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BARGE TRAFFIC ON KENTUCKY RIVERS

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16. Abstract

Kentucky currently has the second longest navigable inland waterway system in the United States. Prior to the design of a bridge at a specific location on a river, a thorough investigation of barge traffic at that location must be conducted. This report investigates the barge traffic on all navigable waterways in Kentucky. This report provides the data necessary to develop the risk assessment procedures for Kentucky vessel impact design problems in accordance with the *AASHTO Guide Specification and Commentary for Vessel Collision Design of Highway Bridges* design Method II. Method II is more rigorous to apply than Method I, but it is recommended by the guide specification for most bridges and should lead to more economical designs.

A computer program was written to process the database and calculate the probability based length, width, and capacity for each barge category. Additionally, a second computer program was written to calculate the probability based number of barges in a flotilla column and row, and subsequently categorize that flotilla based upon the barge length and width categories designated by the U.S. Army Corps of Engineers. The equivalent static impact loads were then calculated using the probability based flotilla sizes and tonnages. The calculations for the Maysville, KY bridge over the Ohio River are offered as a design example.

17. Key Words		18. Distribution Statement
Downbound	Upbound	Unlimited with approval of Kentucky Transportation Cabinet
Flotilla	Impact Load	
Probability	Normal Distribution	

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Unclassified	Unclassified	288	

I. Executive Summary

The 1993 collapse of a Louisiana railroad bridge killing 44 people after being struck by a barge flotilla (Lexington Herald-Leader, July 18, 1993) is a typical example of the vulnerability of bridges to vessel (barge or ship) impact loads. Not only can a bridge collapse result in the loss of life, but it may also cause an impasse for automobiles and commercial vehicles resulting in great economic loss for the community.

The Louisiana railroad bridge collapse is not an isolated incident of bridge collapse due to barge flotilla collision or impact. In addition to the event described above, on November 22, 1993, two major bridges over the Ohio River near Cincinnati were struck by barges causing one of them to be closed for several days while repairs were completed.

Given that Kentucky has the second longest navigable inland waterway system in the United States, the aforementioned incidences bring to light the importance of designing waterway bridges to resist barge impacts. In order to accomplish this task, a thorough investigation of the barge traffic on the inland waterways of Kentucky must be completed.

SCOPE OF STUDY

The primary purpose of this study was to collect the data necessary to develop the risk assessment procedures for Kentucky vessel impact design problems in accordance with the *AASHTO Guide Specification and Commentary for Vessel Collision Design of Highway Bridges* design Method II. The following items were identified as information required to implement the design method: barge sizes and tonnages, flotilla column and row counts, river elevations, barge transit velocities, probabilities of aberrancy, design barge acceptance criteria, and scour requirements. Most of the databases required to obtain this information were not released to the University of Kentucky because of the size and complexity of the data files. Consequently data queries were conducted and the results were sent to the University of Kentucky on computer disks or printouts. Therefore, the responsibility for maintaining or updating the data must lie with the engineer since specific queries must be processed by the appropriate agency.

River Elevations

The *AASHTO Guide Specification* seems to require that the barge impact loads be

applied at the 2% flow elevation of the river. As determined from daily river flow data, the 2% flow elevation is the elevation the river exceeds just 2% of the time. The normal pool, 2% flow, Q_{50}, Q_{100}, and Q_{500} elevations are reported at regular intervals along most of the navigable inland waterways in Kentucky. These data were obtained from the U.S. Army Corps of Engineers' district offices in Louisville, KY, Nashville, TN, and Huntington, WV. The Nashville District Office was assisted by the Tennessee Valley Authority (TVA) in obtaining the requested information.

Barge Velocities

The vessel velocity (does not include river flow velocity) is based on data provided by the U.S. Coast Guard. The U.S. Coast Guard defines the velocity a vessel may achieve on still water as the "vessel transit velocity". However, to be consistent with AASHTO terminology, the term "vessel transit velocity" will be used in this report to define the algebraic sum of the vessel velocity and the river velocity. The data indicated that typical vessel velocities were between 5 mph (2.13 m/s, 7 fps, 4 knots) to 7 mph (3.05 m/s, 10 fps, 6 knots). Higher velocities may be possible for some flotillas. However, for most fully loaded flotillas, the 7 mph velocity is recommended as a reasonable and conservative value.

Design Barge Acceptance Criteria

Method II of the *AASHTO Guide Specification* is a probabilistic design methodology. In this method, the possibility that a flotilla impact with a bridge will cause failure is deemed acceptable provided the annual frequency of collapse (AF) of the bridge is extremely low. Based on the recommendations of the guide specification, the acceptable level of failure for ***critical bridges*** is $AF_c = 0.0001$ per year, and for ***regular bridges***, $AF_r = 0.001$ per year.

Barge Sizes and Tonnages

Barge sizes and tonnages are based on the information contained in the Waterborne Transportation Lines of the United States database. A computer program was written to process the database and calculate the sizes and tonnages to be assigned to the barges found on the inland waterway system of Kentucky. These barges can be classified into one of 24 barge types based on the U.S. Army Corps of Engineers length and width designation system. Since barge sizes and tonnages vary considerably within a category, a probability based approach was adopted to determine conservative values for each.

Flotilla Column and Row Counts

The number of barges in a flotilla column or row for the 24 categories is based on the information recorded in the 1992 Performance Monitoring System database. However, this database only contains information on the total number of barges in a flotilla, the overall dimensions of each flotilla, and the number of passages within a year of flotillas having similar dimensions. Therefore, a probability based approach was adopted in order to determine the number of barges in a typical column or row. While the flotillas are not necessarily comprised of only one barge size or type, assuming a uniform composition of barges leads to reasonable results.

Probability of Aberrancy

The guide specification recommends determining the probability of aberrancy from long-term accident data. Vessel accident statistics, maintained by the U.S. Coast Guard for the past 11 years (since 1983) for most of the navigable waterways in Kentucky, were used to calculate the probabilities of aberrancy. Within this report, the probability of aberrancy is typically calculated for stretches of rivers between locks.

Scour Requirements

The current *AASHTO Guide Specification* does not provide guidance on the application of scour to the barge impact design of highway bridges. However, the FHWA Region 4 office has directed that the impact loads for the loaded barge flotillas be applied in conjunction with 100% of the long-term scour plus the local scour caused by a Q_5 (five year return period) flood event. The FHWA Region 4 office has also directed that the impact loads for the single free-floating barge should be applied with 100% of the long-term scour plus the scour caused by the Q_{100} (100 year return period) flood event. One-hundred percent of the long-term scour can be determined by the methods presented in HEC-20, *Stream Stability in Highway Structures*, Section 2.4: Long-Term Aggradation and Degradation.

RECOMMENDATIONS

Design Barge Sizes and Tonnages

Sizes and tonnages vary significantly within the 24 flotilla categories which occur on the inland navigable waterways of Kentucky. Therefore, a probability based approach

was adopted in order to select the appropriate sizes and tonnages to assign to individual barge types. Since it was assumed that the variation of the sizes and tonnages attributed to individual barges could be represented by a normal distribution, it is recommended that the average plus two standard deviations be used for the sizes and tonnages associated with each barge type. This indicates only a 2.25% chance of the values used being exceeded. In the cases where the maximum value within a category is less than the average plus two standard deviations, then the maximum value is used. Since the database contains all barges operating within Kentucky waterways, if the maximum value is used, there is a 0% chance that the sizes and tonnages will be exceeded.

It is recommended that a 15.2-ft value be used for the draft cutoff. This value is based on information from the U.S. Coast Guard that barges with a draft in excess of 12-ft do not typically operate on Kentucky waterways. The 15.2-ft value would include some barges in the database that could conceivably operate during high water conditions. This will lead to reasonably conservative results. Only barges typically operating on the Mississippi River System and the Gulf Coast Intercostal Waterway should be used in the calculations, since only these barges could conceivably travel on the navigable waterways of Kentucky.

Design Flotilla Column Lengths

Since it was assumed that the variation of the number of barges within a flotilla could be represented by a normal distribution, it is recommended that the average plus two standard deviations be used for the number of barges comprising a flotilla column. This indicates only a 2.25% chance of the values used being exceeded on a yearly basis. In the cases where the maximum value within a category is less than the average plus two standard deviations, then the maximum value is used. Since the database contains all barges operating within Kentucky waterways, if the maximum value is used, there is a 0% chance that the number of barges in a flotilla column or row will be exceeded.

Since the flotilla width seemingly varies in regular increments, the number of barges in a row is determined first. In order to determine the number of barges per flotilla column, it is recommended for the engineer to assume that barge widths do not typically exceed 55 feet. Non-integer values for the number of barges comprising a flotilla column are acceptable since Method II is a probability based analysis procedure. Flotilla column lengths include the possibility of a barge attached to the side of the tow boat. Since tow boat tonnages are generally lower than barge tonnages, it is more conservative to replace the tow boat with a barge.

CREDITS

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We would also like to thank the U.S. Army Corps of Engineers, the U.S. Coast Guard, and the American Waterways Operators for the information they provided for use in this report.

II. Design Example

This is a design example for the Maysville, Kentucky bridge over the Ohio River. The information provided in this example is in accordance with the 1991 *AASHTO Guide Specification and Commentary for Vessel Collision Design of Highway Bridges*; however, it is only intended to illustrate the application of design Method II with the data provided in this report. This example does **not** constitute a rigorous analysis of the bridge pier design. In the sections to follow, and unless otherwise specified, all references to AASHTO sections or the 1991 *AASHTO Guide Specification* refer to sections in the *AASHTO Guide Specification and Commentary for Vessel Collision Design of Highway Bridges*. All references to chapters refer to chapters found within this report.

II.1. Introduction

The *AASHTO Guide Specification* recommends that the impact loads from transiting flotillas be applied at the 2% flow as the water elevation. For the Maysville bridge, only the tower piers are located in the waterway at this elevation, as illustrated in Figure II.1. Therefore, only the tower piers need resist the flotilla impact loads. This example follows the design procedure flow charts illustrated in Figures II.2 and II.3.

II.2. Determine Importance Classification

AASHTO Section 3.3

Based on the guidelines of the *FHWA Seismic Retrofitting Manual For Highway Bridges*, the Maysville bridge may be defined as an **essential bridge**. Therefore, the Maysville bridge shall be assigned a **critical bridge** importance classification.

II.3. Determine Navigable Channel Characteristics

AASHTO Sections 3.4 and 4.2
Report Chapter 3

River velocity values used in the barge flotilla impact force calculations are for 2% flow at the east and west tower piers. The single free floating barge impact forces were calculated using the 100-year flood velocity at the tower piers. River velocities were calculated by Palmer Engineering of Winchester, KY, using a WSPRO analysis (reference

3). However, the one-dimensional WSPRO analysis does not give the river flow directions at the tower piers necessary to determine the longitudinal and transverse components, with respect to the bridge pier, of the barge impact force. A two-dimensional analysis, such as the University of Kentucky's FESWMS computer program, is required in order to calculate flow directions.

River elevations for the navigable channel of the Ohio River are presented in Table 3.1. For this example, the desired elevations of the river at the precise bridge location, mile 411.29, were linearly interpolated from the data at miles 410 and 415.

II.4. Determine Vessel Fleet Characteristics

AASHTO Sections 3.5 and 4.4
Report Chapters 4, 6, and 7

II.4.1. Vessel Velocity

Report Chapter 4

The vessel velocity does not include the river flow velocity. The vessel velocity used in the impact force calculations is based on data provided by the U.S. Coast Guard. It should be noted that the use of the term "flotilla velocity" to describe the speed a flotilla may obtain when the river velocity is zero is consistent with AASHTO terminology, and this terminology is adpoted in this report. However, it should be noted that this terminology conflicts with the one adopted by the U.S. Coast Guard, which defines "flotilla transit velocity" as the speed a flotilla may obtain on still water. The data indicated that typical vessel velocities were between 5 mph (2.13 m/s, 7 fps, 4 knots) and 7 mph (3.05 m/s, 10 fps, 6 knots). The higher value of 7 mph was used in the calculations.

II.4.2. Probability Based Barge Sizes and Tonnages

Report Chapter 6

The computer program in Appendix A was written to process the database and calculate the sizes and tonnages to be assigned to the barges comprising a flotilla category. The results are summarized in Tables 6.3 and 6.4 from the output listed in Appendix B.

II.4.3. Probability Based Flotilla Column and Row Count

Report Chapter 7

The computer program in Appendix C was written to process the database and calculate the number of barges to be assigned to the rows and columns of each flotilla category. These categories are based on the U.S. Army Corps of Engineers' barge length

and width classifications as found in Tables 6.1 and 6.2. The total numbers of barges per column and row are listed in the output of Appendix D by river, milepost and flotilla category. Values for the average and the average plus two standard deviations, in addition to the maximum number of barges in a column or row encountered for a specific category, are reported.

The flotilla frequency distribution (number of passages per year) was determined by dividing the total number of barges for each category by the average number of barges comprising each of the flotilla categories. The average number was used in place of the average plus two standard deviations since it would result in a more conservative flotilla frequency distribution.

II.5. Determine Vessel Transit Path

AASHTO Section 4.2.1

Per Item 1 of Section 4.2.1 of the *AASHTO Guide Specification*, the vessel transit path width for the Maysville bridge shall be taken to be equal to the navigation channel width.

II.6. Determine Vessel Transit Velocity

AASHTO Section 3.7
Report Chapter 4

Typically, the vessel transit velocity at the bridge pier is calculated by adding the vessel velocity to the centerline river velocity and applying section 3.7 of the *AASHTO Guide Specification* to reduce the centerline velocity to the value expected at the bridge piers. However, for the Maysville bridge the vessel transit path width is equal to the navigation channel width.

II.7. Preliminary Bridge Design and Layout

At this time the preliminary design of the bridge and the proposed layout should be completed.

II.8. Determine Water Depths

AASHTO Section 4.2.2

Based on information obtained from the U.S. Coast Guard, barges with a draft in excess of 12-ft do not typically operate on Kentucky waterways. However a draft cut-off of 15.2-ft was used to include some barges in the database that could conceivably operate during high water conditions.

II.9. Determine Vessel Impact Speed

AASHTO Section 3.7
Report Chapter 4

The vessel impact velocities at the bridge piers are equal to the vessel transit velocities at the transit path centerline when calculated in accordance with section 3.7 of the *AASHTO Guide Specification*, since the transit path width is equal to the navigable channel width. This seems conservative since the river velocity would decrease due to frictional effects as the river bank is approached. The river velocities discussed above were added to the vessel velocity to generate the vessel impact velocity at the two tower piers.

II.10. Determine Analysis Method

Three analysis methods are presented in the *AASHTO Guide Specification*, Methods I, II, and III. For this example design Method II is used.

II.10.1. Determine Acceptance Criteria for Bridge Components

AASHTO Section 4.8.2
Report Chapter 5

For the Maysville bridge, which has a **critical bridge** importance classification, the acceptable annual frequency of collapse (AF_c) shall be less than or equal to 0.01 in 100 years or $AF_c = 0.0001$. The annual frequency of bridge collapse is distributed, either equally or at the designers discretion, over all piers that are located within the waterway. For the Maysville bridge, however, only the two tower piers will be in the river at the 2% flow elevation. Therefore, the acceptable annual frequency of collapse for each tower pier (AF_p) should be:

$$AF_p = \frac{AF_c}{2} = \frac{0.0001}{2} = 0.00005 \quad (1)$$

The summation of the annual frequencies of collapse for all flotilla categories, with respect to an individual tower pier, should then be less than or equal to 0.00005.

II.10.2. Determine Barge Type, Size, and Frequency of Travel
AASHTO Section 4.8.3.1
Report Chapters 6 and 7

II.10.2.1. Probability Based Barge Sizes and Tonnages

Figure II.4 is a condensed version of the output in Appendix B based upon the barge sizes and tonnages for the 12 flotilla categories associated with the Maysville section of the Ohio River. It should be noted that there are 24 possible flotilla categories for all of the waterways in Kentucky; however, only 12 of the 24 appear on the Maysville section of the Ohio River.

II.10.2.2. Probability Based Flotilla Column and Row Count

Figure II.5 is condensed from the output of Appendix D based upon the 12 flotilla categories which occur along the Maysville stretch of the Ohio River.

Table 7.2 lists the flotilla frequency for the Maysville section of the Ohio River (data at milepost 436 is used). Average annual flotilla traffic growth rates are given in Table 7.28 for the Ohio River. Flotilla traffic projections along the Maysville section of the Ohio River for the next 50 years, in ten year increments, are given in Table 7.33.

II.10.3. Determine Probability of Aberrancy
AASHTO Section 4.8.3.2
Report Chapter 8

It is recommended that the value of 1.770×10^{-4} be used for the probability of aberrancy since the Maysville, Kentucky, section of the Ohio River falls within the 341-436 mile range as presented in Table 8.1.

II.10.4. Determine Geometric Probability
AASHTO Section 4.8.3.3

Figure II.6 illustrates the appropriate geometry for calculating the geometric

probability (PG) along the Maysville section of the Ohio River. Calculations for these geometric probabilities are presented in Figure II.7. It was conservatively assumed that the geometric probabilities for the west tower pier are the same as the east tower pier. In addition, it was assumed that the entire flotilla could fit between the tower piers and the river banks.

II.10.5. Determine Impact Forces
AASHTO Sections 3.9, 3.11, 3.12, and 3.14

II.10.5.1. Probability Based Impact Loads for the Tower Piers

As presented previously in Table 6.5, for the Maysville section of the Ohio River, upbound barges operate at only 33% of cargo capacity and travel at maximum absolute velocities (barge transit velocity minus river velocity) of approximately four knots (2.13 m/s, 7 fps, 5 mph). On the other hand, downbound barges travel at 92% of cargo capacity with absolute velocities (barge transit velocity plus river velocity) of ten knots (5.18 m/s, 17 fps, 12 mph). Consequently, impact loads and barge counts neglect upbound barge traffic since impact loads from upbound barges are insignificant compared to downbound barges.

Flotilla categories currently using the Maysville section of the Ohio River are given in column 1 of Table II.1. The impact loads, as calculated in Figure II.8, and their associated frequencies are also given in columns 3-5 of Table II.1 for the west and east tower piers.

II.10.5.2. Minimum Impact Loads for Tower Piers

As a minimum, the *AASHTO Guide Specification* requires that all waterway piers, with available water depth equal to the empty draft of a free floating barge, be designed to resist the impact of the empty barge floating with the yearly mean current velocity and elevation at the bridge location. However, the Kentucky Transportation Cabinet has established the more conservative requirement of a single barge, fully loaded, or loaded to a draft equal to the available water depth, drifting at the 100-year current as the design minimum.

The design minimum barge selected for the Maysville section of the Ohio River was a 53-ft x 290-ft barge since it is one of the largest barges currently in use on the river. Barge traffic records indicate 205 downbound passages per year of flotillas with this barge type (see Table 7.2 - values for the number of passages per year are halved to account for downbound and upbound trips). The typical dimensions for the 53-ft x 290-ft barge, along with other barge sizes, are given in Table II.2. Calculations for the uniform impact load of a single, fully loaded barge are given in Figure II.9; the uniform impact load

magnitude, length, and bridge pier starting elevations are given in Table II.3.

II.10.5.3. Location of Tower Pier Impact Loads

The stability of the pier must be checked by applying the impact load as a concentrated load at the mean high water level per Section 3.15.1 of the *AASHTO Guide Specification*. It is recommended that the concentrated impact load be applied to the tower piers at the 2% flow elevation of 496.5-ft. In addition, the *AASHTO Guide Specification* allows for the local or impacted pier to be designed with the barge impact load applied as a uniformly distributed load. The recommended starting elevation and length of the uniform barge impact loads are given in columns 6 and 7 of Table II.1 by flotilla category. The elevations assume that the barge contacts only the tower pier columns and does not contact the substructure (e.g., pile footing, etc.).

II.10.6. Determine Bridge Resistance Strength AASHTO Sections 4.8.3.4

In the absence of a preliminary bridge design and layout for this example, an initial pier impact capacity was assumed to be 5000 kips.

II.10.7. Determine Probability of Collapse AASHTO Sections 4.8.3.4

The probabilities of collapse (PC) for each flotilla category were determined for each tower pier, as shown in Table II.4, using the equivalent static impact forces calculated in Figure II.8 and listed in Table II.1.

II.10.8. Determine Annual Frequency of Collapse AASHTO Sections 4.8.3

Combining the information from the previous sections, the annual frequency of collapse for a pier (AF_p) can be determined from:

$$AF_p = N(PA)(PG)(PC) \qquad (2)$$

where N is the frequency of a particular flotilla category. Calculations for AF_p for both the east and west tower piers are located in Tables II.5 and II.6, respectively.

II.10.9. Determine Design Vessel AASHTO Sections 4.8.2

Based on an initial pier capacity of 5000 kips, the design vessel was determined from the equivalent static impact loads listed in Table II.1 to be flotilla category DB impacting the east tower pier.

II.10.10. Determine Bridge Adequacy

After an *unacceptable* annual frequency of collapse was noted, the initial pier capacity was determined to be inadequate. Therefore, the process was repeated until an impact capacity of 7170 kips yielded satisfactory results. Tables II.7 through II.9 give the results for the revised calculations. It should be noted that even though the AF_p for the east tower pier slightly exceeds the acceptable value of 0.00005, the summation of the annual frequencies of collapse for all flotilla categories, with respect to both tower piers, is 0.0001. The design vessel for this bridge resistance strength was determined to be flotilla category BC impacting the west tower pier.

Conclusions

There is a tremendous variation in the size and types of barges and flotillas in use on the Ohio River. Based on the procedures used in this report, there are currently 12 flotilla categories on the Maysville section of the Ohio River. The flotilla sizes and tonnages used to calculate the equivalent static loads for each category have at most a 2.25% chance that a flotilla will pass the Maysville Bridge with greater size or load. Calculations for the equivalent static loads indicated that some categories may be combined since they result in nearly identical impact loads.

Once navigable channel and vessel characteristics have been established, Method II becomes an iterative process whereby an engineer must determine a bridge resistance strength which satisfies the annual frequency of collapse criteria. For this example, a bridge pier capacity of 7170 kips, which corresponds to the equivalent static impact force on the west tower pier of flotilla category BC, yielded an acceptable annual frequency of collapse. Again, it should be noted that the information provided in this example is in accordance with the *AASHTO Guide Specification*; however, it is only intended to illustrate the application of design Method II with the data provided in this report. This example does not constitute a rigorous analysis of the bridge pier design.

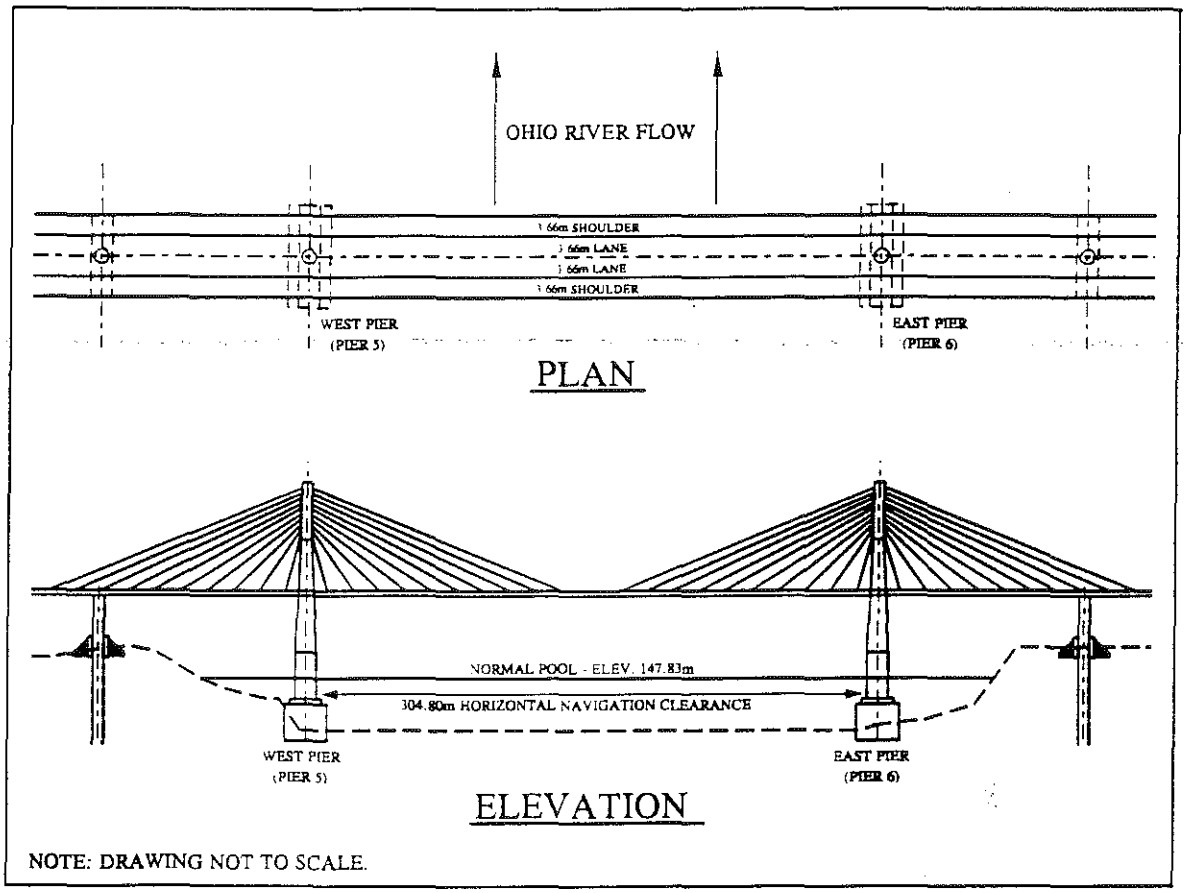


Figure II.1: Plan and Elevation Views of the Cable Suspended Bridge Over the Ohio River at Maysville, KY.

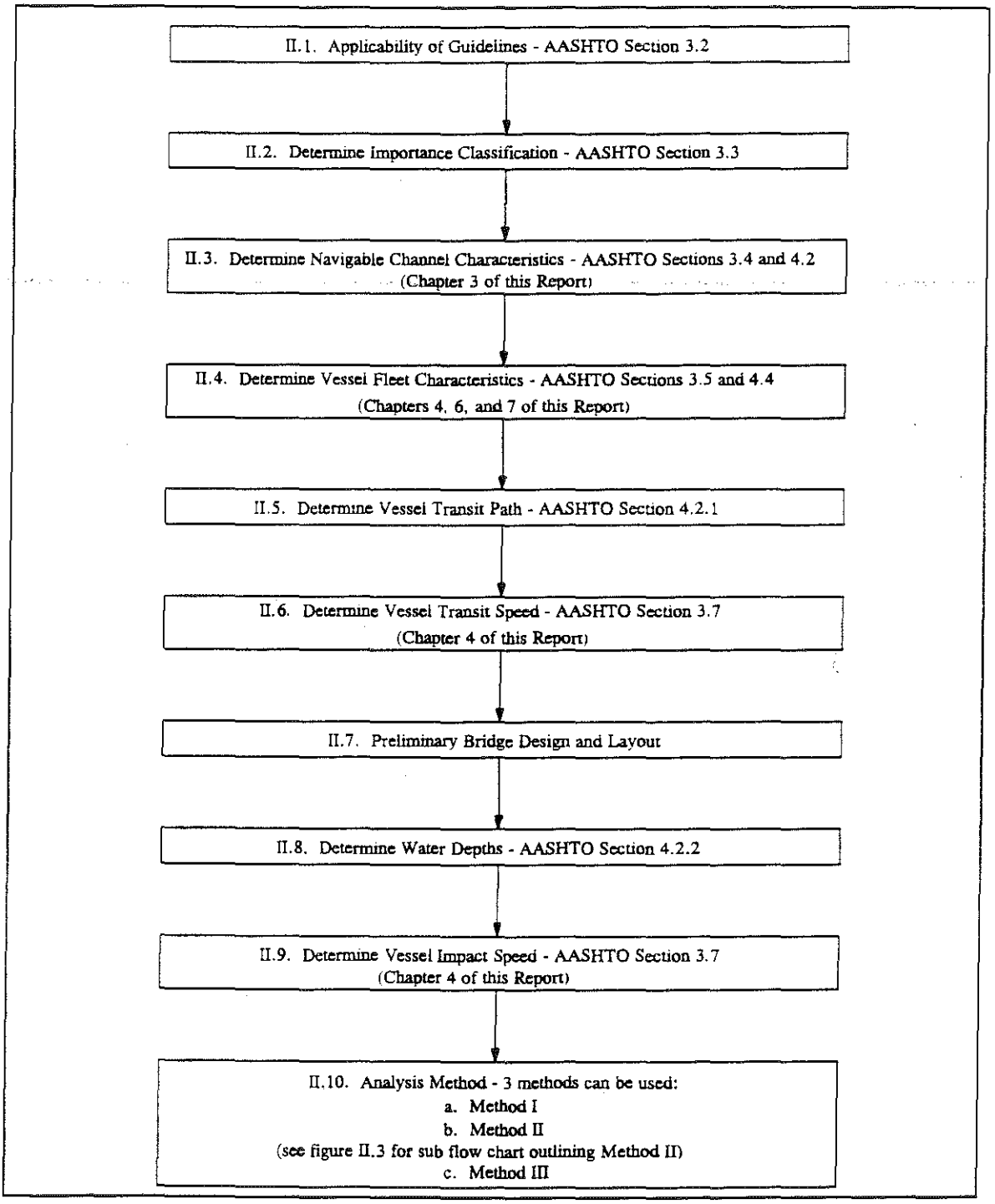


Figure II.2: Design Procedure Flow Chart (Modified After *AASHTO Guide Specification for Vessel Collision Design of Highway Bridges*).

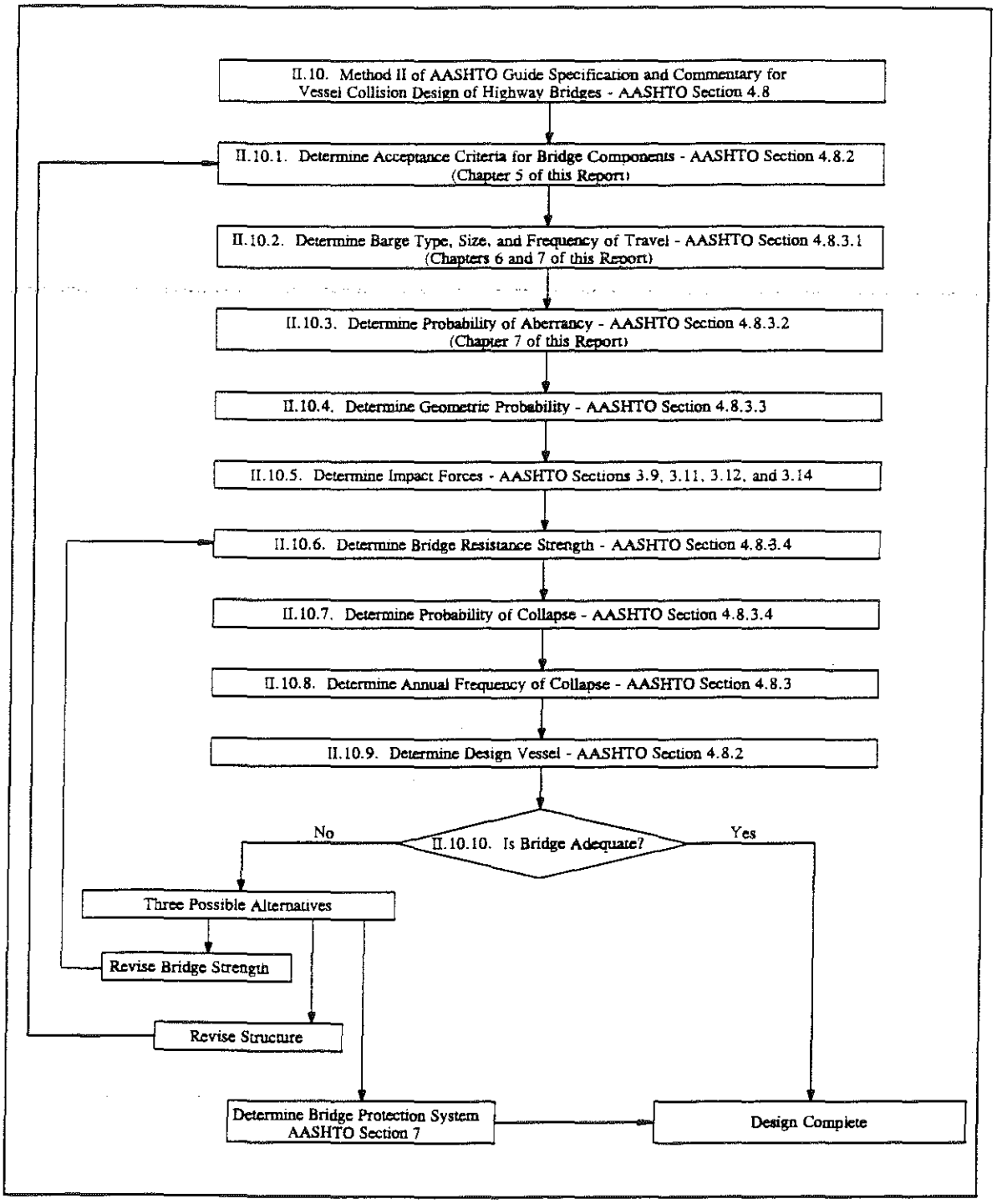


Figure II.3: Sub Flow Chart for Method II (Modified After *AASHTO Guide Specification for Vessel Collision Design of Highway Bridges*).

**********CATEGORY AVERAGE VALUES**********

CATEG.	COUNT	CAPACITY (tons)	LENGTH (ft)	WIDTH (ft)	E DRAFT (ft)	L DRAFT (ft)
6 (BB)	1586.00	668.95	122.44	29.48	1.81	6.63
7 (BC)	980.00	1584.43	142.57	43.00	2.92	8.96
10 (CC)	312.00	1981.08	180.14	42.70	2.74	9.65
12 (DB)	491.00	1361.57	195.00	26.02	1.72	9.01
13 (DC)	13069.00	1844.64	195.01	35.10	1.67	9.09
14 (DD)	1.00	2642.67	196.10	54.10	5.00	8.00
16 (EB)	3.00	1257.39	200.00	26.00	1.53	8.67
17 (EC)	6838.00	2075.87	202.29	35.98	1.64	9.21
19 (FC)	353.00	3643.62	265.48	51.43	1.72	9.63
21 (GC)	621.00	4307.98	295.34	53.17	1.72	9.65
23 (HC)	35.00	4837.30	333.02	52.44	2.53	9.47
24 (HD)	2.00	5504.16	340.05	54.55	2.25	11.55

**********AVERAGE PLUS TWO STANDARD DEVIATIONS**********

CATEG.	COUNT	CAPACITY (tons)	LENGTH (ft)	WIDTH (ft)	E DRAFT (ft)	L DRAFT (ft)
6 (BB)	1586.00	1232.49	150.97	33.59	4.23	12.00
7 (BC)	980.00	3416.13	174.00	54.00	8.30	15.00
10 (CC)	312.00	3657.39	191.08	54.00	7.48	14.00
12 (DB)	491.00	1890.02	195.09	26.74	2.00	10.00
13 (DC)	13069.00	2715.35	195.25	37.49	2.29	15.00
14 (DD)	1.00	2642.67	196.10	54.10	5.00	8.00
16 (EB)	3.00	1375.00	200.00	26.00	1.80	9.50
17 (EC)	6838.00	3046.69	221.03	43.22	2.56	14.50
19 (FC)	353.00	5315.08	279.26	54.00	2.53	13.40
21 (GC)	621.00	6480.20	300.00	54.00	2.61	13.40
23 (HC)	35.00	8382.55	404.27	54.00	4.00	12.00
24 (HD)	2.00	6349.50	360.10	55.82	2.50	12.10

Figure II.4: Barge Sizes and Tonnages for the 12 Categories Occurring on the Maysville Section of the Ohio River. (NOTE: The first letter in parenthesis is the length of barge designation, as found in Table 6.1, and the second letter is the width of barge designation, as found in Table 6.2.)

CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
6 (BB)	3.3333 (5.4415)	4.0000*	1.6667 (2.7208)	2.0000*
7 (BC)	3.4219 (5.9171)	7.5000	1.7188 (2.4995)	2.0000*
10 (CC)	3.3490 (5.1076)	6.5000	1.9688 (2.4667)	3.0000
12 (DB)	5.0000 (5.0000)	5.0000	1.0000 (1.0000)	1.0000
13 (DC)	4.5837 (5.3813)	5.5000	2.8274 (3.4682)	3.0000*
14 (DD)	6.0000 (6.0000)	6.0000	2.0000 (2.0000)	2.0000
16 (EB)	5.0000 (5.0000)	5.0000	1.0000 (1.0000)	1.0000
17 (EC)	4.5837 (5.3813)	5.5000	2.8274 (3.4682)	3.0000*
19 (FC)	3.3537 (4.6113)	4.5000*	2.3159 (3.3007)	3.0000*
21 (GC)	3.3884 (4.6127)	4.0000*	1.9876 (2.7581)	3.0000
23 (HC)	2.0000 (3.2295)	3.5000	1.7176 (2.7621)	3.0000
24 (HD)	1.6667 (2.8214)	2.0000*	1.0000 (1.0000)	1.0000

Figure II.5: Flotilla Column and Row Barge Output Based on the 12 Categories Occurring at the Maysville Section of the Ohio River. (NOTE: The first letter in parenthesis is the length of barge designation, as found in Table 6.1, and the second letter is the width of barge designation, as found in Table 6.2. The "*" indicates that the maximum number of barges in a column or row encountered for the flotilla category is less than the average plus two standard deviations number of barges.)

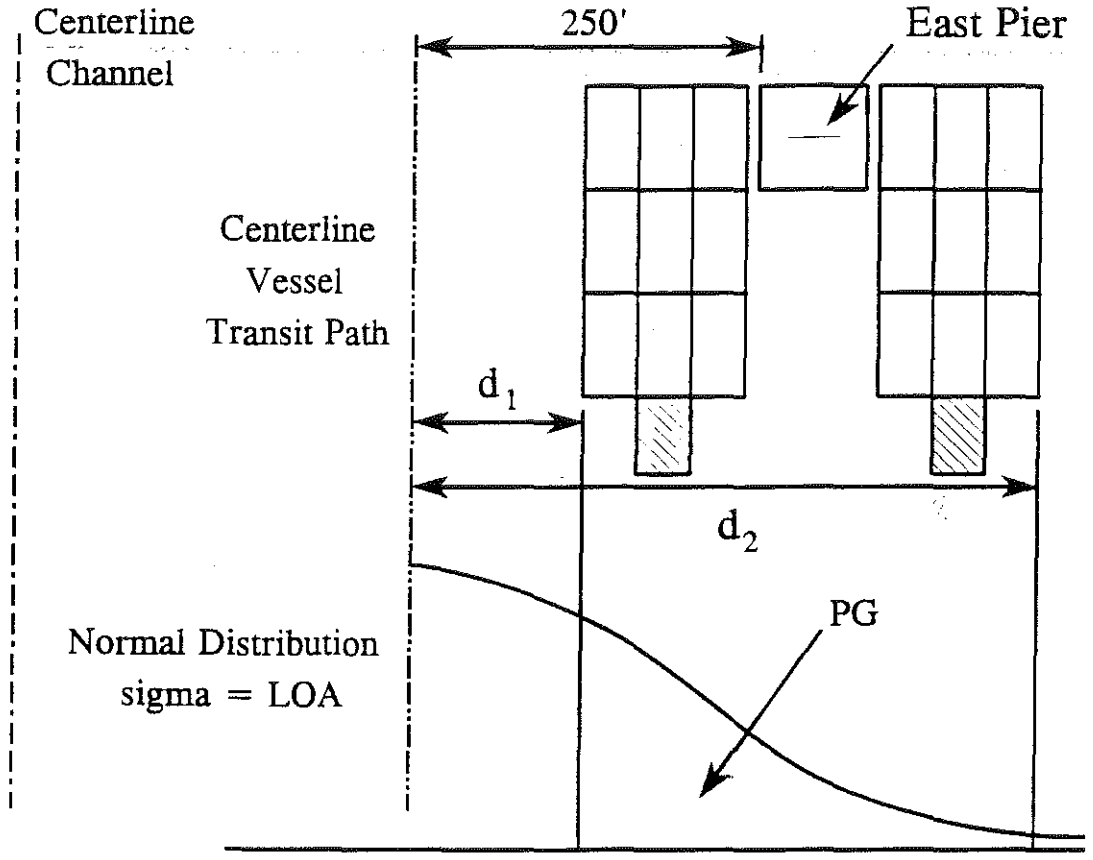


Figure II.6: Dimensions for the Calculation of Geometric Probability for the Maysville Section of the Ohio River.

Geometric Probabilities (PG) for Design Example

$$PG(x1, x2) = \int_{x1}^{x2} \frac{1}{\sqrt{2 \cdot pi}} \cdot \exp\left(-\frac{1}{2} \cdot t^2\right) dt$$

Equation for normal distribution of data - see section B4.8.3.3 of *AASHTO Guide Specification*

Flotilla Category 1 PG Calculation: nbrgcol=number of barges per column, nbrgrow=number of barges per row, blength=barge length, and bwidth=barge width.

nbrgcol = 4.00 nbrgrow = 2.00 blength = 150.86 bwidth = 33.59

LOA = nbrgcol · blength

d1 = 250 − (nbrgrow · bwidth) $x1 = \frac{d1}{LOA}$

d2 = 250 − (nbrgrow · bwidth − 35) $x2 = \frac{d2}{LOA}$

PG(x1 , x2) = 0.1012

Flotilla Category 2 PG Calculation

nbrgcol = 5.92 nbrgrow = 2.00 blength = 174.00 bwidth = 54.00

LOA = nbrgcol · blength

d1 = 250 − (nbrgrow · bwidth) $x1 = \frac{d1}{LOA}$

d2 = 250 − (nbrgrow · bwidth − 35) $x2 = \frac{d2}{LOA}$

PG(x1 , x2) = 0.0938

Flotilla Category 3 PG Calculation

nbrgcol = 5.11 nbrgrow = 2.47 blength = 191.19 bwidth = 54.00

LOA = nbrgcol · blength

d1 = 250 − (nbrgrow · bwidth) $x1 = \frac{d1}{LOA}$

d2 = 250 − (nbrgrow · bwidth − 35) $x2 = \frac{d2}{LOA}$

PG(x1 , x2) = 0.1183

Figure II.7: Geometric Probability Calculations for the Maysville Section of the Ohio River.

Flotilla Category 4 PG Calculation

nbrgcol = 5.00 nbrgrow = 3.00 blength = 195.09 bwidth = 26.74

LOA = nbrgcol · blength

d1 = 250 − (nbrgrow · bwidth)

$$x1 = \frac{d1}{LOA}$$

d2 = 250 − (nbrgrow · bwidth + 35)

$$x2 = \frac{d2}{LOA}$$

PG(x1 , x2) = 0.0348

Flotilla Category 5 PG Calculation

nbrgcol = 5.38 nbrgrow = 3.00 blength = 195.25 bwidth = 37.49

LOA = nbrgcol · blength

d1 = 250 − (nbrgrow · bwidth)

$$x1 = \frac{d1}{LOA}$$

d2 = 250 − (nbrgrow · bwidth + 35)

$$x2 = \frac{d2}{LOA}$$

PG(x1 , x2) = 0.0953

Flotilla Category 6 PG Calculation

nbrgcol = 6.00 nbrgrow = 2.00 blength = 196.10 bwidth = 54.10

LOA = nbrgcol · blength

d1 = 250 − (nbrgrow · bwidth)

$$x1 = \frac{d1}{LOA}$$

d2 = 250 − (nbrgrow · bwidth + 35)

$$x2 = \frac{d2}{LOA}$$

PG(x1 , x2) = 0.0829

Figure II.7 (continued): Geometric Probability Calculations for the Maysville Section of the Ohio River.

Flotilla Category 7 PG Calculation

nbrgcol = 5.00 nbrgrow = 1.00 blength = 200.00 bwidth = 26.00

LOA = nbrgcol · blength

d1 = 250 − (nbrgrow · bwidth)

$x1 = \frac{d1}{LOA}$

d2 = 250 − (nbrgrow · bwidth − 35)

$x2 = \frac{d2}{LOA}$

PG(x1 , x2) = 0.0335

Flotilla Category 8 PG Calculation

nbrgcol = 5.38 nbrgrow = 3.00 blength = 221.03 bwidth = 43.23

LOA = nbrgcol · blength

d1 = 250 − (nbrgrow · bwidth)

$x1 = \frac{d1}{LOA}$

d2 = 250 − (nbrgrow · bwidth − 35)

$x2 = \frac{d2}{LOA}$

PG(x1 , x2) = 0.0961

Flotilla Category 9 PG Calculation

nbrgcol = 4.50 nbrgrow = 3.00 blength = 279.26 bwidth = 54.00

LOA = nbrgcol · blength

d1 = 250 − (nbrgrow · bwidth)

$x1 = \frac{d1}{LOA}$

d2 = 250 − (nbrgrow · bwidth − 35)

$x2 = \frac{d2}{LOA}$

PG(x1 , x2) = 0.1111

Figure II.7 (continued): Geometric Probability Calculations for the Maysville Section of the Ohio River.

Flotilla Category 10 PG Calculation

nbrgcol = 4.00 nbrgrow = 2.76 blength = 300.00 bwidth = 54.00

LOA = nbrgcol · blength

d1 = 250 − (nbrgrow · bwidth) $x1 = \frac{d1}{LOA}$

d2 = 250 − (nbrgrow · bwidth − 35) $x2 = \frac{d2}{LOA}$

PG(x1 , x2) = 0.1077

Flotilla Category 11 PG Calculation

nbrgcol = 3.23 nbrgrow = 2.76 blength = 404.27 bwidth = 54.00

LOA = nbrgcol · blength

d1 = 250 − (nbrgrow · bwidth) $x1 = \frac{d1}{LOA}$

d2 = 250 − (nbrgrow · bwidth − 35) $x2 = \frac{d2}{LOA}$

PG(x1 , x2) = 0.0994

Flotilla Category 12 PG Calculation

nbrgcol = 2.00 nbrgrow = 1.00 blength = 360.10 bwidth = 55.82

LOA = nbrgcol · blength

d1 = 250 − (nbrgrow · bwidth) $x1 = \frac{d1}{LOA}$

d2 = 250 − (nbrgrow · bwidth − 35) $x2 = \frac{d2}{LOA}$

PG(x1 , x2) = 0.0757

Figure II.7 (continued): Geometric Probability Calculations for the Maysville Section of the Ohio River.

THE MAYSVILLE KENTUCKY BRIDGE OVER THE OHIO RIVER
BARGE EQUIVALENT STATIC IMPACT FORCE CALCULATIONS

Barge Design Impact Velocity
West Pier: Barge Transit V= 10.27 fps (7.00 mph)
Waterway V=5.7 fps (3.89 mph)

V_W = (10.27 - 5.7) (fps)

Barge Design Impact Velocity
East Pier: Barge Transit V= 10.27 fps (7.00 mph)
Waterway V= 6.1 fps (4.15 mph)

V_E = (10.27 - 6.1) (fps)

Hydrodynamic Coefficient

C_H = 1.05

Individual Barge Displacement (tons): By barge type, i = 1,2,...,24.

TI_i defines the 97.75 percentile barge tonnages.

TI_1 633	TI_9 1868	TI_{17} 3047
TI_2 953	TI_{10} 3657	TI_{18} 7714
TI_3 4486	TI_{11} 421	TI_{19} 5315
TI_4 501	TI_{12} 1890	TI_{20} 4261
TI_5 1433	TI_{13} 2715	TI_{21} 6480
TI_6 1232	TI_{14} 2643	TI_{22} 7497
TI_7 3416	TI_{15} 1156	TI_{23} 8383
TI_8 3664	TI_{16} 1375	TI_{24} 6350

Figure II.8: Barge Equivalent Static Impact Force Calculations for the Maysville Section of the Ohio River.

$i := 13..24$

W	E
$1.21 \cdot 10^5$	$1.28 \cdot 10^5$
$1.32 \cdot 10^5$	$1.39 \cdot 10^5$
0	0
$5.72 \cdot 10^4$	$6.01 \cdot 10^4$
$1.36 \cdot 10^5$	$1.43 \cdot 10^5$
0	0
$1.99 \cdot 10^5$	$2.09 \cdot 10^5$
0	0
$2.16 \cdot 10^5$	$2.26 \cdot 10^5$
0	0
$2.25 \cdot 10^5$	$2.37 \cdot 10^5$
$1.06 \cdot 10^5$	$1.11 \cdot 10^5$

Barge Width Correction Factors: Using the Most Conservative Width in the Flotilla Category (per AASHTO definition R = ratio of barge width to 35-ft.)

$R_1 := \frac{25.70}{35}$ $R_9 := \frac{26.98}{35}$ $R_{17} := \frac{43.23}{35}$

$R_2 := \frac{33.13}{35}$ $R_{10} := \frac{54.00}{35}$ $R_{18} := \frac{72.00}{35}$

$R_3 := \frac{54.00}{35}$ $R_{11} := \frac{60.00}{35}$ $R_{19} := \frac{54.00}{35}$

$R_4 := \frac{55.00}{35}$ $R_{12} := \frac{26.74}{35}$ $R_{20} := \frac{62.69}{35}$

$R_5 := \frac{25.00}{35}$ $R_{13} := \frac{37.49}{35}$ $R_{21} := \frac{54.00}{35}$

$R_6 := \frac{33.59}{35}$ $R_{14} := \frac{54.00}{35}$ $R_{22} := \frac{56.64}{35}$

$R_7 := \frac{54.00}{35}$ $R_{15} := \frac{25.00}{35}$ $R_{23} := \frac{54.00}{35}$

$R_8 := \frac{59.30}{35}$ $R_{16} := \frac{26.00}{35}$ $R_{24} := \frac{55.82}{35}$

Figure II.8 (continued): Barge Equivalent Static Impact Force Calculations for the Maysville Section of the Ohio River.

Barge Damage Depth a_{BW}
West Tower Pier (ft.)
AASHTO Eqn. 3.13-1

Barge Damage Depth a_{BE}
East Tower Pier (ft.)
AASHTO Eqn. 3.13-1

$i := 1..24$

$$aBW_i := \frac{\left(1 - \frac{W_i}{5672}\right)^{\frac{1}{2}} \cdot 10.2}{R_i} \qquad aBE_i := \frac{\left(1 - \frac{E_i}{5672}\right)^{\frac{1}{2}} \cdot 10.2}{R_i}$$

aBW_i	aBE_i
0	0
0	0
0	0
0	0
0	0
19.85	20.53
29.99	30.88
0	0
0	0
28.62	29.47
0	0
38.11	39.31
35.56	36.64
25.95	26.73
0	0
31.98	33.02
33.06	34.06
0	0
33.09	34.06
0	0
34.68	35.69
0	0
35.57	36.6
21.93	22.61

Barge Equivalent Static Impact Force P_{BW} for the West Tower Pier (kips)
AASHTO Eqn. 3.12.1-1b

Barge Equivalent Static Impact Force P_{BE} for the East Tower Pier (kips)
AASHTO Eqn. 3.12.1-1b

$$PBW_i := 1349 - 110 \cdot aBW_i \cdot R_i \qquad PBE_i := 1349 - 110 \cdot aBE_i \cdot R_i$$

Figure II.8 (continued): Barge Equivalent Static Impact Force Calculations for the Maysville Section of the Ohio River.

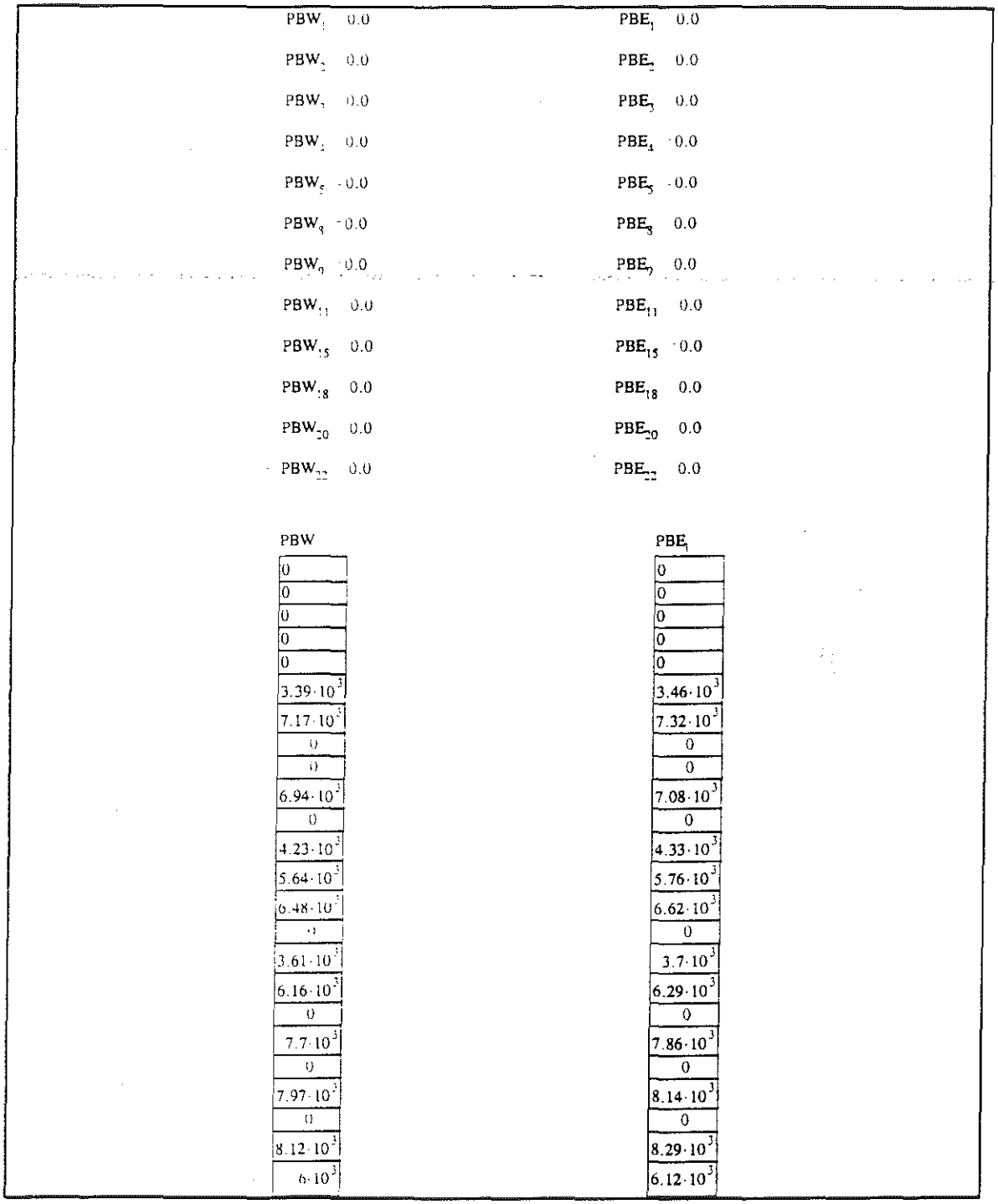


Figure II.8 (continued): Barge Equivalent Static Impact Force Calculations for the Maysville Section of the Ohio River.

BARGE EQUIVALENT STATIC IMPACT FORCE
CALCULATIONS FOR A SINGLE FREE DRIFTING BARGE

Barge Design Impact Velocity
West Pier: Barge V=0.0 fps
Waterway V=6.8 fps
East Pier: Barge V=0.0 fps
Waterway V=7.1 fps

$V_W := 6.8$ (fps)

$V_E := 7.1$ (fps)

Hydrodynamic Coefficient

$C_H := 1.05$

Single Free-Drifting Barge Loaded Tonnage - Barge Type GC (tons):

$T_i := 6480$

Barge Kinetic Energy West Tower Pier (k-ft) AASHTO Eqn. C3.8-1

$i := 1 \quad R_i := 1.53$

$$W_i := \frac{C_H \cdot T_i \cdot 2 \cdot V_W^2}{2 \cdot 32.2}$$

$W_i = 9.77 \cdot 10^3$

Barge Kinetic Energy East Tower Pier (k-ft) AASHTO Eqn. C3.8-1

$i := 1 \quad R_i := 1.53$

$$E_i := \frac{C_H \cdot T_i \cdot 2 \cdot V_E^2}{2 \cdot 32.2}$$

$E_i = 1.07 \cdot 10^4$

Barge Damage Depth a_{BW} West Tower Pier (ft.) AASHTO Eqn. 3.13-1

$$aBW_i := \frac{\left(1 - \left(\frac{W_i}{5672}\right)^{\frac{1}{2}}\right) \cdot 10.2}{R_i}$$

$aBW_i = 4.33$

Barge Damage Depth a_{BE} East Tower Pier (ft.) AASHTO Eqn. 3.13-1

$$aBE_i := \frac{\left(1 - \left(\frac{E_i}{5672}\right)^{\frac{1}{2}}\right) \cdot 10.2}{R_i}$$

$aBE_i = 4.64$

Barge Equivalent Static Impact Force P_{BW} for the West Tower Pier (kips) AASHTO Eqn. 3.12.1-1b

$PBW_i := 1349 - 110 \cdot aBW_i \cdot R_i$

$PBW_i = 2.79 \cdot 10^3$

Barge Equivalent Static Impact Force P_{BE} for the East Tower Pier (kips) AASHTO Eqn. 3.12.1-1b

$PBE_i := 1349 - 110 \cdot aBE_i \cdot R_i$

$PBE_i = 2.85 \cdot 10^3$

Figure II.9: Barge Equivalent Static Impact Force Calculations for the Maysville Section of the Ohio River - Single Free Floating Barge.

Table II.1: Equivalent Static Barge Impact Loads and Frequencies for the West and East Tower Piers for the Maysville. Kentucky Bridge.

Flotilla Category[a] (1)	Number of Barges in Flotilla Column[b] (2)	Flotilla Frequency (number of downbound passages per year)[c] (3)	Equivalent Static Impact Force for West Tower Pier (kips) (4)	Equivalent Static Impact Force for East Tower Pier (kips) (5)	Starting Elevation of Uniform Barge Impact Load[d] (ft) (6)	Length of Uniform Barge Impact Load (ft) (7)
6 (BB)	3.33	4	3,390	3,460	499.5	3.0
7 (BC)	3.42	105	7,170	7,320	499.5	3.0
10 (CC)	3.35	46	6,940	7,080	499.5	3.0
12 (DB)	5.00	25	4,230	4,330	499.5	3.0
13 (DC)	4.58	2076	5,640	5,760	499.5	3.0
14 (DD)	6.00	1	6,480	6,620	500.5	4.0
16 (EB)	5.00	1	3,610	3,700	499.5	3.0
17 (EC)	4.58	195	6,160	6,290	499.5	3.0
19 (FC)	3.35	5	7,700	7,860	499.5	3.0
21 (GC)	3.39	205	7,970	8,140	500.5	4.0
23 (HC)	2.00	5	8,120	8,290	500.5	4.0
24 (HD)	1.67	19	6,000	6,120	500.5	4.0

[a] The first letter in parentheses refers to the length of barge designation as presented in Table 6.1, and the second letter in parentheses refers to the width of barge designation as presented in Table 6.2.

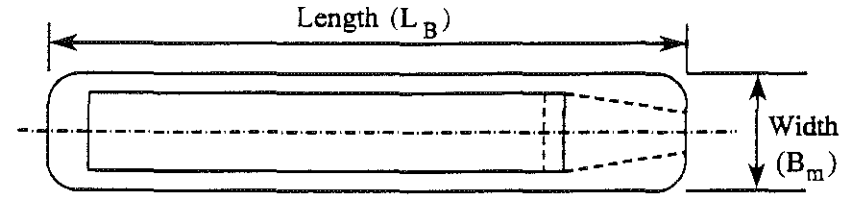
[b] Non-integer values for the number of barges comprising a flotilla column are acceptable since Method II is a probability based method of analysis.

[c] Downbound traffic for 1992. Average traffic growth rate for 1991 - 1992 is -2%.

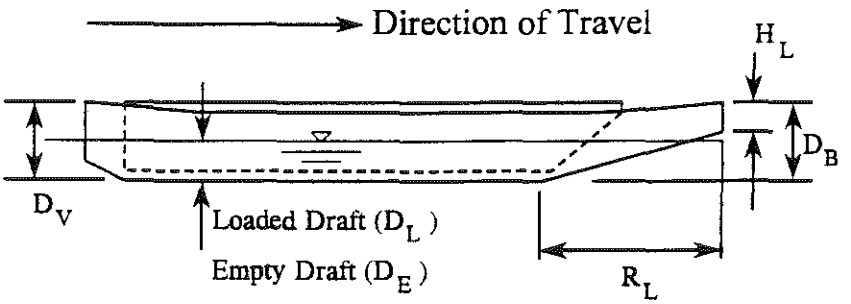
[d] For both the west and east tower piers.

Table II.2: Typical Barge Size Dimensions.

Length, L_B	**(ft)**	195	290	250
Width, B_M	**(ft)**	35	53	72
Depth, D_V	**(ft)**	12	12	17
Empty Draft, D_E	**(ft)**	1.7	1.7	2.5
Loaded Draft, D_L	**(ft)**	8.7	8.7	12.5
Depth of Bow, D_B	**(ft)**	13	13	18
Bow Rake Length, R_L	**(ft)**	20	25	30
Head Log Height, H_L	**(ft)**	2-3	2-3	3-5
Cargo Weight, C_c	**(tons)**	1700	3700	5000
Empty Weight, W_E	**(tons)**	200	600	1300
Total Weight, W_L	**(tons)**	1900	4300	6300



PLAN



ELEVATION

Table II.3: Equivalent Static Impact Loads for the West and East Tower Piers for a Single Free Floating 53-ft x 290-ft Barge.

Uniform Barge Impact Load Starting Elevation (ft)	Uniform Barge Impact Load Length (ft)	Equivalent Static Impact Force West Pier (kips)	Equivalent Static Impact Force East Pier (kips)
(1)	(2)	(3)	(4)
500.5	4.0	2,790	2,850

Table II.4: Probability of Collapse for the Maysville Bridge (H_p = 5000 kips).

Category	H_p/P_s[a]		Probability of Collapse[b]	
	East Pier	West Pier	East Pier	West Pier
6 (BB)	1.4451	1.4749	0.0000	0.0000
7 (BC)	0.6831	0.6974	0.0352	0.0336
10 (CC)	0.7062	0.7205	0.0326	0.0311
12 (DB)	1.1547	1.1820	0.0000	0.0000
13 (DC)	0.8681	0.8865	0.0147	0.0126
14 (DD)	0.7553	0.7716	0.0272	0.0254
16 (EB)	1.3514	1.3850	0.0000	0.0000
17 (EC)	0.7949	0.8117	0.0228	0.0209
19 (FC)	0.6361	0.6494	0.0404	0.0390
21 (GC)	0.6143	0.6274	0.0429	0.0414
23 (HC)	0.6031	0.6158	0.0441	0.0427
24 (HD)	0.8170	0.8333	0.0203	0.0185

[a] H_p is the pier capacity and P_s is the equivalent static load for each flotilla category as found in Table II.1.

[b] The Probability of Collapse is calculated as:

$PC = (1-H_p/P_s)/9$ for $0.1 \leq H_p/P_s \leq 1.0$.

$PC = 0$ for $H_p/P_s > 1.0$.

Table II.5: Annual Frequency of Collapse for East Tower Pier with H_p = 5000 kips.

Category	Flotilla Frequency (N)	Probability of Aberrancy (PA)	Geometric Probability (PG)	Probability of Collapse (PC)	Annual Frequency (AF)	Summation of Annual Frequency
6 (BB)	4	1.7704×10^{-4}	0.1012	0.0000	0.0000	0.0000
7 (BC)	105	1.7704×10^{-4}	0.0938	0.0352	6.140×10^{-5}	6.140×10^{-5}
10 (CC)	46	1.7704×10^{-4}	0.1183	0.0326	3.145×10^{-5}	9.285×10^{-5}
12 (DB)	25	1.7704×10^{-4}	0.0348	0.0000	0.0000	9.285×10^{-5}
13 (DC)	2076	1.7704×10^{-4}	0.0953	0.0147	5.135×10^{-4}	6.064×10^{-4}
14 (DD)	1	1.7704×10^{-4}	0.0829	0.0272	3.991×10^{-7}	6.068×10^{-4}
16 (EB)	1	1.7704×10^{-4}	0.0335	0.0000	0.0000	6.068×10^{-4}
17 (EC)	195	1.7704×10^{-4}	0.0961	0.0228	7.560×10^{-5}	6.824×10^{-4}
19 (FC)	5	1.7704×10^{-4}	0.1111	0.0404	3.976×10^{-6}	6.863×10^{-4}
21 (GC)	205	1.7704×10^{-4}	0.1077	0.0429	1.675×10^{-4}	8.539×10^{-4}
23 (HC)	5	1.7704×10^{-4}	0.0994	0.0441	3.880×10^{-6}	8.577×10^{-4}
24 (HD)	19	1.7704×10^{-4}	0.0757	0.0203	5.178×10^{-6}	8.629×10^{-4}

Table II.6: Annual Frequency of Collapse for West Tower Pier with H_p = 5000 kips.

Category	Flotilla Frequency (N)	Probability of Aberrancy (PA)	Geometric Probability (PG)	Probability of Collapse (PC)	Annual Frequency (AF)	Summation of Annual Frequency
6 (BB)	4	1.7704×10^{-4}	0.1012	0.0000	0.0000	0.0000
7 (BC)	105	1.7704×10^{-4}	0.0938	0.0336	5.864×10^{-5}	5.864×10^{-5}
10 (CC)	46	1.7704×10^{-4}	0.1183	0.0311	2.992×10^{-5}	8.856×10^{-5}
12 (DB)	25	1.7704×10^{-4}	0.0348	0.0000	0.0000	8.856×10^{-5}
13 (DC)	2076	1.7704×10^{-4}	0.0953	0.0126	4.416×10^{-4}	5.302×10^{-4}
14 (DD)	1	1.7704×10^{-4}	0.0829	0.0254	3.725×10^{-7}	5.306×10^{-4}
16 (EB)	1	1.7704×10^{-4}	0.0335	0.0000	0.0000	5.306×10^{-4}
17 (EC)	195	1.7704×10^{-4}	0.0961	0.0209	6.942×10^{-5}	6.000×10^{-4}
19 (FC)	5	1.7704×10^{-4}	0.1111	0.0390	3.832×10^{-6}	6.038×10^{-4}
21 (GC)	205	1.7704×10^{-4}	0.1077	0.0414	1.618×10^{-4}	7.657×10^{-4}
23 (HC)	5	1.7704×10^{-4}	0.0994	0.0427	3.757×10^{-6}	7.694×10^{-4}
24 (HD)	19	1.7704×10^{-4}	0.0757	0.0200	4.716×10^{-6}	7.741×10^{-4}

Table II.7: Probability of Collapse for the Maysville Bridge (H_p = 7170 kips).

Category	H_p/P_s		Probability of Collapse[a]	
	East Pier	West Pier	East Pier	West Pier
6 (BB)	2.0723	2.1150	0.0000	0.0000
7 (BC)	0.9795	1.0000	0.0023	0.0000
10 (CC)	1.0127	1.0331	0.0000	0.0000
12 (DB)	1.6559	1.6950	0.0000	0.0000
13 (DC)	1.2448	1.2713	0.0000	0.0000
14 (DD)	1.0831	1.1065	0.0000	0.0000
16 (EB)	1.9378	1.9861	0.0000	0.0000
17 (EC)	1.1399	1.1640	0.0000	0.0000
19 (FC)	0.9122	0.9312	0.0098	0.0076
21 (GC)	0.8808	0.8996	0.0132	0.0112
23 (HC)	0.8649	0.8830	0.0150	0.0130
24 (HD)	1.1716	1.1950	0.0000	0.0000

Table II.8: Annual Frequency of Collapse for East Tower Pier with H_p = 7170 kips.

Category	Flotilla Frequency (N)	Probability of Aberrancy (PA)	Geometric Probability (PG)	Probability of Collapse (PC)	Annual Frequency (AF)	Summation of Annual Frequency
6 (BB)	4	1.7704×10^{-4}	0.1012	0.0000	0.0000	0.0000
7 (BC)	105	1.7704×10^{-4}	0.0938	0.0023	3.970×10^{-6}	3.970×10^{-6}
10 (CC)	46	1.7704×10^{-4}	0.1183	0.0000	0.0000	3.970×10^{-6}
12 (DB)	25	1.7704×10^{-4}	0.0348	0.0000	0.0000	3.970×10^{-6}
13 (DC)	2076	1.7704×10^{-4}	0.0953	0.0000	0.0000	3.970×10^{-6}
14 (DD)	1	1.7704×10^{-4}	0.0829	0.0000	0.0000	3.970×10^{-6}
16 (EB)	1	1.7704×10^{-4}	0.0335	0.0000	0.0000	3.970×10^{-6}
17 (EC)	195	1.7704×10^{-4}	0.0961	0.0000	0.0000	3.970×10^{-6}
19 (FC)	5	1.7704×10^{-4}	0.1111	0.0098	9.593×10^{-7}	4.929×10^{-6}
21 (GC)	205	1.7704×10^{-4}	0.1077	0.0132	5.175×10^{-5}	5.668×10^{-5}
23 (HC)	5	1.7704×10^{-4}	0.0994	0.0150	1.321×10^{-6}	5.800×10^{-5}
24 (HD)	19	1.7704×10^{-4}	0.0757	0.0000	0.0000	5.800×10^{-5}

Table II.9: Annual Frequency of Collapse for West Tower Pier with H_p = 7170 kips.

Category	Flotilla Frequency (N)	Probability of Aberrancy (PA)	Geometric Probability (PG)	Probability of Collapse (PC)	Annual Frequency (AF)	Summation of Annual Frequency
6 (BB)	4	1.7704×10^{-4}	0.1012	0.0000	0.0000	0.0000
7 (BC)	105	1.7704×10^{-4}	0.0938	0.0000	0.0000	0.0000
10 (CC)	46	1.7704×10^{-4}	0.1183	0.0000	0.0000	0.0000
12 (DB)	25	1.7704×10^{-4}	0.0348	0.0000	0.0000	0.0000
13 (DC)	2076	1.7704×10^{-4}	0.0953	0.0000	0.0000	0.0000
14 (DD)	1	1.7704×10^{-4}	0.0829	0.0000	0.0000	0.0000
16 (EB)	1	1.7704×10^{-4}	0.0335	0.0000	0.0000	0.0000
17 (EC)	195	1.7704×10^{-4}	0.0961	0.0000	0.0000	0.0000
19 (FC)	5	1.7704×10^{-4}	0.1111	0.0076	7.521×10^{-7}	7.521×10^{-7}
21 (GC)	205	1.7704×10^{-4}	0.1077	0.0112	4.359×10^{-5}	4.435×10^{-5}
23 (HC)	5	1.7704×10^{-4}	0.0994	0.0130	1.144×10^{-6}	4.549×10^{-5}
24 (HD)	19	1.7704×10^{-4}	0.0757	0.0000	0.0000	4.549×10^{-5}

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1. INTRODUCTION

The 1993 collapse of a Louisiana railroad bridge killing 44 people after being struck by a barge flotilla (Lexington Herald-Leader, July 18, 1993) is a typical example of the vulnerability of bridges to vessel (barge or ship) impact loads. Not only can a bridge collapse result in the loss of life, but it may also cause an impasse for automobiles and commercial vehicles resulting in great economic loss for the community.

The Louisiana railroad bridge collapse is not an isolated incident of bridge collapse due to barge flotilla collision or impact. In addition to the event described above, two major bridges over the Ohio River near Cincinnati were struck by barges on November 22, 1993, causing one of them to be closed for several days while repairs were completed.

A large number of bridges are designed each year to resist ship impact loads using the *AASHTO Guide Specification and Commentary for Vessel Collision Design of Highway Bridges* (reference 4). The guide specification provides three vessel impact design methods, called Methods I, II, and III. Most bridges are designed using Method I when determining the design vessel since it is simple and easy to use; however, this method may result in expensive and overly conservative design.

Although Method II is much more difficult to apply then Method I, it is recommended by the *AASHTO Guide Specification* for most bridges and should lead to more economical designs. However, in order to apply this method, detailed data collection and analysis are required. In addition, the code is oriented towards the design of bridges for ship impact rather than for impact from barges. Barges are the primary type of vessels using the navigable inland waterways of Kentucky. Figures 1.1 and 1.2 illustrate typical barge flotillas that travel on the Ohio River.

This report provides the information necessary to apply design Method II to the navigable inland waterways of Kentucky, namely the Ohio, Tennessee, Cumberland, Green, and Kentucky Rivers. Figures 1.3 and 1.4 illustrate the design flow chart for vessel collision design of bridges using Method II as presented in the *AASHTO Guide Specification*. Although no barge traffic along the Kentucky River is reported by the Performance Monitoring System Database of the U.S. Army Corps of Engineers, barge traffic along this river does exist. Therefore, it is included in this report and should at least be considered in the design for impact due to a flotilla composed of three barges in a single column.

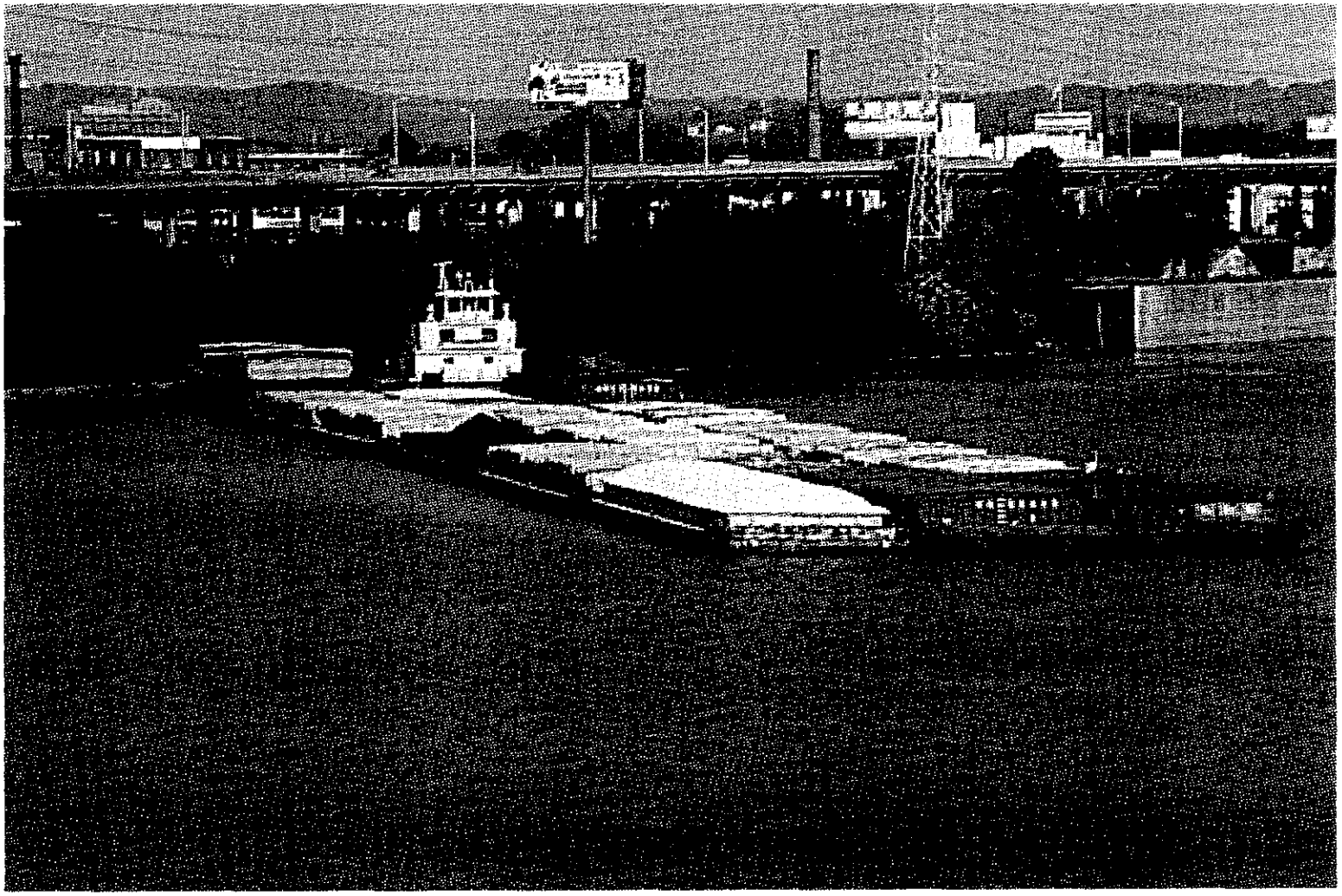


Figure 1.1: Barge Flotilla Emerging from Lock in Louisville, Kentucky.

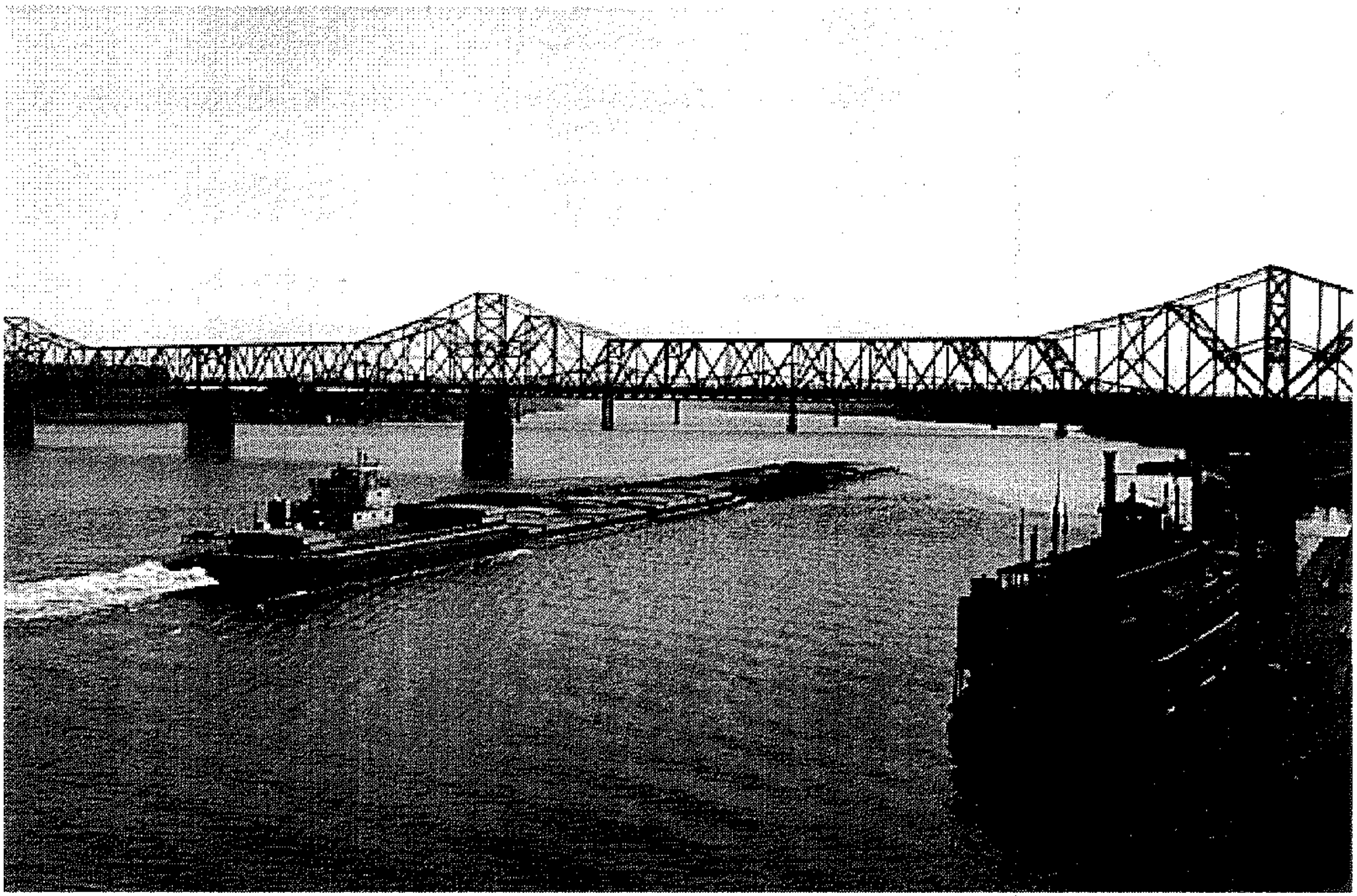


Figure 1.2: Barge Flotilla Passing Under the George Rogers Clark Memorial Bridge in Louisville, Kentucky.

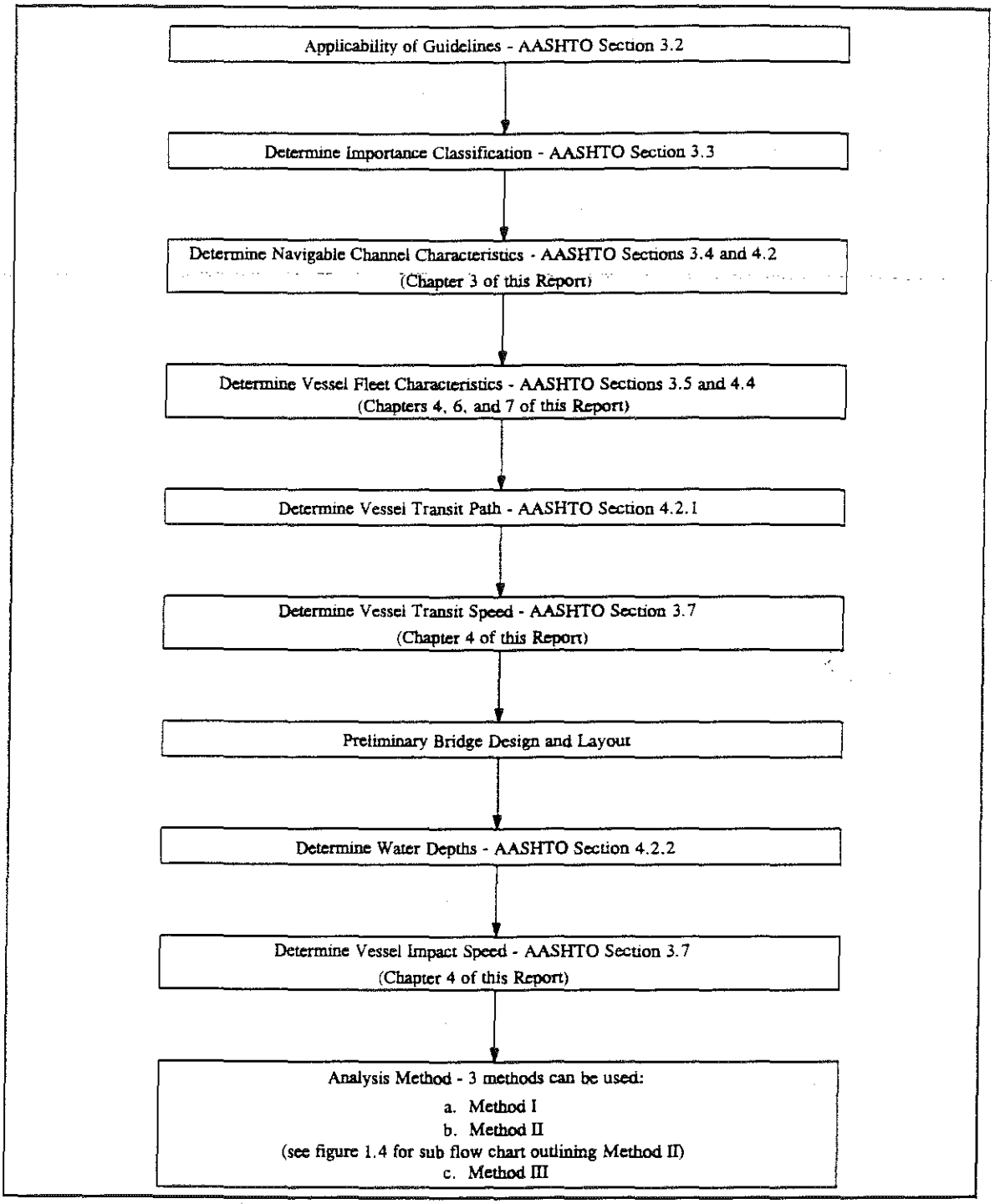


Figure 1.3: Design Procedure Flow Chart (Modified After *AASHTO Guide Specification for Vessel Collision Design of Highway Bridges*).

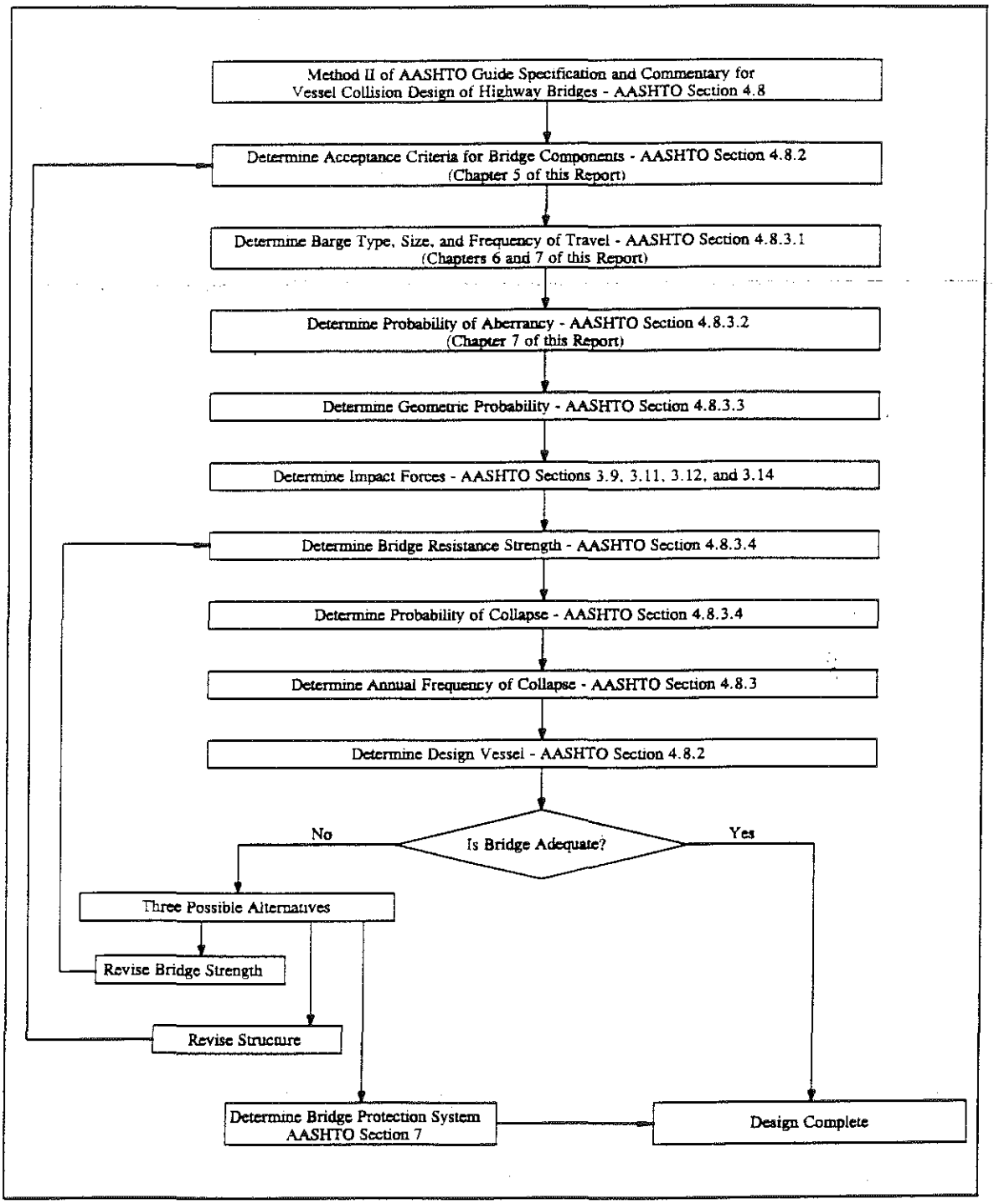


Figure 1.4: **Sub Flow Chart for Method II (Modified After *AASHTO Guide Specification for Vessel Collision Design of Highway Bridges*).**

2. Data Collection

The data included in this report are in accordance with the *AASHTO Guide Specification and Commentary for Vessel Collision Design of Highway Bridges*. The results generated are based on statistical data obtained from the U.S. Coast Guard, the U.S. Army Corps of Engineers, and the American Waterways Operators, and are necessary to apply design Method II of the guide specification. Specifically, the data are needed to calculate: the probability of aberrancy, the size and tonnages of the barges using the waterways, the flotilla category distributions, the number of barges in the flotilla column and row, and the waterway elevation profiles. Most of the databases required to obtain this information were not released to the University of Kentucky because of the size and complexity of the data files. Consequently data queries were conducted and the results were sent to the University of Kentucky on computer disks or printouts. Therefore, the responsibility for maintaining or updating the data must lie with the engineer since specific queries must be processed by the appropriate agency. Addresses and telephone numbers of the contributing agencies are listed in Figures 2.1 through 2.7 of this report.

In order to calculate the probability of aberrancy on Kentucky waterways in accordance with the *AASHTO Guide Specification*, long-term vessel casualty (accident) data were required. The U.S. Coast Guard, Marine Safety Evaluation Branch, Washington, D.C., has maintained a database on vessel casualties for the past 11 years for Kentucky waterways. The database contains casualty reports for all vessel types operating on the waterway system, including barge tows. In addition, the database gives the nature of the casualty, i.e. collision, grounding, etc.

A data query was conducted by the U.S. Coast Guard computer specialists for the University of Kentucky under the Freedom of Information Act. From this information the probability of aberrancy for particular segments of the Kentucky waterway system was determined. This is shown diagrammatically in Figure 2.1.

The information necessary to calculate the flotilla category distributions and the number of barges in the flotilla columns or rows was provided by the U.S. Coast Guard Navigation Data Center, Washington, D.C., from the Performance Monitoring System database. The purpose of the database is to track the efficiency of movement of cargo by barge along the U.S. inland waterway system. Data collection points for the database are located at the locks on the waterway system.

The information provided in the database is the annual cumulative number of barges categorized by the U.S. Army Corps of Engineers classification system and the

sizes and frequencies of the flotillas traveling on the waterways. From the information provided in the database, the flotilla frequency distribution by category, and the number of barges to be assigned to the flotilla column and row were calculated. This is illustrated in Figures 2.2 and 2.3.

The database was not released to the University of Kentucky because of the size and complexity of the data files. All data queries were conducted by the U.S. Army Corps of Engineers' computer specialists with results sent to the University of Kentucky on computer disks; generally requiring five to six MBytes of storage. Computer programs were then written to process the query results and conduct a statistical analysis on the data.

In addition to maintaining the Performance Monitoring System Database, the Navigation Data Center annually conducts a statistical analysis of the barge traffic on the U.S. waterway system. Among the results of the analysis are the average upbound cargo capacity, average downbound cargo capacity, and the average percentage change in total barge traffic at each of the data collection points on the U.S. waterways. Average upbound and downbound capacities, and changes in barge traffic were collected for Kentucky waterways for the most recent years of 1992 and 1993.

Barge type tonnages and sizes were calculated using the information contained in the Waterborne Commerce of the United States database. This database is maintained by the U.S. Army Corps of Engineers' Waterborne Commerce Office in New Orleans, LA, and was released to the University of Kentucky under the Freedom of Information Act. The database requires approximately 7.2 MBytes of computer storage and comes as a formatted ASCII (FASCII) file. A computer program was written to process and conduct a statistical analysis of the data in order to assign barge sizes and tonnages to the 24 barge types. The information flow is shown in Figure 2.4.

The elevations for the rivers of Kentucky were provided by the U.S. Army Corps District Engineers. Figure 2.5 lists the three district engineers who provided information for all of Kentucky's waterways. It should be noted that the Nashville District Office was assisted by the Tennessee Valley Authority. The river elevations for the normal pool, 2%, Q_{50}, Q_{100}, and Q_{500} flow conditions were sought for all of Kentucky's navigable rivers. However, for some sections of the Kentucky and Cumberland Rivers, complete data records were not maintained and the information was not available from any known source.

The American Waterways Operators and the U.S. Coast Guard Captain of the Port, Louisville, KY, provided various records on barge transit speeds, typical flotilla sizes, barge draft depths, etc. This is depicted in Figures 2.6 and 2.7.

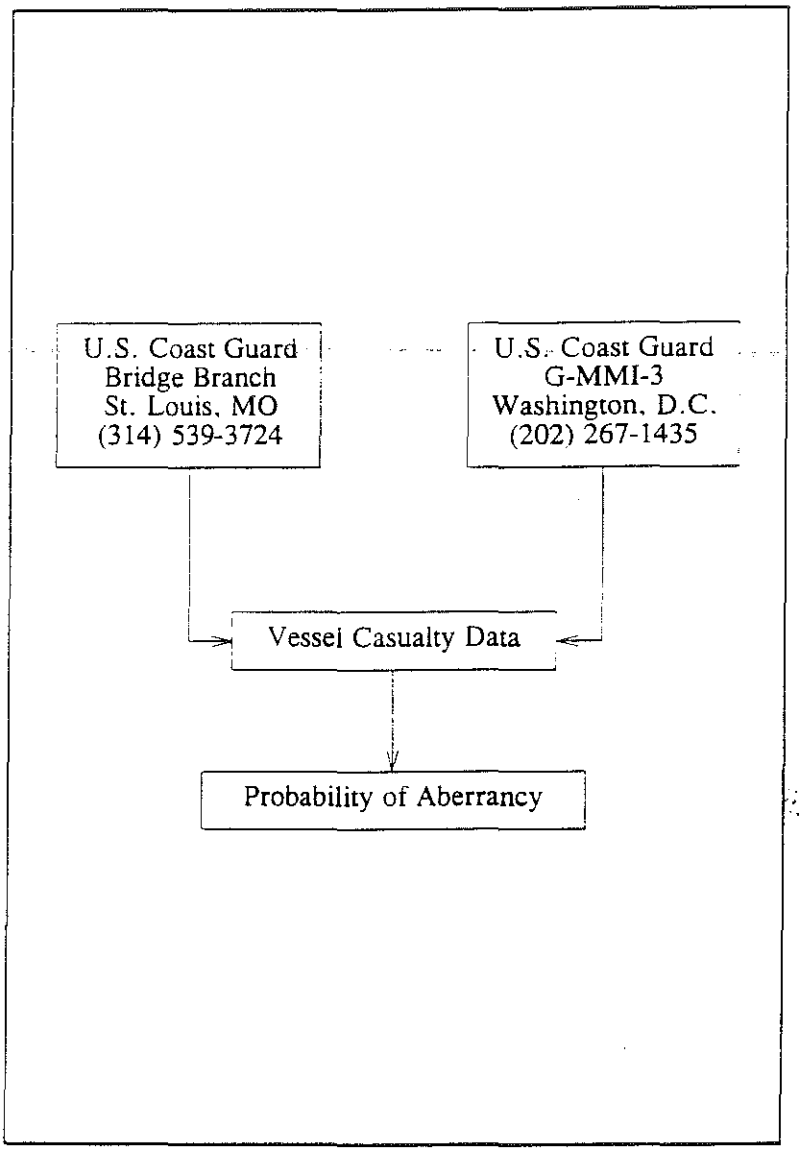


Figure 2.1: Probability of Aberrancy Data Collection Flow Chart.

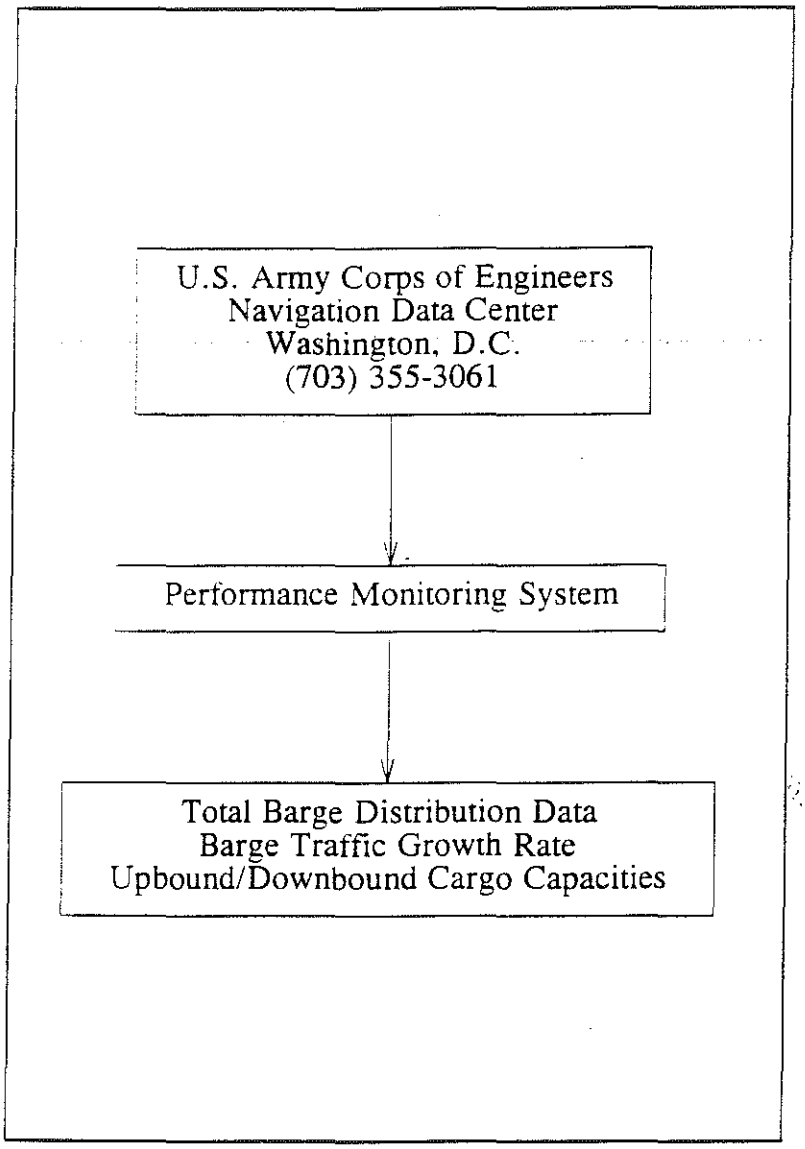


Figure 2.2: Total Barge Distribution Data Collection Flow Chart.

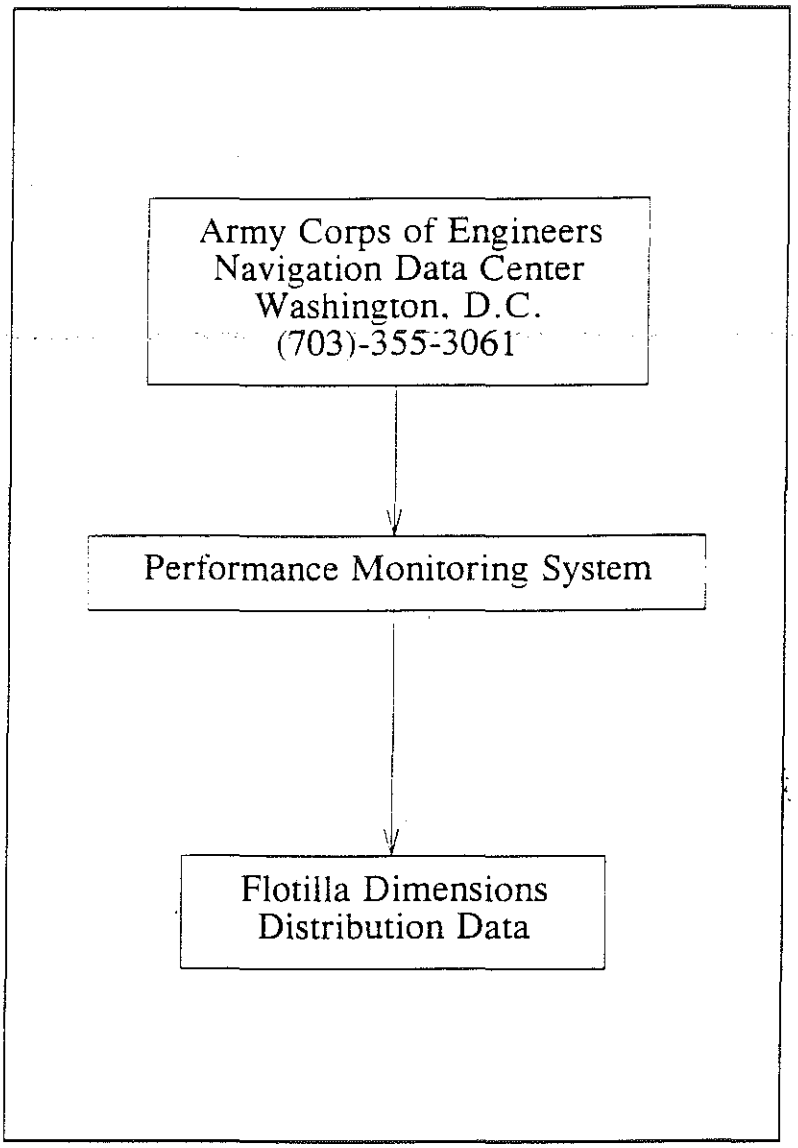


Figure 2.3: Flotilla Dimensions Data Collection Flow Chart.

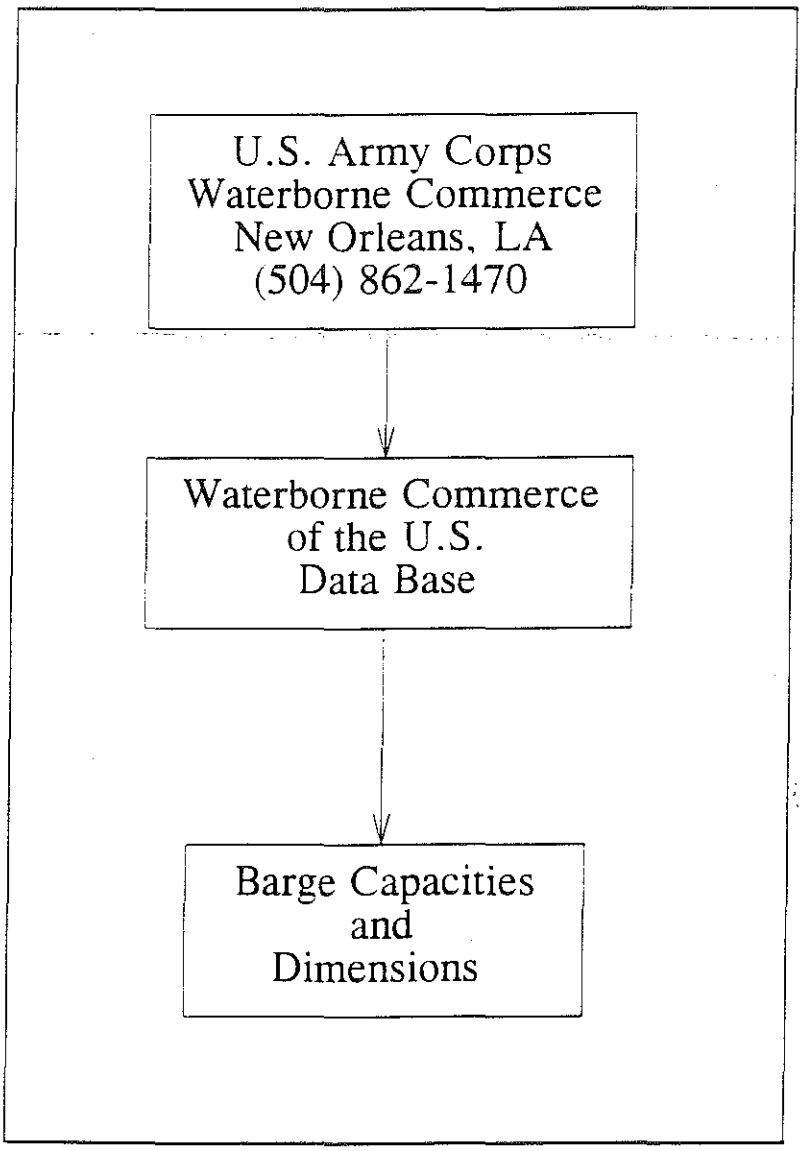


Figure 2.4: Barge Capacities and Dimensions Data Collection Flow Chart.

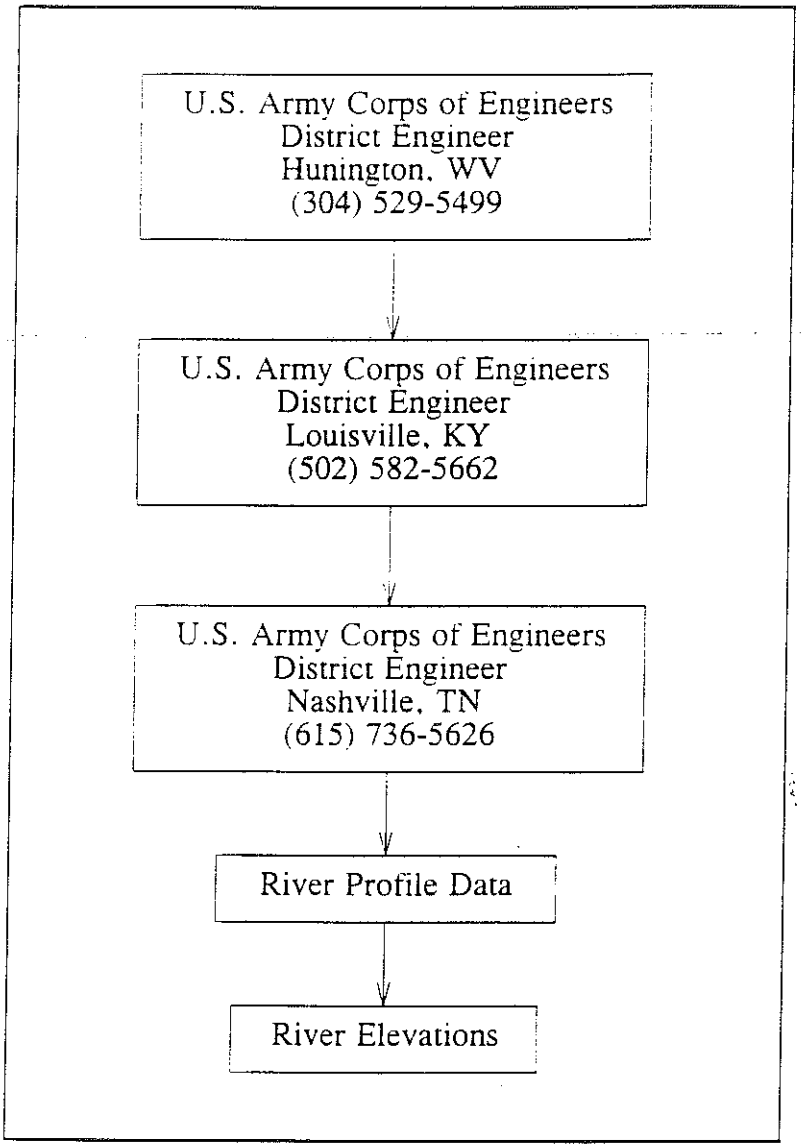


Figure 2.5: River Elevations Data Collection Flow Chart.

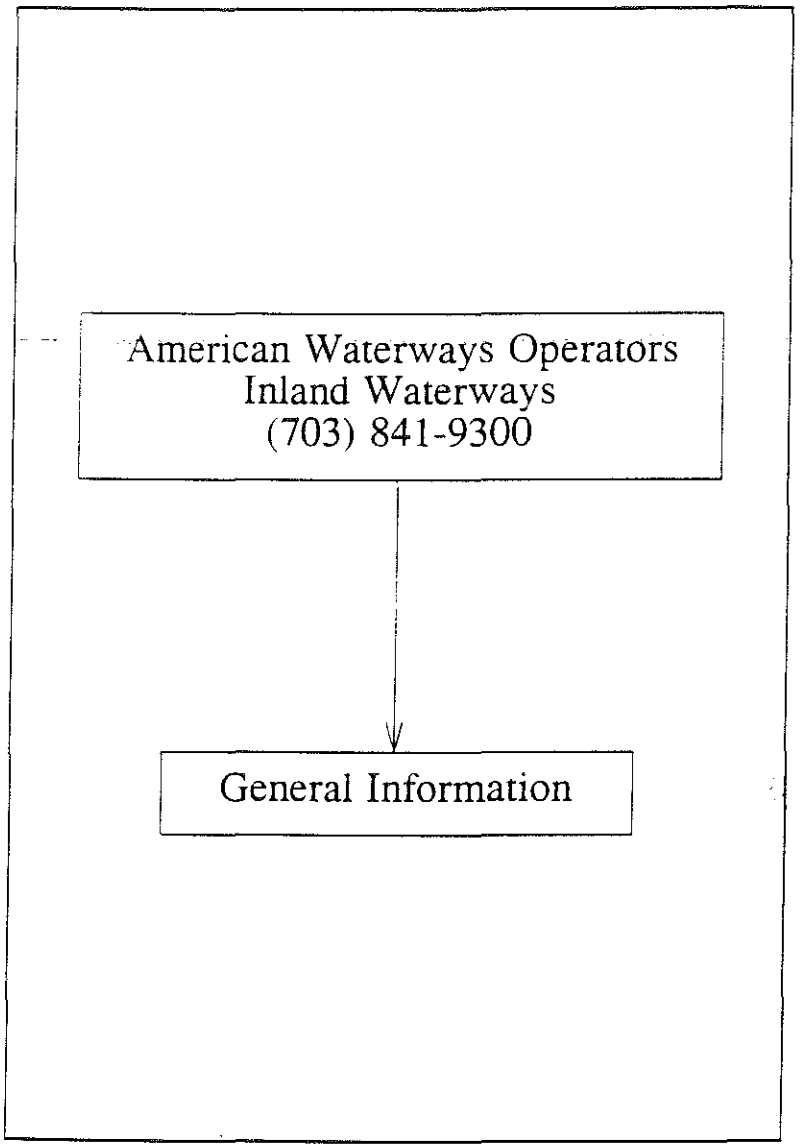


Figure 2.6: General Information Data Collection Flow Chart.

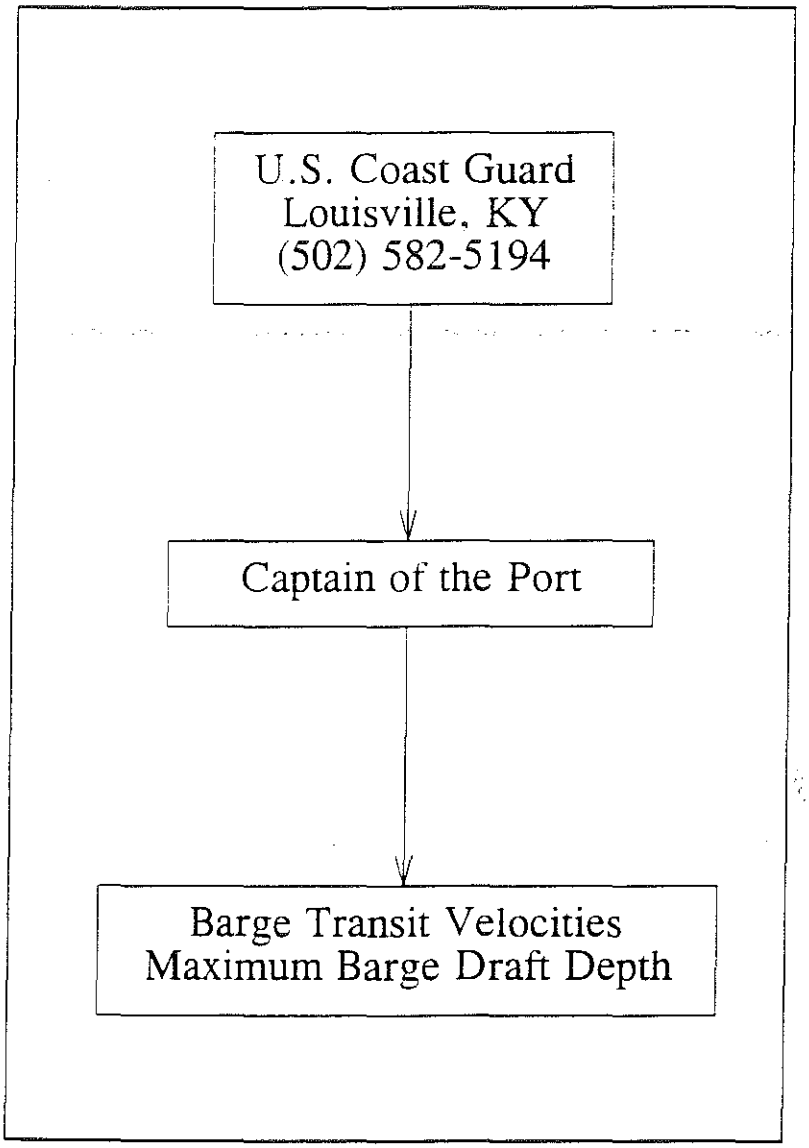


Figure 2.7: Barge Transit Velocities Data Collection Flow Chart.

3. River Elevations

The *AASHTO Guide Specification and Commentary for Vessel Collision Design of Highway Bridges* appears to require that the barge impact loads be applied at the river 2% flow elevation. As determined from daily river flow data, the 2% flow elevation is the elevation the river exceeds just 2% of the time. The normal pool, 2% flow, Q_{50}, Q_{100}, and Q_{500} elevations are reported at regular intervals along most of the navigable inland waterways in Kentucky, as shown in Tables 3.1 through 3.5. The river elevations were provided by the U.S. Army Corps of Engineers district offices in Louisville, KY, Nashville, TN, and Huntington, WV. The Tennessee Valley Authority (TVA) assisted the Nashville District Office in obtaining the requested information. The river elevations for the normal pool, 2%, Q_{50}, Q_{100} and Q_{500} flow conditions were sought for all of the rivers in Kentucky that supported barge traffic. However, for some sections of the Kentucky and Cumberland Rivers, complete data records were not maintained and the information was not available from any known source.

Table 3.1: River Elevation Data for the Ohio River

miles below Pittsburgh	normal pool (ft)	2% flow (ft)	Q_{50} (ft)	Q_{100} (ft)	Q_{500} (ft)
mouth	296.0	318.0	329.0	330.5	333.0
975.0	297.0	319.0	329.0	330.5	333.0
970.0	302.0	320.0	329.0	331.5	333.0
965.0	302.0	321.0	330.0	332.5	334.0
960.0	302.0	322.0	331.5	333.5	335.5
955.0	303.0	323.0	332.5	334.5	337.0
950.0	303.0	323.0	333.5	336.0	338.5
945.0	303.0	325.0	334.5	337.0	339.5
940.0	303.0	325.0	336.0	338.0	341.0
935.0	304.0	326.0	337.0	339.5	342.5
930.0	305.0	328.0	338.5	341.0	344.0
925.0	306.0	329.0	339.5	342.0	345.0
920.0	307.0	331.0	341.0	343.5	347.0
915.0	324.0	332.0	344.0	346.0	350.0
910.0	324.0	333.0	346.5	348.5	352.5
905.0	325.0	335.0	348.5	350.5	354.0
900.0	325.0	337.0	351.0	353.0	357.0
895.0	325.0	338.0	353.0	355.0	359.0
890.0	326.0	340.0	355.5	358.0	362.5

Table 3.1 (continued): River Elevation Data for the Ohio River

miles below Pittsburgh	normal pool (ft)	2% flow (ft)	Q_{50} (ft)	Q_{100} (ft)	Q_{500} (ft)
885.0	327.0	341.0	357.5	359.5	364.0
880.0	327.0	343.0	359.0	361.5	366.0
875.0	327.0	344.0	360.5	363.0	368.0
870.0	328.0	346.0	362.0	364.5	369.0
865.0	329.0	347.0	364.0	366.0	371.0
860.0	330.0	349.0	365.0	367.0	372.0
855.0	330.0	351.0	366.0	368.5	373.0
850.0	331.0	352.0	366.5	369.0	373.5
845.0	342.0	353.0	367.5	369.5	374.0
840.0	343.0	355.0	368.5	370.5	374.0
835.0	343.0	356.0	369.0	371.0	375.0
830.0	344.0	358.0	369.5	371.5	375.5
825.0	345.0	359.0	371.0	372.5	376.5
820.0	345.0	361.0	371.5	373.0	377.0
815.0	345.0	362.0	372.5	374.0	378.0
810.0	346.0	364.0	373.5	375.0	378.0
805.0	346.0	365.0	374.5	376.5	378.5
800.0	347.0	367.0	375.5	377.0	379.0
795.0	347.0	369.0	376.0	378.0	380.0

Table 3.1 (continued): River Elevation Data for the Ohio River

miles below Pittsburgh	normal pool (ft)	2% flow (ft)	Q_{50} (ft)	Q_{100} (ft)	Q_{500} (ft)
790.0	348.0	370.0	377.0	378.5	380.5
785.0	349.0	371.0	378.0	380.0	381.5
780.0	350.0	373.0	380.0	381.5	383.0
775.0	358.0	374.0	381.5	383.0	385.5
770.0	358.0	376.0	383.0	384.5	387.5
765.0	358.0	377.0	385.0	386.5	389.5
760.0	358.0	379.0	386.5	388.0	391.0
755.0	359.0	380.0	388.5	390.0	393.0
750.0	359.0	381.0	390.0	391.0	394.0
745.0	360.0	383.0	391.5	393.0	396.0
740.0	361.0	384.0	393.0	394.5	397.5
735.0	362.0	385.0	395.0	396.5	399.5
730.0	363.0	387.0	397.0	398.5	402.0
725.0	363.0	389.0	399.0	400.5	404.0
720.0	383.0	390.0	401.0	402.5	406.0
715.0	383.0	391.0	403.5	405.0	409.0
710.0	383.0	393.0	406.0	408.0	412.0
705.0	384.0	395.0	408.5	410.5	415.0
700.0	384.0	396.0	411.0	413.0	417.5

Table 3.1 (continued): River Elevation Data for the Ohio River

miles below Pittsburgh	normal pool (ft)	2% flow (ft)	Q_{50} (ft)	Q_{100} (ft)	Q_{500} (ft)
695.0	384.0	398.0	413.5	416.0	420.5
690.0	384.0	399.0	416.0	418.0	423.0
685.0	385.0	401.0	417.5	420.0	425.0
680.0	385.0	402.0	420.5	423.0	428.0
675.0	385.0	403.0	423.0	425.5	431.0
670.0	386.0	405.0	425.0	428.0	433.0
665.0	386.0	406.0	428.0	430.5	436.0
660.0	387.0	408.0	429.5	432.0	438.0
655.0	387.0	409.0	431.0	434.0	439.5
650.0	388.0	411.0	433.0	435.5	441.5
645.0	388.0	413.0	434.5	437.0	443.0
640.0	388.0	414.0	436.0	439.0	445.0
635.0	389.0	415.0	438.5	441.0	447.5
630.0	389.0	417.0	440.0	443.0	449.0
625.0	390.0	419.0	441.0	444.0	450.0
620.0	390.0	420.0	442.0	445.0	451.0
615.0	391.0	421.0	443.5	446.5	452.5
610.0	391.0	423.0	444.5	447.5	453.5
605.0	420.0	425.0	447.0	450.0	455.0

Table 3.1 (continued): River Elevation Data for the Ohio River

miles below Pittsburgh	normal pool (ft)	2% flow (ft)	Q_{50} (ft)	Q_{100} (ft)	Q_{500} (ft)
600.0	420.0	426.0	448.5	451.0	456.0
595.0	421.0	428.0	450.0	452.5	457.5
590.0	421.0	430.0	451.0	453.5	458.5
585.0	421.0	432.0	452.5	455.0	460.0
580.0	421.0	434.0	453.5	456.0	461.5
575.0	422.0	436.0	455.5	458.0	463.0
570.0	422.0	437.0	457.5	460.0	465.0
565.0	422.0	439.0	459.0	461.5	467.0
560.0	422.0	441.0	461.0	463.5	469.0
555.0	423.0	443.0	462.5	465.0	470.5
550.0	423.0	445.0	464.0	467.0	472.5
545.0	423.0	447.0	466.0	468.5	474.0
540.0	424.0	449.0	468.0	470.5	476.0
535.0	425.0	451.0	469.5	472.0	477.5
530.0	455.0	453.0	471.0	474.0	479.5
525.0	455.0	455.0	473.0	475.5	481.5
520.0	455.0	457.0	475.0	478.0	484.0
515.0	455.0	458.0	477.0	480.0	486.0
510.0	455.0	460.0	479.0	482.0	488.0

Table 3.1 (continued): River Elevation Data for the Ohio River

miles below Pittsburgh	normal pool (ft)	2% flow (ft)	Q_{50} (ft)	Q_{100} (ft)	Q_{500} (ft)
505.0	456.0	462.0	481.0	484.0	490.5
500.0	456.0	464.0	483.0	486.0	492.0
495.0	456.0	466.0	485.5	488.5	495.0
490.0	456.0	468.0	487.5	491.0	497.0
485.0	457.0	470.0	489.5	492.5	499.0
480.0	457.0	472.0	491.0	494.5	501.0
475.0	457.0	473.0	493.0	496.0	502.5
470.0	458.0	475.0	495.5	498.5	505.5
465.0	458.0	477.0	497.5	500.5	507.5
460.0	459.0	479.0	499.0	502.5	509.5
455.0	460.0	481.0	500.5	503.5	510.5
450.0	461.0	482.0	501.5	504.5	511.5
445.0	462.0	484.0	502.5	505.0	512.5
440.0	463.0	486.0	503.5	506.5	513.5
435.0	485.0	487.0	504.5	507.5	514.0
430.0	485.0	489.0	506.0	509.0	elevations were not available
425.0	485.0	491.0	507.5	511.0	
420.0	486.0	493.0	509.0	512.5	
415.0	486.0	494.0	510.5	514.0	

Table 3.1 (continued): River Elevation Data for the Ohio River

miles below Pittsburgh	normal pool (ft)	2% flow (ft)	Q_{50} (ft)	Q_{100} (ft)	Q_{500} (ft)
410.0	486.0	496.0	512.5	515.5	elevations were not available
405.0	486.0	498.0	514.5	517.0	
400.0	487.0	499.0	516.0	518.5	
395.0	487.0	501.0	517.0	520.5	
390.0	488.0	503.0	518.5	522.0	
385.0	488.0	505.0	521.0	524.0	
380.0	488.0	507.0	523.0	526.0	
375.0	489.0	508.0	525.5	528.5	
370.0	490.0	510.0	527.5	530.5	
365.0	490.0	512.0	529.5	532.0	
360.0	491.0	514.0	532.0	534.0	
355.0	491.0	515.0	533.5	536.0	
350.0	492.0	517.0	535.0	537.5	
345.0	493.0	519.0	537.0	539.5	
340.0	515.0	521.0	539.0	541.0	
335.0	515.0	523.0	540.5	543.0	
330.0	515.0	525.0	542.5	544.5	
325.0	516.0	527.0	544.5	546.5	
320.0	516.0	529.0	546.0	548.5	

Table 3.2: River Elevation Data for the Tennessee River

miles above mouth	normal pool (ft)	2% flow (ft)	Q_{50} (ft)	Q_{100} (ft)	Q_{500} (ft)
mouth[a]	304.0	326.0	337.0	339.5	342.5
5.30	elevations were not available	330.4	340.1	341.5	344.4
21.60		331.6	343.1	344.9	349.1
22.35		331.9	343.5	345.4	349.5
22.35 to 62.40	359.0	362.3	372.5	375.0	375.0

[a] the mouth of the Tennessee River is at mile 934.4 of the Ohio River.

Table 3.3: River Elevation Data for the Cumberland River

miles above mouth	normal pool (ft)	2% flow (ft)	Q_{50} (ft)	Q_{100} (ft)	Q_{500} (ft)
mouth[a]	306.0	330.0	340.0	343.0	346.0
31.9	elevations were not available		354.0	354.0	elevations were not available
38.7			356.0	356.5	
46.3			358.2	359.2	
52.6			359.8	361.0	
58.1			361.2	362.6	
63.1			362.4	363.9	
70.8			365.0	366.8	
77.0			367.1	369.1	
148			elevations were not available		
216					

[a] the mouth of the Cumberland River is at mile 922.5 of the Ohio River.

Table 3.4: River Elevation Data for the Green River

miles above mouth	normal pool (ft)	2% flow (ft)	Q_{50} (ft)	Q_{100} (ft)	Q_{500} (ft)
mouth[a]	349.0	372.0	378.5	380.0	382.0
36.0	349.0	elevations were not available	381.0	384.0	385.0
40.0	349.0		382.0	385.0	386.0
44.0	349.0		382.0	385.0	386.0
48.0	349.0		383.0	386.0	387.0
52.0	349.0		384.0	386.0	387.0
56.0	349.0		385.0	387.0	388.0
60.0	349.0		387.0	388.0	390.0
64.0	363.0		388.0	389.0	391.0
68.0	363.0		389.0	390.0	392.0
72.0	363.0		391.0	392.0	394.0
76.0	363.0		392.0	393.0	396.0
80.0	363.0		394.0	395.0	398.0
84.0	363.0		396.0	397.0	400.0
88.0	363.0		397.0	398.0	401.0
92.0	363.0		398.0	399.0	402.0
96.0	363.0		399.0	400.0	403.0
100.0	363.0		400.0	401.0	404.0
104.0	363.0		401.0	402.0	404.0
108.0	363.0		401.0	402.0	405.0

[a] the mouth of the Green River is at mile 784.2 of the Ohio River.

Table 3.4 (continued): River Elevation Data for the Green River

miles above mouth	normal pool (ft)	2% flow (ft)	Q_{50} (ft)	Q_{100} (ft)	Q_{500} (ft)
112.0	379.9	elevations were not available	403.0	404.0	406.0
116.0	379.9		405.0	406.0	408.0
120.0	379.9		408.0	409.0	411.0
124.0	379.9		410.0	411.0	414.0
128.0	379.9		412.0	413.0	416.0
132.0	379.9		413.0	414.0	417.0
136.0	379.9		414.0	415.0	418.0
140.0	379.9		416.0	417.0	420.0
144.0	379.9		418.0	420.0	423.0
148.0	379.9		421.0	422.0	425.0
152.0	396.1		423.0	424.0	428.0
156.0	396.1		426.0	428.0	431.0
160.0	396.1		430.0	431.0	434.0
164.0	396.1		432.0	434.0	437.0
168.0	411.0		434.0	436.0	439.0
172.0	411.0		439.0	441.0	445.0
176.0	411.0		442.0	444.0	448.0
180.0	411.0		445.0	447.0	452.0

Table 3.5: River Elevation Data for the Kentucky River

miles above mouth	normal pool (ft)	2% flow (ft)	Q_{50} (ft)	Q_{100} (ft)	Q_{500} (ft)
mouth[a]	423.0	447.0	465.8	468.3	473.9
4.0	elevations were not available		468.0	470.0	475.0
8.0			471.0	473.0	477.0
12.0			472.0	474.0	479.0
16.0			476.0	478.0	483.0
20.0			478.0	480.0	484.0
24.0			481.0	483.0	487.0
28.0			484.0	486.0	489.0
32.0			486.0	488.0	491.0
36.0			488.0	490.0	494.0
40.0			491.0	493.0	496.0
44.0			493.0	495.0	499.0
48.0			496.0	498.0	501.0
52.0			498.0	500.0	504.0
56.0			501.0	502.0	506.0
60.0			503.0	505.0	508.0
64.0			505.0	507.0	511.0
68.0			508.0	510.0	514.0
72.0			511.0	513.0	517.0

[a] the mouth of the Kentucky River is at mile 545.8 of the Ohio River.

Table 3.5 (continued): River Elevation Data for the Kentucky River

miles above mouth	normal pool (ft)	2% flow (ft)	Q_{50} (ft)	Q_{100} (ft)	Q_{500} (ft)
76.0	elevations were not available		514.0	516.0	520.0
80.0			518.0	520.0	523.0
84.0			521.0	523.0	527.0
88.0			525.0	527.0	531.0
92.0			528.0	531.0	535.0
96.0			532.0	534.0	539.0
100.0			535.0	538.0	542.0
104.0			538.0	541.0	545.0
108.0			542.0	544.0	548.0
112.0			545.0	547.0	551.0
116.0			548.0	550.0	554.0
120.0			552.0	554.0	558.0
124.0			555.0	557.0	561.0
128.0			558.0	560.0	563.0
132.0			561.0	563.0	567.0
136.0			564.0	566.0	569.0
140.0			566.0	568.0	572.0
144.0			570.0	572.0	575.0
148.0			573.0	575.0	578.0

Table 3.5 (continued): River Elevation Data for the Kentucky River

miles above mouth	normal pool (ft)	2% flow (ft)	Q_{50} (ft)	Q_{100} (ft)	Q_{500} (ft)
152.0	elevations were not available		576.0	578.0	581.0
156.0			579.0	581.0	584.0
160.0			582.0	584.0	587.0
164.0			585.0	586.0	589.0
168.0			587.0	589.0	592.0
172.0			590.0	592.0	595.0
176.0			592.0	594.0	597.0
180.0			596.0	598.0	600.0
184.0			600.0	602.0	604.0
188.0			603.0	604.0	607.0
192.0			607.0	608.0	610.0
196.0			610.0	611.0	613.0
200.0			613.0	614.0	616.0
204.0			618.0	619.0	621.0
208.0			621.0	622.0	625.0
212.0			624.0	625.0	627.0
216.0			627.0	628.0	630.0
220.0			629.0	631.0	633.0
224.0			633.0	634.0	636.0

Table 3.5 (continued): River Elevation Data for the Kentucky River

miles above mouth	normal pool (ft)	2% flow (ft)	Q_{50} (ft)	Q_{100} (ft)	Q_{500} (ft)
228.0	elevations were not available		635.0	636.0	638.0
232.0			639.0	640.0	642.0
236.0			643.0	644.0	647.0
240.0			647.0	649.0	651.0
244.0			652.0	654.0	657.0
248.0			658.0	660.0	664.0
252.0			666.0	668.0	671.0
256.0			670.0	672.0	675.0

4. Flotilla Velocity

Per AASHTO terminology, flotilla velocity is defined as the speed a flotilla can achieve if the river velocity is zero (transit velocity minus the river velocity). The maximum velocity is dependent on many factors including the power of the tow boat, the number and size of the individual barges in the flotilla. and the size of the load in each barge. Since there are so many variations possible for these factors, a logical approach to determining the barge velocity at a particular bridge site is to physically measure the barge transit velocity and subtract the river velocity.

A second approach is to use a conservative upper bound velocity that would represent the maximum attainable speed for a fully loaded (or nearly fully loaded) flotilla traveling under ideal conditions. Table 4.1 gives the maximum attainable speeds for fully loaded flotillas under ideal conditions as determined by a survey of the U.S. Coast Guard and the barge operators. Presently, there is no available data about barge traffic on the Kentucky River reported by the Performance Monitoring System Database, but barge traffic does exist along this river. Therefore, the minimum value of 5 mph in the table is warranted for use as the velocity for flotillas traveling on the Kentucky River.

Though the upper bound approach leads to conservative results, it may be overly conservative when the structure is located on a section of a river where the flotilla must reduce speed in order to maintain control. For these cases, it may be desirable to survey the U.S. Coast Guard to determine the usual transit speeds at the bridge location or to physically measure the transit velocity and deduct the river velocity at the time of measurement. It should be noted that the use of the term "flotilla velocity" to describe the speed a flotilla may obtain when the river velocity is zero is consistent with AASHTO terminology. However, it conflicts with the terminology adopted by the U.S. Coast Guard, which defines "flotilla transit velocity" as the speed a flotilla may obtain on still water.

Table 4.1: Flotilla Velocity for Kentucky Rivers

River	Flotilla Velocity (mph)
Ohio	7
Tennessee	7
Cumberland	5
Green	5
Kentucky	5[a]

[a] The Performance Monitoring System database currently does not record barge traffic on the Kentucky River, although it does exist. Therefore, the minimum value of 5 mph in the table is recommended for use.

5. Design Barge Acceptance Criteria

Method II of the *AASHTO Guide Specification* is a probabilistic design methodology. In this method, the possibility that a barge flotilla impact with a bridge will cause failure is deemed acceptable provided the probability of the failure of the bridge is extremely low. Section 4.8.2 of the *AASHTO Guide Specification* recommends that the design flotilla be selected in accordance with the following acceptance criteria for the total bridge:

- **CRITICAL BRIDGES.** The acceptable annual frequency of collapse, AF_c, of critical bridges shall be equal to, or less than, 0.01 in 100 years ($AF = AF_c = 0.0001$).

- **REGULAR BRIDGES.** The acceptable annual frequency of collapse, AF_r, of regular bridges shall be equal to, or less than, 0.1 in 100 years ($AF = AF_r = 0.001$).

It is recommended that the definition of a **critical bridge** be the same as the definition of an **essential bridge** as given in the *FHWA Seismic Retrofitting Manual For Highway Bridges* (reference 9). An **essential bridge**, as defined in the *Retrofitting Manual*, satisfies one or more of the following conditions:

- a bridge that is required to provide secondary life safety; e.g., a bridge that provides access to local emergency services such as hospitals. This category also includes those bridges that cross routes which provide secondary life safety, and bridges that carry lifelines such as electric power and water supply pipelines;

- a bridge whose loss would create a major economic impact; e.g., a bridge that serves as a major link in a transportation system;

- a bridge that is formally defined by a local emergency plan as critical; e.g., a bridge that enables civil defense, fire departments, and public health agencies to respond immediately to disaster situations. This category also includes those bridges that cross routes which are defined as critical in a local emergency response plan and those that are located on identified evacuation routes; or

- a bridge that serves as a critical link in the security/defense roadway network.

All other bridges not satisfying one or more of the above definitions should be classified as **regular bridges**.

The acceptable annual frequency of bridge collapse is distributed, either equally or at the designers discretion, over all piers that are located within the waterway. However, it is recommended that the annual frequency of collapse (AF) be distributed to each pier based on its percentage value of the replacement cost of the structure. For example, the annual frequency of collapse for a pier (AF_p) which constitutes 25 percent of the replacement cost of a critical bridge ($AF = AF_c$) would be:

$$AF_p = \frac{AF_c}{4} = \frac{0.0001}{4} = 0.000025 \qquad (3)$$

The summation of the annual frequencies of collapse for all barge size categories, with respect to the individual piers, should then be less than or equal to the AF_p assigned to each component. The data required for calculating the annual frequencies of collapse for all barge size types can be generated using the same procedure as outlined in the Design Example presented earlier in this report.

6. Barge Sizes and Tonnages

In order to apply Method II of the *AASHTO Guide Specification*, the barge sizes and displacement tonnages comprising the flotillas currently using the waterways of Kentucky must be determined. The 24 barge types defined in this report are based on the U.S. Army Corps of Engineers barge length and width designation system and are given in Tables 6.1 and 6.2 (see Figure 6.1 for the definition of barge length and width). The sizes and tonnages associated with the 24 barge types are based on the information contained in the Waterborne Transportation Lines of the United States database (reference 10). The database contains sizes and tonnages of every barge registered to operate in the U.S. A computer program (given in Appendix A) was written to process the database and calculate the sizes and tonnages to be assigned to the barges comprising a flotilla category. The computer calculations were based on the following assumptions:

1. The variation of the barge sizes and tonnages within a category could be represented by a normal distribution.

2. The barges using the waterways of Kentucky do not exceed a loaded draft of 15.2-ft. Figure 6.1 shows the concept of "loaded draft."

   The draft cutoff of 15.2-ft was based on information from the U.S. Coast Guard that barges with a draft in excess of 12-ft do not typically operate on Kentucky waterways. The 15.2-ft value was used to include some barges in the database that could conceivably operate during high water conditions. This will lead to reasonably conservative results.

3. The minimums of the following values are used:

   - The maximum sizes, and tonnages encountered for a category within the database.
   - The average sizes and tonnages plus two standard deviations calculated for a category.

   Since the variation of the barge sizes and tonnages within a category could be represented by a normal distribution, use of the average plus two standard deviations assures that the barge sizes and tonnages assigned to a category have only a 2.25% chance of being exceeded. In the cases where the maximum value within a category is less than the average plus two

standard deviations, then the maximum value is used. Since the database contains all barges operating within Kentucky waterways, if the maximum value is used, there is a 0% chance that the sizes and tonnages will be exceeded.

4. Only barges typically operating on the Mississippi River System and the Gulf Coast Intercostal Waterway are used in the calculations.

5. The barge self weight could be linearly interpolated from the relationship:

$$self\ weight = (cargo\ capacity) * \left[\frac{light\ draft}{loaded\ draft - light\ draft} \right] \qquad (4)$$

The results from the computer program calculations listed in Appendix B are given in Tables 6.3 and 6.4. Figures 6.2 and 6.3 illustrate typical barge length and width distributions for flotilla categories BB and HD, respectively.

Barges using the Kentucky waterways may not always be fully loaded when operating on the waterway system. Tables 6.5 through 6.8 give the average percentage of cargo capacity for the upbound and downbound barges at each of the data collection points on the Kentucky rivers. The cargo capacities were calculated by the Navigation Data Center in its annual statistical analysis of the barge traffic on the U.S. waterway system.

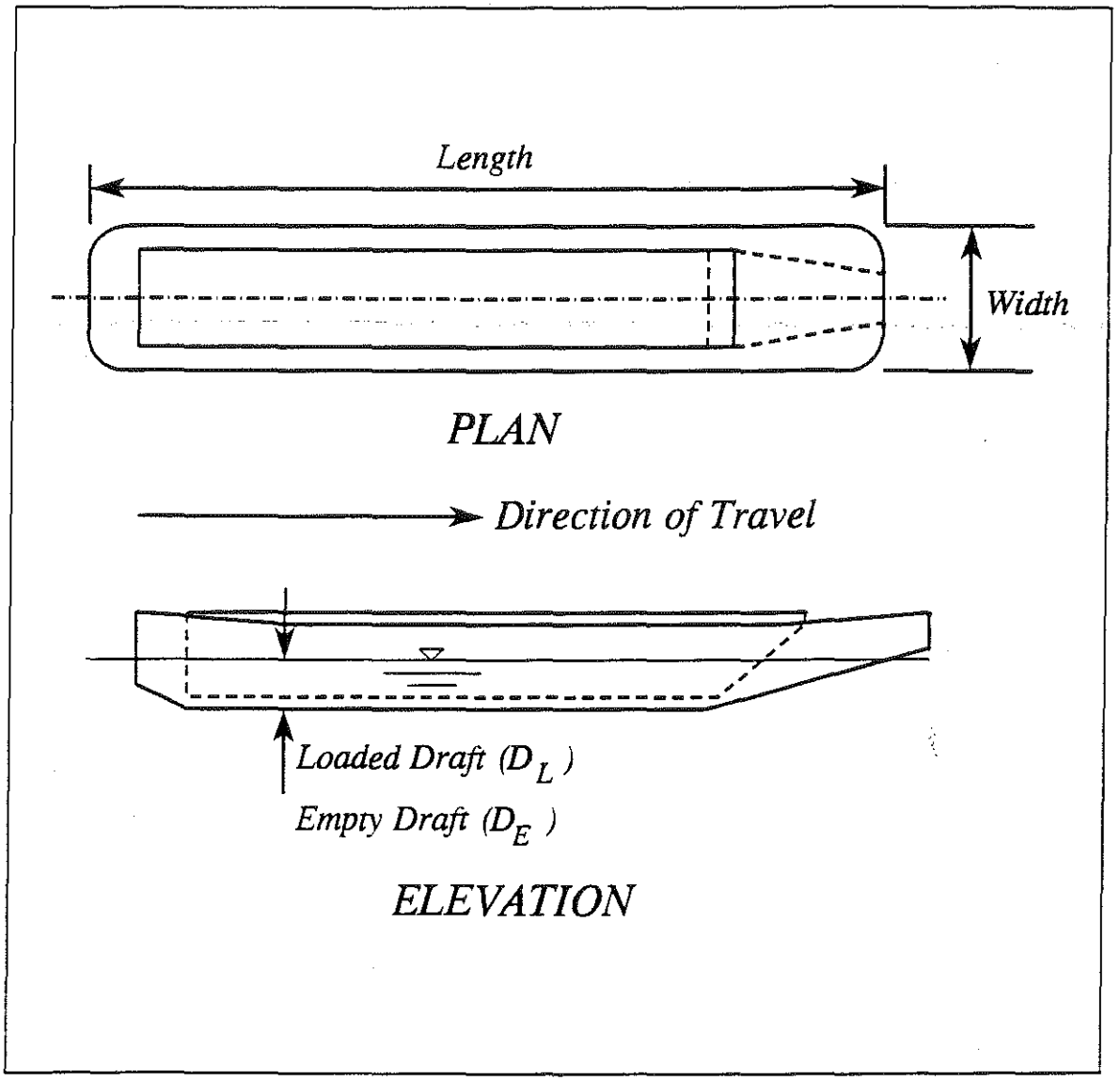
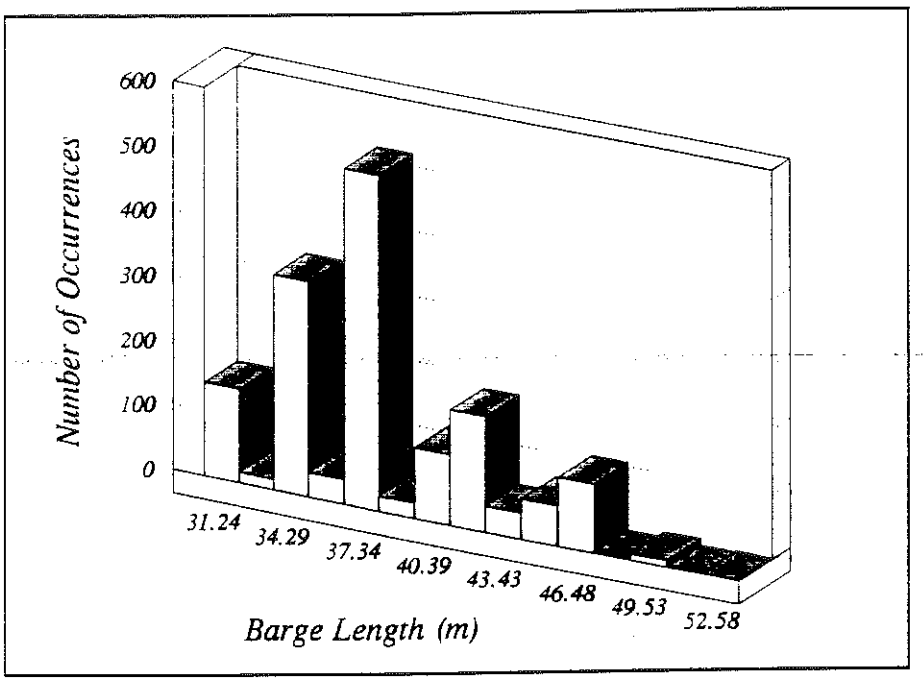


Figure 6.1: Barge Length, Width, and Loaded Draft Definition.



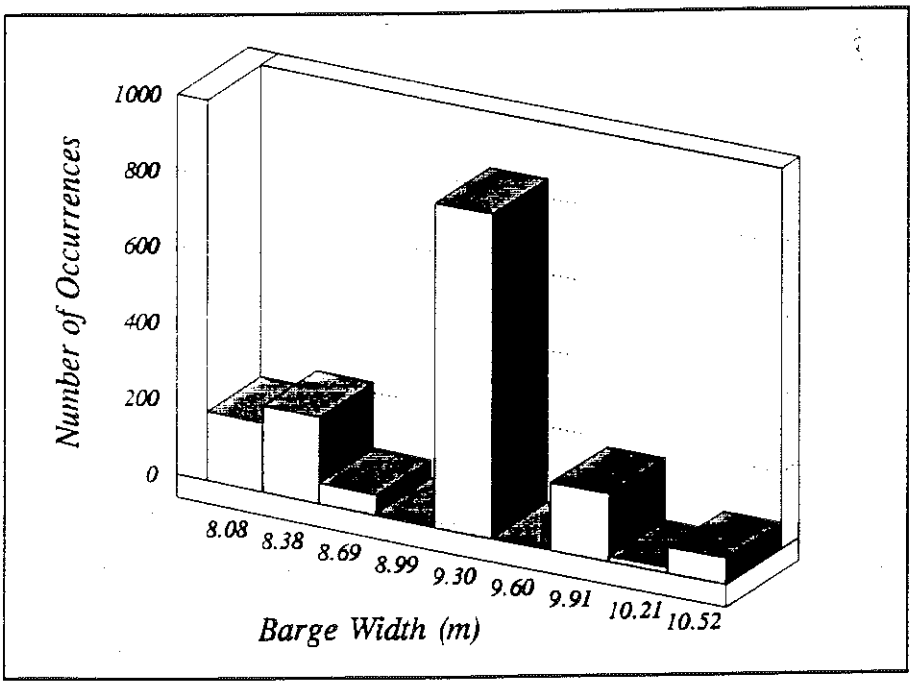
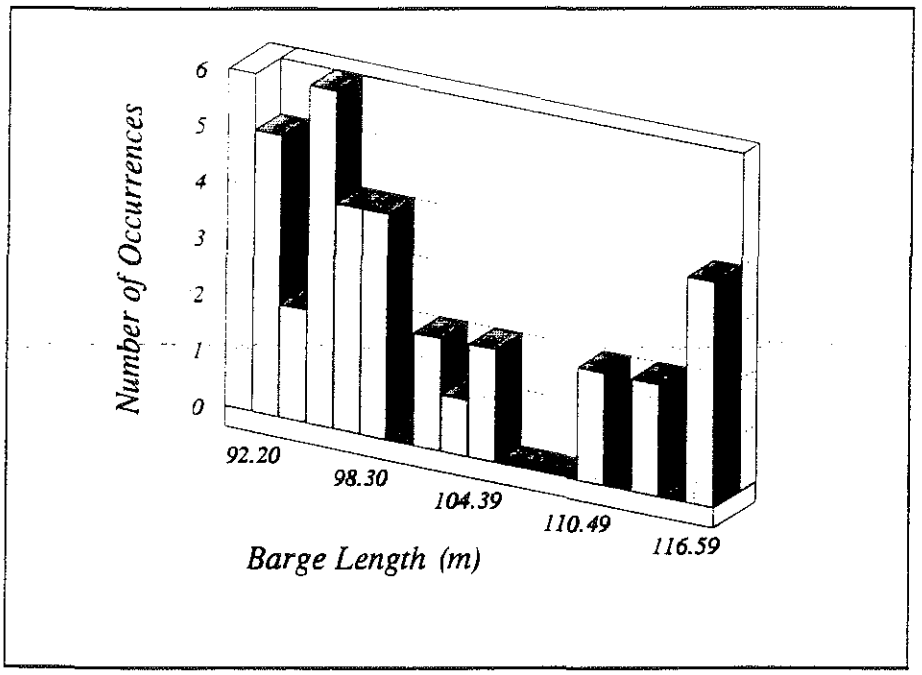


Figure 6.2: Typical Barge Length and Width Distribution for Category BB.



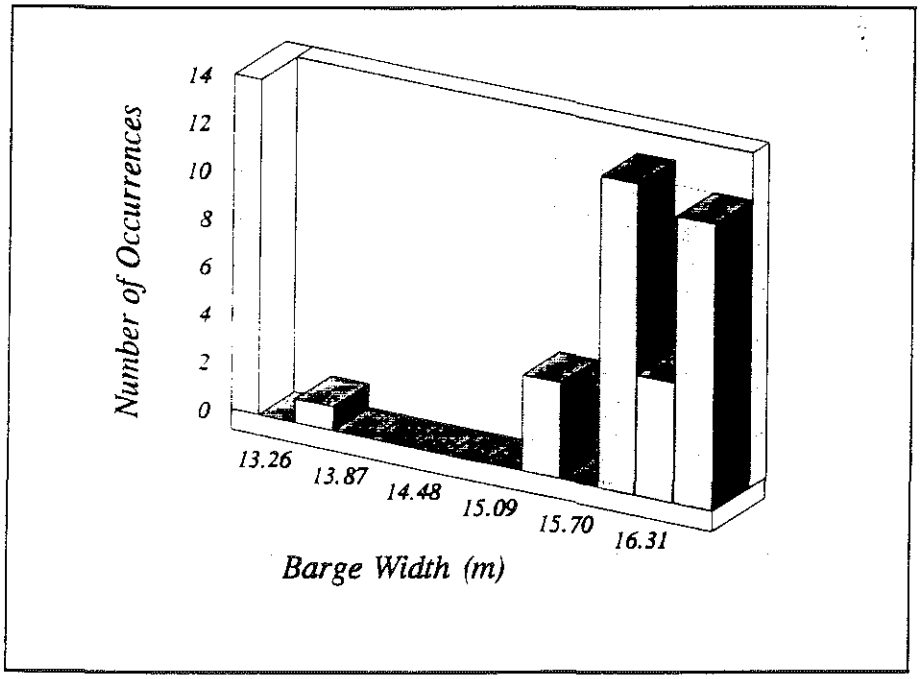


Figure 6.3: Typical Barge Length and Width Distribution for Category HD.

Table 6.1: Length of Barge Designation

Length of Barge	
A	less than 100 feet
B	100 to 174 feet
C	175 to 194 feet
D	195 to 199 feet
E	200 to 259 feet
F	260 to 289 feet
G	290 to 300 feet
H	greater than 300 feet

Table 6.2: Width of Barge Designation

Width of Barge	
A	less than 26 feet
B	26 to 34 feet
C	35 to 54 feet
D	greater than 54 feet

Table 6.3: Barge Tonnages per Flotilla Category - Average Values

Flotilla Category	Barge Size Range for Flotilla Category	Barge Total Weight[b] (tons)	Length (ft)	Width (ft)	Empty Draft (ft)	Loaded Draft (ft)
1 (AA)[a]	(<100') x (<26')	229.09	72.73	20.73	4.25	6.40
2 (AB)	(<100') x (26'-34')	567.84	62.98	30.95	2.02	8.72
3 (AC)	(<100') x (35'-54')	1957.22	87.75	40.36	1.32	8.69
4 (AD)	(<100') x (>54')	500.57	98.00	55.00	1.00	8.00
5 (BA)	(100'-174') x (<26')	635.57	112.65	23.56	2.91	6.33
6 (BB)	(100'-174') x (26'-34')	668.95	122.44	29.48	1.81	6.63
7 (BC)	(100'-174') x (35'-54')	1584.43	142.57	43.00	2.92	8.96
8 (BD)	(100'-174') x (>54')	1810.48	133.83	55.37	1.59	7.64
9 (CB)	(175'-194') x (26'-34')	1160.92	175.05	26.06	1.57	8.90
10 (CC)	(175'-194') x (35'-54')	1981.08	180.14	42.70	2.74	9.65
11 (CD)	(175'-194') x (>54')	420.65	188.00	60.00	4.00	8.60
12 (DB)	(195'-199') x (26'-34')	1361.57	195.00	26.02	1.72	9.01
13 (DC)	(195'-199') x (35'-54')	1844.64	195.01	35.10	1.67	9.09
14 (DD)	(195'-199') x (>54')	2642.67	196.10	54.10	5.00	8.00
15 (EA)	(200'-259') x (<26')	1155.56	215.00	25.00	1.00	10.00
16 (EB)	(200'-259') x (26'-34')	1257.39	200.00	26.00	1.53	8.67
17 (EC)	(200'-259') x (35'-54')	2075.87	202.29	35.98	1.64	9.21
18 (ED)	(200'-259') x (>54')	5100.61	242.68	71.23	2.39	12.58
19 (FC)	(260'-289') x (35'-54')	3643.62	265.48	51.43	1.72	9.63
20 (FD)	(260'-289') x (>54')	3666.95	268.35	56.18	2.42	10.33
21 (GC)	(290'-300') x (35'-54')	4307.98	295.34	53.17	1.72	9.65
22 (GD)	(290'-300') x (>54')	4875.17	297.30	54.33	2.04	9.96
23 (HC)	(>300') x (35'-54')	4837.30	333.02	52.44	2.53	9.47
24 (HD)	(>300') x (>54')	5504.16	340.05	54.55	2.25	11.55

[a] AA: the first letter in parenthesis is the length of barge designation (Table 3.1) and the second letter is the width of barge designation (Table 3.2).

[b] *Barge Total Weight* is the sum of the barge self weight plus the cargo weight.

Table 6.4: Barge Tonnages per Flotilla Category - Average Plus Two Standard Deviations Values

Flotilla Category	Barge Size Range for Flotilla Category	Barge Total Weight (tons)	Length (ft)	Width (ft)	Empty Draft (ft)	Loaded Draft (ft)
1 (AA)	(<100') x (<26')	632.56	99.50	25.70	8.80	12.00
2 (AB)	(<100') x (26'-34')	952.72	75.87	33.13	3.30	12.50
3 (AC)	(<100') x (35'-54')	4485.83	99.40	54.00	2.06	12.00
4 (AD)	(<100') x (>54')	500.57	98.00	55.00	1.00	8.00
5 (BA)	(100'-174') x (<26')	1432.99	144.42	25.00	7.28	11.40
6 (BB)	(100'-174') x (26'-34')	1232.49	150.97	33.59	4.23	12.00
7 (BC)	(100'-174') x (35'-54')	3416.13	174.00	54.00	8.30	15.00
8 (BD)	(100'-174') x (>54')	3663.90	160.00	59.30	2.00	12.00
9 (CB)	(175'-194') x (26'-34')	1868.19	176.11	26.98	2.32	11.60
10 (CC)	(175'-194') x (35'-54')	3657.39	191.08	54.00	7.48	14.00
11 (CD)	(175'-194') x (>54')	420.65	188.00	60.00	4.00	8.60
12 (DB)	(195'-199') x (26'-34')	1890.02	195.09	26.74	2.00	10.00
13 (DC)	(195'-199') x (35'-54')	2715.35	195.25	37.49	2.29	15.00
14 (DD)	(195'-199') x (>54')	2642.67	196.10	54.10	5.00	8.00
15 (EA)	(200'-259') x (<26')	1155.56	215.00	25.00	1.00	10.00
16 (EB)	(200'-259') x (26'-34')	1375.00	200.00	26.00	1.80	9.50
17 (EC)	(200'-259') x (35'-54')	3046.69	221.03	43.22	2.56	14.50
18 (ED)	(200'-259') x (>54')	7714.29	250.00	72.00	4.36	15.00
19 (FC)	(260'-289') x (35'-54')	5315.08	279.26	54.00	2.53	13.40
20 (FD)	(260'-289') x (>54')	4260.87	285.00	62.69	4.00	14.00
21 (GC)	(290'-300') x (35'-54')	6480.20	300.00	54.00	2.61	13.40
22 (GD)	(290'-300') x (>54')	7497.49	297.90	56.64	4.35	14.90
23 (HC)	(>300') x (35'-54')	8382.55	404.27	54.00	4.00	12.00
24 (HD)	(>300') x (>54')	6349.50	360.10	55.82	2.50	12.10

Table 6.5: Percentage of Cargo Capacity for the Ohio River

Mile	Upbound Cargo Capacity		Downbound Cargo Capacity		Average Cargo Capacity	
	1992	1993	1992	1993	1992	1993
341	32%	32%	90%	91%	61%	61%
436	31%	33%	92%	92%	62%	62%
531	46%	48%	88%	87%	67%	67%
606	59%	58%	83%	85%	71%	72%
720	56%	55%	83%	86%	70%	70%
776	59%	57%	70%	72%	65%	65%
846	46%	50%	76%	76%	61%	62%
918	37%	40%	79%	79%	59%	59%
938	45%	49%	73%	71%	60%	60%

Table 6.6: Percentage of Cargo Capacity for the Tennessee River

Mile	Upbound Cargo Capacity		Downbound Cargo Capacity		Average Cargo Capacity	
	1992	1993	1992	1993	1992	1993
22	68%	72%	50%	42%	60%	58%
206	95%	96%	11%	12%	52%	52%
259	88%	88%	27%	25%	57%	56%
274	90%	90%	26%	23%	58%	57%
349	93%	90%	27%	28%	60%	59%
424	78%	81%	31%	32%	55%	57%
471	86%	88%	35%	40%	60%	64%
529	76%	77%	58%	64%	67%	71%
602	43%	55%	60%	53%	52%	54%

Table 6.7: Percentage of Cargo Capacity for the Cumberland River

Mile	Upbound Cargo Capacity		Downbound Cargo Capacity		Average Cargo Capacity	
	1992	1993	1992	1993	1992	1993
30	84%	91%	10%	9%	21%	34%
148	98%	98%	7%	7%	53%	53%
216	94%	96%	9%	7%	52%	51%

Table 6.8: Percentage of Cargo Capacity for the Green River

Mile	Upbound Cargo Capacity		Downbound Cargo Capacity		Average Cargo Capacity	
	1992	1993	1992	1993	1992	1993
9	14%	27%	91%	85%	52%	56%
63	12%	56%	89%	48%	50%	52%

7. Flotilla Column and Row Count

The application of Method II of the *AASHTO Guide Specification* requires knowledge of the number of barges comprising the flotillas currently using the waterways. Therefore, the numbers of barges in the flotillas for 24 flotilla categories were determined based on the information contained in the 1992 Performance Monitoring System Database of the U.S. Army Corps of Engineers (reference 7). The 24 flotilla categories are based on the U.S. Army Corps of Engineers barge length and width designation system as presented previously in Tables 6.1 and 6.2. The Performance Monitoring System database contains information on the total number of flotillas using the locks of the United States waterways in 1992. However, the database only contains information on the total number of barges in each flotilla and the dimensions of each flotilla.

It should be noted that, even though flotillas are not entirely comprised of one barge size or type, they are generally made up of mostly the same barge size and type. Nevertheless, there is still a very large variation in the flotillas using the Kentucky waterway system. Therefore, a probability based approach was adopted to calculate the number of barges making up the 24 flotilla categories for all navigable rivers in Kentucky which currently have barge traffic.

A computer program (given in Appendix C) was written to process the database and calculate the number of barges to be assigned to the rows and columns of the 24 flotilla categories. The computer program was based on the following assumptions:

1. The variation of the number of barges comprising the rows and columns of a flotilla within a flotilla category could be represented by a normal distribution.

2. Since the flotilla width seemingly varies in regular increments, the number of barges in a row is determined first.

3. Barge widths do not *typically* exceed 55 feet.

4. The minimums of the following values are used:

    - The maximum number of barges making up the rows and columns encountered for a category within the database.
    - The average number of barges making up the rows and columns plus two standard deviations calculated for a category.

Based upon a normal distribution of data, using the average plus two standard deviations indicates there is only a 2.25% chance of the values used being exceeded on a yearly basis. In the cases where the maximum value within a category is less than the average plus two standard deviations, then the maximum value is used. Since the database contains all barges operating within Kentucky waterways, if the maximum value is used, there is a 0% chance that the number of barges in a flotilla column or row will be exceeded.

5. Non-integer values for the number of barges per flotilla column or row are acceptable since Method II is a probability based analysis procedure.

6. Flotilla column lengths include the possibility of barges attached to the sides of the tow boat. Since tow boat tonnages are generally lower than barge tonnages, the tow boat was conservatively replaced by a barge (see Figure 7.1).

The flotilla frequency distributions (number of passages per year) for each river and data collection milepost are given in Tables 7.1 through 7.23. These values were determined by dividing the total number of barges for each category by the average number of barges comprising each of the flotilla categories. These values also account for both the upbound and downbound passages per year. The number of downbound flotilla passages per year can be obtained by dividing the values presented in Tables 7.1 through 7.23 by two. The average number was used in place of the average plus two standard deviations since it would result in a more conservative flotilla frequency distribution. The total numbers of barges for each category were determined by completing a data query on the 1992 Performance Monitoring System Database. The total numbers of barges for each flotilla category are given in Tables 7.24 through 7.27.

The frequency distribution should reflect the anticipated rate of growth of flotilla traffic over the design life of the structure; usually 50 years for a major bridge. Average annual flotilla traffic growth rates for 1992 and 1993 are given in Tables 7.28 through 7.31 for each river and milepost considered in this report. The growth rates were calculated by the Navigation Data Center in its annual statistical analysis of the barge traffic on the U.S. waterway system.

Currently the *AASHTO Guide Specification* gives no guidance for using future barge traffic projections when considering the design life of the bridge. Therefore, it is recommended that a 50 year design life be used. Assuming the bridge service begins in the year 2000, projected barge traffic for the year 2050 should be used. Tables 7.32

through 7.54 give the projected barge traffic as calculated by the Planning Division of the U.S. Army Corps of Engineers's Navigation Data Center. Assuming that barge sizes and cargo capacities would remain constant, flotilla frequencies were increased proportionally to meet the tonnage projections for each ten year period. These projections assume that the locks have sufficient capacity to transport the future volume of cargo.

The information in Appendix D is the output from the aforementioned computer program. Values for the average and the average plus two standard deviations, in addition to the maximum number of barges in a column or row encountered in a specific category, are reported. Figures 7.2 and 7.3 illustrate typical distributions for the number of barges per column and row for flotilla categories BB and HD, respectively. Some barge types do not occur as flotillas, but rather are incorporated in flotillas comprised primarily of other barge types. The flotilla categories whose barge type is incorporated in another flotilla are assigned a "zero" flotilla frequency.

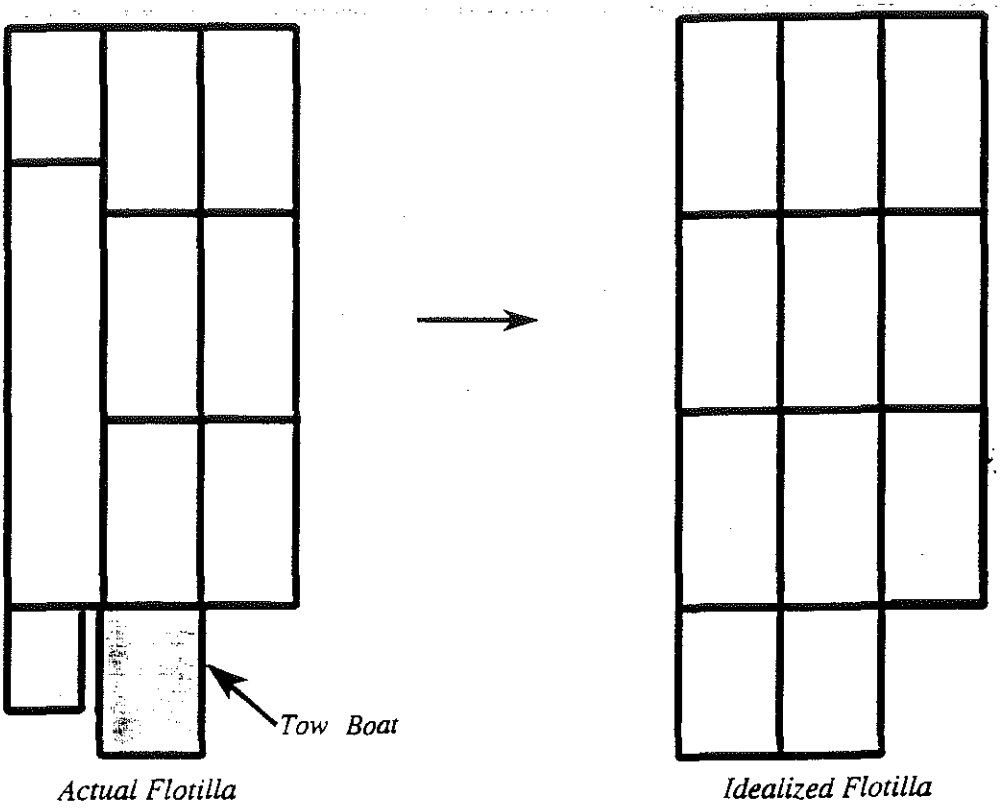
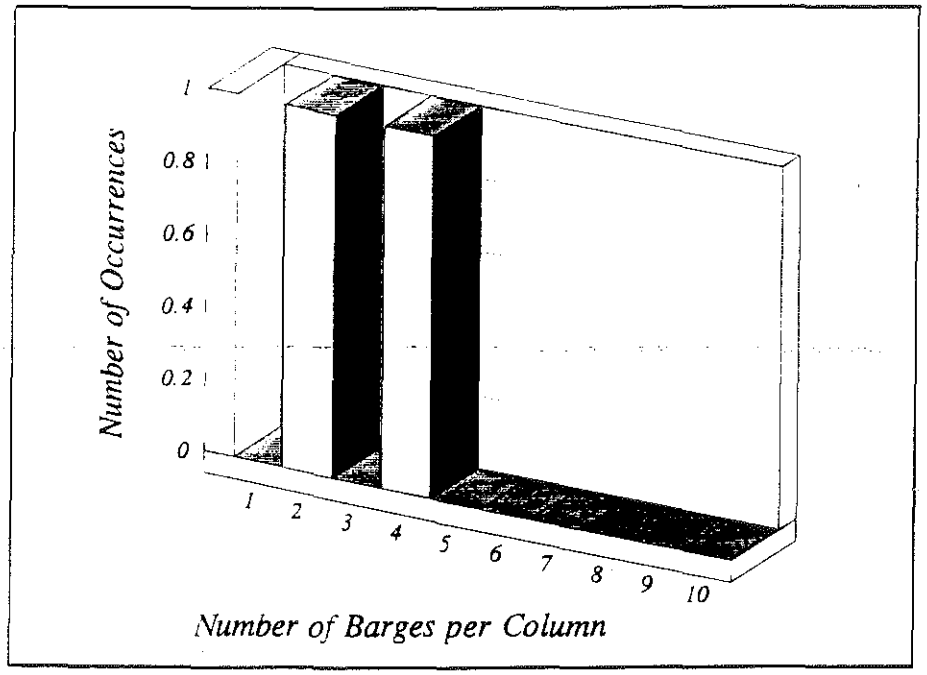


Figure 7.1: Flotilla Idealization Example.



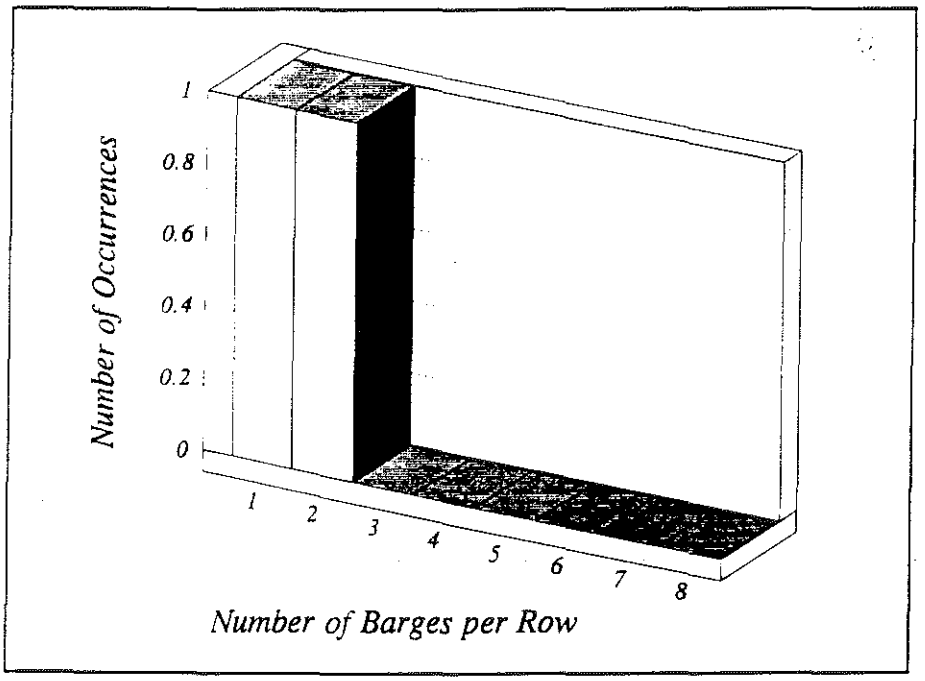
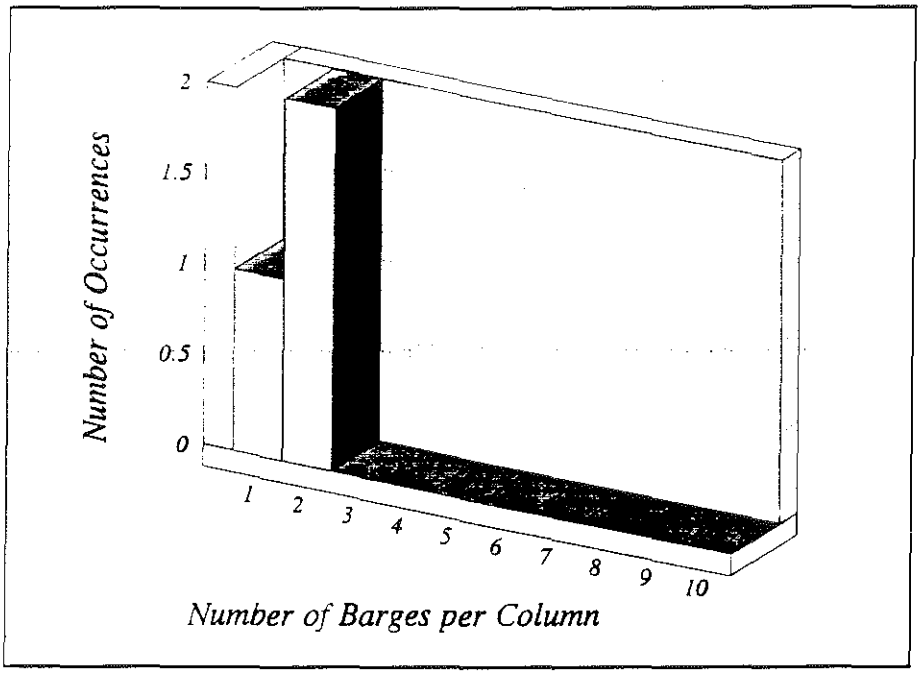


Figure 7.2: Barge Distribution per Column and Row for Category BB.



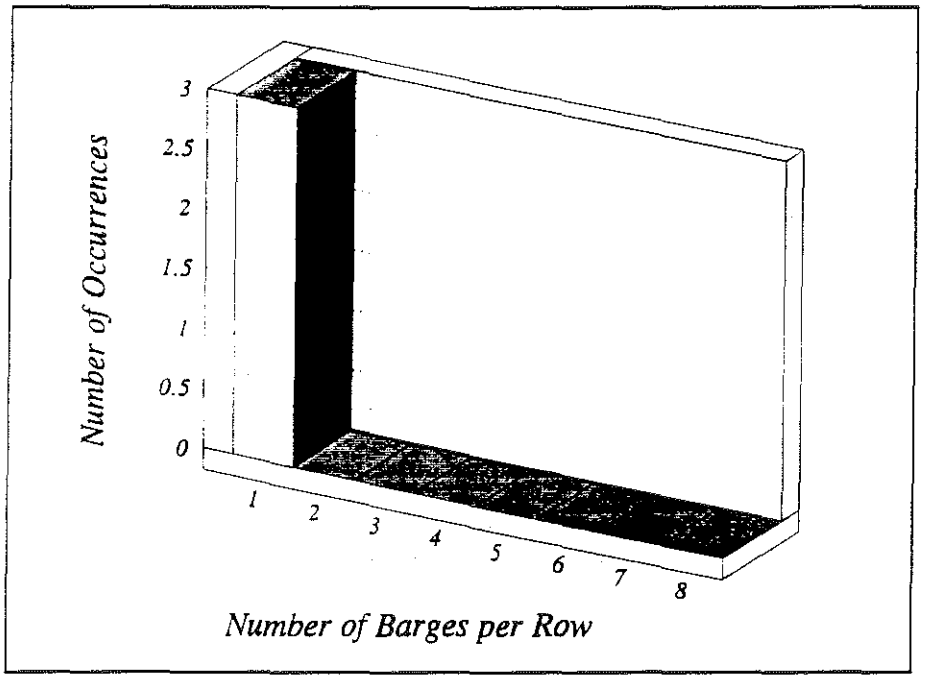


Figure 7.3: Barge Distribution per Column and Row for Category HD.

Table 7.1: Barge Flotilla Data for the Ohio River, Milepost 341

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)[a]	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	0.00	0.00	0.00	0
3 (AC)	(<100') x (35'-54')	4.38	1.63	7.11	1
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	1.00	1.00	1.00	0
6 (BB)	(100'-174') x (26'-34')	1.33	1.00	1.33	34
7 (BC)	(100'-174') x (35'-54')	4.13	1.65	6.81	163
8 (BD)	(100'-174') x (>54')	6.63	1.75	11.59	0
9 (CB)	(175'-194') x (26'-34')	0.00	0.00	0.00	0
10 (CC)	(175'-194') x (35'-54')	3.23	1.87	6.04	106
11 (CD)	(175'-194') x (>54')	3.75	1.25	4.69	14
12 (DB)	(195'-199') x (26'-34')	2.50	1.50	3.75	60
13 (DC)	(195'-199') x (35'-54')	4.46	2.75	12.27	4,454
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	5.00	1.50	7.50	0
16 (EB)	(200'-259') x (26'-34')	2.50	1.50	3.75	0
17 (EC)	(200'-259') x (35'-54')	4.46	2.75	12.27	360
18 (ED)	(200'-259') x (>54')	1.67	1.00	1.67	4
19 (FC)	(260'-289') x (35'-54')	3.27	2.31	7.54	17
20 (FD)	(260'-289') x (>54')	2.75	1.00	2.75	3
21 (GC)	(290'-300') x (35'-54')	3.32	1.94	6.44	483
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.91	1.64	3.13	54
24 (HD)	(>300') x (>54')	1.50	1.00	1.50	176
TOTAL					5,929

[a]AA: the first letter in parenthesis is the length of barge designation (Table 6.1) and the second letter is the width of barge designation (Table 6.2).

Table 7.2: Barge Flotilla Data for the Ohio River, Milepost 436

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	0.00	0.00	0.00	0
3 (AC)	(<100') x (35'-54')	4.40	1.20	5.28	0
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	1.00	1.00	1.00	0
6 (BB)	(100'-174') x (26'-34')	3.33	1.67	5.56	8
7 (BC)	(100'-174') x (35'-54')	3.42	1.72	5.88	209
8 (BD)	(100'-174') x (>54')	3.25	1.25	4.06	0
9 (CB)	(175'-194') x (26'-34')	0.00	0.00	0.00	0
10 (CC)	(175'-194') x (35'-54')	3.35	1.97	6.59	91
11 (CD)	(175'-194') x (>54')	0.00	0.00	0.00	0
12 (DB)	(195'-199') x (26'-34')	5.00	1.00	5.00	49
13 (DC)	(195'-199') x (35'-54')	4.58	2.83	9612.00	4,151
14 (DD)	(195'-199') x (>54')	6.00	2.00	12.00	1
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	5.00	1.00	5.00	1
17 (EC)	(200'-259') x (35'-54')	4.58	2.83	12.96	390
18 (ED)	(200'-259') x (>54')	0.00	0.00	0.00	0
19 (FC)	(260'-289') x (35'-54')	3.35	2.32	7.77	9
20 (FD)	(260'-289') x (>54')	0.00	0.00	0.00	0
21 (GC)	(290'-300') x (35'-54')	3.39	1.99	6.73	409
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	2.00	1.72	3.44	9
24 (HD)	(>300') x (>54')	1.67	1.00	1.67	38
TOTAL					5,365

Table 7.3: Barge Flotilla Data for the Ohio River, Milepost 531

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	6.00	1.00	6.00	3
2 (AB)	(<100') x (26'-34')	4.00	2.00	8.00	7
3 (AC)	(<100') x (35'-54')	10.00	1.50	15.00	2
4 (AD)	(<100') x (>54')	8.50	1.00	8.50	0
5 (BA)	(100'-174') x (<26')	1.00	1.00	1.00	1
6 (BB)	(100'-174') x (26'-34')	3.33	1.67	5.56	10
7 (BC)	(100'-174') x (35'-54')	4.19	1.54	6.47	188
8 (BD)	(100'-174') x (>54')	5.56	1.78	9.88	1
9 (CB)	(175'-194') x (26'-34')	0.00	0.00	0.00	0
10 (CC)	(175'-194') x (35'-54')	3.75	1.82	6.82	132
11 (CD)	(175'-194') x (>54')	2.67	1.00	2.67	77
12 (DB)	(195'-199') x (26'-34')	1.00	1.00	1.00	38
13 (DC)	(195'-199') x (35'-54')	4.47	2.79	12.50	3,302
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	1.00	1.00	1.00	17
17 (EC)	(200'-259') x (35'-54')	4.47	2.79	12.50	621
18 (ED)	(200'-259') x (>54')	3.00	1.00	3.00	18
19 (FC)	(260'-289') x (35'-54')	3.12	2.17	6.78	53
20 (FD)	(260'-289') x (>54')	0.00	0.00	0.00	0
21 (GC)	(290'-300') x (35'-54')	2.67	1.82	4.87	502
22 (GD)	(290'-300') x (>54')	1.50	2.00	3.00	6
23 (HC)	(>300') x (35'-54')	1.98	1.69	3.34	17
24 (HD)	(>300') x (>54')	1.25	2.00	2.50	139
TOTAL					5,134

Table 7.4: Barge Flotilla Data for the Ohio River, Milepost 606

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	2.00	1.00	2.00	22
2 (AB)	(<100') x (26'-34')	4.00	1.33	5.33	28
3 (AC)	(<100') x (35'-54')	5.95	1.76	10.50	2
4 (AD)	(<100') x (>54')	3.00	1.00	3.00	1
5 (BA)	(100'-174') x (<26')	1.00	1.00	1.00	6
6 (BB)	(100'-174') x (26'-34')	2.63	1.58	4.16	24
7 (BC)	(100'-174') x (35'-54')	4.90	1.74	8.52	115
8 (BD)	(100'-174') x (>54')	5.65	1.77	10.00	1
9 (CB)	(175'-194') x (26'-34')	1.10	1.20	1.32	35
10 (CC)	(175'-194') x (35'-54')	4.16	1.83	7.62	121
11 (CD)	(175'-194') x (>54')	3.63	1.25	4.53	24
12 (DB)	(195'-199') x (26'-34')	1.44	1.22	1.77	50
13 (DC)	(195'-199') x (35'-54')	4.52	2.77	12.53	3,458
14 (DD)	(195'-199') x (>54')	2.67	1.00	2.67	27
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	1.44	1.22	1.77	2
17 (EC)	(200'-259') x (35'-54')	4.52	2.77	12.53	640
18 (ED)	(200'-259') x (>54')	2.33	1.00	2.33	17
19 (FC)	(260'-289') x (35'-54')	2.61	1.88	4.91	67
20 (FD)	(260'-289') x (>54')	4.00	1.00	4.00	3
21 (GC)	(290'-300') x (35'-54')	2.36	1.64	3.88	613
22 (GD)	(290'-300') x (>54')	1.75	1.50	2.63	9
23 (HC)	(>300') x (35'-54')	1.86	1.64	3.05	17
24 (HD)	(>300') x (>54')	1.86	1.00	1.86	14
TOTAL					5,296

Table 7.5: Barge Flotilla Data for the Ohio River, Milepost 720

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	4.33	1.33	5.78	23
3 (AC)	(<100') x (35'-54')	14.33	1.00	14.33	2
4 (AD)	(<100') x (>54')	3.00	1.00	3.00	1
5 (BA)	(100'-174') x (<26')	1.00	1.00	1.00	2
6 (BB)	(100'-174') x (26'-34')	3.86	2.00	7.71	17
7 (BC)	(100'-174') x (35'-54')	4.58	1.57	7.16	140
8 (BD)	(100'-174') x (>54')	7.25	2.00	14.50	1
9 (CB)	(175'-194') x (26'-34')	1.00	1.00	1.00	4
10 (CC)	(175'-194') x (35'-54')	2.68	1.91	5.12	187
11 (CD)	(175'-194') x (>54')	3.00	1.00	3.00	20
12 (DB)	(195'-199') x (26'-34')	1.00	2.00	2.00	27
13 (DC)	(195'-199') x (35'-54')	4.48	2.79	12.49	3,791
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	1.00	2.00	2.00	2
17 (EC)	(200'-259') x (35'-54')	4.48	2.79	12.49	719
18 (ED)	(200'-259') x (>54')	0.00	0.00	0.00	0
19 (FC)	(260'-289') x (35'-54')	3.38	2.12	7.18	76
20 (FD)	(260'-289') x (>54')	4.00	1.00	4.00	2
21 (GC)	(290'-300') x (35'-54')	2.70	1.79	4.85	421
22 (GD)	(290'-300') x (>54')	2.00	1.00	2.00	16
23 (HC)	(>300') x (35'-54')	1.92	1.64	3.16	18
24 (HD)	(>300') x (>54')	0.00	0.00	0.00	0
TOTAL					5,469

Table 7.6: Barge Flotilla Data for the Ohio River, Milepost 776

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	3.00	1.00	3.00	13
2 (AB)	(<100') x (26'-34')	4.17	1.00	4.17	41
3 (AC)	(<100') x (35'-54')	7.64	1.85	14.11	6
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	4.06	1.38	5.59	0
6 (BB)	(100'-174') x (26'-34')	3.29	1.71	5.63	14
7 (BC)	(100'-174') x (35'-54')	3.98	1.79	7.12	153
8 (BD)	(100'-174') x (>54')	6.28	1.87	11.75	1
9 (CB)	(175'-194') x (26'-34')	0.00	0.00	0.00	0
10 (CC)	(175'-194') x (35'-54')	2.86	1.73	4.96	222
11 (CD)	(175'-194') x (>54')	3.83	1.33	5.11	13
12 (DB)	(195'-199') x (26'-34')	2.20	1.20	2.64	45
13 (DC)	(195'-199') x (35'-54')	4.35	2.72	11.85	4,948
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	3.00	1.00	3.00	0
16 (EB)	(200'-259') x (26'-34')	2.20	1.20	2.64	2
17 (EC)	(200'-259') x (35'-54')	4.35	2.72	11.85	973
18 (ED)	(200'-259') x (>54')	3.67	1.67	6.11	13
19 (FC)	(260'-289') x (35'-54')	2.87	1.99	5.71	119
20 (FD)	(260'-289') x (>54')	0.00	0.00	0.00	0
21 (GC)	(290'-300') x (35'-54')	2.65	1.79	4.75	398
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.89	1.61	3.05	32
24 (HD)	(>300') x (>54')	1.25	1.50	1.88	83
TOTAL					7,076

Table 7.7: Barge Flotilla Data for the Ohio River, Milepost 846

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	6.50	1.25	8.13	26
3 (AC)	(<100') x (35'-54')	7.88	1.63	12.80	10
4 (AD)	(<100') x (>54')	2.50	1.00	2.50	17
5 (BA)	(100'-174') x (<26')	8.00	1.00	8.00	0
6 (BB)	(100'-174') x (26'-34')	3.92	1.50	5.88	14
7 (BC)	(100'-174') x (35'-54')	4.75	1.86	8.82	145
8 (BD)	(100'-174') x (>54')	6.40	1.87	11.95	1
9 (CB)	(175'-194') x (26'-34')	0.00	0.00	0.00	0
10 (CC)	(175'-194') x (35'-54')	4.11	1.73	7.10	181
11 (CD)	(175'-194') x (>54')	2.00	1.00	2.00	45
12 (DB)	(195'-199') x (26'-34')	1.33	1.67	2.22	105
13 (DC)	(195'-199') x (35'-54')	4.68	2.82	13.20	4,691
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	1.33	1.67	2.22	0
17 (EC)	(200'-259') x (35'-54')	4.68	2.82	13.20	1,194
18 (ED)	(200'-259') x (>54')	2.75	1.50	4.13	28
19 (FC)	(260'-289') x (35'-54')	3.05	2.11	6.44	441
20 (FD)	(260'-289') x (>54')	3.00	1.00	3.00	5
21 (GC)	(290'-300') x (35'-54')	3.63	2.60	9.45	244
22 (GD)	(290'-300') x (>54')	2.67	1.67	4.44	14
23 (HC)	(>300') x (35'-54')	1.94	1.68	3.26	31
24 (HD)	(>300') x (>54')	1.83	1.33	2.44	40
TOTAL					7,232

Table 7.8: Barge Flotilla Data for the Ohio River, Milepost 918

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	5.80	1.20	6.96	31
3 (AC)	(<100') x (35'-54')	11.33	1.33	15.11	6
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	2.67	1.33	3.56	0
6 (BB)	(100'-174') x (26'-34')	2.42	1.33	3.22	32
7 (BC)	(100'-174') x (35'-54')	4.09	1.82	7.47	162
8 (BD)	(100'-174') x (>54')	7.11	1.93	13.71	1
9 (CB)	(175'-194') x (26'-34')	0.00	0.00	0.00	0
10 (CC)	(175'-194') x (35'-54')	4.00	2.08	8.32	166
11 (CD)	(175'-194') x (>54')	3.75	1.50	5.63	16
12 (DB)	(195'-199') x (26'-34')	1.75	1.25	2.19	59
13 (DC)	(195'-199') x (35'-54')	4.69	2.83	13.28	5,825
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	1.75	1.25	2.19	0
17 (EC)	(200'-259') x (35'-54')	4.69	2.83	13.28	1,505
18 (ED)	(200'-259') x (>54')	2.00	1.00	2.00	52
19 (FC)	(260'-289') x (35'-54')	3.05	2.02	6.18	478
20 (FD)	(260'-289') x (>54')	4.00	1.00	4.00	2
21 (GC)	(290'-300') x (35'-54')	3.20	2.19	7.00	363
22 (GD)	(290'-300') x (>54')	2.40	1.60	3.84	10
23 (HC)	(>300') x (35'-54')	1.92	1.46	2.81	35
24 (HD)	(>300') x (>54')	2.50	2.00	5.00	17
TOTAL					8,760

Table 7.9: Barge Flotilla Data for the Ohio River, Milepost 938

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	1.00	1.00	1.00	94
2 (AB)	(<100') x (26'-34')	4.83	1.17	5.64	38
3 (AC)	(<100') x (35'-54')	11.60	1.50	17.40	6
4 (AD)	(<100') x (>54')	12.50	2.00	25.00	0
5 (BA)	(100'-174') x (<26')	2.75	1.33	3.67	2
6 (BB)	(100'-174') x (26'-34')	2.00	1.42	2.84	50
7 (BC)	(100'-174') x (35'-54')	3.70	1.95	7.21	171
8 (BD)	(100'-174') x (>54')	5.75	1.79	10.27	1
9 (CB)	(175'-194') x (26'-34')	1.00	1.00	1.00	44
10 (CC)	(175'-194') x (35'-54')	3.83	2.27	8.67	94
11 (CD)	(175'-194') x (>54')	4.00	1.60	6.40	5
12 (DB)	(195'-199') x (26'-34')	1.92	1.54	2.96	53
13 (DC)	(195'-199') x (35'-54')	4.26	2.95	12.55	7,960
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	2.50	1.50	3.75	0
16 (EB)	(200'-259') x (26'-34')	1.92	1.54	2.96	5
17 (EC)	(200'-259') x (35'-54')	4.26	2.95	12.55	695
18 (ED)	(200'-259') x (>54')	4.19	2.00	8.38	1
19 (FC)	(260'-289') x (35'-54')	2.91	2.43	7.06	320
20 (FD)	(260'-289') x (>54')	3.50	1.00	3.50	3
21 (GC)	(290'-300') x (35'-54')	2.39	1.73	4.15	673
22 (GD)	(290'-300') x (>54')	2.14	1.43	3.06	4
23 (HC)	(>300') x (35'-54')	2.14	1.76	3.77	36
24 (HD)	(>300') x (>54')	1.86	1.45	2.71	19
TOTAL					10,274

Table 7.10: Barge Flotilla Data for the Tennessee River, Milepost 22

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	0.00	0.00	0.00	0
3 (AC)	(<100') x (35'-54')	0.00	0.00	0.00	0
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	0.00	0.00	0.00	0
6 (BB)	(100'-174') x (26'-34')	2.50	2.00	5.00	13
7 (BC)	(100'-174') x (35'-54')	3.42	1.98	6.77	36
8 (BD)	(100'-174') x (>54')	2.86	1.29	3.67	1
9 (CB)	(175'-194') x (26'-34')	0.00	0.00	0.00	0
10 (CC)	(175'-194') x (35'-54')	2.90	1.91	5.56	27
11 (CD)	(175'-194') x (>54')	0.00	0.00	0.00	0
12 (DB)	(195'-199') x (26'-34')	0.00	0.00	0.00	0
13 (DC)	(195'-199') x (35'-54')	3.92	2.82	11.07	2,673
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	0.00	0.00	0.00	0
17 (EC)	(200'-259') x (35'-54')	3.92	2.82	11.07	508
18 (ED)	(200'-259') x (>54')	2.00	1.00	2.00	6
19 (FC)	(260'-289') x (35'-54')	2.55	2.24	5.72	16
20 (FD)	(260'-289') x (>54')	3.50	1.00	3.50	0
21 (GC)	(290'-300') x (35'-54')	2.43	1.68	4.08	207
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.76	1.66	2.93	11
24 (HD)	(>300') x (>54')	2.00	1.00	2.00	10
TOTAL					3,508

Table 7.11: Barge Flotilla Data for the Tennessee River, Milepost 206

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	0.00	0.00	0.00	0
3 (AC)	(<100') x (35'-54')	3.11	2.33	7.26	1
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	1.00	1.00	1.00	4
6 (BB)	(100'-174') x (26'-34')	1.75	1.50	2.63	33
7 (BC)	(100'-174') x (35'-54')	3.62	1.99	7.20	27
8 (BD)	(100'-174') x (>54')	8.00	2.00	16.00	0
9 (CB)	(175'-194') x (26'-34')	0.00	0.00	0.00	0
10 (CC)	(175'-194') x (35'-54')	2.87	2.04	5.84	18
11 (CD)	(175'-194') x (>54')	0.00	0.00	0.00	0
12 (DB)	(195'-199') x (26'-34')	0.00	0.00	0.00	0
13 (DC)	(195'-199') x (35'-54')	4.34	2.85	12.36	1,689
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	0.00	0.00	0.00	0
17 (EC)	(200'-259') x (35'-54')	4.34	2.85	12.36	402
18 (ED)	(200'-259') x (>54')	1.00	1.00	1.00	7
19 (FC)	(260'-289') x (35'-54')	2.87	2.17	6.23	14
20 (FD)	(260'-289') x (>54')	0.00	0.00	0.00	0
21 (GC)	(290'-300') x (35'-54')	2.43	1.54	3.75	176
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.77	1.62	2.87	26
24 (HD)	(>300') x (>54')	1.50	1.50	2.25	36
TOTAL					2,433

Table 7.12: Barge Flotilla Data for the Tennessee River, Milepost 259

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	0.00	0.00	0.00	0
3 (AC)	(<100') x (35'-54')	0.00	0.00	0.00	0
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	0.00	0.00	0.00	0
6 (BB)	(100'-174') x (26'-34')	1.00	1.00	1.00	64
7 (BC)	(100'-174') x (35'-54')	4.67	1.91	8.92	15
8 (BD)	(100'-174') x (>54')	2.50	1.00	2.50	4
9 (CB)	(175'-194') x (26'-34')	1.00	1.00	1.00	0
10 (CC)	(175'-194') x (35'-54')	3.00	1.92	5.77	13
11 (CD)	(175'-194') x (>54')	0.00	0.00	0.00	0
12 (DB)	(195'-199') x (26'-34')	0.00	0.00	0.00	0
13 (DC)	(195'-199') x (35'-54')	3.99	2.77	11.05	894
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	0.00	0.00	0.00	0
17 (EC)	(200'-259') x (35'-54')	3.99	2.77	11.05	202
18 (ED)	(200'-259') x (>54')	0.00	0.00	0.00	0
19 (FC)	(260'-289') x (35'-54')	3.00	2.24	6.71	10
20 (FD)	(260'-289') x (>54')	2.00	2.00	4.00	0
21 (GC)	(290'-300') x (35'-54')	2.37	1.44	3.41	181
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.56	1.55	2.41	17
24 (HD)	(>300') x (>54')	0.00	0.00	0.00	0
TOTAL					1,400

Table 7.13: Barge Flotilla Data for the Tennessee River, Milepost 274

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	2.00	1.00	2.00	14
2 (AB)	(<100') x (26'-34')	0.00	0.00	0.00	0
3 (AC)	(<100') x (35'-54')	2.00	1.00	2.00	5
4 (AD)	(<100') x (>54')	2.00	1.00	2.00	0
5 (BA)	(100'-174') x (<26')	4.25	1.50	6.38	2
6 (BB)	(100'-174') x (26'-34')	0.00	0.00	0.00	0
7 (BC)	(100'-174') x (35'-54')	4.16	1.76	7.33	21
8 (BD)	(100'-174') x (>54')	2.50	1.00	2.50	6
9 (CB)	(175'-194') x (26'-34')	1.00	1.00	1.00	1
10 (CC)	(175'-194') x (35'-54')	3.64	1.93	7.03	14
11 (CD)	(175'-194') x (>54')	0.00	0.00	0.00	0
12 (DB)	(195'-199') x (26'-34')	0.00	0.00	0.00	0
13 (DC)	(195'-199') x (35'-54')	3.97	2.81	11.15	868
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	0.00	0.00	0.00	0
17 (EC)	(200'-259') x (35'-54')	3.97	2.81	11.15	208
18 (ED)	(200'-259') x (>54')	2.00	1.00	2.00	7
19 (FC)	(260'-289') x (35'-54')	3.01	2.22	6.66	9
20 (FD)	(260'-289') x (>54')	0.00	0.00	0.00	0
21 (GC)	(290'-300') x (35'-54')	2.32	1.56	3.63	176
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.52	1.47	2.24	28
24 (HD)	(>300') x (>54')	0.00	0.00	0.00	0
TOTAL					1,359

Table 7.14: Barge Flotilla Data for the Tennessee River, Milepost 349

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	0.00	0.00	0.00	0
3 (AC)	(<100') x (35'-54')	0.00	0.00	0.00	0
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	0.00	0.00	0.00	0
6 (BB)	(100'-174') x (26'-34')	0.00	0.00	0.00	0
7 (BC)	(100'-174') x (35'-54')	3.79	2.00	7.59	10
8 (BD)	(100'-174') x (>54')	2.00	1.00	2.00	2
9 (CB)	(175'-194') x (26'-34')	1.00	1.00	1.00	0
10 (CC)	(175'-194') x (35'-54')	3.31	1.97	6.51	7
11 (CD)	(175'-194') x (>54')	3.00	1.00	3.00	0
12 (DB)	(195'-199') x (26'-34')	1.00	2.00	2.00	1
13 (DC)	(195'-199') x (35'-54')	3.88	2.78	10.81	740
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	1.00	2.00	2.00	1
17 (EC)	(200'-259') x (35'-54')	3.88	2.78	10.81	169
18 (ED)	(200'-259') x (>54')	0.00	0.00	0.00	0
19 (FC)	(260'-289') x (35'-54')	2.80	2.64	7.37	1
20 (FD)	(260'-289') x (>54')	0.00	0.00	0.00	0
21 (GC)	(290'-300') x (35'-54')	2.29	1.55	3.56	79
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.90	1.95	3.70	8
24 (HD)	(>300') x (>54')	0.00	0.00	0.00	0
TOTAL					1,017

Table 7.15: Barge Flotilla Data for the Tennessee River, Milepost 424

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	0.00	0.00	0.00	0
3 (AC)	(<100') x (35'-54')	0.00	0.00	0.00	0
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	1.00	1.00	1.00	8
6 (BB)	(100'-174') x (26'-34')	1.00	1.00	1.00	51
7 (BC)	(100'-174') x (35'-54')	3.49	1.92	6.68	11
8 (BD)	(100'-174') x (>54')	3.00	1.00	3.00	1
9 (CB)	(175'-194') x (26'-34')	1.00	1.00	1.00	1
10 (CC)	(175'-194') x (35'-54')	2.98	1.95	5.81	3
11 (CD)	(175'-194') x (>54')	2.50	1.00	2.50	3
12 (DB)	(195'-199') x (26'-34')	0.00	0.00	0.00	0
13 (DC)	(195'-199') x (35'-54')	3.15	2.55	8.03	533
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	0.00	0.00	0.00	0
17 (EC)	(200'-259') x (35'-54')	3.15	2.55	8.03	128
18 (ED)	(200'-259') x (>54')	1.50	1.00	1.50	4
19 (FC)	(260'-289') x (35'-54')	2.67	2.55	6.81	2
20 (FD)	(260'-289') x (>54')	0.00	0.00	0.00	0
21 (GC)	(290'-300') x (35'-54')	2.22	1.58	3.52	74
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.59	1.75	2.78	8
24 (HD)	(>300') x (>54')	0.00	0.00	0.00	0
TOTAL					827

Table 7.16: Barge Flotilla Data for the Tennessee River, Milepost 471

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	0.00	0.00	0.00	0
3 (AC)	(<100') x (35'-54')	2.50	1.00	2.50	2
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	0.00	0.00	0.00	0
6 (BB)	(100'-174') x (26'-34')	1.83	1.33	2.44	20
7 (BC)	(100'-174') x (35'-54')	3.21	1.71	5.51	5
8 (BD)	(100'-174') x (>54')	1.50	1.00	1.50	1
9 (CB)	(175'-194') x (26'-34')	0.00	0.00	0.00	0
10 (CC)	(175'-194') x (35'-54')	2.83	2.33	6.61	2
11 (CD)	(175'-194') x (>54')	0.00	0.00	0.00	0
12 (DB)	(195'-199') x (26'-34')	0.00	0.00	0.00	0
13 (DC)	(195'-199') x (35'-54')	3.18	2.56	8.12	179
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	0.00	0.00	0.00	0
17 (EC)	(200'-259') x (35'-54')	3.18	2.56	8.12	97
18 (ED)	(200'-259') x (>54')	0.00	0.00	0.00	0
19 (FC)	(260'-289') x (35'-54')	2.69	2.09	5.63	1
20 (FD)	(260'-289') x (>54')	0.00	0.00	0.00	0
21 (GC)	(290'-300') x (35'-54')	2.24	1.21	2.70	36
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.91	1.18	2.25	14
24 (HD)	(>300') x (>54')	0.00	0.00	0.00	0
TOTAL					357

Table 7.17: Barge Flotilla Data for the Tennessee River, Milepost 529

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	0.00	0.00	0.00	0
3 (AC)	(<100') x (35'-54')	2.00	2.00	4.00	1
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	0.00	0.00	0.00	0
6 (BB)	(100'-174') x (26'-34')	0.00	0.00	0.00	0
7 (BC)	(100'-174') x (35'-54')	2.81	1.50	4.22	20
8 (BD)	(100'-174') x (>54')	6.50	2.00	13.00	0
9 (CB)	(175'-194') x (26'-34')	0.00	0.00	0.00	0
10 (CC)	(175'-194') x (35'-54')	3.00	1.00	3.00	1
11 (CD)	(175'-194') x (>54')	0.00	0.00	0.00	0
12 (DB)	(195'-199') x (26'-34')	0.00	0.00	0.00	0
13 (DC)	(195'-199') x (35'-54')	3.05	2.38	7.25	85
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	0.00	0.00	0.00	0
17 (EC)	(200'-259') x (35'-54')	3.05	2.38	7.25	69
18 (ED)	(200'-259') x (>54')	1.00	1.00	1.00	0
19 (FC)	(260'-289') x (35'-54')	2.71	2.06	5.58	0
20 (FD)	(260'-289') x (>54')	0.00	0.00	0.00	0
21 (GC)	(290'-300') x (35'-54')	2.14	1.13	2.42	40
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.85	1.10	2.03	15
24 (HD)	(>300') x (>54')	0.00	0.00	0.00	0
TOTAL					231

Table 7.18: Barge Flotilla Data for the Tennessee River, Milepost 602

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	0.00	0.00	0.00	0
3 (AC)	(<100') x (35'-54')	0.00	0.00	0.00	0
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	0.00	0.00	0.00	0
6 (BB)	(100'-174') x (26'-34')	1.00	1.00	1.00	17
7 (BC)	(100'-174') x (35'-54')	3.00	1.00	3.00	3
8 (BD)	(100'-174') x (>54')	0.00	0.00	0.00	0
9 (CB)	(175'-194') x (26'-34')	0.00	0.00	0.00	0
10 (CC)	(175'-194') x (35'-54')	2.67	1.33	3.56	2
11 (CD)	(175'-194') x (>54')	0.00	0.00	0.00	0
12 (DB)	(195'-199') x (26'-34')	0.00	0.00	0.00	0
13 (DC)	(195'-199') x (35'-54')	2.42	1.39	3.37	39
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	0.00	0.00	0.00	0
17 (EC)	(200'-259') x (35'-54')	2.42	1.39	3.37	45
18 (ED)	(200'-259') x (>54')	0.00	0.00	0.00	0
19 (FC)	(260'-289') x (35'-54')	1.67	1.35	2.25	2
20 (FD)	(260'-289') x (>54')	0.00	0.00	0.00	0
21 (GC)	(290'-300') x (35'-54')	2.08	1.06	2.20	39
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.85	1.11	2.06	14
24 (HD)	(>300') x (>54')	0.00	0.00	0.00	0
TOTAL					161

Table 7.19: Barge Flotilla Data for the Cumberland River, Milepost 30

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	0.00	0.00	0.00	0
3 (AC)	(<100') x (35'-54')	0.00	0.00	0.00	0
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	1.00	1.00	1.00	2
6 (BB)	(100'-174') x (26'-34')	0.00	0.00	0.00	0
7 (BC)	(100'-174') x (35'-54')	3.13	1.97	6.17	14
8 (BD)	(100'-174') x (>54')	4.17	1.33	5.56	0
9 (CB)	(175'-194') x (26'-34')	1.00	1.00	1.00	7
10 (CC)	(175'-194') x (35'-54')	2.46	1.92	4.73	57
11 (CD)	(175'-194') x (>54')	0.00	0.00	0.00	0
12 (DB)	(195'-199') x (26'-34')	0.00	0.00	0.00	0
13 (DC)	(195'-199') x (35'-54')	3.58	2.80	10.02	777
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	0.00	0.00	0.00	0
17 (EC)	(200'-259') x (35'-54')	3.58	2.80	10.02	273
18 (ED)	(200'-259') x (>54')	0.00	0.00	0.00	0
19 (FC)	(260'-289') x (35'-54')	2.29	2.08	4.77	13
20 (FD)	(260'-289') x (>54')	0.00	0.00	0.00	0
21 (GC)	(290'-300') x (35'-54')	2.12	2.00	4.24	118
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.72	1.57	2.69	3
24 (HD)	(>300') x (>54')	2.00	1.00	2.00	8
TOTAL					1,272

Table 7.20: Barge Flotilla Data for the Cumberland River, Milepost 148

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	3.00	1.00	3.00	4
2 (AB)	(<100') x (26'-34')	0.00	0.00	0.00	0
3 (AC)	(<100') x (35'-54')	0.00	0.00	0.00	0
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	0.00	0.00	0.00	0
6 (BB)	(100'-174') x (26'-34')	1.00	1.00	1.00	85
7 (BC)	(100'-174') x (35'-54')	3.11	2.03	6.33	16
8 (BD)	(100'-174') x (>54')	2.00	1.00	2.00	2
9 (CB)	(175'-194') x (26'-34')	1.00	1.00	1.00	87
10 (CC)	(175'-194') x (35'-54')	2.64	1.71	4.53	52
11 (CD)	(175'-194') x (>54')	0.00	0.00	0.00	0
12 (DB)	(195'-199') x (26'-34')	0.00	0.00	0.00	0
13 (DC)	(195'-199') x (35'-54')	2.78	2.42	6.73	582
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	0.00	0.00	0.00	0
17 (EC)	(200'-259') x (35'-54')	2.78	2.42	6.73	55
18 (ED)	(200'-259') x (>54')	0.00	0.00	0.00	0
19 (FC)	(260'-289') x (35'-54')	2.43	2.17	5.28	13
20 (FD)	(260'-289') x (>54')	0.00	0.00	0.00	0
21 (GC)	(290'-300') x (35'-54')	2.36	2.11	4.97	119
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.63	1.52	2.48	5
24 (HD)	(>300') x (>54')	1.50	2.00	3.00	2
TOTAL					1,022

Table 7.21: Barge Flotilla Data for the Cumberland River, Milepost 216

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	1.00	2.00	2.00	1
3 (AC)	(<100') x (35'-54')	0.00	0.00	0.00	0
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	0.00	0.00	0.00	0
6 (BB)	(100'-174') x (26'-34')	1.00	1.00	1.00	34
7 (BC)	(100'-174') x (35'-54')	0.00	0.00	0.00	0
8 (BD)	(100'-174') x (>54')	2.00	1.00	2.00	0
9 (CB)	(175'-194') x (26'-34')	0.00	0.00	0.00	0
10 (CC)	(175'-194') x (35'-54')	2.00	1.00	2.00	5
11 (CD)	(175'-194') x (>54')	0.00	0.00	0.00	0
12 (DB)	(195'-199') x (26'-34')	0.00	0.00	0.00	0
13 (DC)	(195'-199') x (35'-54')	1.55	1.35	2.10	147
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	0.00	0.00	0.00	0
17 (EC)	(200'-259') x (35'-54')	1.55	1.35	2.10	48
18 (ED)	(200'-259') x (>54')	0.00	0.00	0.00	0
19 (FC)	(260'-289') x (35'-54')	1.43	1.12	1.60	4
20 (FD)	(260'-289') x (>54')	0.00	0.00	0.00	0
21 (GC)	(290'-300') x (35'-54')	1.15	1.26	1.45	32
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.08	1.06	1.14	9
24 (HD)	(>300') x (>54')	0.00	0.00	0.00	0
TOTAL					280

Table 7.22: Barge Flotilla Data for the Green River, Milepost 9

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	0.00	0.00	0.00	0
3 (AC)	(<100') x (35'-54')	0.00	0.00	0.00	0
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	0.00	0.00	0.00	0
6 (BB)	(100'-174') x (26'-34')	0.00	0.00	0.00	0
7 (BC)	(100'-174') x (35'-54')	2.00	1.18	2.36	0
8 (BD)	(100'-174') x (>54')	0.00	0.00	0.00	0
9 (CB)	(175'-194') x (26'-34')	0.00	0.00	0.00	0
10 (CC)	(175'-194') x (35'-54')	2.20	1.40	3.08	13
11 (CD)	(175'-194') x (>54')	0.00	0.00	0.00	0
12 (DB)	(195'-199') x (26'-34')	2.00	1.00	2.00	2
13 (DC)	(195'-199') x (35'-54')	2.01	1.87	3.76	2,413
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	0.00	0.00	0.00	0
16 (EB)	(200'-259') x (26'-34')	2.00	1.00	2.00	0
17 (EC)	(200'-259') x (35'-54')	2.01	1.87	3.76	261
18 (ED)	(200'-259') x (>54')	0.00	0.00	0.00	0
19 (FC)	(260'-289') x (35'-54')	1.13	1.25	1.41	5
20 (FD)	(260'-289') x (>54')	1.00	1.00	1.00	0
21 (GC)	(290'-300') x (35'-54')	1.20	1.20	1.44	6
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.17	1.33	1.56	5
24 (HD)	(>300') x (>54')	0.00	0.00	0.00	0
TOTAL					2,703

Table 7.23: Barge Flotilla Data for the Green River, Milepost 63

Flotilla Category	Barge Size Range for Flotilla Category	Barges per Flotilla			Number of Flotilla Passages per Year
		column	row	TOTAL	
1 (AA)	(<100') x (<26')	0.00	0.00	0.00	0
2 (AB)	(<100') x (26'-34')	0.00	0.00	0.00	0
3 (AC)	(<100') x (35'-54')	0.00	0.00	0.00	0
4 (AD)	(<100') x (>54')	0.00	0.00	0.00	0
5 (BA)	(100'-174') x (<26')	0.00	0.00	0.00	0
6 (BB)	(100'-174') x (26'-34')	0.00	1.29	0.00	0
7 (BC)	(100'-174') x (35'-54')	2.71	1.00	3.49	0
8 (BD)	(100'-174') x (>54')	3.00	0.00	3.00	0
9 (CB)	(175'-194') x (26'-34')	0.00	0.00	0.00	0
10 (CC)	(175'-194') x (35'-54')	2.00	2.00	4.00	2
11 (CD)	(175'-194') x (>54')	0.00	0.00	0.00	0
12 (DB)	(195'-199') x (26'-34')	2.00	1.33	2.67	0
13 (DC)	(195'-199') x (35'-54')	1.99	1.79	3.56	1,297
14 (DD)	(195'-199') x (>54')	0.00	0.00	0.00	0
15 (EA)	(200'-259') x (<26')	2.00	1.00	2.00	0
16 (EB)	(200'-259') x (26'-34')	2.00	1.33	2.67	0
17 (EC)	(200'-259') x (35'-54')	1.99	1.79	3.56	45
18 (ED)	(200'-259') x (>54')	1.00	1.00	1.00	0
19 (FC)	(260'-289') x (35'-54')	1.00	1.11	1.11	2
20 (FD)	(260'-289') x (>54')	0.00	0.00	0.00	0
21 (GC)	(290'-300') x (35'-54')	1.50	1.00	1.50	0
22 (GD)	(290'-300') x (>54')	0.00	0.00	0.00	0
23 (HC)	(>300') x (35'-54')	1.00	1.00	1.00	2
24 (HD)	(>300') x (>54')	0.00	0.00	0.00	0
TOTAL					1,348

Table 7.24: Total Barge Distribution Data for the Ohio River

Flotilla Category	Barge Size Range for Flotilla Category	Number of Barges		
		Mile 279	Mile 341	Mile 436
1 (AA)[a]	(<100') x (<26')	43	5	18
2 (AB)	(<100') x (26'-34')	79	29	30
3 (AC)	(<100') x (35'-54')	24	7	1
4 (AD)	(<100') x (>54')	25	0	0
5 (BA)	(100'-174') x (<26')	13	0	0
6 (BB)	(100'-174') x (26'-34')	127	45	43
7 (BC)	(100'-174') x (35'-54')	1,303	1,114	1,170
8 (BD)	(100'-174') x (>54')	2	1	0
9 (CB)	(175'-194') x (26'-34')	1,994	33	70
10 (CC)	(175'-194') x (35'-54')	606	642	571
11 (CD)	(175'-194') x (>54')	114	68	11
12 (DB)	(195'-199') x (26'-34')	5,384	228	233
13 (DC)	(195'-199') x (35'-54')	28,232	54,694	51,269
14 (DD)	(195'-199') x (>54')	101	52	11
15 (EA)	(200'-259') x (<26')	1	0	0
16 (EB)	(200'-259') x (26'-34')	52	1	4
17 (EC)	(200'-259') x (35'-54')	3,807	4,415	4,822
18 (ED)	(200'-259') x (>54')	31	6	15
19 (FC)	(260'-289') x (35'-54')	106	127	70
20 (FD)	(260'-289') x (>54')	0	9	1
21 (GC)	(290'-300') x (35'-54')	2,195	3,111	2,628
22 (GD)	(290'-300') x (>54')	8	5	15
23 (HC)	(>300') x (35'-54')	36	170	30
24 (HD)	(>300') x (>54')	134	264	61
TOTAL		44,417	65,026	61,073

[a]AA: the first letter in parenthesis is the length of barge designation (Table 6.1) and the second letter is the width of barge designation (Table 6.2).

Table 7.24 (continued): Total Barge Distribution Data for the Ohio River

Flotilla Category	Barge Size Range for Flotilla Category	Number of Barges			
		Mile 531	Mile 606	Mile 720	Mile 776
1 (AA)	(<100') x (<26')	17	41	38	37
2 (AB)	(<100') x (26'-34')	52	142	126	166
3 (AC)	(<100') x (35'-54')	33	18	30	77
4 (AD)	(<100') x (>54')	3	2	3	1
5 (BA)	(100'-174') x (<26')	1	6	2	0
6 (BB)	(100'-174') x (26'-34')	56	93	120	75
7 (BC)	(100'-174') x (35'-54')	1,175	921	943	1,054
8 (BD)	(100'-174') x (>54')	12	14	7	6
9 (CB)	(175'-194') x (26'-34')	48	45	7	22
10 (CC)	(175'-194') x (35'-54')	873	871	904	1,062
11 (CD)	(175'-194') x (>54')	199	104	56	66
12 (DB)	(195'-199') x (26'-34')	37	86	51	114
13 (DC)	(195'-199') x (35'-54')	39,901	40,882	44,599	56,641
14 (DD)	(195'-199') x (>54')	86	67	92	101
15 (EA)	(200'-259') x (<26')	0	0	0	0
16 (EB)	(200'-259') x (26'-34')	16	4	4	4
17 (EC)	(200'-259') x (35'-54')	7,504	7,561	8,457	11,140
18 (ED)	(200'-259') x (>54')	53	38	70	76
19 (FC)	(260'-289') x (35'-54')	345	310	516	654
20 (FD)	(260'-289') x (>54')	5	10	9	9
21 (GC)	(290'-300') x (35'-54')	2,366	2,247	1,925	1,827
22 (GD)	(290'-300') x (>54')	16	23	31	51
23 (HC)	(>300') x (35'-54')	55	53	54	94
24 (HD)	(>300') x (>54')	337	83	73	151
TOTAL		53,190	53,621	58,117	73,428

Table 7.24 (continued): Total Barge Distribution Data for the Ohio River

Flotilla Category	Barge Size Range for Flotilla Category	Number of Barges		
		Mile 846	Mile 918	Mile 938
1 (AA)	(<100') x (<26')	47	36	84
2 (AB)	(<100') x (26'-34')	196	198	190
3 (AC)	(<100') x (35'-54')	117	86	87
4 (AD)	(<100') x (>54')	40	0	2
5 (BA)	(100'-174') x (<26')	2	1	8
6 (BB)	(100'-174') x (26'-34')	77	93	126
7 (BC)	(100'-174') x (35'-54')	1,201	1,098	1,104
8 (BD)	(100'-174') x (>54')	11	11	8
9 (CB)	(175'-194') x (26'-34')	17	48	43
10 (CC)	(175'-194') x (35'-54')	1,205	1,252	729
11 (CD)	(175'-194') x (>54')	84	84	27
12 (DB)	(195'-199') x (26'-34')	219	134	140
13 (DC)	(195'-199') x (35'-54')	58,129	70,203	89,340
14 (DD)	(195'-199') x (>54')	165	145	73
15 (EA)	(200'-259') x (<26')	0	0	0
16 (EB)	(200'-259') x (26'-34')	0	0	12
17 (EC)	(200'-259') x (35'-54')	14,794	18,144	7,805
18 (ED)	(200'-259') x (>54')	108	94	7
19 (FC)	(260'-289') x (35'-54')	2,664	2,686	2,020
20 (FD)	(260'-289') x (>54')	14	9	10
21 (GC)	(290'-300') x (35'-54')	2,161	2,310	2,498
22 (GD)	(290'-300') x (>54')	58	36	10
23 (HC)	(>300') x (35'-54')	94	89	122
24 (HD)	(>300') x (>54')	91	76	45
TOTAL		81,494	96,833	104,490

Table 7.25: Total Barge Distribution Data for the Tennessee River

Flotilla Category	Barge Size Range for Flotilla Category	Number of Barges		
		Mile 22	Mile 206	Mile 259
1 (AA)	(<100') x (<26')	19	23	9
2 (AB)	(<100') x (26'-34')	18	8	4
3 (AC)	(<100') x (35'-54')	3	10	9
4 (AD)	(<100') x (>54')	2	3	0
5 (BA)	(100'-174') x (<26')	3	4	1
6 (BB)	(100'-174') x (26'-34')	60	84	60
7 (BC)	(100'-174') x (35'-54')	223	185	128
8 (BD)	(100'-174') x (>54')	5	3	9
9 (CB)	(175'-194') x (26'-34')	82	1	0
10 (CC)	(175'-194') x (35'-54')	141	99	69
11 (CD)	(175'-194') x (>54')	4	21	3
12 (DB)	(195'-199') x (26'-34')	73	1	6
13 (DC)	(195'-199') x (35'-54')	27,310	20,000	9,253
14 (DD)	(195'-199') x (>54')	14	3	2
15 (EA)	(200'-259') x (<26')	0	0	0
16 (EB)	(200'-259') x (26'-34')	2	0	0
17 (EC)	(200'-259') x (35'-54')	5,190	4,755	2,094
18 (ED)	(200'-259') x (>54')	11	7	4
19 (FC)	(260'-289') x (35'-54')	86	82	64
20 (FD)	(260'-289') x (>54')	1	0	1
21 (GC)	(290'-300') x (35'-54')	780	633	578
22 (GD)	(290'-300') x (>54')	1	5	15
23 (HC)	(>300') x (35'-54')	29	72	39
24 (HD)	(>300') x (>54')	19	78	28
TOTAL		34,076	26,077	12,376

Table 7.25 (continued): Total Barge Distribution Data for the Tennessee River

Flotilla Category	Barge Size Range for Flotilla Category	Number of Barges		
		Mile 274	Mile 349	Mile 424
1 (AA)	(<100') x (<26')	26	18	20
2 (AB)	(<100') x (26'-34')	4	3	2
3 (AC)	(<100') x (35'-54')	9	5	10
4 (AD)	(<100') x (>54')	0	3	0
5 (BA)	(100'-174') x (<26')	10	7	8
6 (BB)	(100'-174') x (26'-34')	60	47	48
7 (BC)	(100'-174') x (35'-54')	142	67	70
8 (BD)	(100'-174') x (>54')	14	3	2
9 (CB)	(175'-194') x (26'-34')	1	0	1
10 (CC)	(175'-194') x (35'-54')	88	42	16
11 (CD)	(175'-194') x (>54')	7	0	8
12 (DB)	(195'-199') x (26'-34')	14	1	1
13 (DC)	(195'-199') x (35'-54')	8,746	6,996	4,030
14 (DD)	(195'-199') x (>54')	24	12	5
15 (EA)	(200'-259') x (<26')	0	0	0
16 (EB)	(200'-259') x (26'-34')	0	2	0
17 (EC)	(200'-259') x (35'-54')	2,094	1,601	971
18 (ED)	(200'-259') x (>54')	12	3	5
19 (FC)	(260'-289') x (35'-54')	56	8	15
20 (FD)	(260'-289') x (>54')	0	0	0
21 (GC)	(290'-300') x (35'-54')	577	246	244
22 (GD)	(290'-300') x (>54')	5	0	0
23 (HC)	(>300') x (35'-54')	56	25	20
24 (HD)	(>300') x (>54')	32	5	3
TOTAL		11,977	9,094	5,479

Table 7.25 (continued): Total Barge Distribution Data for the Tennessee River

Flotilla Category	Barge Size Range for Flotilla Category	Number of Barges		
		Mile 471	Mile 529	Mile 602
1 (AA)	(<100') x (<26')	3	4	2
2 (AB)	(<100') x (26'-34')	3	2	1
3 (AC)	(<100') x (35'-54')	5	2	0
4 (AD)	(<100') x (>54')	1	0	0
5 (BA)	(100'-174') x (<26')	10	0	0
6 (BB)	(100'-174') x (26'-34')	48	29	17
7 (BC)	(100'-174') x (35'-54')	27	79	9
8 (BD)	(100'-174') x (>54')	1	2	0
9 (CB)	(175'-194') x (26'-34')	1	0	0
10 (CC)	(175'-194') x (35'-54')	14	3	6
11 (CD)	(175'-194') x (>54')	0	0	0
12 (DB)	(195'-199') x (26'-34')	1	0	0
13 (DC)	(195'-199') x (35'-54')	1,402	570	134
14 (DD)	(195'-199') x (>54')	9	0	1
15 (EA)	(200'-259') x (<26')	0	0	0
16 (EB)	(200'-259') x (26'-34')	0	0	0
17 (EC)	(200'-259') x (35'-54')	763	463	154
18 (ED)	(200'-259') x (>54')	0	0	0
19 (FC)	(260'-289') x (35'-54')	5	1	4
20 (FD)	(260'-289') x (>54')	0	0	0
21 (GC)	(290'-300') x (35'-54')	93	89	87
22 (GD)	(290'-300') x (>54')	0	0	0
23 (HC)	(>300') x (35'-54')	30	28	29
24 (HD)	(>300') x (>54')	14	0	0
TOTAL		2,430	1,272	444

Table 7.26: Total Barge Distribution Data for the Cumberland River

Flotilla Category	Barge Size Range for Flotilla Category	Number of Barges		
		Mile 30	Mile 148	Mile 216
1 (AA)	(<100') x (<26')	3	10	4
2 (AB)	(<100') x (26'-34')	3	14	2
3 (AC)	(<100') x (35'-54')	2	9	1
4 (AD)	(<100') x (>54')	0	0	0
5 (BA)	(100'-174') x (<26')	2	1	4
6 (BB)	(100'-174') x (26'-34')	7	78	30
7 (BC)	(100'-174') x (35'-54')	77	95	7
8 (BD)	(100'-174') x (>54')	1	3	0
9 (CB)	(175'-194') x (26'-34')	6	80	2
10 (CC)	(175'-194') x (35'-54')	241	218	9
11 (CD)	(175'-194') x (>54')	16	8	2
12 (DB)	(195'-199') x (26'-34')	89	206	5
13 (DC)	(195'-199') x (35'-54')	7007	3599	271
14 (DD)	(195'-199') x (>54')	4	7	0
15 (EA)	(200'-259') x (<26')	0	0	0
16 (EB)	(200'-259') x (26'-34')	0	2	1
17 (EC)	(200'-259') x (35'-54')	2463	340	89
18 (ED)	(200'-259') x (>54')	5	13	6
19 (FC)	(260'-289') x (35'-54')	57	65	6
20 (FD)	(260'-289') x (>54')	0	0	1
21 (GC)	(290'-300') x (35'-54')	449	545	41
22 (GD)	(290'-300') x (>54')	7	5	2
23 (HC)	(>300') x (35'-54')	8	11	9
24 (HD)	(>300') x (>54')	15	5	0
TOTAL		10,464	5,314	493

Table 7.27: Total Barge Distribution Data for the Green River

Flotilla Category	Barge Size Range for Flotilla Category	Number of Barges	
		Mile 9	Mile 63
1 (AA)	(<100') x (<26')	0	0
2 (AB)	(<100') x (26'-34')	0	0
3 (AC)	(<100') x (35'-54')	0	0
4 (AD)	(<100') x (>54')	0	0
5 (BA)	(100'-174') x (<26')	0	0
6 (BB)	(100'-174') x (26'-34')	0	1
7 (BC)	(100'-174') x (35'-54')	0	0
8 (BD)	(100'-174') x (>54')	0	1
9 (CB)	(175'-194') x (26'-34')	0	0
10 (CC)	(175'-194') x (35'-54')	41	6
11 (CD)	(175'-194') x (>54')	2	4
12 (DB)	(195'-199') x (26'-34')	4	0
13 (DC)	(195'-199') x (35'-54')	9,244	4,543
14 (DD)	(195'-199') x (>54')	8	0
15 (EA)	(200'-259') x (<26')	0	0
16 (EB)	(200'-259') x (26'-34')	0	0
17 (EC)	(200'-259') x (35'-54')	998	157
18 (ED)	(200'-259') x (>54')	0	0
19 (FC)	(260'-289') x (35'-54')	7	2
20 (FD)	(260'-289') x (>54')	0	1
21 (GC)	(290'-300') x (35'-54')	9	0
22 (GD)	(290'-300') x (>54')	0	0
23 (HC)	(>300') x (35'-54')	8	2
24 (HD)	(>300') x (>54')	43	2
TOTAL		10,364	4,719

Table 7.28: Ohio River Total Barge Traffic Growth Rates

Mile	Percent Change[a]	
	1991-1992	1992-1993
341	17%	0%
436	-2%	3%
531	-2%	6%
606	-6%	3%
720	-8%	3%
776	-8%	4%
846	-8%	1%
918	-6%	-2%
938	-5%	2%

[a] Percent change in barge traffic is calculated by the U.S. Army Corps of Engineers as:

$$\frac{T_{i+1} - T_i}{T_{i+1}}$$

where T_i is the barge traffic report for year i.

Table 7.29: Tennessee River Total Barge Traffic Growth Rates

Mile	Percent Change[a]	
	1991-1992	1992-1993
22	1%	13%
206	8%	-1%
259	10%	7%
274	5%	11%
349	17%	5%
424	-2%	3%
471	5%	-8%
529	0%	-4%
602	3%	8%

[a] Percent change in barge traffic is calculated by the U.S. Army Corps of Engineers as:

$$\frac{T_{i+1} - T_i}{T_{i+1}}$$

where T_i is the barge traffic report for year i.

Table 7.30: Cumberland River Total Barge Traffic Growth Rates

Mile	Percent Change[a]	
	1991-1992	1992-1993
30	40%	-18%
148	-6%	12%
216	-109%	18%

[a] Percent change in barge traffic is calculated by the U.S. Army Corps of Engineers as:

$$\frac{T_{i+1} - T_i}{T_{i+1}}$$

where T_i is the barge traffic report for year i.

Table 7.31: Green River Total Barge Traffic Growth Rates

Mile	Percent Change[a]	
	1991-1992	1992-1993
9	-18%	-22%
63	-23%	-32%

[a] Percent change in barge traffic is calculated by the U.S. Army Corps of Engineers as:

$$\frac{T_{i+1} - T_i}{T_{i+1}}$$

where T_i is the barge traffic report for year i.

Table 7.32: Flotilla Frequency Projections for the Ohio River, Milepost 341

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)[a]	0	0	0	0	0	0	0
2 (AB)	0	0	0	0	0	0	0
3 (AC)	1	1	2	2	2	2	2
4 (AD)	0	0	0	0	0	0	0
5 (BA)	0	0	0	0	0	0	0
6 (BB)	34	47	54	61	68	76	82
7 (BC)	163	226	261	294	328	365	392
8 (BD)	0	0	0	0	0	0	0
9 (CB)	0	0	0	0	0	0	0
10 (CC)	106	147	170	192	213	238	255
11 (CD)	14	19	22	25	28	31	34
12 (DB)	60	83	96	108	121	134	144
13 (DC)	4,454	6,189	7,133	8,047	8,963	9,982	10,719
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	360	500	577	650	724	807	866
18 (ED)	4	6	6	7	8	9	10
19 (FC)	17	24	27	31	34	38	41
20 (FD)	3	4	5	5	6	7	7
21 (GC)	483	671	774	873	972	1,082	1,162
22 (GD)	0	0	0	0	0	0	0
23 (HC)	54	75	86	98	109	121	130
24 (HD)	176	245	282	318	354	394	424

[a]AA: the first letter in parenthesis is the length of barge designation (Table 6.1) and the second letter is the width of barge designation (Table 6.2).

Table 7.33: Flotilla Frequency Projections for the Ohio River, Milepost 436

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	0	0	0	0	0	0	0
3 (AC)	0	0	0	0	0	0	0
4 (AD)	0	0	0	0	0	0	0
5 (BA)	0	0	0	0	0	0	0
6 (BB)	8	10	12	14	15	17	18
7 (BC)	209	273	317	357	399	444	476
8 (BD)	0	0	0	0	0	0	0
9 (CB)	0	0	0	0	0	0	0
10 (CC)	91	119	138	156	174	193	207
11 (CD)	0	0	0	0	0	0	0
12 (DB)	49	64	74	84	93	104	112
13 (DC)	4,151	5,431	6,304	7,100	7,915	8,809	9,460
14 (DD)	1	1	2	2	2	2	2
15 (EA)	0	0	0	0	0	0	0
16 (EB)	1	1	2	2	2	2	2
17 (EC)	390	510	592	667	744	828	889
18 (ED)	0	0	0	0	0	0	0
19 (FC)	9	12	14	15	17	19	21
20 (FD)	0	0	0	0	0	0	0
21 (GC)	409	535	621	700	780	868	932
22 (GD)	0	0	0	0	0	0	0
23 (HC)	9	12	14	15	17	19	21
24 (HD)	38	50	58	65	72	81	87

Table 7.34: Flotilla Frequency Projections for the Ohio River, Milepost 531

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	3	4	5	5	6	6	7
2 (AB)	7	9	11	12	14	15	16
3 (AC)	2	3	3	3	4	4	5
4 (AD)	0	0	0	0	0	0	0
5 (BA)	1	1	2	2	2	2	2
6 (BB)	10	13	15	17	19	22	24
7 (BC)	188	243	284	323	363	407	443
8 (BD)	1	1	2	2	2	2	2
9 (CB)	0	0	0	0	0	0	0
10 (CC)	132	171	199	227	255	286	311
11 (CD)	77	99	116	132	149	167	181
12 (DB)	38	49	57	65	73	82	89
13 (DC)	3,302	4,266	4,990	5,667	6,368	7,145	7,777
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	17	22	26	29	33	37	40
17 (EC)	621	802	939	1,066	1,198	1,344	1,463
18 (ED)	18	23	27	31	35	39	42
19 (FC)	53	68	80	91	102	115	125
20 (FD)	0	0	0	0	0	0	0
21 (GC)	502	649	759	861	968	1,086	1,182
22 (GD)	6	8	9	10	12	13	14
23 (HC)	17	22	26	29	33	37	40
24 (HD)	139	180	210	239	268	301	327

Table 7.35: Flotilla Frequency Projections for the Ohio River, Milepost 606

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	22	28	32	36	41	46	50
2 (AB)	28	35	41	46	52	58	63
3 (AC)	2	3	3	3	4	4	5
4 (AD)	1	1	1	2	2	2	2
5 (BA)	6	8	9	10	11	12	14
6 (BB)	24	30	35	40	45	50	54
7 (BC)	115	144	168	191	214	239	260
8 (BD)	1	1	1	2	2	2	2
9 (CB)	35	44	51	58	65	73	79
10 (CC)	121	152	177	201	225	252	274
11 (CD)	24	30	35	40	45	50	54
12 (DB)	50	63	73	83	93	104	113
13 (DC)	3,458	4,342	5,064	5,731	6,427	7,198	7,832
14 (DD)	27	34	40	45	50	56	61
15 (EA)	0	0	0	0	0	0	0
16 (EB)	2	3	3	3	4	4	5
17 (EC)	640	804	937	1,061	1,189	1,332	1,450
18 (ED)	17	21	25	28	32	35	39
19 (FC)	67	84	98	111	125	139	152
20 (FD)	3	4	4	5	6	6	7
21 (GC)	613	770	898	1,016	1,139	1,276	1,388
22 (GD)	9	11	13	15	17	19	20
23 (HC)	17	21	25	28	32	35	39
24 (HD)	14	18	21	23	26	29	32

Table 7.36: Flotilla Frequency Projections for the Ohio River, Milepost 720

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	23	29	34	39	44	49	53
3 (AC)	2	3	3	3	4	4	5
4 (AD)	1	1	1	2	2	2	2
5 (BA)	2	3	3	3	4	4	5
6 (BB)	17	22	25	29	32	36	39
7 (BC)	140	179	209	237	266	298	324
8 (BD)	1	1	1	2	2	2	2
9 (CB)	4	5	6	7	8	9	9
10 (CC)	187	239	279	317	355	398	433
11 (CD)	20	26	30	34	38	43	46
12 (DB)	27	34	40	46	51	57	62
13 (DC)	3,791	4,841	5,662	6,419	7,200	8,063	8,768
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	2	3	3	3	4	4	5
17 (EC)	719	918	1,074	1,217	1,366	1,529	1,663
18 (ED)	0	0	0	0	0	0	0
19 (FC)	76	97	114	129	144	162	176
20 (FD)	2	3	3	3	4	4	5
21 (GC)	421	538	629	713	800	895	974
22 (GD)	16	20	24	27	30	34	37
23 (HC)	18	23	27	30	34	38	42
24 (HD)	0	0	0	0	0	0	0

Table 7.37: Flotilla Frequency Projections for the Ohio River, Milepost 776

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	13	16	19	21	23	26	28
2 (AB)	41	51	59	66	74	82	89
3 (AC)	6	7	9	10	11	12	13
4 (AD)	0	0	0	0	0	0	0
5 (BA)	0	0	0	0	0	0	0
6 (BB)	14	17	20	23	25	28	30
7 (BC)	153	189	220	247	276	307	333
8 (BD)	1	1	1	2	2	2	2
9 (CB)	0	0	0	0	0	0	0
10 (CC)	222	275	320	359	400	445	483
11 (CD)	13	16	19	21	23	26	28
12 (DB)	45	56	65	73	81	90	98
13 (DC)	4,948	6,124	7,126	8,000	8,914	9,927	10,763
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	2	2	3	3	4	4	4
17 (EC)	973	1,204	1,401	1,573	1,753	1,952	2,116
18 (ED)	13	16	19	21	23	26	28
19 (FC)	119	147	171	192	214	239	259
20 (FD)	0	0	0	0	0	0	0
21 (GC)	398	493	573	644	717	799	866
22 (GD)	0	0	0	0	0	0	0
23 (HC)	32	40	46	52	58	64	70
24 (HD)	83	103	120	134	150	167	181

Table 7.38: Flotilla Frequency Projections for the Ohio River, Milepost 846

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	26	33	39	44	50	57	63
3 (AC)	10	13	15	17	19	22	24
4 (AD)	17	22	25	29	33	37	41
5 (BA)	0	0	0	0	0	0	0
6 (BB)	14	18	21	24	27	31	34
7 (BC)	145	187	217	245	279	319	352
8 (BD)	1	1	1	2	2	2	2
9 (CB)	0	0	0	0	0	0	0
10 (CC)	181	233	270	306	349	399	439
11 (CD)	45	58	67	76	87	99	109
12 (DB)	105	135	157	178	202	231	255
13 (DC)	4,691	6,038	7,007	7,930	9,035	10,335	11,373
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	1,194	1,537	1,784	2,018	2,300	2,631	2,895
18 (ED)	28	36	42	47	54	62	68
19 (FC)	441	568	659	746	849	972	1,069
20 (FD)	5	6	7	8	10	11	12
21 (GC)	244	314	364	412	470	538	592
22 (GD)	14	18	21	24	27	31	34
23 (HC)	31	40	46	52	60	68	75
24 (HD)	40	51	60	68	77	88	97

Table 7.39: Flotilla Frequency Projections for the Ohio River, Milepost 918

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	31	39	46	52	60	69	76
3 (AC)	6	8	9	10	12	13	15
4 (AD)	0	0	0	0	0	0	0
5 (BA)	0	0	0	0	0	0	0
6 (BB)	32	41	47	54	62	71	78
7 (BC)	162	206	240	272	313	360	397
8 (BD)	1	1	1	2	2	2	2
9 (CB)	0	0	0	0	0	0	0
10 (CC)	166	211	246	279	320	369	407
11 (CD)	16	20	24	27	31	36	39
12 (DB)	59	75	87	99	114	131	145
13 (DC)	5,825	7,412	8,629	9,789	11,245	12,945	14,281
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	1,505	1,915	2,230	2,529	2,905	3,345	3,690
18 (ED)	52	66	77	87	100	116	127
19 (FC)	478	608	708	803	923	1,062	1,172
20 (FD)	2	3	3	3	4	4	5
21 (GC)	363	462	538	610	701	807	890
22 (GD)	10	13	15	17	19	22	25
23 (HC)	35	45	52	59	68	78	86
24 (HD)	17	22	25	29	33	38	42

Table 7.40: Flotilla Frequency Projections for the Ohio River, Milepost 938

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	94	120	139	158	179	203	224
2 (AB)	38	48	56	64	72	82	90
3 (AC)	6	8	9	10	11	13	14
4 (AD)	0	0	0	0	0	0	0
5 (BA)	2	3	3	3	4	4	5
6 (BB)	50	64	74	84	95	108	119
7 (BC)	171	218	254	288	326	370	407
8 (BD)	1	1	1	2	2	2	2
9 (CB)	44	56	65	74	84	95	105
10 (CC)	94	120	139	158	179	203	224
11 (CD)	5	6	7	8	10	11	12
12 (DB)	53	67	79	89	101	115	126
13 (DC)	7,960	10,128	11,811	13,383	15,173	17,215	18,935
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	5	6	7	8	10	11	12
17 (EC)	695	884	1,031	1,169	1,325	1,503	1,653
18 (ED)	1	1	1	2	2	2	2
19 (FC)	320	407	475	538	610	692	761
20 (FD)	3	4	4	5	6	6	7
21 (GC)	673	856	999	1,132	1,283	1,455	1,601
22 (GD)	4	5	6	7	8	9	10
23 (HC)	36	46	53	61	69	78	86
24 (HD)	19	24	28	32	36	41	45

Table 7.41: Flotilla Frequency Projections for the Tennessee River, Milepost 22

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	0	0	0	0	0	0	0
3 (AC)	0	0	0	0	0	0	0
4 (AD)	0	0	0	0	0	0	0
5 (BA)	0	0	0	0	0	0	0
6 (BB)	13	17	18	20	23	27	30
7 (BC)	36	46	51	56	65	75	82
8 (BD)	1	1	1	2	2	2	2
9 (CB)	0	0	0	0	0	0	0
10 (CC)	27	34	38	42	48	56	62
11 (CD)	0	0	0	0	0	0	0
12 (DB)	0	0	0	0	0	0	0
13 (DC)	2.673	3,402	3,777	4,158	4,799	5,559	6,125
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	508	647	718	790	912	1,056	1,164
18 (ED)	6	8	8	9	11	12	14
19 (FC)	16	20	23	25	29	33	37
20 (FD)	0	0	0	0	0	0	0
21 (GC)	207	263	293	322	372	430	474
22 (GD)	0	0	0	0	0	0	0
23 (HC)	11	14	16	17	20	23	25
24 (HD)	10	13	14	16	18	21	23

Table 7.42: Flotilla Frequency Projections for the Tennessee River, Milepost 206

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	0	0	0	0	0	0	0
3 (AC)	1	1	2	2	2	2	3
4 (AD)	0	0	0	0	0	0	0
5 (BA)	4	6	6	7	8	9	10
6 (BB)	33	46	52	59	67	77	84
7 (BC)	27	37	42	49	55	63	69
8 (BD)	0	0	0	0	0	0	0
9 (CB)	0	0	0	0	0	0	0
10 (CC)	18	25	28	32	37	42	46
11 (CD)	0	0	0	0	0	0	0
12 (DB)	0	0	0	0	0	0	0
13 (DC)	1,689	2,337	2,656	3,045	3,454	3,924	4,297
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	402	556	632	725	822	934	1,023
18 (ED)	7	10	11	13	14	16	18
19 (FC)	14	19	22	25	29	33	36
20 (FD)	0	0	0	0	0	0	0
21 (GC)	176	244	277	317	360	409	448
22 (GD)	0	0	0	0	0	0	0
23 (HC)	26	36	41	47	53	60	66
24 (HD)	36	50	57	65	74	84	92

Table 7.43: Flotilla Frequency Projections for the Tennessee River, Milepost 259

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	0	0	0	0	0	0	0
3 (AC)	0	0	0	0	0	0	0
4 (AD)	0	0	0	0	0	0	0
5 (BA)	0	0	0	0	0	0	0
6 (BB)	64	99	109	119	133	148	162
7 (BC)	15	23	25	28	31	35	38
8 (BD)	4	6	7	7	8	9	10
9 (CB)	0	0	0	0	0	0	0
10 (CC)	13	20	22	24	27	30	33
11 (CD)	0	0	0	0	0	0	0
12 (DB)	0	0	0	0	0	0	0
13 (DC)	894	1,379	1,518	1,667	1,855	2,070	2,261
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	202	312	343	377	419	468	511
18 (ED)	0	0	0	0	0	0	0
19 (FC)	10	15	17	19	21	23	25
20 (FD)	0	0	0	0	0	0	0
21 (GC)	181	279	307	337	375	419	458
22 (GD)	0	0	0	0	0	0	0
23 (HC)	17	26	29	32	35	39	43
24 (HD)	0	0	0	0	0	0	0

Table 7.44: Flotilla Frequency Projections for the Tennessee River, Milepost 274

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	14	22	24	26	29	32	35
2 (AB)	0	0	0	0	0	0	0
3 (AC)	5	8	8	9	10	12	13
4 (AD)	0	0	0	0	0	0	0
5 (BA)	2	3	3	4	4	5	5
6 (BB)	0	0	0	0	0	0	0
7 (BC)	21	32	36	39	44	49	53
8 (BD)	6	9	10	11	12	14	15
9 (CB)	1	2	2	2	2	2	3
10 (CC)	14	22	24	26	29	32	35
11 (CD)	0	0	0	0	0	0	0
12 (DB)	0	0	0	0	0	0	0
13 (DC)	868	1,339	1,473	1,617	1,800	2,010	2,196
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	208	321	353	387	431	482	526
18 (ED)	7	11	12	13	15	16	18
19 (FC)	9	14	15	17	19	21	23
20 (FD)	0	0	0	0	0	0	0
21 (GC)	176	271	299	328	365	407	445
22 (GD)	0	0	0	0	0	0	0
23 (HC)	28	43	48	52	58	65	71
24 (HD)	0	0	0	0	0	0	0

Table 7.45: Flotilla Frequency Projections for the Tennessee River, Milepost 349

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	0	0	0	0	0	0	0
3 (AC)	0	0	0	0	0	0	0
4 (AD)	0	0	0	0	0	0	0
5 (BA)	0	0	0	0	0	0	0
6 (BB)	0	0	0	0	0	0	0
7 (BC)	10	15	17	19	21	24	26
8 (BD)	2	3	3	4	4	5	5
9 (CB)	0	0	0	0	0	0	0
10 (CC)	7	11	12	13	15	17	18
11 (CD)	0	0	0	0	0	0	0
12 (DB)	1	2	2	2	2	2	3
13 (DC)	740	1,142	1,263	1,395	1,568	1,768	1,936
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	1	2	2	2	2	2	3
17 (EC)	169	261	288	319	358	404	442
18 (ED)	0	0	0	0	0	0	0
19 (FC)	1	2	2	2	2	2	3
20 (FD)	0	0	0	0	0	0	0
21 (GC)	79	122	135	149	167	189	207
22 (GD)	0	0	0	0	0	0	0
23 (HC)	8	12	14	15	17	19	21
24 (HD)	0	0	0	0	0	0	0

Table 7.46: Flotilla Frequency Projections for the Tennessee River, Milepost 424

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	0	0	0	0	0	0	0
3 (AC)	0	0	0	0	0	0	0
4 (AD)	0	0	0	0	0	0	0
5 (BA)	8	12	14	15	16	18	19
6 (BB)	51	79	87	95	104	113	123
7 (BC)	11	17	19	21	22	24	27
8 (BD)	1	2	2	2	2	2	2
9 (CB)	1	2	2	2	2	2	2
10 (CC)	3	5	5	6	6	7	7
11 (CD)	3	5	5	6	6	7	7
12 (DB)	0	0	0	0	0	0	0
13 (DC)	533	827	913	997	1,086	1,182	1,285
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	128	199	219	239	261	284	309
18 (ED)	4	6	7	7	8	9	10
19 (FC)	2	3	3	4	4	4	5
20 (FD)	0	0	0	0	0	0	0
21 (GC)	74	115	127	138	151	164	178
22 (GD)	0	0	0	0	0	0	0
23 (HC)	8	12	14	15	16	18	19
24 (HD)	0	0	0	0	0	0	0

Table 7.47: Flotilla Frequency Projections for the Tennessee River, Milepost 471

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	0	0	0	0	0	0	0
3 (AC)	2	5	5	6	6	7	8
4 (AD)	0	0	0	0	0	0	0
5 (BA)	0	0	0	0	0	0	0
6 (BB)	20	48	53	59	64	70	77
7 (BC)	5	12	13	15	16	18	19
8 (BD)	1	2	3	3	3	4	4
9 (CB)	0	0	0	0	0	0	0
10 (CC)	2	5	5	6	6	7	8
11 (CD)	0	0	0	0	0	0	0
12 (DB)	0	0	0	0	0	0	0
13 (DC)	179	430	478	526	575	629	686
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	97	233	259	285	312	341	372
18 (ED)	0	0	0	0	0	0	0
19 (FC)	1	2	3	3	3	4	4
20 (FD)	0	0	0	0	0	0	0
21 (GC)	36	86	96	106	116	126	138
22 (GD)	0	0	0	0	0	0	0
23 (HC)	14	34	37	41	45	49	54
24 (HD)	0	0	0	0	0	0	0

Table 7.48: Flotilla Frequency Projections for the Tennessee River, Milepost 529

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	0	0	0	0	0	0	0
3 (AC)	1	2	3	3	3	3	4
4 (AD)	0	0	0	0	0	0	0
5 (BA)	0	0	0	0	0	0	0
6 (BB)	0	0	0	0	0	0	0
7 (BC)	20	49	53	58	63	68	74
8 (BD)	0	0	0	0	0	0	0
9 (CB)	0	0	0	0	0	0	0
10 (CC)	1	2	3	3	3	3	4
11 (CD)	0	0	0	0	0	0	0
12 (DB)	0	0	0	0	0	0	0
13 (DC)	85	207	227	246	267	290	315
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	69	168	184	200	217	235	256
18 (ED)	0	0	0	0	0	0	0
19 (FC)	0	0	0	0	0	0	0
20 (FD)	0	0	0	0	0	0	0
21 (GC)	40	97	107	116	126	136	148
22 (GD)	0	0	0	0	0	0	0
23 (HC)	15	37	40	43	47	51	56
24 (HD)	0	0	0	0	0	0	0

Table 7.49: Flotilla Frequency Projections for the Tennessee River, Milepost 602

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	0	0	0	0	0	0	0
3 (AC)	0	0	0	0	0	0	0
4 (AD)	0	0	0	0	0	0	0
5 (BA)	0	0	0	0	0	0	0
6 (BB)	17	44	51	57	64	71	79
7 (BC)	3	8	9	10	11	13	14
8 (BD)	0	0	0	0	0	0	0
9 (CB)	0	0	0	0	0	0	0
10 (CC)	2	5	6	7	7	8	9
11 (CD)	0	0	0	0	0	0	0
12 (DB)	0	0	0	0	0	0	0
13 (DC)	39	101	116	131	146	163	181
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	45	117	134	151	169	188	209
18 (ED)	0	0	0	0	0	0	0
19 (FC)	2	5	6	7	7	8	9
20 (FD)	0	0	0	0	0	0	0
21 (GC)	39	101	116	131	146	163	181
22 (GD)	0	0	0	0	0	0	0
23 (HC)	14	36	42	47	52	58	65
24 (HD)	0	0	0	0	0	0	0

Table 7.50: Flotilla Frequency Projections for the Cumberland River, Milepost 30

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	0	0	0	0	0	0	0
3 (AC)	0	0	0	0	0	0	0
4 (AD)	0	0	0	0	0	0	0
5 (BA)	2	5	5	6	7	7	8
6 (BB)	0	0	0	0	0	0	0
7 (BC)	14	32	36	41	46	50	54
8 (BD)	0	0	0	0	0	0	0
9 (CB)	7	16	18	20	23	25	27
10 (CC)	57	132	148	166	187	204	222
11 (CD)	0	0	0	0	0	0	0
12 (DB)	0	0	0	0	0	0	0
13 (DC)	777	1,797	2,023	2,259	2,552	2,782	3,021
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	273	632	711	794	897	978	1,062
18 (ED)	0	0	0	0	0	0	0
19 (FC)	13	30	34	38	43	47	51
20 (FD)	0	0	0	0	0	0	0
21 (GC)	118	273	307	343	388	423	459
22 (GD)	0	0	0	0	0	0	0
23 (HC)	3	7	8	9	10	11	12
24 (HD)	8	19	21	23	26	29	31

Table 7.51: Flotilla Frequency Projections for the Cumberland River, Milepost 148

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	4	6	6	7	8	9	10
2 (AB)	0	0	0	0	0	0	0
3 (AC)	0	0	0	0	0	0	0
4 (AD)	0	0	0	0	0	0	0
5 (BA)	0	0	0	0	0	0	0
6 (BB)	85	122	138	153	172	192	211
7 (BC)	16	23	26	29	32	36	40
8 (BD)	2	3	3	4	4	5	5
9 (CB)	87	125	141	157	176	197	216
10 (CC)	52	75	84	94	105	118	129
11 (CD)	0	0	0	0	0	0	0
12 (DB)	0	0	0	0	0	0	0
13 (DC)	582	835	945	1,050	1,181	1,318	1,448
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	55	79	89	99	112	125	137
18 (ED)	0	0	0	0	0	0	0
19 (FC)	13	19	21	23	26	29	32
20 (FD)	0	0	0	0	0	0	0
21 (GC)	119	171	193	215	241	269	296
22 (GD)	0	0	0	0	0	0	0
23 (HC)	5	7	8	9	10	11	12
24 (HD)	2	3	3	4	4	5	5

Table 7.52: Flotilla Frequency Projections for the Cumberland River, Milepost 216

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	1	2	2	2	2	3	3
3 (AC)	0	0	0	0	0	0	0
4 (AD)	0	0	0	0	0	0	0
5 (BA)	0	0	0	0	0	0	0
6 (BB)	34	61	61	65	77	91	104
7 (BC)	0	0	0	0	0	0	0
8 (BD)	0	0	0	0	0	0	0
9 (CB)	0	0	0	0	0	0	0
10 (CC)	5	9	9	10	11	13	15
11 (CD)	0	0	0	0	0	0	0
12 (DB)	0	0	0	0	0	0	0
13 (DC)	147	265	265	280	333	396	448
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	48	87	86	92	109	129	146
18 (ED)	0	0	0	0	0	0	0
19 (FC)	4	7	7	8	9	11	12
20 (FD)	0	0	0	0	0	0	0
21 (GC)	32	58	58	61	73	86	98
22 (GD)	0	0	0	0	0	0	0
23 (HC)	9	16	16	17	20	24	27
24 (HD)	0	0	0	0	0	0	0

Table 7.53: Flotilla Frequency Projections for the Green River, Milepost 9

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	0	0	0	0	0	0	0
3 (AC)	0	0	0	0	0	0	0
4 (AD)	0	0	0	0	0	0	0
5 (BA)	0	0	0	0	0	0	0
6 (BB)	0	0	0	0	0	0	0
7 (BC)	0	0	0	0	0	0	0
8 (BD)	0	0	0	0	0	0	0
9 (CB)	0	0	0	0	0	0	0
10 (CC)	13	9	9	10	11	11	12
11 (CD)	0	0	0	0	0	0	0
12 (DB)	2	1	1	2	2	2	2
13 (DC)	2,413	1,584	1,721	1,826	1,963	2,126	2,240
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	261	171	186	197	212	230	242
18 (ED)	0	0	0	0	0	0	0
19 (FC)	5	3	4	4	4	4	5
20 (FD)	0	0	0	0	0	0	0
21 (GC)	6	4	4	5	5	5	6
22 (GD)	0	0	0	0	0	0	0
23 (HC)	5	3	4	4	4	4	5
24 (HD)	0	0	0	0	0	0	0

Table 7.54: Flotilla Frequency Projections for the Green River, Milepost 63

Flotilla Category	Flotilla Frequency (Number of Passages Per Year)						
	1992	2000	2010	2020	2030	2040	2050
1 (AA)	0	0	0	0	0	0	0
2 (AB)	0	0	0	0	0	0	0
3 (AC)	0	0	0	0	0	0	0
4 (AD)	0	0	0	0	0	0	0
5 (BA)	0	0	0	0	0	0	0
6 (BB)	0	0	0	0	0	0	0
7 (BC)	0	0	0	0	0	0	0
8 (BD)	0	0	0	0	0	0	0
9 (CB)	0	0	0	0	0	0	0
10 (CC)	2	2	2	2	2	2	3
11 (CD)	0	0	0	0	0	0	0
12 (DB)	0	0	0	0	0	0	0
13 (DC)	1,297	1,179	1,283	1,366	1,482	1,617	1,707
14 (DD)	0	0	0	0	0	0	0
15 (EA)	0	0	0	0	0	0	0
16 (EB)	0	0	0	0	0	0	0
17 (EC)	45	41	45	47	51	56	59
18 (ED)	0	0	0	0	0	0	0
19 (FC)	2	2	2	2	2	2	3
20 (FD)	0	0	0	0	0	0	0
21 (GC)	0	0	0	0	0	0	0
22 (GD)	0	0	0	0	0	0	0
23 (HC)	2	2	2	2	2	2	3
24 (HD)	0	0	0	0	0	0	0

8. Probability of Aberrancy

The likelihood that a flotilla will be out of control (aberrant) must be determined in order to calculate the probability that a flotilla will collide with a bridge. The *AASHTO Guide Specification* recommends determining the probability of aberrancy (PA) from long-term barge casualty (accident) data.

Vessel casualty statistics have been maintained by the U.S. Coast Guard, Washington, D.C., for the past 11 years for all of the navigable rivers in Kentucky. The casualty reports are stored as a database and contain the location, cause, type of vessel, and type of casualty. The types of casualties include:

- collisions with bridges,
- collisions with other vessels,
- collisions with docks,
- collisions with locks, and
- groundings

Each barge within an aberrant flotilla is treated as a separate casualty record or event.

For example, if a flotilla was comprised of 15 barges, of which eight were damaged, then there would be eight separate casualty records in the database. However, since the impacts from the individual barges are applied simultaneously as a unit (i.e. a flotilla), then only one of the eight casualties should be used in calculating the probability of aberrancy. In addition, if more than one flotilla is involved in a collision each flotilla should be treated as a separate event.

The *AASHTO Guide Specification* recommends that all types of barge casualties should be used to calculate the probability of aberrancy. Current ongoing research questions whether groundings and rammings should be used in the calculations. However, since including them leads to more conservative results, it is recommended that almost all types of barge casualties be included in the aberrancy calculations. The only exceptions are casualties which are not the result of flotilla aberrancy, such as groundings or collisions with submerged, unmarked obstacles.

In order to calculate the probability of aberrancy for a navigable waterway, the total number of flotilla casualties for a year is divided by the total number of flotillas traveling the river for that year. However, the waterways of Kentucky are in some cases hundreds of miles long. In addition, the flotilla operating conditions change dramatically

along the waterway. Therefore, the probability of aberrancy is calculated and given for ranges of the navigable rivers of Kentucky.

The ranges of the rivers were selected so that the conditions (e.g., traffic, number of terminals or tipples, etc.) along the section were essentially constant. Therefore, calculating the probability of aberrancy for a section of a river assumes that the likelihood of a flotilla becoming aberrant is constant along the section of the river. The advantage of calculating the probabilities on a section by section basis is that hazardous sections of the river will have higher probabilities of aberrancy and less hazardous sections will have lower probabilities.

The probabilities of aberrancy for the navigable waterways of Kentucky are given in Table 8.1. For most ranges, the values are near what would be calculated using the *AASHTO Guide Specification* approximate method. In some cases though, the probabilities are quite high. However, careful examination of the historical casualty data supports the accuracy of the results.

The probability of aberrancy is calculated by the following equation as described in the first two paragraphs of Section 4.8.3.2 of the *AASHTO Guide Specification*:

$$PA = \frac{1}{ny} \sum_{n=1}^{ny} \left[\frac{2 * nc}{\left(tc_{1n} + tc_{2n} \right)} \right] \qquad \textbf{(5)}$$

where,

tc_{1n} = *Flotilla traffic count at station 1 for year n.*
tc_{2n} = *Flotilla traffic count at station 2 for year n.*
nc = *Number of casualties occurring between traffic reporting stations for year n.*
ny = *Number of years for which the casualties have occurred.*

A weighted average probability of aberrancy for each of the waterways is given in Table 8.2 as a means of comparing the overall waterway probabilities. The weighing factor is the number of miles each probability of aberrancy value represents. However, as mentioned previously, it is better to use the section probabilities as the average tends to either under predict or over predict the actual probability of aberrancy.

Table 8.1: Probability of Aberrancy for Rivers in Kentucky

River	Mile Range	Probability of Aberrancy
Ohio	279-341	4.495×10^{-4}
	341-436	1.770×10^{-4}
	436-531	6.579×10^{-4}
	531-606	10.424×10^{-4}
	606-720	3.030×10^{-4}
	720-776	2.029×10^{-4}
	776-846	3.432×10^{-4}
	846-918	3.638×10^{-4}
	918-938	15.283×10^{-4}
	938-mouth	13.716×10^{-4}
Tennessee	000-099	16.835×10^{-4}
	099-206	15.687×10^{-4}
	206-259	9.485×10^{-4}
	259-274	5.272×10^{-4}
	274-349	15.298×10^{-4}
	349-424	10.840×10^{-4}
	424-471	13.191×10^{-4}
	471-529	7.639×10^{-4}
	529-570	11.411×10^{-4}
	570-602	27.548×10^{-4}
	602-652	13.636×10^{-4}
Cumberland	000-030	18.582×10^{-4}
	030-075	40.738×10^{-4}
	075-148	2.666×10^{-4}
	148-216	19.520×10^{-4}
Green	all	3.140×10^{-4}
Kentucky[a]	all	1.200×10^{-4}

[a] There are no known casualties along the Kentucky River; therefore, the AASHTO minimum probability of aberrancy of 1.200×10^{-4} was used.

Table 8.2: Weighted Average Probability of Aberrancy for Rivers in Kentucky

River	Average Probability of Aberrancy
Ohio	5.291×10^{-4}
Tennessee	13.775×10^{-4}
Cumberland	18.114×10^{-4}
Green	3.140×10^{-4}
Kentucky	1.200×10^{-4}

9. Scour Requirements

The current *AASHTO Guide Specification* does not provide guidance on the application of scour to the barge impact design of bridges. However, in a letter dated September 4, 1992 the FHWA Region 4 office directed the application of the following scour conditions to impact design using the AASHTO Method II procedures:

1. For impact loads applied at normal vessel operating conditions, two scour conditions should be evaluated. The first is the scour having a probability of 1.0, most likely only the long-term scour plus the contraction and local scour caused by a Q_5 event. The second is the maximum anticipated scour (or other critical value determined by the designer). The probability of this scour occurring during the life of the bridge should be included in the calculations.

2. For the case of the free-floating empty barge on the 100-year flood, the maximum anticipated scour should be used.

Therefore, it is recommended that the impact loads for the loaded barge flotillas be applied in conjunction with 100% of long-term scour plus the local scour caused by a Q_5 (five-year return period) flood event. The impact loads for a single free-floating barge should be applied with the scour caused by the Q_{100} flood event plus 100% of the long-term scour. HEC-20, *Stream Stability in Highway Structures*, Section 2.4: Long-Term Aggradation and Degradation offers guidance for determining 100% of the long-term scour. The Design Example presented earlier in this report illustrates this application.

10. Conclusions and Recommendations

Design Barge Sizes and Tonnages

Sizes and tonnages vary significantly within the 24 flotilla categories which occur on the inland navigable waterways of Kentucky. Therefore, a probability based approach was adopted in order to select the appropriate sizes and tonnages to assign to individual barge types. Since it was assumed that the variation of the sizes and tonnages attributed to individual barges could be represented by a normal distribution, it is recommended that the average plus two standard deviations be used for the sizes and tonnages associated with each barge type. This indicates only a 2.25% chance of the values used being exceeded. In the cases where the maximum value within a category is less than the average plus two standard deviations, then the maximum value is used. Since the database contains all barges operating within Kentucky waterways, if the maximum value is used, there is a 0% chance that the sizes and tonnages will be exceeded.

It is recommended that a 15.2-ft value be used for the draft cutoff. This value is based on information from the U.S. Coast Guard that barges with a draft in excess of 12-ft do not typically operate on Kentucky waterways. The 15.2-ft value would include some barges in the database that could conceivably operate during high water conditions. This will lead to reasonably conservative results. Only barges typically operating on the Mississippi River System and the Gulf Coast Intercostal Waterway should be used in the calculations, since only these barges could conceivably travel on the navigable waterways of Kentucky.

Design Flotilla Column Lengths

Since it was assumed that the variation of the number of barges within a flotilla could be represented by a normal distribution, it is recommended that the average plus two standard deviations be used for the number of barges comprising a flotilla column. This indicates only a 2.25% chance of the values used being exceeded on a yearly basis. In the cases where the maximum value within a category is less than the average plus two standard deviations, then the maximum value is used. Since the database contains all barges operating within Kentucky waterways, if the maximum value is used, there is a 0% chance that the number of barges in a flotilla column or row will be exceeded.

Since the flotilla width seemingly varies in regular increments, the number of barges in a row is determined first. In order to determine the number of barges per flotilla

column, it is recommended that the engineer assume barge widths do not typically exceed 55 feet. Non-integer values for the number of barges comprising a flotilla column are acceptable since Method II is a probability based analysis procedure. Flotilla column lengths include the possibility of a barge attached to the side of the tow boat. Since tow boat tonnages are generally lower than barge tonnages, it is more conservative to replace the tow boat with a barge.

Typically, the river mile point nearest to the proposed structure is used for design. For example, flotilla column lengths used in the Design Example are taken from mile point 436 on the Ohio River since this is the nearest data to the actual bridge location of mile 411.29. However, probability of aberrancy values may be taken from the range in which the structure location falls. Likewise, the river elevation(s) for a specific location may be linearly interpolated between the two nearest data points.

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We would also like to thank the U.S. Army Corps of Engineers, the U.S. Coast Guard, and the American Waterways Operators for the information they provided for use in this report.

Appendix A: Barge Capacity Program

```
C**********************************************************************
C
C     READS BARGE CHARACTERISTIC FILE AND SUMS AVERAGE BARGE CAPACITIES
C     BASED ON LENGTH/WIDTH CATEGORY
C
C     CALCULATES CAPACITIES, LENGTHS, AND WIDTHS AS AVERAGE PLUS TWO
C     STANDARD DEVIATIONS
C
C     FINDS MAXIMUM CATEGORY CHARACTERISTICS
C
C     PRINTS MINIMUM OF AVERAGE BARGE CHARACTERISTIC PLUS TWO
C     STANDARD DEVIATIONS OR MAXIMUM VALUE FOUND IN CATEGORY
C
C
C         BY:MICHAEL W. WHITNEY
C            UNIVERSITY OF KENTUCKY
C            LEXINGTON, KY
C
C**********************************************************************
C
C     BLENGTH = BARGE LENGTH
C     BWIDTH = BARGE WIDTH
C     CAPACITY = BARGE CARGO CAPACITY + SELF WEIGHT
C     DRAFT = LOADED DRAFT OF THE BARGE WHICH IS ASSUMED TO BE < 15.2'
C     IAREA = LOCATION THE BARGE OPERATES (FOR KENTUCKY = 4)
C
C**********************************************************************

      IMPLICIT REAL(A-H,L-Z), INTEGER(I-K)
      COMMON/DATA/LCOUNT(25,25),WCOUNT(25,25),SWIDTH(25),SLENGTH(25),
     1            JMAXIMUML(25),JMAXIMUMW(25),LSTEP(25),WSTEP(25),BWIDTH,
     2            BLENGTH,ICAT,IFLAGL,IFLAGW


      OPEN (1, FILE = 'C:\F32\WATER.DAT')
      OPEN (2, FILE = 'C:\F32\WATERBRN.OUT')
      OPEN (3, FILE = 'C:\F32\DISTRIB.OUT')

1000  FORMAT(3X,A2,4X,6F10.2)

C
C     CALCULATE BARGE AVERAGE AND MAXIMUM CHARACTERISTICS
C

      DO WHILE(.NOT.EOF(1))

      READ (1,*) BLENGTH,BWIDTH,CAPACITY,LOADDRAFT,LIGHTDRAFT,IAREA

      IF (BLENGTH.GT.10..AND.BLENGTH.LT.100..AND.BWIDTH.GT.10..AND.
     1    BWIDTH.LT.26. .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
     2    CAPACITY.GT.10.0 .AND. LOADDRAFT .GT. LIGHTDRAFT
```

```
3       .AND.LIGHTDRAFT.GE. 1.00) THEN
        CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
        AACOUNT=AACOUNT+1
        AACAPACITY=AACAPACITY+CAPACITY
        AALENGTH=AALENGTH+BLENGTH
        AAWIDTH=AAWIDTH+BWIDTH
        AAMAXCAPACITY=MAX(AAMAXCAPACITY,CAPACITY)
        AAMAXLENGTH=MAX(AAMAXLENGTH,BLENGTH)
        AAMAXWIDTH=MAX(AAMAXWIDTH,BWIDTH)
        AAEDRAFT=AAEDRAFT+LIGHTDRAFT
        AAMAXEDRAFT=MAX(AAMAXEDRAFT,LIGHTDRAFT)
        AALDRAFT=AALDRAFT+LOADDRAFT
        AAMAXLDRAFT=MAX(AAMAXLDRAFT,LOADDRAFT)

        ICAT=1
        LSTEP(ICAT)=5.0
        SLENGTH(ICAT)=10.0
        WSTEP(ICAT)=1.0
        SWIDTH(ICAT)=10.0

 CALL DISTRIBUTION()
 IF(IFLAGL.EQ.1) WRITE(3,*)"******ICAT BLENGTH",ICAT,BLENGTH
 IF(IFLAGW.EQ.1) WRITE(3,*)"******ICAT BWIDTH",ICAT,BWIDTH

 GOTO 1

 ENDIF

 IF (BLENGTH.GT.10..AND.BLENGTH.LT.100..AND.BWIDTH.GE.26..AND.
1     BWIDTH.LT.35.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 4000.0 .AND. LOADDRAFT
3     .GT. LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
        CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
        ABCOUNT=ABCOUNT +1
        ABCAPACITY=ABCAPACITY+CAPACITY
        ABLENGTH=ABLENGTH+BLENGTH
        ABWIDTH=ABWIDTH+BWIDTH
        ABMAXCAPACITY=MAX(ABMAXCAPACITY,CAPACITY)
        ABMAXLENGTH=MAX(ABMAXLENGTH,BLENGTH)
        ABMAXWIDTH=MAX(ABMAXWIDTH,BWIDTH)
        ABEDRAFT=ABEDRAFT+LIGHTDRAFT
        ABMAXEDRAFT=MAX(ABMAXEDRAFT,LIGHTDRAFT)
        ABLDRAFT=ABLDRAFT+LOADDRAFT
        ABMAXLDRAFT=MAX(ABMAXLDRAFT,LOADDRAFT)

        ICAT=2
        LSTEP(ICAT)=5.0
        SLENGTH(ICAT)=10.0
        WSTEP(ICAT)=1.0
        SWIDTH(ICAT)=26.0
```

```
 CALL DISTRIBUTION()

 GOTO 1

 ENDIF

 IF (BLENGTH.GT.10..AND.BLENGTH.LT.100..AND.BWIDTH.GE.35.0.AND.
1    BWIDTH.LE.54.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 5000.0 .AND. LOADDRAFT
3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
     CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
     ACCOUNT=ACCOUNT +1
     ACCAPACITY=ACCAPACITY+CAPACITY
     ACLENGTH=ACLENGTH+BLENGTH
     ACWIDTH=ACWIDTH+BWIDTH
     ACMAXCAPACITY=MAX(ACMAXCAPACITY,CAPACITY)
     ACMAXLENGTH=MAX(ACMAXLENGTH,BLENGTH)
     ACMAXWIDTH=MAX(ACMAXWIDTH,BWIDTH)
     ACEDRAFT=ACEDRAFT+LIGHTDRAFT
     ACMAXEDRAFT=MAX(ACMAXEDRAFT,LIGHTDRAFT)
     ACLDRAFT=ACLDRAFT+LOADDRAFT
     ACMAXLDRAFT=MAX(ACMAXLDRAFT,LOADDRAFT)


     ICAT=3
     LSTEP(ICAT)=5.0
     SLENGTH(ICAT)=10.0
     WSTEP(ICAT)=1.0
     SWIDTH(ICAT)=35.0

 CALL DISTRIBUTION()
 IF(IFLAGL.EQ.1) WRITE(3,*)"******ICAT BLENGTH",ICAT,BLENGTH
 IF(IFLAGW.EQ.1) WRITE(3,*)"******ICAT BWIDTH",ICAT,BWIDTH

 GOTO 1

 ENDIF

 IF (BLENGTH.GT.10..AND.BLENGTH.LT.100..AND.BWIDTH.GT.54.0.AND.
1    BWIDTH.LE.79 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00 ) THEN
     CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
     ADCOUNT=ADCOUNT +1
     ADLENGTH=ADLENGTH+BLENGTH
     ADWIDTH=ADWIDTH+BWIDTH
     ADCAPACITY=ADCAPACITY+CAPACITY
     ADMAXCAPACITY=MAX(ADMAXCAPACITY,CAPACITY)
     ADMAXLENGTH=MAX(ADMAXLENGTH,BLENGTH)
     ADMAXWIDTH=MAX(ADMAXWIDTH,BWIDTH)
     ADEDRAFT=ADEDRAFT+LIGHTDRAFT
```

```
      ADMAXEDRAFT=MAX(ADMAXEDRAFT,LIGHTDRAFT)
      ADLDRAFT=ADLDRAFT+LOADDRAFT
      ADMAXLDRAFT=MAX(ADMAXLDRAFT,LOADDRAFT)

      ICAT=4
      LSTEP(ICAT)=5.0
      SLENGTH(ICAT)=10.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=54.0

 CALL DISTRIBUTION()

 GOTO 1

 ENDIF

 IF (BLENGTH.GE.100..AND.BLENGTH.LE.174..AND.BWIDTH.GT.10..AND.
1     BWIDTH.LT.26. .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
      BACOUNT=BACOUNT +1
      BALENGTH=BALENGTH+BLENGTH
      BAWIDTH=BAWIDTH+BWIDTH
      BACAPACITY=BACAPACITY+CAPACITY
      BAMAXCAPACITY=MAX(BAMAXCAPACITY,CAPACITY)
      BAMAXLENGTH=MAX(BAMAXLENGTH,BLENGTH)
      BAMAXWIDTH=MAX(BAMAXWIDTH,BWIDTH)
      BAEDRAFT=BAEDRAFT+LIGHTDRAFT
      BAMAXEDRAFT=MAX(BAMAXEDRAFT,LIGHTDRAFT)
      BALDRAFT=BALDRAFT+LOADDRAFT
      BAMAXLDRAFT=MAX(BAMAXLDRAFT,LOADDRAFT)

      ICAT=5
      LSTEP(ICAT)=5.0
      SLENGTH(ICAT)=100.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=10.0

 CALL DISTRIBUTION()
 IF(IFLAGL.EQ.1) WRITE(3,*)"******ICAT BLENGTH",ICAT,BLENGTH
 IF(IFLAGW.EQ.1) WRITE(3,*)"******ICAT BWIDTH",ICAT,BWIDTH

 GOTO 1

 ENDIF

 IF (BLENGTH.GE.100..AND.BLENGTH.LE.174..AND.BWIDTH.GE.26..AND.
1     BWIDTH.LT.35.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
```

```
      CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
      BBCOUNT=BBCOUNT +1
      BBLENGTH=BBLENGTH+BLENGTH
      BBWIDTH=BBWIDTH+BWIDTH
      BBCAPACITY=BBCAPACITY+CAPACITY
      BBMAXCAPACITY=MAX(BBMAXCAPACITY,CAPACITY)
      BBMAXLENGTH=MAX(BBMAXLENGTH,BLENGTH)
      BBMAXWIDTH=MAX(BBMAXWIDTH,BWIDTH)
      BBEDRAFT=BBEDRAFT+LIGHTDRAFT
      BBMAXEDRAFT=MAX(BBMAXEDRAFT,LIGHTDRAFT)
      BBLDRAFT=BBLDRAFT+LOADDRAFT
      BBMAXLDRAFT=MAX(BBMAXLDRAFT,LOADDRAFT)

      ICAT=6
      LSTEP(ICAT)=5.0
      SLENGTH(ICAT)=100.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=26.0

 CALL DISTRIBUTION()

 GOTO 1

 ENDIF

 IF (BLENGTH.GE.100..AND.BLENGTH.LE.174..AND.BWIDTH.GE.35.0.AND.
1     BWIDTH.LE.54.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
      BCCOUNT=BCCOUNT +1
      BCLENGTH=BCLENGTH+BLENGTH
      BCWIDTH=BCWIDTH+BWIDTH
      BCCAPACITY=BCCAPACITY+CAPACITY
      BCMAXCAPACITY=MAX(BCMAXCAPACITY,CAPACITY)
      BCMAXLENGTH=MAX(BCMAXLENGTH,BLENGTH)
      BCMAXWIDTH=MAX(BCMAXWIDTH,BWIDTH)
      BCEDRAFT=BCEDRAFT+LIGHTDRAFT
      BCMAXEDRAFT=MAX(BCMAXEDRAFT,LIGHTDRAFT)
      BCLDRAFT=BCLDRAFT+LOADDRAFT
      BCMAXLDRAFT=MAX(BCMAXLDRAFT,LOADDRAFT)

      ICAT=7
      LSTEP(ICAT)=5.0
      SLENGTH(ICAT)=100.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=35.0

 CALL DISTRIBUTION()

 GOTO 1
```

```
 ENDIF

 IF (BLENGTH.GE.100..AND.BLENGTH.LE.174..AND.BWIDTH.GT.54.0.AND.
1    BWIDTH.LE.79 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
     CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
     BDCOUNT=BDCOUNT +1
     BDLENGTH=BDLENGTH+BLENGTH
     BDWIDTH=BDWIDTH+BWIDTH
     BDCAPACITY=BDCAPACITY+CAPACITY
     BDMAXCAPACITY=MAX(BDMAXCAPACITY,CAPACITY)
     BDMAXLENGTH=MAX(BDMAXLENGTH,BLENGTH)
     BDMAXWIDTH=MAX(BDMAXWIDTH,BWIDTH)
     BDEDRAFT=BDEDRAFT+LIGHTDRAFT
     BDMAXEDRAFT=MAX(BDMAXEDRAFT,LIGHTDRAFT)
     BDLDRAFT=BDLDRAFT+LOADDRAFT
     BDMAXLDRAFT=MAX(BDMAXLDRAFT,LOADDRAFT)

     ICAT=8
     LSTEP(ICAT)=5.0
     SLENGTH(ICAT)=100.0
     WSTEP(ICAT)=1.0
     SWIDTH(ICAT)=54.0

 CALL DISTRIBUTION()

 GOTO 1

 ENDIF

 IF (BLENGTH.GE.175..AND.BLENGTH.LE.194..AND.BWIDTH.GE.26..AND.
1    BWIDTH.LT.35.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
     CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
     CBCOUNT=CBCOUNT +1
     CBLENGTH=CBLENGTH+BLENGTH
     CBWIDTH=CBWIDTH+BWIDTH
     CBCAPACITY=CBCAPACITY+CAPACITY
     CBMAXCAPACITY=MAX(CBMAXCAPACITY,CAPACITY)
     CBMAXLENGTH=MAX(CBMAXLENGTH,BLENGTH)
     CBMAXWIDTH=MAX(CBMAXWIDTH,BWIDTH)
     CBEDRAFT=CBEDRAFT+LIGHTDRAFT
     CBMAXEDRAFT=MAX(CBMAXEDRAFT,LIGHTDRAFT)
     CBLDRAFT=CBLDRAFT+LOADDRAFT
     CBMAXLDRAFT=MAX(CBMAXLDRAFT,LOADDRAFT)

     ICAT=9
     LSTEP(ICAT)=5.0
     SLENGTH(ICAT)=175.0
```

```
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=26.0

 CALL DISTRIBUTION()

 GOTO 1

 ENDIF

 IF (BLENGTH.GE.175..AND.BLENGTH.LE.194..AND.BWIDTH.GE.35.0.AND.
1     BWIDTH.LE.54.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
      CCCOUNT=CCCOUNT +1
      CCLENGTH=CCLENGTH+BLENGTH
      CCWIDTH=CCWIDTH+BWIDTH
      CCCAPACITY=CCCAPACITY+CAPACITY
      CCMAXCAPACITY=MAX(CCMAXCAPACITY,CAPACITY)
      CCMAXLENGTH=MAX(CCMAXLENGTH,BLENGTH)
      CCMAXWIDTH=MAX(CCMAXWIDTH,BWIDTH)
      CCEDRAFT=CCEDRAFT+LIGHTDRAFT
      CCMAXEDRAFT=MAX(CCMAXEDRAFT,LIGHTDRAFT)
      CCLDRAFT=CCLDRAFT+LOADDRAFT
      CCMAXLDRAFT=MAX(CCMAXLDRAFT,LOADDRAFT)

      ICAT=10
      LSTEP(ICAT)=5.0
      SLENGTH(ICAT)=175.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=35.0

 CALL DISTRIBUTION()

 GOTO 1

 ENDIF

 IF (BLENGTH.GE.175..AND.BLENGTH.LE.194..AND.BWIDTH.GT.54.0.AND.
1     BWIDTH.LE.79 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
      CDCOUNT=CDCOUNT +1
      CDLENGTH=CDLENGTH+BLENGTH
      CDWIDTH=CDWIDTH+BWIDTH
      CDCAPACITY=CDCAPACITY+CAPACITY
      CDMAXCAPACITY=MAX(CDMAXCAPACITY,CAPACITY)
      CDMAXLENGTH=MAX(CDMAXLENGTH,BLENGTH)
      CDMAXWIDTH=MAX(CDMAXWIDTH,BWIDTH)
      CDEDRAFT=CDEDRAFT+LIGHTDRAFT
```

```
      CDMAXEDRAFT=MAX(CDMAXEDRAFT,LIGHTDRAFT)
      CDLDRAFT=CDLDRAFT+LOADDRAFT
      CDMAXLDRAFT=MAX(CDMAXLDRAFT,LOADDRAFT)

      ICAT=11
      LSTEP(ICAT)=5.0
      SLENGTH(ICAT)=175.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=54.0

 CALL DISTRIBUTION()

 GOTO 1

 ENDIF

 IF (BLENGTH.GE.195..AND.BLENGTH.LE.199..AND.BWIDTH.GE.26..AND.
1     BWIDTH.LT.35.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
      DBCOUNT=DBCOUNT +1
      DBLENGTH=DBLENGTH+BLENGTH
      DBWIDTH=DBWIDTH+BWIDTH
      DBCAPACITY=DBCAPACITY+CAPACITY
      DBMAXCAPACITY=MAX(DBMAXCAPACITY,CAPACITY)
      DBMAXLENGTH=MAX(DBMAXLENGTH,BLENGTH)
      DBMAXWIDTH=MAX(DBMAXWIDTH,BWIDTH)
      DBEDRAFT=DBEDRAFT+LIGHTDRAFT
      DBMAXEDRAFT=MAX(DBMAXEDRAFT,LIGHTDRAFT)
      DBLDRAFT=DBLDRAFT+LOADDRAFT
      DBMAXLDRAFT=MAX(DBMAXLDRAFT,LOADDRAFT)

      ICAT=12
      LSTEP(ICAT)=1.0
      SLENGTH(ICAT)=195.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=26.0

 CALL DISTRIBUTION()

 GOTO 1

 ENDIF

 IF (BLENGTH.GE.195..AND.BLENGTH.LE.199..AND.BWIDTH.GE.35.0.AND.
1     BWIDTH.LE.54.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
      DCCOUNT=DCCOUNT +1
```

```
      DCLENGTH=DCLENGTH+BLENGTH
      DCWIDTH=DCWIDTH+BWIDTH
      DCCAPACITY=DCCAPACITY+CAPACITY
      DCMAXCAPACITY=MAX(DCMAXCAPACITY,CAPACITY)
      DCMAXLENGTH=MAX(DCMAXLENGTH,BLENGTH)
      DCMAXWIDTH=MAX(DCMAXWIDTH,BWIDTH)
      DCEDRAFT=DCEDRAFT+LIGHTDRAFT
      DCMAXEDRAFT=MAX(DCMAXEDRAFT,LIGHTDRAFT)
      DCLDRAFT=DCLDRAFT+LOADDRAFT
      DCMAXLDRAFT=MAX(DCMAXLDRAFT,LOADDRAFT)

      ICAT=13
      LSTEP(ICAT)=1.0
      SLENGTH(ICAT)=195.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=35.0

  CALL DISTRIBUTION()

  GOTO 1

  ENDIF

  IF (BLENGTH.GE.195..AND.BLENGTH.LE.199..AND.BWIDTH.GT.54.0.AND.
 1     BWIDTH.LE.79 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
 2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
 3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
      DDCOUNT=DDCOUNT +1
      DDLENGTH=DDLENGTH+BLENGTH
      DDWIDTH=DDWIDTH+BWIDTH
      DDCAPACITY=DDCAPACITY+CAPACITY
      DDMAXCAPACITY=MAX(DDMAXCAPACITY,CAPACITY)
      DDMAXLENGTH=MAX(DDMAXLENGTH,BLENGTH)
      DDMAXWIDTH=MAX(DDMAXWIDTH,BWIDTH)
      DDEDRAFT=DDEDRAFT+LIGHTDRAFT
      DDMAXEDRAFT=MAX(DDMAXEDRAFT,LIGHTDRAFT)
      DDLDRAFT=DDLDRAFT+LOADDRAFT
      DDMAXLDRAFT=MAX(DDMAXLDRAFT,LOADDRAFT)

      ICAT=14
      LSTEP(ICAT)=1.0
      SLENGTH(ICAT)=195.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=54.0

  CALL DISTRIBUTION()

  GOTO 1

  ENDIF
```

```
 IF (BLENGTH.GE.200..AND.BLENGTH.LE.259..AND.BWIDTH.GT.10..AND.
1     BWIDTH.LT.26. .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
      EACOUNT=EACOUNT +1
      EALENGTH=EALENGTH+BLENGTH
      EAWIDTH=EAWIDTH+BWIDTH
      EACAPACITY=EACAPACITY+CAPACITY
      EAMAXCAPACITY=MAX(EAMAXCAPACITY,CAPACITY)
      EAMAXLENGTH=MAX(EAMAXLENGTH,BLENGTH)
      EAMAXWIDTH=MAX(EAMAXWIDTH,BWIDTH)
      EAEDRAFT=EAEDRAFT+LIGHTDRAFT
      EAMAXEDRAFT=MAX(EAMAXEDRAFT,LIGHTDRAFT)
      EALDRAFT=EALDRAFT+LOADDRAFT
      EAMAXLDRAFT=MAX(EAMAXLDRAFT,LOADDRAFT)

      ICAT=15
      LSTEP(ICAT)=5.0
      SLENGTH(ICAT)=200.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=10.0

 CALL DISTRIBUTION()

 GOTO 1

 ENDIF

 IF (BLENGTH.GE.200..AND.BLENGTH.LE.259..AND.BWIDTH.GE.26..AND.
1     BWIDTH.LT.35.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
      EBCOUNT=EBCOUNT +1
      EBLENGTH=EBLENGTH+BLENGTH
      EBWIDTH=EBWIDTH+BWIDTH
      EBCAPACITY=EBCAPACITY+CAPACITY
      EBMAXCAPACITY=MAX(EBMAXCAPACITY,CAPACITY)
      EBMAXLENGTH=MAX(EBMAXLENGTH,BLENGTH)
      EBMAXWIDTH=MAX(EBMAXWIDTH,BWIDTH)
      EBEDRAFT=EBEDRAFT+LIGHTDRAFT
      EBMAXEDRAFT=MAX(EBMAXEDRAFT,LIGHTDRAFT)
      EBLDRAFT=EBLDRAFT+LOADDRAFT
      EBMAXLDRAFT=MAX(EBMAXLDRAFT,LOADDRAFT)

      ICAT=16
      LSTEP(ICAT)=5.0
      SLENGTH(ICAT)=200.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=26.0
```

```
      CALL DISTRIBUTION()

      GOTO 1

      ENDIF

      IF (BLENGTH.GE.200..AND.BLENGTH.LE.259..AND.BWIDTH.GE.35.0.AND.
     1    BWIDTH.LE.54.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
     2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
     3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
          CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
          ECCOUNT=ECCOUNT +1
          ECLENGTH=ECLENGTH+BLENGTH
          ECWIDTH=ECWIDTH+BWIDTH
          ECCAPACITY=ECCAPACITY+CAPACITY
          ECMAXCAPACITY=MAX(ECMAXCAPACITY,CAPACITY)
          ECMAXLENGTH=MAX(ECMAXLENGTH,BLENGTH)
          ECMAXWIDTH=MAX(ECMAXWIDTH,BWIDTH)
          ECEDRAFT=ECEDRAFT+LIGHTDRAFT
          ECMAXEDRAFT=MAX(ECMAXEDRAFT,LIGHTDRAFT)
          ECLDRAFT=ECLDRAFT+LOADDRAFT
          ECMAXLDRAFT=MAX(ECMAXLDRAFT,LOADDRAFT)

          ICAT=17
          LSTEP(ICAT)=5.0
          SLENGTH(ICAT)=200.0
          WSTEP(ICAT)=1.0
          SWIDTH(ICAT)=35.0

      CALL DISTRIBUTION()

      GOTO 1

      ENDIF

      IF (BLENGTH.GE.200..AND.BLENGTH.LE.259..AND.BWIDTH.GT.54.0.AND.
     1    BWIDTH.LE.79 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
     2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
     3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
          CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
          EDCOUNT=EDCOUNT +1
          EDLENGTH=EDLENGTH+BLENGTH
          EDWIDTH=EDWIDTH+BWIDTH
          EDCAPACITY=EDCAPACITY+CAPACITY
          EDMAXCAPACITY=MAX(EDMAXCAPACITY,CAPACITY)
          EDMAXLENGTH=MAX(EDMAXLENGTH,BLENGTH)
          EDMAXWIDTH=MAX(EDMAXWIDTH,BWIDTH)
          EDEDRAFT=EDEDRAFT+LIGHTDRAFT
          EDMAXEDRAFT=MAX(EDMAXEDRAFT,LIGHTDRAFT)
          EDLDRAFT=EDLDRAFT+LOADDRAFT
          EDMAXLDRAFT=MAX(EDMAXLDRAFT,LOADDRAFT)
```

```
      ICAT=18
      LSTEP(ICAT)=5.0
      SLENGTH(ICAT)=200.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=54.0

 CALL DISTRIBUTION()

 GOTO 1

 ENDIF

 IF (BLENGTH.GE.260..AND.BLENGTH.LE.289..AND.BWIDTH.GE.35.0.AND.
1     BWIDTH.LE.54.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
      FCCOUNT=FCCOUNT +1
      FCLENGTH=FCLENGTH+BLENGTH
      FCWIDTH=FCWIDTH+BWIDTH
      FCCAPACITY=FCCAPACITY+CAPACITY
      FCMAXCAPACITY=MAX(FCMAXCAPACITY,CAPACITY)
      FCMAXLENGTH=MAX(FCMAXLENGTH,BLENGTH)
      FCMAXWIDTH=MAX(FCMAXWIDTH,BWIDTH)
      FCEDRAFT=FCEDRAFT+LIGHTDRAFT
      FCMAXEDRAFT=MAX(FCMAXEDRAFT,LIGHTDRAFT)
      FCLDRAFT=FCLDRAFT+LOADDRAFT
      FCMAXLDRAFT=MAX(FCMAXLDRAFT,LOADDRAFT)

      ICAT=19
      LSTEP(ICAT)=5.0
      SLENGTH(ICAT)=260.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=35.0

 CALL DISTRIBUTION()

 GOTO 1

 ENDIF

 IF (BLENGTH.GE.260..AND.BLENGTH.LE.289..AND.BWIDTH.GT.54.0.AND.
1     BWIDTH.LE.79 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
      FDCOUNT=FDCOUNT +1
      FDLENGTH=FDLENGTH+BLENGTH
      FDWIDTH=FDWIDTH+BWIDTH
      FDCAPACITY=FDCAPACITY+CAPACITY
      FDMAXCAPACITY=MAX(FDMAXCAPACITY,CAPACITY)
```

```
      FDMAXLENGTH=MAX(FDMAXLENGTH,BLENGTH)
      FDMAXWIDTH=MAX(FDMAXWIDTH,BWIDTH)
      FDEDRAFT=FDEDRAFT+LIGHTDRAFT
      FDMAXEDRAFT=MAX(FDMAXEDRAFT,LIGHTDRAFT)
      FDLDRAFT=FDLDRAFT+LOADDRAFT
      FDMAXLDRAFT=MAX(FDMAXLDRAFT,LOADDRAFT)

      ICAT=20
      LSTEP(ICAT)=5.0
      SLENGTH(ICAT)=260.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=54.0

 CALL DISTRIBUTION()

 GOTO 1

 ENDIF

 IF (BLENGTH.GE.290..AND.BLENGTH.LE.300..AND.BWIDTH.GE.35.0.AND.
1     BWIDTH.LE.54.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
      GCCOUNT=GCCOUNT +1
      GCLENGTH=GCLENGTH+BLENGTH
      GCWIDTH=GCWIDTH+BWIDTH
      GCCAPACITY=GCCAPACITY+CAPACITY
      GCMAXCAPACITY=MAX(GCMAXCAPACITY,CAPACITY)
      GCMAXLENGTH=MAX(GCMAXLENGTH,BLENGTH)
      GCMAXWIDTH=MAX(GCMAXWIDTH,BWIDTH)
      GCEDRAFT=GCEDRAFT+LIGHTDRAFT
      GCMAXEDRAFT=MAX(GCMAXEDRAFT,LIGHTDRAFT)
      GCLDRAFT=GCLDRAFT+LOADDRAFT
      GCMAXLDRAFT=MAX(GCMAXLDRAFT,LOADDRAFT)

      ICAT=21
      LSTEP(ICAT)=1.0
      SLENGTH(ICAT)=290.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=35.0

 CALL DISTRIBUTION()

 GOTO 1

 ENDIF

 IF (BLENGTH.GE.290..AND.BLENGTH.LE.300..AND.BWIDTH.GT.54.0.AND.
1     BWIDTH.LE.79 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
```

```
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
      GDCOUNT=GDCOUNT +1
      GDLENGTH=GDLENGTH+BLENGTH
      GDWIDTH=GDWIDTH+BWIDTH
      GDCAPACITY=GDCAPACITY+CAPACITY
      GDMAXCAPACITY=MAX(GDMAXCAPACITY,CAPACITY)
      GDMAXLENGTH=MAX(GDMAXLENGTH,BLENGTH)
      GDMAXWIDTH=MAX(GDMAXWIDTH,BWIDTH)
      GDEDRAFT=GDEDRAFT+LIGHTDRAFT
      GDMAXEDRAFT=MAX(GDMAXEDRAFT,LIGHTDRAFT)
      GDLDRAFT=GDLDRAFT+LOADDRAFT
      GDMAXLDRAFT=MAX(GDMAXLDRAFT,LOADDRAFT)

      ICAT=22
      LSTEP(ICAT)=1.0
      SLENGTH(ICAT)=290.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=54.0

 CALL DISTRIBUTION()

 GOTO 1

 ENDIF

 IF (BLENGTH.GT.300.0 .AND.BWIDTH.GE.26..AND.BWIDTH.LT.35.0 .AND.
1     IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.10.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT. 0.0 .AND. LIGHTDRAFT .GE. 1.00) THEN
      CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
      HBCOUNT=HBCOUNT +1
      HBLENGTH=HBLENGTH+BLENGTH
      HBWIDTH=HBWIDTH+BWIDTH
      HBCAPACITY=HBCAPACITY+CAPACITY
      HBMAXCAPACITY=MAX(HBMAXCAPACITY,CAPACITY)
      HBMAXLENGTH=MAX(HBMAXLENGTH,BLENGTH)
      HBMAXWIDTH=MAX(HBMAXWIDTH,BWIDTH)
      HBEDRAFT=HBEDRAFT+LIGHTDRAFT
      HBMAXEDRAFT=MAX(HBMAXEDRAFT,LIGHTDRAFT)
      HBLDRAFT=HBLDRAFT+LOADDRAFT
      HBMAXLDRAFT=MAX(HBMAXLDRAFT,LOADDRAFT)

      ICAT=23
      LSTEP(ICAT)=5.0
      SLENGTH(ICAT)=300.0
      WSTEP(ICAT)=1.0
      SWIDTH(ICAT)=26.0

 CALL DISTRIBUTION()
 IF(IFLAGL.EQ.1) WRITE(3,*)"******ICAT BLENGTH",ICAT,BLENGTH
```

```
      IF(IFLAGW.EQ.1) WRITE(3,*)"******ICAT BWIDTH",ICAT,BWIDTH

      GOTO 1

      ENDIF

      IF (BLENGTH.GT.300.0 .AND. BLENGTH .LT. 500.0 .AND.BWIDTH.GE.35.0
     1      .AND.BWIDTH.LE.54.0 .AND.
     2     IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
     3     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
     3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
          CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
          HCCOUNT=HCCOUNT +1
          HCLENGTH=HCLENGTH+BLENGTH
          HCWIDTH=HCWIDTH+BWIDTH
          HCCAPACITY=HCCAPACITY+CAPACITY
          HCMAXCAPACITY=MAX(HCMAXCAPACITY,CAPACITY)
          HCMAXLENGTH=MAX(HCMAXLENGTH,BLENGTH)
          HCMAXWIDTH=MAX(HCMAXWIDTH,BWIDTH)
          HCEDRAFT=HCEDRAFT+LIGHTDRAFT
          HCMAXEDRAFT=MAX(HCMAXEDRAFT,LIGHTDRAFT)
          HCLDRAFT=HCLDRAFT+LOADDRAFT
          HCMAXLDRAFT=MAX(HCMAXLDRAFT,LOADDRAFT)

          ICAT=24
          LSTEP(ICAT)=5.0
          SLENGTH(ICAT)=300.0
          WSTEP(ICAT)=1.0
          SWIDTH(ICAT)=35.0

      CALL DISTRIBUTION()
      IF(IFLAGL.EQ.1) WRITE(3,*)"******ICAT BLENGTH",ICAT,BLENGTH
      IF(IFLAGW.EQ.1) WRITE(3,*)"******ICAT BWIDTH",ICAT,BWIDTH

      GOTO 1

      ENDIF

      IF (BLENGTH.GT.300. .AND.BWIDTH.GT.54.0 .AND. IAREA.EQ.4 .AND.
     1     BWIDTH.LE.79 .AND. LOADDRAFT.LT.15.2 .AND.
     2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0.AND.
     3     LIGHTDRAFT.GE. 1.00 ) THEN
          CAPACITY=CAPACITY+(LIGHTDRAFT/(LOADDRAFT-LIGHTDRAFT))*CAPACITY
          HDCOUNT=HDCOUNT +1
          HDLENGTH=HDLENGTH+BLENGTH
          HDWIDTH=HDWIDTH+BWIDTH
          HDCAPACITY=HDCAPACITY+CAPACITY
          HDMAXCAPACITY=MAX(HDMAXCAPACITY,CAPACITY)
          HDMAXLENGTH=MAX(HDMAXLENGTH,BLENGTH)
          HDMAXWIDTH=MAX(HDMAXWIDTH,BWIDTH)
          HDEDRAFT=HDEDRAFT+LIGHTDRAFT
```

```
            HDMAXEDRAFT=MAX(HDMAXEDRAFT,LIGHTDRAFT)
            HDLDRAFT=HDLDRAFT+LOADDRAFT
            HDMAXLDRAFT=MAX(HDMAXLDRAFT,LOADDRAFT)

            ICAT=25
            LSTEP(ICAT)=5.0
            SLENGTH(ICAT)=300.0
            WSTEP(ICAT)=1.0
            SWIDTH(ICAT)=54.0

          CALL DISTRIBUTION()

          GOTO 1

          ENDIF

1         END DO

101       AACAPACITY=AACAPACITY/AACOUNT
          ABCAPACITY=ABCAPACITY/ABCOUNT
          ACCAPACITY=ACCAPACITY/ACCOUNT
          ADCAPACITY=ADCAPACITY/ADCOUNT

          BACAPACITY=BACAPACITY/BACOUNT
          BBCAPACITY=BBCAPACITY/BBCOUNT
          BCCAPACITY=BCCAPACITY/BCCOUNT
          BDCAPACITY=BDCAPACITY/BDCOUNT

          CBCAPACITY=CBCAPACITY/CBCOUNT
          CCCAPACITY=CCCAPACITY/CCCOUNT
          CDCAPACITY=CDCAPACITY/CDCOUNT

          DBCAPACITY=DBCAPACITY/DBCOUNT
          DCCAPACITY=DCCAPACITY/DCCOUNT
          DDCAPACITY=DDCAPACITY/DDCOUNT

          EACAPACITY=EACAPACITY/EACOUNT
          EBCAPACITY=EBCAPACITY/EBCOUNT
          ECCAPACITY=ECCAPACITY/ECCOUNT
          EDCAPACITY=EDCAPACITY/EDCOUNT

          FCCAPACITY=FCCAPACITY/FCCOUNT
          FDCAPACITY=FDCAPACITY/FDCOUNT

          GCCAPACITY=GCCAPACITY/GCCOUNT
          GDCAPACITY=GDCAPACITY/GDCOUNT

          HBCAPACITY=HBCAPACITY/HBCOUNT
          HCCAPACITY=HCCAPACITY/HCCOUNT
          HDCAPACITY=HDCAPACITY/HDCOUNT
```

```
AAWIDTH=AAWIDTH/AACOUNT
ABWIDTH=ABWIDTH/ABCOUNT
ACWIDTH=ACWIDTH/ACCOUNT
ADWIDTH=ADWIDTH/ADCOUNT

BAWIDTH=BAWIDTH/BACOUNT
BBWIDTH=BBWIDTH/BBCOUNT
BCWIDTH=BCWIDTH/BCCOUNT
BDWIDTH=BDWIDTH/BDCOUNT

CBWIDTH=CBWIDTH/CBCOUNT
CCWIDTH=CCWIDTH/CCCOUNT
CDWIDTH=CDWIDTH/CDCOUNT

DBWIDTH=DBWIDTH/DBCOUNT
DCWIDTH=DCWIDTH/DCCOUNT
DDWIDTH=DDWIDTH/DDCOUNT

EAWIDTH=EAWIDTH/EACOUNT
EBWIDTH=EBWIDTH/EBCOUNT
ECWIDTH=ECWIDTH/ECCOUNT
EDWIDTH=EDWIDTH/EDCOUNT

FCWIDTH=FCWIDTH/FCCOUNT
FDWIDTH=FDWIDTH/FDCOUNT

GCWIDTH=GCWIDTH/GCCOUNT
GDWIDTH=GDWIDTH/GDCOUNT

HBWIDTH=HBWIDTH/HBCOUNT
HCWIDTH=HCWIDTH/HCCOUNT
HDWIDTH=HDWIDTH/HDCOUNT

AALENGTH=AALENGTH/AACOUNT
ABLENGTH=ABLENGTH/ABCOUNT
ACLENGTH=ACLENGTH/ACCOUNT
ADLENGTH=ADLENGTH/ADCOUNT

BALENGTH=BALENGTH/BACOUNT
BBLENGTH=BBLENGTH/BBCOUNT
BCLENGTH=BCLENGTH/BCCOUNT
BDLENGTH=BDLENGTH/BDCOUNT

CBLENGTH=CBLENGTH/CBCOUNT
CCLENGTH=CCLENGTH/CCCOUNT
CDLENGTH=CDLENGTH/CDCOUNT

DBLENGTH=DBLENGTH/DBCOUNT
DCLENGTH=DCLENGTH/DCCOUNT
DDLENGTH=DDLENGTH/DDCOUNT
```

```
EALENGTH=EALENGTH/EACOUNT
EBLENGTH=EBLENGTH/EBCOUNT
ECLENGTH=ECLENGTH/ECCOUNT
EDLENGTH=EDLENGTH/EDCOUNT

FCLENGTH=FCLENGTH/FCCOUNT
FDLENGTH=FDLENGTH/FDCOUNT

GCLENGTH=GCLENGTH/GCCOUNT
GDLENGTH=GDLENGTH/GDCOUNT

HBLENGTH=HBLENGTH/HBCOUNT
HCLENGTH=HCLENGTH/HCCOUNT
HDLENGTH=HDLENGTH/HDCOUNT

AAEDRAFT=AAEDRAFT/AACOUNT
ABEDRAFT=ABEDRAFT/ABCOUNT
ACEDRAFT=ACEDRAFT/ACCOUNT
ADEDRAFT=ADEDRAFT/ADCOUNT

BAEDRAFT=BAEDRAFT/BACOUNT
BBEDRAFT=BBEDRAFT/BBCOUNT
BCEDRAFT=BCEDRAFT/BCCOUNT
BDEDRAFT=BDEDRAFT/BDCOUNT

CBEDRAFT=CBEDRAFT/CBCOUNT
CCEDRAFT=CCEDRAFT/CCCOUNT
CDEDRAFT=CDEDRAFT/CDCOUNT

DBEDRAFT=DBEDRAFT/DBCOUNT
DCEDRAFT=DCEDRAFT/DCCOUNT
DDEDRAFT=DDEDRAFT/DDCOUNT

EAEDRAFT=EAEDRAFT/EACOUNT
EBEDRAFT=EBEDRAFT/EBCOUNT
ECEDRAFT=ECEDRAFT/ECCOUNT
EDEDRAFT=EDEDRAFT/EDCOUNT

FCEDRAFT=FCEDRAFT/FCCOUNT
FDEDRAFT=FDEDRAFT/FDCOUNT

GCEDRAFT=GCEDRAFT/GCCOUNT
GDEDRAFT=GDEDRAFT/GDCOUNT

HBEDRAFT=HBEDRAFT/HBCOUNT
HCEDRAFT=HCEDRAFT/HCCOUNT
HDEDRAFT=HDEDRAFT/HDCOUNT

AALDRAFT=AALDRAFT/AACOUNT
ABLDRAFT=ABLDRAFT/ABCOUNT
ACLDRAFT=ACLDRAFT/ACCOUNT
```

```
 ADLDRAFT=ADLDRAFT/ADCOUNT

 BALDRAFT=BALDRAFT/BACOUNT
 BBLDRAFT=BBLDRAFT/BBCOUNT
 BCLDRAFT=BCLDRAFT/BCCOUNT
 BDLDRAFT=BDLDRAFT/BDCOUNT

 CBLDRAFT=CBLDRAFT/CBCOUNT
 CCLDRAFT=CCLDRAFT/CCCOUNT
 CDLDRAFT=CDLDRAFT/CDCOUNT

 DBLDRAFT=DBLDRAFT/DBCOUNT
 DCLDRAFT=DCLDRAFT/DCCOUNT
 DDLDRAFT=DDLDRAFT/DDCOUNT

 EALDRAFT=EALDRAFT/EACOUNT
 EBLDRAFT=EBLDRAFT/EBCOUNT
 ECLDRAFT=ECLDRAFT/ECCOUNT
 EDLDRAFT=EDLDRAFT/EDCOUNT

 FCLDRAFT=FCLDRAFT/FCCOUNT
 FDLDRAFT=FDLDRAFT/FDCOUNT

 GCLDRAFT=GCLDRAFT/GCCOUNT
 GDLDRAFT=GDLDRAFT/GDCOUNT

 HBLDRAFT=HBLDRAFT/HBCOUNT
 HCLDRAFT=HCLDRAFT/HCCOUNT
 HDLDRAFT=HDLDRAFT/HDCOUNT

 WRITE(2,*) "****************CATEGORY AVERAGE VALUES**************"
 WRITE(2,*)"CATEG.     ","COUNT          ","CAPACITY     ",
1           "LENGTH         ","WIDTH","    E DRAFT","     L DRAFT"

 WRITE(2,1000)"AA",AACOUNT,AACAPACITY,AALENGTH,AAWIDTH
1           ,AAEDRAFT,AALDRAFT
 WRITE(2,1000)"AB",ABCOUNT,ABCAPACITY,ABLENGTH,ABWIDTH
1           ,ABEDRAFT,ABLDRAFT
 WRITE(2,1000)"AC",ACCOUNT,ACCAPACITY,ACLENGTH,ACWIDTH
1           ,ACEDRAFT,ACLDRAFT
 WRITE(2,1000)"AD",ADCOUNT,ADCAPACITY,ADLENGTH,ADWIDTH
1           ,ADEDRAFT,ADLDRAFT

 WRITE(2,1000)"BA",BACOUNT,BACAPACITY,BALENGTH,BAWIDTH
1           ,BAEDRAFT,BALDRAFT
 WRITE(2,1000)"BB",BBCOUNT,BBCAPACITY,BBLENGTH,BBWIDTH
1           ,BBEDRAFT,BBLDRAFT
 WRITE(2,1000)"BC",BCCOUNT,BCCAPACITY,BCLENGTH,BCWIDTH
1           ,BCEDRAFT,BCLDRAFT
 WRITE(2,1000)"BD",BDCOUNT,BDCAPACITY,BDLENGTH,BDWIDTH
1           ,BDEDRAFT,BDLDRAFT
```

```
      WRITE(2,1000)"CB",CBCOUNT,CBCAPACITY,CBLENGTH,CBWIDTH
     1            ,CBEDRAFT,CBLDRAFT
      WRITE(2,1000)"CC",CCCOUNT,CCCAPACITY,CCLENGTH,CCWIDTH
     1            ,CCEDRAFT,CCLDRAFT
      WRITE(2,1000)"CD",CDCOUNT,CDCAPACITY,CDLENGTH,CDWIDTH
     1            ,CDEDRAFT,CDLDRAFT

      WRITE(2,1000)"DB",DBCOUNT,DBCAPACITY,DBLENGTH,DBWIDTH
     1            ,DBEDRAFT,DBLDRAFT
      WRITE(2,1000)"DC",DCCOUNT,DCCAPACITY,DCLENGTH,DCWIDTH
     1            ,DCEDRAFT,DCLDRAFT
      WRITE(2,1000)"DD",DDCOUNT,DDCAPACITY,DDLENGTH,DDWIDTH
     1            ,DDEDRAFT,DDLDRAFT

      WRITE(2,1000)"EA",EACOUNT,EACAPACITY,EALENGTH,EAWIDTH
     1            ,EAEDRAFT,EALDRAFT
      WRITE(2,1000)"EB",EBCOUNT,EBCAPACITY,EBLENGTH,EBWIDTH
     1            ,EBEDRAFT,EBLDRAFT
      WRITE(2,1000)"EC",ECCOUNT,ECCAPACITY,ECLENGTH,ECWIDTH
     1            ,ECEDRAFT,ECLDRAFT
      WRITE(2,1000)"ED",EDCOUNT,EDCAPACITY,EDLENGTH,EDWIDTH
     1            ,EDEDRAFT,EDLDRAFT

      WRITE(2,1000)"FC",FCCOUNT,FCCAPACITY,FCLENGTH,FCWIDTH
     1            ,FCEDRAFT,FCLDRAFT
      WRITE(2,1000)"FD",FDCOUNT,FDCAPACITY,FDLENGTH,FDWIDTH
     1            ,FDEDRAFT,FDLDRAFT

      WRITE(2,1000)"GC",GCCOUNT,GCCAPACITY,GCLENGTH,GCWIDTH
     1            ,GCEDRAFT,GCLDRAFT
      WRITE(2,1000)"GD",GDCOUNT,GDCAPACITY,GDLENGTH,GDWIDTH
     1            ,GDEDRAFT,GDLDRAFT

      WRITE(2,1000)"HB",HBCOUNT,HBCAPACITY,HBLENGTH,HBWIDTH
     1            ,HBEDRAFT,HBLDRAFT
      WRITE(2,1000)"HC",HCCOUNT,HCCAPACITY,HCLENGTH,HCWIDTH
     1            ,HCEDRAFT,HCLDRAFT
      WRITE(2,1000)"HD",HDCOUNT,HDCAPACITY,HDLENGTH,HDWIDTH
     1            ,HDEDRAFT,HDLDRAFT

      CALL PRINTDIST()
      STOP

      REWIND(1)

C
C     CALCULATE STANDARD DEVIATIONS OF BARGE CHARACTERISTICS
C

      DO WHILE(.NOT.EOF(1))
```

```
      READ (1,*) BLENGTH,BWIDTH,CAPACITY,LOADDRAFT,LIGHTDRAFT,IAREA

      IF (BLENGTH.GT.10..AND.BLENGTH.LT.100..AND.BWIDTH.GT.10..AND.
     1    BWIDTH.LT.26. .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
     2    CAPACITY.GT.10.0 .AND. LOADDRAFT
     3    .GT. 0.0 .AND. LIGHTDRAFT .GE. 1.00) THEN
          AASDCAPACITY=AASDCAPACITY+(CAPACITY-AACAPACITY)**2
          AASDLENGTH=AASDLENGTH+(BLENGTH-AALENGTH)**2
          AASDWIDTH=AASDWIDTH+(BWIDTH-AAWIDTH)**2
          AASDEDRAFT=AASDEDRAFT+(LIGHTDRAFT-AAEDRAFT)**2
          AASDLDRAFT=AASDLDRAFT+(LIGHTDRAFT-AALDRAFT)**2

      ENDIF

      IF (BLENGTH.GT.10..AND.BLENGTH.LT.100..AND.BWIDTH.GE.26..AND.
     1    BWIDTH.LT.35.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
     2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 4000.0 .AND. LOADDRAFT
     3    .GT. 0.0 .AND. LIGHTDRAFT .GE. 1.00) THEN
          ABSDCAPACITY=ABSDCAPACITY+(CAPACITY-ABCAPACITY)**2
          ABSDLENGTH=ABSDLENGTH+(BLENGTH-ABLENGTH)**2
          ABSDWIDTH=ABSDWIDTH+(BWIDTH-ABWIDTH)**2
          ABSDEDRAFT=ABSDEDRAFT+(LIGHTDRAFT-ABEDRAFT)**2
          ABSDLDRAFT=ABSDLDRAFT+(LIGHTDRAFT-ABLDRAFT)**2

      ENDIF

      IF (BLENGTH.GT.10..AND.BLENGTH.LT.100..AND.BWIDTH.GE.35.0.AND.
     1    BWIDTH.LE.54.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
     2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 5000.0 .AND. LOADDRAFT
     3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
          ACSDCAPACITY=ACSDCAPACITY+(CAPACITY-ACCAPACITY)**2
          ACSDLENGTH=ACSDLENGTH+(BLENGTH-ACLENGTH)**2
          ACSDWIDTH=ACSDWIDTH+(BWIDTH-ACWIDTH)**2
          ACSDEDRAFT=ACSDEDRAFT+(LIGHTDRAFT-ACEDRAFT)**2
          ACSDLDRAFT=ACSDLDRAFT+(LIGHTDRAFT-ACLDRAFT)**2

      ENDIF

      IF (BLENGTH.GT.10..AND.BLENGTH.LT.100..AND.BWIDTH.GT.54.0.AND.
     1    BWIDTH.LE.79 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
     2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
     3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
          ADSDCAPACITY=ADSDCAPACITY+(CAPACITY-ADCAPACITY)**2
          ADSDLENGTH=ADSDLENGTH+(BLENGTH-ADLENGTH)**2
          ADSDWIDTH=ADSDWIDTH+(BWIDTH-ADWIDTH)**2
          ADSDEDRAFT=ADSDEDRAFT+(LIGHTDRAFT-ADEDRAFT)**2
          ADSDLDRAFT=ADSDLDRAFT+(LIGHTDRAFT-ADLDRAFT)**2

      ENDIF

      IF (BLENGTH.GE.100..AND.BLENGTH.LE.174..AND.BWIDTH.GT.10..AND.
```

```
1     BWIDTH.LT.26. .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      BASDCAPACITY=BASDCAPACITY+(CAPACITY-BACAPACITY)**2
      BASDLENGTH=BASDLENGTH+(BLENGTH-BALENGTH)**2
      BASDWIDTH=BASDWIDTH+(BWIDTH-BAWIDTH)**2
      BASDEDRAFT=BASDEDRAFT+(LIGHTDRAFT-BAEDRAFT)**2
      BASDLDRAFT=BASDLDRAFT+(LIGHTDRAFT-BALDRAFT)**2

 ENDIF

 IF (BLENGTH.GE.100..AND.BLENGTH.LE.174..AND.BWIDTH.GE.26..AND.
1     BWIDTH.LT.35.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      BBSDCAPACITY=BBSDCAPACITY+(CAPACITY-BBCAPACITY)**2
      BBSDLENGTH=BBSDLENGTH+(BLENGTH-BBLENGTH)**2
      BBSDWIDTH=BBSDWIDTH+(BWIDTH-BBWIDTH)**2
      BBSDEDRAFT=BBSDEDRAFT+(LIGHTDRAFT-BBEDRAFT)**2
      BBSDLDRAFT=BBSDLDRAFT+(LIGHTDRAFT-BBLDRAFT)**2

 ENDIF

 IF (BLENGTH.GE.100..AND.BLENGTH.LE.174..AND.BWIDTH.GE.35.0.AND.
1     BWIDTH.LE.54.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      BCSDCAPACITY=BCSDCAPACITY+(CAPACITY-BCCAPACITY)**2
      BCSDLENGTH=BCSDLENGTH+(BLENGTH-BCLENGTH)**2
      BCSDWIDTH=BCSDWIDTH+(BWIDTH-BCWIDTH)**2
      BCSDEDRAFT=BCSDEDRAFT+(LIGHTDRAFT-BCEDRAFT)**2
      BCSDLDRAFT=BCSDLDRAFT+(LIGHTDRAFT-BCLDRAFT)**2

 ENDIF

 IF (BLENGTH.GE.100..AND.BLENGTH.LE.174..AND.BWIDTH.GT.54.0.AND.
1     BWIDTH.LE.79 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      BDSDCAPACITY=BDSDCAPACITY+(CAPACITY-BDCAPACITY)**2
      BDSDLENGTH=BDSDLENGTH+(BLENGTH-BDLENGTH)**2
      BDSDWIDTH=BDSDWIDTH+(BWIDTH-BDWIDTH)**2
      BDSDEDRAFT=BDSDEDRAFT+(LIGHTDRAFT-BDEDRAFT)**2
      BDSDLDRAFT=BDSDLDRAFT+(LIGHTDRAFT-BDLDRAFT)**2

 ENDIF

 IF (BLENGTH.GE.175..AND.BLENGTH.LE.194..AND.BWIDTH.GE.26..AND.
1     BWIDTH.LT.35.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
```

```
      CBSDCAPACITY=CBSDCAPACITY+(CAPACITY-CBCAPACITY)**2
      CBSDLENGTH=CBSDLENGTH+(BLENGTH-CBLENGTH)**2
      CBSDWIDTH=CBSDWIDTH+(BWIDTH-CBWIDTH)**2
      CBSDEDRAFT=CBSDEDRAFT+(LIGHTDRAFT-CBEDRAFT)**2
      CBSDLDRAFT=CBSDLDRAFT+(LIGHTDRAFT-CBLDRAFT)**2

 ENDIF

 IF (BLENGTH.GE.175..AND.BLENGTH.LE.194..AND.BWIDTH.GE.35.0.AND.
1    BWIDTH.LE.54.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      CCSDCAPACITY=CCSDCAPACITY+(CAPACITY-CCCAPACITY)**2
      CCSDLENGTH=CCSDLENGTH+(BLENGTH-CCLENGTH)**2
      CCSDWIDTH=CCSDWIDTH+(BWIDTH-CCWIDTH)**2
      CCSDEDRAFT=CCSDEDRAFT+(LIGHTDRAFT-CCEDRAFT)**2
      CCSDLDRAFT=CCSDLDRAFT+(LIGHTDRAFT-CCLDRAFT)**2

 ENDIF

 IF (BLENGTH.GE.175..AND.BLENGTH.LE.194..AND.BWIDTH.GT.54.0.AND.
1    BWIDTH.LE.79 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      CDSDCAPACITY=CDSDCAPACITY+(CAPACITY-CDCAPACITY)**2
      CDSDLENGTH=CDSDLENGTH+(BLENGTH-CDLENGTH)**2
      CDSDWIDTH=CDSDWIDTH+(BWIDTH-CDWIDTH)**2
      CDSDEDRAFT=CDSDEDRAFT+(LIGHTDRAFT-CDEDRAFT)**2
      CDSDLDRAFT=CDSDLDRAFT+(LIGHTDRAFT-CDLDRAFT)**2

 ENDIF

 IF (BLENGTH.GE.195..AND.BLENGTH.LE.199..AND.BWIDTH.GE.26..AND.
1    BWIDTH.LT.35.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      DBSDCAPACITY=DBSDCAPACITY+(CAPACITY-DBCAPACITY)**2
      DBSDLENGTH=DBSDLENGTH+(BLENGTH-DBLENGTH)**2
      DBSDWIDTH=DBSDWIDTH+(BWIDTH-DBWIDTH)**2
      DBSDEDRAFT=DBSDEDRAFT+(LIGHTDRAFT-DBEDRAFT)**2
      DBSDLDRAFT=DBSDLDRAFT+(LIGHTDRAFT-DBLDRAFT)**2

 ENDIF

 IF (BLENGTH.GE.195..AND.BLENGTH.LE.199..AND.BWIDTH.GE.35.0.AND.
1    BWIDTH.LE.54.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      DCSDCAPACITY=DCSDCAPACITY+(CAPACITY-DCCAPACITY)**2
      DCSDLENGTH=DCSDLENGTH+(BLENGTH-DCLENGTH)**2
      DCSDWIDTH=DCSDWIDTH+(BWIDTH-DCWIDTH)**2
```

```
      DCSDEDRAFT=DCSDEDRAFT+(LIGHTDRAFT-DCEDRAFT)**2
      DCSDLDRAFT=DCSDLDRAFT+(LIGHTDRAFT-DCLDRAFT)**2

 ENDIF

 IF (BLENGTH.GE.195..AND.BLENGTH.LE.199..AND.BWIDTH.GT.54.0.AND.
1     BWIDTH.LE.79 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      DDSDCAPACITY=DDSDCAPACITY+(CAPACITY-DDCAPACITY)**2
      DDSDLENGTH=DDSDLENGTH+(BLENGTH-DDLENGTH)**2
      DDSDWIDTH=DDSDWIDTH+(BWIDTH-DDWIDTH)**2
      DDSDEDRAFT=DDSDEDRAFT+(LIGHTDRAFT-DDEDRAFT)**2
      DDSDLDRAFT=DDSDLDRAFT+(LIGHTDRAFT-DDLDRAFT)**2

 ENDIF

 IF (BLENGTH.GE.200..AND.BLENGTH.LE.259..AND.BWIDTH.GT.10..AND.
1     BWIDTH.LT.26. .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      EASDCAPACITY=EASDCAPACITY+(CAPACITY-EACAPACITY)**2
      EASDLENGTH=EASDLENGTH+(BLENGTH-EALENGTH)**2
      EASDWIDTH=EASDWIDTH+(BWIDTH-EAWIDTH)**2
      EASDEDRAFT=EASDEDRAFT+(LIGHTDRAFT-EAEDRAFT)**2
      EASDLDRAFT=EASDLDRAFT+(LIGHTDRAFT-EALDRAFT)**2

 ENDIF

 IF (BLENGTH.GE.200..AND.BLENGTH.LE.259..AND.BWIDTH.GE.26..AND.
1     BWIDTH.LT.35.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      EBSDCAPACITY=EBSDCAPACITY+(CAPACITY-EBCAPACITY)**2
      EBSDLENGTH=EBSDLENGTH+(BLENGTH-EBLENGTH)**2
      EBSDWIDTH=EBSDWIDTH+(BWIDTH-EBWIDTH)**2
      EBSDEDRAFT=EBSDEDRAFT+(LIGHTDRAFT-EBEDRAFT)**2
      EBSDLDRAFT=EBSDLDRAFT+(LIGHTDRAFT-EBLDRAFT)**2

 ENDIF

 IF (BLENGTH.GE.200..AND.BLENGTH.LE.259..AND.BWIDTH.GE.35.0.AND.
1     BWIDTH.LE.54.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
      ECSDCAPACITY=ECSDCAPACITY+(CAPACITY-ECCAPACITY)**2
      ECSDLENGTH=ECSDLENGTH+(BLENGTH-ECLENGTH)**2
      ECSDWIDTH=ECSDWIDTH+(BWIDTH-ECWIDTH)**2
      ECSDEDRAFT=ECSDEDRAFT+(LIGHTDRAFT-ECEDRAFT)**2
      ECSDLDRAFT=ECSDLDRAFT+(LIGHTDRAFT-ECLDRAFT)**2
```

```
      ENDIF

      IF (BLENGTH.GE.200..AND.BLENGTH.LE.259..AND.BWIDTH.GT.54.0.AND.
     1    BWIDTH.LE.79 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
     2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
     3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
          EDSDCAPACITY=EDSDCAPACITY+(CAPACITY-EDCAPACITY)**2
          EDSDLENGTH=EDSDLENGTH+(BLENGTH-EDLENGTH)**2
          EDSDWIDTH=EDSDWIDTH+(BWIDTH-EDWIDTH)**2
          EDSDEDRAFT=EDSDEDRAFT+(LIGHTDRAFT-EDEDRAFT)**2
          EDSDLDRAFT=EDSDLDRAFT+(LIGHTDRAFT-EDLDRAFT)**2

      ENDIF

      IF (BLENGTH.GE.260..AND.BLENGTH.LE.289..AND.BWIDTH.GE.35.0.AND.
     1    BWIDTH.LE.54.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
     2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
     3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
          FCSDCAPACITY=FCSDCAPACITY+(CAPACITY-FCCAPACITY)**2
          FCSDLENGTH=FCSDLENGTH+(BLENGTH-FCLENGTH)**2
          FCSDWIDTH=FCSDWIDTH+(BWIDTH-FCWIDTH)**2
          FCSDEDRAFT=FCSDEDRAFT+(LIGHTDRAFT-FCEDRAFT)**2
          FCSDLDRAFT=FCSDLDRAFT+(LIGHTDRAFT-FCLDRAFT)**2

      ENDIF

      IF (BLENGTH.GE.260..AND.BLENGTH.LE.289..AND.BWIDTH.GT.54.0.AND.
     1    BWIDTH.LE.79 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
     2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
     3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
          FDSDCAPACITY=FDSDCAPACITY+(CAPACITY-FDCAPACITY)**2
          FDSDLENGTH=FDSDLENGTH+(BLENGTH-FDLENGTH)**2
          FDSDWIDTH=FDSDWIDTH+(BWIDTH-FDWIDTH)**2
          FDSDEDRAFT=FDSDEDRAFT+(LIGHTDRAFT-FDEDRAFT)**2
          FDSDLDRAFT=FDSDLDRAFT+(LIGHTDRAFT-FDLDRAFT)**2

      ENDIF

      IF (BLENGTH.GE.290..AND.BLENGTH.LE.300..AND.BWIDTH.GE.35.0.AND.
     1    BWIDTH.LE.54.0 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
     2    CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
     3    .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
          GCSDCAPACITY=GCSDCAPACITY+(CAPACITY-GCCAPACITY)**2
          GCSDLENGTH=GCSDLENGTH+(BLENGTH-GCLENGTH)**2
          GCSDWIDTH=GCSDWIDTH+(BWIDTH-GCWIDTH)**2
          GCSDEDRAFT=GCSDEDRAFT+(LIGHTDRAFT-GCEDRAFT)**2
          GCSDLDRAFT=GCSDLDRAFT+(LIGHTDRAFT-GCLDRAFT)**2

      ENDIF

      IF (BLENGTH.GE.290..AND.BLENGTH.LE.300..AND.BWIDTH.GT.54.0.AND.
```

```
     1     BWIDTH.LE.79 .AND. IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
     2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
     3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
           GDSDCAPACITY=GDSDCAPACITY+(CAPACITY-GDCAPACITY)**2
           GDSDLENGTH=GDSDLENGTH+(BLENGTH-GDLENGTH)**2
           GDSDWIDTH=GDSDWIDTH+(BWIDTH-GDWIDTH)**2
           GDSDEDRAFT=GDSDEDRAFT+(LIGHTDRAFT-GDEDRAFT)**2
           GDSDLDRAFT=GDSDLDRAFT+(LIGHTDRAFT-GDLDRAFT)**2

          ENDIF

          IF (BLENGTH.GT.300. .AND.BWIDTH.GE.26..AND.BWIDTH.LT.35.0 .AND.
     1     IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
     2     CAPACITY.GT.10.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
     3     .GT. 0.0 .AND. LIGHTDRAFT .GE. 1.00) THEN
           HBSDCAPACITY=HBSDCAPACITY+(CAPACITY-HBCAPACITY)**2
           HBSDLENGTH=HBSDLENGTH+(BLENGTH-HBLENGTH)**2
           HBSDWIDTH=HBSDWIDTH+(BWIDTH-HBWIDTH)**2
           HBSDEDRAFT=HBSDEDRAFT+(LIGHTDRAFT-HBEDRAFT)**2
           HBSDLDRAFT=HBSDLDRAFT+(LIGHTDRAFT-HBLDRAFT)**2

          ENDIF

          IF (BLENGTH.GT.300.0 .AND. BLENGTH .LT. 500.0
     1      .AND.BWIDTH.GE.35.0.AND.BWIDTH.LE.54.0 .AND.
     2     IAREA.EQ.4 .AND. LOADDRAFT.LT.15.2 .AND.
     3     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
     3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GE. 1.00) THEN
           HCSDCAPACITY=HCSDCAPACITY+(CAPACITY-HCCAPACITY)**2
           HCSDLENGTH=HCSDLENGTH+(BLENGTH-HCLENGTH)**2
           HCSDWIDTH=HCSDWIDTH+(BWIDTH-HCWIDTH)**2
           HCSDEDRAFT=HCSDEDRAFT+(LIGHTDRAFT-HCEDRAFT)**2
           HCSDLDRAFT=HCSDLDRAFT+(LIGHTDRAFT-HCLDRAFT)**2

          ENDIF

          IF (BLENGTH.GT.300. .AND.BWIDTH.GT.54.0 .AND. IAREA.EQ.4 .AND.
     1     BWIDTH.LE.79 .AND. LOADDRAFT.LT.15.2 .AND.
     2     CAPACITY.GT.99.0 .AND. CAPACITY .LT. 10000.0 .AND. LOADDRAFT
     3     .GT.LIGHTDRAFT.AND.LIGHTDRAFT.GT..99999) THEN
           HDSDCAPACITY=HDSDCAPACITY+(CAPACITY-HDCAPACITY)**2
           HDSDLENGTH=HDSDLENGTH+(BLENGTH-HDLENGTH)**2
           HDSDWIDTH=HDSDWIDTH+(BWIDTH-HDWIDTH)**2
           HDSDEDRAFT=HDSDEDRAFT+(LIGHTDRAFT-HDEDRAFT)**2
           HDSDLDRAFT=HDSDLDRAFT+(LIGHTDRAFT-HDLDRAFT)**2

          ENDIF

200       END DO

C
```

```
C          NOTE: CATEGORIES WITH SMALL COUNTS DO NOT INCLUDE THE
C                TWO STANDARD DEVIATIONS
C

201    AACAPACITY=AACAPACITY+2*SQRT(AASDCAPACITY/(AACOUNT-1))

       ABCAPACITY=ABCAPACITY+2*SQRT(ABSDCAPACITY/(ABCOUNT-1))
       ACCAPACITY=ACCAPACITY+2*SQRT(ACSDCAPACITY/(ACCOUNT-1))
C
C      NEGLECT FOLLOWING LINE SINCE ADCOUNT=1
C
C      ADCAPACITY=ADCAPACITY+2*SQRT(ADSDCAPACITY/(ADCOUNT-1))

       BACAPACITY=BACAPACITY+2*SQRT(BASDCAPACITY/(BACOUNT-1))
       BBCAPACITY=BBCAPACITY+2*SQRT(BBSDCAPACITY/(BBCOUNT-1))
       BCCAPACITY=BCCAPACITY+2*SQRT(BCSDCAPACITY/(BCCOUNT-1))

       BDCAPACITY=BDCAPACITY+2*SQRT(BDSDCAPACITY/(BDCOUNT-1))

       CBCAPACITY=CBCAPACITY+2*SQRT(CBSDCAPACITY/(CBCOUNT-1))
       CCCAPACITY=CCCAPACITY+2*SQRT(CCSDCAPACITY/(CCCOUNT-1))
C
C      NEGLECT FOLLOWING LINE SINCE CDCOUNT=1
C
C      CDCAPACITY=CDCAPACITY+2*SQRT(CDSDCAPACITY/(CDCOUNT-1))

       DBCAPACITY=DBCAPACITY+2*SQRT(DBSDCAPACITY/(DBCOUNT-1))
       DCCAPACITY=DCCAPACITY+2*SQRT(DCSDCAPACITY/(DCCOUNT-1))

C
C      NEGLECT FOLLOWING LINE SINCE DDCOUNT=1
C
C      DDCAPACITY=DDCAPACITY+2*SQRT(DDSDCAPACITY/(DDCOUNT-1))

       EACAPACITY=EACAPACITY+2*SQRT(EASDCAPACITY/(EACOUNT-1))

       EBCAPACITY=EBCAPACITY+2*SQRT(EBSDCAPACITY/(EBCOUNT-1))
       ECCAPACITY=ECCAPACITY+2*SQRT(ECSDCAPACITY/(ECCOUNT-1))

       EDCAPACITY=EDCAPACITY+2*SQRT(EDSDCAPACITY/(EDCOUNT-1))

       FCCAPACITY=FCCAPACITY+2*SQRT(FCSDCAPACITY/(FCCOUNT-1))

       FDCAPACITY=FDCAPACITY+2*SQRT(FDSDCAPACITY/(FDCOUNT-1))

       GCCAPACITY=GCCAPACITY+2*SQRT(GCSDCAPACITY/(GCCOUNT-1))

       GDCAPACITY=GDCAPACITY+2*SQRT(GDSDCAPACITY/(GDCOUNT-1))

C
C      NEGLECT FOLLOWING LINE SINCE HBCOUNT=1
```

```
C
C       HBCAPACITY=HBCAPACITY+2*SQRT(HBSDCAPACITY/(HBCOUNT-1))
        HCCAPACITY=HCCAPACITY+2*SQRT(HCSDCAPACITY/(HCCOUNT-1))

        HDCAPACITY=HDCAPACITY+2*SQRT(HDSDCAPACITY/(HDCOUNT-1))

        AAWIDTH=AAWIDTH+2*SQRT(AASDWIDTH/(AACOUNT-1))
        ABWIDTH=ABWIDTH+2*SQRT(ABSDWIDTH/(ABCOUNT-1))
        ACWIDTH=ACWIDTH+2*SQRT(ACSDWIDTH/(ACCOUNT-1))
C
C       NEGLECT FOLLOWING LINE SINCE ADCOUNT=1
C
C       ADWIDTH=ADWIDTH+2*SQRT(ADSDWIDTH/(ADCOUNT-1))

        BAWIDTH=BAWIDTH+2*SQRT(BASDWIDTH/(BACOUNT-1))
        BBWIDTH=BBWIDTH+2*SQRT(BBSDWIDTH/(BBCOUNT-1))
        BCWIDTH=BCWIDTH+2*SQRT(BCSDWIDTH/(BCCOUNT-1))
        BDWIDTH=BDWIDTH+2*SQRT(BDSDWIDTH/(BDCOUNT-1))

        CBWIDTH=CBWIDTH+2*SQRT(CBSDWIDTH/(CBCOUNT-1))
        CCWIDTH=CCWIDTH+2*SQRT(CCSDWIDTH/(CCCOUNT-1))

C
C       NEGLECT FOLLOWING LINE SINCE CDCOUNT=1
C
C       CDWIDTH=CDWIDTH+2*SQRT(CDSDWIDTH/(CDCOUNT-1))

        DBWIDTH=DBWIDTH+2*SQRT(DBSDWIDTH/(DBCOUNT-1))
        DCWIDTH=DCWIDTH+2*SQRT(DCSDWIDTH/(DCCOUNT-1))
C
C       NEGLECT FOLLOWING LINE SINCE DDCOUNT=1
C
C       DDWIDTH=DDWIDTH+2*SQRT(DDSDWIDTH/(DDCOUNT-1))

        EAWIDTH=EAWIDTH+2*SQRT(EASDWIDTH/(EACOUNT-1))
        EBWIDTH=EBWIDTH+2*SQRT(EBSDWIDTH/(EBCOUNT-1))
        ECWIDTH=ECWIDTH+2*SQRT(ECSDWIDTH/(ECCOUNT-1))
        EDWIDTH=EDWIDTH+2*SQRT(EDSDWIDTH/(EDCOUNT-1))

        FCWIDTH=FCWIDTH+2*SQRT(FCSDWIDTH/(FCCOUNT-1))
        FDWIDTH=FDWIDTH+2*SQRT(FDSDWIDTH/(FDCOUNT-1))

        GCWIDTH=GCWIDTH+2*SQRT(GCSDWIDTH/(GCCOUNT-1))
        GDWIDTH=GDWIDTH+2*SQRT(GDSDWIDTH/(GDCOUNT-1))

C
C       NEGLECT FOLLOWING LINE SINCE HBCOUNT=1
C
C       HBWIDTH=HBWIDTH+2*SQRT(HBSDWIDTH/(HBCOUNT-1))
        HCWIDTH=HCWIDTH+2*SQRT(HCSDWIDTH/(HCCOUNT-1))
        HDWIDTH=HDWIDTH+2*SQRT(HDSDWIDTH/(HDCOUNT-1))
```

```
      AALENGTH=AALENGTH+2*SQRT(AASDLENGTH/(AACOUNT-1))
      ABLENGTH=ABLENGTH+2*SQRT(ABSDLENGTH/(ABCOUNT-1))
      ACLENGTH=ACLENGTH+2*SQRT(ACSDLENGTH/(ACCOUNT-1))
C
C     NEGLECT FOLLOWING LINE SINCE ADCOUNT=1
C
C     ADLENGTH=ADLENGTH+2*SQRT(ADSDLENGTH/(ADCOUNT-1))

      BALENGTH=BALENGTH+2*SQRT(BASDLENGTH/(BACOUNT-1))
      BBLENGTH=BBLENGTH+2*SQRT(BBSDLENGTH/(BBCOUNT-1))
      BCLENGTH=BCLENGTH+2*SQRT(BCSDLENGTH/(BCCOUNT-1))
      BDLENGTH=BDLENGTH+2*SQRT(BDSDLENGTH/(BDCOUNT-1))

      CBLENGTH=CBLENGTH+2*SQRT(CBSDLENGTH/(CBCOUNT-1))
      CCLENGTH=CCLENGTH+2*SQRT(CCSDLENGTH/(CCCOUNT-1))
C
C     NEGLECT FOLLOWING LINE SINCE CDCOUNT=1
C
C     CDLENGTH=CDLENGTH+2*SQRT(CDSDLENGTH/(CDCOUNT-1))

      DBLENGTH=DBLENGTH+2*SQRT(DBSDLENGTH/(DBCOUNT-1))
      DCLENGTH=DCLENGTH+2*SQRT(DCSDLENGTH/(DCCOUNT-1))
C
C     NEGLECT FOLLOWING LINE SINCE DDCOUNT=1
C
C     DDLENGTH=DDLENGTH+2*SQRT(DDSDLENGTH/(DDCOUNT-1))

      EALENGTH=EALENGTH+2*SQRT(EASDLENGTH/(EACOUNT-1))
      EBLENGTH=EBLENGTH+2*SQRT(EBSDLENGTH/(EBCOUNT-1))
      ECLENGTH=ECLENGTH+2*SQRT(ECSDLENGTH/(ECCOUNT-1))
      EDLENGTH=EDLENGTH+2*SQRT(EDSDLENGTH/(EDCOUNT-1))

      FCLENGTH=FCLENGTH+2*SQRT(FCSDLENGTH/(FCCOUNT-1))
      FDLENGTH=FDLENGTH+2*SQRT(FDSDLENGTH/(FDCOUNT-1))

      GCLENGTH=GCLENGTH+2*SQRT(GCSDLENGTH/(GCCOUNT-1))
      GDLENGTH=GDLENGTH+2*SQRT(GDSDLENGTH/(GDCOUNT-1))

C
C     NEGLECT FOLLOWING LINE SINCE HBCOUNT=1
C
C     HBLENGTH=HBLENGTH+2*SQRT(HBSDLENGTH/(HBCOUNT-1))
      HCLENGTH=HCLENGTH+2*SQRT(HCSDLENGTH/(HCCOUNT-1))
      HDLENGTH=HDLENGTH+2*SQRT(HDSDLENGTH/(HDCOUNT-1))

      AAEDRAFT=AAEDRAFT+2*SQRT(AASDEDRAFT/(AACOUNT-1))
      ABEDRAFT=ABEDRAFT+2*SQRT(ABSDEDRAFT/(ABCOUNT-1))
      ACEDRAFT=ACEDRAFT+2*SQRT(ACSDEDRAFT/(ACCOUNT-1))
C
C     NEGLECT FOLLOWING LINE SINCE ADCOUNT=1
```

```
C
C       ADEDRAFT=ADEDRAFT+2*SQRT(ADSDEDRAFT/(ADCOUNT-1))

        BAEDRAFT=BAEDRAFT+2*SQRT(BASDEDRAFT/(BACOUNT-1))
        BBEDRAFT=BBEDRAFT+2*SQRT(BBSDEDRAFT/(BBCOUNT-1))
        BCEDRAFT=BCEDRAFT+2*SQRT(BCSDEDRAFT/(BCCOUNT-1))
        BDEDRAFT=BDEDRAFT+2*SQRT(BDSDEDRAFT/(BDCOUNT-1))

        CBEDRAFT=CBEDRAFT+2*SQRT(CBSDEDRAFT/(CBCOUNT-1))
        CCEDRAFT=CCEDRAFT+2*SQRT(CCSDEDRAFT/(CCCOUNT-1))
C
C       NEGLECT FOLLOWING LINE SINCE CDCOUNT=1
C
C       CDEDRAFT=CDEDRAFT+2*SQRT(CDSDEDRAFT/(CDCOUNT-1))

        DBEDRAFT=DBEDRAFT+2*SQRT(DBSDEDRAFT/(DBCOUNT-1))
        DCEDRAFT=DCEDRAFT+2*SQRT(DCSDEDRAFT/(DCCOUNT-1))
C
C       NEGLECT FOLLOWING LINE SINCE DDCOUNT=1
C
C       DDEDRAFT=DDEDRAFT+2*SQRT(DDSDEDRAFT/(DDCOUNT-1))

        EAEDRAFT=EAEDRAFT+2*SQRT(EASDEDRAFT/(EACOUNT-1))
        EBEDRAFT=EBEDRAFT+2*SQRT(EBSDEDRAFT/(EBCOUNT-1))
        ECEDRAFT=ECEDRAFT+2*SQRT(ECSDEDRAFT/(ECCOUNT-1))
        EDEDRAFT=EDEDRAFT+2*SQRT(EDSDEDRAFT/(EDCOUNT-1))

        FCEDRAFT=FCEDRAFT+2*SQRT(FCSDEDRAFT/(FCCOUNT-1))
        FDEDRAFT=FDEDRAFT+2*SQRT(FDSDEDRAFT/(FDCOUNT-1))

        GCEDRAFT=GCEDRAFT+2*SQRT(GCSDEDRAFT/(GCCOUNT-1))
        GDEDRAFT=GDEDRAFT+2*SQRT(GDSDEDRAFT/(GDCOUNT-1))

C
C       NEGLECT FOLLOWING LINE SINCE HBCOUNT=1
C
C       HBEDRAFT=HBEDRAFT+2*SQRT(HBSDEDRAFT/(HBCOUNT-1))
        HCEDRAFT=HCEDRAFT+2*SQRT(HCSDEDRAFT/(HCCOUNT-1))
        HDEDRAFT=HDEDRAFT+2*SQRT(HDSDEDRAFT/(HDCOUNT-1))

        AALDRAFT=AALDRAFT+2*SQRT(AASDLDRAFT/(AACOUNT-1))
        ABLDRAFT=ABLDRAFT+2*SQRT(ABSDLDRAFT/(ABCOUNT-1))
        ACLDRAFT=ACLDRAFT+2*SQRT(ACSDLDRAFT/(ACCOUNT-1))
C
C       NEGLECT FOLLOWING LINE SINCE ADCOUNT=1
C
C       ADLDRAFT=ADLDRAFT+2*SQRT(ADSDLDRAFT/(ADCOUNT-1))

        BALDRAFT=BALDRAFT+2*SQRT(BASDLDRAFT/(BACOUNT-1))
        BBLDRAFT=BBLDRAFT+2*SQRT(BBSDLDRAFT/(BBCOUNT-1))
        BCLDRAFT=BCLDRAFT+2*SQRT(BCSDLDRAFT/(BCCOUNT-1))
```

```
      BDLDRAFT=BDLDRAFT+2*SQRT(BDSDLDRAFT/(BDCOUNT-1))

      CBLDRAFT=CBLDRAFT+2*SQRT(CBSDLDRAFT/(CBCOUNT-1))
      CCLDRAFT=CCLDRAFT+2*SQRT(CCSDLDRAFT/(CCCOUNT-1))
C
C     NEGLECT FOLLOWING LINE SINCE CDCOUNT=1
C
C     CDLDRAFT=CDLDRAFT+2*SQRT(CDSDLDRAFT/(CDCOUNT-1))

      DBLDRAFT=DBLDRAFT+2*SQRT(DBSDLDRAFT/(DBCOUNT-1))
      DCLDRAFT=DCLDRAFT+2*SQRT(DCSDLDRAFT/(DCCOUNT-1))
C
C     NEGLECT FOLLOWING LINE SINCE DDCOUNT=1
C
C     DDLDRAFT=DDLDRAFT+2*SQRT(DDSDLDRAFT/(DDCOUNT-1))

      EALDRAFT=EALDRAFT+2*SQRT(EASDLDRAFT/(EACOUNT-1))
      EBLDRAFT=EBLDRAFT+2*SQRT(EBSDLDRAFT/(EBCOUNT-1))
      ECLDRAFT=ECLDRAFT+2*SQRT(ECSDLDRAFT/(ECCOUNT-1))
      EDLDRAFT=EDLDRAFT+2*SQRT(EDSDLDRAFT/(EDCOUNT-1))

      FCLDRAFT=FCLDRAFT+2*SQRT(FCSDLDRAFT/(FCCOUNT-1))
      FDLDRAFT=FDLDRAFT+2*SQRT(FDSDLDRAFT/(FDCOUNT-1))

      GCLDRAFT=GCLDRAFT+2*SQRT(GCSDLDRAFT/(GCCOUNT-1))
      GDLDRAFT=GDLDRAFT+2*SQRT(GDSDLDRAFT/(GDCOUNT-1))

C
C     NEGLECT FOLLOWING LINE SINCE HBCOUNT=1
C
C     HBLDRAFT=HBLDRAFT+2*SQRT(HBSDLDRAFT/(HBCOUNT-1))
      HCLDRAFT=HCLDRAFT+2*SQRT(HCSDLDRAFT/(HCCOUNT-1))
      HDLDRAFT=HDLDRAFT+2*SQRT(HDSDLDRAFT/(HDCOUNT-1))
C
C     FIND MINIMUM OF AVERAGE PLUS 2 STANDARD DEVIATIONS OR
C     MAXIMUM CHARACTERISTIC VALUE
C
      AACAPACITY=MIN(AACAPACITY,AAMAXCAPACITY)
      ABCAPACITY=MIN(ABCAPACITY,ABMAXCAPACITY)
      ACCAPACITY=MIN(ACCAPACITY,ACMAXCAPACITY)
C     ADCAPACITY=MIN(ADCAPACITY,ADMAXCAPACITY)

      BACAPACITY=MIN(BACAPACITY,BAMAXCAPACITY)
      BBCAPACITY=MIN(BBCAPACITY,BBMAXCAPACITY)
      BCCAPACITY=MIN(BCCAPACITY,BCMAXCAPACITY)
      BDCAPACITY=MIN(BDCAPACITY,BDMAXCAPACITY)

      CBCAPACITY=MIN(CBCAPACITY,CBMAXCAPACITY)
      CCCAPACITY=MIN(CCCAPACITY,CCMAXCAPACITY)
      CDCAPACITY=MIN(CDCAPACITY,CDMAXCAPACITY)
```

```
      DBCAPACITY=MIN(DBCAPACITY,DBMAXCAPACITY)
      DCCAPACITY=MIN(DCCAPACITY,DCMAXCAPACITY)
C     DDCAPACITY=MIN(DDCAPACITY,DDMAXCAPACITY)

      EACAPACITY=MIN(EACAPACITY,EAMAXCAPACITY)
      EBCAPACITY=MIN(EBCAPACITY,EBMAXCAPACITY)
      ECCAPACITY=MIN(ECCAPACITY,ECMAXCAPACITY)
      EDCAPACITY=MIN(EDCAPACITY,EDMAXCAPACITY)

      FCCAPACITY=MIN(FCCAPACITY,FCMAXCAPACITY)
      FDCAPACITY=MIN(FDCAPACITY,FDMAXCAPACITY)

      GCCAPACITY=MIN(GCCAPACITY,GCMAXCAPACITY)
      GDCAPACITY=MIN(GDCAPACITY,GDMAXCAPACITY)

      HBCAPACITY=MIN(HBCAPACITY,HBMAXCAPACITY)
      HCCAPACITY=MIN(HCCAPACITY,HCMAXCAPACITY)
      HDCAPACITY=MIN(HDCAPACITY,HDMAXCAPACITY)


      AALENGTH=MIN(AALENGTH,AAMAXLENGTH)
      ABLENGTH=MIN(ABLENGTH,ABMAXLENGTH)
      ACLENGTH=MIN(ACLENGTH,ACMAXLENGTH)
C     ADLENGTH=MIN(ADLENGTH,ADMAXLENGTH)

      BALENGTH=MIN(BALENGTH,BAMAXLENGTH)
      BBLENGTH=MIN(BBLENGTH,BBMAXLENGTH)
      BCLENGTH=MIN(BCLENGTH,BCMAXLENGTH)
      BDLENGTH=MIN(BDLENGTH,BDMAXLENGTH)

      CBLENGTH=MIN(CBLENGTH,CBMAXLENGTH)
      CCLENGTH=MIN(CCLENGTH,CCMAXLENGTH)
      CDLENGTH=MIN(CDLENGTH,CDMAXLENGTH)

      DBLENGTH=MIN(DBLENGTH,DBMAXLENGTH)
      DCLENGTH=MIN(DCLENGTH,DCMAXLENGTH)
C     DDLENGTH=MIN(DDLENGTH,DDMAXLENGTH)

      EALENGTH=MIN(EALENGTH,EAMAXLENGTH)
      EBLENGTH=MIN(EBLENGTH,EBMAXLENGTH)
      ECLENGTH=MIN(ECLENGTH,ECMAXLENGTH)
      EDLENGTH=MIN(EDLENGTH,EDMAXLENGTH)

      FCLENGTH=MIN(FCLENGTH,FCMAXLENGTH)
      FDLENGTH=MIN(FDLENGTH,FDMAXLENGTH)

      GCLENGTH=MIN(GCLENGTH,GCMAXLENGTH)
      GDLENGTH=MIN(GDLENGTH,GDMAXLENGTH)

      HBLENGTH=MIN(HBLENGTH,HBMAXLENGTH)
      HCLENGTH=MIN(HCLENGTH,HCMAXLENGTH)
```

```
      HDLENGTH=MIN(HDLENGTH,HDMAXLENGTH)

      AAWIDTH=MIN(AAWIDTH,AAMAXWIDTH)
      ABWIDTH=MIN(ABWIDTH,ABMAXWIDTH)
      ACWIDTH=MIN(ACWIDTH,ACMAXWIDTH)
C     ADWIDTH=MIN(ADWIDTH,ADMAXWIDTH)

      BAWIDTH=MIN(BAWIDTH,BAMAXWIDTH)
      BBWIDTH=MIN(BBWIDTH,BBMAXWIDTH)
      BCWIDTH=MIN(BCWIDTH,BCMAXWIDTH)
      BDWIDTH=MIN(BDWIDTH,BDMAXWIDTH)

      CBWIDTH=MIN(CBWIDTH,CBMAXWIDTH)
      CCWIDTH=MIN(CCWIDTH,CCMAXWIDTH)
      CDWIDTH=MIN(CDWIDTH,CDMAXWIDTH)

      DBWIDTH=MIN(DBWIDTH,DBMAXWIDTH)
      DCWIDTH=MIN(DCWIDTH,DCMAXWIDTH)
C     DDWIDTH=MIN(DDWIDTH,DDMAXWIDTH)

      EAWIDTH=MIN(EAWIDTH,EAMAXWIDTH)
      EBWIDTH=MIN(EBWIDTH,EBMAXWIDTH)
      ECWIDTH=MIN(ECWIDTH,ECMAXWIDTH)
      EDWIDTH=MIN(EDWIDTH,EDMAXWIDTH)

      FCWIDTH=MIN(FCWIDTH,FCMAXWIDTH)
      FDWIDTH=MIN(FDWIDTH,FDMAXWIDTH)

      GCWIDTH=MIN(GCWIDTH,GCMAXWIDTH)
      GDWIDTH=MIN(GDWIDTH,GDMAXWIDTH)

      HBWIDTH=MIN(HBWIDTH,HBMAXWIDTH)
      HCWIDTH=MIN(HCWIDTH,HCMAXWIDTH)
C      HDWIDTH=MIN(HDWIDTH,HDMAXWIDTH)


      AAEDRAFT=MIN(AAEDRAFT,AAMAXEDRAFT)
      ABEDRAFT=MIN(ABEDRAFT,ABMAXEDRAFT)
      ACEDRAFT=MIN(ACEDRAFT,ACMAXEDRAFT)
C     ADEDRAFT=MIN(ADEDRAFT,ADMAXEDRAFT)

      BAEDRAFT=MIN(BAEDRAFT,BAMAXEDRAFT)
      BBEDRAFT=MIN(BBEDRAFT,BBMAXEDRAFT)
      BCEDRAFT=MIN(BCEDRAFT,BCMAXEDRAFT)
      BDEDRAFT=MIN(BDEDRAFT,BDMAXEDRAFT)

      CBEDRAFT=MIN(CBEDRAFT,CBMAXEDRAFT)
      CCEDRAFT=MIN(CCEDRAFT,CCMAXEDRAFT)
      CDEDRAFT=MIN(CDEDRAFT,CDMAXEDRAFT)

      DBEDRAFT=MIN(DBEDRAFT,DBMAXEDRAFT)
```

```
      DCEDRAFT=MIN(DCEDRAFT,DCMAXEDRAFT)
C     DDEDRAFT=MIN(DDEDRAFT,DDMAXEDRAFT)

      EAEDRAFT=MIN(EAEDRAFT,EAMAXEDRAFT)
      EBEDRAFT=MIN(EBEDRAFT,EBMAXEDRAFT)
      ECEDRAFT=MIN(ECEDRAFT,ECMAXEDRAFT)
      EDEDRAFT=MIN(EDEDRAFT,EDMAXEDRAFT)

      FCEDRAFT=MIN(FCEDRAFT,FCMAXEDRAFT)
      FDEDRAFT=MIN(FDEDRAFT,FDMAXEDRAFT)

      GCEDRAFT=MIN(GCEDRAFT,GCMAXEDRAFT)
      GDEDRAFT=MIN(GDEDRAFT,GDMAXEDRAFT)

      HBEDRAFT=MIN(HBEDRAFT,HBMAXEDRAFT)
      HCEDRAFT=MIN(HCEDRAFT,HCMAXEDRAFT)
      HDEDRAFT=MIN(HDEDRAFT,HDMAXEDRAFT)

      AALDRAFT=MIN(AALDRAFT,AAMAXLDRAFT)
      ABLDRAFT=MIN(ABLDRAFT,ABMAXLDRAFT)
      ACLDRAFT=MIN(ACLDRAFT,ACMAXLDRAFT)
C     ADLDRAFT=MIN(ADLDRAFT,ADMAXLDRAFT)

      BALDRAFT=MIN(BALDRAFT,BAMAXLDRAFT)
      BBLDRAFT=MIN(BBLDRAFT,BBMAXLDRAFT)
      BCLDRAFT=MIN(BCLDRAFT,BCMAXLDRAFT)
      BDLDRAFT=MIN(BDLDRAFT,BDMAXLDRAFT)

      CBLDRAFT=MIN(CBLDRAFT,CBMAXLDRAFT)
      CCLDRAFT=MIN(CCLDRAFT,CCMAXLDRAFT)
      CDLDRAFT=MIN(CDLDRAFT,CDMAXLDRAFT)

      DBLDRAFT=MIN(DBLDRAFT,DBMAXLDRAFT)
      DCLDRAFT=MIN(DCLDRAFT,DCMAXLDRAFT)
C     DDLDRAFT=MIN(DDLDRAFT,DDMAXLDRAFT)

      EALDRAFT=MIN(EALDRAFT,EAMAXLDRAFT)
      EBLDRAFT=MIN(EBLDRAFT,EBMAXLDRAFT)
      ECLDRAFT=MIN(ECLDRAFT,ECMAXLDRAFT)
      EDLDRAFT=MIN(EDLDRAFT,EDMAXLDRAFT)

      FCLDRAFT=MIN(FCLDRAFT,FCMAXLDRAFT)
      FDLDRAFT=MIN(FDLDRAFT,FDMAXLDRAFT)

      GCLDRAFT=MIN(GCLDRAFT,GCMAXLDRAFT)
      GDLDRAFT=MIN(GDLDRAFT,GDMAXLDRAFT)

      HBLDRAFT=MIN(HBLDRAFT,HBMAXLDRAFT)
      HCLDRAFT=MIN(HCLDRAFT,HCMAXLDRAFT)
      HDLDRAFT=MIN(HDLDRAFT,HDMAXLDRAFT)
```

```
 WRITE(2,*)"*********AVERAGE PLUS TWO STANDARD DEVIATIONS*********"
 WRITE(2,*)"CATEG.     ","COUNT          ","CAPACITY     ",
1          "LENGTH         ","WIDTH","    E DRAFT","    L DRAFT"

 WRITE(2,1000)"AA",AACOUNT,AACAPACITY,AALENGTH,AAWIDTH
1           ,AAEDRAFT,AALDRAFT
 WRITE(2,1000)"AB",ABCOUNT,ABCAPACITY,ABLENGTH,ABWIDTH
1           ,ABEDRAFT,ABLDRAFT
 WRITE(2,1000)"AC",ACCOUNT,ACCAPACITY,ACLENGTH,ACWIDTH
1           ,ACEDRAFT,ACLDRAFT
 WRITE(2,1000)"AD",ADCOUNT,ADCAPACITY,ADLENGTH,ADWIDTH
1           ,ADEDRAFT,ADLDRAFT

 WRITE(2,1000)"BA",BACOUNT,BACAPACITY,BALENGTH,BAWIDTH
1           ,BAEDRAFT,BALDRAFT
 WRITE(2,1000)"BB",BBCOUNT,BBCAPACITY,BBLENGTH,BBWIDTH
1           ,BBEDRAFT,BBLDRAFT
 WRITE(2,1000)"BC",BCCOUNT,BCCAPACITY,BCLENGTH,BCWIDTH
1           ,BCEDRAFT,BCLDRAFT
 WRITE(2,1000)"BD",BDCOUNT,BDCAPACITY,BDLENGTH,BDWIDTH
1           ,BDEDRAFT,BDLDRAFT

 WRITE(2,1000)"CB",CBCOUNT,CBCAPACITY,CBLENGTH,CBWIDTH
1           ,CBEDRAFT,CBLDRAFT
 WRITE(2,1000)"CC",CCCOUNT,CCCAPACITY,CCLENGTH,CCWIDTH
1           ,CCEDRAFT,CCLDRAFT
 WRITE(2,1000)"CD",CDCOUNT,CDCAPACITY,CDLENGTH,CDWIDTH
1           ,CDEDRAFT,CDLDRAFT

 WRITE(2,1000)"DB",DBCOUNT,DBCAPACITY,DBLENGTH,DBWIDTH
1           ,DBEDRAFT,DBLDRAFT
 WRITE(2,1000)"DC",DCCOUNT,DCCAPACITY,DCLENGTH,DCWIDTH
1           ,DCEDRAFT,DCLDRAFT
 WRITE(2,1000)"DD",DDCOUNT,DDCAPACITY,DDLENGTH,DDWIDTH
1           ,DDEDRAFT,DDLDRAFT

 WRITE(2,1000)"EA",EACOUNT,EACAPACITY,EALENGTH,EAWIDTH
1           ,EAEDRAFT,EALDRAFT
 WRITE(2,1000)"EB",EBCOUNT,EBCAPACITY,EBLENGTH,EBWIDTH
1           ,EBEDRAFT,EBLDRAFT
 WRITE(2,1000)"EC",ECCOUNT,ECCAPACITY,ECLENGTH,ECWIDTH
1           ,ECEDRAFT,ECLDRAFT
 WRITE(2,1000)"ED",EDCOUNT,EDCAPACITY,EDLENGTH,EDWIDTH
1           ,EDEDRAFT,EDLDRAFT

 WRITE(2,1000)"FC",FCCOUNT,FCCAPACITY,FCLENGTH,FCWIDTH
1           ,FCEDRAFT,FCLDRAFT
 WRITE(2,1000)"FD",FDCOUNT,FDCAPACITY,FDLENGTH,FDWIDTH
1           ,FDEDRAFT,FDLDRAFT

 WRITE(2,1000)"GC",GCCOUNT,GCCAPACITY,GCLENGTH,GCWIDTH
```

```
     1           ,GCEDRAFT,GCLDRAFT
      WRITE(2,1000)"GD",GDCOUNT,GDCAPACITY,GDLENGTH,GDWIDTH
     1           ,GDEDRAFT,GDLDRAFT

      WRITE(2,1000)"HB",HBCOUNT,HBCAPACITY,HBLENGTH,HBWIDTH
     1           ,HBEDRAFT,HBLDRAFT
      WRITE(2,1000)"HC",HCCOUNT,HCCAPACITY,HCLENGTH,HCWIDTH
     1           ,HCEDRAFT,HCLDRAFT
      WRITE(2,1000)"HD",HDCOUNT,HDCAPACITY,HDLENGTH,HDWIDTH
     1           ,HDEDRAFT,HDLDRAFT

      END

      SUBROUTINE DISTRIBUTION()

C
C     ****************************************************************
C
C               SUBROUTINE TO FIND CATAGORY DISTRIBUTIONS
C
C     ****************************************************************

      IMPLICIT REAL(A-H,L-Z), INTEGER(I-K)
      COMMON/DATA/LCOUNT(25,25),WCOUNT(25,25),SWIDTH(25),SLENGTH(25),
     1            JMAXIMUML(25),JMAXIMUMW(25),LSTEP(25),WSTEP(25),BWIDTH,
     2             BLENGTH,ICAT,IFLAGL,IFLAGW


      J=1
      IFLAGL=0
      IFLAGW=0

111   LENGTH=SLENGTH(ICAT)+J*LSTEP(ICAT)

      IF(BLENGTH.LT.LENGTH.AND.BLENGTH.GE.LENGTH-LSTEP(ICAT)) THEN

          LCOUNT(ICAT,J)=LCOUNT(ICAT,J)+1
          JMAXIMUML(ICAT)=MAX(JMAXIMUML(ICAT),J)
          GOTO 11
      ELSE
          J=J+1
          IF(J.GT.30) THEN
              WRITE(3,*) "******J LENGTH EXCEEDED J,ICAT*****",J,ICAT
              IFLAGL=1
              GOTO 11
          ENDIF
          GOTO 111
      END IF

11    J=1
```

```
211   WIDTH=SWIDTH(ICAT)+J*WSTEP(ICAT)

      IF(BWIDTH.LT.WIDTH.AND.BWIDTH.GE.WIDTH-WSTEP(ICAT)) THEN
          WCOUNT(ICAT,J)=WCOUNT(ICAT,J)+1
          JMAXIMUMW(ICAT)=MAX(JMAXIMUMW(ICAT),J)
          GOTO 311
      ELSE
          J=J+1
          IF(J.GT.30) THEN
              WRITE(3,*) "******J WIDTH EXCEEDED J,ICAT*****",J,ICAT
              IFLAGW=1
              GOTO 311
          ENDIF
          GOTO 211
      END IF

311   RETURN
      END

      SUBROUTINE PRINTDIST
C
C     ****************************************************************
C
C               SUBROUTINE TO PRINT CATAGORY DISTRIBUTIONS
C
C     ****************************************************************


      IMPLICIT REAL(A-H,L-Z), INTEGER(I-K)
      COMMON/DATA/LCOUNT(25,25),WCOUNT(25,25),SWIDTH(25),SLENGTH(25),
     1            JMAXIMUML(25),JMAXIMUMW(25),LSTEP(25),WSTEP(25),BWIDTH,
     2             BLENGTH,ICAT,IFLAGL,IFLAGW

      DO 300 I=1,25
          DO 300 J=1,JMAXIMUML(I)
              LENGTH=SLENGTH(I)+(J-1)*LSTEP(I)+0.5*LSTEP(I)
              WRITE(3,*)I,J,LENGTH,LCOUNT(I,J)
300   CONTINUE

      DO 400 I=1,25
          DO 400 J=1,JMAXIMUMW(I)
              WIDTH=SWIDTH(I)+(J-1)*WSTEP(I)+0.5*WSTEP(I)
              WRITE(3,*)I,J,WIDTH,WCOUNT(I,J)
400   CONTINUE

      RETURN

      END
```

Appendix B: Barge Capacity Output

NOTE: **The first letter in parenthesis is the length of barge designation, as found in Table 6.1, and the second letter is the width of barge designation, as found in Table 6.2**

**********CATEGORY AVERAGE VALUES**********

CATEG.	COUNT	CAPACITY	LENGTH	WIDTH	E DRAFT	L DRAFT
1 (AA)	313.00	229.09	72.73	20.73	4.25	6.40
2 (AB)	811.00	567.84	62.98	30.95	2.02	8.72
3 (AC)	59.00	1957.22	87.75	40.36	1.32	8.69
4 (AD)	1.00	500.57	98.00	55.00	1.00	8.00
5 (BA)	51.00	635.57	112.65	23.56	2.91	6.33
6 (BB)	1586.00	668.95	122.44	29.48	1.81	6.63
7 (BC)	980.00	1584.43	142.57	43.00	2.92	8.96
8 (BD)	24.00	1810.48	133.83	55.37	1.59	7.64
9 (CB)	1034.00	1160.92	175.05	26.06	1.57	8.90
10 (CC)	312.00	1981.08	180.14	42.70	2.74	9.65
11 (CD)	1.00	420.65	188.00	60.00	4.00	8.60
12 (DB)	491.00	1361.57	195.00	26.02	1.72	9.01
13 (DC)	13069.00	1844.64	195.01	35.10	1.67	9.09
14 (DD)	1.00	2642.67	196.10	54.10	5.00	8.00
15 (EA)	3.00	1155.56	215.00	25.00	1.00	10.00
16 (EB)	3.00	1257.39	200.00	26.00	1.53	8.67
17 (EC)	6838.00	2075.87	202.29	35.98	1.64	9.21
18 (ED)	45.00	5100.61	242.68	71.23	2.39	12.58
19 (FC)	353.00	3643.62	265.48	51.43	1.72	9.63
20 (FD)	6.00	3666.95	268.35	56.18	2.42	10.33
21 (GC)	621.00	4307.98	295.34	53.17	1.72	9.65
22 (GD)	26.00	4875.17	297.30	54.33	2.04	9.96
23 (HC)	35.00	4837.30	333.02	52.44	2.53	9.47
24 (HD)	2.00	5504.16	340.05	54.55	2.25	11.55

**********AVERAGE PLUS TWO STANDARD DEVIATIONS**********

CATEG.	COUNT	CAPACITY	LENGTH	WIDTH	E DRAFT	L DRAFT
1 (AA)	313.00	632.56	99.50	25.70	8.80	12.00
2 (AB)	811.00	952.72	75.87	33.13	3.30	12.50
3 (AC)	59.00	4485.83	99.40	54.00	2.06	12.00
4 (AD)	1.00	500.57	98.00	55.00	1.00	8.00
5 (BA)	51.00	1432.99	144.42	25.00	7.28	11.40
6 (BB)	1586.00	1232.49	150.97	33.59	4.23	12.00
7 (BC)	980.00	3416.13	174.00	54.00	8.30	15.00
8 (BD)	24.00	3663.90	160.00	59.30	2.00	12.00
9 (CB)	1034.00	1868.19	176.11	26.98	2.32	11.60
10 (CC)	312.00	3657.39	191.08	54.00	7.48	14.00
11 (CD)	1.00	420.65	188.00	60.00	4.00	8.60
12 (DB)	491.00	1890.02	195.09	26.74	2.00	10.00
13 (DC)	13069.00	2715.35	195.25	37.49	2.29	15.00
14 (DD)	1.00	2642.67	196.10	54.10	5.00	8.00
15 (EA)	3.00	1155.56	215.00	25.00	1.00	10.00
16 (EB)	3.00	1375.00	200.00	26.00	1.80	9.50
17 (EC)	6838.00	3046.69	221.03	43.22	2.56	14.50
18 (ED)	45.00	7714.29	250.00	72.00	4.36	15.00
19 (FC)	353.00	5315.08	279.26	54.00	2.53	13.40
20 (FD)	6.00	4260.87	285.00	62.69	4.00	14.00
21 (GC)	621.00	6480.20	300.00	54.00	2.61	13.40
22 (GD)	26.00	7497.49	297.90	56.64	4.35	14.90
23 (HC)	35.00	8382.55	404.27	54.00	4.00	12.00
24 (HD)	2.00	6349.50	360.10	55.82	2.50	12.10

Appendix C: Barge Column and Row Count Program

```
DECLARE SUB CATEGORY ()
DECLARE SUB CLASSIFY ()
DECLARE SUB CLASSIFY2 ()
DECLARE SUB DEVIATION ()
DECLARE SUB DIVBY1 ()
DECLARE SUB DIVBY2 ()
DECLARE SUB DIVBY3 ()
DECLARE SUB DIVBY4 ()
DECLARE SUB DIVBY5 ()
DECLARE SUB DIVBY6 ()
DECLARE SUB DIVBY7 ()
DECLARE SUB LABEL ()
DECLARE SUB MESSAGE ()
DECLARE SUB RESULTS ()
REM*************************************************************************
REM*                                                                       *
REM*                            AVGBARGE.BAS                               *
REM*                                                                       *
REM*        Program to calculate the average number of barges              *
REM*         per flotilla column and row in each of 32 barge               *
REM*          dimension categories as specified by the U.S.                *
REM*                    Army Corps of Engineers                            *
REM*                                                                       *
REM*                Written by: Jeff Griffin, August 1994                  *
REM*                            University of Kentucky                     *
REM*                            Lexington, KY                              *
REM*                                                                       *
REM*************************************************************************
REM
   COMMON SHARED FILEI$, FILEO$, FILEDIST$, RIVER$, MILE
   COMMON SHARED H%, I%, J%, K%, L%, M%, N%, O%, P%, R%
   COMMON SHARED FL(), FW(), NOC(), NB(), NBCL(), NBRW()
   COMMON SHARED FWAVG(), FLAVG(), NUM
   COMMON SHARED SUMNOC(), SUMNBRWxNOC(), SUMNBCLxNOC()
 COMMON SHARED COUNTCL1(), COUNTCL2(), COUNTCL3(), COUNTCL4(), COUNTCL5()
COMMON SHARED COUNTCL6(), COUNTCL7(), COUNTCL8(), COUNTCL9(), COUNTCL10()
   COMMON SHARED COUNTRW1(), COUNTRW2(), COUNTRW3(), COUNTRW4()
   COMMON SHARED COUNTRW5(), COUNTRW6(), COUNTRW7(), COUNTRW8()
   COMMON SHARED CATAVGC(), CATAVGR(), MAXC(), MAXR()
   COMMON SHARED DEVNUMR(), STDR(), STDR2(), NUMBR
   COMMON SHARED DEVNUMC(), STDC(), STDC2()
   DIM FL(3000), FW(3000), NOC(3000), NB(3000), NBCL(3000), NBRW(3000)
   DIM FWAVG(3000), FLAVG(3000)
   DIM SUMNOC(32), SUMNBRWxNOC(32), SUMNBCLxNOC(32)
 DIM COUNTCL1(32), COUNTCL2(32), COUNTCL3(32), COUNTCL4(32), COUNTCL5(32)
DIM COUNTCL6(32), COUNTCL7(32), COUNTCL8(32), COUNTCL9(32), COUNTCL10(32)
   DIM COUNTRW1(32), COUNTRW2(32), COUNTRW3(32), COUNTRW4(32)
   DIM COUNTRW5(32), COUNTRW6(32), COUNTRW7(32), COUNTRW8(32)
   DIM CATAVGC(32), CATAVGR(32), MAXC(32), MAXR(32)
   DIM DEVNUMR(32), STDR(32), STDR2(32)
   DIM DEVNUMC(32), STDC(32), STDC2(32)
```

```
REM
   CLS
   SCREEN 12
REM
REM*************************************************************************
REM*                                                                       *
REM*              INTIALIZE WEIGHTED AVERAGE SUM VARIABLES                 *
REM*                                                                       *
REM*************************************************************************
REM
   FOR H% = 1 TO 32
     SUMNOC(H%) = 0
      SUMNBRWxNOC(H%) = 0
      SUMNBCLxNOC(H%) = 0
      MAXC(H%) = 0
      MAXR(H%) = 0
      COUNTCL1(H%) = 0
      COUNTCL2(H%) = 0
      COUNTCL3(H%) = 0
      COUNTCL4(H%) = 0
      COUNTCL5(H%) = 0
      COUNTCL6(H%) = 0
      COUNTCL7(H%) = 0
      COUNTCL8(H%) = 0
      COUNTCL9(H%) = 0
      COUNTCL10(H%) = 0
      COUNTRW1(H%) = 0
      COUNTRW2(H%) = 0
      COUNTRW3(H%) = 0
      COUNTRW4(H%) = 0
      COUNTRW5(H%) = 0
      COUNTRW6(H%) = 0
      COUNTRW7(H%) = 0
      COUNTRW8(H%) = 0
   NEXT H%
REM
REM*************************************************************************
REM*                                                                       *
REM*                  FILE INPUT/OUTPUT SPECIFICATION                      *
REM*                                                                       *
REM*************************************************************************
REM
   COLOR 10
    LOCATE 4, 15: PRINT "AVERAGE NUMBER OF BARGES IN FLOTILLA COLUMN
PROGRAM"
   COLOR 15
   LINE (70, 80)-(580, 230), 9, B
    LOCATE 7, 14: INPUT "What is the name of the file to be processed";
FILEI$
   OPEN FILEI$ FOR INPUT AS #1
   LOCATE 9, 14: INPUT "What is the name of the file to be output"; FILEO$
```

```
   OPEN FILEO$ FOR OUTPUT AS #2
    LOCATE 11, 14: INPUT "What is the name of the distribution file";
FILEDIST$
   OPEN FILEDIST$ FOR OUTPUT AS #3
    LOCATE 13, 14: INPUT "What is the river and marker designation";
RIVER$, MILE
REM
REM*************************************************************************
REM*                                                                       *
REM*                          FLOTILLA DATA INPUT                          *
REM*                                                                       *
REM*************************************************************************
REM
   J% = 1
   INPUT #1, FL(1), FW(1), NOC(1), NB(1)
   DO WHILE FL(J%) > 0
      J% = J% + 1
      INPUT #1, FL(J%), FW(J%), NOC(J%), NB(J%)
   LOOP
   CALL MESSAGE
REM
REM*************************************************************************
REM*                                                                       *
REM*      MODIFICATION OF NUMBER OF BARGES IN FLOTILLA TO ADJUST           *
REM*          FOR NUMBER OF BARGES EXPECTED IN COLUMN AND ROW              *
REM*                                                                       *
REM*************************************************************************
REM
   K% = J% - 1
   I% = 1
   DO WHILE I% <= K%
REM
REM   CHECK FLOTILLA WIDTH TO BE WITHIN A REASONABLE RANGE
REM
      IF FW(I%) >= 20 AND FW(I%) <= 245 THEN
REM
REM      CHECK FLOTILLA WIDTH TO BE LESS THAN 50 FEET
REM
         IF FW(I%) < 50 THEN
            CALL DIVBY1
         END IF
REM
REM      CHECK FLOTILLA WIDTH TO BE 50 FEET
REM
         IF FW(I%) = 50 THEN
            IF NB(I%) > 5 THEN
               CALL DIVBY2
            ELSE
               CALL DIVBY1
            END IF
         END IF
```

```
REM
REM       CHECK FLOTILLA WIDTH TO BE BETWEEN 50 AND 60 FEET, EXCLUSIVE
REM
          IF FW(I%) > 50 AND FW(I%) < 60 THEN
             IF FL(I%) < 100 AND NB(I%) > 1 THEN
                CALL DIVBY2
             ELSE
                CALL DIVBY1
             END IF
          END IF
REM
REM       CHECK FLOTILLA WIDTH TO BE 60 FEET
REM
          IF FW(I%) = 60 THEN
             IF FL(I%) > 500 AND NB(I%) <= 3 THEN
                CALL DIVBY1
             ELSE
                CALL DIVBY2
             END IF
          END IF
REM
REM       CHECK FLOTILLA WIDTH TO BE BETWEEN 60 AND 70 FEET, EXCLUSIVE
REM
          IF FW(I%) > 60 AND FW(I%) < 70 THEN
             IF FL(I%) >= 600 AND NB(I%) <= 5 THEN
                CALL DIVBY1
             ELSE
                CALL DIVBY2
             END IF
          END IF
REM
REM       CHECK FLOTILLA WIDTH TO BE 70 FEET
REM
          IF FW(I%) = 70 THEN
             CALL DIVBY2
          END IF
REM
REM       CHECK FLOTILLA WIDTH TO BE BETWEEN 70 AND 85 FEET, EXCLUSIVE
REM
          IF FW(I%) > 70 AND FW(I%) < 85 THEN
             IF NB(I%) >= 4 THEN
                CALL DIVBY2
             ELSE
                CALL DIVBY1
             END IF
          END IF
REM
REM       CHECK FLOTILLA WIDTH TO BE BETWEEN 85 AND EXCLUSIVE 105 FEET
REM
          IF FW(I%) >= 85 AND FW(I%) < 105 THEN
             CALL DIVBY2
```

```
            END IF
REM
REM         CHECK FLOTILLA WIDTH TO BE 105 FEET
REM
            IF FW(I%) = 105 THEN
               IF NB(I%) <= 6 THEN
                  CALL DIVBY2
               ELSE
                  CALL DIVBY3
               END IF
            END IF
REM--
REM         CHECK FLOTILLA WIDTH TO BE BETWEEN EXCLUSIVE 105 AND 110 FEET
REM
            IF FW(I%) > 105 AND FW(I%) <= 110 THEN
               CALL DIVBY2
            END IF
REM
REM         CHECK FLOTILLA WIDTH TO BE BETWEEN 110 AND 120 FEET, EXCLUSIVE
REM
            IF FW(I%) > 110 AND FW(I%) < 120 THEN
               IF NB(I%) > 21 THEN
                  CALL DIVBY3
               ELSE
                  CALL DIVBY2
               END IF
            END IF
REM
REM         CHECK FLOTILLA WIDTH TO BE BETWEEN 120 AND 122 FEET,INCLUSIVE
REM
            IF FW(I%) >= 120 AND FW(I%) <= 122 THEN
               CALL DIVBY4
            END IF
REM
REM         CHECK FLOTILLA WIDTH TO BE BETWEEN 122 AND 140 FEET, EXCLUSIVE
REM
            IF FW(I%) > 122 AND FW(I%) < 140 THEN
               CALL DIVBY3
            END IF
REM
REM         CHECK FLOTILLA WIDTH TO BE 140 FEET
REM
            IF FW(I%) = 140 THEN
               CALL DIVBY4
            END IF
REM
REM         CHECK FLOTILLA WIDTH TO BE BETWEEN 140 AND INCLUSIVE 165 FEET
REM
            IF FW(I%) > 140 AND FW(I%) <= 165 THEN
               CALL DIVBY3
            END IF
```

```
REM
REM       CHECK FLOTILLA WIDTH TO BE BETWEEN 165 AND 175 FEET, EXCLUSIVE
REM
          IF FW(I%) > 165 AND FW(I%) < 175 THEN
             CALL DIVBY4
          END IF
REM
REM       CHECK FLOTILLA WIDTH TO BE 175 FEET
REM
          IF FW(I%) = 175 THEN
             IF NB(I%) <= 10 THEN
                CALL DIVBY4
             ELSE
                CALL DIVBY5
             END IF
          END IF
REM
REM       CHECK FLOTILLA WIDTH TO BE BETWEEN 175 AND INCLUSIVE 180 FEET
REM
          IF FW(I%) > 175 AND FW(I%) <= 180 THEN
             IF NB(I%) <= 10 THEN
                CALL DIVBY2
             END IF
             IF NB(I%) > 10 AND NB(I%) < 19 THEN
                CALL DIVBY4
             END IF
             IF NB(I%) >= 19 THEN
                CALL DIVBY5
             END IF
          END IF
REM
REM       CHECK FLOTILLA WIDTH TO BE BETWEEN 180 AND 200 FEET, EXCLUSIVE
REM
          IF FW(I%) > 180 AND FW(I%) < 200 THEN
             IF NB(I%) < 11 THEN
                CALL DIVBY4
             ELSE
                CALL DIVBY5
             END IF
          END IF
REM
REM       CHECK FLOTILLA WIDTH TO BE BETWEEN INCLUSIVE 200 AND 233 FEET
REM
          IF FW(I%) >= 200 AND FW(I%) < 233 THEN
             IF FW(I%) = 210 AND NB(I%) > 20 THEN
                CALL DIVBY6
             ELSE
                CALL DIVBY4
             END IF
          END IF
REM
```

```
REM       CHECK FLOTILLA WIDTH TO BE BETWEEN 233 AND 290 FEET INCLUSIVE
REM
          IF FW(I%) >= 233 AND FW(I%) <= 290 THEN
             IF FW(I%) = 245 AND NB(I%) > 24 THEN
                CALL DIVBY7
             ELSE
                CALL DIVBY5
             END IF
          END IF
REM
REM       CHECK FLOTILLA WIDTH TO BE BETWEEN 290 AND INCLUSIVE 330 FEET
REM
          IF FW(I%) > 290 AND FW(I%) <= 330 THEN
             CALL DIVBY6
          END IF
REM
REM       CHECK FLOTILLA WIDTH TO BE GREATER THAN 330 FEET
REM
          IF FW(I%) > 330 THEN
             CALL DIVBY7
          END IF
REM
          IF NBCL(I%) < 1 THEN NBCL(I%) = 1
REM
REM*************************************************************************
REM*                                                                       *
REM*     CALCULATE THE AVERAGE BARGE LENGTH IN THE FLOTILLA COLUMN         *
REM*                                                                       *
REM*************************************************************************
REM
          FLAVG(I%) = FL(I%) / NBCL(I%)
REM
REM*************************************************************************
REM*                                                                       *
REM*     DETERMINE THE APPROPRIATE BARGE CATEGORY FOR THE FLOTILLA         *
REM*       BASED UPON THE AVERAGE BARGE LENGTH CALCULATED ABOVE            *
REM*                                                                       *
REM*************************************************************************
REM
          CALL CLASSIFY
REM
REM*************************************************************************
REM*                                                                       *
REM*          SUM THE NUMBER OF BARGES PER ROW AND THE NUMBER OF           *
REM*           OCCURRENCES BASED ON THE CATEGORY ASSIGNED ABOVE            *
REM*                                                                       *
REM*************************************************************************
REM
          CALL CATEGORY
REM
       END IF
```

```
    I% = I% + 1
    LOOP
REM
REM*************************************************************************
REM*                                                                       *
REM*                    CALCULATE THE WEIGHTED AVERAGE                     *
REM*                                                                       *
REM*************************************************************************
REM
    FOR L% = 1 TO 32
        IF SUMNBRWxNOC(L%) = 0 THEN
            CATAVGR(L%) = 0
        ELSE
            CATAVGR(L%) = SUMNBRWxNOC(L%) / SUMNOC(L%)
        END IF
        IF SUMNBCLxNOC(L%) = 0 THEN
            CATAVGC(L%) = 0
        ELSE
            CATAVGC(L%) = SUMNBCLxNOC(L%) / SUMNOC(L%)
        END IF
    NEXT L%
REM
REM*************************************************************************
REM*                                                                       *
REM*            CALCULATE THE STANDARD DEVIATION DENOMINATOR               *
REM*                                                                       *
REM*************************************************************************
REM
    FOR N% = 1 TO K%
        CALL CLASSIFY2
        CALL DEVIATION
    NEXT N%
REM
REM*************************************************************************
REM*                                                                       *
REM*  CALCULATE THE STANDARD DEVIATION FOR EACH OF THE 32 CATEGORIES       *
REM*                                                                       *
REM*************************************************************************
REM
    FOR O% = 1 TO 32
        IF SUMNOC(O%) <= 1 THEN
            STDR(O%) = 0
            STDC(O%) = 0
        ELSE
            STDR(O%) = (DEVNUMR(O%) / (SUMNOC(O%) - 1)) ^ .5
            STDC(O%) = (DEVNUMC(O%) / (SUMNOC(O%) - 1)) ^ .5
        END IF
        STDR2(O%) = 2 * STDR(O%)
        STDC2(O%) = 2 * STDC(O%)
    NEXT O%
REM
```

```
REM*************************************************************************
REM*                                                                       *
REM*             PRINT THE RESULTS TO THE SPECIFIED FILE                   *
REM*                                                                       *
REM*************************************************************************
REM
   CALL RESULTS
REM
   END
   STOP

SUB CATEGORY
   SELECT CASE NUM
      CASE 1
         SUMNOC(1) = SUMNOC(1) + NOC(I%)
         SUMNBRWxNOC(1) = SUMNBRWxNOC(1) + (NBRW(I%) * NOC(I%))
         SUMNBCLxNOC(1) = SUMNBCLxNOC(1) + (NBCL(I%) * NOC(I%))
         IF NBCL(I%) > MAXC(1) THEN
            MAXC(1) = NBCL(I%)
         ELSE
            MAXC(1) = MAXC(1)
         END IF
         IF NBRW(I%) > MAXR(1) THEN
            MAXR(1) = NBRW(I%)
         ELSE
            MAXR(1) = MAXR(1)
         END IF
REM
REM      DETERMINE COLUMN DISTRIBUTION
REM
         IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
            COUNTCL1(1) = COUNTCL1(1) + 1
         END IF
         IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
            COUNTCL2(1) = COUNTCL2(1) + 1
         END IF
         IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
            COUNTCL3(1) = COUNTCL3(1) + 1
         END IF
         IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
            COUNTCL4(1) = COUNTCL4(1) + 1
         END IF
         IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
            COUNTCL5(1) = COUNTCL5(1) + 1
         END IF
         IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
            COUNTCL6(1) = COUNTCL6(1) + 1
         END IF
         IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
            COUNTCL7(1) = COUNTCL7(1) + 1
         END IF
```

```
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(1) = COUNTCL8(1) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(1) = COUNTCL9(1) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(1) = COUNTCL10(1) + 1
            END IF
REM
REM      DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(1) = COUNTRW1(1) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(1) = COUNTRW2(1) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(1) = COUNTRW3(1) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(1) = COUNTRW4(1) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(1) = COUNTRW5(1) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(1) = COUNTRW6(1) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(1) = COUNTRW7(1) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(1) = COUNTRW8(1) + 1
            END IF
         CASE 2
            SUMNOC(2) = SUMNOC(2) + NOC(I%)
            SUMNBRWxNOC(2) = SUMNBRWxNOC(2) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(2) = SUMNBCLxNOC(2) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(2) THEN
               MAXC(2) = NBCL(I%)
            ELSE
               MAXC(2) = MAXC(2)
            END IF
            IF NBRW(I%) > MAXR(2) THEN
               MAXR(2) = NBRW(I%)
            ELSE
               MAXR(2) = MAXR(2)
            END IF
REM
```

```
REM       DETERMINE COLUMN DISTRIBUTION
REM
          IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
             COUNTCL1(2) = COUNTCL1(2) + 1
          END IF
          IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
             COUNTCL2(2) = COUNTCL2(2) + 1
          END IF
          IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
             COUNTCL3(2) = COUNTCL3(2) + 1
          END IF
          IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
             COUNTCL4(2) = COUNTCL4(2) + 1
          END IF
          IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
             COUNTCL5(2) = COUNTCL5(2) + 1
          END IF
          IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
             COUNTCL6(2) = COUNTCL6(2) + 1
          END IF
          IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
             COUNTCL7(2) = COUNTCL7(2) + 1
          END IF
          IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
             COUNTCL8(2) = COUNTCL8(2) + 1
          END IF
          IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
             COUNTCL9(2) = COUNTCL9(2) + 1
          END IF
          IF NBCL(I%) >= 9.5 THEN
             COUNTCL10(2) = COUNTCL10(2) + 1
          END IF
REM
REM       DETERMINE ROW DISTRIBUTION
REM
          IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
             COUNTRW1(2) = COUNTRW1(2) + 1
          END IF
          IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
             COUNTRW2(2) = COUNTRW2(2) + 1
          END IF
          IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
             COUNTRW3(2) = COUNTRW3(2) + 1
          END IF
          IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
             COUNTRW4(2) = COUNTRW4(2) + 1
          END IF
          IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
             COUNTRW5(2) = COUNTRW5(2) + 1
          END IF
          IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
```

```
            COUNTRW6(2) = COUNTRW6(2) + 1
         END IF
         IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
            COUNTRW7(2) = COUNTRW7(2) + 1
         END IF
         IF NBRW(I%) >= 7.5 THEN
            COUNTRW8(2) = COUNTRW8(2) + 1
         END IF
      CASE 3
         SUMNOC(3) = SUMNOC(3) + NOC(I%)
         SUMNBRWxNOC(3) = SUMNBRWxNOC(3) + (NBRW(I%) * NOC(I%))
         SUMNBCLxNOC(3) = SUMNBCLxNOC(3) + (NBCL(I%) * NOC(I%))
         IF NBCL(I%) > MAXC(3) THEN
            MAXC(3) = NBCL(I%)
         ELSE
            MAXC(3) = MAXC(3)
         END IF
         IF NBRW(I%) > MAXR(3) THEN
            MAXR(3) = NBRW(I%)
         ELSE
            MAXR(3) = MAXR(3)
         END IF
REM
REM      DETERMINE COLUMN DISTRIBUTION
REM
         IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
            COUNTCL1(3) = COUNTCL1(3) + 1
         END IF
         IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
            COUNTCL2(3) = COUNTCL2(3) + 1
         END IF
         IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
            COUNTCL3(3) = COUNTCL3(3) + 1
         END IF
         IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
            COUNTCL4(3) = COUNTCL4(3) + 1
         END IF
         IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
            COUNTCL5(3) = COUNTCL5(3) + 1
         END IF
         IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
            COUNTCL6(3) = COUNTCL6(3) + 1
         END IF
         IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
            COUNTCL7(3) = COUNTCL7(3) + 1
         END IF
         IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
            COUNTCL8(3) = COUNTCL8(3) + 1
         END IF
         IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
            COUNTCL9(3) = COUNTCL9(3) + 1
```

```
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(3) = COUNTCL10(3) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(3) = COUNTRW1(3) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(3) = COUNTRW2(3) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(3) = COUNTRW3(3) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(3) = COUNTRW4(3) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(3) = COUNTRW5(3) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(3) = COUNTRW6(3) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(3) = COUNTRW7(3) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(3) = COUNTRW8(3) + 1
            END IF
         CASE 4
            SUMNOC(4) = SUMNOC(4) + NOC(I%)
            SUMNBRWxNOC(4) = SUMNBRWxNOC(4) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(4) = SUMNBCLxNOC(4) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(4) THEN
               MAXC(4) = NBCL(I%)
            ELSE
               MAXC(4) = MAXC(4)
            END IF
            IF NBRW(I%) > MAXR(4) THEN
               MAXR(4) = NBRW(I%)
            ELSE
               MAXR(4) = MAXR(4)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(4) = COUNTCL1(4) + 1
            END IF
```

```
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(4) = COUNTCL2(4) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(4) = COUNTCL3(4) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(4) = COUNTCL4(4) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(4) = COUNTCL5(4) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(4) = COUNTCL6(4) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(4) = COUNTCL7(4) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(4) = COUNTCL8(4) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(4) = COUNTCL9(4) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(4) = COUNTCL10(4) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(4) = COUNTRW1(4) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(4) = COUNTRW2(4) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(4) = COUNTRW3(4) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(4) = COUNTRW4(4) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(4) = COUNTRW5(4) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(4) = COUNTRW6(4) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(4) = COUNTRW7(4) + 1
            END IF
```

```
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(4) = COUNTRW8(4) + 1
            END IF
         CASE 5
            SUMNOC(5) = SUMNOC(5) + NOC(I%)
            SUMNBRWxNOC(5) = SUMNBRWxNOC(5) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(5) = SUMNBCLxNOC(5) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(5) THEN
               MAXC(5) = NBCL(I%)
            ELSE
               MAXC(5) = MAXC(5)
            END IF
            IF NBRW(I%) > MAXR(5) THEN
               MAXR(5) = NBRW(I%)
            ELSE
               MAXR(5) = MAXR(5)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(5) = COUNTCL1(5) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(5) = COUNTCL2(5) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(5) = COUNTCL3(5) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(5) = COUNTCL4(5) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(5) = COUNTCL5(5) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(5) = COUNTCL6(5) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(5) = COUNTCL7(5) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(5) = COUNTCL8(5) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(5) = COUNTCL9(5) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(5) = COUNTCL10(5) + 1
            END IF
REM
```

```
REM       DETERMINE ROW DISTRIBUTION
REM
          IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
             COUNTRW1(5) = COUNTRW1(5) + 1
          END IF
          IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
             COUNTRW2(5) = COUNTRW2(5) + 1
          END IF
          IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
             COUNTRW3(5) = COUNTRW3(5) + 1
          END IF
          IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
             COUNTRW4(5) = COUNTRW4(5) + 1
          END IF
          IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
             COUNTRW5(5) = COUNTRW5(5) + 1
          END IF
          IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
             COUNTRW6(5) = COUNTRW6(5) + 1
          END IF
          IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
             COUNTRW7(5) = COUNTRW7(5) + 1
          END IF
          IF NBRW(I%) >= 7.5 THEN
             COUNTRW8(5) = COUNTRW8(5) + 1
          END IF
       CASE 6
          SUMNOC(6) = SUMNOC(6) + NOC(I%)
          SUMNBRWxNOC(6) = SUMNBRWxNOC(6) + (NBRW(I%) * NOC(I%))
          SUMNBCLxNOC(6) = SUMNBCLxNOC(6) + (NBCL(I%) * NOC(I%))
          IF NBCL(I%) > MAXC(6) THEN
             MAXC(6) = NBCL(I%)
          ELSE
             MAXC(6) = MAXC(6)
          END IF
          IF NBRW(I%) > MAXR(6) THEN
             MAXR(6) = NBRW(I%)
          ELSE
             MAXR(6) = MAXR(6)
          END IF
REM
REM       DETERMINE COLUMN DISTRIBUTION
REM
          IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
             COUNTCL1(6) = COUNTCL1(6) + 1
          END IF
          IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
             COUNTCL2(6) = COUNTCL2(6) + 1
          END IF
          IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
             COUNTCL3(6) = COUNTCL3(6) + 1
```

```
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(6) = COUNTCL4(6) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(6) = COUNTCL5(6) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(6) = COUNTCL6(6) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(6) = COUNTCL7(6) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(6) = COUNTCL8(6) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(6) = COUNTCL9(6) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(6) = COUNTCL10(6) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(6) = COUNTRW1(6) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(6) = COUNTRW2(6) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(6) = COUNTRW3(6) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(6) = COUNTRW4(6) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(6) = COUNTRW5(6) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(6) = COUNTRW6(6) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(6) = COUNTRW7(6) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(6) = COUNTRW8(6) + 1
            END IF
         CASE 7
            SUMNOC(7) = SUMNOC(7) + NOC(I%)
```

```
            SUMNBRWxNOC(7) = SUMNBRWxNOC(7) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(7) = SUMNBCLxNOC(7) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(7) THEN
               MAXC(7) = NBCL(I%)
            ELSE
               MAXC(7) = MAXC(7)
            END IF
            IF NBRW(I%) > MAXR(7) THEN
               MAXR(7) = NBRW(I%)
            ELSE
               MAXR(7) = MAXR(7)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(7) = COUNTCL1(7) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(7) = COUNTCL2(7) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(7) = COUNTCL3(7) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(7) = COUNTCL4(7) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(7) = COUNTCL5(7) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(7) = COUNTCL6(7) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(7) = COUNTCL7(7) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(7) = COUNTCL8(7) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(7) = COUNTCL9(7) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(7) = COUNTCL10(7) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(7) = COUNTRW1(7) + 1
            END IF
```

```
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(7) = COUNTRW2(7) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(7) = COUNTRW3(7) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(7) = COUNTRW4(7) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(7) = COUNTRW5(7) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(7) = COUNTRW6(7) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(7) = COUNTRW7(7) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(7) = COUNTRW8(7) + 1
            END IF
         CASE 8
            SUMNOC(8) = SUMNOC(8) + NOC(I%)
            SUMNBRWxNOC(8) = SUMNBRWxNOC(8) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(8) = SUMNBCLxNOC(8) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(8) THEN
               MAXC(8) = NBCL(I%)
            ELSE
               MAXC(8) = MAXC(8)
            END IF
            IF NBRW(I%) > MAXR(8) THEN
               MAXR(8) = NBRW(I%)
            ELSE
               MAXR(8) = MAXR(8)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(8) = COUNTCL1(8) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(8) = COUNTCL2(8) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(8) = COUNTCL3(8) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(8) = COUNTCL4(8) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
```

```
            COUNTCL5(8) = COUNTCL5(8) + 1
         END IF
         IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
            COUNTCL6(8) = COUNTCL6(8) + 1
         END IF
         IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
            COUNTCL7(8) = COUNTCL7(8) + 1
         END IF
         IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
            COUNTCL8(8) = COUNTCL8(8) + 1
         END IF
         IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
            COUNTCL9(8) = COUNTCL9(8) + 1
         END IF
         IF NBCL(I%) >= 9.5 THEN
            COUNTCL10(8) = COUNTCL10(8) + 1
         END IF
REM
REM      DETERMINE ROW DISTRIBUTION
REM
         IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
            COUNTRW1(8) = COUNTRW1(8) + 1
         END IF
         IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
            COUNTRW2(8) = COUNTRW2(8) + 1
         END IF
         IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
            COUNTRW3(8) = COUNTRW3(8) + 1
         END IF
         IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
            COUNTRW4(8) = COUNTRW4(8) + 1
         END IF
         IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
            COUNTRW5(8) = COUNTRW5(8) + 1
         END IF
         IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
            COUNTRW6(8) = COUNTRW6(8) + 1
         END IF
         IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
            COUNTRW7(8) = COUNTRW7(8) + 1
         END IF
         IF NBRW(I%) >= 7.5 THEN
            COUNTRW8(8) = COUNTRW8(8) + 1
         END IF
      CASE 9
         SUMNOC(9) = SUMNOC(9) + NOC(I%)
         SUMNBRWxNOC(9) = SUMNBRWxNOC(9) + (NBRW(I%) * NOC(I%))
         SUMNBCLxNOC(9) = SUMNBCLxNOC(9) + (NBCL(I%) * NOC(I%))
         IF NBCL(I%) > MAXC(9) THEN
            MAXC(9) = NBCL(I%)
         ELSE
```

```
            MAXC(9) = MAXC(9)
         END IF
         IF NBRW(I%) > MAXR(9) THEN
            MAXR(9) = NBRW(I%)
         ELSE
            MAXR(9) = MAXR(9)
         END IF
REM
REM      DETERMINE COLUMN DISTRIBUTION
REM
         IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
            COUNTCL1(9) = COUNTCL1(9) + 1
         END IF
         IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
            COUNTCL2(9) = COUNTCL2(9) + 1
         END IF
         IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
            COUNTCL3(9) = COUNTCL3(9) + 1
         END IF
         IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
            COUNTCL4(9) = COUNTCL4(9) + 1
         END IF
         IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
            COUNTCL5(9) = COUNTCL5(9) + 1
         END IF
         IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
            COUNTCL6(9) = COUNTCL6(9) + 1
         END IF
         IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
            COUNTCL7(9) = COUNTCL7(9) + 1
         END IF
         IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
            COUNTCL8(9) = COUNTCL8(9) + 1
         END IF
         IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
            COUNTCL9(9) = COUNTCL9(9) + 1
         END IF
         IF NBCL(I%) >= 9.5 THEN
            COUNTCL10(9) = COUNTCL10(9) + 1
         END IF
REM
REM      DETERMINE ROW DISTRIBUTION
REM
         IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
            COUNTRW1(9) = COUNTRW1(9) + 1
         END IF
         IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
            COUNTRW2(9) = COUNTRW2(9) + 1
         END IF
         IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
            COUNTRW3(9) = COUNTRW3(9) + 1
```

```
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(9) = COUNTRW4(9) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(9) = COUNTRW5(9) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(9) = COUNTRW6(9) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(9) = COUNTRW7(9) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(9) = COUNTRW8(9) + 1
            END IF
         CASE 10
            SUMNOC(10) = SUMNOC(10) + NOC(I%)
            SUMNBRWxNOC(10) = SUMNBRWxNOC(10) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(10) = SUMNBCLxNOC(10) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(10) THEN
               MAXC(10) = NBCL(I%)
            ELSE
               MAXC(10) = MAXC(10)
            END IF
            IF NBRW(I%) > MAXR(10) THEN
               MAXR(10) = NBRW(I%)
            ELSE
               MAXR(10) = MAXR(10)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(10) = COUNTCL1(10) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(10) = COUNTCL2(10) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(10) = COUNTCL3(10) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(10) = COUNTCL4(10) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(10) = COUNTCL5(10) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(10) = COUNTCL6(10) + 1
            END IF
```

```
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(10) = COUNTCL7(10) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(10) = COUNTCL8(10) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(10) = COUNTCL9(10) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(10) = COUNTCL10(10) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(10) = COUNTRW1(10) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(10) = COUNTRW2(10) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(10) = COUNTRW3(10) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(10) = COUNTRW4(10) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(10) = COUNTRW5(10) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(10) = COUNTRW6(10) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(10) = COUNTRW7(10) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(10) = COUNTRW8(10) + 1
            END IF
         CASE 11
            SUMNOC(11) = SUMNOC(11) + NOC(I%)
            SUMNBRWxNOC(11) = SUMNBRWxNOC(11) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(11) = SUMNBCLxNOC(11) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(11) THEN
               MAXC(11) = NBCL(I%)
            ELSE
               MAXC(11) = MAXC(11)
            END IF
            IF NBRW(I%) > MAXR(11) THEN
               MAXR(11) = NBRW(I%)
            ELSE
```

```
            MAXR(11) = MAXR(11)
         END IF
REM
REM      DETERMINE COLUMN DISTRIBUTION
REM
         IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
            COUNTCL1(11) = COUNTCL1(11) + 1
         END IF
         IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
            COUNTCL2(11) = COUNTCL2(11) + 1
         END IF
         IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
            COUNTCL3(11) = COUNTCL3(11) + 1
         END IF
         IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
            COUNTCL4(11) = COUNTCL4(11) + 1
         END IF
         IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
            COUNTCL5(11) = COUNTCL5(11) + 1
         END IF
         IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
            COUNTCL6(11) = COUNTCL6(11) + 1
         END IF
         IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
            COUNTCL7(11) = COUNTCL7(11) + 1
         END IF
         IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
            COUNTCL8(11) = COUNTCL8(11) + 1
         END IF
         IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
            COUNTCL9(11) = COUNTCL9(11) + 1
         END IF
         IF NBCL(I%) >= 9.5 THEN
            COUNTCL10(11) = COUNTCL10(11) + 1
         END IF
REM
REM      DETERMINE ROW DISTRIBUTION
REM
         IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
            COUNTRW1(11) = COUNTRW1(11) + 1
         END IF
         IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
            COUNTRW2(11) = COUNTRW2(11) + 1
         END IF
         IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
            COUNTRW3(11) = COUNTRW3(11) + 1
         END IF
         IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
            COUNTRW4(11) = COUNTRW4(11) + 1
         END IF
         IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
```

```
            COUNTRW5(11) = COUNTRW5(11) + 1
         END IF
         IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
            COUNTRW6(11) = COUNTRW6(11) + 1
         END IF
         IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
            COUNTRW7(11) = COUNTRW7(11) + 1
         END IF
         IF NBRW(I%) >= 7.5 THEN
            COUNTRW8(11) = COUNTRW8(11) + 1
         END IF
      CASE 12
         SUMNOC(12) = SUMNOC(12) + NOC(I%)
         SUMNBRWxNOC(12) = SUMNBRWxNOC(12) + (NBRW(I%) * NOC(I%))
         SUMNBCLxNOC(12) = SUMNBCLxNOC(12) + (NBCL(I%) * NOC(I%))
         IF NBCL(I%) > MAXC(12) THEN
            MAXC(12) = NBCL(I%)
         ELSE
            MAXC(12) = MAXC(12)
         END IF
         IF NBRW(I%) > MAXR(12) THEN
            MAXR(12) = NBRW(I%)
         ELSE
            MAXR(12) = MAXR(12)
         END IF
REM
REM      DETERMINE COLUMN DISTRIBUTION
REM
         IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
            COUNTCL1(12) = COUNTCL1(12) + 1
         END IF
         IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
            COUNTCL2(12) = COUNTCL2(12) + 1
         END IF
         IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
            COUNTCL3(12) = COUNTCL3(12) + 1
         END IF
         IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
            COUNTCL4(12) = COUNTCL4(12) + 1
         END IF
         IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
            COUNTCL5(12) = COUNTCL5(12) + 1
         END IF
         IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
            COUNTCL6(12) = COUNTCL6(12) + 1
         END IF
         IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
            COUNTCL7(12) = COUNTCL7(12) + 1
         END IF
         IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
            COUNTCL8(12) = COUNTCL8(12) + 1
```

```
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(12) = COUNTCL9(12) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(12) = COUNTCL10(12) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(12) = COUNTRW1(12) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(12) = COUNTRW2(12) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(12) = COUNTRW3(12) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(12) = COUNTRW4(12) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(12) = COUNTRW5(12) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(12) = COUNTRW6(12) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(12) = COUNTRW7(12) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(12) = COUNTRW8(12) + 1
            END IF
         CASE 13
            SUMNOC(13) = SUMNOC(13) + NOC(I%)
            SUMNBRWxNOC(13) = SUMNBRWxNOC(13) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(13) = SUMNBCLxNOC(13) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(13) THEN
               MAXC(13) = NBCL(I%)
            ELSE
               MAXC(13) = MAXC(13)
            END IF
            IF NBRW(I%) > MAXR(13) THEN
               MAXR(13) = NBRW(I%)
            ELSE
               MAXR(13) = MAXR(13)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
```

```
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(13) = COUNTCL1(13) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(13) = COUNTCL2(13) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(13) = COUNTCL3(13) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(13) = COUNTCL4(13) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(13) = COUNTCL5(13) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(13) = COUNTCL6(13) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(13) = COUNTCL7(13) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(13) = COUNTCL8(13) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(13) = COUNTCL9(13) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(13) = COUNTCL10(13) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(13) = COUNTRW1(13) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(13) = COUNTRW2(13) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(13) = COUNTRW3(13) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(13) = COUNTRW4(13) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(13) = COUNTRW5(13) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(13) = COUNTRW6(13) + 1
            END IF
```

```
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(13) = COUNTRW7(13) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(13) = COUNTRW8(13) + 1
            END IF
         CASE 14
            SUMNOC(14) = SUMNOC(14) + NOC(I%)
            SUMNBRWxNOC(14) = SUMNBRWxNOC(14) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(14) = SUMNBCLxNOC(14) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(14) THEN
               MAXC(14) = NBCL(I%)
            ELSE
               MAXC(14) = MAXC(14)
            END IF
            IF NBRW(I%) > MAXR(14) THEN
               MAXR(14) = NBRW(I%)
            ELSE
               MAXR(14) = MAXR(14)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(14) = COUNTCL1(14) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(14) = COUNTCL2(14) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(14) = COUNTCL3(14) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(14) = COUNTCL4(14) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(14) = COUNTCL5(14) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(14) = COUNTCL6(14) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(14) = COUNTCL7(14) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(14) = COUNTCL8(14) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(14) = COUNTCL9(14) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
```

```
            COUNTCL10(14) = COUNTCL10(14) + 1
         END IF
REM
REM      DETERMINE ROW DISTRIBUTION
REM
         IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
            COUNTRW1(14) = COUNTRW1(14) + 1
         END IF
         IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
            COUNTRW2(14) = COUNTRW2(14) + 1
         END IF
         IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
            COUNTRW3(14) = COUNTRW3(14) + 1
         END IF
         IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
            COUNTRW4(14) = COUNTRW4(14) + 1
         END IF
         IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
            COUNTRW5(14) = COUNTRW5(14) + 1
         END IF
         IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
            COUNTRW6(14) = COUNTRW6(14) + 1
         END IF
         IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
            COUNTRW7(14) = COUNTRW7(14) + 1
         END IF
         IF NBRW(I%) >= 7.5 THEN
            COUNTRW8(14) = COUNTRW8(14) + 1
         END IF
      CASE 15
         SUMNOC(15) = SUMNOC(15) + NOC(I%)
         SUMNBRWxNOC(15) = SUMNBRWxNOC(15) + (NBRW(I%) * NOC(I%))
         SUMNBCLxNOC(15) = SUMNBCLxNOC(15) + (NBCL(I%) * NOC(I%))
         IF NBCL(I%) > MAXC(15) THEN
            MAXC(15) = NBCL(I%)
         ELSE
            MAXC(15) = MAXC(15)
         END IF
         IF NBRW(I%) > MAXR(15) THEN
            MAXR(15) = NBRW(I%)
         ELSE
            MAXR(15) = MAXR(15)
         END IF
REM
REM      DETERMINE COLUMN DISTRIBUTION
REM
         IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
            COUNTCL1(15) = COUNTCL1(15) + 1
         END IF
         IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
            COUNTCL2(15) = COUNTCL2(15) + 1
```

```
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(15) = COUNTCL3(15) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(15) = COUNTCL4(15) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(15) = COUNTCL5(15) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(15) = COUNTCL6(15) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(15) = COUNTCL7(15) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(15) = COUNTCL8(15) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(15) = COUNTCL9(15) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(15) = COUNTCL10(15) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(15) = COUNTRW1(15) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(15) = COUNTRW2(15) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(15) = COUNTRW3(15) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(15) = COUNTRW4(15) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(15) = COUNTRW5(15) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(15) = COUNTRW6(15) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(15) = COUNTRW7(15) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(15) = COUNTRW8(15) + 1
```

```
            END IF
         CASE 16
            SUMNOC(16) = SUMNOC(16) + NOC(I%)
            SUMNBRWxNOC(16) = SUMNBRWxNOC(16) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(16) = SUMNBCLxNOC(16) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(16) THEN
               MAXC(16) = NBCL(I%)
            ELSE
               MAXC(16) = MAXC(16)
            END IF
            IF NBRW(I%) > MAXR(16) THEN
               MAXR(16) = NBRW(I%)
            ELSE
               MAXR(16) = MAXR(16)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(16) = COUNTCL1(16) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(16) = COUNTCL2(16) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(16) = COUNTCL3(16) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(16) = COUNTCL4(16) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(16) = COUNTCL5(16) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(16) = COUNTCL6(16) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(16) = COUNTCL7(16) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(16) = COUNTCL8(16) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(16) = COUNTCL9(16) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(16) = COUNTCL10(16) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
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```
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(16) = COUNTRW1(16) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(16) = COUNTRW2(16) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(16) = COUNTRW3(16) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(16) = COUNTRW4(16) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(16) = COUNTRW5(16) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(16) = COUNTRW6(16) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(16) = COUNTRW7(16) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(16) = COUNTRW8(16) + 1
            END IF
         CASE 17
            SUMNOC(17) = SUMNOC(17) + NOC(I%)
            SUMNBRWxNOC(17) = SUMNBRWxNOC(17) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(17) = SUMNBCLxNOC(17) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(17) THEN
               MAXC(17) = NBCL(I%)
            ELSE
               MAXC(17) = MAXC(17)
            END IF
            IF NBRW(I%) > MAXR(17) THEN
               MAXR(17) = NBRW(I%)
            ELSE
               MAXR(17) = MAXR(17)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(17) = COUNTCL1(17) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(17) = COUNTCL2(17) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(17) = COUNTCL3(17) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
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```
            COUNTCL4(17) = COUNTCL4(17) + 1
         END IF
         IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
            COUNTCL5(17) = COUNTCL5(17) + 1
         END IF
         IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
            COUNTCL6(17) = COUNTCL6(17) + 1
         END IF
         IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
            COUNTCL7(17) = COUNTCL7(17) + 1
         END IF
         IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
            COUNTCL8(17) = COUNTCL8(17) + 1
         END IF
         IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
            COUNTCL9(17) = COUNTCL9(17) + 1
         END IF
         IF NBCL(I%) >= 9.5 THEN
            COUNTCL10(17) = COUNTCL10(17) + 1
         END IF
REM
REM      DETERMINE ROW DISTRIBUTION
REM
         IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
            COUNTRW1(17) = COUNTRW1(17) + 1
         END IF
         IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
            COUNTRW2(17) = COUNTRW2(17) + 1
         END IF
         IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
            COUNTRW3(17) = COUNTRW3(17) + 1
         END IF
         IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
            COUNTRW4(17) = COUNTRW4(17) + 1
         END IF
         IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
            COUNTRW5(17) = COUNTRW5(17) + 1
         END IF
         IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
            COUNTRW6(17) = COUNTRW6(17) + 1
         END IF
         IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
            COUNTRW7(17) = COUNTRW7(17) + 1
         END IF
         IF NBRW(I%) >= 7.5 THEN
            COUNTRW8(17) = COUNTRW8(17) + 1
         END IF
      CASE 18
         SUMNOC(18) = SUMNOC(18) + NOC(I%)
         SUMNBRWxNOC(18) = SUMNBRWxNOC(18) + (NBRW(I%) * NOC(I%))
         SUMNBCLxNOC(18) = SUMNBCLxNOC(18) + (NBCL(I%) * NOC(I%))
```

```
            IF NBCL(I%) > MAXC(18) THEN
               MAXC(18) = NBCL(I%)
            ELSE
               MAXC(18) = MAXC(18)
            END IF
            IF NBRW(I%) > MAXR(18) THEN
               MAXR(18) = NBRW(I%)
            ELSE
               MAXR(18) = MAXR(18)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(18) = COUNTCL1(18) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(18) = COUNTCL2(18) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(18) = COUNTCL3(18) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(18) = COUNTCL4(18) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(18) = COUNTCL5(18) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(18) = COUNTCL6(18) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(18) = COUNTCL7(18) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(18) = COUNTCL8(18) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(18) = COUNTCL9(18) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(18) = COUNTCL10(18) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(18) = COUNTRW1(18) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(18) = COUNTRW2(18) + 1
```

```
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(18) = COUNTRW3(18) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(18) = COUNTRW4(18) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(18) = COUNTRW5(18) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(18) = COUNTRW6(18) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(18) = COUNTRW7(18) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(18) = COUNTRW8(18) + 1
            END IF
         CASE 19
            SUMNOC(19) = SUMNOC(19) + NOC(I%)
            SUMNBRWxNOC(19) = SUMNBRWxNOC(19) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(19) = SUMNBCLxNOC(19) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(19) THEN
               MAXC(19) = NBCL(I%)
            ELSE
               MAXC(19) = MAXC(19)
            END IF
            IF NBRW(I%) > MAXR(19) THEN
               MAXR(19) = NBRW(I%)
            ELSE
               MAXR(19) = MAXR(19)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(19) = COUNTCL1(19) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(19) = COUNTCL2(19) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(19) = COUNTCL3(19) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(19) = COUNTCL4(19) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(19) = COUNTCL5(19) + 1
            END IF
```

```
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(19) = COUNTCL6(19) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(19) = COUNTCL7(19) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(19) = COUNTCL8(19) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(19) = COUNTCL9(19) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(19) = COUNTCL10(19) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(19) = COUNTRW1(19) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(19) = COUNTRW2(19) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(19) = COUNTRW3(19) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(19) = COUNTRW4(19) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(19) = COUNTRW5(19) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(19) = COUNTRW6(19) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(19) = COUNTRW7(19) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(19) = COUNTRW8(19) + 1
            END IF
         CASE 20
            SUMNOC(20) = SUMNOC(20) + NOC(I%)
            SUMNBRWxNOC(20) = SUMNBRWxNOC(20) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(20) = SUMNBCLxNOC(20) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(20) THEN
               MAXC(20) = NBCL(I%)
            ELSE
               MAXC(20) = MAXC(20)
            END IF
```

```
            IF NBRW(I%) > MAXR(20) THEN
               MAXR(20) = NBRW(I%)
            ELSE
               MAXR(20) = MAXR(20)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(20) = COUNTCL1(20) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(20) = COUNTCL2(20) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(20) = COUNTCL3(20) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(20) = COUNTCL4(20) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(20) = COUNTCL5(20) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(20) = COUNTCL6(20) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(20) = COUNTCL7(20) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(20) = COUNTCL8(20) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(20) = COUNTCL9(20) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(20) = COUNTCL10(20) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(20) = COUNTRW1(20) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(20) = COUNTRW2(20) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(20) = COUNTRW3(20) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
```

```
            COUNTRW4(20) = COUNTRW4(20) + 1
         END IF
         IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
            COUNTRW5(20) = COUNTRW5(20) + 1
         END IF
         IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
            COUNTRW6(20) = COUNTRW6(20) + 1
         END IF
         IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
            COUNTRW7(20) = COUNTRW7(20) + 1
         END IF
         IF NBRW(I%) >= 7.5 THEN
            COUNTRW8(20) = COUNTRW8(20) + 1
         END IF
      CASE 21
         SUMNOC(21) = SUMNOC(21) + NOC(I%)
         SUMNBRWxNOC(21) = SUMNBRWxNOC(21) + (NBRW(I%) * NOC(I%))
         SUMNBCLxNOC(21) = SUMNBCLxNOC(21) + (NBCL(I%) * NOC(I%))
         IF NBCL(I%) > MAXC(21) THEN
            MAXC(21) = NBCL(I%)
         ELSE
            MAXC(21) = MAXC(21)
         END IF
         IF NBRW(I%) > MAXR(21) THEN
            MAXR(21) = NBRW(I%)
         ELSE
            MAXR(21) = MAXR(21)
         END IF
REM
REM      DETERMINE COLUMN DISTRIBUTION
REM
         IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
            COUNTCL1(21) = COUNTCL1(21) + 1
         END IF
         IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
            COUNTCL2(21) = COUNTCL2(21) + 1
         END IF
         IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
            COUNTCL3(21) = COUNTCL3(21) + 1
         END IF
         IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
            COUNTCL4(21) = COUNTCL4(21) + 1
         END IF
         IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
            COUNTCL5(21) = COUNTCL5(21) + 1
         END IF
         IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
            COUNTCL6(21) = COUNTCL6(21) + 1
         END IF
         IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
            COUNTCL7(21) = COUNTCL7(21) + 1
```

```
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(21) = COUNTCL8(21) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(21) = COUNTCL9(21) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(21) = COUNTCL10(21) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(21) = COUNTRW1(21) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(21) = COUNTRW2(21) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(21) = COUNTRW3(21) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(21) = COUNTRW4(21) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(21) = COUNTRW5(21) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(21) = COUNTRW6(21) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(21) = COUNTRW7(21) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(21) = COUNTRW8(21) + 1
            END IF
         CASE 22
            SUMNOC(22) = SUMNOC(22) + NOC(I%)
            SUMNBRWxNOC(22) = SUMNBRWxNOC(22) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(22) = SUMNBCLxNOC(22) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(22) THEN
               MAXC(22) = NBCL(I%)
            ELSE
               MAXC(22) = MAXC(22)
            END IF
            IF NBRW(I%) > MAXR(22) THEN
               MAXR(22) = NBRW(I%)
            ELSE
               MAXR(22) = MAXR(22)
            END IF
```

```
REM
REM       DETERMINE COLUMN DISTRIBUTION
REM
          IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
             COUNTCL1(22) = COUNTCL1(22) + 1
          END IF
          IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
             COUNTCL2(22) = COUNTCL2(22) + 1
          END IF
          IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
             COUNTCL3(22) = COUNTCL3(22) + 1
          END IF
          IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
             COUNTCL4(22) = COUNTCL4(22) + 1
          END IF
          IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
             COUNTCL5(22) = COUNTCL5(22) + 1
          END IF
          IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
             COUNTCL6(22) = COUNTCL6(22) + 1
          END IF
          IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
             COUNTCL7(22) = COUNTCL7(22) + 1
          END IF
          IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
             COUNTCL8(22) = COUNTCL8(22) + 1
          END IF
          IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
             COUNTCL9(22) = COUNTCL9(22) + 1
          END IF
          IF NBCL(I%) >= 9.5 THEN
             COUNTCL10(22) = COUNTCL10(22) + 1
          END IF
REM
REM       DETERMINE ROW DISTRIBUTION
REM
          IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
             COUNTRW1(22) = COUNTRW1(22) + 1
          END IF
          IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
             COUNTRW2(22) = COUNTRW2(22) + 1
          END IF
          IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
             COUNTRW3(22) = COUNTRW3(22) + 1
          END IF
          IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
             COUNTRW4(22) = COUNTRW4(22) + 1
          END IF
          IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
             COUNTRW5(22) = COUNTRW5(22) + 1
          END IF
```

```
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(22) = COUNTRW6(22) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(22) = COUNTRW7(22) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(22) = COUNTRW8(22) + 1
            END IF
         CASE 23
            SUMNOC(23) = SUMNOC(23) + NOC(I%)
            SUMNBRWxNOC(23) = SUMNBRWxNOC(23) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(23) = SUMNBCLxNOC(23) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(23) THEN
               MAXC(23) = NBCL(I%)
            ELSE
               MAXC(23) = MAXC(23)
            END IF
            IF NBRW(I%) > MAXR(23) THEN
               MAXR(23) = NBRW(I%)
            ELSE
               MAXR(23) = MAXR(23)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(23) = COUNTCL1(23) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(23) = COUNTCL2(23) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(23) = COUNTCL3(23) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(23) = COUNTCL4(23) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(23) = COUNTCL5(23) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(23) = COUNTCL6(23) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(23) = COUNTCL7(23) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(23) = COUNTCL8(23) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
```

```
            COUNTCL9(23) = COUNTCL9(23) + 1
         END IF
         IF NBCL(I%) >= 9.5 THEN
            COUNTCL10(23) = COUNTCL10(23) + 1
         END IF
REM
REM      DETERMINE ROW DISTRIBUTION
REM
         IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
            COUNTRW1(23) = COUNTRW1(23) + 1
         END IF
         IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
            COUNTRW2(23) = COUNTRW2(23) + 1
         END IF
         IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
            COUNTRW3(23) = COUNTRW3(23) + 1
         END IF
         IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
            COUNTRW4(23) = COUNTRW4(23) + 1
         END IF
         IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
            COUNTRW5(23) = COUNTRW5(23) + 1
         END IF
         IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
            COUNTRW6(23) = COUNTRW6(23) + 1
         END IF
         IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
            COUNTRW7(23) = COUNTRW7(23) + 1
         END IF
         IF NBRW(I%) >= 7.5 THEN
            COUNTRW8(23) = COUNTRW8(23) + 1
         END IF
      CASE 24
         SUMNOC(24) = SUMNOC(24) + NOC(I%)
         SUMNBRWxNOC(24) = SUMNBRWxNOC(24) + (NBRW(I%) * NOC(I%))
         SUMNBCLxNOC(24) = SUMNBCLxNOC(24) + (NBCL(I%) * NOC(I%))
         IF NBCL(I%) > MAXC(24) THEN
            MAXC(24) = NBCL(I%)
         ELSE
            MAXC(24) = MAXC(24)
         END IF
         IF NBRW(I%) > MAXR(24) THEN
            MAXR(24) = NBRW(I%)
         ELSE
            MAXR(24) = MAXR(24)
         END IF
REM
REM      DETERMINE COLUMN DISTRIBUTION
REM
         IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
            COUNTCL1(24) = COUNTCL1(24) + 1
```

```
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(24) = COUNTCL2(24) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(24) = COUNTCL3(24) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(24) = COUNTCL4(24) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(24) = COUNTCL5(24) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(24) = COUNTCL6(24) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(24) = COUNTCL7(24) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(24) = COUNTCL8(24) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(24) = COUNTCL9(24) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(24) = COUNTCL10(24) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(24) = COUNTRW1(24) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(24) = COUNTRW2(24) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(24) = COUNTRW3(24) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(24) = COUNTRW4(24) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(24) = COUNTRW5(24) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(24) = COUNTRW6(24) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(24) = COUNTRW7(24) + 1
```

```
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(24) = COUNTRW8(24) + 1
            END IF
         CASE 25
            SUMNOC(25) = SUMNOC(25) + NOC(I%)
            SUMNBRWxNOC(25) = SUMNBRWxNOC(25) - (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(25) = SUMNBCLxNOC(25) - (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(25) THEN
               MAXC(25) = NBCL(I%)
            ELSE
               MAXC(25) = MAXC(25)
            END IF
            IF NBRW(I%) > MAXR(25) THEN
               MAXR(25) = NBRW(I%)
            ELSE
               MAXR(25) = MAXR(25)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(25) = COUNTCL1(25) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(25) = COUNTCL2(25) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(25) = COUNTCL3(25) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(25) = COUNTCL4(25) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(25) = COUNTCL5(25) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(25) = COUNTCL6(25) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(25) = COUNTCL7(25) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(25) = COUNTCL8(25) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(25) = COUNTCL9(25) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(25) = COUNTCL10(25) + 1
            END IF
```

```
REM
REM       DETERMINE ROW DISTRIBUTION
REM
          IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
             COUNTRW1(25) = COUNTRW1(25) + 1
          END IF
          IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
             COUNTRW2(25) = COUNTRW2(25) + 1
          END IF
          IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
             COUNTRW3(25) = COUNTRW3(25) + 1
          END IF
          IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
             COUNTRW4(25) = COUNTRW4(25) + 1
          END IF
          IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
             COUNTRW5(25) = COUNTRW5(25) + 1
          END IF
          IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
             COUNTRW6(25) = COUNTRW6(25) + 1
          END IF
          IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
             COUNTRW7(25) = COUNTRW7(25) + 1
          END IF
          IF NBRW(I%) >= 7.5 THEN
             COUNTRW8(25) = COUNTRW8(25) + 1
          END IF
       CASE 26
          SUMNOC(26) = SUMNOC(26) + NOC(I%)
          SUMNBRWxNOC(26) = SUMNBRWxNOC(26) + (NBRW(I%) * NOC(I%))
          SUMNBCLxNOC(26) = SUMNBCLxNOC(26) + (NBCL(I%) * NOC(I%))
          IF NBCL(I%) > MAXC(26) THEN
             MAXC(26) = NBCL(I%)
          ELSE
             MAXC(26) = MAXC(26)
          END IF
          IF NBRW(I%) > MAXR(26) THEN
             MAXR(26) = NBRW(I%)
          ELSE
             MAXR(26) = MAXR(26)
          END IF
REM
REM       DETERMINE COLUMN DISTRIBUTION
REM
          IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
             COUNTCL1(26) = COUNTCL1(26) + 1
          END IF
          IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
             COUNTCL2(26) = COUNTCL2(26) + 1
          END IF
          IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
```

```
            COUNTCL3(26) = COUNTCL3(26) + 1
         END IF
         IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
            COUNTCL4(26) = COUNTCL4(26) + 1
         END IF
         IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
            COUNTCL5(26) = COUNTCL5(26) + 1
         END IF
         IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
            COUNTCL6(26) = COUNTCL6(26) + 1
         END IF
         IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
            COUNTCL7(26) = COUNTCL7(26) + 1
         END IF
         IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
            COUNTCL8(26) = COUNTCL8(26) + 1
         END IF
         IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
            COUNTCL9(26) = COUNTCL9(26) + 1
         END IF
         IF NBCL(I%) >= 9.5 THEN
            COUNTCL10(26) = COUNTCL10(26) + 1
         END IF
REM
REM      DETERMINE ROW DISTRIBUTION
REM
         IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
            COUNTRW1(26) = COUNTRW1(26) + 1
         END IF
         IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
            COUNTRW2(26) = COUNTRW2(26) + 1
         END IF
         IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
            COUNTRW3(26) = COUNTRW3(26) + 1
         END IF
         IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
            COUNTRW4(26) = COUNTRW4(26) + 1
         END IF
         IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
            COUNTRW5(26) = COUNTRW5(26) + 1
         END IF
         IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
            COUNTRW6(26) = COUNTRW6(26) + 1
         END IF
         IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
            COUNTRW7(26) = COUNTRW7(26) + 1
         END IF
         IF NBRW(I%) >= 7.5 THEN
            COUNTRW8(26) = COUNTRW8(26) + 1
         END IF
      CASE 27
```

```
            SUMNOC(27) = SUMNOC(27) - NOC(I%)
            SUMNBRWxNOC(27) = SUMNBRWxNOC(27) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(27) = SUMNBCLxNOC(27) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(27) THEN
               MAXC(27) = NBCL(I%)
            ELSE
               MAXC(27) = MAXC(27)
            END IF
            IF NBRW(I%) > MAXR(27) THEN
               MAXR(27) = NBRW(I%)
            ELSE
               MAXR(27) = MAXR(27)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(27) = COUNTCL1(27) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(27) = COUNTCL2(27) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(27) = COUNTCL3(27) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(27) = COUNTCL4(27) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(27) = COUNTCL5(27) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(27) = COUNTCL6(27) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(27) = COUNTCL7(27) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(27) = COUNTCL8(27) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(27) = COUNTCL9(27) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(27) = COUNTCL10(27) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(27) = COUNTRW1(27) + 1
```

```
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(27) = COUNTRW2(27) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(27) = COUNTRW3(27) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(27) = COUNTRW4(27) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(27) = COUNTRW5(27) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(27) = COUNTRW6(27) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(27) = COUNTRW7(27) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(27) = COUNTRW8(27) + 1
            END IF
         CASE 28
            SUMNOC(28) = SUMNOC(28) + NOC(I%)
            SUMNBRWxNOC(28) = SUMNBRWxNOC(28) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(28) = SUMNBCLxNOC(28) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(28) THEN
               MAXC(28) = NBCL(I%)
            ELSE
               MAXC(28) = MAXC(28)
            END IF
            IF NBRW(I%) > MAXR(28) THEN
               MAXR(28) = NBRW(I%)
            ELSE
               MAXR(28) = MAXR(28)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(28) = COUNTCL1(28) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(28) = COUNTCL2(28) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(28) = COUNTCL3(28) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(28) = COUNTCL4(28) + 1
            END IF
```

```
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(28) = COUNTCL5(28) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(28) = COUNTCL6(28) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(28) = COUNTCL7(28) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(28) = COUNTCL8(28) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(28) = COUNTCL9(28) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(28) = COUNTCL10(28) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(28) = COUNTRW1(28) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(28) = COUNTRW2(28) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(28) = COUNTRW3(28) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(28) = COUNTRW4(28) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(28) = COUNTRW5(28) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(28) = COUNTRW6(28) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(28) = COUNTRW7(28) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(28) = COUNTRW8(28) + 1
            END IF
         CASE 29
            SUMNOC(29) = SUMNOC(29) + NOC(I%)
            SUMNBRWxNOC(29) = SUMNBRWxNOC(29) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(29) = SUMNBCLxNOC(29) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(29) THEN
               MAXC(29) = NBCL(I%)
```

```
            ELSE
               MAXC(29) = MAXC(29)
            END IF
            IF NBRW(I%) > MAXR(29) THEN
               MAXR(29) = NBRW(I%)
            ELSE
               MAXR(29) = MAXR(29)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(29) = COUNTCL1(29) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(29) = COUNTCL2(29) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(29) = COUNTCL3(29) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(29) = COUNTCL4(29) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(29) = COUNTCL5(29) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(29) = COUNTCL6(29) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(29) = COUNTCL7(29) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(29) = COUNTCL8(29) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(29) = COUNTCL9(29) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(29) = COUNTCL10(29) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(29) = COUNTRW1(29) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(29) = COUNTRW2(29) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
```

```
            COUNTRW3(29) = COUNTRW3(29) + 1
         END IF
         IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
            COUNTRW4(29) = COUNTRW4(29) + 1
         END IF
         IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
            COUNTRW5(29) = COUNTRW5(29) + 1
         END IF
         IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
            COUNTRW6(29) = COUNTRW6(29) + 1
         END IF
         IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
            COUNTRW7(29) = COUNTRW7(29) + 1
         END IF
         IF NBRW(I%) >= 7.5 THEN
            COUNTRW8(29) = COUNTRW8(29) + 1
         END IF
      CASE 30
         SUMNOC(30) = SUMNOC(30) + NOC(I%)
         SUMNBRWxNOC(30) = SUMNBRWxNOC(30) + (NBRW(I%) * NOC(I%))
         SUMNBCLxNOC(30) = SUMNBCLxNOC(30) + (NBCL(I%) * NOC(I%))
         IF NBCL(I%) > MAXC(30) THEN
            MAXC(30) = NBCL(I%)
         ELSE
            MAXC(30) = MAXC(30)
         END IF
         IF NBRW(I%) > MAXR(30) THEN
            MAXR(30) = NBRW(I%)
         ELSE
            MAXR(30) = MAXR(30)
         END IF
REM
REM      DETERMINE COLUMN DISTRIBUTION
REM
         IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
            COUNTCL1(30) = COUNTCL1(30) + 1
         END IF
         IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
            COUNTCL2(30) = COUNTCL2(30) + 1
         END IF
         IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
            COUNTCL3(30) = COUNTCL3(30) + 1
         END IF
         IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
            COUNTCL4(30) = COUNTCL4(30) + 1
         END IF
         IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
            COUNTCL5(30) = COUNTCL5(30) + 1
         END IF
         IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
            COUNTCL6(30) = COUNTCL6(30) + 1
```

```
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(30) = COUNTCL7(30) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(30) = COUNTCL8(30) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(30) = COUNTCL9(30) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(30) = COUNTCL10(30) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(30) = COUNTRW1(30) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(30) = COUNTRW2(30) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(30) = COUNTRW3(30) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(30) = COUNTRW4(30) + 1
            END IF
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(30) = COUNTRW5(30) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(30) = COUNTRW6(30) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(30) = COUNTRW7(30) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(30) = COUNTRW8(30) + 1
            END IF
         CASE 31
            SUMNOC(31) = SUMNOC(31) + NOC(I%)
            SUMNBRWxNOC(31) = SUMNBRWxNOC(31) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(31) = SUMNBCLxNOC(31) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(31) THEN
               MAXC(31) = NBCL(I%)
            ELSE
               MAXC(31) = MAXC(31)
            END IF
            IF NBRW(I%) > MAXR(31) THEN
               MAXR(31) = NBRW(I%)
```

```
            ELSE
               MAXR(31) = MAXR(31)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(31) = COUNTCL1(31) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(31) = COUNTCL2(31) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(31) = COUNTCL3(31) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(31) = COUNTCL4(31) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(31) = COUNTCL5(31) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(31) = COUNTCL6(31) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(31) = COUNTCL7(31) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
               COUNTCL8(31) = COUNTCL8(31) + 1
            END IF
            IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
               COUNTCL9(31) = COUNTCL9(31) + 1
            END IF
            IF NBCL(I%) >= 9.5 THEN
               COUNTCL10(31) = COUNTCL10(31) + 1
            END IF
REM
REM         DETERMINE ROW DISTRIBUTION
REM
            IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
               COUNTRW1(31) = COUNTRW1(31) + 1
            END IF
            IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
               COUNTRW2(31) = COUNTRW2(31) + 1
            END IF
            IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
               COUNTRW3(31) = COUNTRW3(31) + 1
            END IF
            IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
               COUNTRW4(31) = COUNTRW4(31) + 1
            END IF
```

```
            IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
               COUNTRW5(31) = COUNTRW5(31) + 1
            END IF
            IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
               COUNTRW6(31) = COUNTRW6(31) + 1
            END IF
            IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
               COUNTRW7(31) = COUNTRW7(31) + 1
            END IF
            IF NBRW(I%) >= 7.5 THEN
               COUNTRW8(31) = COUNTRW8(31) + 1
            END IF
         CASE 32
            SUMNOC(32) = SUMNOC(32) + NOC(I%)
            SUMNBRWxNOC(32) = SUMNBRWxNOC(32) + (NBRW(I%) * NOC(I%))
            SUMNBCLxNOC(32) = SUMNBCLxNOC(32) + (NBCL(I%) * NOC(I%))
            IF NBCL(I%) > MAXC(32) THEN
               MAXC(32) = NBCL(I%)
            ELSE
               MAXC(32) = MAXC(32)
            END IF
            IF NBRW(I%) > MAXR(32) THEN
               MAXR(32) = NBRW(I%)
            ELSE
               MAXR(32) = MAXR(32)
            END IF
REM
REM         DETERMINE COLUMN DISTRIBUTION
REM
            IF NBCL(I%) > 0 AND NBCL(I%) < 1.5 THEN
               COUNTCL1(32) = COUNTCL1(32) + 1
            END IF
            IF NBCL(I%) >= 1.5 AND NBCL(I%) < 2.5 THEN
               COUNTCL2(32) = COUNTCL2(32) + 1
            END IF
            IF NBCL(I%) >= 2.5 AND NBCL(I%) < 3.5 THEN
               COUNTCL3(32) = COUNTCL3(32) + 1
            END IF
            IF NBCL(I%) >= 3.5 AND NBCL(I%) < 4.5 THEN
               COUNTCL4(32) = COUNTCL4(32) + 1
            END IF
            IF NBCL(I%) >= 4.5 AND NBCL(I%) < 5.5 THEN
               COUNTCL5(32) = COUNTCL5(32) + 1
            END IF
            IF NBCL(I%) >= 5.5 AND NBCL(I%) < 6.5 THEN
               COUNTCL6(32) = COUNTCL6(32) + 1
            END IF
            IF NBCL(I%) >= 6.5 AND NBCL(I%) < 7.5 THEN
               COUNTCL7(32) = COUNTCL7(32) + 1
            END IF
            IF NBCL(I%) >= 7.5 AND NBCL(I%) < 8.5 THEN
```

```
            COUNTCL8(32) = COUNTCL8(32) + 1
         END IF
         IF NBCL(I%) >= 8.5 AND NBCL(I%) < 9.5 THEN
            COUNTCL9(32) = COUNTCL9(32) + 1
         END IF
         IF NBCL(I%) >= 9.5 THEN
            COUNTCL10(32) = COUNTCL10(32) + 1
         END IF
REM
REM      DETERMINE ROW DISTRIBUTION
REM
         IF NBRW(I%) > 0 AND NBRW(I%) < 1.5 THEN
            COUNTRW1(32) = COUNTRW1(32) + 1
         END IF
         IF NBRW(I%) >= 1.5 AND NBRW(I%) < 2.5 THEN
            COUNTRW2(32) = COUNTRW2(32) + 1
         END IF
         IF NBRW(I%) >= 2.5 AND NBRW(I%) < 3.5 THEN
            COUNTRW3(32) = COUNTRW3(32) + 1
         END IF
         IF NBRW(I%) >= 3.5 AND NBRW(I%) < 4.5 THEN
            COUNTRW4(32) = COUNTRW4(32) + 1
         END IF
         IF NBRW(I%) >= 4.5 AND NBRW(I%) < 5.5 THEN
            COUNTRW5(32) = COUNTRW5(32) + 1
         END IF
         IF NBRW(I%) >= 5.5 AND NBRW(I%) < 6.5 THEN
            COUNTRW6(32) = COUNTRW6(32) + 1
         END IF
         IF NBRW(I%) >= 6.5 AND NBRW(I%) < 7.5 THEN
            COUNTRW7(32) = COUNTRW7(32) + 1
         END IF
         IF NBRW(I%) >= 7.5 THEN
            COUNTRW8(32) = COUNTRW8(32) + 1
         END IF
   END SELECT
END SUB

SUB CLASSIFY
   IF FLAVG(I%) < 100 THEN
      IF FWAVG(I%) < 26 THEN NUM = 1
      IF FWAVG(I%) >= 26 AND FWAVG(I%) < 35 THEN NUM = 2
      IF FWAVG(I%) >= 35 AND FWAVG(I%) <= 54 THEN NUM = 3
      IF FWAVG(I%) > 54 THEN NUM = 4
   END IF
   IF FLAVG(I%) >= 100 AND FLAVG(I%) <= 174 THEN
      IF FWAVG(I%) < 26 THEN NUM = 5
      IF FWAVG(I%) >= 26 AND FWAVG(I%) < 35 THEN NUM = 6
      IF FWAVG(I%) >= 35 AND FWAVG(I%) <= 54 THEN NUM = 7
      IF FWAVG(I%) > 54 THEN NUM = 8
   END IF
```

```
    IF FLAVG(I%) > 174 AND FLAVG(I%) <= 194 THEN
       IF FWAVG(I%) < 26 THEN NUM = 9
       IF FWAVG(I%) >= 26 AND FWAVG(I%) < 35 THEN NUM = 10
       IF FWAVG(I%) >= 35 AND FWAVG(I%) <= 54 THEN NUM = 11
       IF FWAVG(I%) > 54 THEN NUM = 12
    END IF
    IF FLAVG(I%) > 194 AND FLAVG(I%) <= 199 THEN
       IF FWAVG(I%) < 26 THEN NUM = 13
       IF FWAVG(I%) >= 26 AND FWAVG(I%) < 35 THEN NUM = 14
       IF FWAVG(I%) >= 35 AND FWAVG(I%) <= 54 THEN NUM = 15
       IF FWAVG(I%) > 54 THEN NUM = 16
    END IF
    IF FLAVG(I%) > 199 AND FLAVG(I%) <= 259 THEN
       IF FWAVG(I%) < 26 THEN NUM = 17
       IF FWAVG(I%) >= 26 AND FWAVG(I%) < 35 THEN NUM = 18
       IF FWAVG(I%) >= 35 AND FWAVG(I%) <= 54 THEN NUM = 19
       IF FWAVG(I%) > 54 THEN NUM = 20
    END IF
    IF FLAVG(I%) > 259 AND FLAVG(I%) <= 289 THEN
       IF FWAVG(I%) < 26 THEN NUM = 21
       IF FWAVG(I%) >= 26 AND FWAVG(I%) < 35 THEN NUM = 22
       IF FWAVG(I%) >= 35 AND FWAVG(I%) <= 54 THEN NUM = 23
       IF FWAVG(I%) > 54 THEN NUM = 24
    END IF
    IF FLAVG(I%) > 289 AND FLAVG(I%) <= 300 THEN
       IF FWAVG(I%) < 26 THEN NUM = 25
       IF FWAVG(I%) >= 26 AND FWAVG(I%) < 35 THEN NUM = 26
       IF FWAVG(I%) >= 35 AND FWAVG(I%) <= 54 THEN NUM = 27
       IF FWAVG(I%) > 54 THEN NUM = 28
    END IF
    IF FLAVG(I%) > 300 THEN
       IF FWAVG(I%) < 26 THEN NUM = 29
       IF FWAVG(I%) >= 26 AND FWAVG(I%) < 35 THEN NUM = 30
       IF FWAVG(I%) >= 35 AND FWAVG(I%) <= 54 THEN NUM = 31
       IF FWAVG(I%) > 54 THEN NUM = 32
    END IF
END SUB

SUB CLASSIFY2
    IF FLAVG(N%) < 100 THEN
       IF FWAVG(N%) < 26 THEN NUMBR = 1
       IF FWAVG(N%) >= 26 AND FWAVG(N%) < 35 THEN NUMBR = 2
       IF FWAVG(N%) >= 35 AND FWAVG(N%) <= 54 THEN NUMBR = 3
       IF FWAVG(N%) > 54 THEN NUMBR = 4
    END IF
    IF FLAVG(N%) >= 100 AND FLAVG(N%) <= 174 THEN
       IF FWAVG(N%) < 26 THEN NUMBR = 5
       IF FWAVG(N%) >= 26 AND FWAVG(N%) < 35 THEN NUMBR = 6
       IF FWAVG(N%) >= 35 AND FWAVG(N%) <= 54 THEN NUMBR = 7
       IF FWAVG(N%) > 54 THEN NUMBR = 8
    END IF
```

```
    IF FLAVG(N%) > 174 AND FLAVG(N%) <= 194 THEN
       IF FWAVG(N%) < 26 THEN NUMBR = 9
       IF FWAVG(N%) >= 26 AND FWAVG(N%) < 35 THEN NUMBR = 10
       IF FWAVG(N%) >= 35 AND FWAVG(N%) <= 54 THEN NUMBR = 11
       IF FWAVG(N%) > 54 THEN NUMBR = 12
    END IF
    IF FLAVG(N%) > 194 AND FLAVG(N%) <= 199 THEN
       IF FWAVG(N%) < 26 THEN NUMBR = 13
       IF FWAVG(N%) >= 26 AND FWAVG(N%) < 35 THEN NUMBR = 14
       IF FWAVG(N%) >= 35 AND FWAVG(N%) <= 54 THEN NUMBR = 15
       IF FWAVG(N%) > 54 THEN NUMBR = 16
    END IF
    IF FLAVG(N%) > 199 AND FLAVG(N%) <= 259 THEN
       IF FWAVG(N%) < 26 THEN NUMBR = 17
       IF FWAVG(N%) >= 26 AND FWAVG(N%) < 35 THEN NUMBR = 18
       IF FWAVG(N%) >= 35 AND FWAVG(N%) <= 54 THEN NUMBR = 19
       IF FWAVG(N%) > 54 THEN NUMBR = 20
    END IF
    IF FLAVG(N%) > 259 AND FLAVG(N%) <= 289 THEN
       IF FWAVG(N%) < 26 THEN NUMBR = 21
       IF FWAVG(N%) >= 26 AND FWAVG(N%) < 35 THEN NUMBR = 22
       IF FWAVG(N%) >= 35 AND FWAVG(N%) <= 54 THEN NUMBR = 23
       IF FWAVG(N%) > 54 THEN NUMBR = 24
    END IF
    IF FLAVG(N%) > 289 AND FLAVG(N%) <= 300 THEN
       IF FWAVG(N%) < 26 THEN NUMBR = 25
       IF FWAVG(N%) >= 26 AND FWAVG(N%) < 35 THEN NUMBR = 26
       IF FWAVG(N%) >= 35 AND FWAVG(N%) <= 54 THEN NUMBR = 27
       IF FWAVG(N%) > 54 THEN NUMBR = 28
    END IF
    IF FLAVG(N%) > 300 THEN
       IF FWAVG(N%) < 26 THEN NUMBR = 29
       IF FWAVG(N%) >= 26 AND FWAVG(N%) < 35 THEN NUMBR = 30
       IF FWAVG(N%) >= 35 AND FWAVG(N%) <= 54 THEN NUMBR = 31
       IF FWAVG(N%) > 54 THEN NUMBR = 32
    END IF
END SUB

SUB DEVIATION
   SELECT CASE NUMBR
      CASE 1
         DEVNUMR(1) = DEVNUMR(1) + (NBRW(N%) - CATAVGR(1)) ^ 2
         DEVNUMC(1) = DEVNUMC(1) + (NBCL(N%) - CATAVGC(1)) ^ 2
      CASE 2
         DEVNUMR(2) = DEVNUMR(2) + (NBRW(N%) - CATAVGR(2)) ^ 2
         DEVNUMC(2) = DEVNUMC(2) + (NBCL(N%) - CATAVGC(2)) ^ 2
      CASE 3
         DEVNUMR(3) = DEVNUMR(3) + (NBRW(N%) - CATAVGR(3)) ^ 2
         DEVNUMC(3) = DEVNUMC(3) + (NBCL(N%) - CATAVGC(3)) ^ 2
      CASE 4
         DEVNUMR(4) = DEVNUMR(4) + (NBRW(N%) - CATAVGR(4)) ^ 2
```

```
   DEVNUMC(4) = DEVNUMC(4) + (NBCL(N%) - CATAVGC(4)) ^ 2
CASE 5
   DEVNUMR(5) = DEVNUMR(5) + (NBRW(N%) - CATAVGR(5)) ^ 2
   DEVNUMC(5) = DEVNUMC(5) + (NBCL(N%) - CATAVGC(5)) ^ 2
CASE 6
   DEVNUMR(6) = DEVNUMR(6) + (NBRW(N%) - CATAVGR(6)) ^ 2
   DEVNUMC(6) = DEVNUMC(6) + (NBCL(N%) - CATAVGC(6)) ^ 2
CASE 7
   DEVNUMR(7) = DEVNUMR(7) + (NBRW(N%) - CATAVGR(7)) ^ 2
   DEVNUMC(7) = DEVNUMC(7) + (NBCL(N%) - CATAVGC(7)) ^ 2
CASE 8
   DEVNUMR(8) = DEVNUMR(8) + (NBRW(N%) - CATAVGR(8)) ^ 2
   DEVNUMC(8) = DEVNUMC(8) + (NBCL(N%) - CATAVGC(8)) ^ 2
CASE 9
   DEVNUMR(9) = DEVNUMR(9) + (NBRW(N%) - CATAVGR(9)) ^ 2
   DEVNUMC(9) = DEVNUMC(9) + (NBCL(N%) - CATAVGC(9)) ^ 2
CASE 10
   DEVNUMR(10) = DEVNUMR(10) + (NBRW(N%) - CATAVGR(10)) ^ 2
   DEVNUMC(10) = DEVNUMC(10) + (NBCL(N%) - CATAVGC(10)) ^ 2
CASE 11
   DEVNUMR(11) = DEVNUMR(11) + (NBRW(N%) - CATAVGR(11)) ^ 2
   DEVNUMC(11) = DEVNUMC(11) + (NBCL(N%) - CATAVGC(11)) ^ 2
CASE 12
   DEVNUMR(12) = DEVNUMR(12) + (NBRW(N%) - CATAVGR(12)) ^ 2
   DEVNUMC(12) = DEVNUMC(12) + (NBCL(N%) - CATAVGC(12)) ^ 2
CASE 13
   DEVNUMR(13) = DEVNUMR(13) + (NBRW(N%) - CATAVGR(13)) ^ 2
   DEVNUMC(13) = DEVNUMC(13) + (NBCL(N%) - CATAVGC(13)) ^ 2
CASE 14
   DEVNUMR(14) = DEVNUMR(14) + (NBRW(N%) - CATAVGR(14)) ^ 2
   DEVNUMC(14) = DEVNUMC(14) + (NBCL(N%) - CATAVGC(14)) ^ 2
CASE 15
   DEVNUMR(15) = DEVNUMR(15) + (NBRW(N%) - CATAVGR(15)) ^ 2
   DEVNUMC(15) = DEVNUMC(15) + (NBCL(N%) - CATAVGC(15)) ^ 2
CASE 16
   DEVNUMR(16) = DEVNUMR(16) + (NBRW(N%) - CATAVGR(16)) ^ 2
   DEVNUMC(16) = DEVNUMC(16) + (NBCL(N%) - CATAVGC(16)) ^ 2
CASE 17
   DEVNUMR(17) = DEVNUMR(17) + (NBRW(N%) - CATAVGR(17)) ^ 2
   DEVNUMC(17) = DEVNUMC(17) + (NBCL(N%) - CATAVGC(17)) ^ 2
CASE 18
   DEVNUMR(18) = DEVNUMR(18) + (NBRW(N%) - CATAVGR(18)) ^ 2
   DEVNUMC(18) = DEVNUMC(18) + (NBCL(N%) - CATAVGC(18)) ^ 2
CASE 19
   DEVNUMR(19) = DEVNUMR(19) + (NBRW(N%) - CATAVGR(19)) ^ 2
   DEVNUMC(19) = DEVNUMC(19) + (NBCL(N%) - CATAVGC(19)) ^ 2
CASE 20
   DEVNUMR(20) = DEVNUMR(20) + (NBRW(N%) - CATAVGR(20)) ^ 2
   DEVNUMC(20) = DEVNUMC(20) + (NBCL(N%) - CATAVGC(20)) ^ 2
CASE 21
   DEVNUMR(21) = DEVNUMR(21) + (NBRW(N%) - CATAVGR(21)) ^ 2
```

```
            DEVNUMC(21) = DEVNUMC(21) + (NBCL(N%) - CATAVGC(21)) ^ 2
        CASE 22
            DEVNUMR(22) = DEVNUMR(22) + (NBRW(N%) - CATAVGR(22)) ^ 2
            DEVNUMC(22) = DEVNUMC(22) + (NBCL(N%) - CATAVGC(22)) ^ 2
        CASE 23
            DEVNUMR(23) = DEVNUMR(23) + (NBRW(N%) - CATAVGR(23)) ^ 2
            DEVNUMC(23) = DEVNUMC(23) + (NBCL(N%) - CATAVGC(23)) ^ 2
        CASE 24
            DEVNUMR(24) = DEVNUMR(24) + (NBRW(N%) - CATAVGR(24)) ^ 2
            DEVNUMC(24) = DEVNUMC(24) + (NBCL(N%) - CATAVGC(24)) ^ 2
        CASE 25
            DEVNUMR(25) = DEVNUMR(25) + (NBRW(N%) - CATAVGR(25)) ^ 2
            DEVNUMC(25) = DEVNUMC(25) + (NBCL(N%) - CATAVGC(25)) ^ 2
        CASE 26
            DEVNUMR(26) = DEVNUMR(26) + (NBRW(N%) - CATAVGR(26)) ^ 2
            DEVNUMC(26) = DEVNUMC(26) + (NBCL(N%) - CATAVGC(26)) ^ 2
        CASE 27
            DEVNUMR(27) = DEVNUMR(27) + (NBRW(N%) - CATAVGR(27)) ^ 2
            DEVNUMC(27) = DEVNUMC(27) + (NBCL(N%) - CATAVGC(27)) ^ 2
        CASE 28
            DEVNUMR(28) = DEVNUMR(28) + (NBRW(N%) - CATAVGR(28)) ^ 2
            DEVNUMC(28) = DEVNUMC(28) + (NBCL(N%) - CATAVGC(28)) ^ 2
        CASE 29
            DEVNUMR(29) = DEVNUMR(29) + (NBRW(N%) - CATAVGR(29)) ^ 2
            DEVNUMC(29) = DEVNUMC(29) + (NBCL(N%) - CATAVGC(29)) ^ 2
        CASE 30
            DEVNUMR(30) = DEVNUMR(30) + (NBRW(N%) - CATAVGR(30)) ^ 2
            DEVNUMC(30) = DEVNUMC(30) + (NBCL(N%) - CATAVGC(30)) ^ 2
        CASE 31
            DEVNUMR(31) = DEVNUMR(31) + (NBRW(N%) - CATAVGR(31)) ^ 2
            DEVNUMC(31) = DEVNUMC(31) + (NBCL(N%) - CATAVGC(31)) ^ 2
        CASE 32
            DEVNUMR(32) = DEVNUMR(32) + (NBRW(N%) - CATAVGR(32)) ^ 2
            DEVNUMC(32) = DEVNUMC(32) + (NBCL(N%) - CATAVGC(32)) ^ 2
    END SELECT
END SUB

SUB DIVBY1
    NBCL(I%) = NB(I%)
    FWAVG(I%) = FW(I%)
    NBRW(I%) = 1
END SUB

SUB DIVBY2
    NBCL(I%) = (NB(I%) / 2)
    FWAVG(I%) = FW(I%) / 2
    NBRW(I%) = 2
END SUB

SUB DIVBY3
    NBCL(I%) = (NB(I%) / 3)
```

```
    FWAVG(I%) = FW(I%) / 3
    NBRW(I%) = 3
END SUB

SUB DIVBY4
    NBCL(I%) = (NB(I%) / 4)
    FWAVG(I%) = FW(I%) / 4
    NBRW(I%) = 4
END SUB

SUB DIVBY5
    NBCL(I%) = (NB(I%) / 5)
    FWAVG(I%) = FW(I%) / 5
    NBRW(I%) = 5
END SUB

SUB DIVBY6
    NBCL(I%) = (NB(I%) / 6)
    FWAVG(I%) = FW(I%) / 6
    NBRW(I%) = 6
END SUB

SUB DIVBY7
    NBCL(I%) = (NB(I%) / 7)
    FWAVG(I%) = FW(I%) / 7
    NBRW(I%) = 7
END SUB

SUB LABEL
    IF M% = 1 THEN PRINT #2, " (AA)";
    IF M% = 2 THEN PRINT #2, " (AB)";
    IF M% = 3 THEN PRINT #2, " (AC)";
    IF M% = 4 THEN PRINT #2, " (AD)";
    IF M% = 5 THEN PRINT #2, " (BA)";
    IF M% = 6 THEN PRINT #2, " (BB)";
    IF M% = 7 THEN PRINT #2, " (BC)";
    IF M% = 8 THEN PRINT #2, " (BD)";
    IF M% = 9 THEN PRINT #2, " (CA)";
    IF M% = 10 THEN PRINT #2, " (CB)";
    IF M% = 11 THEN PRINT #2, " (CC)";
    IF M% = 12 THEN PRINT #2, " (CD)";
    IF M% = 13 THEN PRINT #2, " (DA)";
    IF M% = 14 THEN PRINT #2, " (DB)";
    IF M% = 15 THEN PRINT #2, " (DC)";
    IF M% = 16 THEN PRINT #2, " (DD)";
    IF M% = 17 THEN PRINT #2, " (EA)";
    IF M% = 18 THEN PRINT #2, " (EB)";
    IF M% = 19 THEN PRINT #2, " (EC)";
    IF M% = 20 THEN PRINT #2, " (ED)";
    IF M% = 21 THEN PRINT #2, " (FA)";
    IF M% = 22 THEN PRINT #2, " (FB)";
```

```
    IF M% = 23 THEN PRINT #2, " (FC)";
    IF M% = 24 THEN PRINT #2, " (FD)";
    IF M% = 25 THEN PRINT #2, " (GA)";
    IF M% = 26 THEN PRINT #2, " (GB)";
    IF M% = 27 THEN PRINT #2, " (GC)";
    IF M% = 28 THEN PRINT #2, " (GD)";
    IF M% = 29 THEN PRINT #2, " (HA)";
    IF M% = 30 THEN PRINT #2, " (HB)";
    IF M% = 31 THEN PRINT #2, " (HC)";
    IF M% = 32 THEN PRINT #2, " (HD)";
END SUB

SUB MESSAGE
   LINE (225, 270)-(410, 350), 9, B
   COLOR 11
   LOCATE 19, 33: PRINT "Input complete."
   COLOR 14
   LOCATE 20, 33: PRINT "Please wait for"
   LOCATE 21, 33: PRINT "computations..."
   COLOR 15
END SUB

SUB RESULTS
   CLS
   LINE (90, 175)-(560, 245), 9, B
   COLOR 12
   LOCATE 13, 38: PRINT "FINISHED!"
   COLOR 15
   LOCATE 14, 20: PRINT "The results have been saved in ";
   COLOR 11
   PRINT FILEO$
   COLOR 15
                              P    R    I    N    T              #    2    ,
"*************************************************************************
****"
    PRINT #2, "*"; SPC(16); RIVER$; " RIVER, MILEMARKER DESIGNATION:";
MILE; TAB(75); "*"
   PRINT #2, "*"; SPC(33); DATE$; TAB(75); "*"
   PRINT #2, "*"; SPC(34); TIME$; TAB(75); "*"
                              P    R    I    N    T              #    2    ,
"*************************************************************************
****"
   PRINT #2,
   PRINT #2, " CATEGORY"; TAB(16); "AVERAGE NUMBER OF"; TAB(36); "COLUMN";
TAB(48); "AVERAGE NUMBER OF"; TAB(70); "ROW"
    PRINT #2, TAB(16); "BARGES IN COLUMN"; TAB(36); "MAXIMUM"; TAB(48);
"BARGES IN THE ROW"; TAB(68); "MAXIMUM"
   PRINT #2, TAB(16); "(AVERAGE NUMBER OF"; TAB(48); "(AVERAGE NUMBER OF"
   PRINT #2, TAB(16); "BARGES IN COLUMN"; TAB(48); "BARGES IN THE ROW"
   PRINT #2, TAB(16); "PLUS 2 STD DEVs)"; TAB(48); "PLUS 2 STD DEVs)"
   PRINT #2,
```

```
    FOR M% = 1 TO 32
       IF M% = 5 THEN PRINT #2,
       IF M% = 9 THEN PRINT #2,
       IF M% = 13 THEN PRINT #2,
       IF M% = 17 THEN PRINT #2,
       IF M% = 21 THEN PRINT #2,
       IF M% = 25 THEN PRINT #2,
       IF M% = 29 THEN PRINT #2,
       PRINT #2, USING "##"; TAB(2); M%;
       CALL LABEL
       PRINT #2, USING "##.####"; TAB(16); CATAVGC(M%);
       PRINT #2, TAB(24); "(";
       PRINT #2, USING "##.####"; TAB(25); (CATAVGC(M%) + STDC2(M%));
       PRINT #2, TAB(32); ")";
       PRINT #2, USING "##.####"; TAB(36); MAXC(M%);
       IF MAXC(M%) < (CATAVGC(M%) + STDC2(M%)) THEN
          PRINT #2, "*";
       END IF
       PRINT #2, USING "##.####"; TAB(48); CATAVGR(M%);
       PRINT #2, TAB(56); "(";
       PRINT #2, USING "##.####"; TAB(57); (CATAVGR(M%) + STDR2(M%));
       PRINT #2, TAB(64); ")";
       PRINT #2, USING "#.####"; TAB(68); MAXR(M%);
       IF MAXR(M%) < (CATAVGR(M%) + STDR2(M%)) THEN
          PRINT #2, "*"
       ELSE
          PRINT #2, ""
       END IF
    NEXT M%
REM
REM    PRINT TO DISTRIBUTION FILE
REM
    PRINT #3,
    FOR P% = 1 TO 32
            PRINT #3, P%; ","; COUNTCL1(P%); ","; COUNTCL2(P%); ","; 
COUNTCL3(P%); ","; COUNTCL4(P%); ","; COUNTCL5(P%); ",";
       PRINT #3, COUNTCL6(P%); ","; COUNTCL7(P%); ","; COUNTCL8(P%); ","; 
COUNTCL9(P%); ","; COUNTCL10(P%)
    NEXT P%
    PRINT #3,
    FOR R% = 1 TO 32
            PRINT #3, R%; ","; COUNTRW1(R%); ","; COUNTRW2(R%); ","; 
COUNTRW3(R%); ","; COUNTRW4(R%); ",";
       PRINT #3, COUNTRW5(R%); ","; COUNTRW6(R%); ","; COUNTRW7(R%); ","; 
COUNTRW8(R%)
    NEXT R%
END SUB
```

Appendix D: Barge Column and Row Count Output

NOTE: The first letter in parenthesis is the length of barge designation, as found in Table 6.1, and the second letter is the width of barge designation, as found in Table 6.2. The "*" indicates that the maximum number of barges in a column or row encountered for the flotilla category is less than the average plus two standard deviations number of barges.

****

* OHIO RIVER. MILEMARKER DESIGNATION: 341 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	4.3750 (7.9105)	7.0000*	1.6250 (3.4573)	3.0000*
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
6 (BB)	1.3333 (2.3874)	2.0000*	1.0000 (1.0000)	1.0000
7 (BC)	4.1338 (7.8650)	8.0000	1.6479 (2.4740)	2.0000*
8 (BD)	6.6250 (11.4813)	8.0000*	1.7500 (2.7500)	2.0000*
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	3.2284 (4.9942)	6.5000	1.8704 (2.7815)	3.0000
11 (CD)	3.7500 (6.7500)	6.0000*	1.2500 (2.2500)	2.0000*
12 (DB)	2.5000 (5.4439)	4.0000*	1.5000 (2.6547)	2.0000*
13 (DC)	4.4609 (5.3880)	5.5000	2.7504 (3.4350)	3.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	5.0000 (5.0000)	5.0000	1.5000 (2.9142)	2.0000*
16 (EB)	2.5000 (5.4439)	4.0000*	1.5000 (2.6547)	2.0000*
17 (EC)	4.4609 (5.3880)	5.5000	2.7504 (3.4350)	3.0000*
18 (ED)	1.6667 (2.8214)	2.0000*	1.0000 (1.0000)	1.0000
19 (FC)	3.2655 (4.5572)	4.5000*	2.3099 (3.2694)	3.0000*
20 (FD)	2.7500 (4.6649)	4.0000*	1.0000 (1.0000)	1.0000
21 (GC)	3.3167 (4.6857)	4.0000*	1.9412 (2.7482)	3.0000
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.9115 (3.1802)	3.5000	1.6397 (2.6566)	3.0000
24 (HD)	1.5000 (2.9142)	2.0000*	1.0000 (1.0000)	1.0000

OHIO RIVER. MILEMARKER DESIGNATION: 436

CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	4.4000 (8.5473)	6.0000*	1.2000 (2.0944)	2.0000*
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
6 (BB)	3.3333 (5.4415)	4.0000*	1.6667 (2.7208)	2.0000*
7 (BC)	3.4219 (5.9171)	7.5000	1.7188 (2.4995)	2.0000*
8 (BD)	3.2500 (8.5099)	7.0000*	1.2500 (2.2500)	2.0000*
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	3.3490 (5.1076)	6.5000	1.9688 (2.4667)	3.0000
11 (CD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
12 (DB)	5.0000 (5.0000)	5.0000	1.0000 (1.0000)	1.0000
13 (DC)	4.5837 (5.3813)	5.5000	2.8274 (3.4682)	3.0000*
14 (DD)	6.0000 (6.0000)	6.0000	2.0000 (2.0000)	2.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	5.0000 (5.0000)	5.0000	1.0000 (1.0000)	1.0000
17 (EC)	4.5837 (5.3813)	5.5000	2.8274 (3.4682)	3.0000*
18 (ED)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
19 (FC)	3.3537 (4.6113)	4.5000*	2.3159 (3.3007)	3.0000*
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	3.3884 (4.6127)	4.0000*	1.9876 (2.7581)	3.0000
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	2.0000 (3.2295)	3.5000	1.7176 (2.7621)	3.0000
24 (HD)	1.6667 (2.8214)	2.0000*	1.0000 (1.0000)	1.0000

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* OHIO RIVER, MILEMARKER DESIGNATION: 531 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	6.0000 (6.0000)	6.0000	1.0000 (1.0000)	1.0000
2 (AB)	4.0000 (4.0000)	4.0000	2.0000 (2.0000)	2.0000
3 (AC)	10.0000 (22.9615)	16.0000*	1.5000 (3.5000)	3.0000*
4 (AD)	8.5000 (26.8848)	15.0000*	1.0000 (1.0000)	1.0000
5 (BA)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
6 (BB)	3.3333 (5.6427)	4.0000*	1.6667 (2.8214)	2.0000*
7 (BC)	4.1920 (8.0997)	10.0000	1.5435 (2.7883)	3.0000
8 (BD)	5.5556 (10.7582)	8.5000*	1.7778 (2.6456)	2.0000*
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	3.7500 (6.4382)	6.5000	1.8182 (2.5793)	2.0000*
11 (CD)	2.6667 (3.8214)	3.0000*	1.0000 (1.0000)	1.0000
12 (DB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
13 (DC)	4.4737 (5.3150)	5.5000	2.7934 (3.4677)	3.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
17 (EC)	4.4737 (5.3150)	5.5000	2.7934 (3.4677)	3.0000*
18 (ED)	3.0000 (5.0000)	4.0000*	1.0000 (1.0000)	1.0000
19 (FC)	3.1248 (4.3374)	4.5000	2.1702 (3.1299)	3.0000*
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	2.6713 (3.9510)	4.0000	1.8241 (2.6632)	3.0000
22 (GD)	1.5000 (1.5000)	1.5000	2.0000 (2.0000)	2.0000
23 (HC)	1.9766 (3.1608)	3.6667	1.6917 (2.5992)	3.0000
24 (HD)	1.2500 (1.9571)	1.5000*	2.0000 (2.0000)	2.0000

OHIO RIVER, MILEMARKER DESIGNATION: 606

CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000
2 (AB)	4.0000 (7.4641)	5.0000*	1.3333 (2.4880)	2.0000*
3 (AC)	5.9510 (14.2471)	15.0000	1.7647 (3.4887)	3.0000*
4 (AD)	3.0000 (3.0000)	3.0000	1.0000 (1.0000)	1.0000
5 (BA)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
6 (BB)	2.6250 (5.7747)	5.0000*	1.5833 (2.4851)	2.0000*
7 (BC)	4.8986 (8.9794)	10.0000	1.7391 (2.6651)	3.0000
8 (BD)	5.6538 (10.2207)	8.0000*	1.7692 (2.6258)	2.0000*
9 (CB)	1.1000 (1.5359)	1.5000*	1.2000 (2.0718)	2.0000*
10 (CC)	4.1574 (7.0143)	6.5000*	1.8333 (2.7523)	3.0000
11 (CD)	3.6250 (7.5726)	6.5000*	1.2500 (2.2500)	2.0000*
12 (DB)	1.4444 (4.0925)	5.0000	1.2222 (2.0900)	2.0000*
13 (DC)	4.5163 (5.4695)	6.0000	2.7736 (3.4401)	3.0000*
14 (DD)	2.6667 (3.8214)	3.0000*	1.0000 (1.0000)	1.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	1.4444 (4.0925)	5.0000	1.2222 (2.0900)	2.0000*
17 (EC)	4.5163 (5.4695)	6.0000	2.7736 (3.4401)	3.0000*
18 (ED)	2.3333 (3.4880)	3.0000*	1.0000 (1.0000)	1.0000
19 (FC)	2.6142 (4.0247)	4.5000	1.8780 (2.8250)	3.0000
20 (FD)	4.0000 (4.0000)	4.0000	1.0000 (1.0000)	1.0000
21 (GC)	2.3628 (3.6731)	4.0000	1.6411 (2.4426)	3.0000
22 (GD)	1.7500 (2.4571)	2.0000*	1.5000 (2.9142)	2.0000*
23 (HC)	1.8621 (3.0162)	3.6667	1.6396 (2.4997)	3.0000
24 (HD)	1.8571 (3.2373)	3.0000*	1.0000 (1.0000)	1.0000

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* OHIO RIVER, MILEMARKER DESIGNATION: 720 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	4.3333 (10.4434)	7.0000*	1.3333 (2.4880)	2.0000*
3 (AC)	14.3333 (16.6427)	15.0000*	1.0000 (1.0000)	1.0000
4 (AD)	3.0000 (3.0000)	3.0000	1.0000 (1.0000)	1.0000
5 (BA)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
6 (BB)	3.8571 (6.0718)	5.0000*	2.0000 (2.0000)	2.0000
7 (BC)	4.5761 (8.1678)	8.0000*	1.5652 (2.5603)	3.0000
8 (BD)	7.2500 (7.9571)	7.5000*	2.0000 (2.0000)	2.0000
9 (CB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
10 (CC)	2.6818 (3.8706)	6.0000	1.9091 (2.3709)	2.0000*
11 (CD)	3.0000 (3.0000)	3.0000	1.0000 (1.0000)	1.0000
12 (DB)	1.0000 (1.0000)	1.0000	2.0000 (2.0000)	2.0000
13 (DC)	4.4775 (5.2151)	6.0000	2.7890 (3.4124)	3.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	1.0000 (1.0000)	1.0000	2.0000 (2.0000)	2.0000
17 (EC)	4.4775 (5.2151)	6.0000	2.7890 (3.4124)	3.0000*
18 (ED)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
19 (FC)	3.3812 (4.5098)	4.5000*	2.1235 (3.2774)	3.0000*
20 (FD)	4.0000 (4.0000)	4.0000	1.0000 (1.0000)	1.0000
21 (GC)	2.7049 (3.9932)	4.0000	1.7926 (2.6151)	3.0000
22 (GD)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000
23 (HC)	1.9246 (2.9491)	3.5000	1.6406 (2.4692)	3.0000
24 (HD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000

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* OHIO RIVER. MILEMARKER DESIGNATION: 776 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	3.0000 (16.4164)	3.0000*	1.0000 (5.4721)	1.0000*
2 (AB)	4.1667 (10.0204)	5.0000*	1.0000 (1.0000)	1.0000
3 (AC)	7.6410 (16.5747)	15.0000*	1.8462 (3.2907)	3.0000*
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	4.0625 (9.3180)	7.5000*	1.3750 (2.3293)	2.0000*
6 (BB)	3.2857 (6.4405)	4.5000*	1.7143 (2.6902)	2.0000*
7 (BC)	3.9785 (7.6581)	10.0000	1.7891 (2.5926)	3.0000
8 (BD)	6.2826 (10.1996)	8.5000*	1.8696 (2.5492)	2.0000*
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	2.8571 (5.5029)	6.5000	1.7347 (2.4799)	2.0000*
11 (CD)	3.8333 (8.5591)	6.5000*	1.3333 (2.4880)	2.0000*
12 (DB)	2.2000 (4.8077)	4.0000*	1.2000 (2.0944)	2.0000*
13 (DC)	4.3514 (6.1765)	6.5000	2.7227 (3.3058)	3.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	3.0000 (3.0000)	3.0000	1.0000 (1.0000)	1.0000
16 (EB)	2.2000 (4.8077)	4.0000*	1.2000 (2.0944)	2.0000*
17 (EC)	4.3514 (6.1765)	6.5000	2.7227 (3.3058)	3.0000*
18 (ED)	3.6667 (7.1786)	6.5000*	1.6667 (2.8214)	2.0000*
19 (FC)	2.8674 (4.0535)	4.5000	1.9905 (2.9025)	3.0000
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	2.6503 (3.9387)	4.0000	1.7914 (2.5164)	3.0000
22 (GD)	0.0000 (0.0000)	1.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.8942 (2.9603)	3.6667	1.6095 (2.4190)	3.0000
24 (HD)	1.2500 (1.9571)	1.5000*	1.5000 (2.9142)	2.0000*

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* OHIO RIVER. MILEMARKER DESIGNATION: 846 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	6.5000 (11.2610)	9.0000*	1.2500 (2.2500)	2.0000*
3 (AC)	7.8750 (18.3187)	15.0000*	1.6250 (3.4573)	3.0000*
4 (AD)	2.5000 (3.9142)	3.0000*	1.0000 (1.0000)	1.0000
5 (BA)	8.0000 (8.0000)	8.0000	1.0000 (1.0000)	1.0000
6 (BB)	3.9167 (8.9133)	8.5000*	1.5000 (2.5954)	2.0000*
7 (BC)	4.7458 (8.4117)	9.0000	1.8586 (2.7839)	3.0000
8 (BD)	6.4000 (10.3993)	8.0000*	1.8667 (2.5631)	2.0000*
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	4.1091 (6.5787)	6.5000*	1.7273 (2.6855)	3.0000
11 (CD)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000
12 (DB)	1.3333 (1.3604)	1.5000*	1.6667 (2.7208)	2.0000*
13 (DC)	4.6835 (5.5348)	6.0000	2.8191 (3.4487)	3.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	1.3333 (1.3604)	1.5000*	1.6667 (2.7208)	2.0000*
17 (EC)	4.6835 (5.5348)	6.0000	2.8191 (3.4487)	3.0000*
18 (ED)	2.7500 (6.3440)	5.0000*	1.5000 (2.5000)	2.0000*
19 (FC)	3.0497 (4.2083)	4.5000	2.1126 (3.1049)	3.0000*
20 (FD)	3.0000 (3.0000)	3.0000	1.0000 (1.0000)	1.0000
21 (GC)	3.6317 (4.5627)	4.0000*	2.6010 (3.4732)	3.0000*
22 (GD)	2.6667 (4.9761)	4.0000*	1.6667 (2.8214)	2.0000*
23 (HC)	1.9354 (2.9166)	3.3333	1.6839 (2.4800)	3.0000
24 (HD)	1.8333 (2.4107)	2.0000*	1.3333 (2.4880)	2.0000*

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* OHIO RIVER, MILEMARKER DESIGNATION: 918 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	5.8000 (10.9769)	9.0000*	1.2000 (2.0944)	2.0000*
3 (AC)	11.3333 (22.6941)	15.0000*	1.3333 (2.9663)	3.0000
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	2.6667 (8.4402)	6.0000*	1.3333 (2.4880)	2.0000*
6 (BB)	2.4167 (5.6673)	4.5000*	1.3333 (2.3661)	2.0000*
7 (BC)	4.0945 (7.6834)	8.0000	1.8247 (2.4957)	3.0000
8 (BD)	7.1071 (10.5445)	8.0000*	1.9286 (2.4572)	2.0000*
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	4.0000 (6.3139)	6.5000	2.0789 (3.1429)	3.0000*
11 (CD)	3.7500 (8.6997)	6.5000*	1.5000 (2.9142)	2.0000*
12 (DB)	1.7500 (4.7500)	4.0000*	1.2500 (2.2500)	2.0000*
13 (DC)	4.6920 (6.4911)	6.0000	2.8311 (3.4126)	3.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	1.7500 (4.7500)	4.0000*	1.2500 (2.2500)	2.0000*
17 (EC)	4.6920 (6.4911)	6.0000	2.8311 (3.4126)	3.0000*
18 (ED)	2.0000 (4.8284)	3.0000*	1.0000 (1.0000)	1.0000
19 (FC)	3.0546 (4.3172)	4.5000	2.0217 (3.0238)	3.0000*
20 (FD)	4.0000 (4.0000)	4.0000	1.0000 (1.0000)	1.0000
21 (GC)	3.2017 (3.8762)	4.0000	2.1865 (2.7244)	3.0000
22 (GD)	2.4000 (4.1889)	4.0000*	1.5000 (2.6954)	2.0000*
23 (HC)	1.9239 (2.7732)	3.6667	1.4615 (2.1602)	3.0000
24 (HD)	2.5000 (5.3284)	3.5000*	2.0000 (2.0000)	2.0000

OHIO RIVER. MILEMARKER DESIGNATION: 938

CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
2 (AB)	4.8333 (10.4071)	9.0000*	1.1667 (1.9832)	2.0000
3 (AC)	11.6000 (20.3022)	15.0000*	1.5000 (2.5000)	2.0000*
4 (AD)	12.5000 (12.5000)	12.5000	2.0000 (2.0000)	2.0000
5 (BA)	2.7500 (8.3936)	8.0000*	1.3333 (2.3222)	2.0000*
6 (BB)	2.0000 (4.7285)	5.5000	1.4211 (2.3755)	2.0000*
7 (BC)	3.7029 (7.2410)	10.0000	1.9480 (3.0691)	5.0000
8 (BD)	5.7500 (10.9861)	11.5000	1.7857 (2.6091)	2.0000*
9 (CB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
10 (CC)	3.8267 (5.4645)	5.5000	2.2667 (3.9149)	5.0000
11 (CD)	4.0000 (8.0620)	6.5000*	1.6000 (2.6954)	2.0000*
12 (DB)	1.9231 (4.2376)	4.0000*	1.5385 (3.2648)	4.0000
13 (DC)	4.2594 (5.2476)	7.0000	2.9454 (3.9363)	7.0000
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	2.5000 (3.9142)	3.0000*	1.5000 (2.9142)	2.0000*
16 (EB)	1.9231 (4.2376)	4.0000*	1.5385 (3.2648)	4.0000
17 (EC)	4.2594 (5.2476)	7.0000	2.9454 (3.9363)	7.0000
18 (ED)	4.1875 (6.1830)	5.5000*	2.0000 (3.8516)	4.0000
19 (FC)	2.9067 (4.0877)	5.6667	2.4290 (3.7603)	7.0000
20 (FD)	3.5000 (4.6547)	4.0000*	1.0000 (1.0000)	1.0000
21 (GC)	2.3926 (3.4097)	4.3333	1.7341 (2.6298)	5.0000
22 (GD)	2.1429 (3.9385)	4.0000	1.4286 (2.4387)	2.0000*
23 (HC)	2.1410 (3.1233)	5.0000	1.7586 (2.6869)	5.0000
24 (HD)	1.8636 (3.4817)	3.0000*	1.4545 (2.4990)	2.0000*

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* TENNESSEE RIVER, MILEMARKER DESIGNATION: 22 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
6 (BB)	2.5000 (2.5000)	2.5000	2.0000 (2.0000)	2.0000
7 (BC)	3.4224 (6.0487)	8.0000	1.9795 (2.3092)	3.0000
8 (BD)	2.8571 (5.9255)	6.0000	1.2857 (2.2333)	2.0000*
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	2.9043 (4.5529)	6.0000	1.9149 (2.3110)	2.0000*
11 (CD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
12 (DB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
13 (DC)	3.9241 (4.8998)	6.0000	2.8209 (3.4337)	3.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
17 (EC)	3.9241 (4.8998)	6.0000	2.8209 (3.4337)	3.0000*
18 (ED)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000
19 (FC)	2.5495 (3.6733)	4.0000	2.2419 (3.2884)	3.0000*
20 (FD)	3.5000 (4.9142)	4.0000*	1.0000 (1.0000)	1.0000
21 (GC)	2.4292 (3.7229)	4.0000	1.6792 (2.5612)	3.0000
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.7649 (2.9658)	3.3333	1.6585 (2.5800)	3.0000
24 (HD)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000

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* TENNESSEE RIVER, MILEMARKER DESIGNATION: 296 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	3.1111 (4.7889)	4.0000*	2.3333 (4.6427)	3.0000*
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
6 (BB)	1.7500 (3.8713)	2.5000*	1.5000 (2.9142)	2.0000*
7 (BC)	3.6238 (7.0680)	11.0000	1.9861 (2.3943)	3.0000
8 (BD)	8.0000 (8.0000)	8.0000	2.0000 (2.0000)	2.0000
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	2.8690 (4.0718)	5.5000	2.0357 (2.4104)	3.0000
11 (CD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
12 (DB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
13 (DC)	4.3423 (5.6046)	8.0000	2.8455 (3.4538)	3.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
17 (EC)	4.3423 (5.6046)	8.0000	2.8455 (3.4538)	3.0000*
18 (ED)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
19 (FC)	2.8683 (4.2459)	6.0000	2.1713 (3.2866)	3.0000*
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	2.4333 (3.8537)	4.0000	1.5429 (2.5996)	3.0000
22 (GD)	0.0000 (0.0000)	1.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.7677 (2.9208)	3.3333	1.6223 (2.5551)	3.0000
24 (HD)	1.5000 (2.9142)	2.0000*	1.5000 (2.9142)	2.0000*

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* TENNESSEE RIVER. MILEMARKER DESIGNATION: 259 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
6 (BB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
7 (BC)	4.6705 (9.1915)	8.5000*	1.9091 (2.4847)	2.0000*
8 (BD)	2.5000 (3.6547)	3.0000*	1.0000 (1.0000)	1.0000
9 (CB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
10 (CC)	3.0000 (4.8257)	5.5000	1.9231 (2.4670)	2.0000*
11 (CD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
12 (DB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
13 (DC)	3.9932 (5.2890)	5.6667	2.7668 (3.4723)	3.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
17 (EC)	3.9932 (5.2890)	5.6667	2.7668 (3.4723)	3.0000*
18 (ED)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
19 (FC)	2.9990 (4.2533)	4.5000	2.2370 (3.3835)	3.0000*
20 (FD)	2.0000 (2.0000)	2.0000	2.0000 (2.0000)	2.0000
21 (GC)	2.3724 (3.9275)	4.0000	1.4375 (2.2807)	3.0000
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.5560 (2.5566)	3.3333	1.5474 (2.3669)	3.0000
24 (HD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000

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* TENNESSEE RIVER, MILEMARKER DESIGNATION: 274 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000
4 (AD)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000
5 (BA)	4.2500 (13.4424)	7.5000*	1.5000 (2.9142)	2.0000*
6 (BB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
7 (BC)	4.1579 (8.2743)	8.0000*	1.7632 (2.5575)	2.0000*
8 (BD)	2.5000 (3.9142)	3.0000*	1.0000 (1.0000)	1.0000
9 (CB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
10 (CC)	3.6429 (5.9952)	6.5000	1.9286 (2.4542)	2.0000*
11 (CD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
12 (DB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
13 (DC)	3.9683 (5.2847)	5.3333	2.8107 (3.5669)	3.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
17 (EC)	3.9683 (5.2847)	5.3333	2.8107 (3.5669)	3.0000*
18 (ED)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000
19 (FC)	3.0058 (4.2854)	4.5000	2.2151 (3.4098)	3.0000*
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	2.3242 (3.6890)	4.0000	1.5616 (2.4384)	3.0000
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.5167 (2.5221)	3.3333	1.4737 (2.2496)	3.0000
24 (HD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000

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* TENNESSEE RIVER. MILEMARKER DESIGNATION: 349 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
6 (BB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
7 (BC)	3.7941 (6.2759)	6.0000*	2.0000 (2.0000)	2.0000
8 (BD)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000
9 (CB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
10 (CC)	3.3065 (5.2123)	6.0000	1.9677 (2.3237)	2.0000*
11 (CD)	3.0000 (3.0000)	3.0000	1.0000 (1.0000)	1.0000
12 (DB)	1.0000 (1.0000)	1.0000	2.0000 (2.0000)	2.0000
13 (DC)	3.8836 (5.1879)	6.6667	2.7847 (3.6008)	3.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	1.0000 (1.0000)	1.0000	2.0000 (2.0000)	2.0000
17 (EC)	3.8836 (5.1879)	6.6667	2.7847 (3.6008)	3.0000*
18 (ED)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
19 (FC)	2.7965 (3.7333)	4.5000	2.6368 (3.5421)	3.0000*
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	2.2905 (3.8086)	4.0000	1.5541 (2.4853)	3.0000
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.9018 (3.2014)	6.6667	1.9464 (2.9947)	3.0000
24 (HD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000

TENNESSEE RIVER, MILEMARKER DESIGNATION: 424

CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
6 (BB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
7 (BC)	3.4861 (6.2208)	7.0000	1.9167 (2.3761)	2.0000*
8 (BD)	3.0000 (3.0000)	3.0000	1.0000 (1.0000)	1.0000
9 (CB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
10 (CC)	2.9762 (4.2236)	5.0000	1.9524 (2.3836)	2.0000*
11 (CD)	2.5000 (3.9142)	3.0000*	1.0000 (1.0000)	1.0000
12 (DB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
13 (DC)	3.1468 (4.5197)	5.6667	2.5532 (3.6133)	3.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
17 (EC)	3.1468 (4.5197)	5.6667	2.5532 (3.6133)	3.0000*
18 (ED)	1.5000 (2.9142)	2.0000*	1.0000 (1.0000)	1.0000
19 (FC)	2.6717 (3.6379)	4.3333	2.5482 (3.5140)	3.0000*
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	2.2239 (3.7412)	4.0000	1.5821 (2.7312)	3.0000
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.5923 (2.5715)	3.0000	1.7482 (2.7022)	3.0000
24 (HD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000

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* TENNESSEE RIVER, MILEMARKER DESIGNATION: 471 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	2.5000 (3.9142)	3.0000*	1.0000 (1.0000)	1.0000
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
6 (BB)	1.8333 (3.3609)	3.5000*	1.3333 (2.4880)	2.0000*
7 (BC)	3.2143 (5.6478)	5.5000*	1.7143 (2.6619)	2.0000*
8 (BD)	1.5000 (2.9142)	3.0000*	1.0000 (1.0000)	1.0000
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	2.8333 (3.2277)	3.0000*	2.3333 (3.2761)	3.0000*
11 (CD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
12 (DB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
13 (DC)	3.1794 (4.1420)	5.0000	2.5551 (3.6322)	4.0000
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
17 (EC)	3.1794 (4.1420)	5.0000	2.5551 (3.6322)	4.0000
18 (ED)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
19 (FC)	2.6875 (4.2162)	4.3333	2.0938 (3.2376)	3.0000*
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	2.2361 (2.8759)	3.0000	1.2083 (2.1769)	3.0000
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.9053 (3.0051)	3.0000*	1.1818 (2.1143)	3.0000
24 (HD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000

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* TENNESSEE RIVER, MILEMARKER DESIGNATION: 529 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	2.0000 (2.0000)	2.0000	2.0000 (2.0000)	2.0000
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
6 (BB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
7 (BC)	2.8125 (4.1875)	4.0000*	1.5000 (2.9639)	3.0000
8 (BD)	6.5000 (6.5000)	6.5000	2.0000 (2.0000)	2.0000
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	3.0000 (3.0000)	3.0000	1.0000 (1.0000)	1.0000
11 (CD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
12 (DB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
13 (DC)	3.0493 (3.7794)	4.3333	2.3760 (3.1897)	3.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
17 (EC)	3.0493 (3.7794)	4.3333	2.3760 (3.1897)	3.0000*
18 (ED)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
19 (FC)	2.7130 (4.1599)	4.0000*	2.0556 (3.3519)	3.0000*
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	2.1449 (2.9543)	3.0000	1.1304 (2.0201)	3.0000
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.8537 (2.8594)	3.0000	1.0976 (1.6839)	2.0000
24 (HD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000

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* TENNESSEE RIVER, MILEMARKER DESIGNATION: 602 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
6 (BB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
7 (BC)	3.0000 (3.0000)	3.0000	1.0000 (1.0000)	1.0000
8 (BD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	2.6667 (3.7621)	3.0000*	1.3333 (2.2278)	2.0000*
11 (CD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
12 (DB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
13 (DC)	2.4180 (3.0993)	3.5000	1.3934 (1.9275)	2.0000
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
17 (EC)	2.4180 (3.0993)	3.5000	1.3934 (1.9275)	2.0000
18 (ED)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
19 (FC)	1.6731 (2.6403)	3.0000	1.3462 (1.8667)	2.0000
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	2.0833 (3.0585)	3.0000*	1.0556 (1.5176)	2.0000
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.8523 (2.8850)	3.0000	1.1136 (1.6772)	2.0000
24 (HD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000

TENNESSEE RIVER. MILEMARKER DESIGNATION: 602

CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
6 (BB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
7 (BC)	3.0000 (3.0000)	3.0000	1.0000 (1.0000)	1.0000
8 (BD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	2.6667 (3.7621)	3.0000*	1.3333 (2.2278)	2.0000*
11 (CD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
12 (DB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
13 (DC)	2.4180 (3.0993)	3.5000	1.3934 (1.9275)	2.0000
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
17 (EC)	2.4180 (3.0993)	3.5000	1.3934 (1.9275)	2.0000
18 (ED)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
19 (FC)	1.6731 (2.6403)	3.0000	1.3462 (1.8667)	2.0000
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	2.0833 (3.0585)	3.0000*	1.0556 (1.5176)	2.0000
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.8523 (2.8850)	3.0000	1.1136 (1.6772)	2.0000
24 (HD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000

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* CUMBERLAND RIVER, MILEMARKER DESIGNATION: 30 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
6 (BB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
7 (BC)	3.1308 (4.6887)	7.5000	1.9692 (2.2136)	2.0000*
8 (BD)	4.1667 (10.0261)	7.5000*	1.3333 (2.4880)	2.0000*
9 (CB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
10 (CC)	2.4615 (3.4511)	3.0000*	1.9231 (2.4724)	2.0000*
11 (CD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
12 (DB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
13 (DC)	3.5752 (4.6976)	6.3333	2.8028 (3.5665)	3.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
17 (EC)	3.5752 (4.6976)	6.3333	2.8028 (3.5665)	3.0000*
18 (ED)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
19 (FC)	2.2917 (3.7428)	4.0000	2.0833 (3.3681)	3.0000*
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	2.1190 (3.1076)	3.0000*	2.0000 (3.1832)	3.0000*
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.7186 (2.6032)	3.3333	1.5658 (2.3670)	3.0000
24 (HD)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000

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* TENNESSEE RIVER, MILEMARKER DESIGNATION: 602 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
6 (BB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
7 (BC)	3.0000 (3.0000)	3.0000	1.0000 (1.0000)	1.0000
8 (BD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	2.6667 (3.7621)	3.0000*	1.3333 (2.2278)	2.0000*
11 (CD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
12 (DB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
13 (DC)	2.4180 (3.0993)	3.5000	1.3934 (1.9275)	2.0000
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
17 (EC)	2.4180 (3.0993)	3.5000	1.3934 (1.9275)	2.0000
18 (ED)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
19 (FC)	1.6731 (2.6403)	3.0000	1.3462 (1.8667)	2.0000
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	2.0833 (3.0585)	3.0000*	1.0556 (1.5176)	2.0000
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.8523 (2.8850)	3.0000	1.1136 (1.6772)	2.0000
24 (HD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000

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* CUMBERLAND RIVER, MILEMARKER DESIGNATION: 148 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	3.0000 (3.0000)	3.0000	1.0000 (1.0000)	1.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
6 (BB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
7 (BC)	3.1092 (4.5905)	5.5000	2.0345 (2.4029)	3.0000
8 (BD)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000
9 (CB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
10 (CC)	2.6429 (3.8864)	4.0000	1.7143 (2.5185)	2.0000*
11 (CD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
12 (DB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
13 (DC)	2.7801 (3.4534)	5.0000	2.4206 (3.2427)	3.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
17 (EC)	2.7801 (3.4534)	5.0000	2.4206 (3.2427)	3.0000*
18 (ED)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
19 (FC)	2.4321 (3.5306)	4.0000	2.1692 (3.1915)	3.0000*
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	2.3576 (3.3576)	4.0000	2.1091 (3.1534)	3.0000*
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.6316 (2.5737)	4.0000	1.5228 (2.3863)	3.0000
24 (HD)	1.5000 (1.5000)	1.5000	2.0000 (2.0000)	2.0000

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* CUMBERLAND RIVER, MILEMARKER DESIGNATION: 216 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	1.0000 (1.0000)	1.0000	2.0000 (2.0000)	2.0000
3 (AC)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
6 (BB)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
7 (BC)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
8 (BD)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000
11 (CD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
12 (DB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
13 (DC)	1.5524 (2.1018)	3.0000	1.3524 (1.8109)	2.0000
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
17 (EC)	1.5524 (2.1018)	3.0000	1.3524 (1.8109)	2.0000
18 (ED)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
19 (FC)	1.4268 (2.1693)	2.0000*	1.1220 (1.7034)	2.0000
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	1.1538 (1.4974)	2.0000	1.2564 (1.7802)	2.0000
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.0778 (1.6357)	3.0000	1.0556 (1.4606)	2.0000
24 (HD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000

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* GREEN RIVER, MILEMARKER DESIGNATION: 9 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
6 (BB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
7 (BC)	2.0000 (2.8944)	3.0000	1.1818 (1.9660)	2.0000
8 (BD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	2.2000 (3.6866)	3.0000*	1.4000 (2.3165)	2.0000*
11 (CD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
12 (DB)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000
13 (DC)	2.0060 (2.1078)	3.0000	1.8735 (2.0276)	2.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
16 (EB)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000
17 (EC)	2.0060 (2.1078)	3.0000	1.8735 (2.0276)	2.0000*
18 (ED)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
19 (FC)	1.1310 (1.6044)	2.0000	1.2500 (1.7059)	2.0000
20 (FD)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
21 (GC)	1.2000 (2.0485)	2.0000*	1.2000 (2.0485)	2.0000*
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.1667 (1.7440)	1.5000*	1.3333 (2.4880)	2.0000*
24 (HD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000

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* GREEN RIVER. MILEMARKER DESIGNATION: 63 *

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CATEGORY	AVERAGE NUMBER OF BARGES IN COLUMN (AVERAGE NUMBER OF BARGES IN COLUMN PLUS 2 STD DEVs)	COLUMN MAXIMUM	AVERAGE NUMBER OF BARGES IN THE ROW (AVERAGE NUMBER OF BARGES IN THE ROW PLUS 2 STD DEVs)	ROW MAXIMUM
1 (AA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
2 (AB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
3 (AC)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
4 (AD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
5 (BA)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
6 (BB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
7 (BC)	2.7143 (4.2080)	4.0000*	1.2857 (2.2333)	2.0000*
8 (BD)	3.0000 (3.0000)	3.0000	1.0000 (1.0000)	1.0000
9 (CB)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
10 (CC)	2.0000 (2.0000)	2.0000	2.0000 (2.0000)	2.0000
11 (CD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
12 (DB)	2.0000 (2.0000)	2.0000	1.3333 (2.3874)	2.0000*
13 (DC)	1.9876 (2.1604)	2.5000	1.7917 (2.0048)	2.0000*
14 (DD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
15 (EA)	2.0000 (2.0000)	2.0000	1.0000 (1.0000)	1.0000
16 (EB)	2.0000 (2.0000)	2.0000	1.3333 (2.3874)	2.0000*
17 (EC)	1.9876 (2.1604)	2.5000	1.7917 (2.0048)	2.0000*
18 (ED)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
19 (FC)	1.0000 (1.0000)	1.0000	1.1053 (1.5221)	2.0000
20 (FD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
21 (GC)	1.5000 (2.9142)	2.0000*	1.0000 (1.0000)	1.0000
22 (GD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000
23 (HC)	1.0000 (1.0000)	1.0000	1.0000 (1.0000)	1.0000
24 (HD)	0.0000 (0.0000)	0.0000	0.0000 (0.0000)	0.0000

APPENDIX E: REFERENCES

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