

CITY OF MADISON

DEPARTMENT OF PLANNING,
ENGINEERING AND BUILDING

DIVISION OF ENGINEERING

CONSTRUCTION SPECIFICATIONS MANUAL FOR PUBLIC IMPROVEMENTS

Third Edition

Reissued June, 1996

As Amended through October, 2001

First Edition (1992) Written by Henry P. "Bud" Darstein, Engineering Inspector

ORDINANCE NO. 96-76

AN ORDINANCE OF THE CITY OF MADISON RELATING TO CONSTRUCTION STANDARDS FOR PUBLIC IMPROVEMENTS; REPEALING ORDINANCE NO. 93-168; ADOPTING A NEW CONSTRUCTION SPECIFICATION IMPROVEMENTS MANUAL FOR PUBLIC IMPROVEMENTS; PROVIDING AN EFFECTIVE DATE.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF MADISON AS FOLLOWS:

Section 1. Ordinance No. 93-168 is hereby repealed in its entirety.

Section 2. The attached Manual, entitled the City of Madison Construction Specifications Manual for Public Improvements, Reissued June, 1996, is hereby adopted.

Section 3. All improvements, as defined in said Manual, which are intended for use by the public, whether or not such improvements are located on public property, shall conform to the standards and specifications therein. No improvements located on public property shall be accepted into the City maintenance program that do not conform to said standards. Additionally, no site improvements that are constructed on private property shall be opened to use by the public that do not conform to said standards.

Section 4. The Community Development Department shall be responsible to inspect new site improvements to ensure that they are constructed in accordance with the Manual herein adopted.

Section 5. In the case of a conflict between the standards adopted herein and the standards of any other regulatory entity, these standards will control, to the extent permitted by law.

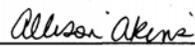
Section 6. This Ordinance shall become effective upon adoption and publication as required by law.

READ, PASSED AND ADOPTED THIS 27th DAY OF JUNE, 1996 BY THE CITY COUNCIL OF THE CITY OF MADISON.



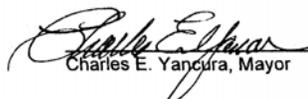
Greg Curtis, President and
Presiding Officer of the
Madison City Council

ATTEST:



Allison Akins
City Clerk-Treasurer

APPROVED THIS 28th DAY OF June, 1996.



Charles E. Yancura, Mayor

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CITY OF MADISON

CONSTRUCTION SPECIFICATION

1. DEFINITIONS

Whenever in the specifications or in any documents or instruments in construction operations where these specifications govern, the following terms, or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

AASHTO The American Association of State Highway and Transportation Officials

AGA The American Gas Association

AHD State of Alabama Highway Department Standard Specifications for Highway Construction, latest edition

A.N.S.I. American National Standards Institute

API The American Petroleum Institute

ASTM American Society for Testing of Materials

Board City of Madison Water and Wastewater Board

CHIEF INSPECTOR Chief Building Inspector of the City of Madison

CITY ENGINEER The duly designated engineer for the City of Madison

CITY INSPECTOR An authorized representative of the City of Madison assigned to make detailed inspections of any portion of or all materials furnished or work performed by the contractor.

CIVIL ENGINEER An engineer whose training or occupation is in the practice of civil engineering and who is a Registered Professional Engineer in the State of Alabama

CIVIL ENGINEERING The application of the knowledge of the forces of nature, principles of mechanics and the properties of

materials to the evaluation, design and construction of civil works for the beneficial use of mankind.

CONTRACT The written agreement between the owner and the contractor, covering the performance of the work and the furnishing of the labor, equipment and materials in the construction.

CONTRACTOR Any person, firm or corporation named as the party of the first part in the contract.

DIRECTOR The Director of the Community Development Department

EASEMENT A piece of land dedicated to the City for use as a corridor for utilities and/or drainage.

EMPLOYEE Any person working on the project to which these Specifications apply and who is under the direction or control of or receives compensation from the contractor or a sub-contractor.

ENGINEER Any person representing or being paid by the engineering firm that has been employed to design, supervise or inspect the construction of the project.

ENGINEER OF RECORD The civil engineer registered and in good standing with the State of Alabama State Board of Registration for Professional Engineers and Land Surveyors and permitted to practice in the City and County of Madison and who is responsible for the completeness and correctness of the information provided on the plans and specifications submitted for approval on behalf of the owners.

EQUIPMENT All machinery, machines, livestock and tools, together with the necessary supplies for upkeep, maintenance and protection, and all apparatus necessary for the proper construction and acceptable completion of the work.

EXTRA WORK Work authorized in writing by the engineer and performed by the contractor in order to complete the job in an acceptable manner. Such work will be supported by a "Change Order" signed by the City Engineer.

FSS Federal Specifications and Standards, General Services Administration

INSPECTOR An authorized representative of the engineer assigned to make detailed inspection of any portion of or all materials furnished and work performed by the contractor.

OWNER The public body, organization, board, district, corporation

or individual having responsibility for the furtherance of the project.

PLANS The drawings, or reproductions thereof, which show the location and general detailed design of the contemplated improvements.

PROJECT One or any number of separate but correlated improvements covered by the work requirements.

STREET Any or all portions of any street, avenue, alley, road or public highway which has been dedicated to the City.

STRUCTURE Any portion of the existing, completed, partially completed, or proposed construction. Buildings, piping, conduits, cables, wiring, utilities and any and all other man-made objects, whether above ground or underground, shall be considered as structure.

SUBCONTRACTOR Any person, firm or corporation who has, with the approval of the engineer, contracted with the primary contractor to execute and perform in his stead any part of the project.

SUPERINTENDENT The executive representative of the contractor, present on the project at all times, authorized to receive and fulfill instructions from the engineer and who is capable of efficiently superintending the work.

TYPICAL SECTION That cross-section established by the plans which represents the lines to which the contractor shall work in the execution of the project.

2.

GENERAL TERMS

2.1 AVOIDANCE OF REPETITION. Wherever the terms "contemplated", "required", "directed", "authorized", "considered necessary", "permitted", "approved", "suitable", "unacceptable", "designated", or terms of like import are used in these specifications, they shall be construed to mean "to" or "by the engineer" or "director" unless the context clearly indicates otherwise.

2.2 PARTS OF THE SPECIFICATIONS. The divisions, sections and articles, or sub-headings of the specifications are intended for convenience of reference only and shall not be considered as having any bearing on the interpretation thereof.

2.3 NOTIFICATION. The contractor shall notify the City of Madison Office of Community Development prior to beginning any work and, through the engineer of record, at the normal inspection points during work.

2.4 CONTROL OF WORK. The City engineer will decide all questions which may arise as to quality and acceptability of materials furnished and work performed.

The City engineer shall have the authority to suspend the work wholly or in part due to failure of the contractor to correct unsafe conditions, for failure to carry out orders, for unsuitable weather, or for any other reason or condition he deems to be in the public interest.

2.5 PERMITS. It shall be the responsibility of any contractor, sub-contractor, public utility or City department to obtain permission from the Public Works Department prior to beginning any work on or affecting present or future streets, rights-of-way or easements.

In an emergency, work may be performed outside of normal business hours and permission obtained at the beginning of business on the next business day.

2.6 APPLICABILITY. These specifications shall apply to all work performed in the City of Madison, including work performed by City employees and contractors employed by the City. They shall apply to all work, whether or not that work is intended to be dedicated to the public or to any public entity.

3.

SPECIFICATION

3.1 INTENT OF PLANS AND SPECIFICATIONS The work to be done shall consist of the complete construction of each and every unit described in the plans, these Standard Specifications, the Supplemental Specifications, and the Special Provisions together with all authorized alterations.

3.2 SPECIAL WORK Construction and conditions which have not been anticipated by the plans and these specifications, or changes, additions or amendments thereto, will be covered by special provisions, and shall be considered a part of the project.

3.3 ALTERATION OF PLANS AND CHARACTER OF WORK The engineer may make alterations in the plans or in the nature of the work which he may consider necessary or desirable during the progress of the work to complete fully and acceptably the proposed construction. To accomplish such alterations, the engineer shall submit any such change as a CHANGE ORDER to the City Engineer and, upon approval by the City Engineer, may direct the contractor to proceed.

3.4.1 MAINTENANCE OF DETOURS No highway, road or street or section thereof shall be closed to traffic except with the written permission of the City engineer and the owner or Agency governing or maintaining that road, street or highway.

3.4.2 DETOURS ALONG PROJECT The contractor shall maintain all detours for traffic along or over the work. Unless otherwise provided, the road, street or highway upon which the improvement or installation is being made shall, except at times deemed impractical by the City engineer, be kept continuously open to public traffic and in passable and safe condition. All entrance trails, roads and highways intersecting it shall be kept open and passable.

Temporary approaches and crossings, including crossings over surfacing and pavements, shall be provided and maintained in safe condition. It shall be the responsibility of the contractor to maintain all roads, streets and highways free of mud and in safe condition. Where the work to be constructed follows the general route of an existing road which is wholly or in part used by the traveling public the contractor shall repair and maintain in safe, passable and convenient condition all such part or parts of such existing roads as are being used between extreme limits of the work during the entire time from initiation of work until final acceptance of the work hereunder. He shall road-machine the traveled way as soon as possible after rains

and at all other times when directed by the engineer and shall operate a drag over it whenever the City Engineer deems it necessary.

3.4.3 ROADS USED BY THE CONTRACTOR The contractor shall, at his expense, repair any damage to existing streets which is caused by his equipment. Should the contractor wish to use a City street as a haul road, he shall meet with representatives of the City prior to starting. They shall review the condition of the street and reach an agreement as to the maintenance or restoration thereof.

Roads used by the contractor for hauling materials and equipment shall be constructed and maintained by him. When the contractor hauls materials over any detour or public road, he shall so regulate his loads that the capacity of the road and its structures is not exceeded and he shall be responsible for any specific damage that may result to the road or its structures from failure to observe regulations governing traffic thereon. Resulting damage shall be repaired, without delay, by the contractor. It shall be the responsibility of the contractor to maintain all public streets and roads adjoining the work in safe and passable condition and free of mud and debris.

3.4.3 CONVENIENCE OF TRAFFIC The contractor will be required to carry traffic over the roads or streets with the least inconvenience to traffic within the limits of the right-of-way and on detours for which he is responsible as hereinabove provided.

3.4.4 NO MUD TO BE DEPOSITED ON PUBLIC ROADS. The contractor shall not permit any mud from any construction site to be carried onto or deposited on any public road by construction vehicles or by any other means.

3.5 REMOVAL AND DISPOSAL OF STRUCTURES AND OBSTRUCTIONS

3.5.1 GENERAL The contractor shall remove any existing structure or part of structure, fence, building or other encumbrance or obstruction that interferes in any way with the new construction, but only with the written permission of the owner of the structure, and only after a demolition permit has been obtained from the City, if required.

3.5.2 PUBLICLY OWNED MATERIALS Any publicly owned materials in structures removed shall be salvaged without damage if deemed proper by the City Engineer and shall be piled neatly and in an acceptable manner at accessible points. Any publicly owned property shall remain the property of the original owner. When publicly owned materials are stored on or beyond the right-of-way the contractor shall be held responsible for their care and

preservation for a period of ten (10) days following the day the last or final increment of materials is placed thereon. The contractor shall remove all discarded material, rubbish or trash from the right-of-way and project site and shall dispose of it as approved or directed by the engineer.

3.5.3 LOCAL MATERIAL SOURCES If the contractor elects or is required to excavate from pits, quarries or deposits beyond the project site or right-of-way he shall trim up such pit, quarry or deposit in a neat and workmanlike manner, remove debris and level surplus material, provide necessary drainage if feasible and perform other work necessary to prevent unsightly appearance. This work will be required as a condition to the use of local material and shall be done in an approved manner.

3.5.4 It shall be the responsibility of the contractor to obtain any necessary grading permits from the Community Development Department prior to beginning any excavation or other earth-moving operation for which a grading permit is required.

4.

CONTROL OF WORK

4.1 AUTHORITY OF ENGINEER All of the work shall be done under the supervision of the engineer. To prevent misunderstandings, disputes and litigation, the engineer shall decide any and all questions which arise concerning the quality and acceptability of materials furnished and work performed, and interpretation of plans and specifications, subject to the approval of the City Engineer. Explanations concerning the meaning of the plans and specifications, all directions necessary to complete or make definite the plans and specifications and give them due effect will be given by the engineer and his findings shall be final and binding. The authority granted in this section shall not, however, be construed to permit the engineer to authorize work not permitted by this manual, or by construction plans approved by the City.

4.2

PLANS AND WORKING DRAWINGS

4.2.1 GENERAL Drawings, showing such details as are necessary to give a comprehensive idea of the construction contemplated will be included in the set of plans. The plans will be supplemented by such working drawings as are necessary adequately to control the work. All authorized alterations affecting the requirements and information given on the approved plans shall be in writing and signed by the City engineer.

4.2.2 ROADWAY PLANS Roadway plans will show title sheet, alignment, profile, typical cross-section of improvements, drainage and other information pertinent to the project.

4.2.3 STRUCTURE OR BRIDGE PLANS Structure or bridge plans will in general show the location of and dimensions of the work contemplated. When the structure plans do not show all dimensions in detail, they will show the general features and such details as are necessary to give a comprehensive idea of the structure. The engineer shall submit to the City at least three (3) sets of such detailed working drawings as may be required for the construction of any part of the work. One set of these supplementary drawings shall be returned to the contractor, one set shall be provided to the City Inspector, and one shall be retained by the engineer of record, and the remaining set shall be maintained in the City files.

4.2.4 WORKING DRAWINGS FOR STEEL STRUCTURES Working drawings for steel structures shall consist of shop details, erection and other working plans showing details, dimensions, sizes of materials and other information necessary for the complete

fabrication and erection of the metal work, including applicable welding, riveting or other fastening specifications.

Working drawings for concrete structures shall consist of such detailed plans as may be reasonably required for the successful prosecution of the work and which are not included in the plans furnished by the engineer. These may include plans for false-work, bracing, cribs, cofferdams, centering and formwork, masonry layout and bending diagrams for reinforcement.

4.2.4.1 DRAWINGS FOR DRAINAGE STRUCTURES All drainage plans shall depict all drainage structures, the direction of water flows, the topography of the land, and the drainage basins within the plat. The drawings shall clearly depict the flow of water in each basin to a collection point, and the flow of water from each collection point to a point or points where water leaves the subdivision. Calculations and other information concerning the flow of water downstream from the subdivision, until said water reaches Waters of the United States, shall also be shown, and the impact of such increased flows as will result from the presence of the project shall be described mathematically. A grading plan will be prepared to demonstrate positive drainage off each individual lot, and all such grading shall be completed prior to final acceptance of the subdivision into the maintenance program.

4.2.5 FURNISHING WORKING DRAWINGS The Engineer shall furnish the City Inspector with such blueprints or similar copies of the working drawings as may be required for approval and construction purposes and upon completion of the work shall provide three (3) copies of "AS BUILT" drawings to the City Engineer.

4.2.6 CONFORMITY WITH PLANS AND ALLOWABLE DEVIATIONS Finished work in all cases shall conform with lines, grades, sections, details and dimensions of the work contemplated as shown on the approved plans except as modified by the written order of the engineer of record and approved by the City Engineer. Any deviation from the approved plans and working drawings that may be required by the exigencies of the construction will be determined by the engineer and approved by the City Engineer.

4.2.7 COORDINATION OF PLANS AND SPECIFICATIONS These specifications, the supplemental specifications, the plans and all supplementary documents are essential parts of the work contemplated and a requirement occurring in one is as binding as though occurring in all. In case of discrepancy, figured dimensions, unless obviously incorrect, shall govern over scaled dimensions.

4.2.8 ERRORS The contractor shall not take advantage of errors or omissions in the plans or discrepancies between the plans and the specifications. The engineer will make such corrections and rectify such omissions as may be necessary and his determination shall be reviewed by the City Engineer.

4.3 COOPERATION WITH UTILITIES The owners or operators of private or public utilities shall have access to the work for the installation, adjustment or repair of main line and service facilities.

4.4 COOPERATION OF THE CONTRACTOR

4.4.1 GENERAL The contractor shall have available on the work site at all times one copy each of the plans, specifications, and supplemental specifications. He shall give the work the constant attention necessary to facilitate the progress thereof and shall cooperate with the engineer, inspectors, and other contractors, if any, in every way possible.

4.4.2 CONTRACTORS REPRESENTATIVE The contractor shall at all times have a competent representative on the work, capable of reading and thoroughly understanding the plans and specifications, as his agent on the work, with full authority to execute the orders or directions of the engineer, or the City engineer or his designated representative without delay. Such representative shall be present on site irrespective of the amount of work sublet and shall have full authority over all sub-contract work.

5.

CLEARING AND GRUBBING

5.1 DESCRIPTION This item shall consist of clearing the entire area within the limits of the right-of-way and grubbing that portion of the right-of-way which will be occupied by the street, except as otherwise directed by the engineer. Clearing and grubbing shall consist of cutting, removing, burning and disposing of all trees, trash, stumps, limb wood, grass, weeds, roots, pole stubs, rubbish, old pavement and all other obstructions resting on or projecting through the surface of the original ground. All fill areas shall be grubbed to a depth of at least one foot below the natural ground. Any required burn permits must be obtained by the contractor from the City Fire Department prior to initiating any burn activities.

This item shall also include the removal and satisfactory disposal of all buildings, fences, structures, or other obstructions.

5.2 CONSTRUCTION METHODS All the area of the right-of-way or so much thereof as the engineer may direct shall be completely cleared of all trees, logs, brush, stumps, grass, weeds, roots, pole stubs, rubbish and other perishable or objectionable matters. Placing the material on abutting property, with or without the consent of the property owners, will not be considered satisfactory disposal. Burial, except in ADEM-approved landfills, is not considered satisfactory disposal.

All clearing and grubbing shall be performed far enough in advance of the grading operations so as to avoid possible delay. Before grading operations start, the area cleared and grubbed must be approved by the contractor and the City engineer.

Special care shall be taken to preserve and protect all trees and shrubs from injury or defacement that are designated to remain in place. Trees that are to be removed shall be felled within the right-of-way and in such manner as will not injure trees that are to remain. All trees cut shall be disposed of as directed by the contractor.

Within the areas where excavation will be made, all logs, roots, stumps, et cetera, more than two inches in diameter shall be pulled or otherwise removed to a depth of not less than two (2) feet below the finished surface of the subgrade and the entire area grubbed free from heavy vegetation, grass, roots and other perishable matter. Trees and stumps outside the construction limits that are not to remain shall be cut off even with the ground surface. Branches of trees extending over the street shall be cut and trimmed as directed by the engineer.

In areas where backfilling is required to bring property to a workable level, the engineer shall provide detailed information showing the impact on drainage and shall provide plans showing the proposed method of handling drainage and runoff.

All cavities, stump holes and areas excavated below grade shall be refilled with suitable material sufficiently in advance of grading to provide ample time for settlement and shall be brought to the same degree of compaction as the surrounding area. If deemed necessary the engineer shall require that the backfill material be flooded or puddled.

Timber, brush, et cetera shall not be burned except with permission of the engineer and after obtaining proper burn permits from the Fire Department.

6.

SUPPLEMENTAL REGULATIONS FOR
INSTALLATION OF SANITARY SEWERS
AND POTABLE WATER TRANSMISSION LINES

The Regulations in this Chapter are supplemental to those published and enforced by the Water and Waste Water Board of the City of Madison. In case of a conflict between these regulations and those of the Board, the Planning Commission will be the ultimate arbiter. However, once approved by the Planning Commission, construction specifications may be changed only by Engineering Change Order.

6.1

PAVEMENT REPLACEMENT

6.1.1 Reserved

6.1.2 Where paved streets, sidewalks, curbs and/or gutters are damaged or removed, within or without the construction limits, they shall be replaced in accordance with these Specifications.

6.1.3 Where chert, gravel, slag, or other unpaved street or driveway surfaces are removed or damaged, they shall be replaced with the same type of materials as were removed.

6.1.4 In replacing pavements and unpaved surfaces, the materials used and the construction methods employed shall comply with these specifications.

6.1.5 Where shown on plans, service lines and small diameter pipe (eight inches in diameter or less) located across paved surfaces shall, where feasible, be installed by boring or other approved methods that will not require cutting or removing pavement.

6.1.6 All concrete pavement replaced shall not be less than four inches thick, or equal to the original if greater than four inches.

6.1.7 Pavements replaced shall be the same type of construction as was removed, except that no asphalt surface replaced shall be less than three inches thick and shall consist of two inches of binder and one inch of wearing surface. Wearing surfaces shall utilize siliceous aggregate.

6.1.8 All road cuts shall be permanently repaired within 30 days after the cut is first made.

6.2

TEMPORARY ROADWAY PAVING REPAIRS

6.2.1 Temporary cold or permanent hot asphalt patching will be required for both longitudinal and transverse roadway cuts upon completing backfilling requirements at the end of each day's work if the road is to be opened for local traffic while work has stopped, unless waived by the City engineer and the Board.

6.3

CONTROLLED TEMPORARY FLOW DIVERSION

6.3.1 During construction, flows in sections of the existing sewer being rehabilitated by removal and replacement shall be accommodated by temporary flow diversion.

6.3.2 The contractor shall use the construction easement for flow diversion if not otherwise shown on the plans. The contractor shall lay diversionary pipe in temporary trenches within the construction easement. The contractor shall use ingenuity and skill to develop a flow diversion program. The program must keep the sewer flowing without discharge or spills. The contractor will seek and obtain inspection of each section of newly laid sewer before taking the diversion out of service and placing the newly laid section in service. Each section of the new sewer shall be tested and accepted by the Board before being put into service.

6.3.3 The material used to construct the temporary line will be the choice of the contractor, subject, however, to Board approval. The material shall be such that no breaks, stream pollution or other nuisance conditions ensue. The temporary line shall be the responsibility of the contractor.

6.3.4 In sections of an existing trunk sewer being rehabilitated by laying a new line parallel to the existing trunk, the existing trunk shall be used to accommodate the existing flow, and no flow diversion will be necessary if the existing trunk is not damaged or its use restricted by the contractor's operations.

6.3.5 The contractor shall provide a temporary closure in all cases practical to insure that in the event of temporary line failure or, in the opinion of the Board, a high likelihood of failure, flows may be directed through the existing permanent line.

6.3.6 The contractor shall provide an approved system of shutoff gates on the temporary diversion line to insure that

alternative flow routing is possible.

6.4 EXISTING UTILITIES

6.4.1 The contractor shall take every possible precaution to minimize the hazards of working in proximity to gas lines and shall be solely responsible for any damage to them or for any injury to persons or damage to property arising from or caused by his operations.

6.4.2 GAS LINE LOCATIONS WITHIN SUBDIVISIONS SHALL BE ON THE EAST OR SOUTH SIDE OF STREETS AND SHALL BE FOUR (4) FEET BEHIND THE BACK OF CURB AND THREE (3) FEET BELOW THE TOP OF CURB.

6.4.3 No excavation or other work shall be done by the contractor within ten feet of a gas transmission line until the owner of the gas pipeline has been notified not less than 72 hours in advance of such work and until the gas line has been exposed by the contractor sufficiently to determine its exact horizontal and vertical location. In addition, the owner of the gas line shall be allowed to keep a qualified representative present while any such construction which could damage such line is being done. Methods of excavation specified by the owner of the utility must be adhered to by the contractor.

6.4.4 The same terms and conditions apply to medium and low pressure gas distribution systems.

6.4.5 No structure shall be constructed over or immediately adjacent to a gas pipeline or gas facility, or within the gas line easement. Gas pipelines shall not pass through manholes or other sewer structures. When sanitary sewer lines cross over gas lines, the minimum cover shall be ten inches, or as specified by the owner of the gas line (Cover is the vertical distance between the outside top and outside bottom of the two pipelines). When sanitary sewer lines cross under or below gas lines, the minimum cover shall be four inches. In both cases the cover space shall be carefully backfilled with thoroughly compacted selected soil. Where gas lines cross pipe trenches, the excavated space below such gas lines shall also be carefully filled with thoroughly compacted selected soil.

6.4.6 In the event that interference with any existing utility is imminent, the contractor shall so notify the appropriate utility agency 72 hours in advance of any construction activities so that the service may be relocated or otherwise preserved and protected.

6.4.7 Should any utility be damaged during the construction work, the following minimum precautions shall be

taken by the contractor:

- (1) Immediately notify the appropriate utility office of the utility of the nature and location of such damage.
- (2) Stop all construction work that could cause further damage to the utility or hazards to other persons or property.
- (3) Give adequate warning to any persons who could be injured or owners of any property which could be damaged.
- (4) Permanent repairs shall be made by the owners of the utility involved or, with their permission, by the contractor. Any repairs made by the contractor shall be made in accordance with the U.S.A. Standard Code for Gas Piping USAS B 31.8, latest edition. The Board Representative will not supervise or approve repairs to damaged gas facilities.

6.4.8 Other utilities, such as steam lines, electrical lines, telephone lines, TV cable and telegraph lines, whether underground or overhead, shall be carefully preserved.

6.4.9 In the event that any interference with any existing utility is imminent, the contractor shall notify the utility seventy-two hours in advance of any construction activities so that service may be relocated or otherwise preserved and protected. The contractor shall contact the Board Service Operations office in the event a conflict with a water line appears imminent. The contractor is to cooperate fully with the representative of the utility company to the extent necessary to accomplish the work.

6.5 WORK WITHIN RIGHTS-OF-WAY OF HIGHWAYS, RAILWAYS OR STREETS

6.5.1 In the event the sewer crosses, runs parallel to or alongside of any State highway, County road, City street or railroad right-of-way, the contractor shall obtain the necessary permits from the governing body affected.

6.5.2 A City license and blasting permits are required for utility work. ALL BLASTING SHALL BE IN CONFORMANCE WITH THE CITY'S BLASTING ORDINANCE.

6.6

SPECIAL CONSTRUCTION

6.6.1 Where the work requires special stream or railroad crossings or any other extraordinary conditions exist, or where alternate construction methods are used that are not covered by this specification, the materials and construction methods shall be as shown in the plans.

6.7

RIGHT-OF-WAY CLEAN UP

6.7.1 After the sewer is installed and backfilled and a sufficient amount of time has elapsed for backfill to settle, the disturbed area shall be machined to a smooth surface matching the adjacent or adjoining ground surfaces and ground profiles shown on the plans.

6.7.2 The contractor shall remove all stumps, fallen trees, uprooted trees, dead trees, trash and debris from the right-of-way and the adjoining property.

6.7.3 The ground preparation before seeding shall consist of cultivation to a loose depth of approximately four inches minimum and the application of lime to the soil at a rate of two tons per acre. The plowing, harrowing, cultivating and all other operations shall be performed with proper equipment and in such a manner as to break up all clods, lumps or earth balls, and remove all boulders, stumps, large roots or other particles which would interfere with the work and which will result in a smooth, uniform, loose, well-broken and fine grained soil, thus providing a suitable bed for seed grass. The ground shall be plowed to the required depth, then cultivated with a rotary tiller and/or disc harrow in both directions, if feasible, until approved. In small or inaccessible areas, the use of hand tools will be permitted. The contractor shall add sufficient water to wet the soil in order to prepare the ground to be seeded. Nine hundred and twenty pounds of 13-13-13 commercial grade fertilizer per acre of ground shall be spread uniformly into the areas to be planted. The fertilizer shall be well pulverized and free of lumps when applied. In no case shall full strength fertilizer be permitted in direct contact with the seeds. When fertilizers are applied hydraulically they must be diluted sufficiently as directed so that no damage is done to either seed or established grasses or legumes.

6.7.4 Work area seeding mixtures shall be as follows:

SEPTEMBER THRU MARCH

Kentucky Blue Grass	6 lb/acre
Pensacola Bahia	20 lb/acre
Reseeding White Clover	30 lb/acre
Kentucky 31 Fescue	20 lb/acre

APRIL THRU JUNE

Pensacola Bahia	20 lb/acre
Kentucky 31 Fescue	20 lb/acre
Common Lespedeza (TN)	10 lb/acre
Bermuda Grass (H)	12 lb/acre

JULY THRU AUGUST

Bermuda Grass (H)	5 lb/acre
Pensacola Bahia	20 lb/acre
Reseeding White Clover	30 lb/acre
Kentucky 31 Fescue	20 lb/acre

6.7.5 Sowing of seed shall, in general, follow promptly after incorporation of fertilizer in a uniform manner at the rates specified for each seed specie. Sowing shall be done by approved mechanical seeders. No sowing shall be done during windy weather, when the prepared surface is crusted, or when the ground is frozen, wet, or otherwise in a non-tillable condition. Unless otherwise directed, after the seed has been sown the seedbed shall be compacted immediately by means of a cultipacker, light roller or approved drag. Rolling or covering of seed may be omitted when seeding is done hydraulically and mulched. Straw mulch shall be applied at the rate of two and one-half tons per acre within forty-eight hours after seed has been first applied.

6.7.6 Straw and hay mulch shall be applied with a mechanical mulch spreader designed to break up balls or clusters of mulch and apply it evenly over the surface so as to provide adequate shading from sunlight. If an asphalt adhesive is used on the mulch the mulch spreader shall be so designed and equipped to apply the asphalt adhesive effectively to the mulch and form a uniform porous and stable mulch blanket held in place by the adhesive over the designated area.

6.7.7 Hay or straw material which contains an excessive quantity of matured seeds or noxious weeds or a species which would constitute a menace to the planted species and to surrounding farmland will not be acceptable. Mulch which is too fresh or is excessively brittle or so decomposed as to retard growth of grass will not be acceptable.

6.7.8 The contractor may, at his option, employ additional measures other than those specified to prevent loss of or damage to the work resulting from the effects of wind and/or water. The erosion control work shall cover all disturbed areas within the sewer right-of-way and/or easement along which the sewer has been installed. Erosion control work shall not be limited to the easement but shall include all disturbed areas as necessary to complete the grassing of the project.

6.7.9 Solid sod may be used if specified. The preparation of the ground will be the same as for seeding. The sod will be placed so as to give a smooth and uniform surface to the area.

6.7.10 Fescue may be substituted for Bahia in work areas adjacent to lawns, as directed by the Board and approved by the engineering inspector.

6.7.11 The contractor shall remove all stumps, fallen trees, uprooted trees, dead trees and debris from the right-of-way. All right-of-way cleanup and grassing on property owned by the City, either in fee simple or easement interest shall be approved by the City engineer or the engineering inspector.

6.8 SPECIAL SLOPE PROTECTION

6.8.1 The work covered by this section consists of furnishing all materials, equipment and labor and performing all operations necessary in connection with the installation of rip-rap or other special slope protection.

6.8.2 Areas to receive rip-rap or special slope protection materials shall be graded to the lines and slopes shown on the plans. Any loose materials shall be compacted by the use of hand or mechanical tampers.

6.8.3 Stone for rip-rap shall be of the size and weight designated on the drawings. In addition, the stones shall be durable and of a suitable quality to insure permanence in the structure and in the climate in which it is to be used. It shall be free of cracks, seams and other defects that would tend to unduly increase its deterioration from natural causes. Not more than five percent of the stones shall have shale seams which would tend to separate when exposed to weathering. The inclusion of objectionable quantities of dirt, sand, clay, or rock fines will not be permitted.

6.8.4 Just prior to placing rip-rap or other slope protection material, the contractor shall install a non-woven plastic filter cloth. The filter cloth shall be approved by the Board and the City engineer and then shall be installed in strict accordance with the manufacturer's instructions for installation and use. Only then, and with the approval of the Board representative and the City engineer, shall the slope protection material be installed on the filter cloth. Where the engineer can demonstrate that conditions are appropriate, the filter cloth may be eliminated.

6.8.5 Precast concrete grids, "Monoslabs" or approved equals, may be used in lieu of rip-rap stone for slope protection, if approved in writing by the Board and the City engineer.

6.9

TUNNELING

6.9.1 Tunneling operations and the installation of liner plates shall be conducted in accordance with the recommendations of the liner plate manufacturer. Tunneling operations shall begin at the low end of the conduit line and proceed up-grade. Care shall be exercised to install the liner to the proper line and grade as shown on the plans. Care shall be taken to avoid loss of ground beyond the tunnel lining and to insure bearing against the ground all around the tunnel. Any spaces between the tunnel liner plates and the earth or rock surface of the tunnel shall be pressure grouted as the work progresses. Brick bulkheads shall be erected at each end after completion of the tunnel and insertion of the carrier pipe. The carrier pipe shall be bedded and restrained within the tunnel in accordance with the plans.

6.9.2 Only personnel thoroughly experienced in performing jacking and tunneling operations shall be employed. Construction operations must not interfere with highway or railway traffic.

6.9.3 Tunnels under railroads may involve special insurance requirements by the railroad company.

6.9.3 The contractor shall notify the railroad company, the Highway Department, or other utility affected prior to beginning any work so that said utility may have a representative present if desired.

6.9.4 The excavation or pit at each end of the tunnel or bore shall be stabilized, using sheeting, shoring, bracing or other means to prevent slides, settlement, movement or erosion of the embankment being tunneled or bored.

7.

RESERVED

8.

STORM SEWERS

8.1 - 8.2 Reserved

8.3 TRENCH EXCAVATION Trench excavation or excavation for pipe lines shall consist of the excavation necessary for the construction of storm sewers and other pipe lines and all other appurtenant facilities therefor, including manholes, saddles, sand or crushed stone cushion, boxes, and pipe protection as called for in the plans. It shall include clearing and grubbing where necessary, backfilling and tamping of pipe trenches and around structures, and the disposal of waste material.

8.4 UNSUITABLE MATERIAL When muck, quicksand, soft clay, swampy or other material unsuitable for foundations or subgrade are encountered which extend below the limits of the excavation, such material shall be removed and replaced with suitable materials.

8.5 LIMIT OF EXCAVATION pipe trenches shall not be excavated more than 300 feet in advance of pipe laying. Temporary bridges or crosswalks shall be constructed where required to maintain vehicular and pedestrian traffic.

8.6 PROTECTION In all cases where materials are deposited along open trenches they shall be placed so that in the event of rain no damage will result to the work and/or adjacent property.

8.7 STORING EXCAVATED MATERIAL Material excavated is to be laid compactly on the side of the trench and shall be kept trimmed up so as to occasion the least practicable inconvenience to the public traffic and to neighboring residents. Where excavation is made in a dedicated street, there shall be maintained an 8 ft. width of roadway and 3 ft. width of sidewalk on the street trenched. To prevent obstructing traffic, only so much of the materials of construction as are actually needed are to be piled along the line. All streets, sidewalks, crossings, fire hydrants, water valves and other similar public utilities are to be kept open or accessible for their intended use. Neither the materials excavated nor those used for construction will be stored upon the street.

8.8 DRAINAGE Every drain, gutter, culvert or sewer for surface drainage encountered is to be kept open for temporary and permanent flow, or, if necessarily closed, other adequate provision is to be made.

8.9 TUNNELING Pipe trenches for storm systems may be

constructed by tunneling methods for relatively short distances for crossing major streets or highways or railroads provided the manner of excavating, bracing, and backfilling are approved by the City engineer.

8.10 NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM
(NPDES)

8.10.1 The contractor and/or his engineer shall provide the City of Madison Community Development Department copies of permit applications (except for disturbances of less than five acres of total land area which are not part of a larger common plan of development or sale), in compliance with 40 CFR Parts 122, 123, and 124, titled "NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT APPLICATION REGULATIONS FOR STORM WATER DISCHARGES, FINAL RULE". The failure of the contractor to adhere to limiting conditions in the NPDES permit, or in the City's NPDES Municipal Separate Stormwater System Permit, shall constitute cause for the City to stop work in progress and contact the Alabama Department of Environmental Management for technical assistance.

8.11 - 8.15 RESERVED

8.16 MATERIALS

8.16.1 ROADWAY PIPE

8.16.1.1 REINFORCED CONCRETE PIPE shall conform to ASTM Specifications Serial Designation C 76-57T, Class III

8.16.1.2 EXTRA STRENGTH REINFORCED PIPE Extra strength reinforced concrete pipe shall conform to ASTM Specifications Serial Designation C 76-57T Class IV.

8.16.1.3 STANDARD STRENGTH NON-REINFORCED CONCRETE PIPE Standard strength non-reinforced concrete pipe 24 inches or less in diameter shall conform to ASTM Specification Serial Designation C 1457 Table I.

8.16.2 SIDE DRAIN PIPE

8.16.2.1 PLASTIC PIPE The term "plastic pipe" shall cover polyethylene, polyvinyl chloride and acrylonitrile butadiene styrene. In addition, High Density Polyethylene pipe and installation, when permitted by the City Engineer, shall meet the requirements of AASHTO M 294, or the manufacturer's specifications (whichever is most restrictive), along with the following restrictions:

(a). The minimum parallel plate stiffness when tested in accordance with ASTM D2412 shall be as follows:

<u>Diameter</u>	<u>Minimum Stiffness</u>
4" - 12"	50 psi
15"	42 psi
18"	40 psi
24"	34 psi
30"	28 psi
36"	22 psi
42"	19 psi
48"	17 psi

(b) Fill heights will be restricted to 20 feet maximum.

(c) Pipe cover shall be 12 inches minimum and shall be installed per ASTM D2321.

(d) Application and use of all plastic pipe shall be approved by the City Engineer.

(e) All joints shall be soil-tight as per the manufacturers recommendation.

(f) Pipe shall be used only in non-traffic areas as approved by the City Engineer.

(g) In addition to these general requirements, pipes shall meet the requirements listed hereinafter for the type plastic used:

Polyvinyl Chloride (PVC) pipe shall meet one of the following specifications: ASTM D-2241, F-789, D-1785, D-2665, D-3034, D-2680, F-794, F-949, or F-679.

Polyethylene (PE) pipe shall meet the requirements of AASHTO M-294, Type C or S. When Type S pipe is used, the inner liner shall have a minimum thickness of 0.05 inches and be fused to the outer shell.

Acrylonitrile Butadiene Styrene (ABS) pipe shall meet the requirements of ASTM D-2751 or D-2680.

8.16.3 CORRUGATED METAL PIPE Corrugated metal pipe (CMP), whether or not coated with asphalt or any other substance, is not permitted to be used for drainage structures, unless the City Engineer determines in writing that, due to special

conditions, CMP is the optimal choice of material for a particular application.

8.16.4. Drainage conveyed within side yards in residential districts shall be confined to pipe systems. No open ditches for the conveyance of stormwater shall be permitted in such side yards. The City Engineer or Director of Community Development shall have the authority to grant exceptions to this policy in cases where large volumes of stormwater must be conveyed through a side yard.

8.17 TESTING All storm sewer pipe and materials used in its manufacture shall be tested and inspected by an approved commercial testing laboratory prior to delivery to the site and all materials which fail to conform to these specifications shall be rejected. After delivery to the site any materials which have been damaged in transit or are otherwise unsuitable for use in the work shall be rejected and removed from the site. Certified copies in duplicate of the inspection and acceptance reports of the testing laboratory shall be supplied to the engineer prior to use of the materials. Each joint of pipe delivered to the work shall be stamped or marked to indicate the testing laboratory's acceptance or approval.

8.18 PIPE LAYING

8.18.1 GENERAL Before storm pipe is placed in position in the trench the bottom and sides of the trench shall be carefully prepared and the necessary bracing and sheeting installed. Each pipe shall be accurately placed to the exact line and grade called for in the plans. Each piece of pipe and special fitting shall be carefully inspected before it is placed and no defective pipe shall be laid in the trench. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the bells uphill. Trench bottoms found to be unsuitable for foundations after pipe laying operations have been started shall be corrected and brought to exact line and grade with compacted earth where necessary. When so directed by the engineer sand cushion shall be installed to provide a satisfactory bearing surface.

8.18.2 BELL HOLES Bell holes shall be of sufficient size to allow ample room for properly making the pipe joints. Bell holes shall be cut not more than five joints ahead of pipe laying. The bottom of the trench between bell holes shall be carefully graded so that the pipe barrel will rest on a solid foundation for its entire length. Each joint shall be laid so that it will form a close concentric joint with the adjoining pipe and so as to avoid sudden offsets or inequalities in the

flow line.

8.18.3 JOINTS Joints shall be prepared in the manner specified below. As the work progresses the interior of all pipe in place shall be thoroughly cleaned. After each line of pipe has been laid it shall be carefully inspected and all earth, trash, rags, and other foreign matter removed from the interior.

8.18.4 BACKFILLING Backfilling of trenches shall be started immediately after the pipe is in place and the joints completed and inspected and approved.

8.19 JOINT CONSTRUCTION

8.19.1 CLEANING The inside of all bells and the outside of all spigots shall be wiped to remove all dirt, water or other foreign matter so that their surfaces are clean and dry when the pipes are joined.

8.19.2 MORTAR JOINTS Joints and lift holes in concrete pipe shall be filled with cement mortar. In larger pipe sizes a bed of mortar shall be placed in the lower quadrant of the bell before the spigot is inserted.

8.19.3 PROTECTION After the joints have been completed they shall be inspected by the engineer before they are covered up. Any leaks or defects discovered at any time after completion of the work shall be repaired immediately. All pipe in place shall be carefully protected from damage until the backfilling operations have been completed. Any pipe which has been disturbed after the joint was completed shall be taken up, the joint cleaned and remade and the pipe relaid.

8.19.4 DEWATERING Water shall not be allowed to run or stand in the trench while pipe laying is in progress or before the joints are completely set or before the trench has been backfilled. The contractor shall not open up at any time more trench than his available pumping facilities are able to handle.

8.19.5 MANHOLES AND INLETS Manholes and inlets shall be constructed to the size, shape and dimensions and at the locations shown on the plans.

8.19.6 SPECIAL CONSTRUCTION Where the work requires special railroad or roadway crossings or any other extraordinary conditions, or where alternate types of construction are used that are not covered by these specifications, the materials and methods shall be as shown on the plans.

9. CURB INLETS, DROP INLETS, HEADWALLS

9.1 GENERAL This section shall cover the construction of curb inlets and drop inlets complete with the necessary metal frames and covers.

Inlet walls may be "cast-in-place" concrete, brick masonry or, with the prior approval of the City engineer, hollow core blocks filled with concrete after laying.

9.2 MATERIALS

(a) Concrete material shall conform to the requirements of ADDENDUM I entitled "Concrete".

(b) Reinforcing steel shall conform to the requirements of ADDENDUM II entitled "Reinforcing Steel".

(c) Brick masonry materials shall be as follows:

- (1) Brick shall conform to ASTM Designation C 32 Grade MA.
- (2) Cement shall meet the requirements of ASTM Designation C 150 for Portland Cement
- (3) Sand for mortar shall consist of hard, strong, durable, uncoated mineral or rock particles, reasonably free from injurious amounts of organic or other deleterious substances. Gradation shall be as follows:

Percentage passing	No. 8	No.50	No.10
by weight	100	15-40	0-100

(4) Water for mortar shall be obtained from the City water system. Any other source of water shall be approved by the engineer.

(5) Curb inlet covers and frames and drop inlet gratings shall conform to the requirements of Section 10 of this Specification.

(6) Inlet and outlet pipe shall conform to the appropriate requirements of the Section of the Specifications covering the kind of pipe with which they are to connect.

9.3 EXCAVATION AND BACKFILL Excavation and backfill shall be performed in accordance with the appropriate requirements as set forth under Section 6.4 of this Specification.

9.4 CONCRETE MASONRY All concrete masonry used in curb inlets and drop inlets shall be Class A and shall be constructed in accordance with the appropriate requirements set forth under addendum I of this Specification.

9.5 BRICK MASONRY The foundation on which brick are to be laid shall be firm and dry. All brick shall be damp at the time of laying. Bricks shall be laid in courses in full, close joints of mortar. The courses shall be level in all places, except where otherwise directed. All exposed surfaces shall be smooth and clean. Broken or chipped bricks shall not be used in the exposed faces of the masonry. Joints shall be cleaned and pointed in a neat workmanlike manner before the mortar sets.

9.6 MORTAR The mortar shall be composed of one part of cement and two parts of sand by volume, on the basis of dry sand, and sufficient water to make a mortar of such consistency that it can be easily spread and handled with a trowel. Mortar shall be mixed only in quantities required for immediate use. Unless an approved mortar mixing machine is used, the sand and cement shall be mixed dry in a tight box until the mixture assumes a uniform color, after which water shall be added as the mixing continues until the mortar attains the proper consistency. Mortar which is not used within 45 minutes after water has been added shall be discarded. Retempering of mortar will not be permitted.

9.7 INLET AND OUTLET PIPE Pipe shall be laid in accordance with the appropriate requirements of the specifications covering the kind of pipe used. Pipe placed in masonry for inlet or outlet connections shall extend through the walls and beyond the outside surface of the walls a sufficient distance to allow for connections, and the masonry shall be carefully constructed around them so that there will be no leakage.

9.8 PLACING CASTINGS Castings shall be set in full mortar beds or otherwise secured as shown on the plans. Castings shall be set to correct elevation. Castings set within the surface of paved streets or streets to be paved shall be set even with the paved surface. (Castings need not be set level but must be graded to fit paving grade.)

9.9 CLEANING all inlets shall be cleaned of all form

material, excess mortar, silt, debris or foreign matter of any kind.

9.10 HEADWALLS

9.10.1 All materials furnished shall conform to the requirements of ADDENDUM I, Concrete and ADDENDUM II, Reinforcing Steel of this Specification.

9.10.2 The concrete mix used for headwalls shall be Class "A", Type 2 unless authorized by the City engineer.

9.10.3 Foundation excavation shall be of the size and depth conforming to the outline of the structure. Unsuitable foundation material below the normal design elevation shall be removed as directed by the engineer. Where rock, gravelly soil, hardpan or other unsuitable material is encountered, it shall be removed as ordered by the engineer for a depth of at least 12 inches below the designated grade.

9.10.4 Foundation backfill shall be deposited uniformly for the full width of the excavation in layers not exceeding 6 inches in depth with each layer compacted.

9.10.5 Construction, forming, placing, etc. of headwalls shall be in accordance with the appropriate requirements of AHD 5.01.03.

9.10.5 All surfaces will receive a Class 1 surface finish and all exposed surfaces will receive a Class 2 surface finish. In order to permit proper surface finishing, forms may be removed as soon as the concrete has set sufficiently that form removal will not damage the green concrete, but in no case less than 12 hours after completion of the placing. Immediately after pouring is completed, surfaces not covered by forms shall be covered with one of the curing materials specified in AHD Section 830. Finishing shall begin immediately after removal of the forms, and curing continued for at least 72 hours after finishing.

9.10.6 The finished concrete shall be within reasonably close conformity to the line, grades and dimensions shown on the plans, and free from objectionable cavities or projections.

10. CURB INLET COVERS AND FRAMES

10.1 DESCRIPTION Curb inlet covers and frames shall be gray iron castings. The castings shall be boldly filleted at angles and the arises shall be sharp and perfect. They shall be true to pattern in form and dimension and shall be free from cracks, pits, blowholes or other defects.

10.2 MATERIAL All frames, covers and gratings shall conform to the requirements of Class No. 20 for Gray Iron Castings, ASTM Designation A 48.

10.3 CLEANING All castings shall be sand blasted or otherwise effectively cleaned of scale and sand so as to present a smooth, clean and uniform surface.

10.4 IDENTIFICATION All frames and covers shall be identified with the name of the foundry and the date of casting. Identification shall be in raised or indented letters in the surface of the casting. Identification on lids and frames shall be on the underside.

10.5 GUARANTEE The manufacturer shall guarantee all castings against defects in material or workmanship for a period of 18 months after date of casting.

11. STREET AND DRAINAGE EXCAVATION

11.1 CONSTRUCTION METHODS

11.1.1 All necessary clearing and grubbing shall be done in proper sequence with excavation and construction. All excavation shall be conducted in such manner and by such methods and equipment as will insure against removing or loosening any material outside of the street right-of way.

11.1.2.0 The following criteria shall be used in the design of all open channels:

1. Open channels shall be designed based on a 25 year storm event.
2. A minimum of 20% depth shall be added for freeboard.
3. Design shall be based on documented, acceptable engineering methods.
4. Sufficient design calculations shall be provided to the City Engineer.

Linings shall meet the following minimum criteria:

Vegetative:

1. Maximum side slope of 3: 1.
2. Minimum slope of 0.75%.
3. Maximum velocity of 5.0 fps and minimum velocity of 2 fps.
4. Not allowed where continuous flow or standing water is present.
5. All channel bottoms shall be sod and must be pinned and staggered.
6. Design shall address stability (new ditch) and capacity (established ditch).
7. 10' of easement shall be provided along the top of one side of the channel for maintenance purposes.

Riprap:

1. Maximum side slope of 2: 1.
2. Minimum velocity of 5.0 fps.
3. Shall be constructed in accordance with design.
4. Filter Blanket is required, either gravel or fabric.
5. 10' of easement shall be provided along the top of one side of the channel for maintenance purposes.

Rigid Linings:

1. Shall consist of either concrete or grouted riprap.
2. Maximum side slope of 1: 1.
3. Slope above linings shall be 3:1 and sodded adjacent to linings and seeded and mulched above sod.
4. Concrete shall be used where slope is less than 0.75% and velocity less than 2.0 fps.
5. Channel shall be constructed in accordance with design.
6. Consideration shall be given to downstream conditions and potential erosion problems in design of ditch system. Use of check dams, boxes, and similar devices may be required.
7. 10' of easement shall be provided along the top of one side of the channel for maintenance purposes.
8. Grouted riprap channels shall be designed and constructed such that voids are eliminated that can result in spaulding and failure of channel.

11.1.2.1 Gutters, ditches, channels and channel changes shall be constructed only when and as shown on the plans or when and as directed by the engineer to lines, grades and cross-sections established by him, in proper sequence with other work and when and as he directs. Excavation for channels shall preferably be made before the excavation for structures is started. When necessary in order to provide proper gradient of flow line, the engineer may direct that channels be extended beyond the limits of the street.

11.1.2.2 Changes of direction in open channels shall have the channel protected from erosion on the bottom and both banks for a sufficient distance upstream and downstream of the directional change. The City Engineer may require calculations to verify the adequacy of channel protection in these areas.

11.1.2.3 Intersections of open channels shall be protected from erosion and scouring by placing concrete on the bottom and both banks of the channels upstream and downstream for a sufficient distance to ensure that the channel is protection from erosion.

11.1.2.4 Headwalls shall be constructed at all points where

underground drain pipes exit into open channels and where open channels enter into sub-surface drains.

11.1.3 Intersecting ditches or dikes shall be constructed as soon as practicable after clearing and grubbing operations are completed and prior to excavating the cuts.

11.1.4 All suitable materials removed from the excavation shall be used as far as practicable in the formation of the embankment, subgrade, base course, shoulders, slopes, bedding and backfill or for such other purposes and at such other places as directed. No excavated material shall be discarded without written permission and when such material is to be discarded it shall be disposed of as prescribed in Section 6.8.1.

11.1.5 The materials excavated from channels, channel changes, waterways and ditches shall be utilized in the construction of embankments, the widening and sloping of embankment slopes, the backfilling of abandoned ditches and channels or otherwise disposed of as directed by the engineer. No excavated material shall be left in unsightly piles but shall be spread in uniform layers, neatly leveled and shaped. No waste or surplus excavation from a ditch or channel shall be deposited or left within 3 feet of the edge of the ditch or channel.

11.1.6 All rock or boulders encountered in the roadway shall be excavated to the lateral limits shown on the plans and to a depth of at least 9 inches below subgrade, and the resulting space backfilled to proper grade with suitable material as directed by the engineer. In blasting rock, a reasonably uniform face shall be left. The engineer, the City engineer or the City fire marshal shall have authority to require cessation of any method of blasting which leads to overshooting or is dangerous to the public or destructive to property or to natural features.

11.1.7 Attention is directed to the possible existence of pipe lines or other public utilities which may be buried within the limits of the work or adjacent thereto, and which may or may not be shown on the plans. The contractor shall be responsible for and take all necessary precautions to protect and preserve any and all existing drains, sewers, surface drains, pipes, conduits and other underground structure or parts thereof which may be affected by his operations on the work and which, in the opinion of the engineer, may properly be continued in use without any changes. The contractor shall assume full responsibility for reimbursing the owners for any damage or injury to property or interference with other services.

11.1.8 The contractor shall repair, replace, relocate, extend, reconstruct or make any other changes in any tile drain, sewer or other subsurface drain, or water, gas line, or other utility line encountered in the prosecution of the work.

11.1.9 Grading operations shall not be performed to the prejudice of the work of blading and maintaining the street bed and subgrade and base course. The engineer or the City engineer shall have full authority to order the suspension of other contract operations pending the adequate and proper performance of such maintenance work.

11.1.10 While the excavation is being done and until the work is finally accepted, the work shall be protected and the loss of material from the street by erosion shall be held to a minimum.

11.2 SOD

11.2.1 Where sod is disturbed in grading lawns between curb and walks, in terracing property, in setting or resetting curb, or in other work it shall be carefully removed, relaid and watered. New sod will be laid where the old sod dies before the acceptance of the work. Sod destroyed by piling of materials or tools shall be replaced with new sod.

11.3 PIPES

11.3.1 The City and those under contract with or having franchise rights from the City shall be permitted to construct or lay sewers, water or gas pipes, and other conduits in those portions of the street or easements where there is a fill before the filling is commenced. The remainder of the street shall be brought to subgrade as soon as possible and the above mentioned parties given an opportunity to lay such pipes or other conduits before the base course is laid. On completion of the laying of pipes in any block or part of a block the grading shall be completed as soon as possible. All parties excavating in streets shall backfill cuts in accordance with Paragraph 6.6.2 of this Specification.

11.3.2 Utilities under streets or in easements adjoining streets shall be installed in strict accordance with Section 18 of this Specification.

11.4 SIDEWALK AND LAWN

11.4.1 The sidewalk and lawn space shall be graded to the lines given by the engineer. Where dirt is removed for curb and

gutter and is thrown in the street or in the sidewalk space or on the sidewalk, the contractor will remove it therefrom prior to the close of work that day.

11.5 MONUMENTS

11.5.1 Engineer's monuments, bench marks, stakes and all meter boxes, manhole rims and covers and other castings will be preserved.

12.1 DESCRIPTION

This section shall cover the placing in embankments suitable material excavated under other sections of this Specification in conformity with the lines, grades and cross-sections shown on the plans. Embankment construction shall include the preparation of the area upon which the embankment is to be constructed, the preparation and selection of materials, the formation, compaction and stability of the embankment and the disposal of surplus and unsuitable material.

12.2 MATERIALS

Only suitable materials shall be used in the construction of embankments and backfills. No brush, roots (larger than 1" in diameter), rubbish, limbs, logs, stumps, heavy vegetation or other unsuitable material shall be incorporated or placed in the embankments or backfill. All unsuitable material shall be disposed of. Grading operations in street and drainage excavation shall be so conducted that all suitable material shall be used where required for the formation of embankments, subgrade, shoulders, approaches, intersections, and for backfilling around structures. The work shall be done in such a manner and sequence that the most suitable soil shall be reserved for topping as far as practicable.

12.3 EQUIPMENT

12.3.1 Rolling Equipment

The rolling equipment shall consist of adequate sheepsfoot tamping rollers or other mechanical compacting equipment and, if required, pneumatic tired rollers of an approved design.

12.3.2 Other Equipment

A blade grader and/or bulldozer shall be kept on the work and shall be used to keep each lift of the fill machined at all times while the embankment is being constructed and tamped.

12.4 PREPARATION

12.4.1 General Before beginning embankment construction, clearing and grubbing shall be performed as provided in Section 5 of this Specification.

12.4.2 Natural Ground Slopes and Old Embankments

12.4.2.1 Where embankments occur adjacent to natural ground which slopes more than 20 degrees from horizontal, such slopes shall be:

- (a) scraped of topsoil
- (b) plowed or loosened to a depth of at least 6 inches before backfilling is commenced and
- (c) the topsoil removed, stored or placed under embankment slopes

12.4.2.2 In cases where widening of embankments is necessary, the slope of the old embankment shall be stepped and plowed before placing additional material. embankment shall be placed to a sufficient height and width so that after full shrinkage, settlement and subsidence, and sloughing of the side slopes, the fills will be at the required grade and have the specified cross-section at all points. When the widening on either side of the center line is less than 6 feet measured horizontally by cross-sections, stepping, parallel layer construction and density as specified herein will be required only in the 2 feet next below subgrade elevation.

12.4.2.3 When the embankment is to be superimposed on old pavements or pavements having concrete bases, (so-called rigid types), the procedure shall be as follows:

- (a) If the depth of new embankment (exclusive of new paving material and base course) is less than 1 foot, the old pavement shall be removed and disposed of.
- (b) If the depth of the new embankment (exclusive of new material and base course) exceeds 1 foot but is less than 3 feet, the old pavement shall be broken with a drop hammer of suitable weight into pieces less than 2 square feet in area, at the same time pounding or forcing such pieces into the subgrade. Broken pieces shall be subsequently covered with sand in an amount sufficient to fill all cracks
- (c) If the depth of embankment (exclusive of new paving material and base course) is 3 feet or over, the old pavement shall not be disturbed.

(d) When embankment is to be superimposed upon any other type of pavement or surface the existing pavement or roadway surface shall, (regardless of the depth of the embankment to be placed thereon), be scarified to such a degree as will provide ample bond between old and new material.

12.5 FORMATION

12.5.1 General The material shall be deposited and spread in successive uniform layers of not more than 8 inches in depth loose measurement for the full width of the required cross-section, and shall be kept level or parallel to the finished subgrade by the use of blade graders, except that around bridge ends and structures, leveling shall be done with bulldozers and hand methods. Each layer of embankment shall be rolled and compacted to specified density hereinafter provided. Embankments and slopes shall be finished true and straight, in conformity with the lines and grades of slope set by the engineer, and all slopes, whether old or new, shall be maintained with true and even surfaces.

12.5.2 Low Swampy Ground Unless specific preparatory treatment is provided, where low swampy ground will not support the vehicles, the thickness of the bottom layer may be increased to a depth not greater than that required to support the said vehicles while placing subsequent layers. Subsequent layers shall be constructed and compacted as provided above.

12.5.3 Predominantly Rock Where embankments are being constructed predominantly of rock, the stones, broken rock and boulders shall be placed in layers and all voids shall be completely filled with suitable earthy materials and thoroughly compacted. No layer of such rocky material shall be placed within 9 inches of the subgrade or finished earth shoulders. Where rock excavation is used in embankments, all excavation, of whatever class in the vicinity, shall be managed so that all coarse rock will be placed and embedded in the embankment before any fine rock and earth shall be used.

12.5.4 Over, Under and Around Structures Embankments over, under and around pipes, culverts, arches, bridges and other structures shall be of selected embankment materials placed and tamped and compacted in a manner and by methods that will avoid unbalanced loading, and that will not cause movement or place undue strain on any structure. The embankments that are placed against or immediately adjacent to bridge abutments, retaining or wing walls, open end bents and culverts shall be built in horizontal layers not exceeding 6 inches loose and must be

compacted by mechanical tamping and/or rolling. This method of building embankments will be required for such distance from these structures until rollers can effectively tamp embankments.

12.5.6 Erosion Control Suitable coarse rock will be used in constructing the stream side of all embankments which are adjacent to or parallel to streams. Materials deposited in any stream channel that in any way whatsoever obstructs or impairs the flow of the stream or endangers a roadway or stream bank shall be removed as directed by the engineer or the City engineer. Side ditches or gutters emptying from cuts to embankments or otherwise shall be so constructed as to avoid damage to embankments by erosion.

12.6 EMBANKMENT COMPACTION

12.6.1 General Embankments shall be rolled as stipulated herein unless otherwise specified by the engineer. The density of each layer (except the top 6" or subgrade layer) shall be not less than 95% of the relative maximum density as determined by AASHTO compaction test T99. The top 6" or subgrade layer shall be as provided by Section 13 of this Specification. Each layer of embankment material which does not contain sufficient moisture to compact thoroughly shall be sprinkled and mixed with water as directed by the engineer. Watering may also be done before material is removed from cuts or pits. Material containing excess moisture shall be allowed to dry out to the proper consistency before compacting is attempted. Successive layers shall not be placed until the layer under construction has been compacted.

12.6.2 Very Sandy Material When the embankment material is of a very sandy nature and it is impractical to compact it with rollers, the material shall be spread in 6" maximum loose layers and each layer watered, then rolled with the tracks or treads of a 10-ton tractor which shall cover the entire surface of the layer.

12.7 SPECIAL SLOPE PROTECTION

12.7.1 The work covered by this section consists of furnishing all materials, equipment and labor and performing all necessary operations in connection with the installation of rip-rap or other special slope protection, as called for in the plans.

12.7.2 Areas to receive rip-rap or special slope protection materials shall be graded to the lines and slopes shown on the plans, or as directed by the City engineer. Any loose material shall be compacted by the use of hand or

mechanical tampers.

12.7.3 Stone for rip-rap shall be of the size and weight designated on the Standard Drawings. In addition, the stones shall be durable and of a suitable quality to insure permanence in the structure in which it is to be used. It shall be free of cracks, seams and other defects that would tend to unduly increase its deterioration from natural causes. No more than five percent of the stones shall have shale seams which would tend to separate when exposed to weathering. The inclusion of objectionable quantities of dirt, sand, clay or rock fines will not be permitted.

12.7.4 Just prior to placing rip-rap or other slope protection material, the contractor shall install a non-woven plastic filter fabric as described in the Standard Drawings. The filter fabric shall be approved by the City engineer for installation and shall then be installed in strict accordance with the manufacturer's specifications for installation and use. Only then, and after approval by the City engineer, shall the slope protection material be installed on the filter fabric. Attention is called to the standards contained in Section 6.8.4 above.

13.1 DESCRIPTION

The subgrade shall be considered as that portion of the street bed on which the base course or curb and gutter is to be placed. After the earth work is substantially completed and after all drains have been laid and after all utilities under the pavement are in place, the subgrade shall be brought to the lines, grades and cross-sections shown on the plans, and finished in accordance with the plans.

Subgrade material shall meet the requirements of Soil Classifications A-1, A-2, A-3, or A-4 as determined by AASHTO specification M-145 within the following limitations:

- a) materials in the A-1 or A-3 classification will not require consideration of a CBR value.
- b) materials in the A-2 or A-4 classification shall have a CBR value of not less than 10.
- c) Materials of the cherty or float gravel type which have a minimum 50% metal retained on the number 8 sieve, 100% passing the 4" sieve, and CBR value of at least 25 will not be required to conform to the soil classification noted above.

Certification by the developers geotechnical engineer shall be submitted to the City addressing the subgrade material.

13.2 PREPARING SUBGRADE

13.2.1 The subgrade shall be so constructed that it will have, as nearly as practicable, uniform density throughout. No base course, surfacing or pavement shall be placed on the subgrade until specified density is obtained, and until the subgrade conforms to the grade and cross-section shown on the plans and until the subgrade has been checked and approved.

13.2.2 Before placing any material on a subgrade, it shall be firm and compacted and shall have passed an inspection for compaction in accordance with Section 13.2.4 of this Specification. When necessary, the subgrade shall be sprinkled.

The subgrade shall be constructed so that it will be uniform in texture and have as nearly as possible uniform density throughout. Subgrade material shall be placed in maximum 8" lifts. No base course or sub-base course shall be placed

on the subgrade until the specified density is obtained, and until the subgrade conforms to the lines, grades and cross-sections shown on the plans. The density of the top 6 inches of subgrade shall be not less than 100% of the maximum density as determined by AASHTO Compaction test T-99. In no case shall any roadbed material, base course, pavement or surface course be placed on a frozen, muddy or excessively dirty subgrade. Storing or stockpiling of material on the subgrade will not be permitted.

13.2.3 All boulders, brick, concrete or similar solid items or ledge rock appearing in the earth excavation shall be removed or broken off to a depth of not less than 9 inches below the subgrade. The depressions left by such excavation shall be filled with suitable material. All soft and unstable material and other portions of the subgrade which will not compact readily or serve the intended purpose shall be removed. The resulting areas and all other low sections, holes or depressions shall be brought to profile grade with satisfactory selected material and the entire subgrade shaped to line, grade and cross-section.

The entire subgrade, both in cut and in fill, shall be compacted to a density of not less than 100% of the maximum density in the top 6" layer as required in section 13.2.2 above and 95% of the maximum density below 6" in depth as determined by AASHTO Compaction Test T-99. Moisture content at the time of the in-place density test shall be within + or - 2% of the optimum moisture content established during the control density test. Density test shall be performed at a minimum of 300' intervals or at least once on short streets less than 300' in length. Developer shall provide the City with results of in-place density test.

13.2.5 Particular attention shall be paid to compaction around manholes, over sewer lines and laterals, and over other utility and drainage crossings. Where deemed necessary by the engineer or the City engineer or his representative, hand tamping shall be required.

13.2.6 Where the plans indicate that a base course, surface course or pavement is to be placed, any requirements as to subgrade contained in the specifications for such base course, surface course or pavement shall be performed accordingly. Subgrade rolling shall be performed with a double axle truck with a minimum net load of 20 tons.

13.2.7 After rolling, the subgrade shall be checked and all portions not at true elevation shall be corrected and compacted to correct elevation. The subgrade shall be tested after rolling and sufficient material shall be added or removed

to bring all portions of the subgrade to proper elevation.

13.2.8 All intersecting public streets or highways shall be graded as shown on the plans, and acceptable materials used on the surface so that a commodious, smooth riding and satisfactory intersection shall be produced. Grading of the subgrade shall be conducted so that berms of earth or other material do not prevent immediate drainage of water to the side ditches or gutters. Gutters, ditches and drains along subgrade shall be so maintained at all times as to drain effectively. When hauling results in ruts or other objectionable irregularities, the subgrade shall be rerolled before the surfacing is placed.

13.3 PROTECTION AND MAINTENANCE OF SUBGRADE

13.3.1 The subgrade shall be maintained free from ruts and other depressions, in a smooth and compacted condition true to lines and grades and to density requirements until the base, surfacing or pavement is placed.

14.1 Description

14.1.1 This item shall consist of dense graded crushed limestone base course composed of one or more well controlled aggregate sizes, water mixed with and without calcium chloride, as directed, placed and compacted in accordance with these Specifications and in conformity with lines, grades and cross-sections shown on the plans. All material shall conform to the requirements set forth in Section 14.1.2 of this Specification.

14.1.2 Coarse Aggregate

(a) Coarse aggregate shall consist of crushed stone, free from adherent coatings and conforming to the requirements of this Specification.

(b) Deleterious Substances in coarse aggregates shall not exceed the following limits:

1. Soft fragments	6.0%
2. Coal and lignite	0.25%
3 Clay lumps	0.25%
4. Material passing a #200 sieve	2.0%
5. Thin or elongated pieces (Length greater than 5 times average thickness)	10.0%
6. Other local deleterious substances	2.0%
7. Total of Nos. 1, 2, 3, and 6 above.....	8.0%

14.1.3 Crushed Stone

(a) Crushed stone shall consist of clean, tough, durable fragments of rock conforming to the class and gradation specified.

(b) Crushed stone shall meet the following requirements for the respective physical tests:

TEST	LIMITS FOR TYPE CONSTRUCTION		
	Concrete	Bituminous	Other
Percent wear, Los Angeles Test (AASHTO T-96)	50 Max	48 Max	60 Max
Percent sound, Soundness Test (AASHTO T-104)	90 Min	90 Min	90 Min

14.2 Gradation

(a) Coarse aggregate shall be graded within the limits specified and the size or sizes designated shall conform to the limits shown in the Coarse Aggregate Gradation Table provided in AHD Specification for Highway Construction (AHDSSHC), Subarticle 801.11(d).

(b) The dense graded mixture as processed shall contain moisture within 2% of the optimum moisture content of the aggregates, and the aggregates shall be blended together in such a manner that if sampled and tested, it shall meet the following gradation without abrupt variation:

TOTAL PASSING	PERCENTAGE BY WEIGHT
2" sieve	100
1.5" sieve90-100
1" sieve	75-98
1/2" sieve	60-85
No. 4 sieve	40-65
No. 8 sieve28-54
No. 16 sieve	19-42
No. 50 sieve	9-27
No. 200 sieve	4-18

14.3 CONSTRUCTION METHODS

a) General

The roadbed must be in an approved condition before placement of any base or subbase will be permitted. Approval shall be based on satisfactorily completion of the roadbed in accordance with the requirements of Section 13.

b) Equipment

In general, it shall be the Contractor's responsibility to select and furnish the proper size and amount of equipment that will produce and deliver to the roadbed, mix, spread, shape and compact the base material.

14.4 MIXING BASE COURSE AGGREGATES

(a) Premixing of the materials for the base course will be required. They shall be mixed by an approved mechanical mixer, either at point of use or at a central mixing plant. Water shall be added during the mixing operation in an amount to make the total moisture content of the mixture not less than 5% by weight, and sufficient to make a workable mixture. At no time during the mixing operation shall the moisture content exceed the designated optimum by more than 2%. In case the material becomes too dry before compaction, water shall be added. For the top layer only, calcium chloride may be added during the mixing operation at the rate of 10 pounds of flakes per loose cubic yard of mixture.

14.5 PLACING MATERIAL

(a) In mixing, handling and placing the base material, care shall be taken to prevent segregation. The base course material shall be placed in not more than 6 inch compacted layers on an accepted subbase or subgrade. The minimum nominal thickness of the base material in place shall be 5", unless otherwise approved by the City Engineer. Reference is made to the typical sections for local and minor collector streets in the Appendix.

14.6 COMPACTING AND MACHINING

(a) The surface of the base course material shall be immediately and continuously machined with motor graders, maintaining the required section and compacted with steel wheel rollers. The base course shall be compacted until it reaches 100% proctor density. The base course shall be rolled with a double-axle dump truck with a minimum net load of 20 tons. Steel wheel rolling shall extend beyond the curb line where curb and gutter is to be placed on the base material, and to the curb and gutter where the curb is placed on subgrade. When compaction is complete, the base course shall be smooth, hard, dense, unyielding and well bonded. The contractor shall provide density tests for the base if requested by the City.

14.7 MAINTENANCE

(a) The entire roadway shall be maintained, and areas found defective shall be corrected and, if necessary, the subgrade and base shall be replaced. Maintenance shall include maintaining the shoulders (where they exist) to a uniform grade and slope, keeping all drainage ditches free from loose earth or

other objectionable material, and keeping the roadbed drained at all times until the surface coat is applied. The base shall be machined as often as necessary to maintain it smooth and to grade and cross-section until the wearing surface is applied. The maximum speed of trucks when hauling or traveling any part of the base course under construction shall be 20 miles per hour.

15.1 GENERAL

(a) This section shall cover the work of constructing portland cement concrete combination curb and gutter.

15.2 MATERIALS

(a) All materials shall conform to the requirements of AHD Specifications Division III. Concrete shall conform to the requirements of Addendum I of this Specification.

15.3 CONSTRUCTION REQUIREMENTS

(a) Concrete mixes shall be as provided by Addendum I of this Specification, with a Class A mix being used with standard forms and a Class A mix, modified as deemed necessary by the engineer to fit the type curbing machine being used.

(b) Foundation shall be constructed or excavated to the required depth below the finished surface in accordance with the cross-section shown on the plans. All soft or other unsuitable material shall be removed and replaced with suitable material in layers not to exceed 4 inches compacted. The foundation shall be proof rolled with a two-axle truck with a minimum 20 ton net load.

15.4 FORMS

(a) General The contractor shall use standard type metal forms as noted hereinafter or an approved automatic extrusion type curb-and-gutter machine.

(b) At each street or driveway crossing where there is to be sidewalk, the curb shall be modified to provide a ramp from the sidewalk to the street.

(c) Combination curb and gutter shall be 24 inches wide at the base

(d) Standard Forms Standard forms shall be metal, except for radial sections. They shall be straight and free from warps and of sufficient strength, when staked, to hold the concrete true to line and grade without distortion. They shall provide the approved typical section and depth of the section shown on the plans. Radial or curved forms may be of flexible metal, or a wood form of approved design may be used.

Bent or damaged forms shall not be used. All forms shall be securely staked, braced and held together to the line and grade established and shall be kept sufficiently tight to prevent leakage of mortar. All forms shall be cleaned and oiled with a suitable oil immediately before concrete is placed against them.

(e) Machine formed Any automatic extrusion type curb-and-gutter machine must produce a section conforming to the dimensions, cross-section, lines and grades shown on the plans within the tolerances provided in Paragraph 15.8(b) of this Specification for formed curb and gutter. All curb and gutter shall be placed in one operation to the depth of cross-section shown on the plans. The use of a two-stage operation will not be permitted.

15.5 SECTIONS

(a) Combination curb and gutter shall be constructed in sections of the lengths shown on the plans. The length of sections may be reduced when necessary to form closure. Sections shall be formed with expansion joints not more than 60 feet apart, and with contraction joints spaced at 10 foot intervals.

15.6 MATERIAL HANDLING, PROPORTIONING AND MIXING

(a) the handling, storing, proportioning and mixing of concrete shall conform to the requirements of ADDENDUM I.

15.7 JOINTS

(a) All expansion, contraction and construction joints shall be constructed as shown on the plans and in accordance with the requirements of ADDENDUM I, Section I-13 of this Specification. If not shown on the plans, joints shall be placed as follows:

(b) Expansion joints shall be placed in curb and gutter to match those in concrete pavement where the two are adjacent, but in no instance shall there be more than 60 feet between expansion joints.

(c) Expansion joints 3/4 inch wide shall be placed where curb and gutter terminates against rigid objects.

(d) Expansion joint filler and sealer shall meet the requirements of ADDENDUM I, Paragraph I-3.8 of this Specification. Expansion joint filler shall extend from the bottom of the curb and gutter to within 1 inch of the top and the sealer shall be 3/4 inch thick and shall be recessed 1/4 inch from the top.

(e) Contraction joints shall be placed in curb-and-gutter to match those in concrete paving where the two are adjacent, but in no instance shall there be more than 10 feet between joints. Contraction joints shall be sawed or otherwise cut 2 inches deep by 1/8 inch wide and shall extend 2 inches below the pavement surface.

15.8 PLACING AND FINISHING - STANDARD METHOD

(a) Placing The subgrade and forms shall be checked and approved just prior to placing concrete against them. All debris or other foreign material shall have been removed from the space to be occupied by the concrete. The subgrade shall be moist but not wet or muddy. The concrete shall be placed in the forms and shall be tamped, spaded or vibrated sufficiently to produce a dense homogeneous mass and to bring the mortar to the surface. Particular attention shall be given to spading and placing the concrete along and against the surface of the forms to prevent honeycombing and to secure a smooth, uniform surface.

(b) When the forms are filled, the concrete shall be struck off with a template cut to the curb edge design. The exposed concrete surface shall then be finished smooth with a wooden float in a manner that will compact the mass and produce a true, even top surface. Plastering with mortar to build up or finish will not be permitted. The surface of the gutter and the top and face of the curb will be checked with a 10 foot straightedge and any irregularities more than 1/4 inch in 10 feet shall be corrected. The alignment and grade shall not at any point vary more than 1/2 inch from that established by the elevation control stakes. Excessive troweling with a steel trowel will not be permitted. A textured finish shall be provided on the exposed surface just before the concrete becomes non-plastic by the use of a burlap or cotton fabric drag, brush or broom which will produce a uniform gritty texture along the length of the curb and gutter. The upper edges of curb shall be rounded with an edging tool to the radius shown on the plans. Joint templates shall be set during the placing of the concrete and allowed to remain in place until the concrete has set sufficiently to hold its shape, but shall be removed while the forms are still in place.

The forms shall be left in place until concrete has set sufficiently so that they can be removed without damage to the work but, unless otherwise directed, they shall be removed within 24 hours after the concrete has been placed. Immediately after removal of the forms, any minor defects shall be repaired.

15.9 PLACING AND FINISHING- MACHINE METHOD

(a) Placing and finishing machine laid curb and gutter shall be in accordance with Paragraph 15.4 of this Specification except that fixed forms are not required.

15.10 CURING AND PROTECTION

(a) Immediately after the finishing operation is completed, the concrete shall be cured as provided in ADDENDUM I, Paragraph I-3.7.

15.11 BACKFILLING

(a) After the concrete has set sufficiently, spaces along the front and back sides of the curb and gutter shall be backfilled to the required elevation with suitable material which shall be compacted by tamping with approved metal tamps or mechanical tamps in layers not more than 4 inches thick until firm and solid.

16.1 DESCRIPTION

This Section pertains to a two step plant mix bituminous application with the mix prepared at a stationary plant.

16.2 BITUMINOUS CONCRETE BINDER LAYER

(a) The work covered by this Section shall consist of a hot bituminous plant mixed binder layer placed on a prepared surface and to be covered by a bituminous wearing surface in accordance with these Specifications and in reasonable close conformity with the lines, grades, and typical cross-section shown on the plans and required by these Specifications.

(b) The materials furnished shall conform to the requirements of AHDSSHC Section 414 and the following:

- The minimum VMA for mixes in this section is 12.
- Fine aggregates shall be sand or crushed aggregate or a mixture of these, meeting the requirements of AHD. Coarse aggregate shall be gravel, crushed gravel, crushed slag, crushed stone, crushed sandstone or combinations thereof, meeting the requirements of AHD. When gravel is used as the aggregate for a mix, at least 50% by weight of material retained on the No.8 sieve shall be crushed material passing the 3/4 inch sieve. When gravel is used in a blend with other aggregates, at least 50% by weight of material retained on the No.8 sieve shall be slag or stone passing the 3/4 inch sieve.
- The coarse and fine aggregates shall be combined in a total blend that will produce an acceptable job mix within the following gradation limits. The job mix shall be designed by the Marshall Method to produce a minimum of 1400 pounds stability.
- Mix A shall be used unless otherwise noted on the plans or ordered by the engineer.

(c) For a Local Street, the binder shall consist of a 2" compacted hot bituminous plant mix binder layer, Mix A according to these specifications. Binder layer shall be installed according to Section 410 of the Alabama Highway Department Standard Specifications for Highway Construction (AHDSSHC) and shall meet the density requirements of Section 306 of AHDSSHC.

For a Minor Collector Street, the binder shall consist of a 2.5" compacted hot bituminous plant mix binder layer, Mix A according to these specifications. Binder layer shall be installed according to Section 410 of the AHDS SHC and shall meet the density requirements of Section 306 of the AHDSSHC.

GENERAL COMPOSITION

SIEVE	PERCENT PASSING BY WEIGHT	
	Mix A	Mix B
Square mesh type		
1-1/2 inch sieve	100	100
3/4 inch sieve	80-95	94-100
1/2 inch sieve		75-90
3/8 inch sieve	54-76	64-80
No. 4 sieve	40-58	46-64
No. 8 sieve	28-46	34-50
No. 50 sieve	8-22	10-22
No.100 sieve	5-15	6-16
No.200 sieve	3-10	4-10

Unless the type of bitumen is specified on the plans, the contractor may select for use either asphalt cement, grade AC-20, AC-30 or AC-40, or tar of a grade approved by the engineer. The proportion of bitumen to total sample by weight shall be 3.5% to 6.0% for Mix A and 3.5% to 6.5% for Mix B. The exact proportion shall be fixed by the job mix formula.

16.3 BITUMINOUS CONCRETE WEARING SURFACE

(a) The work covered by this Section shall consist of constructing a hot bituminous concrete wearing surface on a prepared surface in reasonable close conformity with the lines, grades, and typical cross-section shown on the plans and required by these Specifications.

(b) The materials furnished shall conform to the

requirements of AHD Section 410 and the following:

(c) All mixes in this Section, regardless of the type aggregate used, will require the use of an anti-strip agent. All gravel aggregates shall be washed prior to crushing. All mixes in this Section shall be designed on the fine side of the Maximum Density Curve on the No. 8 sieve.

(d) Aggregates shall meet the requirements of AHD Sections 801 and 802, with particular attention directed to Article 802.04 and the following:

(e) Coarse aggregates for an actual wearing surface shall be limited to siliceous aggregates such as gravel, granite, slag, sandstone, or a combination of the proper sizes of these materials that will produce a mix within the required gradation limits. Carbonate stone, such as limestone, dolomite or aggregates which tend to polish under traffic will be permitted only in underlying layers, shoulder paving, or widening.

(f) All coarse aggregate shall be crushed aggregate meeting the requirements of AHD Section 801.

(g) Fine aggregate such as round, pea or shot gravel, defined as an uncrushed gravel passing the 3/8 inch sieve with more than 50% retained on the No. 8 sieve will not be permitted as a material to be blended in this mix. A sand stockpile may be rejected if it appears that this type of gravel has been blended with a natural sand.

(h) Naturally fine aggregate used in this mix shall be reasonably clean, free from a coating of injurious material, lumps of clay, loam, organic matter or other foreign matter and uniformly graded. All of the aggregate shall pass the 3/8 inch sieve and at least 85% shall pass the No. 4 sieve.

(i) Manufactured fine aggregate used in the mix shall have 100% passing the 3/8 inch sieve with 95% of the material retained on the No. 8 sieve and shall have at least one freshly fractured face.

(j) The aggregates shall be combined in a blend in which at least 80% of the total material retained on the No. 4 sieve shall have at least two freshly fractured faces, and will produce an acceptable job mix within the gradation limits shown below. The job mix shall be designed by the Marshall Method to

produce a minimum stability of 1600 pounds, and a minimum VMA of 15 for Mix A , 14 for Mix B, and 16 for Mix C.

(k) Unless noted on the plans or ordered by the engineer, Mix B shall be used for all layers.

(l) Deleted

GENERAL COMPOSITION

SIEVE (Square Mesh Type)	PERCENT PASSING BY WEIGHT		
	Mix A	Mix B	Mix C
1 inch sieve		100	
3/4 inch sieve	100	95-100	
1/2 inch sieve	95-100	76-90	100
3/8 inch sieve	80-95	66-84	90-100
No. 4 sieve	54-74	46-66	65-82
No.8 sieve	38-56	34-50	45-62
No. 30 Sieve	16-36	16-30	22-38
No. 50 sieve	10-26	10-22	14-28
No. 100 sieve	6-18	5-14	8-20
No. 200 sieve	4-12	4-10	4-14

(m) For a Local Street, the wearing surface shall consist of a 1.5" compacted hot bituminous concrete wearing surface Mix B according to these specifications. The wearing surface course shall be installed according to Section 410 of the AHDSSHC and shall meet the density requirements of Section 306 of the AHDSSHC.

For Minor Collector Street, the wearing surface shall consist of a 1.5" compacted hot bituminous concrete wearing surface Mix B according to these specifications. The wearing surface course shall be installed according to Section 410 of the AHDSSHC and shall meet the density requirements of Section 306 of the AHDSSHC.

(n) Construction requirements shall be as specified in AHD Articles 410.03 through 410.07. In the event the subgrade material and compaction standards cannot meet the standards specified, the design engineer shall present an alternate design for the road section. This design shall meet the following minimum traffic requirements of

Local Street: 2000 vpd

Minor Collector Street: 2500 vpd

The design shall be in accordance with the AASHTO Method of Flexible Pavement Design, Caltrans Method of Flexible Pavement Design, or a method approved by the City Engineer.

In no case, however, shall the pavement section used be less than that required in these specifications.

17.1 RAMPS Where sidewalks intersect cross streets or driveways, ramps shall be constructed from the sidewalk to the street or driveway. Ramps shall have a maximum slope of 1 foot in 8 feet.

17.2 MATERIALS All materials furnished for use shall comply with the requirements of AHD Division III, Materials and the following:

 Concrete shall meet the requirements for a Class A, Type 2 mix as provided in Addendum I of this Specification.

 Reinforcing steel, if required, shall meet the requirements of Addendum II of this Specification

17.3 CONSTRUCTION REQUIREMENTS

17.3.1 The contractor may use forms or, upon approval of the engineer, an approved automatic extrusion type paving machine.

17.3.2 Forms shall be of wood or metal and shall be sufficiently staked to hold them true to line and grade while concrete is being deposited against them. If of wood, they shall be of 2 inch or 3 inch stock lumber surfaced on all sides. If of metal they shall be of approved section having a base width of at least 4 inches and shall have a flat surface on top. The depth of the forms shall equal the depth of the sidewalk. Adequate means shall be provided for securely fastening the ends of forms together.

17.3.3 Any automatic extrusion machine considered must be demonstrated to produce a consolidated concrete section conforming to the dimensions, cross-section, line and grades shown on the plans.

17.4 SUBGRADE All soft or otherwise unsuitable material in the subgrade shall be removed and replaced with suitable material. All fills and filling material shall be placed and compacted with an approved roller or hand tamped in layers not exceeding 6 inches in thickness.

17.5 FOUNDATION BACKFILL Where provided by the plans, foundation backfill shall be placed and constructed as provided in AHD Section 214.

17.6 SETTING FORMS Forms shall be set to true line and grade and rigidly held in place by stakes or braces. Ends of adjoining form sections shall be flush. Forms and division plates shall be cleaned and oiled before placing concrete against them. Unless otherwise shown on the plans, the finished surface of the sidewalk shall slope toward the roadway pavement at the rate of 1/4 inch per foot.

17.7 PLACING CONCRETE A template resting upon the side forms and having its lower edge at the exact elevation of the subgrade shall be drawn along the forms and the subgrade shaped true before any concrete is deposited. The subgrade shall be moist and shall be free of debris and all foreign material when concrete is deposited upon it. The freshly mixed concrete shall be placed promptly on the prepared subgrade to the depth required to complete the sidewalk in one course. It shall then be vibrated and/or tamped and struck off with an approved straightedge resting on the side forms and drawn forward with a sawing motion. The concrete shall then be floated with a wooden float until the surface is true. Concrete laid during cold weather shall conform to the requirements of AHD Section 501.03(d).

17.8 JOINTS Unless otherwise shown by plan details, the surface of sidewalks shall be marked in squares or rectangles not exceeding 36 square feet in area by using an approved marking tool. The marking tool shall provide a groove approximately 1/2 inch in depth and with rounded edges.

17.8.1 Expansion joints a minimum of 3/8 inch wide shall be placed as follows:

(a) where the walks join other concrete units

(b) to line up with expansion joints of adjacent curbs, drives, etc., but in no instance more than 80 feet between joints.

(c) where continuous runs of walks or drives are 80 feet or longer, transverse expansion joints shall be provided; one joint for each 80 feet or fraction thereof of length.

(d) where walks are confined longitudinally by other concrete units and the width of the walk is in excess of 15 feet, one longitudinal expansion joint shall be required for each additional 15 feet or fraction thereof of width.

(e) expansion joints shall be formed using a filler and sealer specified in ADDENDUM I, Paragraph I-3.8.

(f) Unless shown otherwise by plan details, the joint filler shall be from the bottom of the walk to within 1 inch from the top. The sealer shall be 3/4 inch thick and shall be recessed 1/4 inch from the top.

17.9 CURING AND PROTECTING Immediately after the finishing operations have been completed, the entire surface of the newly laid concrete shall be protected against rapid drying out. No vehicles shall be permitted on the new concrete for 7 days and pedestrians shall not be permitted thereon for at least 72 hours.

17.10 BACKFILLING After the concrete has set sufficiently, the side forms shall be removed and the spaces on both sides shall be backfilled with suitable material. This backfill shall be compacted to a level one inch below the walk and left in a neat and workmanlike condition.

18.

UTILITIES

18.1 All utilities shall be installed within the right-of-way unless prior written authorization of the engineer and the City engineer is obtained.

18.2 Utilities shall be installed in accordance with the locations shown in this specification, unless written authorization is obtained from the City Engineer for variation from these specifications. It is understood that the dimensions in back of curb in cul-de-sacs may vary, however the depth from top of curb shall be maintained.

Any variation from the dimensions shown shall be shown on the "As Built" drawings.

18.3 Each utility shall be responsible for repair of any damage it creates to other utilities or to the installed improvements. It shall be the duty of any utility installer to report any damage discovered by him in the course of his work. In the event damage is unreported and is later discovered, the City engineer shall determine responsibility and shall cause repairs to be made and costs to be assessed against the contractor determined to be responsible.

18.4 UTILITIES SHALL BE INSTALLED ONLY IN THE FOLLOWING LOCATIONS:

Underground electric shall be installed eight feet behind back of curb and forty-two inches below top of curb, on either side of the street.

Underground telephone shall be installed six feet behind back of curb and thirty inches below top of curb on either side of the street.

Underground television cable shall be installed eighteen inches behind back of curb and eighteen inches below top of curb on either side of the street.

Water shall be installed four feet behind back of curb and thirty-six inches below top of curb on the NORTH or WEST side of the street.

Gas shall be installed four feet behind back of curb and thirty-six inches below top of curb on the SOUTH or EAST side of the street.

Sewer taps shall be extended twenty-four inches behind back of curb and not more than sixty inches below top of curb.

18.5 Before any utility is installed, the entire width of the right-of-way shall be rough graded.

18.6 In general, the deepest utilities should be installed first to minimize any possible interference with laterals or service lines.

18.7 In cul-de-sacs the dimensions from the back of curb may vary.

18.8 Anyone digging in the right-of-way shall call the appropriate utility to have utilities located.

18.9 Each utility shall be responsible for repair of any damage they create to other utility lines or to the street improvements within the right-of-way. No utility shall be responsible for damage to another utility which is located outside their assigned space.

18.10 Once the road base has been placed, all further installation of utilities under the roadway shall be bored or otherwise shall comply with the street cut requirements of the subdivision regulations.

19.1 The following drainage level of service standards shall be met by all developments:

-Lowest Floor Residential:	100 Year
-Required Yards	25 Year
-Local Streets and drainage structures	10 Year
-Collector and Arterial Roads and drainage structures serving to collect water from more than one subdivision	25 Year
-Open Channels	25 Year

All levels of service are based on a Type II Storm.

19.2 Where a lake or pond is created or exists within 50 feet of the closest edge of the right-of-way of any street, road or alley, there shall be a suitable shrub barrier

19.3 Approach slopes for ponds and wet basins shall be at least 6:1, but more than 3:1 and shall be at least four ft. wide and slope gently toward the basin. The side slopes shall be of a nonerosive material with a slope of 1:1 or flatter. The ledge shall be between four and six ft. wide and shall slope gently toward the shore to prevent people or objects from sliding into deep water. There shall be a freeboard of twelve to eighteen inches above the high water elevation on all retention basins. Alternative designs may be approved by the City Engineer where special circumstances make this necessary.

19.4 Fences, where provided, shall be constructed in accordance with the requirements of ADDENDUM IV of this specification, except for height.

19.5 All drainage shall be designed to guidelines applicable to the particular basin, and shall be based on the City's Drainage Master Plan, latest edition. In the event the Drainage Master Plan calls for additional downstream infrastructure or, alternatively, zero net post-development discharge for future development in a particular location, it shall be the responsibility of the developer/owner to provide for such drainage features as are needed to achieve compatibility with the Drainage Master Plan.

20. ENFORCEMENT, ADMINISTRATION, APPEALS

20.1 Violation of this ordinance shall be punishable according to the terms and provisions of Section 1-8, Madison Code of Ordinances, as may be amended from time to time.

20.2 The City Engineer or Director of Community Development, or their authorized designees, may impose a "STOP WORK" order whenever they find that

- any facility under construction and subject to these regulations is unsafe, and must be corrected promptly to ensure the public safety, or
- any work subject to these regulations is being performed in a manner that may reasonably be expected to create harm to the public (e.g., inadequate or unsafe traffic control, improper diversion of sewer flow, etc.)

Upon imposition of a "STOP WORK" order, all work on the site will stop and all workers leave the site, except for those workers necessary to correct the condition giving rise to the order. The individual issuing the STOP WORK order, the City Engineer, or the Director of Community Development, shall rescind the order when he/she finds that conditions on the site warrant such rescission. Appeal of a "STOP WORK" order shall be administered according to Section 20.3 below.

20.3 No "STOP WORK" order or citation shall be issued for a violation of this Section unless a written notice of the violation has been provided to the project engineer, the contractor, or the authorized representative of one of these, with a 24-hour period given to cure the violation. Provided, however, that no notice is required prior to the imposition of a "STOP WORK" order should the City Engineer, Engineering Inspector, Fire Chief, Police Chief, or Chief Building Official determine that the violation poses an imminent danger to life or property.

20.4 Appeals from the administrative rulings of the City Engineer or the Director of the Community Development Department shall be to the Planning Commission, which shall make the final administrative determination concerning those matters controlled by this Ordinance.

ADDENDUM I

CONCRETE

I-1 CLASSIFICATION AND USES

Concrete shall be classified as Class A or Class B. Each class of concrete shall be used in that part of the structure as provided on the plans or where directed. The following shall govern unless otherwise directed.

CLASS A concrete shall be used in all ordinary reinforced work such as cantilever footings, walls, piers, diaphragms, columns, caps, braces, reinforced footings, concrete slabs, girders, reinforced concrete culverts, reinforced headwalls and inlets, concrete pavement, concrete sidewalk and other areas as directed. Unless otherwise noted, all concrete work shall be Class A.

CLASS B concrete shall be used in all mass footings, massive pier shafts, gravity walls and other mass construction, and leveling courses.

I-2 COMPOSITIONING AND PROPORTIONING

I-2.1 COMPOSITIONING Concrete shall consist of Type I Portland cement, additives (if any), fine aggregate, coarse aggregate and water. Slag cement may be used in the proportion of approximately one part slag cement to two parts Portland cement with the approval of the engineer. The contractor may, at his option and with the approval of the engineer, substitute Type III Portland cement in the construction of concrete. The contractor shall put into each batch the designated number of bags of cement and amount of water, and weigh into each batch the respective weights of fine and coarse aggregate designated for the particular job and class of concrete being used, provided, however, that for batching aggregates for structures 15 yards or less, the contractor may use approved volumetric measuring devices, in which case the volumes of aggregates in each batch will be designated.

I-2.2 PROPORTIONING The following requirements have been designed to give the most economical and practical combination of materials which will produce the necessary workability in the fresh concrete and the required qualities in the hardened concrete.

(a) The maximum size of aggregate that can be used will depend on the size and shape of the concrete structure and the amount and distribution of reinforcing steel. The maximum size shall not exceed 1/5 the minimum dimension of the member, nor 3/4 of the clear spacing between reinforcing bars.

CLASS	COARSE AGGREGATE CONSISTENCY SIZE	WATER IN GAL. PER SACK OF CEMENT	THEORETICAL	
			CEMENT FACTOR IN BAGS PER C.Y. OF CONCRETE	SLUMP IN INCHES
A	1 1/2" to No.4	6	6.35	4-6
A	1" to No.4	6	6.70	4-6
A	3/4" to No. 4	6	6.87	4-6
B	2" to No. 4	8	4.77	6-8
B	1 1/2" to No. 4	8	5.04	6-8

The relative proportion of fine and coarse aggregate shall be set to produce a workable mix of the consistency above specified with the least amount of water. The quantity of sand may vary from 33 to 50% of the total aggregate quantity in an absolute volume basis considering the aggregate to be in a saturated surface dry condition. Since the data in the above table has been based on aggregate in a saturated surface dry condition, it will be necessary in calculating batch weights and mixing water to make corrections for any other moisture condition of the aggregates as delivered to the measuring bins. Once fixed, the total weight of aggregates on a saturated surface dry basis shall not be changed during the progress of the work except under the following conditions:

(b) If during the progress of the work the specific gravity of one or both of the aggregates changes, the batch weights shall be changed to conform to the new specific gravity by absolute volume calculations.

(c) In case the maximum net content of water specified is not needed for proper consistency, solid volumes of combined aggregates may be substituted for an equal volume of water omitted in order to insure as constant cement factor as possible.

(d) In the event that the proportions of the concrete mixture, as established by this specification, do not

produce concrete of a strength desired, the right is reserved to the engineer to increase the quantity of cement in the mixture as may be required to secure the desired strength.

I-3 MATERIALS

I-3.1 CEMENT

(a) Portland Cement shall meet the "Standard Specifications for Portland Cement", ASTM Serial Designation C 150 for Type I and Type III Cements.

(b) Slag Cement shall meet the U.S.Army Corps of Engineers Specifications for Slag Cement CRD-C 248-52.

I-3.2 FINE AGGREGATE

(a) Fine aggregate shall consist of natural sand having clean, hard, durable, uncoated particles meeting the physical requirements of this sub-section and conforming to the gradation shown hereinafter.

(b) The maximum weight of deleterious substances shall not exceed the following percentages:

Removed by decantation	2.0%
Shale	1.0%
Coal and/or lignite	0.5%
Clay lumps	0.5%
Cinders & clinkers	0.5%
Other local deleterious substances such as alkali, mica, coated grains, soft and flaky particles	1.0%
Total shale, coal and/or lignite, clay lumps, cinders and clinkers and other deleterious substances	3.0%

The percentage of clay lumps shall be determined by examining the various fractions which remain after the test for grading. Any particles that can be broken up with the fingers shall be classified as clay lumps and the total percentage by weight of all clay lumps shall be determined on the basis of the total original weight of the sample.

The diameter of deleterious substances shall not exceed the maximum size of aggregate.

(c) Organic Impurities All fine aggregate shall be free from injurious amounts of organic impurities. Aggregates subject to the colorimetric test for organic impurities and producing a color darker than the standard shall be rejected

unless they pass the mortar strength tests as outlined below.

(d) Soundness When subjected to five cycles of the "Soundness Test of Fine Aggregate" by the use of sodium sulfate, the weighted percentage of loss shall not be more than 10% by weight when tested by AASHTO T-104. In lieu of the soundness test, satisfactory evidence may be provided that the fine aggregate has been exposed to natural weathering, either directly or in concrete for a period of at least five years without appreciable disintegration.

(e) Mortar Strength When tested in accordance with ASTM Serial Designation C 87, fine aggregate shall have compressive strength of not less than that of standard sand at 3 days and 28 days with the use of Type III Portland cement or at 7 days and 28 days with the use of Type I Portland cement.

(f) Gradation Uniformity Fine aggregate shall be well graded between the following specified limits, which limits shall be considered the extreme limits in determining suitability for use from all sources of supply.

Sieve	% passing by weight
3/8"	100
No. 4	95-100
No. 8	80-100
No. 16	60-90
No. 50	12-30
No.100	2-10

Tests	Limits
Percent wear, Deval Test (AASHTO T-4)	23 Max.
Percent Sound, Soundness Test (AASHTO T-104)	90 Max

I-3.3 (a) CRUSHED SLAG Crushed slag shall consist of clean, tough, durable pieces of air-cooled blast furnace slag, reasonably uniform in density and quality, free from thin or elongated pieces and free from deleterious substances. The unit weight of crushed slag shall be not less than that indicated in the Coarse Aggregate Table.

Physical tests for crushed slag shall be the same as provided hereinbefore for crushed stone.

(b) Gradation Coarse aggregate of the size or sizes designated shall be well graded between the following limits and the size or sizes shall conform to the limits shown.

Designated Size	1 1/2 to No.4	1" to No.4	3/4" to No.4
-----------------	---------------	------------	--------------

Min. Wt.
per C.F.
(ASTM C-29)

70 lb	70 lb	70 lb
-------	-------	-------

Percent passing sieves by weight	2"	100	---	---
	1 1/2"	95-100	100	---
	1"	40-90	90-100	100
	3/4"	35-70		90-100
	1/2"	---	25-60	---
	3/8	10-30	---	20-55
	No. 4	0-5	0-10	0-10
	No. 8	---	---	0-5

I-3.4 USE, CARE AND HANDLING

(a) Transporting Vehicles: Railway cars, barges, or any other equipment used for transporting aggregate must be clean when the aggregate is placed therein. Trucks or other vehicles used in transporting aggregate must be kept clean, free from all foreign matter, in proper working condition and must have strong substantial bodies which will prevent the loss of materials during transit.

(b) Storage: Unless the weather and site conditions are favorable, aggregates shall be stored on suitable platforms at satisfactory locations. Unless platforms of wood or metal are used, stockpile sites shall be cleared of all grass, weeds, brush, debris and other foreign material before storing the aggregate, and the bottom parts of the stockpile of aggregate that are in contact with the ground surface shall be rejected up to the level where it is practical to remove the aggregate without including dirt or foreign materials.

(c) Stockpiling Stockpiling shall be so conducted that segregation is avoided and the aggregate throughout the piles is of uniform grading. If aggregates are stored in stockpiles either at the unloading point or at the site of the work, stockpiles shall be at least 6 feet in height built up in layers not over 3 feet in thickness. Each layer shall be completely in place before beginning the next, which shall be allowed to "cone" down over the lower layer.

(d) Gradation Gradation from any one source

shall be reasonably uniform and not subject to the extreme percentages shown above. For the purpose of determining the degree of uniformity, a Fineness Modulus determination shall be made upon representative samples from such sources as are proposed to be used. Fine aggregates from any one source having a variation in Fineness Modulus greater than 0.02 either way from the Fineness Modulus of the representative sample submitted may be rejected, or may be accepted subject to such changes in the proportions used as may be directed by the engineer.

I-3.5 COARSE AGGREGATE

(a) General Coarse aggregate shall consist of crushed or uncrushed gravel, crushed stone, or crushed blast furnace slag, having hard, strong, durable pieces, free from adherent coatings and conforming to the requirements of these specifications.

(b) Deleterious Substances The amount of deleterious substances in coarse aggregate shall not exceed the following limits:

(1)	Soft fragments	2.00%
(2)	Coal and lignite	0.25%
(3)	Clay lumps	0.25%
(4)	Material passing a No. 200 sieve	0.50%
(5)	Thin or elongated pieces (length greater than 5 times average thickness)	10.00%
(6)	Other local deleterious substances	2.00%
(7)	Total (1) thru (6) not greater than	3.00%

(c) Crushed stone Crushed stone shall consist of clean, tough, durable fragments of rock meeting the following requirements for the physical tests:

Percent wear, Los Angeles test (AASHTO T-96)	50 Max
Percent sound, Soundness test (AASHTO T-104)	90 Min

(d) Gravel Gravel shall consist of natural rounded or crushed fragments of clean, tough, durable stone, free from coatings of any character.

(e) Storage Different sizes of aggregate and aggregate from different sources shall be stored in separate stockpiles sufficiently removed from each other so that the

material at the edges of the piles will not become intermixed. Any material or mixture of fine or coarse aggregate which segregates so that the grading no longer conforms to that specified shall be rejected for use until screened to the proper grading.

(f) At the time of their use, the aggregate shall be free from all foreign materials such as burlap, paper, wood, straw, dirt, etc. When more than one size aggregate is required, either coarse or fine, for use, they shall be maintained in separate stockpiles and combined in proper proportions at the mixer or plant. Aggregates stored in proportioning bins shall be protected from rain by waterproof coverings.

I-3.6 WATER Water used in concrete shall be fresh, free from oil, and shall not contain impurities in excess of the following limits:

Acidity or Alkalinity Calculated in terms of	
Calcium Carbonate	0.05%
Total Organic Solids	0.05%
Total Inorganic Solids	0.05%

A comparison of the given water with distilled water can be obtained by making standard soundness, time of setting, and mortar strength tests with standard Ottawa sand, using the same cement of standard quality with each water. Any indication of unsoundness, marked change in time of setting, or a variation of more than 10% in strength from results obtained with mixtures containing the distilled water shall be sufficient cause for rejection of the water under test.

Water from City water supplies may be accepted without being tested.

Water used in curing cement concrete or mortar shall be free from any substance which may be injurious to, or discolor concrete when applied to the surface as a curing agent.

I-3.7 CONCRETE CURING AGENTS

(a) Preliminary curing fabrics shall be burlap 8 to 10 ounces weight per 10 square feet, (or two layers of burlap 6 or 7 ounces per ten square feet may be used).

(b) Cotton mats shall meet the requirements of AASHTO Designation M 73

(c) Paper Blankets shall meet the requirements of ASTM Designation C 171.

(d) Earth used in curing cement concrete pavement shall be free of sticks, stones, or other ingredients which may be detrimental to the surface of the concrete and shall be of such nature as to retain moisture.

(e) Straw shall be cured hay suitable for the purpose intended and approved each time used.

(f) Liquid Membrane Curing Compound shall be of a consistency suitable for spraying, shall contain a fugitive dye (unless a colorless type is available), be relatively nontoxic, and adhere satisfactorily to a vertical or horizontal surface of damp concrete when applied immediately after the disappearance of surface water sheen. It shall not react harmfully with the components of concrete, or contain waxes, oils or other materials which would for more than 30 days tend to prevent bonding of reflectorized strips or other traffic marking paints. The resulting film shall be continuous, uniform, moisture impermeable, and free from pinholes.

The nonvolatile material in the curing compound shall be not less than 40% by weight.

The curing compound, when applied to the surface of the mortar specimens in the determination of water loss shall dry to the touch in one hour and shall dry through in not more than four hours. When used in the field, it shall show satisfactory drying properties.

The curing compound shall not permanently darken the natural color of the concrete. The fugitive dye shall have a color strength sufficient to render the film distinctly visible for at least one hour after application. The color of the fugitive dye shall disappear within seven days after application.

The membrane shall not peel. It shall disappear from the surface by gradual disintegration from exposure to the elements over a period of not less than 30 days or more than one year, leaving the concrete hard and without discoloration. It shall be of such viscosity that it may be readily applied by approved pressure spraying equipment at temperatures above 40 degrees F.

When applied by pressure spray to the troweled surface of a vertical, damp concrete specimen one foot square at the rate provided herein, the curing compound shall adhere to the

surface in a continuous tenacious film without running off or appreciably sagging.

The liquid membrane curing compound, when tested in accordance with the method prescribed in ASTM C 156 shall provide a film which will retain within the specimen at the end of 7 days at least 85% of the original water used or contained when the compound was applied.

The curing compound shall have satisfactory resistance to early rainfall and early abrasion. To test for these qualities, at the end of a two hour preliminary hardening period, place the mortar specimen, previously sprayed with the required coating of the compound in such a position that its surface presents a 45 degree angle to water drops. The dropping apparatus shall be capable of permitting 150 drops of water of approximately 0.1 cc per minute to impinge upon a selected spot on the specimen. Fall of drops shall be 7 feet. If after 2 minutes (or 300 drops) the point of impingement shows no breaks, the compound shall be regarded as satisfactorily resistant to early rainfall and early abrasion.

I-3.8 JOINT FILLER

(a) Bituminous Premolded Filler shall consist of preformed strips which have been formed from asphalt or tar, felt and mineral filler to make a coherent matrix. It shall be of such character as not to be deformed or broken by twisting, bending or other ordinary handling after having been subjected for 12 hours to a temperature of 125 degrees F., or when subjected to freezing temperatures.

The dimensions shall be as shown on the plans and tolerances of + or - 1/16 inch thickness, + or - 1/8 inch depth and + or - 1/4 inch length shall be permitted. Absorption shall not be more than 5% by weight.

Distortion shall not be more than 1 inch.

It shall not crack or shatter when subjected to a brittleness test.

A specimen 3/4 inch or more in thickness shall compress to 50% of its original thickness under a pressure of not less than 100 psi, nor more than 1500 psi. The material after compression shall not show a loss of more than 3% of its original weight.

The material shall be tested in accordance with AASHTO T-42.

(b) Poured Bituminous Filler shall be blown asphalt cement, and shall meet the requirements of Grade AF-1 or AF-2.

(c) Premolded Cork Filler shall meet the requirements of ASTM Designation D544, Type I.

(d) Self Expanding Cork Filler shall meet the requirements of ASTM Designation D544, Type II.

(e) Sponge Rubber Filler shall meet the requirements of ASTM Designation Type III.

(f) Cork Rubber Filler shall meet the requirements of ASTM Designation D544 Type IV.

(g) Hot poured rubber sealing compound shall meet the requirements of Federal Specifications SS-F 336a.

(h) Metal used in expansion joints and as water stops in construction joints shall be 24 ounce copper sheets conforming to the requirements of ASTM Designation B-11.

I-3.9 READY-MIXED CONCRETE

(a) Ready-Mixed Concrete shall be understood to mean any concrete which is proportioned and mixed in a central plant and hauled to the site of the work in approved types of agitator trucks, or concrete which is proportioned and partially mixed in a central plant and transported to the site of the work in approved transit-mix trucks, the mixing being completed en route, (Called shrink mixing), or concrete which is proportioned in a central plant and mixed in approved transit-mix trucks en route to or at the site of the work. Ready-mix concrete shall not be used if it shall prove impossible, because of the time concrete is in transit, to finish the placed concrete properly before initial set takes place. Load tickets, stamped so as to prevent alteration, shall indicate load quantity and time of departure of each batch of concrete from the central plant.

I-4 FORMS

(a) General Forms shall be substantial and unyielding and so designed and constructed that the finished concrete will conform to the plan dimensions and contours. All forms shall be designed so that they may be removed without damage to the concrete and as little damage to the forms as possible. Forms shall be so constructed that portions where finishing is required can be removed for that purpose without loosening supports or disturbing portions of forms that must

still remain in place. Sectional forms shall not be used unless securely braced and constructed in a manner that will prevent bulging, settlement or unsightly joints. In forming circular concrete structures or curved portions of structures, the maximum chord of the form at the concrete surface shall be 6 inches.

(b) Materials All forms shall be of material sufficient in strength to hold the concrete without bulging between supports. Ample studding, walling and ties shall be used to effectively prevent bulging and misalignment of the forms. Special attention must be paid to bracing. If, at any stage of the work, during or after placing of concrete in any structure, the forms sag or bulge or show signs of sagging or bulging to such an extent that the concrete will extend below the elevation of the required permanent chamber, or outside the true lines of the form, the concrete affected shall be removed and forms reconstructed to proper elevation or line and new concrete placed.

(c) All lumber used in forms shall be properly sized and dressed. The forms shall be built of air seasoned, selected, matched, tongue and groove or shiplap lumber of sufficient thickness and strength to maintain accurate lines and planes. All form lumber shall be free from large or loose knots, decay, rot, splits, wind shakes or other defects which will mar the appearance of the finished work.

(d) Forms shall be mortar tight and shall be placed and maintained true to lines and grades designated until the concrete has hardened. Forms shall be protected from shrinkage, warping, curling and other distortions during erection and before placing concrete.

(e) Forms shall be filleted and chamfered at all sharp corners unless otherwise directed by the engineer. and shall be given a bevel or draft in the case of all projections, with coping sufficient to insure easy removal, but not such as will reduce the thickness of the concrete. All joints shall be driven tight and shall be securely nailed. Forms shall be securely spiked to stud uprights. The equal sides on triangular moldings or chamfers shall be 3/4", except that for light construction the width shall be 1/2".

(f) Forms shall be cleaned of all chips, dirt, sawdust and other extraneous material immediately prior to placing concrete.

(g) For narrow and/or inaccessible walls or

sections precast, concrete struts or approved steel struts shall be used for spacers. No wooden struts shall be used in such wall sections.

(h) Approved types of bolts or ties shall be used to prevent forms from spreading. All such bolts or ties shall be arranged so that at least one inch of that part adjacent to the concrete surface can be screwed out.

(i) Where indicated on the plans, concrete surfaces shall be cast against plywood, masonite or other approved form liner. Form liner shall be used in large sheets and shall have tight fitting joints. Patchwork and illogical location of joints shall be avoided. All joints shall be backed to prevent leakage. Edges of abutting sheets shall be sufficiently nailed to the same stud.

(j) Forms to be reused or forms previously used shall be maintained at all times in good condition as to accuracy of shape, strength, rigidity, water tightness and smoothness of surface. Any warped, damaged or cupped lumber or section of form shall be carefully re-sized, repaired or replaced before being reused.

(k) Prior to placing reinforcing steel the inside of all forms shall be coated with a non-staining oil or other approved material to prevent the concrete from adhering to them. Tarpaper or oil that will stick to or discolor the concrete shall not be used. The forms shall be inspected before placing reinforcing steel and the interior dimensions checked for conformity with the plans. The inside faces of the form shall be thoroughly examined and any projections, ridges, depressions, offsets or other unevenness corrected so that the surface of the concrete will be smooth, even and true.

(l) All forms shall be drenched and saturated with water sufficiently in advance of placing concrete against them to swell the lumber in order to remove shrinkage cracks between boards and shall be wetted immediately prior to placing the concrete, but no excess water shall remain in the form.

(m) The forms shall be inspected immediately before placing concrete in them and any bulging or warping shall be remedied. At the time of placing the concrete, the forms shall be watertight and have smooth interior surfaces.

(n) The foregoing portions of this Addendum primarily pertaining to wooden forms shall apply with equal force to metal forms. The metal used for forms shall be of such thickness that the forms will remain true to line, grade and

shape. All bolts and rivet heads shall be countersunk and smooth with the surface. Clamps, pins or other connecting devices shall be designed to hold the forms rigidly together, and to allow removal without injury to the concrete. Metal forms which do not present a smooth surface or which do not align properly shall not be used. Special care shall be exercised to keep metal forms free from rust, grease and other foreign matter such as will discolor the concrete.

I-5 FALSEWORK

(a) All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads without appreciable settlement or deformation. Screw jacks and/or hardwood wedges shall be used to take up any settlement in the form work either before or during the placing of concrete.

(b) Falsework which cannot be founded on a satisfactory footing shall be supported on piling which shall be spaced, driven and removed in an approved manner. Framed falsework bents on earth will not be permitted.

I-6 INSPECTION

The contractor shall give the engineer sufficient advance notice before starting to place concrete in any section of the structure to permit the inspection of forms, placing of steel reinforcement and of preparation for placement. Inspection shall be made before concrete is placed in any portion of the structure. Any concrete placed in violation of this provision shall be removed and replaced if so directed by the engineer.

I-7 TIME AND WEATHER LIMITATIONS

(a) All concrete shall be placed in daylight, and the placing of concrete in any portion of the work shall not be started unless it can be completed in daylight, unless written permission to the contrary is received. Such permission shall not be given unless an adequate lighting system is provided.

(b) No concrete shall be placed when the temperature is below 35 degrees F., or below 40 degrees F. and falling, without written permission of the engineer. Under extreme curing conditions at low temperature when directed, the contractor shall enclose the structure and furnish the necessary heat in such a way that the air within the enclosure and the concrete can be kept above 60 degrees F. for a period of 10 days after placing the concrete, and above 40 degrees F. for an

additional 4 days. Heating shall then be discontinued, but the protective covering shall remain in place until the temperature reaches that of the surrounding atmosphere.

I-8

MIXING

(a) For Job Mix Concrete, The aggregates and the cement shall be thoroughly mixed in an approved batch mixer for a period of not less than 1 1/2 minutes, during which time the mixer drum shall be operated at a speed as indicated on the manufacturer's nameplate on the mixer. The mixing water shall start entering the drum ahead of the other materials and shall continue for a short time after the skip is completely emptied. The additional time required for discharging the water into the mixer after the skip is emptied up to 10 seconds will not be included in the period specified for the mixing time. If necessary, the mixing time shall be increased to obtain thorough mixing and uniform consistency. Any concrete mixed less than 1 1/2 minutes shall be rejected and disposed of. The entire contents shall be removed from the drum before the succeeding batch is introduced.

(b) Ready Mix Concrete shall be in accordance with Article I-3.9 of this Addendum.

(c) Hand mixing of concrete shall not be permitted except with written permission of the engineer in an emergency. In the event hand mixing must be done, the procedure shall be as follows:

The sand shall be spread evenly on watertight platforms and the cement spread on it. Then the dry sand and cement shall be thoroughly mixed by square point shovels until the mixture is uniform in color. It shall then be formed into a crater and enough water added to produce the proper consistency of mortar. The mortar shall be uniformly spread on the platforms. The coarse aggregate shall be wetted and uniformly added to the mortar and the entire mass turned and re-turned at least 6 times and/or until all the coarse aggregate particles are thoroughly covered with mortar and the mixture has a uniform color and appearance. Hand mixed batches shall not exceed 1/2 cubic yard in volume. Hand mixing shall not be used for concrete to be placed under water.

CONSISTENCY

(a) The exact quantity of mixing water to be used shall be determined and fixed by the proportions of the other materials. In general, a mixture shall be used which contains the minimum amount of water consistent with the required workability.

(b) In general, the use of a finer coarse aggregate will be required in thin and heavily reinforced sections rather than a wetter consistency.

(c) In general, the consistency of concrete mixtures shall be such that:

The mortar clings to the coarse aggregate.

The concrete is not sufficiently fluid to segregate when transported to the place of deposit.

The concrete, when dropped directly from the discharge chute of the mixer, shall flatten out at the center of the pile but shall stand up and not flow to the edges.

The mortar shall show no free water when removed from the mixer.

The concrete shall settle into place when deposited in the forms and, when transported in metal chutes at an angle of 30 degrees with the horizontal, it shall slide and not flow into place.

(d) In general, the concrete shall have a slump conforming to the requirements of Article I-2.2 of this Addendum. Slump shall be measured by the truncated cone method, ASTM Designation C-143-39.

HANDLING AND PLACING CONCRETE

(a) Job- and hand- mixed concrete shall be placed in the forms within 30 minutes after water is first added to the mix, except that where ready-mix concrete is used, the time control shall be as provided in AHD 450.03(d) and AASHTO M-157. The concrete in each integral part or between established construction joints of the structure shall be placed continuously.

(b) All concrete shall be placed in the dry unless otherwise provided on the plans. When it is necessary to pump water from the excavation during the placing of concrete to deposit the concrete in the dry, the sump for the intake hose shall be located outside the forms. Pumping equipment shall in all cases be of ample capacity to keep the excavation practically free of water until all the concrete is in place.

Water that originates in the footing area or that is necessary to come through or across the footing area shall be handled in approved pipes or conduits to the sump pump. Pumping from the interior of any foundation enclosure shall be done in such manner as to preclude the possibility of any portion of the concrete material being carried away.

(c) The concrete shall be placed in horizontal layers and vibrated, rammed, tamped and spaded until free mortar appears on the surface and it is thoroughly compacted and until all voids are filled. Concrete shall be placed in horizontal layers not more than 12 inches thick unless hereinafter provided. Each layer shall be placed and compacted before the preceding batch has taken initial set to prevent injury to the green concrete and avoid surfaces of separation between batches. Each layer shall be compacted in a manner that will entirely destroy the effect of a construction joint between it and a preceding layer.

(d) When the placing of concrete is temporarily discontinued the concrete, after becoming firm enough to hold its form, shall be cleaned of laitance and all other objectionable material to a sufficient depth to expose sound concrete. To avoid unsightly joints as far as possible upon exposed surfaces, special precautions shall be taken either by inset form work or other means to obtain uniform surfaces and lines. Where a "feather edge" might be produced at a construction joint, inset form work shall be used to form the preceding layer so that the thickness of the edge shall be not less than 6 inches. Work shall not be discontinued within 18 inches below the top of any face, unless provision has been made for a coping less than 18 inches thick, in which case the construction joint shall be made at the underside of the coping.

I-11

USE OF CHUTES, TROUGHS OR PIPES

(a) Concrete shall not be dropped a distance of more than five feet and special care shall be taken to fill each part of the form by depositing the concrete as near final position as possible. Where placing operations would involve dropping the concrete a greater distance, it shall be deposited through adjustable vertical metal pipes in sections not greater than 4 feet in length and not less than 4 inches in diameter. Depositing large quantities at one point in the form and running, flowing or working the concrete along the form will not be permitted. A sufficient number of metal pipes shall be provided to place the concrete in accordance with AHD 450.03(h).

(b) The use of chutes longer than 30 feet for conveying concrete from the mixing plant to the forms will not be permitted except as hereinafter provided. The use of short chutes for conveying concrete from the mixer to the forms will be permitted, provided there is no segregation of the concrete materials. In case segregation of concrete is produced by the use of chutes, their use shall be discontinued and a satisfactory method of placing substituted. All chutes shall have a down-pipe or tremis (at the discharge end) of minimum length of 24 inches.

(c) When open troughs and chutes are used they shall be of metal or metal lined and where steep slopes are required, the velocity of flow shall be retarded by the use of baffles or chokers or a series of short chutes shall be used to change the direction of movement. All chutes, troughs, pipes and other placing equipment shall be kept clean and free from coatings of hardened concrete by cleaning and flushing with water after each use. Water used for flushing shall be discharged clear of the concrete already in place. The inside surface of the forms shall be clean and free from dried or hardened particles or coatings of concrete immediately prior to placing concrete against that part of the surface.

I-12

CLEANING STEEL REINFORCEMENT

See Article II-4(b) of Addendum II.

I-13

PLACING CONSTRUCTION JOINTS

(a) Construction joints shall be placed across regions of low shearing stress, in locations which will be hidden from view to the greatest possible extent, and at only the location shown on the plans.

(b) Unless otherwise shown on the plans, concrete

in structures shall be so placed that all construction joints will be truly horizontal or vertical and, if possible, in locations that will not be exposed to view in the finished structure. Special care shall be taken to avoid construction joints through paneled walls or other large surfaces which are to be treated architecturally. When specified, triangular chamfers will be placed at horizontal construction joints and at designated intervals between joints.

I-14 PROTECTION OF FORMS

(a) During the placing of concrete the contractor shall detail competent workmen to watch the alignment of forms and to correct immediately any yielding of forms or falsework.

(b) After the concrete has initially hardened the forms shall not be jarred nor shall any strain be placed on reinforcing bars partially encased in concrete that will cause damage to the bond.

I-15 CONTROL

(a) Placement of concrete shall be governed by construction joints as shown on the plans or as directed by the engineer.

(b) Concrete shall be deposited continuously for each monolithic section of the work. In case of breakdown of equipment necessitating suspension of placing of concrete for a period in excess of 45 minutes, and that part of the work involved is such that a construction joint will not be permitted, all of the previously placed concrete shall be removed.

(c) Concrete in walls, columns, etc. shall be placed in continuous horizontal layers extending from end to end of the forms.

(d) All concrete floors shall be placed for full thickness in one operation. The operation of placing the concrete in any floor slabs shall be continuous between expansion joints or approved construction joints.

(e) Concrete in structural slabs shall be placed in one continuous operation unless otherwise directed. When cap forms are not constructed with column forms the columns shall be allowed to set at least 12 hours before the caps are placed and/or before any forming for caps begins. No concrete shall be placed in the structural slabs until sufficient column forms have been removed to ascertain the quality of the concrete in the column. The full load of the slab shall not be allowed to come

upon the supports until so approved by the engineer.

I-16 PUMPING

(a) Direct placement of concrete by an accepted and accredited pumping device will be permitted. The equipment shall be so arranged that no vibrations result which might damage freshly placed concrete. Where concrete is conveyed and placed by mechanically applied pressure, the equipment shall be suitable in kind and adequate in capacity for the work. The operation of the pump shall be such that a continuous stream of concrete without air pockets is produced. When pumping is completed the concrete remaining in the pipeline, if it is to be used, shall be ejected in such a manner that there will be no contamination of the concrete or separation of the ingredients. After each placement the entire equipment shall be cleaned to prevent improper results on subsequent operations.

I-17 COMPACTING AND VIBRATING

(a) General Concrete, during and immediately after depositing, shall be compacted and vibrated as provided herein. Concrete shall be well puddled, all air expelled and the mortar brought to the surface and sides of the forms and around the steel reinforcement by working along and against the forms and the reinforcement with concrete spades, steel slicing rods, vibrators or other suitable tools constructed for the purpose. Special care shall be taken to work the larger particles of coarse aggregate away from the face of the forms and the surface and to force the concrete under and around the reinforcement. If directed, the forms shall be vibrated to secure desired puddling and compaction. The compaction, except for handrail, shall be done by mechanical vibration subject to the provisions set forth below.

(b) Vibrator The vibration shall be internal unless special authorization for other methods is granted by the engineer.

(c) Vibration shall be applied at the point of deposit and in the areas of freshly deposited concrete. The vibrators shall be inserted and withdrawn out of the concrete slowly. The vibration shall be of sufficient duration and intensity to compact the concrete, but shall not be continued so as to cause segregation. Vibration shall not be continued at any one point to the extent that localized areas of grout are formed.

(d) Application of vibrators shall be at points uniformly spaced and not farther apart than twice the radius over which the vibration is visibly affected.

(e) Vibration shall not be applied directly or through the reinforcement to sections or layers of concrete which have hardened. It shall not be used to make concrete flow in forms over distances so great as to cause segregation, and vibrators shall not be used to transport concrete in the forms.

(f) Vibrators shall be manipulated so as to work the concrete around the reinforcement and embedded fixtures and into all parts of the form. Vibrating shall be supplemented by such spading as is necessary to insure smooth surfaces and dense concrete.

I-18 BONDING CONSTRUCTION JOINTS

(a) Prior to erecting forms for placement of concrete to join concrete which has already set, the concrete in place shall be scarified and chipped, removing all laitance and foreign matter and exposing the granular surface of sound concrete and shall be washed with clear water. The surface shall then be kept drenched until the new concrete is placed. Immediately before placing the new concrete, the forms shall be drawn tight against the concrete already in place and the old surface shall be completely covered with mortar of the same cement-sand ratio as used in the concrete. Construction joints in points of high shear shall be bonded by keys formed by the insertion and removal of beveled wood strips which have been saturated with water. Steel dowels may, with the approval of the engineer, be used in lieu of keys. The size and spacing of keys and dowels shall be as provided for in the plans

I-19 EXPANSION AND FIXED JOINTS

(a) Open joints shall be placed in locations shown on the plans and shall be constructed by the insertion and subsequent removal of a wood strip, metal plate or other approved material. The insertion and removal of a template shall be accomplished without chipping or breaking the corners of the concrete. Reinforcement shall not extend across an open joint unless so specified on the plans. Bolts used for placing angles shall be cut as soon as concrete has hardened. Joints shall be cleared of all mortar, obstructions, etc.

(b) Poured expansion joints shall be constructed similar to open joints. When premolded types are specified the

filler shall be placed in correct position as the concrete on one side of the joint is placed. When the form is removed the concrete on the other side shall be placed. Water stops shall be placed as shown on the plans.

(c) Mortise joints shall be constructed as shown on the plans and in general shall consist of a metal part sliding in a concrete or metal socket. Construction shall be such as to permit freedom of movement in two directions and, as far as possible, be water tight and rustproof.

(d) Plates, angles or other structural shapes shall be accurately shaped at the shop to conform to the section of the concrete floor. The fabrication and painting shall conform to the requirements of other sections of these specifications and/or the plans. When called for on the plans the material shall be galvanized in lieu of painting. Care shall be taken to insure that the surface in the finished plane is true and free of warping. Positive methods shall be employed in placing the joints to keep them in correct position during the placing of the concrete. The opening in expansion joints shall be that designated on the plans at normal temperature and care shall be taken to avoid impairment of the clearance in any manner.

(e) Water stops shall be molded rubber water stops of the type indicated on the plans. Specifications of the particular material to be furnished shall be submitted to the engineer for his approval prior to ordering. Water stops shall be installed at such places as shown on the plans or as directed by the engineer.

I-20 REMOVAL OF FALSEWORK

(a) Falsework or centering supporting any concrete work shall not be removed or wedges loosened without the consent of the engineer. In general, centering shall not be removed for a period of at least 28 days after the concrete is placed.

I-21 REMOVAL OF FORMS

(a) General To permit proper surface finishing, forms shall, in general, be removed as soon after the concrete has set as is practicable and safe. In the determination of the time for removal of forms, consideration shall be given to the location and character of the structure, the weather, and the material used in the mix. Except as provided in Article I-4 (a), the forms of any part of the structure shall not be removed until

the concrete gives forth a clean sharp ring when struck upon a flat surface with a small hammer and is strong enough to prevent injury to the concrete when the forms are removed.

(b) Methods of form removal likely to cause overstressing of the concrete shall not be used. In general, the forms shall be removed from the bottom upwards. Supports shall be removed in such a manner as to permit the concrete to uniformly and gradually take the stresses due to its own weight.

(c) If field operations are not controlled by cylinder and/or beam tests, the following periods for removal of forms and supports shall be used:

Falsework under beams and floor slabs 14 days

Walls, columns, sides of beams and all other parts 1 to 7 days

THESE TIME PERIODS ARE EXCLUSIVE OF DAYS WHEN FOR 4 HOURS OR MORE, THE TEMPERATURE IS 40 DEGREES FAHRENHEIT OR LESS.

I-22 DEFECTIVE WORK AND MATERIALS

(a) After the forms have been removed, any defective work discovered shall be removed and renewed in a satisfactory manner. If the surface of the concrete is sagged, bulged, uneven or honeycombed to such an extent that it cannot be satisfactorily repaired, the entire section shall be removed and replaced.

(b) Adherence to these specifications will provide a 28 day compression strength for Class "A" concrete considerably in excess of 3000 psi.

(c) Class "A" concrete work covered by 28-day compression tests that breaks at less than 3000 psi shall be removed and replaced.

I-23 WATER TIGHTNESS

(a) The contractor shall make all concrete in all structures water tight. Any cracks or imperfections developing at any point of the work shall be repaired to the satisfaction of the engineer and the City engineer.

(b) If deemed necessary by the engineer, an approved waterproofing material shall be applied to the inside face of the concrete in a manner set forth by the manufacturer of said material.

I-24 CURING CONCRETE

(a) Concrete which has been placed shall be protected against jarring or other movement which might injure it before it has attained strength to resist.

(b) Careful attention shall be given to the proper

curing of the concrete. All surfaces not covered by forms shall be protected with membrane curing compound, dampened burlap, or cotton mats as soon after placing the concrete as possible without marring the surface. Unless membrane curing compound is used, burlap or other approved covering material shall be kept wet and shall remain in place for 10 days, except for portions temporarily uncovered during finishing operations. Burlap or cotton mats shall be securely anchored to the concrete face by weights, ties, etc. for the 10 day period. The provision for continuous wetting shall be strictly adhered to.

(c) No traffic or other superimposed load will be permitted over structural slabs unless tests indicate that compression STRENGTH of 3000 psi has been attained, or until the expiration of 28 days exclusive of days when the temperature has fallen below 40 degrees F. for 4 hours or more.

I-25 PROTECTION

(a) Before beginning operations in slab spans, the contractor shall have on site an approved cover to enclose and protect the concrete, if necessary, until satisfactorily finished. The contractor shall protect the concrete from weather. No aggregate, equipment or other material shall be stockpiled on concrete slabs except as provided by Article I-24 of this Addendum, and in no case shall the loading due thereto exceed 100 pounds per square foot.

I-26 FINISHING

I-26.1 General

(a) The finished work shall be true to form indicated on the plans and wholly free from projections, swells, ridges, depressions, holes, cavities, mortar deficiencies and other defects. The line and grade of the top of all horizontal surfaces shall be checked immediately after placing has been completed and any irregularities corrected at once.

(b) All permanently exposed concrete surfaces shall be given a Class I surface finish. Other surfaces shall be given an ordinary surface finish.

(c) The contractor shall be required to make all concrete in all structures watertight. Any cracks or imperfections developing at any point of the work shall be thoroughly repaired in a manner satisfactory to the engineer. If deemed necessary, the engineer may require that an approved waterproofing material be applied to the concrete.

I-26.2 Ordinary Surface Finish

(a) As soon as the concrete has set sufficiently, the forms shall be carefully removed and all cavities or depressions resulting from the removal of metal ties or from other causes shall be carefully filled and pointed with a mortar of sand and cement in the same proportions which have been used for the particular class of concrete treated and the surface left smooth, even and uniform in color. The surface film of all such pointed surfaces shall be carefully removed before setting occurs. Cement wash will not be permitted. Any fins, ridges or projections shall be struck off.

I-26.3 CLASS I SURFACE FINISH

(a) As soon as the pointing has set sufficiently to permit it, the entire surface shall be wet with a brush and rubbed with a number 16 carborundum stone or an abrasive of equal quality. The rubbing shall be continued for a sufficient time to remove all form marks and projections, producing a smooth dense surface without pits or irregularities.

(b) The material which, in the above process, has been ground to a paste shall then be carefully brushed or spread uniformly over the entire surface and allowed to take a "reset". The final finish shall be obtained by rubbing with a number 30 carborundum stone until the entire surface is smooth and of uniform color. Portions which have been disfigured by the drip from the abrasive shall be cleaned.

I-26.4 No cement wash or plaster coating will be allowed.

I-26..5 FINISHING

After proper screeding, the wearing surface shall be given a float, trowel or broomed finish as indicated on the plans.

(a) Floating

Soon after screeding and while the concrete is still plastic, the surface shall be floated with wood, cork or metal floats or by a finishing machine. The surface shall be brought to true grade, any high spots cut down and low spots filled in and sufficient mortar brought to the surface to produce the desired finish. Where floating is done to provide a coarse texture as the final finish, it may be necessary to float the surface a second time after it has partially hardened so that the desired finish can be produced and the concrete will retain it.

(b) Troweling

Where a smooth dense surface is desired, floating shall be followed by steel troweling. This operation should be delayed as long as possible, at least until after the concrete has hardened enough so that water and fine material are not worked to the surface. Spreading dry cement on the surface to take up excess water will not be permitted.

The first steel troweling should be only sufficient to produce a smooth surface free of defects. This may be followed by a second troweling after the concrete has become hard enough so that no mortar adheres to the edge of the trowel and a ringing sound is produced as the trowel passes over the surface.

(c) Brooming

A scored surface shall be produced by brooming the concrete before it has hardened thoroughly. A rough scoring is produced by the use of a steel wire broom or one made from stiff coarse fibers. The brooming shall be done after the surface has been floated. A fine scoring is produced by troweling once to a smooth surface then brooming transversely to the traffic direction with a hair brush.

ADDENDUM II

REINFORCING STEEL

II-1 DESCRIPTION

This item shall cover furnishing and placing reinforcing steel of the quality, type, size and quantity designated on plans. All bars above 1/4 inch round shall be deformed. The deformation of the bars used must be approved and shall be such as to provide a net section at all points equivalent to that of a plain square or round bar of equal nominal size. The use of cold twisted bars will not be permitted.

II-2 MATERIALS

(a) Billet Steel Reinforcement bars

Structural or intermediate grade new billet steel concrete reinforcement bars shall conform to the requirements of ASTM Serial Designation A-15-50T.

(b) Rail Steel Reinforcement Bars

Rail steel reinforcement bars shall meet the requirements of ASTM Serial Designation A-16-50T.

(c) Welded Steel Wire Reinforcement

Welded steel wire reinforcement shall meet the requirements of ASTM Serial Designation A-185-37.

II-3 DRAWINGS AND IDENTIFICATION

(a) The drawings shall show fabrication, identification, bar bending diagrams and placement of all reinforcing steel.

II-4 HANDLING AND PLACING REINFORCEMENT

(a) Bending

Reinforcement shall be bent to the form and dimensions shown without heating. The radius of bends shall be three or more times the diameter of the bar. Abrupt bends shall be avoided. Bars with kinks or bends and bars appreciably reduced in cross-sectional area shall not be used.

(b) Cleaning

Metal reinforcement shall be cleaned of mill and rust scale and of coatings of dirt, paint, oil, grease or any other foreign substance. Before concrete is placed around any part of the reinforcement, all mortar or other foreign matter

shall be cleaned from that portion of the reinforcement and when, during the deposition of the concrete, mortar splattered on the reinforcement dries or hardens, all such mortar shall be removed from the reinforcement immediately before any concrete is placed against it.

(c) Placing

All reinforcing steel shall be accurately placed and firmly held in position during the placing and hardening of the concrete. Reinforcing steel generally shall be in the middle third vertically in horizontal surfaces and in the middle third horizontally in vertical surfaces.

(d) Wiring and supporting

All intersecting reinforcement shall be rigidly wired or spot welded at each intersection. Reinforcement shall be supported during the placement of concrete. Operations which tend to bend or displace the reinforcement from its correct position shall not be permitted. All reinforcement shall be placed and securely wired, spaced and blocked before placing concrete. In no case shall reinforcing steel be driven or forced into concrete after it has hardened.

All reinforcing metal shall be maintained at the proper distances from the forms by means of stays, mortar blocks, metal ties, chains, hangers or other approved supports. Blocks for holding reinforcement from contact with the forms shall be precast mortar blocks of approved mix, shape, and dimensions. Layers of bars shall be separated by approved metal spacers. The use of pebbles, pieces of broken stone or brick, metal pipe or wooden block as spacers will not be permitted.

II-5 SPLICING AND LAPPING REINFORCEMENT

(a) Splicing

Splices shall be avoided at points of maximum stress. They shall, where possible, be staggered and shall be designed to develop the strength of the steel without exceeding the allowable unit bond stress. Bars shall be lapped 40 diameters to make the splice. In lapped splices, the bars shall be placed in contact and wired together in such a manner as to maintain a clearance of not less than the minimum clear distance to other bars and the minimum distance to the surface of the concrete.

(b) Lapping

Sheets of mesh or bar mat reinforcing shall overlap each other sufficiently to maintain a uniform strength and shall be securely fastened at the ends and edges. The edge lap shall not be less than one mesh in width.

II-6

MINIMUM SPACING

(a) The clear distance between parallel rods shall be not less than 1 1/2 times the diameter of round rods or twice the side dimensions of square rods and in no case less than 1 inch.

(b) Groups of parallel reinforcing bars bundled in contact to act as a unit may be used only when enclosed by ties or stirrups. A maximum of four (4) percent deformed bars will be permitted in a bundle. If full-length bars cannot be used between supports, they shall be staggered a minimum of forty (40) bar-diameters between any discontinuities. The lap length shall increase 20% for three-bar bundles and 33% for a four-bar bundle. In determining minimum distances between a bundle and parallel reinforcing, the bundle shall be treated as a single bar of equivalent area.

II-7

PROTECTIVE COVERING

(a) Minimum concrete covering over steel shall be as follows:

Beams, girders, etc.....	1 1/2" outside of main steel
Solid slabs.....	1" outside of steel
Walls.....	2" outside of steel
Footings.....	3" outside of steel on side and top and bottom
Tied columns.....	2 1/2" outside of main steel

These dimensions are measured from the face of the reinforcement to the face of the form.

ADDENDUM III RESERVED

IV

FENCES

IV-1

LIFT STATIONS

Fences surrounding lift stations may be chain link or wood. Fences shall be eight feet in height. Fences shall be constructed with sufficient clearance so that in the case of an above-ground station the access doors may be opened for their full width without obstruction, and so that the housing may be removed in either direction for its full length, and so that the externally mounted electrical entrance panel and associated equipment inside the fence are accessible.

The gate shall be so located that hoisting equipment will have direct access to the pumps and motors when the housing is removed in either direction, and so that one access door is directly inside the gate when the housing is in place.

In the case of an in-ground lift station, there shall be sufficient clearance inside the fence so that the cover can be rotated 360 degrees horizontally, and so that the electrical entrance panel, the station control panel and associated equipment are accessible, and so that hoisting equipment will have direct access to the motors and pumps.

All lift stations shall have the area between the fence and the lift station mounting pad paved with 2 inches of bituminous paving over a 4 inch base course.

IV-2

CHAIN LINK FENCES

IV-2.1

MATERIALS

CHAIN LINK FABRIC

All chain link fence fabric shall consist of woven wire in the form of approximately 2-inch uniform square mesh, having parallel sides with horizontal and vertical diagonals of approximately uniform dimensions in accordance with the provisions of ASTM A-392. The wire shall not be less than 9 gauge (coated). The fabric shall be 8 feet wide.

The base metal of the fabric shall be a good commercial quality of steel wire coated with prime western spelter or equal (AASHTO M-120) in accordance with the provisions of ASTM A-392 for a Class 2 coating weight. The zinc coating

shall be applied after weaving. The wire after treatment shall have a minimum breaking load of 1290 pounds.

IV-2.1.1 MISCELLANEOUS WIRE

Wire used for bracing or as tension wires shall be No. 9 gauge minimum. Wire used for tying and other purposes shall be No. 11 gauge minimum. The wires may be steel or aluminum of not less than 25,000 psi tensile strength. All miscellaneous steel wire shall have 0.7 oz zinc per square foot of uncoated wire.

IV-2.1.2 FENCE SUPPORTS

GENERAL

The frame, including posts, rails, braces, fittings, etc. shall include an acceptable expansion joint. Fittings and connections may, in general, be of the fabricator's design, provided posts, caps, tops, etc. shall be of the heavy duty cast metal design of either malleable steel or aluminum consistent with other parts of the material; line post caps shall be of such design that the addition of barbed wire arms can be accomplished, if necessary, by a standard arm which is capable of being set at either a vertical position or at a 45 degree angle from the vertical on either side of the fence, all of which can be accomplished without dismantling or removing the post cap. Straps, bands or similar type connections, unless otherwise noted, shall be fabricated from material of not less than 0.125 inches thick.

STEEL

(a) General All steel elements used as fence supports shall be classified as Type A or Type B according to the following requirements. Unless specified on the plans, the contractor shall have the option to use either type.

(1) Type A

All steel elements used in the framework shall be of a good commercial grade steel, hot-dipped, galvanized in accordance with the following: Tubular posts, braces, etc. --ASTM A-120; Castings and miscellaneous hardware -- ASTM A-153. Minimum sizes and weights of posts, rails and framing shall be as follows:

Line posts	2.375" O.D. pipe @ 3.65 #/ft.
Corner and pull posts	2.875" O.D. pipe @ 5.79 #/ft.
Gate posts	4.0" O.D pipe @ 9.10 #/ft.
Top & middle rail	1.625" O.D. pipe @ 2.27 #/ft.
Gate frames	1.625" O.D. pipe at 2.27 #/ft.

Tolerances for steel tubing shall be +/- 1% of dimension and +/- 5% of weight.

(2) Type B

All steel elements of this type shall be produced from a lightweight high tensile/high yield strength steel. The steel shall possess a minimum yield strength which when multiplied by the section modulus of a particular pipe size shall equal or exceed the minimum elastic bending moment of the same outside diameter Type A steel pipe. Type B steel pipe shall meet either or both of the following bending tests with a maximum permanent deflection of not more than 0.25 inches:

O.D. PIPE SIZE	ACTUAL MIN.LOAD BEARING CAPACITY (LBS)	
	10' free supported	4' cantilever
1 5/8"	327	204
2"	468	293
2 1/2"	814	508

The exterior surface of the pipe shall have a hot-dipped galvanized coating, minimum 0.9 oz/sq. ft., followed by a chromate conversion coating. The interior surface of the pipe shall have either these same coatings or a zinc rich based coating having a minimum zinc powder content of 80% by weight. These coatings shall be capable of withstanding weathering in accordance with ASTM A-623 for 250 hours, and humidity in accordance with ASTM D-1735 for 500 hours.

In lieu of the galvanized coatings specified elsewhere in this item, the coating on all surfaces of the fence supports and framing shall be a hot-dipped aluminized coating. The minimum weight of coating shall be 0.75 ounces per square foot, triple spot test, 0.70 ounces per square foot, single spot test, as measured in accordance with ASTM A-428. The external and internal aluminum coating surface shall have a chromate

chemical treatment and a thin resin film to minimize galling and provide wet storage stain resistance during storage and shipment.

Miscellaneous steel fittings and hardware shall be of a good grade commercial steel, meeting the general requirements noted for chain link fence, hot-dipped galvanized after fabrication in accordance with ASTM A-153 or hot dipped aluminized in accordance with this Addendum.

IV-2.1.3 GATES

Gates shall be swing gates as detailed or specified on the plans. The gate frames shall be the height of the top of the posts and covered with the same wire and fabric used on the fence. The frames shall be formed from the tubular shapes noted in this Addendum, with all joints welded or otherwise constructed to form a rigid, tamper-proof unit.

All gates shall be furnished complete with approved tamper-proof hinges, latches, auxiliary braces, and all other necessary fittings. Gate openings shall have a width of 12 feet. Gates shall be 2-panel, side hinged, with one side fastened in the closed position by a drop pin in the center of the opening. Locks shall be the responsibility of the City of Madison Water And Wastewater Board.

IV-2.1.4 CONCRETE FOR SETTING POSTS

Concrete for bedding posts, etc., shall be Class A, complying with the requirements of Addendum I, except the concrete may be dry batched at a central mixing plant and delivered to the project. Before the concrete is placed, water shall be added. This may be done in small amounts as needed and mixed on a mixing board or mortar box. After water is added, the mix shall be used within sixty minutes or shall be wasted. Posts, braces and brace struts shall be held in proper position until the concrete hardens. The concrete for all corner, brace and line posts shall have cured for 72 hours before any strain is placed upon them.

IV-3 CONSTRUCTION REQUIREMENTS

IV-3.1 GENERAL

All construction methods and equipment employed in the setting of fence shall be in accordance with the requirements of the specifications of the manufacturer of the fence being used

and shall be such that the resulting structure will provide the expected service and be durable and complete in every detail.

IV-3.2 CLEARING FENCE LINE

All brush, stumps, logs, large roots, humps of earth, boulders or debris which would interfere with proper construction of the fence in the required location shall be removed before starting fencing operations. Sound standing trees inside the perimeter of the fence shall be removed before starting fencing operations. The clearing and/or grading of the area inside the fence shall be accomplished prior to starting fencing. The clearing and/or grading of the area outside the perimeter and the disposal of all material removed shall be accomplished in such manner that minimum damage will be done.

IV-3.3 SETTING POSTS

Posts and anchorages shall be set at intervals shown on the plans. The posts shall be set plumb and true in alignment on the side to which the fabric is to be attached. All posts (end and corner posts, brace posts, pull posts, line and gate posts) shall be set in concrete. Where unstable soil is encountered, the use of longer posts, concrete anchorage or other approved post stabilization methods shall be required.

IV-3.4 CONSTRUCTING FENCE

Chain link fence shall be stretched taut and securely fastened to each post by means of approved metal bands or No. 9 gauge wire spaced not more than 12 inches apart on posts and not more than 15 inches apart on the rail. The method of attaching at end posts, gates and corner posts shall be as shown on the plans

If barbed wire is called for, the barbed wire, barbed wire arms and methods of attachment shall be shown on the plans. Wire shall be stretched taut and spaced as specified by the engineer.

IV-4 WOOD FENCE

IV-4.1 MATERIALS

IV-4.1.1 GENERAL

All wood shall be treated . Treated wood shall mean

wood of the species called for by the plans, treated by a pressure method to retain 8 pounds of No. 1 creosote oil with 2% by weight of pentachlorophenol, empty cell treatment. In the event that this treatment is not approved by local or federal authorities, an equivalent pressure treated wood, as approved by one of the wood grading authorities recognized by the Standard Building Code, will be accepted.

IV-4.1.2 POSTS

Corner posts and line posts shall be 4x4 rough cut timber extending 8 feet above ground.

Gate posts shall be 6x6 rough cut timber extending 8 feet above ground.

Top and bottom stringers shall be 2x4, either rough cut or smooth.

Palings shall be either 1x6 or 1x8 rough cut lumber, at the option of the contractor.

Gate frames and cross-bucks shall be 2x4, either rough cut or smooth.

Gate hinges and latches shall be heavy duty steel, industrial type, galvanized after fabrication in accordance with ASTM A-153.

Gate hinge and latch fastenings shall be galvanized or chrome plated 3/8 inch minimum diameter carriage bolts of sufficient length that the nut will be backed with a galvanized steel flat washer.

Gate center pin and accessory hardware shall be galvanized steel.

Nails shall be hot dip galvanized 8d or 10d, as appropriate.

Concrete for bedding posts shall be Class A type, complying with applicable sections of Addendum I. The contractor may use ready-mix or concrete may be dry batched at a central mixing plant and delivered to the project. Before the concrete is placed, water shall be added. This may be done in small amounts as needed and mixed in a mortar box. After water is added, the mix shall be used within 60 minutes. Posts shall be held in proper position until the concrete hardens. The concrete shall have cured for 72 hours before any strain is put on the posts.

IV-5 CLEARING FENCE LINE

Clearing fence line shall be as delineated under CHAIN LINK FENCE.

IV-6 SETTING POSTS

Posts shall be set at intervals shown on the plans or as directed by the engineer. The posts shall be set plumb and true in alignment on the side to which the palings are to be attached. All posts shall be set in concrete in accordance with plan details.

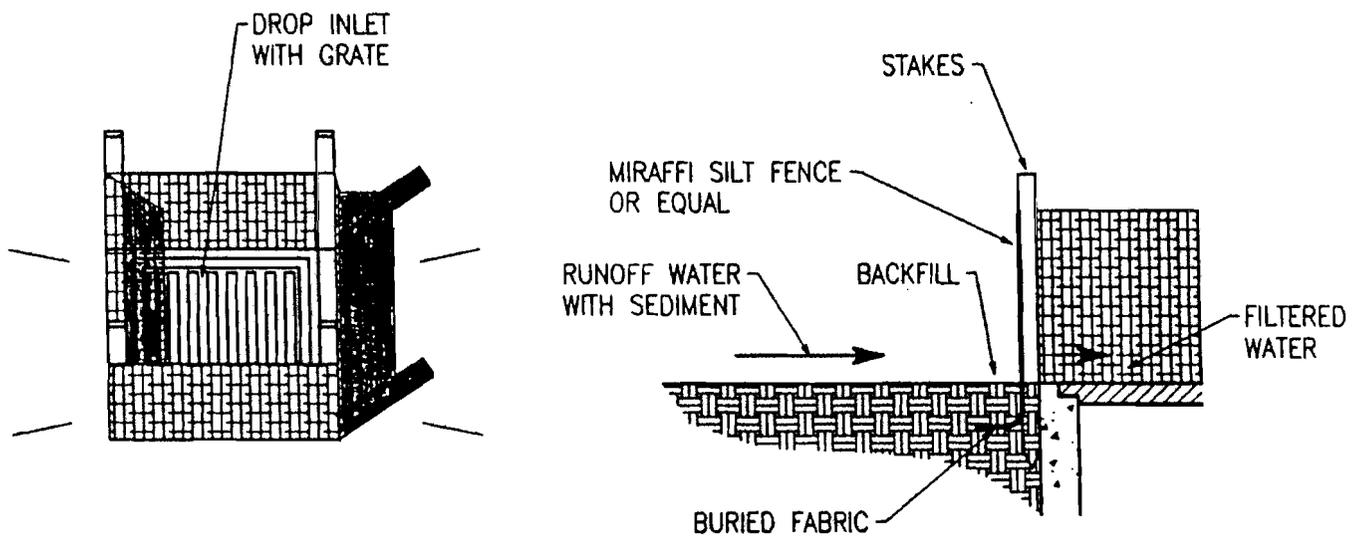
IV-8 CONSTRUCTING FENCE

The fence shall be constructed in accordance with the plan details, except that alternate palings on gates shall be omitted. Particular care shall be paid to placing a diagonal 2x4 from the upper corner of the opening side of the gate frame to the lower corner of the hinge side of the gate frame.

***Construction Detail Sheets Immediately
Following***

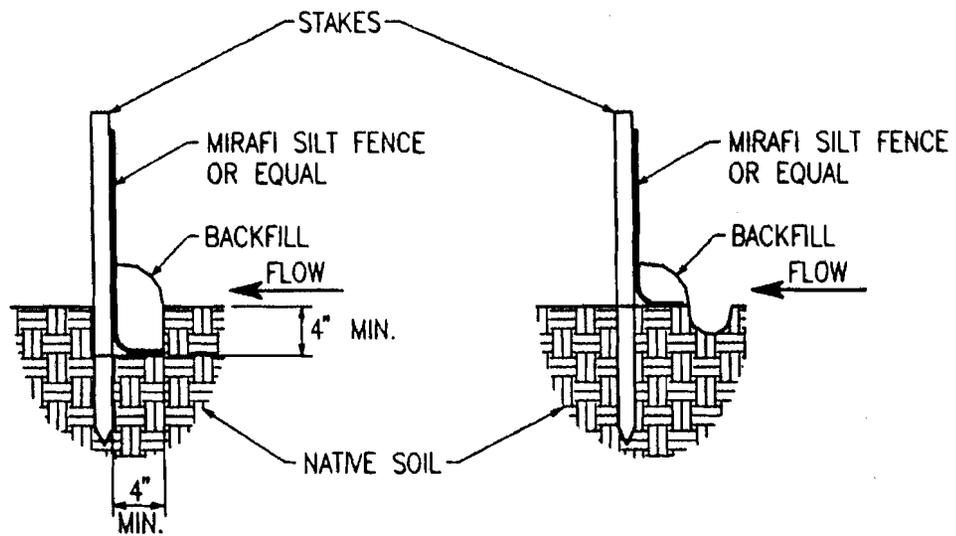
Appendix

Construction Detail Exhibits

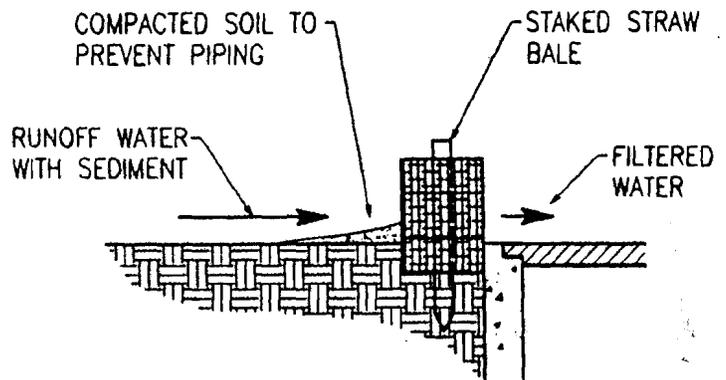
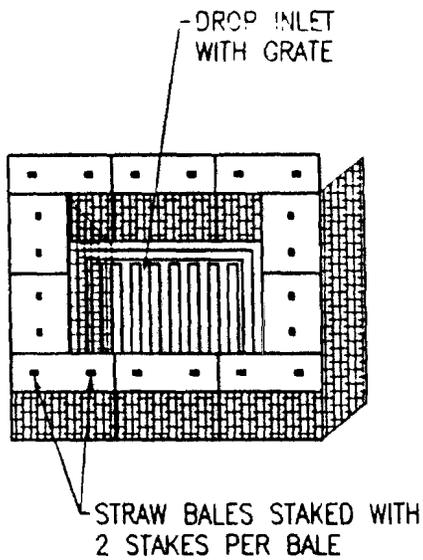


FOR USE WHERE THE INLET DRAINS FLAT AREAS (SLOPES NO GREATER THAN 5%) AND SHEET FLOWS DO NOT EXCEED 0.5 CFS ARE TYPICAL. NOT TO BE USED WHERE CONCENTRATED FLOWS ARE PRESENT.

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	SILT FENCE FOR INLET	
CITY ENGINEER		DATE	ER-100 STD. DWG. NO.	

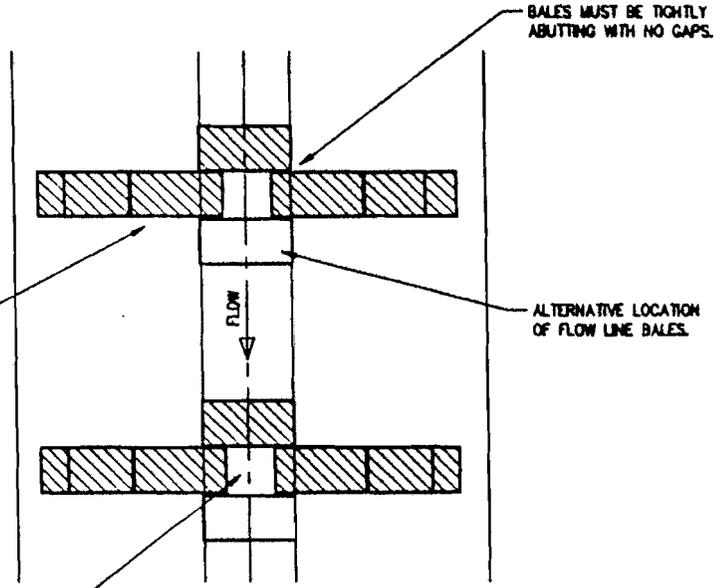
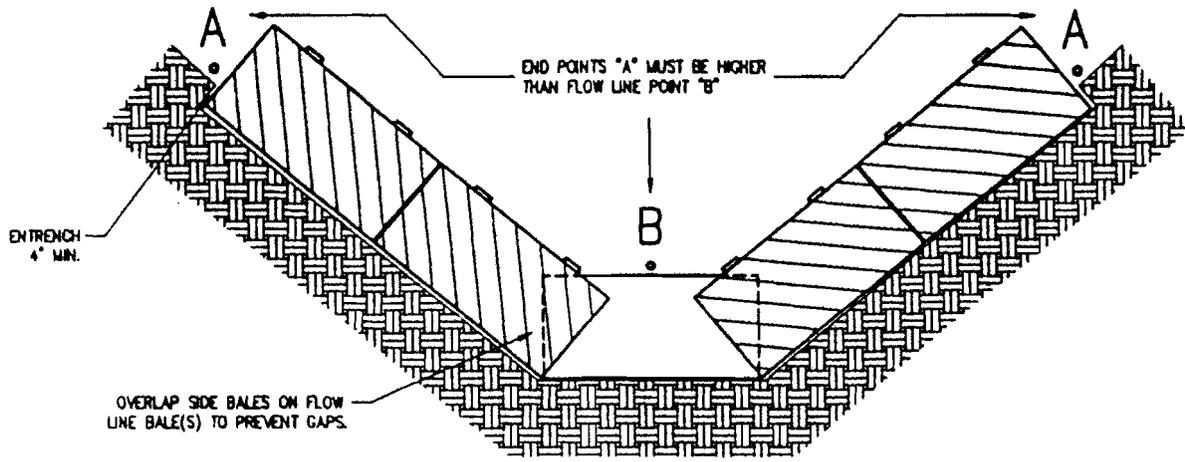


REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	SILT FENCE INSTALLATION	
CITY ENGINEER		DATE		ER-101 STD. DWG NO.

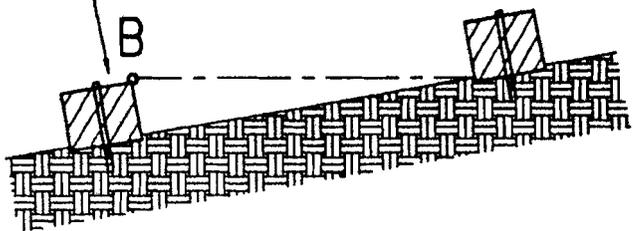


FOR USE WHERE THE INLET DRAINS FLAT AREAS (SLOPES NO GREATER THAN 5%) AND SHEET FLOWS DO NOT EXCEED 0.5 CFS ARE TYPICAL. NOT TO BE USED WHERE CONCENTRATED FLOWS ARE PRESENT.

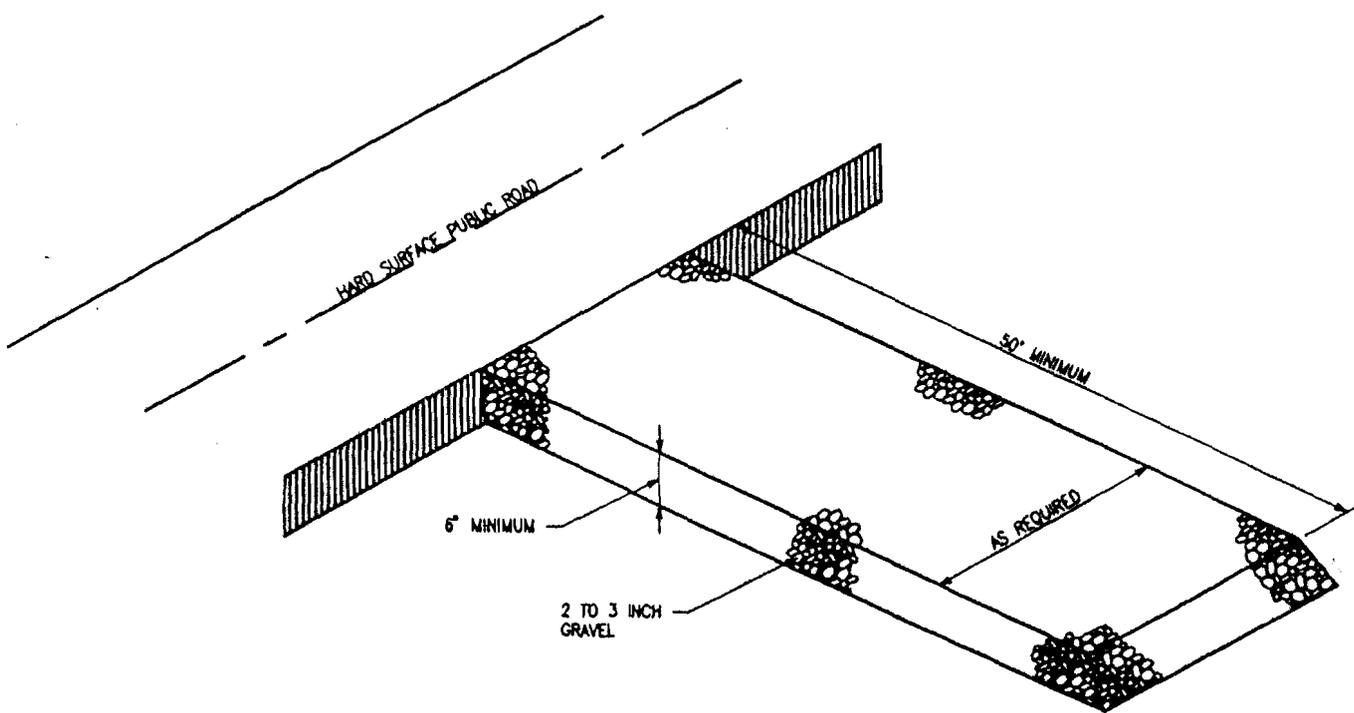
REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	STRAW BALE DAM FOR INLETS	
CITY ENGINEER		DATE		ER-102 STD. DWG. NO.



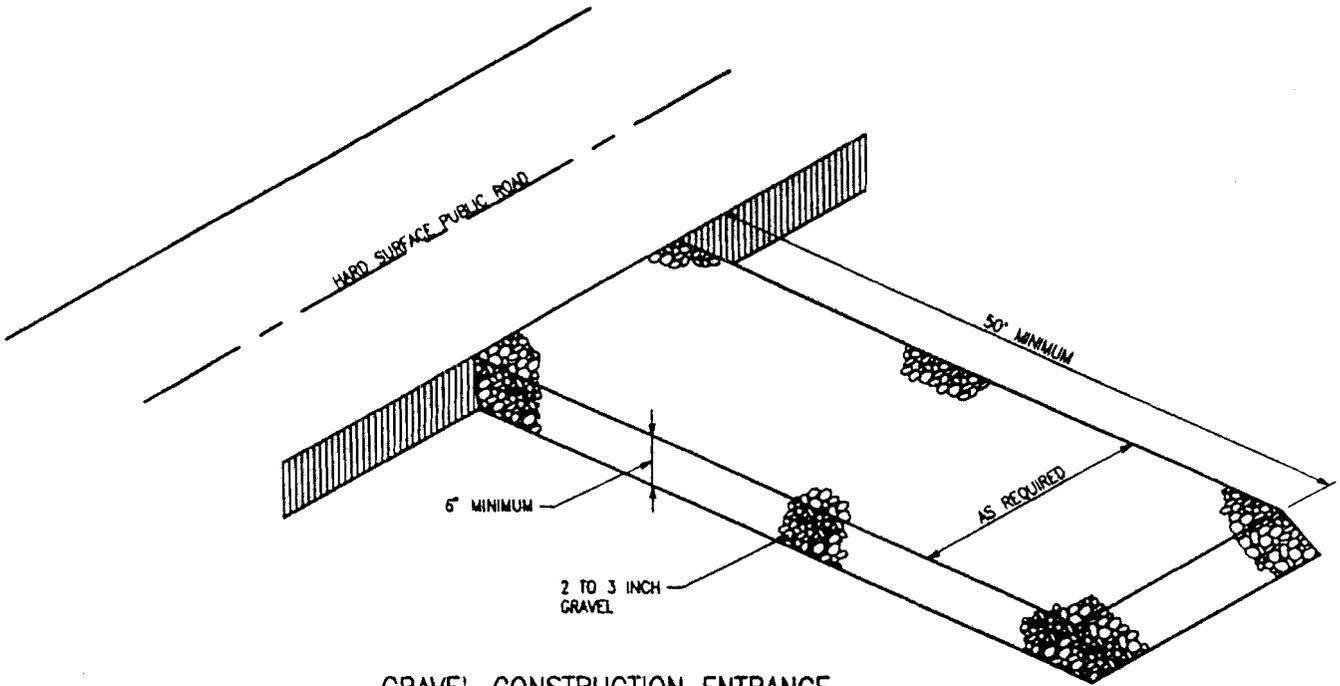
PLACE DOWNSTREAM BALES SUCH THAT POINT "B" IS APPROXIMATELY LEVEL WITH THE LOWEST GROUND ELEVATION OF THE UPSTREAM BALE.



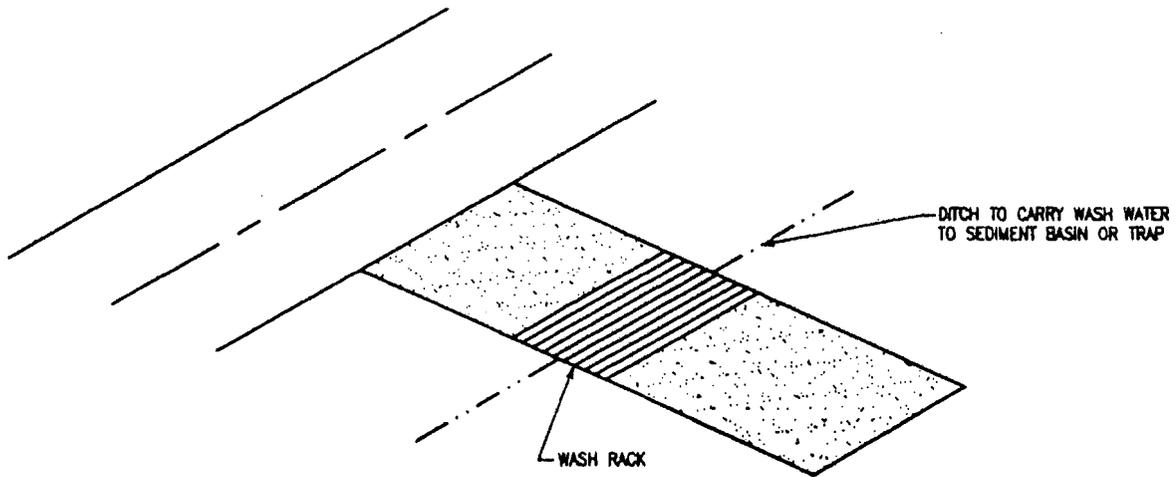
REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	STRAW BALE DAM FOR DITCHES	
CITY ENGINEER		DATE		ER-103 STD. DWG. NO.



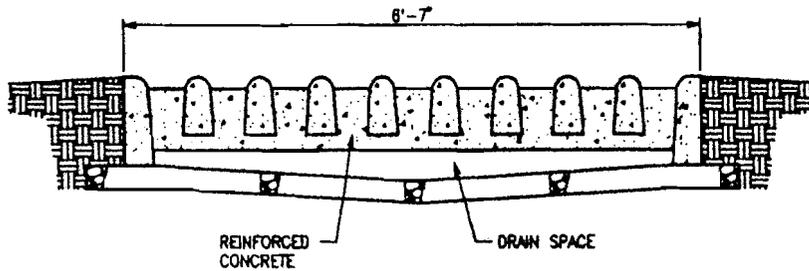
REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	GRAVEL CONSTRUCTION ENTRANCE	
CITY ENGINEER		DATE	ER-104 STD. DWG. NO.	



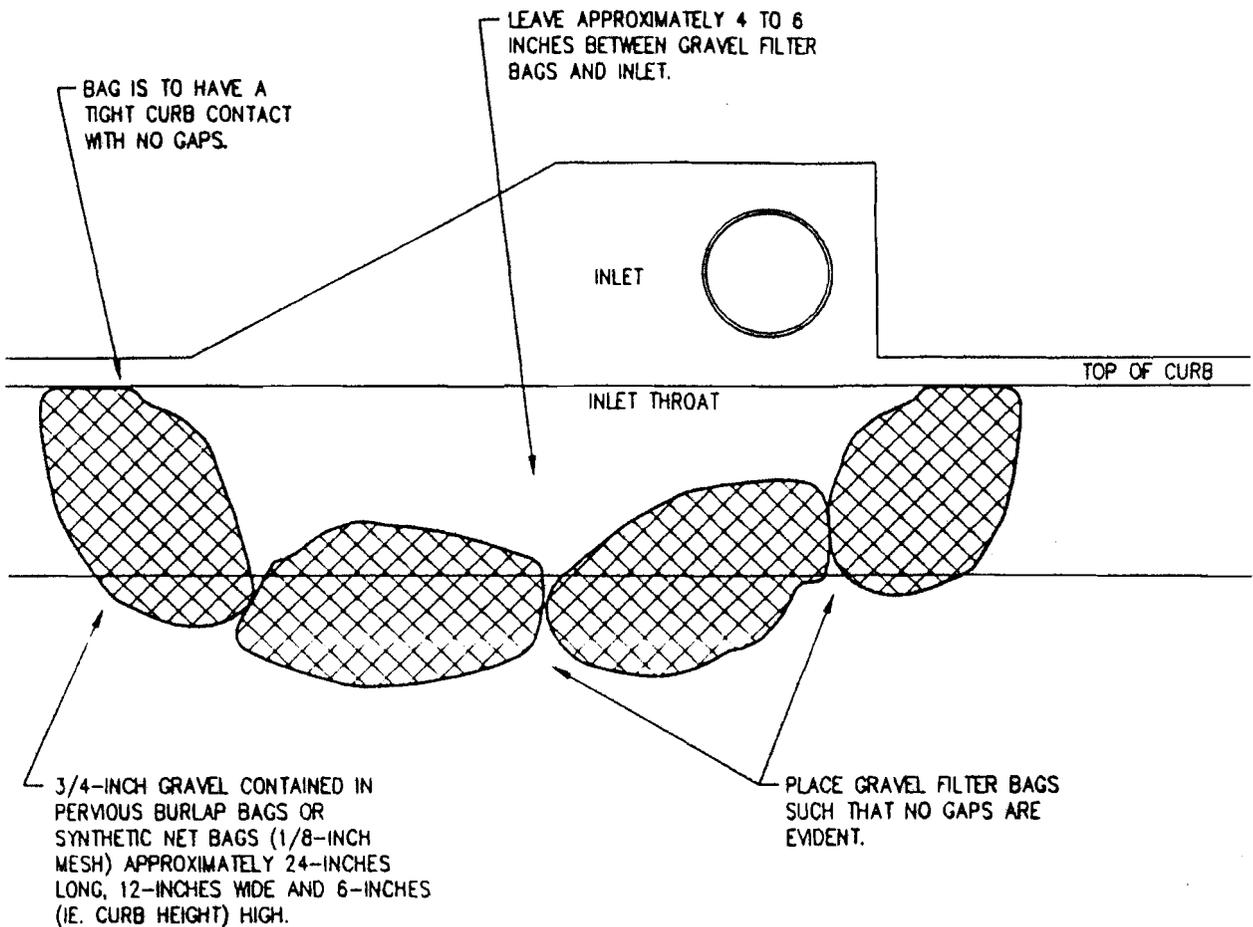
GRAVEL CONSTRUCTION ENTRANCE



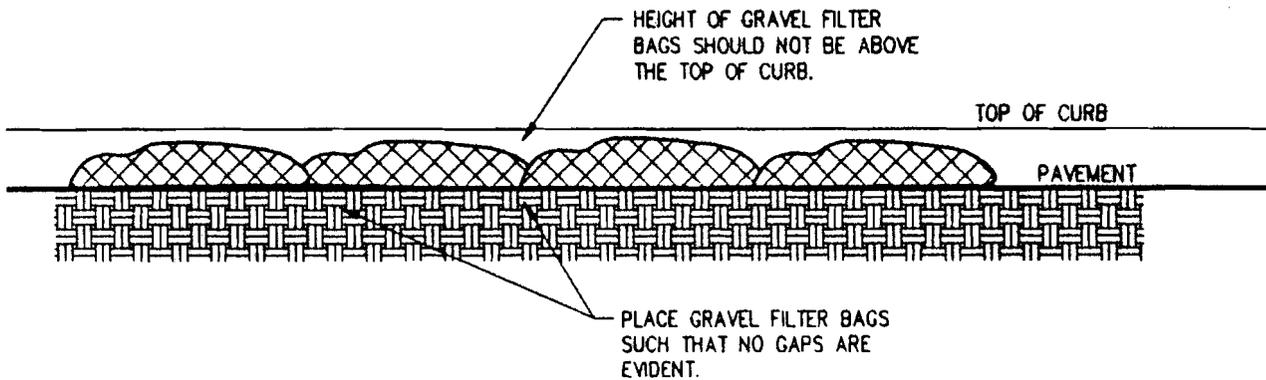
GRAVEL CONSTRUCTION ENTRANCE WITH WASH RACK



REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	GRAVEL CONSTRUCTION ENTRANCE WITH WASH RACK	
CITY ENGINEER		DATE		ER-105 STD. DWG. NO.



PLAN VIEW

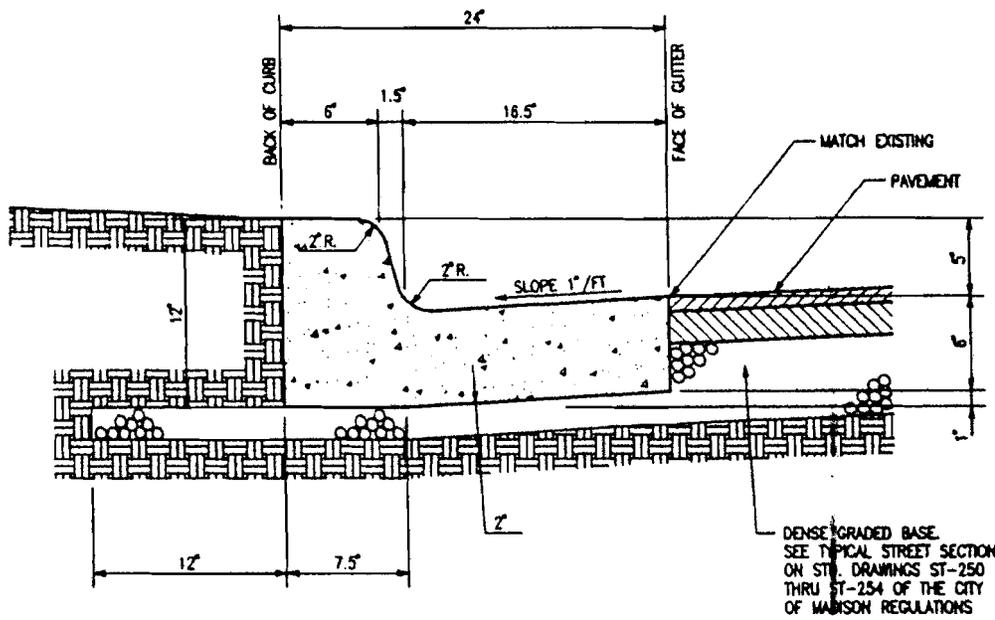


FRONT VIEW

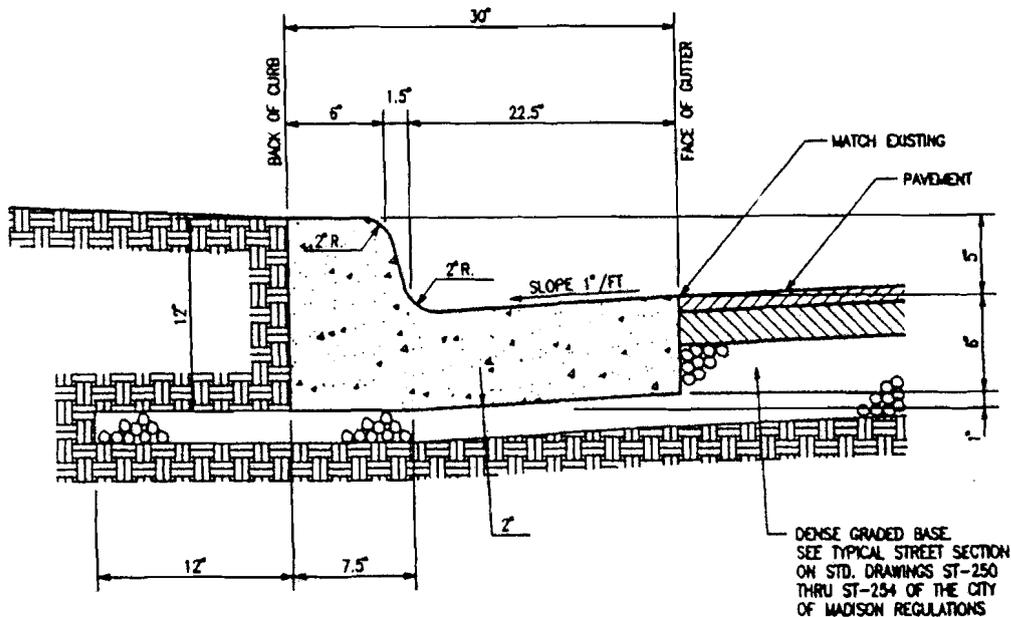
NOTE:
GRAVEL FILTER CAN BE USED
ON PAVEMENT OR BARE GROUND.

REVISIONS		
DESCRIPTION	NAME	DATE
CITY ENGINEER		DATE

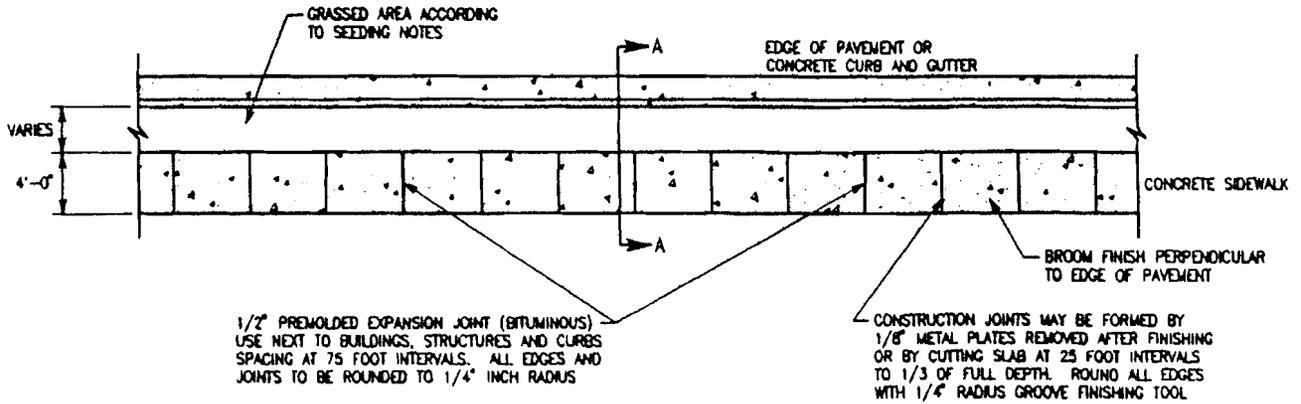
CITY OF MADISON	
GRAVEL BAG FILTER	
	ER-106 STD. DWG. NO.



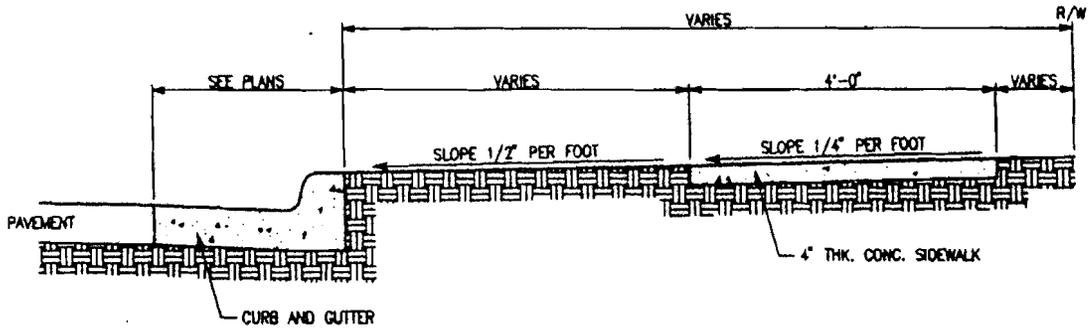
REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	DETAIL FOR STANDARD CURB AND GUTTER 24" TOTAL WIDTH	
CITY ENGINEER		DATE		ST-201A STD. DWG. NO.



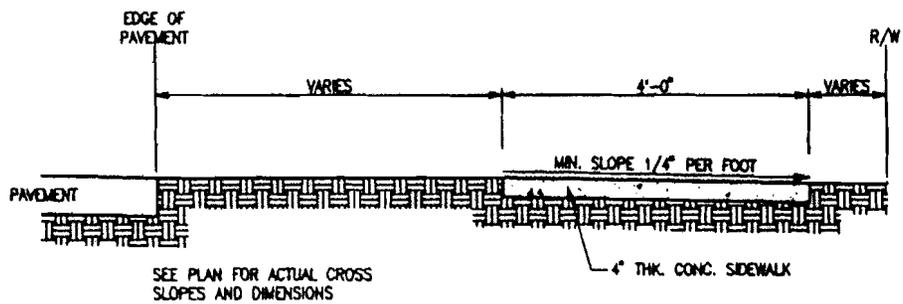
REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	DETAIL FOR STANDARD CURB AND GUTTER 30" TOTAL WIDTH	
CITY ENGINEER		DATE		ST-201B STD. DWG. NO.



PLAN VIEW

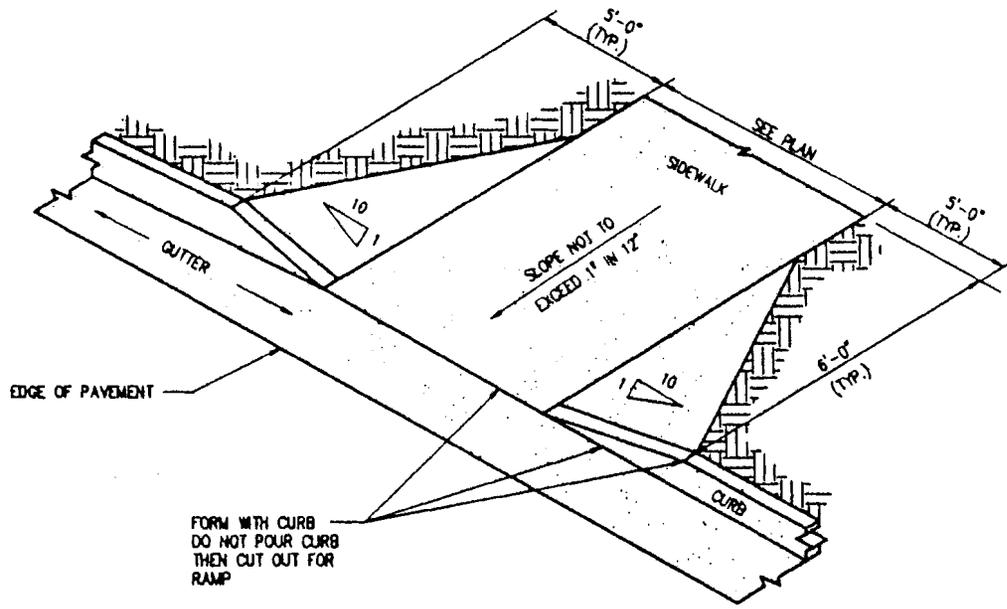


SECTION A-A



SECTION A-A

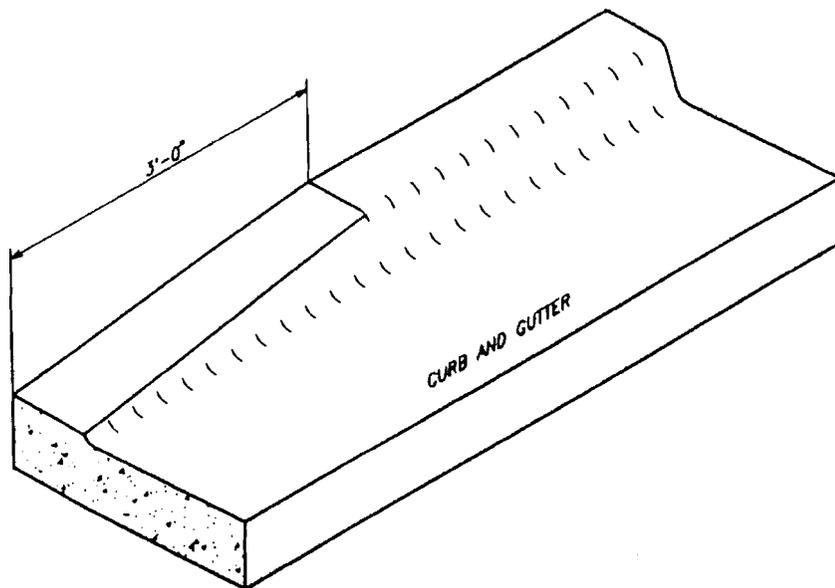
REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	DETAIL FOR STANDARD CONCRETE SIDEWALK	
CITY ENGINEER		DATE		ST-201C STD. DWG NO.



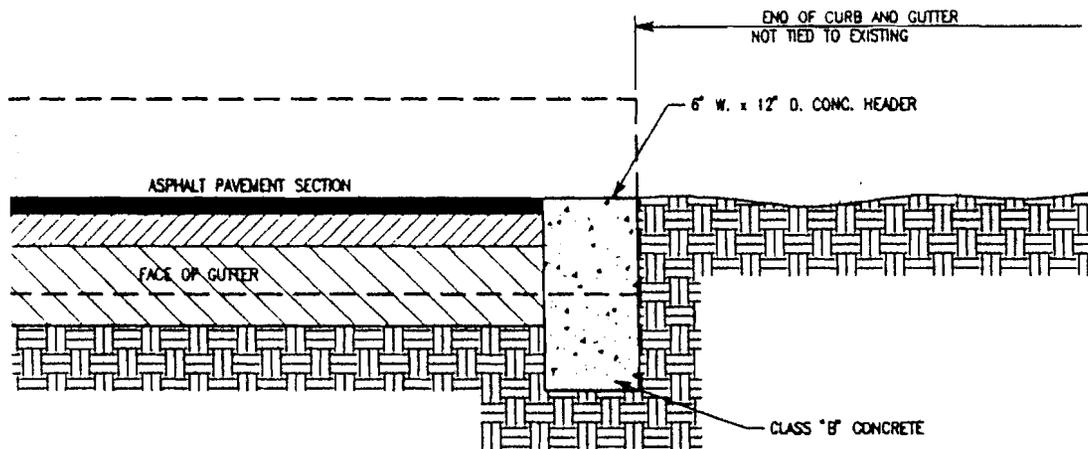
DETECTABLE WARNINGS ON WALKING SURFACES
 DETECTABLE WARNINGS SHALL BE AS REQUIRED PER ADA LATEST RULING.

THE MATERIAL USED TO PROVIDE CONTRAST SHALL BE AN INTEGRAL PART OF THE WALKING SURFACE. DETECTABLE WARNINGS USED ON INTERIOR SURFACES SHALL DIFFER FROM ADJOINING WALKING SURFACES IN RESILIENCY OR SOUND-ON-CANE CONTACT.

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	DETAIL FOR STANDARD CONCRETE SIDEWALK RAMP	
CITY ENGINEER		DATE		ST-201D STD. DWG. NO.

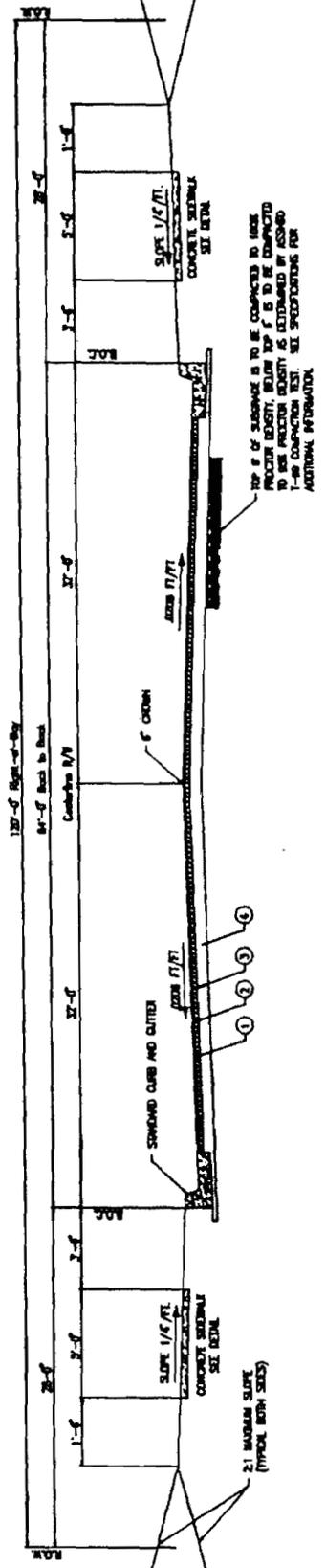


REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	DETAIL FOR STANDARD CURB END	
CITY ENGINEER		DATE		ST-201E STD. DWG NO.



NOTE: THIS DETAIL TO BE USED IN PLACES WHERE PUBLIC STREETS ARE DEAD-ENDED. (I.E. FOR FUTURE EXTENSION)

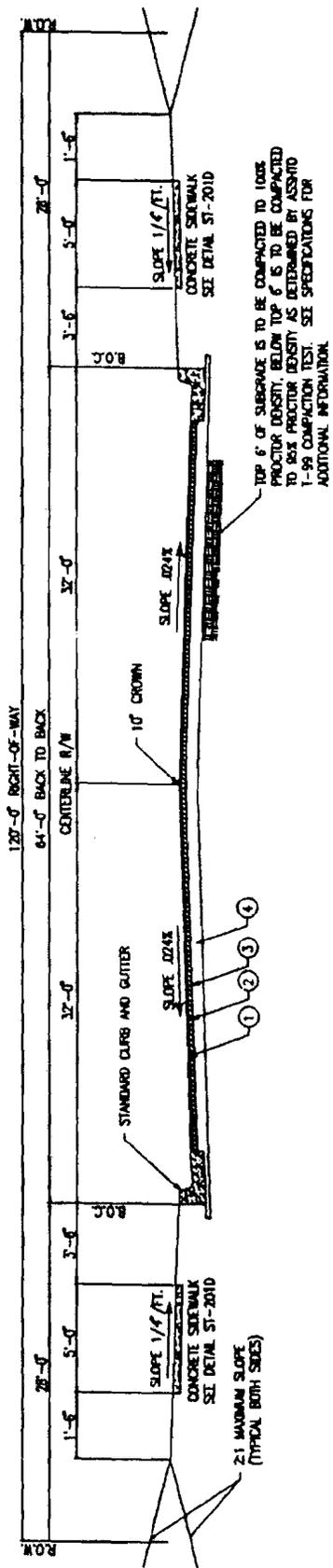
REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	DETAIL FOR STANDARD CONCRETE HEADER	
CITY ENGINEER		DATE		ST-201F STD. DWG NO.



MINIMUM REQUIREMENTS

- ① 2 1/2 IN. (6.4) MIN. BITUMINOUS CONCRETE WEAR COURSE, A.L. HIGHWAY DEPT., MET. 416 AND 1/2% OF SPECIFICATIONS (CALIFORNIA AGREEMENT)
- ② 3/8 IN. (9.5) MIN. BITUMINOUS CONCRETE BASE COURSE, A.L. HIGHWAY DEPT., MET. 414 OF SPECIFICATIONS
- ③ 0.10 CAL. V. BALLASTED ASPHALT OR 0.07 CAL. V. BACK DIRT. ALL MATERIALS ARE TO BE IN ACCORDANCE WITH SECTION 605 OF THE A.L. HIGHWAY DEPT. SPECIFICATIONS.
- ④ 1/2" LAYER OF REINFORCED UNIFORM BASE COURSE AND COMPACTED IN 2" LIFT. ALL MATERIALS SHALL BE IN ACCORDANCE WITH SECTION 604, TYPE "B" COMPACTION TO MEET PROCTOR DENSITY.

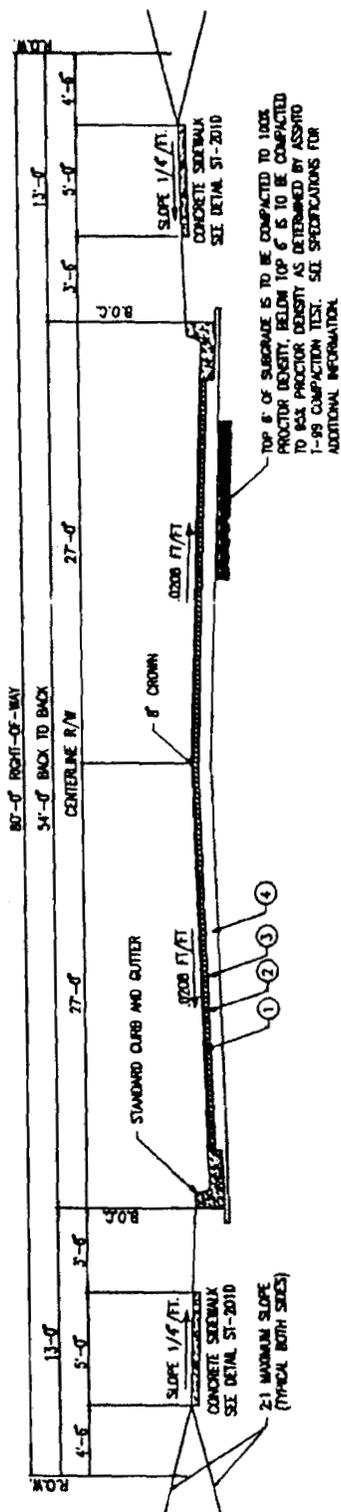
REVISIONS			CITY OF MADISON TYPICAL SECTION MAJOR ARTERIAL STREET (120' R.O.W.)
DESCRIPTION	NAME	DATE	
CITY ENGINEER		DATE	ST-250 STD. DWG. NO.



MINIMUM REQUIREMENTS

- ① 2 1/2 LB./S.Y. (2") HOT BITUMINOUS CONCRETE WEARING COURSE. AL. HIGHWAY DEPT., REF. 416 MIX "A" OF SPECIFICATIONS (SILICIOUS AGGREGATE)
- ② 3 1/2 LB./S.Y. (2") HOT BITUMINOUS CONCRETE BINDER COURSE. AL. HIGHWAY DEPT., REF. 414 OF SPECIFICATIONS.
- ③ 0.10 GAL./S.Y. EMULSIFIED ASPHALT OR 0.07 GAL./S.Y. TACK COAT. ALL MATERIALS ARE TO BE IN ACCORDANCE WITH SECTION 405 OF THE AL. HIGHWAY DEPT. SPECIFICATIONS.
- ④ 10" LAYER OF DENSE GRADED LIMESTONE BASE COURSE LAD AND COMPACTED IN 5" LIFTS. AL. HIGHWAY DEPT., REF. 301 OF SPECIFICATIONS. ALL MATERIALS SHALL BE IN ACCORDANCE WITH SECTION 423, TYPE "B", COMPACTED TO 100% PROCTOR DENSITY.

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE		
CITY ENGINEER		DATE		ST-251 STD. DWG. NO.



MINIMUM REQUIREMENTS

- ① 2 1/2 IN. (2") HOT BITUMINOUS CONCRETE WEARING COURSE, A.L. HIGHWAY DEPT., REF. 416 MAX. % OF SPECIFICATIONS (SUCCESSION AGGREGATE)
- ② 3/4 IN. (3/4") HOT BITUMINOUS CONCRETE BINDER COURSE, A.L. HIGHWAY DEPT., REF. 414 OF SPECIFICATIONS.
- ③ 0.10 CAL./CY. EMULSIFIED ASPHALT OR 0.07 CAL./CY. TACK COAT. ALL MATERIALS ARE TO BE IN ACCORDANCE WITH SECTION 405 OF THE A.L. HIGHWAY DEPT. SPECIFICATIONS.
- ④ 10" LAYER OF DENSE GRADED LIMESTONE BASE COURSE LAD AND COMPACTED IN 5' LIFTS. A.L. HIGHWAY DEPT., REF. 301 OF SPECIFICATIONS. ALL MATERIALS SHALL BE IN ACCORDANCE WITH SECTION 322A, TYPE "B", COMPACTED TO 100% PROCTOR DENSITY.

REVISIONS		
DESCRIPTION	NAME	DATE

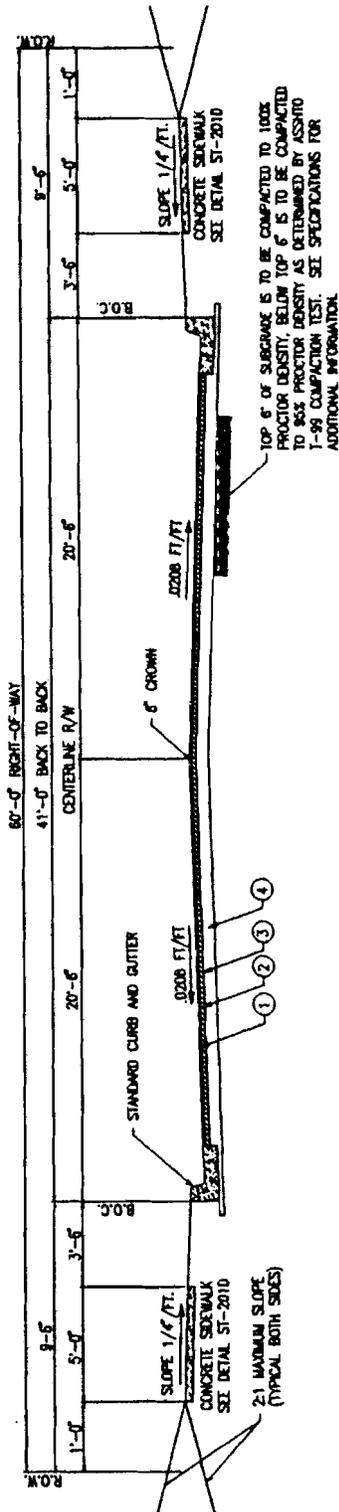
CITY OF MADISON

TYPICAL SECTION

MAJOR COLLECTOR STREET

(80' R.O.W.)

CITY ENGINEER	DATE	ST-252 STD. DWG. NO.
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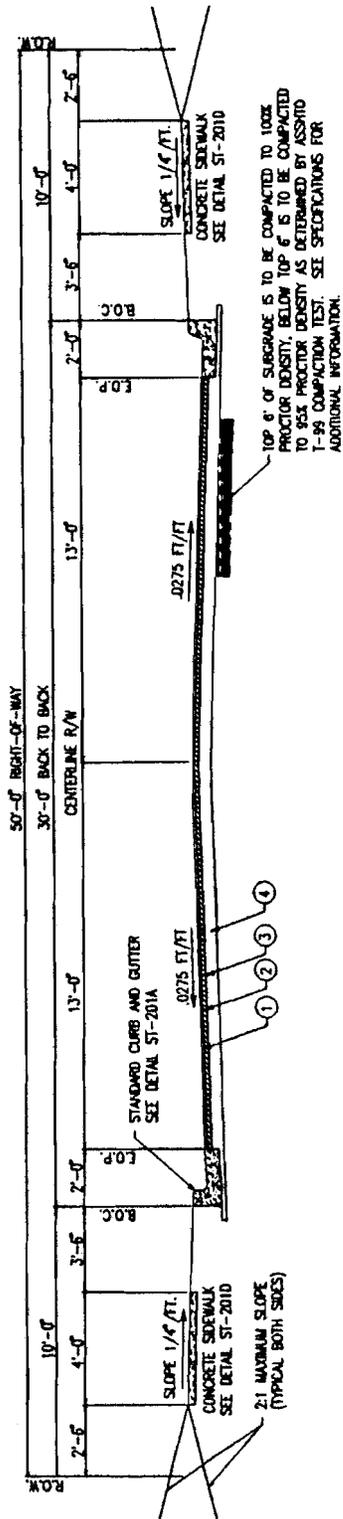


MINIMUM REQUIREMENTS

- ① 108 LBS./S.Y. (1 1/2") HOT BITUMINOUS CONCRETE WEARING COURSE, AL. HIGHWAY DEPT., REF. 416 MIX "B" OF SPECIFICATIONS (SULCUSUS AGGREGATE)
- ② 200 LBS./S.Y. (2 1/2") HOT BITUMINOUS CONCRETE BINDER COURSE, AL. HIGHWAY DEPT., REF. 414 MIX "A" OF SPECIFICATIONS.
- ③ 0.10 GAL./S.Y. EMULSIFIED ASPHALT OR 0.07 GAL./S.Y. TACK COAT. ALL MATERIALS ARE TO BE IN ACCORDANCE WITH SECTION 405 OF THE AL. HIGHWAY DEPT. SPECIFICATIONS.
- ④ 10" LAYER OF DENSE GRADED LIMESTONE BASE COURSE LAD AND COMPACTED IN 5' LIFTS. AL. HIGHWAY DEPT., REF. 301 OF SPECIFICATIONS. ALL MATERIALS SHALL BE IN ACCORDANCE WITH SECTION 825, TYPE "B", COMPACTION TO 100% PROCTOR DENSITY.

REVISIONS		
DESCRIPTION	NAME	DATE
CITY ENGINEER		DATE

<p>CITY OF MADISON TYPICAL SECTION MINOR COLLECTOR STREET (60' R.O.W.)</p>	
	<p>ST-253 STD. DWG. NO.</p>



MINIMUM REQUIREMENTS

- ① 186 LBS./S.Y. (1 1/2") HOT BITUMINOUS CONCRETE WEARING COURSE, AL. HIGHWAY DEPT., REF. 416 MIX "B" OF SPECIFICATIONS (SILICEOUS AGGREGATE)
- ② 224 LBS./S.Y. (2") HOT BITUMINOUS CONCRETE BINDER COURSE, AL. HIGHWAY DEPT., REF. 414 MIX "A" OF SPECIFICATIONS.
- ③ 0.10 GAL./S.Y. EMULSIFIED ASPHALT OR 0.07 GAL./S.Y. TACK COAT. ALL MATERIALS ARE TO BE IN ACCORDANCE WITH SECTION 405 OF THE AL. HIGHWAY DEPT. SPECIFICATIONS.
- ④ 5" LAYER OF DENSE GRADED LIMESTONE BASE COURSE, AL. HIGHWAY DEPT., REF. 301 OF SPECIFICATIONS. ALL MATERIALS SHALL BE IN ACCORDANCE WITH SECTION 825, TYPE "B", COMPACTION TO 100% PROCTOR DENSITY.

REVISIONS

DESCRIPTION	NAME	DATE

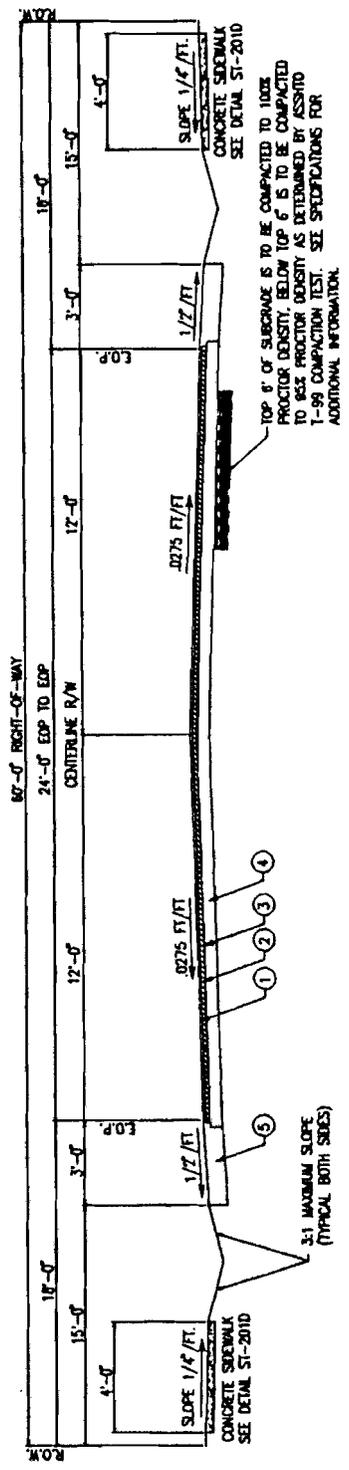
CITY OF MADISON

**TYPICAL SECTION
LOCAL STREET
(50' R.O.W.)**

CITY ENGINEER

DATE

**ST-254
STD. DWG. NO.**



MINIMUM REQUIREMENTS

- ① 188 LBS./S.Y. (1 1/2") HOT BITUMINOUS CONCRETE WEARING COURSE. AL. HIGHWAY DEPT., REF. 416 MIX "B" OF SPECIFICATIONS (SUCCEDED AGGREGATE)
- ② 224 LBS./S.Y. (1 7/8") HOT BITUMINOUS CONCRETE BINDER COURSE. AL. HIGHWAY DEPT., REF. 414 MIX "A" OF SPECIFICATIONS
- ③ 0.10 GAL./S.Y. EMULSIFIED ASPHALT OR 0.07 GAL./S.Y. TACK COAT. ALL MATERIALS ARE TO BE IN ACCORDANCE WITH SECTION 405 OF THE AL. HIGHWAY DEPT. SPECIFICATIONS.
- ④ 5" LAYER OF DENSE GRADED LIMESTONE BASE COURSE. AL. HIGHWAY DEPT., REF. 301 OF SPECIFICATIONS. ALL MATERIALS SHALL BE IN ACCORDANCE WITH SECTION 802, TYPE "B", COMPACTION TO 100% PROCTOR DENSITY.
- ⑤ 5" LAYER OF DENSE GRADED LIMESTONE BASE COURSE. (MIN.) AL. HIGHWAY DEPT., REF. 301 OF SPECIFICATIONS. ALL MATERIALS SHALL BE IN ACCORDANCE WITH SECTION 802, TYPE "B", COMPACTION TO 100% PROCTOR DENSITY WITH BITUMINOUS SURFACE "C" TREATMENT AS PER SECTION 401 OF AHD SPECIFICATIONS.

REVISIONS

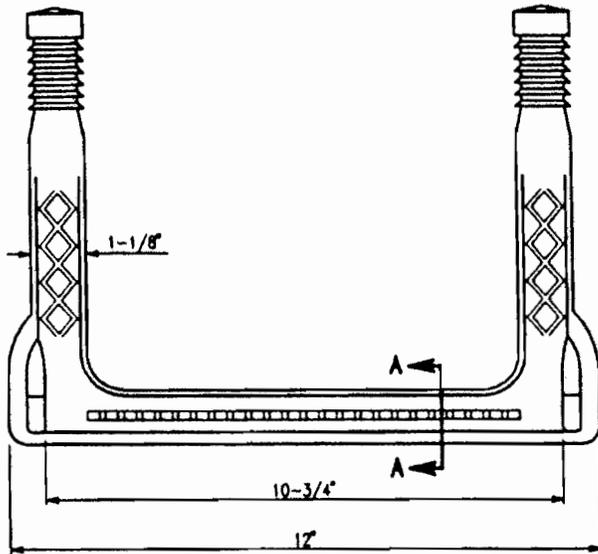
DESCRIPTION	NAME	DATE

CITY OF MADISON
TYPICAL SECTION
LOCAL STREET
(60' R.O.W.)

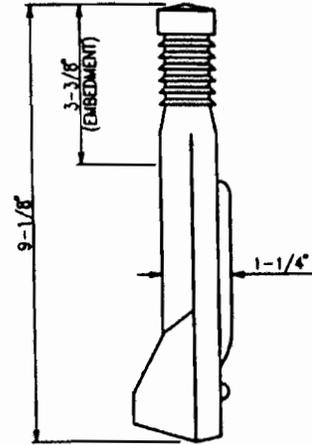
CITY ENGINEER

DATE

ST-255
 STD. DWG. NO.

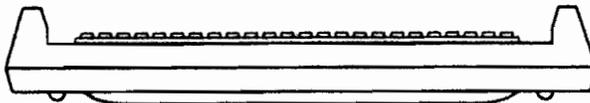


ELEVATION

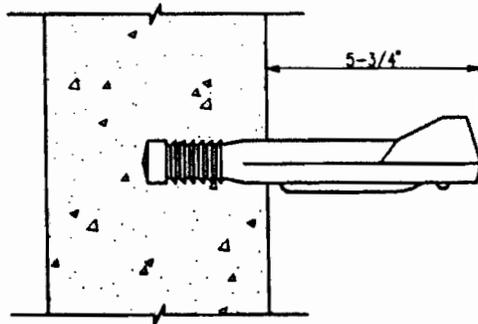


SIDE

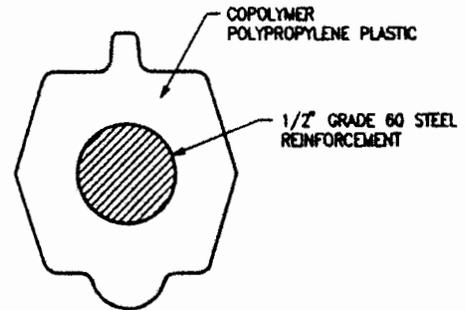
NOTE: MANHOLE STEP TYPE (PSI-PF) AS MANUFACTURED BY M. A. INDUSTRIES, INC. OR APPROVED EQUAL.



(DIMENSIONS SHOWN ARE MINIMUM REQUIREMENTS)



INSTALLATION

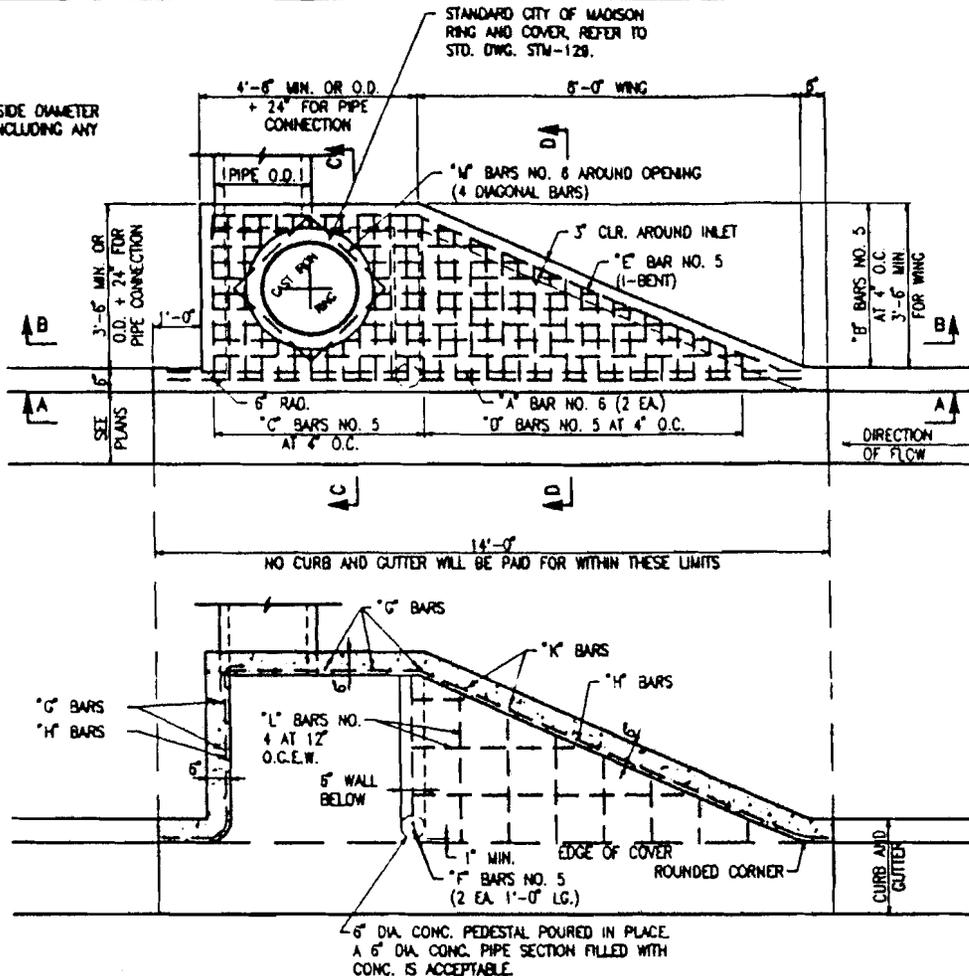


SECTION A-A

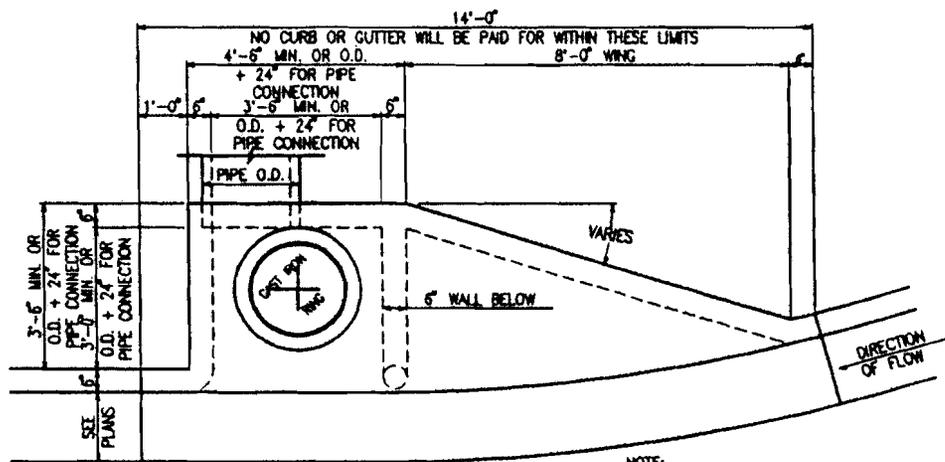
NOTE:
 MANHOLE STEPS SHALL BE MANUFACTURED FROM ALUMINUM OR POLYPROPYLENE PLASTIC REINFORCED WITH A 3/8" OR LARGER STEEL ROD. STEPS SHALL BE EMBEDDED IN THE BASE, RISER AND TOP SECTIONS A MINIMUM OF THREE INCHES AT THE TIME OF CONSTRUCTION. MANHOLE STEPS SHALL BE A MINIMUM OF 10-3/4" WIDE AND EXTEND FROM THE MANHOLE A MINIMUM OF 5-3/4".

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	STANDARD LADDER BAR DETAIL	
CITY ENGINEER		DATE		STM-100 STD. DWG. NO.

NOTE:
O.D. INDICATES THE OUTSIDE DIAMETER
OF INTERSECTING PIPE INCLUDING ANY
ADJUSTMENT FOR SKEW.



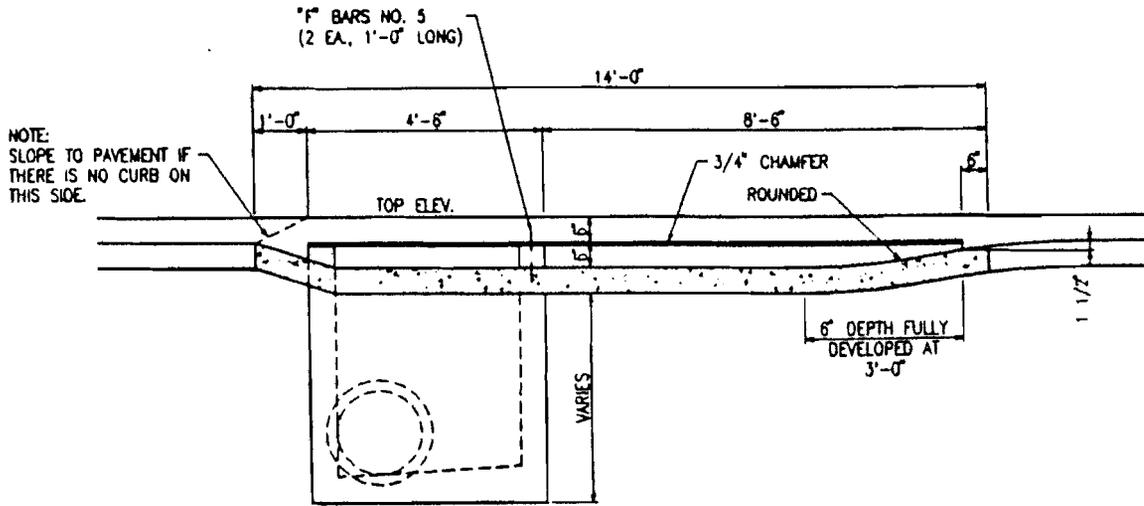
PLAN VIEW
SCALE: 1/2" = 1'-0"



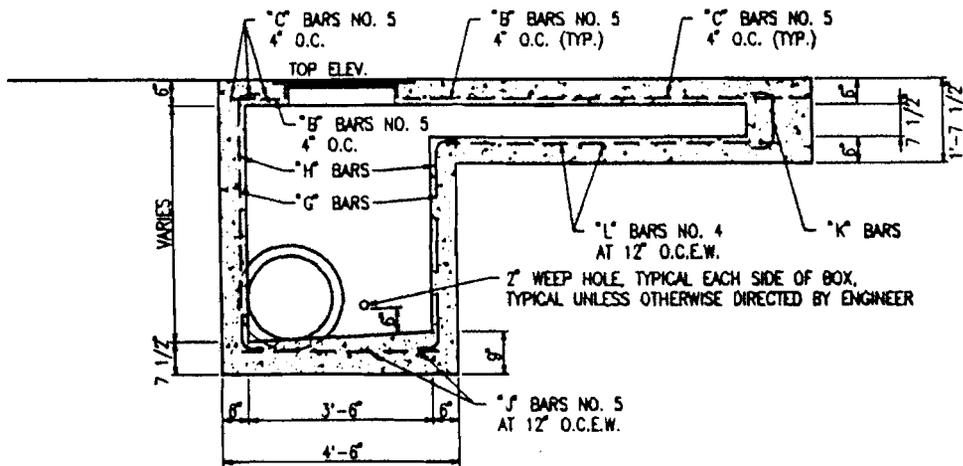
PLAN ON RADIUS
SCALE: 1/2" = 1'-0"

NOTE:
REINFORCING BAR SIZE AND SPACING SHALL
BE SAME AS INLET ON TANGENT LINE.

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	"S" TYPE INLET DETAILS	
CITY ENGINEER		DATE		STM-120A STD. DWG. NO.

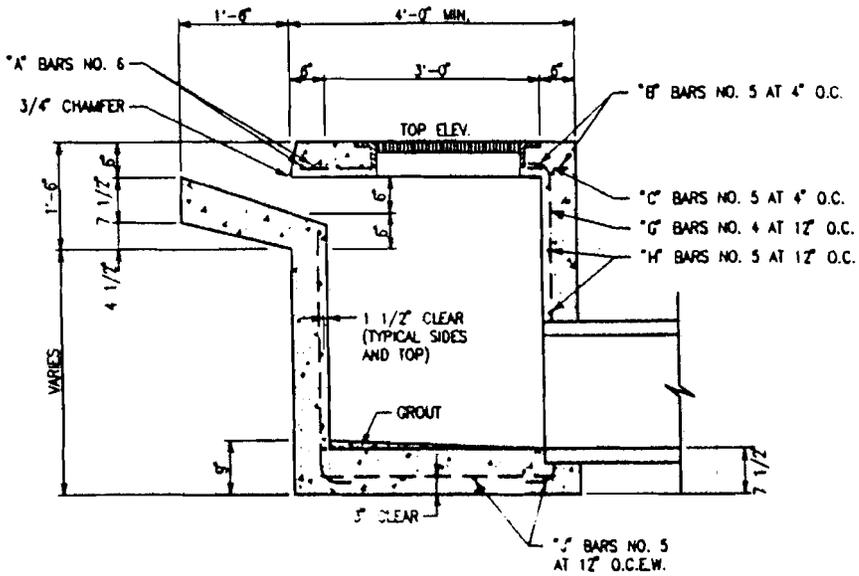


SECTION "A-A"

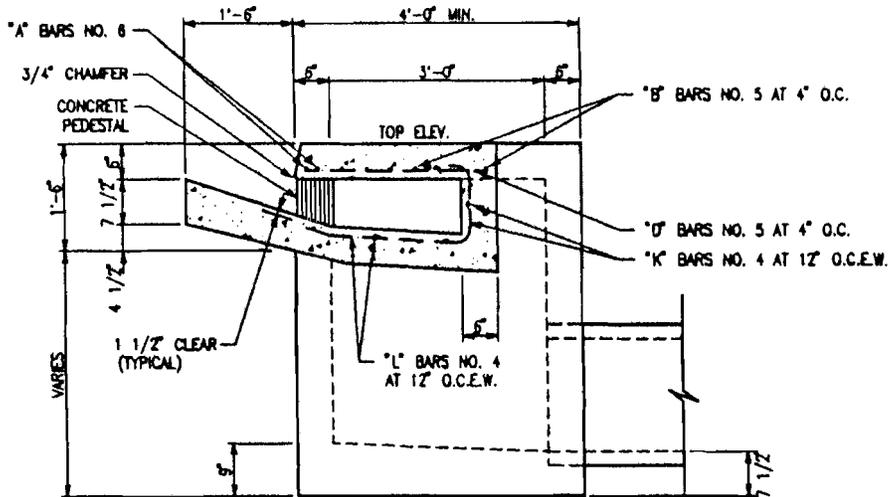


SECTION "B-B"

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	"S" TYPE INLET DETAILS	
CITY ENGINEER		DATE		STM-120B STD. DWG NO.

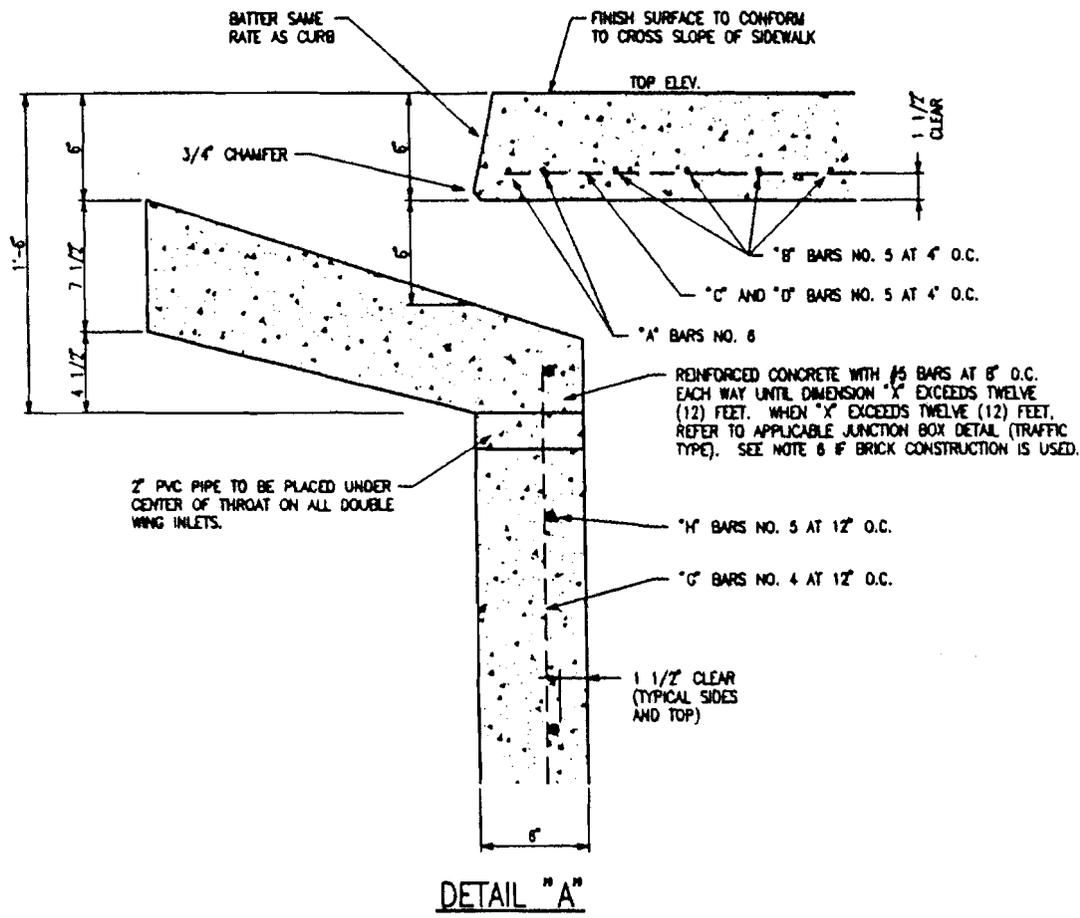


SECTION "C-C"



SECTION "D-D"

REVISIONS				CITY OF MADISON	
DESCRIPTION	NAME	DATE			
			"S" TYPE INLET DETAILS		
CITY ENGINEER		DATE			STM-120C STD. DWG NO.

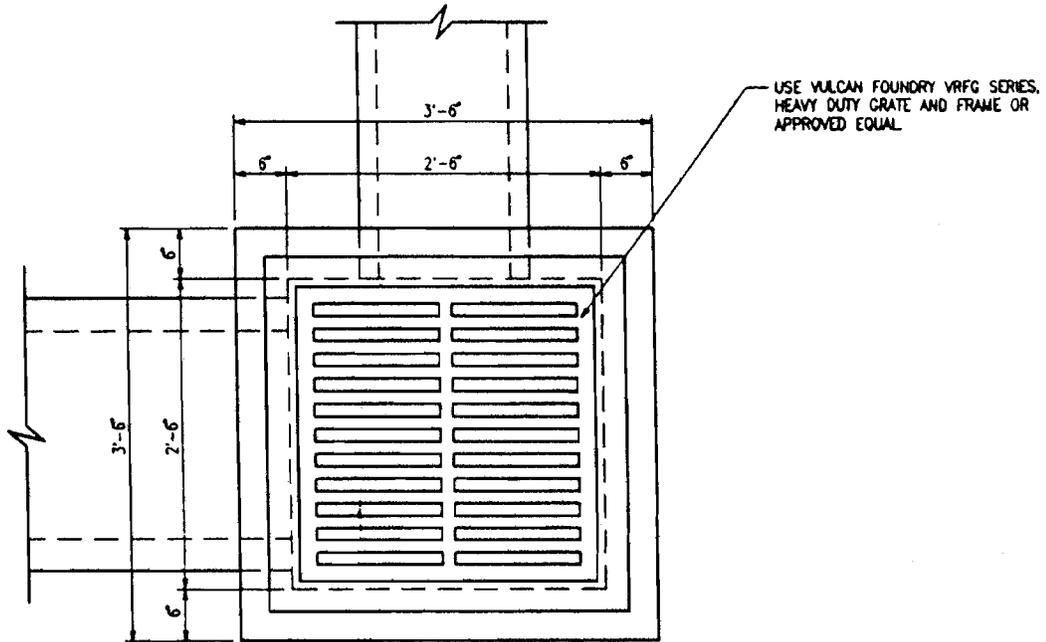


DETAIL "A"

GENERAL NOTES

CONCRETE	ALL CONCRETE SHALL BE CLASS "A" AND DEVELOP A MINIMUM OF 3,000 PSI, 28 DAY COMPRESSIVE STRENGTH.
REINFORCING	ALL REINFORCEMENT SHALL BE DEFORMED BAR, GRADE 60.
INLET WINGS	WHERE THE DIRECTION OF FLOW IS FROM BOTH SIDES OF THE INLET, SIDE WING OPENINGS (AS SHOWN ON ONE SIDE ONLY) SHALL BE BUILT ON BOTH SIDES OF INLET. FOR EACH INLET SO BUILT PAYMENT WILL BE MADE UNDER ITEM "INLETS TYPE S, (DOUBLE WING)". WHERE ONE WING ONLY IS BUILT PAYMENT WILL BE MADE UNDER ITEM "INLETS TYPE S, (SINGLE WING)".
LARGE PIPE	TO ACCOMMODATE LARGE DIAMETER PIPE, OR TO FIT OTHER CONDITIONS, IT MAY BE NECESSARY TO INCREASE ONE OR BOTH PLAN DIMENSIONS OF THE INLET BOX AND COVER SLAB. NO ADDITIONAL COMPENSATION WILL BE ALLOWED FOR THE CORRESPONDING INCREASE IN CONSTRUCTION MATERIALS WHERE CHANGES IN DIMENSIONS ARE REQUIRED.
PIPE CONNECTIONS	PIPE MAY CONNECT WITH INLETS FROM ANY DIRECTION, AND AS MANY CONNECTIONS SHALL BE MADE AS ARE NECESSARY.
WEEP HOLES	2" MINIMUM DIAMETER WEEP HOLES SHALL BE CONSTRUCTED IN INLETS AS DIRECTED BY THE ENGINEER TO FACILITATE SUBGRADE DRAINAGE.
RING AND COVER	SHALL CONFORM TO THE REQUIREMENTS OF CLASS 30 FOR GRAY IRON CASTING A.S.T.M. DESIGNATION A48.
MANHOLE STEPS	MANHOLE STEPS ARE REQUIRED WHEN DIMENSION FROM BOTTOM SLAB FLOW LINE TO TOP SLAB IS GREATER THAN 4'-0". STEPS SHALL BE INSTALLED AT 1'-4" O.C. VERTICALLY.

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	"S" TYPE INLET DETAILS	
CITY ENGINEER		DATE		STM-120D STD. DWG NO.

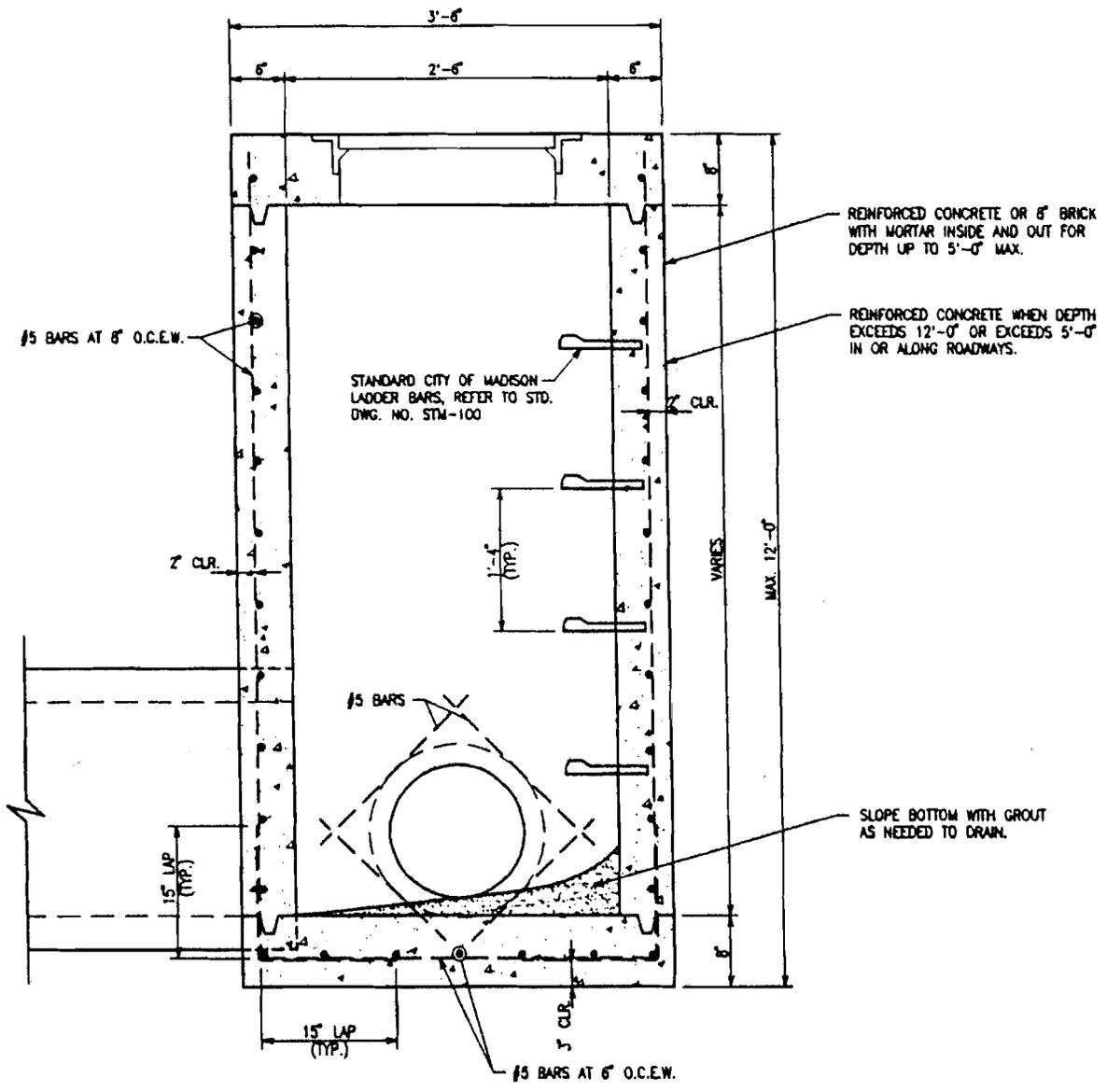


PLAN VIEW

NOTES

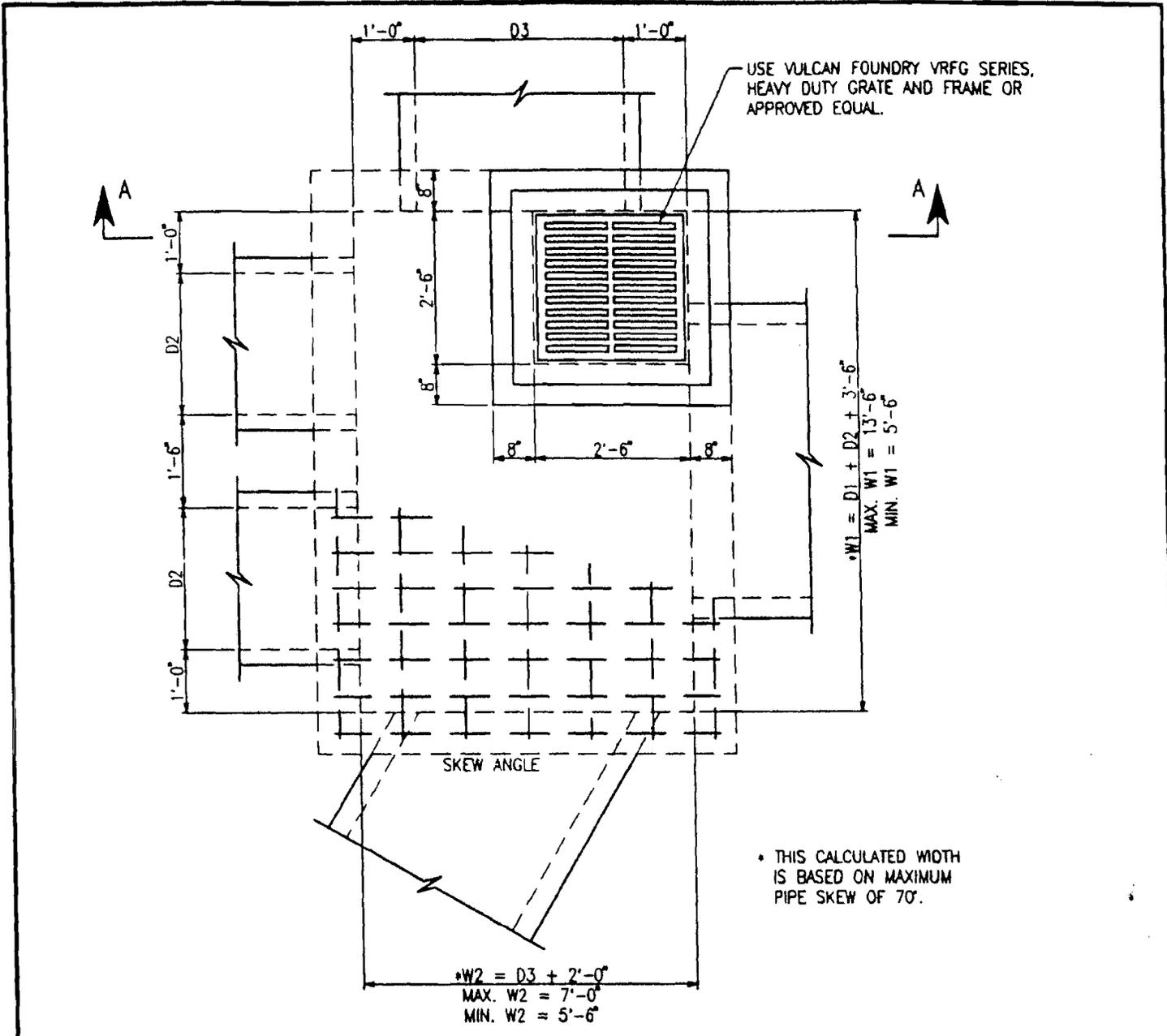
1. MINIMUM SIZE OF AN INLET BOX IS 2'-6" X 2'-6".
2. MAXIMUM SIZE OF AN INLET BOX IS 7'-0" (W2) X 13'-6" (W1) FOR 27" TO 60" PIPES.
3. MINIMUM SIZE OF AN INLET BOX IS 2'-6" X 2'-6" 15" TO 24" PIPES.
4. MAXIMUM HEIGHT OF AN INLET BOX IS AS SHOWN.
5. INLET BOXES GREATER THAN 7'-0" X 13'-6" X 10'-0" SHALL BE A SPECIAL DESIGNED INLET BOX.
6. ALL CONCRETE SHALL BE CLASS "A" AND SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI IN 28 DAYS.
7. REINFORCING SHALL BE INTERMEDIATE GRADE DEFORMED BARS AND SHALL CONFORM TO THE REQUIREMENTS OF THE STANDARD SPECIFICATIONS FOR BILLET STEEL CONCRETE REINFORCEMENT BARS, ASTM A-15 AND DEFORMATIONS CONFORMING TO ASTM A-305.
8. STEPS ARE REQUIRED ON ALL INLET BOXES WHEN DIMENSION FROM TOP TO BOTTOM SLAB FLOW LINE TO TOP OF TOP SLAB IS GREATER THAN 4'-0".

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	OPEN GRATE INLET BOX DETAIL	
			TRAFFIC TYPE	
			15" TO 24" PIPES	
				STM-125A
CITY ENGINEER		DATE		STD. DWG. NO.



SECTIONAL VIEW

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	OPEN GRATE INLET BOX DETAIL	
			TRAFFIC TYPE	
			15" TO 24" PIPES	
CITY ENGINEER		DATE		STM-125B STD. DWG. NO.

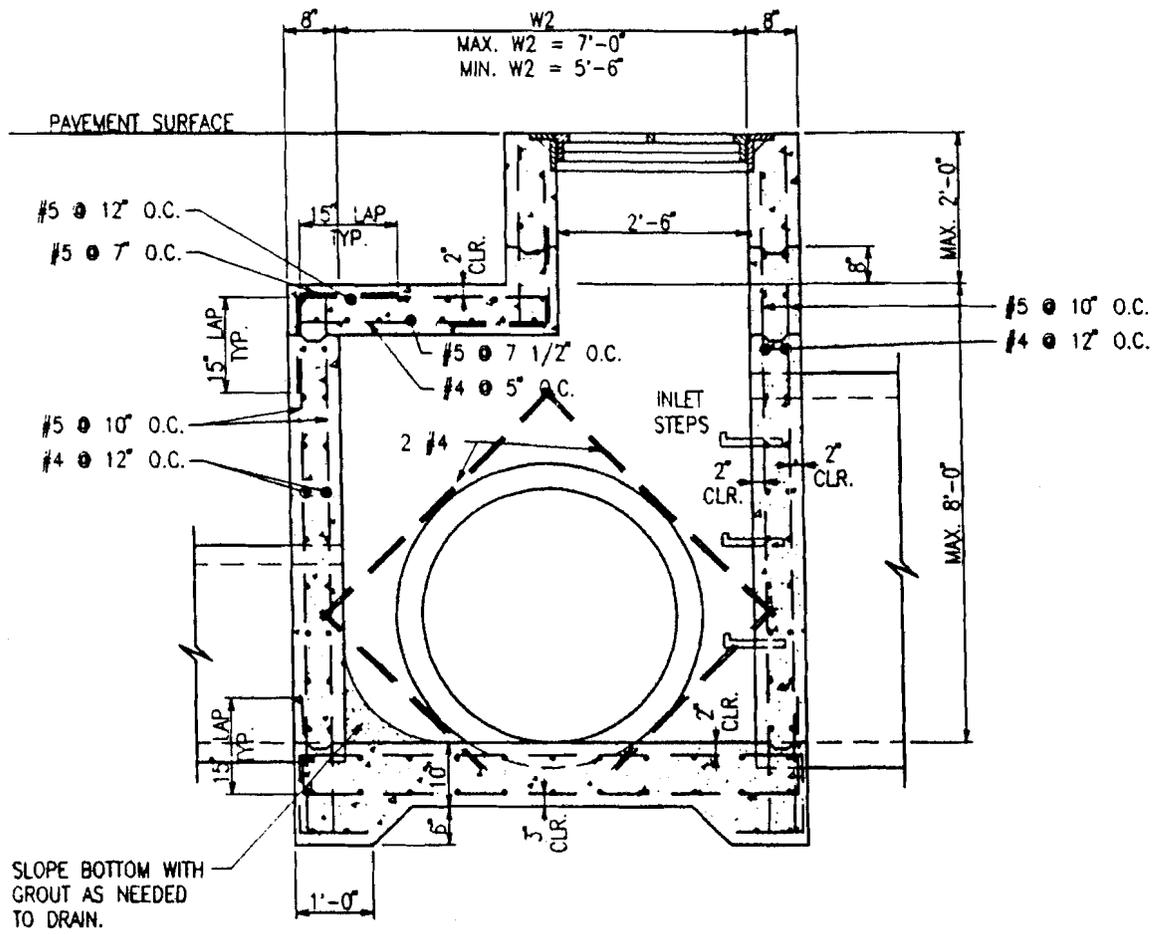


PLAN VIEW

NOTES

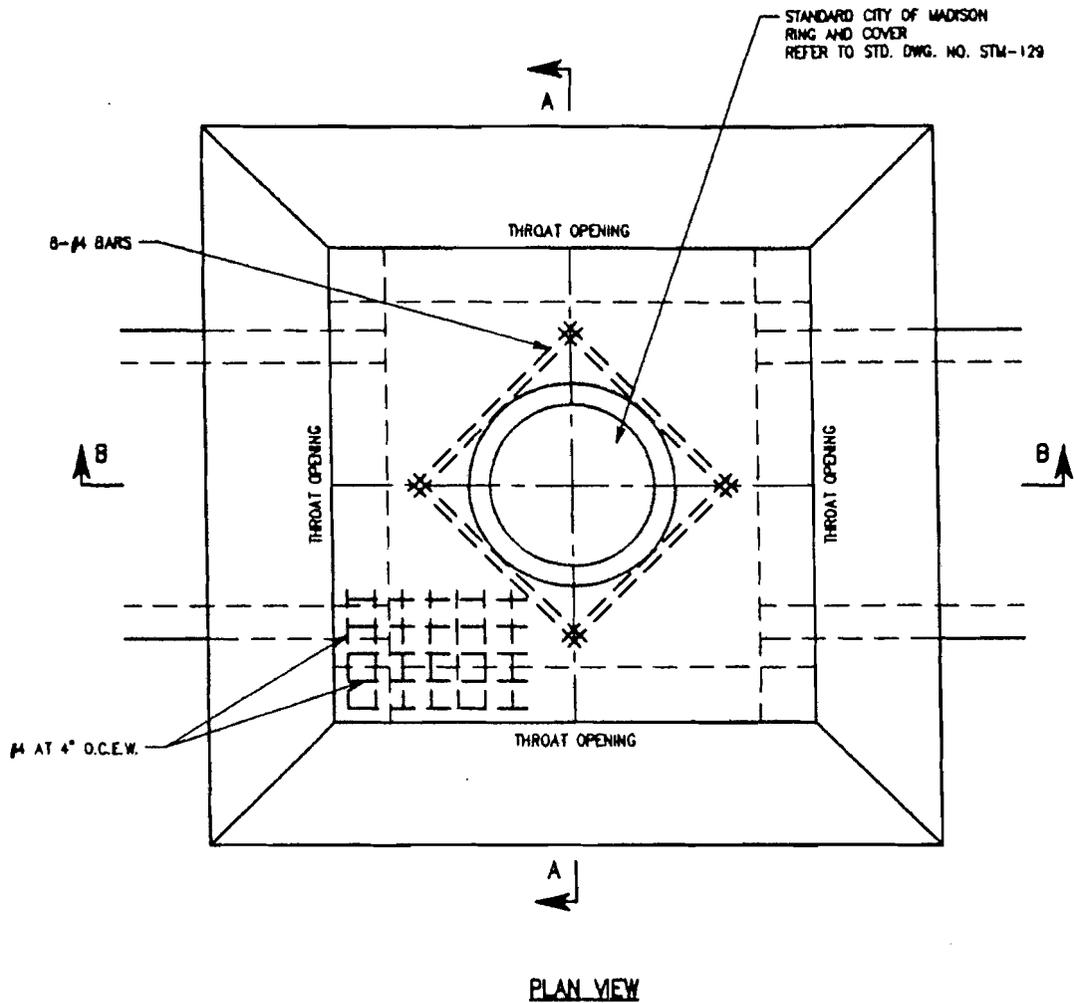
1. MINIMUM SIZE OF AN INLET BOX IS 2'-6" X 2'-6".
2. MAXIMUM SIZE OF AN INLET BOX IS 7'-0" (W2) X 13'-6" (W1) FOR 27" TO 60" PIPES.
3. MINIMUM SIZE OF AN INLET BOX IS 2'-6" X 2'-6" 15" TO 24" PIPES.
4. MAXIMUM HEIGHT OF AN INLET BOX IS AS SHOWN.
5. INLET BOXES GREATER THAN 7'-0" X 13'-6" X 10'-0" SHALL BE A SPECIAL DESIGNED INLET BOX.
6. ALL CONCRETE SHALL BE CLASS "A" AND SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI IN 28 DAYS.
7. REINFORCING SHALL BE INTERMEDIATE GRADE DEFORMED BARS AND SHALL CONFORM TO THE REQUIREMENTS OF THE STANDARD SPECIFICATIONS FOR BILLET STEEL CONCRETE REINFORCEMENT BARS, ASTM A-15 AND DEFORMATIONS CONFORMING TO ASTM A-305.
8. STEPS ARE REQUIRED ON ALL INLET BOXES WHEN DIMENSION FROM TOP TO BOTTOM SLAB FLOW LINE TO TOP OF TOP SLAB IS GREATER THAN 4'-0".

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	OPEN GRATE INLET BOX DETAIL TRAFFIC TYPE 27" TO 60" PIPES	
CITY ENGINEER		DATE		STM-125C STD. DWG. NO.



SECTION A-A

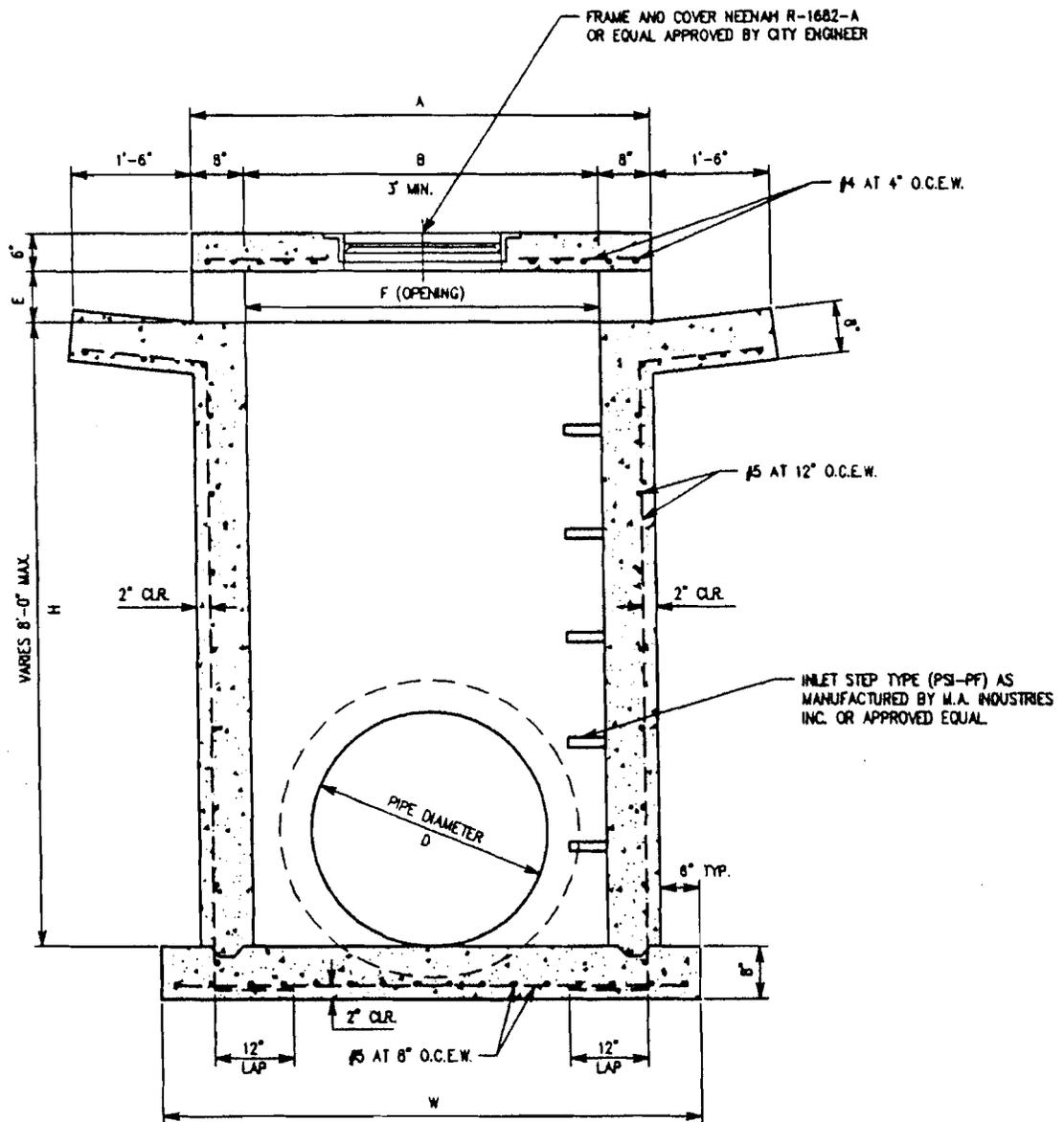
REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	OPEN GRATE INLET BOX DETAIL	
			TRAFFIC TYPE	
			27" TO 60" PIPES	
CITY ENGINEER		DATE		STM-125D STD. DWG NO.



NOTES

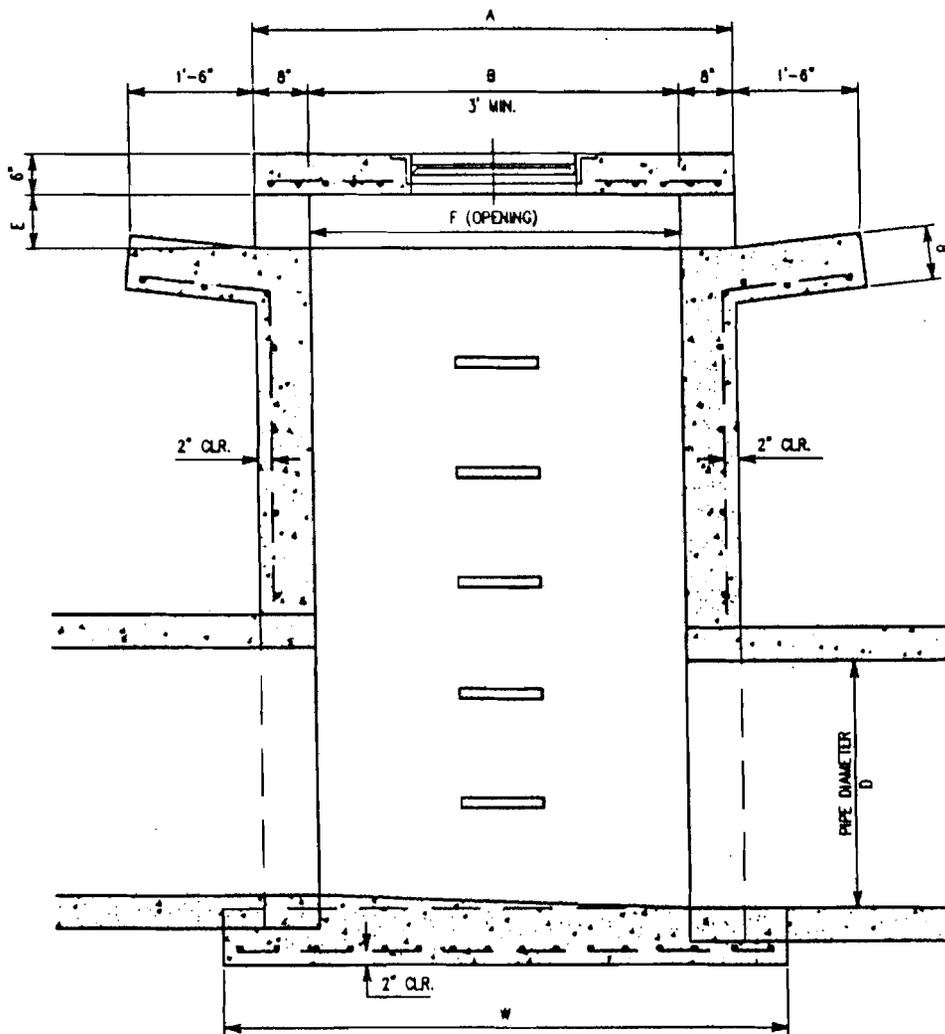
1. DIMENSION "A" IS DETERMINED BY THE LARGEST DIAMETER PIPE ENTERING THE OPEN THROAT INLET.
2. STEPS ARE REQUIRED ON ALL INLETS WHEN DIMENSION FROM BOTTOM SLAB FLOW LINE TO TOP OF TOP SLAB IS GREATER THAN 4'-0".
3. ALL CONCRETE SHALL BE CLASS "A" AND SHALL DEVELOPE A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI IN 28 DAYS.
4. REINFORCING SHALL BE INTERMEDIATE GRADE DEFORMED BARS AND SHALL CONFORM TO THE REQUIREMENTS OF THE STANDARD SPECIFICATIONS FOR BILLET STEEL CONCRETE REINFORCEMENT BARS, ASTM A-15 AND DEFORMATIONS CONFORMING TO ASTM A-305.
5. WHEN BRICK CONSTRUCTION IS USED, WALLS WILL BE 8" BRICK WHEN "H" IS LESS THAN 5'-0". USE 12" BRICK WHEN "H" IS MORE THAN 5'-0". FLOAT WITH 1/2" MORTAR ON BOTH SIDES.
6. PROVIDE CONCRETE APRON AT THROAT OPENINGS.

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	OPEN THROAT INLET DETAIL	
CITY ENGINEER		DATE		STM-127A STD. DWG. NO.



SECTION A-A

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	OPEN THROAT INLET DETAIL	
CITY ENGINEER		DATE		STM-127B STD. DWG NO.



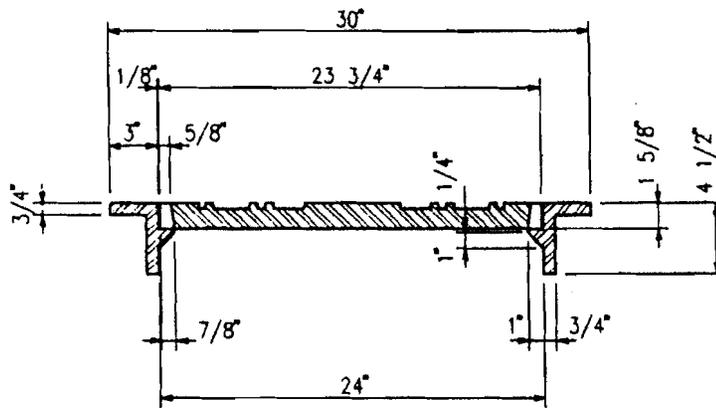
SECTION B-B

INLET DIMENSIONS					
Pipe Size	A	B & F	D	E	W
12"	4'-4"	3'-0"	12"	8"	5'-4"
15"	4'-4"	3'-0"	15"	8"	5'-4"
18"	4'-4"	3'-0"	18"	8"	5'-4"
21"	4'-6"	3'-2"	21"	8"	5'-6"
24"	4'-9"	3'-5"	24"	8"	5'-9"
30"	5'-4"	4'-0"	30"	8"	6'-4"
36"	5'-10"	4'-6"	36"	8"	6'-10"

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	OPEN THROAT INLET DETAIL	
CITY ENGINEER		DATE		STM-127C STD. DWG. NO.



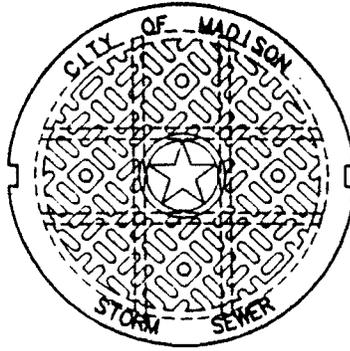
COVER DETAIL



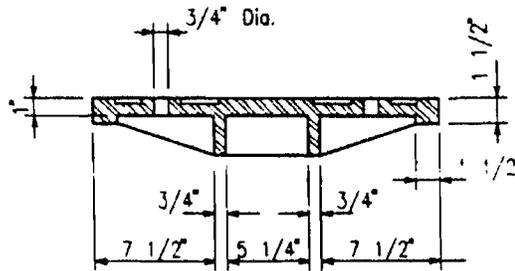
SECTION

NOTE: COVER AND FRAME SHALL CONFORM TO THE REQUIREMENTS OF CLASS 30 FOR GRAY IRON CASTING, ASTM (A 48). FRAME AND COVER SHALL BE CERTIFIED BY MF6. TO BE TRAFFIC BEARING WHEN APPLICABLE.

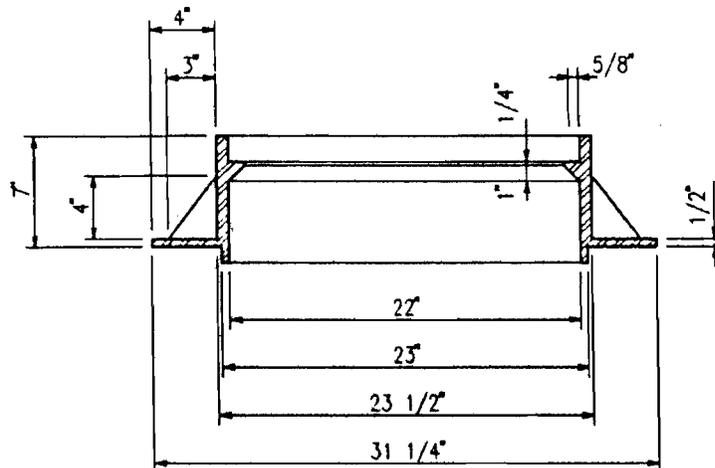
REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	RING AND COVER DETAIL	
CITY ENGINEER		DATE		STM-129A STD. DWG NO.



COVER DETAIL



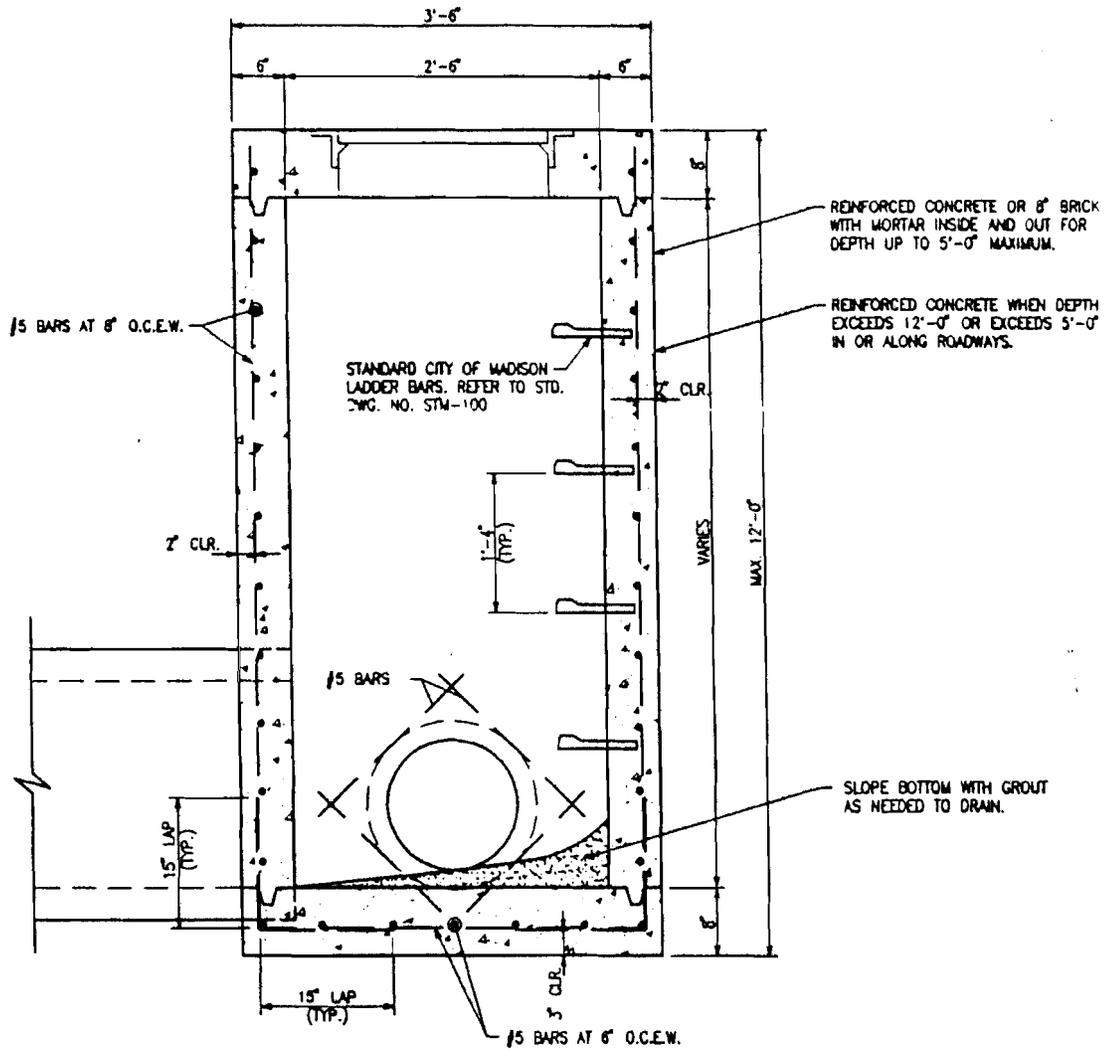
COVER SECTION



RING SECTION

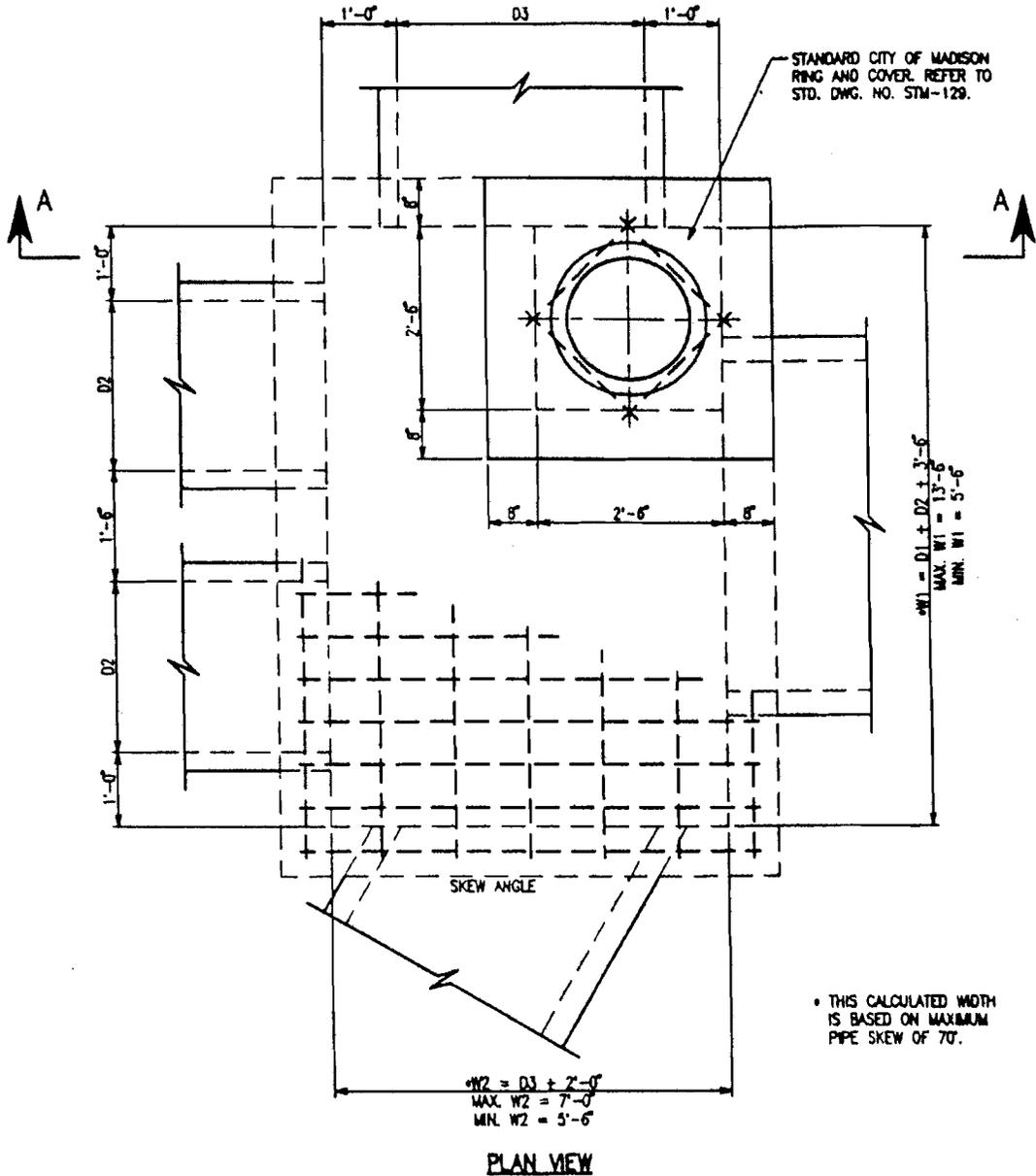
NOTE: COVER AND FRAME SHALL CONFORM TO THE REQUIREMENTS OF CLASS 30 FOR GRAY IRON CASTING, ASTM (A 48). FRAME AND COVER SHALL BE CERTIFIED BY MF6.

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	RING AND COVER DETAIL STORM SEWER MANHOLE TYPE II - TRAFFIC	
CITY ENGINEER		DATE		STM-129B STD. DWG. NO.



SECTIONAL VIEW

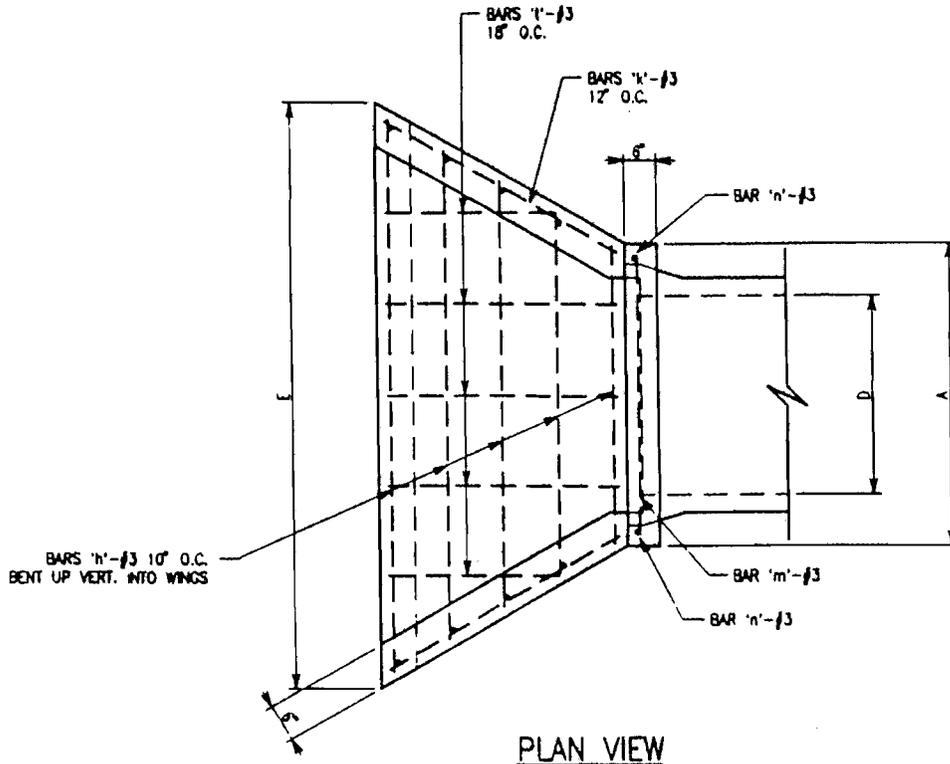
REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	OPEN GRATE INLET BOX DETAIL	
			TRAFFIC TYPE	
			15" TO 24" PIPES	
CITY ENGINEER		DATE		STM-140B STD. DWG. NO.



NOTES

1. MINIMUM SIZE OF AN INLET BOX IS 2'-6" X 2'-6".
2. MAXIMUM SIZE OF AN INLET BOX IS 7'-0" (W2) X 13'-6" (W1) FOR 27" TO 60" PIPES.
3. MINIMUM SIZE OF AN INLET BOX IS 2'-6" X 2'-6" 15" TO 24" PIPES.
4. MAXIMUM HEIGHT OF AN INLET BOX IS AS SHOWN.
5. INLET BOXES GREATER THAN 7'-0" X 13'-6" X 10'-0" SHALL BE A SPECIAL DESIGNED INLET BOX.
6. WHEN BRICK CONSTRUCTION IS USED, WALLS WILL BE 8" BRICK WHEN "H" IS LESS THAN 5'-0".
7. ALL CONCRETE SHALL BE CLASS "A" AND SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI IN 28 DAYS.
8. REINFORCING SHALL BE INTERMEDIATE GRADE DEFORMED BARS AND SHALL CONFORM TO THE REQUIREMENTS OF THE STANDARD SPECIFICATIONS FOR BILLET STEEL CONCRETE REINFORCEMENT BARS, ASTM A-15 AND DEFORMATIONS CONFORMING TO ASTM A-305.
9. STEPS ARE REQUIRED ON ALL INLET BOXES WHEN DIMENSION FROM TOP TO BOTTOM SLAB FLOW LINE TO TOP OF TOP SLAB IS GREATER THAN 4'-0".

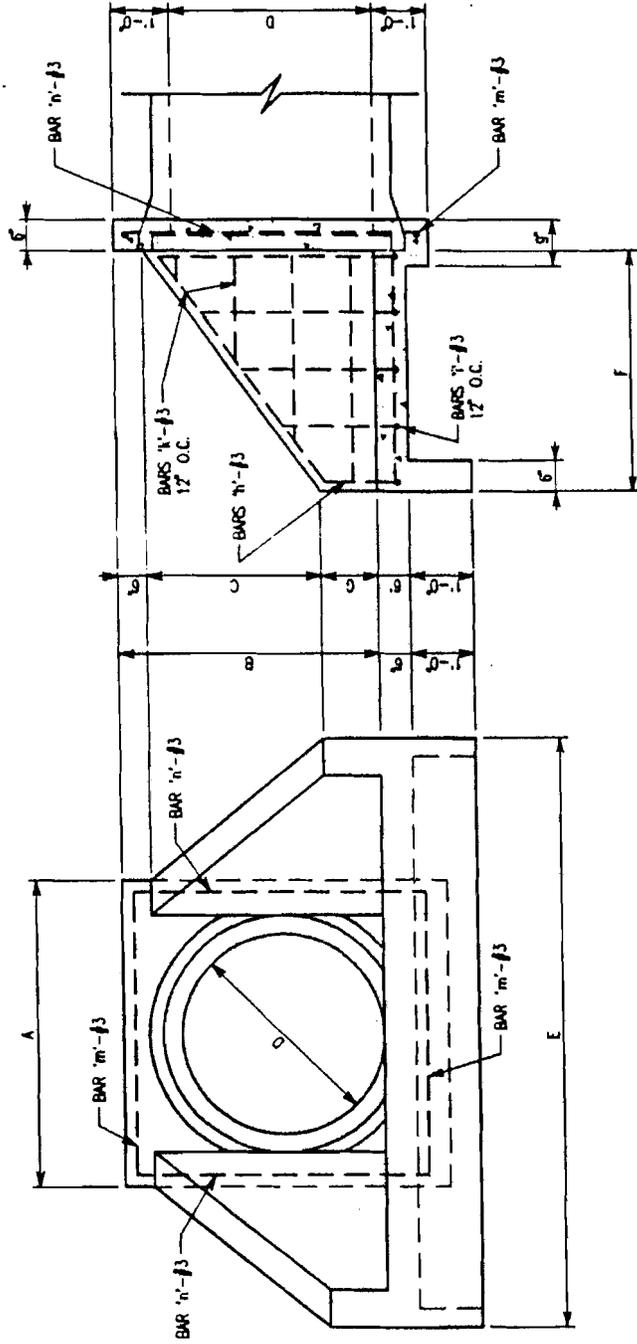
REVISIONS			CITY OF MADISON JUNCTION BOX DETAIL TRAFFIC TYPE 27" TO 60" PIPES
DESCRIPTION	NAME	DATE	
CITY ENGINEER		DATE	STM-141A STD. DWG. NO.



SINGLE HEADWALL DIMENSIONS								
D	A	B	C	E	F	G		
12" OR 15"	2'-11"	2'-3"	1'-3"	5'-1"	1'-10 1/2"	0'-6"		
18"	3'-2"	2'-6"	1'-3"	5'-4"	1'-10 1/2"	0'-9"		
21"	3'-5"	2'-9"	1'-3"	5'-7"	1'-10 1/2"	1'-0"		
24"	3'-8"	3'-0"	1'-6"	6'-3"	2'-3"	1'-0"		
30"	4'-2"	3'-6"	2'-0"	7'-8"	3'-0"	1'-0"		
36"	4'-8"	4'-0"	2'-6"	9'-0"	3'-9"	1'-0"		
42"	5'-2"	4'-6"	3'-0"	10'-4"	4'-8"	1'-6"		
48"	5'-8"	5'-0"	3'-6"	11'-8"	5'-5"	1'-6"		
QUANTITIES PER 2 HDWL'S SINGLE PIPE								
PIPE DIA.	15"	18"	21"	24"	30"	36"	42"	48"
CCNC.	1.38	1.60	1.88	2.14	2.86	3.64	4.42	5.20
STEEL	44	50	56	60	90	118	147	183

NOTE:
WHERE ARCH TYPE PIPE IS SPECIFIED, HORIZONTAL DIMENSION "A" FOR HEADWALLS SHALL CONFORM TO THE HORIZONTAL DIAMETER OF THE PIPE AND VERTICAL DIMENSIONS, AND DIMENSIONS DEPENDENT ON VERTICAL DIMENSIONS, SHALL CONFORM TO THE VERTICAL DIAMETER OF THE PIPE.

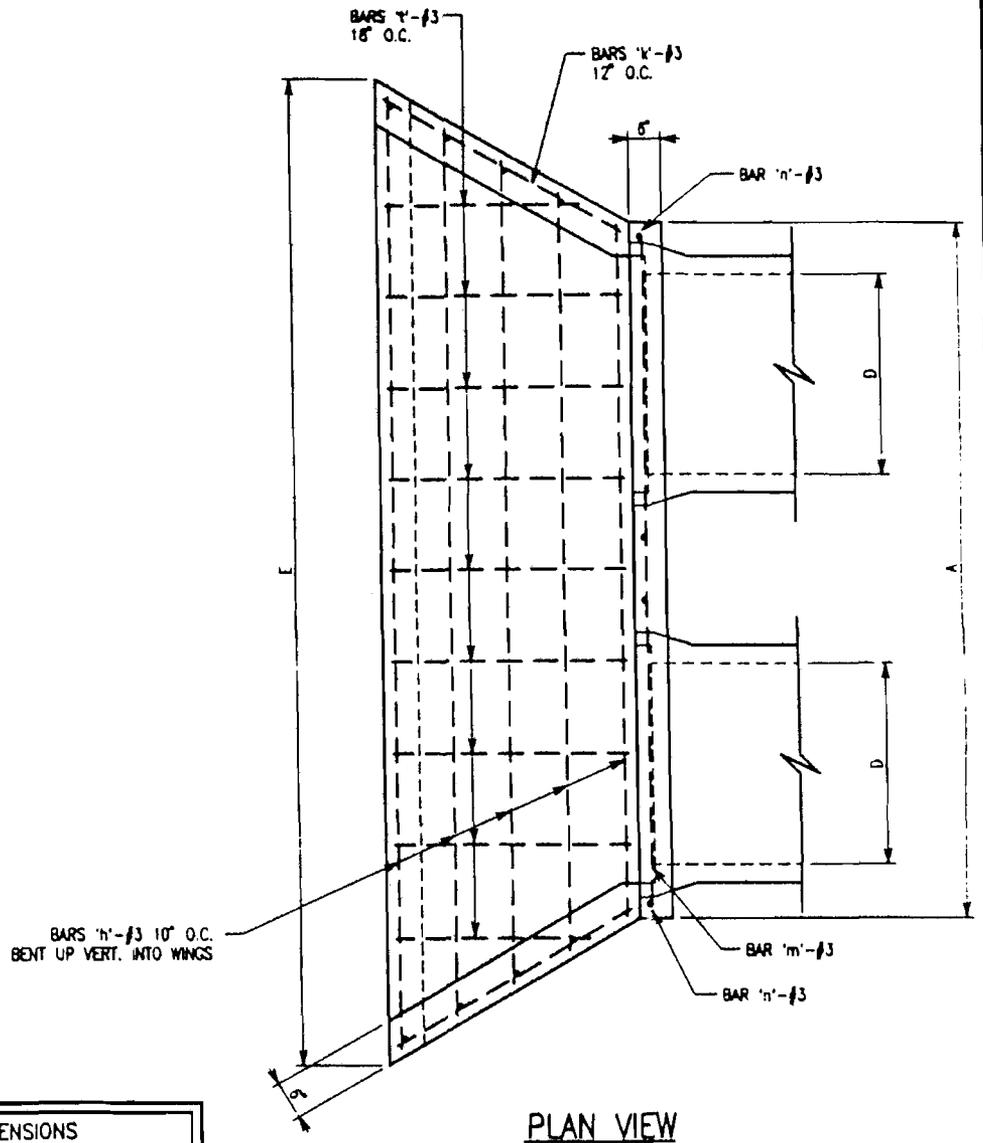
REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	CONCRETE HEADWALL - SINGLE ROUND PIPE DETAIL	
CITY ENGINEER		DATE		STM-150A STD. DWG. NO.



CROSS SECTION

END ELEVATION

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	CONCRETE HEADWALL - SINGLE ROUND PIPE DETAIL	
CITY ENGINEER		DATE		STM-150B STD. DWG. NO.



PLAN VIEW

DOUBLE PIPE HEADWALL DIMENSIONS						
D	A	B	C	E	F	G
15"	6'-2"	2'-3"	1'-3"	8'-4"	1'-10 1/2"	0'-6"
18"	8'-8"	2'-6"	1'-3"	8'-10"	1'-10 1/2"	0'-6"
21"	7'-2"	2'-9"	1'-3"	9'-4"	1'-10 1/2"	1'-0"
24"	7'-8"	3'-0"	1'-6"	10'-3"	2'-3"	1'-0"
30"	8'-8"	3'-6"	2'-0"	12'-2"	3'-0"	1'-0"
36"	9'-8"	4'-0"	2'-6"	14'-0"	3'-9"	1'-0"
QUANTITIES PER 2 HDWL'S DOUBLE LINE						
PIPE DIA.	15"	18"	21"	24"	30"	36"
CONC.	1.68	1.87	2.05	2.43	3.28	4.23
STEEL	54	58	62	72	103	131

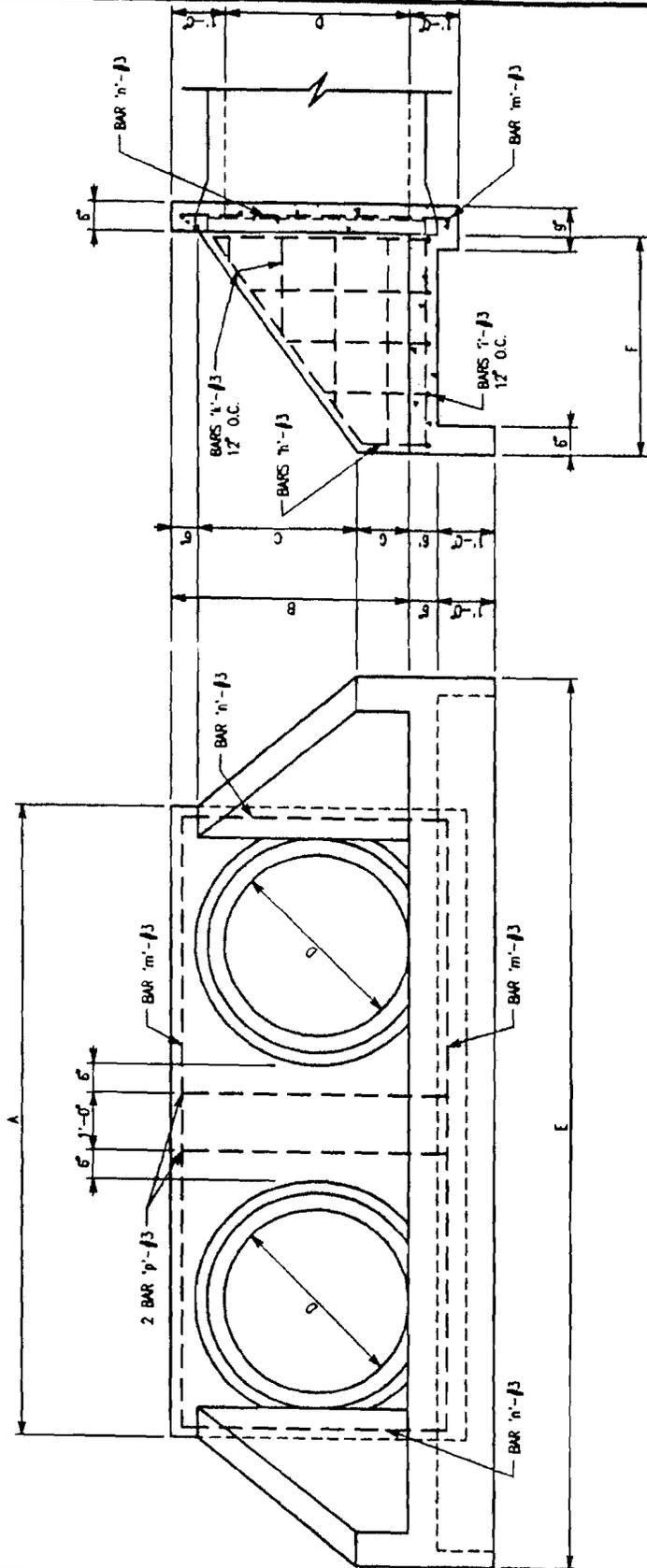
NOTE:
 WHERE ARCH TYPE PIPE IS SPECIFIED, HORIZONTAL DIMENSION "A" FOR HEADWALLS SHALL CONFORM TO THE HORIZONTAL DIAMETER OF THE PIPE AND VERTICAL DIMENSIONS, AND DIMENSIONS DEPENDENT ON VERTICAL DIMENSIONS, SHALL CONFORM TO THE VERTICAL DIAMETER OF THE PIPE.

REVISIONS		
DESCRIPTION	NAME	DATE
CITY ENGINEER		DATE

CITY OF MADISON

CONCRETE HEADWALL - DOUBLE ROUND PIPE DETAIL

	STM-151A STD. DWG NO.
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CROSS SECTION

END ELEVATION

REVISIONS

DESCRIPTION	NAME	DATE

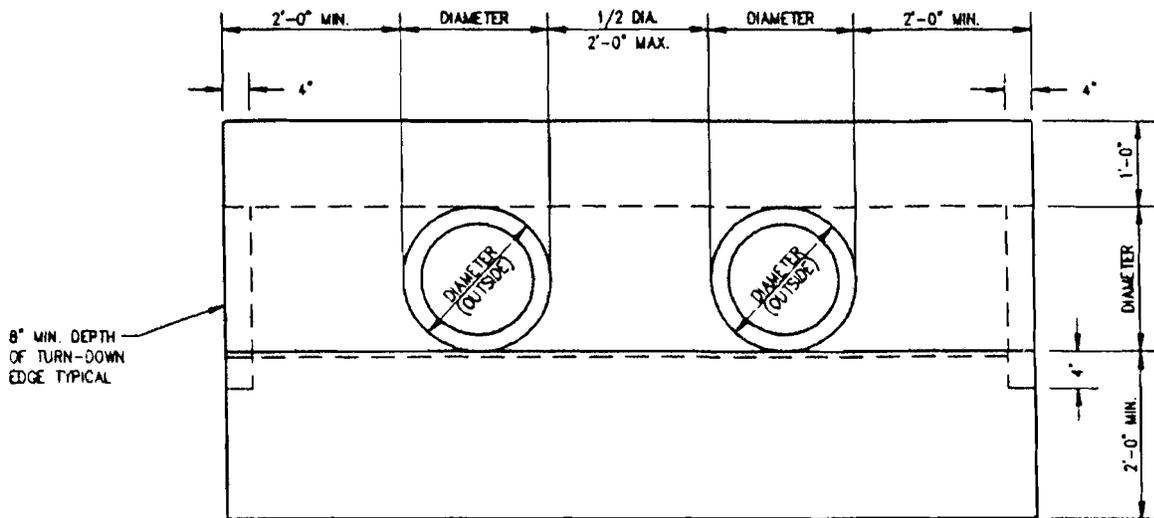
CITY OF MADISON

CONCRETE HEADWALL - DOUBLE ROUND PIPE DETAIL

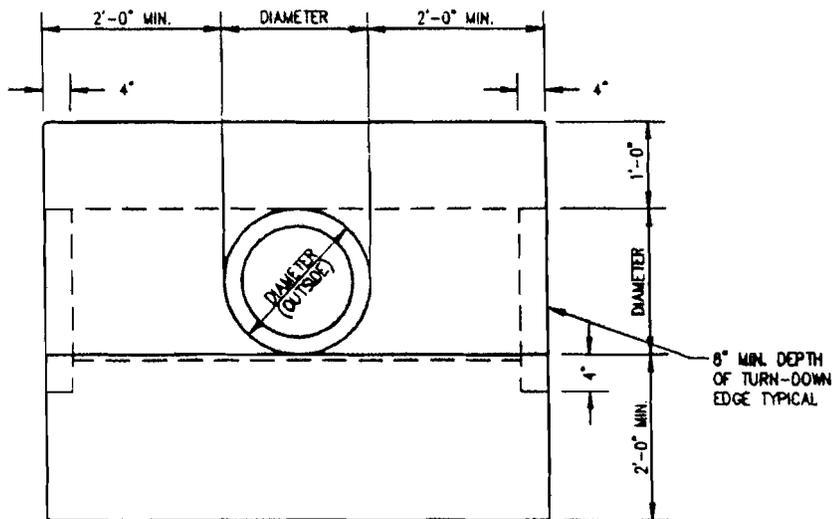
CITY ENGINEER

DATE

STM-151B
STD. DWG NO.



ELEVATION OF DOUBLE PIPE HEADWALL/ENDWALL



ELEVATION OF SINGLE PIPE HEADWALL/ENDWALL

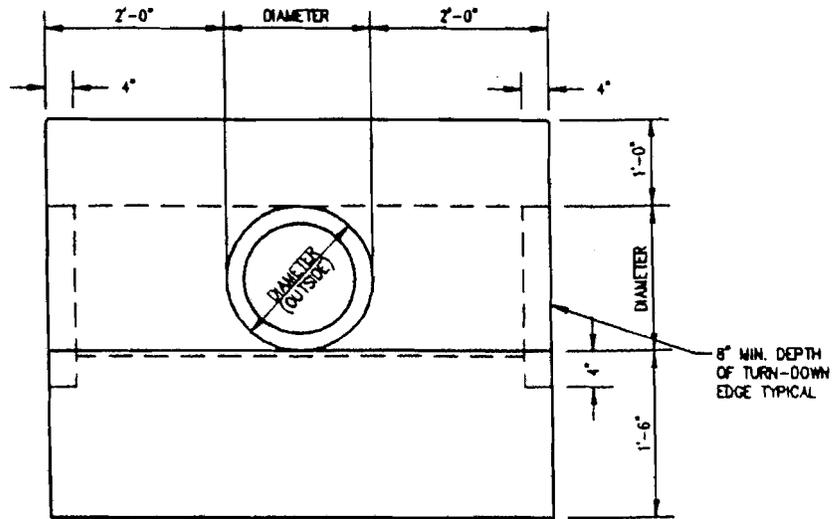
REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	CONCRETE SLOPE PAVED HEADWALL/ENDWALL ROUND PIPE DETAIL	
CITY ENGINEER		DATE		STM-152A STD. DWG NO.

DIMENSIONS FOR ROUND PIPE								
DIAMETER		OPEN AREA	2 TO 1 SLOPE			3 TO 1 SLOPE		
INCHES	FT & IN		B	C	D	B	C	D
8"	0'-8"	0.4	1'-6"	4'-8"	1'-0"	2'-2"	4'-8"	1'-0"
10"	0'-10"	0.5	1'-11"	4'-10"	1'-3"	2'-8"	4'-10"	1'-3"
12"	1'-0"	0.8	2'-5"	5'-0"	1'-6"	3'-2"	5'-0"	1'-6"
15"	1'-3"	1.2	2'-10"	5'-3"	1'-11"	4'-0"	5'-3"	1'-11"
18"	1'-6"	1.8	3'-3"	5'-6"	2'-3"	4'-9"	5'-6"	2'-3"
21"	1'-9"	2.4	3'-11"	5'-9"	2'-7.5"	5'-7"	5'-9"	2'-7.5"
24"	2'-0"	3.1	4'-6"	6'-0"	3'-0"	6'-4"	6'-0"	3'-0"
30"	2'-6"	4.9	5'-3"	6'-6"	3'-9"			
36"	3'-0"	7.1	6'-9"	7'-0"	4'-6"			
42"	3'-6"	9.6	7'-0"	7'-6"	5'-3"			
48"	4'-0"	12.6	9'-0"	8'-0"	6'-0"			
54"	4'-6"	15.9	10'-1"	8'-6"	6'-9"			
60"	5'-0"	19.6	11'-3"	9'-0"	7'-6"			
66"	5'-6"	23.8	12'-4"	9'-6"	8'-3"			
72"	6'-0"	28.3	13'-5"	10'-0"	9'-0"			
78"	6'-6"	33.2	14'-7"	10'-6"	9'-9"			
84"	7'-0"	38.5	15'-8"	11'-0"	10'-6"			
90"	7'-6"	44.2	16'-10"	11'-6"	11'-3"			
96"	8'-0"	50.3	17'-11"	12'-0"	12'-0"			
102"	8'-6"	56.7	19'-0"	12'-9"	12'-6"			
108"	9'-0"	63.6	20'-2"	13'-6"	13'-0"			
114"	9'-6"	70.9	21'-3"	14'-3"	13'-6"			
120"	10'-0"	78.5	22'-5"	15'-0"	14'-0"			

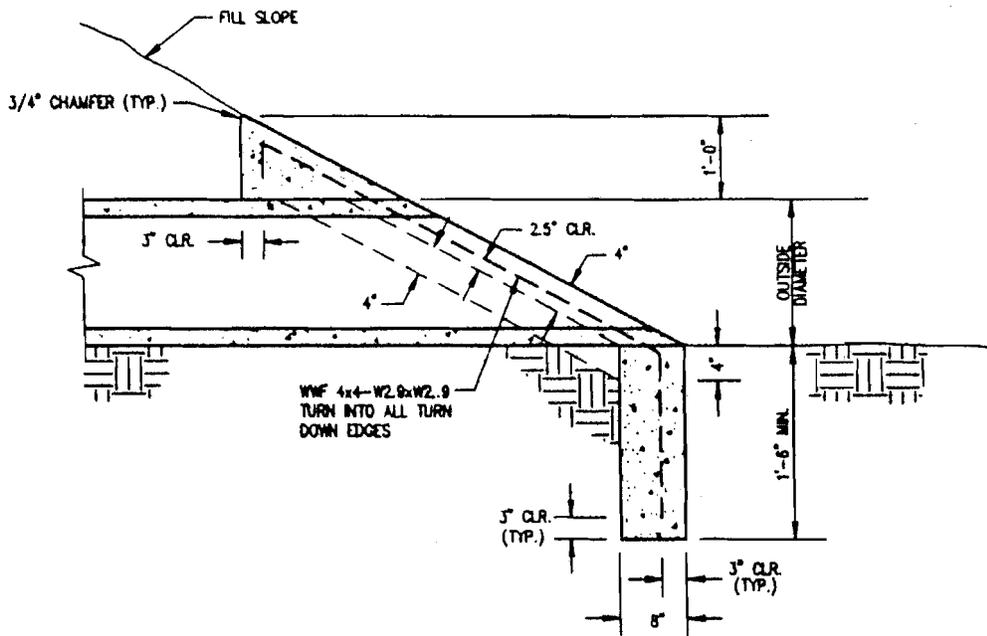
GENERAL NOTES

- THIS HEADWALL IS NOT DESIGNED TO OFFER ANY SUPPORT TO THE PIPE. THE FILL IS TO BE PLACED AND ALL SHORING REMOVED BEFORE THE SLOPE PAVING IS PLACED.
- ALL SLOPE PAVING SHALL CONFORM TO THE CURRENT ALABAMA HIGHWAY DEPARTMENT STANDARD SPECIFICATIONS.
- QUANTITIES SHOWN INCLUDE TWO SLOPE PAVED WALLS AND TWO TOE WALLS.
- CONTRACTOR SHALL INSURE THROUGH MECHANICAL MEANS OR OTHER APPROVED DEVICES THAT CONNECTION BETWEEN BEVELED PIPE END AND CONCRETE WILL NOT BE DETACHED.
- CONCRETE SHALL BE CLASS "A" WITH A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3000 P.S.I.
- PROVIDE 6' x 6' - 5/8 GAGE WELDED WIRE FABRIC FOR PIPES LARGER THAN 36" OR EQUIVALENT.

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	CONCRETE SLOPE PAVED HEADWALL/ENDWALL ROUND PIPE DETAIL	
CITY ENGINEER		DATE		STM-152B STD. DWG. NO.



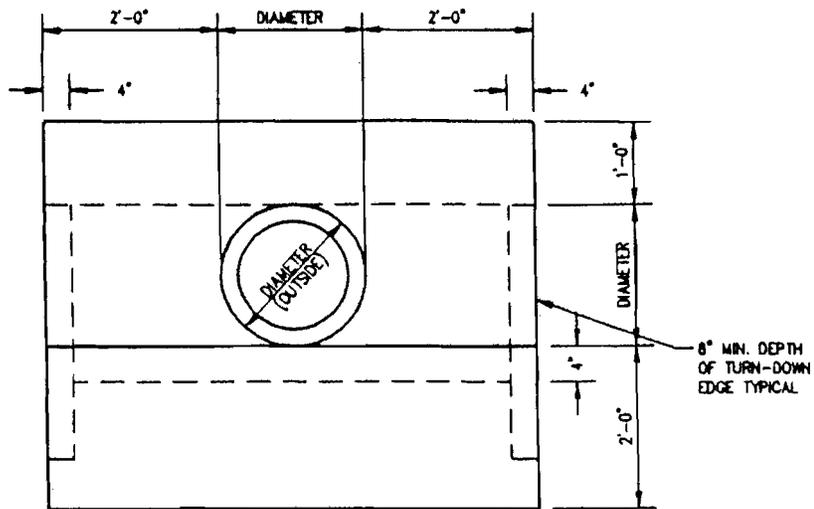
ELEVATION



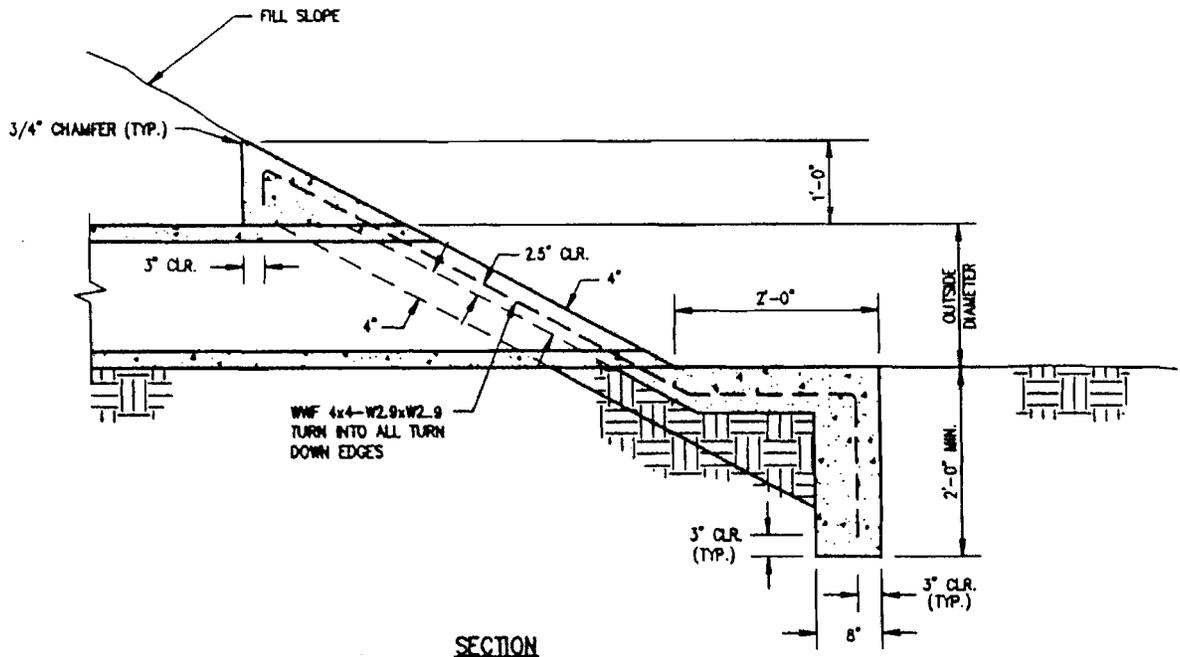
SECTION

NOTE: USE 3/4" CHAMFER ON ALL EXPOSED CONCRETE EDGES.

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	CONCRETE SLOPE PAVED HEADWALL ROUND PIPE DETAIL	
CITY ENGINEER		DATE		STM-152C STD. DWG. NO.



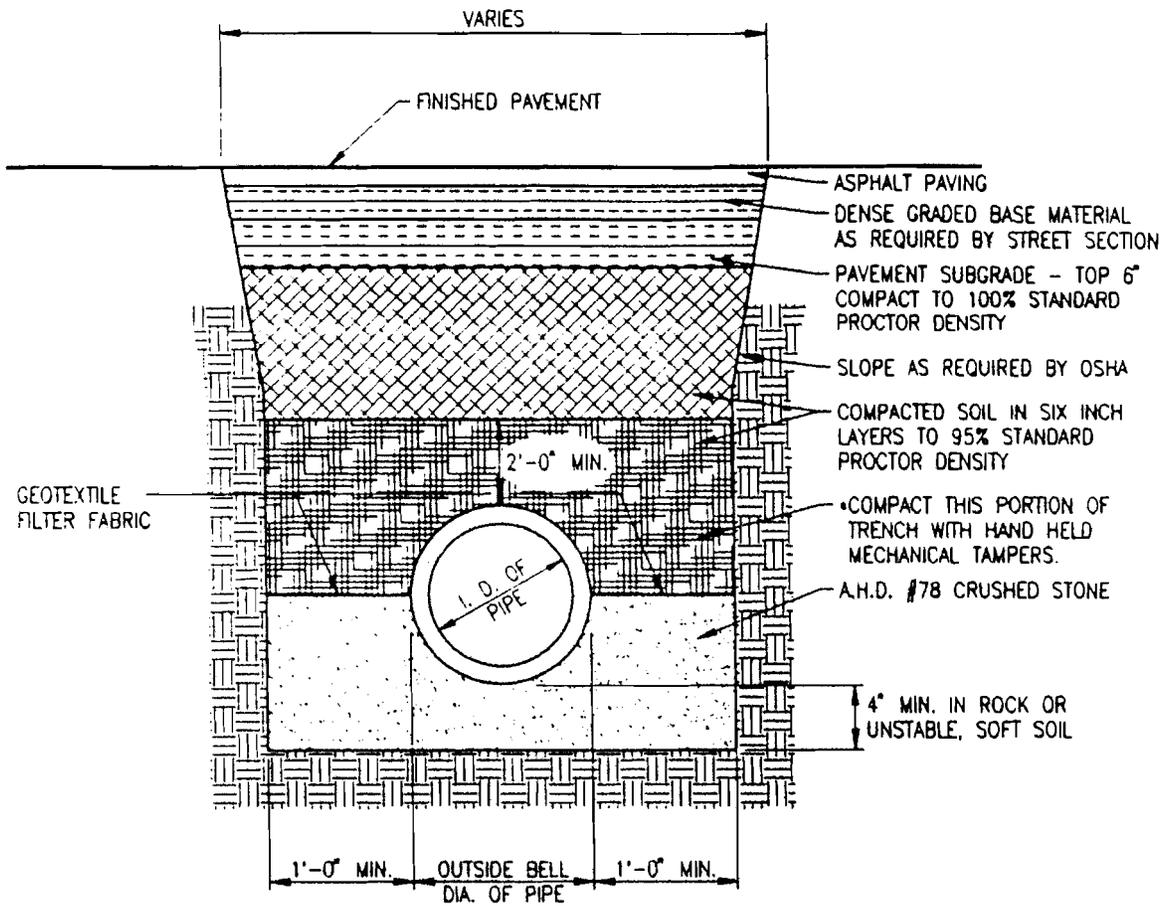
ELEVATION



SECTION

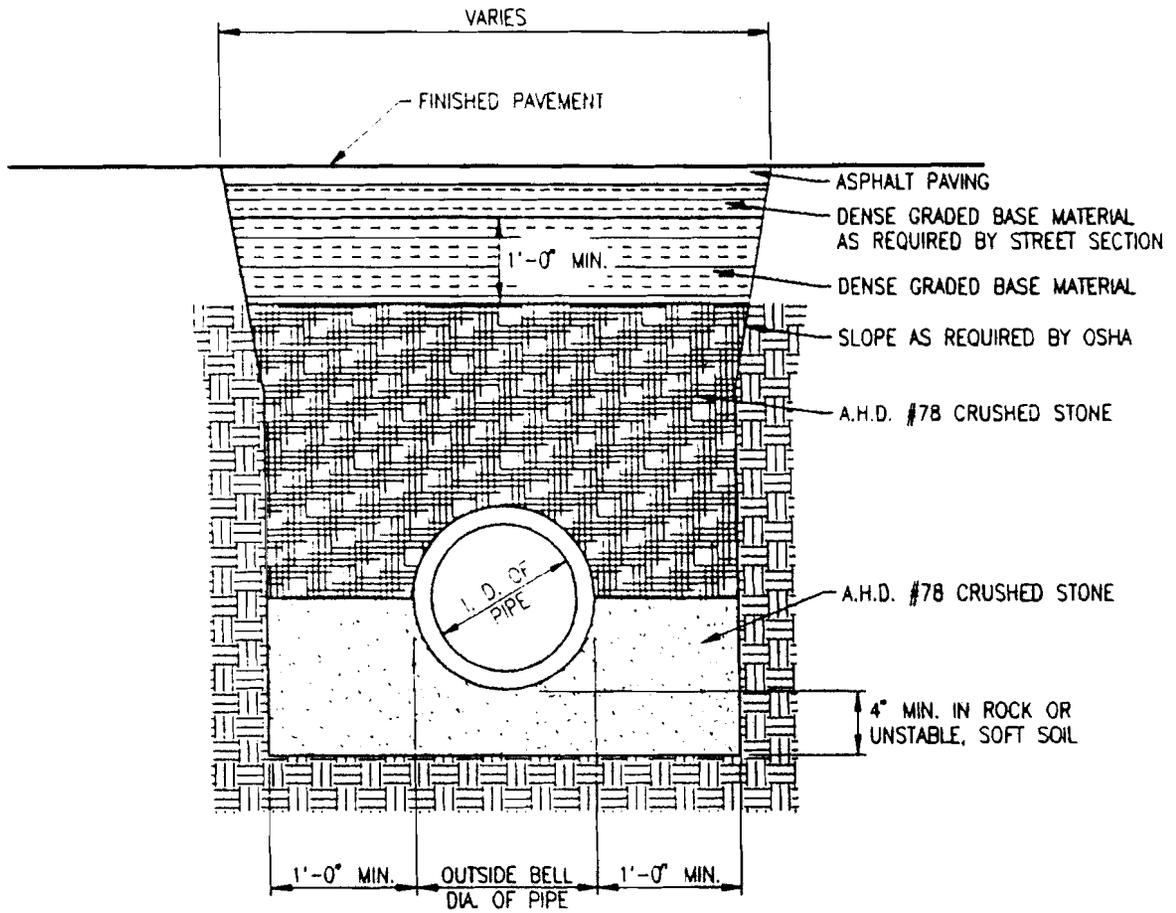
NOTE: USE 3/4" CHAMFER ON ALL EXPOSED CONCRETE EDGES.

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	CONCRETE SLOPE PAVED ENDWALL ROUND PIPE DETAIL	
CITY ENGINEER		DATE		STM-152D STD. DWG NO.

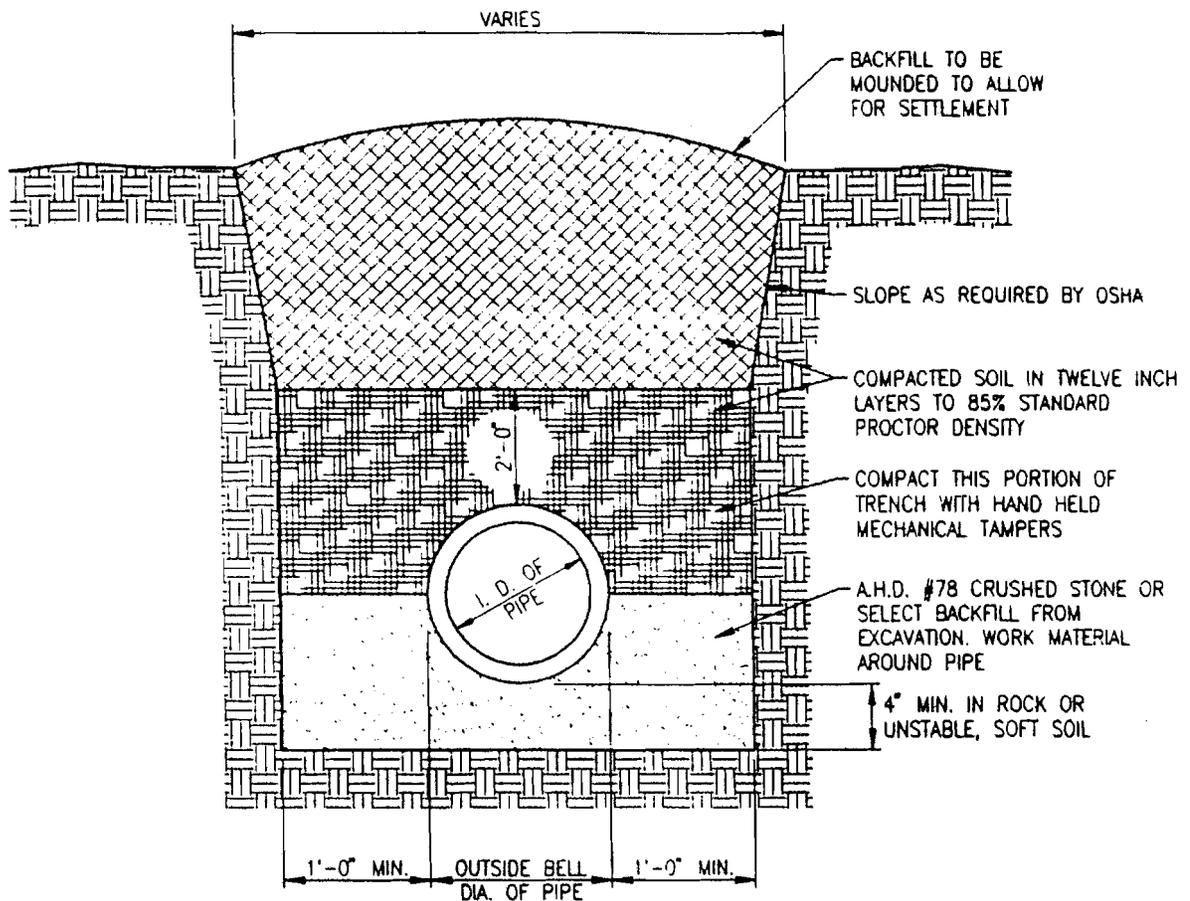


*#78 CRUSHED STONE MAY BE SUBSTITUTED IN THIS AREA, MOVE GEOTEXTILE FILTER FABRIC TO UPPER INTERFACE BETWEEN STONE AND COMPACTED SOIL.

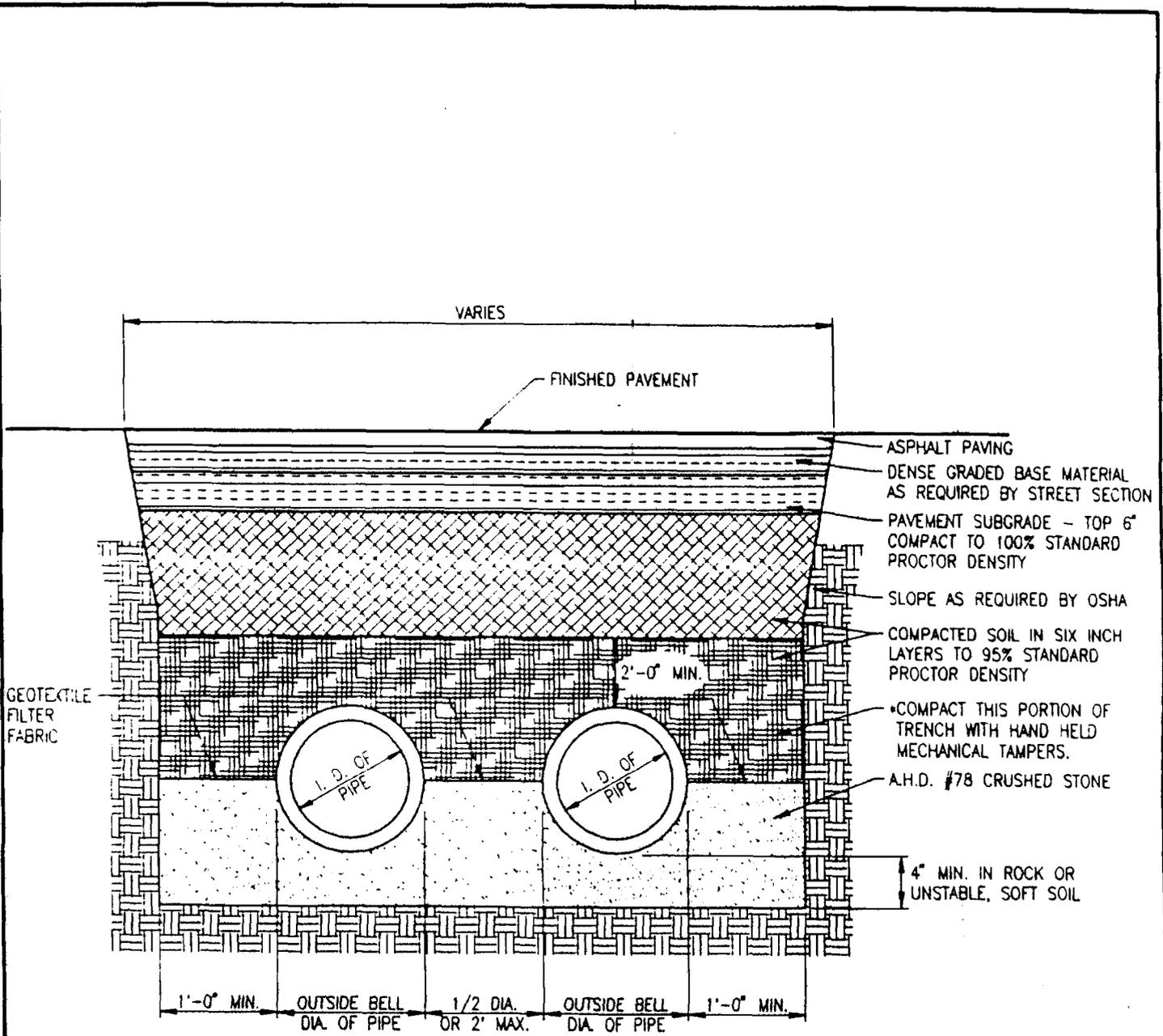
REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	METHOD "A" - PIPE BEDDING DETAIL STORM SEWERS IN PROPOSED TRAFFIC AREAS OR WITHIN STREET RIGHTS-OF-WAY	
CITY ENGINEER		DATE		STM-166A STD. DWG NO.



REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	METHOD "B" - PIPE BEDDING DETAIL STORM SEWERS IN EXISTING TRAFFIC AREAS OR WITHIN STREET RIGHTS-OF WAY	
CITY ENGINEER		DATE	STM-166B STD. DWG NO.	

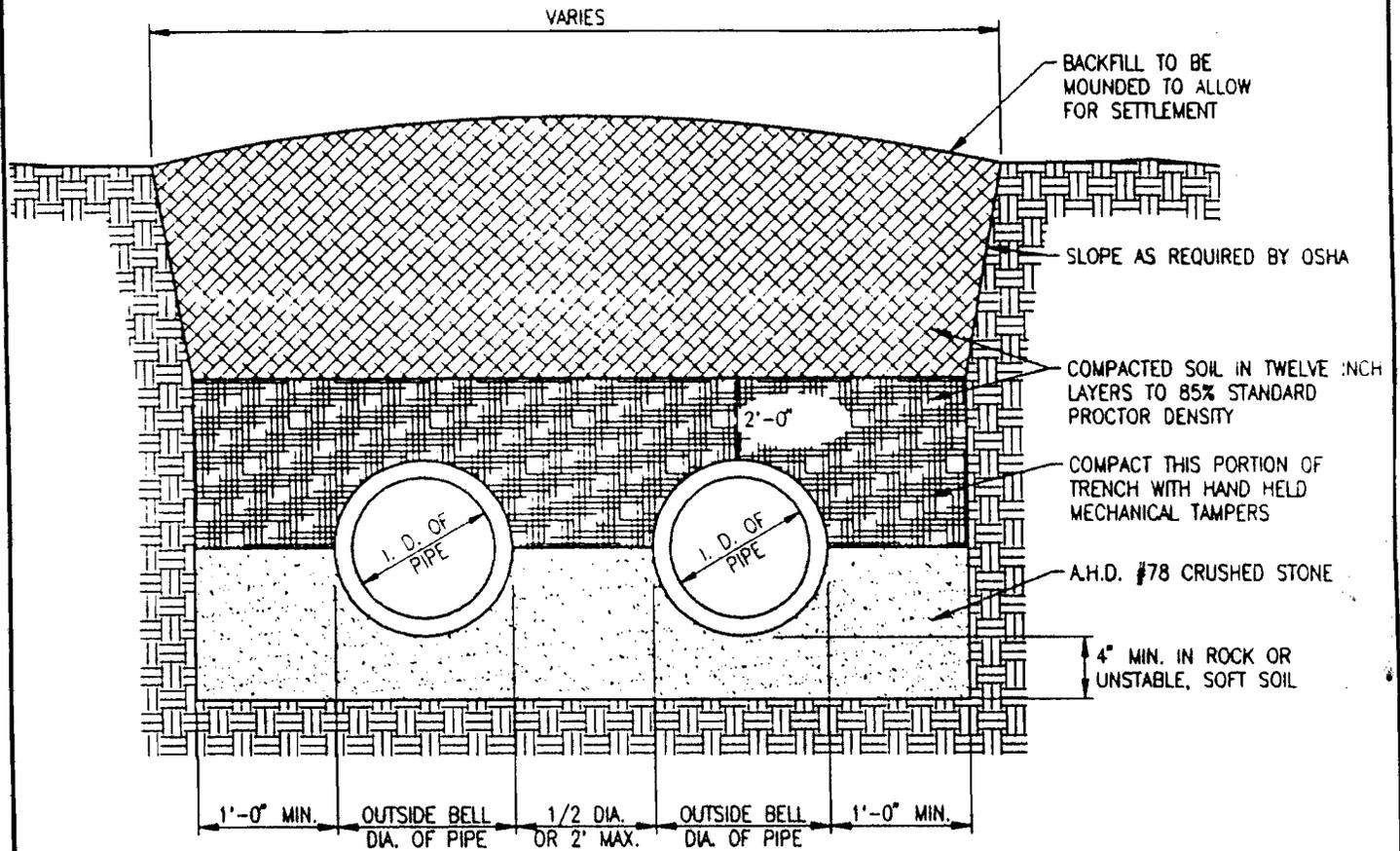


REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE	PIPE BEDDING DETAIL STORM SEWERS IN NON-TRAFFIC AREA	
CITY ENGINEER		DATE		STM-166C STD. DWG. NO.



*#78 CRUSHED STONE MAY BE SUBSTITUTED IN THIS AREA, MOVE GEOTEXTILE FILTER FABRIC TO UPPER INTERFACE BETWEEN STONE AND COMPACTED SOIL.

REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE		
			METHOD "A" - DOUBLE PIPE BEDDING DETAIL	
			STORM SEWERS IN PROPOSED TRAFFIC AREAS	
			OR WITHIN STREET RIGHTS-OF-WAY	
CITY ENGINEER		DATE		STM-166D STD. DWG NO.



REVISIONS			CITY OF MADISON	
DESCRIPTION	NAME	DATE		
			METHOD "B" - DOUBLE PIPE BEDDING DETAIL STORM SEWERS IN NON-TRAFFIC AREA	
CITY ENGINEER		DATE		STM-166E STD. DWG. NO.