P_4*	P_5*
68	5	15A	100	125	182	270	405
69	5	15C	100	122	178	264	442
Average			100	121	176	279	484
Standard Deviation				7	16	48	146

* $P_1 = (GVW_1/GVW_1) \times 100$

$P_2 = (GVW_2/GVW_1) \times 100$

$P_3 = (GVW_3/GVW_1) \times 100$

$P_4 = (GVW_4/GVW_1) \times 100$

$P_5 = (GVW_5/GVW_1) \times 100$

TABLE 31

CRACK PROPAGATION
NONDIMENSIONALIZED THRESHOLD VALUES (%)

CASE	VEHICLE NO.	BRIDGE NO.	P_2' *	P_3' *	P_4' *	P_5' *
46	3	10A	100	143	220	396
47	3	10B	100	160	286	460
48	3	10C	100	143	218	445
49	3	10D	100	155	284	513
50	3	11A	100	150	217	522
51	3	11B	100	158	294	600
52	3	11C	100	146	215	561
53	3	11D	100	156	294	659
54	5	10A	100	136	201	274
55	5	10B	100	149	259	308
56	5	10C	100	133	197	305
57	5	10D	100	146	256	338
58	5	11A	100	147	215	365
59	5	11B	100	154	271	408
60	5	11C	100	148	214	413
61	5	11D	100	148	259	430
62	5	12A	100	141	200	287
63	5	12C	100	138	192	313
64	5	13A	100	138	203	267
65	5	13C	100	134	197	277

TABLE 31 (continued)

CASE	VEHICLE NO.	BRIDGE NO.	P_2' *	P_3' *	P_4' *	P_5' *
66	5	14A	100	139	208	332
67	5	14C	100	140	203	373
68	5	15A	100	146	216	324
69	5	15C	100	146	216	362
70	6	10A	100	146	-	154
71	6	10B	100	145	-	145
72	6	10C	100	144	-	169
73	6	10D	100	148	-	160
Average			100	146	231	397[1]
Standard Deviation			0	7	34	109[1]

* $P_2' = (GVW_2/GVW_2) \times 100$

$P_3' = (GVW_3/GVW_2) \times 100$

$P_4' = (GVW_4/GVW_2) \times 100$

$P_5' = (GVW_5/GVW_2) \times 100$

[1] Except cases 70-73

TABLE 32

TYPE-B DECK DETERIORATION
NONDIMENSIONALIZED THRESHOLD VALUES (%)

CASE	VEHICLE NO.	BRIDGE NO.	$P_{1,1}$*	$P_{2,1}$*	$P_{3,1}$*	$P_{4,1}$*	$P_{5,1}$*
46	3	10A	100	100	100	100	100
47	3	10B	78	76	85	99	88
50	3	11A	100	100	100	100	100
51	3	11B	81	78	83	106	90
54	5	10A	100	100	100	100	100
55	5	10B	75	80	87	103	90
58	5	11A	100	100	100	100	100
59	5	11B	81	82	86	103	92
	AVERAGE		79	79	85	102	90
	% Reduction in Strength		21	21	15	-2	10

* $P_{i,1} = ((GVW)_{BRIDGE-B} / (GVW)_{BRIDGE-A}) \times 100$

TABLE 33

TYPE-C DECK DETERIORATION
NONDIMENSIONALIZED THRESHOLD VALUES (%)

CASE	VEHICLE NO.	BRIDGE NO.	$P_{1,2}$*	$P_{2,2}$*	$P_{3,2}$*	$P_{4,2}$*	$P_{5,2}$*
46	3	10A	100	100	100	100	100
48	3	10C	89	87	86	86	98
50	3	11A	100	100	100	100	100
52	3	11C	86	89	87	88	96
54	5	10A	100	100	100	100	100
56	5	10C	82	89	87	87	99
58	5	11A	100	100	100	100	100
60	5	11C	88	88	88	84	99
62	5	12A	100	100	100	100	100
63	5	12C	100	91	89	88	100
64	5	13A	100	100	100	100	100
65	5	13C	97	92	90	90	96
66	5	14A	100	100	100	100	100
67	5	14C	86	88	88	85	98
68	5	15A	100	100	100	100	100
69	5	15C	89	87	87	87	97
	Average		89.6	89	87.8	86.9	97.9
	Standard Deviation		6.	1.8	1.3	1.9	1.5
	% Reduction in Strength		10	11	12	13	2

* $P_{i,2} = ((GVW)_{BRIDGE-C} / (GVW)_{BRIDGE-A}) \times 100$

TABLE 34

TYPE-D DECK DETERIORATION
NONDIMENSIONALIZED THRESHOLD VALUES (%)

CASE	VEHICLE NO.	BRIDGE NO.	$P_{1,3}$*	$P_{2,3}$*	$P_{3,3}$*	$P_{4,3}$*	$P_{5,3}$*
46	3	10A	100	100	100	100	100
49	3	10D	69	67	73	87	87
50	3	11A	100	100	100	100	100
53	3	11D	70	70	72	94	88
54	5	10A	100	100	100	100	100
57	5	10C	73	70	75	89	87
58	5	11A	100	100	100	100	100
61	5	11D	71	75	75	90	88
	Average		71	71	74	90	88
	% Reduction in Strength		29	29	26	10	12

* $P_{i,3} = ((GVW)_{BRIDGE-D} / (GVW)_{BRIDGE-A}) \times 100$

TABLE 35

EFFECTS OF BEAM SPACING ON THRESHOLD VALUES (%)

CASE	VEHICLE NO.	BRIDGE NO.	$P_{1,4}$*	$P_{2,4}$*	$P_{3,4}$*	$P_{4,4}$*	$P_{5,4}$*
62	5	12A	100	100	100	100	100
64	5	13A	97	94	92	96	88
63	5	12C	100	100	100	100	100
65	5	13C	93	95	93	98	85
66	5	14A	100	100	100	100	100
68	5	15A	97	97	102	101	95
67	5	14C	100	100	100	100	100
69	5	15C	100	97	101	103	94
	Average		97	96	97	100	90

* $P_{i,4} = ((GVW)_{s=7'-6"} / (GVW)_{s=6'6"}) \times 100$

TABLE 36

EFFECTS OF LOADED LANES
ON THRESHOLD VALUES (%)

CASE	VEHICLE NO.	BRIDGE NO.	$P_{1,5}$*	$P_{2,5}$*	$P_{3,5}$*	$P_{4,5}$*	$P_{5,5}$*
54	5	10A	100	100	100	100	100
64	5	13A	87	89	90	90	87
56	5	10C	100	100	100	100	100
65	5	13C	102	92	93	92	84
58	5	11A	100	100	100	100	100
68	5	15A	97	97	96	97	86
60	5	11C	100	100	100	100	100
69	5	15C	98	97	96	98	87
	Average (%)		96	94	94	94	86

* $P_{i,5} = ((GVW)_{OUTSIDE\ LANE} / (GVW)_{INSIDE\ LANE}) \times 100$

FIGURES

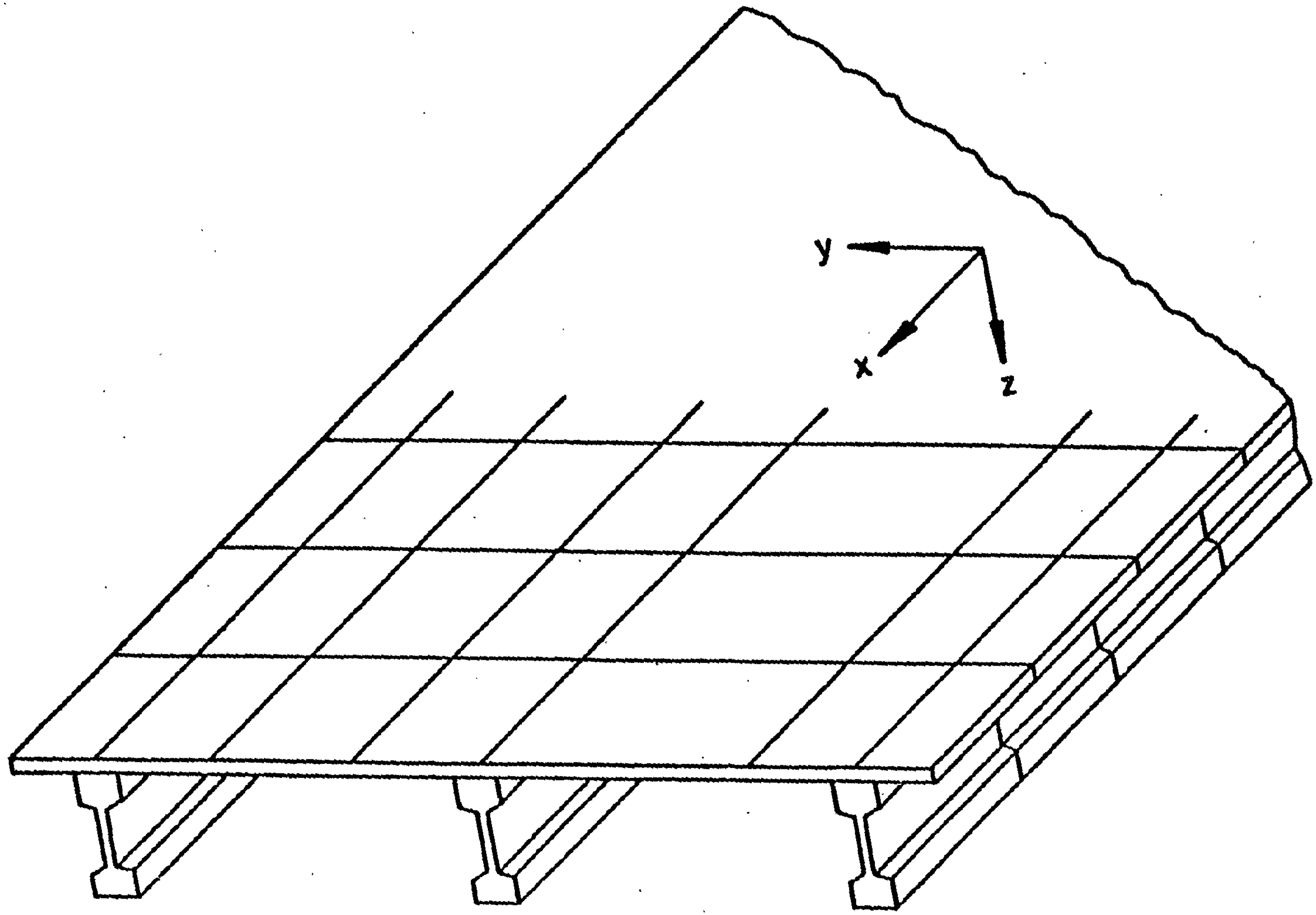


Fig. 1 Finite Element Idealization of Bridge Superstructure

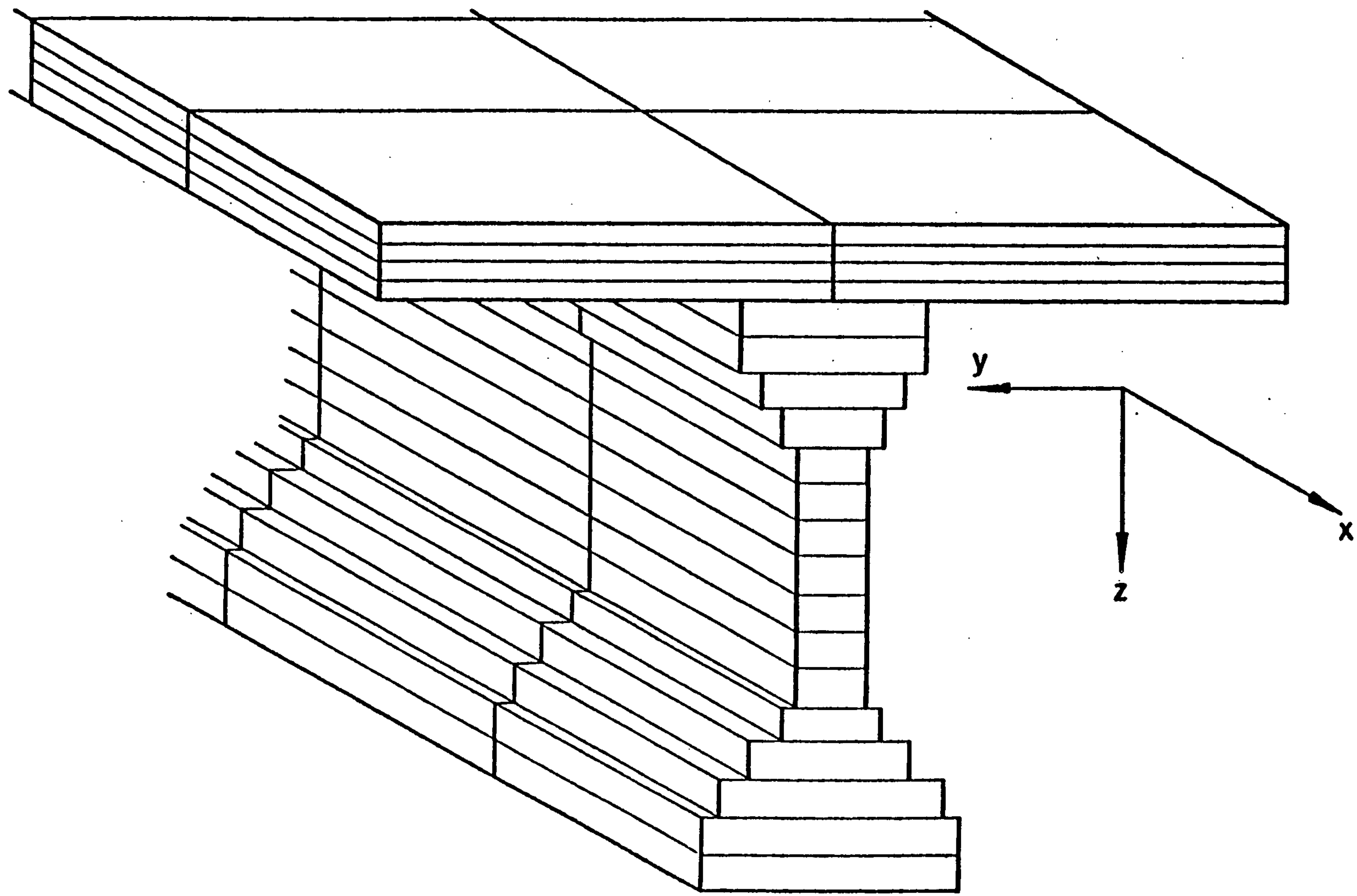


Fig. 2 Layering of Slab and Beam Finite Elements

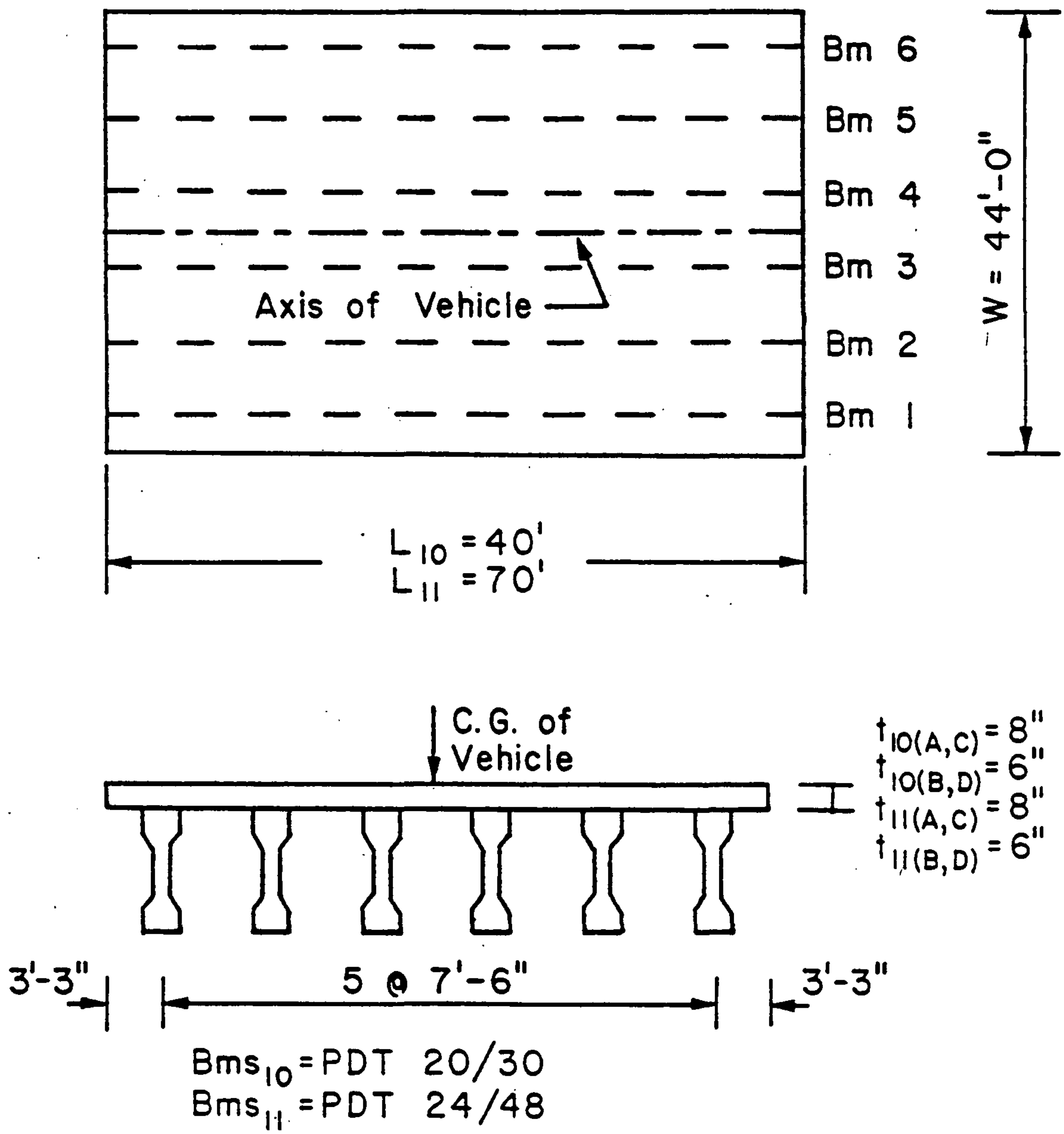


Fig. 3 Plan and Cross-Section of Bridges 10 and 11 (Subscripts Indicate Bridge Numbers and Deck Types Where Necessary)

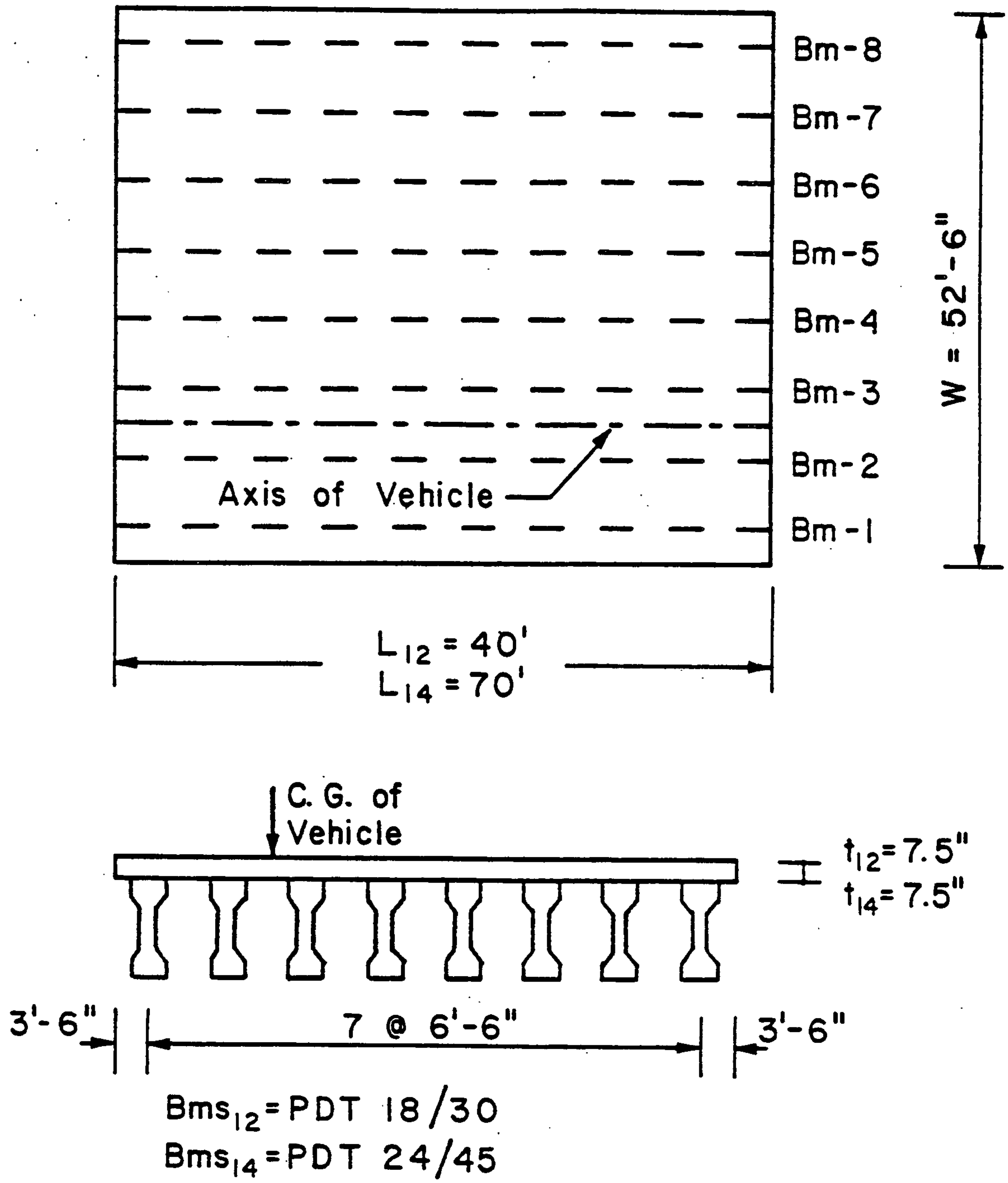


Fig. 4 Plan and Cross-Section of Bridges 12 and 14
(Subscripts Indicate Bridge Numbers)

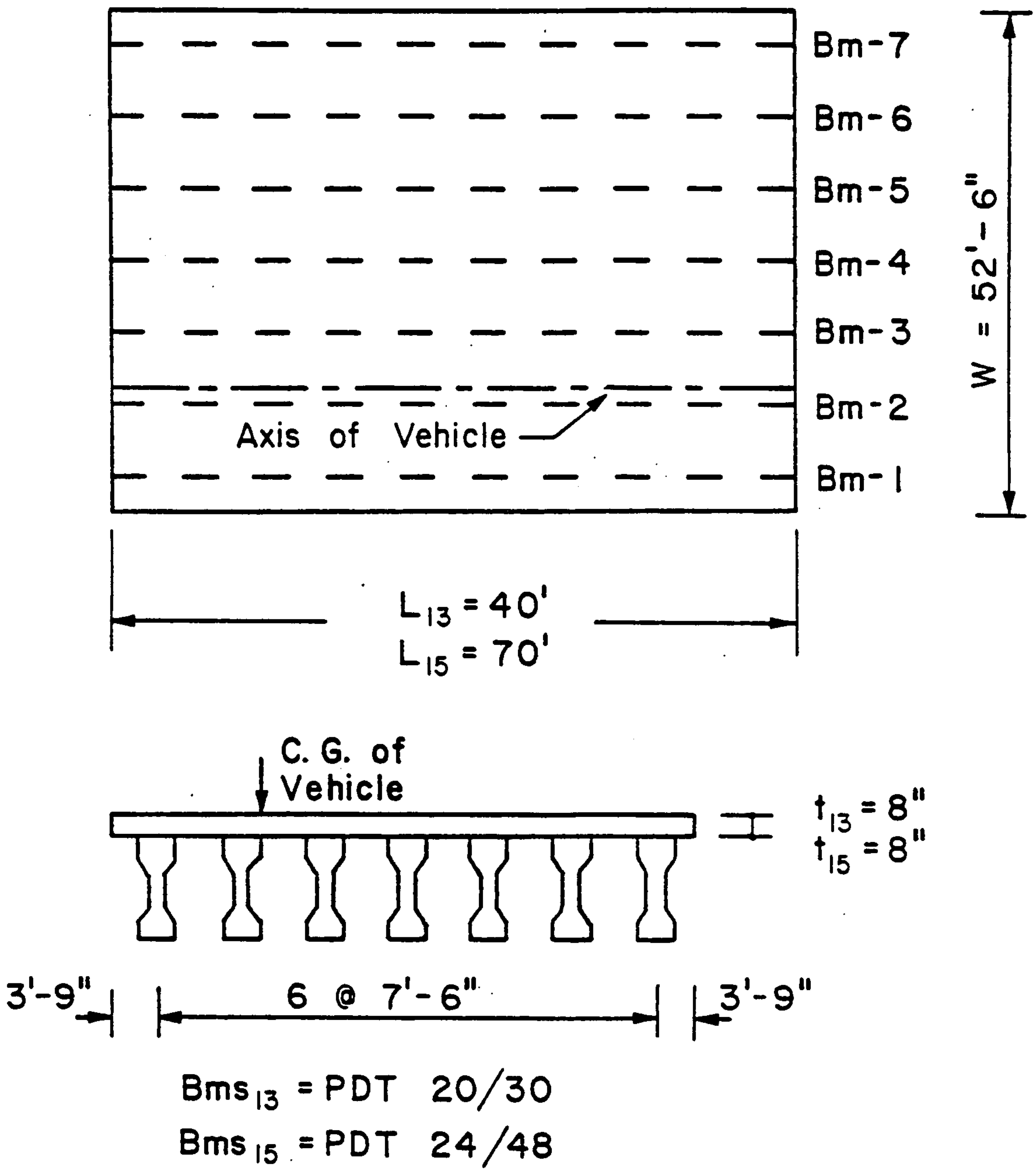


Fig. 5 Plan and Cross-Section of Bridges 13 and 15
(Subscripts Indicate Bridge Numbers)

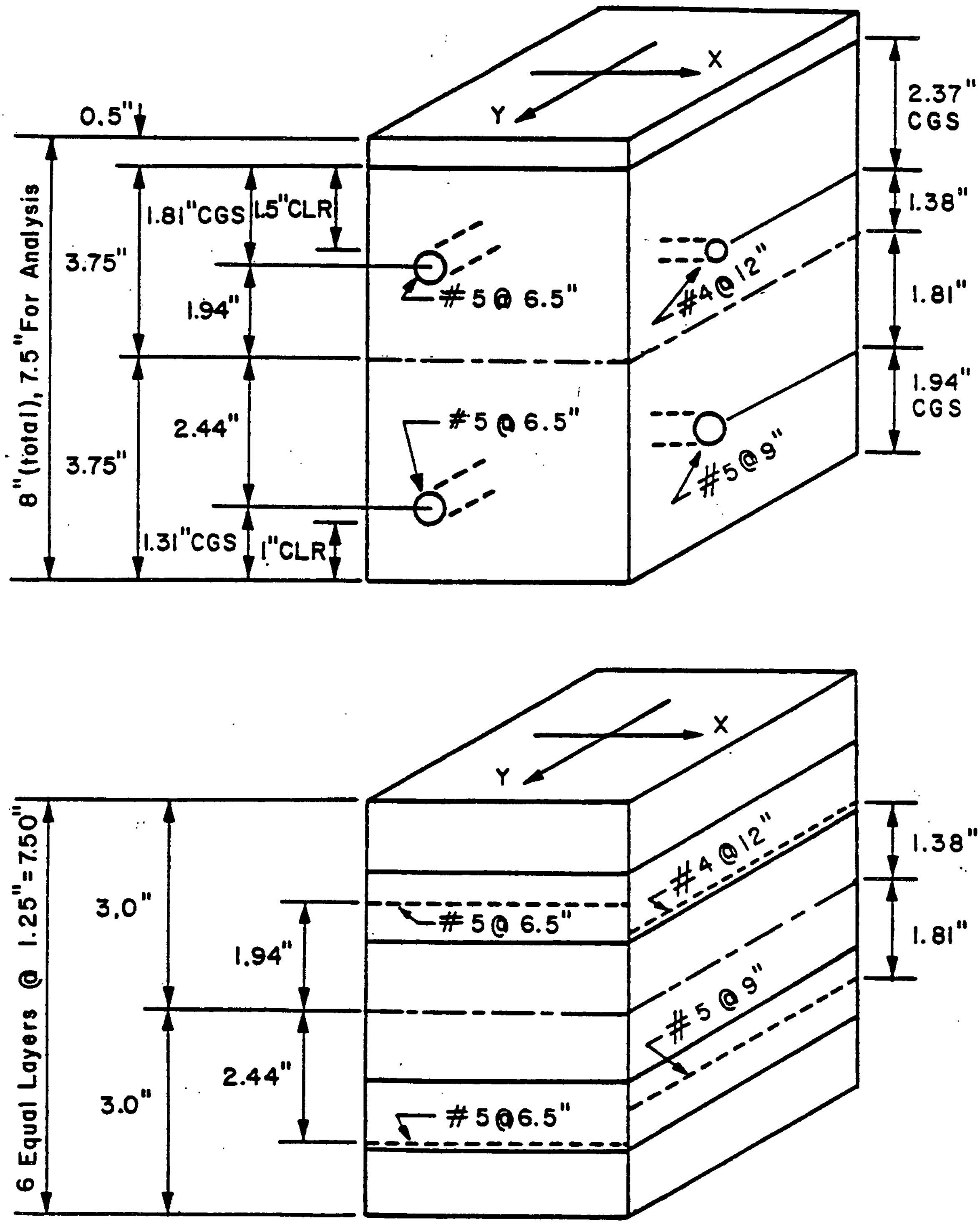


Fig. 6 Slab Details (top) and Finite Element Idealization (bottom) for Bridges 10, 11, 13, and 15 Deck Types A and C (X and Y Indicate Longitudinal and Transverse Directions Respectively)

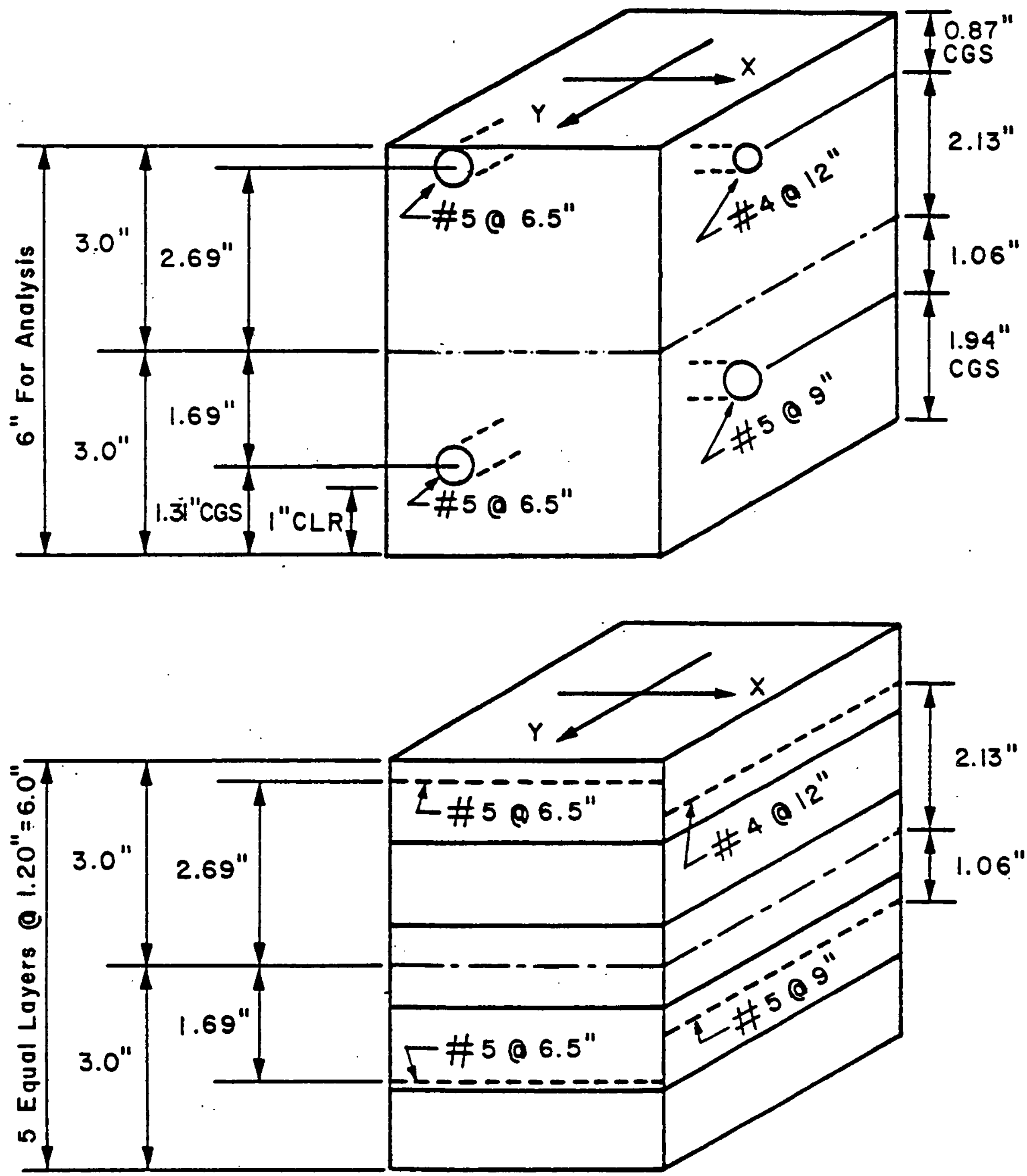
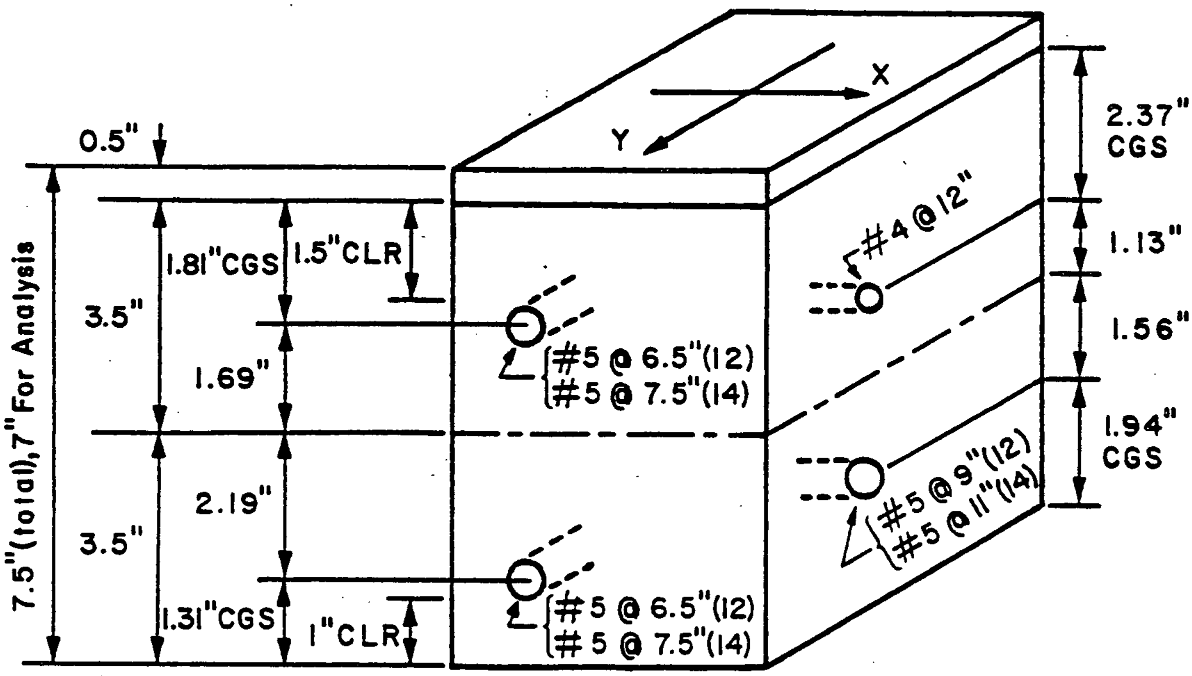


Fig. 7 Slab Details (top) and Finite Element Idealization (bottom) for Bridges 10 and 11 Deck Types B and D (X and Y Indicate Longitudinal and Transverse Directions Respectively)



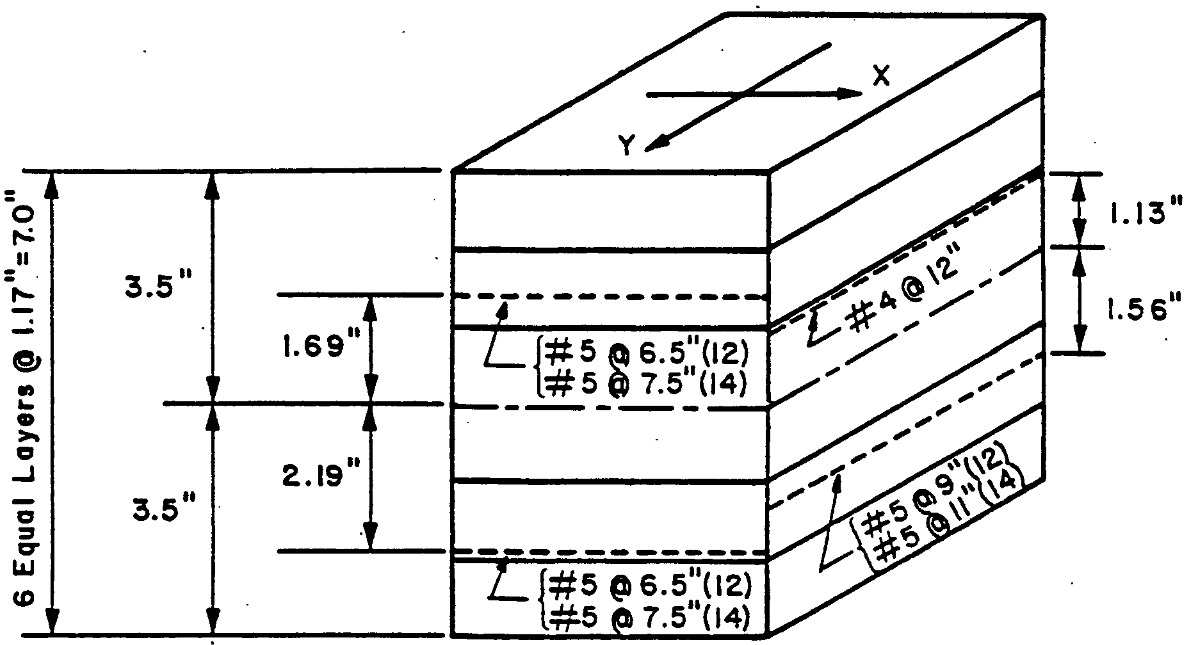


Fig. 8 Slab Details (top) and Finite Element Idealization (bottom) for Bridges 12 and 14 Indicated in Parentheses Deck Types A and C (X and Y Indicate Longitudinal and Transverse Directions Respectively)

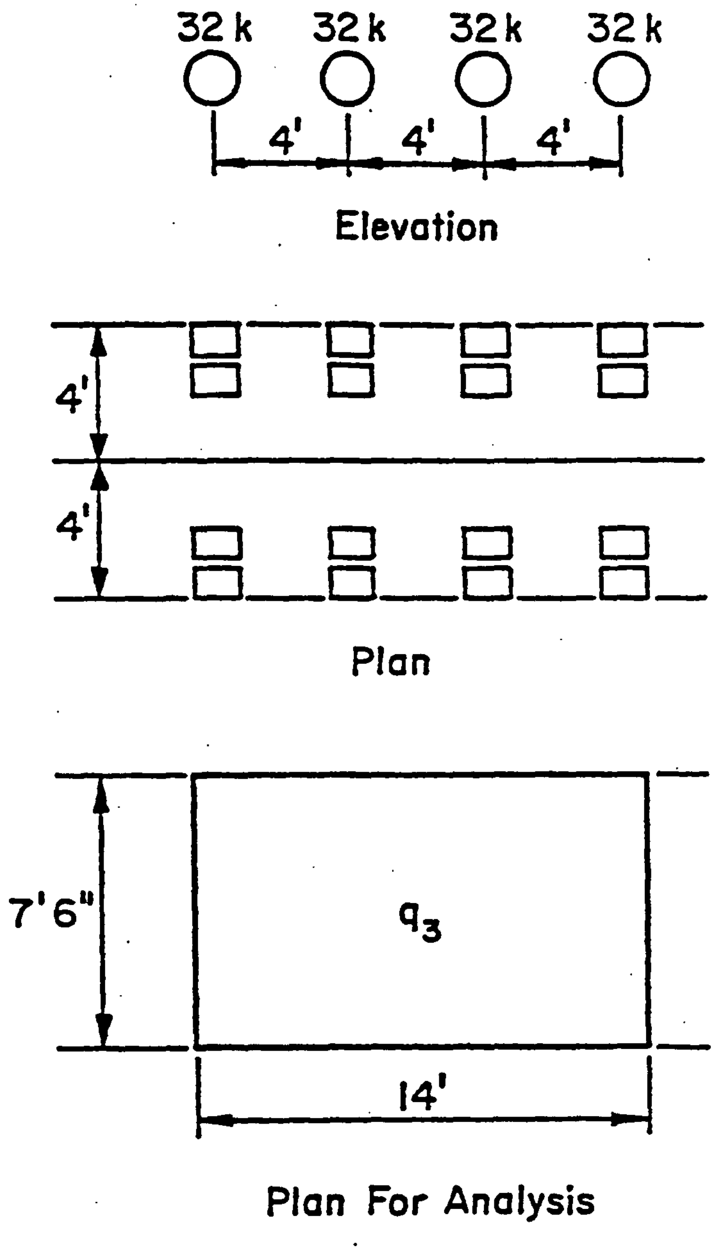


Fig. 9 Overload Vehicle No. 3

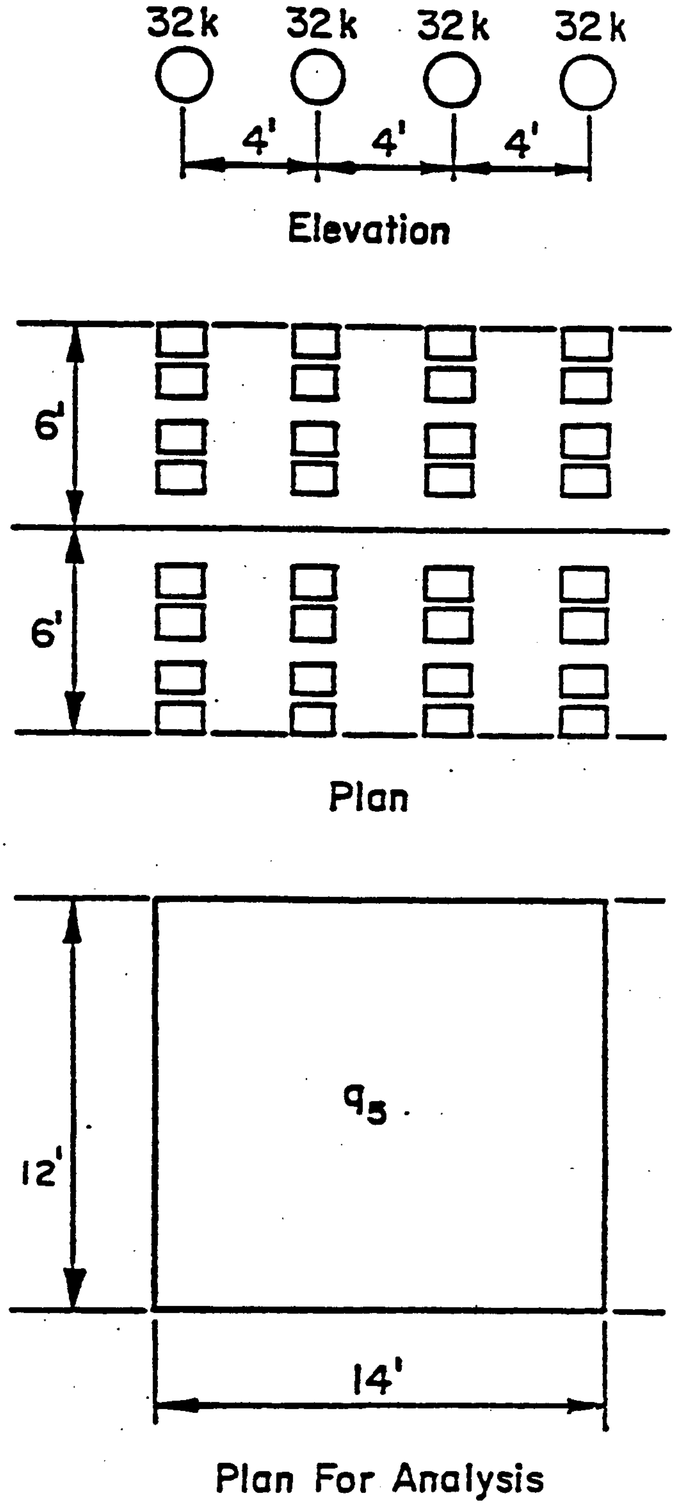


Fig. 10 Overload Vehicle No. 5

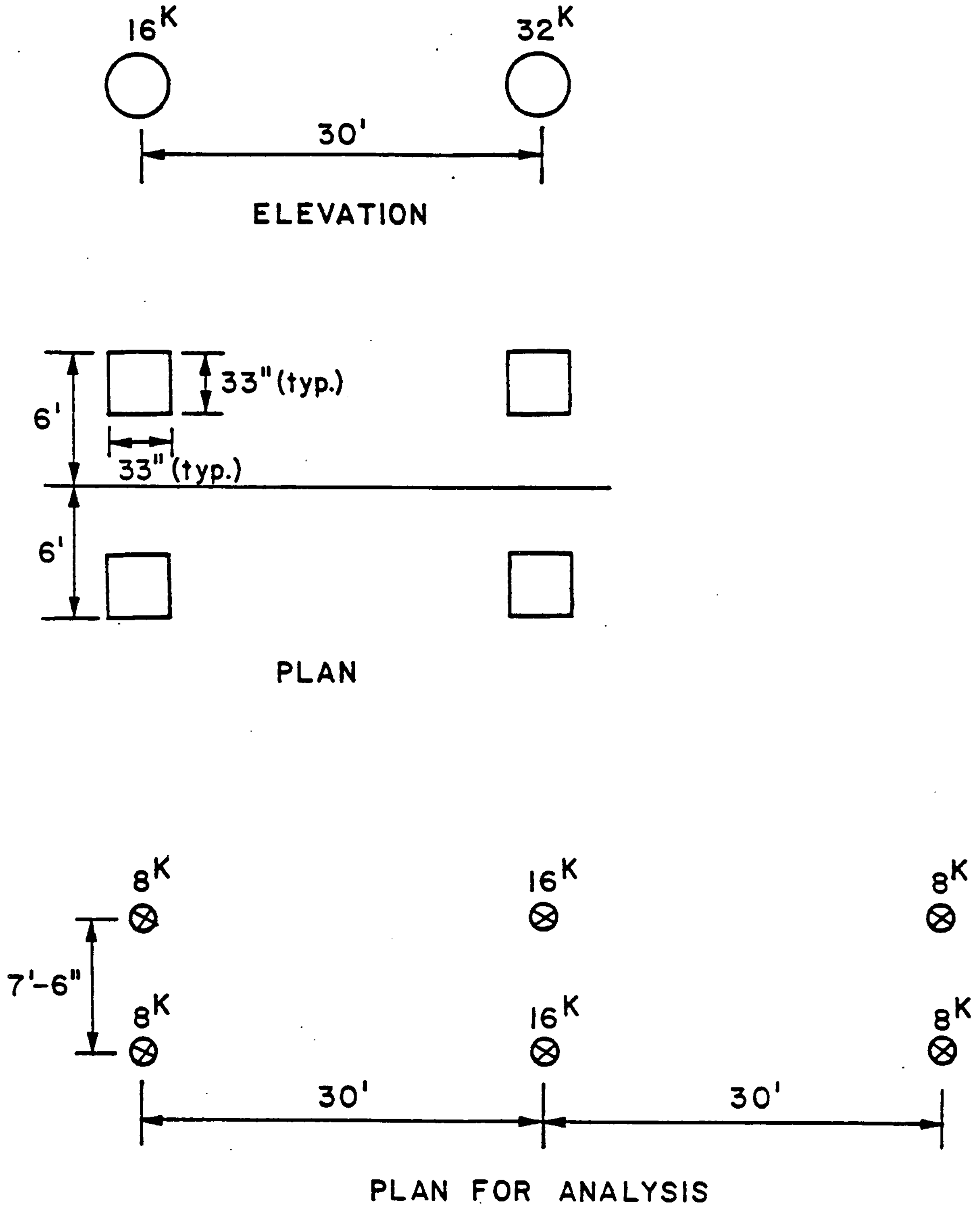


Fig. 11 Overload Vehicle No. 6

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REFERENCES

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ACKNOWLEDGEMENTS

This study was conducted in the Department of Civil Engineering and Fritz Engineering Laboratory, under the auspices of the Lehigh University Office of Research, as a part of the research investigation sponsored by the Pennsylvania Department of Transportation and the U.S. Department of Transportation, Federal Highway Administration. The case studies were executed in the Pennsylvania Department of Transportation's computer facilities.

In the planning and execution of the research the following individuals, representing Pennsylvania Department of Transportation, have provided invaluable guidance and assistance: Mr. B. F. Kotalik, Mr. H. P. Koretzky, Mr. H. K. Hagemann, Mr. W. L. Gramling and Mr. I. Janauschek in the design and the conduct of the experiment reported; Mr. J. Szivos and Mr. D. Lathia in the execution of the reported case studies at PennDOT's computer facilities.

Above all deep gratitude is due to Mrs. Michele Kostem who has typed the manuscript and participated in almost all aspects of the research and the preparation of the report, completely on a voluntary basis.