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This report presents information on possible improvements to the Texas State Department of Highways and Public Transportation's 1985-86 method of on-system bridge project prioritization. Within this project the method has been computerized, giving speed, consistency, and efficiency to the selection process. The program's output divides projects into three groups of bridges, termed Qualifying bridges, Marginal bridges, and Non-Qualifying bridges. Funding recommendations involving Qualifying and Non-Qualifying bridges are relatively straightforward and can be presented via computer. Marginal bridges require additional information and analyses before funding recommendations are made; the computer program produces a list of Marginal bridges and summarizes decision-making information for each. A variety of program inputs can be used and the results from several input files can be compared, offering new information to the decision maker.

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IMPROVEMENTS IN ON-SYSTEM BRIDGE PROJECT PRIORITIZATION

by

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Research Report 439-1

Strategies for Bridge Replacement
Research Project 3-5-86-439

conducted for

Texas State Department of Highways
and Public Transportation

in cooperation with the
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Federal Highway Administration

by the

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The University of Texas at Austin

January 1987

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

PREFACE

This report summarizes work to date on Research Project 3-5-86-439, "Strategies for Bridge Replacement." The project's goal is to provide the Texas State Department of Highways and Public Transportation with a practical tool for prioritizing bridge replacement and rehabilitation projects. We believe the computer programs developed during the project's first stage addresses that goal.

The authors are particularly grateful to Messrs. Dan Williams and Ralph Banks of the Texas State Department of Highways and Public Transportation for assistance as Project Contact Representatives. Many other SDHPT employees have also been helpful, and we thank them, as well as Jeannette Garcia, Tony Tascione, and Dr. M. Muthu. Thanks are also due to the staff at the Center for Transportation Research, especially Lyn Gabbert, for their invaluable assistance in preparing this report.

LIST OF REPORTS

Report No. 439-1, "Improvements in On-System Bridge Project Prioritization," by Chris Boyce, W. R. Hudson, and Ned H. Burns, presents a computerized procedure for prioritizing bridge replacement and rehabilitation projects. Background information and directions for further research are included.

ABSTRACT

This report presents information on possible improvements to the Texas State Department of Highways and Public Transportation's 1985-86 method of on-system bridge project prioritization. Within this project the method has been computerized, giving speed, consistency, and efficiency to the selection process. The program's output divides projects into three groups of bridges, termed Qualifying bridges, Marginal bridges, and Non-Qualifying bridges. Funding recommendations involving Qualifying and Non-Qualifying bridges are relatively straightforward and can be presented via computer. Marginal bridges require additional information and analyses before funding recommendations are made; the computer program produces a list of Marginal bridges and summarizes decision-making information for each. A variety of program inputs can be used and the results from several input files can be compared, offering new information to the decision maker.

SUMMARY

Research Project 439, Strategies for Bridge Replacement, began in September, 1985. A literature search revealed that no existing bridge project prioritization program was completely appropriate for Texas. Computerizing the SDHPT's then-current selection procedure was seen as an immediate improvement to the current prioritization process and these computer programs were developed. The User's Guide for the programs is contained in Appendix A of this report. Project staff added flexibility to the selection process by programming it to sort bridge projects into three groups rather than the previous two (1) definitely qualified for funding (2) quallfied for funding, and (3) not qualified for funding. The three bridge groups are termed Qualifying, Marginal, and Non-Qualifying, respectively. Bridges within each group are ranked by the Cost Per Vehicle (CPV) index, a measure of cost-effectiveness.

The Qualifying group contains bridges which may be funded without further consideration. Bridges with obvious needs are placed in the Qualifying group by the computer program. "Obvious needs" could include very poor structural conditions, inadequate lane widths, or extremely low Sufficiency Ratings, among others. These obvious needs are relatively simple to assess using available BRINSAP data and are suitable for computerization.

The Non-Qualifying group contains bridges which do not currently require funding. Non-Qualifying bridges are those which clearly do not need rehabilitation or replacement. These structures have, in general, good structural conditions, adequate lane widths, and at least mid-range Sufficiency Ratings. As with Qualifying bridges, the computer program can evaluate such bridges fairly easily on the basis of the available data.

The Marginal group contains bridges deserving additional attention before funding decisions are made. The program forms the Marginal group and presents decision-making information for further evaluation by hand. This hand evaluation might examine factors such as roadwork projects in the bridge's vicinity, the presence of other funded bridges on the same route, a rapidly deteriorating structural condition. It is anticipated that evaluation of these additional factors will show some Marginal bridges to be worthy of funding.

The method presented makes the relatively easy decisions by computer (forming Qualifying and Non-Qualifying sets) while allowing complete control over the difficult, Marginal, bridges to remain in the hands of the SDHPT. Inputs for the program may be adjusted easily, permitting a spectrum of scenarios to be analyzed and studied in a fraction of

the time spent producing a single set of output by hand. The program offers a tremendous savings in time and effort, yet retains the current procedure's essence and control. The computerized selection process represents a significant improvement and is a useful decision-making tool.

The scope and purpose of this report is first to comment on the basis and development of the computerized selection process and second to provide information on the use of the programs which comprise the process. The body of the report contains commentary regarding the developed process. It contains basic background information, a presentation of the 1985-86 SDHPT method of project prioritization, and specific documentation of the improved method and its development, as well as recommendations for further study. The Appendix is a User's Guide. It contains information necessary for the use of the specific selection programs, including a general description of the computerized process and specific information about the format of the inputs, and the relationship of the programs. A listing of each of the programs is also provided. This commentary on the development of the selection process and the information contained in the User's Guide, together, are necessary for the examination and implementation of this selection process by the SDHPT.

IMPLEMENTATION STATEMENT

We recommend that the computerized bridge selection procedure be examined by SDHPT and considered for immediate implementation. The program has the potential to significantly reduce the amount of time spent selecting bridges for funding. We recommend the computer programs be used as tools to sort information and to reinforce the good judgement of the SDHPT Bridge Division.

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CHAPTER 1. BACKGROUND INFORMATION

Nearly 40 percent of the Nation's bridges are considered deficient by the Federal Highway Administration (FHWA). The term "deficient" applies to two distinct classes of bridges: those in poor condition (regardless of configuration and design) and those with poor configuration or design (regardless of condition). Bridges in poor condition are termed Structurally Deficient, while those with poor configurations or designs are termed Functionally Obsolete. In Texas, 19 percent of the bridges on the Federal-aid System (on-system) and 72 percent of the bridges off the Federal-aid System (off-system) are deficient (Ref 1). Texas' 5,925 on-system deficient bridges are generally Functionally Obsolete, while its 10,978 off–system deficient bridges are split fairly evenly among the Structurally Deficient and Functionally Obsolete classes.

Available monies are insufficient to fund all of Texas' deficient bridges. In the 1985-86 program, repair or replacement for only 442 on-system bridges and 131 off-system bridges was provided, at a total cost of $209 million (Ref 2). In general, the Federal government funds 80 percent of the total project costs. The remaining 20 percent is funded by the SDHPT for on-state-system bridge projects and by local governments for off-state-system projects. Assuming a constant amount of yearly funding and no additions to the lists of deficient bridges, and neglecting inflation, it will take 13 years just to remedy the currently deficient on-system bridges and 83 years to fix the currently deficient off-system bridges. It will take 69 years to complete a cycle of funding for the entire on-state-system of bridges and 116 years for the entire off-state-system of bridges at the current pace. Clearly, a method of prioritizing bridge projects is required to insure that the available funds are wisely used.

Formal bridge project prioritization programs have existed for at least the last 20 years. Their development began in earnest after the Ohio River Silver Bridge collapsed, killing 46 people, in 1967 (Ref 3). Congressional hearings responding to that collapse revealed a lack of uniform reporting standards for bridges and a need for an inventory of the nation's bridges. The 1968 Federal-Aid Highway Act (Ref 4) charged the Secretary of Transportation with developing bridge maintenance inspection standards, bridge inspection training materials, and a complete inventory of all bridges in the United States. Congress authorized a $100 million bridge program in 1970, making Federal funds available for training bridge inspectors, for making bridge inspections, and for replacing the nation's most

critical bridges (Ref 5). Initial funding programs were limited to bridges on the Federal-aid Highway System, but legislation in November 1978 included off-system bridges as well (Ref 6). The Federal bridge funding program is now termed the Highway Bridge Replacement and Rehabilitation Program (HBRRP).

CHAPTER 2. SDHPT'S CURRENT ON-SYSTEM BRIDGE PROJECT PRIORITIZATION PROCEDURE

Careful study and subsequent discussion with SDHPT officials revealed the nature of Texas' current bridge project prioritization procedure for on-system bridges (referred to as the "current procedure" herein). The procedure for the 1985-86 HBRRP began with bridge inspections and collection of data. Texas, like all other states, is required to provide the United States Secretary of Transportation updated information for all state bridges at least once every two years. The SDHPT data gathering procedure is known as BRINSAP (Bridge Inventory, Inspection And Appraisal Program). The BRINSAP data file contains the Federally required data for each bridge in Texas, along with additional information SDHPT finds useful. A total of 140 items are recorded for each bridge, making BRINSAP a fairly extensive database.

BRINSAP data were used to compute Sufficiency Ratings for every bridge in Texas. Sufficiency Ratings (SR) are scores from 0 to 100 designed to quantify each bridge's sufficiency to remain in service in its present condition. A rating of 100 indicates an entirely sufficient bridge. Such a bridge requires absolutely no work. A rating of 0 indicates an entirely insufficient bridge, one with severe safety problems and large Average Daily Traffic (ADT). FHWA developed the original formula in 1972; it was subsequently revised by the American Association of State Highway and Transportation Officials (AASHTO) Committee on Bridge Replacement Surveys and Inspection Standards in 1976. The FHWA adopted AASHTO's Sufficiency Rating formula in 1977 (Ref 7).

BRINSAP data were also used to determine whether or not bridges were deficient. FHWA considers a bridge Structurally Deficient if it has deteriorated to the point where either the deck, substructure, or superstructure is given a condition rating of 4 ("Marginal condition - potential exists for major rehabilitation") or less (Ref 8). A bridge can also be considered Structurally Deficient if its overall structural condition appraisal rating or its waterway capacity appraisal rating is 2 ("Basically intolerable condition requiring high priority to replace the structure") or less (Ref 8). FHWA considers a bridge Functionally Obsolete if its appraisal rating for roadway geometry, under clearances, approach roadway alignment, structural condition, or waterway adequacy is 3 ("Basically intolerable condition requiring high priority of repair or reconstruction") or less (Ref 8). These definitions are important because the FHWA will provide no funds unless a bridge is deficient and has a Sufficiency Rating of 80 or less.

Knowing which bridges were deficient, and knowing the Sufficiency Rating for each, the SDHPT prepared lists of bridges eligible for Federal funding (herein termed "eligible") and distributed them to the Districts. Approximately 10 percent of the on-system bridges were eligible in the 1985-86 HBRRP. Districts ranked their bridges, indicating their priorities for funding, and returned the results to SDHPT. Because the Federal eligibility criteria were somewhat loose, many of the eligible bridges were not serious candidate projects and were not given any priority by the Districts at all. Results for a total of 772 bridges were returned to SDHPT for further evaluation.

SDHPT's goal was a statewide prioritization of bridge projects based primarily on structural condition and secondarily on cost effectiveness criteria (Ref 9). A screening procedure was developed (Ref 10) and is diagrammed in Fig 2.1. The screening procedure was followed, by hand, for each of the 772 bridges receiving final SDHPT consideration.

According to SDHPT Bridge Division officials, SDHPT could spend up to $180,000,000 on-system in the 1985-86 Highway Bridge Replacement and Rehabilitation Program (Ref 10). Passing levels for the screens were chosen, after discussion among SDHPT officials, to produce a set of bridge projects that would use as much of the allotment as possible. Bridge Division personnel were permitted to override the algorithm in cases of bridges with "other strong considerations" (Ref 2). This procedure produced a set of 442 bridges with a total accumulated project cost of $178,394,000. This figure was deemed sufficiently close to $180,000,000 to negate any need for another set of passing levels.

In summary, then, the 1985-86 on-state system Federal-Aid Bridge Replacement and Rehabilitation Program used FHWA criteria, District Priorities, and SDHPT criteria to select existing bridges for replacement or rehabilitation funding. Projects tested aginst these criteria were divided into two sets: selected and non-selected projects. The first test, in the 1985-86 process, was for FHWA eligibility for funding. Next, District priority was requested for each of the eligible projects. After District priorities were used to further reduce the size of the eligible set, the variables and the values listed in Fig 2.1 were used, along with a provision to override the algorithm, to make the final program selection. These variables and values were determined by the SDHPT Bridge Division. This selection process was performed by individual evaluation of each existing structure by District and Division personnel. And, while the inputs and criteria used in the selection process were reliable, the overall process was looked at as one needing improvement.

Variable Description

CPV - Cost Per Vehicle
COPRI - Cost of Proposed Improvements
ADT - Average Daily Traffic
SR - Sufficiency Rating
DSS - Minimum Condition Rating for Deck, Substructure, and Superstructure
BRIWICO - Bridge Width Condition
TCOST - Accumulated Total Cost

INPUT: Eligible, On–System, BRINSAP with SR added to Tape

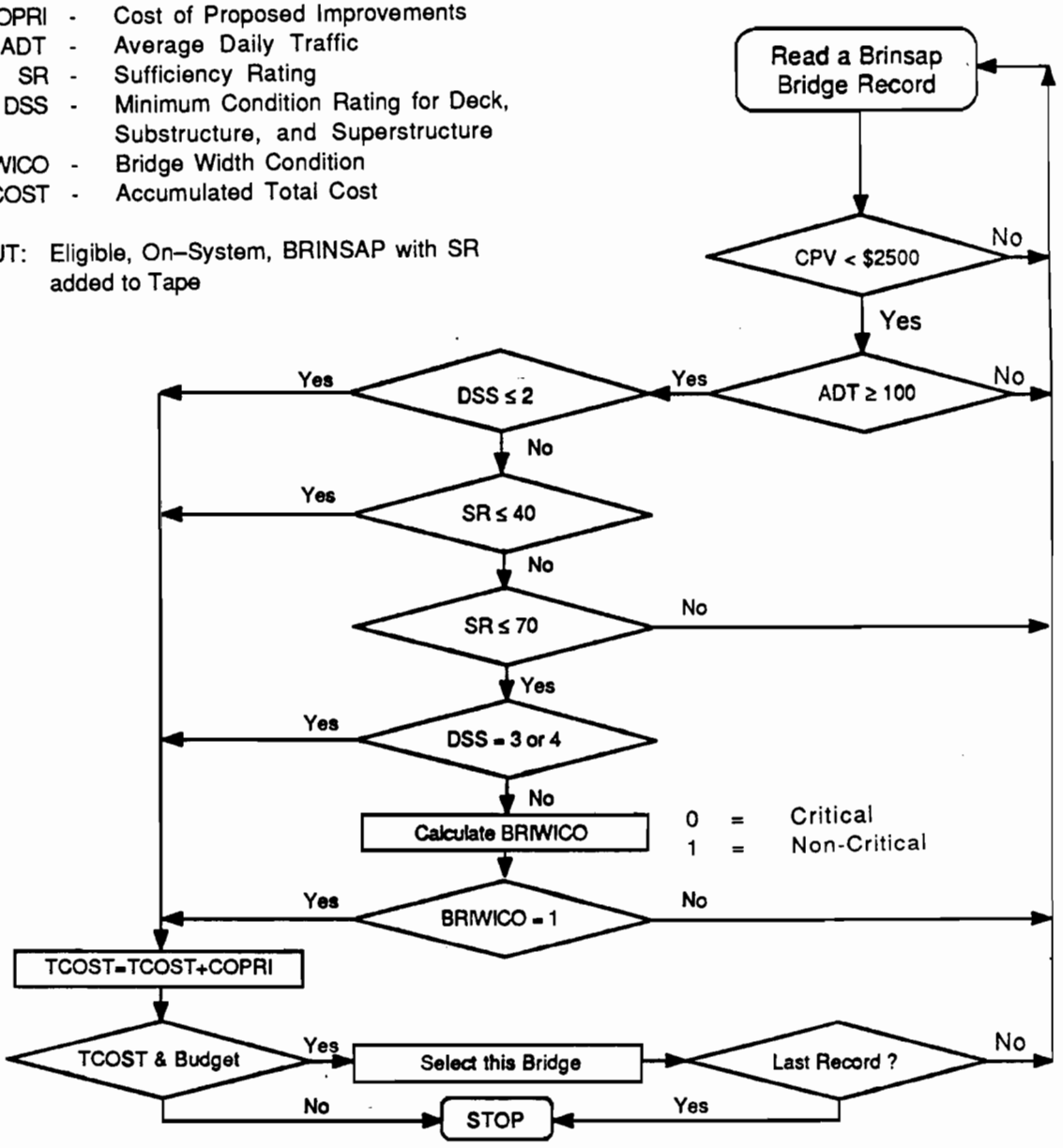

Fig 2.1. The Texas SDHPT's current screening procedure.

CHAPTER 3. THE IMPROVED METHOD AND ITS DEVELOPMENT

One of SDHPT's main concerns at the inception of this project was that the current bridge project prioritization procedure was too laborious An automated, better-justified method of prioritizing bridges was sought. SDHPT staff suggested the researchers immediately address these areas. SDHPT also suggested that the improved selection procedure use the BRINSAP file. Using BRINSAP offers three important advantages. First, SDHPT personnel are already familiar with BRINSAP. Second, the BRINSAP data items are for the most part required for the Sufficiency Rating and must be gathered to meet Federal regulations anyway. Any new database would require additional work on the part of SDHPT for setting up a new database, taking the data, and maintaining the new database. Third, BRINSAP provides researchers a ready database from the project's inception and allows programs developed during the research to be implemented quickly by the SDHPT.

Prooject 439 staff began by programming the then current selection procedure. Computerizing that method was seen as straightforward process, a major improvement, and a good starting place. Project staff coded the current procedure in the Statistical Analysis System (SAS) programming language. Project 439 staff chose SAS because of its tremendous power and flexibility; it easily handles the on-state system BRINSAP data tape, permitting analysis of the entire system at once. SDHPT has SAS and the capability to run both programs developed for this project. The programs are designed for mainframe use, though a version for the IBM PC is available in FORTRAN. However, the FORTRAN version is less efficient than the SAS version and the PC cannot run the entire On-System BRINSAP data file at once. SAS is now available for PCs; the SAS programs will be converted for use with the PC if possible. The flowchart in Fig 2.1 was used as the current procedure was computerized. Information for the flowchart came from the 1985-86 HBRRP on-system list of selected and non-selected projects (Ref 2) and from discussion with SDHPT personnel.

Project 439 staff operated under the assumption that the SDHPT was most interested in bridges eligible for Federal funding. For this reason, the selection algorithm is split into two programs: SURE1 (Sufficiency Rating Evaluator version 1), and TEBS1 (Texas Eligible Bridge Sorter version 1). SURE1 determines each bridge's eligibility for Federal funding. TEBS1 sorts the eligible bridges from SURE1 into the Qualifying, Marginal, and Non-Qualifying groups. It has been suggested, however, that TEBS1 should be run before SURE1,

thereby ordering projects on a statewide basis before verifying Federal Eligibility with SURE1.

THE SURE1 PROGRAM

The SURE1 program computes Sufficiency Ratings according to the BRINSAP Manual of Procedures (Ref 2) and compares them to FHWA thresholds. Currently, a bridge must have a Sufficiency Rating below 50 to be eligible for Federal funds for replacement, or below 80 to be eligible for Federal funds for rehabilitation. In addition, bridges must be either Structurally Deficient or Functionally Obsolete. The SURE1 program terms bridges which meet the Sufficiency Rating thresholds and which are either Structurally Deficient or Functionally Obsolete "eligible" and saves them in an SAS data set. This data set is used in the TEBS1 program; ineligible bridges are not analyzed further.

SURE1 needs to be run only once. The set of eligible bridges may be used and re-used as input to TEBS1 as many times as desired. Note, however, that the SURE1/TEBS1 arrangement does not preclude sorting all bridges, including ineligible ones, into funding groups. Minor modifications to TEBS1 will allow this and would give information on Texas' entire bridge system.

THE TEBS1 PROGRAM

A flexible program was requested by members of the Project 439 Technical Advisory Committee (TAC). TEBS1 addresses flexibility directly. Originally a faithful coding of the 1985-86 on-state system algorithm, the program was modified to produce the Marginal group in addition to the Qualifying and Non-Qualifying ones. The Marginal group introduces flexibility not found in the original code. In effect, the presence of the Marginal group allows "other strong considerations" to be evaluated in a controlled environment. Previously, "other strong considerations" could be cited as a reason for funding any bridge, making the funding algorithm somewhat ineffective due to its inconsistent application. With TEBS1, only Marginal bridges can qualify under "other strong considerations." This modified procedure, including the hand evaluation of Marginal bridges, may be applied consistently. A flowchart

diagramming the entire data stream, from BRINSAP data, through SURE1 and TEBS1, to the Qualifying, Marginal, and Non-Qualifying sets, is shown in Fig A.1. Flowcharts for SURE1 and TEBS1 are found in Figs A.2 and A.3.

TEBS1 evaluates bridges using the variables from the 1985-86 HBRRP to retain as much commonality between the two methods as possible. The variables are Cost Per Vehicle (CPV), Average Daily Traffic (ADT), Sufficiency Rating (SR), the minimum condition rating given to the deck, substructure, or superstructure (DSS), and the bridge width condition rating (BWC). BWC compares lane widths and traffic to minimum acceptable standards to determine whether the bridge width condition is "critical" or not. The bridges are sorted using a weighted-screening procedure or an automatic qualification procedure. Each procedure is straightforward and uncomplicated.

In the Weighted-Screening procedure, each variable (CPV, ADT, SR, DSS, and BWC) is checked against a "passing level" for the variable. These passing levels serve the same purpose as the values used to screen bridges in the 1985-86 HBRRP. TEBS1 assigns points to bridges, depending on which screens are passed. The points assigned for passing the various screens are termed "weights". The total score for a bridge can easily be computed by adding the points from the screens it passes. For example, a bridge that passes only the CPV, SR, and DSS screens will receive points from those three screens, but none from ADT or BWC.

TEBS1 also checks each variable against Automatically Qualifying levels. These levels allow the decision maker to specify some value for a particular variable which makes a bridge Qualifying regardless of the value of the other variables. For example, bridges with SR scores below 10 might be considered worthy of funding no matter what their CPV, ADT, DSS, and BWC variables are. The Automatically Qualifying level for SR would then be 10. The program does not require Automatically Qualifying levels for every variable; the program's user specifies them only if he elects to do so.

After computing a bridge's total score and checking Automatically Qualifying criteria, TEBS1 determines which group the bridge belongs in. Automatially Qualifying bridges are placed in the Qualifying group regardless of total score. If a bridge does not qualify automatically, its score is checked against thresholds to sort it into the appropriate group. These thresholds are also provided by the program user. In simple terms, bridges with high scores (a high priority for funding) are Qualifying, bridges with low scores (a low priority for funding) are Non-Qualifying, and bridges with mid-range scores (a medium priority for

funding) are Marginal. An example is given below using the fictitious "Bridge X" with hypothetical passing levels, automatically qualifying levels, weights, and thresholds.

Screens	Weight (Percent)	Passing Level	Automatic Qualifying Level	Bridge X	Passed?
CPV	10	≤$1000	≤$10	$275	Yes
ADT	10	≥ 300	≥50,000	200	No
SR	35	≤ 60	≤10	47	Yes
DSS	25	≤ 5	≤2	4	Yes
BWC	20	= 0 (Critical)	None	1	No

Bridge X gets 10 points (or 10 percent) for passing the CPV screen, 35 points (or 35 percent) for passing the SR screen, and 25 points (or 25 percent) for passing the DSS screen. The bridge's total score is 10 + 35 + 25 = 70. The bridge does not pass any of the Automatically Qualifying levels. The hypothetical threshold for Qualifying bridges is 80. The hypothetical threshold for Marginal bridges is 65. Bridge X is in the Marginal group and should receive additional evaluation beyond that given by TEBS1.

Output from TEBS1 is shown in Fig A.4. It is important to note that bridges within each group are ordered not by score but by their CPV rankings. This procedure follows the SDHPT's lead from the 1985-86 HBRRP listing and recognizes the relative lack of precision in the scores as compared to the CPV index. Accumulative Project Cost may be read at each line, specifying the amount of money needed to fund a bridge and all bridges above it within the list. Qualifying bridges and Marginal bridges are kept entirely separate.

Two scenarios may arise after TEBS1 has been run. In the first case, there may not be enough money to fund the entire Qualifying bridge list. Accumulative Project Cost is examined, and a line may be drawn at the funding limit. The bridges above the line are the strongest candidates for funding, though all Qualifying bridges may be considered worthy projects. In the second case, the available funds are greater than the Accumulative Project Cost for the

Qualifying list, and the Marginal bridges with low CPV become the strongest candidates for the excess money. These are only general guidelines; the program user should also bear in mind that the second scenario may be forced to occur by varying the threshold values. This would always allow for the individual evaluation of projects in the Marginal Set.

CHAPTER 4. SUMMARY AND RECOMMENDATIONS FOR FURTHER STUDY

With the Computerized Bridge Project Selection Program described in Chapter 3, Project 439 staff tried to address an immediate need it saw for improvement to the selection process used in the 1985-86 HBRRP. The then current selection process was modeled with two programs. One program used FHWA criteria to determine a set of existing bridges eligible for Federal funding. This set of eligible projects is used by the next program, along with a number of user inputs, to determine three output sets: Qualifying, Marginal, and Non–Qualifying bridges. The output classification of an existing structure is based on two processes: Automatic Qualification, or Scoring. The first process uses a set of minimum values for the criteria variables, input by the program user, to check existing structures for Automatic Qualification (i.e., automatic placement into the Qualifying bridges output set). The second process, Scoring, weighs the relative merit of each existing structure, using a combination of the criteria variables. This scoring process completes the Qualifying set, and defines the Marginal and Non-Qualifying bridges. The improved selection process then involved, first, computerization, and, second, the introduction of the three set output. The computerization of the process was performed to reduce the amount of labor necessary for the selection process. The subdivision into three sets was used to address a requirement for flexibility in the improved selection process.

The project 439 Technical Advisory Committee provided clear goals for the bridge project prioritization program. One of those, flexibility, has already been addressed. The remaining goals are to develop a better index of cost effectiveness, to develop an index for essentiality, and to introduce a long term approach to the problem of bridge project prioritization. Cost effectiveness is currently being investigated. A benefit-cost analysis is proposed at this time.

Cost effectiveness is currently measured by the Cost Per Vehicle (CPV) index. CPV is simple to calculate (Cost of Proposed Improvements divided by Average Daily Traffic) but has deficiencies. Firstly, it can be misleading. Consider the following two bridges:

Bridge Type	Length (feet)	Width (feet)	ADT	Rehabilitation Cost (dollars)	CPV (dollars)
Bridge A	100	44	1000	50,000	50
Bridge B	200	44	1000	100,000	100

From a CPV viewpoint, Bridge A is twice as cost effective as Bridge B. But, if the amount of deck area rehabilitated per dollar spent is considered, the bridges are equally cost effective. Clearly the current use of CPV as the sole cost effectiveness criterion makes long bridges appear less cost effective than shorter ones.

Secondly, CPV fails to consider the benefits accrued when bridges are funded. CPV disregards benefits, effectively setting the benefits from all bridge projects equal. Benefits from performing bridge work, such as increases in safety and in level of service provided, should be considered in the selection of bridge projects.

A better index of cost effectiveness can be made by considering the total gains from each proposed bridge project and dividing them by the total project cost to obtain the benefit-cost ratio. The benefit-cost ratio is the amount of gain per dollar spent and allows comparisons to be made among all bridges. Benefit-cost analyses require all benefits and costs to be in some common unit, typically dollars. This can be done, and in fact is done, informally every time a project is considered. To illustrate, suppose we propose a project to add two lanes to a heavily traveled Interstate Highway bridge. If the project cost is $1, the bridge almost certainly should receive funding, because we know the project's benefits are greater than one dollar. However, if the project cost is $1,000,000,000, the bridge almost certainly should not receive funding. We know the project's benefits are not worth a billion dollars. The processes we use to determine the worth of a project can be formalized and quantified; a computer program can be written once the process is known and benefit-cost ratios can be formed for all proposed projects. Benefit-cost ratios can be compared, and those projects giving the most

gain per dollar can be considered the most cost-effective projects. Preliminary developmental work is in progress.

REFERENCES

1. Williams, Dan, "Overview of Strategies for Bridge Replacement and Rehabilitation", unpublished paper, March 1986.
2. "1985-86 Federal-Aid Bridge Replacement and Rehabilitation Program Statewide Listing", unpublished SDHPT document, July 1985.
3. The Office of The United States Comptroller General, "Better Targeting Of Federal Funds Needed To Eliminate Unsafe Bridges", Washington, D.C., August 1981.
4. The Federal Highway Act of 1968 (Public Law 90-495, sec. 26, 82 Stat 815).
5. The Federal Aid Highway Act of 1970 (Public Law 91-605, Sec. 204, 84 Stat. 1713).
6. The Surface Transportation Assistance Act of 1978 (Public Law 95-599, secs. 124 and 202, 92 Stat. 2689).
7. The Office of The United States Comptroller General, "Better Targeting Of Federal Funds Needed To Eliminate Unsafe Bridges", Washington, D.C., August 1981.
8. BRINSAP Manual of Procedures, Rev. 10-85, Texas State Department of Highways and Public Transportation Safety and Maintenance Operations Division, September 1984.
9. Goode, M. G., "Administrative Order No. 7-85", March 8, 1985.
10. Williams, Dan, "Minutes of the Technical Advisory Committee Meeting", Austin, Texas, March 31, 1986.

APPENDIX . A

COMPUTERIZED BRIDGE PROJECT SELECTION PROGRAM FOR TEXAS

A USER'S GUIDE

APPENDIX . A. COMPUTERIZED BRIDGE PROJECT SELECTION PROGRAM FOR TEXAS

A USER'S GUIDE

INTRODUCTION

This user's guide is meant to assist in executing the Computerized Bridge Project Selection Program developed for the Texas State Department of Highways and Public Transportation (SDHPT). This program selects, ranks, and classifies bridges that are eligible for replacement or rehabilitation through the Federal Highway Administration Highway Bridge Replacement and Rehabilitation Program. The program further evaluates the eligible bridges using existing SDHPT criteria.

This guide contains descriptions of both SURE1 and TEBS1 programs, including input and output instructions and a section showing the final output of a sample run. These two programs run independently. SURE1 tests for eligibility, and TEBS1 classifies and ranks the eligible bridges.

DEFINITIONS

(1) SDHPT stands for State Department of Highways and Public Transportation.

(2) FHWA stands for Federal Highway Administration.

(3) Eligible Bridges refers to bridge structures that are eligible for federal funding through the FHWA Highway Bridge Replacement and Rehabilitation Program.

(4) BRINSAP stands for Bridge Inventory, Inspection, and Appraisal Program. BRINSAP is an SDHPT program to implement the National Bridge Inspection Standards which are issued by FHWA.

(5) BRINSAP Data Tape refers to a magnetic tape which contains inventory, inspection, and appraisal data for each bridge and tunnel on public roadways in Texas.

(6) SR stands for Sufficiency Rating. SR is a score calculated using a method that evaluates the factors indicating a bridge's sufficiency to remain in service.

(7) Structurally Deficient refers to bridges in relatively poor physical condition.

(8) Functionally Obsolete refers to bridges with obsolete designs (i.e., narrow roadway width, low under clearance, poor geometry).

Items 6, 7, and 8 all comply with the technical definitions given in the BRINSAP Manual of Procedures, Chapter 3, Section 5.

GENERAL DESCRIPTION

This bridge selection program evaluates all the bridges recorded on the BRINSAP data tape and generates a list of bridges eligible for federal funding under the FHWA Highway Bridge Replacement and Rehabilitation Program. Eligible bridges are then sorted into three categories:

(1) Qualifying. Bridge projects that definitely meet SDHPT criteria for state funding for replacement or rehabilitation.
(2) Marginal. Bridge projects that meet most of the critical SDHPT criteria and may be funded by the state for replacement or rehabilitation under certain conditions.
(3) Non-Qualifying. Bridge projects that definitely do not meet SDHPT criteria for state funding for replacement or rehabilitation.

This computerized process consists of two computer programs: SURE1 (for Sufficiency Rating Evaluator version 1) and TEBS1 (for Texas Eligible Bridge Sorter version 1). Figure A.1 shows the block diagram of the entire computerized sorting procedure.

The SURE1 program checks for missing and improperly coded data on the BRINSAP tape. It computes the Sufficiency Rating (SR), checks for Structural Deficiency and Functional Obsolescence and classifies bridge structures as eligible or non-eligible for federal (FHWA) funding.

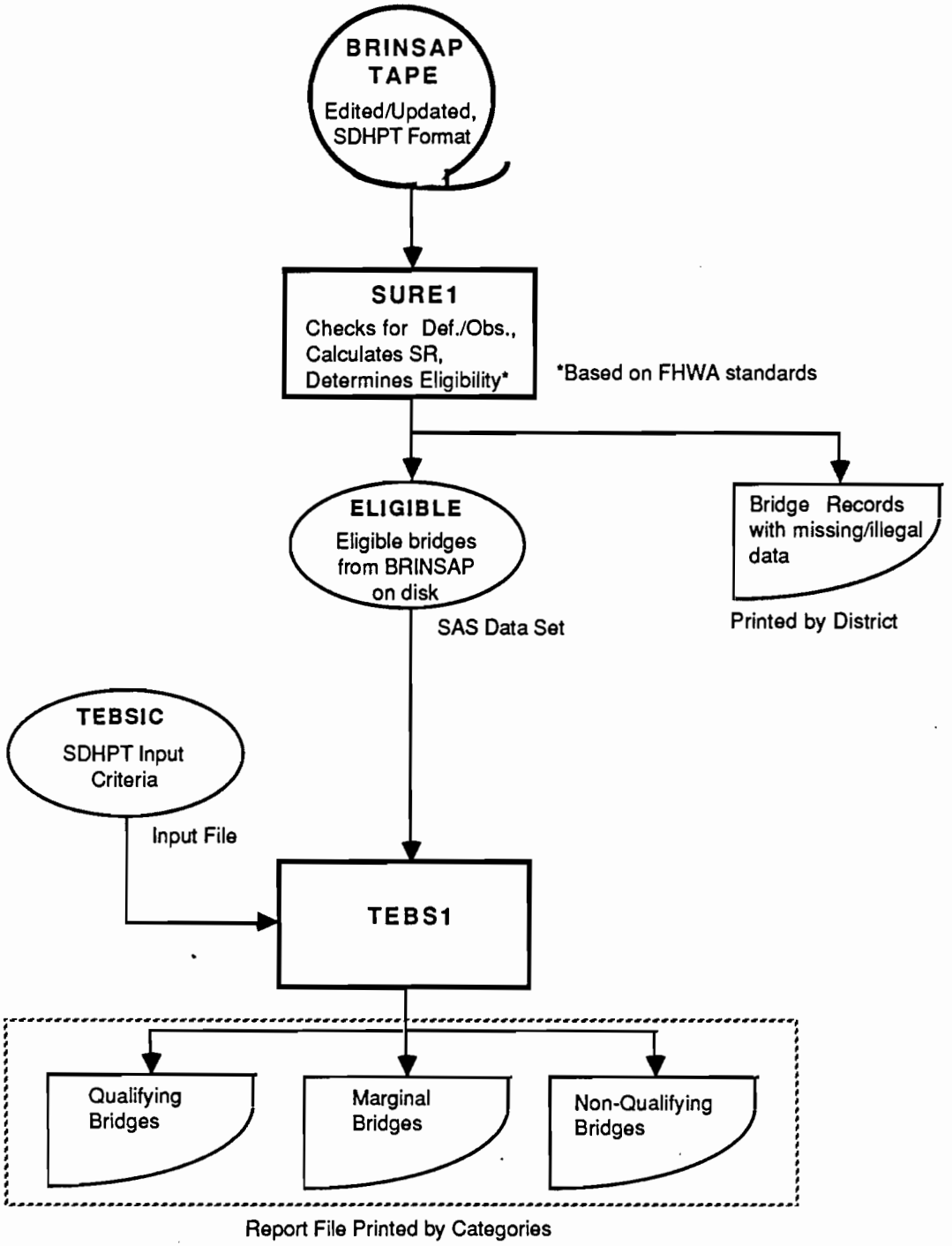

Fig A.1. Flow diagram of the Computerized Bridge Selection Program for Texas.

The TEBS1 program takes the eligible bridge data set output by the SURE1 program and then utilizes an automatic qualification procedure and a weighted screening method to sort bridges into Qualifying, Marginal, and Non-Qualifying groups.

SURE1 and TEBS1 are written in SAS (Statistical Analysis System software package) Version 5 (Release 5.08) language. They run independently, but the SURE1 program must be run first since TEBS1 uses as input one of the SURE1 output files. TEBS1 may be run as many times as desired after SURE1 has been run once.

SURE1 PROGRAM

The Sufficiency Rating Evaluator (SURE1) program generates a set of bridges eligible for federal funding from the BRINSAP data tape. The SURE1 program consists of eight modules, as illustrated in Figure A.2 and described below.

(1) Missing/Illegal Data Check Module - checks for any missing or illegal value involved in the SR calculation.

(2) Deficiency/Obsolescence Module - classifies bridges as structurally deficient (DEF=1), functionally obsolete (OBS=1), both or neither.

(3) S1 Module - calculates S1, the structural adequacy and safety index used in the SR calculation.

(4) S2 Module - calculates S2, the serviceability and functional obsolescence index used in the SR calculation.

(5) S3 Module - calculates S3, the essentiality index used in the SR calculation.

(6) S4 Module - calculates S4, special reductions used in the SR calculation.

(7) SR Module - calculates SR scores by combining subindices S1 thru S4.

(8) Eligibility Module - classifies bridges as eligible or non-eligible based on structural deficiency, functional obsolescence; and sufficiency rating criteria; generates an output set (SAS data set) of eligible bridges with all the variables used by the program as well as identification variables (e.g., district, county, and bridge identification number).

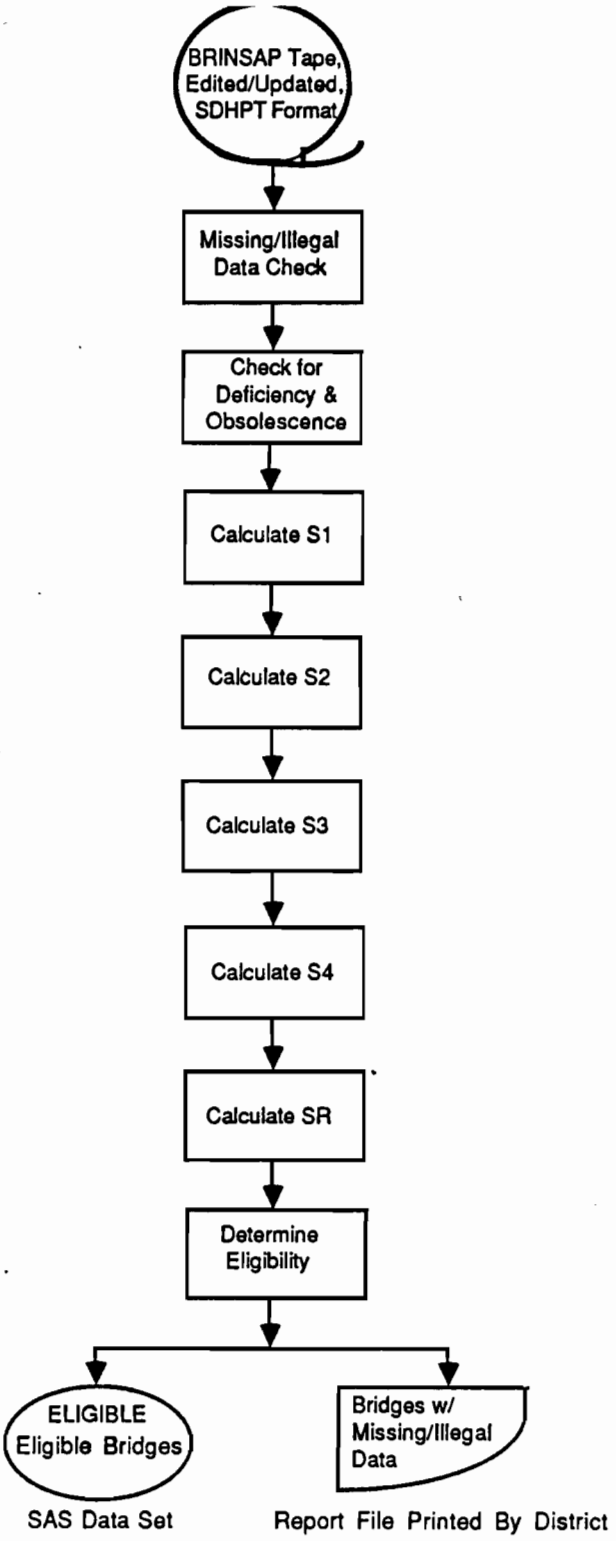

Fig A.2. Flow diagram of the SURE1 program.

All the algorithms in the SURE1 program follow the methods and formulas given in the Texas SDHPT BRINSAP Manual of Procedures, which is based on FHWA guidelines.

Neither missing nor illegal data values will stop the SURE1 program. It estimates the sufficiency rating score when any missing or illegal value is involved in the SR calculation. The result of any calculation that involves a missing or illegal data item is made as large as possible within its range in order to generate a conservative SR score. This procedure guarantees that every bridge on the eligible list is truly eligible for federal funding, even when some data items have been estimated. The program keeps track of SR scores that have been estimated and identifies them with an asterisk each time they are output.

SURE1 INPUT GUIDE

BRINSAP Data Tape

The input is the Texas SDHPT, On-System Bridge Inventory, Inspection, and Appraisal Program data tape, referred to as the BRINSAP data tape. BRINSAP is an SDHPT program to implement the National Bridge Inspection Standards which are used by the Federal Highway Administration. This tape contains more than 30,000 bridge records, one record for each bridge and tunnel on public roadways in Texas. Each record is 510 characters long and consists of 140 data items containing inventory, inspection, and appraisal information for the bridge. The BRINSAP data are maintained by the Texas SDHPT in an accurate and up-to-date condition by changing data to reflect changes in the bridges, by correcting errors found in the data , by adding new records for new bridges, and by deleting records from bridges that are removed from service. The BRINSAP data are edited and updated by SDHPT, using a modified version of the FHWA National Bridge Inventory Edit/Update computer program written in COBOL. The modified version of the program changes the BRINSAP data tape format so that more data items per record are produced in the the SDHPT formatted BRINSAP data tape.

The input for the SURE1 program is the SDHPT formatted BRINSAP data tape which has been edited and updated according to the FHWA National Bridge Inventory Edit/Update Program. The magnetic tape specifications in the SURE1 program are as follows:

9 Track, 1600 BPI, EBCDIC, Fixed Record Format (RECFM=FB), 510 characters per record (LRECL=510), 10 records per block (BLKSIZE=5100).

If these specifications are changed, the tape file definition in the program should be changed as well. The file is addressed as "TAP1" in the CMS Systems Command Section of the SURE1 program.

The BRINSAP data items are described in detail in Chapter IV of the BRINSAP Manual of Procedures. Table A.1 lists all the BRINSAP data variables, with their formats, BRINSAP item numbers, and brief descriptions. Variables without BRINSAP item numbers were introduced by SDHPT. The position of each variable is given in the From and To columns. The From column indicates the starting column and the To column indicates the ending column. The Type, Size and Dec. columns give the BRINSAP format for each item. The FORMAT column shows the input format used by the SURE1 program.

SURE1 OUTPUT

The SURE1 program produces two outputs: a report output file and the eligible SAS data set output file. The report file contains a list of all the data items for bridge records containing missing or illegal data. The eligible data set output file is an SAS data set (filename, type, and location: DUMMY DUMMY A) containing all the eligible bridge records. This last file is in SAS format and can be read only by SAS. It is used as input to the TEBS1 program, and, as the file name implies, will be written to the User's A disk.

TEBS1 PROGRAM

The TEBS1 computer program classifies eligible bridges into three categories: Qualifying, Marginal, and Non-Qualifying. It uses SDHPT qualifying criteria given as input to classify the bridges. The algorithms in this program are based on the Procedures for Selection of On-System Bridge Replacement and Rehabilitation Projects given in the 1985-86 On-State System Federal-Aid Bridge Replacement and Rehabilitation Program statewide and District listings. Figure A.3 illustrates a block diagram for the TEBS1 program.

TABLE A.1. BRINSAP DATA TAPE FORMAT

Item No.	Var. Name	From	To	Type	Size	Dec.	Format	Item Description
2	DIST	1	2	N	2		I2	DISTRICT
	COUNTY	3	5	N	3		A3	THD COUNTY NUMBER
	CONTROL	6	9	AN	4		A4	CONTROL
	SECTION	10	11	AN	2		A2	SECTION
11	MILEPT	12	16	N	5	3	R5.3	MILEPOINT
	STRUCT	17	19	N	3		A3	STRUCTURE
1	STATE	20	22	N	3		I3	STATE
	MS	23	25	A	3		A3	MAINTENANCE SECTION
4	CITY	26	29	N	4		I4	CITY
5.1	RTYPE	30	30	N	1		I1	ROUTE TYPE
5.2	RSYS	31	32	N	2		I2	ROUTE SYSTEM
5.3	RDES	33	33	N	1		I1	ROUTE DESIGN
5.4	RNUM	34	38	N	5		A5	ROUTE NUMBER
5.5	RDIR	39	39	N	1		I1	ROUTE DIRECTION
5.6	RSTR	40	40	N	1		I1	ROUTE STRUCTURE FUNCTION
6.1	FX	41	83	AN	43		A43	FEATURE CROSSED
7	D10FLG	84	115	AN	32		A32	D-10 FLAG
7	FCO	116	116	AN	1		A1	FACILITY CARRIED OVER
9	LOC	117	149	AN	33		A33	LOCATION
10.1	CCTRL	150	150	N	1		I1	CARD CONTROL
10.2	THC	151	154	N	4	1	R4.1	TOTAL HORIZONTAL CLEARANCE
10.3	PRMVR	155	158	N	4	2	R4.2	INV. RT. VERT. CLEARANCE
10.4	WIDE	159	159	N	1		I1	WIDENING
	SR	160	163	A	4		A4	SUFFICIENCY RATING
12	DODRSN	164	168	A	5		A5	DOD ROAD SECTION NUMBER
13	DODBD	169	170	A	2		A2	DOD BRIDGE DESCRIPTION
14	DODMP	171	175	N	5	2	R5.2	DOD MILEPOINT
15	DODSL	176	178	N	3	1	R3.1	DOD SECTION LENGTH
16	LATI	179	183	N	5	1	R5.1	LATITUDE(DEG.MIN.TENTHS)
17	LONGI	184	189	N	6	1	R6.1	LONGITUDE
18	DODPV	190	190	N	1		I1	DOD PHYSICAL VULNERABILITY
19	BDL	191	192	N	2		I2	BYPASS DETOUR LENGTH
20	TOLL	193	193	N	1		I1	TOLL
21	CUSTO	194	194	N	1		I1	CUSTODIAN
22	OWNER	195	195	N	1		I1	OWNER
23.1	PT	196	196	N	1		I1	PROJECT TYPE
23.2	FAPN	197	210	A	14		A14	FEDERAL AID PROJECT NO.
24	FAS	211	212	N	2		I2	FEDERAL AID SYSTEM
25	FA	213	213	N	1		I1	FEDERAL ADMIN
26	FC	214	215	N	2		I2	FUNCTIONAL CLASSIFICATION
27	YB	216	217	N	2		I2	YEAR ORIGINALLY BUILT
27	YWL	218	219	N	2		I2	YEAR WIDENED OR LENGTHEN
28	LOS	220	221	N	2		I2	LANES OVER STRUCTURE
28	LUS	222	223	N	2		I2	LANES UNDER STRUCTURE

(continued)

TABLE A.1. (CONTINUED)

Item No.	Var. Name	From	To	Type	Size	Dec.	Format	Item Description
29	ADT	224	229	N	6		I6	ADT
30	YADT	230	231	N	2		I2	YEAR OF ADT
31	DLOAD	232	232	N	1		I1	DESIGN LOAD
32	AWIDTH	233	235	N	3		I3	APPROACH WIDTH
33	MEDN	236	236	N	1		I1	MEDIAN
34	SKEW	237	238	N	2		I2	SKEW
35	FLARED	239	239	N	1		I1	FLARED
	PIF	240	240	A	1		A1	PROPOSED IMPROVEMENT FLAG
37	HS	241	241	N	1		I1	HISTORICAL SIGNIFICANCE
38	HNC	242	242	N	1		I1	HYDRAULIC NAV. CONTROL
39	NVC	243	245	N	3		I3	NAV. VERTICAL CLEARENCE
40	NHC	246	249	N	4		I4	NAV. HORIZONTAL CLEARANCE
41	OSTAT	250	250	A	1		A1	OPERATIONAL STATUS
42	TS	251	252	N	2		I2	TYPE SERVICE
43.1	MST	253	256	N	4		I4	MAIN SPAN TYPE
43.2	MAAST	257	260	N	4		I4	MAJOR APPROACH SPAN TYPE
43.3	MIAST	261	264	N	4		I4	MINOR APPROACH SPAN TYPE
43.4	CULVERT	265	266	N	2		I2	CULVERT
43.5	TUNNEL	267	267	A	1		I1	TUNNEL
44.1	SMS	268	270	N	3		A3	SUBSTRUCTURE MAIN SPAN
44.2	SMAAS	271	273	N	3		A3	SUBSTRUCTURE MAJOR APPR. SPAN
44.3	SMIAS	274	276	N	3		A3	SUBSTRUCTURE MINOR APPR. SPAN
45.1	NMS	277	279	N	3		I3	NUMBER MAIN SPANS
45.2	NMASS	280	283	N	4		I4	NUMBER MAJOR APPROACH SPAN
45.3	NMIASS	284	287	N	4		I4	NUMBER MINOR APPROACH SPAN
46	TNS	288	291	N	4		I4	TOTAL NUMBER OF SPAN
48	MAXSL	293	296	N	4		I4	MAXIMUM SPAN LENGTH
49	SRTLEN	297	302	N	6		I6	STRUCTURE LENGTH
50	SIWA	303	308	N	6		A6	SIDE WALKS
51	ROWI	309	312	N	4	1	R4.1	ROADWAY WIDTH
52	DEWI	313	316	N	4	1	R4.1	DECK WIDTH
53	VCO	317	320	N	4		I4	VERT.CLEAR.OVER(FT & INCH)
54	VCU	321	324	N	4		I4	VERT.CLEAR.UNDER(FT & INCH)
55	RLC	325	327	N	3	1	R3.1	RIGHT LATERAL CLEARANCE
56	LLC	328	330	N	3	1	R3.1	LEFT LATERAL CLEARANCE
57.1	DTM	331	333	N	3		A3	DECK TYPE MAIN
57.2	DTMAA	334	336	N	3		A3	DECK TYPE MAJOR APPROACH
57.3	DTMIA	337	339	N	3		A3	DECK TYPE MINOR APPROACH
58	DECO	343	343	N	1		I1	DECK CONDITION
59	SSCO	344	344	N	1		I1	SUPER STRUCTURE CONDITION
60	SUBCO	345	345	N	1		I1	SUBSTRUCTURE CONDITION
61	CPCO	346	346	AN	1		A1	CHANNEL & PORT CONDITION
62	RWCO	347	347	AN	1		A1	RETENTION WALL CONDITION
63	ESRELI	348	349	AN	2		A2	ESTIMATED REMAINING LIFE

TABLE A.1. (CONTINUED)

Item No.	Var. Name	From	To	Type	Size	Dec.	Format	Item Description
64	OPRA	350	352	N	3		I3	OPERATION RATING
65	ARCO	353	353	A	1		A1	APPROACH ROADWAY CONDITION
66	INVRA	354	356	N	3		I3	INVENTORY RATINGS
67	SCO	357	357	AN	1		I1	STRUCTURE CONDITION
68	DEGE	358	358	AN	1		I1	DECK GEOMETRY
69	UCVL	359	359	AN	1		I1	UNDER CLEAR VERT & LATERAL
70	SLC	360	360	AN	1		A1	SAFE LOAD CAPACITY
71	WA	361	361	AN	1		I1	WATER WAY ADEQUACY
72	AR	362	362	AN	1		I1	APPROACH ROADWAY
73	YENE	363	364	N	2		I2	YEAR NEED
74	TYSE	365	365	N	1		I1	TYPE SERVICE
75	TYWO	366	368	N	3		I3	TYPE WORK
76	LOI	369	374	N	6		I6	LENGTH OF IMPROVEMENT
77	PDL	375	375	N	1		I1	PROPOSED DESIGN LOAD
78	PRW	376	379	N	4		I4	PROPOSED ROADWAY WIDTH
79	PNL	380	381	N	2		I2	PROPOSED NUMBER OF LANES
80	DEADT	382	387	N	6		I6	DESIGN ADT
81	YEADT	388	389	N	2		I2	YEAR OF ESTIMATED ADT
82	YPARI	390	391	N	2		I2	YEAR OF ADJ RDWY IMPROVEMENT
83	TI	392	392	N	1		I1	TYPE IMPROVEMENTS
84	COPRI	393	397	N	5		I5	COST OF PROPOSED IMPROVEMENT
36	TRASA	398	401	A	4		A4	TRAFFIC SAFETY
90	DLI	402	407	A	6		A6	DATE OF LAST INSPECTION
	DO	408	408	A	1		A1	DEFICIENT/OBSOLETE
6.2	INTCO	409	412	N	4		A4	INTERSECTION CONTROL
6.2	INTSE	413	414	N	2		I2	INTERSECTION SECTION
6.2	INTSTR	415	417	N	3		I3	INTERSECTION STRUCTURE
5.1A	ORO	418	418	N	1		I1	IR OTHER
5.2A	ORS	419	420	N	2		I2	IR SYSTEM
5.3A	IRD	421	421	N	1		I1	IR DESIGN
5.4A	ORN	422	426	N	5		A5	IR NUMBER
5.5A	ORDIR	427	427	N	1		I1	IR DIRECTION
5.6A	ORF	428	428	N	1		I1	IR FUNCTION
10.2A	ORHC	429	432	N	4		I4	IR HORIZONTAL CLEARANCE
11.A	ORMP	433	437	N	5	3	R5.3	IR MILEPOINT
12.A	ORDODRSN	438	442	A	5		A5	IR DOD ROAD SECTION NUMBER
13A	ORBD	443	444	A	2		A2	IR BRIDGE DESCRIPTION
14A	ORDODMP	445	449	N	5	2	R5.2	IR DOD MILEPOINT
15A	ORDODSL	450	452	N	3	1	R3.1	IR DOD SECTION LENGTH
19A	ORBPL	453	454	N	2		I2	IR BYPASS LENGTH
24A	ORFAS	455	456	N	2		I2	IR FEDERAL AID SYSTEM
25A	ORAD	457	457	N	1		I1	IR ADMIN.
26A	ORFC	458	459	N	2		I2	IR FUNCTIONAL CLASS
29A	ORADT	460	465	N	6		I6	IR ADT

TABLE A.1. (CONTINUED)

Item No.	Var. Name	From	To	Type	Size	Dec.	Format	Item Description
30A	ORYADT	466	467	N	2		I2	IR YEAR OF ADT
10.3A	ORMVC	468	471	N	4	2	R5.2	IR INV.RT.VERT.CLEARANCE
85	PEC	475	477	N	3		I3	PRELIMI. ENG. COST
86	DEMOCT	478	480	N	3		I3	DEMOL.COST
87	SUBCT	481	485	N	5		I5	SUBSTRUCTURE COST
88	SUPERCT	486	490	N	5		I5	SUPER STRUCTURE COST
89	BPI	491	494	AN	4		A4	BRIDGE PRIORITY INDEX
91	BPIFLG	495	495	AN	1		A1	'BPI' FLAG

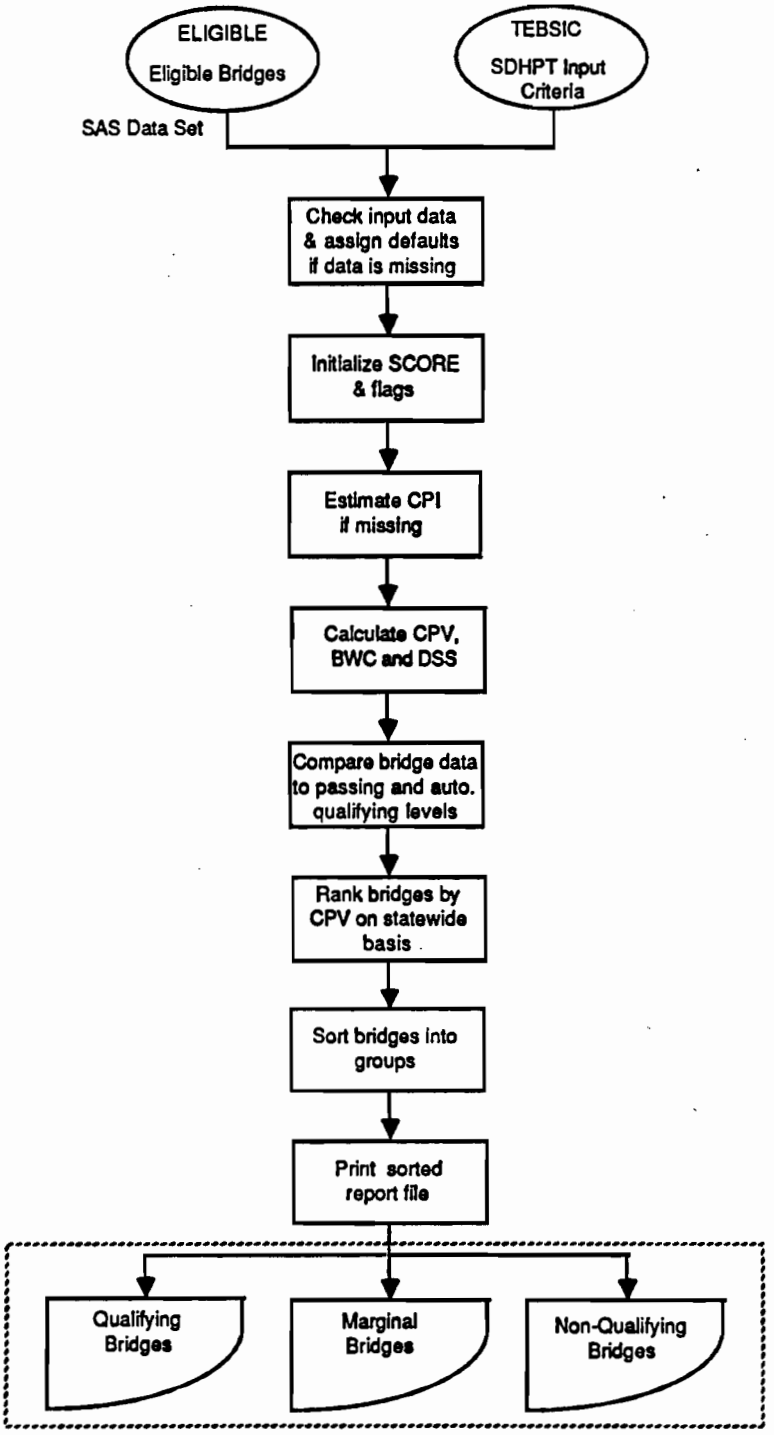

Fig A.3. Flow diagram of the TEBS1 program.

Primarily, the program uses a weighted screening method to assign scores to bridges passing SDHPT screens. Currently, the program works with the following five screens:

(1)	CPV	Cost Per Vehicle (Cost of Proposed Improvements divided by ADT)
(2)	ADT	Average Daily Traffic
(3)	SR	Sufficiency Rating
(4)	DSS	Minimum of Deck, Substructure, and Superstructure Condition Ratings
(5)	BWC	Bridge Width Condition

The screens CPV, DSS, and BWC are calculated by the TEBS1 program as described below. CPV is calculated by dividing the cost of the proposed improvements by the bridge ADT. For bridges with missing ADT, CPV becomes the cost of proposed improvements (Table A.1 Item No. 84 COPR1). If COPR1 is missing, then it is calculated as length of improvements times width of improvements times rehabilitation or replacement costs, depending on the proposed project. If these calculations can not be made, then it is taken as $20,000. DSS is calculated as the minimum value of DECO, SUBCO, and SSCO (Table A.1 Item Nos. 58, 60, 59). DSS is set to zero if at least one of the deck, substructure, or superstructure condition ratings is missing. BWC is defined as critical (BWC=0) or non-critical (BWC=1). It is determined by comparing the roadway width (ROWI) with the bridge ADT. The comparison is based on the following standard requirements given in the SDHPT 1985-86 On-State System Federal-Aid Bridge Replacement and Rehabilitation Program statewide and District listings.

Standard Requirements

Critical Existing Roadway (Feet)	Lane Width (Feet)	Roadway (Feet)	Traffic
Less than 24 feet	12	44 (10-12-12-10)	ADT greater than 1500
	12	40 (8-12-12-8)	ADT greater than 750
Less than 22 feet	11	34 (6-11-11-6)	ADT greater than 400
Less than 20 feet	10	28 (4-10-10-4)	ADT less than 400

Example: An existing bridge width of less than 24 feet is critical if traffic is greater than 750 vpd.

The user inputs a weight, an automatic qualifying level and a passing level for each screen described above. The sum of the weights should total 1.0. Bridges passing at least one automatic qualifying level for any of the screens are placed in the qualifying set for funding. Scores are computed for all eligible bridges, using a weighted screening method. A bridge's score consists of the sum of the weights of each screen passed.

The user also inputs the score thresholds, TQ and TM, defining the qualifying, marginal and non-qualifying categories. Qualifying bridges will have scores greater than (better than) or equal to threshold TQ, non-qualifying bridges will have scores less than (worse than)or threshold TM, and marginal bridges will have scores equal to TM and between thresholds TQ and TM. These methods of automatic qualification and scoring require the automatic qualifying level, the passing level for each screen, weights for each screen, and the thresholds, to be given as input by the program user.

TEBS1 INPUT GUIDE

ELIGIBLE Input File

The ELIGIBLE input file contains all the BRINSAP bridges which are eligible for FHWA funding. It is an SAS data set file created by the SURE1 program. It contains identification data for each eligible bridge as well as all the data items used by the SURE1 and TEBS1 programs. It is addressed with the filename, type, and locations; DUMMY DUMMY A, in the CMS Command Section of the TEBS1 program.

TEBSIC Input File

The TEBSIC input file provides the TEBS1 program with the SDHPT qualifying criteria information. The file is in free format (each data item may be anywhere in its respective line

but must be separated by one or more blanks and in the order shown). All real values are typed with a decimal point as part of the value. It is addressed with the file name, type, and location; TEBSIC DATA A, in the CMS Commands Section of the TEBS1 program.

Note: Due to the free format of the data file, no field may be left blank or the data will be misinterpreted by the program. Type "N" in those fields to be left blank, and type "D" to use the field's default value.

Line No.	Variable Name	Variable Description
1	CFRH	Rehabilitation Cost, in dollars per square foot. Used to estimate the cost of proposed improvements when this data item is missing. Default is 25.
	CFRP	Replacement Cost, in dollars per square foot. Used to estimate the cost of proposed improvements when this data item is missing. Default is 35.
2	WCPV	Weight for CPV. Input as decimal. Default is 0.10 (10 percent).
	WADT	Weight for ADT. Input as decimal. Default is 0.10 (10 percent).
	WSR	Weight for SR. Input as decimal. Default is 0.25 (25 percent).
	WDSS	Weight for DSS. Input as decimal. Default is 0.35 (35 percent).
	WBWC	Weight for BWC. Input as decimal. Default is 0.20 (20 percent).
3	AQCPV	Automatically qualifying level for CPV, in dollars. Default is N.
	AQADT	Automatically qualifying level for ADT. Default is N.
	AQSR	Automatically qualifying level for SR. Default is N.
	AQDSS	Automatically qualifying level for DSS. Default is 2.
	AQBWC	Automatically qualifying level for BWC. Default is N.
4	PLCPV	Passing level for CPV, in dollars. Default is 70.
	PLADT	Passing level for ADT. Default is 1700.
	PLSR	Passing level for SR. Default is 63.
	PLDSS	Passing level for DSS. Default is 6.

	PLBWC	Passing level for BWC. Default is 0.
5	TQ	Threshold for qualifying. Default is 75.
	TM	Threshold for marginal. Default is 65.

TEBS1 OUTPUT

The ouptut of TEBS1 consists of a report file containing the eligible bridges classified in three groups: Qualifying, Marginal, and Non-Qualifying. The bridges are ranked by cost per vehicle on a statewide basis and then printed by cost per vehicle within each category. The report file echoes the input data and lists bridge information relevant to the sorting procedure. A header containing the input qualifying criteria is printed on every page. The relevant information for each bridge is printed on one line, together with the accumulative total cost of the bridges in the group.

EXPLANATION OF PRINTED OUTPUT

Figure A.4 shows a sample page of the report file.

(1) Qualifying and marginal thresholds, input by the user. A bridge with a score greater than or equal to 75 is Qualifying; a bridge with a score between 65 and 75 is Marginal; and a bridge with a score less than 65 is Non-Qualifying.

(2) Rehabilitation and replacement costs (in dollars per square feet), input by the user.

(3) Weights input by the user for the qualifying screens.

CPV has a weight of 0.10 or 10 percent
ADT has a weight of 0.10 or 10 percent
SR has a weight of 0.25 or 25 percent
DSS has a weight of 0.35 or 35 percent
BWC has a weight of 0.20 or 20 percent

TEXAS BRIDGE SORTER 20:21 THURSDAY, NOVEMBER 20, 1986 6

VERSION 1.0

QUALIFYING BRIDGE PROJECTS

DATA SET: BRIDGES ELIGIBLE FOR FEDERAL FUNDING

CRITERIA USED FOR SCREENING

(1) QUALIFYING: SCORE >= 75
MARGINAL: 65 <= SCORE < 75

(2) REHAB COST = $25/SQ FT
REPLACE COST = $35/SQ FT

	CPV	ADT	SR	DSS	BWC
(3) WEIGHTS:	10%	10%	25%	35%	20%
(4) AUTO. QUALIFYING LEVELS:	N <=70	>= NONE >=1,700	N <=63.0	<= 2 <=6	NONE <=0

* = ESTIMATED
M = MISSING

DIST	COUNTY	CONT-SEC-STR	(7) TYPE WORK	(8) CPV RANK	(9) SCORE (6)	(10) CPV	(11) ADT	(12) SR	(13) DSS	(14) BWC	(15) ROWY WIDTH	(16) PROJECT COST	(17) ACCUMULATIVE PROJECT COST
1	FRANKLIN	0169-05-016	RH	713	45* AQ	$21	1,200	73.6*	8*	1	84.8	$25,000	$15,720,000
18	DALLAS	8186-18-004	RP	716	100*	$21	5,000	10.2*	6	0	19.7	$105,000	$15,825,000
18	DENTON	0135-10-062	RH	720	80	$21	9,600	58.1	5	1	28.0	$203,000	$16,028,000
16	NUECES	0989-02-004	RH	722	80*	$21	2,500	59.5*	6	1	24.0	$53,000	$16,081,000
3	YOUNG	0655-01-002	RP	724	80* AQ	$21	2,100	46.3*	0*	1	28.0	$45,000	$16,126,000
2	TARRANT	0363-01-007	RH	732	80	$22	9,700	61.9	5	1	28.0	$212,000	$16,338,000
1	FANNIN	0279-04-013	RH	736	45* AQ	$22	1,000	71.4*	0*	1	46.0	$22,000	$16,360,000
18	DALLAS	0581-01-036	RH	749	80*	$22	7,900	62.9*	6	1	26.0	$176,008	$16,536,000
8	HOWARD	8209-08-001	RP	753	80*	$22	4,600	43.6*	6	1	30.0	$103,000	$16,639,000
18	KAUFMAN	0095-04-112	RP	755	80	$22	12,200	48.6	6	1	28.0	$274,000	$16,913,000
1	RED RIVER	0772-02-013	RH	759	90* AQ	$23	800	57.6*	0*	0	20.7	$18,000	$16,931,000
1	GRAYSON	0410-01-014	RH	769	55* AQ	$23	2,100	71.6	0*	1	48.0	$48,000	$16,979,000
4	POTTER	0275-01-012	RH	770	80	$23	8,900	60.9	4	1	64.0	$204,000	$17,183,000
13	WHARTON	8108-13-004	RP	773	100*	$23	2,000	23.0*	6	0	22.2	$46,000	$17,229,000
23	BROWN	8810-23-001	RP	773	80*	$23	3,000	40.4*	5	1	34.1	$69,000	$17,298,000
20	JEFFERSON	8226-20-001	RP	774	100*	$23	3,200	31.9*	3	0	23.5	$74,000	$17,372,000
2	TARRANT	0172-02-004	RP	784	80*	$23	13,700	11.6*	3	1	30.0	$388,000	$17,680,000
11	HOUSTON	0117-06-053	RH	784	45* AQ	$23	1,500	77.6	0*	1	42.0	$35,000	$17,715,000
3	WILBARGER	0043-06-098	RH	794	80	$24	3,800	56.0	4	1	48.0	$90,000	$17,805,000
3	WILBARGER	0043-06-099	RH	794	80	$24	3,800	56.0	4	1	40.0	$90,000	$17,895,000
1	RED RIVER	0189-02-032	RH	799	45* AQ	$24	1,300	72.6*	0*	1	53.5	$31,000	$17,926,000
1	RED RIVER	0189-02-033	RH	799	45* AQ	$24	1,300	72.6*	0*	1	53.5	$31,000	$17,957,000
8	BORDEN	0295-03-047	RH	807	45* AQ	$24	1,000	78.9	0*	1	84.0	$24,000	$17,981,000
13	VICTORIA	0371-01-010	RP	810	80	$24	6,800	45.6	4	1	44.0	$165,000	$18,146,000
1	GRAYSON	0316-02-003	RH	827	45* AQ	$25	600	72.5*	0*	1	30.8	$15,000	$18,161,000
10	RUSK	1116-01-001	RP	827	90*	$25	1,400	28.0*	4	8	21.0	$35,000	$18,196,000
1	HUNT	0009-06-031	RH	829	80*	$25	2,100	60.3*	6	1	26.0	$53,000	$18,249,000
18	DALLAS	8262-18-004	RH	829	55* AQ	$25	4,200	67.4*	0*	1	56.3	$106,000	$18,355,000
1	GRAYSON	2454-01-001	RH	842	80*	$26	2,800	55.6*	6	1	24.0	$73,000	$18,428,000
15	BEXAR	8137-15-003	RP	845	80*	$26	9,000	48.8*	6	1	39.0	$236,008	$18,664,000
14	GILLESPIE	0071-06-063	RH	847	45* AQ	$26	1,100	76.6	0*	1	44.0	$29,000	$18,693,000
18	DENTON	0081-05-018	RP	851	100*	$26	1,700	34.3*	4	0	20.0	$45,000	$18,738,000
18	DENTON	0081-05-019	RP	851	100*	$26	1,700	27.9*	4	0	20.0	$45,000	$18,783,000
24	ROCKWALL	0451-01-005	RP	868	80*	$27	9,900	44.2*	5	1	24.0	$268,000	$19,051,000

Fig A.4. TEBS1 report file output sample.

(4) Automatically qualifying levels input by the user for the qualifying screens: CPV, ADT, SR, and BWC do not have automatically qualifying levels in this example. The automatically qualifying level for DSS is <= 2. All bridges with DSS less than or equal to 2 are automatically placed in the qualifying set.

(5) Passing levels input by the user for the qualifying screens:

The passing level for CPV is <= $70; all bridges with CPV less than or equal to $70 pass the CPV screen.

The passing level for ADT is >= 1,700; all bridges with ADT greater than or equal to 1,700 pass the ADT screen.

The passing level for SR is <= 63; all bridges with SR less than or equal to 63 pass the SR screen.

The passing level for DSS is <= 6; all bridges with DSS less than or equal to 6 pass the DSS screen.

The passing level for BWC is <= 0; all bridges with BWC less than or equal to 0 pass the BWC screen.

(6) An asterisk indicates an estimated value. An N indicates a missing data value.

(7) Type of work the bridge is eligible for; RH for rehabilitation, RP for replacement.

(8) Statewide cost per vehicle rank, regardless of group.

(9) Bridge score calculated by the program. The score goes from a minimum of 0 to a maximum of 100. AQ means that the bridge automatically qualified.

(10) Cost per vehicle for the bridge project. Calculated as cost of proposed improvements/ ADT. If ADT is missing, it is estimated as follows: CPV = Cost of proposed improvements. If cost of proposed improvements is missing, it is estimated as described below.

(11) Average daily traffic (BRINSAP data item).

(12) Sufficiency Rating score. The SR goes from a minimum of 0 to a maximum of 100.

(13) Minimum of deck, substructure, and superstructure condition ratings.

(14) Bridge width condition: 0 is critical, 1 is non-critical.

(15) Bridge roadway width in feet (BRINSAP data item).

(16) Bridge project cost (cost of proposed improvements) in dollars (BRINSAP data item). If missing in BRINSAP data, it is estimated as follows: If PRW (Proposed Roadway Width) and LOI (Length of Proposed Improvement) are not missing, then Project Cost = PRW x LOI x Rehabilitation or Replacement Costs. If these items are missing, Project Cost = $20,000.

(17) Accumulative total project cost for the "Qualifying" category; this is the sum of the individual project costs.

SURE1 PROGRAM LISTING

```
/*
                    S U R E 1

          SUFFICIENCY RATING EVALUATOR PROGRAM

                    VERSION 1.0
```

WRITTEN BY:
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ON: MAY 1986
LAST UPDATED: JULY 1986

SUREI IS THE FIRST PROGRAM IN A TWO PART SERIES OF SAS PROGRAMS DEVELOPED AND WRITTEN TO COMPUTERIZE THE TEXAS SDHPT BRIDGE PROJECT SELECTION PROCESS. THIS PROGRAM WAS DEVELOPED UNDER CTR RESEARCH PROJECT 439. FOR MORE INFORMATION ABOUT THIS PROGRAM OR THE OTHER IN THE SERIES, REFER TO CTR REPORT 439-1.

SUREI IS A SAS PROGRAM TO CHECK FOR DEFICIENCY/OBSOLECENCE, CALCULATE SUFFICIENCY RATING SCORES AND DETERMINE ELIGIBILITY ON THE SDHPT-FORMATTED ON-SYSTEM BRINSAP (BRIDGE INVENTORY INSPECTION AND APPRAISAL PROGRAM) DATA TAPE. ALL THE ALGORITHMS IN THIS PROGRAM ARE BASED ON THE SDHPT BRINSAP MANUAL OF PROCEDURES.

DEVELOPED AND WRITTEN IN SAS (STATISTICAL ANALYSIS SYSTEM) VERSION 5 (RELEASE 5.08) FOR THE IBM 3081-D RUNNING UNDER VM/SP.

A NOTE ON MISSING OR ILLEGAL DATA:

THIS PROGRAM WILL ESTIMATE THE SUFFICIENCY RATING (SR) VALUE WHEN ANY VALUE INVOLVED IN THE SR CALCULATION IS MISSING OR ILLEGAL. THE SPECIFIC COMPONENT OR SUBINDEX REQUIRING THE MISSING OR ILLEGAL DATA IS MADE AS LARGE AS POSSIBLE IN ORDER TO GENERATE A CONSERVATIVE SR VALUE.

INPUT AND OUTPUT:

INPUT: BRINSAP ON-SYSTEM DATA TAPE IN SDHPT FORMAT. FOR SDHPT FORMAT REFER TO CTR REPORT 439-1 OR TO THE SDHPT BRIDGE DIVISION.
TAPE SPECIFICATIONS: 9-TRACK, 1600 BPI, UNLABELED, EBCDIC, 510 CHARACTERS/RECORD, 5100 RECORDS/BLOCK, FIXED BLOCK LENGTH.
NOTE: IF TAPE SPECS ARE CHANGED, THEN THE SYSTEM FILE DEFINITIONS MUST BE CHANGED TO BE CONSISTENT WITH THE TAPE SPECS.

OUTPUT: THE PROGRAM PRODUCES TWO OUTPUTS: A REPORT OUTPUT FILE AND (SUREI LISTING) AND THE ELIGIBLE DATA SET OUTPUT FILE (ELIGIBLE BRINSAP). THE REPORT FILE CONTAINS A LIST OF ALL THE DATA ITEMS FOR THOSE BRIDGE RECORDS CONTAINING MISSING OR ILLEGAL DATA. THE ELIGIBLE DATA SET OUTPUT FILE IS A

```
        PERMANENT SAS DATA SET CONTAINING ALL THE BRIDGES ELIGIBLE FOR
        FEDERAL FUNDING.  THE ELIGIBLE FILE IS IN SAS FORMAT AND CAN
        ONLY BE READ BY SAS.
                                                    */
/*******************************************************************/
/*  CMS SYSTEM COMMANDS:  INPUT/OUTPUT FILE DEFINITIONS            */

CMS FI INF TAP1 (RECFM FB LRECL 510 BLOCK 5100;
CMS FI BRINSAP DISK DUMMY DUMMY A;
/*******************************************************************/

OPTIONS REPLACE CENTER INVALIDDATA=I MISSING=M;

DATA SRDATA;

/*  DROP ALL TEMPORARY VARIABLES  */
 DROP TS2 A B C D E F G H I J K AI AIT GH AB COUNT DIG1 DIG2 X Y;

 LENGTH EST $ 1;
 MISSING M;
 LABEL DIST='DISTRICT' MILEPT='MILE:POINT' STRUCT='STRUCTURE'
      RSTR='ROUTE:STRUCT.:FUNCT.' SR='SUFF.:RATING'
      DODRSN='DOD ROAD:SECTION NO.' BDL='BYPASS:DETOUR:LENGTH'
      LOS='LANES:OVER:STRUCT.' LUS='LANES:UNDER:STRUCT.'
      AWIDTH='APPROACH:WIDTH' TS='TYPE:SERVICE' MST='MAIN:SPAN:TYPE'
      ROWI='ROADWAY:WIDTH' VCO='VERT.:CLEAR.:OVER'
      DECO='DECK:COND.' SSCO='SUPER-:STRUCT.:COND.'
      SUBCO='SUB-:STRUCT.:COND.' INVRA='INV.:RATING'
      SCO='STRUCT.:COND.' DEGE='DECK:GEOM.'
      UCVL='UNDER:CLEAR.:VERT.& LAT.'
      WA='WATER:ADEQ.' AR='APPR.:ROADWAY' TYWO='TYPE:WORK'
      PRW='PROP.:ROADWAY:WIDTH' PNL='PROP.:NO. OF:LANES'
      COPRI='COST OF:PROP.:IMPROV.' TRASA='TRAFFIC:SAFETY'
      ORBDL='OR:BYPASS:LENGTH' ORADT='OR:ADT'
      W_ADT='ADT'   W_BDL='BYPASS:DETOUR:LENGTH';
 INFILE INF ;
 INPUT DIST 1-2 COUNTY $ 3-5 CONTROL $ 6-9 SECTION $ 10-11
      STRUCT $ 17-19 CITY 26-29 RSTR 40 SURA $ 160-163 DODRSN $ 164-168
      BDL 191-192 LOS 220-221 LUS 222-223 ADT 224-229
      AWIDTH 233-235 TS 251-252 MST 253-256 CULVERT 265-266
      ROWI 309-312 .1 VCO 317-320 DECO 343 SSCO 344 SUBCO 345
      INVRA 354-356  SCO 357 DEGE 358 UCVL 359 WA 361
      AR 362 TYWO 366-368 LOI 369-374 PRW 376-379 PNL 380-381
      COPRI 393-397 TRASA $ 398-401 ORBDL 453-454 ORADT 460-465;

/*  CREATE UNIQUE BRIDGE ID NUMBER   */

 BRID = TRIM(LEFT(COUNTY)) || TRIM(LEFT(CONTROL)) ||
      TRIM(LEFT(SECTION)) || TRIM(LEFT(STRUCT));


/*******************************************************************/
/*   CHECK FOR MISSING AND ILLEGAL DATA                            */
/*******************************************************************/

 SR_EST = ' ';

/*  CHECK FOR MISSING AND ILLEGAL VALUES IN NUMERIC VARIABLES  */

 IF (RSTR < =.Z) OR (LOS < =.Z) OR (LUS < =.Z) OR (TS < =.Z) OR (ROWI < =.Z) OR
   (VCO < =.Z) OR (INVRA < =.Z) OR (CULVERT=.I) OR (AWIDTH=.I) OR
```

```
   (MST = .I) OR (DECO < = .I) OR (SSCO < = .I) OR (SUBCO < = .I) OR (SCO < = .I) OR
   (DEGE < = .I) OR (UCVL < = .I) OR (WA < = .I) OR (AR < = .I)
 THEN SR_EST = '*';

/*  SET WORKING ADT AND BDL VARIABLES (W_ADT AND W_BDL) DEPENDING ON
    WHICH IS THE INVENTORY ROUTE                                    */

 IF (RSTR = 3) OR (RSTR = 4)
  THEN DO;
     IF (ORADT < = .Z) OR (ORBDL < = .Z) THEN SR_EST = '*';
     W_ADT = ORADT;
     W_BDL = ORBDL;
     END;
  ELSE DO;
     IF (ADT < = .Z) OR (BDL < = .Z) THEN SR_EST = '*';
     W_ADT = ADT;
     W_BDL = BDL;
     END;

/*  CHECK FOR MISSING VALUES IN CHARACTER VARIABLES  */

 IF (DODRSN = '  ') OR (TRASA = '  ') THEN SR_EST = '*';



/*********************************************************************/
/*  CHECK FOR "STRUCTURAL DEFICIENCY" (DEF = 1) OR                   */
/*  "FUNCTIONAL OBSOLESCENCE" (OBS = 1)                              */
/*********************************************************************/


 /*  INITIALIZE DO & SPCL  */

 DEF = 0;  OBS = 0;  SPCL = 0;

/*  EXTRACT LAST (SECOND) DIGIT OF TS VARIABLE  */

 TS2 = TS - INT(TS/10)*10;

/*  STRUCTURALLY DEFICIENT  */

 IF (0 < = DECO < = 4) OR (0 < = SSCO < = 4) OR (0 < = SUBCO < = 4) OR
   (0 < = SCO < = 2)
  THEN DEF = 1;
  ELSE IF ((TS2 = 0) OR (5 < = TS2 < = 9)) AND (0 < = WA < = 2)
       THEN DEF = 1;


/*  FUNCTIONALLY OBSOLETE  */

 IF (0 < = DEGE < = 3) THEN
  IF  (( 0 < = W_ADT < =  250) AND (ROWI < 20)) OR
     (( 250 < W_ADT < =  750) AND (ROWI < 22)) OR
     (( 750 < W_ADT < = 2700) AND (ROWI < 24)) OR
     ((2700 < W_ADT < = 5000) AND (ROWI < 30)) OR
     ((5000 < W_ADT < = 9000) AND (ROWI < 44)) OR
     ((9000 < W_ADT < = 35000) AND (ROWI < 56))
  THEN OBS = 1;
  ELSE IF W_ADT > 35000 THEN SPCL = 1;
     ELSE;
 ELSE IF ((0 < = UCVL < = 3) AND
```

```
      (TS2=0 OR TS2=1 OR TS2=2 OR TS2=4 OR TS2=6 OR TS2=7 OR TS2=8))
     OR (0 < = AR < = 3)
   THEN OBS = 1;
   ELSE IF ((WA = 3) AND ((TS2 = 0) OR (5 < = TS2 < = 9))) OR (SCO = 3)
      THEN OBS = 1;

/*************************************************************************/
/*  CALCULATE S1 - STRUCTURAL ADEQUACY AND SAFETY                        */
/*************************************************************************/

 S1 = 0;  /*  INITIALIZE S1  */

/*** CALCULATE  A  -  REDUCTION FOR DETERIORATION ***/

 IF (0 < = SSCO < = 2) OR (0 < = SUBCO < = 2) THEN A = 55;
 ELSE IF (SSCO = 3) OR (SUBCO = 3) THEN A = 40;
    ELSE IF (SSCO = 4) OR (SUBCO = 4) THEN A = 25;
       ELSE IF (SSCO = 5) OR (SUBCO = 5) THEN A = 10;
          ELSE IF (SSCO > = 6) THEN A = 0;
             ELSE A = 0;

/*** CALCULATE  I  -  REDUCTION FOR LOAD CAPACITY ***/

/*  CALCULATE AIT -  ADJUSTED INVENTORY TONNAGE  */

/*  EXTRACT FIRST DIGIT (TYPE OF LOADING) FROM VARIABLE INVRA  */

  DIG1 = INT(INVRA/100);
  IF DIG1 = 1 THEN AIT = (INVRA-100)*1.56;
  ELSE IF DIG1 = 2 THEN AIT = (INVRA-200)*1.00;
     ELSE IF DIG1 = 3 THEN AIT = (INVRA-300)*1.56;
        ELSE IF DIG1 = 4 THEN AIT = (INVRA-400)*1.00;
           ELSE IF DIG1 = 5 THEN AIT = (INVRA-500)*1.21;
              ELSE IF DIG1 = 6 THEN AIT = (INVRA-600)*1.21;
              ELSE IF DIG1 = 9 THEN AIT = (INVRA-900)*1.0;
                 ELSE IF (DIG1 = 7) OR (DIG1 = 8)
                       THEN DO; SR = 999.9; GOTO SKIP; END;
                       ELSE DO; AIT = 36; SR_EST = '*'; END;


  IF (36 - AIT) > 0 THEN I = (36 - AIT)**1.5 * 0.2778;
             ELSE I = 0;
  AI = A + I;
  IF (AI > 55) THEN AI = 55;

/*  CALCULATE S1  */

  S1 = 55 - AI;


/*************************************************************************/
/*  CALCULATE S2 - SERVICEABILITY AND FUNCTIONAL OBSOLESCENCE            */
/*************************************************************************/

 /*  INITIALIZE S2  AND TEMPORARY VARIABLES  */

 S2 = 0;
 A = .;  I = .;
```

```
/*** CALCULATE J - RATING REDUCTIONS ***/

/*  CALCULATE A  */

 IF (0 < = DECO < = 3) THEN A = 5;
 ELSE IF DECO = 4 THEN A = 3;
    ELSE IF DECO = 5 THEN A = 1;
       ELSE IF (DECO > = 6) THEN A = 0;
          ELSE A = 0;

/*  CALCULATE B  */

 IF (0 < = SCO < = 3) THEN B = 4;
 ELSE IF SCO = 4 THEN B = 2;
    ELSE IF SCO = 5 THEN B = 1;
       ELSE IF (SCO > = 6) THEN B = 0;
          ELSE B = 0;

/*  CALCULATE C  */

 IF (0 < = DEGE < = 3) THEN C = 4;
 ELSE IF DEGE = 4 THEN C = 2;
    ELSE IF DEGE = 5 THEN C = 1;
       ELSE IF (DEGE > = 6) THEN C = 0;
          ELSE C = 0;

/*  CALCULATE D  */

 IF (0 < = UCVL < = 3) THEN D = 4;
 ELSE IF UCVL = 4 THEN D = 2;
    ELSE IF UCVL = 5 THEN D = 1;
       ELSE IF (UCVL > = 6) THEN D = 0;
          ELSE D = 0;

/*  CALCULATE E  */

 IF (0 < = WA < = 3) THEN E = 4;
 ELSE IF WA = 4 THEN E = 2;
    ELSE IF WA = 5 THEN E = 1;
       ELSE IF (WA > = 6) THEN E = 0;
          ELSE E = 0;

/*  CALCULATE F  */

 IF (0 < = AR < = 3) THEN F = 4;
 ELSE IF AR = 4 THEN F = 2;
    ELSE IF AR = 5 THEN F = 1;
       ELSE IF (AR > = 6) THEN F = 0;
          ELSE F = 0;

 J = A + B + C + D + E + F;
 IF J > 13 THEN J = 13;

/*** CALCULATE G & H - "WIDTH OF ROADWAY" INSUFFICIENCY ***/

/*  CALCULATE X  */

 IF (RSTR NE 1) AND (RSTR NE 2) AND (RSTR NE 3) AND (RSTR NE 4) AND
   (RSTR NE 8)
  THEN DO; SR = 999.9; GOTO SKIP; END;  /*  BRIDGE N/A  */
```

```
   ELSE IF LOS > 0 THEN X = W_ADT/LOS;
            ELSE X = 0;

/*  IF ADT OR ORADT ARE MISSING THEN X = 0  */
 IF X < 0 THEN X = 0;


/*  CALCULATE G  */

 IF (CULVERT = 0) OR (CULVERT=.) THEN
  IF (ROWI > 0) AND (AWIDTH > 0) THEN
   IF (ROWI+2) < AWIDTH THEN G = 5;
   ELSE G = 0;
  ELSE G = 0;
 ELSE G = 0;

/*  CALCULATE H  */

 IF (ROWI > 0) AND (LOS > 0) THEN Y = ROWI/LOS;
                  ELSE Y = 0;

 IF (LOS = 1)
  THEN IF (0 < Y < 14) THEN H = 15;
     ELSE IF (14 < = Y < 18) THEN H = ((18-Y)*15)/4;
        ELSE H = 0;


/*  NOTE:  IF ONE OF THE FOLLOWING FOUR CONDITIONS ARE MET, NO LANE
    WIDTH REDUCTIONS ARE ALLOWED.                                  */

  ELSE IF ((LOS = 2) AND (Y > = 16)) OR
       ((LOS = 3) AND (Y > = 15)) OR
       ((LOS = 4) AND (Y > = 14)) OR
       ((LOS > = 5) AND (Y > = 12))
      THEN H = 0;
      ELSE IF (0 < = X < = 50)
           THEN IF (0 < Y < 9) THEN H = 7.5;
              ELSE H = 0;
           ELSE IF (50 < X < = 125)
                THEN IF (0 < Y < 10) THEN H = 15;
                ELSE IF (10 < = Y < 13) THEN H = (15*(13-Y))/3;
                   ELSE H = 0;
                ELSE IF (125 < X < = 375)
                     THEN IF (0 < Y < 11) THEN H = 15;
                        ELSE IF (11 < = Y < 14)
                             THEN H = (15*(14-Y))/3;
                             ELSE H = 0;
                     ELSE IF (375 < X < = 1350)
                          THEN IF (0 < Y < 12) THEN H = 15;
                             ELSE IF (12 < = Y < 16)
                                  THEN H=(15*(16-Y))/4;
                                  ELSE H = 0;
                          ELSE IF (X > 1350)
                               THEN IF (0 < = Y < 15)
                                    THEN H = 15;
                                    ELSE IF (15 < = Y < 16)
                                         THEN H=15*(16-Y);
                                         ELSE H = 0;
                               ELSE H = 0;

 GH = G + H;
```

```
 IF GII > 15 THEN GII = 15;

/*** CALCULATE I - "VERTICAL CLEARANCE" INSUFFICIENCY ***/

 IF (DODRSN = '00000') THEN
  IF (VCO >= 1400)
   THEN I = 0;
   ELSE I = 2;
 ELSE IF (DODRSN NE '    ')
      THEN IF (VCO >= 1600)   /*  DEFENSE ROAD  */
           THEN I = 0;
           ELSE I = 2;
      ELSE I = 0;

 IF VCO < 0 THEN I = 0;  /*  IF VCO IS MISSING THEN I = 0  */

/*  CALCULATE S2  */

 S2 = 30 - (J + GII + I);


/*************************************************************************/
/*  CALCULATE S3 - ESSENTIALITY                                          */
/*************************************************************************/


 /*  INITIALIZE S3  AND TEMPORARY VARIABLES  */

 S3 = 0;
 A = .;  B = .;


/*** CALCULATE  A  -  PUBLIC USE ***/

 K = (S1 + S2) / 85;

 IF (RSTR NE 1) AND (RSTR NE 2) AND (RSTR NE 3) AND (RSTR NE 4) AND
   (RSTR NE 8)
  THEN DO; SR = 999.9; GOTO SKIP; END;  /*  BRIDGE N/A  */
  ELSE IF K > 0
       THEN A = (W_ADT*W_BDL*15)/(200000*K);
       ELSE IF K = 0 THEN A = 15;
                ELSE A = 0;

/*  IF ADT OR BDL ARE MISSING THEN A = 0  */
 IF A < 0 THEN A = 0;

/*** CALCULATE  B  -  MILITARY USE ***/

 IF (DODRSN = '00000')
  THEN B = 0;
  ELSE IF (DODRSN NE '    ')
       THEN B = 2;
       ELSE B = 0;

/*  CALCULATE  S3  */

 AB = A + B;
 IF AB > 15 THEN AB = 15;
```

```
S3 = 15 - AB;


/*************************************************************************/
/*  CALCULATE S4 - SPECIAL REDUCTIONS                                    */
/*************************************************************************/


/*  INITIALIZE S4 AND TEMPORARY VARIABLES  */

S4 = 0;
A = .; B = .; C = .; DIG1 = .;


/*  NOTE:  CALCULATE S4 ONLY IF (S1+S2+S3) > = 50  */

IF (S1 + S2 + S3) < 50
 THEN DO;
    S4 = 0;
    GOTO SKIPS4;
    END;


/*** CALCULATE  A  -  "DETOUR LENGTH" REDUCTION ***/

IF (RSTR NE 1) AND (RSTR NE 2) AND (RSTR NE 3) AND (RSTR NE 4) AND
  (RSTR NE 8)
 THEN DO; SR=999.9; GOTO SKIP; END;  /*  BRIDGE N/A  */
 ELSE A = (W_BDL**4) * 5.205 * (10**(-8));

IF A < 0 THEN A = 0;  /* IF BDL OR ORBDL ARE MISSING THEN A = 0  */
      ELSE IF A > 5 THEN A = 5;     /*  SET MAX TO 5  */

/*** CALCULATE  B  -  "STRUCTURE TYPE" REDUCTION ***/

/*  EXTRACT FIRST AND SECOND DIGITS OF VARIABLE MST  */

DIG1 = INT(MST/1000);
DIG2 = INT(MST/100) - DIG1*10;

IF (DIG1 = 7) OR (DIG1 = 8) OR (2 < = DIG2 < = 7)
 THEN B = 5;
 ELSE B = 0;

/*** CALCULATE  C  -  "HIGHWAY SAFETY" REDUCTION ***/

/*  COUNT THE NUMBER OF 0'S IN THE VARIABLE TRASA  */

COUNT = 0;
DO I=1 TO 4;
 IF SUBSTR(TRASA,I,1)='0' THEN COUNT=COUNT + 1;
END;
IF COUNT = 2 THEN C = 1;
ELSE IF COUNT = 3 THEN C = 2;
   ELSE IF COUNT = 4 THEN C = 3;
      ELSE C = 0;

/*  CALCULATE S4  */

S4 = A + B + C;
```

```
 SKIPS4: ;

/*************************************************************************/
/*  CALCULATE SUFFICIENCY RATING                                         */
/*************************************************************************/

 IF (SR NE 999.9) THEN SR = S1 + S2 + S3 - S4;
 IF (SR < 0) THEN SR = 888.8;
 SR = ROUND(SR,.1);


SKIP:  RUN;     /*  END OF SRDATA DATA STEP  */

/*************************************************************************/
/*  DETERMINE ELIGIBILITY                                                */
/*************************************************************************/

DATA ELIGIBLE;
 SET SRDATA;

/*  INITIALIZE ELIG AND WT VARIABLES   */

   ELIG = 0;
   WT = ' ';

/*  SCREEN BRIDGES TO SELECT THOSE WHICH ARE ELIGIBLE FOR
   FOR REPLACEMENT (WT = 'RP') OR REHABILITATION (WT = 'RH').

   DEF = 1 --> BRIDGE IS DEFICIENT;  OBS = 1 --> BRIDGE IS OBSOLETE   */

  IF (DEF = 1)  OR  (OBS = 1)  THEN
   IF (SR < = 80)  AND  (SR > = 50)
    THEN DO;
       ELIG = 1;
       WT = 'RH';
       END;
    ELSE IF (SR < 50)
         THEN DO;
            ELIG = 1;
            WT = 'RP';
            END;

/*  SELECT ONLY THOSE BRIDGES WHICH ARE ELIGIBLE  */

  IF  ELIG = 0  THEN DELETE;

RUN;

/*************************************************************************/
/*  PRINT LIST OF ELIGIBLE BRIDGES                                       */
/*************************************************************************/
/*
PROC SORT DATA = ELIGIBLE OUT = BRINSAP.ELIGIBLE;
 BY DIST ;

TITLE1 'SUFFICIENCY RATING EVALUATION PROGRAM - VERSION 1.0';
TITLE2 ' ';
TITLE3 'ELIGIBLE BRIDGES';
TITLE4 'SORTED BY DISTRICT';
TITLE5 ' ';
```

```
TITLE6 'M - MISSING  DATA     I -ILLEGAL DATA';
TITLE5 ' ';

PROC PRINT DATA = BRINSAP.ELIGIBLE;
  VAR DIST COUNTY CONTROL SECTION STRUCT ELIG WT DEF OBS SPCL
     SR SR_EST S1 S2 S3 S4 ADT DECO SSCO SUBCO ROWI SCO WA
     DEGE UCVL AR TS TYWO INVRA LOS LUS RSTR CULVERT AWIDTH PNL PRW
     ORADT ORBDL DODRSN VCO MST TRASA BDL;
  FORMAT ADT COMMA8. ORADT COMMA8.;
*/

/*************************************************************************/
/*  GENERATE AND PRINT LIST OF BRIDGES WITH MISSING OR ILLEGAL DATA   */
/*************************************************************************/

DATA MISSILL;
  SET SRDATA;
  IF SR_EST = '*';
RUN;

TITLE1 'SUFFICIENCY RATING EVALUATION PROGRAM - VERSION 1.0';
TITLE2 ' ';
TITLE3 'BRIDGE RECORDS WITH MISSING OR ILLEGAL DATA';
TITLE4 'SORTED BY DISTRICT';
TITLE5 ' ';
TITLE6 'M - MISSING DATA     I - ILLEGAL DATA';
TITLE7 ' ';

PROC PRINT;
  VAR DIST COUNTY CONTROL SECTION STRUCT RSTR W_ADT DECO SSCO SUBCO ROWI
     SCO WA DEGE UCVL AR TS TYWO INVRA LOS LUS CULVERT AWIDTH PNL
     PRW W_BDL DODRSN VCO MST TRASA SR;
  BY DIST NOTSORTED;
  PAGEBY DIST;
```

TEBS1 PROGRAM LISTING

```
/*
                    T E B S 1

            TEXAS ELIGIBLE BRIDGE SORTER

                VERSION 1.0

                WRITTEN BY
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                  ON: MAY 1986
            LAST UPDATED: AUGUST 1986

   TEBS1 IS THE SECOND PROGRAM IN A TWO PART SERIES OF SAS PROGRAMS
DEVELOPED TO COMPUTERIZE THE TEXAS SDHPT BRIDGE PROJECT SELECTION
PROCESS. THIS PROGRAM WAS DEVELOPED UNDER CTR RESEARCH PROJECT 439.
FOR MORE INFORMATION ABOUT THIS PROGRAM OR THE OTHER IN THE SERIES,
REFER TO CTR REPORT 439-1.

   THE TEBS1 PROGRAM CLASSIFIES BRIDGES THAT ARE ELIGIBLE FOR FEDERAL
FUNDING INTO THE THREE CATEGORIES DESCRIBED BELOW:

   (1) QUALIFYING: BRIDGE PROJECTS THAT DEFINITELY MEET SDHPT CRITERIA
       FOR STATE FUNDING FOR REPLACEMENT OR REHABILITATION.
   (2) MARGINAL: BRIDGE PROJECTS THAT MEET MOST OF SDHPT CRITERIA
       AND MAY BE FUNDED BY THE STATE FOR REPLACEMENT OR REHABILITATION
       UNDER CERTAIN CONDITIONS.
   (3) NON-QUALIFYING: BRIDGE PROJECTS THAT DEFINITELY DO NOT MEET
       SDHPT CRITERIA FOR STATE FUNDING FOR REPLACEMENT OR
       REHABILITATION.

   TEBS1 UTILIZES A WEIGHTED SCREENING METHOD TO SORT BRIDGES INTO
QUALIFYING, MARGINAL AND NON-QUALIFYING GROUPS.

   DEVELOPED AND WRITTEN IN SAS (STATISTICAL ANALYSIS SYSTEM) LANGUAGE,
VERSION 5 (RELEASE 5.08) FOR THE IBM 3081-D RUNNING UNDER THE VM/SP
OPERATING SYSTEM.

INPUT AND OUTPUT:
-----------------

ELIGIBLE INPUT FILE:

   THIS FILE CONTAINS ALL THE BRINSAP BRIDGES WHICH ARE ELIGIBLE FOR
FEDERAL (FHWA) FUNDING. IT IS A SAS DATA SET FILE CREATED BY THE SURE1
SAS PROGRAM. IT CONTAINS IDENTIFICATION DATA FOR EACH ELIGIBLE BRIDGE,
ALL THE DATA USED BY THE SURE1 PROGRAM AND THE DATA ITEMS THAT WILL BE
USED BY TEBS1.


TEBSIC INPUT FILE:

   THIS FILE PROVIDES TEBS1 WITH THE SDHPT QUALIFYING CRITERIA
INFORMATION. THIS FILE IS IN FREE FORMAT. ALL REAL VALUES ARE TYPED
WITH A DECIMAL POINT AS PART OF THE VALUE.
```

NOTE: DUE TO THE FREE FORMAT OF THE DATA FILE, NO FIELD MAY BE LEFT BLANK OR THE DATA WILL BE MISINTERPRETED BY THE PROGRAM. TYPE "N" IN THOSE FIELDS TO BE LEFT BLANK, AND TYPE "D" TO USE THE FIELD'S DEFAULT VALUE.

LINE NO.	VARIABLE NAME	VARIABLE DESCRIPTION
1	CFRH	REHABILITATION COST, IN DOLLARS/SQ. FT. DEFAULT IS 25. USED TO ESTIMATE THE BRIDGE PROJECT COST IF MISSING.
	CFRP	REPLACEMENT COST, IN DOLLARS/SQ. FT. DEFAULT IS 35. USED TO ESTIMATE THE BRIDGE PROJECT COST IF MISSING.
2	WCPV	WEIGHT FOR CPV. DEFAULT IS 0.10 FOR 10%. REAL.
	WADT	WEIGHT FOR ADT. DEFAULT IS 0.10 FOR 10%. REAL.
	WSR	WEIGHT FOR SR. DEFAULT IS 0.25 FOR 25%. REAL.
	WDSS	WEIGHT FOR DSS. DEFAULT IS 0.35 FOR 35%. REAL.
	WBWC	WEIGHT FOR BWC. DEFAULT IS 0.20 FOR 20%. REAL.
3	AQCPV	AUTOMATIC QUALIFYING LEVEL FOR CPV IN $. DEFAULT IS N.
	AQADT	AUTOMATIC QUALIFYING LEVEL FOR ADT. DEFAULT IS N.
	AQSR	AUTOMATIC QUALIFYING LEVEL FOR SR. DEFAULT IS N.
	AQDSS	AUTOMATIC QUALIFYING LEVEL FOR DSS. DEFAULT IS 2.
	AQBWC	AUTOMATIC QUALIFYING LEVEL FOR BWC. DEFAULT IS N.
4	PLCPV	PASSING LEVEL FOR CPV IN DOLLARS. DEFAULT IS 70.
	PLADT	PASSING LEVEL FOR ADT. DEFAULT IS 1700.
	PLSR	PASSING LEVEL FOR SR. DEFAULT IS 63.
	PLDSS	PASSING LEVEL FOR DSS. DEFAULT IS 6.
	PLBWC	PASSING LEVEL FOR BWC. DEFAULT IS 0.
5	TQ	THRESHOLD FOR QUALIFYING. DEFAULT IS 75.
	TM	THRESHOLD FOR MARGINAL. DEFAULT IS 65.

TEBSI REPORT OUTPUT FILE:

THE OUTPUT OF TEBSI CONSISTS OF A REPORT FILE CONTAINING THE ELIGIBLE BRIDGES CLASSIFIED IN THREE GROUPS: QUALIFYING, MARGINAL AND NON-QUALIFYING. THE BRIDGES ARE RANKED BY COST PER VEHICLE ON A STATEWIDE BASIS AND THEN SORTED BY COST PER VEHICLE WITHIN EACH CATEGORY.

```
                                                    */
/*******************************************************************/
/*  CMS SYSTEM COMMANDS:  I/O FILE DEFINITIONS                     */

CMS FI BRINSAP DISK DUMMY DUMMY A;
CMS FI INF DISK TEBSIC DATA A;

/*  SAS OPTIONS CHOSEN  */
OPTIONS REPLACE CENTER MISSING='M' INVALIDDATA=I;

/*******************************************************************/
/*  START QUALIFICATION PROCESS USING WEIGHTED SCREENING METHOD    */
/*******************************************************************/

DATA QDATA;
 LENGTH GROUP $ 2;
 MISSING N D;

/*  INPUT SDHPT QUALIFYING CRITERIA  */

 INFILE INF EOF=OUT;
 INPUT #1 CFRH CFRP
```

```
      #2 WCPV WADT WSR WDSS WBWC
      #3 AQCPV AQADT AQSR AQDSS AQBWC
      #4 PLCPV PLADT PLSR PLDSS PLBWC
      #5 TQ TM;

/*  CHECK REHABILITATION AND REPLACEMENT COST FACTORS AND ASSIGN
    DEFAULTS IF MISSING OR IF INDICATED BY THE USER                */

 IF CFRH < = .Z THEN CFRH = 25;
 IF CFRP < = .Z THEN CFRP = 35;

/*  CHECK WEIGHTS AND ASSIGN DEFAULTS IF MISSING, OR INDICATED BY
    THE USER, OR THE SUM OF WEIGHTS IS GREATER THAN ONE            */

 SUMW = WCPV + WADT + WSR + WDSS + WBWC;
 IF (WCPV < = .Z) OR (SUMW > 1) THEN WCPV = 0.10;
 IF (WADT < = .Z) OR (SUMW > 1) THEN WADT = 0.10;
 IF (WSR < = .Z) OR (SUMW > 1) THEN WSR = 0.25;
 IF (WDSS < = .Z) OR (SUMW > 1) THEN WDSS = 0.35;
 IF (WBWC < = .Z) OR (SUMW > 1) THEN WBWC = 0.20;

/*  CHECK AUTO QUALIFYING LEVELS AND ASSIGN DEFAULTS IF MISSING OR
    INDICATED BY THE USER                                          */

 IF AQCPV < = .I THEN AQCPV = .N;
 IF AQADT < = .I THEN AQADT = 999999;
 IF AQSR < = .I THEN AQSR = .N;
 IF AQDSS < = .I THEN AQDSS = 2;
 IF AQBWC < = .I THEN AQBWC = .N;

/*  CHECK PASSING LEVELS AND ASSIGN DEFAULTS IF MISSING OR
    INDICATED BY THE USER                                          */

 IF PLCPV < = .Z THEN PLCPV = 70;
 IF PLADT < = .Z THEN PLADT = 1700;
 IF PLSR < = .Z THEN PLSR = 63;
 IF PLDSS < = .Z THEN PLDSS = 6;
 IF PLBWC < = .Z THEN PLBWC = 0;

/*  CHECK THRESHOLDS AND ASSIGN DEFAULTS IF MISSING OR
    INDICATED BY THE USER                                          */

 IF TQ < = .Z THEN TQ = 75;
 IF (TM < = .Z) OR (TM > TQ) THEN TM = 65;



/*  LOOP THROUGH THE ELIGIBLE BRIDGE LIST   */

 DO I = 1 TO TOTOBS;
  SET BRINSAP.ELIGIBLE POINT = I NOBS = TOTOBS;

/*  INITIALIZE ESTIMATE FLAGS AND SCORE   */

  CPI_EST = ' ';  CPV_EST = ' ';  DSS_EST = ' ';  SCORE = 0;
  AQ = ' ';       SCR_EST = ' ';

/*  CHECK IF THE COST OF PROPOSED IMPROVEMENTS (COPRI) IS MISSING
    AND IF IT IS, ESTIMATE IT DEPENDING ON THE TYPE OF WORK OF THE
    BRIDGE PROJECT.                                                */
```

```
IF (COPRI < = 0)
 THEN DO;
    CPI_EST = '*';
    CPV_EST = '*';
    IF TYWO = 371                    /*  REHABILITATION   */
     THEN IF (LOI > 0) AND (PRW > 0)
          THEN CPI = LOI * PRW * CFRH;
          ELSE CPI = 20000;
     ELSE IF (LOI > 0) AND (PRW > 0)    /*  REPLACEMENT   */
          THEN CPI = LOI * PRW * CFRP;
          ELSE CPI = 20000;
    END;
 ELSE CPI = COPRI * 1000;


/*  GET CONTROL-SECTION-STRUCTURE NUMBER   */

 IF (CONTROL = '    ') OR (SECTION = '  ') OR (STRUCT = '   ')
  THEN CSS = .N;
  ELSE CSS = (TRIM(LEFT(CONTROL)) || TRIM(LEFT(SECTION)) ||
        TRIM(LEFT(STRUCT)))*1;

/*  CALCULATE COST PER VEHICLE   */

 IF (W_ADT > 0) THEN CPV = CPI/W_ADT;
        ELSE DO; CPV_EST = '*'; CPV = CPI; END;


/*  CALCULATE THE BRIDGE WIDTH CONDITION:
    BWC = 0 -->  BRIDGE WIDTH IS CRITICAL
    BWC = 1 -->  BRIDGE WIDTH IS NOT CRITICAL   */

 IF ((W_ADT > 750) AND  (0 < ROWI < 24)) OR
   ((750 > = W_ADT > 400) AND  (0 < ROWI < 22)) OR
   ((W_ADT < = 400)  AND  (0 < ROWI < 20))
  THEN BWC = 0;
  ELSE BWC = 1;

/*  CALCULATE MINIMUM OF DECK, SUBSTRUCTURE, SUPERSTRUCTURE CONDITION */

 IF (DECO < = .Z) OR (SSCO < = .Z) OR (SUBCO < = .Z)  THEN  DSS_EST = '*';

 IF (DECO < = .Z) THEN W_DECO = 0;
        ELSE W_DECO = DECO;
 IF (SSCO < = .Z) THEN W_SSCO = 0;
        ELSE W_SSCO = SSCO;
 IF (SUBCO < = .Z) THEN W_SUBCO = 0;
        ELSE W_SUBCO = SUBCO;
 DSS = MIN(W_DECO,W_SUBCO,W_SSCO);


/*  COMPARE BRIDGE DATA TO PASSING LEVELS AND SUM SCORES ON INDIVIDUAL
    PASSING LEVELS TO GET TOTAL SCORE FOR BRIDGE.                  */

 IF (0 < CPV < = PLCPV) THEN SCORE = SCORE + (WCPV*100);
 IF (W_ADT > = PLADT) THEN SCORE = SCORE + (WADT*100);
 IF (0 < = SR < = PLSR) THEN SCORE = SCORE + (WSR*100);
 IF (0 < = DSS < = PLDSS) THEN SCORE = SCORE + (WDSS*100);
 IF (BWC < = PLBWC) THEN SCORE = SCORE + (WBWC*100);

/*  COMPARE BRIDGE DATA TO AUTOMATIC QUALIFYING LEVELS   */
```

```
    IF (AQCPV > .Z) THEN
     IF (0 < = CPV < = AQCPV) THEN AQ = 'AQ';
    IF (AQADT > .Z) THEN
     IF (W_ADT > = AQADT) THEN AQ = 'AQ';
    IF (AQSR > .Z) THEN
     IF (0 < = SR < = AQSR) THEN AQ = 'AQ';
    IF (AQDSS > .Z) THEN
     IF (0 < = DSS < = AQDSS) THEN AQ = 'AQ';
    IF (AQBWC > .Z) THEN
     IF (BWC < = AQBWC) THEN AQ = 'AQ';

/*  FLAG THE SCORE AS ESTIMATED IF ANY OF THE CRITERIA USED HAS BEEN
    ESTIMATED OR IS MISSING                                          */

    IF (CPV_EST = '*') OR (DSS_EST = '*') OR (SR_EST = '*') OR (W_ADT < = .Z)
     THEN SCR_EST = '*';

/*  COMPARE SCORE TO QUALIFYING AND MARGINAL THRESHOLDS
    AND GROUP THEM IN QUALIFYING, MARGINAL AND NON-QUALIFYING LISTS   */

    IF (SCORE > = TQ) OR (AQ = 'AQ')
     THEN DO;
        GROUP = 'Q';
        END;
    ELSE IF (TQ > SCORE > = TM)
        THEN DO;
           GROUP = 'M';
           END;
       ELSE DO;
          GROUP = 'NQ';
          END;

    OUTPUT;   /*  OUTPUT THE BRIDGE TO THE DATA SET   */

  END; /*  OF DO LOOP  */

OUT: STOP;
RUN;


/*  SORT BRIDGE RECORDS BY COST PER VEHICLE   */

PROC RANK TIES = HIGH DATA = QDATA OUT = RANKED;
 VAR CPV;
 RANKS CPV_RNK;

DATA QDATA2;
 SET RANKED;
 IF (CPV_RNK < = .Z) THEN CPV_RNK = 9999;

PROC FORMAT;
 PICTURE CSSPIC 0-HIGH = '9999-99-999';
 PICTURE PC      0-1 = '009%' (MULT = 100);
 PICTURE RK    0-9998 = '0009'
           OTHER  = 'NONE';
 PICTURE ACPV  0-HIGH = '0,009'
           LOW- < 0 = 'NONE'  (PREFIX = '$');
 PICTURE AADT 0-999998 = '000,009'
           OTHER = 'NONE';
 PICTURE ASR    0-100 = '09.9'
```

```
          LOW- < 0 = 'NONE';
PICTURE ADSS      0-9 = '9'
          LOW- < 0 = 'NONE';
PICTURE ABWC      0-1 = '9'
          OTHER = 'NONE';
PICTURE PCPV   0-HIGH = '0000,009'   (PREFIX = '< =');
PICTURE PADT 0-999998 = '00000,009' (PREFIX = '> =');
PICTURE PSR     0-100 = '00009.9'   (PREFIX = '< =');
PICTURE PDSS      0-9 = '009'       (PREFIX = '< =');
PICTURE PBWC    0-HIGH = '009'      (PREFIX = '< =');
VALUE $CNTY '001' = 'ANDERSON' '002' = 'ANDREWS' '003' = 'ANGELINA'
        '004' = 'ARANSAS' '005' = 'ARCHER' '006' = 'ARMSTRONG'
        '007' = 'ATASCOSA' '008' = 'AUSTIN' '009' = 'BAILEY'
        '010' = 'BANDERA' '011' = 'BASTROP' '012' = 'BAYLOR' '013' = 'BEE'
        '014' = 'BELL' '015' = 'BEXAR' '016' = 'BLANCO' '017' = 'BORDEN'
        '018' = 'BOSQUE' '019' = 'BOWIE' '020' = 'BRAZORIA'
        '021' = 'BRAZOS' '022' = 'BREWSTER' '023' = 'BRISCOE'
        '024' = 'BROOKS' '025' = 'BROWN' '026' = 'BURLESON'
        '027' = 'BURNET' '028' = 'CALDWELL' '029' = 'CALHOUN'
        '030' = 'CALLAHAN' '031' = 'CAMERON' '032' = 'CAMP'
        '033' = 'CARSON' '034' = 'CASS' '035' = 'CASTRO' '036' = 'CHAMBERS'
        '037' = 'CHEROKEE' '038' = 'CHILDRESS' '039' = 'CLAY'
        '040' = 'COCHRAN' '041' = 'COKE' '042' = 'COLEMAN' '043' = 'COLLIN'
        '044' = 'COLLINGSWORTH' '045' = 'COLORADO' '046' = 'COMAL'
        '047' = 'COMANCHE' '048' = 'CONCHO' '049' = 'COOKE'
        '050' = 'CORYELL' '051' = 'COTTLE' '052' = 'CRANE'
        '053' = 'CROCKETT' '054' = 'CROSBY' '055' = 'CULBERSON'
        '056' = 'DALLAM' '057' = 'DALLAS' '058' = 'DAWSON'
        '059' = 'DEAF SMITH' '060' = 'DELTA' '061' = 'DENTON'
        '062' = 'DEWITT' '063' = 'DICKENS' '064' = 'DIMMIT'
        '065' = 'DONLEY' '066' = 'KENEDY' '067' = 'DUVAL'
        '068' = 'EASTLAND' '069' = 'ECTOR' '070' = 'EDWARDS'
        '071' = 'ELLIS' '072' = 'EL PASO' '073' = 'ERATH' '074' = 'FALLS'
        '075' = 'FANNIN' '076' = 'FAYETTE' '077' = 'FISHER' '078' = 'FLOYD'
        '079' = 'FOARD' '080' = 'FORT BEND' '081' = 'FRANKLIN'
        '082' = 'FREESTONE' '083' = 'FRIO' '084' = 'GAINES'
        '085' = 'GALVESTON' '086' = 'GARZA' '087' = 'GILLESPIE'
        '088' = 'GLASSCOCK' '089' = 'GOLIAD' '090' = 'GONZALES'
        '091' = 'GRAY' '092' = 'GRAYSON' '093' = 'GREGG' '094' = 'GRIMES'
        '095' = 'GUADALUPE' '096' = 'HALE' '097' = 'HALL'
        '098' = 'HAMILTON' '099' = 'HANSFORD' '100' = 'HARDEMAN'
        '101' = 'HARDIN' '102' = 'HARRIS' '103' = 'HARRISON'
        '104' = 'HARTLEY' '105' = 'HASKELL' '106' = 'HAYS'
        '107' = 'HEMPHILL' '108' = 'HENDERSON' '109' = 'HIDALGO'
        '110' = 'HILL' '111' = 'HOCKLEY' '112' = 'HOOD'
        '113' = 'HOPKINS' '114' = 'HOUSTON' '115' = 'HOWARD'
        '116' = 'HUDSPETH' '117' = 'HUNT' '118' = 'HUTCHINSON'
        '119' = 'IRION' '120' = 'JACK' '121' = 'JACKSON' '122' = 'JASPER'
        '123' = 'JEFF DAVIS' '124' = 'JEFFERSON' '125' = 'JIM HOGG'
        '126' = 'JIM WELLS' '127' = 'JOHNSON' '128' = 'JONES'
        '129' = 'KARNES' '130' = 'KAUFMAN' '131' = 'KENDALL' '132' = 'KENT'
        '133' = 'KERR' '134' = 'KIMBLE' '135' = 'KING' '136' = 'KINNEY'
        '137' = 'KLEBERG' '138' = 'KNOX' '139' = 'LAMAR' '140' = 'LAMB'
        '141' = 'LAMPASAS' '142' = 'LA SALLE' '143' = 'LAVACA'
        '144' = 'LEE' '145' = 'LEON' '146' = 'LIBERTY' '147' = 'LIMESTONE'
        '148' = 'LIPSCOMB' '149' = 'LIVE OAK' '150' = 'LLANO'
        '151' = 'LOVING' '152' = 'LUBBOCK' '153' = 'LYNN' '154' = 'MADISON'
        '155' = 'MARION' '156' = 'MARTIN' '157' = 'MASON'
        '158' = 'MATAGORDA' '159' = 'MAVERICK' '160' = 'MCCULLOCH'
        '161' = 'MCLENNAN' '162' = 'MCMULLEN' '163' = 'MEDINA'
        '164' = 'MENARD' '165' = 'MIDLAND' '166' = 'MILAM' '167' = 'MILLS'
```

```
        '168'='MITCHELL' '169'='MONTAGUE' '170'='MONTGOMERY'
        '171'='MOORE' '172'='MORRIS' '173'='MOTLEY'
        '174'='NACOGDOCHES' '175'='NAVARRO' '176'='NEWTON'
        '177'='NOLAN' '178'='NUECES' '179'='OCHILTREE'
        '180'='OLDHAM' '181'='ORANGE' '182'='PALO PINTO'
        '183'='PANOLA' '184'='PARKER' '185'='PARMER' '186'='PECOS'
        '187'='POLK' '188'='POTTER' '189'='PRESIDIO' '190'='RAINS'
        '191'='RANDALL' '192'='REAGAN' '193'='REAL'
        '194'='RED RIVER' '195'='REEVES' '196'='REFUGIO'
        '197'='ROBERTS' '198'='ROBERTSON' '199'='ROCKWALL'
        '200'='RUNNELS' '201'='RUSK' '202'='SABINE'
        '203'='SAN AUGUSTINE' '204'='SAN JACINTO'
        '205'='SAN PATRICIO' '206'='SAN SABA' '207'='SCHLEICHER'
        '208'='SCURRY' '209'='SHACKELFORD' '210'='SHELBY'
        '211'='SHERMAN' '212'='SMITH' '213'='SOMERVELL'
        '214'='STARR' '215'='STEPHENS' '216'='STERLING'
        '217'='STONEWALL' '218'='SUTTON' '219'='SWISHER'
        '220'='TARRANT' '221'='TAYLOR' '222'='TERRELL'
        '223'='TERRY' '224'='THROCKMORTON' '225'='TITUS'
        '226'='TOM GREEN' '227'='TRAVIS' '228'='TRINITY'
        '229'='TYLER' '230'='UPSHUR' '231'='UPTON' '232'='UVALDE'
        '233'='VAL VERDE' '234'='VAN ZANDT' '235'='VICTORIA'
        '236'='WALKER' '237'='WALLER' '238'='WARD'
        '239'='WASHINGTON' '240'='WEBB' '241'='WHARTON'
        '242'='WHEELER' '243'='WICHITA' '244'='WILBARGER'
        '245'='WILLACY' '246'='WILLIAMSON' '247'='WILSON'
        '248'='WINKLER' '249'='WISE' '250'='WOOD' '251'='YOAKUM'
        '252'='YOUNG' '253'='ZAPATA' '254'='ZAVALA';

/*************************************************************************/
/*  SORT BRIDGES INTO THREE GROUPS:  QUALIFYING, MARGINAL AND            */
/*  NON-QUALIFYING                                                       */
/*************************************************************************/

DATA QB;
 SET QDATA2;
 IF GROUP = 'Q';

PROC SORT DATA=QB;
 BY CPV_RNK DIST;

DATA MB;
 SET QDATA2;
 IF GROUP = 'M';

PROC SORT DATA=MB;
 BY CPV_RNK DIST;

DATA NQB;
 SET QDATA2;
 IF GROUP = 'NQ';

PROC SORT DATA=NQB;
 BY CPV_RNK DIST;

/*  PRINT QUALIFYING BRIDGES  */

 TITLE1 'T E X A S   B R I D G E   S O R T E R';
 TITLE2 ' ';
 TITLE3 'VERSION 1.0';
 TITLE4 ' ';
```

```
 TITLE5 'QUALIFYING BRIDGE PROJECTS';
 TITLE6 ' ';
 TITLE7 'DATA SET:  BRIDGES ELIGIBLE FOR FEDERAL FUNDING';
 TITLE8 ' ';

DATA _NULL_;
 SET QB END=EOF;  BY CPV_RNK DIST;
 CPV_SB='<=';  ADT_SB='>=';  SR_SB='<=';  DSS_SB='<=';  BWC_SB='<=';
 IF AQCPV<=.Z THEN CPV_SB=' ';
 IF AQADT>=999999 THEN ADT_SB=' ';
 IF AQSR<=.Z THEN SR_SB=' ';
 IF AQDSS<=.Z THEN DSS_SB=' ';
 IF AQBWC<=.Z THEN BWC_SB=' ';
 RD4 = REPEAT('-',3);
 RD5 = REPEAT('-',4);
 RD6 = REPEAT('-',5);
 RD7 = REPEAT('-',6);
 RD9 = REPEAT('-',8);
 RD49 = REPEAT('-',48);
 RD131 = REPEAT('-',130);
 ATCOST + CPI;
 FILE PRINT HEADER=H LINESLEFT=L;
 IF L=3 THEN PUT _PAGE_ @;
 PUT @3 DIST 2. @8 COUNTY $CNTY. @23 CSS CSSPIC. @38 WT $2.
    @43 CPV_RNK RK. CPV_EST $1. @50 SCORE 3. SCR_EST $1. @55 AQ $2.
    @60 CPV_DOLLAR7. CPV_EST $1. @68 W_ADT COMMA9. @80 SR 5.1
    SR_EST $1. @90 DSS 1. DSS_EST $1. @97 BWC 1. @101 ROWI 5.1
    @108 CPI DOLLAR10. CPI_EST $1. @121 ATCOST DOLLAR12.;
 RETURN;
 H:PUT / @2 RD49 @54 'CRITERIA USED FOR SCREENING' @84 RD49
     / @5 'QUALIFYING:' @22 'SCORE >= ' @30 TQ 3.
       @106 'REHAB   COST = ' CFRH DOLLAR3. '/SQ FT'
     / @5 'MARGINAL:' @14 TM 3. @19 '<= SCORE <' @30 TQ 3.
       @106 'REPLACE COST = ' CFRP DOLLAR3. '/SQ FT'
     / @61 'CPV' @72 'ADT' @81 'SR' @89 'DSS' @96 'BWC'
     / @59 RD7   @68 RD9   @79 RD6  @87 RD6   @95 RD6
     / @31 'WEIGHTS:' @60 WCPV PC. @71 WADT PC. @80 WSR PC.
       @88 WDSS PC. @96 WBWC PC. @106 '* = ESTIMATED'
     / @31 'AUTO. QUALIFYING LEVELS:' @59 CPV_SB $2.  @61 AQCPV ACPV.
       @68 ADT_SB $2. @70 AQADT AADT. @79 SR_SB $2. @81 AQSR ASR.
       @87 DSS_SB $2. @89 AQDSS ADSS. @95 BWC_SB $2. @97 AQBWC ABWC.
       @106 'M = MISSING'
     / @31 'PASSING LEVELS:'  @58 PLCPV PCPV.
       @68 PLADT PADT.  @78 PLSR PSR.
       @88 PLDSS PDSS.  @95 PLBWC PBWC.
     / @2 RD131
    // @37 'TYPE' @43 'CPV' @101 'RDWY' @112 'PROJECT'
       @121 'ACCUMULATIVE'
     / @2 'DIST' @8 'COUNTY' @23 'CONT-SEC-STR' @37 'WORK'
       @43 'RANK' @50 'SCORE' @61 'CPV' @72 'ADT' @82 'SR'
       @89 'DSS' @96 'BWC' @101 'WIDTH' @114 'COST'
       @121 'PROJECT COST' //;
 RETURN;
 RUN;

/*  PRINT MARGINAL BRIDGES  */

 TITLE1 'T E X A S   B R I D G E   S O R T E R';
 TITLE2 ' ';
 TITLE3 'VERSION 1.0';
 TITLE4 ' ';
```

```
 TITLE5 'MARGINAL BRIDGE PROJECTS';
 TITLE6 ' ';
 TITLE7 'DATA SET:  BRIDGES ELIGIBLE FOR FEDERAL FUNDING';
 TITLE8 ' ';

DATA _NULL_;
 SET MB END=EOF;  BY CPV_RNK DIST;
 CPV_SB='<=';  ADT_SB='>=';  SR_SB='<=';  DSS_SB='<=';  BWC_SB='<=';
 IF AQCPV<=.Z THEN CPV_SB=' ';
 IF AQADT>=999999 THEN ADT_SB=' ';
 IF AQSR<=.Z THEN SR_SB=' ';
 IF AQDSS<=.Z THEN DSS_SB=' ';
 IF AQBWC<=.Z THEN BWC_SB=' ';
 RD4 = REPEAT('-',3);
 RD5 = REPEAT('-',4);
 RD6 = REPEAT('-',5);
 RD7 = REPEAT('-',6);
 RD9 = REPEAT('-',8);
 RD49 = REPEAT('-',48);
 RD131 = REPEAT('-',130);
 ATCOST + CPI;
 FILE PRINT HEADER=H LINESLEFT=L;
 IF L=3 THEN PUT _PAGE_@;
 PUT @3 DIST 2. @8 COUNTY $CNTY. @23 CSS CSSPIC. @38 WT $2.
    @43 CPV_RNK RK. CPV_EST $1. @50 SCORE 3. SCR_EST $1. @55 AQ $2.
    @60 CPV_DOLLAR7. CPV_EST $1. @68 W_ADT COMMA9. @80 SR 5.1
    SR_EST $1. @90 DSS 1. DSS_EST $1. @97 BWC 1. @101 ROWI 5.1
    @108 CPI DOLLAR10. CPI_EST $1. @121 ATCOST DOLLAR12.;
 RETURN;
 H:PUT / @2 RD49 @54 'CRITERIA USED FOR SCREENING' @84 RD49
     / @5 'QUALIFYING:' @22 'SCORE >= ' @30 TQ 3.
       @106 'REHAB  COST = ' CFRH DOLLAR3. '/SQ FT'
     / @5 'MARGINAL:' @14 TM 3. @19 '<= SCORE <' @30 TQ 3.
       @106 'REPLACE COST = ' CFRP DOLLAR3. '/SQ FT'
     / @61 'CPV' @72 'ADT' @81 'SR' @89 'DSS' @96 'BWC'
     / @59 RD7  @68 RD9  @79 RD6  @87 RD6  @95 RD6
     / @31 'WEIGHTS:' @60 WCPV PC. @71 WADT PC. @80 WSR PC.
       @88 WDSS PC. @96 WBWC PC. @106 '* = ESTIMATED'
     / @31 'AUTO. QUALIFYING LEVELS:' @59 CPV_SB $2. @61 AQCPV ACPV.
       @68 ADT_SB $2. @70 AQADT AADT.  @79 SR_SB $2. @81 AQSR ASR.
       @87 DSS_SB $2. @89 AQDSS ADSS.  @95 BWC_SB $2. @97 AQBWC ABWC.
       @106 'M = MISSING'
     / @31 'PASSING LEVELS:' @58 PLCPV PCPV.
       @68 PLADT PADT. @78 PLSR PSR.
       @88 PLDSS PDSS. @95 PLBWC PBWC.
     / @2 RD131
    // @37 'TYPE' @43 'CPV' @101 'RDWY' @112 'PROJECT'
       @121 'ACCUMULATIVE'
     / @2 'DIST' @8 'COUNTY' @23 'CONT-SEC-STR' @37 'WORK'
       @43 'RANK' @50 'SCORE' @61 'CPV' @72 'ADT' @82 'SR'
       @89 'DSS' @96 'BWC' @101 'WIDTH' @114 'COST'
       @121 'PROJECT COST' //;
 RETURN;
 RUN;


/*  PRINT NON-QUALIFYING BRIDGES  */

 TITLE1 'T E X A S  B R I D G E  S O R T E R';
 TITLE2 ' ';
 TITLE3 'VERSION 1.0';
```

```
 TITLE4 ' ';
 TITLE5 'NON-QUALIFYING BRIDGE PROJECTS';
 TITLE6 ' ';
 TITLE7 'DATA SET:  BRIDGES ELIGIBLE FOR FEDERAL FUNDING';
 TITLE8 ' ';

DATA _NULL_;
 SET NQB END=EOF;  BY CPV_RNK DIST;
 CPV_SB='<=';  ADT_SB='>=';  SR_SB='<=';  DSS_SB='<=';  BWC_SB='<=';
 IF AQCPV<=.Z THEN CPV_SB=' ';
 IF AQADT>=999999 THEN ADT_SB=' ';
 IF AQSR<=.Z THEN SR_SB=' ';
 IF AQDSS<=.Z THEN DSS_SB=' ';
 IF AQBWC<=.Z THEN BWC_SB=' ';
 RD4 = REPEAT('-',3);
 RD5 = REPEAT('-',4);
 RD6 = REPEAT('-',5);
 RD7 = REPEAT('-',6);
 RD9 = REPEAT('-',8);
 RD49 = REPEAT('-',48);
 RD131 = REPEAT('-',130);
 ATCOST + CPI;
 FILE PRINT HEADER=H LINESLEFT=L;
 IF L=3 THEN PUT _PAGE_@;
 PUT @3 DIST 2. @8 COUNTY $CNTY. @23 CSS CSSPIC. @38 WT $2.
    @43 CPV_RNK RK. CPV_EST $1. @50 SCORE 3. SCR_EST $1. @55 AQ $2.
    @60 CPV_DOLLAR7. CPV_EST $1. @68 W_ADT COMMA9. @80 SR 5.1
    SR_EST $1. @90 DSS 1. DSS_EST $1. @97 BWC 1. @101 ROWI 5.1
    @108 CPI DOLLAR10. CPI_EST $1. @121 ATCOST DOLLAR12.;
 RETURN;
 H:PUT / @2 RD49 @54 'CRITERIA USED FOR SCREENING' @84 RD49
     / @5 'QUALIFYING:' @22 'SCORE >= ' @30 TQ 3.
       @106 'REHAB   COST = ' CFRH DOLLAR3. '/SQ FT'
     / @5 'MARGINAL:' @14 TM 3. @19 '<= SCORE <' @30 TQ 3.
       @106 'REPLACE COST = ' CFRP DOLLAR3. '/SQ FT'
     / @61 'CPV' @72 'ADT' @81 'SR' @89 'DSS' @96 'BWC'
     / @59 RD7   @68 RD9   @79 RD6  @87 RD6   @95 RD6
     / @31 'WEIGHTS:' @60 WCPV PC. @71 WADT PC. @80 WSR PC.
       @88 WDSS PC. @96 WBWC PC. @106 '* = ESTIMATED'
     / @31 'AUTO. QUALIFYING LEVELS:'  @59 CPV_SB $2. @61 AQCPV ACPV.
       @68 ADT_SB $2. @70 AQADT AADT.  @79 SR_SB $2. @81 AQSR ASR.
       @87 DSS_SB $2. @89 AQDSS ADSS.  @95 BWC_SB $2. @97 AQBWC ABWC.
       @106 'M = MISSING'
     / @31 'PASSING LEVELS:'  @58 PLCPV PCPV.
       @68 PLADT PADT. @78 PLSR PSR.
       @88 PLDSS PDSS. @95 PLBWC PBWC.
     / @2 RD131
    // @37 'TYPE' @43 'CPV' @101 'RDWY' @112 'PROJECT'
       @121 'ACCUMULATIVE'
     / @2 'DIST' @8 'COUNTY' @23 'CONT-SEC-STR' @37 'WORK'
       @43 'RANK' @50 'SCORE' @61 'CPV' @72 'ADT' @82 'SR'
       @89 'DSS' @96 'BWC' @101 'WIDTH' @114 'COST'
       @121 'PROJECT COST' //;
 RETURN;
 RUN;
```

SURE1 PROGRAM LISTING

TEBSIC INPUT FILE

```
25 35
0.10 0.10 0.25 0.35 0.20
N N N 2 N
70 1700 63 6 0
75 65
```

SURE1 REPORT FILE SAMPLE

SUFFICIENCY RATING EVALUATION PROGRAM - VERSION 1.0

101

11:28 WEDNESDAY, SEPTEMBER 17, 1986

BRIDGE RECORDS WITH MISSING OR ILLEGAL DATA
SORTED BY DISTRICT

N - MISSING DATA I - ILLEGAL DATA

-DISTRICT=8-

OBS	DIST	COUNTY	LOCATION	SECTION	SUBSECTION	BRIDGE NO	DECK	SUPER	SUBCOND	ROWID	SCOUR	WEAR	DEGCK	UCWL	APR	TYS	TYPE	INVRAT	LOS	LUS	CULVERT	AVGDTH	PNL	PRW	MBRDL	DOORSN	WCOND	NSTR	TRASA	SR
4254	8	115	0693	01	004	1	1600	6	7	7	44.0	4	4	8	N	6	15	0	115	2	0	N	44	0	0	28		9999	1126	1111	78.9
4255	8	115	0693	01	021	1	1200	N	7	7	78.0	5	4	8	N	6	15	0	236	2	0	23	44	0	0	28		9999	N	NNNN	93.0
4256	8	115	0693	01	012	1	1600	N	7	7	75.0	5	4	8	N	6	15	0	236	2	0	23	44	0	0	28		9999	N	0000	90.0
4257	8	115	1134	01	001	1	360	7	7	8	28.0	5	4	4	N	6	15	0	120	2	0	23	24	0	0	16		9999	N	0000	88.7
4258	8	115	1155	02	002	1	360	7	7	7	30.0	5	4	4	N	6	15	0	120	2	0	23	24	0	0	17		9999	N	0000	88.7
4259	8	115	1155	02	0[illegible]	1	360	7	7	7	30.0	5	4	4	N	6	15	0	120	2	0	23	24	0	0	17		9999	N	0000	88.7
4260	8	115	1155	03	001	1	200	6	6	7	20.0	3	4	3	N	6	15	371	514	2	0	N	22	2	28	17		9999	1125	0000	48.3
4261	8	115	1156	01	001	1	300	7	7	6	34.0	4	3	4	N	6	15	371	115	2	0	23	24	2	28	25		9999	N	0000	75.8
4262	8	115	1156	01	006	1	300	7	9	8	34.0	5	5	4	N	6	15	0	120	2	0	23	24	0	0	25		9999	N	0000	89.4
4263	8	115	1156	01	005	1	900	7	6	8	44.0	5	4	3	N	6	15	0	120	2	0	23	24	0	0	25		9999	N	0000	85.1
4264	8	115	1156	02	003	1	500	7	9	7	30.0	4	4	3	N	6	15	371	115	2	0	23	22	2	34	28		9999	N	0000	75.2
4265	8	115	1156	02	004	1	300	7	7	7	23.0	4	5	3	N	6	15	371	115	2	0	N	24	2	28	28		9999	1125	0000	64.0
4266	8	115	1872	02	002	1	400	N	7	7	30.0	5	5	4	N	6	15	0	120	2	0	23	24	0	0	30		9999	N	0000	89.1
4267	8	115	2326	01	002	1	100	7	7	7	24.0	4	4	4	N	6	15	0	115	2	0	N	24	0	0	40		9999	1125	0000	78.1
4268	8	115	8209	05	001	1	4600	7	6	7	30.0	2	3	3	N	5	15	N	110	2	0	23	35	N	N	3		9999	N	0000	43.6
4269	8	128	0033	05	056	1	100	N	7	7	30.0	5	4	4	N	4	15	0	120	2	0	23	22	0	0	1		999[illegible]	N	000[illegible]	87.1
4270	8	128	0033	05	057	1	100	N	7	7	30.0	5	4	4	N	4	15	0	120	2	0	23	22	0	0	1		9999	N	0000	87.1
4271	8	128	0033	05	058	1	100	N	7	7	30.0	5	4	4	N	4	15	0	120	2	0	23	22	0	0	1		9999	N	0000	87.1
4272	8	128	0317	03	001	1	1600	7	7	7	34.0	4	4	8	N	8	15	0	115	2	0	23	30	0	0	0		9999	N	0000	80.6
4273	8	128	0318	0[illegible]	015	1	700	N	8	8	46.0	5	4	8	N	8	15	0	120	2	0	23	42	0	0	14		9999	N	0000	96.3
4274	8	128	0318	01	001	1	600	N	7	7	47.7	4	4	8	N	8	15	0	115	2	0	23	42	0	0	14		9999	N	0000	79.8
4275	8	128	0318	01	016	1	600	N	8	7	46.0	5	4	8	N	7	15	0	120	2	0	23	42	0	0	14		9999	N	0000	96.4
4276	8	128	0318	01	005	1	600	N	8	7	46.0	4	4	8	N	7	15	0	115	2	0	23	42	0	0	14		9999	N	0000	79.4
4277	8	128	0319	03	011	1	700	N	8	7	65.0	4	4	8	N	8	15	0	115	2	0	23	56	0	0	0		9999	N	0000	80.6
4278	8	128	0484	01	002	1	400	4	6	4	23.5	3	6	4	N	6	15	311	115	2	0	N	22	2	34	10		9999	1125	0000	41.4
4279	8	128	0484	01	002	3	400	6	6	6	24.0	2	6	4	N	6	15	371	514	2	0	N	24	2	34	21		9999	1126	0000	56.7
4280	8	128	0733	01	006	1	400	6	6	6	20.0	4	4	4	N	6	15	0	115	2	0	N	22	0	0	27		9999	1126	0000	64.3
4281	8	128	0733	01	011	1	400	7	7	7	20.0	5	4	5	N	6	15	0	120	2	0	23	26	0	0	27		9999	N	0000	84.3
4282	8	128	0733	01	010	1	400	N	7	7	20.0	5	4	5	N	6	15	0	120	2	0	23	26	0	0	27		9999	N	0000	84.3
4283	8	128	0733	0[illegible]	01[illegible]	1	400	6	6	5	23.4	4	6	4	N	6	15	0	115	2	0	N	26	0	0	27		9999	1125	0000	54.4
4284	8	128	0733	01	017	1	400	5	5	5	23.4	4	6	4	N	6	15	0	115	2	0	N	24	0	0	27		9999	1125	0000	55.8
4285	8	128	0733	01	018	1	400	7	7	8	20.0	5	4	4	N	6	15	0	120	2	0	23	24	0	0	19		9999	N	0000	80.8
4286	8	128	0741	01	002	1	100	7	7	7	21.3	4	6	4	N	6	15	0	115	2	0	N	24	0	0	12		9999	1125	0000	80.5
4287	8	128	0974	02	008		300	6	7	7	24.0	5	6	4	N	6	15	0	120	2	0	N	24	0	0	5		9999	1111	1000	81.9
4288	8	128	0974	03	005	1	400	7	7	8	20.0	5	6	3	N	4	15	311	514	2	0	N	24	2	28	20		9999	1126	0000	47.8
4289	8	128	0974	03	004	1	400	8	8	8	20.0	5	6	3	N	4	15	311	514	2	0	N	24	2	28	20		9999	1126	0000	47.8
4290	8	128	0974	07	012	1	200	N	7	7	44.0	5	4	4	N	6	15	0	120	2	0	23	24	0	0	25		9999	N	0000	88.6
4291	8	128	0974	07	013	1	200	N	7	7	32.0	5	4	4	N	6	15	0	120	2	0	23	24	0	0	25		9999	N	0000	88.6
4292	8	128	0974	07	014	1	200	7	7	7	32.0	5	4	4	N	6	15	0	120	2	0	23	24	0	0	25		9999	N	0000	88.6
4293	8	128	0974	01	001	1	400	6	6	7	21.3	4	6	4	N	6	15	0	115	2	0	N	20	0	0	0		9999	1126	0000	65.6
4294	8	128	0974	01	014	1	400	7	8	8	38.0	7	7	8	N	6	15	0	236	2	0	N	34	0	0	16		9999	2131	1111	99.5
4295	8	128	1360	02	014	1	500	7	7	7	23.3	4	6	4	N	6	15	0	115	2	0	N	24	0	0	10		9999	1125	0000	68.3
4296	8	128	1360	01	005	1	500	8	8	7	28.0	5	4	4	N	6	15	0	120	2	0	23	24	0	0	10		9999	N	0000	88.7
4297	8	128	1360	01	003	1	500	8	8	7	28.0	5	6	4	N	6	15	0	120	2	0	23	24	0	0	18		9999	N	1111	88.6

TEBS1 SAMPLE RUN

VERSION 1.0

QUALIFYING BRIDGE PROJECTS

DATA SET: BRIDGES ELIGIBLE FOR FEDERAL FUNDING

CRITERIA USED FOR SCREENING

QUALIFYING: SCORE >= 75
MARGINAL: 60 <= SCORE < 75

REHAB COST = $25/SQ FT
REPLACE COST = $35/SQ FT

	CPV	ADT	SR	DSS	BWC
WEIGHTS:	10%	10%	25%	35%	20%
AUTO. QUALIFYING LEVELS:	N	>= NONE	N	<= 2	NONE
PASSING LEVELS:	<=70	>=1,700	<=63.0	<=6	<=0

* = ESTIMATED
M = MISSING

DIST	COUNTY	CONT-SEC-STR	TYPE WORK	CPV RANK	SCORE	CPV	ADT	SR	DSS	BWC	RDWY WIDTH	PROJECT COST	ACCUMULATIVE PROJECT COST
1	FRANKLIN	0189-05-016	RH	713	45* AQ	$21	1,200	73.6*	0*	1	84.0	$25,000	$15,720,000
18	DALLAS	8186-18-004	RP	716	100*	$21	5,000	10.2*	6	0	19.7	$105,000	$15,825,000
18	DENTON	0135-10-062	RH	720	80	$21	9,600	58.1	5	1	28.0	$203,000	$16,028,000
16	NUECES	0989-02-004	RH	722	80*	$21	2,500	59.5*	6	1	24.0	$53,000	$16,081,000
3	YOUNG	0655-01-002	RP	724	80* AQ	$21	2,100	46.3*	0*	1	28.0	$45,000	$16,126,000
2	TARRANT	0363-01-007	RH	732	80	$22	9,700	61.9	5	1	28.0	$212,000	$16,338,000
1	FANNIN	0279-04-013	RH	736	45* AQ	$22	1,000	71.4*	0*	1	46.0	$22,000	$16,360,000
18	DALLAS	0581-01-036	RH	749	80*	$22	7,900	62.9*	6	1	26.0	$176,000	$16,536,000
8	HOWARD	8209-08-001	RP	753	80*	$22	4,600	43.6*	6	1	30.0	$103,000	$16,639,000
18	KAUFMAN	0095-04-112	RP	755	80	$22	12,200	48.6	6	1	28.0	$274,000	$16,913,000
1	RED RIVER	0772-02-013	RH	759	90* AQ	$23	800	57.6*	0*	0	20.7	$18,000	$16,931,000
1	GRAYSON	0410-01-014	RH	769	55* AQ	$23	2,100	71.6	0*	1	48.0	$48,000	$16,979,000
4	POTTER	0275-01-012	RH	770	80	$23	8,900	60.9	4	1	64.0	$204,000	$17,183,000
13	WHARTON	8108-13-004	RP	773	100*	$23	2,000	23.0*	6	0	22.2	$46,000	$17,229,000
23	BROWN	8819-23-001	RP	773	80*	$23	3,000	40.4*	5	1	34.1	$69,000	$17,298,000
20	JEFFERSON	8226-20-001	RP	774	100*	$23	3,200	31.9*	3	0	23.5	$74,000	$17,372,000
2	TARRANT	0172-02-004	RP	784	80*	$23	13,700	11.6*	3	1	30.0	$308,000	$17,680,000
11	HOUSTON	0117-06-053	RH	784	45* AQ	$23	1,500	77.6	0*	1	42.0	$35,000	$17,715,000
3	WILBARGER	0043-06-098	RH	794	80	$24	3,800	56.0	4	1	40.0	$90,000	$17,805,000
3	WILBARGER	0043-06-099	RH	794	80	$24	3,800	56.0	4	1	40.0	$90,000	$17,895,000
1	RED RIVER	0189-02-032	RH	799	45* AQ	$24	1,300	72.6*	0*	1	53.5	$31,000	$17,926,000
1	RED RIVER	0189-02-033	RH	799	45* AQ	$24	1,300	72.6*	0*	1	53.5	$31,000	$17,957,000
8	BORDEN	0295-03-047	RH	807	45* AQ	$24	1,000	78.9	0*	1	84.0	$24,000	$17,981,000
13	VICTORIA	0371-01-010	RP	810	80	$24	6,800	45.6	4	1	44.0	$165,000	$18,146,000
1	GRAYSON	0316-02-003	RH	827	45* AQ	$25	600	72.5*	0*	1	30.0	$15,000	$18,161,000
10	RUSK	1116-01-001	RP	827	90*	$25	1,400	28.0*	4	0	21.0	$35,000	$18,196,000
1	HUNT	0009-06-031	RH	829	80*	$25	2,100	60.3*	6	1	26.0	$53,000	$18,249,000
18	DALLAS	8262-18-004	RH	829	55* AQ	$25	4,200	67.4*	0*	1	56.3	$106,000	$18,355,000
1	GRAYSON	2454-01-001	RH	842	80*	$26	2,800	55.6*	6	1	24.0	$73,000	$18,428,000
15	BEXAR	0137-15-003	RP	845	80*	$26	9,000	48.8*	6	1	39.0	$236,000	$18,664,000
14	GILLESPIE	0071-06-063	RH	847	45* AQ	$26	1,100	76.6	0*	1	44.0	$29,000	$18,693,000
18	DENTON	0081-05-018	RP	851	100*	$26	1,700	34.3*	4	0	20.0	$45,000	$18,738,000
18	DENTON	0081-05-019	RP	851	100*	$26	1,700	27.9*	4	0	20.0	$45,000	$18,783,000
18	ROCKWALL	0451-01-005	RP	868	80*	$27	9,900	44.2*	5	1	24.0	$268,000	$19,051,000

VERSION 1.0

MARGINAL BRIDGE PROJECTS

DATA SET: BRIDGES ELIGIBLE FOR FEDERAL FUNDING

CRITERIA USED FOR SCREENING

QUALIFYING: SCORE >= 75
MARGINAL: 6[illegible] <= SCORE < 75

REHAB COST = $25/SQ FT
REPLACE COST = $35/SQ FT

	CPV	ADT	SR	DSS	BWC
WEIGHTS:	10%	10%	25%	35%	20%
AUTO. QUALIFYING LEVELS:	N	>= NONE	N	<= 2	NONE
PASSING LEVELS:	<=70	>=1,700	<=63.0	<=6	<=0

* = ESTIMATED
M = MISSING

DIST	COUNTY	CONT-SEC-STR	TYPE WORK	CPV RANK	SCORE	CPV	ADT	SR	DSS	BWC	RDWY WIDTH	PROJECT COST	ACCUMULATIVE PROJECT COST
9	BELL	0015-05-025	RH	603	75*	$17	3,000	65.7*	4	0	20.0	$52,000	$52,000
1	RED RIVER	0189-03-035	RH	652	70*	$18	1,300	51.0*	6	1	24.0	$24,000	$76,000
1	FANNIN	0174-04-022	RH	931	70*	$30	600	61.3*	6	1	23.5	$18,000	$94,000
8	NOLAN	8412-08-001	RH	984	70*	$33	700	59.2*	6	1	35.9	$23,000	$117,000
13	COLORADO	0027-02-003	RP	1015	70*	$35	1,100	39.5*	4	1	24.5	$38,000	$155,000
14	WILLIAMSON	8509-14-001	RP	1064	70*	$38	600	39.0*	4	1	M	$23,000	$178,000
18	ELLIS	0172-05-034	RH	1215	75*	$49	5,800	71.1*	6	0	23.6	$282,000	$460,000
11	HOUSTON	0340-04-013	RP	1250	70*	$50	600	44.6*	4	1	24.0	$30,000	$490,000
19	UPSHUR	0964-02-005	RP	1250	70*	$50	600	41.3*	4	1	23.3	$30,000	$520,000
20	CHAMBERS	1580-02-002	RH	1250	70*	$50	400	62.9*	6	1	20.0	$20,000	$540,000
18	COLLIN	0047-05-017	RH	1281	75*	$53	3,400	73.4*	6	0	23.0	$179,000	$719,000
1	RED RIVER	0189-03-024	RP	1332	70*	$56	1,500	46.8*	4	1	30.0	$84,000	$803,000
1	LAMAR	0749-01-032	RH	1349	70*	$57	600	61.2*	6	1	24.0	$34,000	$837,000
3	WILBARGER	1769-01-002	RH	1349	70*	$57	300	50.6*	6	1	20.0	$17,000	$854,000
7	RUNNELS	0634-0[illegible]-019	RH	1356	75*	$57	2,800	74.8*	6	0	18.0	$160,000	$1,014,000
10	HENDERSON	0701-01-013	RH	1403	70*	$60	1,000	53.1*	4	1	24.0	$60,000	$1,074,000
18	DALLAS	8143-18-002	RP	1423	70*	$63	1,100	45.6*	5	1	24.0	$69,000	$1,143,000
14	GILLESPIE	8304-14-001	RP	1431	70*	$64	800	48.4*	5	1	M	$51,000	$1,194,000
8	FISHER	0263-05-016	RH	1457	70*	$66	1,500	54.8*	4	1	42.0	$99,000	$1,293,000
13	WHARTON	8105-13-001	RP	1518	70*	$70	300	32.3*	3	1	25.3	$21,000	$1,314,000
3	COOKE	0045-01-107	RH	1521	70	$71	7,400	51.6	5	1	28.0	$523,000	$1,837,000
12	MONTGOMERY	1986-01-003	RH	1526	70*	$72	3,500	50.8*	5	1	24.0	$251,000	$2,088,000
3	COOKE	0045-01-108	RH	1528	70	$72	7,400	51.6	5	1	28.0	$532,000	$2,620,000
2	JACK	0249-06-018	RP	1545	70	$73	1,800	32.9	3	1	36.0	$131,000	$2,751,000
9	LIMESTONE	0056-03-030	RH	1555	70	$73	13,000	53.8	6	1	40.0	$952,000	$3,703,000
12	GALVESTON	0367-03-018	RP	1558	70	$73	3,900	37.1	3	1	40.0	$286,000	$3,989,000
18	DENTON	0135-16-064	RH	1559	70	$73	9,600	59.1	5	1	28.0	$705,000	$4,694,000
2	TARRANT	0094-01-029	RH	1596	70	$76	17,300	56.6	5	1	40.0	$1,318,000	$6,012,000
18	DALLAS	0006-08-027	RP	1597	70*	$76	10,700	46.0*	4	1	44.0	$816,000	$6,828,000
1	GRAYSON	0410-01-032	RP	1640	70	$81	2,700	44.6	4	1	44.0	$219,000	$7,047,000
1	DELTA	0136-03-017	RH	1641	70	$81	2,600	61.5	6	1	29.8	$211,000	$7,258,000
19	HARRISON	0096-09-039	RH	1655	70	$83	10,200	28.5	4	1	52.0	$847,000	$8,105,000
20	HARDIN	0031-01-089	RH	1668	70*	$84	2,700	54.6*	6	1	24.0	$226,000	$8,331,000
14	BASTROP	0471-01-019	RH	1677	70*	$84	2,000	49.6*	5	1	26.0	$168,000	$8,499,000

TEXAS BRIDGE SORTER 20:21 THURSDAY, NOVEMBER 20, 1986 24

VERSION 1.0

NON-QUALIFYING BRIDGE PROJECTS

DATA SET: BRIDGES ELIGIBLE FOR FEDERAL FUNDING

CRITERIA USED FOR SCREENING

QUALIFYING: SCORE >= 75
MARGINAL: 6[illegible] <= SCORE < 75

REHAB COST = $25/SQ FT
REPLACE COST = $35/SQ FT

	CPV	ADT	SR	DSS	BWC	
WEIGHTS:	10%	10%	25%	35%	20%	* = ESTIMATED
AUTO. QUALIFYING LEVELS:	N	>= NONE	N	<= 2	NONE	M = MISSING
PASSING LEVELS:	<=70	>=1,700	<=63.0	<=6	<=0	

DIST	COUNTY	CONT-SEC-STR	TYPE WORK	CPV RANK	SCORE	CPV	ADT	SR	DSS	BWC	RDWY WIDTH	PROJECT COST	ACCUMULATIVE PROJECT COST
12	HARRIS	0500-03-03[illegible]	RH	1	20	$0	144,800	68.6	7	1	170.0	$33,000	$33,000
12	HARRIS	0500-03-022	RH	2	20	$2	95,800	72.7	8	1	114.0	$42,000	$75,000
12	HARRIS	0500-03-037	RH	3	20	$1	134,800	69.0	7	1	112.0	$86,000	$161,000
12	HARRIS	0500-03-021	RH	4	20	$1	121,400	70.3	8	1	114.0	$88,000	$249,000
12	HARRIS	0500-03-025	RH	5	20	$1	100,600	72.2	8	1	122.0	$81,000	$330,000
12	HARRIS	0500-03-023	RH	6	20	$1	107,000	71.6	8	1	124.0	$88,000	$418,000
18	DALLAS	8050-18-039	RH	9	45*	$1	15,300	57.6*	7	1	24.0	$18,000	$436,000
12	GALVESTON	0500-04-034	RH	11	20	$1	26,000	79.2	8	1	116.0	$31,000	$467,000
12	FORT BEND	0027-07-041	RH	13	20	$1	24,000	76.1	8	1	72.0	$34,000	$501,000
15	BEXAR	8068-15-002	RH	14	55*	$1	21,200	67.6*	6	1	40.0	$31,000	$532,000
19	BOWIE	0010-13-062	RH	15*	20*	$2*	13,300	75.0*	8	1	44.0	$20,000*	$552,000
18	DALLAS	0047-07-060	RH	17	55	$2	110,000	73.0	4	1	59.0	$186,000	$738,000
16	NUECES	0102-01-002	RH	18	20	$2	13,600	77.3	8	1	32.0	$24,000	$762,000
10	SMITH	0245-06-025	RH	19	20	$2	13,300	79.1	8	1	64.0	$24,000	$786,000
16	SAN PATRICIO	0371-04-036	RH	20	20	$2	13,100	65.2	8	1	40.0	$24,000	$810,000
19	BOWIE	0610-07-036	RH	22*	20*	$2*	10,400	68.7	8	1	28.0	$20,000*	$830,000
12	MONTGOMERY	0338-04-057	RH	23	20	$2	10,300	79.6	7	1	34.0	$20,000	$850,000
12	MONTGOMERY	0338-04-055	RH	25	20	$2	14,500	78.9	7	1	34.0	$29,000	$879,000
19	BOWIE	0218-01-032	RH	25*	45*	$2*	10,000	62.8	7	1	28.0	$20,000*	$899,000
18	DALLAS	0047-07-049	RH	26	55	$2	52,200	68.1	4	1	28.0	$106,000	$1,005,000
18	DALLAS	0047-0[illegible]-050	RH	28	55	$2	52,200	68.1	4	1	28.0	$109,000	$1,114,000
12	HARRIS	8020-12-006	RH	29	45*	$2	23,900	57.4*	7	1	44.0	$50,000	$1,164,000
10	GREGG	0392-06-001	RH	31	20*	$2	10,000	76.9*	8	1	36.0	$21,000	$1,185,000
18	DALLAS	0196-03-068	RH	33	55	$2	38,900	78.0	4	1	57.2	$82,000	$1,267,000
19	CASS	0218-03-031	RH	33*	45*	$2*	9,400	63.0	8	1	48.0	$20,000*	$1,287,000
18	DALLAS	0196-03-069	RH	35	55	$2	38,900	74.2	4	1	57.8	$85,000	$1,372,000
14	TRAVIS	8020-14-014	RH	37	45*	$2	12,700	50.4*	7	1	M	$28,000	$1,400,000
18	DALLAS	0047-07-045	RH	40	55	$2	47,700	69.1	4	1	28.0	$106,000	$1,506,000
18	DALLAS	0047-07-046	RH	40	55	$2	47,700	69.1	4	1	28.0	$106,000	$1,612,000
20	JEFFERSON	8013-20-003	RH	42	45*	$2	15,300	62.7*	7	1	26.5	$34,000	$1,646,000
12	HARRIS	2632-01-001	RH	43	55*	$2	9,700	75.6*	6	1	40.0	$22,000	$1,668,000
12	HARRIS	8[illegible]1-12-003	RH	45	20*	$2	7,900	67.2*	7	1	24.0	$18,000	$1,686,000
12	GALVESTON	0076-03-008	RH	49	20*	$3	16,000	65.7*	8	1	24.0	$40,000	$1,726,000
12	MONTGOMERY	0338-0[illegible]-059	RH	50	20	$2	9,[illegible]00	75.4	8	1	48.0	$24,000	$1,750,000