DESIGN OF A BRICK PAVEMENT FOR WOODSTOCK ILLINOIS

BY
CLAUDIO JOSE DA SILVA

ARMOUR INSTITUTE OF TECHNOLOGY
1911
AT 210
Da Silva, Claudio Jose
Design of brick pavement for
Woodstock Illinois
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FOR
WOODSTOCK ILLINOIS

THESIS
PRESENTED BY
CLAUDIO JOSE DA SILVA

TO THE
PRESIDENT AND FACULTY
OF
THE ARMOUR INSTITUTE OF TECHNOLOGY
FOR THE DEGREE OF
BACHELOR OF SCIENCE IN CIVIL ENGINEERING
HAVING COMPLETED THE PRESCRIBED
COURSE OF STUDY IN CIVIL ENGINEERING

1911
INTRODUCTION

This thesis is an estimate of the cost of a brick pavement including grading, laying curb, and paving around the public square and all streets leading therefrom for one block in Woodstock Illinois.

Brick will be used because the traffic is a little too heavy for asphalt and not heavy enough for granite blocks. The grades in some places are too steep for asphalt while the brick will give a good foothold for the horses. The brick pavement is easily repaired, easily cleaned, and is durable under moderate traffic.

The contour of the finished surface shall be a parabolic curve where it is possible as shown in the cross-section of the different streets.

The intersection of the streets are not level because the grades of the sidewalks and curbs were originally set so as to make it impossible without a very great expenditure of money and inconvenience to the public.

A storm water sewer system was installed at some previous date but will need a few slight alterations which are not taken into consideration in this thesis.
SPECIFICATIONS.

NOTICE TO CONTRACTORS.

Sealed proposals will be received by the Mayor of the City of Woodstock, Illinois, up to o'clock, P. M. of the day of 1911, for furnishing material and constructing about 4646 square yards of vitrified brick pavement on a concrete foundation on Benton Street, about 3031 square yards on Cass Street, about 2430 square yards on Johnson Street, about 1990 square yards on Van Buren Street, about 1700 square yards on Main Street, about 550 square yards on Jackson Street, about 570 square yards on Dean Street, also about 540 square yards on Dietz Street, in accordance with plans and specifications on file at the office of the Mayor.

Specifications, instruction to bidders, and blank proposals will be kept on file at the office of the Mayor where they may be examined upon request.

The right is reserved to reject any and all bids. Each bid must be accompanied by a certified check, payable to the Mayor of the City of Woodstock, equal to 10% of the bid.

______________________________  ________________________  ______________________
Mayor  Engineer  Clerk
PROPOSAL.

TO FURNISH ALL LABOR, MATERIAL, TOOLS, AND EQUIPMENT FOR THE CONSTRUCTION OF A VITRIFIED BRICK PAVEMENT IN THE CITY OF WOODSTOCK, ILLINOIS.

Name of Bidder________________________
Address of Bidder_______________________

To the City of Woodstock, Illinois.

Gentlemen: - The undersigned do hereby declare:

1. That he has been regularly engaged in the contract work of the class of work required by the annexed contract, plans, and specifications for years, and respectfully invite your attention to the following works that have been constructed by

2. That he has examined the law and ordinances mentioned in the "Instruction to Bidders" annexed and relating to the proposed work, and will undertake to conform to such law and ordinances.

3. That he has personally examined the location of the proposed work and he is satisfied as to the amount and character of the work and the materials necessary to construct and complete the work in accordance with the annexed plans, specifications, and contract.
4. What the undersigned do hereby offer to perform the whole of the work and to furnish all material, labor, watchman, implements, tools, and all material and machinery necessary for the proper construction of all work contemplated in accordance with the plans, profiles, specifications and contract, all of which have been examined by at the office of the Mayor of the City of Woodstock, Illinois, and to conform to all of the conditions hereto at and for the following prices to wit:

$\begin{array}{ll}
15446.50 \text{ Square yards of Vitrified Brick} & @ \$ \text{ per sq. yd.} \\
2541.40 \text{ Cubic yards of excavation} & @ \$ \text{ per cu. yd.} \\
1000.00 \text{ Lineal feet of curb (extra)} & @ \$ \text{ per foot} \\
1009.90 \text{ Lineal feet of curb} & @ \$ \text{ per foot} \\
835.70 \text{ Lineal feet of Resurfaced curb} & @ \$ \text{ per foot} \\
12 \text{ Catch Basins} & @ \$ \text{ each} \\
30 \text{ Inlets} & @ \$ \text{ each} \\
10 \text{ Park Inlets} & @ \$ \text{ each} \\
4 \text{ Valve Basins} & @ \$ \text{ each} \\
\end{array}$

$\text{Total Bid} \ldots \ldOTS

The above prices based on estimated quantities include all work and materials mentioned in said plans and specifications, and completion of the entire work to meet the satisfaction of the Mayor and City Council and their Engineer. Final payments to be based on the actual measurements of the completed work, as certified to by the Engineer of said Council.
Enclosed herewith is a certified check for 10% of the amount of this bid as required by law, submitted with the express condition that if this bid is accepted and the undersigned shall fail to enter into the contract with the said City within ten days after first publication of notice of award, or shall fail to deliver to said City a good and sufficient bond in 50% of the amount of said contract price, in form and security satisfactory to said Board, that the undersigned will duly perform said contract and within the time limited in said specification, said check so deposited shall be forfeited to said City; but if, and as soon as contract and bond have been approved, said check shall be returned to the undersigned.

Payments to be made in cash base on 80% of the actual work done from time to time as certified to be Engineer of said Council.

It is hereby agreed that the work shall be begun within fifteen days of the execution of the contract therefor and entirely and fully completed within three months thereafter. In case of strikes, or delays by act of God, time to be proportionately extended.
Respectfully submitted

Firm Name

Office Address

Individual Name

Residence Address
GENERAL

These specifications are to provide for the construction of a Brick Pavement for the City of Woodstock, Illinois, said pavement to be complete in every respect and ready for operation.

INSTRUCTIONS TO BIDDERS.

1. The attention of bidders is called to the records of the City of Woodstock, Illinois, concerning the proceeding authorizing the raising of funds and City ordinances pertaining to the contemplated improvement.

2. All bids must be filed with the Mayor of the City of Woodstock, on or before the time stated in the "Notice to Contractors."

3. Accompanying these specifications and made a part thereof, are a set of plans, described under the heading "PLANS" - and a blank form of proposal headed "PROPOSAL." Any one desiring to bid on the work will examine the plans and specifications and each bidder must submit his proposal by filling in each and every blank provided for that purpose on the sheet headed "PROPOSAL." Any bid not conforming to this requirement may be rejected as informal.

4. Each proposal must be headed by the name and post office address of the bidder, and if made by a corporation shall be signed and sealed by the legally authorized officer of the company or corporation.
5. Proposals shall be sealed and marked "PROPOSALS FOR BRICK PAVEMENT" on the outside of the envelope, and addressed to the Mayor of Woodstock, Illinois.

6. Parties making proposals on the work contemplated under these specifications must familiarize themselves therewith as regards the work covered by the bid, and such other work as may need to be carried on in conjunction therewith in order that the true spirit and intent of these specifications may be fulfilled.

7. The city reserves the right to reject any or all bids, or to waive any irregularity in the bids that is not in accordance with the general requirements of these specifications.

8. In case these specifications should be deficient or not clearly expressed, the parties submitting proposals should apply to the Engineer for the required information or explanation before their bids are submitted. No change will be allowed in the specification after the awarding of the contract, except those ordered in writing by the Mayor and Committee in charge and made necessary by unforeseen elements encountered during construction.

9. Each bidder must state in his proposal the extent of his experience, and give some references that will enable the City Council to investigate his
experience, skill and business standing, and any proposal not complying with this requirement may be rejected without further consideration.

10. Each bid must be accompanied by a certified check for the sum equal to 10% of the bid. This check shall be made payable to the Mayor of Woodstock, Illinois, and shall be forfeited and become the property of the City, in case the bidder neglects or refuses to enter into contract and to furnish bond within ten (10) days after the contract has been awarded. The check accompanying the accepted bid will be retained until the bond of the successful bidder shall have been submitted and approved by the City Council, but the checks of all other bidders will be returned upon demand after the contract has been awarded.

11. A bond will be required for the faithful performance of the contract in the penal sum of fifty (50%) per cent of the contract price, with two or more approved securities or a regularly incorporated surety company.

12. All bids will be compared upon the basis of the Engineer's estimate of the quantity of work to be done, which is as given on the plans or stated in the specifications.

The Engineer's estimate hereto attached giving the quantities of work to be performed under the contract conforms with the resolution authorizing said
work and the quantities therein given are as accurate as possible to determine in advance. It is expressly understood, however, that the officials in charge are not responsible for its accuracy and that bidders are expected to verify such quantities before the submission of their proposals.

13. Bidders are required to submit their bids upon the following express conditions:

That they have satisfied themselves by personal examination of the location of the proposed work, or by such other means as they have elected as to the nature and quantity of the work, and as to the accuracy of the above estimates; and that they will not at any time after the submission of their bids, dispute said estimate, nor claim any misunderstanding in regard to the nature or amount of work to be done, nor attempt to hold the City Council, nor any person responsible for same.

14. The bidder to whom the contract is awarded will be required to begin work within fifteen (15) days after the contract is signed, and fully complete the work ready for final inspection and acceptance three months thereafter.
**ESTIMATED QUANTITIES AND COST OF A BRICK PAVEMENT TO BE CONSTRUCTED FOR THE CITY OF WOODSTOCK, ILLINOIS.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Rate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>15447 Square yards of Vitirfied Brick</td>
<td>$ 1.90</td>
<td></td>
<td>$29348.35</td>
</tr>
<tr>
<td>2542 Cubic yards of Excavation</td>
<td>.40</td>
<td></td>
<td>1016.80</td>
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<tr>
<td>1000 Lineal feet of Curb (Extra)</td>
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<td></td>
<td>400.00</td>
</tr>
<tr>
<td>1010 Lineal feet of Curb</td>
<td>.30</td>
<td></td>
<td>303.00</td>
</tr>
<tr>
<td>840 Lineal feet of Resurfaced Curb</td>
<td>.20</td>
<td></td>
<td>168.00</td>
</tr>
<tr>
<td>12 Catch Basins</td>
<td>30.00</td>
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<td>360.00</td>
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<td>30 Inlets</td>
<td>12.00</td>
<td></td>
<td>360.00</td>
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<tr>
<td>10 Park Inlets</td>
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<td>60.00</td>
</tr>
<tr>
<td>4 Valve Basins</td>
<td>25.00</td>
<td></td>
<td>100.00</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>$32116.18</strong></td>
</tr>
</tbody>
</table>

These quantities are ascertained with as great a degree of accuracy as possible, but any variation from them will not entitle the contractor to any claim for damages if the quantities of work should prove greater or less than here estimated.
SPECIFICATIONS

BRICK PAVEMENT.

1. For paving Benton Street from Van Buren Street to the C. & N. W. R. R. Tracks; Van Buren Street from Johnson Street to Benton Street; Johnson Street from Van Buren Street to Cass Street; Cass Street from Troop Street to Benton Street; Main Street from Cass Street to Washington Street; Jackson Street from Troop Street to Johnson Street; Dean Street from Van Buren Street to Calhoun Street; Deitz Street from Benton Street to Jefferson Street; with Brick.

GRADING.

2. All grading will be paid for by the cubic yard at the price named in the contract and will be measured in excavation only, excepting borrowed material used in fill. The contract price shall include all trimming, shaping, refilling, and all other work and all materials necessary to bring the completed surface of the road-bed to the exact shape and grade required by these specifications. Only the excavation included in the area covered by the finished pavement will be paid for as grading.

3. The road-bed shall be brought to a sub-grade which will be below the established grade of the street a depth equal to the thickness of the proposed pavement.
and foundation, and shall be graded to the exact form of the cross-section shown on plans.

4. In places where cutting is required to bring the street to the required grade, no plow shall be used below a line three (3) inches above the surface to which the road-bed is to be graded. The remaining three (3) inches to be carefully dressed off with picks or other hand tools.

5. Wherever fill is required, it will be made with any suitable material excavated from this improvement. Should such suitable excavated material not be sufficient to make the necessary fill, the remained of the fill shall be made with suitable gravel or cinders, for which the contractor will be paid the price named in bid. All filling shall be made in uniform layers not to exceed four (4) inches in depth, and each layer shall be thoroughly flooded and rolled, or tamped as may be required to insure a solid bed.

6. The road-bed shall then be brought to the exact sub-grade by thoroughly tamping with an 80 pound tamper, or rolling with a roller weighing not less than 250 pounds per lineal inch, as may be required to procure a solid sub-grade, all hollows or depressions that may appear after this tamping or rolling shall be brought to sub-grade by a
filling of gravel or cinders thoroughly tamped or rolled, for which no compensation will be allowed.

7. All mud or other soft or spongy material, or any material that cannot be made solid and compact in the road-bed, shall be removed and the places refilled with gravel or cinders without compensation.

8. When considered necessary to procure a compact and solid road-bed, the ground, before being rolled, shall be thoroughly flooded with water.

9. All excavated material not used in this work shall be the property of the City and shall be deposited in such place and spread in such manner as may be directed by Engineer, the maximum length of haul not to exceed two thousand (2,000) feet. When haul shall exceed 2,000 feet, the contractor shall be paid the price named in the bid.

10. After the road-bed has been rolled, ready for the concrete foundation, no loaded or empty wagons or other vehicles, that may disturb the finished surface, will be permitted thereon, unless the road-bed is protected by a covering of planks.

CONCRETE CURBING.

11. The curb is to be six (6) inches in height above top of the finished gutter, which height shall be varied at inlets, street crossing, etc., as directed by the Engineer, and six (6) inches in thickness
with the upper face corner rounded to a radius of one and one-half (1½) inches. Around the Public Square the top of curb shall be twenty (20) inches above top of finished gutter as shown on the plans.

12. The top edge of the curb shall conform to the line and grade given by the Engineer.

13. After the excavation has been made along the line of the proposed curbing there shall be laid a foundation of gravel or cinders six (6) inches in thickness after being compacted. This bed shall be flooded with water and thoroughly rammed with a rammer having a surface of not more than 20 square inches and a weight of no less than ten pounds.

14. Upon the foundation prepared as specified in Section 13, shall be set the curb which shall be constructed in alternate sections seven (7) feet in length, the concrete portion shall be composed of one (1) part, loose measure, of best Portland cement, equal in quality to the best imported Portland cement, two (2) parts of clean, coarse, sharp, well screened sand, and four (4) parts of hard lime-stone, flint granite or Joplin Tailing crushed to such a size that the fragments shall not be larger than one and one-half (1½) inches in the greatest dimension. The mixing and placing of the concrete shall be done in the same manner as hereinafter specified for pavement foundation.
15. The concrete portion shall be one (1) inch less in thickness than the finished curb. Before the concrete has begun to set there shall be spread upon it a finish coat one (1) part best Portland Cement and one and one-half (1½) parts clean, coarse, sharp sand well screened.

16. The finished curb shall be protected from the sun and wind by a covering of canvas, which shall be kept moist by sprinkling with water for at least twenty-four (24) hours after completion. Any spalling or splitting off whatever of the finished surface of the curb will be sufficient cause for rejection, and any rejected stone must be removed and replaced with a new one immediately. No patching of any character will be permitted.

17. The price paid for concrete shall be for furnishing all labor and material that may be necessary to construct the same in accordance with the foregoing specifications, and to maintain the same until accepted by the Mayor and City Council. It shall also include all taking out of old curbing, if any, and all excavating, refilling, and removal of waste materials.

REFACEING OLD CURBING,

18. All curbing now constructed shall be faced from sub-grade to top of curb with a coating of mortar one (1) inch in thickness, composed of one (1) part best
quality Portland Cement and two (2) parts clean, coarse, sharp well screened sand. The contractor shall remove all mortar from between the stones of the present curb to a depth of at least one-half ($\frac{1}{2}$) inch and shall thoroughly clean the face of the curbing with water, wire brushes or by such means as will render the surface clean. After the old mortar has been removed from between the stones of the old curb and the surface thoroughly cleaned, a two (2) inch dressed plank form shall be constructed one (1) inch from the face. The form shall be thoroughly braced in position and spreaders shall be placed between the form and the old curb to maintain an average distance of one (1) inch. No face stone shall be less than one-half ($\frac{1}{2}$) inch from the form. All stones or points projecting more than one (1) inch from the general face of the curb shall be chipped off before the form is set.

After the form is in place the space thus provided shall be filled with mortar composed as here-tofore specified.

The facing thus constructed shall be allowed to set sufficiently to permit removal of the form without spalling. After removing the forms all air holes and small irregularities shall be filled with mortar and the surface brushed with a wash of Portland Cement and water.
CONCRETE FOUNDATION.

19. Upon the sub-grade prepared in accordance with the specifications for grading, will be laid a concrete foundation six (6) inches thick after being compacted.

20. The concrete shall be composed of one (1) part by loose measure best American Portland Cement equal in quality to best imported Portland Cement, three (3) parts by loose measure of clean, coarse, sharp, well screened river sand and six (6) parts broken stone.

21. Between the curb lines of intersecting unpaved streets, avenue, or alley, the concrete foundation and pavement shall be finished against a white oak plank three (3) inches in thickness and of such width as to extend from sub-grade to the grade of the finished pavement. The upper edge of the plank shall be dressed off to conform to the surface of the finished pavement. These planks to be held in place by 6 inch cedar posts.

22. The proportions herein specified are intended to produce a concrete in which the mortar will fill all the voids of the aggregate, and the proportions will be so adjusted that when well tamped in placed free mortar will flush to the surface and proportions may be changed to obtain these results.
23. The concrete shall be prepared in any standard mixer, and sufficient water shall be added to make a good mortar of the proper consistency.

24. The concrete thus mixed shall have such a consistency that when rammed the mass will not shake like jelly, but will, when struck, compact within the area of the face of the rammer without displacing laterally.

25. The concrete thus prepared shall be immediately placed in the work. It shall be spread and thoroughly compacted by tamping until free mortar appears on the surface.

26. The whole operation of mixing and laying each batch of concrete shall be performed in an expeditious and workmanlike manner, and be entirely completed before the cement has begun to set.

27. No re-tempering of cement will be permitted and concrete in which the mortar has begun to set will be rejected.

28. The upper surface of the concrete shall be made to conform exactly to the form of the finished pavement and shall be made perfectly smooth by thoroughly brooming it with wire brooms.

29. As soon as laid and before the top becomes dry, the entire surface of the concrete foundation shall be covered with one (1) inch in depth of clean sand to protect it from the sun and wind. The sand so spread
shall be kept moist until the pavement is laid.

30. No driving over the concrete foundation will be permitted, and it shall be allowed to set for three (3) days before any further work shall progress on the same and any damage done by passing over it shall be repaired by contractor without extra pay.

31. No concrete shall be laid when the temperature at any time during the day or night falls below thirty-five (35) degrees Fahrenheit.

32. The tamper used in compacting the concrete must be of cast iron wearing surface and shall have an area of not more than thirty (30) square inches and weigh not more than 20 pounds or less than 15 pounds.

REQUIREMENTS OF MATERIALS.

CEMENT.

33. All cement for concrete foundations shall be American Portland and shall be the best obtainable in the markets. It will be subjected to a rigid inspection and that rejected shall be immediately removed by the contractor.

34. The contractor must submit the cement for inspection and testing at least ten (10) days before using, and such inspection and test will be made only from samples obtained by the inspector from cement delivered on the work. The inspector shall be notified
of each delivery of the cement. All cement must stand the following tests.

35. Two cakes, three (3) inches in diameter and one-half (¼) inch thick with thin edges will be made. One of these cakes as soon as set will be placed in water and examined from day to day. If the cake exhibits checks, cracks, or contortions, the cement will be rejected. The other cake will be used for setting and other tests.

36. The time will be noted when the cake has become hard enough to sustain a wire one-twelfth (1/12) inch in diameter loaded with one-fourth (1/4) pound. When the wire is sustained the cement has begun to set and this time shall not be less than forty-five (45) minutes for Portland Cement.

37. When the cake will sustain a wire one twenty-fourth (1/24) inch in diameter loaded with one (1) pound, the set is complete, and this time must not be less than two (2) hours nor more than six (6) hours for Portland Cement.

38. The cake used for setting test will be preserved, and when examined from day to day must be of uniform color, exhibiting no blotches of discoloration.

39. The cement must be evenly ground, and when tested with the following standard sieves, must pass at least the following percentages.

No. 20 sieve have 20 meshes per lineal inch - 100
per cent.
No. 50 sieve having 50 meshes per lineal inch - 98 per cent.
No. 74 sieve having 74 meshes per lineal inch - 94 per cent.
No. 100 sieve having 100 meshes per lineal inch - 90 per cent.
The diameter of the wire being respectfully,
For No. 20 sieve No. 28 Stub's wire gauge.
For No. 50 sieve No. 35 Stub's wire gauge.
For No. 74 sieve No. 37 Stub's wire gauge.
For No. 100 sieve No. 40 Stub's wire gauge.

40. All cement for test briquetts will be mixed with just sufficient water to make a stiff mortar. The neat briquetts to be pressed into the moulds by hand and the sand briquetts to be compacted by light tamping.

41. The sand for cement tests will be crushed quartize of such fineness that all will pass a No. 20 sieve and none of it a No. 30 sieve.

42. The required tensile strength per square inch shall be as follows:

NEAT CEMENT.

One day initial set in air remainder of time in water 150 lbs.
Seven day - one day in air, six days in water 400 lbs.
Briquettes for the seven (7) day tests shall be covered for the first twenty-four (24) hours with a damp cloth.

SAND.

43. The sand shall be clean, coarse, sharp river sand. It shall be free from all clay or other mineral impurities, loam or organic matter, and shall be thoroughly screened.

STONE.

44. The stone shall be of the best quality of hard lime stone, trap rock, granite, or Joplin Tailings.

45. The broken stone when delivered along the line of the work shall be deposited on platforms made for that purpose.

46. The stone shall be broken with a stone crusher to such a size that the fragments shall not be larger than two and one-half \((2\frac{1}{2})\) inches in the greatest dimension. It shall be free from mud, dirt, dust, loam, or other objectionable material. The broken stone shall be screened when necessary on a one-half \((\frac{1}{2})\) inch screen to eliminate all dust and small particles.

BRICK.

47. The size of the brick shall be two and one-half \((2\frac{1}{2})\) inches, by four \((4)\) inches by eight \((8)\) inches, or three and one-half \((3\frac{1}{2})\) inches by four \((4)\) inches by nine \((9)\) inches. They shall be straight, regular in
size and shape, and free from all flaws, cracks, breaks or projections. They shall be made expressly for paving and shall be hard, tough and thoroughly vitrified, and must fulfill the following requirements.

48. The modulus of rupture for transverse strength must not be less than 2,000 pounds per square inch, computed by the formula $R = \frac{(31 - 2b d^2)}{W}$, where $R$ = modulus of rupture per square inch, $L$ = length between supports in inches, $b$ = breadth in inches, $d$ = depth in inches and $W$ = load in pounds. Bricks to be tested flatwise.

49. They shall not absorb more than two (2) per cent of their own weight of water after being immersed for forty-eight (48) hours.

50. The abrasion test shall be made by placing not more than twelve (12) bricks in an iron rattler twenty-four (24) inches in diameter and three (3) feet long, together with three hundred pounds foundry stars smoothly worn, the pieces of which vary in weight from one-quarter (1/4) pound to five (5) pounds. The rattler will revolve for one hour at the rate of fifteen (15) revolutions per minute. The loss in weight at the end of one hour for the 2 1/2 X 4 X 8 inch bricks shall not exceed nine (9) per cent, and for the 3 1/2 X 4 X 9 inch bricks shall not exceed seven (7) per cent.
null
51. The bricks shall not contain lime in such quantity as to cause disintegration or cracking after ten (10) day immersion in water.

52. These tests will be made after the contract is let and bricks delivered on the street from samples selected at large by the Engineer.

53. No broken or poorly shaped brick shall be used in the pavement except at the end of the courses where half bricks may be used to break joints.

54. The intention of the foregoing requirements is to procure for the work the best paving bricks obtainable in the markets.

55. The bricks delivered for use on the proposed pavement shall be carefully placed by hand, in neat piles along each side of the road way to be improved, at points where the Engineer may direct, and they shall not be thrown or dumped from the wagon.

SAND CUSHION.

56. On the foundation prepared as specified in the foregoing shall be spread a large layer of clean sand two (2) inches in thickness, gauged with a templet to secure the proper forms.

PAVEMENT.

57. On the layer of sand, spread as specified in section 56, shall be laid a course of brick on edge, and end to end across the street at right angles to the curb, except at street and alleys, where they will
be laid in the herringbone pattern.

58. The bricks must be closely and evenly laid in true straight lines care being taken to break joints by not less than three (3) inches.

59. The upper surface of the pavement shall then be made even and true by rolling with a roller weighing not less than 5 tons, or tamping, as may be necessary to best procure this result, the tamping to be done in the following manner: A two (2) inch plank, ten (10) or twelve (12) inches wide by twelve (12) feet in length, shall be placed upon the surface, and a rammer weighing at least sixty (60) pounds, used upon the plank in such a manner as to thoroughly tamp down all bricks to a uniform and smooth surface.

60. The pavement then shall be thoroughly wet by the contract, with water furnished by the city, so that all soft bricks may be removed and replaced with good hard bricks.

61. An expansion cushion must be provided for next to the curb. It shall be one (1) inch in thickness. This cushion shall be composed of asphaltum composition, filling the allotted space.

62. The filler shall be composed of one part each of clean, sharp sand and Portland Cement. The sand shall be dry. The mixture, not exceeding one-third bushel of sand, together with a like amount of cement, shall be
placed in the box and mixed dry, until the mass assumes an even and unbroken shade. Then water shall be added, forming a liquid mixture of the consistency of thin cream.

63. The side and edges of the brick should be thoroughly wet before the filler is applied by being gently sprinkled.

64. From the time the water is applied and until the last drop is removed and floated into the joints of the brick pavement, the mixture must be kept in constant motion.

65. The mixture shall be removed from the box to the street surface with a scoop shovel, all the while being stirred in the box as the same is being thus emptied. The box for this purpose shall be four (4) feet eight (8) inches long, thirty (30) inches wide and fourteen inches deep, resting on legs of different lengths, so that the mixture will readily flow to the lower corner of the box, the bottom of which should be six (6) inches above the pavement. This mixture, from the moment it touches the brick, shall be thoroughly swept into the joints. Five (5) boxes shall be used on the wide streets.

66. The work of filling shall be thus carried forward in line until an advance of fifteen to twenty yards has been made, when the same force and appliances shall be turned back and cover the same spaces in like manner, except to make the proportions two-thirds (2/3)
Portland Cement and one-third ($1/3$) sand.

67. To avoid the possibility of thickening at any point, there shall be a man with a sprinkling can, the head perforated with small holes, sprinkling gently the surface ahead of the sweepers.

68. Within one-half to three-quarters of an hour after this last coat is applied and the grout between the joints has fully subsided and initial set is taking place, the whole surface shall be slightly sprinkled and all surplus mixture left on the tops of the brick swept into the joints, bringing them up flush and full.

69. After the joints are thus filled flush with the top of the brick and sufficient time for hardening has elapsed, so that the coating will not absorb any moisture from the cement mixture, one-half ($1/2$) inch of sand shall be spread over the whole surface, and in case the work is subjected to a hot summer sun, an occasional springling, sufficient to dampen the sand, should be followed for two or three days.

70. The streets shall be closed to traffic for ten (10) days after the filler is applied.
GENERAL SPECIFICATIONS.

71. The contractor will be required to carefully set aside whatever blocks, planking, cobble-stones, crossing-stones, macadam, bricks, or any other material that may be in the street, and he shall deliver same where directly, the length of free haul not to exceed two thousand (2,000) feet.

72. Raised crossings constructed in conformity with plans for same will be laid at all street intersections and at such other places as may be necessary.

73. The contractor shall be required to remove at his own expense all obstructions, such as trees, stones, old blocks and debris.

74. The contractor will be held responsible for any damage done to the water, gas, sewer, or drain pipes and appurtenances.

75. During the progress of said improvement, said contractor will be required to keep free and unobstructed any railing along the line of work, keeping all stones, carts, material and all obstruction of whatever sort away from track of such railway, so that cars may run along the same, and said railway be used in its customary manner, without hindrance.

76. The old pavement, if any, shall not be removed, nor any work of grading done on any part of the roadway to be paved, until the new paving material to
be used shall first have been placed on the line of the street in sufficient quantities to fully complete the work for the full length of roadway disturbed.

77. The contractor shall remove all materials and debris from the street as the work progresses, so that the public may have the use of the street as soon and as fast as completed.

78. No materials of any kind shall be used until they have been examined and approved by the Engineer, and the Contractor shall furnish whatever samples may be required for making tests or examinations.

79. All material used in the construction of any part of said pavement shall be subject to the approval of the Engineer or his authorized agent, and any material that may be considered defective shall be removed immediately from the vicinity of the work, and in case the contractor shall refuse or neglect to remove any condemned material within twenty-four (24) hours after notice, the said Engineer may cause all such material to be removed from the vicinity of the work at the expense of said contractor.

80. Any work condemned by the Engineer shall be immediately, rebuilt, or the defect otherwise remedied as the said Engineer may direct, and in case the Contractor shall refuse or neglect to
remedy such defect as ordered, then the said Engineer may cause such condemned portions to be removed, re-
built, or repaired at the expense of said Contractor.

81. The Contractor shall bring to the surface of the finished pavement, without extra compensation, all casting on lamp-holes, man-holes, catch-basins, flush tanks, or other sewer appurtenances along the line of the improvement.

82. The Contractor shall do all work that may be necessary to connect the new work with adjoining street and alley intersections, or at any other places along the line of the improvement in a good, safe, proper and workmanlike manner.

83. Materials delivered on the street shall be neatly and compactly piled up along the sides of the roadway to be improved, in such manner as the Engineer may direct, so as to cause the least inconvenience to the property owners and general public and not within six (6) feet of any fire hydrants; shade trees and other public or private improvements shall be protected from damage.

84. The Contractor is required to preserve all stakes set for lines, levels, or measurements of the work in their proper places until authorized to remove them by the Engineer. All expense in replacing any stakes that the Contractor or his subordinates may have failed to preserve, will be charged to the Contractor.
85. Shanties or other buildings shall not be erected on the streets without the special permission of the Mayor or City Council.

86. The Contractor shall erect and maintain at all points open to public travel sufficient guards and fences and maintain lights at night from sunset to sunrise, to prevent accidents to persons and property.

87. The work shall be begun at such points and at such time as the Engineer shall direct, and no block shall be closed to the public except during the construction of the improvement.

88. Each block as soon as the pavement is laid shall be open to public use, but such opening or using of the street shall not be deemed or held to be an acceptance of any part of the work.

89. Upon any stoppage of the work, all material shall be piled up snugly, so as not to impede the travel on the sidewalk of carriageway, or the use of fire-plugs or drainage in gutters, and all rubbish or surplus material shall be removed immediately from the street, avenue or alley by the Contractor.

90. Necessary conveniences, properly secluded from observation, shall be constructed wherever needed for the use of laborers on the work.

91. Whenever the Contractor is not present on the
work, directions or orders given by the Engineer to any Superintendent or Foreman, who may have charge of any particular work, shall be received and obeyed the same as if given to the Contractor.

92. Whenever the word "Engineer" is used in these specifications and contract, the same shall be construed to mean the Engineer retained by the City of Woodstock, Illinois, and whenever the word "Contractor" is used, it shall be construed to mean the party of the first part of this Contract.

93. Inspectors will be appointed, whose duty it shall be to point out to the Contractor any neglect or disregard of these specifications, but the right of final acceptance or condemnation of the work shall not be waived in any manner by reason of any act on the part of such Inspectors.

94. The Engineer or Inspectors at all times shall have the right to discharge careless, incompetent or impudent workmen, and such discharged workman shall not again be employed by the Contractor.

95. The Contractor shall provide himself with all necessary tools for the proper and rapid execution of the work, and if in the opinion of the Engineer, the work cannot be completed within the period specified in this contract by reason of the lack of such necessary tools and appliances, then he shall be empowered to provide such tools and appliances at the expense of the
Contractor.

96. The City Council reserves the right to change either the quantity or character of the work from those given in the list of quantities, and such changes, additions, omissions will not entitle the Contractor to any claim for damages, if the quantities of work are greater or less than given in the list of quantities.

97. Any claim for extra work over and above the quantity specified in the list of quantities, shall be made in writing to the Engineer upon the completion of such work.

98. The Contractor shall receive for all extra work over and above the quantity specified in the list of quantities, the price named in the itemized bid.

99. If the amounts specified in the list of quantities are in excess in the actual work completed by the Contractor, the deficit shall be figured at the price named in the itemized bid and deducted from the contract price.

100. No sub-contracts will be permitted without a written permit signed by the Mayor and Engineer. No sub-contracts shall under any circumstances relieve the Contractor of his liabilities and obligations under this contract. Should any sub-contract fail to perform the work undertaken by him in a satisfactory manner and should this provision be violated, the party of the second part may, at their option, end and terminate
such contract.

101. The plans accompanying these specifications and made a part hereof, are drawn accurately to scale and show all necessary elevations, sizes and distances. They shall be followed unless otherwise instructed directly by the Engineer.

102. In the interpretation of these specifications and upon all questions concerning the execution of the work and decision of the Engineer, shall be a condition precedent to legal action by either party of this contract.
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PLANS and PROFILES
of
BRICK PAVEMENT
FOR
WOODSTOCK, ILL.

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PLAT OF WOODSTOCK, ILL.
SHOWING
PROPOSED BRICK PAVEMENT