APPENDIX B

PRINCIPAL DIMENSIONS AND QUANTITIES

Total length of Bridge and Approaches	5750 feet
Length of Louisville Approach	840 feet
Length of Main Structure	3740 feet
Length of Jeffersonville Approach	1170 feet
Width of Bridge	55 feet
Width of Roadway, between curbs	38 feet
Height of Towers, above pool stage	180 feet
Clearance of Bridge, above pool stage	80 feet
Clearance of Bridge, above 1913 high water level	51 feet
Depth of Deepest Foundation, below pool stage	66 feet
Weight of Main Superstructure, per lineal foot	6900 pounds
Live Load Capacity of Main Superstructure, per lineal foot	3350 pounds
Total weight of Main Superstructure, including Roadway Paving and Sidewalk Slabs	20368 tons

SUBSTRUCTURE QUANTITIES

	Main Piers	Louisville Approach	Jeffersonville Approach	Totals
Granite Masonry	4,100 cu. yds.			4,100 cu. yds.
Limestone Masonry		461 cu. yds.	1,542 cu. yds.	2,003 cu. yds.
Concrete Masonry	23,501 cu. yds.	2,060 cu. yds.	1,700 cu. yds.	27,261 cu. yds.
Reinforced Concrete Piles		8,236 lin. ft.	8,610 lin. ft.	16,846 lin. ft.

SUPERSTRUCTURE QUANTITIES

	Wrought and Structural Steel
Main Structure	24,960,677 pounds
Louisville Approach	1,504,977 pounds
Jeffersonville Approach	1,883,095 pounds
Total	28,348,749 pounds

PAVING QUANTITIES

	Roadway Paving	Sidewalk Paving	Total Paving
Main Structure	15,741 sq. yds.	6,222 sq. yds.	21,963 sq. yds.
Louisville Approach	5,154 sq. yds.	1,390 sq. yds.	6,544 sq. yds.
Jeffersonville Approach	10,348 sq. yds.	2,746 sq. yds.	13,094 sq. yds.
Total	31,243 sq. yds.	10,358 sq. yds.	41,601 sq. yds.

APPENDIX C

STATEMENT OF COSTS

LOUISVILLE BRIDGE COMMISSION
315 Illinois Avenue
JEFFERSONVILLE, INDIANA
May 26, 1930

The Secretary of War,
United States of America,
Washington, D. C.

Sir:

Under an act of the General Assembly of the Commonwealth of Kentucky approved February 16, 1928, the Louisville Bridge Commission was organized on March 23, 1928, and proceeded to construct the Louisville Municipal Bridge authorized by Public No. 73, 70th Congress (H. R. 9660). The first caisson was sunk on June 30, 1928; the bridge was opened for traffic November 1, 1929, and was completed on May 23, 1930. The following is a statement of the cost of construction.

Funded Debt Discount	$ 440,000.00	
Interest paid ($387,264.94) less interest received on bank deposits ($128,545.45)	258,719.49	
Trustee's fees	4,000.00	
Printing, authentication & delivery of bonds	3,948.90	
Registrar's Fees	1,003.70	
Traffic Survey	15,000.00	
TOTAL COST OF FINANCING		$ 722,672.09
Purchase price of land and rights less rents received	362,927.46	
Damages to owners and tenants	32,380.00	
Legal Fees, Court Costs, etc.	1,724.52	
Title Insurance, Surveys, etc.	14,205.10	
Taxes	4,316.08	
Removal of obstructions	22,729.58	
TOTAL COST OF LAND AND RIGHTS		438,282.74
Preliminary Borings	8,261.53	
Eight Main Piers	729,564.15	
Superstructure	1,792,378.92	
Approaches	629,502.95	
Lighting and electrical equipment	44,997.28	
Administration Bldg., Toll Houses, etc.	133,099.55	
Landscaping	4,081.30	
Architects' Fees	16,797.74	
Engineers' Fees	182,094.28	
TOTAL COST OF CONSTRUCTION		3,540,777.70

Administrative salaries & attendance fees	11,496.20	
Employees salaries	2,961.83	
Advertising	20,535.71	
Postage	190.25	
Rent for temporary office	1,202.50	
Printing and stationery	1,468.82	
Telephone and Telegraph	418.12	
Office Supplies	256.43	
Legal Fees	13,113.42	
Auditors' Fees	1,472.50	
Traveling Expenses	550.01	
Automobile Insurance and expense	196.31	
Traffic Surveys	2,579.28	
Insurance on Piers	943.80	
Miscellaneous General Expense	1,562.27	
TOTAL COST OF ADMINISTRATION		58,947.45
Office Furniture and Fixtures	2,308.74	
Motor Vehicle Equipment	1,974.78	
Uniforms and Personal Equipment	1,568.51	
Miscellaneous Bridge Equipment	4,555.74	
TOTAL COST OF MISCELLANEOUS EQUIPMENT		10,407.77
TOTAL COST OF BRIDGE		$4,771,087.75
Retained for future Capital expenditures in SPECIAL CAPITAL FUND		50,000.00
GRAND TOTAL COST OF BRIDGE		$4,821,087.75

Respectfully submitted,

LOUISVILLE BRIDGE COMMISSION

By (Signed) G. O. Boomer
Chairman

(Signed) E. H. West
Secretary-Treasurer

APPENDIX D

ABSTRACTS FROM SPECIFICATIONS

CONCRETE

Portland Cement

All cement used in this work shall be Portland Cement of reliable brands which have been in successful use on large engineering works for not less than two years.

The cement shall be delivered in suitable bags or barrels, with the brand and name of manufacturers and point of origin plainly marked thereon. A bag shall contain not less than 94 pounds net. A barrel shall contain 376 pounds, net.

Provision shall be made by the Contractor for storing all cement in a dry place and in such a manner as to permit easy access for proper inspection and identification of each shipment. Sufficient storage shall be provided either in reserve bins at the mill, or at the site, to permit all cement to be held for the results of the tests without delay to the work.

All Portland Cement will be tested according to the Methods of Tests, and shall meet the requirements of the Standard Specifications for Portland Cement of the American Society for Testing Materials (Serial Designation: C 9-26). Samples of each lot shall show practically uniform results in tests; marked deviation from such results will be considered cause for rejection, even though test requirements may be otherwise fulfilled.

Cement shall not be used in the work until it has passed the seven-day and twenty-eight-day tests, except with the permission of the Engineers.

All cement shall be subject to a check test at any time.

Fine Aggregate for Concrete

Sand shall be composed of clean, hard, durable, silicious particles well graded from fine to coarse, and shall not contain more than 3 per cent, by weight, of clay, silt or any other material, determined by elutriation. It shall be free from clay, coal, salt and all other organic or other injurious matter. The grains shall be of such sizes that all shall pass a screen having ¼ inch openings and not more than 15% shall pass a No. 50 screen.

When mixed, according to standard methods, in the proportions of one (1) part cement to three (3) parts sand, the resulting mortar at the age of seven days and of twenty-eight days shall have a tensile strength of at least one hundred per cent of the tensile strength developed in mortar mixed in the same proportions and made of the same cement and Standard Ottawa Sand. The cement used in these tests shall be a sample of the accepted cement to be used in the construction.

Sand when tested in accordance with the "Standard Method of Test for Organic Impurities in Sands for Concrete," (Serial Designation: C 40-27), of the American Society for Testing Materials, shall show a color not darker than the standard color.

Opportunity shall be given for sampling fine and coarse aggregate at least 24 hours before they are required for use in the work.

Coarse Aggregate For Concrete

The coarse aggregate shall be clean, hard, cubical, crushed natural stone from ledge or quarry approved by the Engineers, or clean, hard, natural or crushed gravel from an approved source of supply.

The coarse aggregate shall be uniformly graded in size from ¼ inch to 2 inches, screened of dust and particles less than ¼ inch in size. Not more than 5% of the coarse aggregate furnished shall pass through a No. 4 screen.

Water

Water for concrete shall be free from oil, acid, salt, alkali, vegetable matter or other deleterious substances. Ohio River water may be used, provided that it meets the above requirements and that the points from which it is taken are approved by the Engineers.

CONCRETE

Concrete used on the work shall be a mixture of Portland Cement, fine aggregate (sand), coarse aggregate (broken stone or gravel) and clean water. The proportions will be based on the volume of dry and rodded aggregate except that one bag of Portland Cement weighing ninety-four (94) pounds shall be considered to contain one cubic foot. The Contractor shall take such measures as may be necessary to maintain the required proportions under varying conditions during the progress of the work. The materials shall be of such quality and so graded as to size and so thoroughly mixed that the resulting concrete shall have the following average compressive strength at 28 days when tested as hereinafter specified:

CONCRETE, CLASS A, SUBSTRUCTURE, NOMINAL MIX 1:2:4

1 Part Portland Cement
2 Parts Sand
4 Parts Broken Stone or Gravel
2,000 lbs. per sq. inch

CONCRETE, CLASS B, SUBSTRUCTURE, NOMINAL MIX 1:2½:5

1 Part Portland Cement
2½ Parts Sand
5 Parts Broken Stone or Gravel
1,500 lbs. per sq. inch

CONCRETE, CLASS A, APPROACHES AND ROADWAY, NOMINAL MIX 1:2:3

1 Part Portland Cement
2 Parts Sand
3 Parts Broken Stone or Gravel
2,500 lbs. per sq. inch

CONCRETE, CLASS B, APPROACHES AND ROADWAY, NOMINAL MIX 1:2:4

1 Part Portland Cement
2 Parts Sand
4 Parts Broken Stone or Gravel
2,000 lbs. per sq. inch

The above proportions are based upon the sand and coarse aggregate being so graded in size as to yield the maximum strengths for the specified proportions of cement to total aggregate. If they are not so graded, the proportion of sand to coarse aggregate may be varied at the discretion of the Engineers, without extra compensation to the Contractor; the sum of the parts of total aggregate per part of cement to be as above specified.

At frequent intervals during the conduct of the work the Contractor shall make, under the supervision of the Engineers, test cylinders from the concrete as mixed for the work which shall be tested after 28 days. Test specimens shall be made in accordance with the "Standard Methods of Making and Storing Specimens of Concrete in the Field," (C-31-21) of the American Society for Testing Materials (a copy of which is on file in the office of the Engineers). If these test cylinders fail to meet the test requirements, the Contractor shall make such changes in the materials, mixture or methods as may, in the opinion of the Engineers, be necessary to secure the specified strength.

The Contractor shall employ such approved devices as will enable the proportions of all ingredients to be accurately measured and kept constant for all batches. The mixing plant shall be equipped with approved batch boxes and water control devices.

All concrete shall be mixed in rotating batch mixers of a type and capacity approved by the Engineers. After all of the material required for a batch is placed in the drum, the drum shall be revolved at an approved rate of speed not less than 1½ minutes.

The mixer shall be controlled by an automatic timing device which shall lock the discharge lever during the full period of mixing. Upon the completion of the mixing period, such batch shall be promptly and completely discharged from the drum. No material will be allowed to remain in the drum to mix with a succeeding batch.

The consistency of the concrete shall be, at all times, as directed by the Engineers. In general, the water used shall be the minimum amount necessary to secure a concrete that may be readily worked into a homogeneous mass and into good contact with reinforcement, forms, stone and steel work.

The mixing plant shall be so equipped that the total amount of water per batch can be kept constant after determining the proper consistency to be used, and the ratio between the cement and total water content can be kept constant or varied at the direction of the Engineers.

Concrete mixed and deposited during freezing weather shall have a temperature of not less than 60 degrees Fahrenheit, nor more than 100 degrees Fahrenheit. Suitable means shall be provided for maintaining a temperature of at least 60 degrees Fahrenheit for not less than 72 hours after placing, or until the concrete has thoroughly hardened. The methods of heating the materials and protecting the concrete shall be approved by the Engineers. Salt, chemicals, or other foreign materials shall not be used to prevent freezing.

Before starting to place concrete, all hardened concrete, laitance, and any foreign matter shall be removed from the mixing and conveying equipment, from the reinforcing steel, and any forms against which the concrete is to be placed. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which prevent the separation or loss of its ingredients.

At any construction joints in exposed surfaces, means approved by the Engineers shall be used to the end that the joint may show a straight line and be free from laitance or discoloration of any nature.

Before depositing new concrete on or against concrete that has set, the surfaces of the set concrete shall be roughened, thoroughly cleaned, saturated with water, and slushed with a coating of neat cement grout against which the new concrete shall be placed before the grout has attained its initial set.

Keyways or other means shall be used between successive pours to secure a proper bonding of the materials.

Under no circumstances shall concrete be used after it has begun to set and any material thus injured shall be immediately wasted and removed from the site.

Concrete shall be deposited continuously and as rapidly as practicable until the unit of operation, as approved by the Engineers, is completed.

Concrete for roadway and footwalk slabs shall in all cases be dumped upon iron plates and in no cases directly into forms. Concrete shall not be spouted or chuted to place in the forms.

Special attention shall be given to securing concrete of maximum density and strength, free from voids, stone pockets and air or water bubbles, and completely in contact with all parts of the reinforcement. The Contractor shall provide and operate continuously at each point along the bridge where concrete is being deposited, pneumatic hammers or other approved devices for vibrating the work and reinforcement.

Should it be necessary to place concrete under water in order to seal cofferdams, the methods and equipment to be used shall be submitted to and be approved by the Engineers before the work is started. Concrete shall be deposited by approved tremie or drop-bottom buckets in a manner that will prevent the washing of the cement from the mixture and minimize the formation of laitance and the segregation of materials.

The concrete footing of each pier shall as far as practicable be placed in a continuous operation, keeping the top surface as nearly level as possible. The work shall be carried on with sufficient rapidity to prevent separation into layers. If it becomes necessary to interrupt the pouring and the concrete becomes set, then suitable keyways or other satisfactory means shall be provided to bond together the successive layers of concrete.

If tremie methods are used, the tremie shall be water-tight and sufficiently large to permit a free flow of concrete. It shall be kept filled at all times during depositing.

If a drop-bottom bucket be used, it shall have a capacity of not less than 1 cubic yard and shall be of such type that it cannot be dumped until it rests on the surface upon which the concrete is to be deposited. The bucket shall be designed and equipped with such features as will result in the minimum washing of the concrete.

Concrete Piles

The footings under the pedestals and foundations of the approaches are to be supported by concrete piles. These concrete piles shall be precast, of a type approved by the Engineers, made and driven in accordance with the specifications of the American Association of State Highway Officials, a copy of which is on file in the office of the Engineers. Finished concrete piles in place must be capable of supporting a load of fifty tons per pile. Before starting any of the concrete pile construction, the Contractor shall submit to the Engineers for their approval the details of the pile he proposes using.

Reinforcing Steel

All reinforcement bars shall be of a deformed type approved by the Engineers.

All reinforcing steel, except that used in fabricated reinforcing trusses for the roadway slab, shall meet the requirements of the latest Standard Specifications for Billet Steel Reinforcing Bars, Intermediate Grade, of the American Society for Testing Materials, except as follows:

All steel shall be made by the open hearth process.

Bars rerolled from steel car axles will be accepted if they conform in all other respects to the above specifications.

Steel used in the fabricated reinforcing trusses for the roadway slab shall have the properties specified below for "medium" structural steel.

The reinforcing trusses shall be cut out of a solid section, as indicated on the contract drawings, or if not so cut, shall have web members positively attached to the chord bars. The attachment of the web members to the chord bars shall develop the specified yield point strength of the web members without becoming loose.

The metal in the reinforcing trusses shall nowhere have a thickness less than 3/16 inch. The width of the chord bars shall not exceed 7/8 inch. Details of the truss and method of fabrication shall meet the approval of the Engineers.

Where bent reinforcing bars are required they shall be accurately bent to their required shape and dimensions before placing in the forms. Where it is necessary to splice reinforcing steel, the bars shall be lapped not less than forty times their diameter or side and the adjoining ends securely tied together. Reinforcing steel shall be free from mill scale, grease, injurious rust or other foreign substances when embedded in the concrete.

The reinforcing steel shall be placed in the forms to the position shown by the detail plans, and held in such position during the placing of the concrete by adequate means. The bars shall be firmly secured at each intersection. Reinforcing steel shall be inspected in place before any concrete is deposited.

The Contractor shall support the steel reinforcing trusses on substantial steel chairs or spacers of approved pattern placed on each stringer. These chairs shall be constructed to insure not less than 3/4 inch of concrete below the steel reinforcing trusses and to provide for the accurate spacing of the trusses. The lower longitudinal rods shall be wired to the trusses at not less than 10 per cent of the points of intersection of rods and trusses. The upper longitudinal rods shall be tightly wired to the upper chords of the trusses at not less than 50 per cent of the points of intersection, so that both rods and trusses will be held firmly against displacement. Steel chairs shall also be used to support the reinforcing of the footwalk slabs.

Stone Masonry

Starting at elevation 415 on each footing of piers two to seven, inclusive, and at the elevations shown on the plans for piers one and eight, the construction of the piers will consist of stone backed by concrete so that there will be no exposed concrete surfaces on any portion of the piers.

The stone material as specified elsewhere may be of Granite or of Indiana Limestone laid in regular, coursed masonry as shown on the contract plans and specified herein.

The masonry will be either "Dressed" or "Rock Faced," in accordance with the desired finish.

Granite facing, except as noted below for the upstream noses of piers two to seven, inclusive, unless otherwise shown on contract drawings, shall have a minimum depth of twelve inches for stretchers and twenty-four inches for headers.

Indiana Limestone facing, except as noted below for the upstream noses of piers two to seven, inclusive, unless otherwise shown on contract drawings, shall have a minimum depth of fifteen inches for stretchers and thirty inches for headers.

The backs of both Granite and Indiana Limestone facing shall be left rough and irregular so as to provide a good bond to the concrete backing.

For either Granite or Limestone faced piers, all courses of the upstream curved noses of piers two to seven, inclusive, where the rise of the course is two feet or less, the depths of the stretchers measured on the bottom bed joint lines shall be equal to the rise of the course; where the rise of the course is greater than two feet, the depth of the stretchers measured on the bottom bed joint lines shall be not less than two feet. The depths of the headers in the noses measured on the bottom bed joint lines shall be not less than one foot greater than the adjacent stretchers.

Headers shall be placed over stretchers. No header shall be laid over a joint, and no joint shall come over a header. In general, every third stone shall be a header.

The vertical joints shall be so arranged that the lap of any stone over another in the course below shall be not less than one half the rise of the lower course.

The faces of the upstream noses are to be machine finished or dressed stone. The downstream noses may be machine finished or dressed faces or may be rock faced at the option of the contractor or quarry furnishing the stone.

Unless shown otherwise on the contract plans the length of stretchers shall not be less than two times nor more than three times the rise of the course, and the length of headers shall generally be not less than one and one-fourth and not more than one and three-fourths times the rise of the course.

Where dressed stone is shown by the contract drawings either coarse four-cut or medium machine pointed finished may be furnished, at the option of the Contractor.

The exposed surfaces shall be cut true to the lines indicated by the contract drawings. There shall be no variation from the true face greater than 3/16 inch above or below.

The tooling of four-cut work shall, generally, be vertical except in cases of washes where the tooling shall be at right angles to the wall face. Regular machine finish will be accepted for Indiana Limestone for all dressed faces.

In Rock Face masonry, a bold and irregular rock face is desired. The amount of projection shall vary between 2 inches and 3 inches per foot of rise. The edges of the stones shall be pitched to reasonably true lines, the variation from the pitch line not to exceed 1/4 inch either way. There shall be no depressions in the face back of the plane of the pitch lines. Neither dog holes nor drill marks shall show on the face of any stone.

Bottom beds shall be cut full for not less than three inches in from the pitch lines with no depressions or projections exceeding one-fourth inch from the plane of the stone. The remainder of the bottom bed shall be roughed off with not more than one-half the area of the bed having depressions of more than one inch below the plane of the bed. No depressions in the bottom bed shall be greater than 3 inches and any depressions greater than one inch shall not be less than 6 inches from the pitch lines. All bottom beds shall have a reasonable area of bearing spots back of the face line.

Top beds shall be cut full for not less than 3 inches in from the pitch line. Not more than two-thirds of the remaining area shall have depressions greater than one inch. No depressions shall exceed in depth one-quarter of the distance of such depression from the pitch line. All bridge seats for receiving the end bearing shoes of steel spans shall be dressed to within 1/32 inch of the true plane, after the stone is set in its final position.

Vertical joints shall be cut full for not less than 3 inches from the pitch line. The balance of the joint may fall under the square not to exceed 4 inches.

Each stone stretcher shall be tied to the concrete backing by two anchors having a cross section not less than ½ sq. inch each. The anchors shall extend at their ends not less than 2 inches vertically into the stone and into the concrete. Lewis holes may be used for anchor holes, provided that the anchors extend not less than 8 inches into the backing.

All anchors, dowels and clamps required shall be furnished of iron thoroughly galvanized after bending. The detail drawings for the stone work shall show the size and dimension of all anchors, dowels or clamps to be placed in the finished work.

The proportions of the mortar shall be one part Portland Cement and two parts sand. Mortar shall be used within thirty minutes after mixing. No re-tempering of mortar will be permitted. Sand used in mortar shall meet the specifications for fine aggregate for concrete with the added requirement that it shall pass a ⅛ inch square mesh sieve.

Before setting, all stones shall be washed clean and shall be wet when set. Stones shall be well bedded in cement mortar. Heavy hammering on stone will not be permitted. Generally, the stones shall be set and backed up with concrete one or two courses at a time. Stone becoming loose after the mortar is set shall be reset in fresh mortar.

Before the mortar has set, all face joints shall be raked out to a depth of 1½ inches, washed and pointed with mortar of one part approved Portland Cement and one part approved sand as dry as can be properly worked, with a caulking tool and the surface of the joints struck with an approved tool. All pointing shall be sprinkled and kept wet at the surface until three days after it is finished. No pointing shall be done when there is any chance of freezing.

During shipping and storage, Lewis holes shall be temporarily filled to prevent the collection of water and freezing. No masonry shall be laid in freezing weather, unless permitted by the Engineers, and unless the work is protected and materials warmed so as to insure that the temperature of the masonry does not fall below 50 degrees Fahrenheit until the mortar is thoroughly set.

Granite for the facing of the piers shall be sound and durable and free from structural defects. Stone shall be taken from quarries whose output is, in the opinion of the Engineers, uniform and reliable in quality and ample in quantity to meet the demands of the work. Evidence shall be furnished of its satisfactory endurance to long exposure.

Indiana Limestone for use in this work shall be sound, durable and free from structural defects. It shall all be of the kind known as "Indiana Oolitic Limestone" quarried in Lawrence or Monroe Counties, Indiana, or other stone of equal quality. All stone shall be from quarries the product of which has been tested by the U. S. Bureau of Standards and is recommended by them as suitable for this class of work.

All limestone must be of a uniform grade and texture, with a hard dense structure, well seasoned and free from all quarry sap. It shall be cut from stock which has been quarried well in advance of the cutting and finishing. No fresh quarried stone will be accepted.

The color of the stone in any one piece of work must generally be uniform in appearance but any color tone of stone known to the trade as "Buff," "Variegated," or "Grey" may be used provided the selection and layout of the stone is such as to give a pleasing, uniform variation in the color of the completed work.

Particular care must be taken in the selection of stone to be used in the architectural pylons. It must be uniform in color, texture and density and suitable for carving the completed ornamental work on the pylons. Bearing stones under structural steel shall be selected hard stones.

Indiana Limestone must be prevented from absorbing stain from concrete coming in contact with stone by painting all such surfaces with two coats of an approved brand of bituminous base waterproofing material or other clear waterproofing material which may be approved by the Engineers. All surfaces of limestone below grade, against which fill is to be placed, must be protected in a similar manner.

The face of all exposed stone work under this contract shall be thoroughly cleaned upon

completion with soap powder boiled in clean water and applied vigorously with stiff fibre brushes and then drenched with clear water. The use of wire brushes or acids will not be permitted under any circumstances for cleaning the stone work.

All limestone work may be set with mortar made from an approved brand of masonry cement, or a mixture to consist of one part of dry hydrated lime, three parts of sharp, washed clean sand, with the addition of stainless cement in an amount equal to fifteen per cent of the volume of the lime used; the cement to be added and thoroughly worked into the mixture in small batches just prior to use. The stainless cement used must be of a brand approved by the Engineers.

If approved masonry cement is used for beds and vertical joints, the pointing must be done with the above mixture of mortar, prepared with stainless cement.

STRUCTURAL STEEL

Wrought and Structural Steel

All steel shall be made by the open hearth or electric furnace process, and no steel shall be made at works which have not been in successful operation for at least one year; but this provision will not be held to exclude new furnaces erected in connection with old works.

All steel shall be of uniform quality of each class. It shall be straight, without buckles or kinks, and free from injurious seams, cracks, excessive scale or pitting and other defects.

A sufficient discard shall be made from each ingot to secure freedom from piping and undue segregation.

A variation in cross section or weight of wrought material of more than 2½ per cent from that specified may be cause for rejection. This does not apply to wide sheared plates, for which an allowance will be made in accordance with the latest specifications of the American Railway Engineering Association.

Pins over four inches in diameter shall be forged under hammer or by hydraulic press.

All pins and forgings shall be annealed.

Every finished piece of steel shall be distinctly stamped with the melt number, and steel for pins shall have the melt number stamped on the ends. Rivet and lacing steel and small pieces of plates and shapes may be shipped in bundles, securely wired together, with the melt number on a metal tag attached.

Universal plates and shapes shall be hot stamped. Sheared plates shall be stamped with steel dies after laying out. Painting heat numbers will not be allowed.

All blooms and billets rolled at one mill and shipped to another for rolling into finishd material shall have their respective heat numbers distinctly stamped while hot.

An analysis to determine the quantity of the different elements shall be made by the manufacturer from a test ingot taken during the pouring of each melt. The drillings for this purpose shall be taken at least ½ inch below the surface of the test ingot. A copy of this analysis, certified to by the manufacturer's chief chemist, shall be furnished to the Inspector.

Check analysis of the finished product may be made by the Engineers. The results of such check analysis shall not exceed the requirements specified for sulphur and phosphorous in the test ingot analysis by more han 25 per cent.

The various grades of wrought and structural steel shall be as shown in the following table and shall conform to the following requirements as to chemical and physical percentages of elements. They shall contain not more than the following percentages of elements.

WROUGHT AND STRUCTURAL STEEL*

	Carbon Steel		Pin Steel	Silicon Steel
	Medium	Rivet		
Phosphorus Acid Process Basic Process Sulphur Silicon	0.06 0.04 0.05	0.04 0.04 0.045	0.06 0.04 0.05	0.06 0.04 0.05 * 0.45
Tensile Strength, min., lbs. per sq. inch.	62000–70000	52000–62000	75000 min.	80000–95000
Yield Point, min., lbs. per sq. inch.	37000	30000	50% Tensile Strength	45000
Elongation in 8 inches Minimum per cent Elongation in 2 inches Minimum per cent	*1,500,000* Tens. Str.	*1,500,000* Tens. Str.	*1,650,000* Tens. Str.	*1,600,000* Tens. Str.
Reduction of area Minimum	42%	52%	*2,400,000* Tens. Str. 29%—Min.	35%
Bend Test Material ¾ in. or less Material over ¾ in.	180°D=1xT 180°D=1½xT	180° Flat 180° Flat		180°D=1xT 180°D=1½xT

*The percentage of silicon in silicon steel shall not be less than 0.20.

For rolled steel thicker than ¾ inch, the required percentage of elongation will be reduced by one for each increase in thickness of ⅛ inch or fraction thereof above ¾ inch for mild or medium steel, but in no case shall the elongation be less than 20% for mild steel, or 18% for medium steel.

For rolled steel thicker than ¾ inch, the required percentage of reduction of area will be reduced by one for each increase in thickness of ⅛ inch or fraction thereof above ¾ inch, but in no case shall the reduction of area be less than 35% for medium steel.

Heat Treated Eyebars

Eyebar steel shall be furnished as far as possible from whole heats made for this work.

Eyebar steel shall contain the following percentages of minerals:

Not less than:	
Carbon	0.30
Manganese	0.60
Phosphorous (not more than)	0.04
Sulphur (not more than)	0.05

The Contractor shall prepare two tension tests and one bend test from each heat of steel rolled for eyebars which tests shall be made in the presence of the Inspector and the results recorded for information regarding the physical properties of the material as rolled. These mill specimen tests shall be cut from the finished rolled material. They shall show a yield point of not less than 40,000 lbs. per square inch and an ultimate strength of not less than 70,000 lbs. per square inch.

Eyebars tested to destruction from full size heat treated bars fabricated for this work and selected from the finished bars by the Inspector, shall meet the following requirements:

Yield Point not less than 50,000 lbs. per square inch.

Ultimate Strength not less than 80,000 lbs. per square inch.

Elongation not less than 8% in 18'-0".

Fracture, silky or fine crystalline.

The number and size of full size tests will be determined by the Engineers but the number shall not be less than three (3%) per cent and not more than five (5%) per cent of the eyebars required for the bridge. Additional test bars required by reason of failures are not included in the above percentages.

No bars known to be defective in any way shall be taken for full size tests. Such defective bars shall be rejected. If tested by the manufacturer, the results shall in no way influence the acceptance or rejection of other bars. Full size eyebar tests will be required to break in the body. When a bar breaks in the head and develops the required elongation, another bar of the same size and lot shall be tested, the two tests being counted as one. In case of the failure of full size eyebar tests, the Engineers may require additional tests to be made to assist them in arriving at a decision as to acceptance or rejection; or they may reject, without additional tests all bars represented by the full size test made, or all bars of the same melt as the test so failing. The fracture of full size eyebar tests shall be silky, cupped or angular. A square, coarse, granular fracture shall be sufficient cause for rejection. Only the test bars which meet the requirements of these specifications shall be paid for at the unit price tendered for heat treated eyebars.

In addition to the above full size eyebar tests, the Contractor shall make two Brinnell indentation tests near the head of each bar, as well as make Brinnell tests every 2'-0" of the length of the full size test bars, which Brinnell tests shall be recorded and copies of the results furnished the Engineers and used as a check for the uniformity of the heat treatment of the eyebars. Bars from the same heat of steel showing a wide variation in the Brinnell results shall, upon request of the Engineers, be re-treated.

The form of eyebar heads may be determined by the dies at the maker's plant, if satisfactory to the Engineers, and provided that failure will occur in the body of the bar under full size tests.

The thickness of the head and neck of the bar shall be equal to, or not more than ⅛" greater than, the thickness of the body of the bar.

The head shall be made by upsetting and rolling or forging. The finished bars shall be free from injurious flaws of any kind. No welding will be allowed. The heads shall be symmetrical about the axis of the bar.

Eyebars shall be uniformly heat treated to the proper temperature and shall be carefully handled when hot and during the quenching process so that the amount of straightening required after heat treatment is reduced to a minimum.

Accurate pyrometer readings shall be taken of the temperature of the furnaces heating the bars before the quenching process and of the temperature of the draw-back furnace. These records shall be open for the information and use of the Engineers and Inspectors in order that they may assure themselves that the heat treating process is being carried on in such a manner as to produce uniform and satisfactory results.

Eyebars shall be carefully straightened before being bored. Pin holes shall be in the center line of the bars and in the center of the heads. Eyebars shall be bored so accurately that when bars engaging two pins in common are placed together, the pins can be passed through the holes at both ends at the same time without forcing.

All bars of each panel shall be assembled with their common pins and shall be given a distinctive erection mark.

Pin holes shall be bored true to gage, smooth and straight, at right angles with the axis of the bar and parallel with each other. A finishing cut shall always be taken. The diameter of the pin holes shall not be less than 0.03", nor more than 0.04" greater than that of the pins.

Cast Steel

The chemical requirements shall be the same as for wrought medium steel.

At least two pieces of every melt shall have a coupon 8 inches long and 2 inches square

attached for testing. Specimens prepared from these coupons shall develop an ultimate tensile strength of at least 65,000 pounds per square inch, an elastic limit of not less than 35,000 pounds per square inch, an elongation of not less than 20 per cent in 2 inches, including the fracture, and a reduction of area of not less than 30 per cent. They shall bend cold without cracking 120 degrees around a rod twice the thickness of the piece tested.

The fracture shall be clean and bright and free from blow holes. All steel castings shall be annealed and the coupons shall not be detached until after annealing and proper identification by the Inspector.

All castings shall be sound and free from shrinkage cracks and as free from sand holes and blow holes as the latest and best practice can produce. The Engineers shall be the final judges as to whether a defect is sufficient cause for rejection. All castings shall be submitted to the Inspector for surface inspection after cleaning and before annealing.

No electric or other welding or patching of defects in castings shall be done, unless authorized by the Engineers. Any such welding or patching done without the Engineer's consent will be cause for rejection.

Gates and sink heads shall be sawed off and not burned off.

All steel castings must be true to the drawings, with smooth surfaces, and all re-entrant angles must be neatly filleted.

All cores of castings shall be thoroughly removed and the mold sand thoroughly cleaned from the surfaces.

Paint Materials

Red lead for use in paint furnished under this contract shall be of the quality required to meet the United States Government specifications for Red Lead, Dry and Paste, Federal Specifications Board Standard Specification No. 11, copy of which is on file at the office of the Engineers, and shall be of the grade containing not less than 95% true Pb_3O_4.

White lead for use in paint furnished under this contract shall be of the quality required to meet the United States Government specifications for Basic Carbonate White Lead, Dry and Paste, Federal Specifications Board Standard Specification No. 5, copy of which is on file at the office of the Engineers.

Linseed oil for use in paints furnished under this contract shall be of the quality required to meet the United States Government specifications for Linseed Oil, Raw, Refined and Boiled, Federal Specifications Board Standard Specification No. 4, a copy of which is on file at the office of the Engineers.

Dryer for use in paints furnished under this contract shall be turpentine and linseed oil japan dryer, free from rosin, and containing both lead and manganese. A mixture of one part dryer and fifteen parts raw linseed oil, when spread, in thin films on glass, shall be dry within nine hours at 70 degrees Fahrenheit.

Details of Design

Details of design not otherwise shown or specified shall be in accordance with the specifications for Steel Highway Bridges, Bulletin No. 262 of the American Railway Engineering Association.

The following grades of steel work shall be used in the various parts of the structure.

All eyebars shall be heat-treated and meet the requirements for heat treated eyebars specified elsewhere.

Silicon steel shall be used in all riveted truss members unless noted otherwise on the contract drawings. All main section material as well as pin plates, gusset plates, splice plates and main detail material in silicon steel members shall be made of silicon steel; tie plates, lacing bars, diaphragms, fillers and similar minor details may be made of medium carbon steel.

Medium carbon steel shall be used in truss members where so noted on the contract drawings, and in all floor system members, lateral systems and sway bracing.

Cast steel shall be used in all bearings, rollers, bolsters or other cast items.

Pin steel shall be used in all pins.

Design Loadings

(a) Dead Load.

The dead load in addition to the weight of the structural steel shall be assumed as follows.

Future Paving	1000 lbs. per lin. ft. of bridge
Concrete Roadway Slab	3500 lbs. per lin. ft. of bridge
Concrete Sidewalk Slabs	600 lbs. per lin. ft. of bridge
	5100 lbs. per lin. ft. of bridge

To this shall be added the actual weight of the steel construction.

(b) Live Load.

The live load for floor system per lane of traffic shall consist of a 28 ton motor truck, with 5½ tons on the front, 22½ tons on the rear axle, axles spaced 15' C to C, followed and preceded (with a 10' space between truck axles and the uniform load) by a uniform load of 1000 pounds per lineal foot.

The live loads on the sidewalk shall be assumed as 100 pounds per square foot.

In the design of the stringers the proportion of load to be carried by one stringer shall be $L = \frac{WS}{5}$, where L is the load carried by one stringer, W is the wheel load and S is the stringer spacing in feet.

The floorbeams and local truss members shall be based on the assumption of four lanes of traffic, each loaded with 75% of the above specified load per lane, in conjunction with the above specified sidewalk load.

The design of the main truss members shall be based on the assumption of a live load, uniformly distributed between the two trusses of 3600 pounds per lineal foot of the bridge.

The lateral force shall consist of a moving (or broken) load equal to 30 pounds per square foot on 1½ times the vertical projection of the structure on a plane parallel with its axis.

The lateral bracing between compression chords shall be capable of resisting a transverse force in any panel equal to 2% of the total axial stress in such panel.

The structure shall be proportioned to resist all stresses due to the weight of the structure and the equipment used during erection.

Unit Stresses

The several parts of the structure shall be so proportioned that the unit stresses shall not exceed the following.

	Pounds per sq. inch
Axial tension, med. carbon steel, net section	18000
Axial compression, med. carbon steel, net section,	$16900 - 56\frac{L}{R}$
but not to exceed	14000
Tension in extreme fibres of rolled shapes, built sections and girders, net section, med. carbon steel	18000
Tension in extreme fibres of pins, pin steel	30000
Shear in plate girder webs, gross section	12000
Shear in power driven rivets	12000
Bearing on power driven rivets	24000

The above mentioned values for shear and bearing shall be reduced 25 per cent for countersunk rivets, hand driven rivets, floor connection rivets and turned bolts.

Bearing on pins and outstanding legs of stiffener angles and other steel parts in contact, 24000 pounds per square inch.

Bearing on Granite Masonry, 700 pounds per square inch.

Bearing on expansion rollers, per lineal inch, 600D.

The above unit stresses for medium carbon steel shall be increased ⅓ for silicon steel and heat treated eyebars.

The unit stresses may be increased ⅓ for combinations of wind with dead plus live or for wind with erection but the sections shall not be less than those required if wind stresses are neglected.

APPENDIX E-1

Concrete Design, Mix, Compressive Strength

Date	Location	Designed Strength	Fineness Modulus: Sand	Fineness Modulus: Gravel	Fineness Modulus: Combined Aggregates	Stump	Cement	True Mix: Sand	True Mix: Gravel	Strength Obtained
	CONTRACT NO. 1—MAIN PIERS									
7- 7-28	Caisson—Pier 7	3200	2.91	7.51	5.75	7"	1	2.16	4.08	3942
7- 7-28	Caisson—Pier 7	3200	2.91	7.51	5.75	7"	1	2.16	4.08	4061
7-14-28	Caisson—Pier 7	3200	2.66	7.41	5.75	6"	1	2.44	3.46	3926
7-19-28	Caisson—Pier 5	3000	2.36	7.56	5.75	5"	1	2.28	3.52	4388
7-19-28	Caisson—Pier 5	2000	2.36	7.56	5.75	5"	1	1.92	3.62	4279
7-26-28	Caisson—Pier 4	3200	2.20	6.91	5.75	5"	1	1.92	3.62	3148
8- 1-28	Caisson—Pier 4	2000	2.20	6.91	5.75	7½"	1	2.02	3.40	2440
8- 6-28	Caisson—Pier 6	2000	3.42	7.02	5.80	7½"	1	2.02	3.40	2364
8- 6-28	Caisson—Pier 6	2700	3.42	7.02	5.80	7½"	1	2.44	4.10	2890
8- 5-28	Shaft—Pier 7	2700	3.42	7.02	5.80	9½"	1	2.44	4.10	2458
8- 5-28	Shaft—Pier 7	2700	3.29	7.32	5.75	9½"	1	2.41	4.00	2495
8-12-28	Shaft—Pier 4	2700	3.29	7.32	5.75	9"	1	2.22	4.00	3955
8-12-28	Caisson—Pier 3	3200	2.77	6.83	5.75	1"	1	1.69	3.88	3337
8-12-28	Caisson—Pier 3	3200	2.77	6.83	5.75	1"	1	2.20	4.80	4032
8-16-28	Shaft—Pier 5	2400	2.92	7.07	5.75	7"	1	2.20	4.80	2564
8-21-28	Shaft—Pier 6	2400	2.92	7.07	5.75	7"	1	2.20	3.52	2829
8-28-28	Caisson—Pier 8	3200	3.24	7.45	6.00	5"	1	2.20	3.52	3572
8-28-28	Caisson—Pier 8	3200	3.24	7.45	6.00	5"	1	2.20	3.52	3714
8-28-28	Caisson—Pier 8	3200	3.24	7.45	6.00	5"	1	3.00	4.00	3006
8-28-28	Caisson—Pier 8	2700	3.24	7.45	5.80	4"	1	2.40	3.20	3008
8-31-28	Shaft—Pier 4	3200	2.89	7.06	5.75	5"	1	2.40	3.20	3254
9- 8-28	Caisson—Pier 1	3200	2.89	7.66	5.75	5"	1	2.50	4.10	3039
9- 8-28	Caisson—Pier 1	2700	3.02	7.17	5.75	1"	1	2.70	3.96	2054
9-10-28	Shaft—Pier 6	2700	3.29	7.28	5.75	1"	1	1.85	3.97	2511
9-10-28	Shaft—Pier 5	2200	2.74	6.83	5.75	7½"	1	1.85	3.97	2753
10-21-28	Caisson—Pier 2	3200	2.74	6.83	5.75	7½"	1	2.71	4.14	2102
10-21-28	Caisson—Pier 2	2700	2.93	7.33	5.75	9½"	1	3.29	3.76	3183
10-25-28	Shaft—Pier 8	2700	3.07	7.63	5.75	1"	1	2.77	3.96	2209
11-15-28	Shaft—Pier 2	2700	2.82	7.37	5.75	9"	1	2.03	3.87	3183
11-27-28	Shaft—Pier 1	2700	3.09	7.54	5.75	7"	1			
12- 3-28	Shaft—Pier 1									
	CONTRACT NO. 2—SUPER-STRUCTURE—ROADWAY									
8-29-29	Simple Span	3000	2.42	7.68	5.88	3½"	1	1.48	3.14	4286
9- 2-29	Jeff. N. Cantilever	3000	2.42	7.68	5.88	6"	1	1.48	3.14	3837
9- 5-29	Jeff. N. Cantilever	3000	2.42	7.24	5.88	4"	1	1.21	3.39	3395
9- 9-29	Jeff. 500 ft. Anchor	3000	2.42	7.24	5.88	4"	1	1.21	3.39	2547
9- 9-29	Jeff. 500 ft. Anchor	3000	2.42	7.24	5.88	5"	1	1.21	3.39	2405
9-12-29	Jeff. S. Cantilever	3000	2.42	7.24	5.88	5"	1	1.21	3.39	4067
9-12-29	Jeff. S. Cantilever	3000	3.18	7.42	5.88	6"	1	1.57	3.01	4421
9-19-29	Lou. 500 ft. Anchor	3000	3.18	7.42	5.88	6"	1	1.57	3.01	3183
9-19-29	Lou. 500 ft. Anchor	3000	3.18	7.42	5.88	3½"	1	1.57	3.01	3525
9-23-29	Lou. 360 ft. Anchor	3000	3.18	7.42	5.88	3½"	1	1.57	3.01	4067
9-23-29	Lou. 360 ft. Anchor	3000	3.18	7.42	5.88	4"	1	1.57	3.01	4244
10- 1-29	Simple Span	3000	3.18	7.42	5.88	4"	1	1.57	3.01	4492
10- 1-29	Simple Span	3000	3.31	7.72	5.88	4½"	1	1.74	2.84	4133
10- 4-29	Jeff. 500 ft. Anchor	3000	3.31	7.72	5.88	4½"	1	1.74	2.84	4067
10- 4-29	Jeff. 500 ft. Anchor	3000	3.31	7.72	5.88	4½"	1	1.52	3.09	4075
10-17-29	Lou. Sidewalks	3000	2.97	7.46	5.88	3½"	1	1.52	3.09	4209
10-17-29	Lou. Sidewalks	3000	2.97	7.46	5.88	3½"	1			

Date	Location	Designed Strength	Fineness Modulus: Sand	Fineness Modulus: Gravel	Fineness Modulus: Combined Aggregates	Stump	Cement	True Mix: Sand	True Mix: Gravel	Strength Obtained
	CONTRACT NO. 4—APPROACHES									
2-25-29	Piles—Lou. Approach	4000	3.17	7.37	6.00	3½"	1	1.09	2.57	4598
2-27-29	Piles—Lou. Approach	4000	3.17	7.37	6.00	5"	1	1.09	2.57	5376
3- 1-29	Piles—Lou. Approach	4000	3.17	7.37	6.00	5"	1	1.09	2.57	4846
3- 5-29	Piles—Lou. Approach	4000	3.01	7.39	6.00	4"	1	1.09	2.39	5446
3- 8-29	Piles—Lou. Approach	4000	3.24	7.40	6.00	5"	1	1.16	2.45	3890
1-25-29	Piles—Jeff. Approach	4000	2.79	7.07	6.00	4"	1	0.86	2.87	4421
1-29-29	Piles—Jeff. Approach	4000	2.86	6.75	5.90	2"	1	1.02	2.42	5039
2- 5-29	Piles—Jeff. Approach	4000	2.05	7.14	6.00	3½"	1	0.86	2.76	3979
2- 6-29	Piles—Jeff. Approach	4000	2.05	7.39	6.00	3½"	1	1.00	2.52	3183
2- 8-29	Piles—Jeff. Approach	3000	2.97	7.39	6.00	6"	1	1.07	2.52	2210
3-29-29	Footings—Lou. Appr.	3000	2.59	7.39	5.76	1"	1	1.73	3.85	2882
4- 3-29	Footings—Lou. Appr.	3000	2.59	7.95	5.76	4"	1	2.10	3.54	3006
4- 5-29	Footings—Lou. Appr.	3000	2.59	7.81	5.76	4"	1	2.05	3.54	3890
4- 8-29	Footings—Lou. Appr.	3000	2.75	8.06	5.76	3"	1	2.26	3.69	3122
4-11-29	Footings—Lou. Appr.	3000	2.75	7.84	5.76	3"	1	2.15	3.56	2929
4-16-29	Footings—Lou. Appr.	3000	2.75	7.84	5.76	3"	1	2.15	3.56	2987
4-19-29	Ret. Wall—Lou. Appr.	3000	2.57	7.39	5.88	4"	1	1.34	3.28	2334
4-19-29	Ret. Wall—Lou. Appr.	3000	2.57	7.39	5.88	4"	1	1.34	3.28	1768
3- 7-29	Footings—Jeff. Appr.	3000	3.31	7.28	5.76	2½"	1	2.00	3.57	3431
3-13-29	Footings—Jeff. Appr.	3000	3.31	7.17	5.76	2"	1	1.95	3.68	3714
3-14-29	Footings—Jeff. Appr.	3000	3.31	7.08	5.76	2½"	1	1.84	3.74	4138
3-22-29	Footings—Jeff. Appr.	3000	3.28	7.43	5.76	1½"	1	2.10	3.48	3996
3-22-29	Footings—Jeff. Appr.	3000	3.28	7.43	5.76	1½"	1	2.10	3.48	3183
3-28-29	Footings—Jeff. Appr.	3000	3.28	7.12	5.76	2"	1	1.84	3.71	2617
3-28-29	Footings—Jeff. Appr.	3000	3.28	7.12	5.76	2"	1	1.84	3.71	2440
6-11-29	Encasement—Lou. Appr.	3000	2.57	7.39	5.88	7½"	1	1.34	3.28	2016
6-11-29	Encasement—Lou. Appr.	3000	2.57	7.39	5.88	7½"	1	1.34	3.28	3001
4-29-29	Encasement—Jeff. Appr.	3000	3.96	7.24	5.76	7"	1	2.42	3.07	2652
4-29-29	Encasement—Jeff. Appr.	3000	3.96	7.24	5.76	7"	1	2.42	3.07	2290
5-10-29	Encasement—Jeff. Appr.	3000	2.79	7.40	5.76	7½"	1	1.84	3.68	3183
5-10-29	Encasement—Jeff. Appr.	3000	2.79	7.40	5.76	7½"	1	1.84	3.68	3254
6- 4-29	Roadway—Lou. Appr.	3000	2.57	7.39	5.88	4"	1	1.34	3.28	2531
6- 7-29	Roadway—Lou. Appr.	3000	2.57	7.39	5.88	4"	1	1.34	3.28	2334
6-14-29	Roadway—Lou. Appr.	3000	2.57	7.39	5.88	3"	1	1.34	3.28	3784
6-20-29	Roadway—Lou. Appr.	3000	2.57	7.39	5.88	3"	1	1.34	3.28	4051
6-22-29	Roadway—Lou. Appr.	3000	2.57	7.54	5.88	4"	1	1.56	3.13	2971
7- 6-29	Roadway—Lou. Appr.	3000	2.57	7.54	5.88	4"	1	1.56	3.13	1485
7-15-29	Roadway—Lou. Appr.	3000	2.57	7.54	5.88	3"	1	1.56	3.13	1766
8-15-29	Roadway—Lou. Appr.	3000	2.57	7.40	5.88	4"	1	1.48	3.28	2234
9- 5-29	Roadway—Lou. Appr.	3000	2.57	7.40	5.88	3½"	1	1.48	3.28	4067
5- 7-29	Roadway—Jeff. Appr.	3000	3.96	7.40	5.88	4"	1	1.91	2.61	3395
5-16-29	Roadway—Jeff. Appr.	3000	2.79	7.40	5.88	4½"	1	1.43	3.12	3737
5-24-29	Roadway—Jeff. Appr.	3000	2.79	7.14	5.88	4½"	1	1.59	3.33	2829
5-28-29	Roadway—Jeff. Appr.	3000	2.79	7.14	5.76	4½"	1	1.68	3.88	4508
6- 3-29	Roadway—Jeff. Appr.	3000	3.83	7.00	5.88	4½"	1	1.59	3.26	2723
6-17-29	Roadway—Jeff. Appr.	3000	3.83	7.08	5.88	4"	1	1.39	3.46	2760
6-29-29	Roadway—Jeff. Appr.	3000	3.83	6.89	5.88	3½"	1	1.26	3.30	3183
7-12-29	Roadway—Jeff. Appr.	3000	3.28	6.89	5.88	4"	1	1.26	3.30	2476

APPENDIX E-2

Chemical and Physical Tests of Steel

Silicon Steel

Section	Heat No.	Elastic Limit	Ultimate Strength	Elongation % in 8 in.	Reduction of Area-%	Chemical Analysis				
						C	Mn	P	S	Si
U. M. x 5/8	13447	46920	91560	20.0	45.1	.36	.75	.029	.039	.248
	17358	49080	86740	21.2	46.4	.32	.84	.026	.072	.292
	17418	48600	92580	19.0	42.4	.36	.76	.027	.039	.252
U. M. x 7/16	17441	49180	84840	21.2	48.7	.34	.72	.027	.029	.280
	18440	45640	94260	19.7	42.8	.36	.83	.025	.037	.280
	18441	47440	82560	20.0	48.2	.32	.68	.025	.033	.261
	45180	50100	94600	17.7	43.6	.36	.87	.029	.037	.324
	18486	47940	80840	21.0	50.4	.32	.79	.029	.029	.240
U. M. x 1/2	14506	47280	89560	21.7	45.4	.31	.68	.028	.039	.272
	18511	40830	81540	22.7	48.1	.34	.75	.025	.039	.200
	45253	45480	82780	22.5	47.9	.34	.71	.022	.032	.288
	17432	48420	86540	20.5	40.3	.32	.79	.028	.023	.268
	17434	46000	82260	22.7	47.7	.34	.67	.021	.038	.252
	25428	50890	92080	22.5	46.2	.37	.85	.020	.030	.260
	43392	46620	81420	21.7	46.2	.32	.78	.018	.040	.296
	13459	49060	88280	22.0	45.7	.33	.66	.027	.031	.248
	17418	49000	87400	22.7	44.8	.36	.76	.027	.029	.252
	17419	49800	88000	18.1	44.7	.35	.74	.020	.032	.280
	17420	49780	82500	22.0	48.2	.34	.68	.014	.029	.272
	17423	49180	83850	21.7	47.4	.36	.78	.023	.034	.260
U. M. x 9/16	20384	49780	88000	22.7	45.8	.35	.86	.027	.033	.284
	18444	50000	91800	21.0	43.6	.36	.76	.025	.045	.248
	18464	48800	84760	22.5	45.7	.34	.72	.027	.030	.280
	22115	48710	85140	23.7	47.9	.36	.76	.020	.029	.248
U. M. x 5/8	37290	50970	84460	23.7	46.3	.35	.71	.025	.033	.264
	17411	50210	88040	19.5	43.0	.34	.83	.024	.033	.288
	17417	47340	86480	22.0	50.2	.34	.82	.026	.021	.280
	17419	50460	87500	21.2	42.3	.35	.74	.020	.032	.280
	17424	50400	91440	22.7	45.9	.38	.84	.024	.036	.280
	36392	50960	90360	18.2	41.6	.38	.90	.025	.039	.300
	13219	48760	87380	19.7	48.7	.35	.74	.028	.033	.260
	13229	46620	82320	22.5	45.9	.32	.64	.025	.034	.240
	17447	49080	82020	21.2	42.2	.36	.75	.022	.031	.244
U. M. x 11/16	17406	49720	88960	20.5	46.0	.33	.86	.026	.036	.248
	13459	46760	81000	21.5	41.6	.33	.66	.027	.031	.248
	50118	49000	83140	20.0	47.9	.33	.75	.021	.040	.268
	17440	51450	92120	19.7	44.2	.37	.84	.025	.031	.292
	17445	47000	87400	22.7	48.4	.35	.84	.027	.029	.248
	18456	49720	82260	21.0	40.4	.31	.75	.029	.034	.254
	20409	49740	87200	19.2	46.3	.34	.86	.029	.031	.288
	38467	51800	93660	20.5	46.1	.36	.76	.030	.036	.248
	18461	49460	88100	21.2	42.7	.37	.74	.024	.035	.272
	18487	49340	87060	21.0	42.0	.34	.72	.021	.028	.272
	38483	49880	91000	21.2	45.0	.35	.82	.022	.039	.264
	38466	49870	91000	21.0	40.1	.37	.84	.027	.035	.268
U. M. x 3/4	13147	49380	89080	20.7	42.5	.36	.75	.029	.039	.248
	17405	49020	94600	20.5	44.4	.37	.90	.019	.035	.292
	17408	48800	88420	18.7	44.2	.33	.86	.026	.036	.288
	17407	50180	91740	20.0	44.7	.37	.93	.026	.032	.280
	17408	51540	92200	21.2	42.7	.37	.86	.024	.034	.273
	17409	50840	90410	23.5	44.2	.37	.86	.025	.035	.240
	17410	47520	83810	22.7	43.8	.33	.77	.025	.037	.220
	17411	49310	88290	23.0	41.7	.34	.83	.024	.031	.258
	17417	49020	87350	22.2	42.5	.34	.82	.026	.033	.280
	26381	49730	87120	23.2	45.1	.32	.85	.026	.040	.236

Chemical and Physical Tests of Steel—(Continued)

Silicon Steel

Section	Heat No.	Elastic Limit	Ultimate Strength	Elongation % in 8 in.	Reduction of Area-%	Chemical Analysis				
						C	Mn	P	S	Si
	43392	47880	89560	24.7	45.9	.32	.78	.018	.040	.291
	17358	49080	83740	24.5	44.6	.32	.84	.026	.032	.292
	17423	49200	87700	20.5	44.1	.36	.78	.023	.034	.260
	17433	50060	93800	18.2	38.0	.37	.81	.027	.035	.268
	20384	51120	91180	22.5	45.7	.35	.86	.027	.033	.284
	20394	49450	87780	24.7	44.6	.34	.86	.026	.032	.268
	20396	51100	84800	24.2	44.9	.35	.71	.024	.031	.308
	26346	49200	84600	19.7	39.9	.34	.76	.027	.038	.248
	19399	47500	86200	21.7	47.0	.33	.77	.020	.031	.280
	19400	47600	82500	22.2	47.2	.34	.73	.025	.030	.236
	20408	49920	88360	22.0	42.9	.36	.78	.028	.028	.284
	30392	51550	96860	21.2	40.3	.38	.90	.025	.039	.300
	17386	50440	93880	19.7	40.9	.34	.74	.025	.032	.288
	17438	48380	87060	20.5	41.9	.35	.78	.025	.035	.248
U. M. x 15/16	17410	48670	84160	21.0	45.2	.33	.77	.025	.031	.220
	17424	51680	94200	18.5	40.1	.38	.84	.024	.036	.280
	14515	49190	87090	21.2	44.1	.35	.78	.025	.030	.200
U. M. x 7/8	17407	51120	93820	22.7	40.6	.37	.93	.026	.032	.280
	17412	48410	84170	23.0	41.9	.32	.79	.028	.035	.268
	25428	52000	91940	23.7	45.0	.37	.85	.020	.030	.260
	17420	48600	81160	23.2	46.0	.34	.68	.014	.029	.272
	17421	50460	89160	21.7	43.3	.34	.86	.027	.040	.316
	18441	45760	80500	24.5	42.0	.32	.63	.025	.033	.264
	18459	51000	88200	21.7	37.9	.36	.73	.029	.032	.272
U. M. x 1"	40360	49540	91080	19.2	38.4	.35	.80	.018	.038	.292
ShPl x 7/16	13219	49060	90080	21.5	45.9	.35	.74	.028	.033	.260
	13214	53880	88600	24.0	47.6	.33	.78	.027	.025	.240
ShPl x 1/2	13459	48720	82920	25.5	48.0	.33	.66	.027	.031	.248
	18481	49250	85480	24.2	41.0	.35	.72	.030	.030	.312
	20599	52040	87400	19.7	41.5	.35	.75	.026	.034	.276
ShPl x 5/8	17414	48520	85000	23.5	46.6	.34	.67	.021	.038	.252
	13459	48430	82660	24.2	46.9	.33	.66	.027	.031	.248
	18454	50100	87300	21.0	44.9	.33	.72	.025	.033	.268
	29114	47000	81100	24.5	46.3	.32	.70	.026	.050	.264
ShPl x 11/16	18459	53100	87600	23.5	46.0	.36	.73	.029	.032	.272
ShPl x 11/16	28205	49500	89240	23.0	46.2	.34	.76	.029	.037	.312
	18471	53800	90300	20.2	40.3	.36	.88	.022	.038	.308
	23375	46620	86000	25.5	44.5	.34	.70	.021	.032	.264
	26264	51600	87460	21.7	37.6	.34	.81	.024	.028	.293
	17396	53000	89100	24.7	49.3	.35	.68	.030	.034	.280
	17347	48550	85260	24.2	46.4	.34	.76	.024	.032	.292
ShPl x 3/4	16429	51800	90200	19.7	40.1	.36	.86	.027	.042	.296
	17393	47750	85000	20.0	42.0	.35	.79	.028	.029	.280
	17408	50360	94800	18.7	43.1	.37	.86	.024	.034	.278
	18399	47620	81300	24.5	45.7	.33	.74	.040	.035	.272
	20394	50500	89000	21.2	44.5	.34	.86	.026	.032	.268
	17396	50360	86060	24.2	45.1	.34	.74	.025	.032	.288
	17444	51540	89640	21.7	42.1	.34	.79	.027	.034	.272
	25175	49100	88900	24.5	40.1	.34	.79	.024	.037	.256
	13229	50100	81940	24.2	45.5	.32	.64	.025	.034	.240
	17393	47750	85000	20.0	42.0	.35	.79	.028	.029	.280
	18455	51700	91580	19.5	38.9	.34	.77	.038	.032	.248
ShPl x 15/16	14091	49240	82100	24.2	42.9	.34	.70	.016	.030	.260
	17050	49540	91080	23.5	38.6	.33	.76	.028	.038	.280
	20001	48620	86020	22.5	37.8	.32	.63	.027	.032	.280
ShPl x 7/8	18456	51360	85840	23.0	46.3	.31	.75	.029	.034	.264
	18459	51740	88860	22.5	44.6	.36	.73	.029	.032	.272
	18470	52000	92340	20.5	41.7	.34	.85	.026	.031	.280
S x 6 x 1/2	29457	46040	84700	22.0	44.3	.38	.80	.026	.039	.270
	92668	47000	85480	23.0	47.9	.35	.72	.023	.031	.292
S x 6 x 3/4	38472	50360	89040	22.5	37.4	.34	.79	.022	.035	.260
	30392	50460	92200	19.0	32.5	.38	.90	.025	.039	.300

Chemical and Physical Tests of Steel—(Continued)

SILICON STEEL

Section	Heat No.	Elastic Limit	Ultimate Strength	Elongation % in 8 in.	Reduction of Area-%	Chemical Analysis C	Mn	P	S	Si
6 x 6 x 3/8	34375	49550	81960	22.7	29.8	.34	.62	.018	.035	.208
	43220	48880	88200	22.5	44.6	.30	.78	.020	.035	.250
	314170	52960	90640	20.0	41.0	.36	.90	.022	.045	.264
	60185	50340	93280	20.2	47.8	.36	.72	.031	.046	.208
6 x 6 x 7/16	41371	49650	90120	20.2	47.1	.37	.85	.028	.041	.292
	32008	46600	82200	25.0	52.4	.35	.73	.025	.033	.208
5 x 6 x 1/2	34375	47080	81260	24.0	46.8	.34	.62	.018	.046	.208
	41371	49800	89700	24.5	47.9	.37	.85	.029	.035	.232
	47340	48800	83420	24.0	47.5	.33	.73	.024	.039	.228
	54146	49200	88300	24.5	47.1	.36	.75	.027	.035	.248
6 x 6 x 5/8	45474	48700	81480	23.0	40.1	.36	.74	.017	.040	.304
6 x 6 x 11/16	49280	49850	80780	23.5	44.4	.30	.73	.024	.047	.224
	30687	49080	88040	20.5	37.5	.36	.89	.029	.040	.280
	31449	49180	87400	24.5	40.1	.30	.84	.022	.035	.208
6 x 6 x 3/4	45520	52420	83080	23.7	45 6	.32	.78	.020	.036	.240
	47104	48780	80140	24.7	47.7	.33	.76	.016	.037	.300
	47341	50000	85680	22.5	41.9	.37	.85	.026	.047	.300
	56662	53040	89600	20.5	41.5	.34	.80	.015	.038	.260
6 x 6 x 3/4	30434	48850	81400	24.5	39.2	.36	.74	.028	.035	.248
	45474	48900	87280	22.5	38.5	.36	.84	.017	.040	.280
	31449	53000	86800	22.5	40.7	.34	.74	.026	.036	.260
	37500	48840	82500	22.2	39.6	.34	.83	.023	.039	.312
	38469	50760	85240	23.7	44.9	.36	.89	.029	.047	.324
6 x 6 x 7/8	30287	51060	8.940	21.5	38.2	.34	.74	.026	.038	.260
	37500	49360	87360	23.7	39.5	.24	.76	.021	.038	.252
	40961	48400	82283	24.7	40.6	.33	.84	.022	.034	.330
	305324	51280	87180	22.2	43.9	.34	.70	.014	.033	.270
6 x 4 x 3/8	305362	50240	83800	22.5	45.4	.37	.76	.016	.036	.260
6 x 4 x 7/16	316350	51700	88000	21.2	40 6	.35	.85	.016	.039	.320
	313300	52120	88400	24.7	45.4	.36	.92	.014	.031	.220
	303383	50000	87820	21.2	40.2	.36	.86	.012	.038	.220
	313416	51000	87200	22.5	46.7	.32	.81	.031	.033	.292
	D81006	52180	90100	21.5	44.7	.32	.76	.016	.039	.290
6 x 4 x 1/2	316350	51480	85300	21.2	48 9	.35	.62	.012	.039	.320
	306447	49820	88230	22.5	42.4	.35	.80	.012	.038	.250
	316018	50020	83140	21.2	43.5	.37	.75	.009	.033	.260
	316029	50930	88920	22.2	40.7	.35	.82	.015	.038	.270
6 x 4 x 9/16	315416	49850	840.0	20.0	39.3	.33	.86	.012	.031	.220
	313416	51720	85180	21.5	45.1	.36	.76	.024	.037	.240
	D85033	50560	93880	23.7	45.4	.38	.80	.012	.040	.300
6 x 4 x 11/16	304236	51620	85280	18.7	42.8	.40	.82	.015	.038	.270
	315416	50780	84030	20.5	39.8	.35	.92	.014	.029	.220
6 x 4 x 3/4	306381	50700	82820	22.5	41.3	.39	.76	.010	.040	.280
	306465	48870	86780	19.4	37.5	.37	.80	.024	.037	.210
5 x 4 x 5/8	D85033	52660	88280	20.5	41.1	.38	.75	.014	.022	.280
4 x 4 x 3/8	306384	49100	83250	24.0	46.7	.33	.84	.010	.039	.320
4 x 4 x 7/16	316473	50730	88460	22.5	46.0	.34	.82	.022	.038	.270
	305324	52000	86370	22.5	46.4	.33	.77	.013	.033	.270
	315416	50020	85460	22.7	49.2	.35	.77	.012	.040	.350
4 x 4 x 1/2	310304	50240	85100	19.8	40.7	.37	.70	.012	.040	.270
4 x 4 x 3/4	310304	49180	83640	21.7	36.2	.35	.90	.014	.034	.310
	305302	50820	86583	22.7	44.0	.37	.62	.020	.035	.320
	313379	52200	82060	22.5	39.3	.34	.70	.012	.039	.220
	306447	50200	82720	21.5	40.4	.35	.64	.010	.040	.250
	306463	47040	86200	20.0	37.5	.37	.70	.010	.036	.290
	316489	48040	84400	23.2	47.9	.35	.62	.020	.034	.292
CB18 x 86#	30493	50120	86180	23.7	48.1	.32	.68	.020	.039	.296
	44392	50020	83000	24.0	50.5	.29	.95	.024	.032	.300
	28012	50420	81000	26.0	52.3	.28	.72	.025	.041	.360
CB21 x 80#	39533	47760	81240	24.0	37.5	.30	.82	.024	.038	.228
CB21 x 86#	27238	51700	87010	21.5	42.8	.30	.95	.027	.032	.288
CB21 x 104#	29209	47350	81100	25.5	52.5	.28		.025	.041	.360
	29533	48850								

APPENDIX E-3

Chemical and Physical Tests of Steel—(Continued)

MEDIUM CARBON STEEL

Section	Heat No.	Elastic Limit	Ultimate Strength	Elongation % in 8 in.	Reduction of Area-%	Chemical Analysis C	Mn	P	S	Si
U. M. x 3/8	12422	38440	70120	27.2	49.0	.25	.65	.020	.033	---------
	15385	37050	68100	23.5	51.8	.23	.59	.024	.045	---------
	18409	37860	66100	26.5	50.9	.23	.45	.028	.028	---------
	24417	38160	68540	26.0	50.7	.23	.50	.023	.031	---------
	29277	37180	67260	25.7	51.8	.21	.51	.023	.049	---------
	33379	37980	62180	28.2	51.3	.18	.47	.017	.037	---------
	33380	38000	65760	25.0	49.0	.22	.51	.011	.026	---------
	34387	37440	65760	24.5	48.2	.24	.46	.014	.039	---------
	53436	38870	63800	26.7	50.2	.21	.80	.014	.042	---------
	60575	37760	68810	26.2	54.6	.24	.62	.012	.028	---------
	18410	38120	65320	24.6	50.8	.21	.48	.036	.030	---------
	42381	39260	68910	23.5	47.5	.24	.57	.018	.037	---------
U. M. x 7/16	14038	37240	6.620	28.5	51.7	.26	.68	.033	.033	---------
	46834	37620	62810	27.5	54.6	.22	.42	.018	.040	---------
	48367	37380	67520	26.5	51.4	.24	.45	.012	.031	---------
	52448	36520	68250	21.5	53.1	.21	.48	.023	.046	---------
U. M. x 1/2	12424	37300	64140	26.5	52.8	.20	.56	.019	.032	---------
	12485	37890	67580	27.2	50.9	.24	.52	.025	.036	---------
	13422	37440	70060	24.5	48.4	.25	.65	.029	.033	---------
	24417	37120	68480	27.5	50.3	.23	.50	.023	.031	---------
	33375	37320	64650	26.0	50.8	.19	.57	.025	.037	---------
	43385	37690	62840	26.2	51.0	.22	.45	.015	.028	---------
	43398	37320	62200	28.7	53.9	.19	.44	.014	.034	---------
	48367	38020	70260	25.0	47.2	.24	.43	.012	.031	---------
	28317	37500	66700	28.2	51.1	.24	.60	.020	.035	---------
	38401	37870	62940	29.5	52.2	.21	.45	.014	.030	---------
	13284	37520	64180	27.0	52.3	.24	.48	.017	.038	---------
	23447	38040	65380	25.7	48.8	.26	.52	.027	.035	---------
	33366	37480	65400	27.0	50.4	.23	.41	.018	.030	---------
U. M. x 9/16	49371	40160	70820	21.5	47.2	.28	.51	.016	.034	---------
	58404	37320	66960	26.2	48.9	.21	.57	.020	.042	---------
	18410	37520	66850	24.5	51.2	.21	.48	.036	.030	---------
	38401	37110	61800	26.5	53.2	.23	.45	.014	.030	---------
U. M. x 5/8	13435	37180	67610	26.5	50.8	.24	.46	.025	.040	---------
	24407	37480	64040	26.7	50.3	.22	.50	.020	.036	---------
	34397	37400	65580	28.7	50.2	.24	.46	.014	.020	---------
	40407	37700	63910	25.7	49.3	.22	.45	.015	.034	---------
U. M. x 11/16	43378	37700	63840	26.7	51.9	.22	.46	.015	.035	---------
	37290	37980	64020	29.5	51.6	.24	.49	.018	.035	---------
	41564	37540	63000	27.5	52.3	.22	.41	.017	.035	---------
U. M. x 3/4	43378	37660	63020	27.7	49.8	.22	.46	.015	.035	---------
	18409	38000	65920	26.0	49.6	.21	.45	.028	.038	---------
	23375	37870	63110	30.0	49.5	.19	.57	.025	.037	---------
	53436	37600	63940	26.2	51.7	.21	.80	.014	.042	---------
U. M. x 13/16	55297	37460	62890	27.5	50.8	.24	.54	.016	.030	---------
U. M. x 7/8	31058	37820	63120	28.0	50.5	.22	.51	.025	.049	---------
U. M. x 15/16	12336	37080	66400	25.0	47.8	.27	.53	.024	.040	---------
U. M. x 1"	19602	38020	68610	25.2	48.6	.24	.58	.029	.039	---------
	46314	37280	63940	26.7	50.4	.22	.42	.018	.040	---------
	6370	37080	63960	26.2	49.8	.22	.60	.027	.042	---------
U. M. x 1-1/8	55297	37380	62810	26.5	48.0	.24	.54	.016	.039	---------
	22414	38480	67180	26.2	49.0	.23	.50	.016	.030	---------
U. M. x 1-9/16	24980	37580	64800	25.5	47.9	.23	.60	.024	.034	---------
U. M. x 1-3/4	28880	39440	63960	28.7	47.7	.22	.51	.011	.036	---------
	6370	37200	62920	27.7	49.4	.22	.60	.027	.042	---------
U. M. x 2"	28317	37700	65020	26.2	43.0	.24	.60	.020	.035	---------
	27022	37920	65380	26.2	48.4	.27	.60	.026	.028	---------
U. M. x 2-1/8	23343	37900	65480	25.5	42.3	.26	.52	.017	.031	---------
U. M. x 2-1/2	43507	38180	62710	25.0	45.1	.26	.49	.016	.035	---------
	46423	37200	62260	24.7	46.6	.22	.45	.018	.031	---------

Chemical and Physical Tests of Steel—(Continued)

Medium Carbon Steel

Section	Heat No.	Elastic Limit	Ultimate Strength	Elongation % in 8 in.	Reduction of Area—%	Chemical Analysis				
						C	Mn	P	S	Si
ShPl x 3/8	34377	37740	64280	28.2	50.5	.22	.46	.018	.040	
	37390	37760	65660	26.5	51.9	.24	.49	.018	.035	
	42316	37920	69780	24.2	50.8	.24	.47	.014	.053	
	38340	37540	62910	29.2	56.1	.22	.51	.017	.022	
	7008	40560	64940	30.7	52.1	.23	.47	.022	.035	
ShPl x 7/16	36384	38000	64820	29.5	51.5	.22	.48	.018	.040	
	41350	38100	64080	28.0	54.2	.22	.41	.016	.039	
	41364	38100	64880	27.2	53.4	.23	.41	.017	.035	
	43378	38010	68560	26.2	51.3	.22	.46	.015	.035	
	37511	37200	67120	26.2	46.7	.24	.56	.014	.044	
ShPl x 1/2	12435	36950	68560	26.2	51.5	.24	.46	.025	.040	
	17404	37700	70120	27.5	53.6	.26	.61	.027	.028	
	34377	37020	66700	29.5	50.7	.22	.46	.018	.040	
	36381	38420	65480	28.5	51.8	.22	.48	.018	.040	
	41344	38250	64480	27.2	50.5	.23	.46	.016	.039	
	43378	37880	64680	27.5	51.3	.22	.46	.015	.035	
	43385	37200	64060	30.5	50.4	.22	.45	.013	.028	
	44363	37500	62900	29.2	51.2	.25	.43	.017	.033	
	40346	38230	62480	29.5	57.5	.22	.51	.018	.037	
ShPl x 9/16	34521	37530	66020	25.0	46.6	.27	.55	.014	.038	
	41580	37100	65720	27.2	52.4	.27	.42	.023	.034	
ShPl x 5/8	14437	40050	69900	26.0	46.7	.25	.50	.019	.034	
	45281	37570	65080	25.5	47.6	.27	.50	.028	.034	
ShPl x 11/16	32384	38100	64700	26.2	50.0	.26	.64	.014	.044	
ShPl x 3/4	57511	38400	70700	26.5	50.9	.24	.56	.017	.029	
	24320	38480	68160	24.0	48.1	.24	.48	.029	.031	
ShPl x 1-3/4	4064	42840	62920	23.2	42.4	.26	.60	.024	.028	
	10014	37330	62360	28.0	44.3	.23	.49	.024	.033	
ShPl x 2"	34024	38080	68080	31.0	54.0	.24	.41	.025	.031	
ShPl x 2-1/4	10111	38970	62840	24.0	50.2	.26	.50	.029	.032	
8 x 8 x 1/2	44477	38150	64760	27.2	50.5	.20	.71	.017	.041	
	64618	37900	64680	26.7	54.4	.22	.69	.020	.037	
8 x 8 x 5/8	D38002	38500	65100	26.5	51.2	.21	.55	.025	.026	
	42389	37580	63360	26.2	50.9	.20	.56	.019	.035	
	15443	38040	63960	31.5	52.1	.21	.59	.019	.040	
	64659	38170	64240	26.5	53.4	.18	.61	.025	.036	
8 x 8 x 11/16	42389	37480	64000	27.2	50.4	.20	.56	.027	.043	
8 x 8 x 3/4	D23028	37720	66700	28.2	48.7	.21	.64	.025	.034	
	64660	37850	65000	25.5	50.4	.21	.78	.024	.042	
8 x 6 x 7/16	56419	37900	62900	26.7	51.5	.19	.55	.019	.035	
	24404	38460	63400	27.7	57.5	.19	.52	.025	.039	
8 x 6 x 1/2	D17003	37750	63140	31.5	51.2	.19	.59	.025	.030	
8 x 6 x 5/8	45368	37870	66620	27.7	55.2	.18	.55	.025	.029	
	22518	37900	62160	28.5	53.2	.19	.61	.020	.029	
	48355	37780	61900	27.0	51.3	.20	.54	.018	.032	
	40526	37650	62580	30.0	51.9	.20	.49	.017	.036	
6 x 6 x 3/4	D36003	37800	66720	27.5	50.4	.20	.60	.024	.038	
	D18023	38100	66780	27.7	53.6	.24	.50	.016	.028	
	D13060	37550	66840	26.5	50.3	.21	.58	.022	.032	
	D20004	37840	64780	28.0	51.4	.22	.54	.031	.041	
6 x 6 x 3/8	D58079	37540	64680	27.2	54.3	.21	.53	.025	.030	
	51469	37550	63300	29.0	51.7	.19	.53	.025	.047	
	40502	37640	63000	26.5	49.2	.22	.50	.014	.034	
6 x 6 x 7/16	63615	38000	70070	26.7	53.2	.22	.62	.019	.047	
	20032	38000	64660	27.7	53.5	.21	.70	.022	.034	
	34432	37850	65760	26.2	54.8	.22	.55	.024	.029	
	32455	38140	62860	27.5	51.2	.21	.50	.019	.034	
6 x 6 x 1/2	52539	37850	66140	31.2	58.6	.24	.61	.016	.035	
	19490	37470	67040	26.0	49.8	.22	.59	.016	.033	
	32465	38320	62960	26.7	54.5	.19	.59	.019	.034	
	27495	38140	62840	29.7	53.9	.20	.47	.017	.035	
	37501	37700	63500	28.0	53.3	.22	.55	.017	.031	
	33403	38020	67760	28.7	49.8	.21	.52	.016	.031	
	32610	38000					.60	.015	.027	

Chemical and Physical Tests of Steel—(Concluded)

Medium Carbon Steel

Section	Heat No.	Elastic Limit	Ultimate Strength	Elongation % in 8 in.	Reduction of Area—%	Chemical Analysis				
						C	Mn	P	S	Si
6 x 6 x 9/16	52429	37450	66200	32.0	55.2	.20	.61	.025	.045	
	37637	37960	67420	27.0	51.5	.26	.55	.012	.033	
	46577	37820	68800	26.5	50.1	.25	.64	.025	.035	
	D18021	37300	62700	29.5	50.7	.18	.45	.018	.030	
	D61021	37200	66280	28.5	52.9	.21	.60	.019	.029	
6 x 6 x 5/8	D18021	37540	62600	30.0	55.6	.18	.45	.018	.030	
	D63021	38400	62140	28.5	55.6	.18	.51	.017	.041	
	D29017	37540	62800	30.5	51.2	.22	.50	.015	.030	
	D29017	37380	65600	29.2	49.6	.22	.50	.015	.030	
6 x 6 x 11/16	20613	37580	66340	28.7	51.2	.23	.70	.022	.034	
6 x 6 x 3/4	13500	37940	62860	29.2	52.7	.18	.47	.024	.045	
6 x 6 x 3/4	32611	37680	64380	27.5	50.8	.21	.60	.027	.037	
	D61021	37750	64240	30.0	50.8	.21	.60	.019	.039	
6 x 6 x 1"	51657	38300	69800	26.0	46.9	.10	.58	.027	.049	
	55685	37650	65580	27.2	54.5	.19	.64	.014	.041	
8 x 4 x 3/8	314376	37600	67840	27.5	51.8	.25	.62	.012	.031	
	D49041	38000	69360	26.2	49.3	.22	.53	.024	.029	
6 x 4 x 7/16	315329	38110	65070	26.2	51.7	.20	.40	.012	.035	
	314380	37610	64220	30.0	52.4	.24	.44	.014	.042	
	311419	37740	64680	27.5	52.0	.23	.45	.012	.037	
	31539	37440	66200	26.5	50.5	.22	.48	.016	.032	
8 x 4 x 1/2	315329	39100	68190	26.2	50.0	.20	.40	.012	.035	
6 x 4 x 5/8	312415	38880	68760	24.7	45.4	.26	.52	.012	.033	
	314452	37810	64540	28.7	51.4	.28	.57	.009	.034	
	202542	38160	66210	27.5	44.0	.25	.54	.010	.040	
CB30 x 115#	D31047	38320	69660	25.5	48.9	.22	.60	.017	.038	
	D56050	37680	64400	28.0	51.5	.18	.60	.016	.034	
CB30 x 135#	D55005	37900	62800	31.2	54.7	.18	.60	.022	.036	
CB30 x 180#	D56020	37880	63880	33.7	51.1	.21	.70	.017	.030	
	D47020	37700	70180	28.2	51.2	.20	.79	.018	.032	
CB27 x 91#	51478	38350	66060	27.2	52.2	.20	.69	.014	.043	
	52468	37440	62680	29.7	53.0	.18	.70	.024	.043	
	48388	38080	62460	26.0	49.7	.18	.63	.024	.038	
	58474	38580	65060	24.7	52.2	.23	.71	.023	.044	
	59465	38640	66860	27.5	52.2	.21	.73	.018	.050	
	61459	38440	65760	27.7	54.3	.20	.66	.025	.048	
CB27 x 112#	54670	37210	64120	30.0	52.3	.17	.65	.021	.043	
	D56019	37740	64480	30.0	54.7	.17	.60	.027	.037	
	D63019	38040	65060	26.7	47.8	.17	.64	.030	.042	
CB27 x 145#	D43024	37800	63140	28.5	53.8	.18	.70	.025	.042	
	D66026	37450	64140	29.2	55.5	.17	.73	.024	.035	
	36486	37200	64200	30.0	53.8	.20	.89	.020	.040	
CB27 x 160#	D56051	37840	63140	30.0	50.6	.20	.61	.012	.042	
CB27 x 175#	D66051	37840	62420	29.7	52.4	.20	.61	.012	.042	
	36486	37580	65360	30.5	55.9	.20	.89	.020	.040	
CB24 x 70#	D63041	38260	64600	30.0	52.2	.18	.50	.018	.030	
	D46038	37740	63100	28.5	55.1	.20	.69	.019	.033	
	D53047	37820	64520	26.0	51.0	.18	.55	.017	.038	
CB24 x 70#	44477	37140	64540	26.2	53.4	.20	.71	.029	.052	
CB21 x 80#	52686	38240	67880	25.5	53.2	.18	.61	.027	.048	
	53673	38150	66440	26.7	55.9	.17	.58	.022	.040	
CB18 x 58#	D64058	37650	65280	28.7	51.4	.22	.57	.017	.037	
CB18 x 78#	47487	37940	62000	31.2	59.6	.17	.47	.016	.030	
	60582	37980	63700	30.0	53.1	.16	.61	.023	.050	
CB18 x 86#	D63016	37650	66040	28.7	51.2	.21	.62	.036	.042	
	58675	37850	66240	30.0	57.1	.18	.74	.020	.036	

APPENDIX E-4

Eye Bar Tests

Louisville Superstructure Eyebars

Mark Location	Size of Bar	Heat Number	Brinnell Numbers				Ultimate Strength		Elastic Limit	
			3 ft. From Head	Center	3 ft. From Head	Average	Estimated From Brinnell Number	From Full size Test Same Heat	Estimated From Brinnell Number	From Full size Test Same Heat
UC 2-MC3	14x1-13/16	44494	201	192	207	200	88200	90450	56460	58410
UC 2-MC3	14x1-13/16	34489	197	197	201	198	87300	87710	55870	56400
UC 2-MC3	14x1-13/16	36479	187	197	197	194	85500	88200	54720	55800
UC 2-MC3	14x1-13/16	34482	187	197	187	190	83800	90300	53630	58530
UC 2-MC3	14x1-13/16	34490	187	197	197	194	85500	86120	54720	54760
UA10-UA11	14x1-15/16	34482	192	187	197	192	84700	90300	54210	58530
UA10-UA11	14x1-15/16	34488	187	197	197	194	85500	89020	54720	55600
MA13-LA14	14x1-1/2	34489	201	197	197	198	87300	87710	55870	56400
MA13-LA14	14x1-1/2	35455	197	187	192	192	84700	85680	54210	54680
UA12-MA13	14x1-5/8	36479	197	207	207	202	89000	88200	56960	56800
UA 0-UA1	14x1-15/16	34488	197	197	197	197	86800	89020	55550	56720
UA 0-UA1	14x1-15/16	44472	201	187	187	192	84700	87400	54210	56420
UA 0-UA1	14x1-15/16	35446	212	207	192	204	89000	88270	57540	56420
UA 0-UA1	14x1-15/16	35455	187	197	187	190	82900	86680	53630	54680
UA 0-UC1	14x1-15/16	36479	207	197	207	204	89000	88200	57540	56800
UA 0-UC1	14x1-15/16	36479	187	207	197	197	86800	88200	55550	55800
UC 1-UC2	14x1-15/16	35455	187	187	187	187	82500	87600	52800	54680
UC 1-UC2	14x1-15/16	34489	197	207	197	200	88200	87710	56450	56400
UC 1-UC2	14x1-15/16	34492	207	207	212	209	92100	86110	58940	56540
UA10-UC1	14x1-15/16	34489	187	183	187	186	83000	87710	52480	56400
UA10-UC1	14x1-15/16	35455	187	187	197	187	82500	85680	52800	54680
UC 4-UC5	14x1-5/8	34488	187	187	187	190	83800	89020	53630	55600
UC 4-UC5	14x1-5/8	35446	187	187	187	187	82500	88270	52800	56420
UC 4-UC5	14x1-5/8	34492	207	207	207	207	91300	86110	58430	56540
UC 3-UC4	14x1-5/8	44494	207	197	197	200	88200	90450	56460	58410
UC 3-UC4	14x1-5/8	44472	187	187	187	187	82500	87400	52800	56720
UC 3-UC4	14x1-5/8	35455	197	187	197	194	85500	85680	54720	54680
UC 3-UC4	14x1-5/8	36479	207	197	197	200	88200	88200	56450	55800
UC 3-UC4	14x1-5/8	35446	197	207	197	200	88200	882.0	56450	56420
UC 3-UC4	14x1-5/8	34490	187	187	197	190	83800	86120	53630	54760
UC 3-UC4	14x1-5/8	34488	197	207	187	197	86800	89020	55550	55600
UC 2-UC3	14x1-5/8	34482	207	201	197	202	89000	90300	56960	58530
UC 2-UC3	14x1-5/8	34492	207	207	212	209	92100	86110	58940	56540
UC 2-UC3	14x1-5/8	35455	192	197	197	195	86000	85680	55040	54680
UC 2-UC3	14x1-5/8	44494	207	197	207	204	89900	90450	57540	58410
UC 2-UC3	14x1-15/16	44494	207	212	207	209	92100	90450	58940	58410
UA 1-UA2	14x1-15/16	35455	197	197	197	197	86800	85680	55550	54680
UA 1-UA2	14x1-15/16	34482	207	187	197	197	86800	90300	55550	58530
UA11-UA12	14x1-11/16	34490	207	197	197	200	88200	86120	56450	54760
MC 3-LC4	14x1-3/8	35446	207	201	207	205	90400	88270	57860	56420
UC 5-LS6	14x1-3/8	44472	207	207	197	204	89000	87400	57540	56720
UC 5-LS6	14x1-3/8	34489	207	207	207	207	91300	87710	58430	56400
UC 5-LS6	14x1-3/8	35455	197	187	207	197	86800	85680	55550	54680
UC 5-LS6	14x1-3/8	34490	187	187	197	190	83800	83460	53630	54070
MA 3-LA4	14x1-3/8	34492	207	207	197	204	89900	86110	57540	56540
UA 2-MA3										

Eye Bar Tests

Jeffersonville Superstructure Eyebars

Mark Location	Size of Bar	Heat Number	Brinnell Numbers				Ultimate Strength		Elastic Limit	
			3 ft. From Head	Center	3 ft. From Head	Average	Estimated From Brinnell Number	From Full size Test Same Heat	Estimated From Brinnell Number	From Full size Test Same Heat
UC 1-UC2	14x1-15/16	35824	197	197	192	195	86000	81760	56040	51550
UC 1-UC2	14x1-15/16	46237	217	212	207	212	93400	89250	59780	57140
UC 1-UC2	14x1-15/16	34360	192	197	197	195	86000	86550	56040	54830
UC 3-UC4	14x1-5/8	44364	183	187	187	186	82000	82150	52480	52120
UC 3-UC4	14x1-5/8	43380	183	197	197	192	84700	82560	54210	52840
UC 3-UC4	14x1-5/8	35824	197	197	197	197	86800	81760	55550	51550
UA 0-UC1	14x1-15/16	46237	201	187	207	198	87300	89250	55870	57140
UA 0-UC1	14x1-15/16	46332	197	192	201	196	86400	86250	55300	55490
UA 0-UC1	14x1-15/16	35824	197	192	187	192	84700	81760	54210	51550
UA 0-UC1	14x1-15/16	34360	197	187	201	195	86000	86550	55040	54830
UC 2-UC3	14x1-5/8	43380	187	197	192	192	84700	82560	54210	52840
UC 2-UC3	14x1-5/8	44364	187	197	197	194	85500	82150	54720	52120
UC 2-UC3	14x1-5/8	46237	207	212	212	210	92600	89250	59260	57140
UC 4-UC5	14x1-5/8	46237	187	197	207	197	86800	89250	55550	57140
UC 4-UC5	14x1-5/8	44364	187	187	197	190	83800	82150	53630	52120
UC 4-UC5	14x1-5/8	35824	183	187	187	186	82000	81760	52480	51550
UA 1-UA2	14x1-15/16	46237	207	207	197	204	89900	89250	57540	57140
UA 1-UA2	14x1-15/16	35824	197	187	187	190	83800	81760	53630	51550
UA 1-UA2	14x1-15/16	34361	207	201	187	198	87300	87780	55870	57070
UA 1-UA2	14x1-15/16	34360	207	187	197	197	86800	86550	55550	54830
UA11-UA12	14x1-15/16	46332	197	197	197	197	86800	87540	55550	55790
UA 0-UA1	14x1-15/16	43380	197	197	197	197	86800	82560	55550	52840
UA 0-UA1	14x1-15/16	34361	197	197	197	197	86800	87780	55550	57070
UA10-UA11	14x1-15/16	46332	197	201	207	202	89000	87540	56960	55790
UA10-UC1	14x1-15/16	46332	197	197	197	197	86800	86250	55550	55490
UC 5-LS6	14x1-3/8	34361	187	187	197	190	83800	87780	53630	57070
UC 5-LS6	14x1-3/8	36575	192	192	197	194	85500	89700	54720	58820
UC 2-MC3	14x1-13/16	46333	197	207	192	199	87600	86250	56190	55490
UC 2-MC3	14x1-13/16	43380	187	187	197	190	83800	82560	53630	52840
UC 2-MC3	14x1-13/16	46345	207	207	207	207	91700	89700	58430	58850
MC 3-LC4	14x1-11/16	34360	197	197	192	195	86000	86550	55040	54830
MC 3-LC4	14x1-11/16	34361	187	187	187	187	82500	87780	52800	57070
MC 3-LC4	14x1-11/16	43380	197	187	187	190	83800	82560	53630	52840
UA 2-MA3	14x1-3/8	34361	197	187	207	197	86800	87780	55550	57070
UA 2-MA3	14x1-3/8	46345	197	197	207	200	88200	89700	56450	58850
MA13-LA14	14x1-1/2	46347	187	197	187	190	83800	87640	53630	55710
MA 3-LA4	14x1-3/8	43380	197	197	197	197	86800	82560	55550	52840
MA 3-LA4	14x1-3/8	44364	192	192	197	194	85500	82150	54720	52120
MA 3-LA4	14x1-3/8	36575	197	187	197	194	85500	89700	54720	58820
MA 3-LA4	14x1-3/8	46347	187	197	187	190	83800	87640	53630	55710