

CLAY COUNTY



TECHNICAL SPECIFICATIONS AND DESIGN CRITERIA

FOR PUBLIC IMPROVEMENT PROJECTS

November 8, 1999

Prepared by Clay County Highway Department/PWD

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GENERAL PROVISIONS:

The provisions in this section shall be considered as applicable to all parts of these specifications including all revisions or supplements.

A. DEFINITIONS. Whenever the following words, phrases, or abbreviations appear in these specifications, they shall have the following meanings:

1. County shall mean the Clay County Highway Department/PWD, Missouri, a municipal corporation, acting by and through its duly elected governing body and its duly appointed officials.
2. Engineer shall mean the Highway Administrator of the Clay County Highway Department/PWD and/or his/her authorized representatives acting on behalf of the County.
3. Design Engineer shall mean a Missouri licensed Engineer under contract to the developer or the Clay County Highway Department/PWD for the purpose of preparing and sealing Engineering design drawings for a specific public improvement project.
4. Inspector shall mean an authorized representative of the County Engineer who has been assigned to assure conformance to the requirements of these specifications by the contractor and/or developer.
5. Contractor shall mean the individual, firm, partnership, joint venture, corporation, or association contracting with the County, or private owner, to perform the work.
6. Permit shall mean the official document issued by the County, authorizing the construction of an improvement, subject to County inspection, control and approval.
7. Standard Specifications shall mean the official standard specifications, as adopted by the County Commission.
8. Work or The Work shall mean the furnishing of all labor, materials, equipment and other incidentals necessary for the successful completion and the carrying out of all duties and obligations imposed by the contract or permit.
9. Surety shall mean the corporation, partnership or individual, duly licensed and authorized to do business in Missouri, who is bound with and for the Contractor to assume legal liability for the faithful performance of the contract.
10. Private Owner, or Developer shall mean the individual, corporation, partnership, joint venture, association or other legal entities paying all costs associated with the construction of an improvement under a permit granted by the County.
11. Sub-Contractor is any individual, firm, partnership, corporation, or association licensed or otherwise authorized by law to do business in Missouri, to whom the Contractor, with written consent of the County, sublets a part of the work.

12. Plans shall mean the official drawings, standard plans, profiles, and typical cross sections all as specified in the Special Provisions and supplemental drawings or reproduction thereof, approved and furnished by the Engineer which show the location, character, dimensions and details of the work. All such plans are to be considered as a part of the contract whether attached or separate.
13. Performance and Maintenance Bond and Payment, Labor, Materials bond shall mean the approved form of security furnished by the Contractor and his surety.
14. Extra Work is work over and above that called for in the Contract.
15. Calendar Day is every day shown on the calendar and shall mean a day of twenty-four (24) hours measured from midnight to the next midnight.
16. Or Equal. In order to establish a basis of quality for items of the work, certain processes, equipment, proprietary products or materials and their manufacturer may be mentioned by name. Such mention is not intended to exclude other processes, equipment, proprietary products or materials and their manufacturers, provided they are proven by the Contractor, to the satisfaction of the Engineer, to be equal in quality and performance to the same specified prior to their inclusion in the work.
17. Land, Right-of-Way or Easement shall mean the land provided by the County upon which to construct the work.
18. Construction Easement shall mean the land provided temporarily by the County for use by the Contractor during the construction of the work.

Whenever the words "as directed", "as required", "as permitted", or words of like meaning are utilized it shall be understood that the directions, requirements, or permission of the Engineer is intended. Similarly, the words, "approved", "acceptable", and "satisfactory" shall refer to approval of the Engineer.

B. REFERENCED STANDARDS. Whenever references are made to standard specifications, methods of testing, materials codes, practices, and requirements it shall be understood that the latest revisions of said references shall govern unless a specific revision is stated. Wherever any of the following abbreviations appear they shall have the following meaning:

- | | |
|----------------|--|
| A.A.S.H.T.O. - | American Association of State Highway Transportation Officials |
| A.C.I. - | American Concrete Institute |
| A.I.S.C. - | American Institute of Steel Construction |
| A.W.S. - | American Welding Society |
| A.P.W.A. - | Kansas City Metropolitan Chapter of the American
Public Works Association |
| A.R.E.A. - | American Railway Engineering Association |
| A.S.A. - | American Standards Association |
| A.S.T.M. - | American Society for Testing and Materials |
| A.N.S.I. - | American National Standard Institute |

A.W.W.A. -	American Water Works Association
C.R.S.I. -	Concrete Reinforcing Steel Institute
M.C.I.B. -	Mid-West Concrete Industry Board, Inc.
W.P.C.F. -	Water Pollution Control Federation
M.U.T.C.D. -	Manual of Uniform Traffic Control Devices
M.H.T.D. -	Missouri Highway & Transportation Department
I.T.E. -	Institute of Traffic Engineers

Where the words "these specifications" appear or words of similar connotation are used it shall be understood that such reference refers to the "Technical Specifications for Public Improvement Projects" of the Clay County Highway Department/PWD.

C. PERMIT FOR CONSTRUCTION. No construction of any public improvement project shall be undertaken until the following criteria and requirements have been fully met unless otherwise allowed by the County Engineer.

1. Contract plans and specifications have been submitted to and approved by the County Engineer.
2. A plan review fee of Fifty (50) Dollars will be required for completed construction plans.
3. A suitable performance and maintenance bond submitted to and approved by the Engineer and placed on file with the County. The amount of the bond shall be one hundred ten (110) percent of the contract price. Bonds for street construction shall include work associated with grading and subgrade preparation, curbing, paving, seeding, erosion control, and traffic control signs. Storm sewer work shall be bonded as a part of the roadway construction. Bonds for subdivision construction will be in the form of an irrevocable letter of credit approved by the county counselor.
4. Payment to the County of an amount equal to the following for each type of public improvement project;

↳ Water lines - Four (4) percent of the total estimated cost of the project.

Storm Sewers - Four (4) percent of the total estimated cost of the project.

Sanitary Sewers - Four (4) percent of the total estimated cost of the project.

Streets and Storm Sewers Combined - Five (5) percent of the total estimated cost of the project.

Inspection Fees – are outlined in table IV “Highway Fees”, page 9 of the Clay County Code of Ordinances.

Such payment shall only be required in connection with private developer projects and shall be payable to the Clay County Highway Department, Clay County Treasurer.

Upon request by the County Engineer, permits for construction shall be accompanied by a copy of the executed contract between the developer and the contractor.

5. Advance notification of a minimum five (5) working days from the contractor prior to actual start of work.
6. Final inspection: Written requests for a final inspection shall be made by the contractor and / or developer thirty (30) days before the two (2) year maintenance period is to expire.

Compliance with the above shall constitute a permit for construction activities. Work discovered underway not complying with these requirements shall be ordered to cease and shall not be allowed to commence until such requirements have been met.

D. AUTHORITY OF THE ENGINEER. The County Engineer is designated by the Clay County Commission to exercise all authority on behalf of the County to ascertain that all construction of facilities are equal to or better than the minimum construction requirements set forth in these specifications. The Engineer shall be represented by a project inspector to check any and all work performed, including all materials to be incorporated in the work, and all construction methods and practices. The Engineer shall have the sole authority to issue, in writing, any deviations from the provisions of these specifications or changes to any previously approved drawing.

E. OBSERVATION OF THE WORK.

1. General:

- a. All materials and workmanship shall be subject to observation, examination, or test by the Clay County Highway Department/PWD and the Engineer or his representative at any and all times during construction and at any and all places where such construction is carried on. The Clay County Highway Department/PWD shall have the authority to reject defective material and workmanship or require its correction. Unacceptable workmanship shall be satisfactorily corrected. Rejected material shall be promptly segregated and removed from the project area and replaced with material of the specified quality to the satisfaction of the Engineer. If the contractor fails to proceed at once with correction of rejected workmanship or defective material, the Clay County Highway Department/PWD may contract or otherwise have the defects remedied or rejected materials removed from the project area and charge the cost of the same against the contractor, without prejudice to any other rights or remedies of the Clay County Highway Department/PWD.
- b. The contractor and/or developer shall furnish promptly all materials reasonably necessary for any test, which may be required. All tests by the Clay County Highway Department/PWD will be performed in such manner as not to delay the work unnecessarily and will be made in accordance with the provisions of the Technical Specifications.
- c. The contractor and/or developer shall notify the Clay County Highway Department/PWD sufficiently in advance of backfilling or concealing any

facilities to permit proper observation. If any facilities are concealed without approval or consent of the Clay County Highway Department/PWD, the contractor shall uncover for observation and recover such facilities all at his own expense, when so requested by the Clay County Highway Department/PWD.

- d. Neither observing, testing, approval nor acceptance of the work, in whole or in part, by the Clay County Highway Department/PWD or its agents shall relieve the contractor and/or developer or his sureties of full responsibility for materials furnished or work performed not in strict accordance with the specifications.
- e. Any change or deviation from the approved plans and specifications that has been approved by the Engineer must be received by the inspector in writing prior to implementing the change. The inspectors are not authorized to alter any provisions or to issue instructions contrary to these specifications, or to make any revisions to any previously approved drawing.

2. Defective Work:

- a. The term "defective" is used in these documents to describe work that is unsatisfactory, faulty, not in conformance with the requirements of the specifications, or not meeting the requirements of any observation, test, approval, or acceptance required by law or the specifications.
- b. Any defective work may be disapproved or rejected by the County at any time before final acceptance even though it may have been over-looked and/or included in a previous pay estimate.
- c. Contractor and/or developer shall furnish samples of questionable equipment or materials from completed work for testing purposes when required by the Engineer. All costs in connection with the testing of equipment and materials proven to be defective shall be paid by the contractor and/or developer.
- d. Workmanship and or construction materials not conforming to the Clay County Highway Departments specifications shall be removed and/or replaced at the contractor and/or developer's expense..

3. Uncovering Work:

- a. If any work is covered without concurrence of the inspector it must, if requested by the inspector, be uncovered for his observation. Such work will be at the contractor and/or developer's expense unless the contractor and/or developer has given the inspector timely notice and the inspector has not acted within a reasonable time.
- b. Should it be considered necessary or advisable by the Clay County Highway Department/PWD, at any time before final acceptance of the entire work to

make an examination of work already completed by uncovering the same, the contractor and/or developer shall on request promptly furnish all necessary facilities, labor, and material. If such work is found to be defective in any important or essential respect, due to fault of the contractor and/or developer or his subcontractors, the contractor and/or developer shall defray all the expenses of such examination and of satisfactory reconstruction.

F. WEEKEND OR HOLIDAY WORK. Work on Saturdays or legal holidays shall be as approved by the County Engineer. Such approval shall be granted only upon advance notification of a minimum five (5) working days prior to the anticipated date of the work to be performed. Sunday work will not be allowed under any circumstance unless an emergency exists of life or property. Legal holidays observed by the Clay County Highway Department/PWD are New Year's Day, Martin Luther King Day, Lincoln's Birthday, President's Day, Truman's Birthday, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, the day following Thanksgiving, and Christmas. The actual days off for these holidays may vary and in certain situations additional days may be a part of the amount of time granted as an official holiday by the Clay County Highway Department/PWD. It shall be the contractor and/or developer's responsibility to obtain these days prior to the actual request for inspection services.

G. BONDS. A suitable performance and maintenance and payment, labor, and materials bond shall be furnished to the Clay County Highway Department/PWD guaranteeing the proper completion and maintenance of the construction involved in the public improvement project. The performance bond shall be in an amount equivalent to one hundred ten (110) percent of the full cost of the improvement. The maintenance bond shall remain in effect for a period of two (2) years for all public improvement projects and shall be in an amount of the full cost of the improvement. A private developer will be required to submit an irrevocable letter of credit for one hundred ten (110) percent of the total project for the performance bond and one hundred (100) percent for the two (2) year contractor and/or developer maintenance bond.

No project shall be accepted by the County prior to the submittal and acceptance of the two (2) year contractor and/or developer maintenance bond by the County Engineer and the County Commission.

H. INSURANCE. The contractor for public and private developer projects will be required to carry insurance as stipulated in the General conditions hereto attached, during the lifetime of this contract. Minimum limits for Public Liability and property damage Insurance required as \$1,000,000.00 umbrella coverage.

1. Bodily Injury Liability:

- a. One person.....\$1,000,000.00
- b. One Accident.....\$1,000,000.00

2. Property Damage:

- a. One Accident.....\$1,000,000.00
- b. All Accidents.....\$1,000,000.00

Minimum limits for automobile liability insurance required are a \$1,000,000.00 umbrella coverage.

1. Bodily Injury Liability:

- a. One person.....\$1,000,000.00
- b. One Accident.....\$1,000,000.00

2. Property Damage

- a. Each Occurrence.....\$1,000,000.00

I. CHANGES IN THE WORK. Changes in the work from the approved project plans shall be made only upon the written consent of the County Engineer. All proposed changes must be submitted to the County Engineer (by the design Engineer) to receive written approval by the County. Said written approval shall be received by the inspector prior to implementing the deviation. Any change in the work made without the consent of the County Engineer shall be subject to removal by the contractor and/or developer at his expense.

I. CORRELATION AND INTENT OF DOCUMENT. The plans and specifications are intended to supplement each other. Any work shown on the Plans and not mentioned in the Specifications (or vice versa) shall be as binding and shall be completed the same as if mentioned or shown on both. In case of conflict between the Plans and Specifications, the order of precedence shall be:

First	Special Provision
Second	Detail Plans
Third	Standard Plans
Fourth	Standard specifications

The general character of the detailed work is shown on the plans, but minor modifications may be made in the full size or scale details. Where the word "Similar" occurs on the plans, it shall be used in its general sense and not as meaning identical, and all details shall be worked out in relation to their location and their connection to the other parts of the work. Where on any plans, a portion of the work is drawn out and the remainder is indicated in outline, the parts drawn out shall apply also to all other like portions of the work. Where ornaments or other details are indicated by starting only, such details shall be continued throughout the courses or parts in which they occur and shall also apply to all other similar parts in the work, unless otherwise indicated. In case of differences between small and large scale drawings, the larger scale drawings shall govern.

J. ERRORS AND OMISSIONS. The contractor and/or developer shall check over the plans before beginning construction work, and if errors or omissions are discovered, he shall call them to the attention of the Engineer before proceeding with the work. In no case will the contractor and/or developer make the corrections without first consulting the Engineer. In case revised plans of a supplementary or explanatory nature are necessary or desirable for clarification or to correct any errors and omissions, they will be furnished by the Engineer or Design Engineer as required.

K. TRAFFIC CONTROL. The flow of traffic in street and access to private property shall be reasonably maintained at all times. The contractor and/or developer shall provide a safe roadway, and shall erect and maintain warning signs, barricades and sufficient safeguards around all excavations, embankments, and obstructions. The contractor and/or developer shall provide suitable warning lights or flares and shall keep them lighted from one-half hour prior to sunset until one-half hour after sunrise and all other times when visibility is limited. The contractor and/or developer shall further provide such flagmen and watchmen as required by the Engineer or inspector for the protection of the public. The design, placement and maintenance of traffic control devices shall correlate with and so far as possible conform to the system set forth in the most recent edition of the Manual on Uniform Traffic Control Devices for Streets and Highways.

The roadway shall be properly maintained and the contractor and/or developer shall coordinate his operations with the County Engineer in order that suitable arrangements may be made for detours, parking, access to private property, etc. Whenever a street is closed or partially closed, the Clay County Highway Department/PWD must approve and the Sheriff Department, school districts and Fire Department shall be notified of the closing at least twenty-four (24) hours in advance, and also when normal service is resumed. In the event it is determined that the contractor and/or developer is not maintaining a safe roadway, the Engineer may improve the roadway conditions at the contractor and/or developer's expense.

L. CONTRACT TIME FOR COMPLETION OF THE WORK. When the time for the completion of the work is specified, it is an essential part of the contract. The Contractor and/or developer will not be entitled to any extension of contract time because of unsuitable weather conditions unless suspension of the work for such conditions was authorized in writing by the Engineer.

The Engineer may make allowances for time lost due to causes which he deems justification for extension of contract time. If the Contractor and/or developer claims an extension of contract time on the grounds that he is unable to work due to causes beyond his control, written notice of intention to claim an extension of contract time on the above grounds shall be filed with the Engineer at the time the cause or causes occur. The claim shall be filed in writing within thirty (30) days after the claimed cause for the delay has ceased to exist and shall include a statement of the reasons for the delay, proof to establish the claim, and a statement of the number of days the contractor and/or developer was delayed.

M. LIQUIDATED DAMAGES FOR FAILURE OR DELAY IN COMPLETING WORK ON TIME. Time is an essential element of the contract, and it is therefore important that the work be pressed vigorously to completion. Should the Contractor and/or developer or, in case of default, the surety fail to complete the work within the time specified in the contract, or within such extra time as may be allowed, a deduction of an amount as set out in the contract will be made for each and every calendar day that such contract remains uncompleted after the time allowed for the completion. The said amount set out in the contract is hereby agreed upon, not as a penalty, but as liquidated damages for loss to the Clay County Highway Department/PWD and the public, after the expiration of the time stipulated in the contract, and will be deducted from any money due the Contractor and/or developer under the contract, and the Contractor and/or developer and his surety shall be

liable for any and all liquidated damages. Permitting the Contractor and/or developer to continue to finish the work or any part of it after expiration of the specified time, or after any extension of the time, shall in no way operate as a waiver on the part of the Clay County Highway Department/PWD of any of its rights under the contract. This section shall not apply to private subdivision developers unless otherwise noted.

- N. COOPERATION BY CONTRACTOR. The Contractor and/or developer shall give the work the constant attention necessary to facilitate the progress thereof, and shall cooperate with the Engineer and other contractor and/or developers in every way possible.

The Contractor and/or developer shall have on the work at all times, as his agent, a competent superintendent capable of reading and thoroughly understanding the plans and specifications and thoroughly experienced in the type of work being performed, who shall receive instruction from the Engineer. The superintendent shall have full authority to execute orders or directions of the Engineer without delay, and to promptly supply such materials, equipment, tools, labor, and incidentals as may be required. Such superintendence shall be furnished regardless of the quantity of work sublet.

- O. COOPERATION BETWEEN CONTRACTORS. The County reserves the right at any time to contract for and perform other or additional work on or near the work covered by the contract for county public works projects.

If separate contracts are let within the limits of any one project, each contractor and/or developer shall conduct his work so as not to interfere with or hinder the progress of completion of the work being performed by other contractor and/or developers. Contractors and/or developers working on the same project shall cooperate with each other as directed.

Each Contractor and/or developer involved shall assume all liability, financial or otherwise, in connection with his contract and shall protect and save harmless the County from any and all damages or claims that may arise because of inconvenience, delay, or loss experienced by him because of the presence and operations of other contractors working within the limits of the same project.

The Contractor and/or developer shall arrange his work and shall place and dispose of the materials being used so as not to interfere with the operations of the other contractors within the limits of the same project. He shall join his work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the others.

- P. COOPERATION WITH UTILITIES. The Contractor and/or developer shall notify all railroad and utility owners, all pipe line owners, or other parties affected, and endeavor to have all necessary adjustments of the public or private utility fixtures, pipe lines, and other appurtenances within or adjacent to the limits of construction, prior to commencing work on the project.

Water lines, gas lines, wire lines, service connections, water and gas meter boxes, water and gas valve boxes, light standards, cableways, signals, and all other utility appurtenances within the limits of the proposed construction which are to be relocated or adjusted are to be moved by the owners except as otherwise provided or as noted on the plans.

The Contractor and/or developer shall coordinate his operations with the work of owners making necessary adjustments, removals, or construction of new fixtures, and shall permit free access to the site for such work.

It is understood and agreed that the Contractor and/or developer has considered in his bid all of the permanent and temporary utility appurtenances in their present or relocated positions whether or not shown on the plans and that no additional compensation will be allowed for any delays, inconvenience, or damage sustained by him due to any interference from the said utility appurtenances or the operation of moving them.

Should there be located within the right-of-way public or private utility facilities which are to remain in place and which will interfere with the Contractor and/or developer's proposed methods of operation, the Contractor and/or developer shall make all necessary arrangements with the owners for any temporary or permanent removal or relocation of such facilities desired for his convenience. Any cost involved shall be borne by the Contractor and/or developer.

The Contractor and/or developer shall use every precaution necessary to prevent damage to all public and private utility wires, lines, pipes, poles, cables, and conduits within the right-of-way. The Contractor and/or developer shall be responsible for all damage to any utility facility due directly to his operations regardless of location and he shall repair and replace as necessary any such damaged facility or make payment to the owner for repair or replacement.

Q. USE OF PRIVATE PROPERTY. The Contractor and/or developer shall confine his work to the County's premises, including construction easements and construction permit lines. He shall not enter upon or place materials on any private premises except by written consent of the individual owners, and he shall save the County harmless from all suits and actions of every kind and description that might result from his use of private property.

R. DAMAGES. The Contractor and/or developer hereby expressly binds himself or itself to indemnify and save harmless the County and its officers and employees for any and all expenses, including reasonable attorney's fees, against all suits or actions of every kind and nature brought or which may be brought, or sustained by any person, firm, or corporation, or persons, firms or corporations, in connection with or on account of the contractor and/or developer's work or in consequence of any negligence in connection with same, or on account of any poor workmanship, or on account of any act of commission or omission of the contractor and/or developer or his, its, or their agent or employees, or for any cause arising during the course of construction.

The Contractor and/or developer shall further indemnify the Clay County Highway Department/PWD for any and all expenses, including reasonable attorney's fees, incurred in the County's pursuing any remedial action required to correct deficiencies in the work on account of poor workmanship, his negligence, or for any act of omission of the contractor and/or developer or his, its, or their agents or employees.

The County may retain from any payment due or to become due the Contractor and/or developer such sums as are deemed necessary to protect its interests until all such claims or suits have been settled or disposed of and suitable evidence to that effect furnished to the County.

S. CLEANING UP. The Contractor and/or developer shall frequently clean up all refuse, rubbish scrap materials, and debris as a result of his operations, so that at all times the site of the work shall present a neat, orderly, and workmanlike appearance. As may be ordered by the Engineer, and immediately after completion of the work, the Contractor and/or developer shall at his own expense clean-up and remove all refuse and unused materials of any kind resulting from the work. Upon failure to do so within seventy-two (72) hours after such request by the Engineer, the work may be done by the County and cost thereof charged to the Contractor and/or developer and deducted from his/her final payment (if applicable). Upon completion of the work, the Contractor and/or developer shall remove all his/her equipment and put the area of the work in a neat and clean condition and do all other cleaning necessary to complete the work in a workmanlike manner satisfactory to the Engineer.

T. PROTESTS. If the Contractor and/or developer considers any work demanded of him by the inspector to be outside the requirements of the specifications, he shall immediately ask for a written decision or instructions and shall proceed to perform the work to conform with the inspector's ruling. If the Contractor and/or developer considers such instructions unsatisfactory, he shall, within twenty-four (24) hours after their receipt, file a written protest with the Engineer, stating his objections and the reasons therefore. Unless protests or objections are made in the manner specified and within the time limit stated herein, the contractor and/or developer hereby waives all ground for protest.

U. CONTRACTOR'S RESPONSIBILITY FOR WORK. Until work is accepted by the Engineer, it shall be in the custody and under the charge and care of the Contractor and/or developer, who shall take every precaution against damage to the work, by action of the elements or any other cause. The Contractor and/or developer shall rebuild, repair, restore and make good, at his own expense, all damages to any portion of the work before its completion and acceptance.

V. FINAL INSPECTION. As soon as practical after completion, the entire work will be examined thoroughly by the Engineer. The Contractor and/or developer will be notified when the examination is to be made so that he, his representative or both may be present.

If the inspection reveals any defective or unsatisfactory work, it shall be replaced or repaired as the Engineer may order before final acceptance. The cost of all such repairs and replacements shall be borne by the Contractor and/or developer.

W. ACCEPTANCE OF WORK.

1. Partial Acceptance. The County reserves the right to accept and make use of any completed section of the work without obligating the County to accept the remainder of the work or any portion thereof; however, the warranty period shall start when the project is complete and the County has issued the Project Completion Certificate or two (2) year developer maintenance resolution.

2. Final Acceptance. When the final clean-up has been performed, the contractor and/or developer shall notify the inspector in writing that all work has been completed. At the same time, the contractor and/or developer shall notify the design Engineer that the project has been completed and should forward to the design Engineer all changes he has noted on his plans during the course of the work. The design Engineer, based upon noted changes, shall prepare construction record ("as-built") drawings indicating all revisions made during the construction of the project. Upon receiving such notification, the design Engineer shall compute any changes in the original contract amount and send a letter to the County verifying the final contract amount. Within a reasonable time the inspector shall perform all necessary inspection procedures on the completed work. The contractor and/or developer shall receive written notification of any defects in the project. The Project Completion Certificate or two (2) year developer maintenance resolution will be issued after all defects have been corrected and the County has received and accepted construction record ("as-built") drawings accurately and completely depicting all changes made during the course of the work. Issuance of the Project Completion Certificate by the County or two (2) year developer maintenance resolution will not constitute formal acceptance of the project, only the commencement of the maintenance period specified in the maintenance bond form or resolution.

X. WARRANTY INSPECTION. Thirty (30) days prior to the expiration date of the maintenance bond or two (2) year developer maintenance resolution, a warranty inspection will be made. The Contractor and/or developer and surety will notify the Clay County Highway Department/PWD when the final inspection will be made. Within the time period prescribed by the bond or two (2) year developer maintenance resolution, the Contractor and/or developer as ordered by the Engineer shall repair, replace, or rebuild such portions of the work which are found to be faulty because of materials or workmanship. The Contractor and/or developer shall begin the remedial work not later than five (5) days after the order from the Engineer. In case the Contractor and/or developer does not start the remedial work within the above time limit, or in case of an emergency condition caused by faulty work, the County may take remedial action and charge the cost thereof against the Contractor and/or developer and his surety.

After the completed work or project has completed the two (2) year developer maintenance period for private developer projects, the engineer will recommend to the County Commission that the project be accepted into the county system by resolution and release any irrevocable letter or any other bond back to the developer.

SECTION 1000 SITE PREPARATION

1001 SCOPE. This section governs the furnishing of all labor, equipment, tools and materials and the performance of all clearing, grubbing and demolition within the limits of work as defined in Section 1003(A) of this specification, in the Special Provisions or as shown on the plans.

1002 DEFINITIONS.

- A. **Clearing.** shall consist of removing all vegetable matter such as trees, brush, down timber and other objectionable materials found on or above the surface of the site. It shall include removing buildings, fences, lumber, waste dumps and trash and the salvaging of such materials as may be specified and disposing of the debris. The Contractor and/or developer shall scalp all excavation and embankment areas. Scalping shall include the removal of material such as sod, grass, residue or agricultural crops and decayed vegetable matter from the surface of the ground without removing more earth than is necessary.
- B. **Grubbing.** shall consist of removing and disposing of all vegetable matter such as stumps, roots, buried trees and brush encountered below the surface of the ground or sub-grade, whichever is lower, which have not been included in Section 1002(A) entitled "Clearing".

In all cases of grubbing, the vegetable matter shall be removed to a minimum depth of 12 inches below ground line or subgrade, whichever is lower, except as provided in Section 1003(C).

When deleterious materials are encountered below ground line which may be detrimental to the proposed improvement, these shall be removed to a depth necessary to provide adequate support for the proposed improvement.

- C. **Demolition and Removal.** This work shall consist of demolishing, removing and disposing of all structures and improvements within the construction limits unless included in other items of work as shown on the plans or Special Provisions. This work shall apply to all structures and improvements, whether on, above or below the surface of the ground or sub-grade.

Demolition and removal shall include but not be limited to items such as buildings, drainage structures, pipes, pavements, fences, retaining walls, guardrails and signs.

Items such as fences and guardrails shall be salvaged and relinquished to the appropriate owner or relocated, where indicated on the plans.

Relocation of signs, fences, guardrails, etc. shall be considered incidental to removal work except where such relocation is listed separately in the itemized Proposal.

All pipes which are to be abandoned shall be removed unless otherwise shown on the plans or approved by the Engineer.

In removing items such as portland cement concrete pavement, base courses, curbs, curb and gutters, sidewalks, and similar objects where portions of said objects are to be left in place, they shall be removed to an existing joint or to a new joint sawed to a minimum depth of two (2) inches or 1/4 the slab thickness, whichever is greater, with a true line and vertical face. Sufficient portions of these objects shall be removed to provide for the proper grade and connection to the new work.

- D. Trees. Vegetable growth 6 inches in diameter, measured 3 feet above ground shall be classified as a tree.
- E. Brush. Vegetable growth less than 6 inches in diameter, measured 3 feet above ground shall be classified as brush.

1003 CONSTRUCTION DETAILS.

- A. Limits of Work. The limits for clearing, grubbing and demolition shall extend to the construction limits unless otherwise shown on the plans.

In the event construction limits have not been indicated on the plans, the limits for clearing, grubbing, and demolition shall not extend beyond the limits of the right-of-way, County property lines, or easements.

- B. Erosion Control. All erosion control will be placed before any ground breaking will occur. Erosion control will consist of silt fence and or silt straw bales. These will be located on the construction plans at places such as:

1. Behind curbs.
2. In front of curb inlets.
3. Low lying areas.
4. All slopes
5. To protect local properties.

;

Contractor and/or developer will be required to maintain all erosion control measures until project is completely accepted. Once project is accepted all erosion control will be removed by contractor and/or developer.

- C. Silt Fence Construction Specifications:

1. Post which supports the silt fence shall be installed on a slight angle toward the anticipated runoff source and spaced at a maximum eight (8) feet apart or to silt fence manufacturers specifications, whichever is stricter.
2. Silt fence shall be trenched in with a spade or a mechanical trencher so that the downslope face of the trench is flat and perpendicular to the line of flow.
3. The trench should be a minimum of six (6) inches deep and three to four (3-4) inches wide to allow the silt fence to be laid in the in the ground and backfilled.

4. Silt fence should be securely fastened to each support post.
5. Inspection shall be frequent and repair or replacement shall be made as promptly as needed.
6. Silt fence shall be removed when it has served its usefulness.
7. Sediment trapped by this practice shall be uniformly distributed on the source area prior to topsoiling.
8. Silt fence shall be (MIRAFI-100X) filter fabric or an approved equal.

D. Baled Straw or Hay Construction Specifications.

1. Bales shall be placed in a row with ends tightly abutting the adjacent bales.
2. Each bale shall be embedded in the soil a minimum of four (4) inches.
3. Bales shall be securely anchored in place by stakes or re-bars driven through the bales. The first stake in each bale shall be angled toward the previous laid bale to force the bales together. Stakes should be driven flush with the bales.
4. Inspection shall be frequent and repaired and replaced when needed.
5. Bales shall be removed when they have served their usefulness.

E. Protection of Greenery, Existing Structures and Private Facilities. The plans will designate trees, shrubs or other plants that are to be saved and the Contractor and/or developer will take necessary steps to protect this greenery. Trees may be pruned, upon prior approval of the Engineer, but only in accordance with the best practices of arboriculture in respect to the individual species with due regard to their natural form and growth characteristics.

Existing structures within or adjacent to the construction limits that are not to be removed or demolished shall be protected by the Contractor and/or developer during construction. Any private facilities such as house sewer laterals which are disturbed or damaged by the Contractor and/or developer's work, shall be repaired by the contractor and/or developer prior to the close of the workday. This repair shall be made in a manner sufficient to restore utility service to that property.

F. Embankment Area. When undisturbed stumps and roots are encountered where the fill depth will exceed three (3) feet, the stumps and roots may be left in place provided they do not extend more than three (3) inches above the original ground line.

G. Borrow Areas. All stumps, roots and other objectionable matter shall be removed from the borrow material used for embankment or fill. The borrow area shall be left in a well drained and smooth condition.

- H. Backfilling the Site. All trenches, holes, pits and basement areas resulting from the operations of clearing, grubbing, demolition and removal on the site, shall be backfilled with suitable material placed and compacted in conformance with Section 1106 entitled "Embankment".
- I. Disposal of Materials. All materials, with the exception of those which are designated for salvage or which are used in the embankment in conformance with this specification, shall become the Contractor and/or developer's property and shall be disposed of by him outside of the project limits, unless otherwise indicated on the plans.

1004 PROGRESS OF CONSTRUCTION.

- A. Clearing. shall proceed well in advance of the construction operations so as not to delay the progress of the work. The refuse resulting from clearing may be hauled to a waste site secured by the Contractor and/or developer or shall be burned, buried or mulched in such a manner as to meet all laws, regulations, and requirements of any governing authority regarding health, safety, and public welfare. When authorized by the Fire Department, the Contractor and/or developer may dispose of such refuse by burning on the site of the project, provided all requirements as determined by the Fire Department are met. Under no circumstances will the authorization to burn on the site relieve the Contractor and/or developer in any way from damages which may result from his operations. In no case shall any materials be left on the project site, shoved into abutting properties, or buried in embankments or trenches on the site.

- B. Grubbing. shall parallel the clearing as nearly as the sequence of operations will permit.

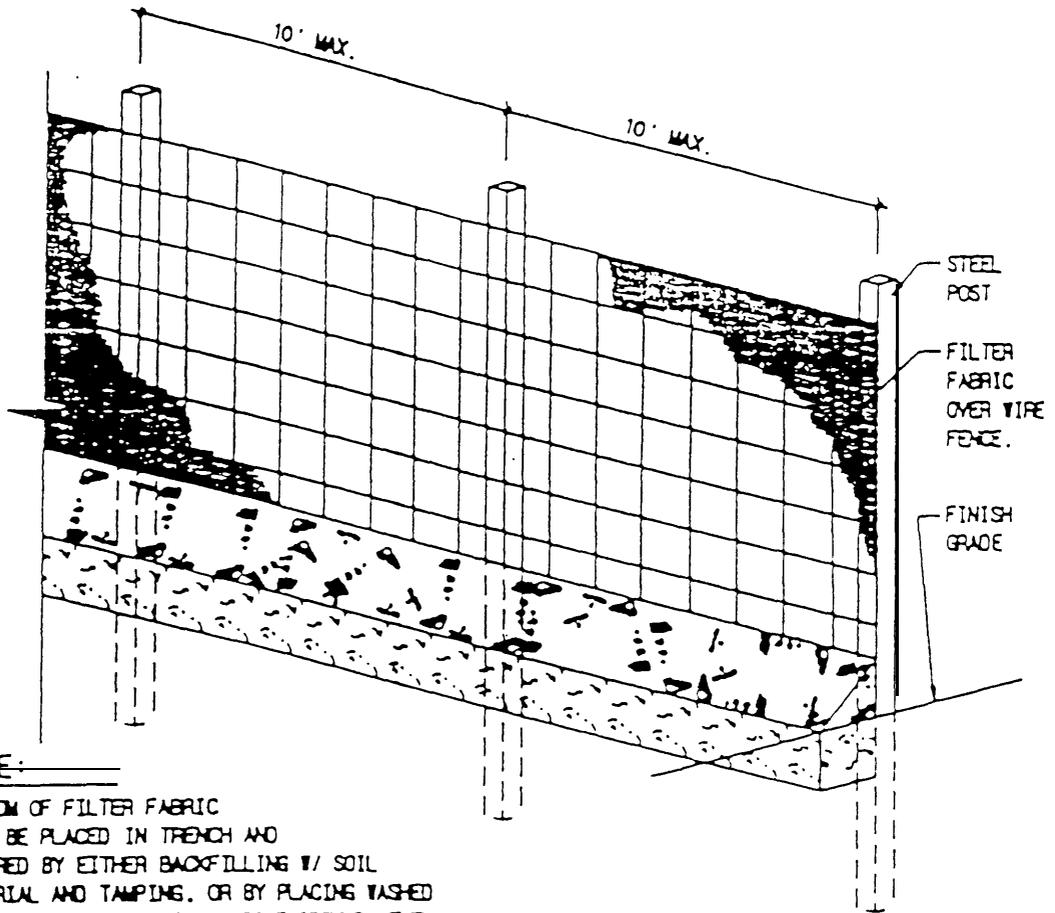
Piling and butts of utility poles within the limits shall be removed to a minimum depth of two (2) feet below the subgrade or the original ground, whichever is lower.

All stumps, roots, and other objectionable matter found within borrow material to be used for embankment or fill material shall be removed.

- C. Demolition. Demolition work shall occur well in advance of the construction operations. Masonry and concrete walls, miscellaneous foundations, or other objects extending below ground shall be removed to a depth of at least twelve (12) inches below the original ground or subgrade, whichever is lower.

When explosives are used in demolition, the Contractor and/or developer shall comply with the provisions of Specification Section 7000 entitled "Blasting".

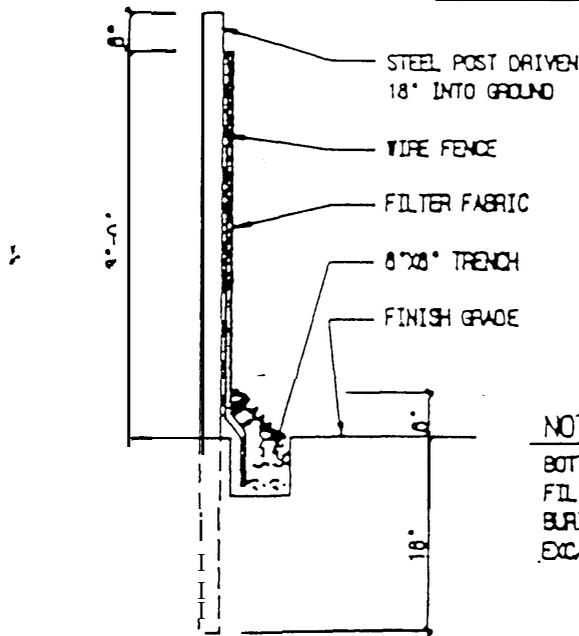
1005 UTILITY COORDINATION. The Contractor and/or developer shall be responsible for protecting any improvement of any agency, public or private, in the vicinity of clearing, grubbing or demolition operations. When necessary, the Contractor and/or developer shall enlist the assistance of the affected agencies in the location of their utilities. The Contractor and/or developer will be responsible for the cost to any agency for assistance in the location of its facilities and for the cost of all damage to such facilities arising from his carelessness or negligence.



NOTE:

BOTTOM OF FILTER FABRIC MUST BE PLACED IN TRENCH AND SECURED BY EITHER BACKFILLING W/ SOIL MATERIAL AND TAMPING, OR BY PLACING WASHED STONE TO A HEIGHT OF 6" ABOVE GROUND LEVEL.

ELEVATION



NOTE:

BOTTOM OF WIRE FENCE & FILTER FABRIC ARE TO BE BURIED IN A 6"x8" EXCAVATED TRENCH.

CROSS-SECTION

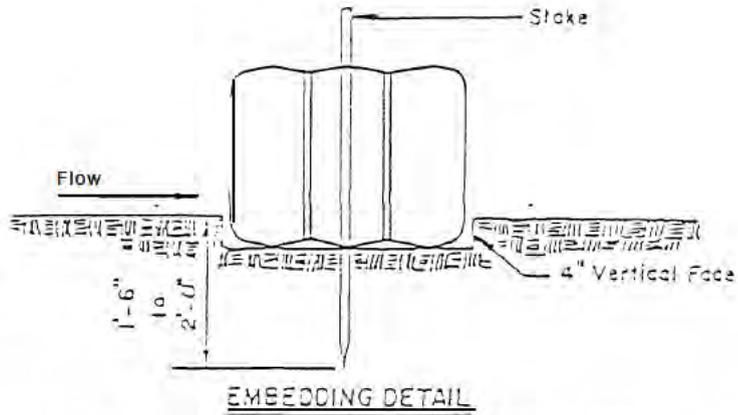
SILT FENCE



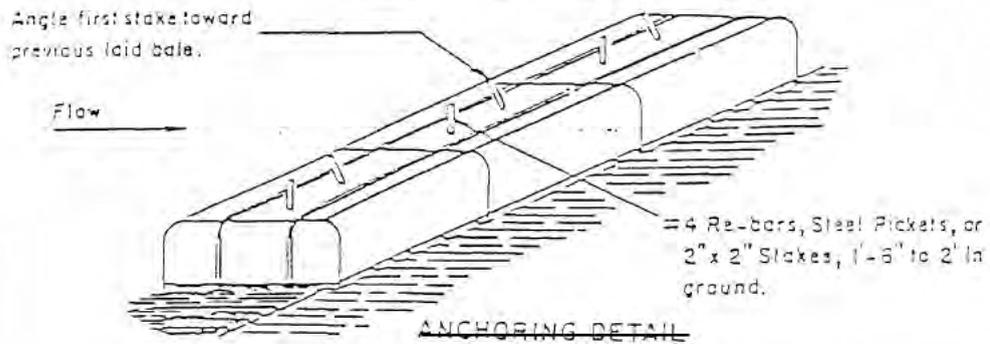
County of Clay
HIGHWAY
DEPARTMENT/PWD

SILT FENCE DETAIL

D10-1



EMBEDDING DETAIL



ANCHORING DETAIL

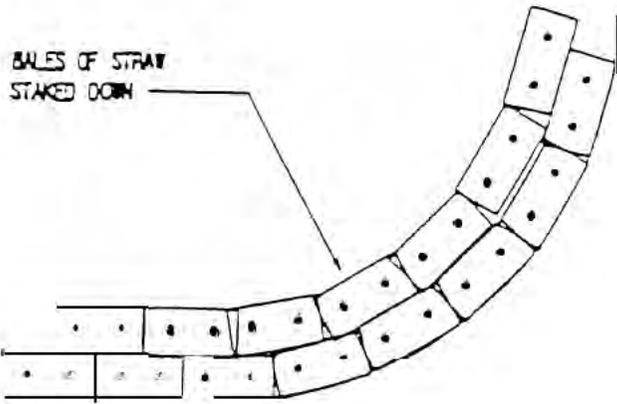
STRAW BALE DIKE DETAIL



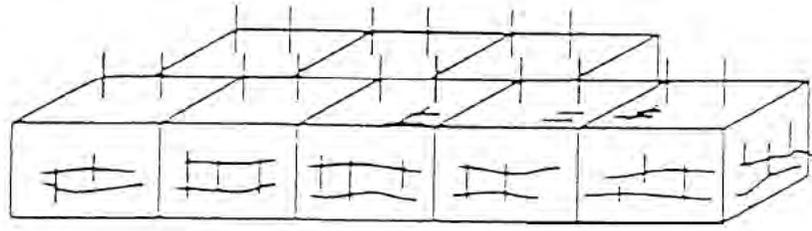
County of Clay
 HIGHWAY
 DEPARTMENT/PWD

STRAW BALE
 DIKE DETAIL

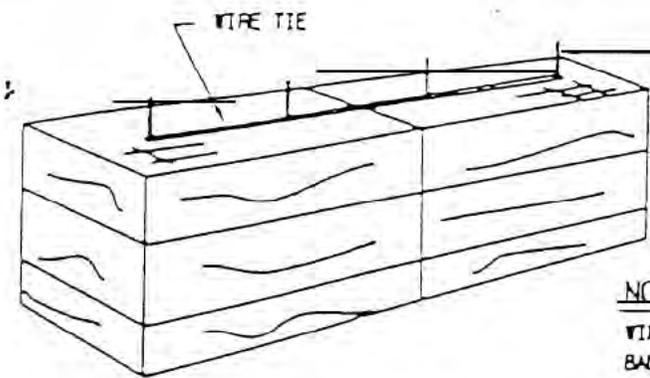
DIO-2



DOUBLE ROW OF BALES OF STRAW TO BE PLACED PRIOR TO THE START OF ROUGH GRADING. BALES ARE TO BE PLACED AS CLOSELY TOGETHER AS POSSIBLE IN ORDER TO PROVIDE MAXIMUM PROTECTION.



FRONT VIEW



2 REBARS, STEEL PICKETS, OR 2"x2" STAKES 1-1/2' TO 2' IN GROUND.

NOTE:
WIRE OR NYLON BOUND BALES ARE REQUIRED FOR DURABILITY.

ANCHORING BALES

STRAW BALE BARRIER



County of Clay
HIGHWAY
DEPARTMENT/PWD

STRAW BALE
BARRIER DETAIL

DIO-3

SECTION 1100 GRADING

1101 SCOPE. This section governs the performance of all work required to excavate, remove, dispose or compact all materials encountered within the limits of the project, at the locations shown on the contract documents.

1102 DEFINITIONS.

- A. Grading. Grading as used herein shall mean the performance of all excavation, embankment, and backfill in connection with the construction of all improvements.
- B. Excavation. Excavation is defined as the removal of materials from the construction area to the lines and grades shown on the plans.
- (1) Unclassified Excavation. Unclassified excavation is defined as the removal of all material encountered regardless of its nature. All material excavated will be considered as Unclassified Excavation unless the Special Provisions specify Classified Materials.
- (2) Rock Excavation. Rock excavation is defined as the removal of all rock ledges 6 inches or more in thickness, and detached rocks or boulders having a volume of more than 1½ cubic yards, and shale occurring in its natural state, hard and unweathered.
- A rock ledge is defined as a continuous body of rock, which may include thin interbedded seams of shale or other soft materials less than twelve (12) inches thick. The vertical limit of each ledge shall be defined by interbedded seams of soft materials twelve (12) inches in thickness. The beds of soft interbedded material twelve (12) inches in thickness shall not be included in the measurement of "Rock Excavation" but shall be included in the measurement for "Earth Excavation".
- (3) Earth Excavation. Earth excavation is defined as the removal of all material not defined as rock.
- C. Embankment or Backfill. Embankment or backfill is defined as the placing and compacting of material in the construction area to the lines and grades shown on the plans.
- (1) Unsuitable Material. Unsuitable material is defined as muck, frozen material, organic material, top soil, rubbish, and rock with a maximum dimension greater than 24 inches.
- (2) Suitable Material. Suitable material is defined as entirely imperishable with that portion passing the No. 40 Sieve having liquid limit not exceeding 40 and a plastic index not exceeding 25, when tested in accordance with ASTM D-423 and D-424, respectively.

- a. Rock Embankment. Material for rock embankment shall be free of unsuitable material and shall contain, by volume, greater than ten (10) percent rock or gravel, having a maximum dimension greater than three (3) inches but not greater than twenty-four (24) inches.
 - b. Earth Embankment. Material for earth embankment shall be free of unsuitable material and shall, contain by volume, less than ten (10) percent rock or gravel, having a maximum dimension greater than three (3) inches.
- D. Borrow. Borrow is defined as approved material excavated from an area outside the project limits and required for the construction of the embankment.
- E. Waste. Waste is defined as excavation material not used in the embankment and disposed of outside the embankment areas.
- F. Structures. Structures as used herein refers to bridges, culverts, storm sewer and/or sanitary appurtenances, retaining walls and similar construction.

1103 CONSTRUCTION DETAILS - GENERAL. The contractor and/or developer shall adhere to any and all statutes regarding the notification of utilities prior to beginning any work within public right-of-way. Relocation or protection of any existing utilities located in street right-of-way shall be governed by the applicable section of these Specifications. The relocation and/or protection of any utility that is shown on the plans, that lies within a utility easement and is endangered by this construction shall be the responsibility of the contractor and/or developer.

The contractor and/or developer shall make every reasonable effort to protect private facilities. These facilities may not be shown on the plans. When these facilities are disturbed or damaged by work, the contractor and/or developer shall make necessary arrangements for repairs to the facilities for continuous service prior to the close of that work day.

It shall be the responsibility of the contractor and/or developer to protect all property lot corners and control monumentation. Should it be necessary to disturb such monument, whether stake, pin, bar, disk, box or other, it remains the responsibility of the contractor and/or developer to reference such markers prior to removal, reset them, and file such relocations or monumentation documents as the law may require. Any such references, removal, replacement and certification of monuments shall be performed by a surveyor registered and licensed in the State of Missouri. A copy of all such certification documents shall be provided to the Engineer prior to completion to the project. Any monument destroyed or improperly reset by the contractor and/or developer may be replaced by the Engineer to the standards required by law at the expense of the contractor and/or developer.

Grading, excavation, and backfilling for all improvements, shall be made to the lines, grades, and cross section indicated by the plans.

In addition to any erosion control measures shown on the plans, the contractor and/or developer shall schedule and conduct his operation in such a manner that shall provide any necessary control facilities to protect downstream and adjacent properties from pollution, sedimentation or erosion caused by the grading operations as provided for in the Storm Water Management Ordinance. Any pollution or damage occurring as a result of the work shall be the responsibility of the contractor and/or developer.

During construction the graded area shall be maintained by the contractor and/or developer in such condition that it will be well drained at all times. Roadway ditches, channel changes, inlet and outlet ditches and other ditches in connection with the roadway shall be cut and maintained to the required cross section. All drainage work shall be performed in proper sequence with other operations. All ditches and channels shall be kept free of debris or obstructions.

1104 EXCAVATION. This section governs the excavation for all improvements.

All suitable material removed by excavation shall be used as far as practicable in the formation of embankment as required to complete the work. The contractor and/or developer shall sort all excavating material and stockpile when necessary, so as to provide suitable materials for embankments.

After removal of the roadway excavation material to the required section, all material between lines one (1) foot outside the curbs and within the top six (6) inches of the subgrade shall be compacted to ninety-five (95) percent of maximum density for the material as defined in Section 1106(E).

Rock encountered within the full width of the roadway, toe of slope to toe of slope, shall be undergraded to an elevation of six (6) inches below the finished subgrade elevation. Care shall be taken to avoid overshooting when blasting. Rock shall be removed in such a manner as to leave no excessive water pockets in the surface.

Areas of undergrading or overbreak in rock between lines one (1) foot outside of the curbs shall be backfilled with spalls, rock fragments or granular type material. Backfill materials shall have a plasticity index not to exceed ten (10) and a gradation such that at least fifty (50) percent of the material will be retained on the No. 4 Sieve.

1105 UNDERGRADING. Where materials are encountered which are deemed as unsuitable by the Engineer for use in the work, they shall be removed to the depth and limits as ordered by the Engineer. Areas undergraded shall be backfilled with one of the following materials:

- A. Replacement with suitable materials from excavation on the work site or from an off-site borrow area, compacted to the required moisture and density requirements where practicable.
- B. Mixing of stone base or rock materials, hydrated lime, portland cement or fly ash into the sub-grade.
- C. Placement of compacted Missouri State Highway Type 1 aggregate.

1106 EMBANKMENT. This section governs embankment for all improvements.

The embankments shall be constructed using suitable materials, as herein defined, procured from excavations made on the project site or from borrow areas as required to complete the grading work.

- A. Starting the Embankment. Where embankments, regardless of height, are placed against hillsides or existing embankments, either of which have a slope steeper than one (1) vertical to four (4) horizontal, the existing slope shall be benched or stepped in approximately twenty-four (24) inch rises as the new fill is brought up in twelve (12) inch maximum layers or lifts. The material bladed out, the bottom of the area cut into, and the embankment material being placed, shall be compacted to the required density. The existing surface upon which embankment material is to be placed shall have all unstable and unsuitable material removed before starting the embankment work.

Where embankments two (2) feet or less in depth are to be placed on areas covered by existing pavement, the existing pavement shall be removed and the cleared ground surface shall be compacted to the specified density. Where embankments greater than two (2) feet in depth are to be placed on areas covered by existing pavement, the existing pavement shall be broken into pieces not larger than twenty-four (24) inches maximum dimension, left in place and the embankment started thereon.

- B. Placing Earth Embankment. Earth shall be placed in successive horizontal layers distributed uniformly over the full width of the embankment area. Each layer of materials shall not exceed twelve (12) inches maximum in thickness (loose state) and shall be compacted to not less than the required density before the next layer is placed thereon. As the compaction of each layer progresses, continuous blading, or dozing will be required to level the surface and to insure uniform compaction. Embankment construction shall not be performed when material contains frost, is frozen or is snow covered.
- C. Placing Earth and Rock Embankment. When earth and stone or rock fragments are mixed in the embankment, all stones or rock fragments exceeding the thickness of the compacted lift shall be disposed of by being incorporated into the embankment outside the limits of the proposed surfaced areas. The thickness of the layer in these areas may be increased if necessary to accommodate the rocks, but shall not exceed fifteen (15) inches in thickness (loose state). The stones or rock fragments are to be placed so there will be no nesting.
- D. Consolidated Rock Embankment. When the excavated material consists predominantly of stone or rock fragments of such size that the material cannot be placed in layers of the thickness prescribed, such material shall be placed in the embankment in layers having a thickness of approximate average size of the larger rocks, but not to exceed twenty-four (24) inches. Rock or boulders too large to permit placing in a twenty-four (24) inch layer shall be reduced in size as necessary to permit placement. Rock shall not be dumped in place but shall be distributed by blading or dozing in a manner to insure proper placement in final position in the embankment. The spalls and smaller stone fragments shall be left on the surface of each layer as formed. Each layer shall be thoroughly consolidated before the next layer is placed.

- E. Compacting the Embankment. Before placing any embankment, the surface of the existing ground shall be prepared as heretofore specified, moistened as required, and the top six (6) inches compacted to a density of ninety (90) percent as prescribed by the following paragraph.

All embankment shall be compacted to a density of at least ninety (90) percent of the maximum density for the material used as determined by ASTM D-698 and within a tolerance of minus three (3) percent and plus two (2) percent of the optimum moisture at maximum density as determined by the Moisture Density Curve obtained. In addition to the above required compaction, the subgrade between lines one (1) foot outside of the curbs and within the top six (6) inches of the subgrade shall be compacted to a density of at least ninety-five (95) percent of the maximum density for material used as determined by ASTM D-698 and with a tolerance of minus three (3) percent and plus two (2) percent of the optimum moisture at maximum density as determined by the Moisture Density Curve obtained.

All work involved in either adding moisture to or removing moisture from embankment materials to within these moisture limits shall be considered incidental to the completion of the grading operation.

- F. Moisture - Density Determination. In-place density and moisture content of the embankment will be determined by the Standard Method of Test for Density of Soil in Place by the Sand-Cone Method, ASTM D-11556; or the Rubber Balloon Method, ASTM D-2167; or by Nuclear Methods, ASTM D-2911.

- G. Backfilling Curb and Gutter. Backfilling behind curb or curb and gutter shall be done within seven (7) days after being laid unless otherwise approved by the Engineer. The material used to fill the void behind curb or curb and gutter shall be free of rock and debris and shall be of a type that will leave no voids to pocket water and that will self-compact. Unless otherwise shown on the contract drawings, the finish grading from the back of the curb to the right-of-way line and/or utility easement line or construction easement line shall be performed to provide a smooth transition between existing yard grades at the right-of-way line and/or easement line to the curb so that positive drainage will exist.

The top portion of the backfill within right-of-way areas shall be finished with at least twelve (12) inches of topsoil corresponding to, or better than, that underlying adjoining sodded areas. Top soil shall be approved by the Engineer prior to placement, and unless otherwise directed, shall be material previously excavated and stockpiled for the purpose during excavating and grading operations. Immediately prior to dumping and spreading topsoil, the surface shall be loosened by discing or scarifying to a depth of two (2) inches to permit bonding of the topsoil to the underlying surface.

1107 SEEDING AND SODDING

- A. Scope. This section covers the furnishings of all labor, equipment, tools and materials, and the performance of all work for seeding or sodding as designated on the contract drawings.
- B. General. The seeding work shall consist of furnishing and drilling in or sowing seed by an experienced seeding contractor having approved equipment manufactured expressly for the purpose, such as a seed drill with fertilizer attachment, mulch chopper and blower for the application of hay or straw mulch, mulch puncher, or straight serrated disc for punching mulch into soil and a multipacker that may be used for final compaction.

Seeding shall be required at all disturbed locations and for all grass covered areas that are disturbed by construction operations, either by grading, parking of equipment, temporary roads, or any other operation that has destroyed the existing grasses of the original site, and that is not designated on the drawings to be replaced with sod. This work shall be accomplished prior to acceptance of Public Improvements.

Sod work shall be performed by an experienced sod-laying contractor.

- C. Material. The sod shall be densely-rooted Kentucky Bluegrass. The sod shall contain a growth of not more than ten (10) percent of grasses and clovers, shall be free from all prohibited and noxious weeds, and shall be three-fourths (3/4) to one and one-fourth (1 1/4) inch; each strip containing at least one (1) square yard. Sod shall be cut in strips not less than twelve (12) inches wide.

Commercial fertilizer for seeded or sodded areas shall contain twelve (12) percent (by weight) nitrogen, twelve (12) percent (by weight) phosphoric acid, and twelve (12) percent (by weight) potash. It shall be uniform in composition, free flowing, and delivered to the site in standard size bags, showing weight, analysis, and name of manufacturer. It shall be stored until use in a weatherproof storage place in such a manner that it will be kept dry and its effectiveness will not be impaired.

- Seeds for cover crops shall be the kind and mixture of seeds specified herein. Seeds shall be free of prohibited weed seeds and shall not have more that one (1) percent of noxious weed seeds. Seeds shall be delivered to the site in convenient containers, each fully labeled, bearing the name, or trade mark and a warranty of the producer and a certificate of the percentage of the purity and germination of each kind of seed specified. The tags shall be made available to the Engineer for filing.

The following formula shall be used to determine the amount of commercial seed required to provide for each kind of seed the specified quantities of pure live seeds.

$$\begin{aligned} \text{Pounds of Commercial Seed Required} = & \\ & \frac{10,000 \times \text{Rate of Pure Live Seeds (lbs/acre)}}{\text{Purity \%} \times \text{Germination \%}} \end{aligned}$$

When seeding is required in areas of established yards, shoulders, and slopes in street right-of-way, and any other areas where a high-quality seeding is deemed necessary, the seed mixture will be as follows:

<u>Kind of Seed</u>	<u>Minimum Pure Live Seed, %</u>	<u>Rate of Pure Live Seed, Pound/Acre</u>
Perennial Rye (Derby or equivalent)	80	35
Certified Bluegrass (Park or equivalent)	80	90
Annual		<u>10</u>
	TOTAL	135#/Acre

Where seeding is required in areas off street right-of-way that are not maintained periodically, the seed mixture will be as follows:

<u>Kind of Seed</u>	<u>Minimum Pure Live Seed, %</u>	<u>Rate of Pure Live Seed, Pound/Acre</u>
Alta Fescue or Kentucky 31 Fescue (Festuc Elatior Var. Arundinaces)	75	90
Rye Grass (Lolium Perenne Or L. Multiflorum)	80	<u>50</u>
	TOTAL	145 #/Acre

Mulch for application to seedbed areas shall include wheat straw, oat straw, smooth bromegrass hay, sudan grass hay, or prairie hay. Prairie hay shall consist chiefly of Bluestem grasses, switchgrass, Indian grass, and other desirable native perennial grasses. Mulch shall be free of prohibited and noxious weed seeds.

- D. Time of Seeding or Sodding. Seeding and fertilizing shall be performed between August 15 and September 30 for Fall planting and between February 15 and April 20 for Spring planting, unless otherwise acceptable to the Engineer. Seeding and fertilizing shall not be done during periods of such severe drought, high winds, or excessive moisture, as determined by the Engineer, that satisfactory results are not likely to be obtained.

Sod may be planted during the periods of March 1 to April 15 and September 1 to November 15. Sod may be planted during the period, November 15 to March 1, when the soil and sod is workable and with the approval of the Engineer. If sod is planted between November 15 and March 1, the contractor and/or developer will maintain the sod until 20

days after the beginning of the spring sodding season. The engineer reserves the right to delay the sodding of all types of sod or to vary the permissible sodding seasons, due to weather, soil conditions or for other causes.

Any seeding or sodding to be performed during periods other than those previously designated will required a written request to extend the permissible period for performing such work. Said request shall explain the reason for the variance and shall include a guarantee (by the contractor and/or developer) of satisfactory results by the end of the first four (4) weeks of the following growing season as previously defined, or the necessary re-seeding or re-sodding work performed at that time. The request shall be initiated by the contractor and/or developer and directed to the County Engineer for consideration for approval.

- E. Application of Fertilizer. Before tilling of the soil for seeded areas, the commercial fertilizer of the type specified shall be uniformly distributed over the entire site at the rate of six hundred (600) pounds per acre, and incorporated into the soil to a depth of at least two (2) inches by discing or harrowing methods or with a fertilizer drill. The fertilizer may be applied with the seeding operation only if a seed drill with a fertilizer attachment is used. (The above fertilizer rate is equivalent to seven (7) pounds to five hundred (500) square feet.)

- F. Preparation of Sod Bed. The sod bed shall have a uniform surface free from washes and depressions and shall conform to the finished grade profile or cross section shown on the plans. The soil, except where fresh top soil has just been applied and compacted, shall be thoroughly tilled to a depth of two (2) inches. Freshly-graded areas, which have set long enough to become dry and crusted over, shall be tilled as specified above, preparatory to placing the sod.

- G. Placement of Sod. Sod shall be transplanted within twenty-four (24) hours from the time it is harvested unless stacked at its destination in a manner acceptable to the Engineer. All sod in stacks shall be kept moist and protected from exposure to the sun and from freezing. In no event shall more than one week elapse between cutting and planting.

The fertilized sod beds shall be in a firm but not too compacted condition with relatively fine texture at the time of sodding. Sod shall be moist when it is placed. The use of dry sod will not be permitted. Sod strips shall be laid along contour lines by hand, commencing at the lowest point of the area and working upward. The transverse joints of sod strips shall be staggered and the sod carefully placed to reduce tight joints. The sod shall be firmed, watered, and refirmed immediately after it is placed. The "firming" shall be accomplished by application of a roller weighting not less than sixty (60) pounds nor more than ninety (90) pounds per linear foot of roller. On steep slopes, the sod may be firmed by compacting with hand shovels. The firming process shall pack the sod roots firmly into the prepared soil.

- H. Preparation of The Seedbed. The area to be seeded shall be thoroughly tilled to a depth of at least three (3) inches by discing, harrowing, or other approved methods until the soil is well pulverized. After completion of the tilling operation, the surface shall be cleaned of all stones, stumps, or other objects larger than 1½ inches in thickness or diameter, and of roots, wire, grade stakes, and other objects that might be a hindrance to maintenance operations. Areas tilled shall then be brought to the desired line and grade and maintained until seeding and mulching is complete to insure a smooth area with no gullies or depressions.

Any objectionable undulations or irregularities in the surface resulting from tillage or other operations shall be removed before planting operations are begun. Seedbed preparation shall be performed only during periods when satisfactory results are likely to be obtained. When results are not satisfactory because of drought, excessive moisture, or other causes, the work shall be stopped until such conditions have been corrected to the satisfaction of the Engineer.

- I. Placement of Seed. Seeding may be accomplished by means of approved mechanical power-drawn drills followed by packer wheels, or by broadcast-type seeders or hydraulic type seeders in small areas not accessible to machine methods, or as approved by the County Engineer. Mechanical power-drawn drills shall have depth bands set to maintain a planting depth of at least one-quarter (1/4) inch but not to exceed one-half (1/2) inch. All seed sown by broadcast type seeders shall be "raked in" or otherwise covered with soil to a depth of at least one-quarter inch and rolled to obtain a firm seed bed. Water shall be applied when necessary.

Hydraulic seeding equipment shall include a pump capable of being operated at one hundred (100) gallons per minute and at one hundred (100) pounds per square inch pressure, unless otherwise directed. The equipment shall have an acceptable gauge and a nozzle adaptable to hydraulic seeding requirements. Storage tanks shall have a means of agitation and a means of estimation of the volume use, or remaining in the tank.

- Seed shall not be drilled or sown during windy weather or when the ground is frozen or otherwise untillable. When a seed drill is used, it shall be set to space the rows not more than four (4) inches apart.

- J. Mulching. Straw or hay mulch shall be applied uniformly to seeded areas at the rate of not less than two (2) tons per acre. Baled straw or hay shall be broken up and loosened sufficiently before being fed into the blower hopper to avoid the placing of matted or unbroken clumps. The use of wet straw or hay is prohibited.

Mulching shall be performed within twenty-four (24) hours after seeding, but shall not be done during windy or rainy weather or when such weather is imminent. Mulching shall be started at the windward side of relatively flat areas, or at the upper part of steep slopes and shall continue uniformly until each area is covered.

The mulching material shall be disced and punched into the soil so that it is partially covered. Several passes may be required, if a straight disc is used, in order to mix the mulching material with the topsoil sufficiently to insure protection from erosion by either wind or water. The mulch tilling operation shall be performed parallel to the ground contours.

- K. Maintenance of Seeded and Sodded Areas. All seeded and sodded areas shall be protected against damage by vehicle and pedestrian traffic by the use of barriers and appropriate warning signs. If at any time before completion and acceptance of the seeding work any portion of the seeded area becomes gullied or otherwise damaged, such damaged areas shall be repaired by filling with soil to original grade, re-seeding or re-sodding and re-mulching. All costs of repair work shall be born by the Contractor and/or developer.

The Contractor and/or developer shall be responsible for watering areas seeded and sodded for a period of five (5) weeks after the time of planting, except when thoroughly wetted by rain. Watering shall be on a daily basis. Sprinkling of the seeded areas shall be carefully done in such a manner as to avoid standing water, surface wash, or scour.

- L. Guarantee. The Contractor and/or developer shall guarantee all work and materials for a period of one full growing season (Spring to Fall) after the date of final payment under the contract. During the guarantee period, all turf which dies shall be replaced, by and at the expense of the Contractor and/or developer, with like material.

SECTION 1200 SUBGRADE PREPARATION

1201 SCOPE. This section governs the furnishing of all labor, equipment, tools, and materials, and performance of all work connected with subgrade preparation, prior to constructing pavements for streets, alleys, parking areas, sidewalks, drive approaches and the construction of concrete curb and curb and gutters. **This section does not include the construction of any base courses.**

1202 DEFINITIONS.

- A. Subgrade. Subgrade is defined as a well-graded and compacted surface, constructed as specified herein to the grades, lines and cross-section shown, bladed and compacted to the specified density, preparatory to constructing pavements, or other improvements thereon.
- B. Subgrade Preparation. Subgrade preparation is the repeated operation of fine grading and compacting the subgrade until the specified lines, grades, and cross-sections have been obtained and the materials are compacted to the specified depth and density.

1203 CONSTRUCTION REQUIREMENTS.

- A. General. All underground work contemplated, including clearing, grubbing, and demolition, shall be completed in accordance with the requirements of Section 1100 "Grading" prior to commencement of any subgrade preparation.

The subgrade surface shall be brought to the specified lines, grades, and cross-sections by repeatedly adding or removing material and compacting to the specified density with suitable equipment to perform these operations. Tolerance allowed on all lines, grades and cross-sections shall be a compensating maximum deviation of 1/4 inch.

- B. Subgrade Scarifying. This work shall consist of loosening the surface of the roadbed and removing all rock larger than four (4) inches. This work shall also consist of tilling and manipulating the subgrade to achieve the specified optimum moisture content. Scarifying shall be considered subsidiary to work done in connection with subgrade preparation.

Scarifying of the subgrade shall be required in the preparation of the roadbed regardless of whether it is in a cut or fill area unless otherwise allowed by the County Engineer. The Contractor and/or developer shall perform all work necessary, with the proper equipment, to loosen and manipulate the roadbed over its full width to a depth between six (6) and eighteen (18) inches below the finished grading section. After adequate drying, oversized materials shall be removed and the roadbed shall be brought back to a satisfactory grade and cross-section by the addition of or removal of extra material, if needed.

- C. Subgrade Compaction. The soil below grade line shall be scarified, broken up, adjusted to a moisture content within the designated moisture range and compacted to the designated type of compaction. A proctor sample will be taken to determine the soil classification and the optimum moisture. A copy of the soil proctor shall be submitted to the Clay County Highway Department. All costs occurred for testing purposes shall be the contractor and/or developer's obligation.

The top six (6) inches of subgrade for pavements shall be compacted to ninety-five (95) per cent of the maximum density for the material used as determined by ASTM D-698 and within a tolerance of plus two (2) per cent and minus three (3) per cent of the optimum moisture at maximum density as determined by the moisture density curve obtained.

Prior to laying base or setting paving forms, the subgrade shall conform to the moisture and density requirements for compaction. Soft spots and unsuitable material shall be removed to a depth not to exceed twenty-four (24) inches and backfilled with an approved stable material at the expense of the Contractor and/or developer.

- D. Sub-Grade Stabilization. It is recognized that, in some areas, efforts to compact sub-grade to the moisture and density requirements may result in "pumping" subsurface water to the surface. In such areas where initial compaction efforts clearly indicate, in the opinion of the Engineer, that further compactive effort, including scarification and aeration, would be useless and detrimental, then such compactive efforts shall be halted.

Unsuitable earth may be encountered in areas where it may or may not be practicable to replace with suitable materials from excavation on the work site.

For conditions described above to a depth of eighteen (18) inches below the top of the finished subgrade, the Contractor and/or developer shall stabilize the sub-grade, at his own expense. The sub-grade shall be stabilized to at least the extent necessary to support paving equipment and delivery vehicles to be operated thereon without undue deformation of the sub-grade and so that the paving can be constructed in accordance with the requirements of the Specifications. Methods used may be any of those described in Section 1105, subject to the concurrence of the Engineer and which will provide adequate support.

- E. Moisture Control Requirements. The moisture content of the soil at the time of compaction shall be as necessary to obtain the density as designated on the contract drawings unless it is determined by the Engineer that the soil is unstable with that moisture content. When the moisture content of the soil is not satisfactory to the Engineer, water shall be added or the material aerated, whichever is needed to adjust the soil to the proper moisture content. In no case, shall water be added without the consent of the Engineer.
- F. Compaction Control Requirements. Roadway embankment earth (fill) materials shall be placed in horizontal layers not exceeding twelve (12) inches unless otherwise approved by the Engineer and shall be compacted as specified in Section 1205 before the next layer is placed. Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compaction. Water shall be added or removed on the approval of the Engineer, in order to obtain the required density.

1204 MOISTURE CONTENT REQUIREMENTS. The moisture content of the soil at the time of compaction shall be uniform and shall be such that the soil can be compacted to the requirements of the type of compaction as designated on the contract drawings or as directed by the Engineer.

1205 COMPACTION REQUIREMENTS.

- A. Pavements. The subgrade for pavements shall be compacted to a density of at least ninety-five (95) percent of the maximum density for the material used for a depth of at least six (6) inches below the finished subgrade elevation and within the tolerance of the moisture for the type of material at ninety-five (95) percent of maximum density, as determined by the standard proctor test (ASTM D698) for cohesive soils. Any further compacted layers shall be accomplished in the same manner as specified.

The compacted density is to be such that the tamping or sheepsfoot roller, while rolling the layer or lift, will walk out of the material and ride the top portion of the lift.

Compaction of low plasticity or non-plastic, fine-grained material shall be considered adequate when additional passes of the roller do not bring the tamping feet closer to the surface of the lift, provided the entire weight of the roller is supported on the tamping feet and none by material directly in contact with the drum.

Sand and gravel which cannot be compacted satisfactorily with a sheepsfoot roller shall be rolled with a pneumatic-tired roller.

Each lift shall be rolled until no further consolidation is evident.

- B. Sidewalks. The subgrade for sidewalk pavements shall be compacted to a density equivalent to the density of the immediately surrounding soil in areas not requiring fill. In areas where fill is required, the subgrade shall be compacted to ninety-five (95) percent of the maximum dry density as determined by ASTM D698 for cohesive soils or seventy (70) percent relative density as determined by ASTM D2049 for non-cohesive soils.
- C. Drive Approaches and Concrete Curb & Gutter. The subgrade for drive approaches and concrete curb and gutter shall be compacted to the same requirements as stated above in part A Pavements.

1206 PROTECTION AND MAINTENANCE OF SUBGRADE. The newly finished subgrade shall be repaired from action of the elements or others. Any settlement or erosion that occurs prior to placing the pavement thereon, shall be repaired and the specific lines, grades and cross-section reestablished.

Any subgrade that has become unacceptable shall be reworked as necessary to restore the subgrade to shape, tolerance, density, and moisture content range for such density, immediately prior to the placing of the pavement.

The Contractor and/or developer shall protect all existing improvements from damage resulting from his subgrade operation. Any improvement damaged shall be repaired or replaced by the Contractor and/or developer at his own expense.

1207 CLEAN-UP. Subgrade clean-up shall follow the work progressively. The Contractor and/or developer shall remove from the project site all rubbish, equipment, tools, surplus or discarded material and temporary construction items.

1208 COMPACTION TESTING. At the option of the County Engineer, compaction testing may be performed in the field using a nuclear density-moisture measuring device to determine the density of the subgrade. If as a result of this field testing the Engineer determines that further compaction is required, the Contractor and/or developer shall revise his methods or procedures to obtain the specified density. Certified results of testing shall be submitted to the County within five (5) working days of the testing. Copies of field testing results shall be submitted upon completion of the tests.

1209 PROOF ROLLING. Proof rolling will be a required in lieu of or as a part of the requirements of nuclear density – moisture test. Proof rolling will be done with a 50,000 pounds gross weight tandem dump truck. Subgrade must be a non-yielding surface. Areas found weak (exhibit any pumping) and those areas which fail shall be ripped, scarified, wetted or driven if necessary and recompact to the requirements for compaction, density and moisture at the contractor and/or developer's expense. Once this has been completed, the contractor and/or developer will reschedule for another proof roll test. The operating weight of the truck will not be less than twelve and one half (12½) tons per wheel. Tires shall be inflated to a minimum pressure of seventy (70) pounds per square inch and a maximum pressure of ninety (90) pounds per square inch. If at any point during the proof roll test the loaded tandem truck tires leave tracks of one (1) inch or more, the subgrade test will be failed.

A. Definitions.

1. Proofrolling Definition: A physical compaction test performed with a rear double axled dump truck with a gross weight of 50,000 pounds. The loaded dump truck will roll over the soil subgrade where the proposed concrete curb or asphalt concrete is to be placed. As the proofroll truck at two to five miles per hour rolls over areas being tested and does not yield or pump, it is considered passing and suitable for concrete and asphalt placement.
2. Yielding Definition: Giving way readily to pressure, pumping, flexible.
3. Non-Yielding Definition: Not giving way readily to pressure, rutting does not occur, solid.
4. Tracking Definition: A mark or print left after proofroll truck tires have passed over subgrade.

SECTION 1300 PRIME AND TACK COAT

1301 SCOPE. This section governs the requirements for all labor, equipment and materials for the application of liquid asphalt to a prepared pavement (concrete, asphaltic concrete), granular base or subbase. The type and grade of asphalt material to be used as prime or tack coat, is as specified in the special Provisions or as indicated by the plans.

1302 LIQUID ASPHALT MATERIAL. The liquid asphalt material to be used for surface preparation shall be as listed in the following table.

<u>Condition</u>	<u>Type</u>	<u>Gal./Sq.Yd.</u>	<u>Usage</u>	<u>Temperature</u>	<u>Cure Time</u>
Concrete	RC-70	.05-.10	Tack	100-140	1-6 hours
Asphalt	Emulsion	.05-.12	Tack	120-170	1-3 hours
	SS-CRS	.05-.12	Tack	120-170	1-4 hours
	RC-70	.05-.12	Prime	100-140	1-6 hours
Treated	CRS	.10-.20	Prime	120-170	1-3 hours
Base	MC-70	.10-.20	Prime	100-140	24-48 hours
	RC-800	.10-.20	Prime	150-225	1-6 hours
Rock	MC-70	.2-.5	Prime	100-140	24-48 hours

The asphalt material shall conform to the latest ASTM specifications for "Asphalt Cements and Liquid Asphalts." Sampling shall be in accordance with ASTM D-140.

1303 SAND COVER. Sand cover, if used, shall be any clean granular mineral meeting the following grading requirements. When tested with laboratory sieves one hundred (100) percent shall pass the No. 4 sieve and not more than two (2) percent shall pass the No. 200 sieve. The moisture content of the sand shall not exceed three (3) percent by weight.

1304 APPROVAL OF MATERIALS. Asphalt materials shall be approved by the Engineer prior to use in the work. The Engineer may accept a certified analysis by the refinery laboratory when a copy of the certified analysis accompanies each shipment of asphalt to the project. The Engineer will reserve the right to make check tests of the asphalt received on the job and, if the system of certified analysis proves to be unsatisfactory to the Engineer, he may discontinue this arrangement.

1305 PRESSURE DISTRIBUTOR. The distributor used in applying bituminous materials shall be of a self-propelled pressure type, equipped with suitable mechanical circulating appliances which will provide a uniform temperature in the entire mass of the material. The distributor shall be so constructed and equipped as to meet the following requirements:

- A. It shall be capable of applying bituminous material on the street at an accurately controlled uniform rate within the range of 0.01 to .050 gallons per square yard throughout the entire length of the bar, regardless of the load carried, gradient or change in direction of the street.

- B. The spray bar shall be equipped with nozzles of such design and size that they can be adjusted to height and able to produce a uniform application, without streaks or ridges, throughout the entire width of application. The Contractor and/or developer shall make tests and adjustments as necessary to insure that a uniform application is obtained. If nonuniform spraying occurs during priming operations, the Contractor and/or developer shall correct the malfunction. If the malfunction cannot be corrected, a different distributor that functions properly shall be obtained, or operations will be terminated until corrections are made. The Contractor and/or developer shall make a test application with the repaired or substituted distributor to insure proper operation of such equipment.
- C. The pressure system on the spray bar shall be controlled to maintain a uniform pressure throughout the entire length of the spray bar at all times.
- D. The distributor shall be equipped with a heating and circulating device to maintain the bituminous material within the bar at the specified temperature at all times.
- E. The distributor or spray bar shall be equipped with a shutoff valve constructed and located as to provide instantaneous discharge of the bituminous material from the spray nozzles when the valve is opened, and instantaneous shutoff of the bituminous material discharge, without dripping, when the valve is closed.
- F. The spray bar shall be so constructed that the width of application can be varied from four (4) feet to thirteen (13) feet.
- G. The circulating system shall be equipped with a readily accessible strainer in the discharge line.
- H. The distributor tank shall be equipped with a thermometer placed so that it will accurately indicate the temperature of the contents of the distributor.
- I. A calibrated measuring stick graduated in gallons shall be supplied to accurately determine the volume of the bituminous material in the distributor tank. If so directed by the Engineer, the measuring stick shall be recalibrated on the job and the Contractor and/or developer shall furnish all equipment, materials and labor for such calibration.
- J. A meter shall be provided, operated by an independent wheel, to indicate the speed in feet per minute. It shall be located in such a position that is readily visible to the driver when the vehicle is in operation.
- K. An auxiliary spraying hose equipped with a shutoff valve on the operating handle shall be provided for attachment to the pressurized system.

1306 PREPARATION OF EXISTING SURFACE. Immediately before applying the prime or tack coat, the area to receive asphalt shall be dry and cleaned of all undesirable material.

1307 APPLICATION OF ASPHALT MATERIAL. Application of the asphalt material shall be made uniformly at the rate of gallons per square yard as specified in Section 1302 and shall be applied with a pressure distributor unless otherwise directed by the Engineer.

The spray bar shall be cut off instantaneously after each application to secure a straight line and full application of asphalt primer. If necessary, to prevent dripping and excess leakage, a drip pan shall be inserted under the nozzles when the application is stopped.

An auxiliary spraying hose shall be used to apply asphalt material to any and all locations that are unavoidably missed by the spray bar. The auxiliary spraying hose shall be used to apply material to small irregular areas not practical to apply with the spray bar. Hand spraying shall not be performed on any stretch of roadway in excess of one hundred (100) feet in length unless authorized.

1308 APPLICATION OF SAND COVER. If the asphalt material is not completely cured within the maximum specified curing time, sufficient sand shall be spread over the surface with a mechanical spreader to blot up the excess asphalt. The rate of application shall be specified or approved by the Engineer. Prior to placing an asphalt paving course, all loose sand shall be swept from the primed or tacked surface.

SECTION 1400 ASPHALTIC CONCRETE SURFACE AND BASE

1401 SCOPE. This section covers the requirements for all labor, equipment, materials and quality of work for the construction of asphalt concrete base and/or asphalt concrete surface.

The contractor and/or developer shall cooperate with other contractor and/or developers, public utility companies and other parties involved in arranging a schedule of operations. Such schedule shall be submitted to the County Engineer for approval prior to commencing work when requested.

1402 GENERAL. Pavement shall be constructed to the lines, grades, dimensions and details contained herein or indicated on the plans.

Asphaltic concrete pavement shall conform to mix designs conforming to Section 1404 of these specifications and shall be as follows:

Surface Course Mix	Type 3 (Type 4- if approved by County Engineer)
Base Course Mix	Type 1 (Type 2- if approved by County Engineer)

Alternate mix designs may be used only where approved by the County Engineer.

1403 MATERIALS. No material shall be used until it has been checked or tested for compliance with specifications and approved by the County Engineer. Representative samples of all materials proposed for use under these specifications shall be submitted at the Contractor and/or developer's expense, for testing and the preparation of trial mixes to determine the job-mix formula. All tests necessary for determining conformance with the requirements specified herein will be performed at the expense of the Contractor and/or developer.

- A. Asphalt. Asphalt cement used in the manufacture of asphalt paving mixtures shall be of the penetration grade 50-60, 60-70, 70-85, or 85-100 or AC Designations 2.5, 5, 10, or 20 as designated by the County Engineer. Such designation will be made at the time of the job-mix formula determination.

The asphalt cement shall conform to ASTM D-946. Sampling shall be in accordance with ASTM D-140.

If stripping of asphalt from the aggregate occurs in the mixing process, one (1) percent of single strength anti-stripping agent shall be added to the liquid asphalt.

Asphalt materials shall be approved by the County Engineer prior to use in the work. However, the County Engineer may accept a certified analysis by the refinery laboratory when a copy of the certified analysis accompanies each shipment of asphalt to the project. The County Engineer will reserve the right to make check tests of the asphalt received on the job, and if the system of certified analysis proves to be unsatisfactory to the County Engineer, he may discontinue this arrangement.

The Contractor and/or developer or asphalt supplier shall furnish the County Engineer with data on the temperature-viscosity relationship of each asphalt to be used on the project. This data shall cover the range of temperatures and viscosities within which the asphalt may be used.

Copies of all freight bills and weigh bills shall be furnished upon request to the County Engineer as the work progresses.

- B. Aggregate. The quality of aggregates used in Asphaltic Concrete shall conform to the following sections of MCIB: Section 4-Materials; Coarse Aggregate-Paragraph 2 (Quality) except that a total shale, clay, coal, and lignite content shall not exceed 0.5 percent by weight; and Fine Aggregate-Paragraph 3 (Deleterious Substances).

Sampling shall be in accordance with ASTM D-75. Gradation analysis shall be in accordance with Standard Method of Test for Material Finer than No. 200 Sieve in Mineral Aggregates by Washing, ASTM C-117 and Standard Method Test for Sieve Analysis of Fine and Coarse Aggregate, ASTM C-136.

1404 MIXING AND PROPORTIONING.

- A. Composition of the Mix. Asphaltic concrete mixtures shall consist of Mineral Aggregate and Asphalt Cement within the following limits for the type specified.

	ASPHALTIC CONCRETE-TYPE		
	1	2	3
	<u>Percent by Weight of Total Mixture</u>		
Asphalt Cement	4-6	4-7	4-7
Aggregate-U.S.Standard			
Square Sieve Size	<u>Total Percent Passing by Weight</u>		
1 ½"	100	---	---
1"	75-100	100	---
¾"	60-85	80-100	100
½"	---	---	85-100
⅜"	40-65	60-80	70-90
No. 4	30-50	48-65	50-75
No. 10	17-33	32-43	34-43
No. 40	---	16-27	16-27
No. 80	5-12	7-15	7-16
No. 200	2-10	3-8	4-10

In addition to the above limits, the difference between the "Percent Passing Square Mesh Sieve" of successive sieve sizes shall not exceed 25 for Type 1 Asphaltic Concrete nor 20 for Type 2,3 and 4 Asphaltic Concrete.

That fraction of material retained on the No. 4 Sieve shall be composed of particles with not less than seventy-five (75) percent having two (2) or more fractured faces, and not more than twenty (20) percent by weight of that fraction shall be composed of flat or elongated particles (flat being a ratio of 1 to 3 between thickness and least width and a ratio of 1 to 3 between the least width and length).

That portion of the aggregate retained on the No. 10 Sieve shall be composed of at least ninety-five (95) percent by weight of crushed aggregate.

The job-mix formula shall be within the limits specified above. The maximum permissible variation from the job-mix formula, within the specification limits, shall be as follows:

<u>U.S. Standard Sieve Size</u>	<u>Permissible Variation</u>	
	<u>Percent by Weight of Total Mix</u>	
	<u>Type 1</u>	<u>Type 2,3,& 4</u>
No. 4 and larger	5.0	4.0
No. 10	4.0	3.0
No. 40	4.0	3.0
No. 200	2.0	1.0
Asphalt Cement	0.5	0.3

- B. Mix Design Criteria. Laboratory Test Specimen(s) of the Paving Mix, combined in proportions of the job-mix formula, shall be prepared and tested in accordance with ASTM D-1559.

Test requirements and criteria for the paving mixes under these specifications shall be as follows:

Marshall Stability, Types 2, 3, and 4 only	1500 lbs. minimum
No. of compaction blows	50
Flow, all mixtures	.08-16 inches
Air Voids: (Lab Specimen)	Percent
Base	1-8
Surface	1-5
Voids in Mineral Aggregate (Max Size)	Percent (Minimum)
1 ½"	12
1"	13
¾"	14
½"	15
3/8"	16

Mix designs for asphaltic concrete surface and base courses shall be submitted to the County Engineer for review and approval prior to placement. Work in progress without prior mix design approval by the County Engineer will be subject to removal at the expense of the Contractor and/or developer.

- C. Sampling and Testing of the Mixture. Mixes shall be sampled in accordance with ASTM D-979. The mixtures will be tested for Bitumen content in accordance with ASTM D-2172. The recovered aggregate will be sieved in accordance with Methods of Test for Mechanical Analysis of Extracted Aggregate, AASHTO T-30. When recovered Bitumen is required for further testing it will be obtained according to ASTM D-1856.

- D. Mixture Temperature Requirements. To aid in determining the proper temperature of the completed batch, current viscosity data shall be provided and shall be available at the plant at all times. With information relative to the viscosity of the particular asphalt being used, the temperature of the completed mix at the plant and at the paver shall be designated by the County Engineer after discussing with the Contractor and/or developer the hauling and placing conditions.

When the mix is produced in a batch-type plant, the aggregate shall be weighed accurately in the designated proportions to provide the specified batch weight. The temperature of the aggregate at the time of introduction into the mixed shall be as directed by the County Engineer, with a tolerance of + or - 25 degrees F. In no case, however, shall the temperature of the mixture exceed 350 degrees F.

Continuous Mix or Drum Dryer Mixed plants shall, in general, be controlled in the same manner as batch-type plants. Details of control, differing because of the continuous mixing principle, shall be governed by instructions issued by the plant manufacturer, wherever these instructions are not contrary to these specifications.

- E. Control of Mixing Time. The dry mixing period is the interval of time between the opening of the weigh box gate and the application of the asphalt. The wet mixing period is the interval of time between the application of all asphalt and the opening of the mixer gate for discharge. When it is applied by spray system, the wet mixing time shall begin with the start of the asphalt spray.

1. Batch-Type Plants. The length of time of both the dry and wet mixing periods shall be such to insure a uniformly and completely coated mix. Mixing period time shall not be altered unless so ordered by the County Engineer. A dry mixing period of not less than five (5) seconds shall precede the addition of asphalt to the mix. Excess wet mixing shall be avoided. Wet mixing shall continue as long as necessary to obtain a thoroughly blended mix, but shall not exceed seventy-five (75) seconds nor be less than thirty (30) seconds.

2. Continuous Type Plants. The determination of mixing time shall be by a weight method under the following formula, unless otherwise required:

$$\text{Mixing Time (sec)} = \frac{\text{Pugmill Dead Capacity (lbs)}}{\text{Pugmill Output (lbs per sec)}}$$

- F. Preparation of Asphalt Cement. The asphalt cement shall be heated at the paving plant to a temperature at which it can be uniformly distributed throughout the mix. It shall be delivered into the Contractor's tank at a temperature not exceeding 350 degrees F, and shall not be heated above this temperature for any operation of the paving plant.

The asphalt shall be heated so that it can be distributed uniformly throughout the batch. For mixing application, the specified temperature generally will be such that the asphalt viscosity is within the range of 75-150 seconds, Saybolt Furol. The material shall be sufficiently fluid to produce a complete coating on every particle of aggregate within the specified mixing time.

- G. Preparation and Handling of Aggregate. Coarse and fine aggregate shall be stored at the plant in such a manner that the separate sizes will not become intermixed. Cold aggregates shall be carefully fed to the plant in such proportions that surpluses and shortages in the hot bins will not cause breaks in the continuous operation. When loading aggregate into stockpiles, and into cars, barges, and trucks, the material shall be placed in such a manner as to prevent segregation of aggregate sizes. Stockpiles shall be built in uniform layers not exceeding five (5) feet in depth.

Coarse and fine aggregate shall be sampled and tested upon arrival at the plant in accordance with the standard method specified in Section 1403(B). Samples of coarse and fine aggregate shall be submitted to an approved testing laboratory for testing, prior to the start of work, and as often thereafter as requested by the County Engineer. When coarse aggregate grading is such that the material will tend to segregate during stockpiling or handling, it shall be supplied in two or more sizes. Each size of coarse aggregate required to produce the combined gradation specified shall be placed in individual stockpiles at the plant site and separated by bulkheads or other means approved by the County Engineer. Likewise, when it is necessary to blend fine aggregates from one or more sources to produce the combined gradation, each source or size of fine aggregate shall also be placed in individual stockpiles. Aggregate from the individual stockpiles shall be fed through separate bins to the cold elevator feeders and they shall not be blended in the stockpile.

1. Drying. The aggregate shall be thoroughly dried and heated to provide a paving mix temperature within a tolerance of + or - 25 degree F, of that specified by the County Engineer. The moisture content of the heated and dried aggregate shall not exceed 1.0 percent. The quantity of material fed through the dryer shall, in all cases, be held to an amount which can be thoroughly dried and heated.
2. Screening. Aggregates shall be screened into sizes such that they may be recombined into a gradation meeting the requirements of the job-mix formula.
3. Hot Aggregate Storage. Hot screened aggregate storage shall be accomplished in such a manner as to minimize segregation and loss of temperature of the aggregate.

H. Inspection and Control of Asphalt Mixing Plant.

1. Job Mix Formula. The County Engineer may make frequent gradation analysis of the hot aggregates and of the completed mix to be certain that the materials being used and produced are within the tolerances of the job mix formula, and the specifications of the mix number being used. If the mix is found to be outside of the job-mix formula tolerances, or outside of the specifications limits as specified in Section 1404, correction shall be made in quantities measured from the hot bins and adjustments made at the cold bin feeders.
2. Sampling and Testing. Stockpiles and bins may be sampled for gradation analysis and examined for dust coating and for other purposes, in compliance with state requirements.

Gradation analysis of each hot bin will be performed and a combined analysis computed at least once for every four (4) hours of plant operation if requested by the County Engineer. At least one sample shall be taken from each three hundred (300) tons of the mix being produced. Samples will be used to determine compliance with general and special requirements set forth in Section 1404.

When requested by the County Engineer, the Contractor and/or developer shall provide representative samples by taking aggregate from the discharge of the aggregate through each of the hot bin gates, or by drawing aggregate from each bin through the mixture chamber (without asphalt cement) into a truck or other receptacle.

1405 ASPHALT MIXING PLANT. Plants used by the Contractor and/or developer for preparation of the asphalt paving mix shall conform to the following requirements:

A. Requirements for all Plants.

1. Consistency. The plants shall be designed, coordinated, and operated to produce a well-graded mixture within job mix tolerances as covered in Section 1404.
2. Equipment for Preparation of Asphalt. Tanks for storage of asphalt shall be provided with a device for controlled heating of the material to temperature requirements set forth in Section 1404 (F). Heating shall be accomplished so that no flame shall come in contact with the heating tank. A circulating system of adequate size to insure proper and continuous circulation of asphalt between storage tank and mixed during the entire operating period shall be provided. Storage tank capacity shall be sufficient to hold enough asphalt for at least one day's production.
3. Cold Aggregate Feeder. The plant shall be provided with an accurate mechanical means for feeding the mineral aggregate into the dryer to secure a uniform production and constant temperature. The feeder or feeders shall be capable of delivering, in preset conditions, the maximum number of aggregate sizes required. When more than one cold elevator is used, each shall be fed as a separate unit and the individual controls shall be integrated with a master control.
4. Dryer. The plant shall include a rotary drum dryer that will continuously agitate the mineral aggregates during the heating and drying process. It shall be capable of continuously supplying aggregate to the mixing unit operating at capacity, to provide a mix at the temperatures specified in Section 1404, and at a moisture content not in excess of 1.0 percent.
5. Screens. Plant screens capable of separating all aggregates to the sizes required for proportioning, and by having normal capacity in excess of the full capacity of the mixer or the dryer, shall be provided. The Plant Operator shall expose the screens for inspection at the request of the County Engineer. The plant screens shall have an efficiency such that the undersize and oversize aggregate in the associated bins shall not exceed the following percentages:

<u>Bin Sequence from Hot Aggregate Discharge</u>	<u>Undersize Per Cent</u>	<u>Oversize Per Cent</u>
1	---	10
2	-10	10
3	-15	5
4	-15	0

The screen tolerances shall not invalidate the job-mix tolerances specified in Section 1404.

6. Bins. Bins shall be divided into compartments arranged to insure separate storage of the appropriate fractions of aggregates. Each compartment shall be provided with an overflow pipe that will prevent any backing up of material into other compartments or bins against the screens. The overflow material shall be wasted.

When mineral filler is required, additional dry storage shall be provided and the provision shall be made for proportioning it into the mix.

7. Asphalt Control Unit. Means shall be provided to obtain the required percentage of asphalt in the mix within tolerance specified, either by weighing, metering, or measuring volumetrically. Where the quantity of asphalt is controlled by metering, provision shall be made for the amount of asphalt delivered through the meter to be readily checked by weight. Steam jacketing or other insulation shall be provided which will maintain the specified temperatures of asphalt in pipelines, meters, weigh buckets, spray bars or other containers.

8. Thermometric Equipment (Graduated in 10 degree Increments). An armored thermometer reading from 200 degrees F to 400 degrees F shall be fixed in the asphalt feed line at a location near the discharge valve at the mixer unit. A pyrometric thermometer will be supplied in the sand bin and one in the intermediate aggregate bins. The plant shall be further equipped with an approved dial scale, mercury-actuated thermometer, a recording electric pyrometer, or other approved thermometric instrument having an accuracy of + or - 5 degrees F, place at the discharge chute of the dryer to indicate the temperature of the heated aggregate. Any thermometric instrument used shall be sensitive to a rate of temperature change not less than 10 degrees F per minute.

9. Dust Collector. The plant shall be provided with a dust collector, designed to waste, or return in a constant and uniform flow to the hot elevator by mechanical means, all or part of the material collected. Prior to permitting the return of such collected dust, the County Engineer will examine the characteristics of the dust in relation to the mix requirements.

The plant shall have a mixer cover and such additional housing as may be necessary to insure proper control of dust. The plant shall operate in conformance with all applicable regulations concerning Air Quality Control.

10. Inspection Access. Adequate, safe and unobstructed access to all areas of the plant from which material samples are required shall be provided. These areas shall include, but not be limited to, Dryer, Screens, Storage Bins, Asphalt Control Unit, and Truck Loading Space. In addition, a ladder or platform shall be provided at the truck loading space to permit easy and safe inspection or sampling of the mix as it is delivered into the truck.
11. Screen By-Pass Operation. The producer of asphaltic concrete material may operate his asphalt plant by discharging the hot dry aggregate material from the dryer into one of the hot storage bins instead of separating the aggregate by screening. The asphaltic concrete mixture discharged from the pugmill with the operating screen on by-pass shall comply with the specification and job-mix formula criteria.
12. Field Testing Laboratory. The Contractor and/or developer shall provide a laboratory building or room at the plant site, for the exclusive use of the County Engineer for performing tests, keeping records, and making reports when requested.

The Contractor and/or developer shall also furnish necessary laboratory sieves and a powered shaker device for sieve analysis, scales, extractor and supplementary equipment to make aggregate sieve analysis, asphaltic concrete paving mixture analysis, and paving mixture density tests if requested by the County Engineer.

B. Special requirements for Batch Type Plants.

1. Plant Scales. Scales for any weight box or hopper may be of either the springless dial or beam type and shall be of an established make and design accurate to within 0.5 percent of the indicated load.

Dial scales shall be designed, constructed and installed in such manner as to be free from vibration. All dials shall be so located as to be plainly visible to the operator at all times. The numbers on the dial shall be large enough to be read at a distance of twenty-five (25) feet. The end of the pointer shall be set close to the face of the dial to minimize parallax. The scale shall be provided with adjustable pointers for marking the weight of each material to be weighed into the batch.

When the scales are of the beam type, there shall be a tare beam for balancing the hopper and a separate beam for the aggregate from each hot bin. A telltale dial shall be provided that will start to function when the load being applied is within one hundred (100) pounds of the weight desired. Each beam shall have a locking device designed and so located that the beam can easily be suspended or put into action. Scales for the weighing of asphalt cement shall conform to the requirements for aggregate scales, except that beam scales shall consist of a full capacity beam and tare beam.

The minimum gradation shall not be greater than one (1) pound and there shall be attached a telltale device which will start to function when the load being applied is within twenty-five (25) pounds of the weight desired. Dial scales for weighing

the asphalt cement shall read to the nearest pound. All scales for weighing the asphalt shall have a capacity of not more than ten (10) percent of the normal capacity of the mixer.

Scales shall be tested and sealed as often as the County Engineer may deem it necessary to insure their accuracy. All weighing equipment shall be well constructed and designed to permit easy realignment and adjustment. Weighing equipment that gets out of adjustment shall be replaced or repaired when ordered by the County Engineer. The Contractor and/or developer shall provide and have available at least to 50-pound standard weights for frequent testing of all scales. For each scale, a suitable cradle, or platform, shall be provided for applying the test load so that the load is distributed uniformly. The test weights shall be kept clean and stored near the scales.

2. Weight Box or Hopper. Equipment shall include a weight box or hopper, large enough to hold a full batch without hand raking or running over, for accurately weighing each bin size aggregate. The weight box or fulcrums and knife edges shall be so constructed that they will not readily be thrown out of alignment. Gates on both bins and hopper shall prevent leakage when they are closed. An interlocking device which prevents the opening of more than one gate at a time shall be provided. Proportioning of aggregates and charging of mixer shall be performed to blend the aggregates thoroughly and prevent segregation in the mixer.

Automatic plants may proportion all aggregates by simultaneous measuring if a weight hopper with a separate compartment for each bin size, calibrated by weight, is used.

3. Asphalt Cement Measuring Equipment. Asphalt measuring equipment provided on the plant shall accurately measure into each batch the required amount of asphalt within a tolerance of plus or minus two (2) pounds.

When an asphalt bucket is used, it shall be a nontilting type provided with a loose sheet-metal cover. The capacity of the asphalt bucket shall be at least ten (10) percent in excess of the weight of asphalt required for a one-batch mix. The plant shall have a steam-jacketed, quick closing, non-dripping, charging valve.

The length of the discharge opening or spray bar shall not be less than three-fourths of the length of the mixer and it shall discharge directly into the mixer. The discharge system shall be designed and arranged to deliver the asphalt the full length of the mixer in a thin, uniform sheet or in multiple streams or sprays.

When a volumetric meter is used, it shall automatically meter the asphalt into each batch. The dial to indicate the amount of asphalt shall have a capacity of at least ten (10) percent in excess of the weight or gallons of asphalt required in one batch.

The meter shall be constructed so that it may be locked at any dial setting and will automatically reset to this reading after the addition of the flow of asphalt to each batch. The dial shall be in full view of the mixer operator. The flow of asphalt shall be controlled to begin automatically when the dry mixing period is over. All of the asphalt required for one batch shall be discharged in not more than fifteen (15) seconds after the flow has started. The section of the asphalt flow line located between the charging valve and the outlet shall be used for checking and testing the accuracy of the meter.

4. Mixer Unit for Batch Method. The plant shall include a batch mixer and a batch capacity of not less than 2000 pounds. It shall be capable of producing, uniformly, a mix within the job-mix tolerances established in Section 1404. Deviation in size of batches will be permitted to provide for mixing batches down to twenty (20) percent below and up to fifteen (15) percent above the rated capacity in the mixer, provided the quality of the mix is not impaired.

The paddles shall be set to insure a completely uniform mixture. If not enclosed, the mixer box shall be equipped with a dust hood to prevent loss of dust. The mixer shall be so constructed as to prevent leakage of contents.

5. Interlock, Time Control and Batch Counter. The Mixer shall have an interlocking control to lock the weight box gate until the material in the pugmill has been discharged and the pugmill has been closed. The interlock shall also lock the asphalt bucket throughout the dry and wet mixing periods. The timing control shall be flexible, permitting adjustments of cycles up to three minutes in five second intervals. A batch counter, designed to register only completely mixed batches, shall be installed.

C. Special Requirements for Continuous Mixing Plants.

1. Feeder Signal Devices. The aggregate bins shall be provided with signal devices and controls which will warn of low levels and thereby lead to stopping the flow of all aggregate and asphalt to the mixer when the aggregate in any one bin is so low that the feeder will not operate at set capacity. The asphalt storage system shall be provided with signal devices and controls which will warn of low levels of asphalt and which will stop the entire plant operation when the asphalt storage lever is lowered to the point of exposing the feed end of the asphalt suction line.
2. Aggregate Feed Unit. The proportioning unit shall include a feeder mounted under the bins. Each bin compartment shall have an accurately controlled mechanically adjustable gate to form an opening for volumetrically measuring the material drawn from it. The opening shall be rectangular and provided with a lock. Indicators shall be provided on each gate to show the gate opening in inches. Mineral filler, if specified, shall be proportioned separately from a hopper equipped with an adjustable feed which may be accurately and conveniently calibrated and which shall be interlocked with the aggregate and asphalt feeds.

3. Calibration of Aggregate Feed. Samples shall be taken and weighed as a means of calibrating gate openings. Material shall be fed out of a bin through the individual opening and bypassed to a leakproof test box. The material from each compartment shall be taken separately. The plant shall be equipped to handle conveniently test samples weighing not less than two hundred (200) pounds. A platform scale shall be provided by the Contractor and/or developer to weigh the test samples to an accuracy of + or - 0.5 percent of the indicated load.
 4. Synchronization of Aggregate and Asphalt Feed. Positive interlocking control shall be assured between the flow of aggregate from the bins and the flow of asphalt from the meter or other proportioning device. This shall be accomplished by a positive interlocking method.
 5. Mixer Unit for Continuous Method. The plant shall include a continuous mixer capable of uniformly producing a mix within the job-mix tolerance specified in Section 1404(A). The mixer shall carry a manufacturer's plate giving the net volumetric contents of the mixer at the several heights inscribed on a permanent gauge.
- D. Special Requirements for Drum Dryer Mixing. Asphaltic concrete mixtures may be manufactured by the process of incorporating asphalt cement with aggregate as the material passes through the dryer. The drum dryer mixing operations shall be approved by the County Engineer prior to the manufacture of asphaltic concrete mixes. The material so produced shall comply with specifications and job-mix formula criteria.

The aggregate bins and asphalt storage system shall be equipped with feeder control devices in conformance with Section 1405(C,1). The Contractor and/or developer shall provide and have available standard weights of sufficient sizes to calibrate the aggregate feed conveyor scales from their minimum to maximum readings in one (1) pound increments.

1406 TRANSPORTATION OF MIX. The mix shall be transported to the job site in vehicles with tight metal bottoms, clean of all foreign material which may affect the mix. The inside of the truck beds shall be lubricated with a thin coating of volatile oil to prevent the mix from adhering to the bed, but an excess of lubricant will not be permitted. The dispatching of vehicles shall be so scheduled that all materials delivered may be placed in daylight unless the County Engineer approves artificial light. Delivery of the material to the paver shall be at a uniform rate and in an amount within the capacity of the paving and compacting equipment.

Haul trucks shall be provided with covers of sufficient size and weight to completely cover the truck bed to protect the load and to prevent cooling of the upper surface. Failure to have the load completely covered shall be sufficient cause for rejection of the entire load. The load shall remain covered until the truck is next in line to be unloaded. In no case shall a load remain uncovered for more than ten (10) minutes before starting to use the load. If for any reason there is a delay in completely using a load, the remaining part of the load shall be re-covered until it can be used. It shall be the responsibility of the Contractor and/or developer to inform all truck drivers of these provisions before starting work.

1407 SCALES AND WEIGHING OF VEHICLES. The vehicle's tare and gross weight shall be established by actually weighing the vehicle on a certified scale. The tare weight will be established at least twice each day. The vehicle, when establishing tare, shall be clean, bed empty, fuel tanks filled and shall have all side and back boards in place.

Scales used to determine the weight of vehicles shall be of the axle-load type. Certification of scales shall be accomplished by a scale company capable of testing the performance of axle-load for compliance with the National Bureau of Standards Handbook #44, "Specifications, Tolerance and other Technical Requirements for Commercial Weighing and Measuring Devices."

1408 REQUIREMENTS FOR ASPHALT PAVING EQUIPMENT. All asphalt paving equipment used by the Contractor and/or developer shall meet the requirements of this section and shall be maintained in acceptable mechanical condition. Equipment shall be serviced and lubricated away from the paving site. Units that drip fuel, oil or grease shall be removed from the project until such leakage is corrected.

- A. Pavers and Laydown Machines. Mechanical self-powered pavers shall be capable of spreading the mix, within the specified tolerances, true to the line, grade and crown indicated on the plans.

Pavers shall be equipped with quick and efficient steering devices and shall be capable of traveling both forward and in reverse. They shall be equipped with hoppers and distributing screws which place the mix evenly in front of the adjustable screeds. They shall be equipped with either a vibrating screed or a tamping bar immediately preceding a static screed.

There shall be sufficient auxiliary attachments for the paving machine so that it may be operated to lay 8, 9, 10, 11 and 12 foot strips. The necessary width for laying shall be determined in the field by the County Engineer. Vibrating screed or tamping bars shall be provided for the full width of all paving operations.

The screed shall include a strike-off device which is effective on mixes at workable temperatures without tearing, shoving or gouging them, and which produces a finished surface of an even and uniform texture. The screed shall be adjustable as to the height and crown and shall be equipped with a controlled heating device for use when required. For irregular width paving, hydraulic extensions, without tamping bars and vibrating screed, may be used only along the curb or outer edge of pavement.

- 1. Electronic Screed Controls. The paver shall be equipped with an approved system capable of automatically controlling the elevation and transverse slope of the paver screed. An erected stringline, traveling stringline or other approved device operating on the roadbed being paved or the surfaces of the previously placed lane shall be used to establish the grade reference. The grade reference device shall operate on either or both sides of the paver as required and shall be capable of maintaining the desired transverse slope regardless of changes in the screed elevation.

The traveling stringline shall be constructed in such a manner that it does not vibrate or cause the sensor to make erroneous readings during the layout operation.

The length of the beam to be used shall be approved by the County Engineer and shall be between twenty (20) feet and forty (40) feet.

In the event of failure of the automatic screed control system, the Contractor and/or developer will be permitted to continue placing the asphaltic concrete mix for the rest of the day in which the failure occurred. The Contractor and/or developer will not be permitted to continue operations without using automatic screed controls unless permission has been granted by the County Engineer on each succeeding day following the failure.

The use of the automatic screed control devices on asphalt pavers will not be required for paving small irregular areas, entrances, approaches, or side street connections. Automatic screed control devices will be required for matching the joint with all previously laid strips, except for those areas noted above.

2. Beveled Joint. The paver shall be equipped with a shoe which will produce a joint between laying strips having its face inclined at an angle of thirty (30) degrees from the vertical. This type joint shall be used with all asphaltic concrete mixes. The shoe shall be designed in a manner that it will be capable of beveling depth up to four (4) inches.

B. Rollers. Compaction equipment may consist of vibratory steel wheel, static steel wheel or pneumatic-tired rollers. They shall be self-propelled and equipped with such controls that starting, stopping and reversing direction can be accomplished without displacing the hot asphaltic concrete pavement.

1. Steel-Wheeled Rollers. Steel-Wheeled Rollers may be as follows: three-wheeled rollers, vibratory rollers, tow-axle tandem rollers, or three-axle tandem rollers. These rollers shall develop contact pressure of 195 to 350 pounds per inch of width. Rollers shall be in good condition.

Rollers shall be equipped with adjustable scrapers to keep the wheel surfaces clean and with efficient means of keeping them wet to prevent mixes from sticking. These surfaces shall have no flat areas, openings or projections which will mar the surface of the pavement.

The three-axle tandem rollers shall be so constructed that, when locked in position with all treads in one plane, the roller wheels are held with such rigidity if either front or center wheel is unsupported, the other two wheels will not vary from the plane more than 1/4 inch.

2. Pneumatic-Tired Rollers. The rollers shall be equipped with pneumatic tires of equal size and diameter which are capable of exerting average contact pressures varying from 40 psi to 110 psi by adjusting the ballast and or tire inflating pressures. The wheels of the roller shall be so spaced than one pass will accomplish one complete coverage equal to the rolling width of the roller. There shall be a

minimum of 1.4 inch overlay of the tracking wheel. The wheels shall oscillate but not wobble. The roller shall be so constructed that the contact pressure shall be uniform for all wheels, and the tire pressure of the several tires shall not vary more than 5 psi. Pneumatic-tired rollers shall be constructed with enough ballast space to provide uniform wheel loadings as may be varied by order of the County Engineer to obtain contact pressures that will result in the required density.

3. Trench Rollers. Trench rollers shall have an auxiliary wheel that operates outside the area to be compacted at such a distance from the pavement edge as to cause no damage thereto. It shall be mounted upon an axle that is adjustable in height. The auxiliary wheel shall be kept in adjustment so that the compression wheels will develop a smooth, compacted surface true to crown and grade.

The contact pressure of the compression wheels shall be from 195 to 350 pounds per inch of width.

Trench rollers shall be equipped with adjustable scrapers to keep the rollers clean and with efficient means of wetting the compression wheels to prevent mixed from sticking.

In lieu of the above requirements pertaining to non-vibratory compaction equipment, consideration will be given to use other types of equipment which are capable of producing equivalent results consistent with the requirements of the specifications.

- C. Pressure Distributor. The pressure distributor shall meet the requirements of Section 1305.
- D. Hand Tools. The Contractor and/or developer shall provide sufficient lutes, rakes, shovels, tamping irons and other equipment as required to produce results consistent with the specifications.

1409 CONSTRUCTION REQUIREMENTS.

- A. Preparation of the Area to be Paved. The area to be paved shall be true to line and grade, and have properly prepared surface prior to the start of the paving operations. Using a mechanical sweeper, Clay County Highway Department will require that the contractor and/or developer remove all dirt, mud and foreign material before placement of the tack coat. If a street, road or highway that is being prepared for an overlay is heavily tracked with mud, the contractor and/or developer will be required to wash entire street before the overlay will start. This will be a subsidiary item to the contract. Immediately after the contractor and/or developer has overlaid the roadways and the final rolling for compaction is done, the contractor and/or developer will use a mechanical sweeper or hand brooms to remove all excess asphalt material from street curb/gutter, grass areas, residential drives and commercial parking areas.

Where a base is rough or uneven, a leveling course shall be placed and properly compacted before the placing of subsequent courses.

When leveling course is not required, all depressions and other irregularities shall be patched or corrected, and the work approved by the County Engineer before the paving operation begins.

The area to be paved shall be primed uniformly in accordance with the provisions of Section 1300. The asphalt emulsion may be diluted 1:1 to 1:3 parts emulsion to water.

The surfaces of curbs, gutters, vertical faces of existing pavements and all structures in actual contact with asphalt mixes shall be painted with a thin, complete coating of asphaltic material to provide a closely bonded, watertight joint.

- B. Weather Limitations. When the moisture of the aggregate in the stockpile or from the dryer interferes with the quality of mix production, or with normal plant operations, or when pools of water are observed on the surface to be paved, the mixing and placing of hot-mix asphalt will not be permitted without the special permission of the County Engineer.

Hot mix asphalt paving shall not be mixed or placed when the ambient temperature is below 40 degrees F, or when there is frost in the subgrade or any other time when weather conditions are unsuitable for the type of material being placed without expressed approval of the County Engineer. The minimum temperature of the asphaltic concrete when placing at the construction site shall be 300 to 285 degrees F when the ambient temperature is from 40 - 50 degrees F, 280 degrees F when the ambient temperature is from 50 - 60 degrees F, and 280degrees F when the ambient temperature is above 60 degrees F.

- C. Spreading and Finishing. The spreading and finishing of each course shall be to the thickness and width indicated on the plans or Special Provisions. The thickness of individual lifts shall not exceed the following for the respective type of mixture.

Type 1	Asphalt Concrete Base	4"
Type 2	Asphalt Concrete Base	4"
Type 3	Asphalt Concrete Surface	2"
Type 4	Asphalt Concrete Surface	2"

Spreading and finishing shall be conducted in the following manner:

1. Mechanical Pavers. The base and surface courses shall be spread and struck-off with a mechanical paving machine meeting the requirements of Section 1408 (A). The paving machine shall be operated so that the material does not accumulate and remain along the sides of the receiving hopper.

Equipment which leaves tracks or indented areas which cannot be corrected in normal operation, or which produces other permanent blemishes or fails to produce a satisfactory surface, shall not be used.

Longitudinal joint and edges shall be constructed to true line markings. Lines for the paver to follow in placing individual lanes will be established parallel to the centerline of the proposed roadway. The paver shall be positioned and operated to follow closely the established line. When using pavers in echelon, the second paver shall follow the edge of the material placed by the first paver. The length of each laydown pass shall be limited, depending on weather conditions, to assure a hot joint and obtain proper compaction.

As soon as the first load of material has been spread, the texture of the unrolled surface shall be checked to determine its uniformity. Segregation of materials shall not be permitted. If segregation occurs, the spreading operation shall be immediately suspended until the cause is determined and corrected.

For asphalt overlays, the contractor and/or developer shall cut with a small milling machine a two (2) inch header into existing asphalt the entire width of the road to make a smooth transition.

Any irregularities in alignment left by the paver shall be corrected by trimming directly behind the machine. Immediately after trimming, the edges of the course shall be thoroughly compacted by tamping. Distortion of the pavement during this operation shall be avoided.

Edges against which additional pavement is to be placed shall be beveled 30 degrees from the vertical plane. A lute or rake shall be used immediately behind the paver to obtain a true line and beveled edge. Any irregularities in the surface of the pavement course shall be corrected directly behind the paver. Excess material forming high spots shall be removed by a shovel or lute. Indented areas shall be filled with hot mix and smoothed. Fanning of material shall not be permitted.

2. Hand Spreading. In small areas where the use of mechanical finishing equipment is not practical, the mix may be spread and finished by hand. Placing by hand shall be performed carefully; the material shall be distributed uniformly to avoid segregation of the coarse and fine aggregate. Broadcasting of material shall not be permitted. During the spreading operation, all material shall be thoroughly loosened and uniformly distributed by lutes or rakes. Material that has formed into lumps and does not break down readily shall be rejected. Following placing and before rolling, the surface shall be checked with templates and straightedges and all irregularities corrected.

D. Compaction.

1. General. Rolling equipment for use in compacting mixes shall meet the requirements of Section 1408 (B). Unless otherwise approved by the County Engineer, at least three (3) rollers shall be required at all times. Additional rollers shall be used as necessary to provide specified pavement density.

All rolling shall proceed as directed by the County Engineer, but in general shall be longitudinal, starting near the edge of the pavement and proceeding toward the center of the roadway, overlapping on successive trips by not less than one-third (1/3) and no more than one-half (1/2) the width of the roller. Alternate trips of the roller shall be of slightly different lengths. The initial rolling shall take place as closely behind the laying machine as the temperature and condition of the mat will allow.

The motion of the roller shall be slow enough at all times to avoid displacement of the hot mixture. The initial compaction roll shall be accomplished with the roller drive wheel leading the tiller wheel. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected immediately by the use of rakes and fresh mixture when required. To prevent adhesion of the mixture the wheels shall be kept properly moistened, but excess water will not be permitted.

Immediately after spreading, each course of the pavement mixture shall be compacted by rolling. The initial or "breakdown" rolling shall be accomplished with a smooth-wheeled roller. The pneumatic tired roller shall be used to knead and compact the pavement mixture following the initial rolling and preceding the final rolling. Care shall be exercised in the use of the pneumatic-tired roller to ensure that the pavement mixture is sufficiently cooled to avoid "picking-up" of the mixture on the tires of the roller, and also to ensure that the pneumatic-tired rolling is completed before the mixture becomes too cool to allow satisfactory finish rolling. Final, or finish rolling, shall be done with a smooth-wheeled roller. The surface of the mixture after compaction shall be smooth and true to established section and grade. Any surface which shows an uneven mixture or which becomes loose, or is in any way defective, shall be removed and replaced with fresh hot mixture at the Contractor and/or developer's expense, and be immediately compacted to conform with the surrounding area.

2. Rolling Procedure. When paving in single widths, rolling shall proceed in the following order:
- a. Transverse Joint
 - b. Outside Edge
 - c. Initial or Breakdown rolling, beginning on the low side and progressing toward the high side
 - d. Second rolling same procedure as 3
 - e. Finish rolling

When paving in echelon, or abutting a previously placed lane the longitudinal joint, rolling shall follow the transverse joint rolling.

When paving in echelon, two to three inches of the edge, which the second paver is following, shall be left unrolled, and rolled when the joint between the lanes is rolled. Edges shall not be exposed more than fifteen minutes without being rolled. Particular attention shall be given to the construction of transverse and longitudinal joints in all courses.

In laying a surface mix adjacent to any finished area, it shall be placed sufficiently high so that, when compacted, the finished surface will be true and uniform. Where the grade is slight, gutters will be checked with a straightedge to insure drainage to the desired outlet.

3. Transverse Joints. Transverse joints shall be carefully constructed and thoroughly compacted to provide a smooth riding surface. If the joint has been distorted, it shall be trimmed to a line. The joint face shall be painted with a thin coating of asphalt before the fresh material is placed against it. Transverse joints shall be held to a minimum. At the end of the paving day all lanes shall be completed to approximately the same station.
4. Longitudinal Joints. Longitudinal joints shall be rolled directly behind the paving operation. The first lane placed shall be true to line and grade. In spreading, the material shall overlap the edge of the lane previously placed by two (2) to four (4) inches. The width and depth of the overlapped material shall be kept uniform along the joint for alignment purposes. Before rolling, the coarse aggregate in the material overlapping the joint shall be carefully removed with a rake or lute and discarded.
5. Edges. The edges of the pavement shall be rolled concurrently with or immediately after rolling the longitudinal joint.

Care shall be exercised in consolidating the material along the entire length of the edges. Before it is compacted, the material along the unsupported edges shall be slightly elevated with a tamping tool or lute. This will permit the full weight of the roller wheel to bear on the material to the extreme edges of the mat. In rolling pavement edges, roller wheels shall extend approximately one (1) inch beyond the pavement edge.

6. Breakdown Rolling. Breakdown rolling shall immediately follow the rolling of the longitudinal joint and edges. Rollers shall be operated as close to the paver as necessary to obtain adequate density without causing undue displacement. The breakdown roller shall be operated with the drive wheel nearest the finishing machine. Exceptions may be made by the County Engineer when working on steep slopes or super-elevated curves.
7. Intermediate Rolling. Pneumatic-tired rollers as specified in Section 1408(B,2) shall be used for intermediate rolling. The intermediate rolling shall follow the breakdown rolling as closely as possible and while the paving mix is still of a temperature that will result in maximum density from the operation.

Pneumatic-tired rolling shall be continuous after the initial rolling until all of the mix placed has been compacted to the required density. Turning of pneumatic-tired rollers on the hot paving mix which causes displacement shall not be permitted.

8. Finish Rolling. The finish rolling shall be accomplished while the material is still warm enough for the removal of roller marks. All roller marks shall be removed by the finish rolling operation.

All rolling operations shall be conducted in close sequence. In places inaccessible for the operation of standard rollers as specified, compaction shall be performed by trench rollers or others meeting the requirements of Section 1408 (B.3). The trench roller shall be operated until the course is thoroughly compacted. Hand tamping, manual or mechanical, may be used in such areas, if such operations will give the required density.

- E. Density and Surface Requirements. The completed asphalt concrete paving shall have a density equal to or greater than ninety-five (95) percent for Type 1 and 2 Asphalt Concrete Base and ninety-seven (97) percent for Type 3 and 4 Asphalt Concrete Surface. Density is based on laboratory specimens prepared as specified in Section 1404 (B) and made from plant mix conforming to the job mix formula.

All unsatisfactory work shall be repaired, replaced or corrected at the direction of the County Engineer. The surface of the final course shall be of a uniform texture and conform to line and grade shown on the plans.

Both density and thickness shall be carefully controlled during construction and shall be in full compliance with plans and specifications. During compaction, preliminary tests, as an aid for controlling thickness shall be made by means approved by the County Engineer.

Upon request of the County Engineer, representative samples of the compacted asphalt paving shall be obtained by the Contractor and/or developer under the supervision of the County Engineer and shall be tested by a suitable independent or municipal testing laboratory as necessary to verify compliance with respective density requirements.

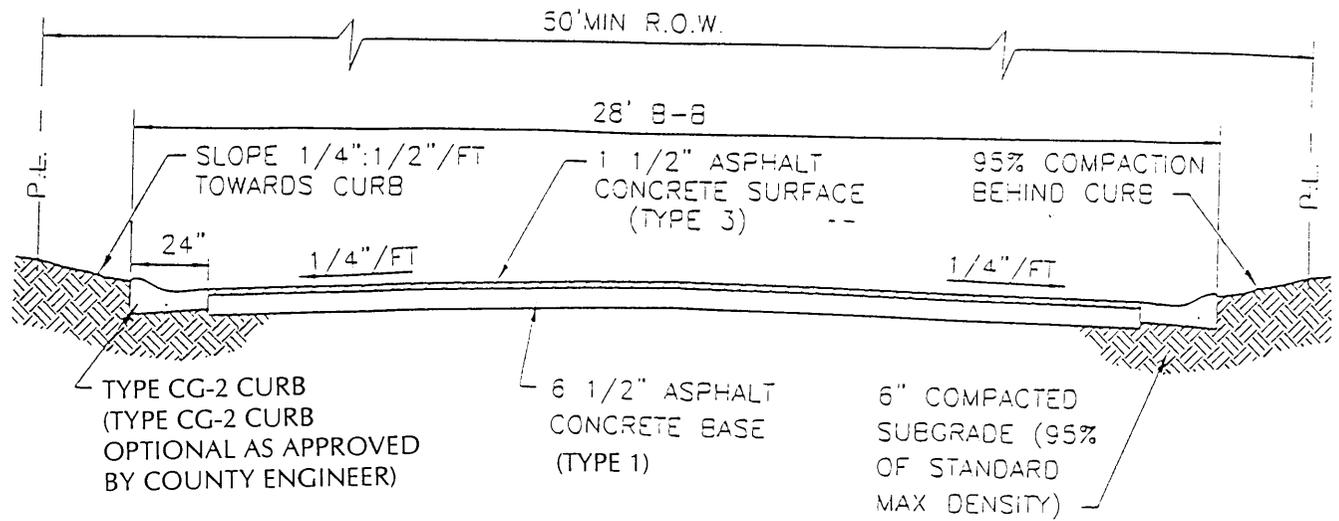
Selection of the independent testing laboratory, the number, timing, location and testing procedures for the representative samples shall be approved by the County Engineer. The testing laboratory shall submit to the County Engineer four (4) copies of each report covering the details and results of the tests. All costs for the testing laboratory and all other costs of testing shall be borne by the Contractor and/or developer, unless otherwise specified.

The surface of the final surface course shall not vary from a ten (10) foot straight edge, applied parallel to the centerline, by more than one-fourth (1/4) inch.

1410 PROTECTION OF PAVEMENT. The Contractor and/or developer shall protect all sections of newly compacted base and surface courses from traffic until they have hardened properly, or as directed by the County Engineer.

1411 COMPACTION TESTING. At the option of the County Engineer, compaction testing may be performed in the field using a nuclear density-moisture measuring device to determine the density of the mixture as placed. Field test results shall be immediately available to the inspector. If as a result of this field testing the County Engineer determines that further compaction is required, the Contractor and/or developer shall revise his rolling procedure to obtain the density as specified. All testing shall be at the expense of the Contractor and/or developer.

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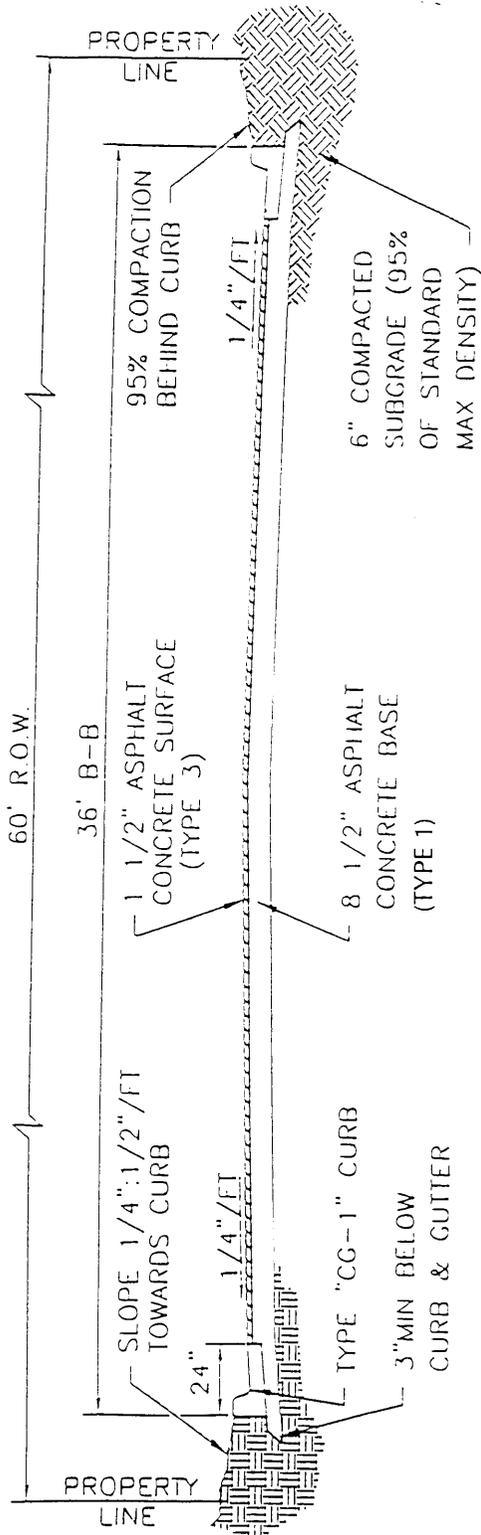
NOTE:
 ASPHALTIC CONCRETE BASE MIX TYPE TO BE AS APPROVED BY THE COUNTY ENGINEER. UNLESS APPROVED IN WRITING BY THE COUNTY ENGINEER, BASE MIX SHALL BE TYPE 1



County of Clay
 HIGHWAY
 DEPARTMENT/PWD

TOTAL ASPHALT
 LOCAL STREET DETAIL

D14-1



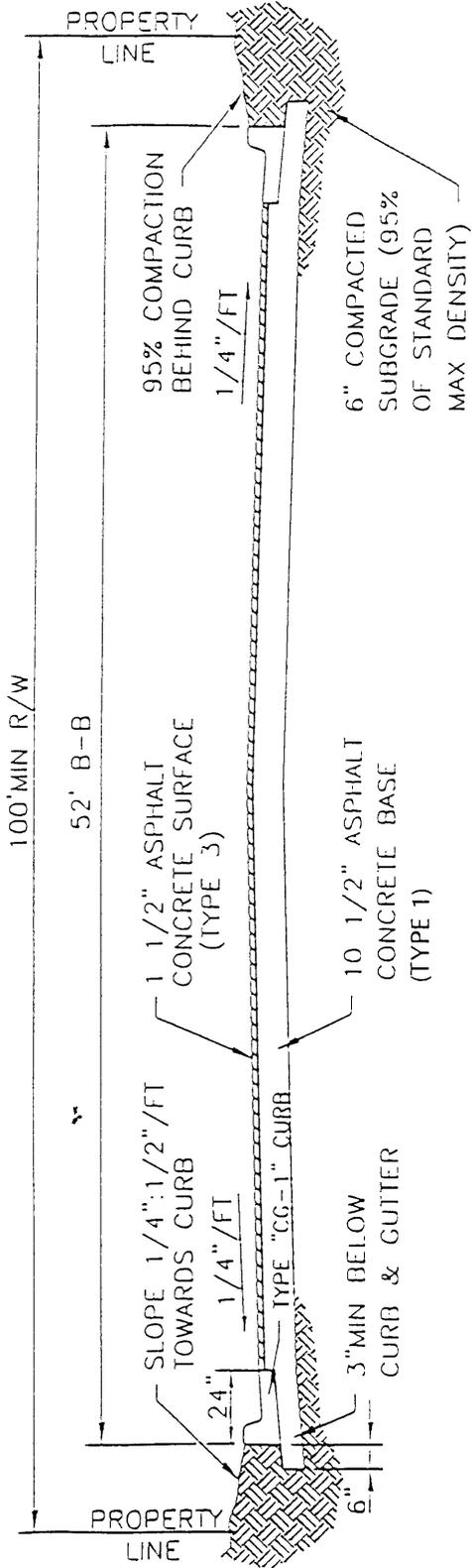
NOTE: ASPHALTIC CONCRETE BASE MIX TYPE TO BE AS APPROVED BY THE COUNTY ENGINEER. UNLESS APPROVED IN WRITING BY THE COUNTY ENGINEER, BASE MIX SHALL BE TYPE 1



County of Clay
HIGHWAY
DEPARTMENT/PWD

TOTAL ASPHALT COLLECTION
COMM. STREET DETAIL

D14-2



- NOTE:
1. DESIGN GEOMETRICS TO BE APPROVED BY THE COUNTY ENGINEER FOR EACH INDIVIDUAL PROJECT
 2. ASPHALTIC CONCRETE BASE MIX TYPE TO BE AS APPROVED BY THE COUNTY ENGINEER. UNLESS APPROVED IN WRITING BY THE COUNTY ENGINEER, BASE MIX SHALL BE TYPE 1



County of Clay
 HIGHWAY
 DEPARTMENT/PWD

TOTAL ASPHALT MINOR
 ARTERIAL STREET DETAIL

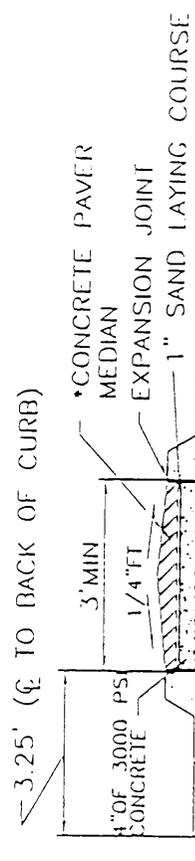
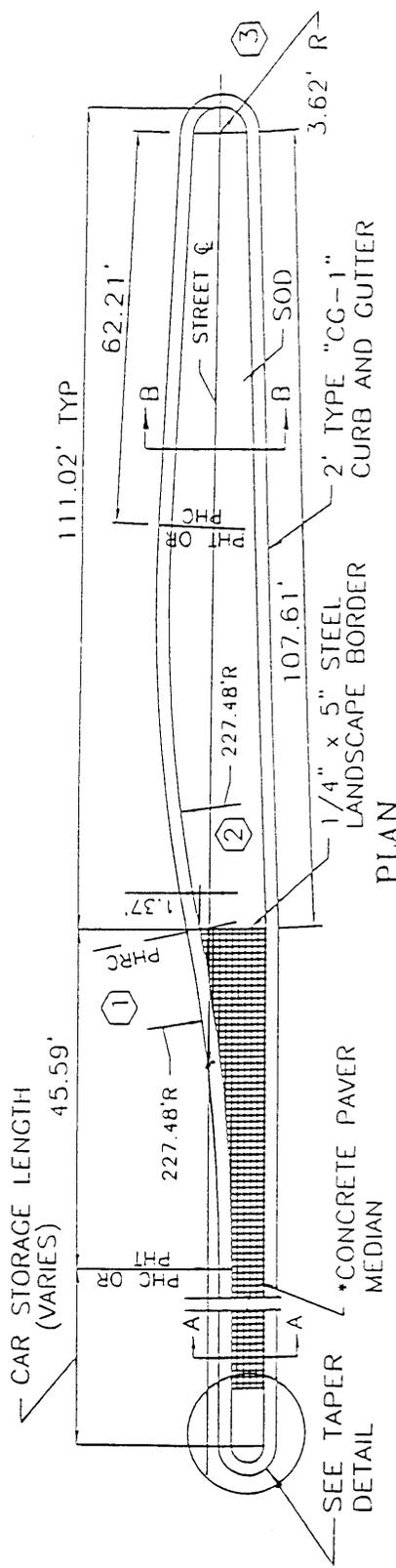
D14-3



County of Clay
 HIGHWAY
 DEPARTMENT/PWD

TYPICAL MEDIAN DETAIL
 (MINOR ARTERIAL)

D14-4



CURVE INFO

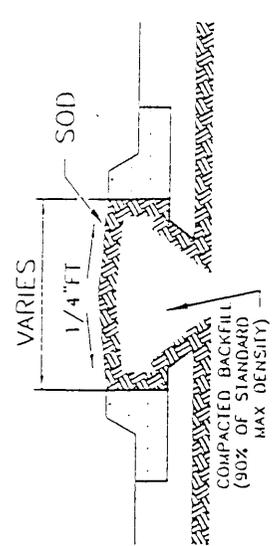
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	C=	45.59
	Δ =	11.50
	R=	227.48
	T=	22.91

(2)

A=	45.67
C=	45.59
Δ =	11.50
R=	227.48
T=	22.91

(3)

A=	11.65
C=	7.23
Δ =	175.69
R=	3.62
T=	96.16



SEC A-A

SEC B-B

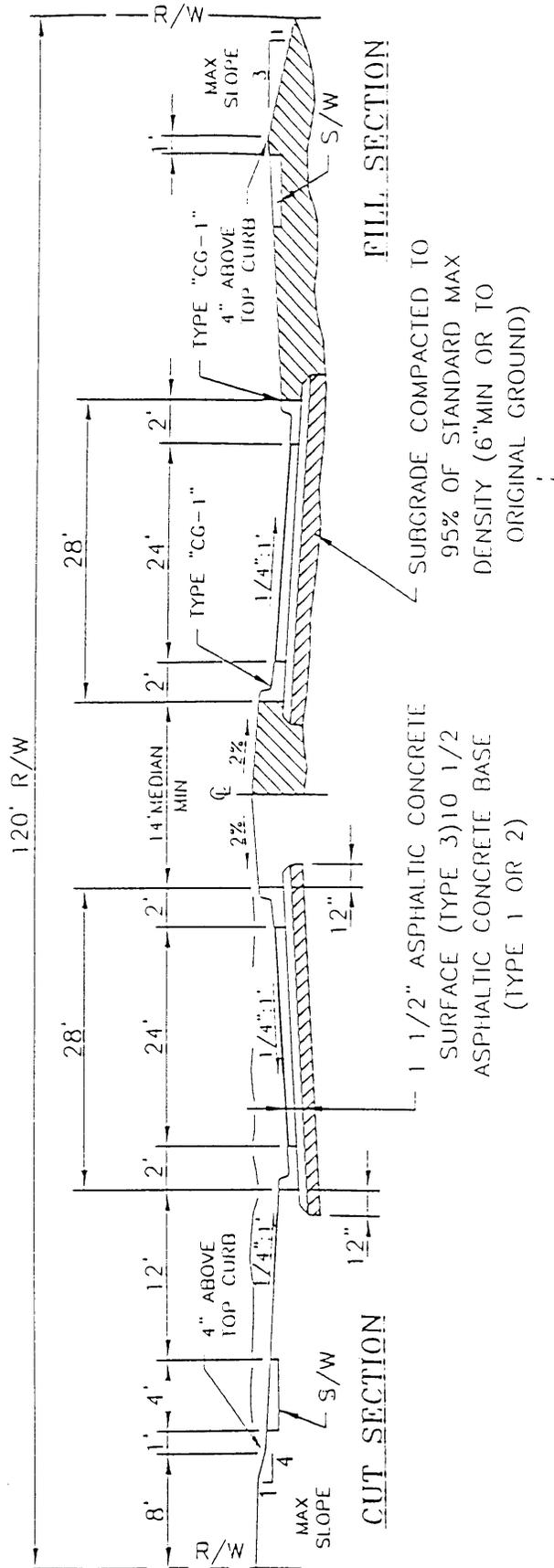
* CONCRETE PAVE TYPE, PATTERN AND COLOR TO BE SELECTED BY COUNTY ENGINEER



County of Clay
 HIGHWAY
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TOTAL ASPHALT MAJOR
 ARTERIAL STREET DETAIL

D14-5



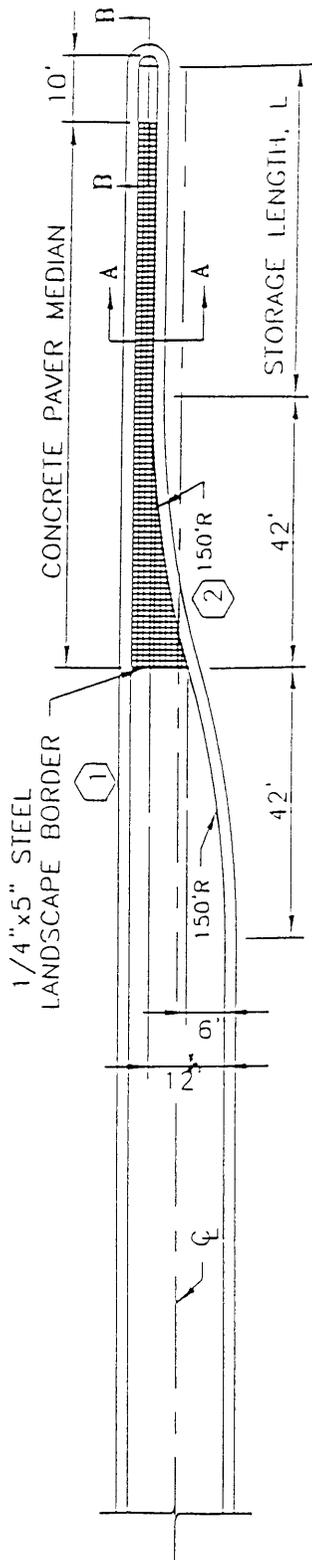
NOTE:
 ASPHALTIC CONCRETE BASE MIX SHALL BE TYPE 2
 UNLESS OTHERWISE APPROVED BY COUNTY ENGINEER



County of Clay
 HIGHWAY
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TYPICAL MEDIAN DETAIL
 (MAJOR ARTERIAL)

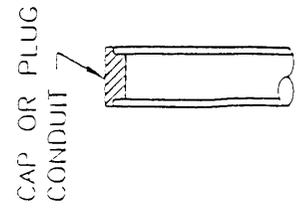
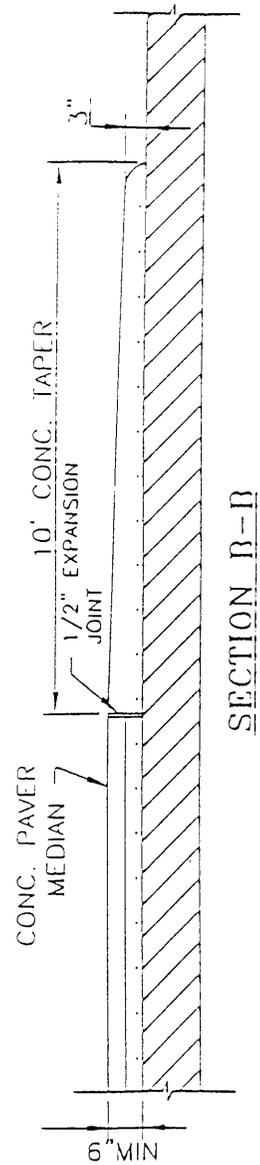
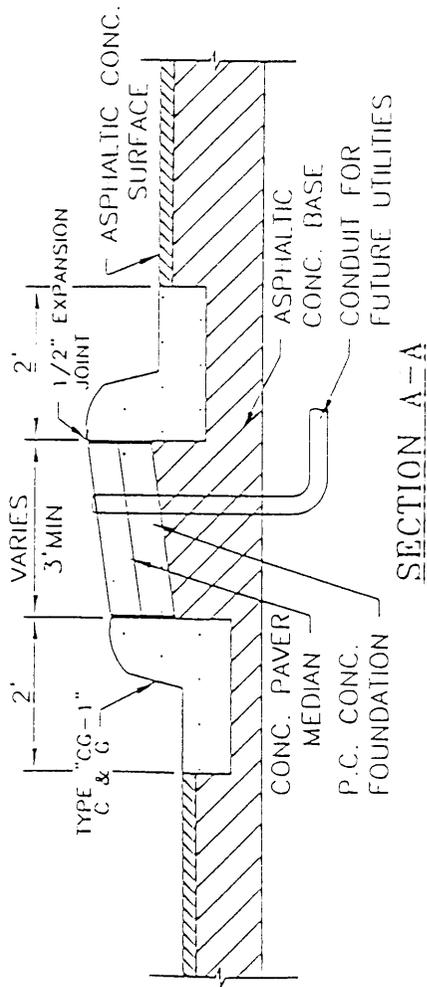
D14-6



TYPICAL LEFT TURN LANE

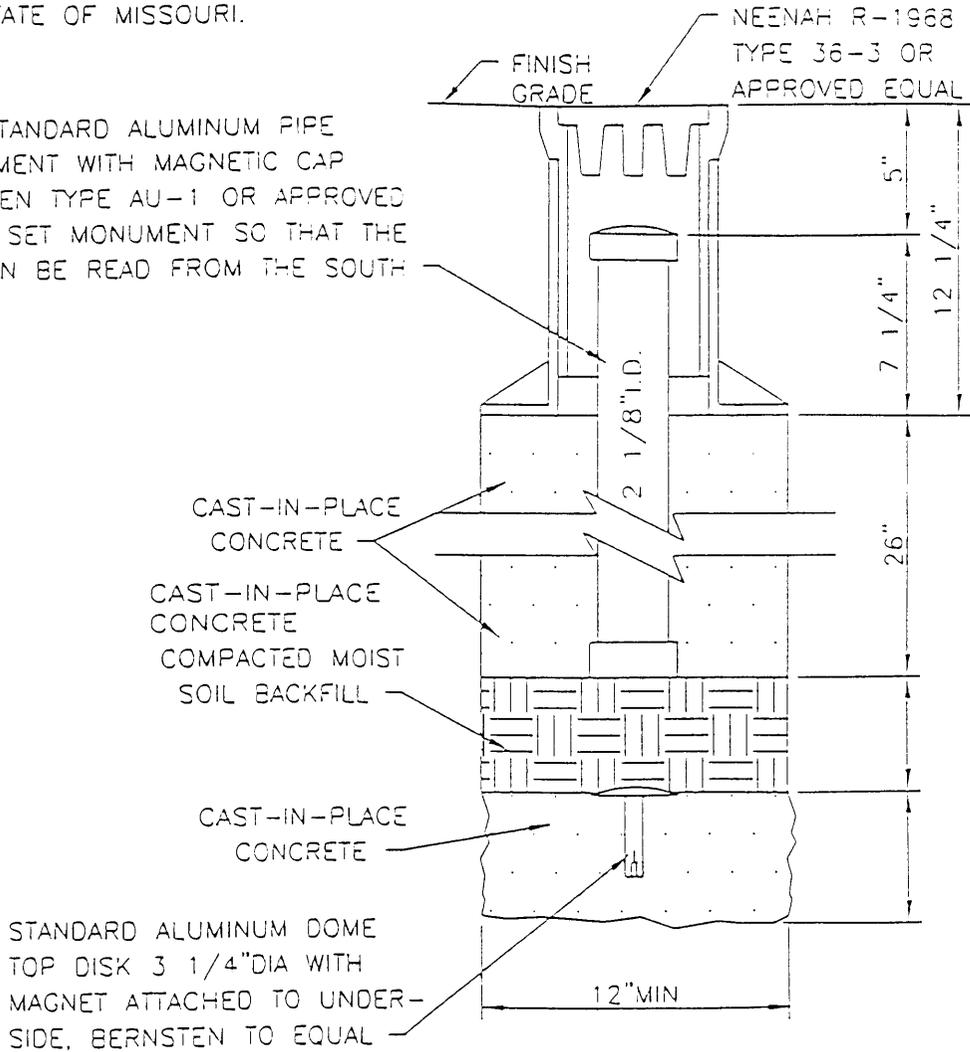
CURVE INFO

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	T=	21.21
②	A=	42.14
	C=	42.00
	Δ=	16.10
	R=	150.00
	T=	21.21



NOTE:
 CAP FURNISHED BY CONTRACTOR.
 SECTION, TOWNSHIP MARKER TO
 HAVE AND RANGE STAMPED ON
 THE TOP WITH TRUE SECTION
 CORNER ETCHED ON THE SURFACE
 BY SURVEYOR LICENSED IN THE
 STATE OF MISSOURI.

30" STANDARD ALUMINUM PIPE
 MONUMENT WITH MAGNETIC CAP
 BERNSTEN TYPE AU-1 OR APPROVED
 EQUAL. SET MONUMENT SO THAT THE
 CAP CAN BE READ FROM THE SOUTH



STANDARD LAND CORNER MONUMENT

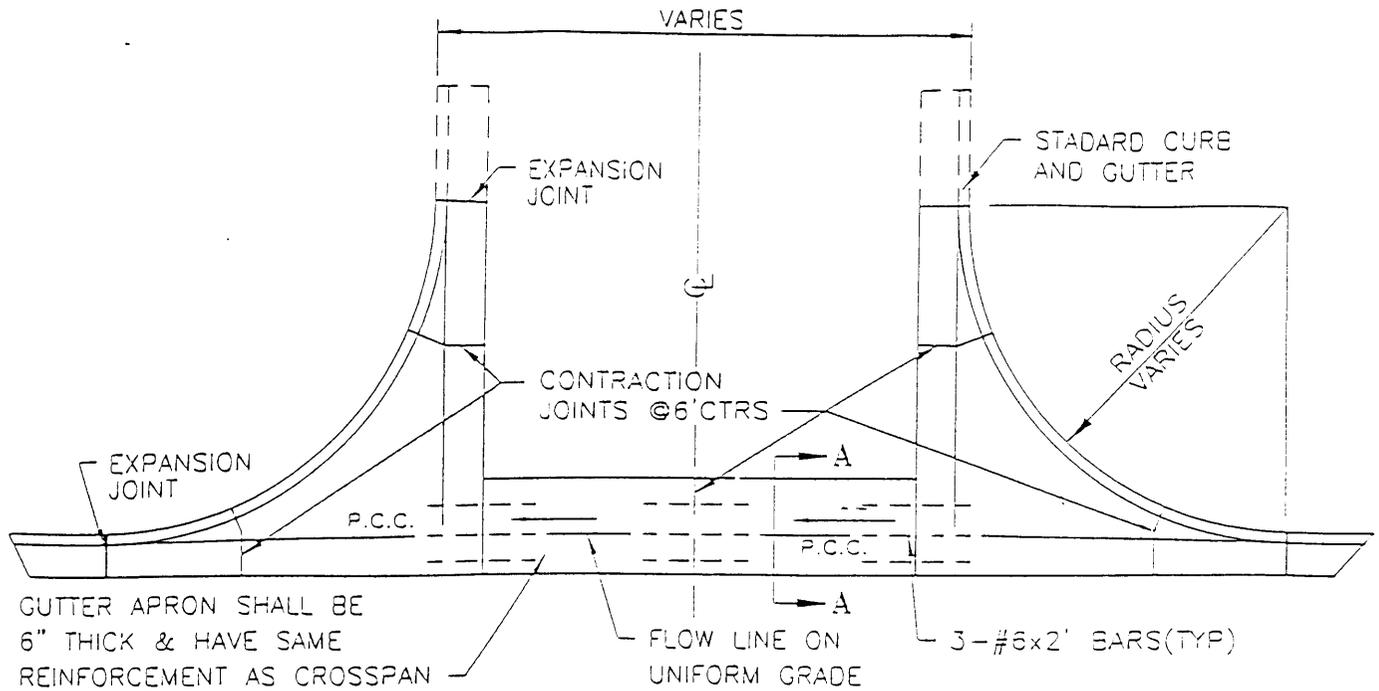
(NO SCALE)



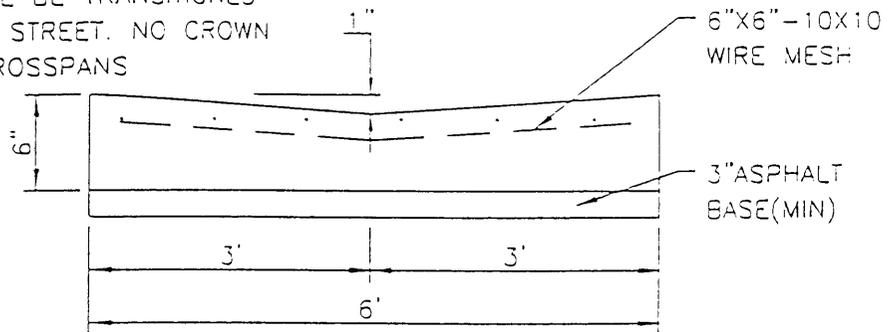
County of Clay
 HIGHWAY
 DEPARTMENT/PWD

MONUMENT BOX DETAIL

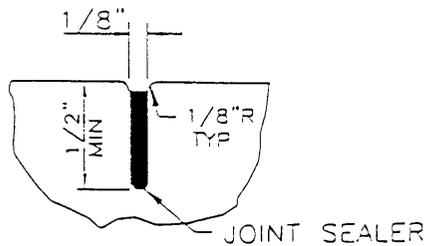
D14-7



CROWN SHALL BE TRANSITIONED OUT OF THE STREET. NO CROWN EXISTS IN CROSSPANS



SECTION A-A



CONTRACTION JOINT

NOTE:

CROSS PAN DETAIL SHALL BE USED AT ALL LOCATIONS WHERE DRAINAGE TO BE TRANSPORTED ACROSS RETURN WITH LONGITUDINAL SLOPE OR ROADWAY BETWEEN .5% & 1% UNLESS OTHERWISE DIRECTED BY HIGHWAY ADMINISTRATOR

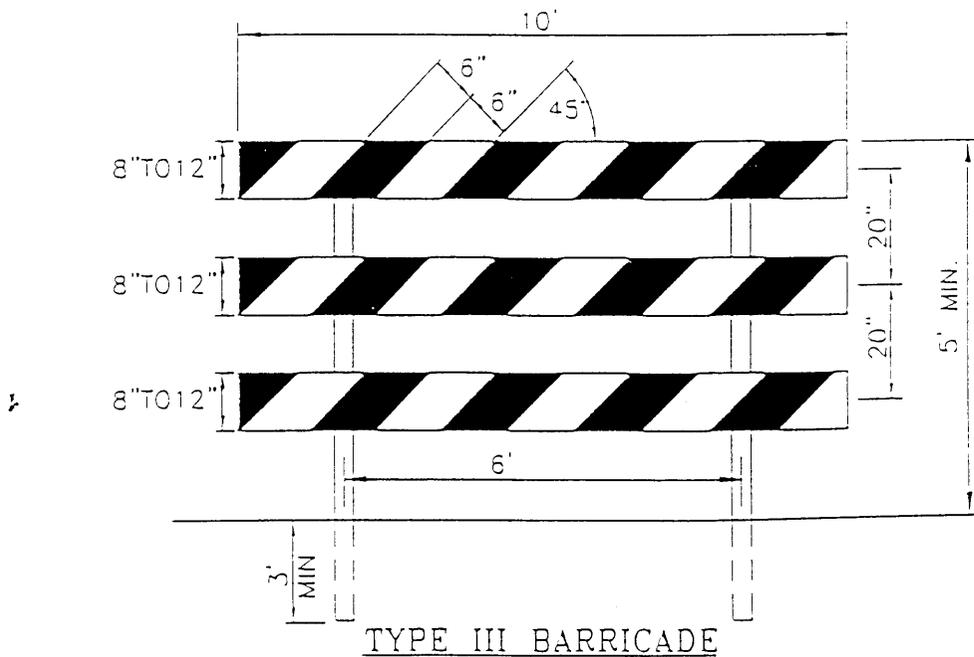
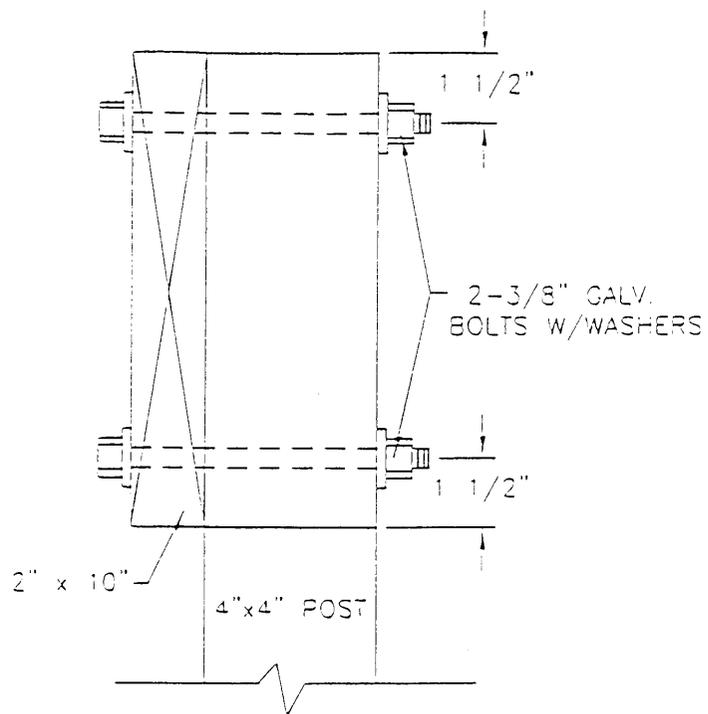
FOR USE WITH ASPHALT CONCRETE END RETURNS



County of Clay
HIGHWAY
DEPARTMENT/PWD

CROSS PAN DETAIL

D14-8



NOTE:

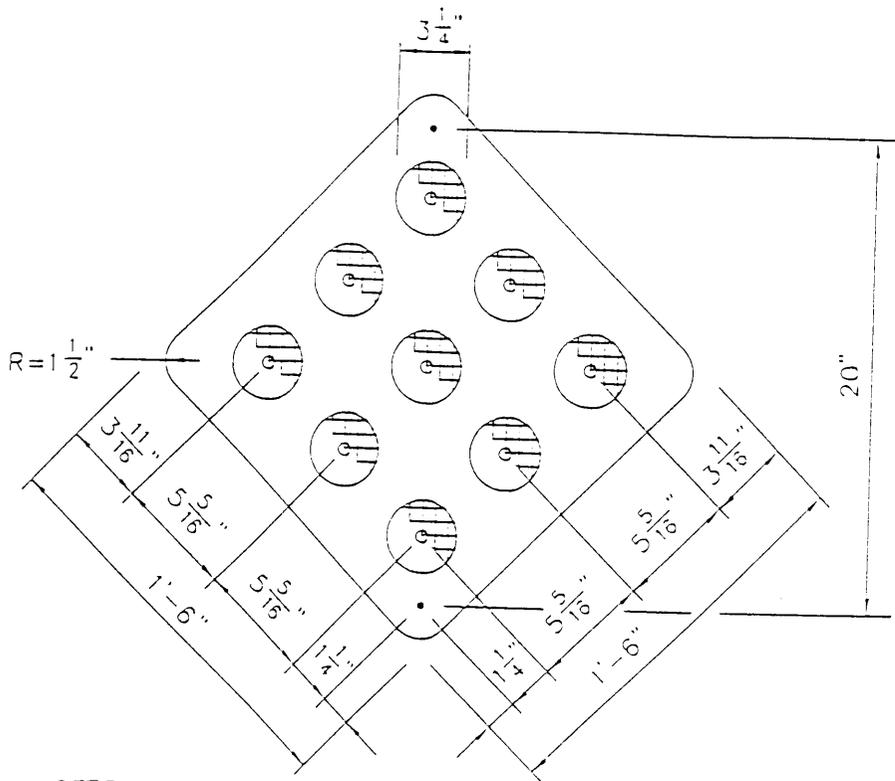
1. STRIPES SHALL BE MADE WITH ALTERNATING WHITE AND RED REFLECTORIZED SHEETING OR PAINT.
2. POSTS SHALL BE 4"x4" WOLMANIZED PRESSURE TREATED CEDAR PAINTED WHITE.



County of Clay
HIGHWAY
DEPARTMENT/PWD

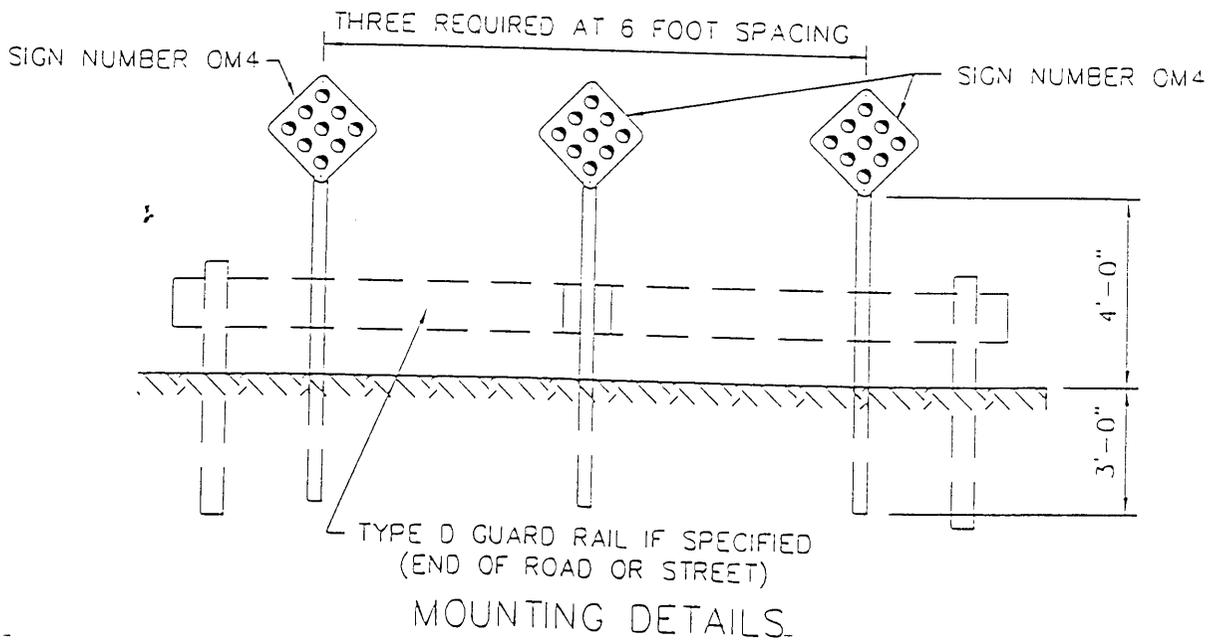
END OF PAVEMENT
TYPE 3 BARRICADE

D14-9



NOTES:
 THICKNESS OF FLAT SHEET FOR TYPE IV OBJECT MARKERS
 SHALL BE 0.063". RED REFLECTORS ON RED BACKGROUND

SIGN DETAILS



MOUNTING DETAILS.



County of Clay
 HIGHWAY
 DEPARTMENT/PWD

END OF PAVEMENT
 TYPE IV BARRICADE

D14-10

SECTION 1500 PORTLAND CEMENT CONCRETE PAVEMENT

1501 SCOPE. This section governs the furnishing of all labor, equipment, tools, and materials and the performance of all work necessary to construct Portland Cement Concrete Pavement.

1502 MATERIALS. Except as modified herein, all materials used for construction of Portland Cement Concrete pavement shall conform to the requirements stipulated in applicable sections of these Specifications.

- A. Concrete. The concrete for the use in construction of Portland Cement Concrete pavement shall conform to the requirements established in Section 2000, "Concrete" with the following modifications.

Cement	Portland Cement shall conform to ASTM C150, Type II. Type III cement may be used only upon written approval of the County Engineer.
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- B. Reinforcing Steel.

Bars	Bars shall conform to ASTM A615, A616, and A617.
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Welded Steel Wire Fabric	ASTM A185
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Supporting Elements	Representative samples of supporting elements shall be submitted and approved by the Engineer prior to their use in the project.
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- C. Expansion Joint Fillers. Expansion joint fillers shall conform to ASTM D994, D1751 or D1752.

- D. Joint Sealing Compounds. Joint sealing compounds shall conform to ASTM D1190.

- E. Curing Membrane. All material to be used or employed in curing Portland Cement Concrete must be approved by the Engineer prior to its use. It shall be of the liquid membrane type and shall conform to ASTM C309.

1503 CONSTRUCTION DETAILS. The Portland Cement Concrete pavement shall be constructed to the configuration, and to the lines and grades shown on the plans.

- A. Grading and Subgrade Preparation. All excavation or embankment required shall be as defined in Sections 1100 and 1200 of these Technical Specifications entitled "Grading" and "Subgrade Preparation".

B. Forms. All forms shall be in good condition, clean, and free from imperfections. Each form shall not vary more than one-fourth (1/4) inch in horizontal and vertical alignment for each ten (10) feet in length.

1. Material & Size. Forms shall be made of metal and shall have a height equal to or greater than the prescribed edge thickness of the pavement slab.
2. Strength. Forms shall be of such cross-section and strength, and so secured as to resist the pressure of the concrete when struck off, vibrated, and finished, and the impact and vibration of any equipment which they may support.
3. Installation. Forms shall be set true to line and grade, supported through their length and, joined neatly in such a manner that the joints are free from movement in any direction.
4. Preparation. Forms shall be cleaned and lubricated prior to each use and shall be so designed to permit their removal without damage to the new concrete.
5. Paving Machine. A slip-form paving machine may be used in lieu of forms. The machine must be equipped with mechanical internal vibrators, and be capable of placing the Portland Cement Concrete pavement to the correct cross-section, thickness, line and grade within the allowable tolerances.

1504 JOINTS. Generally joints shall be formed at right angles to the true alignment of the pavement and to the depths and configuration specified by the standard drawings or as modified by the plans and specifications.

A. Expansion Joints. Expansion joints shall be placed at all locations where shown on the plans and standard details or as directed by the Engineer.

1. General. Expansion joints shall extend the entire width of the pavement and from the sub-grade to one (1) inch below the surface of the pavement or the material will have a suitable tear strip provided to allow for the application of the joint sealer.

Under no circumstances shall any concrete be left across the expansion joint at any point.

2. Material. Expansion joints shall be formed by a one piece, one (1) inch thick, preformed joint filler cut to the configuration of the correct pavement section.
3. Stability. Expansion joints shall be secured in such a manner that they will not be disturbed during the placement, consolidation and finishing of the concrete.

4. Dowels. If expansion joints are to be equipped with dowels they shall be of the size and type specified, and shall be firmly supported in place, by means of a dowel basket which shall remain in place. One half of each dowel shall be pointed, greased or fitted with a dowel sleeve of the dimensions shown on the plans or standard drawings.
- B. Contraction Joints. Contraction joints shall be placed where indicated and to the depth indicated by the plans and specifications or standard drawings.
1. Templates. The templates shall be removed as soon as the concrete has attained its initial set and finished as outlined for tooling joints.
 2. Sawing. When transverse contraction joints are to be formed by sawing, care must be taken to saw the grooves soon after placing the concrete to prevent the formation of cracks due to contraction of the slab. All transverse joints shall be sawed at least one-fourth (1/4) of the slab depth. Any procedures for sawing joints that result in premature and uncontrolled cracking shall be revised immediately by adjusting the time intervals between the placing of the concrete and the cutting of the joints.
 3. Tooling. Tooling or contraction joints will be permitted if completed to the width and depth specified on the construction plans or the standard drawings, and shall be true to line.
 4. Pre-molded Strip Joints. Pre-molded strip joints shall be of the proper dimensions as shown on the plans and standard drawings and shall be secured at the proper location so as not to be disturbed by the finishing of the concrete.
- C. Longitudinal and Construction Joints. Longitudinal joints or construction joints shall be placed as shown on the plans or where the Contractor and/or developer's construction procedure may require them to be placed.
1. Center Joints. Longitudinal center joints shall be constructed using the methods specified in Section 1504(B) "Contraction Joints".
 2. Longitudinal Construction Joints. Longitudinal construction joints (joints between construction lanes) shall be keyed joints of the dimensions shown on the plans or standard drawings.
 3. Transverse Construction Joints. Transverse construction joints of the type shown on the plans or standard drawings shall be placed wherever concrete placement is suspended for more than thirty (30) minutes.
 4. Tiebars. Tiebars shall be of deformed steel of the dimensions specified by the plans or standard drawings. Tiebars shall be installed at the specified spacing and firmly secured so as not to be disturbed by the construction procedure.

1505 PLACING, FINISHING, CURING, AND PROTECTION.

Concrete shall be furnished in quantities required for immediate use and shall be placed in accordance with the requirements of Section 2000 of these Technical Specifications and as specified herein.

- A. Concrete Placement. Prior to placement of the concrete pavement, all debris and foreign material shall be removed from the inner surfaces of the forms and all forms and subgrade properly moistened. All required reinforcement and other special metal parts shall be properly and firmly set into position to preclude movement during placement of the concrete. The concrete shall be deposited on the prepared subgrade to the required depth and width of the construction lane in successive batches and in a continuous operation without the use of intermediate forms or bulkheads. The concrete shall be placed as uniformly possible in order to minimize the amount of additional spreading necessary. While being placed, the concrete shall be vibrated and compacted with suitable tools so that the formation of voids or honeycomb pockets is prevented. In no case shall "jitterbug" vibrators be used.

The concrete shall be well vibrated and tamped against the forms and along all joints. Care shall be taken in the distribution of the concrete to deposit a sufficient volume along the outside form lines so that the curb section can be consolidated and finished simultaneously with the slab.

No concrete shall be placed around manholes or other structures until they have been brought to the required grade, alignment, and cross slope. Concrete shall not be allowed to extrude below the forms.

- B. Concrete Finishing. The pavement shall be struck off and consolidated with a mechanical finishing machine or by hand-finishing methods.

When a mechanical finishing machine is used, the concrete shall be struck off at such a height that after consolidation and final finishing it shall be at the exact elevations as shown on the plans. A depth of at least two (2) inches of concrete shall be carried in front of the strike-off screed for the full width of the slab, whenever the screed is being used to strike off the pavement. The finishing machine shall be provided with a screed which will consolidate the concrete by pressure. The concrete shall, through the use of this machine, be brought to a true and even surface, free from rock pockets, with the fewest possible number of passes of the machine. The edge of the screeds along the curb line may be notched out to allow for sufficient concrete to form the integral curb. Hand-finishing tools shall be kept available for use in case the finishing machine breaks down.

When hand finishing is used, the pavement shall be struck off and consolidated by a vibrating screed to the exact elevation as shown on the plans. When the forward motion of the vibrating screed is stopped, the vibrator shall be shut off; it shall not be allowed to idle on the concrete. Internal mechanical vibration shall be used along all formed surfaces.

1. Longitudinal Floating. After the concrete has been struck off and consolidated, it shall be further smoothed by means of a mechanical longitudinal float or float finishers using a longitudinal hand float. If a longitudinal hand float is used, it shall be operated from foot bridges spanning the pavement and shall be worked with a wiping motion parallel to the centerline, and passing from one side of the pavement to the other. Movement ahead along the centerline of the pavement shall be in successive advances of not more than one-half (1/2) of the length of the float. The float shall not be less than twelve (12) feet in length and six (6) inches in width, and shall be properly stiffened and provided with handles at each end. This operation may be eliminated if specified tolerances can be attained by some other approved method.

In cases where the longitudinal floating operation has been eliminated, the pavement shall be scraped with a straight edge ten (10) feet long, equipped with a handle to permit it to be operated from the edge of the pavement. The longitudinal float and straight edge shall be operated so that any excess water and laitance are removed from the surface of the pavement. After the scraping operation, the surface of the pavement shall be within the specified tolerances.

2. Straight Edging. While the concrete is still plastic, the slab surface shall be tested for smoothness with a ten (10) foot straight edge swung from handles three (3) feet longer than one-half the width of the slab. The straight edge shall be placed on the surface parallel to the centerline of the pavement and at not more than five (5) foot intervals transversely. After each test the straight edge shall be moved forward one-half its length and the operation repeated. When irregularities are discovered, they shall be corrected by adding or removing concrete. All disturbed places shall be smoothed with a float not less than three (3) feet long and not less than six (6) inches wide, and again straight edged. The pavement surface shall have no depression in which water will stand.
3. Edging. Before final finishing is completed and before the concrete has taken its initial set, the edges of the slab and curb shall be carefully finished with an edger of the radius shown on the plans or standard details.
4. Final Surface Finish. A burlap drag or a broom finish shall be used as the final finishing method. When a drag is used it shall be at least three (3) feet in width and long enough to cover the entire pavement width. It shall be kept clean and saturated while in use. It shall be laid on the surface of the pavement and dragged in the direction in which the pavement is being laid. When broom finishing, a hard bristle broom shall be used. The broom shall be kept clean and used in such a manner as to provide a uniform texture surface. The curb shall have the same final finish as the pavement.

The final surface of the concrete pavement and curb shall have a uniform gritty texture free from excessive harshness and true to the grades and cross section shown on the plans. The Engineer may require changes in the final finishing procedure as required to produce the desired final surface texture.

- C. Curing. Curing shall conform to the requirements set forth in Section 2000, "Concrete" with the exception that water proof paper, or polyethylene sheeting, shall not be acceptable as curing methods for concrete pavement. The use of straw or burlap for curing shall be as approved by the Engineer.

As soon as practical after the concrete is finished it shall be cured with one of the acceptable methods. If a liquid curing membrane is used, it shall be according to the manufacturer's directions.

A nozzle producing a uniform mist pattern will be used on all spray equipment when applying the liquid curing membrane. Rate of application to the pavement shall be (1 gallon/175 ft) with a wet thickness of 6 to 10 mils. If the forms are removed from finished concrete pavement within a period of seventy-two (72) hours or if a slip form paving machine has been used, these surfaces shall also be cured.

- D. Protection. The Contractor and/or developer shall, at his own expense, protect the concrete work against damage or defacement of any kind until it has been accepted by the County.

All vehicular traffic shall be prohibited from using the new concrete pavement until it has attained seventy (70) percent of the twenty-eight (28) day compressive design strength.

Concrete pavement which is not acceptable to the Engineer because of damage or defacement, shall be removed and replaced, or repaired to the satisfaction of the Engineer, at the expense of the Contractor and/or developer.

- E. Temperature Limitation. Concrete work shall proceed in accordance with the requirements established in Section 2000, "Concrete".

1506 BACKFILL. A minimum of twenty-four (24) hours shall lapse before forms are removed and five (5) days shall lapse before pavement shall be backfilled unless otherwise approved by the Engineer.

Backfill shall be accomplished in accordance with Section 1100 and 1200 entitled "Grading" and "Subgrade Preparation".

The Contractor and/or developer shall be responsible for the repair of any existing street pavement disturbed by the construction to the satisfaction of the Engineer.

1507 JOINT SEALING AND CLEAN-UP. All joints shall be sealed with an approved joint sealer applied in accordance with the manufacturer's directions within seven (7) days of the placement of the concrete and prior to the opening of the pavement to traffic.

The Contractor and/or developer shall be responsible for the removal of excess dirt, rock, broken concrete, concrete splatters and overspray from the area of the construction.

1508 INTEGRAL CURB. Integral curbs shall be required along the edges of all street pavement as indicated on the plans or standard drawings except at such locations as the Engineer may direct.

The integral curb shall be constructed immediately following the finishing operation unless otherwise shown on the plans. Special care shall be taken so that the curb construction does not lag the pavement construction and form a "cold joint".

Steel curb forms shall be required to form the backs of all curbs except where impractical because of small radii street returns or other special sections.

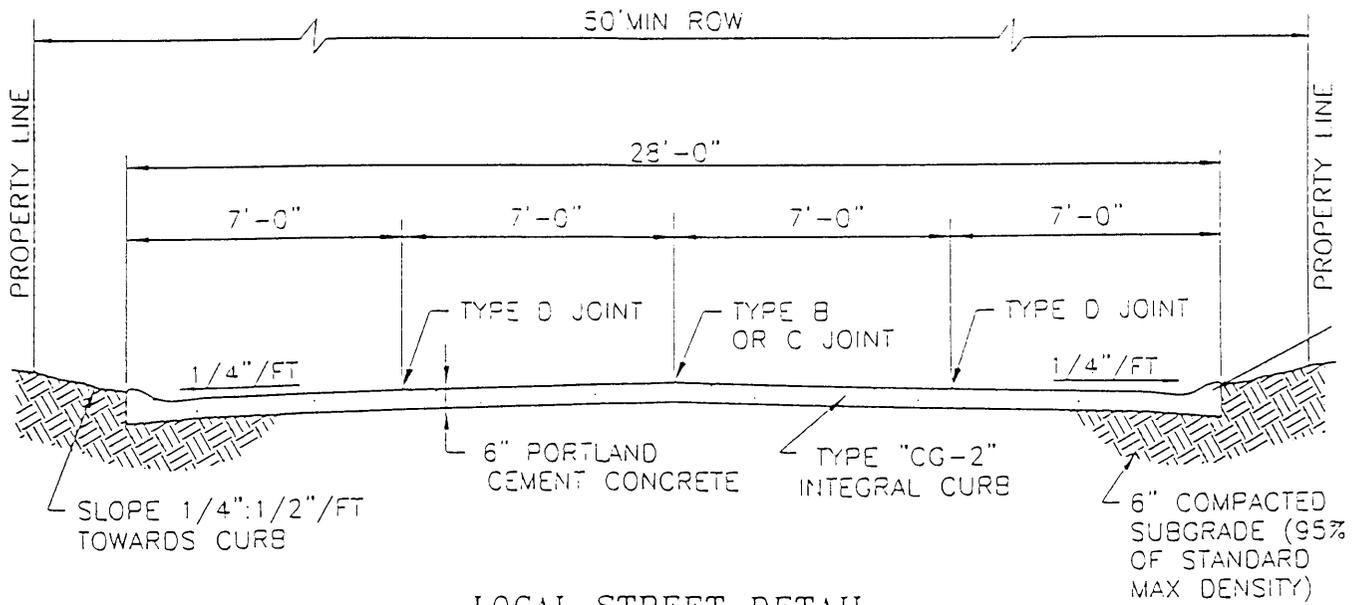
In placing curb concrete, sufficient spading shall be done to secure adequate bond with the paving slab and eliminate all voids in the curb.

Curbs shall be formed to the cross section as shown on the drawings with a mule or templates supported on the side forms and with a float not less than four (4) feet in length.

The finished surface of the curb and gutter shall be checked by the use of a ten (10) foot straight edge and corrected if necessary. Where grades are flat and while the concrete is still plastic, the drainage of the gutter should be checked by pouring water at the gutter summit and observing its flow to the inlet.

1509 SURFACE TOLERANCES. Concrete pavement shall have a surface tolerance in all directions of one-quarter (1/4) inch in ten (10) feet when checked with a ten (10) foot straight edge.

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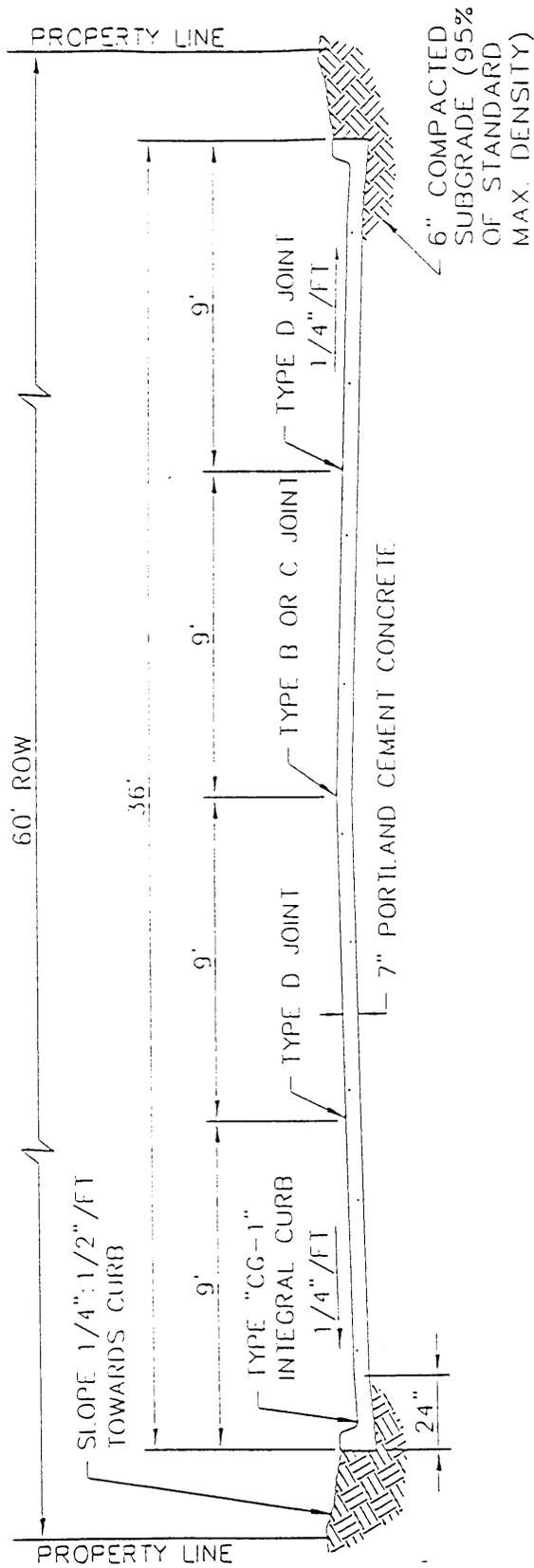
LOCAL STREET DETAIL



County of Clay
 HIGHWAY
 DEPARTMENT/PWD

CONCRETE PAVEMENT CROSS
 SECTION & JOINT LOCATIONS

D15-1



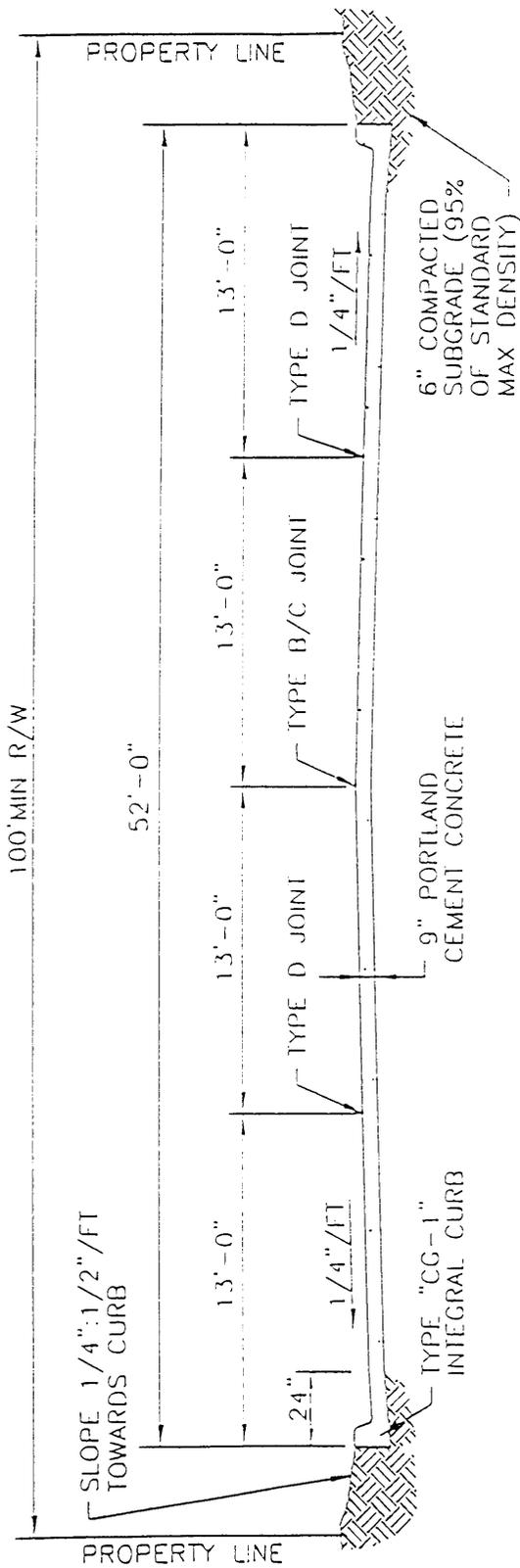
COLLECTOR / COMMERCIAL STREET DETAIL



County of Clay
HIGHWAY
DEPARTMENT/PWD

CONCRETE PAVEMENT CROSS
SECTION & JOINT LOCATIONS

D15-2



NOTE: DESIGN GEOMETRICS TO BE APPROVED BY THE COUNTY ENGINEER FOR EACH INDIVIDUAL PROJECT

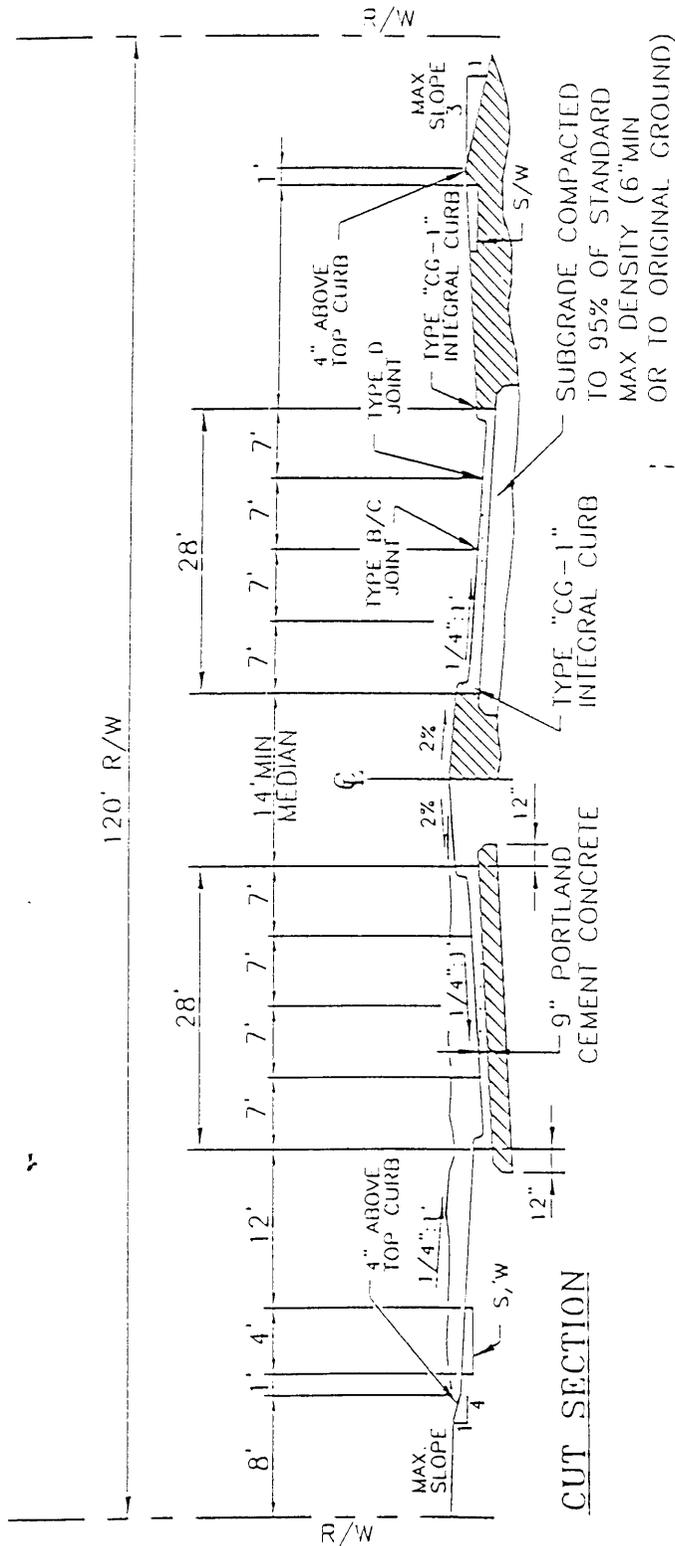
MINOR ARTERIAL STREET DETAIL



County of Clay
HIGHWAY
DEPARTMENT/PWD

CONCRETE PAVEMENT CROSS
SECTION & JOINT LOCATIONS

D15-3



FILL SECTION

CUT SECTION

NOTE: DESIGN GEOMETRICS TO BE APPROVED BY THE COUNTY ENGINEER FOR EACH INDIVIDUAL PROJECT

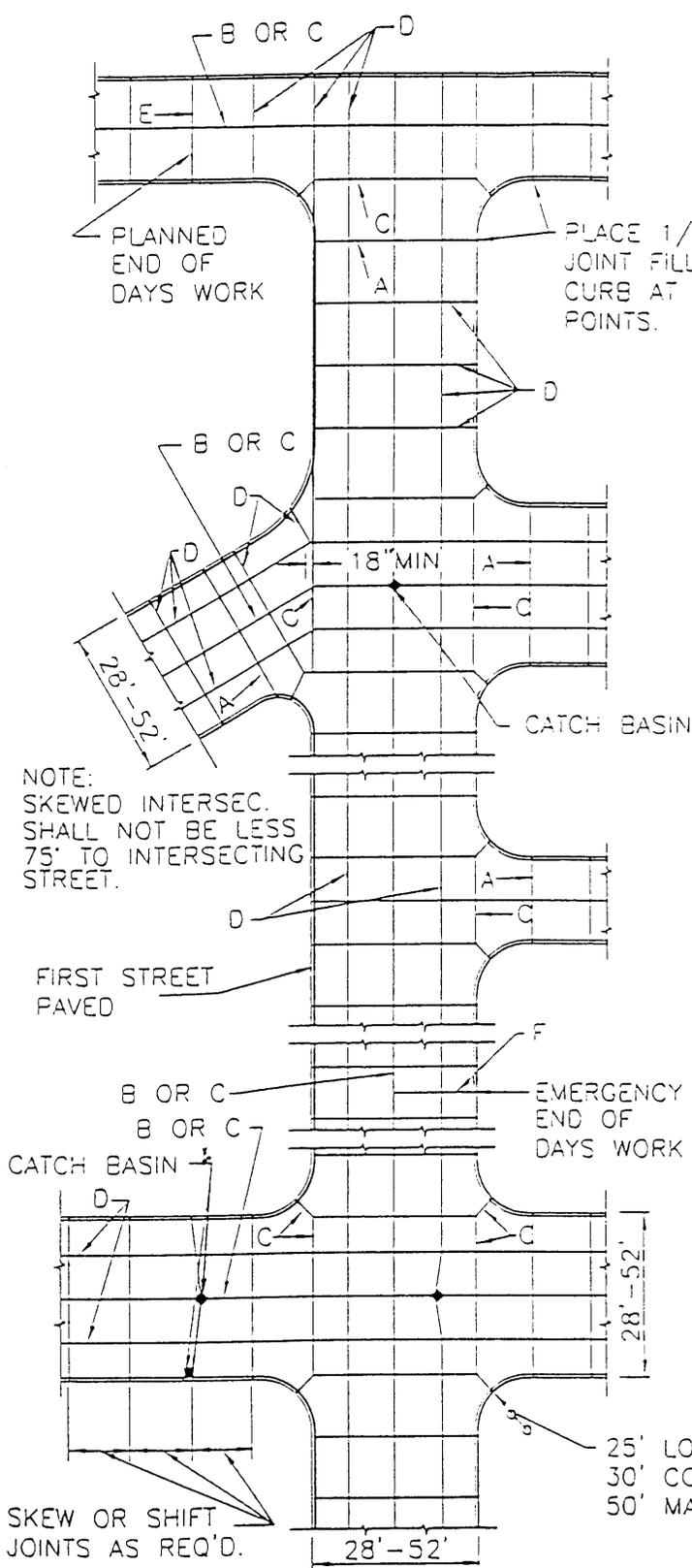
MAJOR ARTERIAL STREET DETAIL



County of Clay
HIGHWAY
DEPARTMENT/PWD

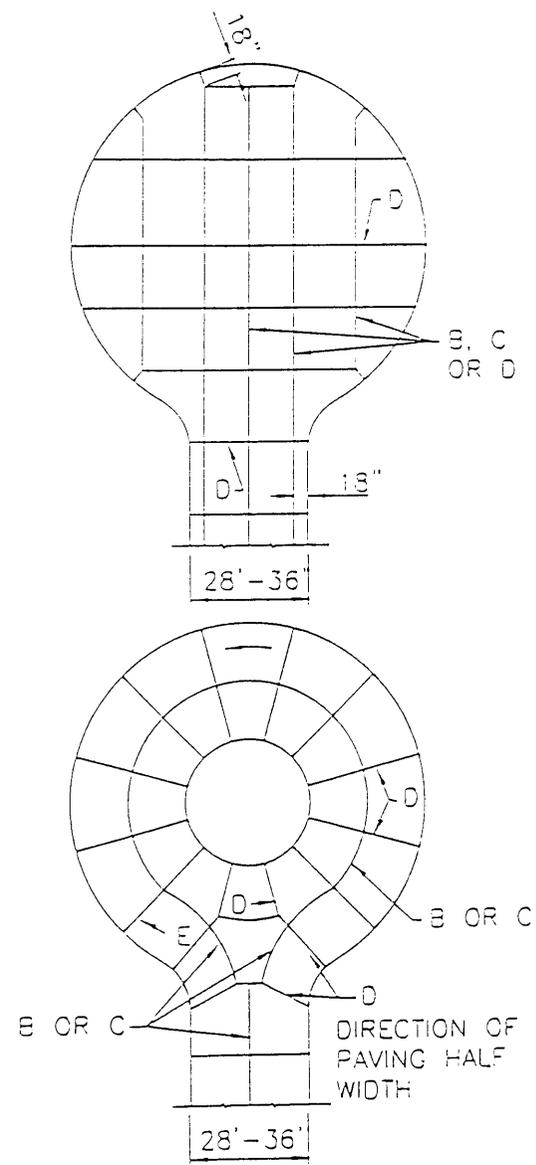
CONCRETE PAVEMENT CROSS
SECTION & JOINT LOCATIONS

D15-4



NOTE:
SKEWED INTERSEC.
SHALL NOT BE LESS
75° TO INTERSECTING
STREET.

PLACE 1/2" EXPANSION
JOINT FILLER IN TOP OF
CURB AT ALL RADIUS
POINTS.



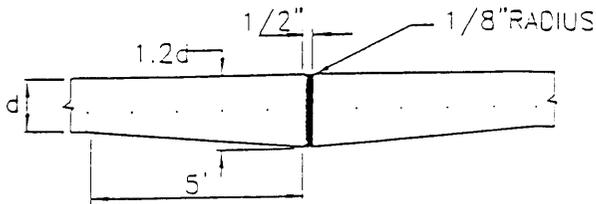
25' LOCAL
30' COLLECTOR
50' MAJOR AND MINOR ARTERIAL



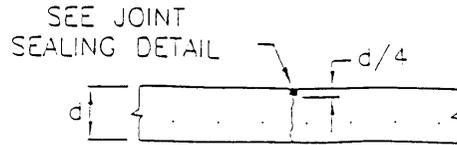
County of Clay
HIGHWAY
DEPARTMENT/PWD

CONCRETE PAVING
JOINT LOCATIONS

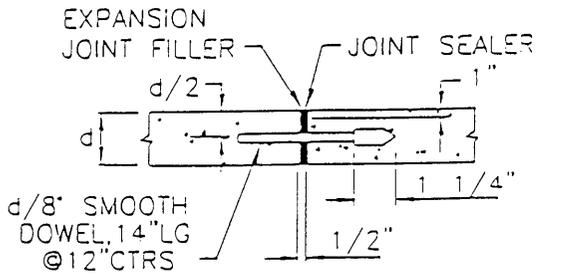
D15-5



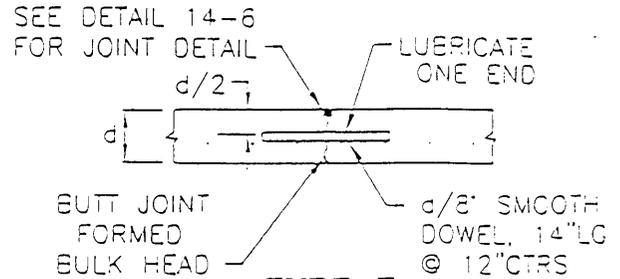
TYPE A
EXPANSION JOINT



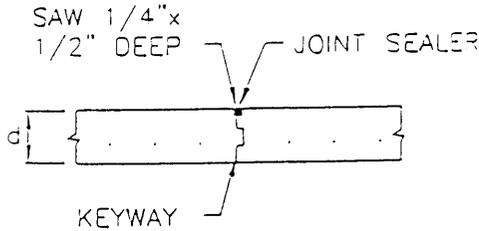
TYPE D
SAWED LONGITUDINAL OR TRANSVERSE



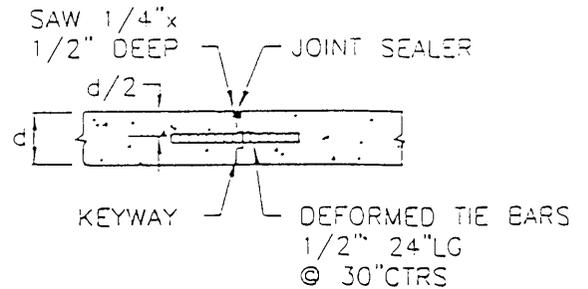
TYPE A
ALTERNATE EXPANSION JOINT



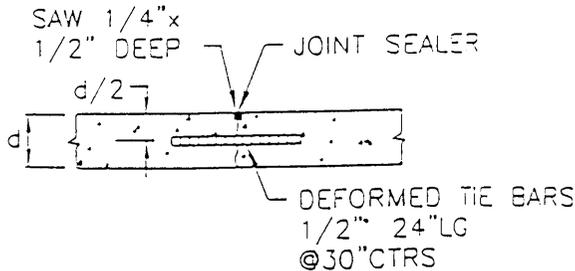
TYPE E
PLANNED TRANSVERSE
CONSTRUCTION JOINT
(USED AT NORMAL JOINT SPACING)



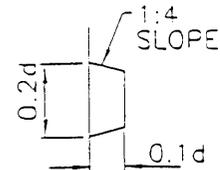
TYPE B
LONGITUDINAL CONSTRUCTION JOINT



TYPE F
EMERGENCY TIED TRANSVERSE
CONSTRUCTION JOINT
(USED AT MIDDLE THIRD NORMAL
JOINT SPACING)



TYPE C
TIED BUTT LONGITUDINAL
CONSTRUCTION JOINT



KEYWAY FOR TYPE B & F
CONSTRUCTION JOINT



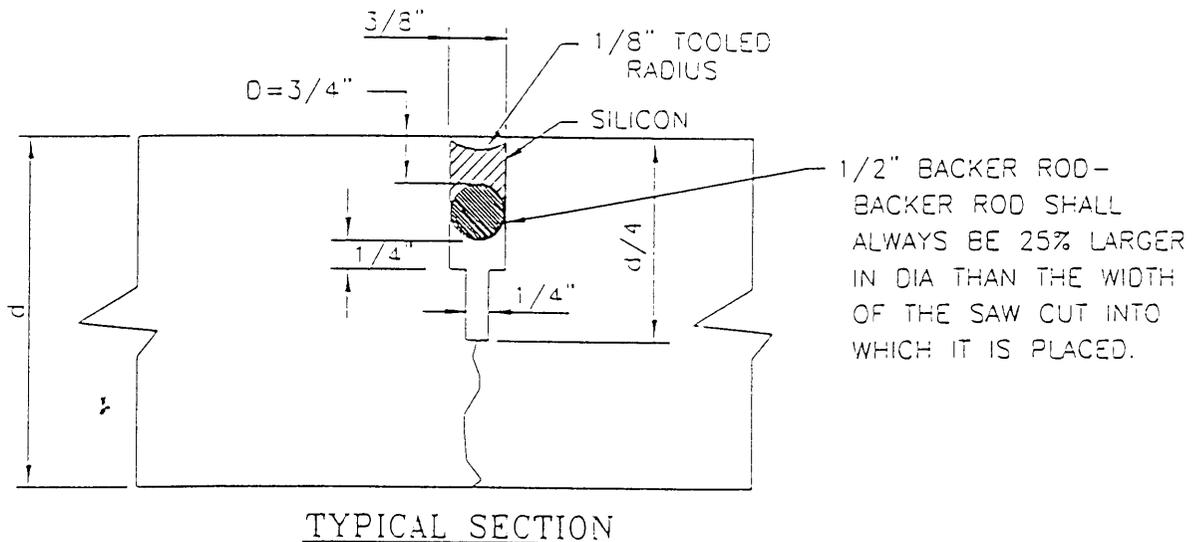
County of Clay
HIGHWAY
DEPARTMENT/PWD

CONCRETE PAVING
JOINT DETAILS

D15-6

NOTES:

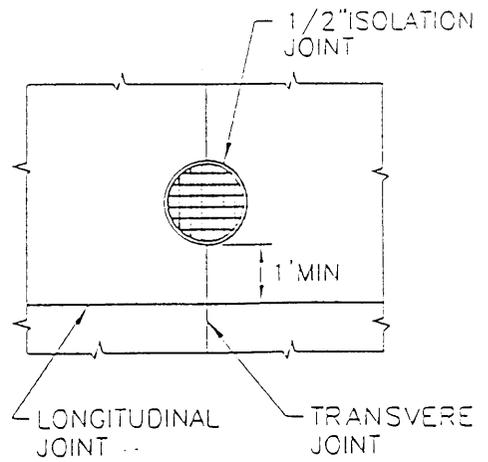
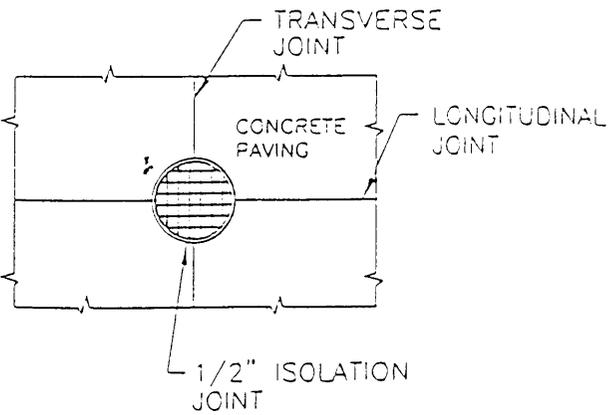
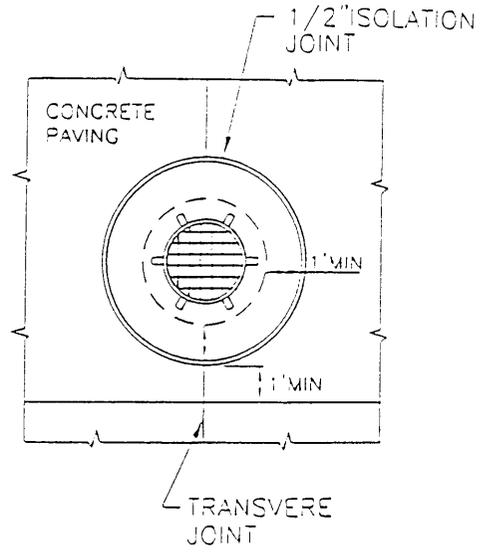
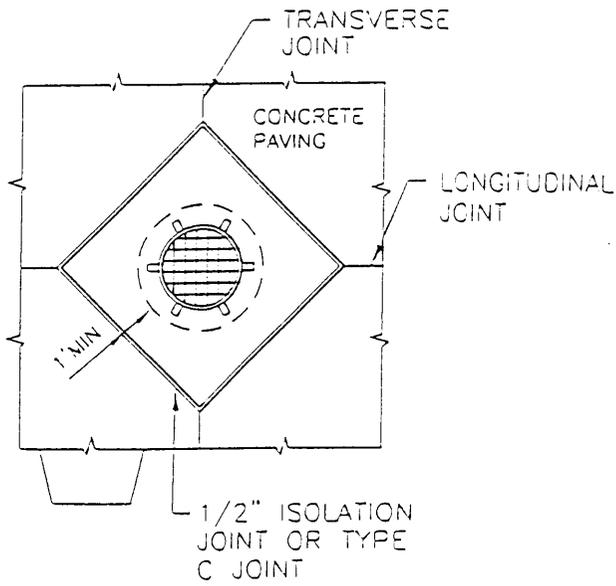
1. SILICONE JOINT SEALING MATERIAL SHALL BE COLD-APPLIED, SINGLE COMPONENT TYPE CONFORMING TO REQUIREMENTS OF FED. SPEC. TT-S-1543, DOW CORNING "888 SILICONE HIGHWAY JOINT SEALANT". SEALING MATERIAL SHALL BE PRESSURE MACHINE APPLIED IN ACCORDANCE WITH THE SEALING MATERIAL MANUFACTURER'S RECOMMENDATIONS. THE MATERIAL FURNISHED FOR THE BACKER ROD SHALL BE A RESILIENT, CLOSED CELL POLYETHYLENE FOAM ROD AS RECOMMENDED BY THE MANUFACTURE OF THE SEALANT.
2. d = DEPTH OF SLAB
3. D = DEPTH TO TOP OF BACKER ROD. DEPTH "D" SHALL ALWAYS BE TWICE THE WIDTH OF THE JOINT.



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CONCRETE PAVING
JOINT SEALING DETAILS

D15-7



County of Clay
 HIGHWAY
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CONCRETE PAVING
 ISOLATION JOINT DETAILS

D15-8

SECTION 1600 PAVEMENT MARKING

1601 GENERAL. The Contractor and/or developer shall furnish and apply painted reflectorized pavement marking materials at the locations and in conformance with the details shown on the plans. Three types of materials are allowed unless otherwise required in the Special Provisions or contract drawings.

- A. Scope. The Contractor and/or developer shall furnish and apply white and yellow plastic or painted reflectorized pavement marking materials at the locations and in conformance with the details shown on the plans. Three types of materials are required, as follows:
1. Hot applied type shall be used for all longitudinal line markings unless otherwise indicated and shall be applied to the pavement surface in a molten state by mechanical means with surface application of glass spheres, and which upon cooling to normal pavement temperature, produces an adherent reflectorized stripe of specified thickness and width and is capable of resisting deformation.
 2. Cold applied type shall be used for all transverse and symbol markings unless otherwise indicated and shall consist of a homogeneous, extruded, prefabricated material of specified thickness and width, which shall contain reflective glass spheres uniformly distributed throughout the cross-section, and shall be applied to the pavement surface by means of a precoated adhesive and pressure.
 3. Paint applied type shall only be used for those markings as indicated on the plans and shall be of good commercial quality, adhere to the asphaltic concrete, and shall be approved by the Engineer.

1602 HOT APPLIED TYPE.

A. General.

This specification describes the materials and application procedures for heated white and yellow thermoplastic pavement markings extruded or sprayed to the roadway surface in a molten state. After cooling to normal temperature, the materials shall produce an adherent reflectorized stripe of specified thickness and width. The sprayed or extruded materials shall be used for edge lines, lane lines, centerlines, medians, no passing zones and gore areas.

The compound shall not deteriorate upon contact with sodium chloride, calcium chloride, or other chemicals used to prevent formation of ice on roadways or streets or because of the content of pavement materials or from petroleum falling from vehicular traffic. In the plastic state, the material shall not give off fumes which are toxic or otherwise injurious to persons or property. The material shall not break down or deteriorate if held at the plastic temperature for a period of four (4) hours or by

reason of three (3) reheatings to the plastic temperature (400 degrees F to 450 degrees F). The temperature versus viscosity characteristics and the color of the plastic material shall remain constant through reheatings, and shall be the same from batch to batch.

B. Material.

The material shall be a mixture of resins and other materials providing an essentially nonvolatile thermoplastic compound specifically developed for traffic marking.

1. Binder. The binder shall be composed entirely of alkyd type resins, seventy (70) percent minimum of which shall be a maleic modified glycerol ester of rosin. The total binder content of the thermoplastic compound shall be no less than eighteen (18) percent by weight.
2. Pigment. The pigment used for the white thermoplastic compound shall be titanium dioxide, meeting the requirements of ASTM D 476-73, Type II. The titanium dioxide pigment content shall be no less than ten (10) percent by weight of the white thermoplastic compound and be uniformly distributed throughout the thermoplastic compound. The yellow thermoplastic compound shall be no less than two and one half (2.5) percent by weight of yellow pigment provided that yellow thermoplastic material shall be "Federal Yellow" in color (Federal Test Method Standard 141 Method 4252). The material shall not change its color or brightness character even after prolonged exposure to sunlight.
3. Filler. The filler to be incorporated with the resins as binder shall be a white calcium carbonate or equivalent filler.
4. Glass Beads. During manufacture, Type II B (Missouri State Highway Department Specifications for reflectorizing glass spheres) spheres shall be mixed into the material at the rate of not less than thirty (30) percent nor more than forty (40) percent by weight of thermoplastic compound immediately after the thermoplastic material is applied. Glass beads shall meet the following requirements:
 - a. General Properties. Glass beads shall be manufactured from high quality material of a composition design to be highly resistant to traffic wear and to effects of weathers and shall be clean, clear, colorless and free from foreign matter.
 - b. Sieve Analysis. The glass beads shall meet the following gradation requirements:

U.S. Standard Sieve Numbers	TYPE IIA		TYPE IIB	
	Min.	Max.	Min.	Max.
16	100	---	---	---
18	98	100	---	---
30	60	90	100	---
40	---	---	80	100
50	15	50	---	---
80	---	---	0	10
100	0	10	---	---
200	0	5	---	---

- c. Index of Refraction. The index of refraction of Type IIA and IIB glass beads shall be at least 1.50 when tested by the immersion method at seventy-seven (77) degrees F.
- d. Irregular Shapes. Glass beads shall be spherical in shape containing not more than thirty (30) percent irregular shapes, when tested in accordance with ASTM Method D 1155-53 (1975).
- e. Tests. Glass beads, when subjected to the following tests shall show no readily discernable darkening and/or dulling.
1. Ten grams + 0.5 grams of glass beads placed in Whitman single thickness cellulose extraction thimble, 33 by 80 millimeters, are refluxed for one (1) hour in a Soxhlet extractor having an eighty (80) millimeter siphon capacity using one hundred fifty (150) millimeters of distilled water. All connections shall be ground glass. At the end of the refluxing period, allow the filtrate to cool to room temperature and titrate with 0.1 normal hydrochloric acid (not to exceed 4.5 milliliters) using phenolphthalein indicator. The beads shall be dried to one hundred ten (110) degrees C and examined for dulling under 60 power magnification.
 2. Method of Determining Calcium Chloride Resistance. Immerse approximately ten (10) grams of glass beads in a 1.0 normal calcium chloride solution for three (3) hours. Rinse well, by decantation, with distilled water. Spread beads on clean filter paper and allow to dry. Examine the beads for darkening under 60 power magnification.
 3. Method of Determining Sodium Sulfide Resistance. Immerse approximately ten (10) grams of glass beads in a fifty (50) percent solution of Sodium Sulfide for one (1) hour. Rinse well by decantation, with distilled water. Spread beads on a clean filter paper and allow to dry. Examine the beads for darkening under 60 power magnification.

- f. Binder-Sealer. Binder-Sealer shall be a butadiene styrene, neoprene, epoxy or other material recommended by the manufacturer of the thermoplastic material.
- g. Packaging and Marking. The granulated thermoplastic material shall be packaged in suitable bags to which it will not adhere during shipment and storage. Each bag shall weigh approximately fifty (50) pounds (23kg). Each container label shall designate the color, manufacturer's name, batch number, and date of manufacture. Each batch manufactured shall have its own separate number. The label shall warn the user that the material shall be heated to 211 degrees + 7 degrees C (412.5 degrees +/- 12.5 degrees F) during application. The Contractor and/or developer shall assume all costs resulting from the use of patented materials, equipment, devices, or processes used on, or incorporated in, the work and shall agree to indemnify and save harmless the purchaser and his duly authorized representatives from all suites at law, or action of every nature for, or on account of, the use of any patented materials, equipment, devices, or processes.

C. Characteristic Requirements.

- 1. The material shall be capable of being applied at a temperature range of 400 degrees to 450 degrees F and to a thickness of 0.09 or 0.125 inch. It shall set to withstand vehicular traffic in not more than two (2) minutes when the air temperature is 50 degrees F and not more than (ten) 10 minutes when the air temperature is 90 degrees F. After application and setting, the material shall show no appreciable deformation or discoloration, shall remain free from track, and shall not leave from the pavement under normal traffic conditions within a pavement temperature range of -20 degrees F to 150 degrees F. The stripe shall maintain its original dimensions and placement.
 - a. Color. White thermoplastic material shall, after setting, be pure white and free from dirt or tint. Yellow thermoplastic shall match Federal Test Standards Number 595A-Color 13538. The material shall not change its color and brightness characteristics after prolonged exposure to sunlight.
- 2. Manufacturer's Certification. The contractor and/or developer shall furnish a manufacturer's certification in triplicate, to the engineer, attesting that all materials supplied conform to the requirements of these specifications. The certification shall include, or have attached, a certified test report from an approved independent testing laboratory, showing specific test results conforming to all test requirements of these specifications. The following tests shall be made on at least ten (10) pounds of thermoplastic material from each batch manufactured.

- a. White material shall not show deviations from a magnesium oxide standard greater than the following data, using a standard color difference meter:

<u>Scale Definition</u>	<u>Magnesium Oxide Std. Minimum</u>	<u>Sample</u>
RE. Reflection	100	75
A-Redness-Greenness	0	-5 to +5
B-Yellowness,-Blueness	0	-10 to +10

- b. Materials shall be tested in accordance with ASTM D 1501-71, Procedure A, "Standard Recommended Practice for Exposure of Plastic to Fluorescent Sunlamps." There shall be no darkening of color after one hundred (100) hours of exposure.
- c. Material shall have not more than 0.5 percent by weight of retained water when tested by ASTM D 570-63 (1972), "Water Absorption of Plastics." The procedure for twenty-four (24) hour immersion, Paragraph 6.1, shall be used for this test.
- d. The softening point of the thermoplastic compound (as measured by the ball and ring method ASTM E 28-67 (1972) shall not occur at a temperature less than 200 degrees F.
- e. There shall be no cracking, checking, flaking or separation of the sample material from the sample base prepared as follows:

A clean standard concrete block having uniform temperature of 75 degrees F to 80 degrees F shall have the surface primed with a binder-sealer proposed for use by the manufacturer. A four (4) inch wide, one-eighth (1/8) inch thick stripe of the thermoplastic material shall be applied and the sample conditioned for twenty-four (24) hours at 12 degrees F to 18 degrees F.

- f. Specific gravity of the compound at 77 degrees F shall be 2.15.
- g. Bond strength of the compound applied to Portland Cement concrete shall exceed 180 psi.
- h. Freeze/Thaw bond strength of the compound subjected to five (5) cycles of sixteen (16) hours at 15 degrees C, then eight (8) hours submerged in water, the bond strength to primed Portland Cement concrete shall exceed 120 psi.
- i. The material shall meet the requirements of this specification for a period of one (1) year. The thermoplastic must also melt uniformly with no evidence of skins or unmelted particles for this one year period Any material not meeting the above requirements shall be

replaced by the manufacturer.

The Clay County Highway Department/PWD reserves the right to sample test and reject any and all materials provided and installed under this project.

3. Application.

Marking on this project shall be applied only on clean, dry pavement and at pavement surface and air temperatures above 50 degrees F. The contractor and/or developer shall remove loose debris (such as dust, dirt, sand and gravel) from the pavement surface, where the marking is to be located, immediately prior to application of the binder-sealer or marking material.

a. When required, binder-sealer shall be applied to the pavement surface in sufficient quantities to completely cover the area occupied by the thermoplastic material.

1. Sprayed Thermoplastic.

A binder-sealer shall be applied to the pavement surface prior to application of sprayed marking material if recommended by the manufacturer of the marking material.

2. Extruded Thermoplastic.

A binder-sealer shall be applied to Portland Concrete pavement surfaces prior to application of thermoplastic markings.

On bituminous pavement mixtures and seal coats, a binder-sealer shall be applied prior to marking application if recommended by the manufacturer of the marking material.

b. Application Temperature.

Thermoplastic material shall be applied at a temperature between 400 degrees and 450 degrees F.

c. Marking Dimensions.

Longitudinal and transverse dimensions shall be as shown on the plans. Application of the marking material shall be performed in a manner which will provide continuous uniformity in the dimensions of the stripe. The cutoff ends of each stripe shall be square. The sides of each stripe shall be uniform and straight (excluding final bead application and binder-sealer). Width and thickness dimensions

shall be as follows:

1. White Markings
 - (1) Lane Line 4" by 0.09"
 - (2) Edge Line 4" by 0.09"
 - (3) Stop Line 18" by 0.125"
 - (4) Crosswalk Line 6" by 0.125"
 - (5) Block Style Crosswalk 24" by 0.125" by 6'
 - (6) Symbols and Legends M.U.T.C.D. Standard
2. Yellow Markings
 - (1) Center Line 4" by 0.09"
 - (2) Cross-hatch Line 12" by 0.09"

d. Immediate Reflectance.

Type II-A glass beads shall be applied by an automatic dispenser to the top surface of the hot applied thermoplastic stripe immediately after the stripe is formed on the pavement. The glass shall be embedded into the top surface of the stripe to at least one-half of the bead diameter and at an application rate of three (3) pounds of beads per one hundred (100) lineal feet.

4. Equipment.

All sprayed or extruded marking shall be applied using a vehicle (or vehicles) of sufficient size and stability to provide smooth, straight, uniform markings. The equipment used to install hot thermoplastic materials under this specification shall be constructed to provide mixing and agitation of the material. Conveying parts of the equipment between the main material reservoir and the shaping die or sprayer head shall be so constructed as to prevent accumulation and clogging. All parts of the equipment which come in contact with the material shall be so constructed as to be easily accessible and exposable for cleaning and maintenance.

The equipment shall be constructed so that all mixing and conveying parts up to and including the shaping die or sprayer head will maintain the material at a temperature not less than 375 degrees F (191 degrees C).

To assure that the thermoplastic does not fall below the minimum temperature, the shaping die or sprayed head shall be heated by means of a gas-fired infrared heater or a heated, oil-jacketed system.

The equipment shall be so constructed as to insure continuous uniformity in the dimensions of the stripe. The applicator shall provide a means for cleanly cutting off square stripe ends and shall provide a method of applying "skip" lines. The use of pans, aprons or similar appliances, into which the die overruns, will not be permitted under this specification. The equipment shall

be so constructed as to provide for varying die widths and to produce varying widths of traffic marking.

A special kettle shall be provided for melting and heating the thermoplastic material. The kettle must be equipped with a thermostat so that the heating can be done by controlled heat transfer liquid rather than by direct flame, so as to provide positive temperature control and prevent overheating of the material. The heating kettle and applicator shall be so equipped and arranged as to meet the requirements of the National Board of Fire Underwriters, of the National Fire Protection Association, of the State, and of the Local Authorities.

Glass spheres applied to the surface of the completed stripe shall be applied by an automatic bead dispenser attached to the striping machine in such a manner that the beads are dispensed almost instantaneously upon the installed line. The glass sphere dispenser shall be equipped with an automatic cut-off control synchronized with the cut-off of the thermoplastic material.

The equipment shall be so arranged as to permit preheating of the pavement immediately prior to application of the thermoplastic material, if pre-heating is recommended by the thermoplastic manufacturer. The applicator shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.

The applicator shall be capable of containing a minimum of one hundred twenty-five (125) pounds of molten material.

5. Application Techniques. The surface shall be dry and all dust, debris and other foreign matter shall be removed from the road surface prior to the application of the binder-sealer and the thermoplastic material. A rough-textured surface shall be cleaned by air blast. A smooth-textured surface may be cleaned by brooming but if there is any doubt about the resulting cleanliness the Engineer can require use of air blast.

Those sections of pavement where extra dust and grime collects, such as gore areas and adjacent to raised islands, may require a water wash and scrubbing in addition to brushing and air blast.

To insure proper adhesion, the Contractor and/or developer shall apply the binder-sealer over the application area prior to the actual thermoplastic installation. The binder-sealer shall be applied by spraying, shall form a continuous wet film of approximately 2 -3 mils thickness and shall be at least two (2) inches wider than the applied thermoplastic so as to assure adhesion at the edges. The binder-sealer shall be allowed to set long enough for the solvent to evaporate and become tacky. This can be as much as one (1) hour or longer but not less than thirty (30) minutes. If there is doubt, the longer time shall be used even though some tackiness might be lost.

For bituminous surfaces less than two (2) months old and having less than

twenty (20) percent bare, exposed aggregate, the application of binder-sealer may be waived.

Bubbles forming in the applied thermoplastic is evidence that solvent remains in the binder-sealer. Rather than reduce the rate of application of the binder-sealer more time should be allowed for evaporation of the solvent before continuing.

1603 COLD APPLIED TYPE.

A. Materials.

1. The preformed markings shall consist of a yellow or white conformable ribbon or other flat shape as specified and shall be fabricated of resins, plasticizers, fillers, suitable pigments, reflective glass beads, and a pressure sensitive adhesive.
2. The reflective glass beads shall be distributed evenly throughout and applied into the top surface to produce immediate and continuous retro reflection. The marking material shall be so formulated and the top dressing of glass beads so distributed over the surface that the applied lines and shapes will show a high initial visibility which will remain during the effective life of the material. Any material, which permits or promotes adherence of excessive amounts of road film so as to decrease markedly visual impact, shall not be acceptable regardless of compliance with other provisions of this specification. The glass bead adhesion shall be such that beads are not easily removed when the material surface is scratched with a thumbnail.
3. The daylight reflectance of white marking material shall not be less than fifty (50) per cent when tested according to ASTM E97. The color of yellow marking material shall be within the red and green tolerance limits of the highway Yellow Color Tolerance Chart issued by the U.S. Department of Transportation.
4. Preformed words and symbols shall conform to the applicable shapes and sizes as prescribed in the latest revision of the Manual on Uniform Traffic Control Devices for Streets and Highways.
5. The preformed markings shall be capable of being adhered to asphalt concrete or portland cement concrete pavement and be precoated with a factory applied, pressure sensitive adhesive. A primer may be used to precondition the pavement surface, when recommended by the manufacturer, due to climate or pavement conditions. When the adhesive backing is supplemented by a solvent or other type of adhesive, the material used and the application procedure shall be in accordance with the manufacturer's recommendation.

6. The thermoplastic pavement marking material shall mold itself to pavement contours, breaks and faults by action of traffic at normal pavement temperatures, and shall be formulated with resealing characteristics enabling the material to fuse with itself and with previously applied marking materials of the same composition without externally applied tackifiers or adhesives.
7. Materials will be considered only from manufacturers of reflectorized plastic pavement markers and legends, who can submit evidence of successful product use over the past five (5) years, under climatic conditions similar to that of the work location.
8. The marking material shall be a minimum of .06 inches in thickness when measured without the precoated adhesive.
9. Retro reflectance. The material, when tested under actual conditions, shall conform to those requirements set forth in Texas Text method 828-B, entitled "Method for Determining Retro reflectance of Pavement Markings".
10. Skid Resistance. The surface of the retroflective pavement marking film shall provide a minimum skid resistance value of 35 BPN when tested according to ASTM E 303.
11. Glass Sphere Retention. The plastic shall have glass sphere retention qualities. A two (2) inch by six (6) inch specimen of plastic shall be cut at a right angle to the beveled edge and bent parallel to the beveled edge of a one-half (1/2) inch mandrel. While the specimen is bent, a strip of one-half (1/2) inch wide masking tape (such as Utilitape, manufactured by Permaceel) shall be applied firmly along the length of the area of maximum bend and then removed. Should any glass spheres remain on the masking tape when the strip is removed, the sample shall be rejected.
12. Reflectivity Retention. To have a good effective performance life, the glass beads must be strongly bonded and not be easily removed by traffic wear.

One of the following tests shall be employed to measure reflectivity retention:

a. Taber Abraser Simulation Test

Using a Taber Abraser with an H-18 wheel and a 125 gram load to sample shall be inspected at 200 cycles, under a microscope to observe the extent and type of bead failure.

No more than fifteen (15) per cent of the beads shall be lost due to popout and the predominant mode of failure shall be "wear down" of

the beads.

or

b. Federal Test Method Standard No. 141a

Using H-18 calibrade wheels with a 1000 gram load on each wheel, the sample shall be inspected at 500 cycles to determine the extent and type of bead failure.

The maximum loss in weight shall be 0.25 grams due to bead abrasion.

13. Tensile Strength. The film shall have a minimum tensile strength of one hundred fifty (150) pounds per square inch of cross-section when tested according to ASTM D 638-76.
14. Effective Performance Life. The film, when applied according to the recommendations of the manufacturer, shall provide a neat durable marking that will not flow or distort due to temperature if the pavement surface remains stable. Although reflectivity is reduced by wear, the pliant polymer shall provide a cushioned, resilient substrate that reduces bead crushing and loss. The film shall be weather resistant and, through normal traffic wear, shall show no fading, lifting or shrinkage which will significantly impair the intended usage of the marking throughout its useful life and shall show no significant tearing, roll back or other signs of poor adhesion.

B. Installation.

1. Cold applied thermoplastic materials shall be applied to clean, dry pavement surfaces, free of dirt and foreign matter, by removing the release paper and placing the plastic on the surface with continuous pressure for a period of about thirty (30) seconds, then permitting traffic to pass over it.
2. All markings shall be applied in accordance with the manufacturers recommendations. Marking configurations shall be in accordance with the "Manual on Uniform Traffic Control Devices".
3. New Pavement. In all areas where pavement markings are to be placed on new asphalt pavement, installation shall be performed by rolling the material into the surface course with the final pass of the roller.
4. Existing Pavement. In areas where pavement markings are specified to be used on existing pavement, a pavement primer should be used as recommended by the manufacturer in addition to the precoated adhesive.
5. The plastic and its adhesive shall be sufficiently free to tack so that it can be easily handled without the protective backing, and be repositioned on the

surface to which it is to be applied, before permanently fixing it in this position with a downward pressure.

C. Submittals.

1. The Contractor and/or developer shall furnish a manufacturer's certification attesting that all materials supplied conform to the requirements of these Specifications. The certification shall include, or have attached, specific results of laboratory tests for the specified physical and chemical properties as determined from samples representative of the lot or lots of thermoplastic compound, glass spheres and reflectorized plastic marker material supplied. These submittals shall be the basis of acceptance of these materials.
2. The manufacturer shall supply instructions describing the application of this material and identify all activators and additional adhesives which are to be used at the time of application, if any.
3. Each work and symbol marking shall be supplied with a diagram with each section numbered to correspond with the completed layout.
4. The Contractor and/or developer shall identify proper solvents and/or primers (where necessary) to be applied at the time of application, all equipment necessary for proper application, and recommendations for application that will assure the materials shall be suitable for use for one year after the date of receipt.

1604 PAINT APPLIED TYPE.

A. Materials.

The paint shall be of good commercial quality, which conforms with Federal Specifications TT-P-85D. The traffic paint shall provide optimum adhesion for glass spheres when both binder and glass spheres are applied in recommended quantities. The Contractor and/or developer shall have the manufacturer submit material specifications to the Engineer prior to approval.

B. Construction Requirements.

1. The Contractor and/or developer shall be responsible for laying out the lines accordance with the plans.
2. The pavement shall be clean and dry prior to applying the paint.
3. The traffic paint should be applied at a wet film thickness of fifteen (15) mils (0.38 mm) and glass spheres should be applied at the rate of six (6) pounds per gallon (0.7 kg per liter) of paint.
4. The glass beads shall be sprayed into the wet traffic paint through a

pressurized glass gun set one (1) inch to four (4) inches (2.5 to 10.2 cm) behind the paint spray gun.

1605 MEASURING AND PREMARKINGS. The Contractor and/or developer shall do all measuring and premarking required for application of the pavement markings.

1606 REMOVAL OF EXISTING PAVEMENT MARKINGS. The Contractor and/or developer shall remove the necessary existing pavement markings by grinding, burning, or obliterating them by some other approved means. Painting them will not be acceptable. The Engineer will direct the Contractor and/or developer to which markings need to be removed and the extent of the removal shall meet the approval of the Engineer.

1607 PLOWABLE REFLECTORS. Plowable reflector pavement markers shall be low profile, two-way, blue or yellow colored reflector pavement markers and shall have cast iron housing with acrylic prismatic reflectors measuring 9.25 inches by 5.86 inches by 1.69 inches with a .025 inch maximum projection above the roadway. Each reflector shall be visible from both directions and shall have a 1.87 square inch reflective face. Plowable reflectors shall be Model 96L as manufactured by Stimsonite Corporation of Niles, Illinois or approved equal. Installation shall be as per manufacturer's recommendations. All excess epoxy used in the installation process shall be removed from the face and surrounding area of the marker.

2

SECTION 1700 TRAFFIC CONTROL SIGNING

1701 SCOPE. The work of this Section shall consist of all labor, materials, equipment and services necessary to complete the supplementary traffic control signing as shown on the Plans and herein specified.

1702 GENERAL. The signs shall meet the requirements of the latest edition of the Manual of Uniform Traffic Control Devices, unless otherwise required in the Special Provisions or contract drawings.

The Contractor and/or developer shall locate the signs in the field in accordance with the Plans, the Manual on Uniform Traffic Control Devices, and subject to the approval of the County Engineer. Dimensions on the detailed drawings on the Plans shall take precedence. The contractor and/or developer will be responsible for orientation, elevation, offset and level of all signs erected.

The Contractor and/or developer shall verify, prior to erecting any sign, that underground utilities will not be damaged as a result of placing the sign post.

1703 MATERIALS.

A. Steel Sign Posts:

1. Steel: ASTM A 446, commercial quality.
2. Shape and Holes: Steel "U" Channel Section Sign Posts. The posts furnished under this specification shall be formed from hot rolled high carbon rail steel. After all fabrication, including punching, is completed, the posts shall be hot dipped galvanized to comply with the requirements of ASTM A123. Posts shall be painted green after galvanizing.
 - a. All posts shall have a uniform "U" cross section and shall be the lengths designated on the plans.
 - b. The posts shall weigh, before punching, not less than three (3) pounds per linear foot of post length.
 - c. Posts shall be punched on the center line of the web while hot. The holes shall be three-eighths (3/8) inch in diameter and shall be punched one (1) inch apart on centers starting one (1) inch from the top of the post and extending down for six (6) feet.

B. Square Steel Sign Posts:

1. Steel: ASTM A570, Grade 50. Yield strength after cold-forming is 60,000 psi minimum.

2. Shape and Holes: Steel Square Sign Posts. The posts furnished under this specification shall be formed of 14 gauge (.083 U.S.S. gauge) steel, carefully rolled to size and shall be welded directly in the corner by high frequency resistance welding and externally scarfed to agree with corner radii. After all fabrication is completed, the posts shall be hot-dipped galvanized conforming to ASTM A653, G90, Structural Quality, Grade 50 Class 1. The corner weld is zinc coated after scarfing operation. Both interior and exterior of the post shall be galvanized.

Perforated sign posts shall be one or more of the following sizes:

Size	U.S.S. Gauge	Weight/ft
1 3/4" x 1 3/4"	14	1.71
2" x 2"	14	1.99

Holes shall be 7/16 inch +/- 1/64 inch in diameter on one (1) inch centers on all four sides down the entire length of the post. On square tubing, holes shall be on centerline on each side in true alignment and opposite each other directly and diagonally. The finished posts shall be straight and have a smooth, uniform finish. It shall be possible to telescope all consecutive sizes of square tubes freely and for not less than ten (10) feet of their length without the necessity of matching any particular face to any other face. All holes and ends shall be free from burrs and ends shall be cut square. Permissible variation in straightness is 1/16 of an inch in three (3) feet.

C. Round Steel Street Name Posts:

1. Steel: ASTM A446.
2. Shape: Round steel posts shall be 2 3/8 inches in diameter and .065 inches U.S.S. gauge. Posts shall be hot-dipped galvanized conforming to ASTM A653, G90.

D. Bolts and Nuts. ASTM Design A307 galvanized in accordance with ASTM Design A153. Bolts shall be round-headed as shown on plans and shall have screw driver slots.

E. Aluminum Flat Sheets. ASTM B209, Alloy 6061-T6.

F. Reflective Sheeting:

1. Description. This material shall be a reflective sheeting capable of being used to reflectorize any properly prepared, smooth, flat, wood or metal surface. It shall be furnished in two classes, as follows:

Flat Surface (Enclosed Lens)

Class 1 - Heat Activated Adhesive

Class 2 - Pressure Sensitive Adhesive

All sheeting that is used on R1-1 and R2-1 signs shall be high intensity (encapsulated lens) or super County Engineering grade (with heart design).

2. Construction and Materials:

a. A uniform monolayer of spherical glass lens elements shall be embedded in a binder over light reflecting material resulting in an optical reflective system. The light reflecting material shall have a pre-coated adhesive backing protected by a removable liner.

(1) Type 1 Sheeting (Flat Surface-Enclosed Lens) shall have a transparent flexible covering, applied as a sheet or a sprayed-on coating, to produce a flat, smooth, moisture resisting film over the lens elements.

b. Adhesive Backing. The adhesive backing shall produce a bond to support a one and three-quarters (1 3/4) pound weight for five (5) minutes without the bond peeling more than a distance of two (2) inches when tested according to (4.4.4) Federal Specification L-S-300A. The adhesive for Class 1 shall be as specified in (b) (2.1) and for Class 2 shall be as specified in (b) (2.2).

(1) Class 1 Adhesive. The backing for Class 2 Sheeting shall have a tack-free adhesive which shall be activated by applying heat to the material in a temperature range of 175 F to 250 F. The adhesive must be such that the sheeting can be positioned at temperatures up to 100 R. without damage to the sheeting.

(2) Class 2 Adhesives. The backing for Class 2 Sheeting shall have a pressure sensitive adhesive which requires no heat, solvent, or other preparation for adhesion to smooth, dry, clean surfaces.

c. Liner. The adhesive backing of the sheeting shall be completely covered by a protective liner which shall be easily removable without soaking in water or other solvents. During removal, the liner shall not break or tear, and shall not remove the adhesive from the backing when tested according to (4.4.4) of Federal Specification L-S-300A. Removal of the liner shall cause no dimension change or other defect in the sheeting.

3. Color. The colors, by visual inspection, shall conform to the colors shown and specified in the latest edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways".

4. Uniformity. The surface appearance of the sheeting shall be uniform. There shall be no streaks, discoloration or other condition that will cause the sheeting to show a non-uniform appearance when examined at a distance of fifty (50) feet in daylight or at night in the light from an automobile head lamp. In a single sign, variation in color or reflectivity of the sheeting noticeable at a distance of not less than fifty (50) feet under day or night conditions shall be cause for rejection of the sign.

5. Performance:
 - a. Specular Glass. When measured with an 85 Gloss Meter, Type I sheeting shall have a specular gloss reading of not less than forty (40). Gloss shall be measured according to Federal Standard Test Method 141/6103.

 - b. Reflective Intensity. The reflective intensity values of the sheeting shall be not less than the values specified in Table I. The reflective values shall be determined according to (4.4.7) of Federal Specification L-S-300A.

 - c. Shrinkage. When tested as in (4.4.11) of Federal Specification L-S-300A, the sheeting shall not shrink more than one thirty-second (1/32) of an inch in ten (10) minutes or more than one-eighth (1/8) of an inch in twenty-four (24) hours.

 - d. Accelerated Weathering.
 1. When subjected to twelve hundred (1200) hours of accelerated weathering, the sheeting shall be substantially equal in appearance to the unweathered sheeting. There shall be no more than a slight loss of gloss and no evidence of cracking, scaling, pitting, delamination, edge lifting or curling or more than one thirty-second (1/32) of an inch of shrinkage or expansion. The lens elements shall show no cracking or other deterioration except that slight etching or crazing of the elements will be permitted.

 2. Accelerated weathering will be conducted in a twin arc ATLAS WEATHEROMETER operated according to ASTM E42, Apparatus D, with the following additions and exceptions.
 - a. At the end of each twenty (20) hour cycle, the panels will be placed in a cold cabinet at approximately 0 F for one (1) hour. After removal from the cold cabinet

the panels will be returned to the weatherometer to await the start of the next cycle.

- b. Water used in the weatherometer will be water softened to a total hardness content of less than five (5) parts per million expressed as calcium carbonate.

G. SUBMITTALS:

1. The Contractor and/or developer shall show manufacturer's certifications attaching typical test results representative of the materials and certifying that all materials supplied conform to all of the requirements specified.
2. The Contractor and/or developer shall furnish a written statement from the sheeting manufacturer guaranteeing satisfactory performance of the sheeting materials.

H. FABRICATION OF FLAT SHEET SIGN PANELS:

Flat sheet signs shall be cut to the size and shape shown on the plans. They shall be free from buckles, warps, dents, cockles, burrs and other defects caused by fabrication. Signs shall be attached to posts as shown on the plans.

I. APPLICATION OF REFLECTIVE SHEETING:

1. Preparation of metal and application of reflective sheeting shall be strictly in accordance with the sheeting manufacturer's instructions.
2. The applicator shall use equipment recommended by the sheeting manufacture and shall be experienced in the application of the particular sheeting specified.

1704 INSTALLATION. Installation shall be in accordance with the details on the plans and as specified herein. The posts shall be erected by driving, either by hand or with mechanical devices. The method of driving shall not substantially alter the cross-sectional dimensions of the posts or materially damage the spelter coating. All areas where the galvanizing has been removed or damaged shall be cleaned and painted with zinc rich paint. Battered tops will not be permitted. Posts which are bent or otherwise damaged, during or after erection, shall be removed from the site and replaced at the contractor and/or developer's expense. After driving, the portion of the posts above ground shall be oriented as required above and the posts shall be firm in the ground.

1705 EXISTING SIGNS. The Contractor and/or developer shall preserve all existing traffic signs in useful condition so as to provide traffic control during construction. All existing traffic signs, except those signs to be removed, shall be reused and relocated, as shown on the plans, after construction. All existing signs that are to be removed after construction shall be carefully protected and shall be removed and returned to a place designated by the County Highway Department/PWD.



County of Clay
HIGHWAY
DEPARTMENT/PWD

TRAFFIC SIGN
DESIGNATIONS

D17-1A

WARNING SIGNS

SIGN	SIZE (INCHES)	AREA SQ. FT.	SYMBOL LEGEND BORDER	BACK GROUND	DESCRIPTION
W1-1R	30X30	5.18	BLACK	YELLOW	CURVE SIGN (RIGHT) SHARP
W1-2R	30X30	5.18	BLACK	YELLOW	CURVE SIGN (RIGHT)
W1-1L	30X30	5.18	BLACK	YELLOW	CURVE SIGN (LEFT) SHARP
W1-2L	30X30	5.18	BLACK	YELLOW	CURVE SIGN (LEFT)
W1-3R	30X30	5.18	BLACK	YELLOW	REVERSE CURVE (RIGHT) SHARP
W1-4R	30X30	5.18	BLACK	YELLOW	REVERSE CURVE RIGHT
W1-3L	30X30	5.18	BLACK	YELLOW	REVERSE CURVE (LEFT) SHARP
W1-4L	30X30	5.18	BLACK	YELLOW	REVERSE CURVE (LEFT)
W1-6	48X24	8.0	BLACK	YELLOW	LARGE ARROW SIGN
W1-7	48X24	8.0	BLACK	YELLOW	LARGE ARROW SIGN
W1-8	18X24	3.0	BLACK	YELLOW	CHEVRON
W2-1	30X30	5.18	BLACK	YELLOW	CROSS ROAD
W2-2	30X30	5.18	BLACK	YELLOW	SIDE ROAD
W2-3	30X30	5.18	BLACK	YELLOW	SIDE ROAD
W3-1A	36X36	5.18	BLACK	YELLOW	STOP AHEAD
W3-2A	36X36	9.0	BLACK	YELLOW	YIELD AHEAD
W3-3	36X36	9.0	BLACK	YELLOW	SIGNAL AHEAD
W11-2	30X30	9.0	BLACK	YELLOW	ADVANCE PEDESTRIAN CROSSING
W11A-2	30X30	5.18	BLACK	YELLOW	PEDESTRIAN CROSSING
S1-1	36X36	9.0	BLACK	YELLOW	ADVANCE SCHOOL CROSSING
S2-1	36X36	9.0	BLACK	YELLOW	SCHOOL CROSSING
OM-4	18X18	2.25	BLACK	RED	OBJECT MARKER



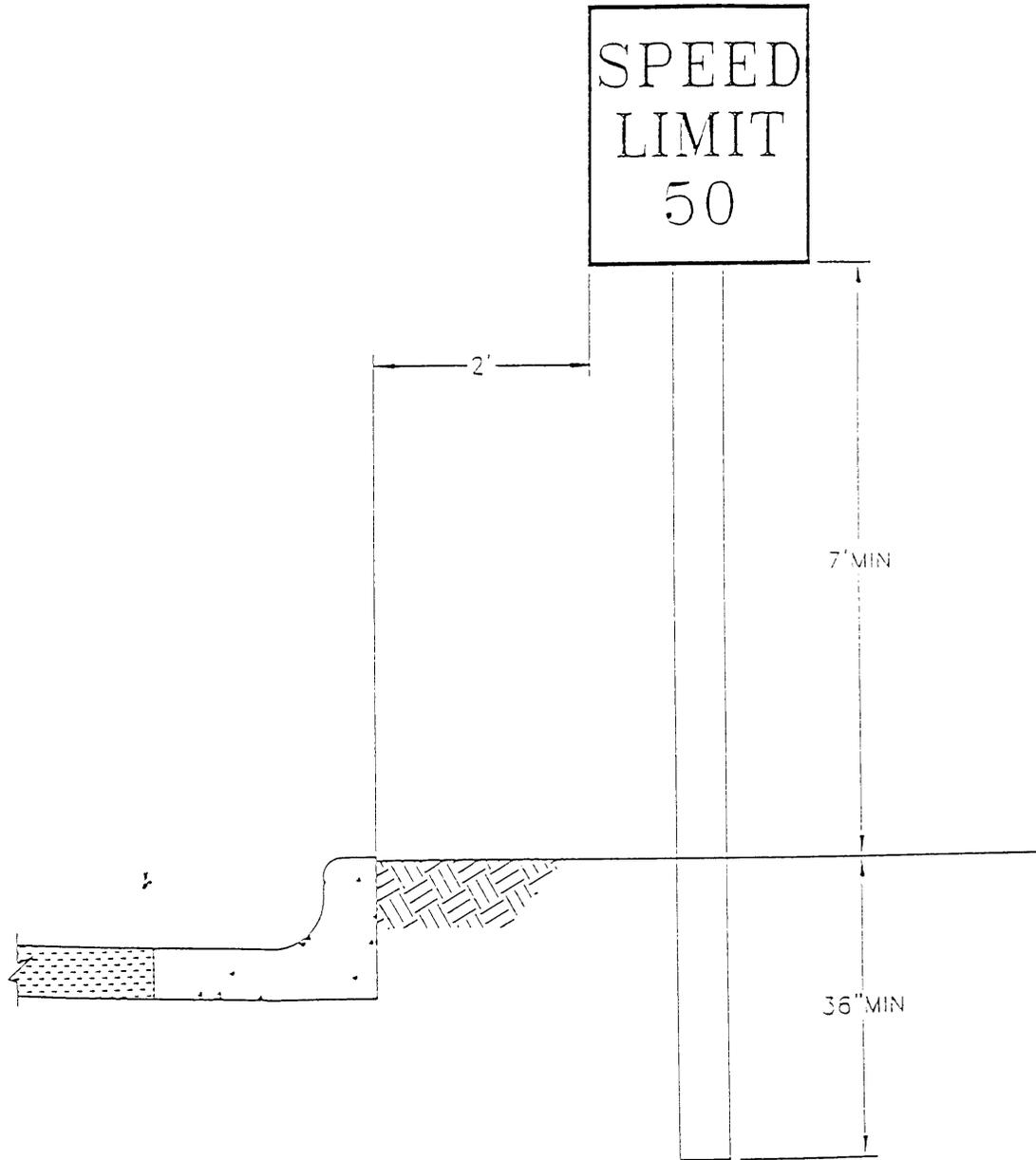
County of Clay
HIGHWAY
DEPARTMENT/PWD

TRAFFIC SIGN
DESIGNATIONS

D17-1B

REGULATORY SIGNS

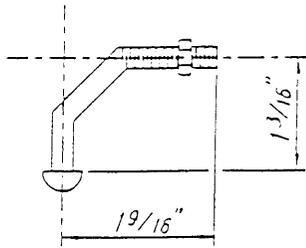
SIGN	SIZE (INCHES)	AREA SQ. FT.	SYMBOL		BACK GROUND	DESCRIPTION
			LEGEND	BORDER		
R1-1	30X30	5.18	WHITE		RED	STOP
R1-2	38X38X38	3.9	RED		WHITE	YIELD
R1-3	20X9	1.25	WHITE		RED	4-WAY (PLAQUE)
R1-5	20X9	1.25	WHITE		RED	3-WAY (PLAQUE)
R2-1	24X30	5.0	BLACK		WHITE	SPEED LIMIT
R2-5A	30X42	8.75	BLACK		WHITE	REDUCES SPEED AHEAD
R3-1	24X24	4.0	RED		WHITE	NO RIGHT TURN (SYMBOL)
R3-1X	24X18	3.0	BLACK		WHITE	NO RIGHT TURN (PLAQUE)
R3-2	24X24	4.0	RED		WHITE	NO LEFT TURN (SYMBOL)
R3-2X	24X18	3.0	BLACK		WHITE	NO LEFT TURN (PLAQUE)
R3-3	24X24	4.0	BLACK		WHITE	NO TURNS
R3-4	24X24	4.0	RED		WHITE	NO U TURN (SYMBOL)
R3-4X	24X18	3.0	BLACK		WHITE	NO U TURN(PLAQUE)
R3-7R	30X30	6.25	BLACK		WHITE	RIGHT LANE MUST TURN RIGHT
R3-7L	30X30	6.25	BLACK		WHITE	LEFT LANE MUST TURN LEFT
R4-7	24X30	5.0	BLACK		WHITE	KEEP RIGHT (SYMBOL)
R4-7X	24X18	3.0	BLACK		WHITE	KEEP RIGHT (PLAQUE)
R5-1	30X30	6.25	RED		WHITE	DO NOT ENTER
R4-8a	24X30	5.0	BLACK		WHITE	KEEP LEFT (SYMBOL)
R5-9	38X24	6.0	WHITE		RED	WRONG WAY
R6-1L	38X12	3.0	BLACK		BLACK	ONE WAY ARROW (LEFT)
R6-1R	38X12	3.0	BLACK		BLACK	ONE WAY ARROW (RIGHT)
R6-2L	18X24	3.0	BLACK		WHITE	ONE WAY (LEFT)
R6-2R	18X24	3.0	BLACK		WHITE	ONE WAY (RIGHT)



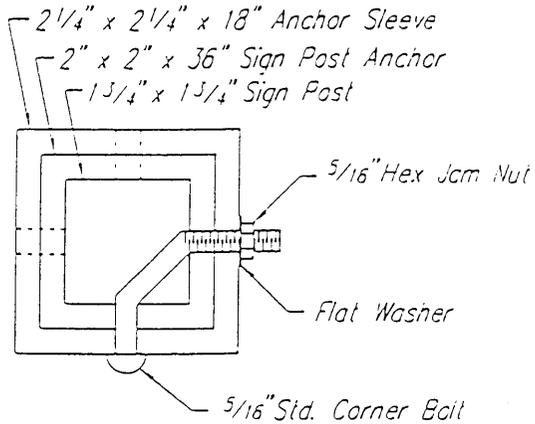
County of Clay
HIGHWAY
DEPARTMENT/PWD

TYPICAL TRAFFIC
SIGN PLACEMENT

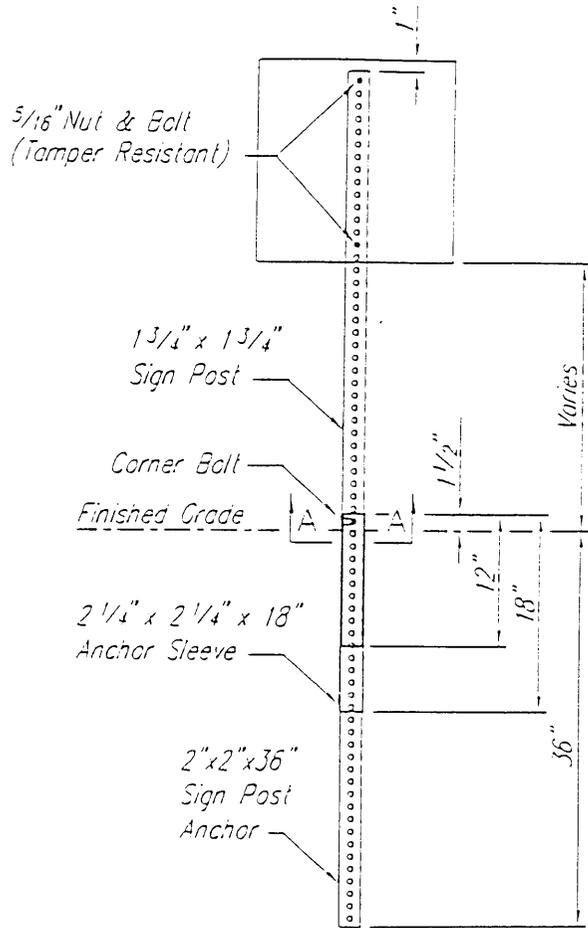
D17-2



BOLT DETAIL



SECTION A-A



ELEVATION

BREAK AWAY SIGN POST DETAIL

Installation Sequence:

1. Where conduit is in place, backfill conduit with earth
2. Drive sign post anchor into subgrade.
3. Drive anchor sleeve over the sign post.
4. Insert sign post into the sign post anchor and bolt in place.

Note:

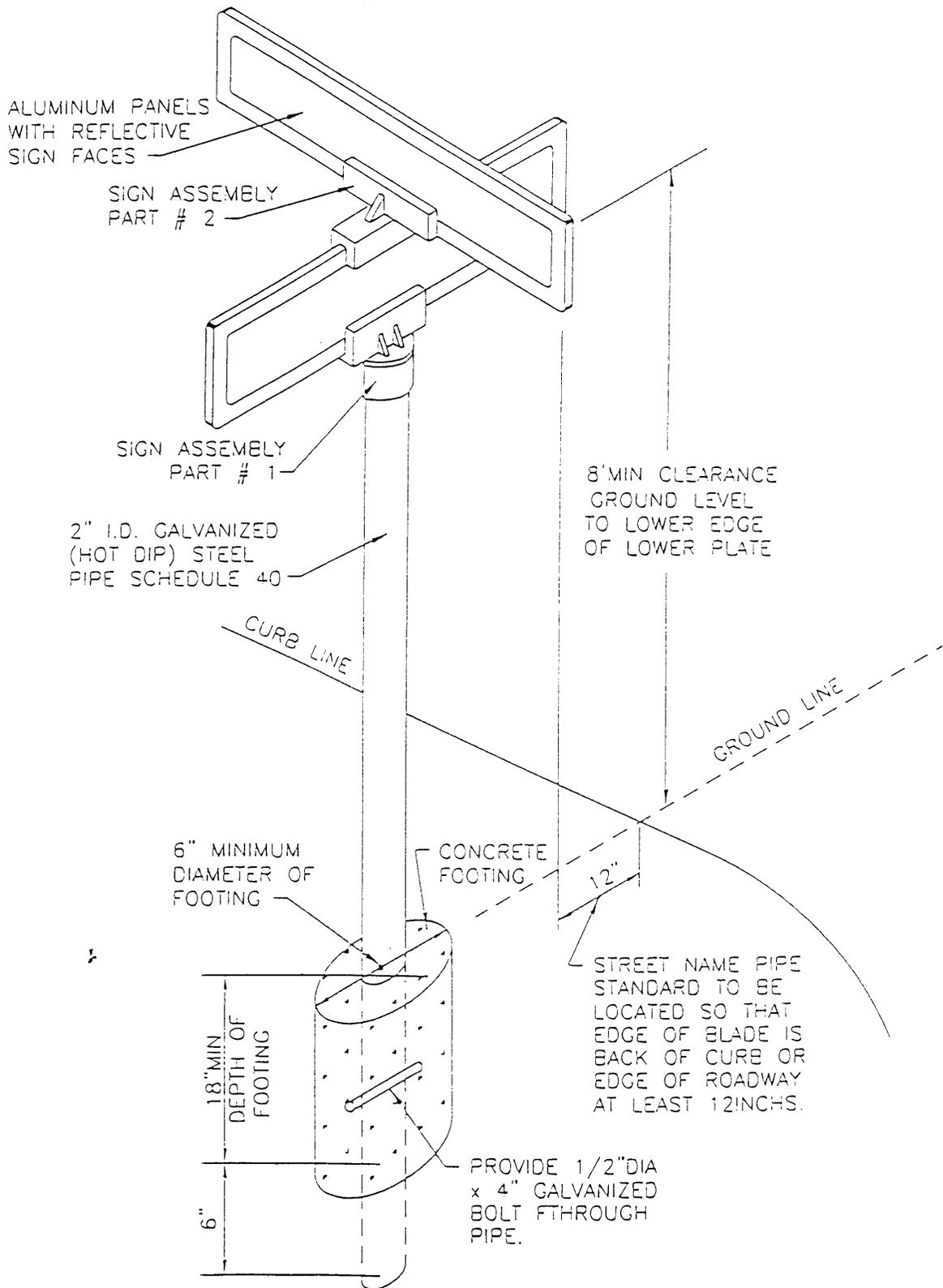
In all installations the first hole above the finished grade level in all three units must be in line for insertion of the corner bolt.



County of Clay
HIGHWAY
DEPARTMENT/PWD

BREAK AWAY SIGN
POST DETAIL

D17-3



County of Clay
HIGHWAY
DEPARTMENT/PWD

TYPICAL STREET NAME
SIGN ASSEMBLY

D17-4

STREET NAME SIGN ASSEMBLY

A typical street name assembly shall consist of the following:

1. Four sign faces of silver color reflective sheeting of appropriate size stenciled by the reverse silk-green process with transparent green background or four faces of green color reflective sheeting with white reflective cut-out letters. The reflective sheeting shall conform to Federal Highway Administration Specification Fp-71, Section 633.06, Table III, Level A.
2. Two extruded aluminum sign plates, .080 inches thick with dimensions of 6 inches high by 24, 30 or 36 inches wide as required by the street name length. The reflective sheeting is to be applied to both sides of each sign panel in accordance application methods recommended by the manufacturer.

All wiring shall be 4 inches, standard alphabet, C series. Prefix and suffix abbreviations shall be 2 inches, standard alphabets, C series. All lettering shall be upper case and the letter size, series and spacing shall conform to the Federal Highway Administration, standard, alphabet (1966). The length of the sign shall depend on the length of the total between the street name and degree of sign.

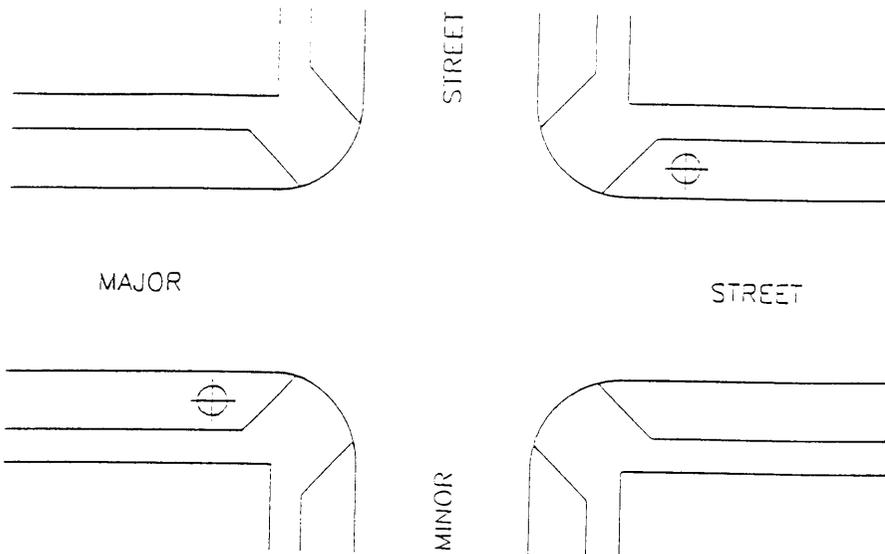
3. Two sign assembly parts (#1 & #2) as indicated on Standard Drawing No.17-6 used to connect the sign assembly th\o the pipe standard.



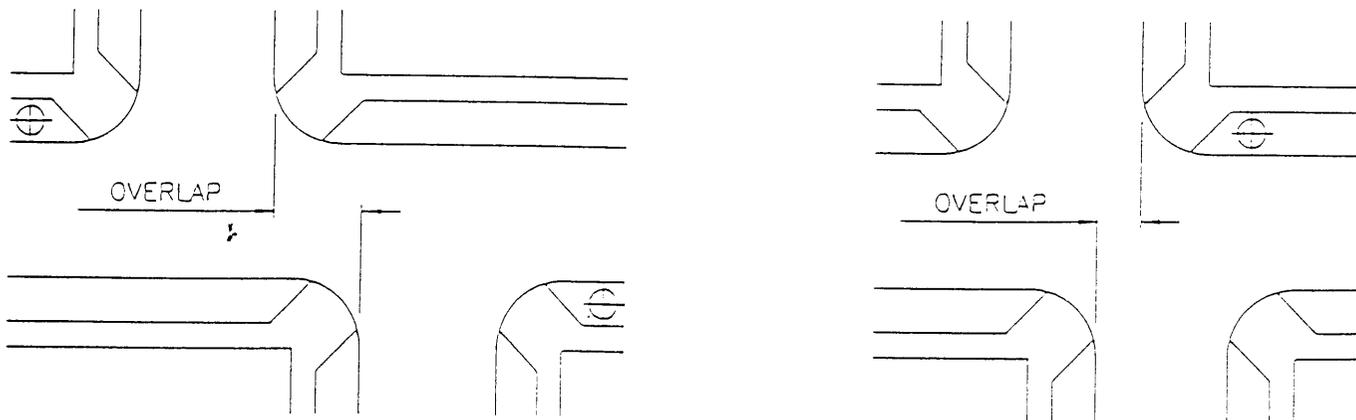
County of Clay
HIGHWAY
DEPARTMENT/PWD

STREET NAME
SIGN FABRICATION

D17-6



"FOUR WAY" INTERSECTION



"JOG" INTERSECTIONS

TYPICAL STREET NAME SIGN PLACEMENT



County of Clay
HIGHWAY
DEPARTMENT/PWD

TYPICAL STREET NAME
SIGN PLACEMENT

D17-7

SECTION 2000 CONCRETE

2001 SCOPE. This section covers all cast-in-place concrete, including reinforcing steel, forms, finishing, curing, and other appurtenant work.

2002 GENERAL. All cast-in-place concrete shall be accurately formed, and properly placed and finished as shown on the drawings and specified herein. The Contractor and/or developer shall inform the Engineer at least twenty-four (24) hours in advance of the times and places at which he intends to place concrete.

2003 MATERIALS. All material used in the manufacture of concrete shall conform to the following:

- A. Concrete Control and Quality. The current editions of the "Bulletins" and Approved Sections of the "Standard Concrete Specifications" issued by the Mid-West Concrete Industry Board, Inc. (MCIB) are made a part hereof by reference. However, when the provisions of such "Bulletins" and "Sections" differ from these specifications, the provisions of this Specification shall govern.
- B. Concrete. Concrete for use in construction shall conform to the requirements of Sections 2005 and 2006.
 1. Cement. Portland Cement shall conform to ASTM C-150, Type I, II or III.
 2. Coarse Aggregate. Coarse Aggregate shall conform MCIB Section 4 except that only limestone of the Bethany Falls or Calloway ledges may be used.
 3. Fine Aggregate and Mixing Water. Fine aggregate and mixing water shall conform to MCIB Section 4.
 4. Admixtures. Admixtures shall conform to MCIB Section 5 and ASTM 494.
- C. Reinforcing Steel.
 1. Bars. Bars shall conform to ASTM A-615, A-616, and A-617.
 2. Welded Steel Wire. Welded steel wire fabric shall conform to ASTM A-185.
 3. Supporting Elements. Representative samples of supporting elements shall be submitted and approved by the Engineer prior to their use in the project.
- D. Expansion Joint Fillers. Expansion joint fillers shall confirm to ASTM D-1752.
- E. Joint Sealing Compounds. Joint sealing compounds shall be one or two component rubberized polysulfide urethanes conforming to Federal Specification Numbers TT-00227 or TT-00230-C.

- F. Curing Membrane. All material to be used or employed in curing Portland Cement Concrete must be approved by the Engineer prior to its use. It shall be of the liquid membrane type and shall conform to one of the following:
1. A white pigmented two component water insensitive epoxy with a solid epoxy content of 40 to 60 percent. Application rate is 5 to 8 mils wet.
 2. A white pigmented liquid system of styrene acrylate Type I Class 2 or liquid chlorinated rubber Type II Class 2, complying with Federal Specification No. TT-C-800A. Application rate 6 to 10 mils wet.
 3. A white pigmented liquid system of a water based compound. Application rate 6 to 10 mils wet.
- G. Method of Applying Curing Membrane. A nozzle producing a uniform fan pattern will be used on all spray equipment when applying the liquid curing membrane. The curing compound shall be stirred prior to and during use to insure a uniform mixing of the compound. Care shall be taken that the tip is clean and unclogged at all times. Should clogging occur, spraying shall be stopped immediately and tip cleaned.

2004 PRELIMINARY REVIEW. A report shall be submitted to the Engineer prior to the placement of concrete and shall include data on proposed concrete mix proportions and the fine and coarse aggregate gradation. Mix proportions shall be selected preferably on the basis of field experience and may be adjusted upon approval of the Engineer where required to produce concrete of proper workability, uniform consistency, and acceptable density and strength.

A tentative concrete mix shall be designed and tested for each size and gradation of aggregate and for each slump intended to be used on the work. Design quantities and test results of each mix shall be submitted to the Engineer for review and approval.

2005¹ CONCRETE MIX DESIGNATIONS. The following tabulation indicates minimum strengths for the various types of concrete which will be accepted.

<u>Class</u>	<u>Min. Compressive Strength</u>		
	<u>7-days</u>	<u>28-days</u>	<u>Slump</u>
I	2000 psi	4000 psi	4 inches max.
II	2650 psi	4000 psi	2-4 inches max.

All cast-in-place or precast construction for pavements, curbs, curb and gutter, sidewalks, drive approaches, inlets, manholes, reinforced concrete boxes, bridges and as otherwise required by the Engineer shall be of Class II concrete. The use of Class I concrete shall be confined to non-structural elements such as manhole or inlet inverts and pipe encasements. When high-early strength cement is to be used for concrete, the mix shall obtain a seven (7) day strength not less than the minimum twenty-eight (28) day strength specified for concrete of the same class.

2006 LIMITING REQUIREMENTS. Each concrete mix shall be designed and concrete shall be controlled within the following limits.(6 % air entrainment + or - 1 1/2%)

	Max. Size		Cement	Max. Water	Max. Gals
	Design	Course	Content	Cement	Water per
	<u>Slump</u>	<u>Aggregate</u>	<u>Lbs./C.Y.</u>	<u>Weight Ratio</u>	<u>Sack of Cement</u>
Class I (4000 psi)	4"	1"	618	.421	4.75
Class II (4000 psi)	2"	1"	558	.421	4.75
	3"	1"	588	.421	4.75
	4"	1"	618	.421	4.75

The quantity of portland cement shall be not less than that shown in the preceding table. The use of plasticizers in concrete mixes shall only be as approved by the Engineer. If an approved plasticizer is utilized in the concrete mix, the cement factor shown shall be decreased ten (10) percent, or as approved by the Engineer.

Concrete slump shall be kept as low as possible, consistent with proper handling and thorough compaction. Maximum slump for portland cement concrete pavement shall be two (2) inches. Slumps for concrete work other than pavement construction shall not exceed four (4) inches. Use of slumps in excess of those specified shall be only when authorized by the Engineer. The use of water to obtain so-called "improved workability" shall not be permitted.

The initial set as determined by ASTM C403 shall be attained five and one-half (5 ½) hours, plus or minus one (1) hour, after the water and cement are added to the aggregates. If such use has been approved by the Engineer, the quantity of retarding or accelerating admixture shall be adjusted to compensate for variations in temperature and job conditions.

The admixture content shall be in accordance with the recommendations of the manufacturer for compliance with these specifications.

The total volumetric air content of concrete after placement shall be six (6) percent, plus or minus one (1) percent.

The minimum acceptable compressive strengths shall be as determined by ASTM C39.

As the work progresses, the Engineer reserves the right to change the proportions from time to time if conditions warrant such changes to produce a satisfactory job. Any such changes may be made within the limits of the specifications at no additional compensation to the Contractor and/or developer.

2007 BATCHING AND MIXING. Concrete shall be furnished by an acceptable ready-mixed concrete supplier and shall conform to ASTM C94.

The consistency of concrete shall be suitable for placement conditions. Aggregates shall float uniformly throughout the mass and the concrete shall flow sluggishly when vibrated or spaded. The slump shall be kept uniform.

2008 PLACEMENT. The limits of each concrete pour shall be predetermined by the Contractor and/or developer and shall be acceptable to the Engineer. All concrete within such limits shall be placed in one continuous operation.

Before concrete is placed, forms, reinforcements, and embedments shall be rigidly secured in proper position and all dirt, mud, water and debris shall be removed from the space to be occupied by the concrete. Bonding surfaces shall be cleaned of all foreign material and shall be free from laitance. Concrete shall not be placed on frozen subgrade or in excavations which have been dewatered.

Placement of concrete shall conform to requirements of ACI 304. Concrete shall be placed within forty-five (45) minutes of mixing operations, with the exception that the Engineer may extend the period to ninety (90) minutes (maximum) dependent upon weather conditions. Concrete shall not be placed in horizontal layers exceeding eighteen (18) inches. During and immediately after placement, concrete shall be thoroughly compacted and worked around all reinforcements and embedments and into the corners of the forms. The concrete shall be vibrated or spaded to produce a solid mass without honeycomb or surface air bubbles.

2009 COLD WEATHER CONCRETING. Unless authorized in writing by the Engineer, mixing and concreting operations shall be discontinued when the descending air temperature in the shade and away from artificial heat reaches 40 degrees F or when forecast to drop below 40 degrees F within twenty-four (24) hours of placement, and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35 degrees F.

When concrete work is authorized during cold weather, the aggregates may be heated by methods approved by the Engineer prior to being placed in the mixer. No ingredient that is frozen or contains ice shall be placed in the mixer. The temperature of the concrete shall be not less than 60 degrees F and not more than 80 degrees F at the time of placement in the forms. Under no circumstances shall concreting operations continue when the air temperature is less than 20 degrees F. No concrete shall be placed on frozen subgrade. Sudden cooling of concrete shall not be permitted. Concrete injured by frost action or freezing weather shall be removed and replaced at the Contractor and/or developer's expense.

2010 HOT WEATHER CONCRETING. The provisions of this section shall apply to all concrete work which is done when the air temperature is above 80 degrees F at the time of placement.

The temperature of the concrete, when placed, shall not be high enough to cause excessive loss of slump, flash set or cold joints. In no case shall the temperature of the concrete, when placed, exceed 90 degrees F. Forms, reinforcing and subgrade surfaces against which the concrete is to be placed shall be wetted down immediately before placement.

When the air temperature exceeds 90 degrees F and as soon as practicable without causing damage to the surface finish, all exposed concrete shall be kept continuously moist by means of fog sprays, wet burlap, cotton mats, or other means acceptable to the Engineer. This cooling with water shall be in addition to the initial sealing by membrane curing compound.

2011 CURING AND PROTECTION. Concrete shall be cured by protecting it against loss of moisture, rapid temperature changes and mechanical injury for at least four (4) days after placement. Acceptable methods shall be moist curing, waterproof paper, white polyethylene sheeting, liquid membrane-forming compounds, or a combination thereof. After concrete finishing operations have been completed, the entire surface of the newly-placed concrete shall be covered by the curing medium applicable to local conditions and acceptable to the Engineer. The Contractor and/or developer shall have the necessary equipment for adequate curing on hand and be ready to install prior to concrete placement.

Moist curing shall be accomplished by a covering of burlap or other approved fabric mat used singly or in combination. Curing mats shall be thoroughly wet when applied and kept continuously wet and in intimate contact with the surface for the duration of the moist-curing period. Burlap or fabric mats shall be long enough to cover the entire surface of the work and lapped at joints to prevent drying between adjacent sheets.

Waterproof paper or white polyethylene sheets shall be large enough to cover the entire surface of the work and shall be lapped not less than eighteen (18) inches. The sheets shall be adequately weighted to prevent displacement or billowing due to wind. Tear holes appearing in the material during the curing period shall be immediately repaired or replaced with material in acceptable condition.

White membrane curing compound shall be applied after finishing operations have been completed and immediately after the free water has left the surface. The surface of the work shall be completely coated and sealed with a uniform layer of the curing compound at a rate of not less than one gallon per one hundred fifty (150) square feet. The compound shall not be thinned and shall be kept agitated to prevent settlement of pigment. On surfaces where forms are removed prior to the end of the specified curing period, the entire exposed surface shall be coated at the specified rate of coverage. If rain falls on the newly-coated surface before the film dries sufficiently to resist damage, or if the film is damaged in any other way, the Contractor and/or developer will be required to apply a new coat of compound to the affected area.

During cold weather concreting when the ambient air temperature is expected to drop below 40 degrees F, sufficient supply of burlap, straw, hay, or other blanketing material shall be provided along the work to protect the concrete and maintain a minimum temperature of 40 degrees F in the concrete as measured on the surface. An approved moisture barrier such as wet burlap or plastic sheeting shall be placed on the concrete prior to placement of the blanketing material. This type of curing shall be maintained for a period of six (6) days as the initial cure.

Sidewalks, curb and gutter, and miscellaneous concrete shall be protected and cured for a period of not less than seventy-two (72) hours after the placing of the concrete by covering with wet burlap or by the application of a membrane curing compound as specified above.

2012 FORMS. Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions shown on the drawings. They shall be sufficiently tight to prevent leakage of mortar and shall be braced or tied to maintain the desired position, shape, and alignment during and after concrete placement.

Forms may be of wood or metal and shall be designed to permit easy removal without injury to the concrete. Forms for all exterior exposed surfaces, which will be visible after backfilling, shall be prefabricated plywood panel forms, job-built plywood forms, or forms that are lined with plywood or fiberboard. Forms shall be coated with an approved light oil to prevent concrete from adhering and shall be thoroughly cleaned and re-oiled before re-use.

Forms shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all dead and live loads. Care shall be taken in form removal to avoid surface gouging, corner or edge breakage, and other damage to the concrete. The following table gives the approximate minimum time that forms shall be left in place.

Average Air Temperature Greater Than	70 Deg	60 Deg	50 Deg	40 Deg
Structural Member	Time in Place (24 Hour Days)			
Slab Shoring	10	12	14	21
Slab Forms	7	7	7	7
Beams Soffits and Shoring	10	12	14	21
Beam Side Forms	1	1	2	3
Wall Side Forms	2	2	3	4

2013; FINISHING FORMED SURFACES. Fins and other surface projections shall be removed from all formed surfaces except exterior surfaces that will be in contact with backfill. A power grinder shall be used, if necessary, to remove projections and provide a flush surface. Surfaces to be dampproofed shall have fins removed and tie holes filled, but no additional finishing will be required.

Tie holes in all formed surfaces shall be cleaned, wetted, and filled with patching mortar. Tie hole patches shall be finished flush and shall match the texture of the adjacent concrete.

The surface of all exposed formed exterior surfaces not in contact with backfill shall be finished by rubbing or by other means as directed by the County Engineer.

2014 REPAIRING DEFECTIVE AND DAMAGED CONCRETE. Any concrete found not to be formed as indicated on the plans, or out of alignment or level, or having a defective surface, or damaged prior to acceptance of the project by the County, shall be considered as not conforming

to the intent of these specifications and may be ordered removed and replaced by the contractor and/or developer at his expense unless the Engineer authorizes patching of the defective or damaged area. Surface defects such as ridges and bulges shall be removed by grinding.

Honeycombed and other defective concrete that does not affect the structural integrity of the structure shall be chipped out and the vacated area shall be filled. The methods used in this type of repair shall be approved by the Engineer. Material used for patching shall be a non-shrink, non-metallic grout with a minimum twenty-eight (28) day compressive strength of 5000 psi or a similar material approved by the Engineer. Prior to placement of the repair filling, the contact surface of the affected area shall be thoroughly cleaned of all loose and foreign material and shall be coated with an epoxy bonding agent.

Concrete repair work shall conform to Chapter 9 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing or surrounding concrete. Repair work shall be adequately cured and protected from further damage.

2015 REINFORCEMENTS. The metal reinforcement shall be protected by the thickness of concrete indicated on the construction drawings. Where not otherwise shown, the thickness of concrete over the reinforcement shall be as follows:

<u>Location of Reinforcement</u>	<u>Cover in Inches</u>
Surfaces where concrete is deposited directly against the ground.	3
Formed surfaces exposed to the ground, to water, or to weathering.	2
Beams, girder, and columns not exposed to ground, water, or weathering.	1-½
All surfaces other than those above.	1

Reinforcing steel shall be accurately placed and positioned on supports, spacers, hangers, or other reinforcing steel as approved by the Engineer and shall be secured in place with wire ties or suitable clips. The minimum clear distance between parallel bars shall not be less than one and one-half (1½) times the diameter of round bars, except that in no case shall clear spacing between parallel bars be less than two (2) inches or less than one and one-half (1½) times the nominal size of the coarse aggregate.

Splices in reinforcing steel will not be permitted at points of maximum stress. When it becomes necessary to splice reinforcing steel at points other than those shown on the contract drawings, the character and location of the splice shall be approved by the Engineer. Welding or tack welding of reinforcement will not be permitted. Reinforcements upon which unauthorized welding has been done shall be removed and replaced as directed by the Engineer. Spliced bars shall be placed in contact and securely tied together.

Metal reinforcement at the time concrete is placed shall be free from rust, scale, or other contaminants that will destroy or reduce the bond.

2016 CONSTRUCTION JOINTS. Construction joints shall be made at locations indicated on the drawings or specified, and shall conform to the requirements of ACI 318. When the Contractor and/or developer desires to make construction joints at other locations, he shall anticipate such changes far enough in advance of the construction operations to allow the Engineer to investigate such changes and approve additional construction joints.

2017 EXPANSION AND CONTRACTION JOINTS. Expansion and contraction joints shall be at locations indicated on the drawings or as specified.

Contraction joints shall consist of planes of weakness created by forming or cutting grooves in the surface of the concrete. Formed grooves shall be made by depressing an approved tool or device into the plastic concrete. Sawn joints shall be constructed by sawing through the surface of the concrete with an approved concrete saw. Sawing of the joints shall begin as soon as the concrete has hardened sufficiently to prevent excessive raveling.

Expansion joints shall be formed with pre-formed expansion joint filler of the non-extruding and resilient types which shall include the following; Cork, self-expanding cork, sponge rubber, cork rubber, and bituminous fiber. These materials shall meet the requirements of ASTM D994, D1751 and D1752.

2018 REINFORCED CONCRETE BOX FORMING SEQUENCE. Wall forms may be placed the day following the placement of the bottom slab, as long as care is taken to protect the slab against rough or abusive handling of forms and or placing equipment. The actual placement of concrete shall not occur prior to the fifth day after placing the bottom slab. Top forms may be placed with wall forms if the walls and top are to be monolithic construction, otherwise top forms are not to be placed until the third day after placing the walls. The actual placement of concrete for the top shall not occur prior to the fifth day after placing the walls (for base to top shoring) or until the walls have reached their design minimum of two (2) days after the walls are poured. Wall forms shall remain in place a minimum of two (2) days after the walls are poured. Supports for the top slab shall be left in place according to the schedule shown on page 20-6, Section 2012, Forms.

The above guidelines for placing forms for reinforced concrete boxes are based on the use of standard forming procedures and with the use of concrete containing no admixtures to achieve high early strength. Variations in forming techniques and/or the use of high early strength concrete shall only be allowed after the contractor and/or developer obtains the written approval of the County Engineer.

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Contraction joints shall consist of planes of weakness created by forming or cutting grooves in the surface of the concrete. Formed grooves shall be made by depressing an approved tool or device into the plastic concrete. Sawed joints shall be constructed by sawing through the surface of the concrete with an approved concrete saw. Sawing of the joints shall begin as soon as the concrete has hardened sufficiently to prevent excessive raveling.

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SECTION 2100 CONCRETE CURB AND CURB AND GUTTER

2101 SCOPE. This section governs the furnishing of all labor, equipment, tools, and materials and the performance of all work necessary to construct or reconstruct curbing and/or curb and gutter.

2102 MATERIALS. All items of material included in this section shall conform to Section 2000 except as follows:

- A. Concrete Mix. Concrete shall conform to the requirements set forth for Class II mix design. Slump shall be approved by the Engineer.
- B. Expansion Material. Expansion material shall be a preformed, one-piece, non-extruding material such as "Bondex" No. 941 pre-formed rubber joint, "Rubatex" both manufactured by Rubatex Co., or "Homex" as manufactured by Homasote Co. or equal. Any substitute material requires the approval of the Engineer.
- C. Joint Sealer. Joint sealer shall be a one component, gun-grade, moisture cured epoxy or urethane such as "Vulcum 45" as manufactured by Maneco International, "Sidaflex 1-A" by Sika Chemical Corporation or "Pecora CG-9" by Pecora Co., or equal as approved by the Engineer.
- D. Curing Membrane. Curing membrane shall be as specified in Section 2003 (F).

2103 CONSTRUCTION DETAILS. The curbing shall be constructed or reconstructed to the configuration and to the lines and grades shown on the plans. Generally the curbing shall be placed prior to the placement of pavement or sidewalk sections, except when curb and gutter is integral with the pavement, and as directed by the Engineer.

- A. Removal of Existing Curbing for Reconstruction. Existing curbing shall be totally removed to the nearest contraction or expansion joint or, with the approval of the Engineer, it may be sawed, provided no free section is left that is less than five (5) lineal feet in length, and provided the entire curbing section is sawed a minimum of two (2) inches below top of pavement elevation.
- B. Grading and Subgrade Preparation. All excavation or embankment shall conform to Section 1000, Site Preparation and 1200, Subgrade Preparation; and as follows:

The top six (6) inches of the subgrade shall be compacted to obtain a density of ninety-five (95) percent of the maximum in conformance with Section 1205(A).

If, during reconstruction operations, additional fill material is needed beneath the curb, it shall be of crushed limestone, placed in lifts of four (4) inches not to exceed twelve (12) inches maximum thickness, moistened if necessary, and compacted by mechanical tampers to a density of ninety-five (95) percent of the maximum.

C. Forms. All forms shall be in good condition, clean, and free from imperfections. Each form shall not vary more than one-fourth (1/4) inch in horizontal and vertical alignment for each ten (10) feet in length.

1. General. Face forms will be used with all curb standards as applicable.

Forms shall have a height equal to or greater than the height of the curb section.

The forms shall be set true to line and grade and shall be supported to stay in position while depositing and consolidating the concrete. The forms shall be designed to permit their removal without damage to the concrete. The forms shall be lubricated.

2. Curb Machine. A slip-form curb machine may be used in lieu of forms. The machine must be equipped with mechanical internal vibrators and be capable of placing curb to the correct cross section, line and grade within the allowable tolerances.

2104 JOINTS. The joints shall be formed at right angles to the alignment of the curbing and to the depth specified by the appropriate standard or as modified by the plans.

A. Expansion Joints. Expansion joints shall be placed at all radius points, driveways, curb inlets, or where directed by the plans or Engineer. In no case shall expansion joints be placed more that three hundred (300) feet apart.

1. Material. Expansion joints shall be formed by a one piece of three-quarter (3/4) inch thick preformed joint filler cut to the configuration of the correct curb section.

2. Stability. Expansion joints shall be secured in a manner so they will not be disturbed by depositing and consolidation of concrete.

3. Edging. The edges of the joints shall be rounded with an edging tool of one-quarter (1/4) inch radius.

B. Contraction Joints. Curbing shall have contraction joints formed at intervals of ten (10) feet. They shall extend through the entire curb section from the top of the curb to a depth of twenty-five (25) percent of the total depth of the curb.

1. Method. Contraction joints may be formed by a template, tooling, or sawing.

a. Templates. Templates shall be one-eighth (1/8) inch metal cut to the configuration of the curbing section. The templates shall be secured at the proper locations so that they will not be disturbed by the depositing of concrete. The templates shall be removed as soon as the concrete has attained its initial set and finished as outlined below.

- b. Tooling. Tooling of contraction joints will be permitted if done to the depths specified on the appropriate standard. Tooled contraction joints shall be constructed with a one-quarter (1/4) inch radius on all exposed edges.
- c. Sawing. Sawing of contraction joints is permitted when a curb machine has been used. The sawing of joints must be completed within twenty-four (24) hours of the placing of concrete.

2. Joint Sealer. Joint sealer is not required on contraction joints.

2105 CONCRETE WORK. Concrete for curbing shall be placed in accordance with the requirements of MCIB Standard Concrete Specifications. Expansion and contraction joints shall be constructed as shown on the plans, standards, or where directed by the Engineer.

- A. Concrete Placement. Concrete shall be mechanically vibrated when directed by the Engineer and shall not be allowed to extrude below the forms to cause an irregular alignment of the abutting street pavement.
- B. Finishing. After placing and initial strike-off, the curb shall be tooled to the required radii. If the surface of the concrete is sufficiently wet that a ridge is formed at the inside of the radius tool, finishing will cease until the excessive moisture has evaporated.

After initial set, the face forms and templates, if used, shall be removed and the surface finished to the required dimensions. No water, dryer, or additional mortar shall be applied to the free surface of the concrete.

The finished surface of the concrete shall be broomed with a clean broom to provide an anti-skid surface.

In all cases, the finished curb shall have a true surface, free from sags, twists, or warps, and shall have a uniform color and appearance.

- C. Curing. As soon as practical after the concrete is finished, it shall be cured with one of the acceptable liquid curing membranes applied according to the manufacturer's directions.

If front and/or back forms are removed from finished curbing within a period of seventy-two (72) hours of placement, these surfaces shall also be cured.

Wet burlap, cotton mat, waterproof paper, polyethylene sheeting or earth backfill is not an acceptable curing method for curbing.

- D. Protection. The Contractor and/or developer shall protect the concrete work against damage or defacement of any kind until it has been accepted by the County. Concrete which is damaged or defaced shall be removed and replaced or repaired to the satisfaction of the Engineer, at the expense of the Contractor and/or developer.

- E. Temperature Limitations. Concrete work shall be placed in accordance with requirements of Section 2009 and 2010.

2106 BACKFILL. A minimum of twenty-four (24) hours shall lapse before forms are removed and curb sections are backfilled unless otherwise approved by the Engineer. Backfill shall be accomplished in accordance with Sections 1100 and 1200 entitled "Site Preparation" and "Subgrade Preparation".

The Contractor and/or developer shall be responsible for the repair of any street pavement disturbed by the construction to the satisfaction of the Engineer.

2107 JOINT SEALING AND CLEAN-UP. Only the sidewalk portion of the curbing will require joint sealing. An approved joint sealer shall be applied in accordance with the manufacturer's directions within seven (7) days of the placement of the concrete.

The Contractor and/or developer shall be responsible for the removal of excess dirt, rock, broken concrete, concrete splatters and overspray from the area of construction.

2108 SURFACE TOLERANCES. Curbing shall have a surface tolerance of one-quarter (1/4) inch in ten (10) feet when checked with a ten (10) foot straightedge.

2109 REINFORCEMENT (CURB AND GUTTER). Reinforcement for concrete curb and gutter shall be as designated on the Standard Details. The exception to this shall be when the curb and gutter is to be constructed on an asphaltic concrete base with a minimum depth of three (3) inches. In this case, no reinforcement shall be required unless otherwise determined by the County Engineer.

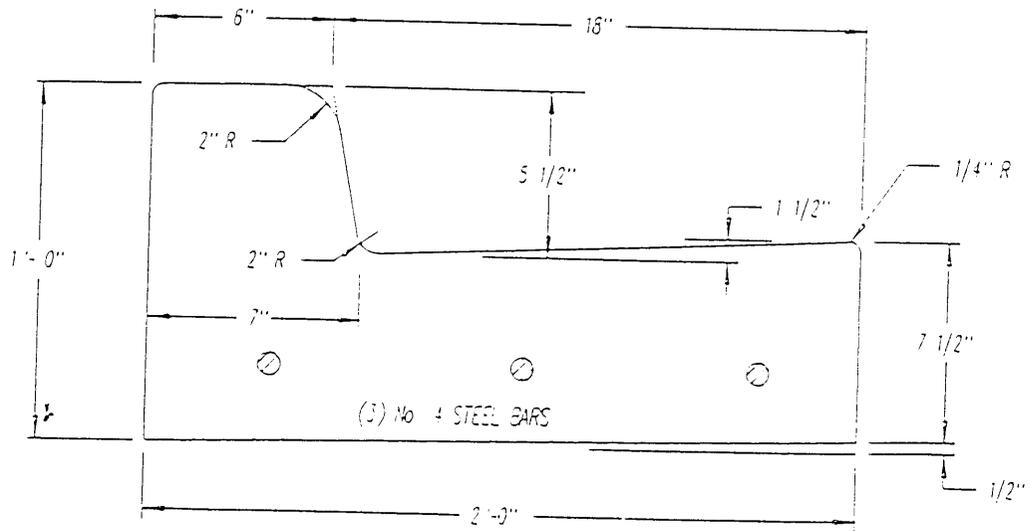
2110 REINFORCEMENT (OTHER). Reinforcement for all other work shall be as shown on the contract drawings or as depicted on details contained in this specification.

;

TYPE CG-1
CONCRETE CURB AND GUTTER

NOTES:

1. ½ " PREMOULDED EXPANSION JOINTS SHALL BE PLACED AT POINTS OF CURVATURE, CURB RETURNS, CURB INLETS AND AT 250' CENTERS. CONTRACTION JOINTS SHALL BE 2" DEEP AND PLACE AT 10' INTERVALS EQUALLY SPACED BETWEEN EXPANSION JOINTS.
2. #3 TIES TO HOLD REINFORCING STEEL, EVERY 20'.
3. CLEAN ROCK (½ " TO ¾ ") IS TO BE USED FOR BEDDING

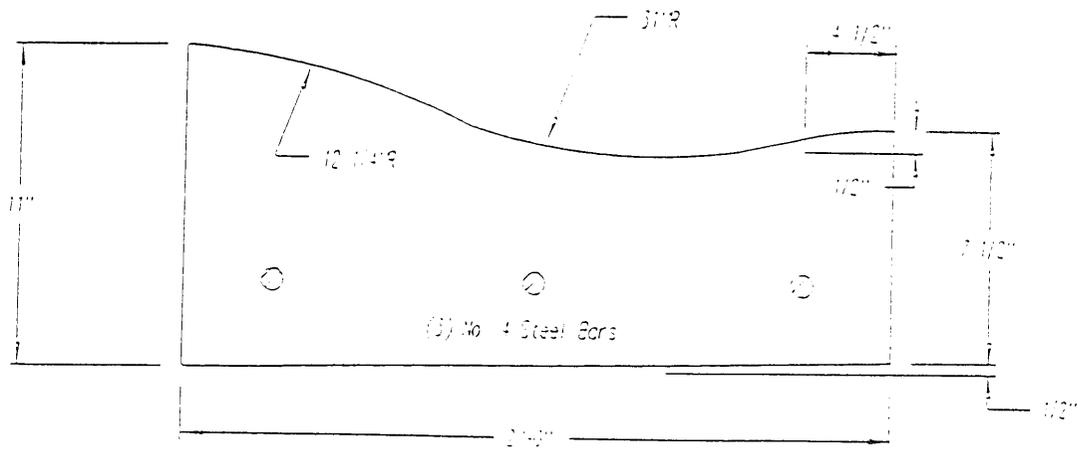


County of Clay
HIGHWAY
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TYPE CG-1
CURB AND GUTTER

D21-1

TYPE CG-2
CONCRETE CURB AND GUTTER



NOTES:

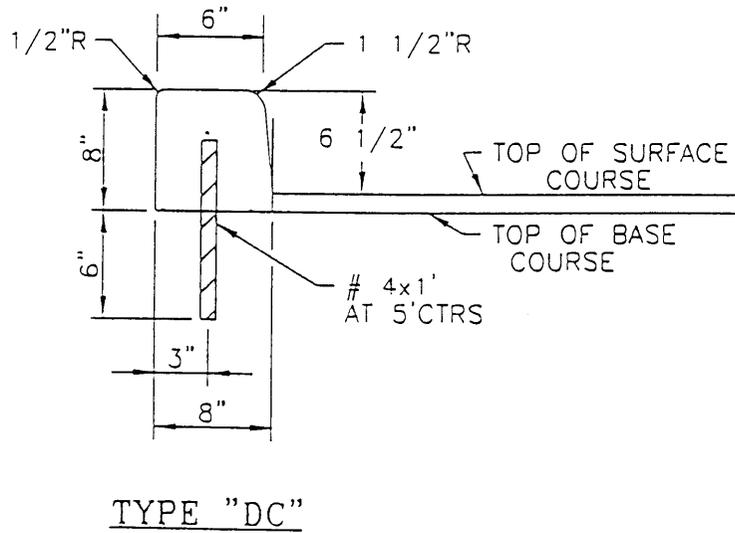
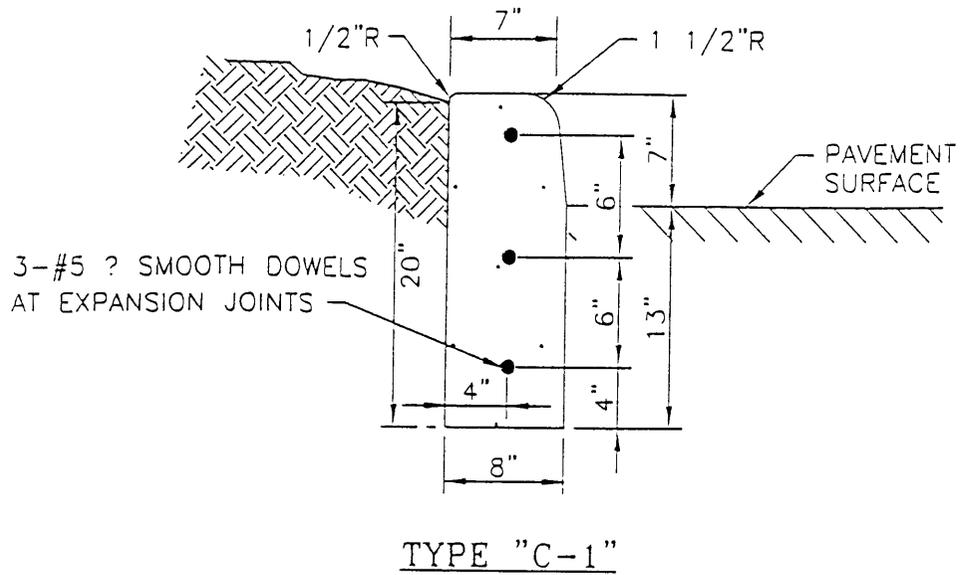
1. EXPANSION, CONTRACTION, OR CONSTRUCTION JOINT ARE TO BE SIMILAR TO NOTES ON STANDARD DETAIL 21-1
2. #3 TIES TO HOLD REINFORCING STEEL, EVERY 20'.
3. CLEAN ROCK (1/2 " TO 3/4 ") IS TO BE USED FOR BEDDING



County of Clay
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TYPE CG-2
CURB AND GUTTER

D21-2



NOTE:

1. EXPANSION, CONTRACTION, OR CONSTRUCTION JOINTS ARE TO BE SAME AS NOTED ON TYPE "CG-1" CURB AND GUTTER DETAIL.
2. ALL CURBS MUST BE CAST IN PLACE.
3. TYPE "CG-1" CURB & GUTTER CAN ALSO BE USED IN PARKING LOT CONSTRUCTION.

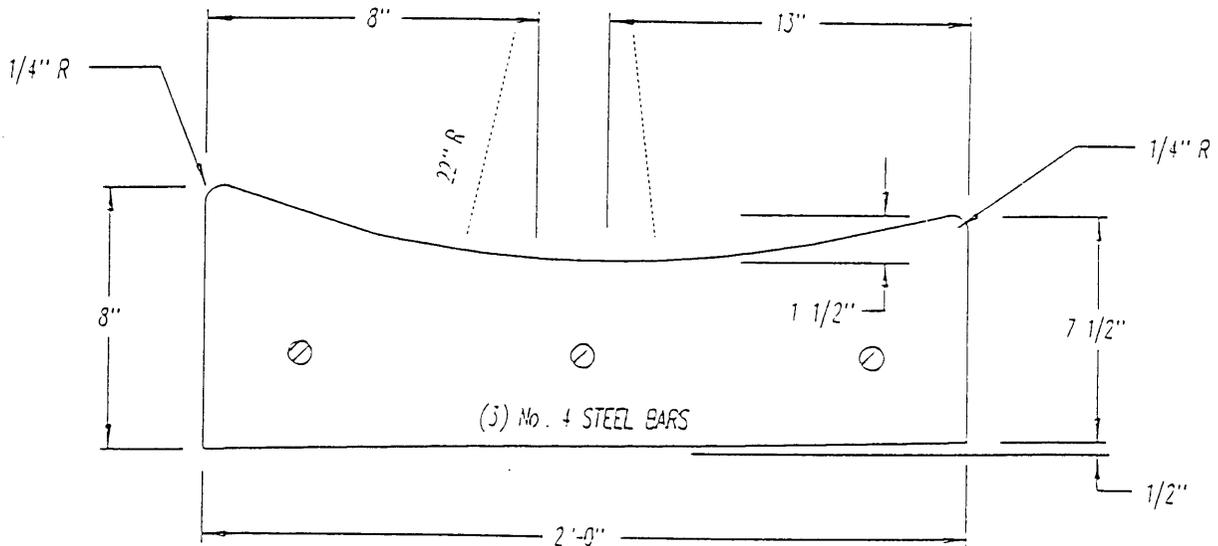


County of Clay
HIGHWAY
DEPARTMENT/PWD

TYPE C-1 AND
DC CURB

D21-3

TYPE CG-3
CONCRETE CURB AND GUTTER



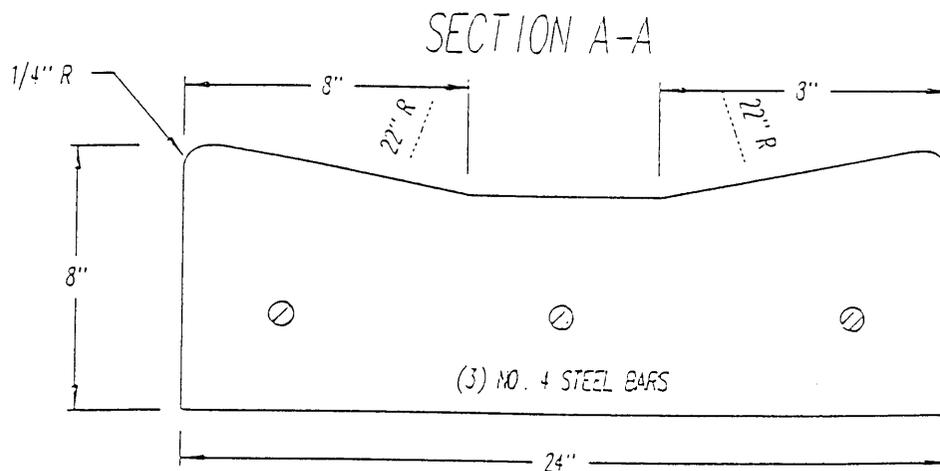
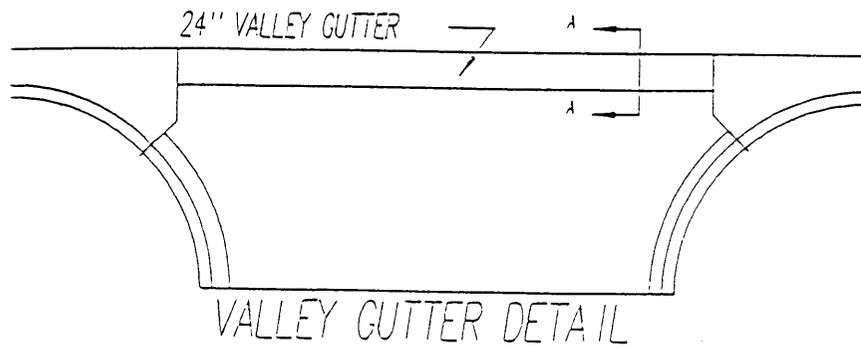
- NOTES:
1. EXPANSION, CONTRACTION, OR CONSTRUCTION JOINT ARE TO BE SIMILAR TO NOTES ON STANDARD DETAIL 21-1
 2. #3 TIES TO HOLD REINFORCING STEEL, EVERY 20'.
 3. CLEAN ROCK (1/2 " TO 3/4 ") IS TO BE USED FOR BEDDING



County of Clay
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TYPE CG-3
CURB AND GUTTER

D21-4



NOTE
 EXPANSION, CONTRACTION, OR CONSTRUCTION JOINTS ARE TO BE
 SIMILAR TO NOTES ON STANDARD DETAIL 21-1.

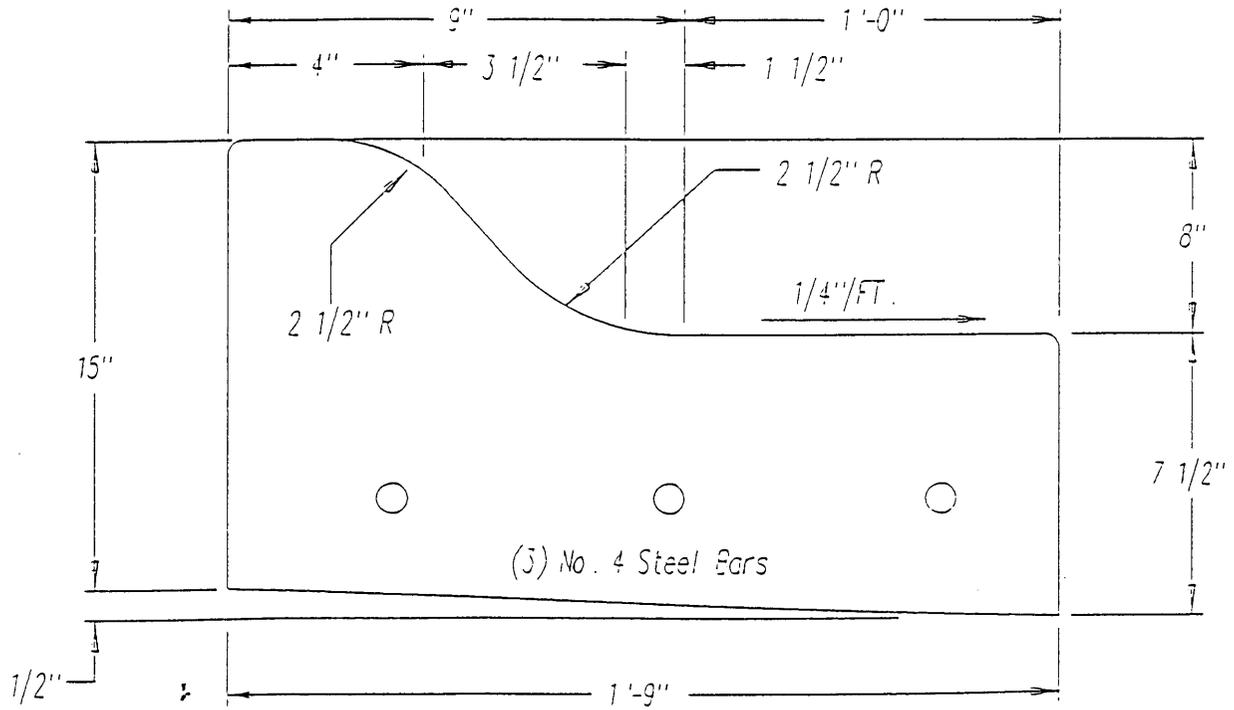


County of Clay
 HIGHWAY
 DEPARTMENT/PWD

VALLEY GUTTER
 C ALTERNATE

D21-4A

TYPE CG-4
CONCRETE CURB AND GUTTER



NOTES:

1. EXPANSION, CONTRACTION, OR CONSTRUCTION JOINT ARE TO BE SIMILAR TO NOTES ON STANDARD DETAIL 21-1
2. #3 TIES TO HOLD REINFORCING STEEL, EVERY 20'.
3. CLEAN ROCK (1/2 " TO 3/4 ") IS TO BE USED FOR BEDDING

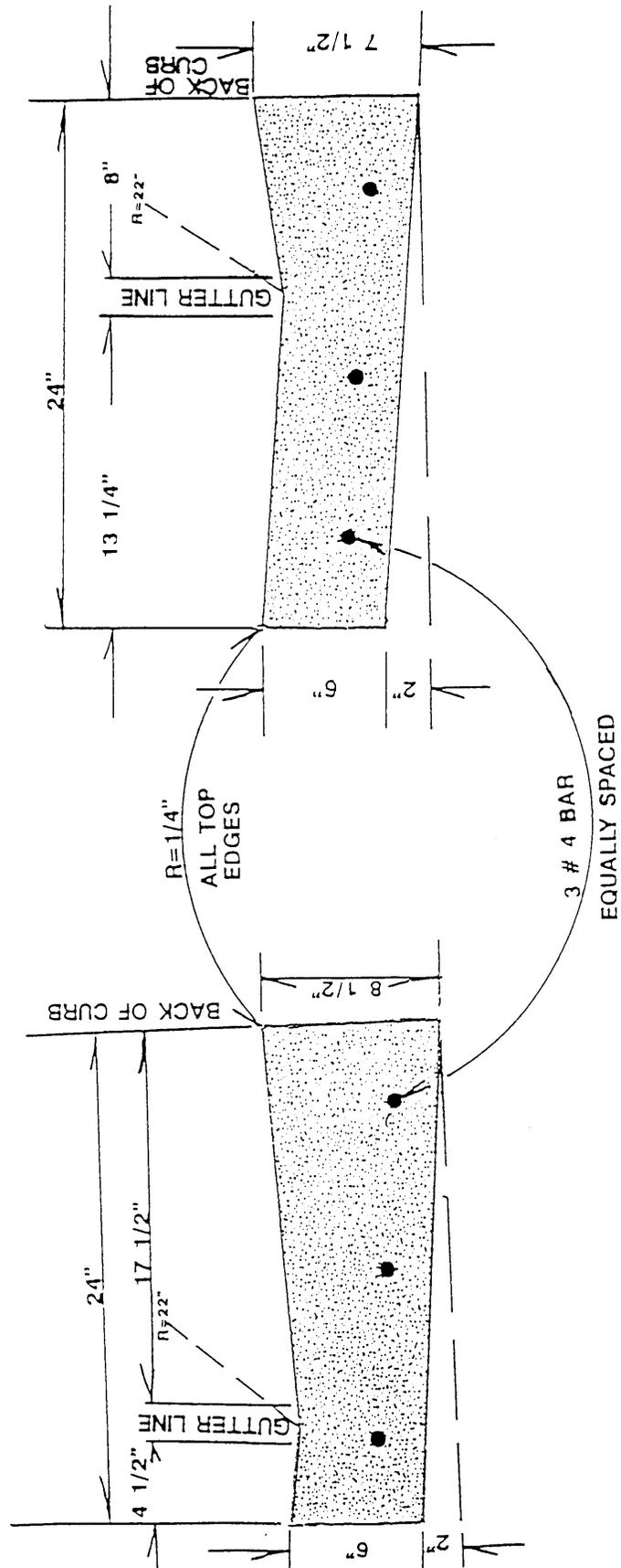


County of Clay
HIGHWAY
DEPARTMENT/PWD

TYPE CG-4
CONCRETE MEDIAN CURB

D21-5

TYPE CG-5
CURB DETAIL FOR WHEEL CHAIR RAMPS



- NOTES:
1. EXPANSION, CONTRACTION, OR CONSTRUCTION JOINT ARE TO BE SIMILAR TO NOTES ON STANDARD DETAIL 21-1
 2. #3 TIES TO HOLD REINFORCING STEEL, EVERY 20'.
 3. CLEAN ROCK (1/2" * TO 3/4") IS TO BE USED FOR BEDDING



County of Clay
HIGHWAY
DEPARTMENT/PWD

TYPE CG-5
CURB DETAIL

D21-6

SECTION 2200 STANDARD SIDEWALKS AND DRIVEWAYS

2201 SCOPE. This section governs the furnishing of all labor, equipment, tools, material, and the performance of all work necessary to construct or reconstruct sidewalks and driveways.

2202 MATERIALS. All items of material included in this section shall conform in general to the requirements of Section 2000, "Concrete" for Class II concrete.

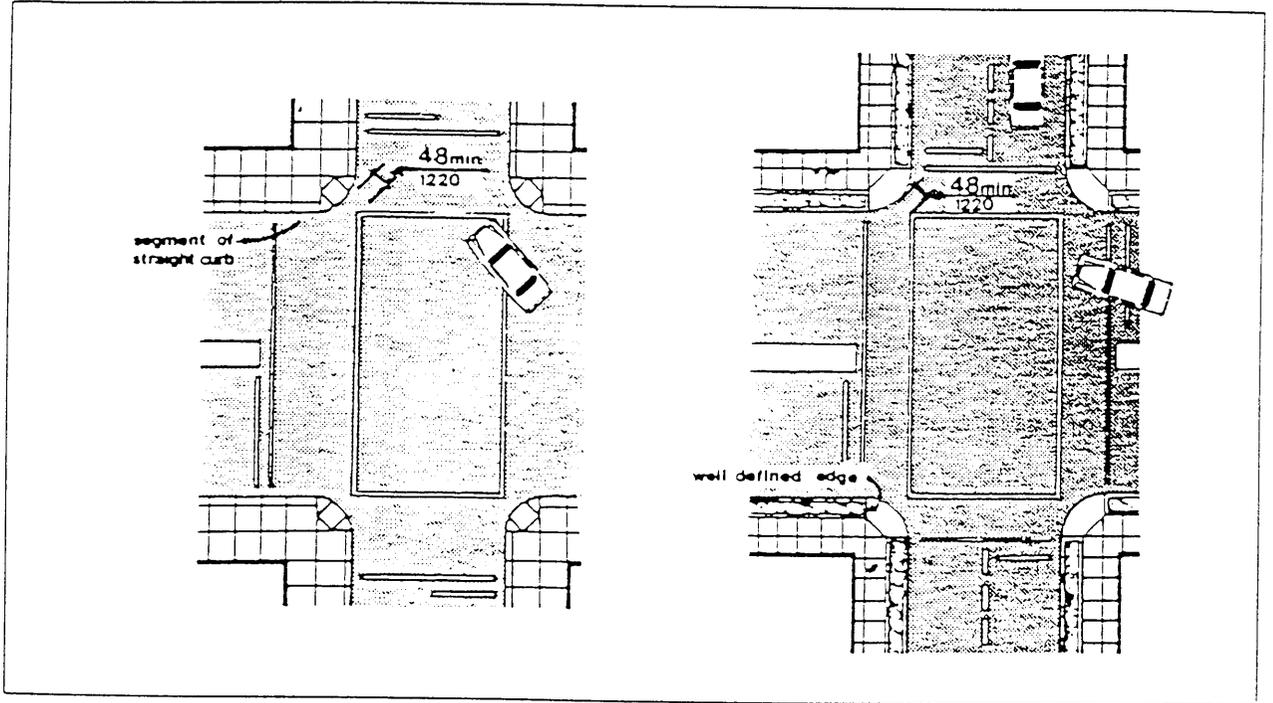
- A. Concrete Mix. Concrete shall conform to the requirements. When the ambient air temperature is 90 degree F or higher, a retarder will be used in all concrete mixes.
- B. Reinforcement. Reinforcement shall be 6x6-W2.9 x W2.9, welded steel wire fabric or as shown by the plans and specifications.

2203 CONSTRUCTION DETAILS. The sidewalks or driveways shall be constructed or reconstructed to the configuration, and to the lines and grades indicated by the plans. Generally sidewalks and driveways should be constructed after the curbing if applicable.

For new and replacement sidewalk construction. Sidewalk wheelchair ramps will be constructed according to ADAGE's latest requirements. Some ramp requirements are covered under ADAGE's Section (4) as follows:

- 4.7.0. Ramps: Curb ramps and interior or exterior ramps to be constructed on sites or in existing buildings or facilities where space limitations prohibit the use of a 1:12 slopes and rises as follows:
 - a. A slope between 1:10 and 1:12 is allowed for a maximum rise of six inches.
 - b. A slope between 1:8 and 1:10 is allowed for a maximum rise of three inches. A slope steeper than 1:8 is not allowed.

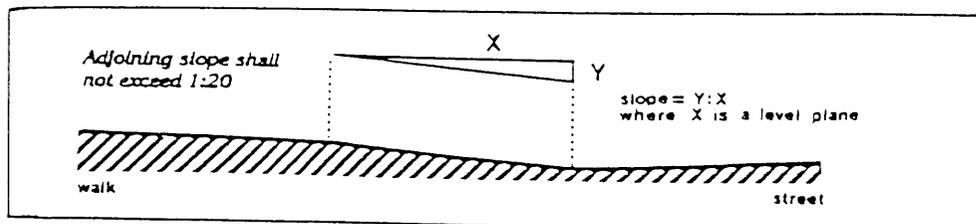
4.7.1. Diagonal Curbs Ramps. If diagonal (or corner type) curb ramps have returned or other well-defined edges, such edges shall be parallel to the direction of pedestrian flow. The bottom of diagonal curb ramps shall have forty-eight (48) inches (1220 mm) minimum clear space as shown in figure (15). If diagonal ramps at the marked crossings, the forty-eight (48) inch (1220 mm) clear space shall be within the markings (see fig 15). If diagonal curbs have flared sides, they shall also have at least twenty-four (24) inch (610) long segment of straight curb located on each side of the curb ramp and within the marked curb crossing.



Curb Ramps at Marked Crossings

4.7.2. Slopes. Slopes of ramps shall comply with section 4.8.2. The slope shall be measured figure 11. Transitions from ramps to walks, gutters, or streets shall be flush and free of abrupt changes. Maximum slopes of adjoining gutters, road surface immediately adjacent to the curb ramp, or accessible route shall not exceed 1:20.

4.7.3. Width. The maximum width of a curb ramp shall be thirty-six (36) inches (915 mm), exclusive of flared sides.



Measurement of Curb Ramp Slopes

4.8.1. General. Any part of an accessible route with a slope greater than 1:20 shall be considered a ramp and shall comply with Section 4.8.

4.8.2 Slope And Rise. The least possible slope shall be used for any ramp. The maximum slope of a ramp in new construction shall be 1:12 . The maximum rise for any run shall be thirty (30) inches (760 mm). Curb ramps and ramps to be constructed on any existing sites or in any existing buildings or facilities may have slopes and rises as allowed in Section 4.1.6.(3)(a) if space limitations prohibit the use of a 1:12 slope or less.

A. The contractor and/or developer must excavate the wet subgrade and place back suitable compacted material in any areas where new sidewalk is to be placed or after removal of any sidewalk. Subgrade must not yield or pump. This will be a subsidiary item to the contract. Any with sunken subgrade, will be required to be brought up to grade with an approved and compacted material. This material must be approved by the County Engineer or his or her representative. This will be subsidiary to the contract.

B. The contractor and/or developer shall be responsible for locating all utility lines and facilities prior to commencing construction procedures.

Removal. Existing sidewalks or driveways shall be totally removed to the nearest contraction or expansion joint. With the approval of the Engineer, the sidewalk or driveway may be sawed provided no "free section" is left of less than fifteen (15) square feet. It is preferred that the section be sawed full depth; however, as a minimum the section shall be sawed ½ the depth of the concrete.

C. Grading and Subgrade Preparation. All excavation or embankment required in the grading or subgrade preparation shall be defined in the Sections 1000 and 1200, except as follows:

The top six (6) inches of the subgrade shall be compacted to obtain a density of ninety-five (95) percent of maximum in conformance with Section 1205(A).

If during reconstruction operations additional fill material is needed beneath sidewalks or driveways it shall be of crushed limestone, placed in maximum lifts of four (4) inches, moistened if necessary, and compacted by mechanical tampers to a density of ninety-five (95) percent of the maximum.

- D. Forms. All forms shall be in good condition, clean, and free from imperfections. Each form shall not vary more than one-quarter (1/4) inch in horizontal or vertical alignment for each ten (10) feet in length.
1. Size. Forms shall have a height equal to or greater than the depth of the sidewalk or driveway section.
 2. Installation. The forms shall be set true to line and grade, and shall be supported to remain in position while depositing and consolidating the concrete.
 3. Preparation. The forms shall be lubricated and shall be designed to permit their removal without damage to the concrete.

2204 JOINTS. Unless directed by the Engineer the joints shall be formed at right angles to the alignment of the sidewalk or driveway, and to the configuration specified by the plans or standards.

A. Joint Patterns.

1. Sidewalks. Sidewalk surfaces shall be marked with a transverse joint spaced at a distance equal to the width of the sidewalk. Sidewalks greater than six (6) feet in width shall be divided by longitudinal joints spaced not less than thirty (30) inches nor more than forty-eight (48) inches with transverse joints spaced to form a square (picture frame) pattern. Edger tool marks shall remain showing.
2. Wide driveways. Driveways in excess of twenty (20) feet in width shall have a transverse joint located in the center.

B. Expansion Joints. Expansion joints shall be placed where directed by the plans or Engineer. The expansion joints shall be located to give the sidewalk or driveway an appearance of continuity.

1. General. The preformed expansion joint material shall either be left one-half (1/2) inch below the surface, or a suitable tear strip will be provided to allow for the application of the joint sealer.
2. Material. Expansion joints shall be formed by 1 piece of one-half (1/2) inch preformed joint filler cut to the configuration of the correct section. The filler material shall be as specified in Section 2003 (D).
3. Stability. Expansion joints shall be secured in a manner so they will not be disturbed by depositing and consolidating the concrete.

4. Edging. The edges of these joints shall be rounded with an edging tool of one-quarter (1/4) inch radius.
- C. Contraction Joints. Contraction joints or false joints shall be one (1) inch deep by one-eighth (1/8) inch wide with one-quarter (1/4) inch radii edging.
1. Edging. Edger marks or "Ribbons" shall be left on sidewalks and driveways.
 2. Contraction Joints. Contraction joints may be sawed with the approval of the Engineer.
 3. Joint Sealer. Joint Sealer is not required on contraction joints.

2205 CONCRETE WORK. Concrete work for sidewalks and driveways shall be placed in accordance with the requirements of MCIB Standard Concrete Specifications. Joints shall be constructed as in Section 2204 or as modified by the plans or special provisions.

- A. Concrete Placement. Concrete shall not be allowed to extrude from below the forms. Vibration is not required for sidewalks or driveways.
- B. Finishing. After placing and the initial strike off, if the surface of the concrete is sufficiently wet that a ridge is formed at the inside of the edging tool, finishing will cease until the excessive moisture has evaporated. No water, dryer or additional mortar shall be applied to the free surface of the concrete.

After finishing, the surface of the concrete shall be broomed with a fine clean broom to provide an antiskid surface, and the edges and joints retooled.

In all cases the finished sidewalk or driveway shall have a true surface, free from sags, twists, or warps, and shall have a uniform color and appearance.

- C. Curing. As soon as practical after the concrete is finished it shall be cured with one of the acceptable liquid curing membranes applied according to manufacturers directions.

If forms are removed from sidewalks or driveways within a period of seventy-two (72) hours of placement those surfaces shall also be cured.

Wet burlap, cotton mats, waterproof paper, polyethylene sheeting or earth backfill shall not be acceptable as curing methods for sidewalks or driveways.

- D. Protection. The Contractor and/or developer shall protect the concrete work against damage or defacement of any kind until it has been accepted by the County. Concrete which is damaged or defaced, shall be removed and replaced or repaired to the satisfaction of the Engineer at the expense of the Contractor and/or developer.

- E. Temperature Limitations. Concrete shall be placed in accordance with requirements of Section 2009 and 2010.

2206 BACKFILL. A minimum of twenty-four (24) hours shall lapse before forms are removed and sidewalks or driveways are backfilled unless otherwise approved by the Engineer.

Backfill shall be accomplished in accordance with Sections 1100 and 1200.

The Contractor and/or developer shall be responsible for the repair of any street pavement disturbed by the construction.

2207 JOINT SEALING AND CLEAN-UP. All expansion joints shall be sealed with an approved joint sealer applied in accordance with Section 2003 within seven (7) days of the placement of the concrete.

The Contractor and/or developer shall be responsible for the removal of excess dirt, rock, broken concrete, splatters and over spray from the area of the construction within ten (10) days of the date of placement.

2208 SURFACE TOLERANCES. Sidewalks or driveways shall have a surface tolerance of one-quarter (1/4) inch in ten (10) feet when checked with a ten (10) foot straightedge.

Driveways using concrete under new construction or replacement, when connecting with existing uncurbed county roadways, shall be left (1") below gravel, asphalt or chipseal surface.

2209 SIGHT DISTANCE REQUIREMENTS.

Both vertical and horizontal alignment can limit sight distance.

- A. Permits for Driveways can be obtained at the Clay County Highway Department.
- B. Vertical Sight Distance. In order to measure actual sight distance limited by vertical alignment (see sight distance drawing D22-11), place a sighting 1300 mm (4.25 feet) above the edge of pavement at a point 3.6 meter (12 feet) from the edge of pavement (approximate location of a driver approaching the roadway) at the proposed driveway location. Sighting from a height of 1070 mm (3.5 feet), move along the roadway away from the proposed driveway site to a point beyond where the target disappears. Now move toward the target until it can first be seen and place a mark on the pavement. Measure the distance along the roadway between the mark and the target. Measurement may be made with an accurate measuring device mounted on an automobile. This measured distance is the sight distance.

- C. Horizontal Sight Distance. (See drawing D22-11). Horizontal sight distance is determined by placing a target 1300 mm (4.25 feet) above the edge of pavement and 3.6 meters (12 feet) from the edge of pavement at the proposed driveway location. Move away from the target along the roadway and around the horizontal curve until the target is out of sight or the line of sight is beyond the right-of-way limits. The line of sight must stay within the limits of the right-of-way. Consideration may also be given to vegetation both on the right-of-way and adjacent to the right-of-way as it may impede vision more at one time of the year than another. Sighting from a height of 1070 mm (3.5 feet), move along the roadway toward the target until it can first be seen and place a mark on the pavement. Measure the distance to the driveway target along the roadway. This measured distance in the sight distance.

Posted speed at horizontal curves may be used to determine required sight distance for driveways within the limits of a horizontal curve.

- D. Additional Considerations. Even when the applicant is present, sight distance measurements in terms of meters (feet) may be difficult for an applicant to understand when it comes to getting on and off the roadway. A measurement of time lapse may help the applicant get a better understanding of critical nature of the situation.

A sight distance visibility time for the driver exiting a driveway to see an approaching vehicle can be used. A value of seven (7) seconds enables a stopped passenger car to cross a two (2) lane highway. A value of ten (10) seconds allows vehicles exiting the driveway to turn left or right onto two (2) lane roads without interference (slowing down) of through traffic at speeds up to fifty (50) kmph/thirty (30) mph. At speeds greater than fifty (50) kmph/thirty (30) mph, the value of ten (10) seconds will require some slowing of through traffic.

Trucks require greater sight distance than needed for passenger cars, however, the greater driver eye height, typically over 1.8 meters (6 feet), provides an allowance for vertical curve conditions. If the obstruction to sight is a horizontal curve or other lateral blockage, a fifty (50) percent increase in visibility is recommended.

Grading on the right-of-way to improve sight distance should be considered and included in the permit for driveway construction.

Public street entrances should meet or exceed Design Entering Sight Distance.

E. Sight Distance Requirments.

Posted Speed		Minimum Entrance Stopping Sight Distance		Minimum Entering Sight Distance		Design Entering Sight Distance	
<i>Kmph</i>	<i>Mph</i>	<i>Meter</i>	<i>Feet</i>	<i>Meter</i>	<i>Feet</i>	<i>Meter</i>	<i>Feet</i>
50	30	60	200	95	310	120	395
	35		225		360		450
60	40	75	275	125	410	175	575
70	45	95	325	135	445	200	655
80	50	115	375	155	510	250	820
90	55	135	425	170	560	300	985
100	60	160	525	190	625	365	1200
110	65	180	600	210	700	450	1340
120	70	205	700	225	740	475	1560

The above distances are based on Table III-1 and Figure IX-41 of the AASHTO Green Book 1994 Edition and the MHTD Metric Design Manual.

F. Notes Regarding Using Sight Distance Requirements Table. If the sight distance is less than the Design Entering Sight Distance but greater that the Minimum Entering Sight Distance, the following Applicant’s Responsibility Clause must be added to the permit. “Applicant understands the presence of this driveway creates a potential sight distance problem and has been so informed in writing by the department.”

If the sight distance is less than the Minimum Entering Sight Distance but greater than or equal to the distance shown for Minimum Entrance Stopping Sight Distance, a permit may be issued. However, the applicant responsibility clause and the following statement must both be shown on the permit. “Applicant is aware that the sight distance of this driveway is severely restricted. The sight distance is the minimum distance necessary for a vehicle traveling at the posted speed to complete a stop prior to the driveway.”



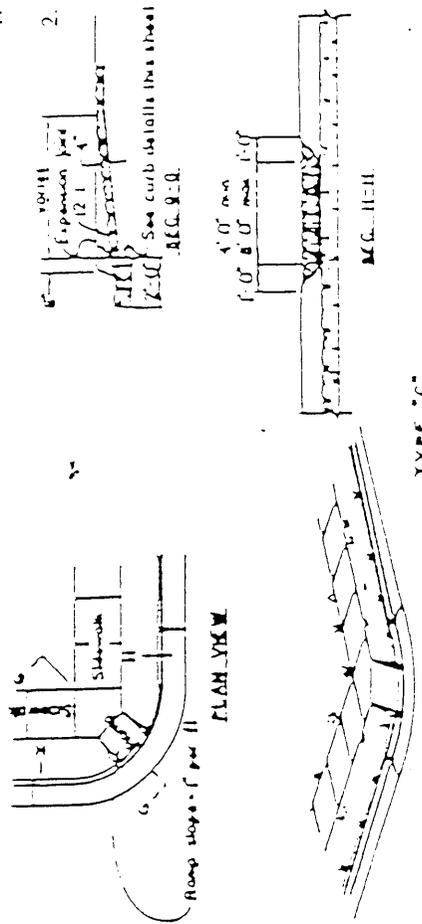
County of Clay
HIGHWAY
DEPARTMENT/PWD

ADA RAMP DETAILS

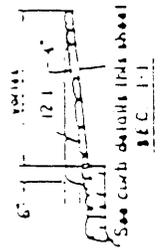
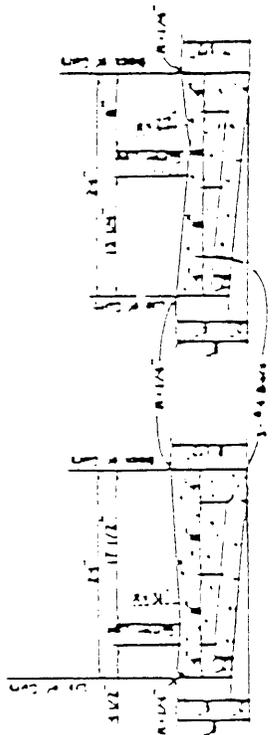
D22-0

NOTES:

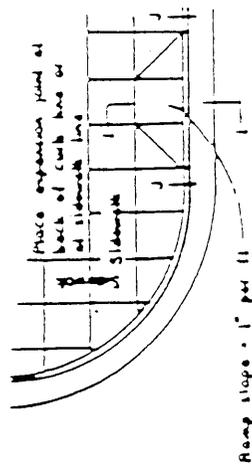
1. SURFACE TEXTURE SHALL BE A COARSE BROOM FINISH, TRANSVERSE TO THE SLOPE OF THE RAMP.
2. SPECIFICATIONS FOR CONSTRUCTION OF WHEELCHAIR RAMPS SHALL CONFORM WITH THE LATEST ADAGES REQUIREMENTS.



TYPE "C"

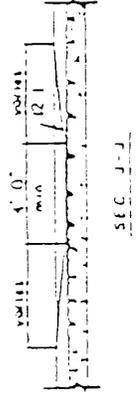


FLASH VIEW



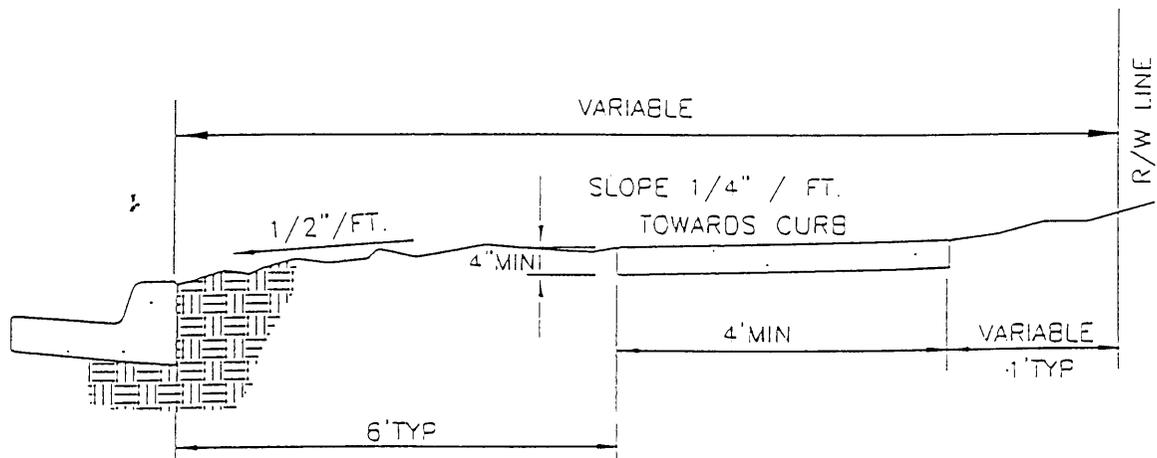
TYPE "D"

To be used where sidewalk abuts side area between curb and flangery line



NOTES:

1. JOINTS SHALL BE FORMED AT RIGHT ANGLES TO THE ALIGNMENT OF THE SIDEWALK AND TO THE DEPTHS INDICATED BELOW.
2. THE SIDEWALK SHALL BE MARKED OFF INTO SQUARE STONES (PICTURE FRAMED) BY CONTRACTION JOINTS. CONTRACTION JOINTS SHALL BE ONE-EIGHTH ($1/8$) INCH WIDE BY ONE (1) INCH DEEP AND SHALL BE FORMED BY TOOLING.
3. EXPANSION JOINTS SHALL BE FORMED BY A ONE-HALF ($1/2$) INCH THICK PREFORMED JOINT FILLER, EXTENDING THE FULL DEPTH OF THE SLAB, AND SECURED SO THAT THEY ARE NOT MOVED BY DEPOSITING AND COMPACTING THE CONCRETE AT THESE JOINTS.
4. EXPANSION JOINTS SHALL BE PLACED WHERE SIDEWALK ABUTS OTHER STRUCTURES AND SHALL NOT BE SPACED MORE THAN 50 FEET APART ON STRAIGHT RUNS FOR HAND LAID SIDEWALK AND NOT MORE THAN 100 FEET APART ON STRAIGHT RUNS FOR MACHINE LAID SIDEWALKS.



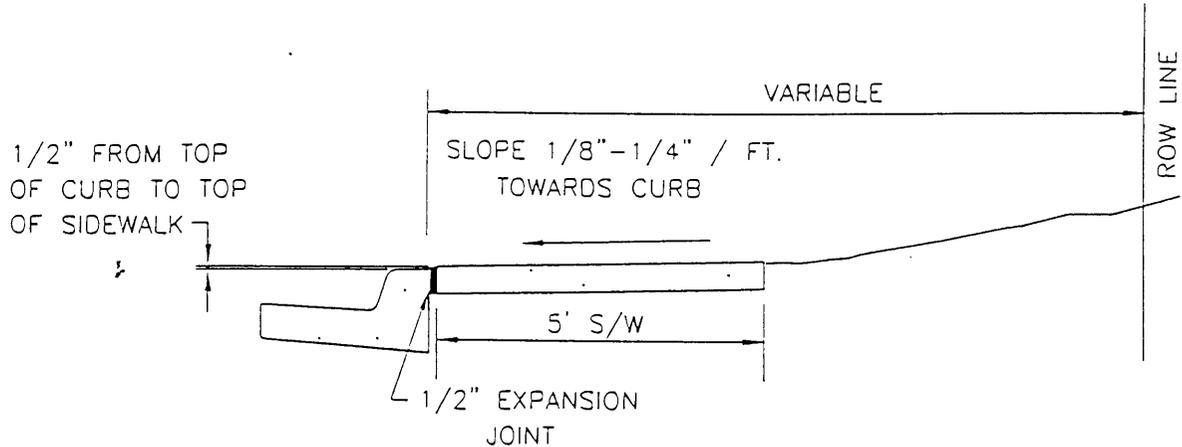
County of Clay
HIGHWAY
DEPARTMENT/PWD

4' CONCRETE
SIDEWALK DETAIL

D22-1

NOTES:

1. JOINTS SHALL BE FORMED AT RIGHT ANGLES TO THE ALIGNMENT OF THE SIDEWALK AND TO THE DEPTHS INDICATED BELOW.
2. THE SIDEWALK SHALL BE MARKED OFF INTO SQUARE STONES (PICTURE FRAMED) BY CONTRACTION JOINTS. CONTRACTION JOINTS SHALL BE ONE-EIGHTH (1/8) INCH WIDE BY ONE (1) INCH DEEP AND SHALL BE FORMED BY TOOLING.
3. EXPANSION JOINTS SHALL BE FORMED BY A ONE-HALF (1/2) INCH THICK PREFORMED JOINT FILLER, EXTENDING THE FULL DEPTH OF THE SLAB, AND SECURED SO THAT THEY ARE NOT MOVED BY DEPOSITING AND COMPACTING THE CONCRETE AT THESE JOINTS.
4. EXPANSION JOINTS SHALL BE PLACED WHERE SIDEWALK ABUTS OTHER STRUCTURES AND SHALL NOT BE SPACED MORE THAN 50 FT. APART ON STRAIGHT RUNS FOR HAND LAID SIDEWALK AND NOT MORE THAN 100 FT. APART ON STRAIGHT RUNS FOR MACHINE LAID SIDEWALKS.



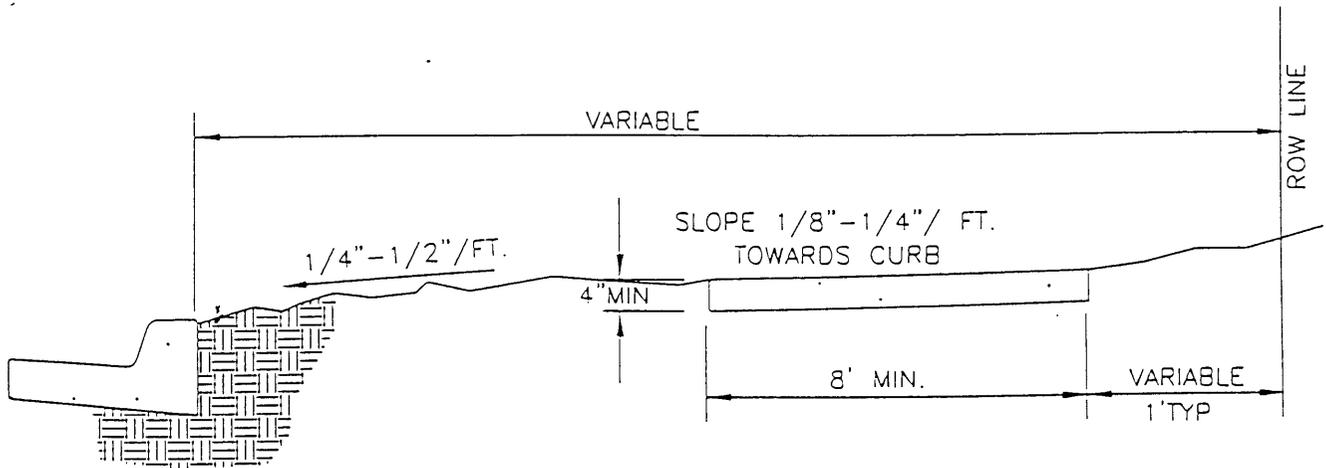
County of Clay
HIGHWAY
DEPARTMENT/PWD

5' CONCRETE
SIDEWALK DETAIL

D22-2

NOTES:

1. JOINTS SHALL BE SAWED AT RIGHT ANGLES TO THE ALIGNMENT OF THE SIDEWALK AND TO THE DEPTHS INDICATED BELOW.
2. THE SIDEWALK SHALL BE MARKED OFF INTO SQUARE STONES BY CONTRACTION JOINTS. CONTRACTION JOINTS SHALL BE ONE-EIGHTH (1/8) INCH WIDE BY ONE (1) INCH DEEP AND SHALL BE FORMED BY TOOLING.
3. EXPANSION JOINTS SHALL BE FORMED BY A ONE-HALF (1/2) INCH THICK PREFORMED JOINT FILLER, EXTENDING THE FULL DEPTH OF THE SLAB, AND SECURED SO THAT THEY ARE NOT MOVED BY DEPOSITING AND COMPACTING THE CONCRETE AT THESE JOINTS.
4. EXPANSION JOINTS SHALL BE PLACED WHERE SIDEWALK ABUTS OTHER STRUCTURES AND SHALL NOT BE SPACED MORE THAN 50 FEET APART ON STRAIGHT RUNS FOR HAND LAID SIDEWALK AND NOT MORE THAN 100 FEET APART ON STRAIGHT RUNS FOR MACHINE LAID SIDEWALKS.
5. CONCRETE SHALL BE USED FOR THE CONSTRUCTION OF THE BICYCLE TRAILS LOCATED WITHIN CITY STREET R-O-W. AT THE DISCRETION OF THE CITY ENGINEER A 4" THICK ASPHALT SIDEWALK 8 FEET WIDE ON A 4" THICK AB-3 BASE MAY BE CONSTRUCTED ON CITY R-O-W NOT ADJACENT TO A STREET.

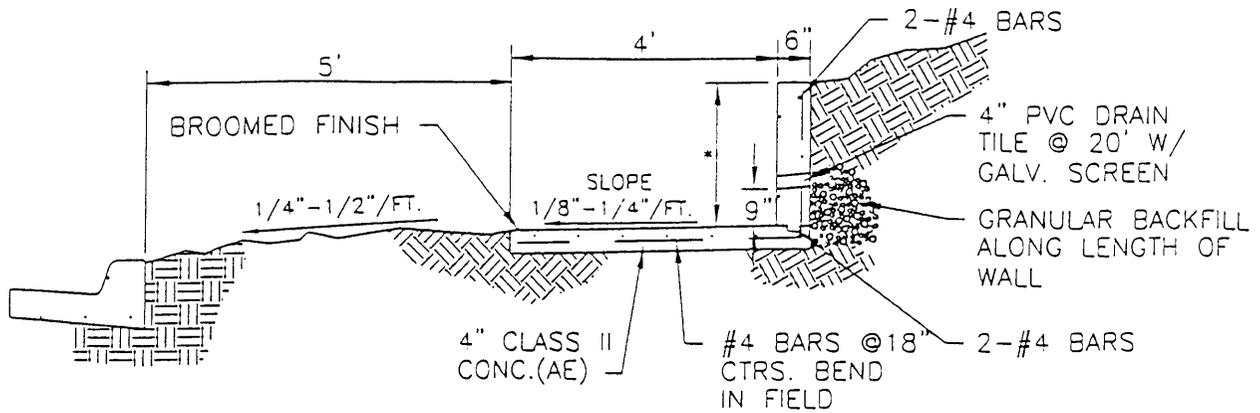


County of Clay
HIGHWAY
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8' BICYCLE TRAIL

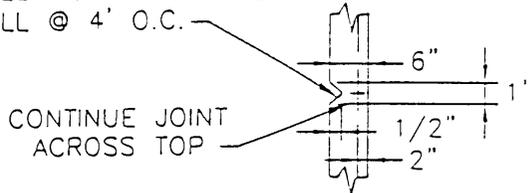
D22-3

* = VARIES 6" TO 24"



SECTION

FORMED VERTICAL JOINT
FULL HEIGHT IN FACE OF
WALL @ 4' O.C.



TOP VIEW

NOTE:

FOR HEIGHTS GREATER
THAN 24", DESIGN CALCS.
MUST BE SUBMITTED

NOTES:

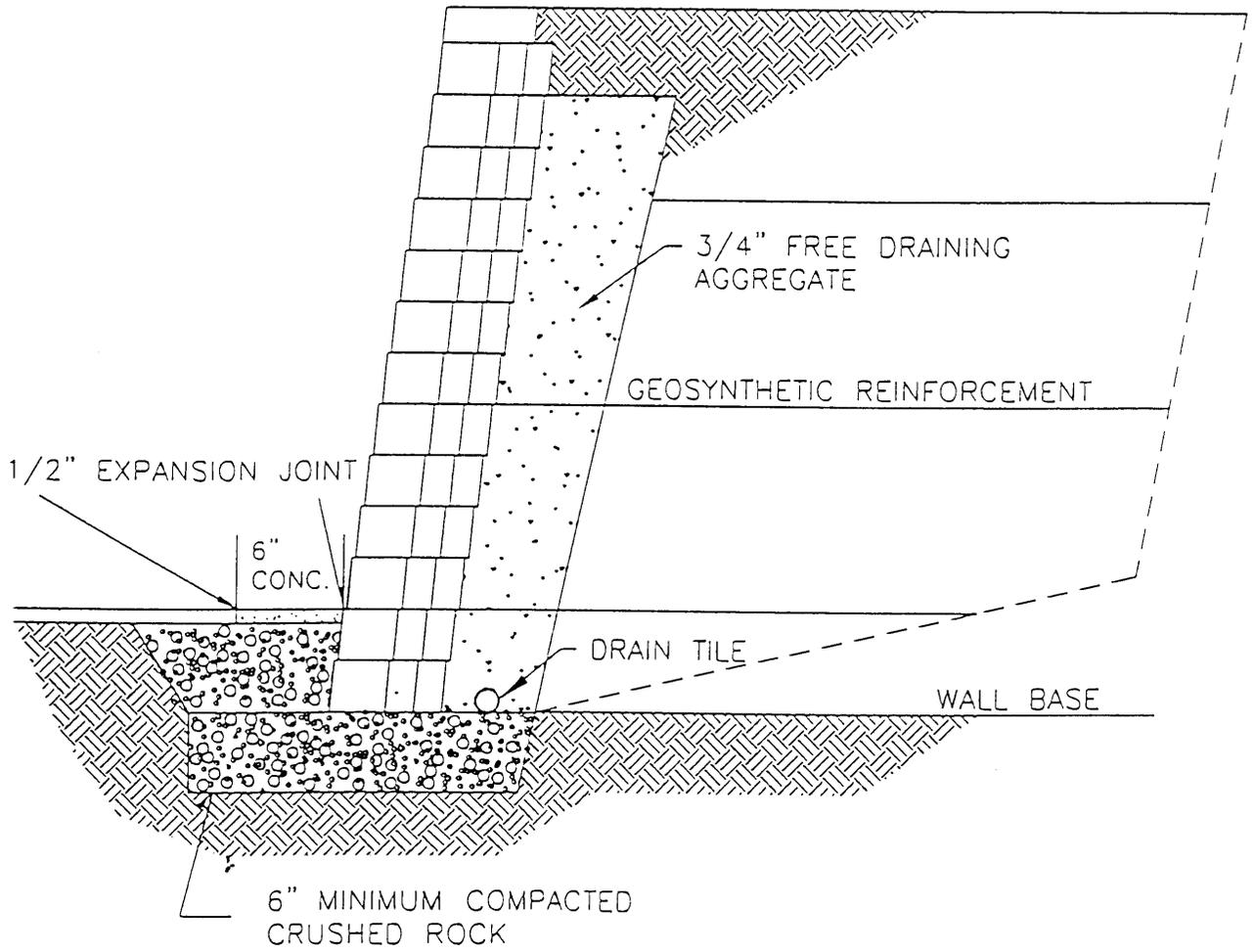
1. JOINTS SHALL BE FORMED AT RIGHT ANGLES TO THE ALIGNMENT OF THE SIDEWALK AND TO THE DEPTHS INDICATED BELOW. SIDEWALK JOINTS SHALL MATCH RETAINING WALL JOINTS.
2. THE SIDEWALK SHALL BE MARKED OFF INTO SQUARE STONES (PICTURE FRAMED) BY CONTRACTION JOINTS. CONTRACTION JOINTS SHALL BE ONE-EIGHTH (1/8) INCH WIDE BY ONE (1) INCH DEEP AND SHALL BE FORMED BY TOOLING.
3. EXPANSION JOINTS SHALL BE FORMED BY A ONE-HALF (1/2) INCH THICK PREFORMED JOINT FILLER, EXTENDING THE FULL DEPTH OF THE SLAB, AND SECURED SO THAT THEY ARE NOT MOVED BY DEPOSITING AND COMPACTING THE CONCRETE AT THESE JOINTS.
4. EXPANSION JOINTS SHALL BE PLACED WHERE SIDEWALK ABUTS OTHER STRUCTURES AND SHALL NOT BE SPACED MORE THAN 50 FT. APART ON STRAIGHT RUNS FOR HAND LAID SIDEWALK AND NOT MORE THAN 100 FT. APART ON STRAIGHT RUNS FOR MACHINE LAID SIDEWALKS.
5. PROVIDE 4" DIA. PVC DRAIN TILE AT 20' INTERVALS ALONG LENGTH OF RETAINING WALL WITH GALVANIZED SCREEN AND GRANULAR BACKFILL WHEN WALL HEIGHT IS GREATER THAN OR EQUAL TO 1'-6" FROM TOP SURFACE OF SIDEWALK.
6. ALL EXPOSED CORNERS OF WALL SHALL BE CHAMFERED.



County of Clay
HIGHWAY
DEPARTMENT/PWD

SIDEWALK DETAIL WITH ABUTTING
CONCRETE RETAINING WALL

D22-4



County of Clay
 HIGHWAY
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MODULAR WALL
 SIDEWALK OPTIONAL

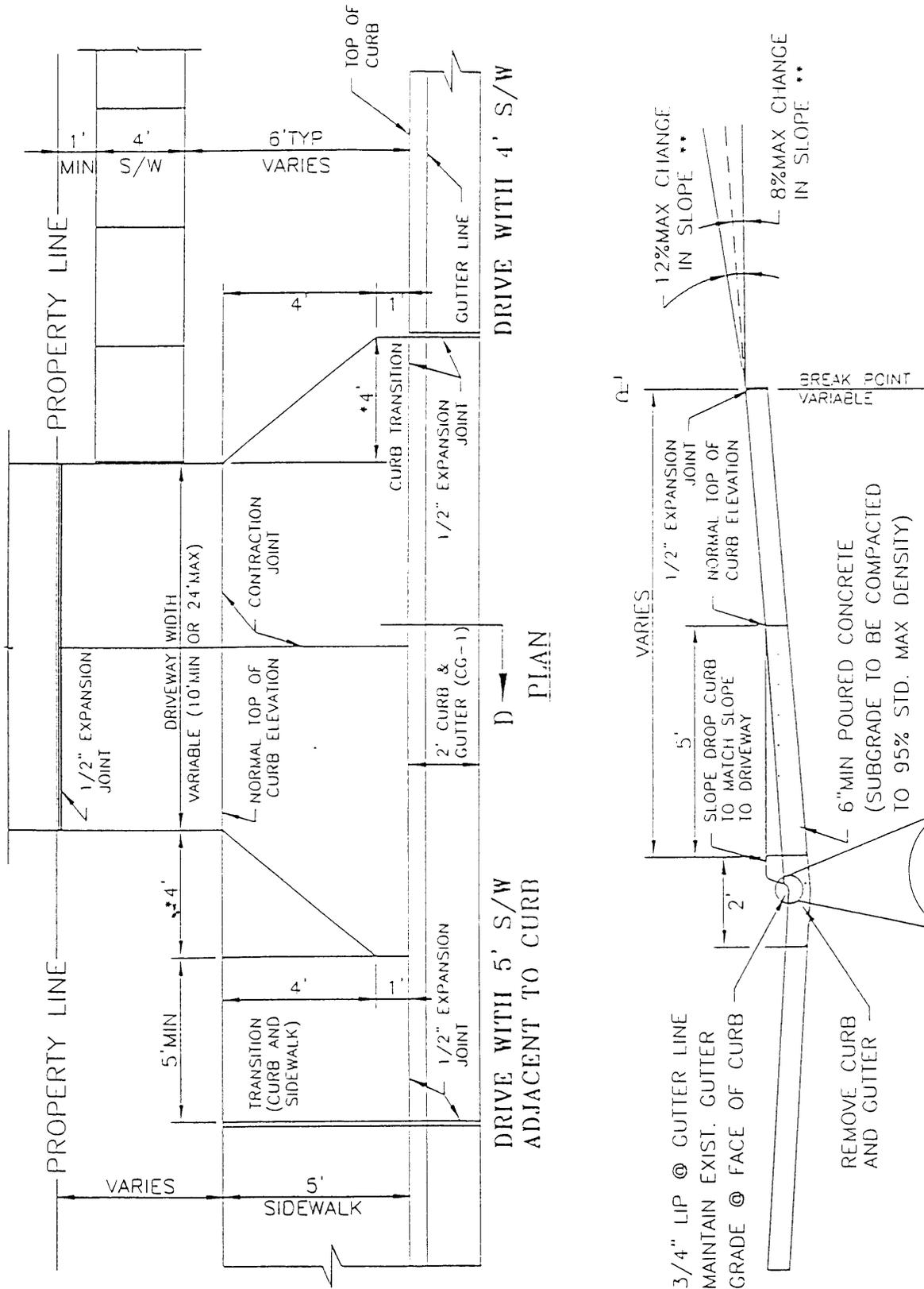
D22-5



County of Clay
HIGHWAY
DEPARTMENT/PWD

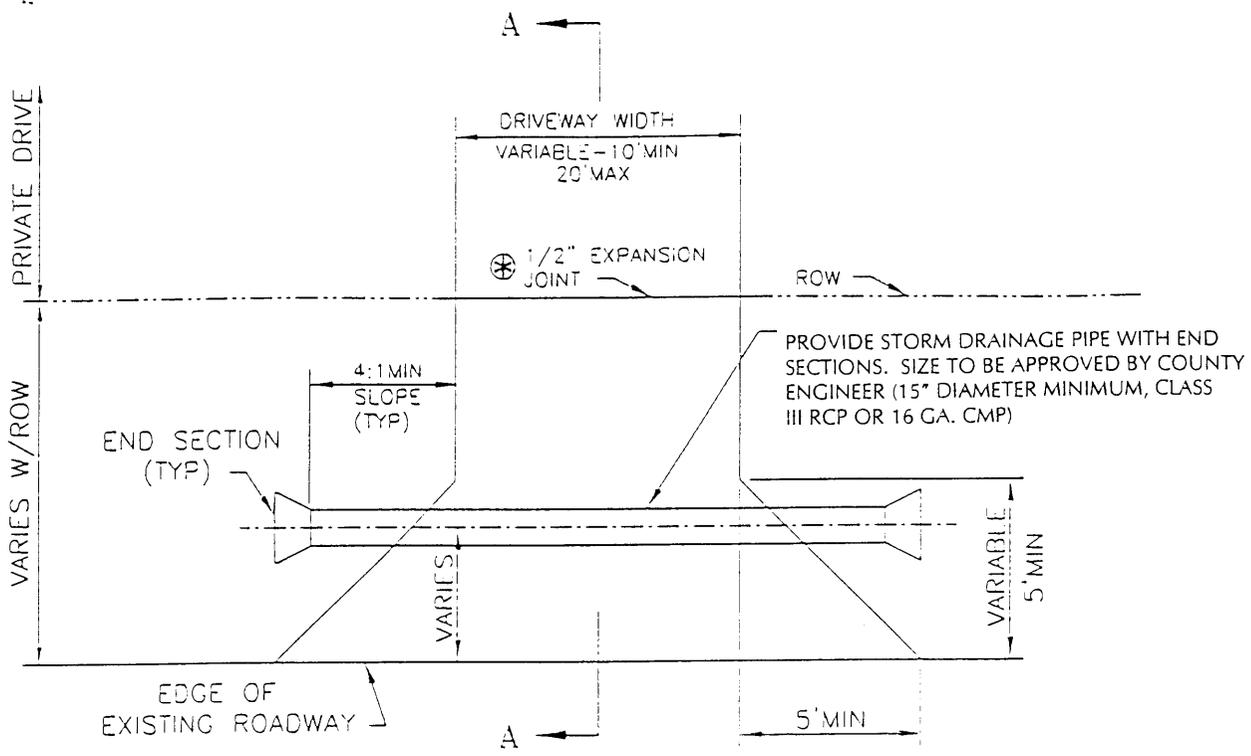
RESIDENTIAL DRIVE DETAIL
W/CG-1 CURB AND GUTTER

D22-6

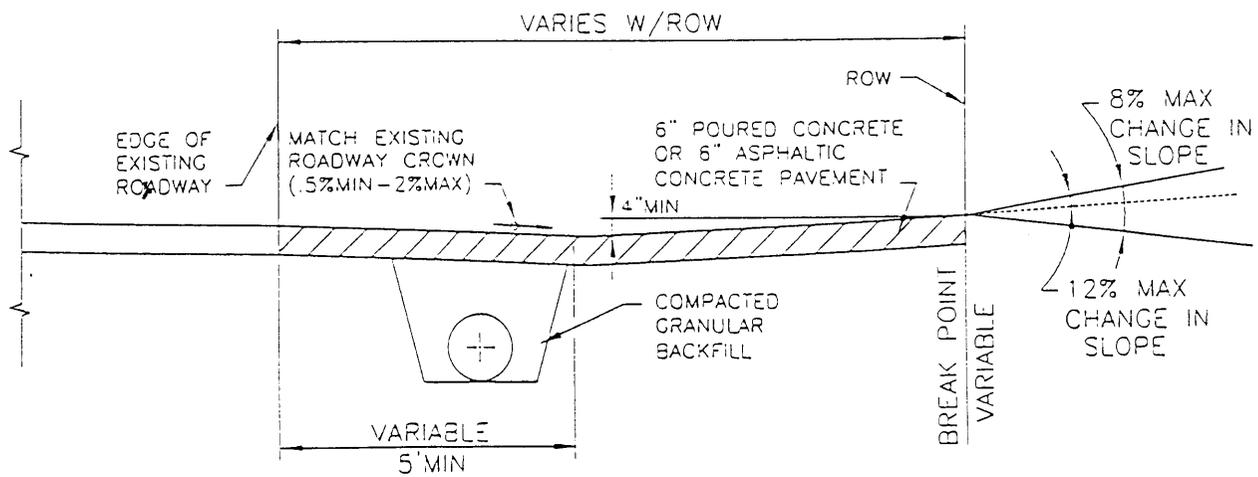


** MAY BE VARIED UPON APPROVAL OF COUNTY ENGINEER
2' MINIMUM FOR DRIVEWAY WIDTH > 15'
4' MINIMUM FOR DRIVEWAY WIDTH < 15'

SECTION D-D



PLAN



SECTION A-A

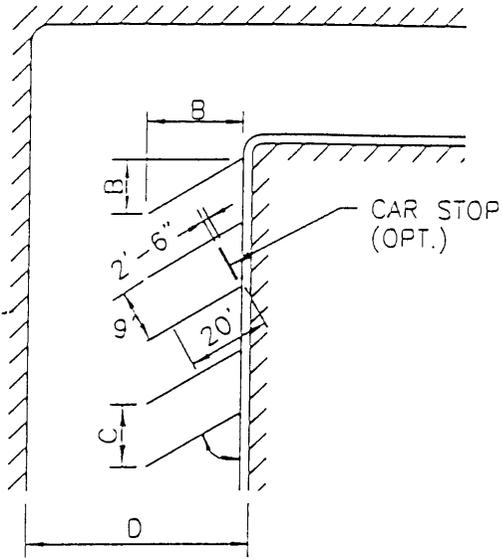
⊕ REQUIRED WITH
 CONCRETE DRIVEWAY
 CONSTRUCTION ONLY



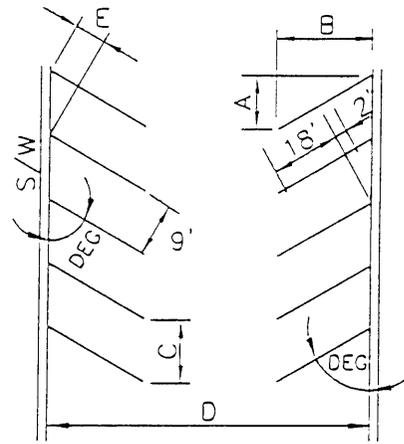
County of Clay
 HIGHWAY
 DEPARTMENT/PWD

RESIDENTIAL DRIVE
 AT NON-CURBED STREET

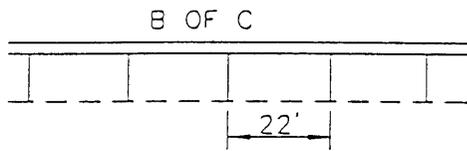
D22-8



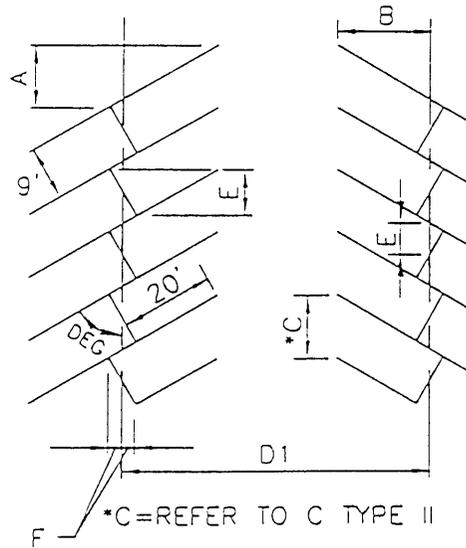
TYPE I



TYPE II



PARALLEL PARKING STALL



TYPE III

NOTE: DIMENSIONS BELOW ARE GIVEN IN FEET

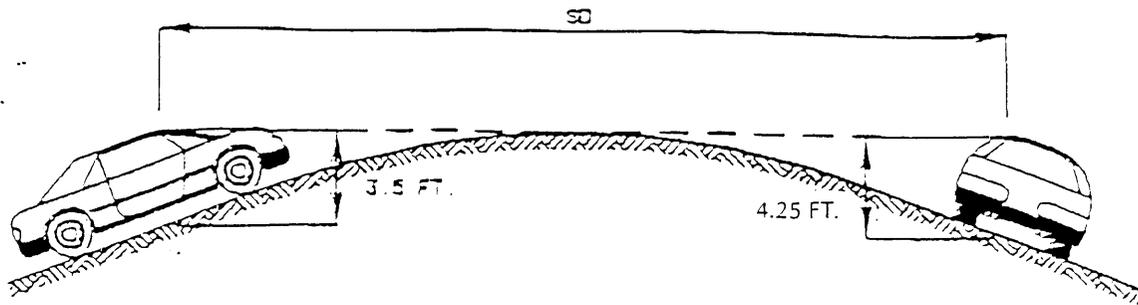
	TYPE I				TYPE II					TYPE III				
DEG	A	B	C	D	A	B	C	D	E	A	B	D	E	F
45	20.5	20.5	12.7	34	19.1	19.1	12.7	47	9.0	20.5	17.3	50.6	6.4	3.2
60	12.6	21.8	10.4	40	11.6	20.1	10.4	56	5.2	12.6	19.6	55	7.8	2.3
90	0.0	20.0	9.0	42	0.0	18.0	9.0	60	0.0	0.0	20.0	60	9.0	0.0



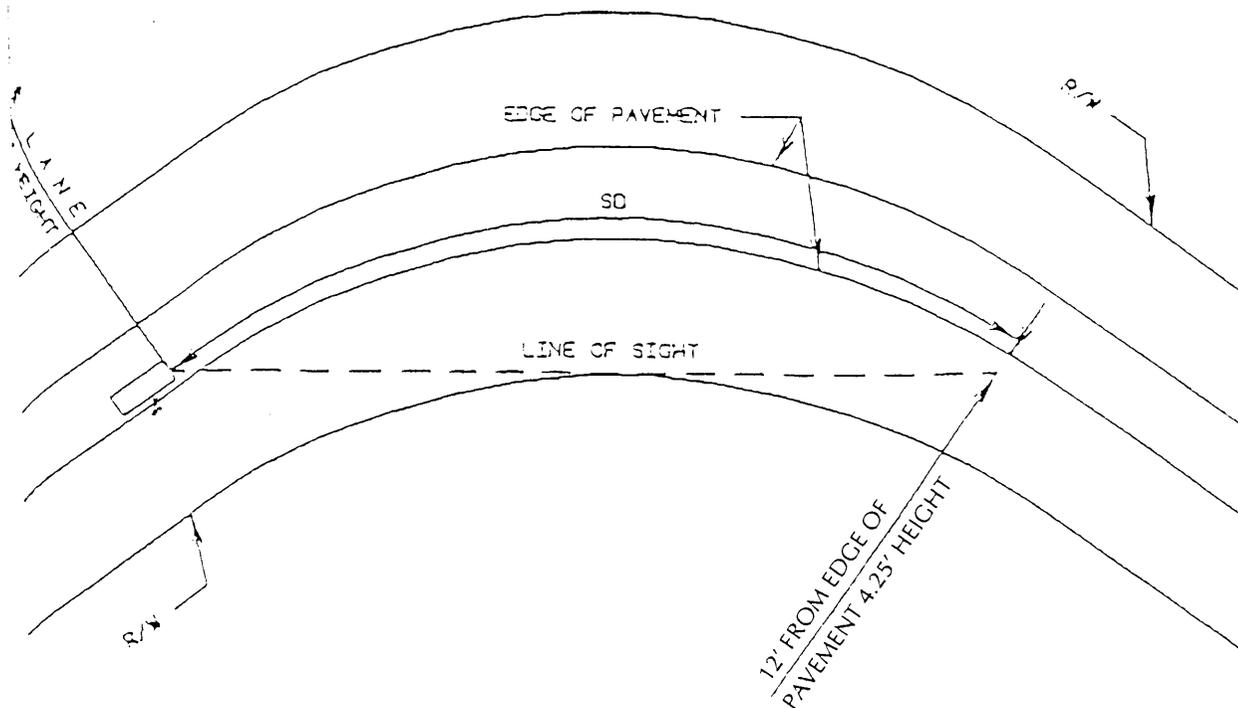
County of Clay
HIGHWAY
DEPARTMENT/PWD

PARKING LOT DETAIL

D22-10



VERTICAL SD



HORIZONTAL SD

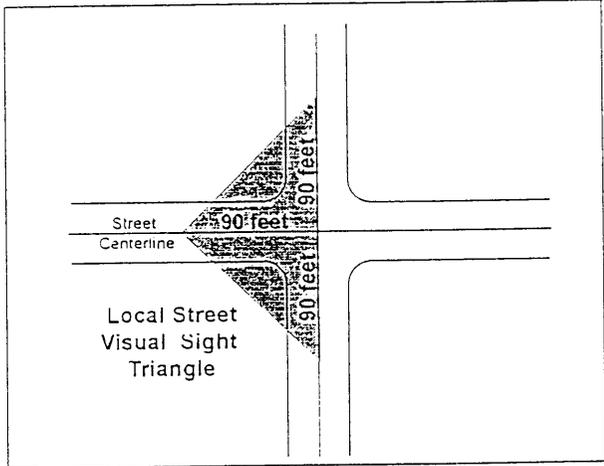
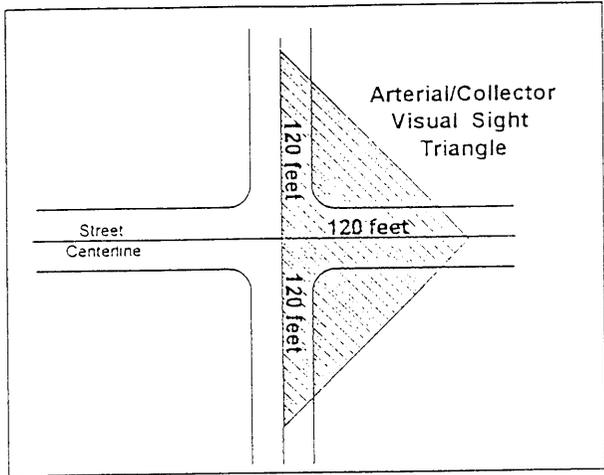


County of Clay
HIGHWAY
DEPARTMENT/PWD

VERTICAL AND HORIZONTAL
SIGHT DISTANCE

D22-11

1. Sight Triangle



County of Clay
HIGHWAY
DEPARTMENT/PWSD

SIGHT DISTANCE TRIANGLE
FOR ARTERIAL AND COLLECTOR
STREETS

D22-12

SECTION 2300 STEEL BEAM GUIDERAIL

2301 SCOPE. This section governs the furnishing of all labor, equipment, tools, and materials and the performance of all work necessary for the installation of steel beam Guiderail as shown on the construction plans or standard drawings.

2302 MATERIALS.

- A. Steel Posts. All posts, terminal posts connectors, and steel blocks for Guiderail shall be formed from a structural steel meeting the requirements of ASTM M-180 Class A, Type I.
- B. Guiderail and Hardware. All Guiderail and hardware shall conform to the requirements of AASHTO M-180 Class A, Type I.

2303 ERECTION.

- A. Setting Posts. Posts shall be set to the depth and spaced at the intervals shown on the construction plans or standard drawings. They shall be set vertical and true to line and grade. Steel posts may be driven by a power hammer or may be set in dug or bored holes of a size sufficient to permit thorough compacting of the backfill around the post. The backfill material shall be dry sand, placed in layers not exceeding twelve (12) inches in thickness to a height twelve (12) inches below the finished grade. After erecting and adjusting the rail to true line and grade, the sand backfill shall be compacted by flooding. The final twelve (12) inches of backfill consisting of suitable earth material shall then be compacted in six (6) inch lifts. Any "mushrooming" of the top of the post shall be removed and damaged spelter coating on posts shall be repaired by the Zinc alloy stick method while the surface is heated to approximately 600 degree F. Other methods of repairing the spelter coating shall receive prior approval of the Engineer.
- B. Placing the Guiderail. Bolt holes shall be shop punched. Field punching, reaming and drilling will not be permitted. Guiderail beams shall be spliced, only at posts by lapping in the direction of traffic, using the required number of splice bolts. Beams for twisted turned down terminal section may be either field or shop twisted. Sufficient twist shall be introduced such that the beam shall retain the required shape in a relaxed condition. Beams to be erected on a radius of one hundred fifty (150) feet or less shall be shop-curved as shown on the plans.

Each end of every installation of Guiderail shall have an end, bridge anchor, or terminal section of the design and type shown on the construction plans or standard drawings. They shall be of the same material and shall be galvanized in accordance with the requirements for the Guiderail beam.

Galvanized rail shall be handled in a manner to avoid damage to the galvanized coating. Any section of rail, end sections or terminal sections on which the spelter coating has been bruised or broken shall be rejected, or may, with the prior approval of the Engineer, be repaired by the method described for repairing damaged spelter coating of steel posts.

SECTION 2400 TRAFFIC

2401 GENERAL. The Contractor and/or developer shall be responsible for maintenance, control, and the safeguarding of traffic within and immediately abutting the project as further outlined herein, and as may otherwise be provided for in the Special Provisions. Additionally, the contractor and/or developer will be responsible for maintenance, control, and safeguarding of traffic on all detours which do not lie within the project limits, unless otherwise required in the Special Provisions or contract drawings.

The Contractor and/or developer must provide a detour plan to the Engineer and notify the Engineer at least forty-eight (48) hours prior to implementing a detour plan or closing a street.

The Contractor and/or developer shall notify the central dispatcher of the Fire Department and the Police Department prior to the closing or cutting of any public thoroughfare.

Failure to notify the Engineer and police dispatcher will result in an immediate suspension of work.

2402 STREET CLOSURES. Streets may not be closed to through traffic unless otherwise provided for in the Special Provisions. Streets shall not be closed to traffic until such closure has been approved by the Engineer. Street closures shall be made in such a manner as to provide for maximum public safety and public convenience, and if closed, shall be opened to through traffic at such time as the work has been completed, or as the Engineer may direct.

2403 EXISTING TRAFFIC SIGNS AND FACILITIES. The County, unless otherwise indicated, will make all necessary adjustments to traffic signals and traffic signal activators at no cost to the Contractor and/or developer. Existing traffic and street name signs which will interfere with construction shall be removed by the Contractor and/or developer and stored in a safe place. These signs shall not be removed until the Engineer has so directed and until the necessary measures have been taken to safeguard traffic after the signs have been removed. Preservation and maintenance of the signs shall be the sole responsibility of the Contractor and/or developer. Upon completion of the project, the Contractor and/or developer shall reset all such signs.

2404 DETOURS. Detours outside the limits of the project shall be the sole responsibility of the Contractor and/or developer unless otherwise provided in the Special Provisions. Detours within the limits of the project such as side street crossings, temporary bridges over freshly placed concrete, utilization of one or more lanes of the construction are for maintenance of traffic, and such related facilities for the maintenance of traffic shall be the responsibility of the Contractor and/or developer, the costs which shall be included in the unit contract prices unless otherwise provided for in the Special Provisions. All detour signage shall conform to the standards set forth in MUTCD.

2405 LOCAL AND EMERGENCY TRAFFIC. Local traffic shall be provided access to private properties at all time, except during some urgent states of construction when it is impracticable to carry on the construction and maintain traffic simultaneously, such as for the placing of asphalt concrete pavement, placing and curing of portland cement concrete pavement, and deep sewer excavations which prohibit safe travel of vehicular traffic.

No private driveway may be closed without the approval of the Engineer, unless written permission has been given the Contractor and/or developer by the owner of the property affected. Emergency traffic such as police, fire and disaster units shall be provided reasonable access at all times. The Contractor and/or developer shall be liable for any damages which may result from his failure to provide such reasonable access.

2406 PROTECTION OF PEDESTRIAN AND VEHICULAR TRAFFIC. The Contractor and/or developer shall take every precaution to protect pedestrian and vehicular traffic. Whenever, in the opinion of the Engineer, the Contractor and/or developer has not provided sufficient or proper safety precautions and safeguards, he shall do so immediately and to whatever extent the Engineer deems advisable.

2407 RESTRICTION OF PARKING. Where parking is a hazard to through traffic or to the construction work, it shall be restricted either entirely or during the time when it creates a hazard. Signs for this purpose will be initially furnished and placed by the County unless indicated otherwise. The Contractor and/or developer shall be responsible for and shall maintain the signs if they are used on any street which is directly involved in the construction work. If the parking signs are to be used beyond the confines of the work area, such as another street being used as a detour, the signs will be the responsibility of the Contractor and/or developer.

2408 FLAGMEN. The Contractor and/or developer shall furnish at his own expense all flagmen who may be needed unless otherwise provided for in the Special Provisions. Flagmen will be required when equipment is crossing a road that is open to vehicular traffic. Hand signaling devices, flagman attire, flagging procedures, and flagman stations shall be in accordance with the M.U.T.C.D.. On projects requiring handling of two-way traffic over a single lane, each flagman involved in controlling traffic through and along the work area shall be equipped with a portable transceiver radio and a Stop - Slow hand signaling device.

2409 TRAFFIC CONTROL WITHIN AND ABUTTING THE PROJECT. The contractor and/or developer shall place and maintain all signs, barricades and warning lights within the limits of the project on all streets, alleys, and driveways entering the project so that approaching traffic will turn right or left on existing and undisturbed streets before reaching the warning signs and barriers immediately abutting the project. Unless otherwise provided for in the Special Provisions, all required signs will be furnished by the Contractor and/or developer.

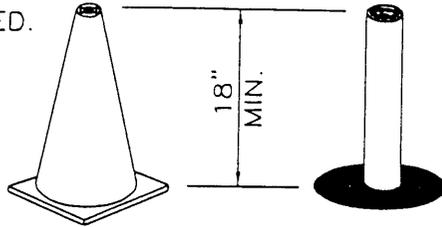
Barricades shall be furnished by the Contractor and/or developer. The barricades shall be of a conventional design normally used in street construction work, and painted a current traffic yellow with black stripes as shown in Part VI of the Manual on Uniform Traffic Control Devices, latest edition.

2410 FLASHERS. Flashers used shall be a type approved by the Engineer with a seven (7) inch lens, amber in color, and reflectorized rim. The rate of flashes shall be regular and shall be between 50 and 60 flashes per minute + or - 5 percent; the "on" time shall be at least twenty-five (25) percent of the cycle + or - 5 percent. Batteries shall be replaced in flasher units when the voltage is less than 4.6 volts for a 6-volt unit and 9.2 volts for a 12-volt unit.

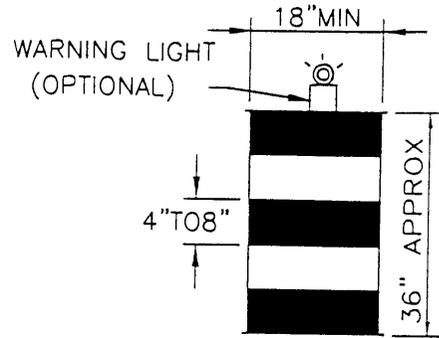
2411 TEMPORARY SURFACING. Whenever the Engineer determines the construction operation requires surfacing to permit vehicular or pedestrian traffic, the contractor and/or developer shall provide temporary surfacing of crushed stone. Whenever temporary surfacing will be required for a sustained period or on high volume roadways, the top one and one-half (1 1/2) inch or temporary surface shall be of Bituminous cold mix "Possipatch" or approved equal. Such temporary surfacing shall be maintained by the Contractor and/or developer in a safe, reasonably smooth condition as long as it is in use. Crushed stone for temporary surfacing shall meet the requirements of Paragraph 1007.2 Missouri Highway Specifications for Type 2 Aggregate, Gradation A.

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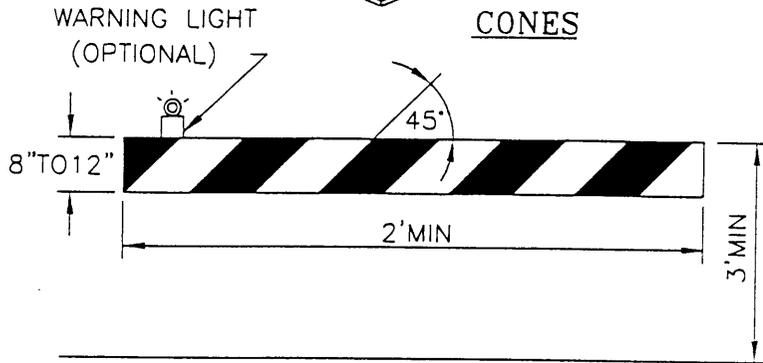
NOTE:
FLASHING OR STEADY
BURN WARNING LIGHTS
SHOULD BE USED ON
BARRICADES, PANELS,
DRUMS AS REQUIRED.



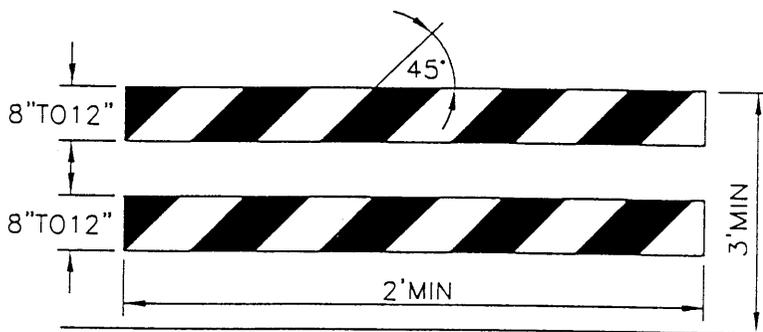
CONES



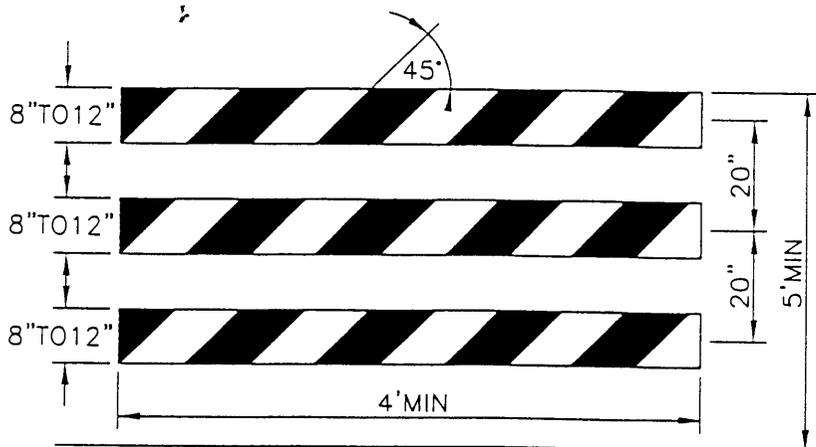
DRUMS



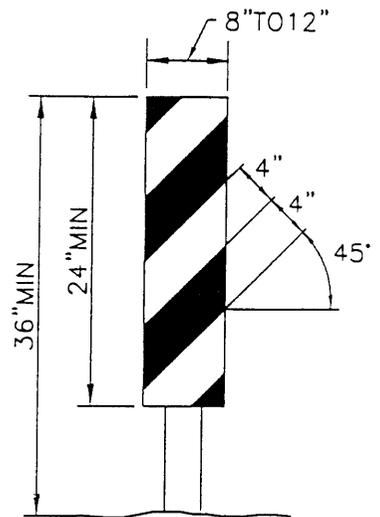
TYPE I BARRICADE



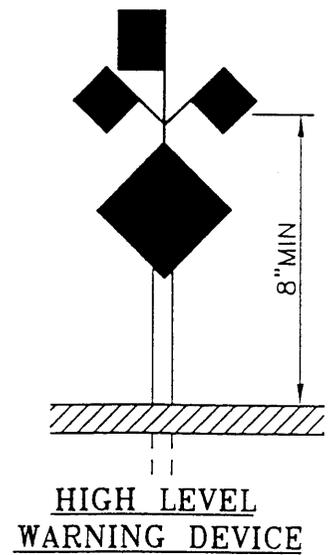
TYPE II BARRICADE



TYPE III BARRICADE



VERTICAL PANEL



HIGH LEVEL
WARNING DEVICE



County of Clay
HIGHWAY
DEPARTMENT/PWD

CHANNELIZING DEVICE &
HIGH LEVEL WARNING DEVICES

D24-1

SECTION 2500 PLANING

2501 SCOPE. This section governs the furnishing of all labor, equipment, tools, and materials and the performance of all work required for planing pavement surfaces.

2502 EQUIPMENT. Planing the surface of pavements shall be completed by the user of a planer conforming to one of the two (2) following types:

a. Heater Planing.

1. Machine. The heater planing machine shall be designed and built for planing work, be self propelled and shall have the means of heating, planing and cutting the old surface and blading the cuttings into a single windrow.
2. Heater. The machine shall be equipped with an adequate pavement surface heater to heat the surface to the optimum temperature for planing.
3. Operating Width. The heating and cutting width of the machine shall be the same and shall not be less than eight (8) feet.
4. Drive Wheels. The rear driving wheels shall be tandem to protect the softened surface of the pavement.
5. Speed. The machine shall be capable of operating at a speed compatible with the heating capacity of the burner.
6. Power. The planer shall have adequate power to force the cutting edge to the proper depth below the surface of the heated pavement without chattering or causing irregularities in the surface of the planed pavement. This machine shall have enough power to operate all auxiliary equipment without interfering with the performance of the machine as a planer.
7. Air Pollution. The machine shall comply with current air pollution standards.
8. Warning Lights. The planing machine shall be equipped with a flashing warning light visible from three hundred sixty (360) degrees. The light shall be mounted near the rear of the machine, at least two (2) feet above the highest part of the planing machine, and shall be used whenever the machine is being used or moved upon the County streets or roads.

B. Cold Planing.

1. Machine. The cold planing machine shall be self-propelled and shall have in combination the means of planing and cutting, without softening, the old surface and blading the cuttings into a single windrow.

2. Air Pollution. The machine shall be equipped with a dust suppression system including water storage tanks and high pressure spray bars.
3. Operating Width. It is desirable that the cutting width be greater than five (5) feet. In the event the cutting width is less than five (5) feet a system of electronic grade control for consecutive passes will be required.
4. Cutting Drum. The cutting drum shall be totally enclosed to prevent discharge of any loosened material on adjacent work areas.
5. Warning Lights. The planing machine shall be equipped with a flashing warning light visible from three hundred sixty (360) degrees. The light shall be mounted near the rear of the machine, at least two (2) feet above the highest part of the planing machine, and shall be used whenever the machine is being used or moved upon the County streets or roads.

2503 CONSTRUCTION DETAILS.

A. Methods of operations for Planing:

1. Operator. The planing machine shall be operated by an experienced and capable operator.
2. Utilities. Street or road surfaces adjacent to manholes, water valves and other utility extensions, shall be completely removed to the full depth of cut specified for the street or road unless otherwise specified by the Engineer.
3. Material Disposal. The material left windrowed by the machine, or removed by hand labor methods, shall be removed immediately from the surface of the pavement and disposed by the Contractor at a disposal area designated or as directed by the Engineer.
4. Surface Conditions
 - a. Heater Planing. The temperatures at which the work is performed, the nature and condition of the equipment and the manner of performance of the work shall be such that the pavement is not torn, gouged, broken or otherwise damaged by the planing operation.
 - b. Cold Planing. The drum lacing patterns shall produce a smooth surface finish after planing, with groove depths not to exceed one-quarter (1/4) inch unless otherwise approved by the Engineer.
 - c. Tolerance. The maximum tolerance for cold planing in a longitudinal direction shall be one-fourth (1/4) inch under a ten (10) foot straight edge and shall be three-eighth (3/8) inch under an eight (8) foot straight edge in a transverse direction.

B. Types of Cuts to be made by Planing:

1. Leveling. Sufficient passes shall be made such that all irregularities or high spots are eliminated, and that one hundred (100) percent of the surface is planed.
2. Average Depth. Sufficient passes, or cuts, shall be made in order to remove a specified depth over the entire street section. These depths will be designated in the Special Provisions or as directed by the Engineer.
3. Bridge Deck Planing. Sufficient passes, or cuts, shall be made in order to remove the material as specified on the plans or in the Special Provisions.
4. Cold Planing (Six (6) Foot Width Curb Cut.) In areas designated for Cold Planing (six (6) foot curb cut) sufficient passes, or cuts, shall be made such that all irregular or high spots are eliminated from the top edge of the concrete gutter to a point of two (2) inches below the edge of the gutter. The depth shall taper from zero (0) inches at a distance of six (6) foot from the edge of the gutter. This type of cold planing shall be used in areas where an asphalt overlay is to be done next to a existing curb, so not to overlay asphalt higher than the curb.

- C. Clean-up. The contractor shall remove all cuttings and debris from the street that can be removed by a self-propelled street sweeper with a hooper immediately after the designed area has been milled. Material shall not remain that would recompact or leave an unsuitable surface for subsequent overlay operations.

SECTION 2600 ASPHALT CRACK SEALING; IMPROVED STREET, SHOULDER AND PARKING LOT CHIP SEAL; SLURRY SEAL; AND UNIMPROVED STREET SEAL

2601 SCOPE. This section governs the furnishing of all labor, equipment, tools and material, and the performance of all work necessary for minor pavement patching and crack cleaning and sealing, construction of asphalt seal-coat and slurry seal, complete, in place at the locations specified in the Special Provisions and as directed by the Engineer.

2602 CRACK SEALING.

- A. Crack Sealing Material. Asphalt Material used for crack sealing shall be Derrafill3408 L.M. range for this material shall be 240-290 degree F when applied.
- B. Weather Limitations. Crack sealing shall be performed only on days when the ambient temperature is greater than 25 degree F and rising at the time work is to begin. Crack sealing shall not be done on days when ice or other conditions prevent proper cleaning of the cracks.
- C. Distributor. A distributor as listed in Section 1305 is required for handling the liquid asphalt for crack sealing.
- D. Cleaning. All cracks shall be thoroughly cleaned of undesirable material by the use of an 85 to 90 C.F.M. compressor with air hoses and attachments. All vegetation will be removed.
- E. Filling Procedure. After all cracks have been thoroughly cleaned, the operator of the hand hose shall apply hot liquid asphalt to the cleaned cracks. Application of the liquid asphalt shall be done in such a manner to avoid an accumulation of excess material on areas adjacent to the cracks. Excess material on the cracked areas shall be redistributed by means of a U-shaped squeegee.

2603 IMPROVED STREET SHOULDER & PARKING LOT CHIP SEAL.

- A. Description. This work shall consist of the application of asphaltic cements and cover aggregate to an existing street shoulder and or parking lot surface.
- B. Requirements for Materials to be used for street shoulder or parking lot Sealing.
 - 1. Asphalt Cement.
 - a. The asphalt cement for sealing shall be 85-100 penetration grade, complying with ASTM D-946.

The material shall be sampled and tested as set forth by Section 4 of ASTM D-946.

- b. A sample of the liquid bituminous materials may be taken from each distributor or relay on the job site. If the liquid bituminous materials do not meet the specifications as set out in the contract after applying, the Contractor and/or developer shall correct, at his own expense, all unsatisfactory areas. No additional areas shall be sealed until corrections have been accomplished.

2. Cover Aggregates.

a. Limestone Rock.

- (1) Gradation. Limestone chips to be used for sealing shall, when graded through sieves with square openings, conform to the following percentages:

<u>Sieve Size</u>	<u>Percent Passing</u>
1/2"	100
3/8"	95-100
No. 4	18 Max.
No. 10	0-2

- (2) Physical Properties. The chips, when tested by Los Angeles Abrasion test, shall have a percentage of wear not to exceed thirty-five (35) percent after five hundred (500) revolutions as determined by ASTM C-131. The shale content of the material shall not exceed 0.5 percent by weight. The materials shall be free of acid or other deleterious substances.
- (3) Asphalt Coating. Asphalt for the coating of limestone cover aggregate shall be MC-70 conforming to ASTM D-2027, Liquid Asphalt, Medium Cure.

b. Lightweight Cover Aggregate.

- (1) Aggregate. Lightweight cover aggregate consists of expanded shale produced by the rotary kiln method and shall comply with the quality and gradation requirements as set forth in these specifications.
- (2) Unit Weight. The dry loose weight of Lightweight Cover Aggregate shall not be less than thirty-nine (39) nor more than forty-eight (48) pounds per cubic foot.
- (3) Quality Requirements.
 - (a) Soundness. The loss ration for Lightweight Cover Aggregate shall not be less than 0.90 when subjected to 25 cycles of the freezing and thawing test as set forth in Section 4, MCIB Specification.

(b) Wear. The percent loss shall not exceed twenty-five (25) percent when tested by the Los Angeles Abrasion Test Method (ASTM C-131).

(c) Deleterious Substances. The deleterious substances in each individual aggregate shall not exceed the following percentages by weight:

Sticks (wet weight)	0.5
Coal	0.5
Soft Friable Materials	2.5
Unburned or Underburned Shale	0.5

The above percentages are when taken separately. In addition, any combination of the above shall not exceed 3.0 percent.

(d) Absorption. The water absorption of the expanded shale aggregate shall not exceed eighteen (18) percent when soaked for twenty-four (24) hours.

(4) Gradation. Lightweight cover aggregate shall conform to the grading requirements as follows:

Sieve Size	Percent Passing
3/8	100
No. 4	0-15
No. 8	0-2
No. 100	0-0.5

c. Weighing of Cover Aggregate.

The Contractor and/or developer shall furnish scales for weighing cover aggregate as required in Section 1407 entitled "Scales and Weighing of Vehicles." All loads of cover aggregate will be weighed and evidenced by approved delivery tickets showing the net weight in pounds for each load. Two (2) copies of each ticket shall accompany the load to the work site. Upon the load being incorporated in the work, both copies will be signed by the inspector and one (1) of these copies will be returned to the Contractor and/or developer.

C. Spot Patching.

Holes, where the surface is broken out, shall be cleaned of any loose material. Holes shall be tacked with a light coating of emulsified asphalt. The tack coat shall extend beyond the limits of the patch.

The emulsified asphalt used for the tack coat shall be either CRS-1, RS-1, MS-1 or SS-1h conforming to ASTM D-977. Patches shall be made in holes or depressions where the surface is in good condition. The Engineer will indicate the extent to which patches shall be made.

The prepared hole shall be patched with hot-mix asphaltic patching material by placing in layers not to exceed two (2) inches; each layer being thoroughly compacted before the next layer is placed. After the patching material is placed and raked to a uniform surface, it shall be thoroughly compacted by rolling with a tandem or three-wheeled roller with a minimum weight of one hundred eighty (180) pounds per lineal inch or a vibrating shoe compactor. An appropriate number of passes shall be made to insure that the patch is firmly consolidated. The edges shall be will bonded with the old surface. The completed patch shall be in the same plane as the existing pavement.

The asphaltic concrete used for patching at the different locations shall be as directed by the Engineer and shall conform to one of the mixes as set out in Section 1404, for Types 3 and 4 Asphaltic Concrete Surface. Generally the Type 4 mix shall be used for patching.

D. Sealing.

1. Cleaning. After all holes and cracks have been repaired to the satisfaction of the Engineer, and immediately before sealing, the Contractor and/or developer shall thoroughly clean the area to be sealed. The street shall be dry before applying the seal coat.
2. Sealing. After the street has been prepared as set forth above, the Contractor and/or developer shall apply the liquid asphalt by means of an approved distributor meeting the requirements of Section 1305. Provisions shall be made by the Contractor and/or developer to properly protect the curbs and gutters from the asphaltic spray. Liquid bituminous material shall be applied at a rate between 0.16 and 0.22 gallons per square yard. The specific rate for each job will be determined by the Engineer in the field.

To insure uniform application of the bituminous material to the street surface at the beginning of each distributor load or portion thereof, the Contractor and/or developer will be required to cover a portion of the street surface with building paper. The area covered by the building paper shall be used as the starting point for each distributor load or each part of a distributor load after a temporary delay, and the spray bars shall be discharged on this paper until all nozzles are working properly. After use, the building paper shall be removed and disposed of by the Contractor and/or developer.

Immediately after the application of the asphalt, the Contractor and/or developer shall, by means of a self-propelled mechanical spreader, apply a uniform layer of cover aggregate. This material shall be spread at the rate specified by the Engineer. This rate shall be between ten (10) and twenty (20) pounds per square yard for limestone chips and between eight (8) and ten (10) pounds per square yard for

lightweight aggregate. If material is spread on any area in excess of the amount specified by the Engineer, the surplus shall be immediately removed and placed elsewhere as directed. No payments will be made to the Contractor and/or developer for the picking up and redistribution of each excess. Hand spreading will be permitted only in those areas not accessible to the mechanical spreader.

Immediately after spreading the cover aggregate, the entire surface shall be rolled with multiple wheel, pneumatic-type rollers. Rolling shall be continued until a thoroughly compacted surface with a uniform aggregate coverage has been obtained. The Engineer may require additional rollers if one roller cannot keep up with the operations. The first pass of the rollers over the cover aggregate shall not exceed five (5) miles per hour. The rollers shall not exceed ten (10) miles per hour during any rolling operation.

Where double sealing is specified or directed by the Engineer, the area shall be treated with two coats. The top seal coat shall be applied the same day as the first seal coat. Double sealing will be performed as set out for sealing.

The Contractor and/or developer shall seal all roadway or street areas within the right-of-way, except private driveways, including sealing of intersections, alleys, etc, to the property line.

During the sealing operation as described above, the Contractor and/or developer shall cooperate with the Engineer in arranging a program and schedule of work so traffic may be handled or routed around or through the section being sealed. Whenever possible, the street or road will be closed; but when this is not possible, the sealing will be done in strips while traffic is diverted to the balance of the street or road. No traffic will be permitted on the sealed portion of the street or roadway until rolling is completed.

When bleeding occurs or more material is required, additional cover aggregate shall be spread as directed. As soon as the cover material has adhered to the surface, all excess cover aggregate shall be immediately removed.

2604 SLURRY SEAL.

- A. Description. This work shall consist of the application of Slurry Seal Material to an existing surface. The Slurry Seal shall consist of a mixture of emulsified asphalt, mineral aggregate and water, properly proportioned, mixed and spread on the surface in accordance with this specification and as directed by the Engineer.

- B. Materials.
 - 1. Emulsified Asphalt. The Emulsified Asphalt to be used for this work shall be CRS-1h unless otherwise specified.

2. Aggregate for Slurry Seal. The mineral aggregate used for this work shall be chat aggregate which is a by-product of the milling of lead and zinc ores, and shall conform to the following grading requirements:

Sieve Size	Percent Passing
3/8"	100
No. 4	82-94
No. 8	45-65
No. 16	25-46
No. 30	15-35
No. 50	10-25
No. 200 *	5-15

* The percent passing the No. 200 Sieve shall be determined by ASTM C-117.

3. Mineral Filler. Mineral Filler shall be any recognized brand of Portland Cement that is free from lumps.
4. Water. Water shall be potable and shall be free of harmful soluble salts.

C. Equipment.

1. Slurry Mixing Equipment. The slurry mixing machine shall be self-propelled. Sufficient storage capacity for aggregate, emulsified asphalt, cement and water shall be provided to properly mix and apply a minimum of eight (8) tons of aggregate without the use of auxiliary tracks and tanks. The mixed unit shall be capable of delivering to the spreader unit a properly proportioned and thoroughly mixed slurry on a continuous flow basis.

The mixing machine shall be equipped with an approved fines feeder that shall provide a uniform, positive, accurately metered, predetermined amount of the specified mineral filler at the same time and location that the aggregate is fed.

2. Slurry Spreading Equipment. Attached to the slurry mixing machine shall be a squeegee distributor equipped with flexible material in contact with the surface to prevent loss of slurry from the distributor box. The rear flexible seal shall act as a strike off and be adjustable in width. It shall be maintained to prevent loss of slurry on varying grades and crown by adjustments to assure uniform spread. A burlap drag will be required to obtain the desired texture. The box shall be equipped with a steering device and shall be kept clean and free of any build up of asphalt and aggregate.

- D. Proportioning. The Engineer shall approve all Slurry Seal Materials and methods prior to mixing and application. The proportions of the mixture to be used shall be as follows unless variations are approved by the Engineer:

Aggregate for Slurry Seal	13.5 to 16.5 lbs per sq. yd. (dry basis)
Emulsified Asphalt	9.5 to 10.5 percent by weight of dry aggregate.
Mineral Filler (added)	1.5 to 3.0 percent by weight of dry aggregate.
Water	Quantity to produce proper consistency.

Once the proper consistency is obtained changes in proportioning of the various components of the mixture shall be held to a minimum.

E. Construction Requirements.

1. Surface Preparation. Immediately prior to applying the Slurry Seal, the surface shall be thoroughly cleaned of all objectionable materials and pre-wetted, leaving no standing water.
2. Application. The mixture shall be spread to leave a uniform non-skid film of fine aggregate and asphalt on the surface. Squeegees shall be used to spread the Slurry Seal mixture in areas inaccessible to the spreader box and other areas where hand spreading may be required. A hand drag shall be used at these locations to give the same texture as the machine-layed surface.

A sufficient amount of slurry shall be carried in all parts of the spreader box at all time so that complete coverage is obtained. No lumping, balling, or unmixed aggregate shall be permitted. Any oversized aggregates or foreign materials shall be removed from the aggregate prior to delivery to the mixing machine. No streaks or slick spots shall be left in the unfinished surface.

3. Weather Limitations. Slurry Seal shall be placed only when the surface temperature is 60 degree F or above, the relative humidity is below eighty (80) percent and no precipitation.

- F. Property Owner Notification. The County will supply the Contractor and/or developer door tags which shall be placed on the doors of all involved property owners. The door tag shall comply with the included sample or an approved equal.

2605 UNIMPROVED STREET SEALING.

- A. Description. This work shall consist of applying a single liquid asphaltic coat with limestone cover aggregate to unimproved streets.

B. Requirements for Liquid Asphalt Materials.

The particular grade of liquid asphalt required on different streets will be an R-C or M-C liquid asphalt, as determined by the Engineer, conforming to the requirements of ASTM D-2027 entitled "Specifications for Liquid Asphalt Type M-C or R-C".

C. Cover Aggregate.

This material shall be limestone chips of the Bethany Falls Ledge or an approved equal, and the shale content shall not be greater than 0.5 percent maximum by weight.

The chips when tested by Los Angeles Abrasion Test shall have a percentage of wear not to exceed thirty-five (35) percent after five hundred (500) revolutions as determined by ASTM C-131.

All chips shall have less than one (1) percent moisture, adhere immediately to the liquid asphalt, and not strip from the surface.

Gradation for limestone chips to be used for sealing shall conform to the following:

<u>Square Sieve Size</u>	<u>Percent Passing</u>
1/2"	100
3/8"	80-100
No.	0-26
No.10	0-2

The Contractor and/or developer shall furnish scales for weighing cover aggregate as required in Section 1407 entitled "Scales and Weighing of Vehicles." All loads of cover aggregate will be weighed as required, and evidenced by approved delivery tickets showing the net weight in pounds for each load. Two copies of each ticket shall accompany the load to the work site. Upon the load being incorporated in the work, both copies will be signed by the inspector and one of these copies will be returned to the Contractor and/or developer.

D. Sealing.

The rate of application shall be 0.15 to 0.25 gallons per square yard and shall contain one (1) percent of an anti-stripping agent (single strength), thoroughly mixed with the cutback asphalt. The specific rate of application will be determined for each street by the Engineer. The distributor used shall meet the requirements of Section 1305.

Immediately after the application of the liquid asphalt the Contractor and/or developer shall, by means of a mechanical spreader, apply a uniform layer of cover aggregate. This material shall be spread at the rate specified by the Engineer within the range of sixteen (16) and twenty-four (24) pounds per square yard. If material is spread on any area in excess of the amount specified by the Engineer, the surplus shall be immediately removed and placed elsewhere as directed. No payment will be made to the Contractor and/or

developer for the picking up and redistribution of such excess. The same applies for spillage. Hand spreading will be permitted only in those areas not accessible to the mechanical spreader.

Immediately after spreading the seal coat aggregate, the entire surface shall be rolled with multiple wheel, pneumatic-type rollers. Rolling shall be continued until a thoroughly compacted surface with uniform aggregate coverage has been obtained. These rollers shall weigh between eight (8) and ten (10) tons.

Where double sealing is called for, or required by the Engineer, the area shall be treated with two seal coats, the top coat to be applied in the same manner as set out for sealing.

During the sealing operation as described above, the Contractor and/or developer shall cooperate with the Engineer in arranging a program and schedule of work so traffic may be routed around or through the section being sealed. Whenever possible, the street will be closed; but when this is not possible, the sealing shall be done in strips while traffic is diverted to the balance of the street. No traffic will be permitted on the sealed portion of the roadway until the rolling is completed.

The Contractor and/or developer will be required to maintain a uniform aggregate coverage over the entire surface until such time as no more aggregate will be needed on any part of the surface to make a completed and finished job. When bleeding occurs or more material is required, additional cover aggregate shall be spread as directed.

2606 PROVISIONS FOR PUBLIC CONVENIENCE DURING SEALING OPERATION. The Contractor and/or developer shall provide and maintain sufficient signs, barricades, warning lights, flag persons and watch persons to protect the work and public in a manner satisfactory to the Engineer. Any areas damaged prior to acceptance by the County shall be repaired at the Contractor and/or developer's expense.

Signs for "No Parking" to be used will be furnished by the Contractor and/or developer. These signs shall comply with the standards established by the MUTCD with regard to size, color, wording, height and placement. When "No Parking" signs are posted on the streets with parking meters, the Contractor and/or developer shall cover the parking meter heads with cloth or paper bags.

The Contractor and/or developer shall take all necessary precautions to protect the public (pedestrian and vehicular) from flying debris. The Contractor and/or developer shall use warning signs and devices to warn motorists of work ahead and shall use traffic cones where necessary to guide traffic.

SECTION 3000 MATERIALS AND CONSTRUCTION - SANITARY SEWERS

3001 GENERAL. Sanitary sewer construction shall consist of furnishing all labor, materials and equipment for the complete installation of sewers and appurtenances.

3002 SPECIFICATION MODIFICATIONS. It is understood that throughout this section these specifications may be modified or deleted (in public works projects) by appropriate items in the contract drawings.

3003 MATERIALS AND TESTING. Furnish pipe of materials, joint types, sizes, and strength classes indicated and specified. Higher strengths may be furnished at the Contractor and/or developer's option and at no additional cost to the County.

The manufacturer shall be experienced in the design, manufacture and commercial supplying of the specific material.

Testing is to be performed by the manufacturer's quality control personnel in conformance with applicable standards. Upon request by the Engineer and prior to delivery, the Contractor and/or developer shall provide three (3) copies of certified test reports indicating that the material does conform to the specifications.

No pipe or fitting shall be delivered until approved by the Materials Laboratory and are so marked. The manufacturer, contractor and/or developer shall use equipment and methods adequate to protect pipe, joint elements and prevent shock contact of adjacent units during moving or storage. Damaged sections that cause reasonable doubt as to their structural strength or watertightness will be rejected.

3004 REINFORCED CONCRETE PIPE. Conform to ASTM C76, C 497, C 506, and C 507, except as otherwise noted herein.

- A. Materials. Cement shall not contain tricalcium aluminate in excess of 5.0 percent. Fine aggregate shall be natural sand conforming to the requirements of MCIB Bulletin No. 1.
- B. General. Furnish maximum lengths manufactured by supplier, except for fittings, closures and specials. Moisture absorption by boiling test shall not exceed 5.0 percent. Concrete pipe sections shall be cut while still green, reinforcing shall be exposed and welded together at junctions and miters. Splice shall be built up to nominal wall thickness with mortar or concrete.
- C. Circular Pipe. Furnish ASTM C 76, Class III minimum, with either Wall B or Wall C. Reinforcement shall be circular or elliptical. Elliptically reinforced pipe shall be marked in accordance with Section 15.2, ASTM C 76, for correct installation.
- D. Arch Pipe. Furnish ASTM C 506, Class A-III minimum. Reinforcement shall be single line or double line.
- E. Elliptical Pipe. Furnish ASTM C 507, Class HE-III or Class VE-III minimum. Reinforcement shall be double cage.

- F. Low-Head Pressure Pipe. Furnish ASTM C 361. Reinforcement shall be circular or elliptical. Elliptically reinforced pipe shall be marked in accordance with Section 15.1.4, ASTM C 361, for correct installation.
- G. Joints. Flexible gasketed joints in concrete pipe shall be made with continuous ring, compression type rubber gaskets. Design of joints and physical requirements of rubber type gaskets shall conform to ASTM C 361 and C 443. Natural rubber will not be acceptable.

3005 VITRIFIED CLAY PIPE. Conform to ASTM C 700, except as otherwise specified herein.

- A. General. Furnish maximum pipe lengths manufactured by the supplier, except for fittings, closures and specials.
- B. Design. Provide ASTM C 700 Extra Strength pipe and fittings in sizes eighteen (18) inch and smaller. Provide either ASTM C 700 Standard Strength or Extra Strength pipe and fittings in sizes twenty-one (21) inch and larger as specified by the Owner or Engineer. Standard Strength pipe shall be designed for Class B Bedding in accordance with ASTM C 12, unless otherwise noted on the Plans.
- C. Joints. Flexible gasketed joints for bell and spigot clay pipe shall be compounded of high quality polyurethane plastic bonded to both the bell and spigot ends of the pipe and properly molded and cured to a uniform hardness and compressibility to form a tight compression joint. All bell and spigot joints shall conform to ASTM C 425. Compression couplings for Clay plain-end pipe shall conform to ASTM C 594.
- D. Fittings. Provide fittings, if specified, defined as tee or wye connections suitable for assembly to house or building sewers similar to W. S. Dickey Clay Co. "Perma-T" and "Perma-Y".

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3006 DUCTILE-IRON PIPE. Conform to ANSI A21.51; ASTM A536, Grade 60-42-10, except as otherwise specified herein.

- A. Design. Design of pipe shall be in accordance with ANSI A21.50 laying conditions S, Type 2 or 3. Minimum wall thickness shall be Class 50.
- B. Joints. Mechanical and push-on joints for ductile-iron pipe and fittings shall conform to the requirements of ANSI A21.11. Gaskets shall be neoprene or other synthetic rubber material. Natural rubber gaskets will not be acceptable.
- C. Fittings. Fittings shall be in accordance with ANSI A21.10 and shall have a pressure rating of not less than that specified for pipe. Fittings used with ductile-iron pipe shall be ductile-iron or cast iron. Fittings for pipe with mechanical joints shall have mechanical joints. Fittings for pipe with push-on joints shall be either mechanical joint or push-on joint.

- D. Lining & Coating. All ductile-iron pipe, fittings and specials shall be cement mortar lined in accordance with ANSI A21.4. Coat all pipe, fittings and specials with manufacturers standard coal tar coating.

3007 POLY VINYL CHLORIDE (PVC) SEWER PIPE. Conform to ASTM D3034, except as otherwise specified herein.

- A. General. Furnish maximum pipe lengths manufactured by the supplier, except for fitting, closures and specials.
- B. Design. The minimum wall thickness for PVC Pipe shall conform to SDR-35 (SDR-26 for stublines). PVC Material shall conform to ASTM D1784 and shall have a cell classification of 12454-B, 12454-C, or 13364-B.
- C. Joints. Flexible gasketed joints shall be compression type with a gasket confined in a machined groove in the spigot end of the pipe. Oil resistant rubber gasket rings shall conform to the requirements of ASTM D 1869. Gaskets shall be neoprene or other synthetic material. Natural rubber gaskets will not be acceptable.
- D. Fittings. Fittings defined as tee or wye connections suitable for assembly to 4-inch or 6-inch house or building sewers shall be saddle-type fittings molded of PVC plastic.

3008 CONCRETE. Concrete, whether reinforced or non-reinforced, shall conform to MCIB Specifications and to the requirements set forth in Section 2000 "Concrete".

3009 REINFORCING STEEL. Reinforcing steel shall be placed as shown on the plans and shall conform to ASTM Specifications as follows:

- A. Bars and rods shall be deformed billet-steel conforming to ASTM A 615, Grade 40.
- B. Welded wire fabric shall conform to ASTM A 185, Grade 40.
- C. Fabricated steel bar and rod mats shall conform to ASTM A 184. Bar material shall conform to ASTM A 615, Grade 40.
- D. Smooth bars shall be round carbon steel bars conforming to ASTM A 306, Grade 60.

3010 MANHOLE MATERIALS.

- A. General. Manholes shall conform to the Standard Drawings included in these specifications.
- B. Precast Concrete. Precast concrete manholes shall conform to ASTM C 478. Joints shall be of material as specified for reinforced concrete pipe joints or a bitumastic material or preformed flexible joint sealants applied in accordance with manufacturer's recommendations.

- C. Cast in Place Concrete. Concrete used shall conform to requirements set forth in Section 2000, "Concrete".
- D. Waterproofing. Waterproofing will be required on all manholes. The bitumen shall consist of two coats Koppers Bitumastic No. 50 or approved equal. Precast manholes shall be shop coated.

3011 MANHOLE CASTINGS.

- A. General: Cast-iron rings, covers, and steps shall conform to County Standard Drawing. Manhole rings and covers shall be Clay and Bailey No. 2008BV, Deeter No. 1315, or approved equal. The exception shall be for use on shallow manholes where manhole covers shall be Clay & Bailey No. 2020, Deeter No. 2016 or approved equal.

When bolt-down type manhole rings and covers are required and specified, Clay and Bailey No. 2014, Deeter 1310 or approved equal, with rubber gaskets and stainless steel cover bolts 5/8-inch diameter with hexagonal-head bolts shall be furnished. Bolt-down type manhole rings shall be anchored to the manhole with not less than four (4) 3/4-inch diameter anchor bolts having a minimum of fourteen (14) inches of embedment, (excluding adjustment rings) except in concrete manholes in which the ring is embedded in concrete.

All covers shall have Clay County-Sewer cast onto the top surface.

Frame and grade adjustments on all bolt-down manholes or manholes in paved surfaces shall be sealed with an internal or external rubber chimney seal as manufactured by Cretex Specialty Products, or approved equal.

Cast iron manhole steps shall be Clay and Bailey, or approved equal, No. 2102 for precast concrete manholes and No. 2104 for concrete manholes.

- 3. Polypropylene coated steel reinforced "plastic steps" shall be M.A. Industries, Inc. model PS-2-PF or approved equal manhole step for precast concrete manholes.

The castings shall meet or exceed the following minimum requirements.

1. Iron castings shall conform to the requirements of ASTM A 48, Class 25.
2. Castings shall be clean and whole, and without blow or sand holes or any other surface defects which would impair serviceability. Plugging or filling of holes or other defects will not be permitted.
3. Parting fins and pouring gates shall be removed.

3012 BEDDING AGGREGATE. All materials used for crushed stone pipe bedding shall conform to the requirements of MCIB Specification Sec. 4 Materials for coarse aggregate and shall meet the gradation specified therein under Column III, Table 2, for three quarters (3/4) inch maximum size aggregate with the following modifications.

Sieve Size	Percentage Passing
No. 4	0-5
No. 8	0-2

3013 CONSTRUCTION REQUIREMENTS.

A. Grading and Excavation.

1. Scope. Excavation and trenching work shall include the necessary clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching as required; the handling, storage, transportation and disposal of all excavated material; all necessary sheeting, shoring and protection work; preparation of subgrades; pumping and dewatering as necessary or required; protection of adjacent property; and other appurtenant work.
2. General. Excavation and trenching work shall be performed in a safe and proper manner with suitable precautions being taken against all hazards. The Contractor and/or developer shall explore and expose any and all obstructions in advance of excavation so that minor changes in grade and alignment may be made.

In paralleling present water and gas mains, the Contractor and/or developer shall protect all service connections and shall arrange to furnish service to the consumers with minimum interruption. Door hanger notifications will be furnished by the County and the Contractor and/or developer shall inform consumers twenty-four (24) hours in advance of any interrupted service.

2. All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory provisions made for street drainage.

3. Classification of Excavated Material. When specifically indicated in the proposal and contract, classification of excavated materials will be made as follows:
 - a. Rock. Rock excavation will be so classified when sandstone, limestone, blue shale or other similar material is encountered and, in the opinion of the Engineer, requires drilling or blasting or remove the material.
 - b. Earth. All material not classified as rock.
4. Clearing. The Contractor and/or developer shall do all clearing necessary for access, stringing of pipeline materials, and construction of the pipeline and appurtenant structures.

5. Unauthorized Excavation. Any part of the trench excavated below grade shall be corrected with material approved by the Engineer placed and compacted by the Contractor and/or developer.
6. Dewatering. The Contractor and/or developer shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation or other cause will result.

All excavations for concrete structures or trenches which extend down to or below static groundwater elevations shall be dewatered by lowering and maintaining the groundwater surface beneath such excavations a distance of not less than twelve (12) inches below the bottom of the excavation.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

The Contractor and/or developer will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduit shall be left clean and free of sediment.

7. Sheeting and Shoring. Except where banks are cut back on a stable slope, excavation for structures and trenches shall be properly and substantially sheeted, braced, or shored as necessary to prevent caving or sliding, to provide protection for workmen and the work, and to provide protection for existing structures and facilities. Sheeting, bracing and shoring shall be designed and built to withstand all loads that might be caused by earth movement of pressure and shall be rigid, maintaining shape and position under all circumstances.

Trench sheeting shall not be pulled unless pipe strength is sufficient to carry trench loads based on trench width to the back of sheeting. Sheeting shall not be pulled after backfilling. When ordered by the Engineer, wood sheeting shall be left permanently in the trench.

Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

8. Stabilization. Trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen.

Trench bottoms which are otherwise solid but which become mucky on top due to construction operations shall be reinforced with one or more layers of crushed stone or gravel. Not more than one-half (1/2) inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon.

9. Trench Excavation. The Contractor and/or developer shall not open more trenching advance of pipe laying than is necessary to expedite the work. One block or three hundred (300) feet whichever is the shorter, shall be the maximum length of open trench ahead of pipe laying unless by written permission of the Engineer.

Except where tunneling or boring and jacking is specified and shown on the plan by the Engineer, all trench excavations shall be open cut.

10. Alignment and Grade. The alignment and grade or elevation of the pipeline shall be as shown on the plans.

The Contractor and/or developer must maintain a constant check of the pipe alignment and trench depth and will be held responsible for any deviations therefrom.

11. Limiting Trench Width. Trenches shall be excavated to a width, which will provide adequate working space and pipe clearances for proper pipe installation, jointing, and embedment. Ledge rock, boulders, and large stones shall be removed to provide a clearance of six (6) inches below and on each side of all pipe. These distances are minimum clear distances, which will be permitted between any part of the pipe and appurtenances being laid on any part, projection, or point of such rock, boulder, or stone.

Cutting trench banks on slopes to reduce earth load to prevent sliding and caving will be permitted only in areas where the increased trench width will not interfere with surface features or encroach on right-of-way limits. Slopes shall not extend lower than one (1) foot above the top of the pipe.

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Limiting trench widths below an elevation of one (1) foot above the exterior top of the installed pipe shall be not less than fifteen (15) inches nor more than twenty-four (24) inches greater than the nominal outside diameter of the pipe.

12. Unauthorized Trench Widths. When, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted in the foregoing, either pipe of adequate strength, special pipe embedment, or arch concrete encasement, as required by loading conditions and as determined by the Engineer, shall be furnished and installed by and at the Contractor and/or developer's expense.

13. Trench Bottom in Earth. The trench in earth shall have a flat bottom the full width of the trench and shall be excavated to the grade to which the pipe is to be laid. The surface shall be graded to provide a uniform bearing and continuous support for each pipe at every point along its entire length.

14. Rock Exploration. Unless shown otherwise on the plans or noted in the Special Provisions, no rock exploration has been made. On those projects where rock exploration has been made, test holes have been drilled at locations and intervals as shown on the plans or subsurface information report to determine the approximate location and depth of rock. Resistance to penetration was assumed to be "solid rock". This information is furnished for general reference purposes only.
15. Trench Bottoms in Rock. All rock excavation shall be carried to a minimum of six (6) inches below the bottom of the pipe. Granular pipe embedment material shall be used to restore the trench bottom to the desired elevation and grade and to provide an uniform bearing and continuous support for the pipe along its entire length. Care shall be exercised to prevent any portion of the pipe from coming to bear on solid rock or boulders.
16. Mechanical Excavation. The use of mechanical equipment will not be permitted in locations where its operations would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand-excavating methods shall be used.

Mechanical equipment used for trench excavation shall be of the type, design and construction and shall be so operated that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from the bottom of the trench, and that trench alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

All mechanical trenching equipment, its operating conditions, and the manner of its operations shall be subject at all times to the approval of the Engineer.

17. Stream Crossings. Stream crossings shall be made in accordance with these specifications and as shown on the plans.

The trench width shall be as required for proper pipe installation and the trench depth shall be as required to give minimum cover shown on the plans, Pipe encasement, where required, shall be in accordance with the specifications and placed as indicated on the plans.

18. Highway and Railroad Crossings. The Contractor and/or developer shall make highway and railroad crossing in accordance with these specifications, the Special Provisions and as shown on the plans.

All construction or work performed and all operations of the Contractor and/or developer, his employees, or his subcontractors within the limits of highway or railroad right-of-ways shall be in conformity with all the requirements, regulations and be under the control of the authority owning or having jurisdiction over and control of the right-of-way. All notifications of the owning authority shall be through the Engineer

The Contractor and/or developer shall pay fees and obtain permits to make the crossings unless otherwise directed.

3014 HANDLING. Handle pipe materials and fittings in a manner to insure installation in sound and undamaged condition. Do not drop or bump. Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements and coatings. In handling plastic pipe of ten (10) feet in length or greater, a double sling will be required unless otherwise approved by the Engineer.

Materials shall be shipped, moved and stored with provisions to prevent movement or shock contact with adjacent units.

3015 INSTALLATION.

- A. All work shall be in accordance with the following standards:

Vitrified Clay Pipe; ASTM C12
Flexible Thermoplastic Pipe; ASTM C600
Ductile Iron Water Mains; AWWA C600
Reinforced Concrete Pipe;

Joints for reinforced concrete pipe shall conform to Section 7 of ASTM C361, except that gaskets shall have a circular cross section and shall be confined in a groove in the pipe spigot. Pipe with collars in lieu of integral bells will not be acceptable.

Core holes and handling holes in concrete pipe shall be repaired by cementing a properly shaped concrete plug in place with epoxy cement or by other methods acceptable to the Engineer.

- B. Utilize equipment, methods and materials insuring installation to lines and grades indicated.

1. Maintain the following tolerances from true alignment and grade:

Alignment	3 inches
Grade	+/- 1 inch

Joint deflection shall not exceed the maximum allowable deflection per joint according to ASTM C 425, ASTM C 594 and AWWA C 600. Only one correction for alignment and/or grade shall be made between adjacent manholes.

2. Except where pipe sections are being encased in concrete, no pipe is to be supported by blocks.
3. Accomplish curve alignments with bends, bevels, and open joints. Limit joint opening in concrete pipe to three-eighth (3/8) inch in laying schedule and one-half (1/2) inch in actual installation. Limit joint deflection with clay, cast iron or ductile iron pipe not to exceed the maximum allowable deflection per joint according to ASTM C 425, ASTM C 594, and AWWA C 600.

- C. Install pipe of size, material, strength class, and joint type with embedment as shown on the Plans.

Reinforced concrete pipe with elliptical reinforcement shall be installed and positioned in accordance with the pipe manufacturer's pipe markings indicating top and bottom of pipe.

- D. Insofar as possible, commence laying at downstream end of line and install pipe with spigot or tongue end downstream.
- E. Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation. Close open ends of pipe with snug fitting closures. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate. Remove water, sand, mud and other undesirable materials from trench before removal of end cap.
- F. Install pipe only when weather and trench conditions are suitable. Do not lay in water. Brace or anchor pipe as required to prevent displacement after establishing final position.

3016 PIPE BEDDING. The sewer trench shall be carried to a point not less than two (2) inches below bottom of pipe bell, or less than four (4) inches below bottom of pipe barrel, whichever is greater. Crushed stone pipe bedding, compacted to full width of trench, shall then be placed and compacted to bottom of pipe with proper allowance for bell joints or couplings. After each length of pipe being laid has been shoved "home" and placed in proper alignment, it shall be securely anchored and held in position by crushed stone backfill extending to a point not less than six (6) inches above the top of the pipe bell or coupling. If unstable subgrade conditions are encountered and it is determined by the Engineer that the bedding specified will not provide suitable support for the pipe, additional excavation to the limits determined by the Engineer will be required. This additional excavation shall be backfilled with crushed stone material approved by the Engineer.

3017 JOINTING.

- A. General Requirements.
 - 1. Locate joints to provide for differential movement at changes in type of pipe embedment, concrete collars, and structures. Support pipe from wall of manhole at first joint in normal sewer trench with concrete cradle structurally continuous with base slab or footing.
 - 2. Clean and lubricate all joint and gasket surfaces with lubricant recommended by pipe manufacturer.
 - 3. Utilize methods and equipment capable of fully homing or making up joints without damage.
 - 4. Check joint opening and deflection for specification limits.

5. Examine each piece of pipe prior to installation for soundness and specification compliance.
- B. Provisions for Jointing Clay Pipe.
1. Conform with ASTM C 12, Section 8.
 2. Handle pipe having premolded joint rings or attached couplings so that no weight, including the weight of the pipe itself, will bear on or be supported by the jointing material.
- C. Provisions for Jointing Concrete Pipe. Check gasket position and condition after assembly with feeler gauge prior to installation of next section.
- D. Provisions for Jointing Ductile Iron Pipe.
1. Conform with AWWA C 600.
 2. Paint suspected damaged portions with turpentine and dust with cement to check for cracks. Remove turpentine and cement by washing when crack test is satisfactorily completed. If cracks are found, the pipe shall be rejected.
 3. Check gasket position and condition after assembly prior to installation of next pipe section.
- E. Provisions for Jointing PVC Pipe. Check gasket for position and condition after assembly prior to installation of next pipe section.

3018 CUTTING. Cut in neat workmanlike manner without damage to pipe. Observe specification regarding joint locations. Smooth cut by power grinding to remove burrs and sharp edges. Repair lining as required and approved.

3019 TEMPORARY PLUGS.

- A. Plugs. Provide and install plugs as manufactured by pipe supplier or as fabricated by Contractor and/or developer if approved. Plugs shall be water-tight against heads up to twenty (20) feet of water. Secure plugs in place in a manner to facilitate removal when required to connect pipe.
- B. Location. Plugs shall be installed as specified or where shown on Plans. Also the open end of the sewer shall be plugged at the end of the workday with a suitable mechanical plug to prevent entry of foreign material until work is resumed.

3020 CONNECTIONS TO EXISTING PIPELINES AND STRUCTURES.

- A. Connect pipe to existing structures and pipelines where indicated. Observe pertinent articles of specifications pertaining to joint locations.

- B. Prepare structure by making an opening with at least two (2) inches clearance all around fitting to be inserted. The concrete structure shall be initially cut with a concrete saw in conformance with the method and tolerances shown on the Standard Drawings. Opening between pipe and manhole wall shall be filled with an expansive grout in such a manner that a watertight condition will result.
- C. Manholes to be built on an existing sewer shall be constructed in such a manner as will not disrupt service of the existing sewer. The manhole base, walls and invert shall be completed before the top half of the sewer pipe is cut or broken away. Rough edges of the pipe thus exposed shall be covered with expansive grout, in such a manner as to produce a smooth and acceptable finish. Any portion of the existing sewer damaged by the Contractor and/or developer shall be repaired or replaced at no expense to the County.
- D. Connections between different pipe materials shall be made using proprietary transition coupling, unless otherwise specified on the Plans.

3021 TRENCH BACKFILL. Compacted backfill shall be required for the full depth of the trench above the embedment where beneath structures, street, road, or highway right-of-way, driveways, walks, parking areas, and at all locations shown on the plans or as directed by the Engineer during the progress of the work.

The top portion of the backfill beneath established sodded areas shall be finished with at least twelve (12) inches of topsoil corresponding to, or better than, that underlying adjoining sodded areas. Topsoil shall be approved by the Engineer prior to placement, and unless otherwise directed, shall be material previously excavated and stockpiled for the purpose during excavating and grading operations. Grades on areas to receive topsoil shall be established and maintained as a part of the grading operations. Immediately prior to dumping and spreading topsoil, the surface shall be loosened by discing or scarifying to a depth of two (2) inches to permit bonding of the topsoil to the underlying surface.

At the option of the Contractor and/or developer, compacted backfill may be job-excavated material or material obtained "off site", except that all street crossings shall be backfilled with MoDot Type I rock, four (4) feet back of curb to four (4) feet back of curb, unless authorized by the County Engineer. Job-excavated material may be used for compacted backfill (outside of Street Right of Ways) when the job-excavated material is finely divided and free from debris, organic material, cinders, or other corrosive material, and stones larger than three (3) inches in greatest dimension. Large masses of moist, stiff clay shall not be used. Job-excavated material shall be compacted to ninety-five (95) percent of maximum density at optimum moisture content as determined by ASTM D698 when the test is appropriate, or to seventy (70) percent relative density as determined by ASTM D2049 when that test is appropriate.

The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe.

The combination of the thickness of the layer, the method of compaction and the type of compaction equipment used shall be at the discretion of the Contractor and/or developer subject to obtaining the densities as specified above.

Backfill shall not be placed when material contains frost, is frozen, or a blanket or snow prevents proper compaction. Backfill shall not contain waste material, organic material, or debris of any kind.

Trench backfill above pipe embedment in locations other than those specified shall be compacted to ninety (90) percent of maximum density at optimum moisture content as determined by ASTM D698, unless otherwise permitted by the Engineer.

Uncompacted earth backfill material to be placed above embedments shall be free of brush; roots, more than two (2) inches in diameter; debris; cinders; or other corrosive material and junk; but may contain rubble and debris from rock excavation, stones, and boulders in certain portions of the trench depth. Uncompacted backfill material above embedments may be placed by any method acceptable to the Engineer which will not impose excessive concentrated or unbalanced loads, shock, or impact on and which will not result in displacement of installed pipe. Uncompacted backfill shall be placed to the extent necessary to prevent excessive future settlement.

Compact masses of stiff clay or other consolidated material more than one (1) cubic foot in volume shall not be permitted to fall more than five (5) feet into the trench unless cushioned by at least two (2) feet of loose backfill above pipe embedment.

No uncompacted trench backfill material containing rocks, or rock excavation detritus, shall be placed in the upper eighteen (18) inches of the trench except with specific permission of the Engineer, nor shall any stone larger than eight (8) inches in its greatest dimension be placed within three (3) feet of the top of pipe. Large stones may be placed in the remainder of the trench backfill only if well separated and so arranged that no interference with backfill settlement will result.

3022 STRUCTURE BACKFILL. Backfill around structures shall be compacted to the extent necessary to prevent future settlement by tamping or other means acceptable to the Engineer.

Material for backfill shall be composed of earth only and shall contain no wood, grass, roots, broken concrete, stones, trash, or debris of any kind. No tamped or otherwise mechanically-compacted backfill shall be deposited or compacted in water.

No backfill shall be placed over or around any structure until the concrete or mortar therein has attained a minimum strength of 2000 psi and can sufficiently support the loads imposed by the backfill without damage.

The Contractor and/or developer shall use utmost care to avoid any wedging action between the side of the excavation and structure that would cause any movement of the structure. Any damage caused by premature backfill or by the use of equipment on or near a structure will be the responsibility of the Contractor and/or developer.

Backfill shall be placed and compacted on all sides of the structure simultaneously, and operations shall be so conducted that the backfill is approximately the same elevation on all sides of the structure.

No excavated rock larger than four (4) inches maximum dimension shall be placed within one (1) foot of the exterior surface of any structure.

3023 DENSITY TESTING. At the option of the Engineer, in-place field density testing to determine compliance with specified compaction requirements may be performed using a nuclear moisture-density measuring device. Such testing shall be performed in trenches with no more than one (1) foot lifts. The field testing results shall be immediately available to the inspector. If, as a result of this field testing, the engineer determines that further compaction is required, the Contractor and/or developer shall revise his compaction procedures to obtain the results specified.

3024 DRAINAGE MAINTENANCE. Trenches across roadways, driveways, walks, or other trafficways adjacent to drainage ditches or water courses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the trafficway, to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the Contractor and/or developer. Backfilling shall be done so that water will not accumulate in unfilled or partially-filled trenches. All material deposited in roadway ditches or other water courses crossed by the line of trench shall be removed immediately after backfilling is completed and the original section, grades, and contours of ditches or water courses shall be restored. Surface drainage shall not be obstructed longer than necessary.

3025 PROTECTION OF TRENCH BACKFILL IN DRAINAGE COURSES. Where trenches are constructed in ditches or other water courses, backfill shall be protected from surface erosion. When the grade of the ditch exceeds one (1) percent, ditch checks shall be installed. Unless otherwise shown on the drawings or directed by the Engineer, ditch checks shall be concrete. Ditch checks shall extend not less than two (2) feet below the original ditch or water course bottom for the full bottom width and at least eighteen (18) inches into the side slopes and shall be at least twelve (12) inches thick.

3026 DISPOSAL OF EXCESS EXCAVATED MATERIALS. Except as otherwise permitted, all excess excavated materials shall be disposed of away from the site or work. Broken concrete and other debris resulting from pavement or sidewalk removal, excavated rock in excess of the amount permitted to be and actually installed in trench backfill, junk, and debris encountered in excavation work and other similar waste materials shall be disposed of away from the site of the work.

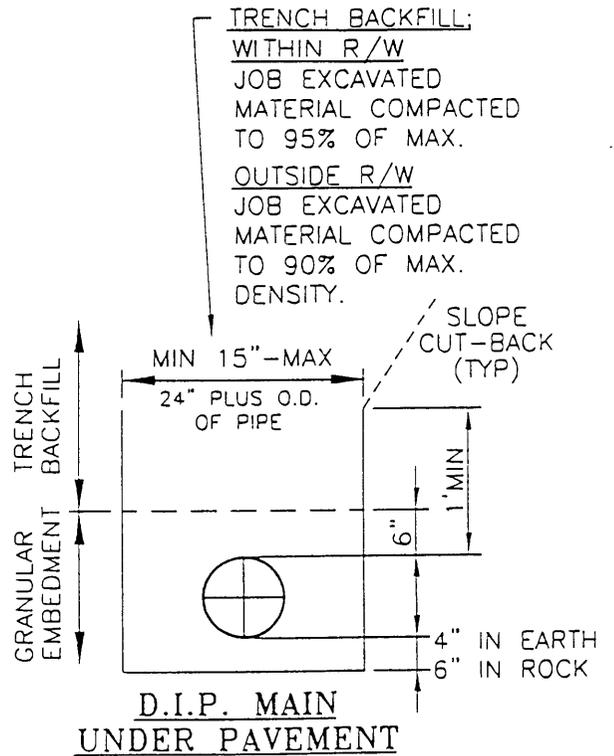
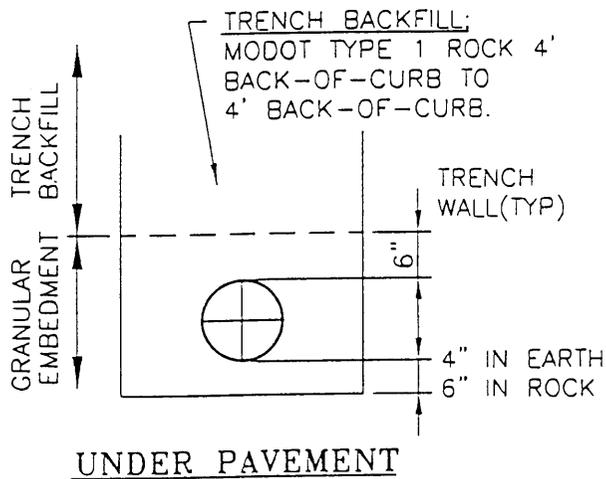
Excess earth from excavation located in unimproved property shall be distributed directly over the pipe trench and within the pipeline right-of-way to a maximum depth of six (6) inches above the original ground surface elevation at and across the trench and sloping uniformly. Drag with blade machine, or other suitable tool to a smooth, uniform surface without obstructing drainage at any point. Wasting of excess excavated material in the above manner will not be permitted where the line of trench crosses or is within a railroad, public road, or highway right-of-way. The disposal of waste and excess excavated materials, including hauling, handling, grading, and surfacing shall be a subsidiary obligation of the contractor and/or developer.

3027 SETTLEMENT. The Engineer may perform periodic inspections to insure that no settlement has occurred. The Contractor and/or developer shall be responsible for all settlement of backfill, fills and embankments, which may occur within two (2) years of time after final acceptance of the contract and/or the two (2) year developer maintenance resolution under which the work was performed.

A suitable maintenance bond in an amount approved by the County Engineer shall be furnished to Clay County by the Contractor and/or developer guaranteeing the maintenance of the construction under which the contract was performed. Said bond shall remain in effect for the period mentioned above from the date

of completion until acceptance of the work by the County or the two (2) year developer maintenance resolution is completed and the work accepted by the County.

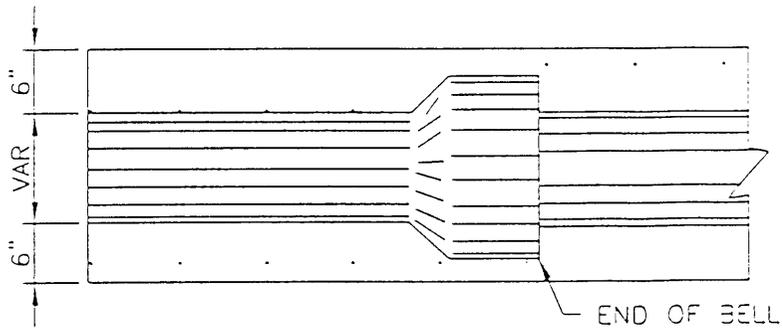
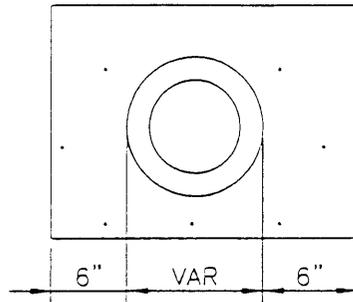
The Contractor and/or developer shall make, or cause to be made, all repairs or replacements made necessary by settlement within thirty (30) days after notice from the Engineer. Should the Contractor and/or developer fail to make such repairs, the County Engineer may cause repairs to be made and the cost of these repairs shall be the responsibility of the Contractor and/or developer.



County of Clay
HIGHWAY
DEPARTMENT/PWD

EMBEDMENT & BACKFILL
FOR SANITARY SEWERS

D30-1



FOR USE ONLY WHERE INDICATED ON PLANS THE CONCRETE ENCASEMENT SHALL BE OF MCIB 548 CONCRETE WITH A MINIMUM THICKNESS ON ALL SIDES OF 6".

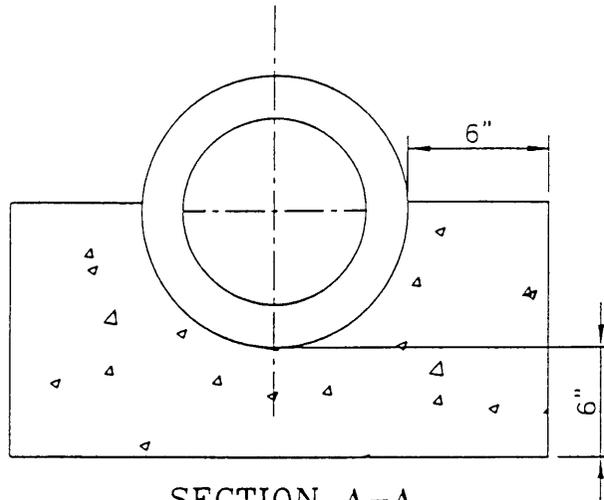
1. 8" DIA = .11 C.Y. OF CONCRETE PER LINEAL FT
2. 10" DIA = .12 C.Y. OF CONCRETE PER LINEAL FT
3. 12" DIA = .14 C.Y. OF CONCRETE PER LINEAL FT
4. 15" DIA = .15 C.Y. OF CONCRETE PER LINEAL FT



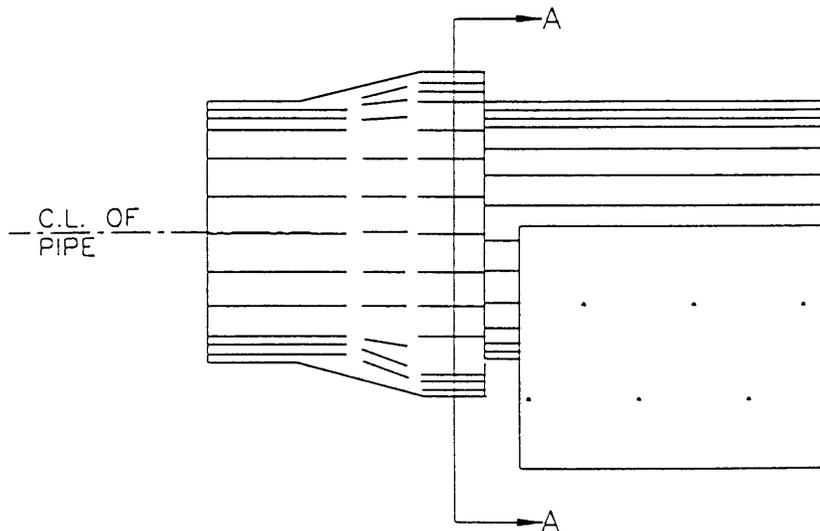
County of Clay
HIGHWAY
DEPARTMENT/PWD

CONCRETE
ENCASEMENT DETAIL

D30-2



SECTION A-A



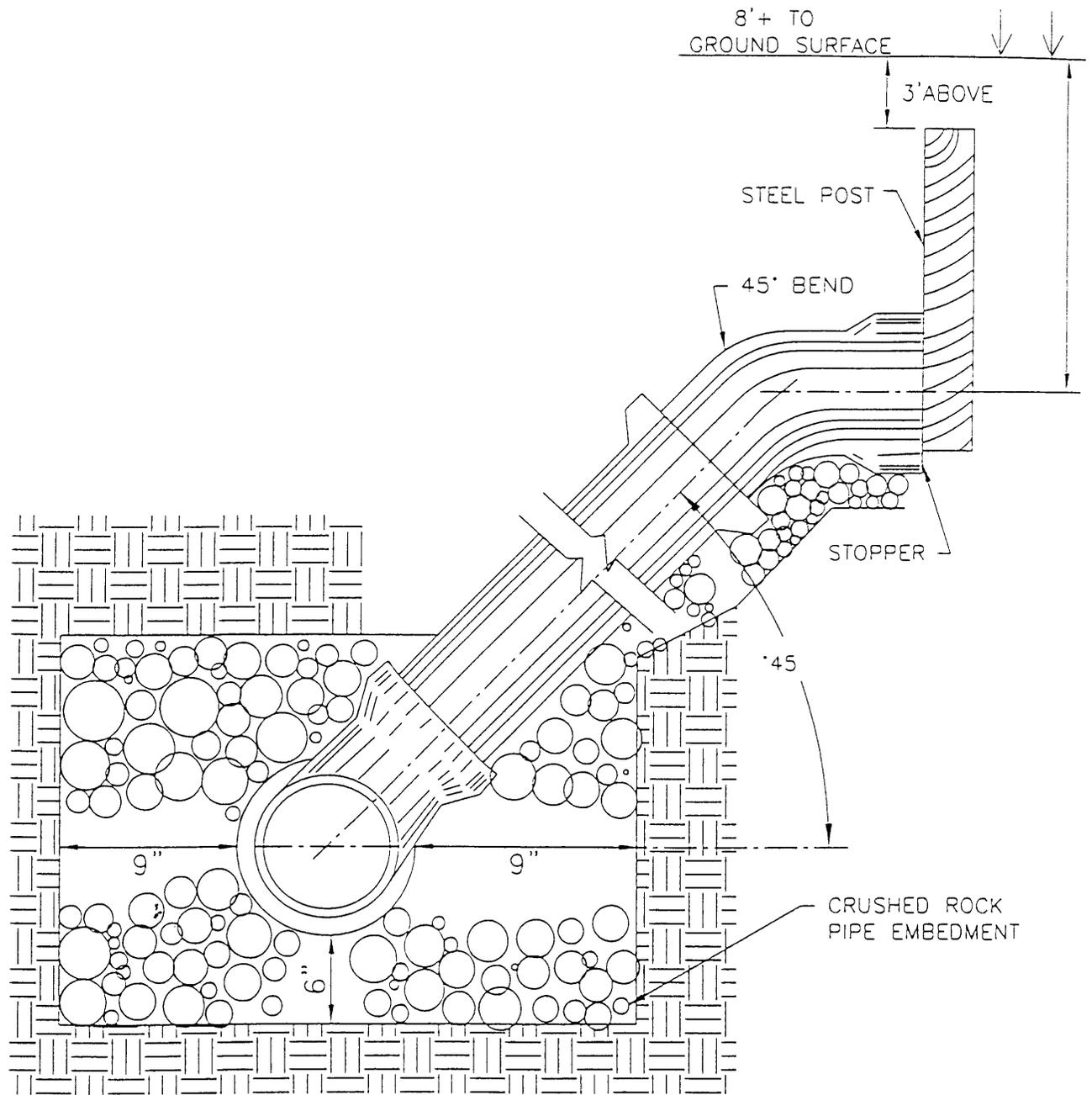
FOR USE ONLY WHERE INDICATED ON PLANS.
 THE CONCRETE SHALL BE 3000 PSI CONCRETE.
 THE MIN THICKNESS, ON THE SIDES AND BOTTOM
 SHALL BE 6" THE TOP OF THE CONCRETE SHALL
 BE AT LEAST TO THE CENTER OF THE PIPE.



County of Clay
 HIGHWAY
 DEPARTMENT/PWD

CONCRETE
 CRADLE DETAIL

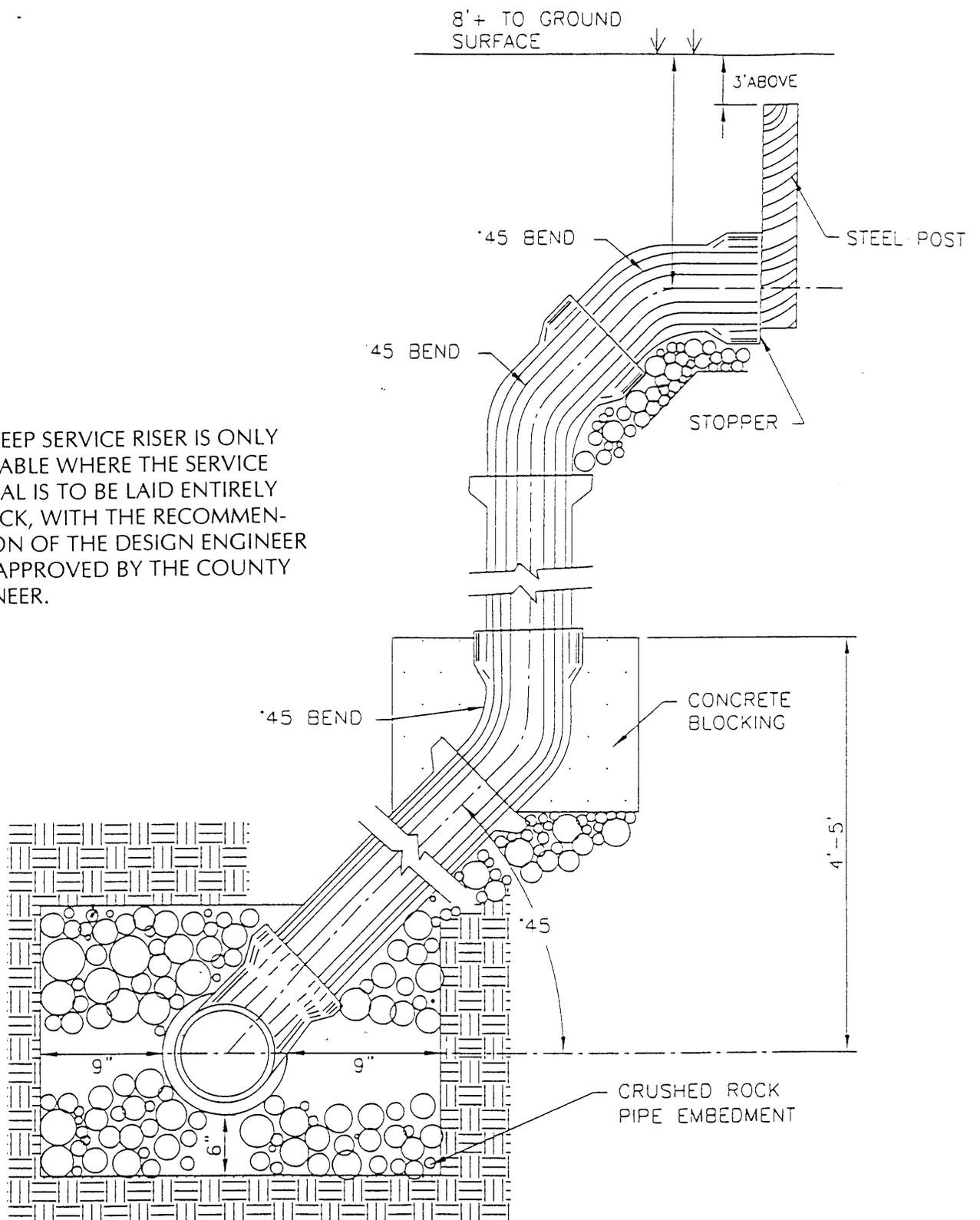
D30-3



County of Clay
 HIGHWAY
 DEPARTMENT/PWD

STANDARD DEEP TRENCH
 SERVICE RISER

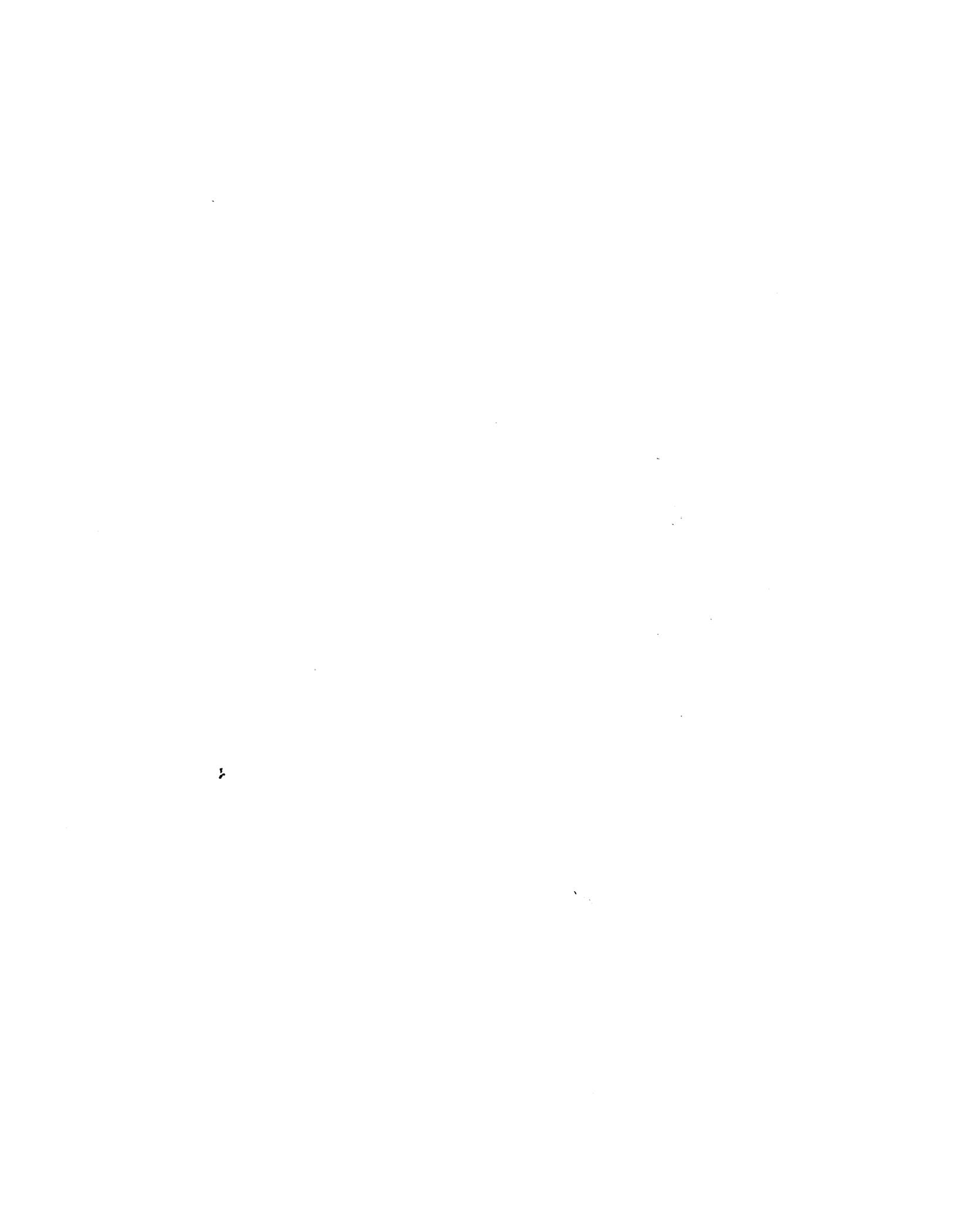
D30-4



County of Clay
HIGHWAY
DEPARTMENT/PWD

STANDARD DEEP TRENCH
SERVICE RISER

D30-5



SECTION 3100 MANHOLE AND SPECIAL STRUCTURES - SANITARY SEWERS

3101 SCOPE. This section governs the furnishing of all labor, equipment, tools, and materials, and the performance of all work incidental to the construction of manholes, drop manholes and special sewer structures complete with covers, steps, fittings and appurtenances as required for sanitary sewer construction.

3102 GENERAL. As used herein special structures refers to manholes on large sewers, special junction structures, metering stations, siphons and similar structures constructed on the pipeline.

Manholes and special structures may be constructed of precast concrete sections or cast-in-place concrete. Construction of brick masonry will not be allowed.

3103 CONSTRUCTION.

- A. General. Manholes and special structures shall be constructed at locations indicated and in accordance with details as shown on the plans or County Standard Drawings. Manholes will be constructed with eccentric cones unless otherwise approved by the County Engineer.
- B. Precast Wall and Reducing Cone Sections. Handle with care to avoid damage to joint ends of each section. Damaged sections may be subject to rejection at the discretion of the Engineer.

When using bitumastic joints, both spigot and bell end shall be primed with solvent material compatible to the adhesive in the mastic. Approved bitumastic material shall completely fill the joints so that a minimum of one-fourth (1/4) inch bead of material is visible after jointing, to be smoothed off after completion of the jointing operation.

When a flexible preformed butyl rubber or bituminous polymer compounded with modifiers is used to seal jointed sections of manholes, the extrusion of sealant from the joint is not required. The vertical spacing between manhole section shall not exceed one-fourth (1/4) inch. Preformed joint sealers shall remain flexible at temperatures as low as 0 deg. F.

All bitumastic materials or preformed flexible joint sealants shall not be applied to wet or damp surfaces.

- C. Cast-in-Place. Consolidate concrete with mechanical vibrators to eliminate entrapped air voids and rock pockets. Forms shall be supported in such a manner as to prevent any movement of the forms while concrete is being cured. Any movement of the forms may be cause for rejection.

- D. Invert Channels. Alignment of the invert channels shall be as shown on the Contract Drawings. When no specific details and dimensions are given, changes in flow direction shall be smooth, uniform and made with the longest radius possible. The cross sectional shape of invert channels shall match the lower halves of the entering and exiting pipes. The surfaces of the channels shall be troweled to produce a dense, smooth surface.

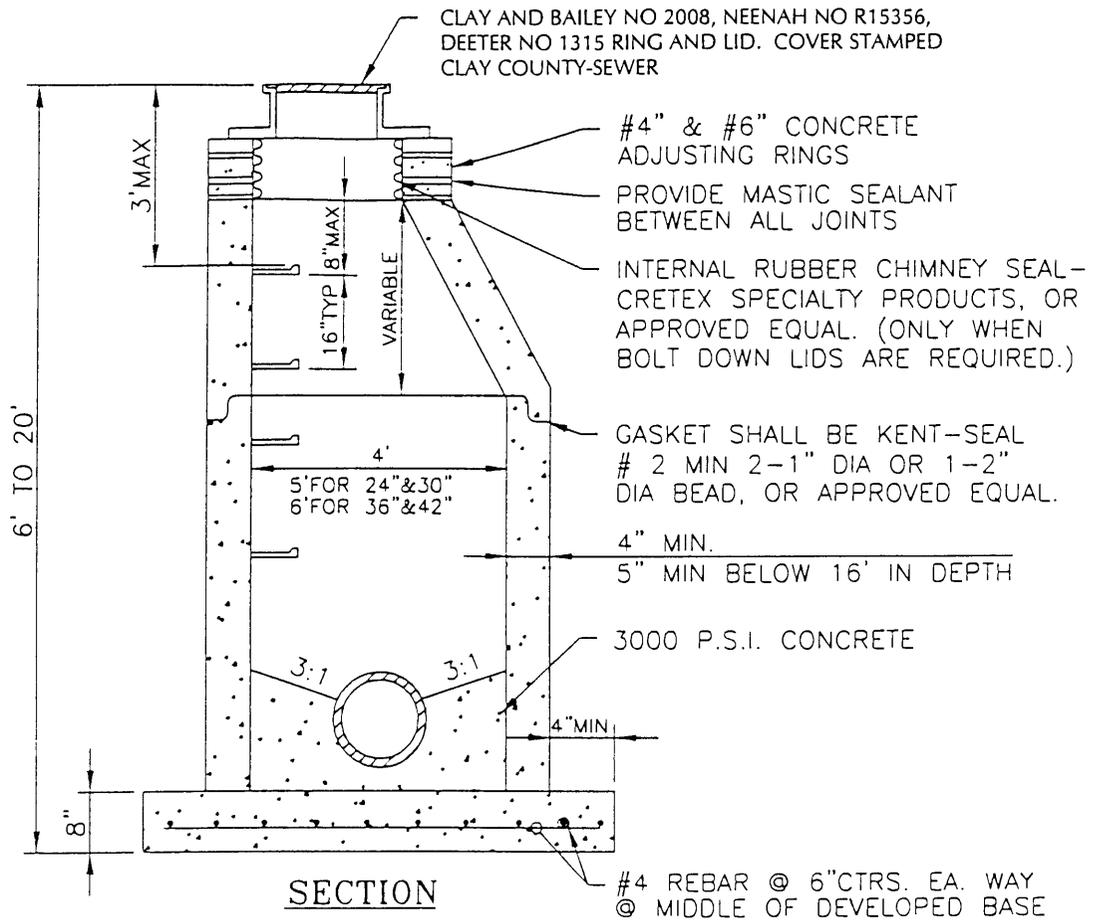
When filling openings around pipes through the manhole walls, mortar and/or masonry units shall be placed so that the resulting joints are water-tight. Mortar shall be of the non-expanding type. Mortar used in the joint closure shall not interfere with the invert channel.

3104 CURING. All masonry, plaster coating and cast-in-place concrete shall be adequately protected from freezing and loss of moisture for the first twenty-four (24) hours. The curing methods and materials to be used shall be approved by the Engineer.

3105 MANHOLE RINGS. All rings for manhole covers shall be set to match elevations indicated on the County approved plans. Each ring shall be set on one four (4) inch and one six (6) inch adjusting ring as indicated on the Standard Details. Mastic sealant shall be provided between all joints.

3106 WATER-PROOFING. Waterproofing will be required on the exterior surface of manhole structures from base to manhole rings. Precast manholes will be shop coated. The waterproof coating shall be Koppers Company, Inc. Bitumastic No. 50 or Tnemec Company, Inc. asphalt base foundation coat and shall consist of two coats wet thickness of 22-26 mils with a combined dry thickness of 31 mils. The coating shall be applied in sufficient quantity so that no bare or thin spots show. The coating shall be applied in sufficient time to permit proper curing prior to backfilling the excavation. Proper methods and material shall be used during backfilling to prevent damage to the coating. Any damage to the coating which does occur shall be immediately repaired.

3107, INTERNAL OR EXTERNAL RUBBER CHIMNEY SEAL. An internal rubber chimney seal as manufactured by Cretex Specialty Products or approved equal shall be installed, sealing all joints from the manhole frame to the corbel. Internal rubber chimney seal extension shall be used if necessary.



NOTES:

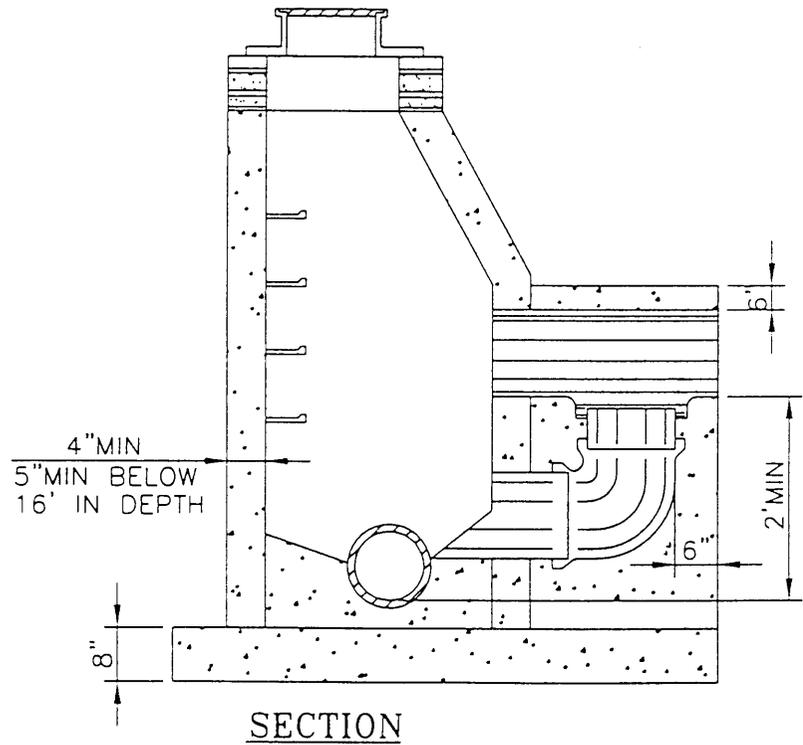
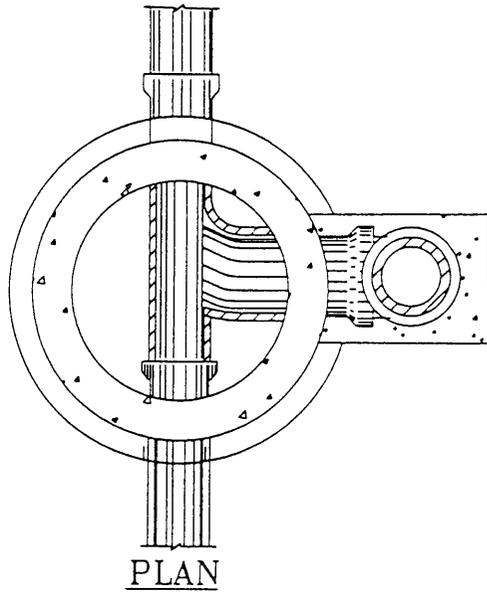
1. PRECAST CONCRETE MANHOLES SHALL CONFORM TO ASTM C478 EXCEPT AS MODIFIED BY THE SPECIFICATIONS.
2. BASES NOT BUILT MONOLITHIC WITH BOTTOM SECTION SHALL BE POURED OF 3000 PSI CONCRETE.
3. MANHOLE MAY BE TRANSITIONED TO 4' DIA., 8' ABOVE F.L. OF OUTFALL FOR 5' & 6' MANHOLES.
4. THE BOTTOM SECTION OF ALL PRECAST MANHOLES NOT BUILT MONOLITHIC WITH THE BASE SHALL BE SET INTO A STEEL REINFORCED POURED CONCRETE BASE A MIN OF 4". (#4 @ 6" E.W.)
5. WATERPROOFING WILL BE REQUIRED ON THE EXTERIOR SURFACE OF MANHOLE STRUCTURES FROM BASE TO MANHOLE RINGS. PRECAST MANHOLES WILL BE SHOP COATED. THE WATERPROOF COATING SHALL BE KOPPERS COMPANY, INC. BITUMASTIC NO. 50 OR TNE MEC COMPANY, INC. ASPHALT BASE FOUNDATION COAT AND SHALL CONSIST OF TWO COATS WET THICKNESS OF 22-26 MILS WITH A COMBINED DRY THICKNESS OF 31 MILS.
6. THE COMPRESSIVE STRENGTH OF CONCRETE USED IN THE CONSTRUCTION OR PRECAST REINFORCED CONCRETE MANHOLES SHALL NOT BE LESS THAN 4000 PSI.
7. ONLY ECCENTRIC MANHOLE CONES WILL BE ALLOWED UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
8. ADDITIONAL BASE THICKNESS FOR MANHOLES GREATER THAN 20' DEEP SHALL BE APPROVED BY CITY ENGINEER WITH SUBMITTAL OR APPROPRIATE CALCULATIONS.



County of Clay
HIGHWAY
DEPARTMENT/PWD

STANDARD PRECAST
MANHOLE DETAIL

D31-1



1. FOR ALL DIMENSIONS NOT SHOWN, SEE STANDARD MANHOLE DETAIL.
2. WATERPROOFING WILL BE REQUIRED ON THE EXTERIOR SURFACE OF MANHOLE STRUCTURES FROM BASE TO MANHOLE RINGS. PRECAST MANHOLES WILL BE SHOP COATED. THE WATERPROOF COATING SHALL BE KOPPERS COMPANY, INC. BITUMASTIC NO. 50 OR TNEMEC CO., INC. ASPHALT BASE FOUNDATION COAT AND SHALL CONSIST OF TWO COATS WET THICKNESS OF 22-26 MILS WITH A COMBINED DRY THICKNESS OF 31 MILS.

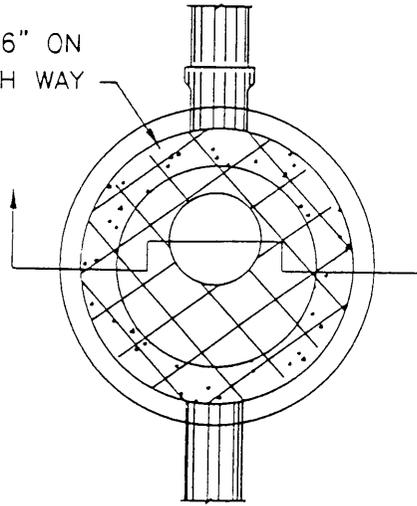


County of Clay
HIGHWAY
DEPARTMENT/PWD

STANDARD DROP
MANHOLE DETAIL

D31-2

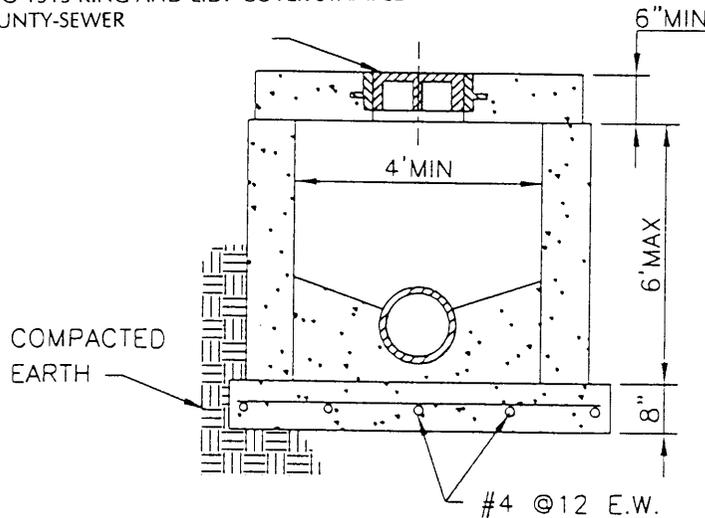
#5 BARS AT 6" ON CENTERS EACH WAY



PLAN

USE OF A STANDARD LID AND RING WILL BE ALLOWED WHERE GRADE PERMITS (SEE SPEC. FOR APPROVED TYPES)

CLAY AND BAILEY NO 2008, NEENAH NO R15356, DEETER NO 1315 RING AND LID. COVER STAMPED CLAY COUNTY-SEWER



SECTION

NOTE:

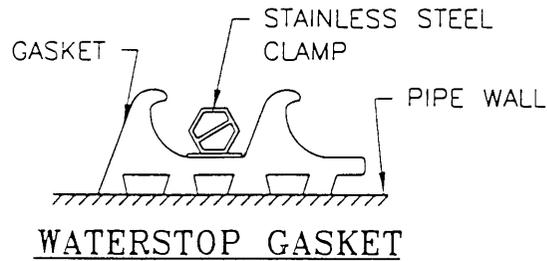
1. WATERPROOFING WILL BE REQUIRED ON THE EXTERIOR SURFACE OF MANHOLE STRUCTURES FROM BASE TO MANHOLE RINGS. PRECAST MANHOLES WILL BE SHOP COATED. THE WATERPROOF COATING SHALL BE KOPPERS COMPANY, INC. BITUMASTIC NO. 50 OR TNEMEC CO., INC. ASPHALT BASE FOUNDATION COAT AND SHALL CONSIST OF TWO COATS WET THICKNESS OF 22-26 MILS WITH A COMBINED DRY THICKNESS OF 31 MILS.
2. FOR ALL DIMENSIONS NOT SHOWN, SEE STANDARD MANHOLE DETAIL.



County of Clay
HIGHWAY
DEPARTMENT/PWD

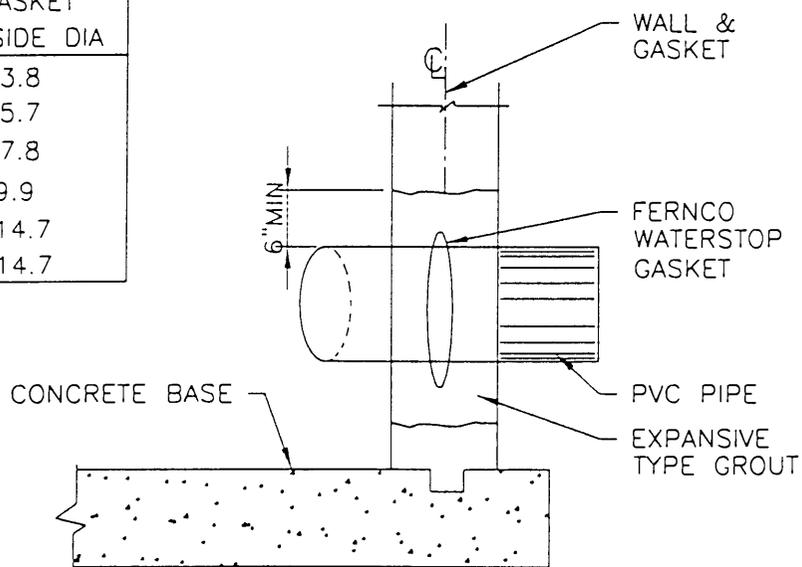
STANDARD SHALLOW
MANHOLE DETAIL

D31-3



DIMENSION TABLE FOR
WATERSTOP GASKET

NOMINAL PIPE SIZE	GASKET INSIDE DIA
4	3.8
6	5.7
8	7.8
10	9.9
12	14.7
15	14.7



NOTES:

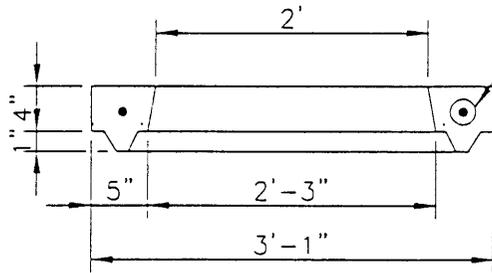
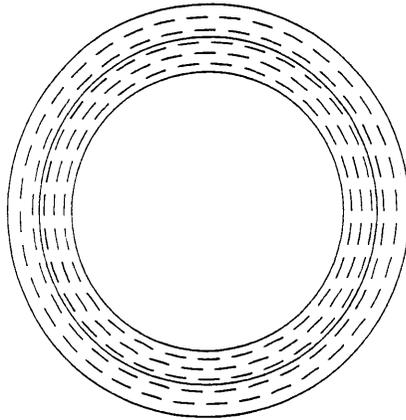
1. WATERSTOP GASKET - GASKET CROSS SECTION SHALL BE EQUAL TO HAMILTON KENT DIE NO 2347.
2. CLAMP - CLAMPS SHALL BE WORM DRIVE WITH 3/8" HEX HEAD SLOTTED SCREW WITH 9/16" WIDE BAND WHICH IS CONTINUOUSLY GEAR SLOTTED ALL AROUND. CLAMPS SHALL BE ALL STAINLESS STEEL-BAND AND A HOUSING OF 300 SERIES AND WORM SCREW OF 400 SERIES S.S. CLAMPS SHALL BE EQUAL TO IDEAL, 64 SERIES OR 68 SERIES, 0.024" THICK.
3. INSTALLATION - STRETCH GASKET AND SLIP OVER PIPE INTO POSITION. PLACE CLAMP OVER GASKET AS SHOWN ABOVE AND TIGHTEN WORM DRIVE TO 10'LBS TORQUE. ENCASE IN EXPANSIVE TYPE CEMENT GROUT FOR 4" MIN COVER ALL AROUND. GROUT SHALL BE A METALLIC ADDITIVE NON-SHRINK TYPE EQUAL TO MASTER BUILDERS "EMBECO".



County of Clay
HIGHWAY
DEPARTMENT/PWD

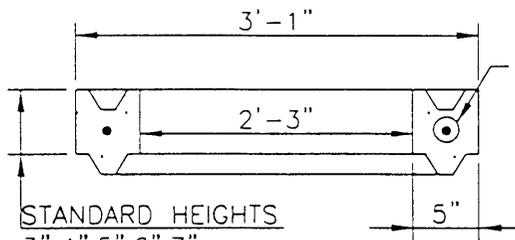
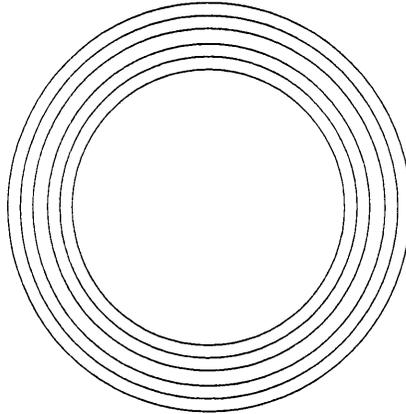
MANHOLE CONNECTIONS
W/PVC SEWER PIPE

D31-4



#4 WIRE
CENTERED

REDUCER
GRADE RING
WEIGHT: 165 LB.



#4 WIRE
CENTERED

GRADE RING
WEIGHT: 41 LB./V IN.

STANDARD HEIGHTS
3", 4", 5", 6", 7",
8", 10", 12"

NOTES:

GRADE RINGS SHALL MEET REQUIREMENTS OF
ASTM DESIGNATION C-478-80 STANDARD
SPECIFICATION FOR PRECAST REINFORCED
CONCRETE MANHOLE SECTIONS.

CONCRETE: 4000 P.S.I.

REINFORCEMENT: #4 WIRE, ASTMA-82



County of Clay
HIGHWAY
DEPARTMENT/PWD

GRADE RINGS

D31-5

SECTION 3200 ACCEPTANCE TESTS FOR SANITARY SEWERS

3201 SCOPE. This section governs the furnishing of all labor, equipment, tools and materials, and the performance of any or all acceptance tests as required by the Plans, Special Provisions, and these specifications.

3202 ACCEPTANCE TESTS FOR GRAVITY SEWERS.

A. Visual Inspection

1. Contractor and/or developer shall clean pipe of excess mortar, joint sealant and other dirt and debris prior to inspection.
2. Sewer will be inspected by flashing a light between manholes, running a TV camera the full length of the line and recording on tape (tape to be retained by the County) and/or by physical passage where space permits. Determine from illumination, TV and/or physical inspection, the presence of any misaligned, displaced, or broken pipe and the presence of visible infiltration or other defects. The pipe between successive manholes shall not be more than one-fourth (1/4) of the pipe diameter out of alignment.
3. Correct defects as required prior to conducting leakage tests.

B. Leakage Tests. A leakage test shall be performed on the full length of all sewer lines prior to acceptance.

1. Exfiltration Leakage Test.

- a. Contractor and/or developer may perform leakage testing by exfiltration on sewer pipe larger than eighteen (18) inches I.D.
- b. Furnish all labor, equipment, tools and materials required including bulkheads, water and all miscellaneous items required to perform the tests.
- c. Test all sewer pipe over eighteen (18) inches I.D. after either the completed backfill or partial backfill sufficient to stabilize the position of the pipe in both alignment and grade is accomplished. Contractor and/or developer may select section of the project for testing at any time by notifying the Engineer twenty-four (24) hours in advance.
- d. Perform at depths of water as measured above center line of pipe of not less than two (2) feet nor more than ten (10) feet (consideration shall be given for water table above said centerline).

- e. Maintain test as necessary to locate all leaks but not less than two (2) hours.
- f. Repeat as necessary after repair of leaks and defects until leakage, as measured, does not exceed 0.15 gallons per inch of internal diameter per hour per 1000 feet of pipe length (200 gal/inch of I.D./day/mile).
- g. Protect manholes and other structures by means of bulkheads to prevent bursting pressures from being applied inside the structure.
- h. De-water pipe upon completion of testing.

2. Air Leakage Testing.

- a. Contractor and/or developer shall perform air tests for all pipe sizes.
- b. Furnish all facilities required including necessary piping connections, test pumping equipment, pressure gauges, bulkheads, regulator to avoid over pressurization, and all miscellaneous items required.

(1). The pipe plug for introducing air to the sewer line shall be equipped with two taps. One tap will be used to introduce air into the line being tested, through suitable valves and fittings, so that the input air may be regulated. The second tap will be fitted with valve and fittings to accept a pressure test gauge indicating internal pressure in the sewer pipe. An additional valve and fitting will be incorporated on the tap used to check internal pressure so that a second test gauge may be attached to the internal pressure tap. The pressure test gauge will also be used to indicate loss of air pressure due to leaks in the sewer line.

(2). The pressure test gauge shall meet the following minimum specifications:

Size (diameter)	4-1/2 inches
Pressure Range	0-15 P.S.I.
Figure Intervals	1 P.S.I. Increments
Minor Subdivisions	0.05 P.S.I.
Pressure Tube	Bourdon Tube or Diaphragm
Accuracy	+/- 0.25% of maximum scale reading
Dial	White coated aluminum with black lettering, 270 deg. Arc and mirror edge.
Pipe Connection	Low Male 1.2" N.P.T.

Calibration data will be supplied with all pressure test gauges. Certification of pressure test gauge will be required from the gauge manufacturer. This certification data shall be up to date (within one (1) year from test) will be available when tests are performed

- c. Test each reach of sewer pipe between manholes after completion of the installation of pipe and appurtenances and the backfill of sewer trench.
- d. Plug ends of line and cap or plug all connections to withstand internal pressure. One of the plugs provided must have two taps for connecting equipment. After connecting air control equipment to the air hose, monitor air pressure so that internal pressure does not exceed 5.0 psig. After reaching 4.0 psig throttle the air supply to maintain between 4.0 and 3.5 psig for at least two (2) minutes in order to allow equilibrium between air temperature and pipe walls. During this time, check all plugs to detect any leakage. If plugs are found to leak, bleed off air, tighten plugs, and again begin supplying air. After temperature has stabilized, the pressured is allowed to decrease to 3.5 psig. At 3.5 psig, begin timing to determine the time required for pressure to drop from 3.5 psig to 2.5 psig. If the time, in seconds, for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than that shown in the table below, the pipe shall be presumed free of defects.

Pipe size	Required Time per 100 LF	Maximum Required Time
8"	70 sec	227 sec
10"	110 sec	283 sec
12"	158 sec	340 sec
15"	248 sec	425 sec
18"	356 sec	510 sec
21"	485 sec	595 sec
24"	634 sec	680 sec
27"	765 sec	765 sec
30"	851 sec	851 sec
33"	935 sec	935 sec

If air test fails to meet above requirements, repeat test as necessary after all leaks and defects have been repaired. Prior to acceptance all constructed sewer lines shall satisfactorily pass the low pressure air test.

- e. In areas where ground water is know to exist, install a one-half (1/2) inch diameter capped pipe nipple, approximately ten (10) inches long, through manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, ground water level shall be determined by removing pipe cap, blowing air through pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to pipe nipple. The hose shall be held vertically and a measurement of height in feet of water shall be taken after the water stops rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings.

- C. Deflection Tests. A deflection test shall be required on all installations involving flexible or semi-rigid pipe after said pipe has been laid and backfilled. The maximum allowable deflection shall not exceed 5.0% of the pipe's internal diameter. The deflection test shall consist of guiding a devise of the appropriate size for the pipe involved to accurately measure any deflection in the pipe. The devise to be used shall be approved by the County Engineer prior to its use. Attention is directed to the fact that the pipe's nominal diameter is greater than the actual internal diameter of the pipe. Lamping or other visual testing will not be approved as a substitution for deflection testing.

Upon completion of the testing, all piping showing a deflection greater than 5.0% shall be excavated, replaced, backfilled, and retested to the satisfaction of the Engineer.

3203 ACCEPTANCE TESTS FOR PRESSURE SEWAGE FORCE MAINS.

- A. Perform hydrostatic pressure and leakage tests. Conform to AWWA C 600 procedures as modified herein. Test shall apply to all pressure sewers. Perform after backfilling.
- B. Test separately in segments between sectionalizing valves, between a sectionalizing valve and a test plug, or between test plugs. Select test segments such that adjustable seated valves are isolated for individual checking. Contractor and/or developer shall furnish and install test plugs at no additional cost to the Owner, including all anchors, braces, and other devices to withstand hydrostatic pressure on plugs. Contractor and/or developer shall be responsible for any damage to public or private property caused by failure of plugs. Limit fill rate of line to available venting capacity.

- C. Pressure Test. Conduct at 1.5 time, maximum operating pressure determined by the following formula:

$P_{pt} = 0.650 (OP-GE)$, in which P_{pt} = test pressure in psi at gauge elevation.

OP = operating pressure in feet as indicated for highest elevation of the hydraulic gradient of each section of the line.

GE = elevation in feet at center line of gauge.

Perform satisfactorily prior to determining leakage.

- D. Leakage Test. Conduct at maximum operating pressure determined by the following formula:

$P_{lt} = 0.433 (OP-GE)$, in which P_{lt} = test pressure in psi at gauge elevation

OP and GE - as in previous article

3204 ACCEPTANCE TEST FOR MANHOLES:

- A. Visual Inspection.

All precast concrete manholes shall be visually inspected to determine the presence of misaligned, displaced, broken manhole sections or other physical defects. All defects shall be satisfactorily corrected prior to conducting vacuum leakage tests.

- B. Vacuum leakage tests:

Each manhole shall be tested immediately after assembly and prior to backfilling. All lifting holes shall be plugged with non-shrink grout. No standing water shall be allowed in the excavation during testing.

- C. Vacuum testing procedure:

All pipes entering the manhole shall be plugged, taking care to securely brace the plugs from being drawn into the manhole. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendation. A vacuum of at least ten and one half (10 1/2) inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum drop from ten (10) inches to nine (9) inches. The manhole shall pass if the time is greater than two (2) minutes for a forty eight (48) inch diameter manhole, two and one half (2 1/2) minutes for sixty (60) inch manholes and three (3) minutes for seventy two (72) inch manholes. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained. If the joint mastic or gasket is displaced during the vacuum testing, the manhole shall be disassembled, the real replaced and the manhole retested.

4000 MATERIALS AND CONSTRUCTION - STORM SEWERS

4001 SCOPE. Storm sewer construction shall consist of furnishing all labor, materials, and equipment necessary for the complete installation of storm sewers and appurtenances. Unless otherwise noted within these specifications, the word "sewers" shall refer to pipe sewers, or open channels.

4002 SPECIFICATION MODIFICATION. It is understood that throughout this section these specifications may be modified or deleted by appropriate items in the Special Provisions or notes on the contract drawings.

4003 REVISIONS OF STANDARDS. When reference is made to a standard specification (ASTM, MCIB, etc.), the specification referred to shall be understood to mean the latest revision of said specification as amended at the time of the Notice to Bidders, except as noted on the contract drawings or as provided for in the Special Provisions.

4004 MATERIALS

A. Reinforced Concrete Pipe:

1. Reinforced concrete pipe shall conform to the following ASTM Standards and be of the minimum strength designated herein or such higher strength as may be required by the Plans or Special Provisions:
 - a. Round Pipe: ASTM C-76, Class III, Wall B.
 - b. Elliptical Pipe: ASTM C-507, Class HE-III.
 - c. Arch Culvert Pipe: ASTM C-506, Class A-III.
2. Joints:
 - a. Flexible Gasket: Flexible gaskets may be either flat gaskets cemented to the pipe tongue or spigot, O-ring gaskets, or roll-on gaskets. All gaskets shall conform to ASTM C-433.
 - b. Cement Mortar: Cement mortar shall consist of one part Type I portland cement by volume to three parts sand conforming to ASTM C-144 by volume mixed with sufficient water to form a workable stiff mortar paste.
 - c. Plastic Compound: This compound shall be a homogeneous blend of bituminous material, inert filler and suitable solvents or plasticizing compounds thoroughly mixed at the factory to a uniform consistency suitable for sealing joints of concrete pipe. The compound shall conform to the following requirements:

Bitumin, soluble in CS, percent by weight, minimum	.45%
Ash, percent by weight	15-50%
Penetration, standard cone	150g, 5 seconds, 25 C
Trowel grade, bulk type	110-250mm
Extruded rope or flat tape type	50-120mm

d. Preformed Plastic Compound: This compound shall be either rope form or flat tape form conforming to Federal Specification SS-S-210A. Primer, as recommended by the manufacturer, shall be used to maintain the material in position while pipe sections are being joined.

B. Corrugated Steel Pipe. Pipe and coupling bands shall conform to the requirements of AASHTO M-36. Bituminous and/or other coatings shall be provided when required by the special Provisions. Bituminous coating shall conform to AASHTO M-190. Minimum thickness of the metal after galvanizing shall be as follows:

Circular Culvert Pipe

(2 2/3" x 1/2" corrugations)

<u>Under Roadways or In Street Right-of-Way</u>		<u>Under Railroads</u>		<u>Not under Roadways</u>	
Minimum Diameter Thickness		Minimum Diameter Thickness		Minimum Diameter Thickness	
15-21"	.064"	15-18"	.079"	15-30"	.064"
24-30"	.079"	21-24"	.109"	36-54"	.079"
36-54"	.109"	30-36"	.138"	60-84"	.109"
60-72"	.138"	42-84"	.168"		
84"	.168"				

Circular Culvert Pipe

(3" x 1" corrugations)

<u>Under Roadways or In Street Right-of-Way</u>		<u>Not under Roadways</u>	
Minimum Diameter Thickness		Minimum Diameter Thickness	
36-54"	.079"	36-54"	.064"
60-84"	.109"	60-84"	.079"

Circular Culvert Pipe
(5" x 1" corrugations)

Under Roadways or In
Street Right-of-Way

Not under Roadways

Minimum
Diameter Thickness
36-54" .079"
60-84" .109"

Minimum
Diameter Thickness
36-54" .064"
60-84" .079"

Arch Culvert Pipe
(2 2/3" x 1/2" corrugations)

<u>Equivalent Diameter</u>	<u>Minimum Thickness</u>	<u>Span*</u>	<u>Rise*</u>
15"	.064	17"	13"
18"	.064	21"	15"
21"	.064	24"	18"
24"	.079	28"	20"
30"	.079	35"	24"
36"	.109	42"	29"
42"	.109	49"	33"
48"	.109	57"	38"
54"	.109	64"	43"
60"	.138	71"	47"

*Subject to manufacturing tolerances.

Arch Culvert Pipe
(2 2/3" x 1/2" corrugations)

<u>Equivalent Diameter</u>	<u>Minimum Thickness</u>	<u>Span*</u>	<u>Rise*</u>
36"	.046	40"	31"
42"	.064	46"	36"
48"	.064	53"	41"
54"	.079	60"	46"
60"	.079	66"	51"
66"	.079	73"	55"
72"	.079	81"	59"
78"	.109	87"	63"
84"	.109	95"	67"
90"	.109	103"	71"

*Subject to manufacturing tolerances.

<u>Minimum Thickness</u>	<u>Equivalent Nominal Gage</u>
.064	16
.079	14
.109	12
.138	10

- C. Structural Plate Pipe and Pipe Arches. Structural plate shall conform to the requirements of AASHTO M-167. Corrugations shall have a depth of two (2) inches and a pitch of six (6) inches, and be galvanized with a zinc coating of 2.0 ounces per square foot for plates 0.168 inch and less thickness, and 3.0 ounces per square foot for plates greater than 0.168 inches in thickness. Bolts, nuts, and washers for connecting plates shall be galvanized in accordance with AASHTO M-232. Bolts shall be not less than three-fourths (3/4) inch diameter and conform to ASTM A-449. Nuts shall conform to ASTM A-563, Grade C.

4005 CONSTRUCTION DETAILS.

- A. Trench Excavation. Trenches shall be excavated to the width and depth as necessary to lay the sewer pipe to the grade line as indicated on the plans. Deviation from plan line and grade will not be permitted except under special circumstances subject to approval of the Engineer. The materials to be excavated are to be deposited on the sides of trenches and excavations, and beyond the reach of slides, or transported to the spoil banks, or used for backfilling. The length of the trench excavation opened at one time shall be limited depending on the nature of the soil or other safety considerations.

Trenches shall be excavated to a width, which will provide adequate working space and pipe clearances for proper pipe installation, jointing and embedment. However, the limiting trench widths must comply with bedding class requirements as shown on the plans. Over excavation shall be replaced with granular bedding material.

1. Unclassified Excavation. Unclassified excavation is defined as the removal of all material encountered regardless of its nature. All material excavated will be considered as Unclassified Excavation unless the Special Provisions specify Classified Materials.
2. Rock Excavation: Rock excavation is defined as the removal of all rock ledges six (6) inches or more in thickness, and detached rock or boulders having a volume of more than one & one half (1 1/2) cubic yards and shale occurring in its natural state, hard and unweathered.

A rock ledge is defined as a continuous body of rock, which may include interbedded seams of shale or other soft materials. Suck interbedded soft material seams less than twelve (12) inches in thickness will be included in the measurement of rock excavation. Such seams twelve (12) inches or

greater in thickness will be included only in the measurement of earth excavation. No soft or disintegrated rock which can be removed with a pick or digging machine, no loose, Shaken or previously blasted rock, no broken stones, and no rock which may fall into the trench from outside the limits of excavation will be included. When solid rock is encountered in the trench, it shall be stripped of earth, and the Engineer notified. When blasting is permitted by the Engineer, the Contractor and/or developer shall use the utmost care to protect life and property. The Contractor and/or developer shall comply with all laws, ordinances, and applicable safety code requirements and regulations relative to the handling, storage and use of explosives and protection of life and property, and he shall be responsible for all damage thereto caused by his or his subcontractor and/or developer's operations.

When blasting is required for rock excavation, all such operations shall conform to the requirements set forth in section 7000 entitled "Blasting".

3. Earth Excavation. Earth excavation is defined as the removal of all material not defined as rock.
4. De-watering. The Contractor and/or developer shall remove any water which may accumulate, or be found in the trenches and other excavations made under the Contract.

The Contractor and/or developer shall form all dams, flumes or other works necessary to keep them clear of water while the sewers and their foundation, and other foundations works, are being constructed. All water shall be removed from such excavation in a manner to not damage property.

5. Cribbing and Sheeting. The Contractor and/or developer shall furnish, install, and maintain such sheeting, bracing, etc., as may be required to support any excavation and to prevent any movement which could in any way injure or delay the work or endanger adjacent pavement, building or other structures. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed they shall be immediately filled and consolidated.

For the purpose of preventing injury or property damage, the Contractor and/or developer may leave in place all sheeting or bracing, etc., to be embedded in the backfill of the trench. No sheeting or bracing, however, shall be left in place within five (5) feet of the surface without the written permission of the Engineer.

Whenever timber or other sheeting is driven to a depth below the elevation of the top of the pipe, or whenever any sheeting is driven for protection of trench walls in water bearing soil, the Engineer shall determine whether or not this section of the sheeting may be removed. Should he determine that any portion of this sheeting must be left in place, it shall be considered as "Extra Work" and will be compensated for on such a basis.

6. Unstable Foundation. Where materials are encountered in the bottom of the trench which are deemed as unsuitable by the Engineer to afford a sufficiently stable pipe foundation, the materials shall be removed to a depth and limits as ordered by the Engineer. Areas undergraded shall be backfilled with approved granular material or materials meeting the approval of the Engineer.
7. Protection of Property. The contractor and/or developer shall satisfactorily shore, support, and protect any and all structures and all pipes, sewers, drains, conduits, and other facilities, and shall be responsible for any damage resulting thereto. The Contractor and/or developer shall not be entitled to any damages or extra pay on account of any postponement, interference, or delay caused by any such structures and facilities being on the line of work, whether they are shown on the plans or not; specifically, but not limited to damage due to delay in utility relocation.

B. Laying and Jointing:

1. Handling and Protection: All pipe shall be protected during installation against shock and free fall, and be installed without cracking, chipping, breaking, bending, or damage to coating materials. Damaged pipe materials shall be replaced with new materials except as repair may be permitted by the Engineer.
2. Grade Control. Maximum deviation from plan line or grade of any pipe after installation and backfilling shall not be greater than 0.1 foot. All pipe shall have a continuous slope free from depressions that will not drain. The Contractor and/or developer shall establish such grade control devices as are necessary to maintain the above tolerances.
3. Laying. The laying of pipe in finished trenches shall be commenced at the lowest point and installed with the bell end forward or upgrade. All pipe shall be laid with ends abutting and true to line and grade. They shall be carefully centered so that when laid they will form a sewer with a uniform invert.
4. Bedding. The class of bedding required shall be as indicated on the plans or standard details. Bedding shall be rodded, spaded, and compacted as necessary to provide firm uniform support for the pipe; and not subject it to settlement or displacement.
5. Jointing. Preparatory to making pipe joints, all surfaces of the portions of the pipe to be jointed shall be clean and dry. Lubricants, primers, adhesives, etc. that are used shall be compatible with the jointing material recommended or specified. All bell and spigot ends of concrete pipe shall be primed prior to application of trowelable bitumastic plastic compound.

Trenches shall be kept water-free and as dry as possible during bedding. Laying and jointing, and for as long a period as required to protect the pipe joints and concrete structures.

As soon as possible after the joint is made, sufficient material shall be placed alongside each side of the pipe to offset conditions that might tend to move the pipe off line and grade.

a. Concrete Pipe:

- (1) Plastic joint sealant shall be applied to the tongue or spigot prior to the insertion into the bell or groove. A sufficient amount of sealant shall be used to fill the annular joint space with some squeeze out. Wipe the outside surface of the joint with additional material to assure a complete seal.
- (2) Mortar. When cement mortar is used the joint surface shall be clean and soaked with water immediately before the joint is made. A layer of mortar shall be placed in the loser portion of the bell or groove of the installed pipe and on the upper portion of the tongue or spigot of the pipe section to be installed. The tongue or spigot shall then be inserted into the bell or groove of the installed pipe until the mortar is squeezed out on both the interior and exterior surfaces. The annular joint space shall be completely filled and abutting joint sections flush and even, with excess mortar stuck off.
- (3) Flexible Gaskets. Flat gaskets may be cemented to the pipe tongue or spigot. O-ring gaskets shall be recessed in the groove of the pipe tongue or spigot and confined by the bell or groove after the joint is completed. Roll-on gaskets shall be placed around the tongue or spigot and rolled into position as the joint is assembled. Flat gaskets and o-ring gaskets shall be lubricated as recommended by the manufacturer.

- b. Corrugated Steel Pipe. Corrugated steel pipes shall be joined with a band type of coupling. The band shall be drawn and secured on the pipe by connecting devices as furnished by the manufacturer. Pipe ends for annular corrugations shall be identical to the rest of the pipe barrel (plain ends), or in the case of helical pipe, the pipe ends at the joint shall be reformed to an annular corrugation or flange (reformed end). Gaskets, if required, shall be furnished in accordance with the plans and Special Provisions.

C. Trench Backfill.

1. Compacted backfill shall be required for the full depth of the trench above the embedment where beneath structures, street, road, or highway right-of-way, driveways, walks, parking areas, and at all locations shown on the plans or as directed by the Engineer during the progress of the work.
2. The top portion of the backfill beneath established sodded areas shall be finished with at least twelve (12) inches of topsoil corresponding to, or better than, that underlying adjoining sodded areas. Topsoil shall be approved by the Engineer prior to placement, and unless otherwise directed, shall be material previously excavated and stockpiled for the purpose during excavating and grading operations. Grades on areas to receive topsoil shall be established and maintained as a part of the grading operations. Immediately prior to dumping and spreading topsoil, the surface shall be loosened by discing or scarifying to a depth of two (2) inches to permit bonding of the topsoil to the underlying surface.
3. At the option of the Contractor and/or developer, compacted backfill may be job-excavated material or material obtained "off site", except that all street crossings shall be backfilled with MoDot Type I rock, four (4) feet back of curb to four (4) feet back of curb. Job-excavated material may be used for compacted backfill (outside of Street Right of Ways) when the job-excavated material is finely divided and free from debris, organic material, cinders, or other corrosive material, and stones larger than three (3) inches in greatest dimension. Large masses of moist, stiff clay shall not be used. Job-excavated material shall be compacted to ninety-five (95) percent of maximum density at optimum moisture content as determined by ASTM D698 when the test is appropriate, or to seventy (70) percent relative density as determined by ASTM D2049 when that test is appropriate.
4. The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe.

The combination of the thickness of the layer, the method of compaction and the type of compaction equipment used shall be at the discretion of the Contractor and/or developer subject to obtaining the densities as specified above.

5. Backfill shall not be placed when material contains frost, is frozen, or a blanket or snow prevents proper compaction. Backfill shall not contain waste material, organic material, or debris of any kind.

6. Trench backfill above pipe embedment in locations other than those specified shall be compacted to ninety (90) percent of maximum density at optimum moisture content as determined by ASTM D698, unless otherwise permitted by the Engineer.
7. Uncompacted earth backfill material to be placed above embedments shall be free of brush, roots, more than two (2) inches in diameter, debris, cinders, or other corrosive material, and junk, but may contain rubble and detritus from rock excavation, stones, and boulders in certain portions of the trench depth. Uncompacted backfill material above embedments may be placed by any method acceptable to the Engineer which will not impose excessive concentrated or unbalanced loads, shock, or impact on and which will not result in displacement of installed pipe. Uncompacted backfill shall be placed to the extent necessary to prevent excessive future settlement.
8. Compact masses of stiff clay or other consolidated material more than one (1) cubic foot in volume shall not be permitted to fall more than five (5) feet into the trench unless cushioned by at least two (2) feet of loose backfill above pipe embedment.
9. No uncompacted trench backfill material containing rocks, or rock excavation detritus, shall be placed in the upper eighteen (18) inches of the trench except with specific permission of the Engineer, nor shall any stone larger than eight (8) inches in its greatest dimension be placed within three (3) feet of the top of pipe. Large stones may be placed in the remainder of the trench backfill only if well separated and so arranged that no interference with backfill settlement will result.

- C. Structural Plate Erection. Structural plate pipe, fabricated from hot-dip galvanized steel plates, shall be assembled by bolting individual plates together to erect the pipes or structures as shown on the plans. Bolts, fittings, and other appurtenances shall be furnished by the plate manufacturer. All materials shall be handled in such a manner that they are not chipped, dented, or bent. If the base material is exposed in any way it shall be rejected, or repaired to the satisfaction of the Engineer.

4006 DRAINAGE MAINTENANCE. Trenches across roadways, driveways, walks, or other trafficways adjacent to drainage ditches or water courses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the traffic way, to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the Contractor and/or developer. Backfilling shall be done so that water will not accumulate in unfilled or partially-filled trenches. All material deposited in roadway ditches or other water courses crossed by the line of trench shall be removed immediately after backfilling is completed and the original section, grades, and contours of ditches or water courses shall be restored. Surface drainage shall not be obstructed longer than necessary.

4007 DISPOSAL OF EXCESS EXCAVATED MATERIALS. Except as otherwise permitted, all excess excavated materials shall be disposed of away from the site of work.

Broken concrete and other debris resulting from pavement or sidewalk removal, excavated rock in excess of the amount permitted to be and actually installed in trench backfill, junk, and debris encountered in excavation work and other similar waste materials shall be disposed of away from the site of the work.

Excess earth from excavations located in unimproved property shall be distributed directly over the pipe trench and within the pipeline right-of-way to a maximum depth of six (6) inches above the original ground surface elevation at and across the trench and sloping uniformly. Drag with blade machine, or other suitable tool to a smooth, uniform surface without obstructing drainage at any point. Wasting of excess excavated material in the above manner will not be permitted where the line of trench crosses or is within a railroad, public road, or highway right-of-way. The disposal of waste and excess excavated materials, including hauling, handling, grading, and surfacing shall be a subsidiary obligation of the contractor and/or developer and no separate payment will be made therefore.

4008 SETTLEMENT. The Engineer may perform periodic inspections to insure that no settlement has occurred. The Contractor and/or developer shall be responsible for all settlement of backfill, fills and embankments which may occur within two (2) years of time after final acceptance of the contract under which the work was performed.

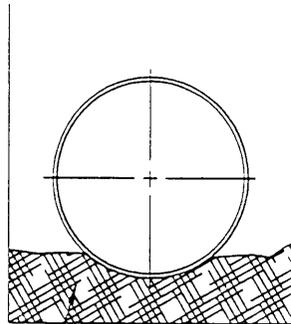
A suitable maintenance bond in an amount approved by the County Engineer shall be furnished to Clay County by the Contractor and/or developer guaranteeing the maintenance of the construction under which the contract was performed. Said bond shall remain in effect for the period mentioned above from the date of completion until acceptance of the work by the County or the two (2) year developer maintenance resolution has expired and the County has accepted the work.

The Contractor and/or developer shall make, or cause to be made, all repairs or replacements made necessary by settlement within thirty (30) days after notice from the Engineer. Should the Contractor and/or developer fail to make such repairs the County Engineer may cause repairs to be made, and the cost of these repairs shall be the responsibility of the Contractor and/or developer.

TRENCH BACKFILL:

WITHIN R/W
JOB EXCAVATED
MATERIAL COMPACTED
TO 95% OF MAX
DENSITY

OUTSIDE R/W
JOB EXCAVATED
MATERIAL COMPACTED
TO 90% OF MAX
DENSITY

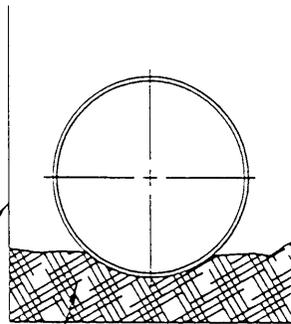


SHAPED TRENCH BOTTOM
IN EARTH (6" GRAVEL
EMBEDMENT IN ROCK)

NOT UNDER PAVEMENT

TRENCH BACKFILL
FOR PIPE WITH DIA
LESS THAN 48" TO
BE MoDOT TYPE 1
ROCK FROM 4'
BACK-OF-CURB TO
4' BACK-OF-CURB

TRENCH WALL
(TYPICAL)



SHAPED TRENCH BOTTOM
IN EARTH (6" GRAVEL
EMBEDMENT IN ROCK)

UNDER PAVEMENT

TRENCH BACKFILL
FOR PIPE WITH
DIA GREATER THAN
48" TO BE JOB
EXCAVATED MATERIAL
COMPACTED TO 95%
OF MAX DENSITY OR
MHTD TYPE 1 FROM
4' BACK-OF-CURB TO
4' BACK-OF-CURB



County of Clay
HIGHWAY
DEPARTMENT/PWD

EMBEDMENT/BACKFILL
FOR STORM SEWERS

D40-1

SECTION 4100 STRUCTURES - STORM SEWERS

4101 SCOPE. This section governs the performance of all work necessary for construction of cast-in-place and precast concrete and masonry structures for inlets, manholes, junction boxes, box culverts, headwalls, and incidental structures.

4102 MATERIALS.

- A. Concrete Mixes. Concrete shall conform to requirements set forth in Section 2000, "Concrete".
- B. Reinforcing Steel. Reinforcing bars shall conform to ASTM A-615, Grade 60 Welded steel wire fabric shall conform to ASTM A-185.
- C. Precast Concrete Structures.
 - 1. Manholes. Precast manholes shall conform to ASTM C-478. Joints between concrete manhole sections shall be made with plastic joint compound or preformed plastic compound as specified in Section 4004. Minimum cross sectional area of preformed compound shall be one (1) inch square or 1.25 inches diameter.
 - 2. End Sections for Concrete Pipe. Shall be flared end sections of the pipe manufacturer's standard design, and shall meet all applicable requirements of ASTM C-76 for Class II or higher classes of pipe.
 - 3. Rectangular Structures. Shall conform to the inside dimension indicated on the drawings and be designed for the following loads:
 - a. H-20 live load for all structures in/or under pavement, shoulders, driveways, and other traffic areas.
 - b. 2,000-lb wheel live load for curb opening inlets and junction boxes in non-traffic areas.
 - c. 50 pcf equivalent fluid pressure for soil pressure on vertical walls.
 - d. 120 pcf for unit weight of soil cover on top slabs.
- D. Cement Mortar. Pre-mix mortar non-shrink or expansive grout in mortar for packing pipe in openings of precast structures, setting castings, and other incidental work shall consist of one part portland cement and two parts sand by volume mixed with sufficient water to form a workable stiff grout.

- E. Metal Castings. Castings shall be gray iron conforming to ASTM A-48, Class 30. Castings shall be of the shape, dimension and minimum weight indicated on the drawings, and be free from manufacturing defects. Castings shall be cleaned and painted with one coat coal tar before delivery. Bearing surfaces between frames and covers for installation in traffic areas shall be machined to provide even seating. Manhole rings and covers shall be Clay and Bailey No. 2008BV, Deeter No. 1315 or approved equal. Inlet rings and covers shall be Clay and Bailey No. 2020, Deeter No. 2016 or approved equal. All covers shall have Clay County - Storm cast on the top.
- F. Metal End Sections. Metal end sections shall be fabricated from galvanized base metal as specified in Section 4004, and shall be flared end sections of the metal pipe manufacturer's standard design. End sections shall be furnished with a metal toe plate. Bituminous coating is not required.
- G. Toe Walls. Flared end sections for concrete and metal pipe shall be set on a concrete toe wall centered on the end of the section. Toe walls shall be six (6) inches thick by thirty (30) inches deep by the width of the end section.

4103 CONSTRUCTION DETAILS.

- A. Concrete Structures. Concrete construction shall conform to the requirements set forth in Section 2000, "Concrete".
 - 1. Precast Structures. The Contractor and/or developer may, at his option, construct precast concrete inlets, junction boxes, and box culverts, in lieu of the cast-in-place structures indicated on the drawings; except that all concrete base slabs for pre-cast inlets, manholes, and junctions boxes may be cast-in-place. Solid concrete brick or block shall be used to block inlets and similar structures to grade during placement of base slab concrete.

↳ Precast concrete box culvert sections shall be installed on a 4 inch leveling course of untreated compacted aggregate conforming to the following:

<u>U.S. Standard Square Mesh Sieve</u>	<u>Percent Passing Square Mesh Sieve</u>
1 1/4"	100
1"	72-100
3/4"	60-90
3/8"	43-74
No. 4	28-60
No. 10	16-40
No. 40	3-22
No. 200	0-15

In addition to the above limits, the difference between the "Percent Passing Square Mesh Sieve" of successive sieve sizes shall not exceed twenty-five (25). That fraction of the material passing the No. 40 Sieve shall have a plasticity index not to exceed eight (8) when tested in accordance with ASTM D-423, and D-424.

Leveling courses shall extend one foot past the line of the box section, and be finished to a true plane surface to provide uniform bearing for the precast section.

2. Finishing.

a. Formed Surfaces. Immediately following removal of the form, fins and irregular projections shall be removed. Form tie connections, holes, honeycomb spots, and other defects shall be thoroughly cleaned, saturated with water, and pointed with grout. The repaired surfaces shall be cured in accordance with Section 2000, "Concrete".

b. Exposed Slabs. Finish for exposed slabs shall be wood float texture in accordance with MCIB Specification Section 24. Exposed edges shall be beveled or edged with a radial tool.

3. Form Removal. Forms shall remain in place until the concrete has attained sufficient strength to support loads imposed by backfilling, construction, and traffic, but not less than:

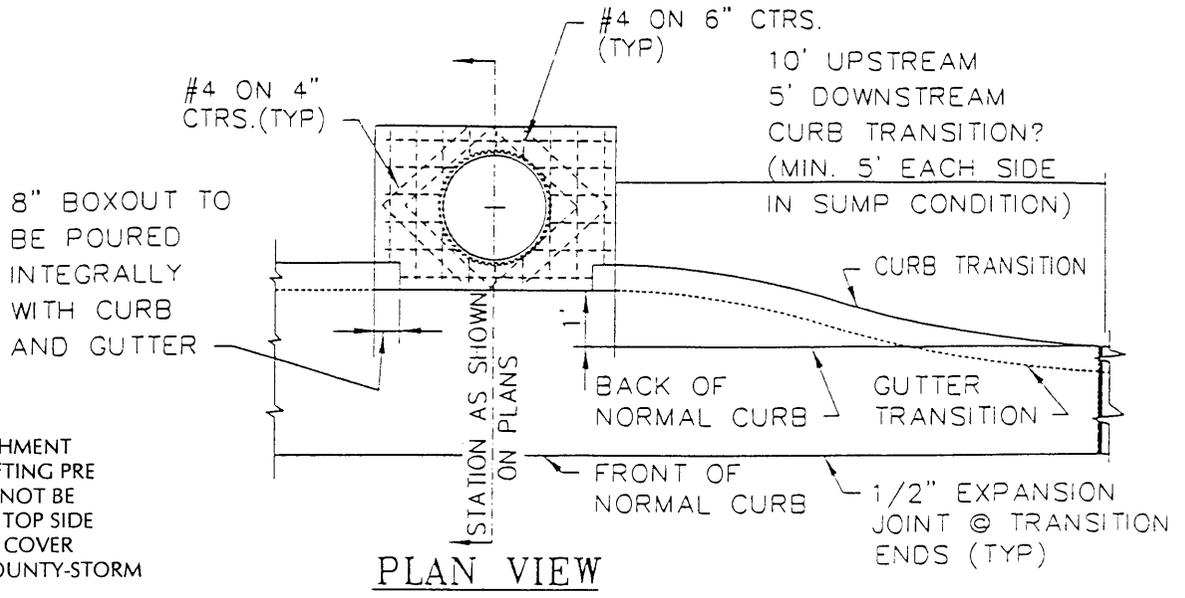
a. Walls. Forms shall remain in place for a minimum of three (3) days or until the concrete reaches a minimum strength of 2000 p.s.i.

b. Slabs. Form shall remain in place for a minimum of seven (7) days or until the concrete reaches a minimum strength of 3000 p.s.i.

B. Invert Channels. Form concrete invert channels in manholes, inlets, and junction boxes to make changes in direction of flow with smooth curves of as large a radius as permitted by the inside dimension of the structure. Grade changes and transitions shall be smooth and uniform and all parts of the invert channel and adjacent floor shall slope to drain. Channel bottom shall be finished smooth without roughness or irregularity. Invert channels for precast concrete structures may be cast integrally with the structure base slabs at the Contractor and/or developer's option.

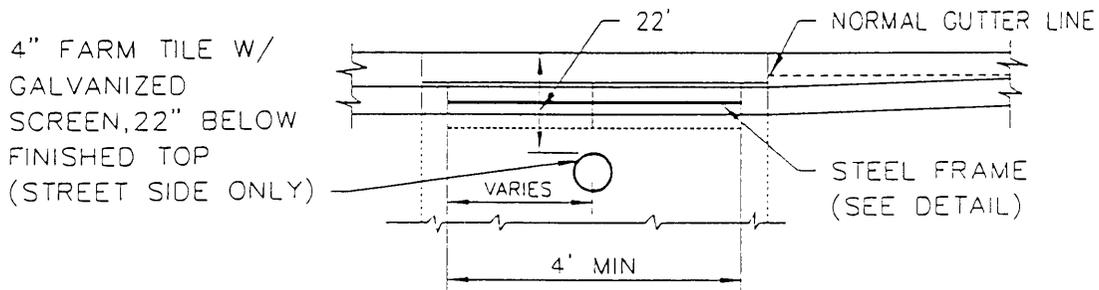
C. Excavation and Backfill. All excavation and backfill shall be in conformance with Section 1100 entitled "Grading" and as specified herein.

1. Excavation. Excavation for structures shall be carried a sufficient distance, but not less than eighteen (18) inches outside the limits of the structure to permit efficient erection and removal of forms and laying of masonry units, and shall be sloped, stepped, or braced as required for stability. When unsuitable soils are encountered at the bearing elevation of the structure, they shall be removed and replaced with either fill concrete or compacted granular material at the Contractor and/or developer's option. Over excavation shall be corrected in like manner. The Contractor and/or developer shall maintain the excavation free of standing water until backfilling is complete.
2. Backfilling. Backfilling shall conform to the requirements of Section 4005(C) and as follows:
 - a. No backfill shall be placed over or around any structure until the concrete or mortar therein has attained a minimum strength of 2000 p.s.i. and can sufficiently support the loads imposed by the backfill without damage.
 - b. The Contractor and/or developer shall use utmost care to avoid any wedging action between the side of the excavation and the structure that would cause any movement of the structure. Any damage caused by premature backfill or by the use of equipment on or near a structure will be the responsibility of the Contractor and/or developer.
 - c. Backfill shall be placed and compacted on all sides of the structure simultaneously, and operations shall be so conducted that the backfill is always at approximately the same elevation on all sides of the structure.
 - d. No excavated rock larger than four (4) inches maximum dimension shall be placed within one (1) foot of the exterior surface of any structure.

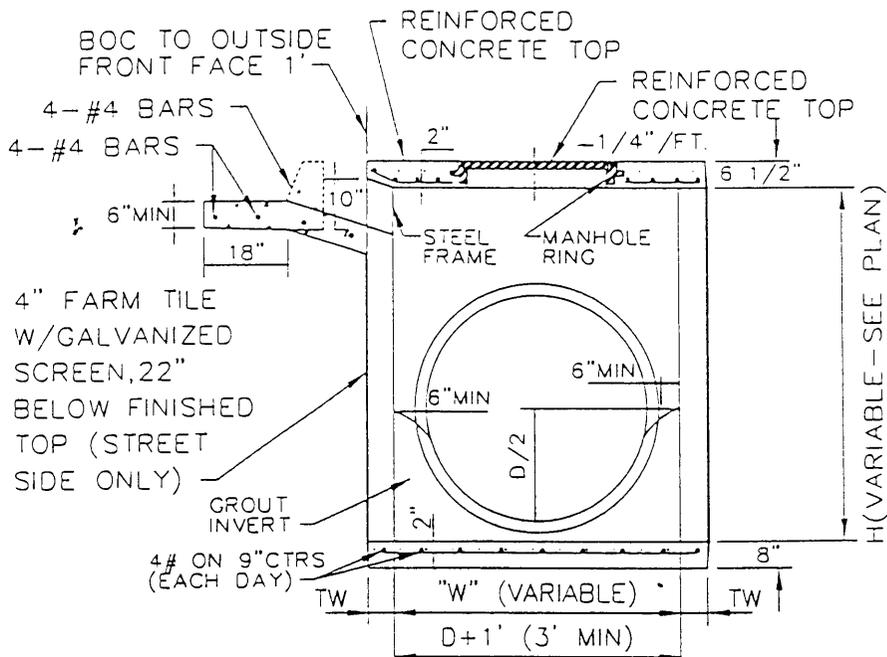


NOTE:
 POINTS OF ATTACHMENT PROVIDED FOR LIFTING PRE CAST TOPS SHALL NOT BE LOCATED ON THE TOP SIDE OF THE INLET TOP COVER STAMPED CLAY COUNTY-STORM

PLAN VIEW



FRONT ELEVATION



SECTION A-A



County of Clay
 HIGHWAY
 DEPARTMENT/PWD

STANDARD
 CURB INLET

D41-1

NOTES:

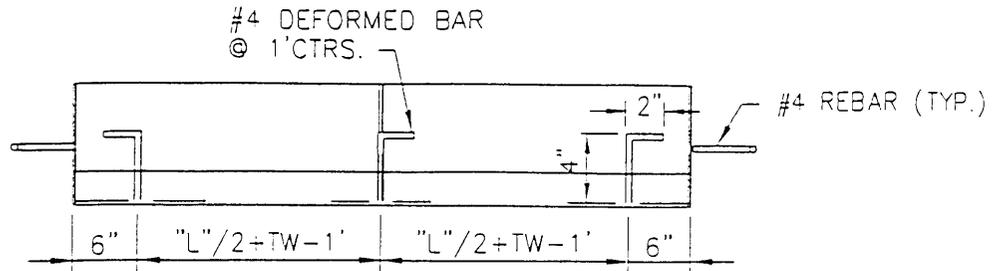
1. CONTRACTOR SHALL PROVIDE STEPS SPACED AT 1'-4" O.C. WHERE INLET OR MANHOLE DEPTH IS GREATER THAN 4'. STEPS SHALL BE M.A. INDUSTRIES, INC. MODEL PS-2-PF OR APPROVED EQUAL.
2. USE OF PRECAST CONCRETE REQUIRES APPROVAL OF COUNTY ENGINEER OF SHOP DRAWINGS.
3. MANHOLE RING AND LID SHALL BE CLAY & BAILEY NO. 2020, DEETER 2016 (185 LBS.) OR AN APPROVED EQUAL.
4. SPACER SHALL BE PLACED AT EQUAL INTERVALS ACCORDING TO THE FOLLOWING: L=4', 2 SPACES; L=5', 2 SPACES; L=6', 2 SPACES; L=7', 2 SPACES; L=8', 3 SPACES; L=10', 3 SPACES.
5. THE FIRST DIMENSION IN THE PLAN NOTATIONS REFERS TO THE "L" DIMENSION; I.E., TYPE VI DENOTES L=6'.
6. THE SECOND DIMENSION IN THE PLAN NOTATIONS REFERS TO THE "W" DIMENSION.
7. "JUNCTION BOX" AS CALLED FOR IN THE PLANS, SHALL BE CONSTRUCTED TO CONFORM, WHERE APPLICABLE, WITH THE DIMENSIONS, THICKNESSES AND DETAILS SHOWN.
8. ALL METAL SURFACES, AFTER BEING CLEANED OF ALL DUST, MILL SCALE AND WELD SCALE SHALL BE GALVANISED.
9. CURB CONTRACTOR SHALL HAND FORM AND FINISH GUTTER WITHIN THE INLET THROAT TO THE REAR OF FRONT INLET WALL AT THE TIME THE FINISHING OF NORMAL CURB IS ACCOMPLISHED.
10. USE CLASS I 3000 PSI CONCRETE FOR ALL STANDARD CATCH BASIN AND INLET INVERTS.
11. THE INVERT SHALL HAVE A TROWEL FINISH TO SECURE SMOOTH INVERT SLOPING TO OUTLET PIPE.
12. OUTLET OR INLET PIPE SHALL BE PLACED AS SPECIFIED OR AS DIRECTED BY THE ENGINEER. REINFORCING STEEL SHALL BE BENT AROUND PIPE.
13. USE CLASS II 4000 PSI CONCRETE FOR ALL STANDARD CATCH BASINS AND INLETS.



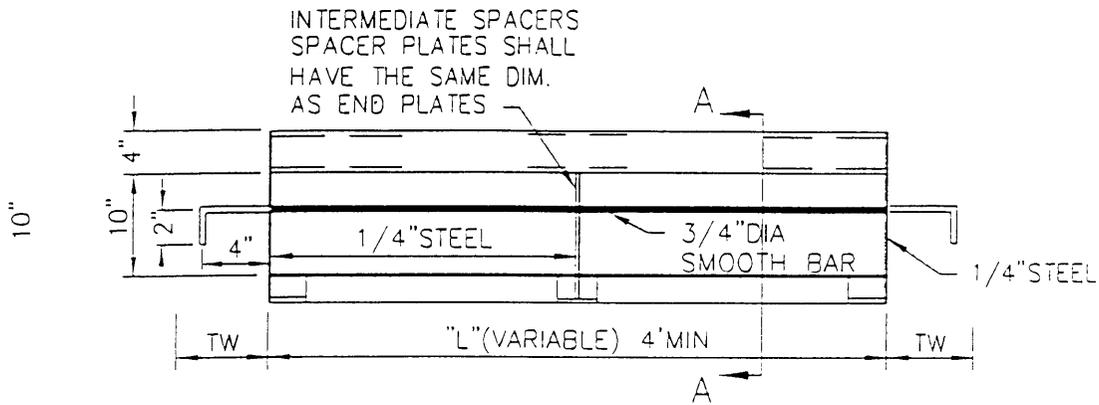
County of Clay
HIGHWAY
DEPARTMENT/PWD

STANDARD
CURB INLET

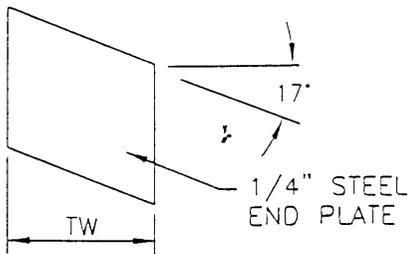
D41-1A



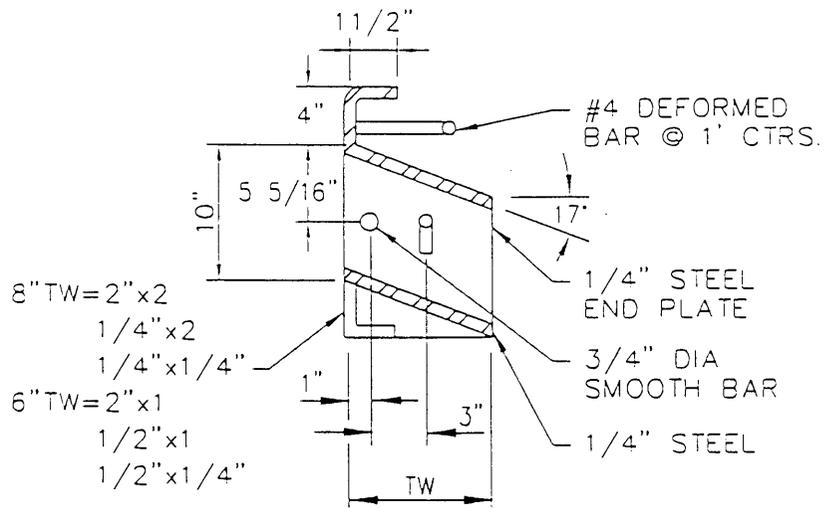
TOP VIEW



FRONT VIEW



END PLATE



SECTION A-A

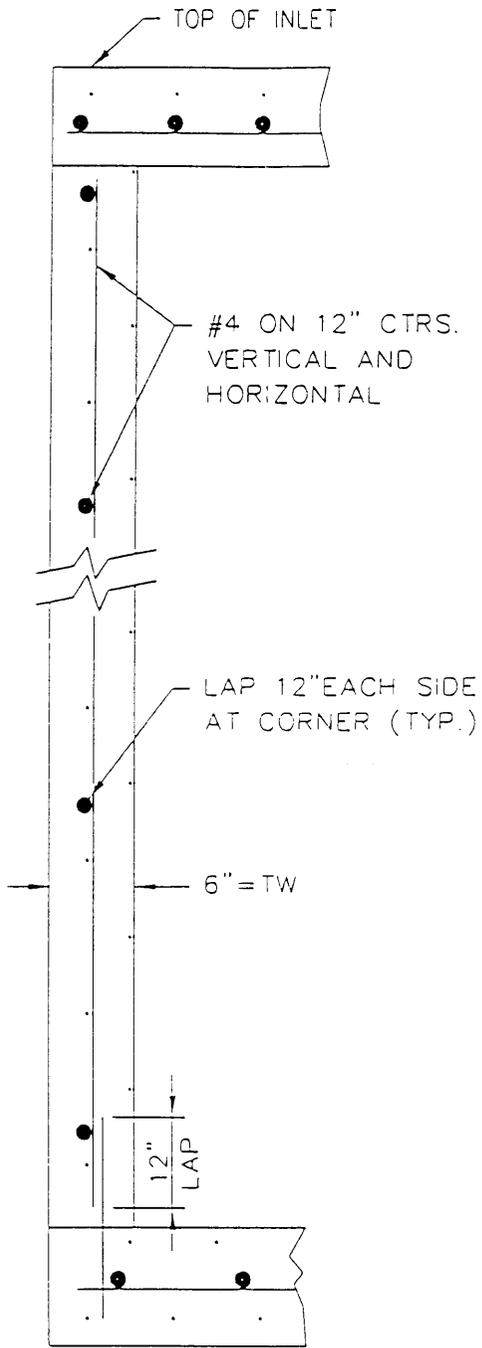
NOTE: SEE NOTES STANDARD CURB
INLET DETAIL SHEET



County of Clay
HIGHWAY
DEPARTMENT/PWD

STEEL FRAME
DETAIL

D41-2



CONCRETE

NOTE:
SEE NOTES STANDARD
CURB INLET DETAIL SHEET.

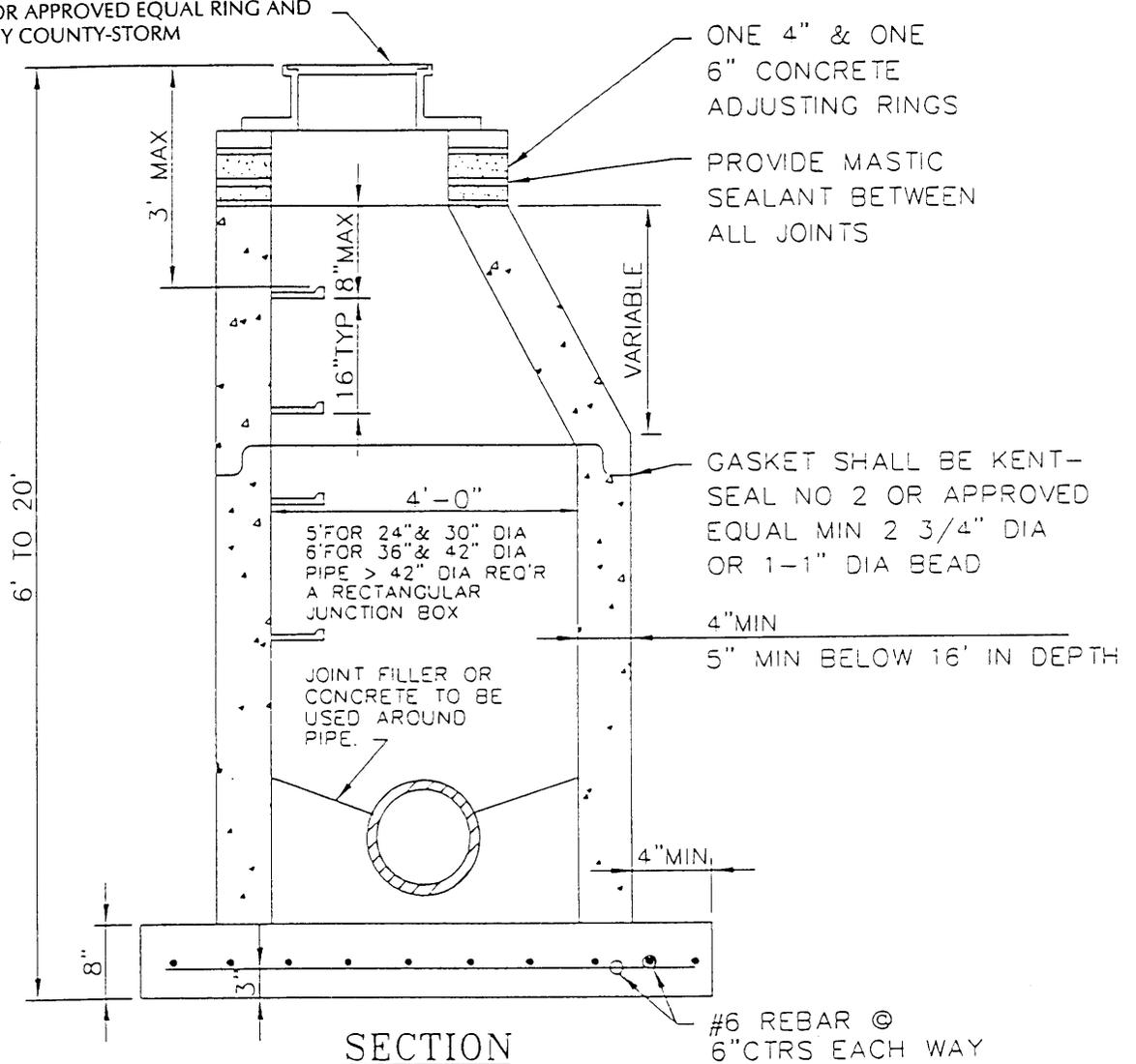


County of Clay
HIGHWAY
DEPARTMENT/PWD

WALL SECTION

D41-3

CLAY AND BAILEY NO 2008, NEENAH NO R15356,
DEETER NO 1315 OR APPROVED EQUAL RING AND
LID STAMPED CLAY COUNTY-STORM



NOTE:

1. PRECAST CONCRETE MANHOLES SHALL CONFORM TO ASTM C478 EXCEPT AS MODIFIED BY THE SPECIFICATIONS.
2. BASES NOT BUILT MONOLITHIC WITH BOTTOM SECTION; THE BOTTOM SEE SHALL BE POURED OF CLASS I 3000 PSI CONCRETE.
3. MANHOLE MAY BE TRANSITIONED TO 4' DIA., 8' ABOVE F.L. OF OUTFALL FOR 5' AND 6' MANHOLES.
4. THE BOTTOM SECTION OF ALL PRECAST MANHOLES NOT BUILT MONOLITHIC WITH THE BASE SHALL BE SET INTO A STEEL REINFORCED POURED CONCRETE BASE A MIN OF 4" (#4 @ 6" E.W.)
5. THE COMPRESSIVE STRENGTH OF CONCRETE USED IN THE CONSTRUCTION OR PRECAST REINFORCED CONCRETE MANHOLES SHALL NOT BE LESS THAN 4000 PSI.
6. ONLY ECCENTRIC MANHOLE CONES WILL BE ALLOWED UNLESS OTHERWISE APPROVED BY THE COUNTY ENGINEER

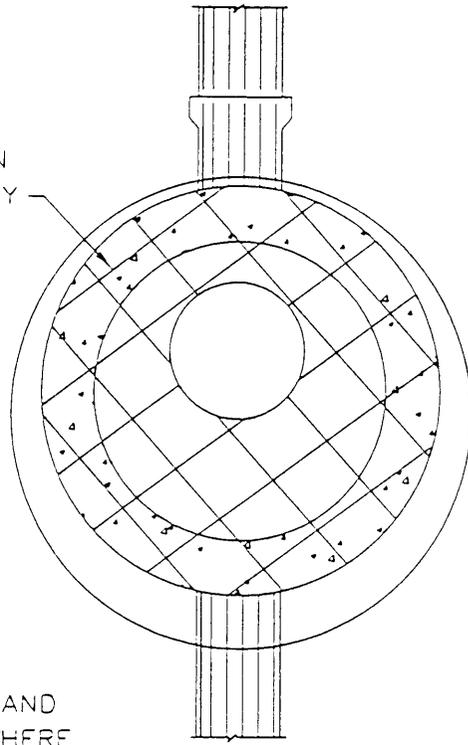


County of Clay
HIGHWAY
DEPARTMENT/PWD

STANDARD STORM
SEWER MANHOLE

D41-4

#5 BARS AT 6" ON CENTERS EACH WAY

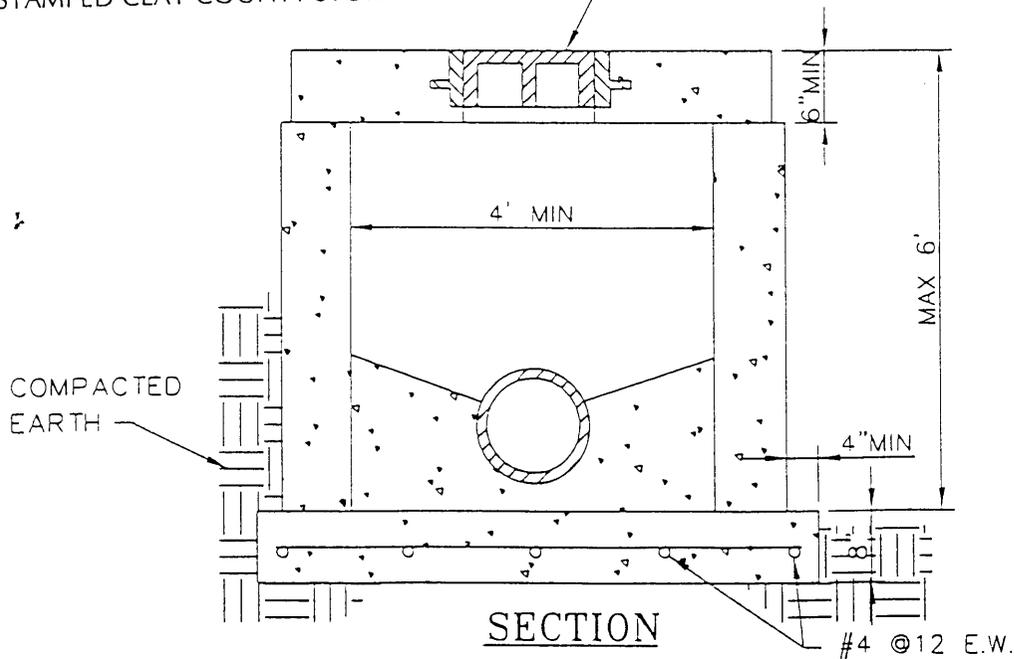


PLAN

NOTE:

1. USE OF A STANDARD LID AND RING WILL BE ALLOWED WHERE GRADE PERMITS (SEE SPEC. FOR APPROVED TYPES).
2. FOR DIMENSIONS NOT SHOWN SEE STANDARD STORM SEWER MANHOLE DETAIL.
3. COVER STAMPED CLAY COUNTY-STORM

CLAY & BAILEY NO 2020 DEETER NO 2016 OR APPROVED EQUAL. RING AND LID (CAST IN MANHOLE TOP).



SECTION



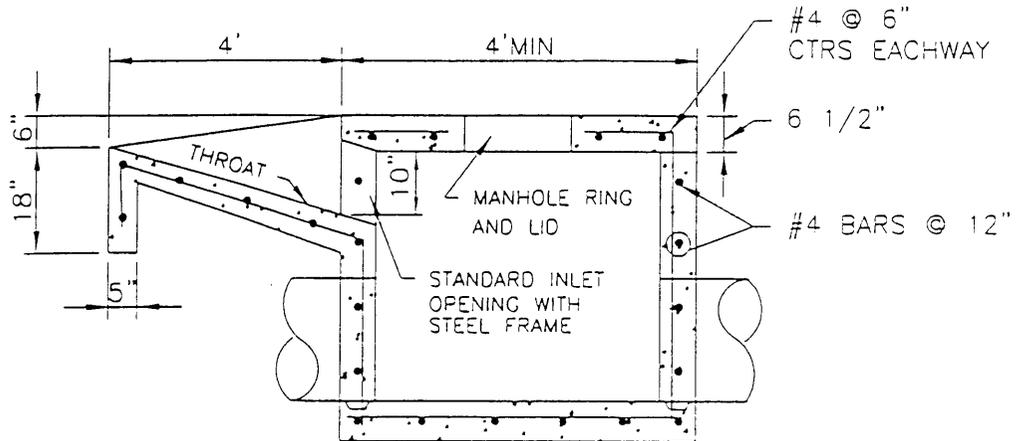
County of Clay
HIGHWAY
DEPARTMENT/PWD

SHALLOW JUNCTION
BOX DETAIL

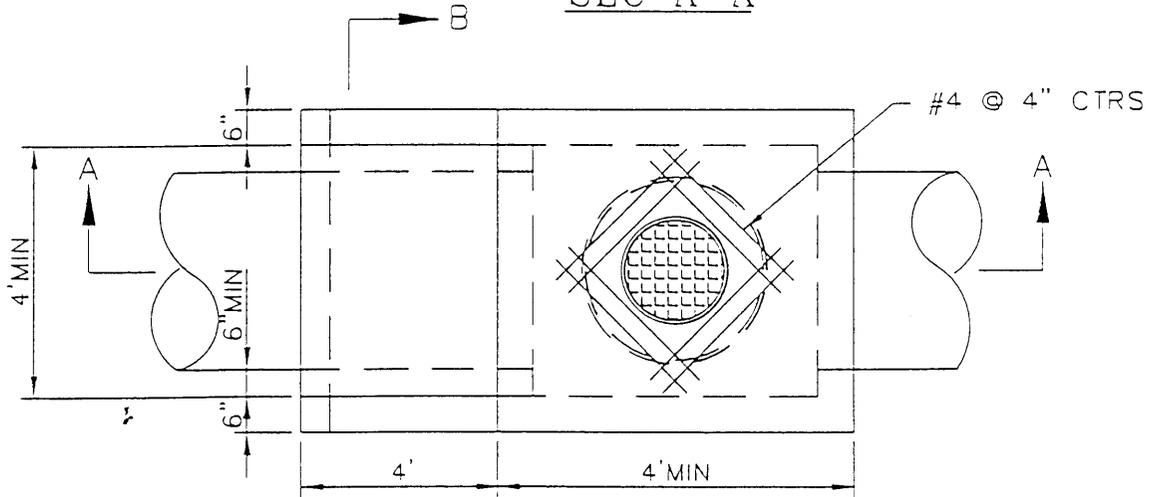
D41-5

NOTE:

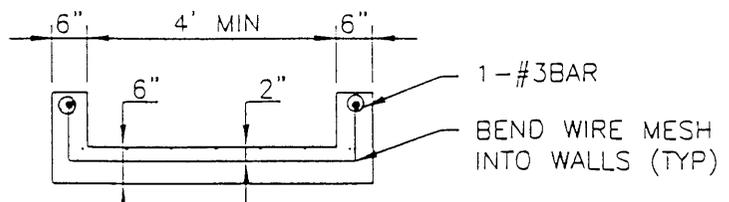
1. THROAT AND THROAT WALL SHALL BE POURED MONOLITHIC UNLESS PRECAST BOX IS USED.
2. MANHOLE RING AND LID SHALL BE CLAY & BAILEY NO. 2020 OR DEETER 2016 (185 LBS.)
3. COVER STAMPED CLAY COUNTY-STORM



SEC A-A



PLAN



SEC B-B

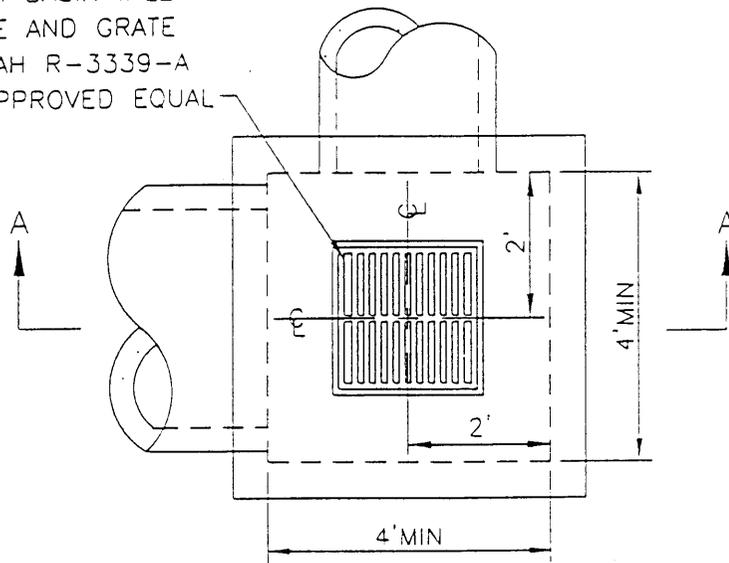


County of Clay
HIGHWAY
DEPARTMENT/PWD

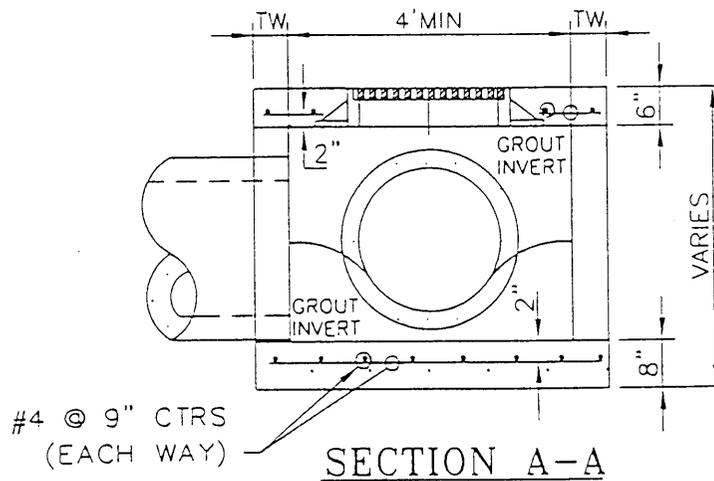
YARD INLET
DETAIL

D41-6

CATCH BASIN INLET
 FRAME AND GRATE
 NEENAH R-3339-A
 OR APPROVED EQUAL



PLAN



SECTION A-A

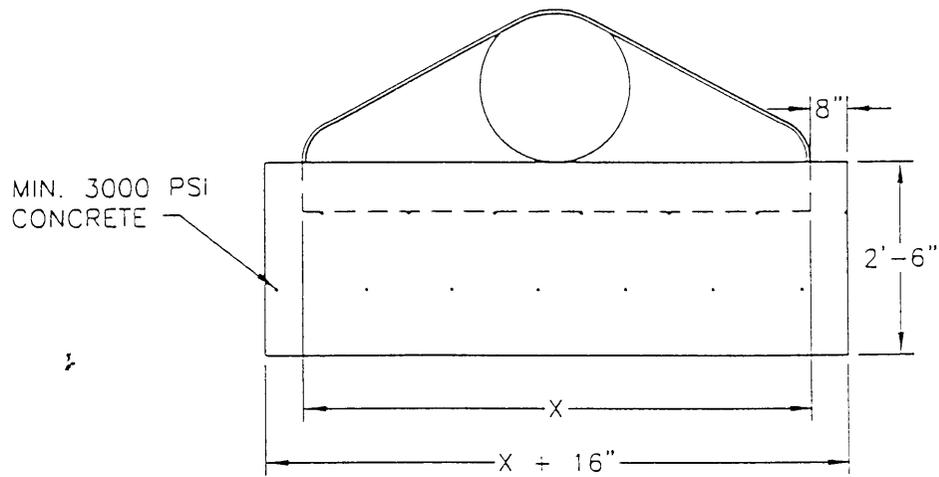
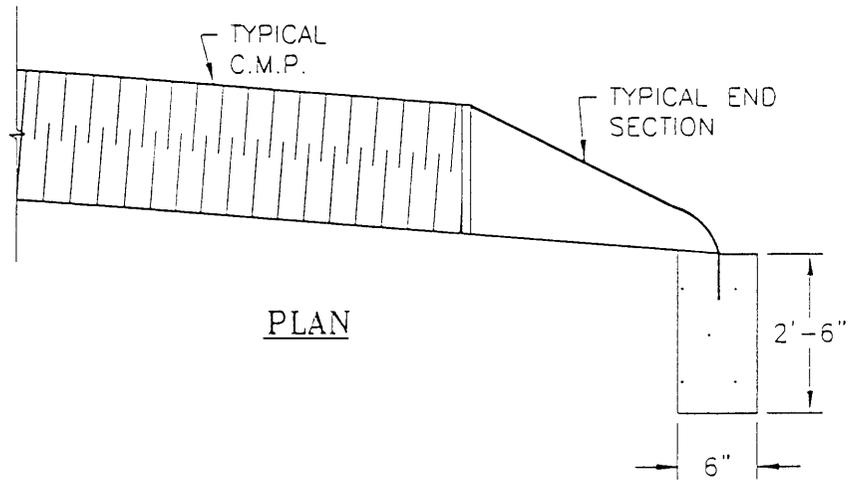
FOR WALL SECTION SEE STANDARD DETAIL



County of Clay
 HIGHWAY
 DEPARTMENT/PWD

AREA INLET
 DETAIL

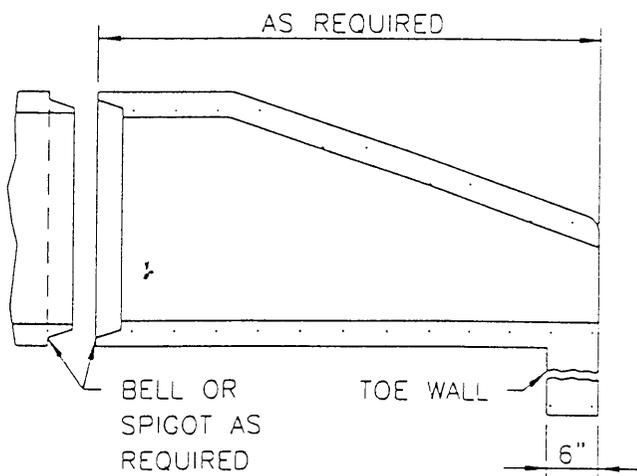
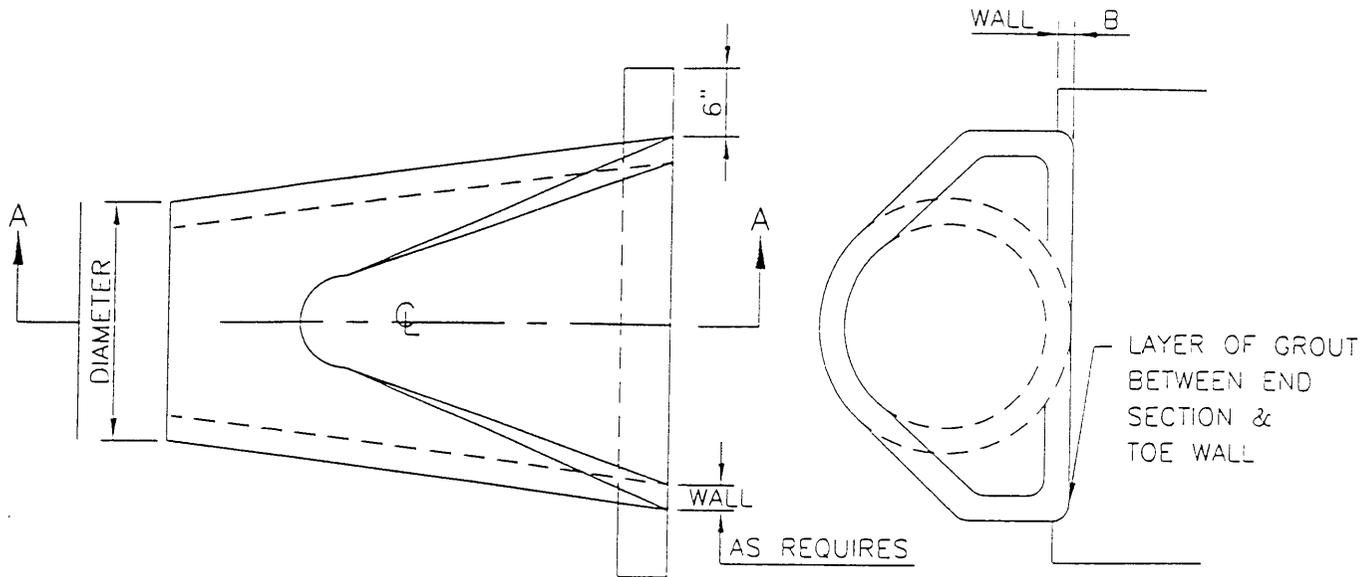
D41-7



County of Clay
HIGHWAY
DEPARTMENT/PWD

TYPICAL METAL END
SECTION DETAIL

D41-8



SECTION A-A

DIMENSIONS	
DIAMETER	8
12"-12"	18"
24"-48"	24"
54"-66"	36"



County of Clay
HIGHWAY
DEPARTMENT/PWD

TYPICAL PRECAST END
SECTION DETAIL

D41-9



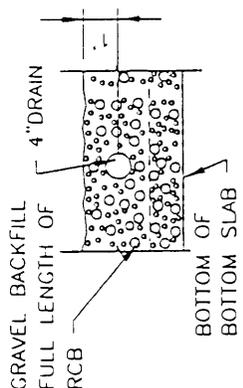
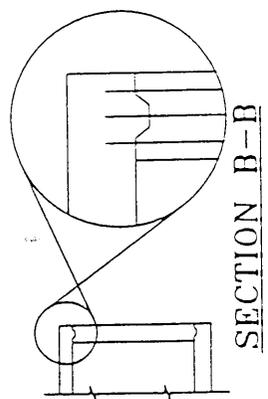
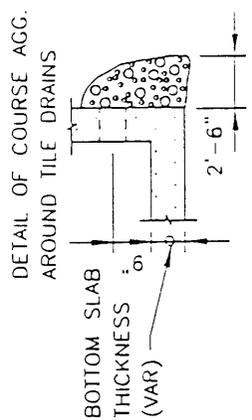
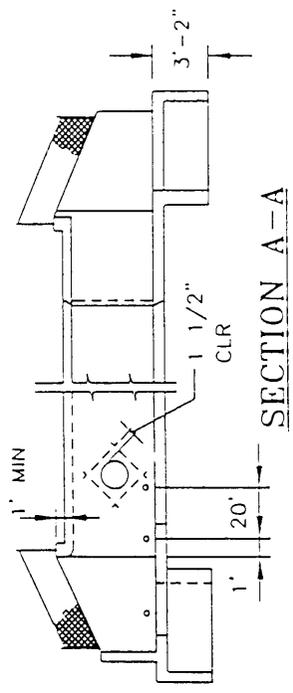
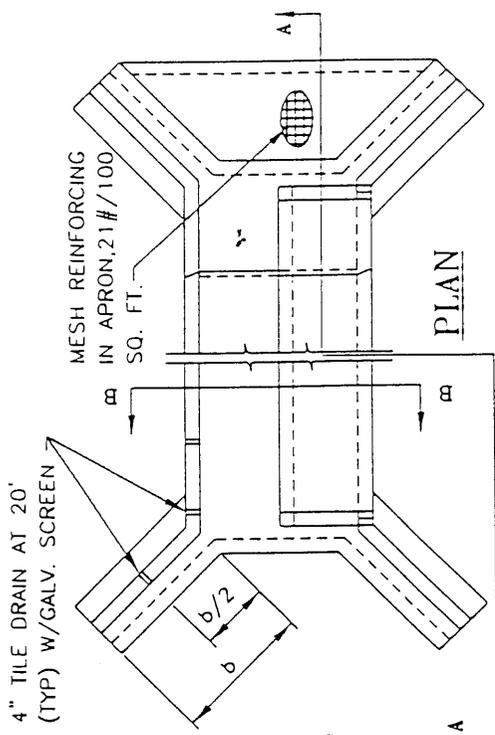
County of Clay
HIGHWAY
DEPARTMENT/PWD

REINFORCED
CONCRETE BOX

D41-10

GENERAL NOTE:

1. RCB'S SHALL BE DESIGNED TO CARRY AASH TO HS20 44 LOADING AS OUTLINED IN THE STANDARD SPEC. FOR HIGHWAY BRIDGES, ADOPTED BY THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, 1977 EDITION.
2. ALL CONCRETE SHALL DEVELOP A MIN. 28 DAY COMPRESSIVE STRENGTH OF $F_c = 4000$ PSI.
3. REINFORCING STEEL SHALL BE ASTM A 615 GRADE 60, EXCEPT TIES AND STIRRUPS WHICH SHALL BE GRADE 40.
4. AT ALL HOLES IN CONCRETE WALLS, ADD 4#5 BARS (OPENING DIMENSION PLUS 60 BARS DIA. LONG) DIAGONALLY TO THE MAIN WALL REINFORCEMENT. SPREAD MAIN REINFORCEMENT AT ALL PENETRATIONS, DO NOT CUT OR ELIMINATE.
5. A CONCRETE SEAL COURSE SHALL BE CONSTRUCTED WHERE SPECIFIED ON THE PLANS OR BY THE COUNTY ENGINEER. ALL RCB BASE SLABS SHALL BE CONSTRUCTED WHERE SPECIFIED ON THE PLANS OR BY THE COUNTY ENGINEER. ALL RCB BASE SLABS SHALL BE CONSTRUCTED ON STABLE SUBGRADE.
6. KEYED JOINTS SHALL BE PROVIDED AS SHOWN IN ALL CULVERTS WHERE THE LENGTH IS 40' OR MORE. THESE JOINTS SHALL BE SPACED SO AS TO DIVIDE THE BOX INTO SECTIONS OF EQUAL LENGTH. THE REINFORCING STEEL SHALL BE CARRIED THROUGH EACH KEYED JOINT AND STEEL LAPS SHALL BE 24 TIMES THE BAR DIA. OR A MIN. OF 12".
7. STANDARD CONCRETE COVER OF BARS UNLESS OTHERWISE NOTED SHALL BE:
WHERE DIRT FORMED.....3"
CONCRETE EXPOSED TO EARTH OR WEATHER
#5 BARS AND SMALLER.....1 1/2"
#6 THROUGH #18 BARS.....2"
8. BACKFILLING MAY NOT BEGIN UNTIL THE CONCRETE REACHES A STRENGTH EQUAL TO 75% OF THE DESIGN STRENGTH OR A MIN. OF 14 DAYS AFTER POURING THE TOP UNLESS THE DESIGN STRENGTH OF THE CONCRETE (4000 PSI) IS ATTAINED PRIOR TO THE 14 DAY PERIOD.
9. A STANDARD 42" HIGH CHAIN LINK FENCE SHALL BE REQUIRED AT EACH END OF ALL RCB'S UNLESS APPROVED OTHERWISE BY THE CITY ENGINEER. FENCING SHALL EXTEND CONTINUOUSLY ALONG THE HUB GUARD AND DOWN EACH WINGWALL.
10. HUB GUARDS SHALL BE DESIGNED TO ACCOMMODATE GRADING WITH A 6:1 MAX. SLOPE BETWEEN BACK OF CURB AND THE HUB GUARD (OR EDGE OF SIDEWALK AND THE HUB GUARD IF APPLICABLE).
11. CONTRACTOR TO SUPPLY AN EXTRA AMOUNT OF REINFORCEMENT. 1% OF THE TOTAL WEIGHT OF THE DESIGNED REINFORCEMENT IN VARIOUS LENGTHS AND SIZE TO BE USED AT THE DISCRETION OF THE CITY ENGINEER.
12. FLOATING APRON SHALL BE REQUIRED AT DOWNSTREAM END OF RCB, UNLESS BOTTOM OF CHANELL RESTS ON SOUND BEDROCK.
13. TOE WALL TO BE CONSTRUCTED AT EACH END OF RCB. TOE WALL TO 3'-2" MIN. BELOW FLOWLINE OF RCB OR 6" INTO BEDROCK IF APPLICABLE.



NOTE:
IF TOP AND WALLS ARE MONO-LITHICALLY POURED THEN UPPER KEYWAY CAN BE DELETED. REBAR MUST CONTINUE THROUGH KEYWAY AS SHOWN.

4200 OPEN CHANNELS

4201 SCOPE. This section includes all work for construction of open channel lining at the location, and to the lines, grades and dimension indicated on the drawings. Grading shall have been previously completed in accordance with Sections 1000 and 1100 "Site Preparation" and "Grading".

4202 MATERIALS.

- A. Concrete. Concrete and materials shall conform to the requirements set forth in Section 2000, "Concrete".
- B. Stone. Stone for riprap, grouted riprap, and gabion linings shall consist of quarried rock and be sound, durable, and angular in shape. No more than ten (10) percent shall have an elongation greater than 3:1, and no stone shall have an elongation greater than 4:1. Material shall be free from cracks, seams, or other defects. Shale and stone with shale seams are not acceptable.
 - 1. The minimum weight of the stone shall be one hundred fifty-five (155) pounds per cubic foot as computed by multiplying the specific gravity times 62.4 pounds per cubic foot.
 - 2. Not more than ten (10) percent of the stone shall exhibit splitting, crumbling, or spalling when subject to five (5) cycles of the sodium sulfate soundness test in accordance with AASHTO T104.
 - 3. Stone shall be of the following gradations:

Riprap (15 Inch Minimum Thickness)

<u>Weight of Stone in lbs.</u>	<u>Percent Lighter by Weight</u>
180	100 (minimum)
120	80 (maximum)
60	50 (maximum)
6	10 (maximum)

Grouted Stone Lining (12 Inch Minimum Thickness)

<u>Weight of Stone in lbs.</u>	<u>Percent Lighter by Weight</u>
90	100 (minimum)
60	80 (maximum)
30	50 (maximum)
3	10 (maximum)

Gabion Fill Stone

<u>Stone Size</u> <u>Inches</u>	<u>Percent Smaller</u> <u>by Weight</u>
*	100
2 ½	0

* one half of least dimension of gabion basket.

Stone shall be graded within the above limits as required to provide a unit weight in-place of one hundred (100) pounds per cubic foot or greater.

C. Filter Blanket. Filter blanket may be either of the following types at the Contractor and/or developer's option:

1. Granular Filter. Granular filter material shall consist of sound, durable rock particles conforming to the following gradation.

<u>Sieve Size</u>	<u>Cumulative Percent</u> <u>Passing By Weight</u>
1"	100
½"	70-100
No. 4	50-85
No.10	35-70
No.40	20-50
No.100	15-40

2. Filter Fabric. Filter fabric shall consist of woven or nonwoven fabric. The synthetic fiber of either the woven or nonwoven fabric shall consist of polypropylene, nylon, or polyester filaments. The percent open area shall be not less than four (4) percent nor more than ten (10) percent. The cloth shall provide an Equivalent Opening Size (EOS) no finer than the U.S. Standard Sieve No. 70. In addition, filter fabric shall meet the following physical requirements:

a. Tensile Strength. Minimum grab tensile strength, both warpwise and fillingwise, shall be two hundred (200) pounds when tested in accordance with ASTM D 1682, using a four (4) inch by six (6) inch specimen and a jaw speed of twelve (12) inches per minute.

b. Elongation. Grab elongation shall be not less than fifteen (15) percent nor more than sixty (60) percent, both warpwise and fillingwise, when tested in accordance with ASTM D 1682.

c. Tear Strength. Minimum trapezoid tear strength shall be one hundred (100) pounds, both warpwise and fillingwise. Method of test for woven fabrics shall be in accordance with ASTM D 1117.

- d. Bursting Strength. Minimum bursting strength shall be 200 psi when tested in accordance with ASTM D 3887.
- e. Seam Strength. Woven fabric shall have a minimum seam-breaking strength of one hundred eighty (180) pounds when tested in accordance with ASTM D 1683, using a jaw speed of twelve (12) inches per minute.
- f. Width. Filter fabrics shall be furnished in widths of not less than six (6) feet.

D. Gabion Baskets. Baskets shall be of the dimensions indicated on the drawings and be fabricated using hexagonal triple-twist wire mesh.

1. Wire.

- a. Wire shall be galvanized-steel having a minimum tensile strength of 60,000 psi, and be zinc coated with a minimum coating weight of 0.80 oz. psf.
- b. Wire shall be plastic coated with a minimum tensile strength of 60,000 psi, and with a coating with a nominal thickness of .02165". It shall be capable of resisting deleterious effects of natural weather exposure or immersion in salt water.

2. Wire Mesh. Maximum dimension of the mesh opening shall be four and one-half (4 ½) inches or less, and the maximum area of the mesh opening shall not exceed twelve (12) square inches. Wire shall be 0.115 inch (minimum) diameter.

3. Selvedge Wire. Selvedge wire shall be 0.150 inch (minimum) diameter. All perimeter edges of the mesh forming the gabion selvedges have a strength equal to or greater than the body of the basket.

4. Lacing and Stay Wire. Wire shall be 0.091 inch diameter or larger.

5. Diaphragms. Gabions shall be divided into cells not greater than four (4) feet in width by wire mesh diaphragms. Diaphragms shall be factory secured to the base of the basket by continuous spiral wire.

E. Grout. Grout shall consist of one part portland cement and five parts aggregate by volume. The aggregate shall be a mixture of crushed stone and clean sand. Uniformly graded from coarse to fine, and meet the following gradation:

<u>Sieve Size</u>	<u>Cumulative % Passing</u>
½"	100
No.4	40-60

Water shall be proportioned to provide a grout having a consistency to permit thorough penetration of the grout into the joints and voids between the stones, but shall not exceed 5.0 gallons per sack of cement. The Contractor and/or developer may use concrete conforming to MCIB Mix Number A 384- 1/2-2 or A 420 1/2-4 in lieu of the grout here-in-before specified.

4203 CONSTRUCTION DETAILS.

- A. Foundation Preparation. After completion of grading in accordance with Section 1100, the area to receive channel lining shall be trimmed and dressed to conform to the cross sections indicated on the drawings within a tolerance of plus or minus two (2) inches from the theoretical slope lines and grades. All deleterious materials shall be removed from the foundation area.

- B. Concrete Lining.
 - 1. Preparation. Earth foundation subgrade shall be moistened by sprinkling. Forms shall be securely staked, braced, and set to line and grade. Reinforcement and tie bars shall be held in position by bar chairs, concrete brick, or other approved devices.

 - 2. Placing and Finishing. Place, consolidate, and strike off concrete to the thickness indicated on the drawings. Concrete shall be tamped or vibrated to eliminate all voids and bring sufficient mortar to the top for finishing. Surface finish shall be a wood-float finish. Round all edges and joints with a one-fourth (1/4) inch radius edging tool, except contraction joints may be sawed to a depth of thirty (30) percent of the thickness of the concrete lining after concrete has hardened but before uncontrolled cracking occurs. Apply curing membrane as specified in Section 2000.

- C. Filter Blanket.
 - 1. Granular Filter. Place granular filter to its full thickness in a single operation. Construction methods shall be such that the material is placed without segregation. Compaction of granular filter material is not required.

 - 2. Filter Fabric. Place filter fabric with its long dimension horizontal and lay free of tension, stress, folds, wrinkles, or creases.
 - a. Place to provide eighteen (18) inches minimum overlap at each joint and anchor to prevent dislocation during construction of overlaying material.

- b. Fabric shall not be left exposed more than two (2) weeks prior to placement of overlaying material. Tracked or wheeled equipment or vehicles shall not be operated on the fabric.

D. Riprap Placement. Riprap shall be placed on the prepared foundation in a manner which will provide a reasonably well-graded mass of stone with the minimum practicable percentage of voids. The entire mass of stone shall be placed so as to be in conformance with the lines, grades, and thicknesses indicated. Riprap shall be placed to full-course thickness in one operation and in such a manner as to avoid displacing the underlying material. If the underlying layer consists of filter fabric, the Contractor and/or developer shall place the riprap in such a way as to not tear, puncture, or shift the fabric. Riprap shall not be dropped more than three (3) feet when being placed directly on the fabric. Tears or rips in the fabric shall be repaired with fabric lapped a minimum of twelve (12) inches in all directions.

1. Placing. Placing of riprap in layers, or by dumping into chutes, or by similar methods likely to cause segregation will not be permitted.

2. Distributing. The larger stones shall be well distributed and the entire mass of stone shall conform to the specified gradation. All material shall be so placed and distributed that there will be no objectionable accumulations of either the larger or smaller sizes of stone.

3. Hand Placing. It is the intent of these specifications to produce a fairly compact riprap protection in which all sizes of material are placed in their proper proportions. Hand placing or rearranging of individual stones by mechanical equipment may be required to the extent necessary to secure the specified results.

Damage to baskets by mechanical equipment will not be allowed. Any damaged baskets shall be repaired or replaced at the direction of the Engineer.

E. Grouted Stone Lining. Place stone and grout in a manner to produce a securely bound solid mass with the stone interstices completely filled. Sweep the surface clean of all surplus grout with a stiff broom. Apply curing membrane as specified in Section 2000.

F. Gabion Lining.

1. Assembly. Assemble each gabion unit by binding all vertical edges together with a continuous piece of connecting wire stitched around the vertical edge with coils spaced at three (3) inches or less. Set empty units to line and grade and join units by stitching with connecting wire along adjoining edges. Stainless steel “hog rings” spaced no more than six (6) inches apart and shall conform to ASTM A313-92. Installation shall be by mechanical means. Install and securely fasten internal tie wires in each cell if necessary to retain the shape of the cell during filling operations.
2. Filling. Fill gabion cells with stone carefully by hand or machine to provide a minimum of voids and avoid bulges and distortions of the gabion. After filling, secure the lid to the sides, ends, and diaphragm by stitching with connecting wire.

SECTION 5000 MATERIALS, CONSTRUCTION AND TESTING - WATER LINES

5001 GENERAL. The purpose of this specification is to govern the furnishing of all materials, labor, equipment, tools, superintendence, and other services necessary to construct water mains, complete with appurtenances including extensions and relocations at the locations shown on the plans.

5002 ADEQUACY OF SERVICE REQUIREMENT. Water systems serving a development must provide adequate water pressure and quantity to each dwelling unit that could be built in the subdivision. The county shall be authorized to require a licensed engineer, registered in the state of Missouri, certify that the water system serving the development will be adequate to serve without diversely effecting the service of the existing dwelling units. Public water services, including rural water districts, shall be used whenever available. Lines shall be installed to form a closed service loop wherever possible.

5003 USE OF PRIVATE WELLS. Private wells may permitted on lots larger than five (5) acres in all development tiers when service is not available from a public water district, provided the applicant has a letter from the applicable water district that the water service is not available and the property owner has signed a notarized statement that he/she will connect within ninety (90) days to the public water supply when service becomes available within two hundred (200) feet of the property. This agreement and connection requirement shall be noted on the preliminary and the final plats.

5004 ADEQUACY OF TRANSMISSION. Distribution pipe shall have a minimum six hundred (600) pounds bursting pressure.

5005 MATERIALS.

- A. Scope. This section governs materials for water mains having diameter of two (2) inches and larger.
- B. Pipe and Fittings.
 - 1. Ductile-Iron Pipe. Unless indicated otherwise on the construction plans or directed by the Engineer, all six (6) inch pipe and larger shall be Class 50 ductile iron, all four (4) inch pipe shall be Class 51 Ductile iron complete with all accessories and conforming to ANSI A21.51, AWWA C151, ASTM A536, and Grade 60-42-10.

Joints, unless otherwise specified, shall be of the push-on type conforming to ANSI A21.11/AWWA C111, except gaskets shall be synthetic rubber. Natural rubber will not be acceptable. The pipe shall be cement mortar lined, conforming to ANSI A21.4/AWWA C104 and shall be coated inside and out with a bituminous coating.

2. Ductile-Iron Fittings. Ductile-iron fittings shall be complete with all accessories and shall be ASTM A536, Grade 70-50-05, conforming to ANSI A21.10/AWWA C110, ANSI A21.53/AWWA C153, 350 psi pressure rating. Joints shall be of the standard mechanical joint type conforming to ANSI A21.11/AWWA C104 and shall be coated inside and out with a bituminous coating. Fittings shall have distinctly cast upon them the pressure rating and letters "DI" or "DUCTILE".

C. Valves and Valve Boxes.

1. Gate Valves. Generally, and unless otherwise directed by the Engineer, gate valves shall be used on all water mains, twelve (12) inches nominal diameter and smaller. The type, size and location of valves shall be as shown on the Plans. Except as modified or provided herein all gate valves in pipe lines shall be 200 psi, iron body, gate valves with nonrising stems. Gate valves shall be resilient-seated conforming with all applicable requirements of ANSI/AWWA C509. See appendix "A" for valve types.
2. Butterfly Valves. Butterfly valves shall be used for water lines valves larger than twelve (12) inches in diameter otherwise directed by the County Engineer. Butterfly valves shall be of the rubber-seat, tight-closing type. Valve discs shall seat at 90 degree with the pipe axis. Flanged end valves shall be of the short body type. Buried service, shaft shall be O-ring.

All butterfly valves and operators shall conform to AWWA C504. Metal mating seat surfaces shall be 18-8 stainless steel or monel. Each valve shall be provided with an operator with a torque rating at least equal to the torques listed in AWWA C504, Table 1.

See appendix "A" for valve types.

3. Valve Ends. Valve ends shall be of the mechanical joint type, conforming to ANSI A21.11/AWWA C111 except where flange ends are required on the plans.

The end flanges of flange gate valves shall conform in dimensions and drilling to ANSI B16.1 for cast-iron flanges and flange fittings, Class 125, unless explicitly provided otherwise on the plans and Special Provisions. The laying lengths of the flange valves shall conform to the dimensions of ANSI B16.10.

4. Bonnet Thrust Plates. The bonnet shall have a removable thrust plate to permit the removal and replacement of the valve stem and "O" ring seal while the valve is in service.

5. Tapping Valves and Sleeves. The size and location of the tapping valves, shall be as shown on the plans. The valves shall be 200 psi, iron body, resilient-seated gate valves with nonrising stems conforming with all applicable requirements of ANSI/AWWA C509, except that the outlet end shall be standard mechanical joint end conforming to ANSI A21.11/AWWA C111 and the inlet end shall have an inlet flange conforming to ANSI B16.1 for cast iron flanges, Class 125.

Tapping sleeves shall have a body of 18-8 Type 304 Stainless Steel. The flange shall be CF8 cast Stainless Steel - equivalent to 18-8 Type 304 Stainless Steel, ANSI 150 lb. Drilling, recessed for tapping valve per MMSS-SP 60. Bolts shall be Stainless Steel, Type 304. The Branch Outlet shall be heavy Stainless Steel Pipe. The gasket shall be full circumferential compounded for use with water, salt solutions, mild acids, bases and sewage.

6. Stem Seals and Coatings.

- a. All valves shall be provided with stem seals of the "O" ring type. Two (2)"O" rings shall be used with at least one (1) "O" ring inserted above the thrust collar. The packing plate shall be attached to the valve bonnet by not less than three (3) bolts and one (1) "O" ring below the thrust collar.

- b. All exterior surfaces of each valve shall be cleaned and painted in the shop with two (2) coats of asphalt varnish conforming to Federal Specifications TT-V-51-E or be epoxy coated. The interior surfaces of resilient-seated gate valves shall have a protective coating of fusion-bonded, nontoxic epoxy which is safe for potable water.

7. Valve Operation. All valves shall be equipped with a two (2) inch square wrench nut and the direction of rotation to open the valve shall be to the left (counterclockwise). Each valve body or operator shall have cast thereon the work "Open" and an arrow indicating the direction to open.

8. Extension Stems. Extension stems and stem guides shall be provided where shown, specified, or required for proper operation. Extension stems shall be fabricated from solid steel shafting not smaller in diameter than the stem of the valve or from galvanized steel piping having an ID not smaller than the OD of the valve stem. Extension stems shall be connected to the valve by a flexible, socket-type coupling. All connections shall be pinned, keyed, or socket type. Pipe couplings will not be acceptable.

Extension stems shall be provided for buried valves when the operating nut is more than three feet below finished grade. Each extension stem for a buried valve shall extend to between three (3) feet and three (3) feet six (6) inches of the ground surface, NO EXCEPTIONS WILL BE ALLOWED, and shall be provided with spacers which will center the stem in the valve box, and shall be equipped with a wrench nut.

9. Valve boxes, Bases, Lids and Covers.

- a. All buried valves shall be provided with valve boxes. Valve boxes shall be of cast iron, extension sleeve screw type, suitable for the depth of cover required by the drawings. Valve boxes shall be Clay & Bailey No. P-1108 or approved equal.
- b. All parts of valve boxes, bases, and covers shall be coated by dipping in bituminous varnish.

Valves and valve boxes shall be set plumb. Each valve box shall be placed directly over the valve it serves, with the top of the box brought flush with the finished grade. After being placed in proper position, earth shall be filled in around each valve box and thoroughly tamped on each side of the box.

- c. Fire Hydrants. Fire hydrants shall be furnished with a six (6)-inch auxiliary gate valve. The fire hydrants shall be pressure rated at 150 psi working pressure and 300 psi test pressure. Hydrants shall be traffic model with breakaway flange or coupling. Fire hydrants shall conform to AWWA C502 with information required by Section 2 as follows: Fire Hydrant type as shown in appendix "A".

Type of Shutoff	Compression
Size of Hydrant	5 1/4 inches
Inlet Connection	6 inches
Outlet Nozzles	2-2 1/2 inch hose and 1-4 1/2 inch pumper
Outlet Nozzle Threads	ANSI B-26
Direction to Open	Counterclockwise
Stem Seals	O-ring
Outlet Nozzle Cap Chains	Required
Drain Outlet	Required
Finish Paint	Factory or field painted above the ground line with yellow enameled paint. Sherwin Williams industrial yellow No. B54 Y37.
Weather Cap on Operating Nut	Required
Oil Reservoir	Required

Hydrants shall be furnished with all joint glands, gaskets, bolts, and nuts required for installation. Hydrants shall be set so that at least the minimum pipe cover is provided for the branch supply line. Each hydrant shall be set on a concrete foundation at least eighteen (18) inches square and six (6) inches thick. Each hydrant shall be suitably anchored.

Hydrant drainage shall be provided by installing around the hydrant, and below the top of the hydrant supply pipe, at least one-half (1/2) cubic yard of three-fourths (3/4)-inch rock.

Fire hydrant installations shall conform to the Standard Detail. All hydrants shall stand plumb. The exact direction the nozzles will be facing shall be determined by the Engineer.

- D. Flushing Assembly. Flushing assemblies shall be as manufactured by Aquarius model "One-O-One GH two (2) inch Hidden Hydrant or approved equal. Flushing assemblies shall be of the non-freeze type and shall be self-draining. All working parts shall be brass. The inlet connection shall be two and one-half (2 ½) inch IP with the outlet being two and one-half (2 ½) inch NST. All operating parts shall be removable from above ground with no special wrenches. A standard meter box may be used to fit over the hydrant at ground level.

The flushing assembly shall be furnished with all appurtenances required for installation and shall be set so that the minimum pipe cover of forty-two (42) inches is provided for the supply line.

Flushing assembly drainage shall be provided by installing at least four (4) cubic feet of three fourths (3/4) inch rock around the assembly base.

E. Specials.

1. General. Air release, meter, and pressure-reducing valve vaults shall be precast concrete conforming to ASTM C478. Access lid castings shall be as noted in the Special Provisions or as shown on the plans.

Vaults which, by their special nature, must be cast in place shall conform to the plans and concrete specifications in Section 2000 "Concrete".

2. Pressure-Reducing Valves. Pressure-reducing valves shall be designed to provide tight shutoff under conditions of no flow and shall not "hunt" under ordinary flow conditions. Pressure-reducing valves shall be as noted in the Special Provisions, selected and sized as recommended by the valve manufacturer. Pressure-reducing valves shall be suitable for operation under the pressure and flow conditions as shown on the plans.

3. Combination Air Valves. Combination air-release and vacuum-relief valves shall be installed at the locations indicated on the plans. Each valve assembly shall be installed complete with appropriate piping and valves as shown on the plans. All piping and isolation valves shall be brass except for the air outlet from the valve which shall be brass or copper tubing.

Air releases for mains, twelve (12) inches in diameter or smaller, shall have one (1) inch combination air-release valves, APCO No. 143C or approved equal.

4. Tapping Sleeves. Shall be as described in section 5002 paragraph 5.

- F. Bedding Aggregate. All materials used for crushed stone pipe bedding shall conform to the requirements of MCIB Specification Sec. 4 Materials for coarse aggregate and shall meet the gradation specified therein under Column III, Table 2, for three quarters (3/4) inch maximum size aggregate with the following modifications.

Sieve Size	Percentage Passing
No. 4	0-5
No. 8	0-2

5006 CONSTRUCTION REQUIREMENTS.

- A. Grading and Excavation.

1. Scope. Excavation and trenching work shall include the necessary clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching as required; the handling, storage, transportation and disposal of all excavated material; all necessary sheeting, shoring and protection work; preparation of subgrades; pumping and dewatering as necessary or required; protection of adjacent property; and other appurtenant work.

2. General. Excavation and trenching work shall be performed in a safe and proper manner with suitable precautions being taken against all hazards.

The Contractor and/or developer shall explore and expose any and all obstructions in advance of excavation so that minor changes in grade and alignment may be made.

In paralleling existing water, sewer, and gas mains, the Contractor and/or developer shall protect all service connections and shall arrange to furnish service to the consumers with minimum interruption.

All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory provisions made for street drainage.

3. Classification of Excavated Material. No classification of excavated materials will be made unless otherwise indicated on the contract drawings. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work regardless of the type, character, composition, or condition thereof.
4. Unauthorized Excavation. Any part of the trench excavated below grade shall be corrected with material approved by the Engineer placed and compacted by the Contractor and/or developer.
5. Removal of Water. The Contractor and/or developer shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation or other cause will result.

All excavations for concrete structures or trenches which extend down to or below static groundwater elevations shall be dewatered by lowering and maintaining the groundwater surface beneath such excavations a distance of not less than twelve (12) inches below the bottom of the excavation.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

The Contractor and/or developer will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

6. Sheeting and Shoring. Except where banks are cut back on a stable slope, excavation for structures and trenches shall be properly and substantially sheeted, braced, or shored as necessary to prevent caving or sliding, to provide protection for workmen and the work, and to provide protection for existing structures and facilities. Sheeting, bracing and shoring shall be designed and built to withstand all loads that might be caused by earth movement or pressure and shall be rigid, maintaining shape and position under all circumstances.

Trench sheeting shall not be pulled unless pipe strength is sufficient to carry trench loads based on trench width to the back of sheeting. Sheeting shall not be pulled after backfilling. When ordered by the Engineer, wood sheeting shall be left permanently in the trench.

Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

7. Stabilization. Trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen.

Trench bottoms which are otherwise solid but which become mucky on top due to construction operations shall be reinforced with one or more layers of crushed stone or gravel. Not more than one-half (1/2) inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon.

8. Trench Excavation. The Contractor and/or developer shall not open more trench in advance of pipe laying than is necessary to expedite the work. One block or three hundred (300) feet whichever is the shorter, shall be the maximum length of open trench ahead of pipe laying unless by written permission of the Engineer.

Except where tunneling or boring and jacking is specified and shown on the plan by the Engineer, all trench excavations shall be open cut.

9. Alignment and Grade. The alignment and grade or elevation of the pipeline shall be as shown on the plans.

The Contractor and/or developer must maintain a constant check of the pipe alignment and trench depth and will be held responsible for any deviations therefrom.

Unless otherwise shown or indicated on the plans or unless otherwise set forth by the Engineer, the horizontal and vertical alignment of the water main shall be maintained to within the following tolerances:

Horizontal

3"

Vertical

42" to 48" Depth of Cover

10. Minimum Cover. Except where otherwise shown, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe as indicated above. Greater pipe cover depths may be necessary on existing pipe, conduits, drains, drainage structures, or other obstruction encountered at normal pipe grades.

Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finish grade or pavement surface elevations.

11. Limiting Trench Width. Trenches shall be excavated to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing and embedment. However, the limiting trench width below an elevation six (6) inches above the top of the installed pipe shall be as follows:

Ductile-Iron Pipe

<u>Pipe Size</u>	<u>Minimum Trench width in Earth</u>	<u>Maximum Trench width in Earth</u>	<u>Minimum Clearance in Rock</u>
4"	18"	30"	6"
6"	24"	30"	6"
8"	26"	32"	6"
10"	28"	34"	6"
12"	28"	34"	6"

Where necessary to reduce earth load on trench banks to prevent sliding and caving, banks may be cut back on slopes which shall not extend lower than one (1) foot above the top of the pipe.

12. Unauthorized Trench Widths. When, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted in the foregoing tables, either pipe of adequate strength, special pipe embedment, or arch concrete encasement, as required by loading conditions and as determined by the Engineer, shall be furnished and installed by and at the Contractor and/or developer's expense.
13. Trench Bottom in Earth. The trench in earth shall have a flat bottom the full width of the trench and shall be excavated to the grade to which the pipe is to be laid. The surface shall be graded to provide a uniform bearing and continuous support for each pipe at every point along its entire length.
14. Bell Holes. Bell holes for the pipe shall be dug after the trench has been cut to proper grade and immediately prior to the laying of the pipe length. No part of the bell shall be allowed in contact with the trench bottom.
15. Bell Hole Option. The Contractor and/or developer, at his option, may use granular material in the trench bottom in lieu of bell holes. The granular fill material shall be spread the surface graded to provide a uniform bearing with continuous support along each section of pipe.

16. Rock Exploration. Unless shown otherwise on the plans or noted in the Special Provisions, no rock exploration has been made. On those projects where rock exploration has been made, test holes have been drilled at locations and intervals as shown on the plans or subsurface information report to determine the approximate location and depth of rock. Resistance to penetration was assumed to be "solid rock". This information is furnished for general reference purposes only.

The Contractor and/or developer must form his own opinion as to the character of materials which will be encountered from an inspection in the ground, from his own investigation of the test hole information, or from such other investigations as he may desire.

17. Trench Bottoms in Rock. All rock excavation shall be carried to a minimum of six (6) inches below the bottom of the pipe. Granular pipe embedment material shall be used to restore the trench bottom to the desired elevation and grade and to provide a uniform bearing and continuous support for the pipe along its entire length. Care shall be exercised to prevent any portion of the pipe from coming to bear on solid rock or boulders.

18. Mechanical Excavation. The use of mechanical equipment will not be permitted in locations where its operations would cause damage to trees, buildings, culverts, or other existing property, utilities or structures above or below ground. In all such locations, hand-excavating methods shall be used.

Mechanical equipment used for trench excavation shall be of the type, design and construction and shall be so operated that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from the bottom of the trench, and that trench alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

All mechanical trenching equipment, its operating conditions, and the manner of its operations shall be subject at all times to the approval of the Engineer.

19. Stream Crossings. Stream crossings shall be made in accordance with these specifications and as shown on the plans.

The trench width shall be as required for proper pipe installation and the trench depth shall be as required to give minimum cover shown on the plans. Pipe encasement, where required, shall be in accordance with the specifications and placed as indicated on the plans.

20. Highway and Railroad Crossings. The Contractor and/or developer shall make highway and railroad crossing in accordance with these specifications, the Special Provisions and as shown on the plans.

All construction or work performed and all operations of the Contractor and/or developer, his employees, or his subcontractor and/or developers within the limits of highway or railroad right-of-ways shall be in conformity with all the requirements, regulations and be under the control (through the Engineer) of the authority owning or having jurisdiction over and control of the right-of-way.

The Contractor and/or developer shall pay fees and obtain permits to make the crossings unless otherwise directed.

5007 INSTALLATION.

- A. General. Laying of ductile-iron pipe; installation of valves, and hydrants; and embedment and backfill shall conform to the following specifications and the details as shown on the plans.

1. Unless otherwise specified or shown on the plans, the water mains shall be laid to have a minimum cover of forty-two (42) inches, measured from the finished grade or from established street grades shown on the plans.
2. Whenever pipe laying is stopped, the open end of the line shall be sealed with a watertight plug which will prevent trench water from entering the pipe.
3. Where the pipe is to be installed inside a casing pipe or tunnel liner, creosote timber or teflon skids shall be strapped to each pipe before it is placed in the casing pipe or tunnel liner in accordance with these specifications and as shown on the plans. Sand fill shall be used when shown on the plans or required by the Special Provisions. The ends of each casing pipe or tunnel liner shall be closed with a dry brick wall or as shown on the plans. The closures for each casing pipe or tunnel line shall not be constructed until all testing of the line has been completed and accepted.

- B. Ductile-Iron Pipe.

1. Handling. Pipe, fittings and accessories shall be handled in a manner that will ensure installation in a sound, undamaged condition. Equipment, tools, and methods used in unloading, reloading, hauling, and laying pipe and fittings shall be such that the pipe, pipe coating, and fittings are not damaged. Hooks shall not be used. Under no circumstances shall pipe or accessories be dropped or dumped. Pipe and fittings on which the cement

lining has been broken or loosened shall be replaced by the Contractor and/or developer. Where the damaged areas are small and readily accessible, the Contractor and/or developer may be permitted to repair the lining.

All pipe coating, which has been damaged, shall be repaired by the Contractor and/or developer before installing the pipe.

2. Cutting Pipe. Ductile-iron pipe shall be cut with either a saw or an abrasive wheel. Cutting of existing cast-iron pipe shall be done with mechanical pipe cutters. The cutting of pipe with a torch will not be permitted.

Cutting shall be done in a neat manner without damage to the pipe, or the cement lining. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed with a file or beveled by mechanical means to remove all roughness and sharp corners.

3. Cleaning. The interior of all pipe and fittings shall be thoroughly cleaned of foreign matter before being installed and shall be kept clean until the work has been accepted. Such surfaces shall be wire brushed, if necessary, wiped clean, and kept clean until jointing is completed.
4. Inspection. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. Spigot ends shall be examined with particular care since they are vulnerable to damage from handling. All defective, damaged, or unsound pipe and fittings shall be rejected and marked as such and removed from the site of the work.
5. Alignment of Bell-and-Spigot Pipe. Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the quantities stipulated in Tables 4 and 5 of ANSI/AWWA C600.
6. Laying Pipe. Pipe shall be protected from lateral displacement by pipe embedment material installed as specified. Under no circumstances shall the pipe be laid in water, and no pipe shall be laid under unsuitable trench conditions.

5008 JOINTING.

- A. Push-on Joints. The gasket seat in the bell shall be wiped clean after which the gasket should be placed. A thick film of lubricant should be applied to all of the inner surface of the gasket and on the spigot end of the pipe.

The lubricant and the gaskets shall be as recommended and supplied by the manufacturer of the pipe being used. The lubricant shall be odorless, tasteless, nontoxic, and suitable for use in potable water.

Field-cut pipe shall be beveled by filing or by mechanical means to remove any sharp or rough edges which might otherwise damage the gasket.

- B. Mechanical Joints. The mechanical joint shall be used only when shown on the plans and shall be installed in strict accordance with the manufacturer's recommendations.

- C. Flanged Joints. When bolting flanged joints, care shall be taken to ensure that there is no restraint on the opposite end of the pipe or fitting which would prevent uniform gasket compression or which would cause unnecessary stress in the flanges. One flange shall be free to move in any direction while the flange bolts are being tightened. Bell-and-spigot joints shall not be packed or assembled until all flanged joints affected thereby have been tightened. Bolts shall be tightened gradually and at a uniform rate so that gasket compression is uniform.

- D. Restrained Joints. Restrained joints and anchoring joints shall be installed in strict accordance with the pipe manufacturer's recommendations.

5009 CONNECTION TO EXISTING MAINS. The Contractor and/or developer shall furnish and install all fittings necessary to join the existing and new water mains as shown on the plans.

No connections to existing mains shall be started without prior approval of the Engineering Department, and each connection with an existing main shall be made at a time and under conditions which will least interfere with service to customers affected thereby.

In all cases where it is necessary to take an existing main or service line out of service in order to accomplish the work to be performed, the Contractor and/or developer shall notify the Engineering Department at least twenty-four (24) hours in advance as to the approximate length of time the main or service line will be out of service. The contractor and/or developer shall also be responsible for notifying all customers to be affected by loss or interruption of service by means of printed information sheets (door hangers, furnished by the County) forty-eight (48) hours in advance of taking the main or service line out of operation.

When the closing of a valve to make the connections affects a customer who cannot be without service, the Contractor and/or developer shall arrange to supply a temporary service and schedule the time which is most convenient to the customer for making the connection to the existing mains.

Facilities shall be provided for properly dewatering and for disposal of all water removed from the dewatered lines and excavations without damage to adjacent property.

5010 POLYETHYLENE ENCASEMENT.

- A. General. Polyethylene encasement shall be installed on ductile-iron pipe and fittings when indicated on the plans.
- B. Installation. The polyethylene encasement shall be installed as specified in "Method A" or "Method B" below.
 - 1. Method A: Polyethylene tubing shall be approximately two (2) feet longer than the length of the pipe section to provide a one (1) foot overlap on each adjacent pipe section. Tube ends need not be taped in place unless Contractor and/or developer is directed to do so by the Engineer.
 - 2. Method B. Polyethylene tubing shall be one (1) foot shorter than the length of the pipe section with a three (3) foot length of polyethylene tube center over pipe joint and lapped over pipe section and its tubing. Tube ends need not be taped in place unless the Contractor and/or developer is directed to do so by the Engineer.
 - 3. Repairs. Any rips, punctures, or other damages to the polyethylene shall be repaired with adhesive tape or with a short length of polyethylene tube cut open, wrapped around the pipe, and secured with adhesive tape.

5011 SETTING VALVES, FITTINGS AND HYDRANTS.

- A. Valves and Fittings. All valves, fittings, plugs and caps shall be set and joined to the pipe in the manner heretofore specified for cleaning, laying and joining pipe, except that large valves may require special support so that the pipe will not be required to support the valve weight.
 - ↳ Each valve shall be inspected before installation to ensure that all foreign substances have been removed from within the valve body, and shall be opened and closed to see that all parts are in first-class working condition. Gate valves shall be set vertical in the horizontal pipeline. Valves and pipe shall be supported in such a manner as to prevent stress in either with no deflection in the valve/pipe joint.

Valve boxes and lids shall be installed at each valve and shall be supported and maintained centered and plumb over the operating nut of the valve. The valve box shaft shall not transmit shock or stress to the valve. Install valve box covers flush with the surface of the finished area or as directed by the Engineer.

All bends and tees shall be provided with thrust blocks of plain concrete, as specified. All dead ends on new mains shall be closed with plugs or caps suitably restrained to prevent blowing off under test pressure.

- B. Hydrants. All new hydrant installations shall be as shown on the plans or Standard Drawings and shall include all necessary excavation and backfill to make the installation complete.

Each hydrant shall be inspected before installation for direction of opening, nozzle size and threading, nozzle caps and chains, operating nut, and cap nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow and weep hole openings, and handling damage and cracks. Defective hydrants shall be corrected or replaced.

All hydrants shall stand plumb. The weep holes of the hydrant shall be kept clear and free to drain. The areas around each hydrant and hydrant valve shall be thoroughly compacted to prevent settlement of these areas.

Hydrants shall be set to a grade that allows their proper operation. Traffic hydrants with breakaway joint must be set with the joint above the ground line. Hydrants behind curbs shall be placed with the hydrant centerline at least thirty (30) inches from the back of curb. Hydrants shall be rotated so as to have the pumper nozzle facing the street or rotated to face any direction as required by the Engineer.

5012 THRUST RESTRAINTS.

- A. Hydrants. The back of the base elbow of each hydrant shall be braced against a sufficient area of unexcavated earth or rock and be restrained by suitable restrained joints as shown on the plans or the Standard Drawings.
- B. Fittings. All plugs, caps, tees, bends and other fittings, unless otherwise specified, shall be provided with reaction blocking or suitable restrained joints as shown on the plans or Standard Drawings.
- C. Thrust Blocks. Vertical and horizontal reaction blocking shall be concrete as specified herein. Thrust blocks shall be installed between solid ground and the fitting to be restrained. Concrete shall be located to contain the resultant thrust force and permit access to pipe and fitting joint for repairs. All nuts and bolts shall be protected with plastic to prevent covering or contaminating with concrete.
- D. Restrained Joints. Restrained push-on or mechanical joints, mechanical joint anchoring fittings, and Meg-A-Lug retainer glands may be used in lieu of concrete thrust blocking if so indicated on the plans or approved by the Engineer.

5013 TRENCH BACKFILLING.

Compacted backfill shall be required for the full depth of the trench above the embedment where beneath structures, street, road, or highway right-of-way or abutting easements, driveways, walks, parking areas, and at all locations shown on the plans or as directed by the Engineer during the progress of the work.

The top portion of the backfill beneath established sodded areas shall be finished with at least twelve (12) inches of topsoil corresponding to, or better than, that underlying adjoining sodded areas. Topsoil shall be approved by the Engineer prior to placement, and unless otherwise directed, shall be material previously excavated and stockpiled for the purpose during excavating and grading operations. Grades on areas to receive topsoil shall be established and maintained as a part of the grading operations. Immediately prior to dumping and spreading topsoil, the surface shall be loosened by discing or scarifying to a depth of two (2) inches to permit bonding of the topsoil to the underlying surface.

At the option of the Contractor and/or developer, compacted backfill may be job-excavated material or material obtained "off site", except that all street crossings shall be backfilled with MoDOT Type I rock, or on site material provided testing is performed in one (1) foot lifts in the trench four (4) feet back of curb to four (4) feet back of curb. Job-excavated material may be used for compacted backfill (outside of Street Right of Ways) when the job-excavated material is finely divided and free from debris, organic material, cinders, or other corrosive material, and stones larger than three (3) inches in greatest dimension. Large masses of moist, stiff clay shall not be used. Job-excavated material shall be compacted to ninety-five (95) percent of maximum density at optimum moisture content as determined by ASTM D698 when the test is appropriate, or to seventy (70) percent relative density as determined by ASTM D2049 when that test is appropriate.

The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe.

The combination of the thickness of the layer, the method of compaction and the type of compaction equipment used shall be at the discretion of the Contractor and/or developer subject to obtaining the densities as specified above.

Backfill shall not be placed when material contains frost, is frozen, or a blanket of snow prevents proper compaction. Backfill shall not contain waste material, organic material, or debris of any kind.

Trench backfill above pipe embedment in locations other than those specified shall be compacted to ninety (90) percent of maximum density at optimum moisture content as determined by ASTM D698, unless otherwise permitted by the County Engineer.

Uncompacted earth backfill material to be placed above embedments shall be free of brush, roots more than two (2) inches in diameter, debris, cinders, or other corrosive material, and junk, but may contain rubble and detritus from rock excavation, stones, and boulders in certain portions of the trench depth. Uncompacted backfill material above embedments may be placed by any method acceptable to the Engineer which will not impose excessive concentrated or unbalanced loads, shock, or impact on and which will not result in displacement of installed pipe. Uncompacted backfill shall be placed to the extent necessary to prevent excessive future settlement.

Compact masses of stiff clay or other consolidated material more than one (1) cubic foot in volume shall not be permitted to fall more than five (5) feet into the trench unless cushioned by at least two (2) feet of loose backfill above pipe embedment.

No uncompacted trench backfill material containing rocks, or rock excavation detritus, shall be placed in the upper eighteen (18) inches of the trench except with specific permission of the Engineer, nor shall any stone larger than eight (8) inches in its greatest dimension be placed within three (3) feet of the top of pipe. Large stones may be placed in the remainder of the trench backfill only if well separated and so arranged that no interference with backfill settlement will result.

5014 DENSITY TESTING. At the option of the Engineer, in-place field density testing to determine compliance with specified compaction requirements may be performed using a nuclear moisture-density measuring device. The laboratory shall furnish field results to the inspector immediately. If, as a result of this field testing, the engineer determines that further compaction is required, the Contractor and/or developer shall revise his compaction procedures to obtain the results specified.

5015 DRAINAGE MAINTENANCE. Trenches across roadways, driveways, walks, or other trafficways adjacent to drainage ditches or water courses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the trafficway, to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the contractor and/or developer. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. All material deposited in roadway ditches or other water courses crossed by the line of trench shall be removed immediately after backfilling is completed and the original section, grades, and contours of ditches or water courses shall be restored. Surface drainage shall not be obstructed longer than necessary.

5016 DISPOSAL OF EXCESS EXCAVATED MATERIALS. Except as otherwise permitted, all excess excavated materials shall be disposed of away from the site of work.

Broken concrete and other debris resulting from pavement or sidewalk removal, excavated rock in excess of the amount permitted to be and actually installed in trench backfill, junk, and debris encountered in excavation work and other similar waste materials shall be disposed of away from the site of the work.

Excess earth from excavations located in unimproved property shall be distributed directly over the pipe trench and within the pipeline right-of-way to a maximum depth of six (6) inches above the original ground surface elevation at and across the trench and sloping uniformly. Drag with blade machine, or other suitable tool to a smooth, uniform surface without obstructing drainage at any point. Wasting of excess excavated material in the above manner will not be permitted where the line of trench crosses or is within a railroad, public road, or highway right-of-way. The disposal of waste and excess excavated materials, including hauling, handling, grading, and surfacing shall be a subsidiary obligation of the contractor and/or developer and no separate payment will be made therefore.

5017 SETTLEMENT. The contractor and/or developer shall be responsible for all settlement of backfill, fills and embankments which may occur within two (2) years of time after final acceptance of the contract under which the work was performed. This will include the two (2) year developer maintenance resolution completion, and acceptance by the County.

A suitable maintenance bond in an amount approved by the County Engineer shall be furnished to Clay County by the contractor and/or developer guaranteeing the maintenance of the construction under which the contract was performed. Said bond shall remain in effect for the period of two (2) years from the date of completion and acceptance of the work by the County or the period of the two (2) year developer maintenance resolution period then acceptance by the County.

5018 DISINFECTION AND TESTING.

- A. Disinfection. After installation, the entire main shall be flushed and disinfected by chlorination. Flushing shall be carried out until a turbidity-free water is obtained from all points along the main.

Immediately prior to disinfection, the main to be disinfected shall be flushed at the maximum velocity which can be developed. The flushing velocity shall be at least 2.5 feet per second.

All flushing work shall be done in the presence of the Engineer. The contractor and/or developer shall notify the Engineer at least twenty-four (24) hours in advance of the times and places at which flushing work is to be done.

1. Chlorination by the Contractor and/or developer shall conform to AWWA C601 and be performed using a one (1) percent chlorine solution prepared from granular calcium hypochlorite (one (1) pound of HTH per eight (8) gallons of water). Water entering the new main shall receive a dose of the chlorine solution fed at a constant rate such that the water will have not less than 50 mg/l free chlorine.

**Chlorine Required to Produce 50 mg/l
Concentration in 100 feet of Pipe**

<u>Pipe Diameter/inch</u>	<u>1 percent Chlorine Solution/gallon</u>
4	0.16
6	0.36
8	0.65
10	1.02
12	1.44

2. The chlorinated water shall be retained in the main for at least twenty-four (24) hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances.

3. At the end of the twenty-four (24) hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/l free chlorine.
4. Mains shall be flushed prior to placing in service. The water shall be disposed of without damage to public or private property.
5. Following the flushing of the mains, a water sample shall be taken from the new main and tested by an independent testing company for bacteria. This expense will borne to contractor or the developer. No less than three (3) sample points shall be installed on any water main. Locations shall be as follows:
 - a. Within fifty (50) feet of the beginning of the pipeline, mid-way in the pipeline, and within fifty (50) feet of the end of the Pipeline.
 - b. Sample points shall be located at a minimum of every one thousand (1,000) feet in addition to the locations at the beginning and end of the line, in addition to which sample points shall be located on all branch lines.
6. The contractor and/or developer shall repeat disinfection procedure should initial treatment fail to yield satisfactory results.

B. Hydrostatic Testing. The Contractor and/or developer shall perform hydrostatic pressure and leakage tests in accordance with AWWA C600 procedures. Where practicable, mains shall be tested in lengths between line valves or plugs of no more than fifteen hundred (1,500) feet in length.

Conduct test at a pressure of 150 psi measured at the highest point of the main. Duration of the test shall be not less than two (2) hours. Any loss of pressure throughout test of - 5 psi of test pressure shall constitute failure of the test.

Leakage test shall be conducted concurrently with the pressure test. Acceptable when leakage does not exceed that determined by the following formula:

English Units

$L = 0.0000075SD \sqrt{(P)}$, in which

L = maximum allowable leakage in gallons per hour

S = length of pipe tested in feet

D = nominal internal diameter of pipe being tested in inches

P = average actual leakage test pressure in psi

When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in of nominal valve size shall be allowed. When hydrants are in the test section, the test shall be made against the closed hydrant.

All visible leaks at exposed joints and all leaks evident on the surface where joints are covered shall be repaired regardless of total leakage as shown by test. All pipe, fittings, valves and other materials found to be defective under test shall be removed and replaced at the Contractor and/or developer's expense.

Lines which fail to meet test shall be repaired and retested as necessary until the test requirements are met.

5019 WATER MAINS NEAR SEWERS.

- A. Horizontal Separation. Whenever possible, a water main shall be laid at least ten (10) feet horizontally from any sanitary sewer, storm sewer, or manhole. When local conditions prevent a lateral separation of ten (10) feet, a water main may be laid closer than ten (10) feet to a sanitary or storm sewer, provided that the water main is laid in a separate trench, or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least eighteen (18) inches above the top of the sewer. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both the water main and sewer must be constructed of mechanical or slip-on ductile iron pipe, or prestressed concrete cylinder pipe and should be pressure tested to assure water tightness before backfilling.
- B. Vertical Separation. Whenever water mains must cross sanitary sewers, house sewers, or storm drains, the water main shall be laid at such an elevation that the bottom of the water main is eighteen (18) inches above the top of the drain or sewer. A full length of water main pipe shall be centered over the sewer line to be crossed so that the joints will be equally distant from the sewer and as remote therefrom as possible. This vertical separation shall be maintained for that portion of the water main located within ten (10) feet, horizontally, of any sewer or drain it crosses.
- C. Unusual Conditions. Where conditions prevent the minimum vertical separation set forth above from being maintained, or when it is necessary for the water main to pass under a sewer or drain, the water main shall be laid with slip-on or mechanical joint ductile iron pipe which must extend on each side of the crossing to a distance from the sewer of at least ten (10) feet. In making such a crossing, a full length of water main pipe must be centered over or under the sewer to be crossed, so that the joints will be equidistant from the sewer and as remote therefrom as possible. The sewer line must also be constructed of ductile iron pipe with slip-on mechanical joints until the normal distance from the sewer line to the water main is at least ten (10) feet. Where a water main must cross under a sewer, a vertical separation of eighteen (18) inches between the bottom of the sewer and the top of the water main shall be maintained, with adequate support, especially for the larger sized sewer lines to prevent them from settling on and breaking the water main. The sewer shall be constructed of ductile iron pipe for a distance of ten (10) feet on either side of the crossing, or other suitable protection as approved by the Engineer shall be provided. Where these conditions cannot be met, the Engineer shall be consulted as to the precautions to be taken to protect the public water supply.

- D. Sewer Manholes. No water pipe shall pass through, or come in contact with, any part of a sewer or a sewer manhole.

APPENDIX "A"

VALVES:

American Flow Control model AFC-2500
Kennedy model 1571
Clow 6100

BUTTERFLY VALVES:

Kennedy 50C
American Class 150-B
Clow F-5370

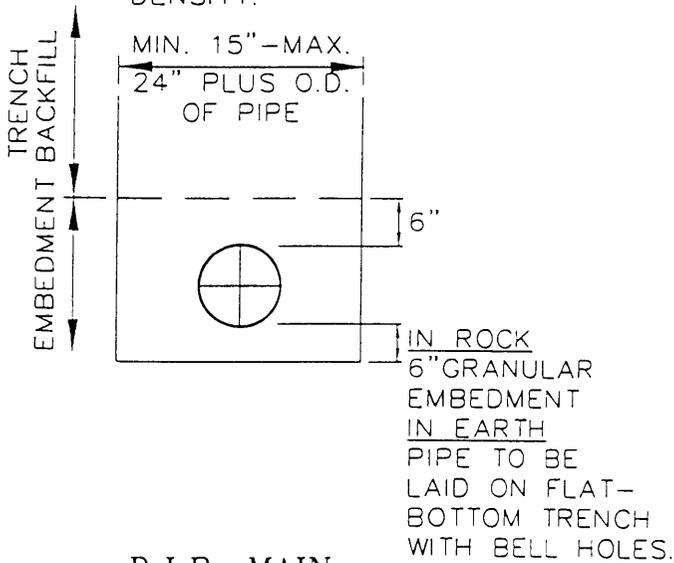
FIRE HYDRANTS:

U. S. Pipe - Metropolitan
Kennedy K81A
Clow - Medallion

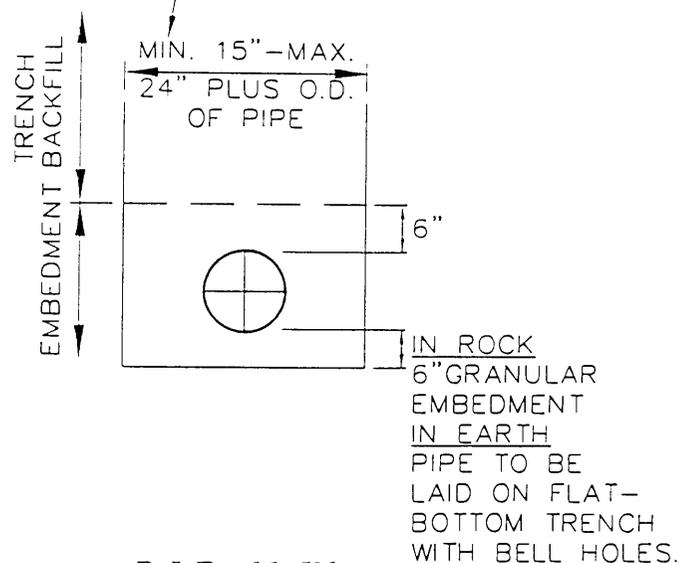
TRENCH BACKFILL:
WITHIN R/W
 JOB EXCAVATED
 MATERIAL COMPACTED
 TO 95% OF MAX.

OUTSIDE R/W
 JOB EXCAVATED
 MATERIAL COMPACTED
 TO 90% OF MAX.
 DENSITY.

TRENCH BACKFILL:
 MHTD TYPE 1 ROCK 4'
 BACK-OF-CURB TO
 4' BACK-OF-CURB.



D.I.P. MAIN
OUTSIDE PAVEMENT



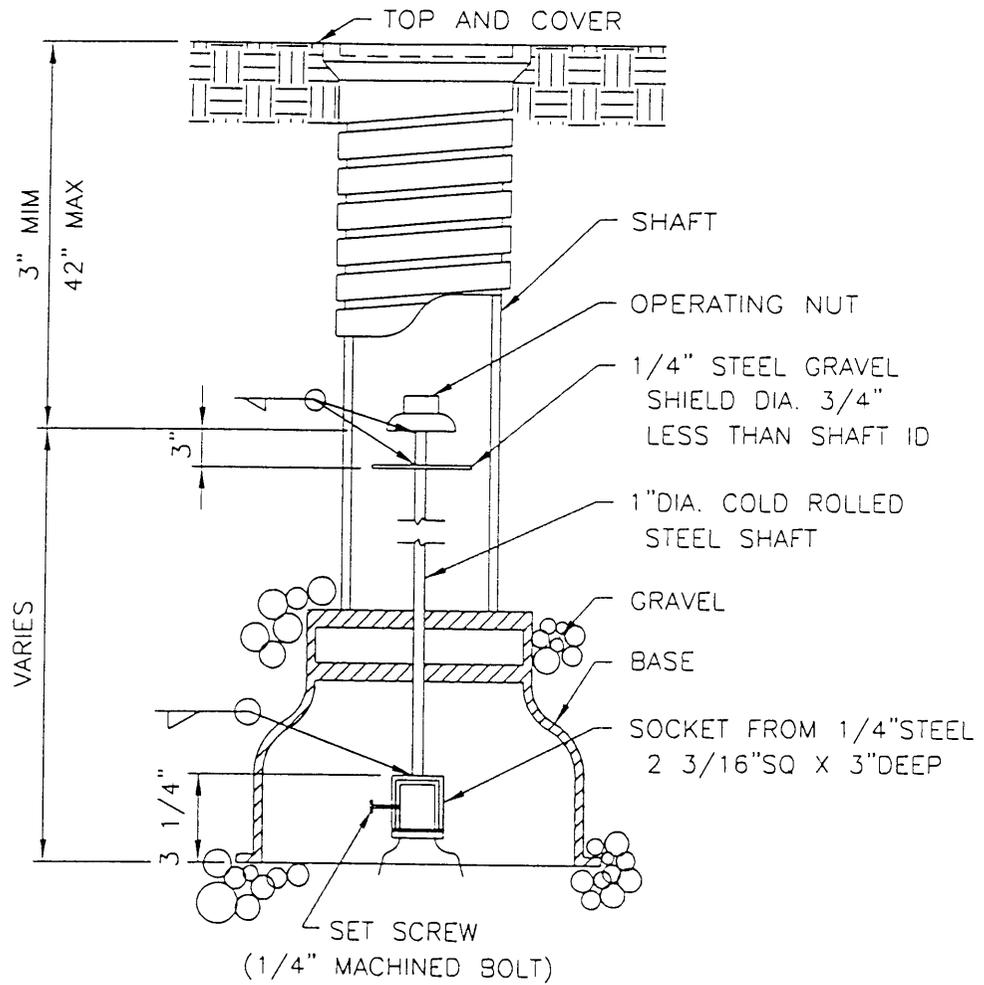
D.I.P. MAIN
UNDER PAVEMENT



County of Clay
 HIGHWAY
 DEPARTMENT/PWD

EMBEDMENT & BACKFILL
 FOR WATERMAINS

D50-1



NOTE:

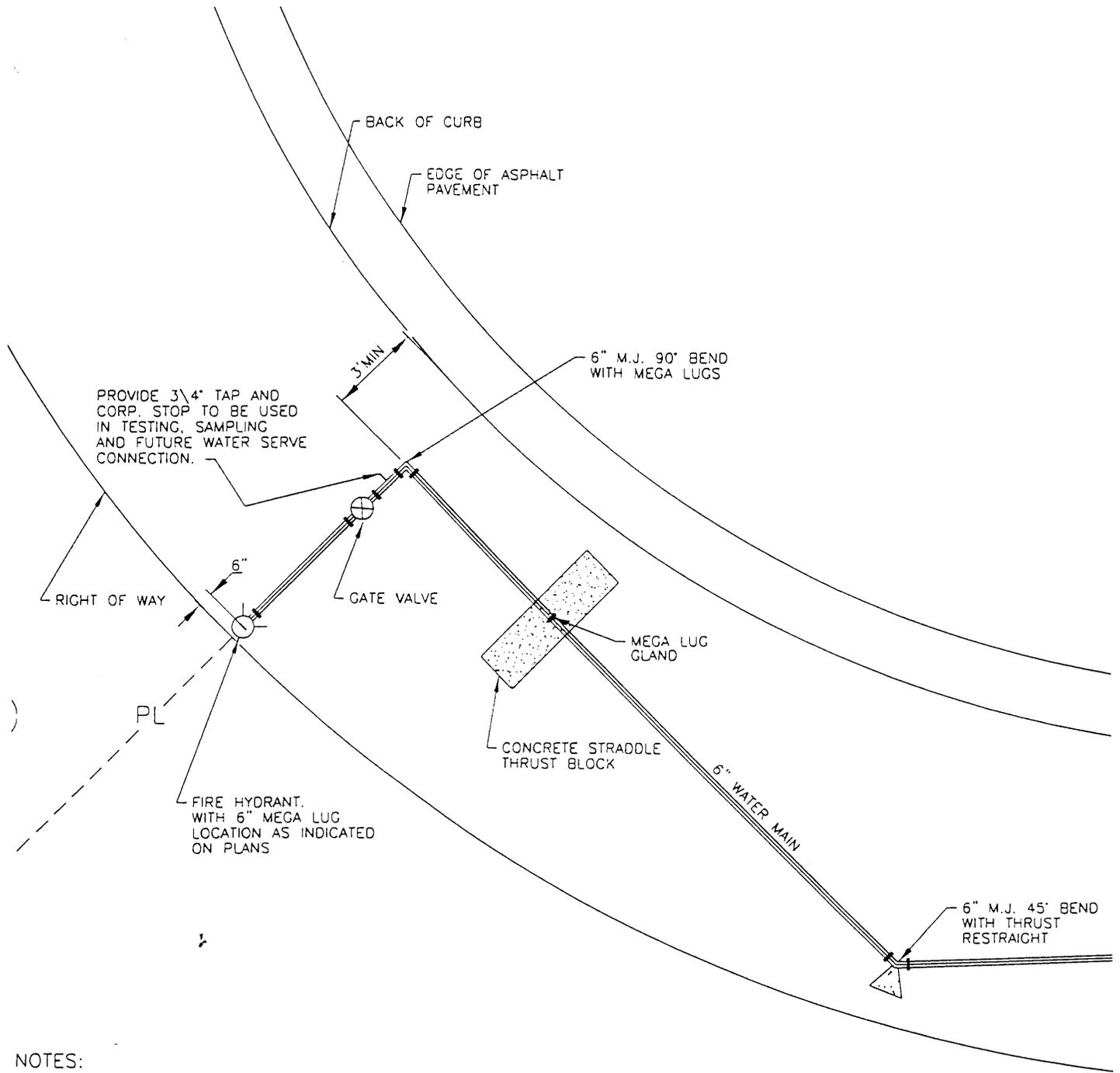
SET STEEL POST 3'-0" ABOVE GRADE
NEXT TO VALVE BOX LOCATION.
POST TO REMAIN UNTIL FINAL GRADING
AND SEEDING OR SOD IS IN PLACE.



County of Clay
HIGHWAY
DEPARTMENT/PWD

SCREW SHAFT TYPE
VALVE BOX DETAIL

D50-2



NOTES:

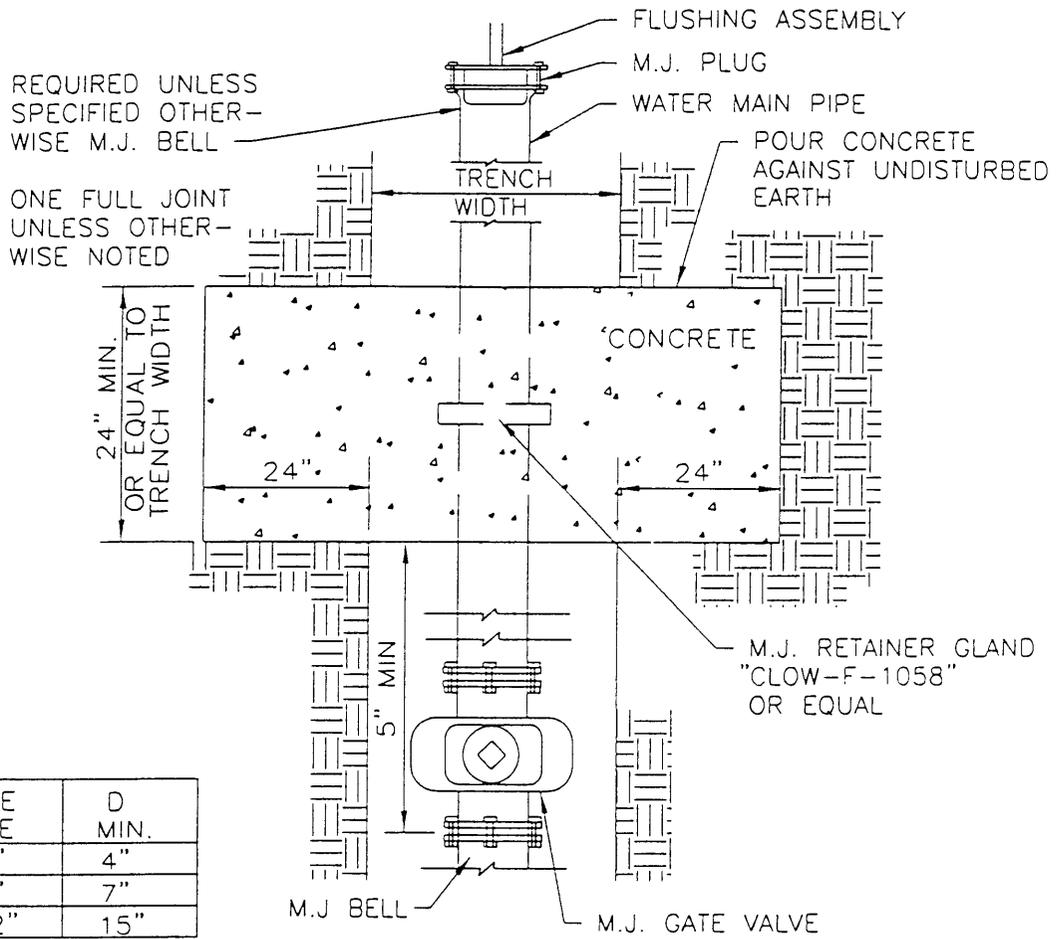
1. USE M.J. ANCHOR PIPE AND FITTINGS BEYOND THE STRADDLE BLOCK.
2. ALIGNMENT OF DIP WATER LINE AROUND CUL-DE-SAC VARIES TO MAINTAIN CLEARANCE FROM SANITARY SEWER.
3. MAIN TO BE EXTENDED TO INSURE DIP WATER LINE IS LOCATED ON PROPERTY LINE FOR FUTURE TAPPING PURPOSES.
4. ALL JOINTS TO BE RETAINED BY MEGALUG.



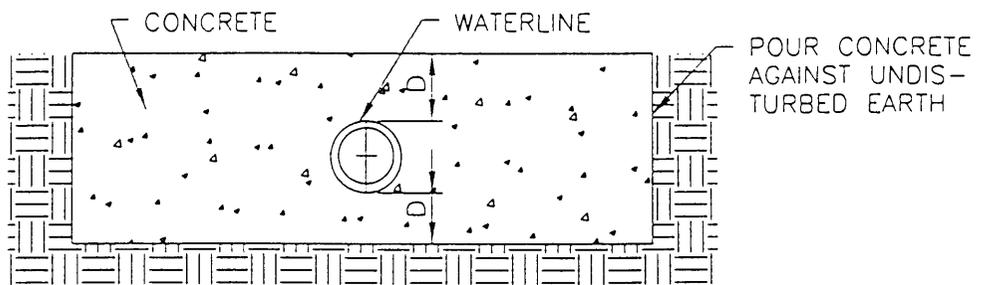
County of Clay
 HIGHWAY
 DEPARTMENT/PWD

END OF LINE ON
 CUL-DE-SAC

D50-3



PIPE SIZE	D MIN.
6"	4"
8"	7"
12"	15"



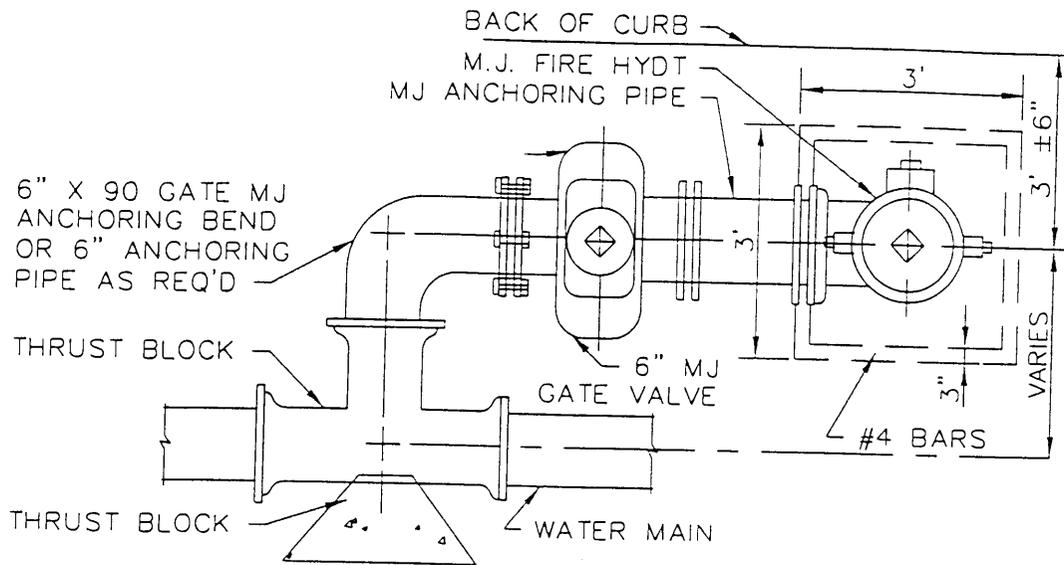
DEAD END LINE ASSEMBLY



County of Clay
HIGHWAY
DEPARTMENT/PWD

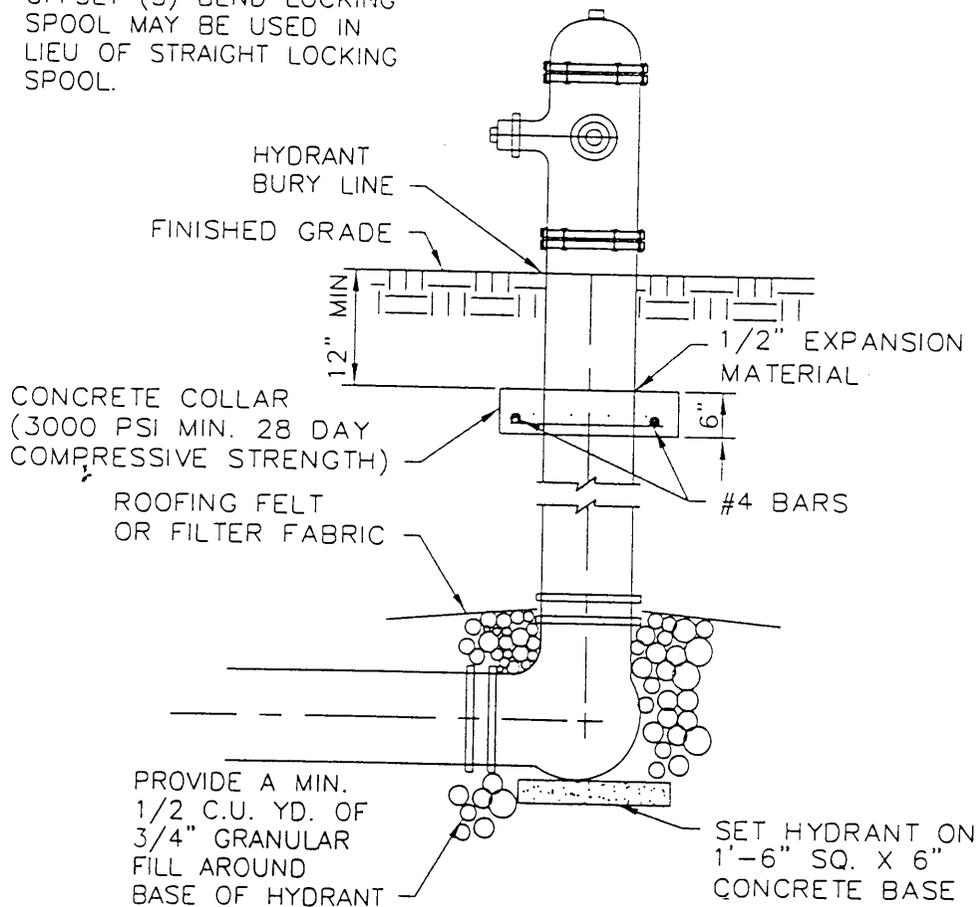
DEAD END
LINE ASSEMBLY

D50-4



NOTE:

OFFSET (S) BEND LOCKING SPOOL MAY BE USED IN LIEU OF STRAIGHT LOCKING SPOOL.

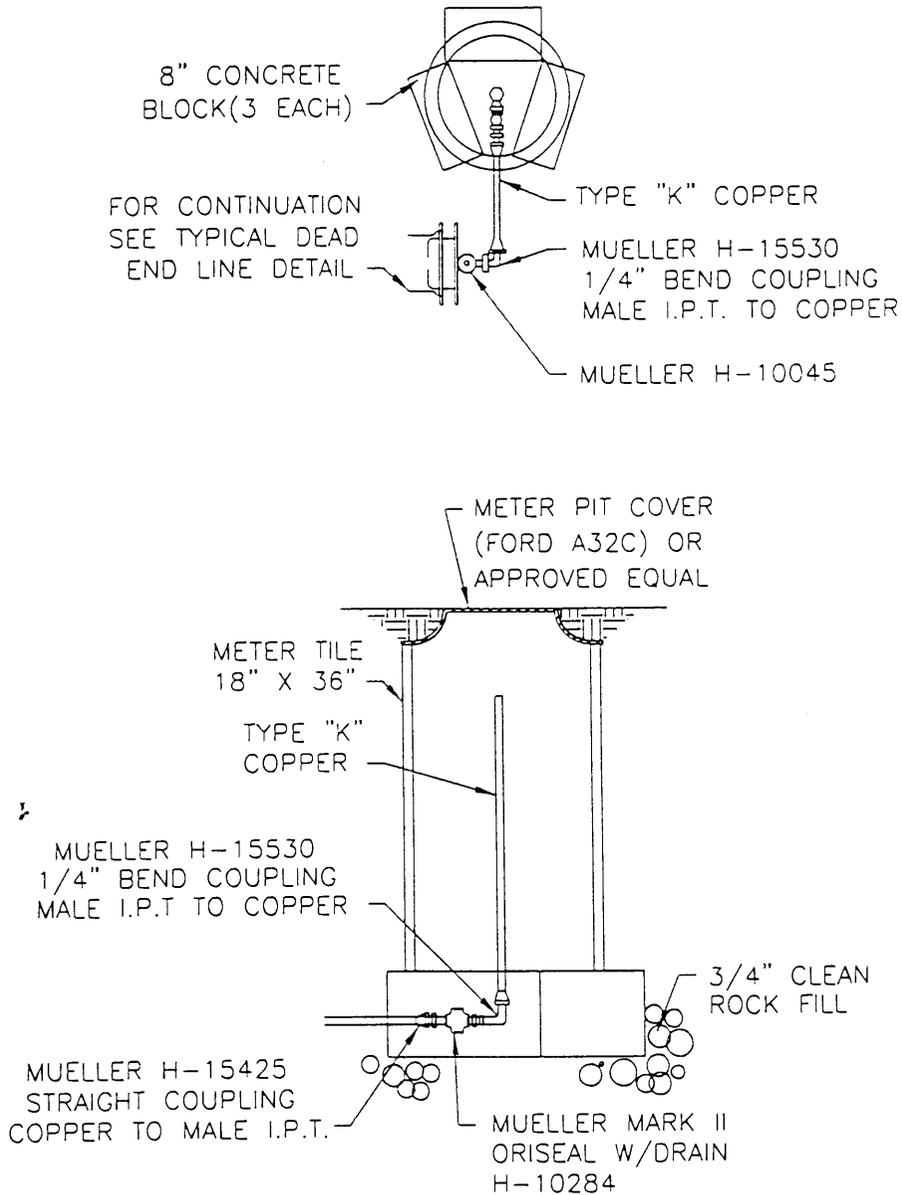


County of Clay
HIGHWAY
DEPARTMENT/PWD

TYPICAL FIRE HYDRANT
INSTALLATION DETAIL

D50-5

1. WHERE MAIN IS LOCATED BEHIND CURB IN STREET R/W OR EASEMENT, FLUSHING ASSEMBLY MAY BE CONSTRUCTED OVER END OF LINE WITHOUT THE OFFSET AS SHOWN BELOW.
2. ASSEMBLY TO BE USED ON NEW MAIN EXTENSION WHERE MAIN IS WITHIN PAVED SURFACE, SHOULDER OR IN DITCH LINE. LOCATE TILE IN ESTABLISHED GRADE AREA.
3. SET 5'-0" STEEL POST NEAR BLOW OFF ASSEMBLY.
4. ALL FITTINGS AND PIPING SHALL BE 2".



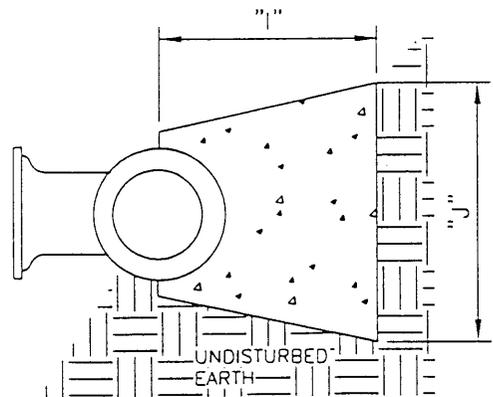
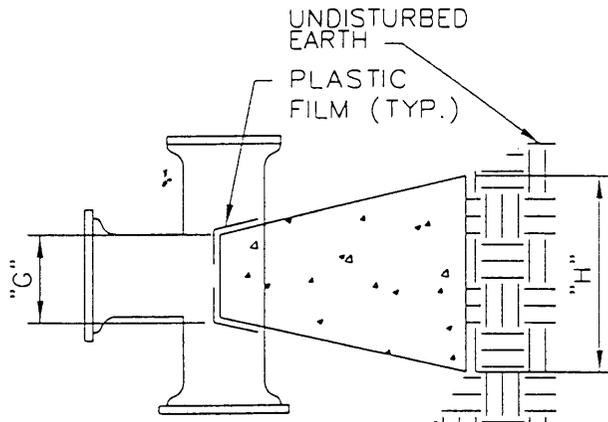
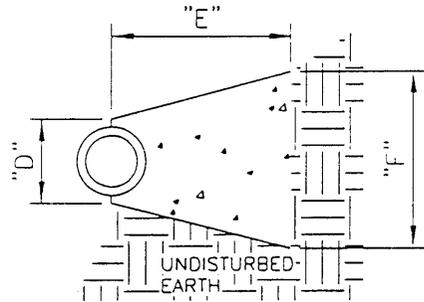
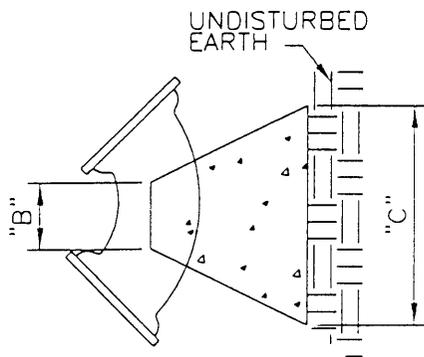
County of Clay
HIGHWAY
DEPARTMENT/PWD

FLUSHING ASSEMBLY

D50-6

BENDS		B	C	D	E	F	BENDS		B	C	D	E	F
6" 11 1/4	DEG	8"	15"	12"	24"	12"	6" 45	DEG	8"	30"	12"	24"	14"
6" 22 1/2	DEG	8"	19"	12"	24"	13"	6" 90	DEG	8"	30"	12"	24"	27"
8" 11 1/4	DEG	8"	20"	12"	24"	12"	8" 45	DEG	8"	30"	12"	24"	24"
8" 22 1/2	DEG	8"	22"	12"	24"	17"	8" 90	DEG	8"	38"	12"	24"	36"
12" 11 1/4	DEG	8"	30"	12"	24"	15"	12" 45	DEG	8"	40"	12"	24"	40"
12" 22 1/2	DEG	8"	35"	12"	24"	25"	12" 90	DEG	8"	60"	12"	24"	52"

TEES	G	H	I	J	TEES	G	H	I	J
6" X 6" X 6"	12"	24"	24"	18"	12" X 12" X 6"	12"	24"	24"	18"
8" X 8" X 6"	12"	24"	24"	18"	12" X 12" X 8"	12"	24"	24"	24"
8" X 8" X 8"	12"	24"	24"	24"	12" X 12" X 12"	12"	36"	24"	36"



NOTES:

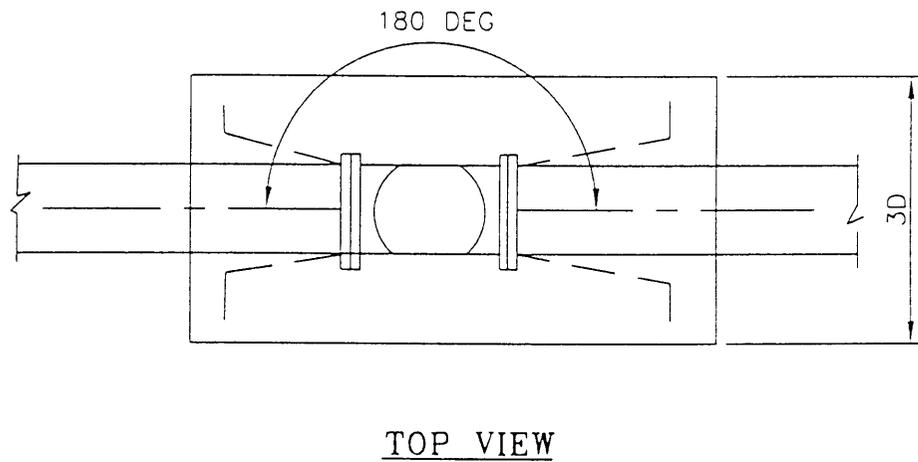
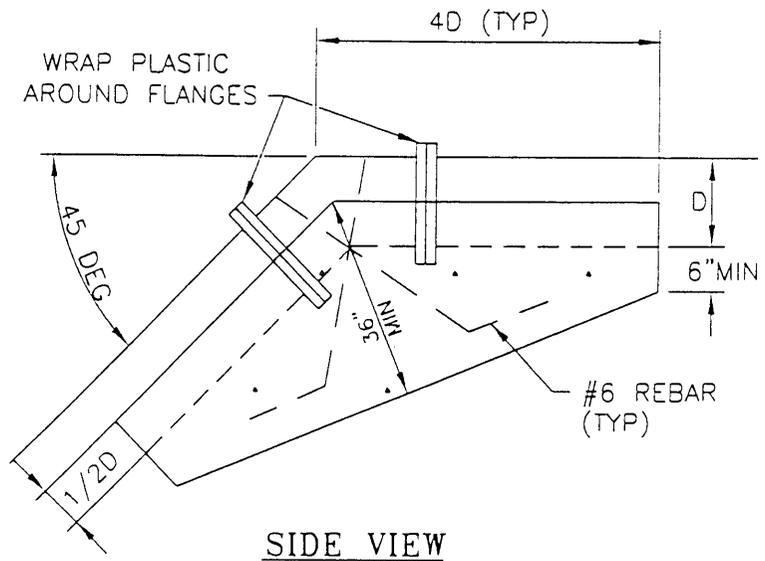
1. CONCRETE SHALL HAVE A MIN. 28-DAY COMPRESSIVE STRENGTH OF 3000 PSI.
2. ALL BLOCKING TO BE FORMED.
3. BOLT SHALL NOT BE CONTACTED BY CONCRETE.



County of Clay
HIGHWAY
DEPARTMENT/PWD

CONCRETE BLOCKING
DETAIL

D50-7



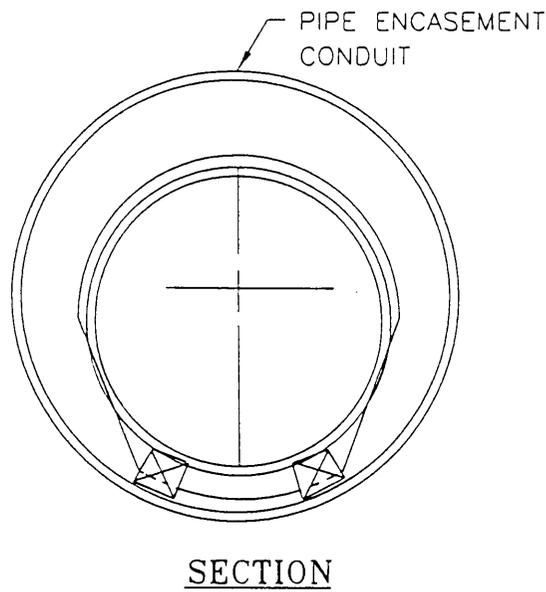
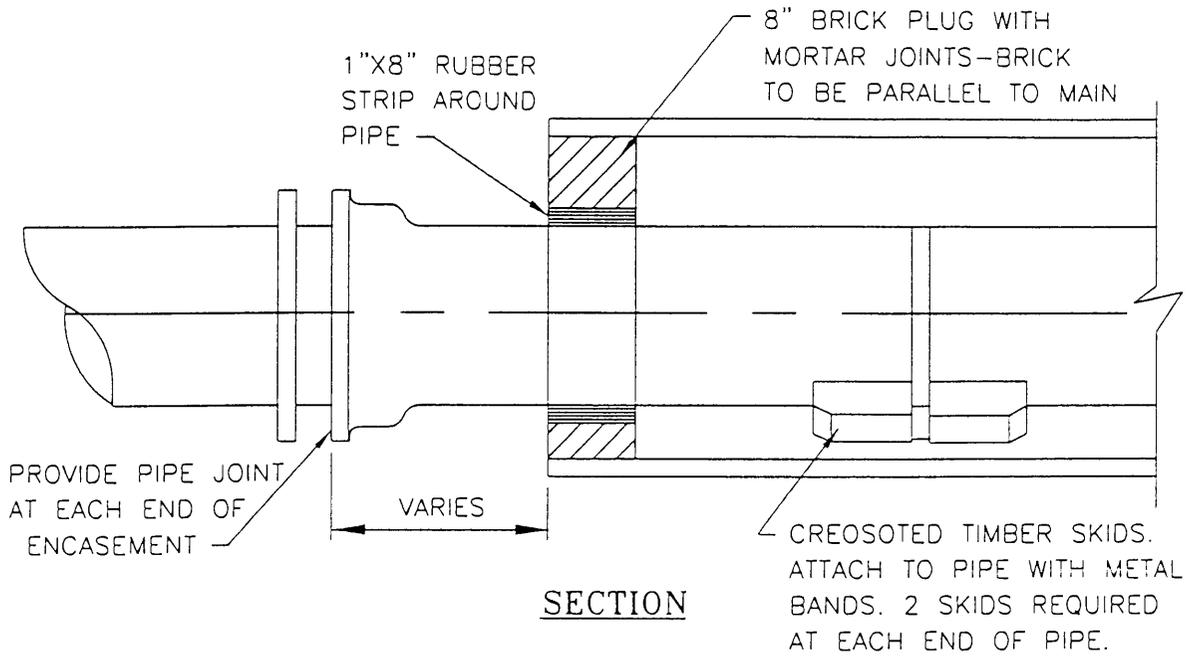
NOTE: RETAINER GLANDS WILL BE USED
ON ALL VERTICAL BENDS.



County of Clay
HIGHWAY
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VERTICAL BEND
BLOCKING DETAIL

D50-8



County of Clay
HIGHWAY
DEPARTMENT/PWD

PIPE ENCASEMENT
DETAIL

D50-9



County of Clay
HIGHWAY
DEPARTMENT/PWD

ALLOWABLE LEAKAGE
FOR WATERLINES

D50-10

ALLOWABLE LEAKAGE PER 1,000 FEET OF PIPELINE* -- gph

NOMINAL PIPE DIAMETER (INCHES)

AVERAGE TEST PRESSURE (psi)	4	6	8	10	12	14	16	18	20	24
300	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12
275	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99
250	0.47	0.71	.095	1.19	1.42	1.66	1.90	2.14	2.37	2.85
225	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70
200	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55
175	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38
150	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21
125	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01
100	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80

* FOR PIPE WITH 18-FOOT NOMINAL LENGTHS. TO OBTAIN THE RECOMMENDED ALLOWABLE LEAKAGE FOR PIPE WITH 20-FOOT LENGTHS, MULTIPLY THE LEAKAGE CALCULATED FROM THE TABLE BY 0.9. IF THE PIPELINE UNDER TEST CONTAINS SECTIONS OF VARIOUS DIAMETERS, THE ALLOWABLE LEAKAGE WILL BE THE SUM OF THE COMPUTED LEAKAGE FOR EACH SIZE.

SECTION 6000 TUNNELING, BORING AND JACKING (PIPELINES)

6001 SCOPE. This section governs construction of steel casings, complete with bulkheads and sand fill, by boring and/or jacking at the locations and to the lines and grades indicated on the drawings directed by the Engineer, or where constructed at the contractor and/or developer's option, when approved, to bypass obstructions without open cutting.

6002 MATERIALS.

A. Steel Liner Plate. Steel tunnel liner plates shall be Armco "Standard", Commercial Shearing and Stamping Company "Commercial", Republic "Truscon Paneled Out", or equal and shall be galvanized in accordance with ASTM A 123. The design and shape of the liner plates shall be such that assembly can take place entirely from within the tunnel liner. Sufficient sections shall be provided with one and one-half (1 1/2) inch or larger grouting holes, located near the centers, so that when the plates are installed there will be one line of holes on either side of the tunnel and one at the crown. The holes in each line shall not be more than nine (9) feet apart and, unless otherwise approved, shall be staggered. Bolts and nuts shall conform to ASTM A 153, A 307, A 325 and A 449 as applicable.

B. Steel Casing.

1. Steel casing for bored or jacked construction shall conform to ASTM A-139.
2. Steel shall be grade B under railroads and grade A for all other uses.
3. Minimum wall thickness for steel casing shall be in accordance with the following table:

<u>Diameter of Casing</u>	<u>Under Railroads</u>	<u>All Other Uses</u>
24"	0.406"	0.281"
26"	0.438"	0.281"
28"	0.469"	0.312"
30"	0.469"	0.312"
32"	0.500"	0.312"
34"	0.500"	0.312"
36"	0.500"	0.312"

4. Casing joints shall be welded by a certified welder in accordance with AWWA C-206.

C. End Seals. End seals shall be brick conforming with Section 4102(D) of these specifications. Mortar shall comply with Section 4102(E) of these specifications.

D. Sand Fill. Sand fill shall comply with ASTM C-33 or MCIB Section 4, Fine Aggregate. Moisture content of the sand shall not exceed. 0.5%.

6003 CONSTRUCTION DETAILS.

A. General.

1. Prior to starting work, complete details of the method of operation and liner materials to be used shall be submitted to the Engineer. The pipe line, in the area to be tunneled, bored or jacked, shall be completed before the construction of adjacent portions of the same pipe line. The purpose of this requirement is to allow for slight discrepancies in alignment and grade which may occur in the tunneled, bored or jacked installation, so minor adjustments in the adjacent pipe can be made.
2. The maximum allowable deviation from plan alignment and grade shall be as follows except when altered by the Plans or Special Provisions:
 - a. Alignment 1.0%
 - b. Grade 1.0%

B. Casing Installation.

1. The steel casing shall be advanced in a continuous operation without interruption. Sections of the casing pipe shall be welded together to form a continuous conduit capable of resisting all stresses, including jacking stresses. The casing in its final position shall be within alignment and grade tolerances specified in Section 6003 (A2). There shall be no space between the earth and the outside of the casing. Any voids which do occur shall be filled by pressure grouting.
2. Boring operations shall be performed by experienced crews using a rotary type boring machine designed especially for this purpose. Boring shall be performed in a manner to prevent disturbing the overlying and adjacent materials.
3. Jacking.
 - a. Jacking frame, guides, blocking, head and reaction devices shall be arranged to apply uniform pressure about the casing circumference without damage to the casing material, and to maintain alignment within specified tolerances.
 - b. Jacking reaction device shall provide adequate resistance to withstand two hundred (200) percent of the maximum jacking pressure.
 - c. Provide jacks of adequate number and size for the required jacking pressure, but not less than two jacks.

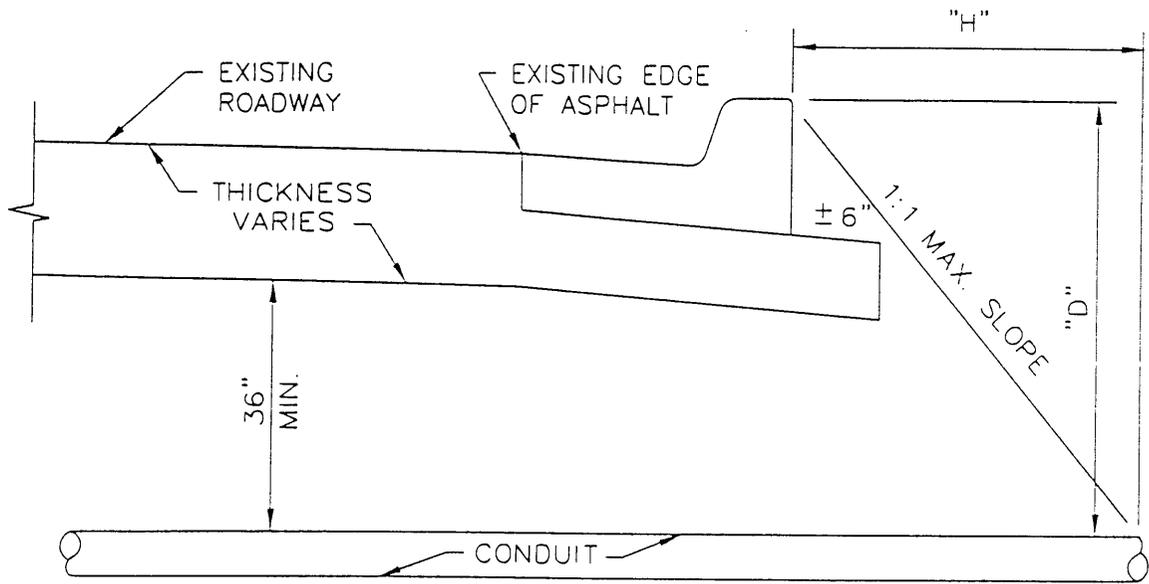
- d. Maintain jacking pit and pipe installation in such condition that drainage does not accumulate. Control and disposition of surface and subsurface water at the site of jacking operations shall be the Contractor and/or developer's responsibility subject to the approval of the Engineer.
 - e. Excavation of the heading shall not be extended more than one (1) inch outside the top and sides (upper three hundred (300) degree sector) of the casing and shall be true to grade at the invert (lower sixty (60) degree sector).
 - f. Once jacking begins, it shall proceed without interruption until installation of the entire length of the jacked line is complete.
4. Excavation in Jacked Casings. Perform excavation within jacked casings by hand or machine methods as necessary to remove the materials encountered without disturbing the overlying material. The jacked casing shall be advanced a sufficient distance ahead of the excavation face and/or shield used as necessary to protect the workman and the work, and to prevent the uncontrolled entry of unstable materials into the casing.
5. Unstable Materials. If materials are encountered during casing installation that cannot be excavated safely or without creating voids around the exterior of the casing, the Contractor and/or developer shall discontinue casing installation and stabilize such materials by dewatering, chemical soil stabilization, grouting, or other methods, and/or modify equipment and procedures as necessary to complete the casing installation.

C. Lining Installation.

- 1. Excavation. Excavate by approved methods applicable to materials encountered. Boring operations shall be performed by experienced crews using a rotary type boring machine designed especially for this purpose. Include dewatering and chemical soil stabilization or grouting when necessary due to existing field conditions. Conduct excavation in a manner to prevent disturbing the overlaying and adjacent material.
- 2. Lining. Assemble liner plates immediately following the excavation. Advance casing continuously with excavation. When liner plates are being installed, care shall be taken to maintain alignment, grade and circular shape of the tunnel. All voids between liner and surrounding earth shall be filled with grout forced in under pressure. The grout shall consist of two parts of sand to one part of Portland Cement, mixed with sufficient water to maintain a freely pouring consistency. As the pumping through any hole is stopped, it shall be plugged to prevent the backflow of grout. After lining installation is complete it shall be cleaned of all debris and all leaks which allow flowing or seeping water into tunnel, shall be stopped.

D. Pipe Installation.

1. Pipe shall be placed inside the casing to the plan line and grade by the use of wood skids or other equivalent methods. The wood shall be pressure treated with creosote, pentachlorophenol, or salt-type preservative in accordance with AWWA C2. Cut surfaces shall be given two (2) heavy brush coats of the same preservative. The wood skids shall be securely fastened to the pipe with steel straps.
2. End seals shall be constructed after the pipe is installed and approved.
3. In sanitary sewer construction, the annular space between the casing and pipe shall be filled with stabilized sand blown in so that all space is filled without disturbing the alignment and grade of the pipe.
4. No interruption of traffic will be permitted at any location where a tunnel or casing is required.



"H" MIN. DISTANCE BEHIND CURB
 TO START PUNCH OR BORE
 "D" = TOTAL DEPTH FROM TOP OF
 CURB TO TOP OF CONDUIT.
 "H" = "D"

(BY PUNCH OR BORE METHOD)



County of Clay
 HIGHWAY
 DEPARTMENT/PWD

ROADWAY CONDUIT
 CROSSING DETAIL

D60-1

SECTION 7000 BLASTING

7001 GENERAL. The Contractor and/or developer shall comply with all laws, ordinances, applicable safety code requirements, and regulations relative to the handling, storage, and use of explosives and the protection of life and property. The Contractor and/or developer shall be responsible for all damage caused by his blasting operations and shall be responsible for responding to all complaints.

7002 PERMITS. The Contractor and/or developer shall not blast any rock or other materials or allow the same to be done in prosecution of the work unless he secures proper insurance coverage and a blasting permit from the Chief Building Official as required by the Uniform Fire Code as adopted by reference in the Clay County Code.

7003 PREBLAST SURVEY. Unless otherwise directed by the Engineer, the Contractor and/or developer shall provide a preblast survey of all structures located within a minimum five hundred (500) feet radius of his blast sites. The survey shall be of such nature as to accurately establish the structural condition of all houses, buildings, bridges, overpasses, etc., within the specified area. No blasting shall be allowed until the preblast survey has been completed and has been reviewed and accepted by the Engineer. The contractor and/or developer must submit, or make available, to the Engineer preblast survey reports for all structures within the specified area. The preblast survey shall be performed by qualified personnel regularly engaged in blast operations.

7004 BLASTING OPERATIONS. Before blasting is started, the Contractor and/or developer shall inform all residents within a minimum radius of five hundred (500) feet of the blasting location by means of printed information sheets, news releases or other acceptable methods.

The Contractor and/or developer shall provide suitable warning by siren or whistle prior to all blasts.

When blasting is to occur within five hundred (500) feet of any structure adjacent to the blast site, the Contractor and/or developer shall obtain ground vibration monitoring and interpretation for each blast by qualified personnel regularly engaged in blast operation monitoring and control. One copy of the recorded data from each blast, including the computed interpretations, shall be furnished to the Engineer. Maximum particle velocity allowed shall be 1.0 inches per second. To reduce annoyance to local residents, vibration should be kept as much below the one (1) inch per second level as possible and still permit efficient performance of the required demolition work.

Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench. All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed by the Engineer.

The requirements presented herein shall not relieve the contractor and/or developer from responsibility to avoid disturbing earth or rock beyond indicated and specified lines and levels.

SECTION 8000 RESTORATION OF SURFACE CONSTRUCTION

8001 SCOPE This section covers restoration of concrete and asphalt pavement, gravel surfacing, walks, drives, curbs, and other surface construction removed or damaged during construction.

8002 GENERAL. All pavement or other surface construction which is removed or damaged during the progress of the work shall be restored to its original or better condition by the Contractor and/or developer. All restoration work shall be subject to acceptance by the Engineer and the Owner or the agency having jurisdiction thereof. All materials used for restoration work shall be new.

8003 REFERENCE STANDARD. Materials and construction methods, as referred to herein, shall conform to all applicable sections of these technical specifications.

8004 PAVEMENT REPLACEMENT. The replacement of all street surfacing shall be in accordance with the pavement replacement detail shown on the Standard Detail. The replacement concrete and asphalt pavement shall be composed of a concrete base course at least seven (7) inches thick and an asphaltic concrete overlay at least two (2) inches thick. Materials and workmanship shall conform to the following:

Concrete	As specified in Section 2000
Asphaltic Concrete	As specified in Section 1400
Trench Backfill	MoDot Type I

All drives, parking areas, and other pavement or asphalt surfaces which are removed or damaged shall be replaced to at least their original thickness. Materials used shall be new and shall match the existing surfacing as closely as possible in type, kind and quality.

8005 CONCRETE WALKS. Concrete walks removed in connection with, or damaged as a result of, construction operations shall be replaced with new construction. Such walks shall be constructed of concrete on a thoroughly compacted subgrade, shall have a vertical thickness at least as thick as the existing walks, but not less than four (4) inches thick, shall be constructed with expansion joints spaced not exceeding fifty (50) feet apart, and shall be sloped for drainage at right angles to the longitudinal centerline in the amount of approximately one-fourth (1/4) inch per foot of walk width.

Concrete materials and workmanship shall conform to the applicable requirements of Section 2000, "Concrete" of these specifications.

Surface finish of concrete walks replaced shall conform to, and shall match as closely as possible, that of existing concrete walk surfaces.

8006 CONCRETE CURBS AND GUTTERS. Concrete curbs and gutters which have been removed or damaged by reason of construction operations or any other cause shall be replaced with new concrete construction. New curb and gutter sections shall be as designated on the drawings and as detailed on the Standard Details.

Concrete materials and workmanship shall conform to the applicable requirements of Section 2000. Construction and expansion joints, dimensions, elevations and surface finish of curb and gutter replacements shall conform to, and shall match as closely as possible, that of adjacent existing concrete curbs and gutters.

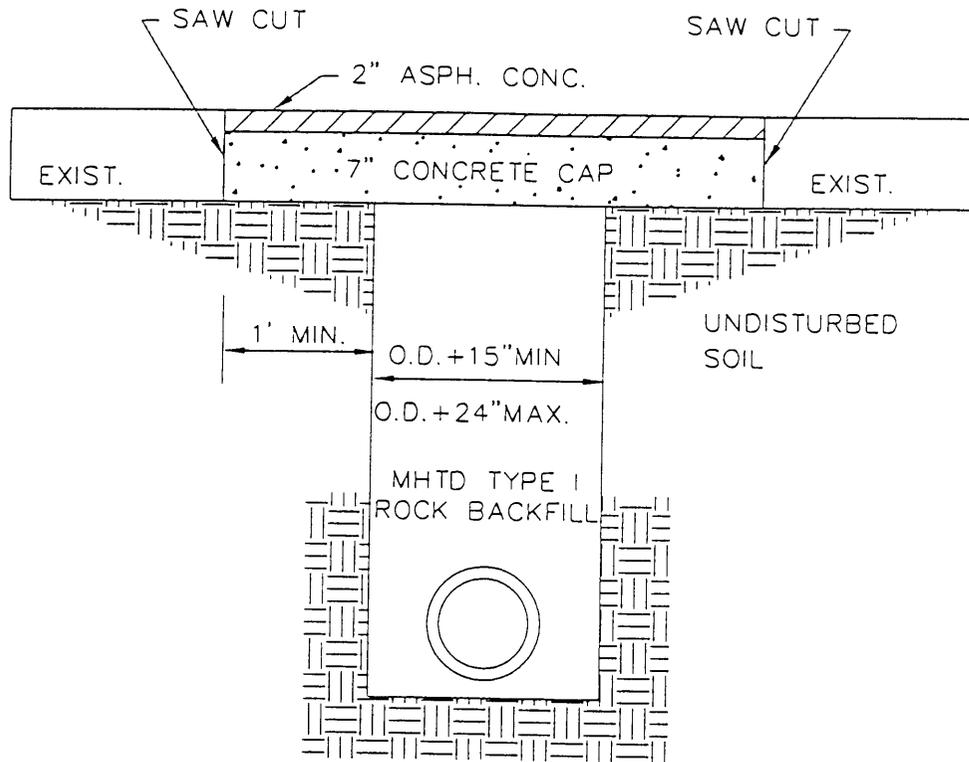
8007 GRAVEL SURFACING. Existing gravel drives, parking and surfacing which is removed or damaged during the progress of the work shall be replaced with an aggregate surfacing at least as thick as that removed, but in no case less than four (4) inches.

New aggregate surfacing shall match existing surfacing as nearly as possible in size, gradation, color, and compaction.

8008 MISCELLANEOUS REPAIR WORK. All existing items and construction, whether or not indicated by the drawings but which are removed or damaged as a result of construction operations, shall be repaired or replaced unless otherwise required by the drawings.

Repair or replacement shall be with materials similar to those existing, and shall in each case restore the item to its original or better condition as acceptable to the Engineer and the Owner thereof.

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NOTE:

1. THE 1 FT. ON EITHER SIDE OF ACTUAL TRENCH WIDTH SHALL NOT BE REMOVED UNTIL THE TRENCH HAS BEEN FILLED AND COMPACTED.



County of Clay
HIGHWAY
DEPARTMENT/PWD

STREET PATCH
DETAIL

D80-1

SECTION 8100 CHAIN LINK FENCING

8101 SCOPE. This specification covers chain link fencing and gates.

8102 FENCE TYPE. Fencing shall conform to the alignment and details shown on the drawings and shall consist of galvanized or aluminum-coated steel fabric, steel posts, top rail, and bottom rail or tension wire. Posts shall be set in concrete.

8103 MATERIALS. All steel or malleable iron parts and accessories shall be hot-dip galvanized or aluminum coated after fabrication.

Fabric	9 gauge, 2 inch mesh; galvanized ASTM A392, Class II or aluminum-coated ASTM A491, Class II.
Posts	Steel H-Section , 0.35 percent carbon; steel pipe, ASTM A120, standard weight (Schedule 40); or steel hollow structural tubing, ASTM A500 or A501.
Line Posts	
For 6 foot Fencing	H-Section 4.10 pounds per foot; 2 3/8 inch OD pipe, 3.65 pounds per foot; or 2 inch square, 3.85 pounds per foot.
For 42 inch Fencing	H-Section, 2.70 pounds per foot; or 1 7/8 inch OD pipe, 2.72 pounds per foot.
Terminal Posts	End, corner, and pull posts.
For 6 foot Fencing	2 7/8 inch OD pipe, 5.79 pounds per foot; or 2 1/2 inch square, 5.59 pounds per foot.
For 42 inch Fencing	2 3/8 inch OD pipe, 3.65 pounds per foot; or 2 inch square, 3.85 pounds per foot.
Gate Posts	Gate or leaf 6 foot or less, 2 7/8 inch OD pipe, 5.79 pounds per foot; or 2 1/2 inch square, 5.59 pounds per foot; gate or leaf over 6 foot, 4 inch OD pipe, 9.10 pounds per foot; or 3 inch square, 9.10 pounds per foot.
Top Rail	1 5/8 inch OD steel tubing, 1.40 pounds per foot.
Rail Couplings	Sleeve type, 6 inches long.

Post Tops (when barbed wires are required at the top of the fence)	Pressed steel, malleable iron, with pressed steel extension arm, or one-piece aluminum casting; with hole for top rail, designed to prevent entry of moisture into tubular posts.
Post Tops	Pressed steel, malleable iron, or cast aluminum; designed to prevent entry of moisture into tubular posts.
Barbed Wire	Galvanized, ASTM A121, Class 2 or aluminum coated ASTM A585, Class II; two 12 1/2 gauge steel wires with 4 point barbs.
Stretcher Bars	Steel, 3/16 inch by 3/4 inch, or equivalent area.
Fabric Ties	Aluminum bands or wires.
Gate Frames	Steel tubing, 1 7/8 inch OD, 2.09 pounds per foot; or 2 inch square, 2.10 pounds per foot.
Tension Wire	Galvanized or aluminum coated coil spring wire, 7 gauge.
Handrail-Setting Cement	Hallemitte "Por-rok Cement".

8104 GATES. Gates shall be swing type, hinged to swing 90 degree from closed to open, complete with frames, latches, stops, keepers, hinges, and fabric. Gate leaves shall have intermediate members and diagonal truss rods as required for rigid construction. Joints between frame members shall be made by welding or by means of heavy fittings, and shall be rigid and water tight. Gate fabric shall be same as fence fabric and shall be attached to frame ends by stretcher bars, bolt hooks, or other mechanical means.

Hinges shall be heavy pattern with large bearing surfaces and shall not twist or turn under the action of the gate. Latches shall be plunger bar type, full gate height, and arranged to engage the gate stop, except single gates less than ten (10) feet wide may be provided with a forked latch. Latches shall be arranged for padlocking with the padlock accessible from both sides of the gate. Stops shall consist of a roadway plate with anchor set in concrete and arranged to engage the plunger. Keepers shall consist of mechanical devices for securing and supporting the free end of gates when in the full-open position.

Gates shall be installed so that they cannot be removed without disassembly of the hardware. Hardware attachment bolts shall be peened so that removal will be difficult.

8105 FENCE CONSTRUCTION. The installed fence shall conform to the alignment and finish grade indicated. All posts shall be plumb unless otherwise shown or required shall be spaced ten (10) feet apart for 6 foot fencing and six (6) feet apart for 42 inch fencing. Where necessary, the fence grade shall be adjusted to fit the ground contour by slipping the fence fabric links. Found surface irregularities shall be graded as required to maintain not more than a two (2) inch clearance below the bottom of the fence fabric.

Where posts are set in earth, concrete foundations thirty-six (36) inches deep shall be provided. If bedrock is encountered, post excavation shall be continued to the thirty-six (36) inch depth or eighteen (18) inches into the rock, whichever is less. Concrete foundation shall be circular in horizontal section, not less than ten (10) inches in diameter for line posts, and with a diameter not less than the post OD plus nine (9) inches for terminal and gate posts, except that foundations in bedrock shall be a minimum of six (6) inches larger than the outside dimension of the post. Foundations shall extend above the ground surface and shall be crowned approximately one (1) inch. Concrete for foundations shall conform to the requirements of Section 2000 "Concrete". Each foundation shall be cured for at least seventy-two (72) hours before further work is done on the post.

- Top rails and bottom tension wires shall be installed before the fabric. Top rails shall be furnished in at least eighteen (18) foot lengths and shall be securely connected to gate and terminal posts. Tension wires shall be installed approximately six (6) inches above grade and shall be attached to each post and securely anchored at terminal and gate posts. Straight runs between braced posts shall not exceed fifteen hundred (1,500) feet. A terminal post shall be provided at each change in slope.

Fabric shall be attached to the top rail, bottom rail, and bottom tension wire at twenty-four (24) inch centers and to the line posts at fifteen (15) inch centers. Barbed wire shall be fastened to each extension arm by internal clips or external fabric ties. Each stretcher bar shall be threaded through the fabric and anchored to the post at fifteen (15) inch center by positive mechanical means.

Each gate and terminal post shall be braced by horizontal pipe brace and an adjustable truss extending to an adjacent line post. Corner posts shall be braced in both directions.

Fabrics shall be stretched taut and anchored so that a pull of one hundred fifty (150) pounds at the middle of a panel will not lift the bottom of the fabric more than six (6) inches.