



**SANITARY SEWER**

**CONSTRUCTION SPECIFICATIONS**

**DESERT WATER AGENCY**  
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## **GENERAL REQUIREMENTS**

## GENERAL REQUIREMENTS

### 1. Definitions

Whenever the terms herein defined occur in these Specifications or other related documents, they shall have the meanings here given.

- a. "Agency" or "Owner" shall mean the DESERT WATER AGENCY, Post Office Box 1710 (92263-1710), 1200 Gene Autry Trail South, Palm Springs, California 92264, its Manager, and any other person or persons designated by the Owner to act on its behalf.
- b. "Manager" shall mean the person designated by the Board of Directors of the DESERT WATER AGENCY to have charge, supervision, and administration of said Owner.
- c. "Contractor" shall mean the person, firm, or corporation responsible for the construction of facilities and improvements or any portions thereof to be integrated into Owner's facilities, either on behalf of the Owner or on behalf of a Developer.

Contractor shall at all times be represented on the Work in person or by a duly designated agent or superintendent. Contractor shall hold a valid Contractor's License in accordance with the provisions of Division 3, Chapter 9 of the Business and Professions Code of the State of California, and any amendments thereto.

- d. "Work" shall mean all Work to be performed by Contractor and shall be as specified by these Specifications and the Construction Drawings, Special Requirements, and Specific Directions for any particular project.

The Owner may at any time during Work, by written order, make such changes as found necessary in the character, quality, or quantity of the Work to be furnished.

- e. "Construction Drawings" shall mean those drawings approved by the Owner showing dimensions, details, features, and requirements of the Work. Said Construction Drawings shall be used in conjunction with Special Requirements or Specific Directions and shall be augmented by these Specifications and the Standard Drawings.
- f. "Special Requirements" shall mean those requirements describing Work not specified by Construction Drawings or Specific Directions, clarifying Work as shown by Construction Drawings or as described by Specific Directions, or supplementing or modifying these Specifications. Said requirements may be written or verbal.
- g. "Specific Directions" shall mean those instructions of the Owner supplementing or modifying the Construction Drawings, Special Requirements, and Specifications and shall include all Work not specified by Construction Drawings or Special Requirements. Said instructions may be written or verbal.
- h. "Specifications", also "Construction Specifications", shall mean the requirements contained herein and shall apply to all Work, where applicable, unless specified otherwise, in the Construction Drawings, Special Requirements, or Specific Directions. Said Specifications shall augment Construction Drawings, Special Requirements, or Specific Directions and shall pertain to all methods and materials of construction.
- i. "Standard Drawings" shall mean all drawings referenced as such and bound with the Specifications. Said Standard Drawings shall be considered an integral part of the Specifications.
- j. "Standard Specifications" shall mean the Standard Specifications for Public Works Construction, latest edition, as published by Building News, Inc, Los Angeles, California. The Standard Specifications shall augment, not supersede, the "Construction Specifications". As used herein, the Standard Specifications shall not apply to measurement, payment, schedule, delays, or extra work.

**2. Abbreviations**

Whenever used in these Specifications, the following abbreviations shall refer to the agency shown:

a.	AASHTO	American Association of State Highway and Transportation Officials
b.	ACI	American Concrete Institute
c.	AISC	American Institute of Steel Construction
d.	AISI	American Iron and Steel Institute
e.	ANSI	American National Standards Institute
f.	API	American Petroleum Institute
g.	ASTM	American Society for Testing Materials
h.	AWWA	American Water Works Association
i.	AWS	American Welding Society
j.	CRSI	Concrete Reinforcement and Steel Institute
k.	DIPRA	Ductile Iron Pipe Research Institute
l.	EIA	Electronic Industries Association
m.	IEEE	Institute of Electrical and Electronic Engineers
n.	IPCEA	Insulated Power Cable Engineers' Association
o.	NBFU	National Board of Fire Underwriters
p.	NEC	National Electrical Code
q.	NEMA	National Electrical Manufacturing Association
r.	REA	Rural Electrification Administration
s.	SSPC	Steel Structures Painting Council
t.	UL	Underwriters' Laboratories

All references to Specifications of any of the above agencies shall mean the latest editions thereof.

**3. Permits, Certificates, Laws, and Ordinances**

Unless specified otherwise, Contractor shall at no cost to the Owner obtain all necessary permits, certificates, and licenses from such Federal, State, and local agencies as required to perform the Work. Contractor shall comply with all laws, ordinances, or rules and regulations of said agencies in performance of the Work.

**4. Contractor's Liability**

Contractor shall be responsible, and the Owner shall not be answerable or accountable in any manner, for any loss or damage that may happen to the Work performed by Contractor, subcontractors, or those associated with or working under Contractor, or for any of materials or equipment used or employed in performing the Work, or for injury to any person or persons, including employees, the public, or others, or for damage to property from any cause which might have been prevented by Contractor, subcontractors, or those associated with or working under Contractor. Contractor having control over such Work must properly guard and does indemnify and hold the Owner harmless, and will defend the Owner therefrom at Contractor's own expense, against all injuries or damages to persons and property.

Contractor shall indemnify, defend, and hold the Owner harmless from any and all claims, demands, fines, and penalties imposed or levied by any Federal, State, or local agency associated with or related to the taking (as defined by the United States Fish and Wildlife Service and, or the California Department of Fish and Game) of any protected animal or plant species or habitat by Contractor, subcontractors, or those associated with or working under Contractor.

**5. Rights-of-Way**

a. Permanent Rights-of-Way

For Developer financed Work, Developer shall provide the Owner with all permanent rights-of-way or permanent easements in a form approved by the Owner, unless specified otherwise.

For Owner financed Work, Owner will obtain all permanent rights-of-way or permanent easements as required to perform the Work unless specified otherwise. Said rights-of-way will not include rights-of-way for which permits, certificates, and licenses are required from Federal, State, and local agencies, unless specified otherwise.

b. Access or Temporary Rights-of-Way

Contractor shall, at no cost to the Owner, obtain all access or construction rights-of-way of a temporary nature other than specified.

**6. Interferences**

Any and all crossings of public utility facilities such as water mains, sewer lines, gas lines, electrical or control cables and/or conduits, telephone and/or telegraph cables and/or conduits shall be made by Contractor in accordance with requirements and Specifications of appropriate agencies. Contractor shall obtain any necessary permits, licenses, and/or agreements required by said agencies.

Whenever facilities are encountered by Contractor, he shall ascertain the ownership thereof and shall make all necessary arrangements with the owners for the protection, removal, relocation, and/or replacement thereof. Contractor shall give the owners due notice of his requirements and shall give them convenient access and cooperate with them in every way while any work of removal and/or replacement is being performed.

**7. Sanitation**

All parts of the Work shall be maintained in a neat, clean, sanitary condition. Fixed and portable toilets, inaccessible to insects, shall be provided wherever needed for use by employees and their use shall be strictly enforced. All waste and refuse from sanitary facilities or from any source related to Contractor's operations shall be disposed of in a sanitary manner satisfactory to the Owner and in accordance with laws and regulations pertaining thereto. Contractor shall rigorously prohibit and prevent committing of nuisance within the Work area or upon the Owner's right-of-way or adjacent private property. Contractor shall furnish all facilities and means for proper sanitation for the Work and shall indemnify, protect, and save the Owner harmless from any liability resulting from improper or insufficient sanitation.

**8. Accident Prevention and First Aid**

Contractor shall provide a safe working environment for all persons working on or affected by the Work. Contractor shall take precautions for the protection of persons and property at all times during the course of the Work. Contractor shall exercise and observe the safety provisions of applicable laws and building and construction codes. Contractor shall maintain in good and safe operating condition all equipment and facilities required for proper execution and inspection of the Work.

Contractor shall guard machinery, equipment, and hazards in accordance with safety provisions of the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America, the Construction Safety Orders and Trench Construction Safety Orders as issued by the Division of Industrial Safety of the Department of Industrial relations of the State of California, and Chapter 8 ("Traffic Control and Protection of Workmen") of the Manual of Instruction for the Maintenance Department of the California State Division of Highways, to the extent that such provisions are not inconsistent with applicable laws or regulations.

All warning signs, lights, barricades, and other measures designed to protect the travelling public shall be erected and maintained in good order by Contractor in accordance with applicable provisions of Chapter 21 ("Maintenance Signs, Barricades, and Traffic Control") of the Manual of Instruction for the Maintenance Department of the California State Division of Highways and of the applicable ordinances

of the public agency having jurisdiction over the maintenance and policing of highways, thoroughfares, and streets. Special regard shall be given to the rights and convenience of the traveling public and the property owners and residents in the area of Work. Cross-over boards or steel plates approved by the Owner shall be placed and other precautions taken whenever necessary to provide for at least one-way traffic along all traveled streets and to provide access to driveways and residences, unless specified otherwise.

**9. First Aid Facilities**

Contractor shall keep first aid facilities and supplies on the jobsite. Contractor shall provide instruction in first aid as required by State regulations. Contractor shall provide emergency first aid treatment and supplies for his employees sufficient to comply with all applicable laws.

**10. Materials**

Contractor shall furnish only approved materials as listed in the Owner's approved material list. All materials to be furnished by Contractor shall be new and of the best quality for their intended use. All like materials shall be of one manufacture for any particular project.

Contractor shall submit 3 copies of all material lists to the Owner for approval thereof. Said material lists shall include manufacturer's name, designation, description, and related information of all materials to be furnished and installed or otherwise used by Contractor in the performance of the Work. Said material lists shall be submitted at or prior to project preconstruction meeting and said lists shall be approved by the Owner prior to beginning construction.

**11. Construction**

Contractor alone shall be responsible for the safety, efficiency, and adequacy of his plant, equipment, appliances, and methods and for any damage which may result from their failure or their improper construction, maintenance, or operation.

Contractor shall be responsible for examining all Construction Drawings, Specifications, Standard Drawings, Work site, delivery routes, and local conditions which may affect the Work.

Before proceeding with the Work, Contractor shall furnish the Owner any information required of him by the Construction Drawings, Specifications, Standard Drawings, Special Requirements, and Directions of the Owner.

Contractor shall keep at jobsite a complete set of Construction Drawings, Specifications, Standard Drawings, permits, certificates and licenses for the Work, and all other data required by the Owner. Contractor shall be responsible for checking all dimensions and quantities on said drawings or schedules and shall notify the Owner of any errors and omissions found.

Until acceptance of the Work by the Owner, Contractor shall bear the risk of injury or damage to any part of the Work by action of the elements or from any other cause and Contractor shall rebuild, repair, restore, and make good any injuries or damages to the Work except as limited in the Contract Appendix.

Contractor shall cooperate with other contractors who are working in the project area as the Owner may specify and he shall comply with all orders of the Owner. Contractor shall employ only competent and skillful persons to perform the Work. Said persons shall be qualified or certified to perform the Work in accordance with requirements of said person's trade.

Contractor shall submit to the Owner for approval a construction schedule covering all Work based on normal work periods. Contractor shall not deviate from approved schedule without prior permission from the Owner. Whenever Contractor arranges to work at night or at any time other than normal work

periods or to vary the period during which Work is to be carried on each day, he shall obtain special permission from the Owner to do so and he shall keep the Owner properly informed of his activities. Construction schedule shall show the order in which Contractor proposes to carry out Work, dates of anticipated commencement and completion of Work and salient components thereof, and estimated percentage of Work to be completed at any time during the construction period.

**12. Records of Construction**

Contractor shall maintain at least one complete set of Construction Drawings on the jobsite during the course of construction upon which he shall note any changes in the Work as they occur. Contractor shall maintain said Drawings so that the Owner may at any time during the course of construction ascertain the changes that have occurred. Said Construction Drawings shall be the basis of the two sets of record drawings that Contractor shall provide the Owner upon completion of the Work.

**13. Inspection**

All materials and equipment furnished and all Work performed shall be subject to rigid inspection by the Owner. Contractor may be required to remove and replace under proper inspection any Work performed in the absence of prescribed inspection, with the entire cost being borne by Contractor irrespective of whether such Work is found to be defective. Work covered up without authority of the Owner shall, upon order of the Owner, be uncovered to the extent required to permit inspection, repair, or replacement and thereafter be recovered, and Contractor shall bear entire cost.

**14. Examination of Work**

Contractor shall furnish the Owner every reasonable facility for ascertaining whether Work is being accomplished in accordance with the requirements and intention of the Construction Drawings, Specifications, Standard Drawings, Special Requirements, and Directions of the Owner.

**15. Right to Occupy Work**

The Owner may wish to occupy or place in service portions of the Work before its final completion and shall be at liberty to do so. Such occupancy or placing in service of any portion of the Work shall not relieve Contractor of his responsibility of protection and care of all Work until final completion and acceptance provided, however, that expense directly attributable to operation and placing portions of Work in service shall not be chargeable to Contractor.

**16. Maintenance and Guarantee**

Contractor shall guarantee that all Work performed by him meets all requirements specified as to character, quality, and quantity of materials and workmanship. Contractor shall replace all materials and pay all installation costs made necessary by defects in materials or workmanship supplied by him that become evident within one year after acceptance of the facilities or the date of final payment, whichever occurs later.

Contractor shall replace all defective materials promptly upon receipt of written notice from the Owner. If Contractor fails to replace all defective materials promptly, the Owner may secure the service of others to perform the Work and Contractor shall be liable to the Owner for any costs including removal and replacement thereof.

**17. Construction Power**

Contractor shall provide all necessary power required for his operations, and shall provide and maintain in good order such modern power equipment and installation as shall be adequate, in the opinion of the Owner, to perform the required Work in a safe and satisfactory manner.

**18. Construction Water**

Unless specified otherwise, the Owner will provide construction water to Contractor from its existing system at established rates. Contractor shall furnish and install all necessary piping and appurtenances necessary to convey water from the Owner's metered service connection to place of use.

**19. Welding**

Welding shall be done by the electric arc method using a process which excludes the atmosphere from the molten metal, except where otherwise approved by the Owner. Welding electrodes used for manual welding shall be an approved type. Except as modified herein, welding process qualification and operator qualification shall comply with the applicable requirements of the "Code for Arc and Gas Welding in Building Construction" of the AWS.

Each weld shall be uniform in width and size throughout its entire length. Each layer shall be smooth, free from slag, cracks, pinholes, and undercut and shall be completely fused to adjacent weld beads and base metal. Cover pass shall be completely free of course ripples, irregular surfaces, non-uniform bead pattern, high crown, deep ridges, or valleys between beads, and shall blend smoothly and gradually into surface of base metal. Butt welds shall be slightly convex, of uniform height, and shall have full penetration. Fillet welds shall be of size indicated, with full throat, and with each leg of equal length. Repair, chipping, or grinding of welds shall not gouge, groove, or reduce base metal thickness.

**20. Environmental Factors**

Contractor shall take all reasonable precautions to protect the environment.

a. Air Pollution

Contractor shall use only machinery and equipment which is equipped with suitable air pollution control devices so that undue quantities of pollutants are not added to the atmosphere in the vicinity of the Work site. Contractor's equipment shall meet all Federal, State, and local requirements for air quality emissions and Contractor shall comply with all applicable Federal, State, and local air pollution control regulations.

Contractor shall also take all necessary precautions to control dust created by construction operations. Contractor shall be especially diligent in implementing his dust control program and he shall be prepared to respond immediately and positively to any instructions for corrective action given by the Owner. Contractor shall use dust palliatives if necessary to satisfactorily control dust; however, Contractor shall secure the Owner's approval for use of dust palliatives other than water.

b. Explosives

Contractor shall handle, transport, store, and use explosives in accordance with applicable Federal, State, and local laws and regulations. Contractor shall be responsible for and make good any damage caused by his use of explosives.

c. Fires

Contractor shall exercise all precautions necessary to prevent unauthorized fires within or adjacent to the limits of the Work. Contractor shall be responsible for all damage resulting from fire due directly or indirectly to his or his employees' activities or the activities of his subcontractors or their employees.

d. Drainage and Flooding

Contractor shall manage excavation and spoil banks such that existing drainage conditions are not impaired. Contractor shall provide drainage in all cases where the existing drainage conditions are being unavoidably altered or disturbed by his operations. Temporary diversions, ditches, checks, swales, or other drainage structures or features necessary to ensure proper drainage and flood control shall be provided by Contractor at no extra cost to the Owner.

e. Historical and Archaeological Sites

If Contractor should encounter any evidence of historical or archaeological significance, he shall immediately cease construction, notify the Owner, and refrain from any activity until the Owner orders Work to resume. The Owner will assume full responsibility for any delays caused by historical or archaeological investigations.

f. Noise Pollution

Contractor shall equip all machinery and equipment used for construction with noise control devices such as mufflers for internal combustion engines or other suitable noise suppressors. Noise produced by construction operations shall be kept to a minimum and shall be consistent with reasonable human health requirements considering time of day and location of Work site. Contractor shall comply with all applicable Federal, State, and local noise pollution control regulations.

Unless specified otherwise, noise levels in connection with the Work shall not exceed 75 dB(A) at a distance of one hundred (100) feet for relatively continuous exposure and they shall not exceed 90 dB(A) at that same distance for relatively infrequent intermittent exposure. Contractor shall be prepared to respond immediately and positively to any instructions for corrective action given by the Owner particularly with respect to complaints from the public.

g. Public Relations

Contractor shall give due consideration to the comfort and convenience of the public and he shall instruct his employees to be polite and respectful in their dealings with the public at the Work site and in traveling to and from the Work site.

h. Traffic

Contractor shall adequately protect the public using any roads which are involved in Contractor's operations and he shall maintain safe traffic flow in the vicinity of the Work. Contractor shall use signs, barricades, delineators, flashers, and flagmen, all in strict compliance with Federal, State, and local rules and regulations regarding traffic control. Public roadways shall not be barricaded or blockaded except in accordance with requirements of public agencies having jurisdiction over same. Contractor shall provide access to all walkways, sidewalks, driveways, and streets at all times. If requested by the Owner, Contractor shall furnish a traffic control program for the Work.

i. Vegetation and Wildlife

Contractor shall not destroy or disturb any vegetation or habitat unless absolutely necessary for the performance of the Work. Contractor shall take all steps necessary to ensure that his employees do not destroy or disturb any vegetation or wildlife in the prosecution of the Work or incidental thereto, including travel to and from the Work site.

j. Water Pollution

Contractor shall discard materials which might adversely affect ground or surface water at approved dump sites only. Chemicals and other water pollutants shall not be discharged into natural watercourses or on land tributary to said watercourses. Contractor shall comply with all applicable Federal, State, and local water pollution control regulations.

k. Cleanup

Contractor shall keep the premises occupied by him in a neat, clean condition free from unsightly accumulation of rubbish. Contractor shall maintain all Work areas within or without the project limits free from dust which would cause a hazard to the Work, operations of other contractors, or other persons or property. Upon completion of the Work, Contractor shall at his own expense satisfactorily dispose of or remove from the vicinity of the Work all plants, building, rubbish, unused materials, concrete forms, and other equipment and materials belonging to him or used under his direction during construction and, if he fails to do so, the same may be removed and disposed of by the Owner at Contractor's expense.

the 1990s, the number of people aged 65 and over in the United States is projected to increase from 20 million to 35 million.

As the number of people aged 65 and over increases, the number of people aged 75 and over is also projected to increase. In 1990, there were 10 million people aged 75 and over in the United States. By 2010, this number is projected to increase to 15 million. This increase in the number of people aged 75 and over is expected to be driven by the increase in the number of people aged 65 and over, as well as by the increase in life expectancy.

The increase in the number of people aged 75 and over is expected to have a significant impact on the economy. For example, the number of people aged 75 and over is expected to increase from 10 million in 1990 to 15 million in 2010. This increase is expected to be driven by the increase in the number of people aged 65 and over, as well as by the increase in life expectancy.

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# **BASIC CONCRETE**

## BASIC CONCRETE SPECIFICATIONS

### PART 1 - GENERAL

#### 1.01 General Requirements

- A. Contractor shall furnish all materials for concrete in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete, all in accordance with the requirements of the Contract Documents.
- B. All cast-in-place concrete falls into one of the following categories and shall comply with all requirements of this basic specification.
  - 1. Structural Concrete (or Class "A" Concrete). Concrete to be used in all cases except where noted otherwise in the Contract Documents.
  - 2. Sitework Concrete (or Class "B" Concrete). Concrete to be used for curbs, gutters, catch basins, sidewalks, pavements, fence and guard post embedment, underground duct bank encasement and all other concrete appurtenant to electrical facilities unless otherwise shown.
  - 3. Lean Concrete (or Class "C" Concrete). Concrete to be used for thrust blocks, pipe trench cut-off blocks and cradles, where the preceding items are detailed on the drawings as unreinforced. Concrete to be used as protective cover for dowels intended for future connection.

#### 1.02 Reference Specifications, Codes, and Standards

##### A. Specifications

Items specified elsewhere in these Contract Documents:

Concrete Formwork - See Basic Concrete Formwork Specification.

Concrete Reinforcement - See Basic Concrete Reinforcement Specification.

##### B. Codes

The Building Code, as referenced herein, shall be the Uniform Building Code (UBC), of the International Conference of Building Officials (ICBO), latest edition.

##### C. Commercial Standards

Where not covered in this specification, all work shall comply with the following standards, latest editions:

ACI 214	Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 301	Specifications for Structural Concrete for Buildings
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 347	Recommended Practice for Concrete Formwork
ACI 318	Building Code Requirements for Reinforced Concrete
ASTM C 494	Specification for Chemical Admixtures for Concrete

### 1.03 Contractor Submittals

#### A. Mix Designs

Prior to beginning the work, Contractor shall submit to Engineer, for review, preliminary concrete mix designs which shall show the proportions and gradations of all materials proposed for each class and type of concrete to be used on the job. The mix designs shall be designed by an independent testing laboratory acceptable to Engineer. All costs related to such mix design shall be borne by the Contractor.

#### B. Certified Delivery Tickets

Where ready-mix concrete is used, Contractor shall provide certified delivery tickets at the time of delivery of each load of concrete. Each certificate shall show the total quantities (by weight) of cement, sand, each class of aggregate, and admixtures, and the amounts of water (by gallons) in the aggregate and added at the batching plant as well as the amount of water allowed to be added at the site for the specific design mix. Each certificate shall, in addition, state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to when the batch was dispatched, when it left the plant, when it arrived at the job, the time that unloading began, and the time that unloading was finished.

### 1.04 Quality Assurance

A. Tests on component materials and for compressive strength of concrete will be performed as specified herein. Test for determining slump will be in accordance with the requirements of ASTM C 143.

B. The cost of all laboratory tests on concrete will be borne by the Owner. However, Contractor shall be charged for the cost of any additional tests and investigation on work performed which fails to meet specification.

C. Concrete for testing shall be supplied by Contractor at no cost to the Owner, and Contractor shall provide assistance to the Engineer in obtaining samples, and disposal and cleanup of excess material.

#### D. Field Compression Tests

1. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as selected by the Engineer to insure continued compliance with these specifications. Each set of test specimens will be a minimum of 4 cylinders.
2. Compression test specimens for concrete shall be made in accordance with ASTM C 31. Specimens shall be 6 inch diameter by 12 inch high cylinders.
3. Compression tests shall be performed in accordance with ASTM C 39. One test cylinder will be tested at 7 days and 2 at 28 days.

The remaining cylinder will be held to verify test results, if needed.

E. Evaluation and Acceptance of Concrete

1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 318, Chapter 4 "Concrete Quality", and as specified herein.
2. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for all subsequent batches of the type of concrete affected.
3. All concrete which fails to meet the ACI requirements and these specifications is subject to removal and replacement at the cost of the Contractor.

F. Construction Tolerances

Contractor shall set and maintain concrete forms and perform finishing operations so as to insure that the completed work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 347.

- G. The following construction tolerances are hereby established and apply to finished walls and slab unless otherwise shown:

<u>Item</u>	<u>Tolerance</u>
Variation of the constructed linear outline from the established position in plan	In 10 feet: 1/4 inch; In 20 feet or more: 1/2 inch
Variation from the level or from the grades shown	In 10 feet: 1/8 inch; In 20 feet or more: 1/4 inch
Variation from the plumb	In 10 feet: 1/8 inch; In 20 feet or more: 1/4 inch
Variation in the thickness of slabs and walls	Minus 1/4 inch; Plus 1/2 inch
Variation in the locations and sizes of slab and wall openings	Plus or minus 1/4 inch

Regardless of the tolerances listed herein, it shall be the responsibility of the Contractor to limit deviations in line and grade to tolerances which will permit proper installation and operation of mechanical equipment and piping.

## PART 2 - PRODUCTS

### 2.01 Concrete Materials

- A. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.
- B. All materials furnished for the work shall comply with the requirements of Sections 201, 203, and 204 of ACI 301, as applicable.
- C. Storage of materials shall conform to the requirements of Section 205 of ACI 301.
- D. Materials for concrete shall conform to the following requirements:
  - 1. Cement shall be standard brand portland cement conforming to ASTM C 150 for Type II or Type V. Portland cement shall contain not more than 0.60 percent alkalis. A single brand of cement shall be used throughout the work, and prior to its use, the brand shall be acceptable to the Engineer. The cement shall be suitably protected from exposure to moisture until used. Cement that has become lumpy shall not be used. Stacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports for each shipment of cement to be used shall be submitted to the Engineer if requested regarding compliance with these specifications.
  - 2. Water shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts and other impurities. The water shall be considered potable, for the purposes of this section only, if it meets the requirements of the local governmental agencies. Agricultural water with high total dissolved solids (over 1000 mg/l TDS) shall not be used.
  - 3. Aggregates shall be obtained from pits acceptable to the Engineer, shall be non-reactive, and shall conform to ASTM C 33. Maximum size of coarse aggregate shall be as specified in Paragraph 2.07B. Lightweight sand for fine aggregate will not be permitted.
    - a. Coarse aggregates shall consist of clean, hard, durable gravel, crushed gravel, crushed rock or a combination thereof. The coarse aggregates shall be prepared and handled in two or more size groups for combined aggregates with a maximum size greater than 3/4 inch. When the aggregates are proportioned for each batch of concrete the two size groups shall be combined.
    - b. Fine aggregates shall be natural sand or a combination of natural and manufactured sand that are hard and durable.
    - c. Combined aggregates shall be well graded from coarse to fine sizes, and shall be uniformly graded between screen sizes to produce a concrete that has optimum workability and consolidation characteristics. Where a trial batch is required for a mix design, the final combined aggregate gradations will be established during the trial batch process.
  - 4. Ready-mix concrete shall conform to the requirements of ASTM C 94.

5. Air-entraining agent meeting the requirements of ASTM C 260, shall be used. Sufficient air-entraining agent shall be used to provide a total air content of 4 to 6 percent; provided that, when the mean daily temperature in the vicinity of the worksite falls below 40 degrees F for more than one day, the total air content provided shall be 5 to 7 percent. The Owner reserves the right, at any time, to sample and test the air-entraining agent received on the job by the Contractor. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement.
6. Admixtures. Admixtures shall be required as stated herein and at the Engineer's discretion or, if not required, may be added at the Contractor's option to control the set, effect water reduction, and increase workability. In either case, the addition of an admixture shall be at the Contractor's expense. The use of an admixture shall be subject to acceptance by the Engineer. Concrete containing an admixture shall be first placed at a location determined by the Engineer. If the use of an admixture is producing an inferior end result, Contractor shall discontinue use of the admixture. Admixtures specified herein shall conform to the requirements of ASTM C 494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used. Admixtures shall contain no free chloride ions, be non-toxic after 30 days, and shall be compatible with and made by the same manufacturer as the air entraining admixture.
- a. Low range water reducer shall be used in all structural and sitework concrete and shall conform to ASTM C 494, Type A. It shall be either a hydroxylated carboxylic acid type or a hydroxylated polymer type. The quantity of admixture used and the method of mixing shall be in accordance with the manufacturer's instructions and recommendations.
- b. Set controlling admixture shall be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80 degrees F, a set retarding admixture such as Sika Chemical Corporation's Plastiment, Master Builder's Pozzoloth 300R, or equal shall be used. Where the air temperature at the time of placement is expected to be consistently under 40 degrees F, a set accelerating admixture such as Sika Chemical Corporation's Plastocrete 161FL, Master Builder's Pozzoloth 50C, or equal shall be used.
- c. High range water reducer may be used if approved by Engineer. If allowed it shall be sulfonated polymer conforming to ASTM C 494, Type F or G.
- High range water reducing agent shall only be added to the concrete at the batch plant. It shall be second generation type, Daracem 100, as manufactured by W.R. Grace & Co.; Rhedbuild 1000, as manufactured by Masterbuilders; or equal. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified.
- Concrete shall be mixed at mixing speed for a minimum of 30 mixer revolutions after the addition of the high range water reducer.
7. Calcium Chloride shall not be added to or used in concrete.

## 2.02 Curing Materials

Materials for curing concrete shall conform to the following requirements:

- A. Concrete curing compound shall be Masterkure manufactured by Masterbuilders, Cleveland, OH, or approved equal. The curing compound shall contain a fugitive dye so that areas of application will be readily distinguishable.
- B. Polyethylene sheet for use as concrete curing blanket shall be white, and shall have a nominal thickness of 6 mils. The loss of moisture when determined in accordance with the requirements of ASTM C 156 shall not exceed 0.055 grams per square centimeter of surface.
- C. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, having a nominal thickness of 2 mils and permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A (Int. Amd. 1). The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 gram per square centimeter of surface.
- D. Polyethylene-coated burlap for use as concrete curing blanket shall be 4 mil thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 grams per square centimeter of surface.
- E. Curing mats for use in Curing Method 6 as specified in Paragraph 3.09G herein, shall be heavy shag rugs or carpets or cotton mats quilted at 4 inches on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.
- F. Evaporation retardant shall be a material such as Confilm as manufactured by Masterbuilders, Cleveland, OH; or equal.

## 2.03 Waterstop

- A. Contractor shall provide waterstops at all construction and expansion joints in all water holding structures. Waterstop shall be greenstreak PVC Style 732, 6 inches wide, or Style 735, 9 inches wide, as specified on drawings.
- B. Contractor shall heat fuse joints and connections in strict compliance with manufacturer's instructions using heating tools and devices recommended by same. Waterstops shall be continuous in joints, following offsets and angles in joint until spliced to waterstops at intersecting joints, completely sealing the structure. Waterstops shall be aligned and centered in joints. Contractor shall secure flanges of waterstops to reinforcing bars with 18 gauge wire ties spaced maximum 18 inches on center. Waterstop joints shall be properly heat-spliced at ends and crosses to preserve continuity. Contractor shall locate waterstops where shown on drawings and in all waterbearing walls and slabs where common to: earth-bearing or earth-support; occupied areas; or above-grade exposed surfaces.
- C. All joints with waterstops involving more than 2 ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of 2 dissimilar waterstop sections shall be prefabricated by the Contractor prior to placement in the forms, allowing not less than 24 inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated waterstop joint assemblies shall be butt welded to the straight run portions of waterstop.

- D. Waterstop splices shall have a tensile strength of not less than 60 percent of the unspliced materials tensile strength.

#### 2.04 Expansion Joints

- A. Contractor shall provide expansion joints where indicated on Construction Drawings. Expansion joints shall consist of joint filler material and joint sealant. Filler material shall be held down 1/2 inch for sealant unless otherwise shown.
- B. Expansion joint filler material shall be preformed sponge neoprene or cork conforming to ASTM D 1752. Filler material containing asphalt shall not be used.

#### 2.05 Joint Sealant

- A. Joint sealant for use in construction, control, and expansion joints shall be select seal U-227 reservoir grade as supplied by Select Products Co., or approved equal.

Joint primer shall be as produced and/or recommended by sealant manufacturer.

- B. Contractor shall clean all locations where sealant is placed by sandblasting and be free from oil, foreign materials, and moisture. Lower surfaces of joints shall be isolated with a bond breaker such as polyethylene, polyethylene tape, or equal as recommended by sealant manufacturer.
- C. Sealant shall be placed in strict accordance with manufacture's recommendations by a firm specializing in this type of work, or by the Contractor under direct supervision of the manufacturer. If the Contractor chooses to apply sealant, manufacturer's technical representative shall be present at the beginning of sealant placement to observe and advise on methods for mixing, joint preparation, and application of sealant.

#### 2.06 Concrete Bond Breaker

- A. Bond breaker shall be Super Bond Breaker as manufactured by Burke Company, San Mateo, California; Select Cure CRB as manufactured by Select Products Co., Upland, CA; Tilt-EEZ Bond Breaker as manufactured by Conspec; or approved equal. It shall contain a fugitive dye so that areas of application will be readily distinguishable.
- B. Contractor shall strictly follow manufacturer's application guidelines. Just prior to application, joint shall be thoroughly soaked so that concrete contains approximately the same surface moisture as newly cast concrete. Bond breaker shall be brush applied with a minimum of two coats. Extreme care must be taken to prevent any bond breaker from contacting waterstops. If necessary, wrap waterstop during bond breaker application.

#### 2.07 Concrete Design Requirements

- A. General

Concrete shall be composed of cement, admixtures, aggregates and water. These materials shall be of the qualities specified. The exact proportions in which these materials are to be used for different parts of the work will be determined during the trial batch. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. Mix designs shall not contain more than 43 percent of sand of the total weight of fine and coarse aggregate. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet

the required results at no additional cost to the Owner. All changes shall be approved by Engineer.

**B. Water-Cement Ratio and Compressive Strength**

The minimum compressive strength and cement content of concrete shall be not less than that specified in the following tabulation.

<u>Type of Work</u>	<u>Min. 28-Day Compressive Strength (psi)</u>	<u>Max. Size Aggregate (in.)</u>	<u>Min. Cement per cu yd (sacks)</u>	<u>Max. W/C Ratio (by wt.)</u>
Structural Concrete (Class "A"):				
Walls, roof slabs, floor slabs, columns, and footings and all other concrete items not specified elsewhere	3,500	1	6.2	0.48
Sitework concrete (Class "B"):	3,000	1	5.5	0.52
Lean concrete (Class "C"):	2,000	1	4.0	0.60

**Note:** One sack of cement equals 94 lbs.

**C. Adjustments to Mix Design**

Mixes used shall be changed whenever such change is necessary or desirable to secure required strength, density, workability, and surface finish and Contractor shall be entitled to no additional compensation because of such changes. Approval shall be obtained from Engineer prior to any changes.

**2.08 Consistency**

The quantity of water entering into a batch of concrete shall be just sufficient, with a normal mixing period, to produce concrete which can be worked properly into place without segregation, and which can be compacted by vibratory methods herein specified to give desired density, impermeability and smoothness of surface. The quantity of water shall be changed as necessary, with variations in the nature of moisture content of the aggregates, to maintain uniform production of desired consistency. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slumps shall be as follows:

<u>Part of Work</u>	<u>Slump (in.)</u>
Structural concrete	3 inches (±1 inch)
Other work	4 inches (±1 inch)
With high range water reducer added	8 inches max.

## 2.09 Ready-Mixed Concrete

- A. At Contractor's option, ready-mixed concrete may be used provided it meets all requirements as to materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C 94, including the supplementary requirements specified in Paragraphs 2.09B through 2.09F, herein.
- B. Ready-mixed concrete shall be delivered to the site of the work, and discharge shall be completed within 90 minutes after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first. In hot weather (ambient temperature above 95°F) or under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes.
- C. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.
- D. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolution of mixing.
- E. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than 1 inch when the specified slump is 4 inches or less, or if they differ by more than 2 inches when the specified slump is more than 4 inches, the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.
- F. Each batch of ready-mixed concrete delivered at the job site shall be accompanied by a certified weighmaster delivery ticket furnished to the Engineer in accordance with Paragraph 1.03B, herein.
- G. Non-agitating equipment for transporting ready-mixed concrete shall not be used. Combination truck and trailer equipment for transporting ready-mixed concrete shall not be used. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates may be subject to continuous inspection at the batching plant by the Engineer.
- H. Transit mix trucks delivering concrete to the site shall have full water tanks upon arrival at the site. Any addition of water must be approved by Engineer. Added water must be incorporated by additional mixing of at least 35 revolutions.

## **PART 3 - EXECUTION**

### **3.01 Proportioning and Mixing**

#### **A. Proportioning**

Proportioning of the concrete mix shall conform to the requirements of Chapter 3 "Proportioning" of ACI 301; provided, that the maximum slump for any concrete shall not exceed 4 inches except when the use of high range water reducer is permitted which increases the maximum slump to 8 inches.

#### **B. Mixing**

Mixing of concrete shall conform to the requirements of Chapter 7 of said ACI 301 specifications.

#### **C. Slump**

Maximum slumps shall be as specified in Paragraph 2.08A, herein.

#### **D. Retempering**

Concrete or mortar which has partially hardened shall not be retempered.

### **3.02 Preparation of Surfaces for Concreting**

#### **A. General**

Earth surfaces shall be thoroughly wetted by sprinkling, prior to placing any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. These surfaces shall be free from standing water, mud, and debris at the time of placing concrete.

#### **B. Joints in Concrete**

The location of all construction joints not specifically noted or shown shall be approved by Engineer. Concrete surfaces upon or against which concrete is to be placed, where the placement of the old concrete has been stopped or interrupted so that, as determined by the Engineer, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bond. Except where the drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, and foreign material. Such cleaning shall be accomplished by sandblasting to remove laitance and to provide a uniform surface texture with approximately 1/4 inch of surface sandblasted off. Sandblasting shall be followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.

#### **C. Placing Interruptions**

When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent work; provided that construction joints shall be made only where acceptable to the Engineer.

D. Embedded Items

Concrete shall not be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the Engineer at least 4 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.

E. All inserts or other embedded items shall conform to the requirements herein.

F. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where shown on Contract Drawings and shall be acceptable to the Engineer before any concrete is placed. Accuracy of placement is the responsibility of the Contractor.

G. Concrete anchor bolts and expansion anchors shall be inserted to the minimum depths listed below unless noted otherwise:

<u>Size</u>	<u>Reinforced Concrete</u>
1/4"	3"
3/8"	4"
1/2"	5"
3/4"	6"

Expansion anchors shall be red head wedge, self-driving, stud, multi-set, or equal.

H. All smooth dowels shall have at least one side coated with a bond breaker. Dowel bond breaker shall be a heavy duty industrial grease hand applied. A wax paper or PVC sleeve may be used at the Contractor's option if specifically manufactured to create slip dowels. Paper tubing shall be multi-ply stock and heavily impregnated with paraffin. Maximum sleeve thickness shall be 1/16" and sleeve shall fit snugly over dowel.

I. Casting New Concrete Against Old

Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), surfaces of the old concrete shall be thoroughly cleaned and roughened by sand-blasting (exposing aggregate) prior to placement.

J. Concrete shall not be placed in any old or new structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. Concrete shall not be deposited underwater nor shall the Contractor allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such a manner and at such velocity as to injure the surface finish of the concrete. Contractor shall provide pumping or other necessary dewatering operations for removing groundwater, if required, with methods subject to review by Engineer.

K. Corrosion Protection

Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2 inches clearance between said items and any part of the concrete reinforcement. Contractor shall not secure such items in position by wiring or welding them to the reinforcement.

L. Anchor Bolts shall be accurately set, and shall be maintained in position by templates while being embedded in concrete.

M. Cleaning

Surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before concrete is placed.

**3.03 Handling, Transporting, and Placing**

A. General

Placing of concrete shall conform to the applicable requirements of Chapter 8 of ACI 301 and the requirements of this section.

B. Non-Conforming Work or Materials

Concrete which upon or before placing is found not to conform to the requirements specified herein shall be rejected and immediately removed from the work. Concrete which is not placed in accordance with these specifications, or which is of inferior quality, shall be removed and replaced by and at the expense of the Contractor.

C. Unauthorized Placement

Concrete shall not be placed except in the presence of duly authorized representative of the Engineer. Contractor shall notify Engineer at least 24 hours in advance of placement of any concrete.

D. Placement in Wall Forms

Concrete shall not be dropped through reinforcement steel or into any deep form, whether reinforcement is present or not, causing separation of the coarse aggregate from the mortar on account of repeatedly hitting rods or the sides of the form as it falls, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, some means such as the use of hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. In no case shall the free fall of concrete exceed 4 feet below the ends of ducts, chutes, or buggies. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6 feet in horizontal direction. Concrete in forms shall be deposited in uniform horizontal layers not deeper than 2 feet; and Contractor shall take care to avoid inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft.

E. Placement in Slabs

Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement. As the work progresses, concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.

F. Temperature of Concrete

Temperatures of concrete when it is being placed shall be not more than 90 degrees F nor less than 40 degrees F in moderate weather, and not less than 50 degrees F in weather during which the mean daily temperature drops below 40 degrees F. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, Contractor shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. Contractor shall be entitled to no additional compensation on account of the foregoing requirements.

G. Cold Weather Placement

Earth foundations shall be free from frost or ice when concrete is placed upon or against them. Fly ash concrete shall not be placed when the air temperature falls below 50 degrees F.

**3.04 Pumping of Concrete**

A. General

If the pumped concrete does not produce satisfactory end results, Contractor shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

B. Pumping Equipment

Pumping equipment must have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, Contractor may have a standby pump on the site during pumping.

C. The minimum diameter of hose (conduits) shall be 4 inches.

D. Contractor shall replace pumping equipment and hoses (conduits) that are not functioning properly.

E. Contractor shall not use aluminum conduits for conveying the concrete.

F. Proportioning

Minimum compressive strength, cement content, and maximum size of aggregates shall be as specified in Paragraph 2.07, herein.

G. Gradation of coarse aggregates shall conform to ASTM C 33 and shall be as close to the middle range as possible.

- H. Gradation of fine aggregate shall conform to ASTM C 33, with 15 to 30 percent passing the number 50 screen and 5 to 10 percent passing the number 100 screen. The fineness modulus of sand used shall not be over 3.00.
- I. Water and slump requirements shall conform to Paragraphs 2.01D.2 and 2.07B for water and 2.08A for slump.
- J. Cement and admixtures shall conform to Paragraph 2.01D, herein.

### 3.05 Order of Placing Concrete

The order of placing concrete in all parts of the work shall be acceptable to the Engineer. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints shown. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured at least 7 days before the contiguous unit or units are placed.

### 3.06 Tamping and Vibrating

- A. As concrete is placed in the forms or in excavations, Contractor shall insure it is thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement. Vibrators shall be high speed power vibrators (8000 to 10,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required.
- B. Contractor shall take care in placing concrete around waterstops. Contractor shall carefully work concrete by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration, over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.
- C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be inserted vertically into the concrete and pulled out slowly, penetrating 1/3 of the layer depth of the layer previously placed. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein specified within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

### 3.07 Finishing Concrete Surfaces

#### A. General

Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions shown are defined as tolerances and are specified in Paragraphs 1.04F and 1.04G, herein. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.

B. Formed Surfaces

On surfaces not exposed to view, no treatment is required after form removal except for curing, repair of defective concrete, and treatment of surface defects. An architectural finish is required on exposed to view surfaces in accordance with Section 3.08 unless otherwise specified.

C. Unformed Surfaces

After proper and adequate vibration and tamping, all unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. The classes of finish specified for unformed concrete surfaces are designated and defined as follows:

1. Class "1". After the floated surface (as specified for Class "3") has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. The finish shall be smooth and free of all irregularities.
2. Class "2". Steel trowel finish (as specified for Class "1") without local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise shown. The resulting surface shall be rough enough to provide a nonskid finish.
3. Class "3". After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Contractor shall not excessively float concrete surfaces while the concrete is plastic or dust concrete surfaces with dry cement and sand to absorb excess moisture. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4 inch. Joints and edges shall be tooled where shown or as determined by the Engineer.
4. Class "4". Contractor shall provide sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8 inch. No further special finish is required.

Contractor shall finish unformed surfaces according to the following schedule unless otherwise shown or specified:

Unformed Surface Finish Schedule

<u>Area</u>	<u>Finish</u>
Grade slabs and foundations to be covered with concrete or fill material	Class "4"
Floors to be covered with grouted tile or topping grout	Class "3"
Slabs which are water bearing with slopes 10 percent and less	Class "1"
Sloping slabs which are water bearing with slopes greater than 10 percent	Class "2"

### Unformed Surface Finish Schedule (cont'd)

<u>Area</u>	<u>Finish</u>
Slabs not water bearing	Class "2"
Slabs to be covered with built-up roofing	Class "3"
Interior slabs and floors to receive architectural finish	Class "3"

#### 3.08 Architectural Finish

##### A. Smooth Sacked Finish

Contractor shall provide architectural finish for exposed to view concrete surfaces. Exposed concrete surfaces include the exterior of structures beginning one foot below grade, the tops of walls, and the interior of water holding structures beginning at the top of wall and extending to one foot below the low water line. Architectural finish shall also be provided for interior exposed to view concrete surfaces. All other incidental exposed to view concrete surfaces shall be provided with an architectural finish such as concrete stairways, concrete containment facilities around chemical storage tanks, elevated walkways, and the like. Architectural finish (i.e., smooth sacked finish) shall also be provided where shown.

B. Immediately after the forms have been stripped, the concrete surface shall be inspected by Engineer and any pour joints, voids, rock pockets, or other defective areas shall be repaired by Contractor and all form-tie fastener holes filled as required in Paragraphs 3.12 and 3.13, herein.

C. After the concrete has cured at least 14 days, Contractor shall remove curing compound by sandblasting, the surface shall be wetted, and a grout shall be applied with a brush. The grout shall be made by mixing one part portland cement and one part of fine sand that will pass a No. 16 sieve with sufficient water to give it the consistency of thick paint. The cement used in said grout shall be 1/2 gray and 1/2 white portland cement, as determined by the Engineer. White portland cement shall be Atlas white, or equal, furnished by the Contractor. The freshly applied grout shall be vigorously rubbed into the concrete surface with a wood float filling all small air holes. After all the surface grout had been removed with a steel trowel, the surface shall be allowed to dry and, when dry, shall be vigorously rubbed with burlap to remove completely all surface grout so that there is no visible paint-like film of grout on the concrete. The entire cleaning operation for any area shall be completed the day it is started, and grout shall not be left on the surface overnight.

##### D. Surface Overnight

Cleaning operations for any given day shall be terminated at panel joints. Contractor shall insure that the various operations be carefully timed to secure the desired effect which is a light-colored concrete surface of uniform color and texture without any appearance of a paint or grout film.

E. In the event that improper manipulation results in an inferior finish, Contractor shall rub such inferior areas with carborundum bricks.

F. Before beginning any of the final treatment on exposed surfaces, Contractor shall treat in a satisfactory manner a trial area of at least 200 square feet in some inconspicuous place selected by the Engineer and shall preserve said trial area undisturbed until the completion of the job.

G. All architecturally-treated concrete surfaces shall conform to the accepted sample in texture, color, and quality. It shall be the Contractor's responsibility to maintain and protect the concrete finish.

### 3.09 Curing and Dampproofing

#### A. General

All concrete shall be cured for not less than 14 days after placing in accordance with the methods specified herein for the different parts of the work as follows:

#### Surface to be Cured or Dampproofed

	<u>Method</u>
Unstripped forms	1
Wall sections with forms removed	4
Construction joints between footings and walls, and between floor slab and columns	2
Encasement concrete and thrust blocks	3
All concrete surfaces not specifically provided for elsewhere in this Paragraph	4
Floor slabs on grade in hydraulic structures	5
Roof and slabs not on grade	6

#### B. Method 1

Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removed. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed within 14 days of placing the concrete, curing shall be continued in accordance with Method 4, Paragraph 3.09E herein.

#### C. Method 2

The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.

#### D. Method 3

The surface shall be covered with moist earth not less than 4 hours, nor more than 24 hours, after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.

#### E. Method 4

The surface shall be sprayed with a liquid curing compound.

1. Curing compound shall be applied in accordance with the manufacturer's printed instructions at a maximum coverage rate of 175 square feet per gallon and in such a manner as to cover the surface with a uniform film which will seal thoroughly. Two spray coats shall be applied, with the second coat sprayed at right angle direction from first coat.
2. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the curing period. Should the seal be damaged or broken before the

expiration of the curing period, Contractor shall repair break immediately by the application of additional curing compound over the damaged portion.

3. Wherever curing compound may have been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, said compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.
4. Where curing compound is specified, it shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and within 2 hours after removal of forms from contact with formed surfaces. Repairs required to be made to formed surfaces shall be made within the said 2-hour period; provided, however, that any such repairs which cannot be made within the said 2-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound, following which repairs shall be made as specified herein.

F. Method 5

Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each work operation as necessary to prevent drying shrinkage cracks.

1. Immediately after each square foot of the concrete has been finished, it shall be given a coat of curing compound in accordance with Method 4, Paragraph 3.09E herein. Not less than one hour nor more than 4 hours after the coat of curing compound has been applied, the surface shall be wetted with water delivered through a fog nozzle, and concrete-curing blankets shall be placed on the slabs. The curing blankets shall be polyethylene sheet, polyethylene-coated waterproof paper sheeting or polyethylene-coated burlap. The blankets shall be laid with the edges butted together and with the joints between strips sealed with 2 inch wide strips of sealing tape or with edges lapped not less than 3 inches and fastened together with a waterproof cement to form a continuous watertight joint.
2. Curing blankets shall be left in place during the 14 day curing period and shall not be removed until after concrete for adjacent work has been placed. Should the curing blankets become torn or otherwise ineffective, Contractor shall replace damaged sections. During the first 3 days of the curing period, Contractor shall not allow traffic of any nature or depositing, temporary or otherwise, of any materials on the curing blankets. During the remainder of the curing period, foot traffic and temporary depositing of materials that impose light pressure will be permitted only on top of plywood sheets 5/8 inch minimum thickness, laid over the curing blanket. Contractor shall add water under the curing blanket as often as necessary to maintain damp concrete surfaces at all times.

G. Method 6

Concrete slabs shall be treated with an evaporation retardant as specified in Method 5. The concrete shall be kept continuously wet by the application of water for a minimum period of at least 14 consecutive days beginning immediately after the concrete has been placed or forms removed. Heavy curing mats shall be used as a curing medium to retain the moisture during the curing period. The curing medium shall be weighted or otherwise held in place to prevent being dislodged by wind or any other causes. Until the concrete surface is covered with the curing medium, the entire surface shall be kept damp by applying water using nozzles that

atomize the flow so that the surface is not marred or washed. Curing blankets and concrete shall be kept continuously wet by the use of sprinklers or other means both during and after normal working hours. Immediately after the application of water has terminated at the end of the curing period, the curing medium shall be removed and curing compound immediately applied in accordance with Method 4, Paragraph 3.09E herein. Contractor shall dispose of excess water from the curing operation to avoid damage to the work.

### **3.10 Protection**

Contractor shall protect all concrete against injury until final acceptance by the Owner. Fresh concrete shall be protected from damage due to rain, hail, sleet, or snow. Contractor shall provide such protection while the concrete is still plastic and whenever such precipitation is imminent or occurring. Immediately following the first frost in the fall, Contractor shall be prepared to protect all concrete against freezing. After the first frost, and until the mean daily temperature in the vicinity of the worksite falls below 40 degrees F for more than one day, the concrete shall be maintained at a temperature not lower than 50 degrees F for at least 72 hours after it is placed.

### **3.11 Curing in Cold Weather**

- A. Water curing of concrete may be reduced to 6 days during periods when the mean daily temperature in the vicinity of the worksite is less than 40 degrees F; provided that, during the prescribed period of water curing, when temperatures are such that concrete surfaces may freeze, water curing shall be temporarily discontinued.
- B. Concrete cured by an application of curing compound will require no additional protection from freezing if the protection at 50 degrees F for 72 hours is obtained by means of approved insulation in contact with the forms or concrete surfaces; otherwise, concrete shall be protected against freezing temperatures for 72 hours immediately following 72 hours protection at 50 degrees F. Concrete cured by water curing shall be protected against freezing temperatures for 3 days immediately following the 72 hours of protection at 50 degrees F.
- C. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 degrees F in 24 hours. In the spring, when the mean daily temperature rises above 40 degrees F for more than 3 successive days, the specified 72 hour protection at a temperature not lower than 50 degrees F may be discontinued for as long as the mean daily temperature remains above 40 degrees F; provided, that the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.
- D. Where artificial heat is employed, Contractor shall take special care to prevent the concrete from drying. Use of unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected for the first 24 hours from an excessive carbon dioxide atmosphere by application of curing compound; provided, that the use of curing compound for such surfaces is otherwise permitted by these specifications.

### **3.12 Treatment of Surface Defects**

- A. As soon as forms are removed, all exposed surfaces shall be carefully examined by Engineer and any irregularities shall be immediately rubbed or ground by the Contractor in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Contractor shall not plaster or coat surfaces to be smoothed. Repairs shall not be made until after inspection by the Engineer. Contractor shall not in any case perform extensive patching of honeycombed concrete. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall be repaired as specified herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced. All

repairs and replacements herein specified shall be promptly executed by the Contractor at its own expense.

- B. Defective surfaces to be repaired as specified in Paragraph 3.12A, shall be cut back from trueline a minimum depth of 1/2 inch over the entire area. Edges shall not be feathered. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32 inch depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of applying cement mortar so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to overcome the suction upon which a good bond depends. The concrete shall then be patched as follows:

A bonding material such as acryl 60 shall be applied to the surface of the area to be repaired just prior to application of the repair mixture. The repair mixture shall consist of one part of Type II, low alkali, portland cement to 3 parts concrete sand. Mix solution shall contain 1/3 bonder, such as acryl 60, to 2/3 water and added in quantities sufficient to allow placement but not cause hairchecking or slippage. Quantities prepared should be limited to that able to be completed within 30 minutes. Areas repaired shall be compacted with a wood ramming device and cured with the water/acryl 60 solution. Repair mixture shall be applied in maximum 1 inch lifts.

For exposed walls, the cement shall contain such a proportion of Atlas white portland cement as is required to make the color of the patch match the color of the surrounding concrete.

- C. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired as described in Paragraph 3.12B.
- D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of Paragraph 3.08 or 3.09, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures.

### 3.13 Testing of Hydraulic Structures

#### A. General

Contractor shall water test all concrete tanks, hydraulic channels, sumps, basins, and other structures designed to contain water prior to backfilling. Testing shall be accomplished by filling the structure with water. Testing shall not be performed until roof is in place (if applicable) and all concrete has attained full design strength. Contractor shall provide the following:

1. All pumps, power, piping, and any other equipment required to fill tanks for testing.
2. Necessary provisions to dispose of test water after testing, including pumping if necessary. At completion of tests all temporary piping and connections shall be removed. Waste water shall be disposed of without creating a nuisance or damage to adjacent property.

**B. Test Procedure**

The structure shall be full to high water level at beginning of test. Contractor may elect to keep the tank full of water for as long as 48 hours prior to the test to allow for water absorption by the concrete. Test period shall be 5 consecutive 24 hour periods totaling 5 consecutive days. Liquid level shall be accurately measured at the beginning and end of test to determine amount of leakage. All visible leaks shall be marked for repair after draining. Permissible leakage from the structure shall not exceed 0.5 gpm per million gallon storage capacity in each 24 hour period over a period of 5 consecutive days after allowance is made for evaporation. If the leakage exceeds the permissible amount, the structure shall be emptied, leaks shall be repaired (in a manner favorably reviewed by the Engineer), and the test rerun. Even if structure passes water loss test, all visible leakage shall be repaired.

**3.14 Care and Repair of Concrete**

Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance of the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, fails to conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the Contractor's expense.

## BASIC CONCRETE FORMWORK SPECIFICATIONS

### PART 1 - GENERAL

#### 1.01 General Requirements

Contractor shall furnish all materials for concrete formwork, bracing, shoring, and supports and shall design and construct all falsework, all in accordance with the provisions of the Contract Document.

#### 1.02 Reference Specifications, Codes, and Standards

##### A. Codes

The Building Code, as referenced herein, shall be the Uniform Building Code (UBC) of the International Conference of Building Officials (ICBO), latest edition.

##### B. Commercial Standards

ACI 347 Recommended Practice for Concrete Formwork, latest edition.

#### 1.03 Contractor Submittals

##### A. Falsework Calculations and Drawings

Contractor shall comply with the provisions of Section 1717 of the Division of Industrial Safety, Construction Safety Orders, as revised November 1973, which requires that all falsework or vertical shoring installations where the heights of the falsework or vertical shoring, as measured from the top of the sills to the soffit of the superstructure, exceeds 14 feet, or where individual horizontal span lengths exceed 16 feet, or provision for vehicular or railroad traffic through falsework or vertical shoring is made, shall be approved and signed by a civil Engineer, registered in the State of California; provided further, that a copy of the falsework plan or shoring layout shall be available on the job site at all times.

B. Contractor shall submit detailed plans of the falsework proposed to be used. Such plans shall be in sufficient detail to indicate the general layout, sizes of members, anticipated stresses, grade of materials to be used in the falsework, and typical soil conditions.

#### 1.04 Quality Assurance

##### Tolerances

The variation from established grade, line, plumbness, or thickness shall be as set forth in Section 1.04F of the Basic Concrete Specification, and there shall be no offsets or visible waviness in the finished surface. All other tolerances shall be within the "Suggested Tolerances" specified in Section 203 of ACI 347.

## **PART 2 - PRODUCTS**

### **2.01 General**

Except as otherwise expressly accepted by the Engineer, all lumber brought on the job site for use a forms, shoring, or bracing shall be new materials. All forms shall be smooth surface forms and shall be of the following materials:

Walls	-	Steel or plywood panel
Columns	-	Steel, plywood, or fiber glass
Roof and Floor slabs	-	Plywood
All other work	-	Steel panels, plywood or tongue and groove lumber

### **2.02 Form and Falsework Materials**

- A. Materials for concrete forms, formwork, and falsework shall conform to the following requirements:
1. Lumber shall be Douglas Fir or Southern Pine, construction grade or better, in conformance with U.S. Product Standard PS20.
  2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Pine plywood manufactured especially for concrete formwork and shall conform to the requirements of PS 1 for Concrete Forms, Class I, and shall be edge sealed.
  3. Form materials shall be metal, wood, plywood, or other approved material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade shown. Metal forms shall be an approved type that will accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Ext. Grade.
- B. Unless otherwise shown, exposed edges and corners in concrete members shall be provided with 3/4-inch chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise shown.
- C. Forms and falsework to support the roof and floor slabs shall be designed for the total dead load, plus a live load of 30 psf (minimum).

### **2.03 Form Ties**

- A. Form ties with integral waterstops shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1-1/2 inches; and all such fasteners shall be such as to leave holes of regular shape for reaming.
- B. Form ties for water-retaining structures shall have integral waterstops. Removable taper ties may be used when approved by the Engineer. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie.

## **PART 3 - EXECUTION**

### **3.01 General**

- A. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. Contractor shall assume full responsibility for the adequate design of all forms, and any forms which are unsafe or inadequate in any respect shall promptly be removed from the work and replaced at the Contractor's expense. A sufficient number of forms of each kind shall be provided to permit the required rate of progress to be maintained. The design and inspection of concrete forms, falsework, and shoring shall comply with applicable local, state and federal regulations. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by the Contractor's personnel and by the Engineer and shall be in sufficient number and properly installed. During concrete placement, the Contractor shall continually monitor plumb and string line form positions and immediately correct deficiencies.
- B. Concrete forms shall conform to the shape, lines, and dimensions of members as called for on the Contract Drawings, and shall be substantial, free from surface defects, and sufficiently tight to prevent leakage. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly-placed concrete. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

### **3.02 Form Design**

All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Plywood, 5/8-inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. Forms shall be tight so as to prevent the loss of water, cement and fines during placing and vibrating of the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1 to 1-1/2 inch diameter polyethylene rod held in position to the underside of the wall form. Adequate clean-out holes shall be provided at the bottom of each lift of forms. The size, number, and location of such clean-outs shall be as acceptable to the Engineer.

### **3.03 Construction**

#### **A. Vertical Surfaces**

All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is shown. Not less than 1-inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

#### **B. Construction Joints**

Concrete construction joints shall not be placed at locations other than those shown or specified, except as may be acceptable to the Engineer. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and

tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.

C. Form Ties

1. Embedded Ties

Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar as specified in Section 3.12C of the Basic Concrete Specifications. Wire ties for holding forms shall not be used. Form-tying devices or parts thereof, other than metal, shall not be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. Contractor shall not use snap-ties which cause spalling of the concrete upon form stripping or tie removal. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of the concrete.

2. Removable Ties

Where taper ties are approved for use, the larger end of the taper tie shall be on the wet side of walls in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink grout for water bearing and below-grade walls. The hole shall be completely filled with non-shrink or regular cement grout for above-grade walls which are dry on both sides. Exposed faces of walls shall have the outer 2 inches of the exposed face filled with a cement grout which shall match the color and texture of the surrounding wall surface.

**3.04 Reuse of Forms**

Forms may be reused only if in good condition and only if acceptable to the Engineer. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces which are permanently exposed to view. In the case of forms for the inside wall surfaces of hydraulic/water retaining structures, unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the Engineer.

**3.05 Removal of Forms**

Careful procedures for the removal of forms shall be strictly followed, and this work shall be done with care so as to avoid injury to the concrete. Contractor shall not apply heavy loading on green concrete. In the case of roof slabs and above-ground floor slabs, forms shall remain in place until test cylinders for the roof concrete attain a minimum compressive strength of 75 percent of the 28-day strength specified in the Basic Concrete Specifications; provided, that no forms shall be disturbed or removed under an individual panel or unit before the concrete in the adjacent panel or unit has attained 75 percent of the specified 28-day strength and has been in place for a minimum of 14 days. The time required to establish said strength shall be as determined by the Engineer who will make several test cylinders for this purpose from concrete used in the first group of roof panels placed. If the time so determined is more than the 14-day minimum, then that time shall be used as the minimum length of time. Forms for all vertical walls and columns shall remain in place at least 72 hours after the concrete

has been placed. Forms for all parts of the work not specifically mentioned herein shall remain in place for periods of time as determined by the Engineer.

### **3.06 Maintenance of Forms**

Forms shall be maintained at all times in good condition, particularly as to size, shape, strength, rigidity, tightness, and smoothness of surface. Forms, when in place, shall conform to the established alignment and grades. Before concrete is placed, forms shall be thoroughly cleaned. Form surfaces shall be treated with a nonstaining mineral oil or other lubricant acceptable to the Engineer. Any excess lubricant shall be satisfactorily removed before placing the concrete. Where field oiling of forms is required, Contractor shall perform the oiling at least two weeks in advance of their use. Oil shall be kept off the surfaces of steel reinforcement and other metal items to be embedded in concrete. If oil is inadvertently placed on said metal surfaces, Contractor shall remove oil by sandblasting.

### **3.07 Falsework**

- A. Contractor shall be responsible for the design, engineering, construction, maintenance, and safety of all falsework, including staging, walkways, forms, ladders, and similar appurtenances, which shall equal or exceed the applicable requirements of the provisions of the OSHA Safety and Health Standards for Construction, the requirements of the Construction Safety Orders of the California Division of Industrial Safety, and the requirements specified herein.
- B. All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads. Falsework for the support of a superstructure shall be designed to support the loads that would be imposed if the entire superstructure were placed at one time.
- C. Falsework shall be placed upon a solid footing, safe against undermining, and protected from softening. When the falsework is supported on timber piles, the maximum calculated pile loading shall not exceed 20 tons. When falsework is supported on any portion of the structure which is already constructed, the load imposed by the falsework shall be spread, distributed, and braced in such a way as to avoid any possibility of damage to the structure.

## BASIC CONCRETE REINFORCEMENT SPECIFICATIONS

### PART 1 - GENERAL

#### 1.01 General Requirements

Contractor shall furnish, fabricate, and place all concrete reinforcement steel, welded wire fabric, couplers, and concrete inserts for use in reinforced concrete and masonry construction and shall perform all appurtenant work, including all the wires, clips, supports, chairs, spacers, and other accessories, all in accordance with the Contract Documents.

#### 1.02 Reference Specifications, Codes, and Standards

##### A. Codes

The Building Code, as referenced herein, shall be the Uniform Building Code (UBC) of the International Conference of Building Officials (ICBO), latest edition.

##### B. Commercial Standards

Where not covered in this specification, all work shall comply with the following standards, latest editions:

ACI 315            Details and Detailing of Concrete Reinforcement.

ACI 318            Building Code Requirements for Reinforced Concrete.

WRI                Manual of Standard Practice for Welded Wire Fabric.

AWS D1.4         Structural Welding Code - Reinforcing Steel.

#### 1.03 Contractor Submittals

- A. Contractor shall furnish shop bending diagrams, placing lists, and drawings of all reinforcement steel prior to fabrication.
- B. Details of concrete reinforcement steel and concrete inserts shall be submitted by the Contractor at the earliest possible date after receipt by the Contractor of Notice to Proceed. Said details of reinforcement steel for fabrication and erection shall conform to ACI 315 and the requirements specified and shown. Shop bending diagrams shall show the actual lengths of bars, to the nearest inch measured to the intersection of the extensions (tangents for bars of circular cross section) of the outside surface. Shop drawings shall include bar placement diagrams which clearly indicate the dimensions of each bar splice.
- C. Where mechanical couplers are required or permitted to be used to splice reinforcement steel, Contractor shall submit manufacturer's literature which contains instructions and recommendations for installation for each type of coupler used; certified test reports which verify the load capacity of each type and size of coupler used; and shop drawings which show the location of each coupler with details of how they are to be installed in the formwork.
- D. If reinforcement steel is spliced by welding at any location, Contractor shall submit mill test reports which shall contain the information necessary for the determination of the carbon equivalent as specified in AWS D1.4. Contractor shall submit a written welding procedure for

each type of weld for each size of bar which is to be spliced by welding; merely a statement that AWS procedures will be followed is not acceptable.

#### 1.04 Quality Assurance

- A. If requested by the Engineer, Contractor shall provide samples from each heat of reinforcement steel delivered in a quantity adequate for testing. Costs of initial tests will be paid by the Owner. Costs of additional tests due to material failing initial tests shall be paid by the Contractor.
- B. If reinforcement steel is spliced by welding at any location, Contractor shall submit certifications of procedure qualifications for each welding procedure used and certification of welder qualifications, for each welding procedure, and for each welder performing the work. Such qualifications shall be as specified in AWS D1.4.
- C. If requested by the Engineer, Contractor shall provide samples of each type of welded splice used in the work in a quantity and of dimensions adequate for testing. At the discretion of the Engineer, radiographic testing of direct butt welded splices will be performed. Contractor shall provide assistance necessary to facilitate testing. Contractor shall repair any weld which fails to meet the requirements of AWS D1.4. The costs of testing will be paid by the Owner; except, the costs of all tests which fail to meet specified requirements shall be paid by the Contractor.

### PART 2 - PRODUCTS

#### 2.01 Reinforcement Steel

- A. All reinforcement steel for all cast-in-place reinforced concrete construction shall conform to the following requirements:
  - 1. Bar reinforcement shall conform to the requirements of ASTM A 615 for Grade 60 Billet Steel Reinforcement with supplementary requirement S-1, or as otherwise shown.
  - 2. Welded wire fabric reinforcement shall conform to the requirements of ASTM A 185 and the details shown; provided, that welded wire fabric with longitudinal wire of W9.5 size wire shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches; and provided further, that welded wire fabric with longitudinal wires larger than W9.5 size shall be furnished in flat sheets only.
  - 3. Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A 82.
- B. Accessories
  - 1. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. Slab bolsters shall have gray plastic-coated legs.
  - 2. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Where the concrete blocks are used on concrete surfaces exposed to view, the color and texture of the concrete blocks shall match that required for the finished surface. Wire ties shall be embedded in concrete block bar supports.

## 2.02 Mechanical Couplers

- A. Mechanical couplers shall be provided where shown and where approved by the Engineer. The couplers shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars being spliced at each splice.
- B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied. This shall apply to all mechanical splices, including those splices intended for future connections.
- C. The reinforcement steel and coupler used shall be compatible for obtaining the required strength of the connection.
- D. Couplers which are located at a joint face shall be a type which can be set either flush or recessed from the face as shown. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. After the concrete is placed, Contractor shall plug and seal couplers intended for future connections to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged with plastic plugs which have an O-ring seal.

## 2.03 Welded Splices

- A. Welded splices shall be provided where shown and where approved by the Engineer. All welded splices of reinforcement steel shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars which are connected.
- B. All materials required to perform the welded splices to the requirements of AWS D1.4 shall be provided.

## PART 3 - EXECUTION

### 3.01 General

All reinforcement steel, welded wire fabric, couplers, and other appurtenances shall be fabricated, and placed in accordance with the requirements of the Building Code and the supplementary requirements specified herein.

### 3.02 Fabrication

#### A. General

Reinforcement steel shall be accurately formed to the dimensions and shapes shown, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Drawings. Stirrups and tie bars shall be bent around a pin having a diameter not less than 1-1/2 inch for No. 3 bars, 2-inch for No. 4 bars, and 2-1/2 inch for No. 5 bars. Bends for other bars shall be made around a pin having a diameter not less than 6 times the minimum thickness, except for bars larger than 1 inch, in which case the bends shall be made around a pin of 8 bar diameters. Bars shall be bent cold.

- B. Contractor shall fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists, and placing drawings.

C. Fabricating Tolerances

Bars used for concrete reinforcement shall meet the following requirements for fabricating tolerances:

1. Sheared length:  $\pm 1$  inch
2. Depth of truss bars:  $+ 0, - 1/2$  inch
3. Stirrups, ties, and spirals:  $\pm 1/2$  inch
4. All other bends:  $\pm 1$  inch

3.03 **Placing**

A. Placing

Reinforcement steel shall be accurately positioned as shown, and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcement steel shall be supported by concrete, plastic or metal supports, spaces or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used, in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. All concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties which are embedded in the blocks. For concrete over formwork, Contractor shall furnish concrete, metal, plastic, or other acceptable bar chairs and spacers.

- B. The portions of all accessories in contact with the formwork shall be made of concrete, plastic, or steel coated with a 1/8 inch minimum thickness of plastic which extends at least 1/2 inch from the concrete surface. Plastic shall be gray in color.
- C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.
- D. Bars additional to those shown which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position shall be provided by the Contractor at its own expense.

E. Placing Tolerances

Unless otherwise specified, reinforcement placing tolerances shall be within the limits specified in Section 7.5 of ACI 318 except where in conflict with the requirements of the Building Code.

- F. Bars may be moved as necessary to avoid interference with other reinforcement steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be as acceptable to the Engineer.
- G. Welded wire fabric reinforcement placed over horizontal forms shall be supported on slab bolsters having gray, plastic-coated standard type legs as specified in Paragraph B herein. Slab bolsters shall be spaced not less than 30 inches on centers, shall extend continuously across the entire width of the reinforcement mat, and shall support the reinforcement mat in the plane shown.

- H. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than 3 feet on centers in any direction. Contractor shall not utilize the construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete.

#### 3.04 Spacing of Bars

- A. The clear distance between parallel bars (except in columns and between multiple layers of bars in beams) shall be not less than the nominal diameter of the bars nor less than 1-1/3 times the maximum size of the coarse aggregate, nor less than 1 inch.
- B. Where reinforcement in beams or girders is placed in 2 or more layers, the clear distance between layers shall be not less than 1 inch.
- C. In columns, the clear distance between longitudinal bars shall be not less than 1-1/2 times the bar diameter, not less than 1-1/2 times the maximum size of the coarse aggregate, nor less than 1-1/2 inches.
- D. The clear distance between bars shall also apply to the distance between a contact splice and adjacent splices or bars.

#### 3.05 Splicing

- A. General

Reinforcement bar splices shall only be used at locations shown. When it is necessary to splice reinforcement at points other than where shown, the character of the splice shall be as acceptable to the Engineer.

- B. Splices of Reinforcement

The length of lap for reinforcement bars, unless otherwise shown shall be in accordance with ACI 318, Section 12.15.1 for a class B splice.

- C. Laps of welded wire fabric shall be in accordance with the ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

- D. Splices in column spiral reinforcement, when necessary, shall be made by welding or by a lap of 1-1/2 turns.

- E. Bending or Straightening

Reinforcement shall not be straightened or rebent in a manner which will injure the material. Bars with kinks or bends not shown shall not be used. All bars shall be bent cold, unless otherwise permitted by the Engineer. No bars partially embedded in concrete shall be field-bent except as shown or specifically permitted by the Engineer.

### **3.06 Cleaning and Protection**

- A. Reinforcement steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.**
- B. The surfaces of all reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be reinspected and, if necessary recleaned.**



# **BASIC EARTHWORK**

## **BASIC EARTHWORK SPECIFICATIONS**

### **1. Scope**

Contractor shall furnish all labor, equipment, and material and perform all operations necessary for earthwork construction including clearing, excavating, filling, backfilling, compacting, and grading specified or reasonably required. All debris or material unsuitable for construction shall be removed from site.

Adequate drainage shall be provided at all times and accumulation of water in excavated areas shall be prevented. All work shall be protected by pumping, ditching, and other measures required for the removal of exclusion of water. Any work damaged by the effects of rain runoff or other weather conditions during any phase of construction shall be reconstructed to conform to the specified requirements. Contractor shall not pass equipment over or alongside facilities that are not protected by ample fill material, properly compacted.

Unless otherwise specified or herein modified, all earthwork shall conform to Section 300 of the Standard Specifications for Public Works Construction, published by Building News, Inc., Los Angeles, California, latest edition, hereinafter "Standard Specifications". References in the Standard Specifications to Measurement and Payment shall not apply.

### **2. Protection of Existing Work**

Before beginning any cutting or demolition work for removals, Contractor shall carefully survey the existing work and examine the drawings and Specifications to determine the extent of the work. Contractor shall take all necessary precautions to insure against damage to existing work to remain in place or to be reused and any damage to such work shall be repaired or replaced as approved by Owner at no additional cost to Owner. Contractor shall carefully coordinate the work of this section with all other work and construct and maintain shoring, bracing, and supports as required. Contractor shall insure that structural elements are not overloaded and be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under any part of this Contract.

### **3. Grade Control**

Initial bench marks, lines, and grades will be furnished by Owner. Subsequent control stakes as may be required shall be placed and maintained by Contractor. Bench marks, monuments, and other reference points, if unnecessarily disturbed or destroyed by Contractor, will be restored by Owner at Contractor's expense.

### **4. Clearing and Grubbing**

Except as otherwise specified, indicated areas should be cleaned and grubbed conforming to Section 300-1 of the Standard Specifications. All removed materials shall be disposed off-site in a location approved by Owner. Bituminous pavement to be removed shall be saw cut to clean, straight lines.

### **5. Field Compaction Tests**

Where reference is made to relative compaction, it shall be deemed to mean ASTM D1557, latest, using ten-pound hammer at 18-inch drop.

Cost of all compaction tests having relative compaction less than specified shall be borne by Contractor. Cost of all compaction tests having relative compaction greater than specified will be borne by Owner. Owner will select soil testing engineer.

**6. Materials to be Excavated**

Materials to be excavated shall be non-classified and shall include all materials encountered in excavating and grading operations hereunder. Materials shall be excavated to the depth and extent specified.

**7. Excavation**

Contractor shall excavate to the elevations and dimensions indicated, plus ample space for construction operations and inspection of facilities. All facilities to be constructed shall bear on undisturbed natural ground or material compacted to the relative compaction specified which shall not be less than 90% relative compaction. If so ordered in writing by Owner, Contractor shall perform additional excavation beyond limits originally specified. Concrete shall not be placed in any excavation which has not been approved by Owner. Care shall be taken not to disturb the excavation prepared for concrete and excess material shall not be removed to make grade until just before concrete is to be placed. This work shall conform to Sections 300-2 and 300-3 of the Standard Specifications unless otherwise specified.

**8. Fill and Backfill**

Fill and backfill shall not be placed until all work to be concealed has been inspected and approved by Owner. No fill or backfill material shall be deposited against concrete structures until the concrete has developed its design strength unless authorized by Owner.

Fill and backfill around structures shall be placed in uniform horizontal layers not exceeding 12 inches in loose thickness before compaction and shall be brought up uniformly on all sides of the structure. Regardless of the specified depth of the layers of material to be compacted, Contractor shall place the material at depths required to obtain the specified relative compaction. Each layer of material shall be moistened as required and thoroughly tamped, rolled, or otherwise compacted to the relative compaction specified.

Fill and backfill shall be made with clean, unclassified material excavated from site as approved by Owner. Unless permitted otherwise, said material shall consist of loose earth or sand free from stones, clods, or other deleterious materials larger than 8 inches in greatest dimension.

Whenever permitted by Owner, rock may be placed in certain fills. Rock fragments or boulders up to 24 inches in greatest dimension may be utilized provided that the specified degree of compaction is obtained in the fill material surrounding the rock. The rock fragments or boulders shall be placed in rows on the fill surface so that they are not in contact with one another and fill material shall be placed between and over the rows of rock fragments or boulders and compacted with \*sheeps foot or other suitable rollers. Ample water and compactive effort shall be applied so that the resulting fill is free of uncompacted material surrounding the rock. The rows of rock fragments or boulders shall be as specified with regard to spacing and location within any fill; however, subsequent rows shall be staggered so that one row does not lie directly over another row.

**9. Finish Grading**

Upon completion of construction, Contractor shall bring to finish grade all portions of site affected by contract work. Grading shall be to the finish grade elevations specified. Contractor shall dispose of excess material as directed by Owner.

the 1990s, the number of people who have been employed in the public sector has increased in all countries.

There are a number of reasons for the increase in public sector employment. First, the public sector has become an important source of employment for many people, especially in developing countries. Second, the public sector has become an important source of income for many people, especially in developing countries. Third, the public sector has become an important source of social services for many people, especially in developing countries.

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## **BASIC CONCRETE MASONRY**

## BASIC CONCRETE MASONRY SPECIFICATIONS

### PART 1 - GENERAL

#### 1.01 General Requirements

- A. Contractor shall furnish all labor, material, and equipment and perform all operations necessary to execute all concrete masonry construction as required in the Contract Documents.
- B. Contractor shall make all preparations and do all work necessary to receive and adjoin other work.
- C. Contractor shall give the work his personal supervision and shall keep a competent foreman on the job at all times.
- D. Contractor shall inspect and verify position of all dowels required for masonry on other construction including foundations.
- E. Contractor shall arrange necessary storage space for construction materials at the job site.
- F. Contractor shall call for all inspections required in the course of his work.

#### 1.02 Reference Codes, Specifications, and Standards

A. Codes

Whenever reference is made herein to Building Code, it shall mean the Uniform Building Code (UBC), latest edition, as published by the International Conference of Building Officials.

B. Specifications

Whenever reference is made herein to Standard Specifications, it shall mean the Standard Specifications for Public Works Construction, latest edition, as published by Building News Incorporated of Los Angeles, California.

C. Commercial Standards

Whenever reference is made herein to ASTM, it shall mean the Annual Book of ASTM Standards, latest edition, as published by the American Society for Testing and Materials.

#### 1.03 Quality Assurance

- A. All concrete masonry shall comply with the Building Code and reference material published by the Masonry Institute of America.
- B. Contractor shall submit samples of the block units for approval of type and color by Owner prior to commencing with work.
- C. Certification

Concrete block manufacturer shall certify that the masonry units furnished meet or exceed the requirements of this specification.

D. Sample Panel

Contractor shall build a sample panel, approximately 4 feet by 6 feet, for review and approval by Engineer before any masonry construction is performed. Said sample panel may be part of the project and incorporated into the wall system. Full size concrete masonry units which have been selected and approved by the Engineer to show color range, maximum texture range, bond, mortar, tooling of joints, and quality of workmanship shall be used in the sample panel. Sample panel shall remain on the project for comparison purposes with the actual masonry work.

If the sample panel is not part of the wall system, it shall be demolished and removed from the site after completion and acceptance for the project concrete masonry work, unless Contractor is directed otherwise by Owner.

E. Testing of Grout

1. Test Specimens and Samples

- a. Contractor shall take field samples on the first day of masonry construction, at any change in materials during construction, and whenever, in the judgment of the Engineer, tests are necessary to determine the quality of the materials.
- b. Contractor shall prepare three grout specimens per sample. Each grout specimen shall be a square prism, nominally 3 inches or larger on the sides and twice as high as the width.

2. Procedures

- a. Contractor shall construct samples in the presence of the Engineer or his representative. The same personnel who lays the block in the structure shall construct the grout specimens.
- b. Contractor shall prepare each specimen in a mold consisting of masonry units proposed for construction with the same moisture condition as those being laid. The units shall form a space with dimensions of 3-5/8 inches by 3-5/8 inches by 7-5/8 inches. The space shall be lined with a permeable paper (such as a paper towel) or porous separator to prevent bonding to the masonry units, but still allowing the excess water to be absorbed.

Contractor shall place a representative sample of the grout into the molds, puddle, and keep damp and undisturbed for 48 hours. After 48 hours, Owner's Representative will transport the specimens to a test laboratory for storage.

**1.04 Product Storage**

Contractor shall store and protect all materials as follows:

A. Masonry Units

Masonry units shall be carefully stacked prior to use and shall be properly protected from weather by cover or inside storage. All units shall be handled with reasonable care to prevent marring or damaging of faces, edges, and corners of units. All marred or damaged units shall be discarded.

**B. Lime and Cement**

Lime and cement shall be delivered in original packages and stored on platforms above ground, protected against moisture.

**C. Aggregates**

Aggregates shall be stored on platforms so as to exclude dirt.

**D. Reinforcing Steel**

Reinforcing steel shall be stored above ground to prevent bending or rusting.

**PART 2 - PRODUCTS**

**2.01 Materials**

All products shall conform to the following requirements:

**A. Concrete Masonry Units**

1. Masonry units shall be Grade N-1 units conforming to ASTM C90, latest, and manufactured in accordance with requirements of the Concrete Masonry Association Specifications.
2. Masonry units shall have maximum shrinkage of .08 of 1% from the saturated to the oven dry condition.
3. Masonry units shall be lightweight aggregate (or sand-gravel aggregate) units manufactured by a member of the Concrete Masonry Association. Masonry units may be high temperature steam cured. Owner shall select color of masonry units.

**B. Cement**

1. Cement for mortar shall be Type I (or Type II, or Type III) portland cement conforming to ASTM C150, latest.
2. Air-Entrained Portland Cement for mortar shall be Type I-A (or II-A, or III-A) conforming to ASTM C175, latest. (Note: When using air-entrained cements, mortar shall not contain more than 1/10 part lime putty).
3. Plastic cement shall have less than 12% total volume in approved plasticizing agents and shall conform to all of the requirements for portland cement in ASTM C150, latest, except with respect to limitations on insoluble residue, air-entrained, and additions subsequent to calcination.

**C. Aggregate**

1. Aggregate shall be clean, sharp, and well graded, and free from injurious quantities of dust, lumps, shale, alkali, surface coatings, and organic matter.
2. Sand shall conform to ASTM C144, latest.

3. Pea gravel shall be graded with 100% passing the 3/8 inch sieve and not more than 5% passing the No. 8 sieve.

D. Lime Putty

1. Lime putty shall be made from approved hydrated lime or quicklime and shall weigh not less than 83 pounds per cubic foot.
2. Hydrated lime shall conform to ASTM C207, latest.
3. Quicklime shall conform to ASTM C5, latest. Quicklime shall be slaked and then screened through a 16-mesh sieve. After slaking, screening, and before using, it shall be stored and protected for minimum 10 days.

E. Admixtures

Admixtures shall not be used in mortar or grout unless specifically approved by Engineer.

F. Reinforcing Steel

1. Reinforcing steel shall be Grade 60 deformed bars conforming to ASTM A615, latest, except that 1/4 inch ties may be plain bars.
2. Reinforcing steel shall be clean and free from loose rust, scale, and dirt, and coatings that reduce bond.

**2.02 Mortar & Grout**

A. Mortar

Mortar shall be freshly prepared and uniformly mixed in ratio 1 part portland cement, 1/4 part lime putty, and 3-1/2 parts sand. Mortar shall conform to ASTM C270, latest.

B. Grout

1. Grout shall have minimum compressive strength of 2,000 psi.
2. Grout shall be of fluid consistency and mixed in ratio 1 part cement, 3 parts sand for grout spaces less than 4 inches in any dimension. Grout shall be of fluid consistency and mixed in ratio 1 part cement, 2 parts sand, and 2 parts pea gravel for grout spaces greater than 4 inches.
3. Fluid consistency shall mean that consistency of fluid shall be enough for pouring and yet not so fluid that the constituent parts of the grout separate when grout is poured (slump equals 9 inches  $\pm$  1 inch).

## **PART 3 - EXECUTION**

### **3.01 Workmanship**

- A. Masonry work shall be started only when horizontal and vertical alignment of foundation is within 1 inch of plumb or line.
- B. Contractor shall prevent grout and mortar stains. Contractor shall keep wall continually clean. If grout runs over, Contractor shall clean wall immediately.
- C. All masonry shall be laid true, level and plumb in accordance with the Construction Drawings.
- D. Contractor shall cut all masonry units accurately to fit all openings, conduit, ducts, and plumbing. All holes shall be neatly patched.
- E. Construction support shall not be attached to the wall except where specifically permitted by the Engineer.
- F. The top surface of the concrete foundation shall be clean and free of laitance and the aggregate exposed by sandblasting prior to starting masonry construction.
- G. Where no bond pattern is shown, walls shall be laid up in straight, uniform courses with regular half or running bond.
- H. All work, bond patterns, or special details shown on the Construction Drawings shall be accurately and uniformly executed.

### **3.02 Protection of the Work**

- A. Contractor shall protect all sills, ledges, and offsets from mortar droppings or other damage during construction.
- B. Contractor shall prevent visible mortar and grout stains on the exterior of the work. Contractor shall remove stains immediately if they occur.

### **3.03 Masonry Units**

- A. All masonry units shall be sound, free of cracks, or other defects that would interfere with the proper placing of the unit or impair the strength of construction.
- B. All masonry units shall be stored on the job so that they are kept off the ground and protected from the elements. Wetting of units is not permitted.
- C. Proper masonry units shall be used to provide for all windows, doors, bond beams, lintels, pilasters, and knockouts, with a minimum unit cutting.
- D. Where masonry unit cutting is necessary, Contractor shall utilize a masonry saw making all cuts neat and true.

### **3.04 Joints**

- A. Starting joints on foundations shall be laid with full mortar coverage on the bed joints except that the area where grout occurs shall be free from mortar so that the grout will be in contact with the foundation.
- B. Mortar joints shall be straight, clean, and uniform in thickness and shall be tooled as specified.
- C. Contractor shall tool exposed wall joints with a round bar (or V-shaped bar) 2 feet long to produce a dense, slightly concave surface well bonded to the block at the edges.
- D. Tooling shall be done when the mortar is partially set but sufficiently plastic to bond. All tooling shall be done with a tool which compacts the mortar, pressing the excess mortar out of the joint rather than dragging it out.
- E. Where walls are to receive plaster, Contractor shall strike joints flush.
- F. Where joints are to be concealed under paint, Contractor shall fill joints flush and then sack to produce a dense surface without sheen.
- G. Unless otherwise specified, horizontal and vertical mortar joints shall be 3/8 inch thick with full mortar coverage on the face shells and on the webs surrounding cells to be filled.
- H. Vertical head joints shall be buttered well for a thickness equal to the face shell of the block and these joints shall be shoved tightly so that the mortar bonds well to both blocks. Joints shall be solidly filled from the face of the block to the depth of the face shell.
- I. If it is necessary to move a block so as to open a joint, Contractor shall remove block from wall and set in fresh mortar.
- J. Intersecting masonry walls and partitions shall be bonded by the use of steel ties at 24 inch centers maximum.
- K. Where stack bond is specified, approved metal ties shall be provided horizontally at 24 inch centers maximum.

### **3.05 Reinforcing**

- A. When a foundation dowel does not line up with a vertical core, it shall not be sloped at more than one horizontal to six vertical. Dowels shall be grouted into a core in vertical alignment even though it is in an adjacent cell to the vertical wall reinforcing.
- B. Reinforcing bars shall be straight except for bends around corners or where bends or hooks are detailed on the drawings.
- C. Reinforcing steel where spliced shall be lapped a minimum of 40 bar diameters.
- D. When full length vertical bars are used, they shall be held in position at top and bottom at intervals not exceeding 48 inches along the reinforcement.
- E. Horizontal reinforcing shall be laid on the webs of bond beam units and shall be solidly grouted in place. Reinforcing in channel units shall be spaced off the bottom of the unit.
- F. Vertical reinforcing shall have a minimum clearance of 1/4" from the masonry.

- G. Wire reinforcement shall be completely imbedded in mortar or grout. Mortar joints with wire reinforcement shall be at least twice the thickness of the wire.
- H. Wire reinforcement shall be lapped at least 8 inches at splices and shall contain at least 1 cross wire at each piece of reinforcement in the lap distance.

### **3.06 Grouting**

- A. Reinforcing steel shall be in place and inspected by Engineer before grouting starts.
- B. Unless specified otherwise on drawings, all walls shall be solid grouted. Unless specifically allowed on drawings, height of grout pours shall not exceed 4 feet. All debris and projecting mortar shall be cleaned out before pouring grout. Pours shall be stopped 1-1/2 inches below the top of a course to form a key at pour joints.
- C. Contractor shall consolidate grout by mechanical vibration during placement before loss of plasticity in a manner to fill the grout space. Grout pours greater than 12 inches shall be reconsolidated by mechanical vibration after 3 to 5 minutes to minimize voids due to water loss. Grout pours 12 inches or less in height shall be mechanically vibrated or puddled.
- D. Vertical cells to be filled shall have vertical alignment to maintain a continuous unobstructed cell area not less than 2 inches by 3 inches.
- E. When higher pours are specified, grout lifts shall not exceed 8 feet. A cleanout hole shall be provided at the bottom of each cell to be poured.
- F. Contractor shall grout beams over openings in a continuous operation.
- G. Contractor shall cover the tops of unfilled cell columns under a horizontal masonry beam with metal lath, or special units shall be used to confine the grout fill to the beam section.
- H. Contractor shall install all bolts, anchors, and similar wall inserts prior to grouting and solidly grout them in place.

### **3.07 Cleaning and Protection**

- A. Masonry walls are to be left bare or unpainted unless otherwise specified; Contractor shall prevent mortar splashes.
- B. Construction supports shall not be attached to the wall except where specifically permitted by Engineer.
- C. All forms shall be made tight (special attention is necessary for bottom form of block bond beams) and concrete and grout spilled on the wall shall be washed off immediately.
- D. Walls shall have their surfaces dampened for three days with a light fog spray during the mortar curing period. They shall not be saturated with water for curing or any other purposes.
- E. At the conclusion of work, Contractor shall clean down all masonry walls, remove his scaffolding and equipment used in the work, clean up all debris, refuse, and surplus material, and remove them from the premises.

the 1990s, the number of people with hearing impairment has increased, and the number of people with severe hearing impairment has increased even more (Griffin et al. 2002).

There are a number of reasons why the number of people with hearing impairment has increased. One reason is that the population is getting older, and the number of people with hearing impairment increases with age (Griffin et al. 2002).

Another reason is that people are spending more time in noisy environments, and this can lead to hearing impairment (Griffin et al. 2002).

There are a number of things that can be done to reduce the risk of hearing impairment. One thing is to avoid noisy environments, or to wear earplugs or earmuffs if you have to be in a noisy environment (Griffin et al. 2002).

Another thing is to get your hearing checked regularly, and to use hearing aids if you have hearing impairment (Griffin et al. 2002).

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# **BASIC PAINTING**

## **BASIC PAINTING SPECIFICATIONS**

### **1. Scope**

Contractor shall provide all labor, material, and equipment and perform all operations necessary for all painting work specified including the painting of concrete block walls, reinforced concrete walls, concrete slab floors, and exposed iron and steel work including pumping units, electrical switchgear, piping, valves and miscellaneous metal.

### **2. Materials**

- a. Contractor shall deliver all painting materials to the work site in original containers with seals and labels intact. Containers shall not be opened until after they have been inspected by Owner.
- b. Painting materials shall be in accordance with Owner's Approved Paint System.
- c. Contractor shall submit a color chart to Owner, who in turn will verify compliance with specified finish color(s) or in the alternative select finish color(s) where unspecified.
- d. Prepared material shall be used without cutting or diluting except as specified herein or as directed by manufacturer and approved by Owner.

### **3. Workmanship**

All work shall be done by thoroughly qualified painters in a neat and workmanlike manner. All work which shows carelessness or lack of skill in execution or is defective due to any other cause will be rejected. Said work shall be redone to satisfaction of Owner prior to acceptance of work.

### **4. Application**

- a. Unless otherwise specified paint shall be applied by brush or spray. The prime / barrier coat shall have a minimum dry film thickness of 3 mils. The finish coat shall have a minimum dry film thickness of 5 mils. Unless otherwise specified, the total dry film thickness of the complete system shall be 8 mils minimum.
- b. Paint shall be applied only on thoroughly clean and dry surfaces, unless specified otherwise. Paint shall not be applied in extreme heat, cold, damp, or humid weather or in dust or smoke-laden air.
- c. Paint materials shall be kept sealed or covered when not in use. Oily rags or waste shall be kept in covered containers and disposed of at frequent intervals.
- d. If brushes are used, they shall have sufficient body and length of bristle to spread paint in a uniform coat. Paint shall be evenly spread and thoroughly brushed out, and no residual brush marks shall remain. On surfaces which are inaccessible for brushing, paint shall be applied by spray, sheepskin daubers, or other means as approved by Owner.
- e. If a spray method is used, the operator shall be thoroughly qualified in use of the equipment required. Air compressors employed in spray painting shall be equipped with suitable trapping devices to keep water, oil, and other impurities from entering air lines. Runs, sags, thin areas, or other imperfections in paint coat shall be considered as cause for rejection and Contractor shall be required to make all necessary corrections to satisfaction of Owner.
- f. All exposed iron and steel work together with pumping units, electrical switchgear, piping, valves, and miscellaneous metal shall receive a prime coat(s), shop applied if possible, before installation.

After installation, said materials shall be cleaned and all welds, tool marks, and other defects shall receive a touch-up prime coat. Said materials shall then receive two finish coats.

- g. Surface preparation of all concrete and masonry surfaces shall not begin until at least 30 days after the concrete or masonry has been placed.
- h. Prior to work on all previously coated surfaces, the existing coating shall be tested for compatibility by applying thinner to a small test portion of the areas to be coated. If, after 30 minutes, the existing coating has begun to lift or wrinkle, the manufacturer shall be consulted before performing any work. If the existing coating has not begun to lift or wrinkle, allow an additional 24 hours drying time. Upon completion of drying time, verify adhesion capabilities.
- i. The minimum drying time between prime / barrier coats and finish coat shall be 24 hours.
- j. The drying time between finish coats shall be in accordance with the manufacturer's specifications and shall not be less than 24 hours.
- k. When two or more coats of coating or paint are specified, each coat shall be of a slightly different shade to facilitate inspection of surface coverage of each coat.

## 5. Paint Systems

### a. Previously Uncoated Masonry, Concrete Walls / Ceilings

- 1) All loose concrete, mortar splatter and protrusions shall be removed to leave only sound, firmly bonded concrete or masonry. All cracks and voids shall be filled with an approved concrete / masonry patching compound and cured a minimum of 7 days thereafter. Surfaces shall then be cleaned with steam or with a commercial cleaner. The final surface shall be smooth and free of all voids, cavities, dirt, grease, oil or other contaminants.
- 2) The prime coat shall be applied to all thoroughly clean and dry surfaces.
- 3) The finish coat shall be applied in sufficient quantity to achieve specified thickness (two coats minimum).

### b. Previously Coated Masonry, Concrete Walls, Ceilings

- 1) All surfaces shall be scraped to remove deteriorated coatings and other deleterious materials. All cracks and voids shall be filled with an approved concrete / masonry patching compound and cured a minimum of 7 days thereafter. Surfaces shall then be cleaned with steam or with a commercial cleaner. The final surface shall be smooth and free of all voids, cavities, dirt, grease, oil or other surface contaminants.
- 2) The prime coat shall be applied to all thoroughly clean and dry bare spots.
- 3) The finish coat shall be applied in sufficient quantity to achieve specified thickness (two coats minimum).

### c. Previously Uncoated Concrete Floors

- 1) All loose concrete, mortar splatter and protrusions shall be removed to leave only sound, firmly bonded concrete or masonry. All cracks and voids shall be filled with an approved concrete / masonry patching compound and cured a minimum of 7 days thereafter.

- 2) All surfaces shall be cleaned and etched, in accordance with the manufacturer's recommendations, for removal of all surface contaminants.
- 3) The first finish-coat shall be applied to thoroughly clean and dry surfaces, after it has been thinned approximately 20% with thinner.
- 4) In accordance with the manufacturer's recommendations, a second, unthinned, finish coat shall thereafter be applied. The total dry film thickness of the finish coating shall be a minimum of 10 mils.

d. Previously Coated Concrete Floors

- 1) All surfaces shall be scraped to remove deteriorated coatings and other deleterious materials. All cracks and voids shall be filled with an approved concrete / masonry patching compound and cured a minimum of 7 days thereafter. Surfaces shall then be cleaned with steam or with a commercial cleaner. The final surface shall be smooth and free of all voids, cavities, dirt, grease, oil or other surface contaminants.
- 2) The prime coat shall be applied to all thoroughly clean and dry bare spots.
- 3) The finish coat shall be applied in sufficient quantity to achieve specified thickness (two coats minimum).

e. Galvanized Metal

- 1) Surfaces shall be cleaned with commercial cleaner, dried thoroughly, and treated with a metal conditioner. (Minimum of 0.5 mils.)
- 2) The prime coat shall be applied in one very thin coat.
- 3) The finish coat shall be applied in sufficient quantity to achieve specified thickness (two coats minimum).

f. Ductile Iron / Bare Steel

- 1) All surfaces shall be field sandblasted in conformance with Steel Structures Painting Council Specifications SSPC-SP10 and National Association of Corrosion Engineers Surface Finish NACE No. 2 (Near-white blast cleaning) to achieve a 1.5 - 2.5 mil (40-60 micron) blast profile. Surfaces shall be cleaned with a commercial cleaner to remove all dirt, grease, oil or other surface contaminants.
- 2) The prime coat shall be applied to all thoroughly clean and dry surfaces.
- 3) The finish coat shall be applied in sufficient quantity to achieve specified thickness (two coats minimum).

g. Bare Bronze / PVC

- 1) Surfaces shall be cleaned with commercial cleaner to remove all dirt, grease, oil or other surface contaminants.
- 2) The prime / barrier coat shall be applied to all thoroughly clean and dry surfaces.
- 3) The finish coat shall be applied in sufficient quantity to achieve specified thickness (two coats minimum).

**h. Previously Painted Metal Surfaces**

- 1) All surfaces shall be scraped / wire brushed to remove deteriorated coatings and other deleterious materials. Surfaces shall be cleaned with commercial cleaner to remove all dirt, grease, oil, or other surface contaminants.
- 2) The prime / barrier coat shall be applied to all thoroughly clean and dry welds, toolmarks and bare spots.
- 3) The finish coat shall be applied in sufficient quantity to achieve specified thickness (two coats minimum).

**6. Protection**

- a. Contractor shall protect freshly painted surfaces from accumulation of dust, dirt, water or other foreign materials, whatever the cause or source. Any damaged surfaces shall be wiped clean, sanded, or stripped to a clean, dry condition and repainted to satisfaction of Owner.
- b. Contractor shall protect all parts of the work site during his operation. Tarps and cloths shall be placed where required to protect floors and equipment from spatter and droppings. Electric switchplates, lighting fixtures, nameplates, hardware, glass, vehicles and all other items not to be painted shall be removed, covered, or otherwise protected during painting operations. Contractor shall clean or otherwise restore any surfaces which are painted as a result of Contractor's failure to provide proper protection and said restoration shall be performed to satisfaction of Owner.

**7. Data to be Submitted by Contractor**

Contractor shall submit a material list for all materials required for painting work and said list shall include manufacturer's name, designation, description, color charts, and related data. Contractor shall also submit appropriate catalog data including applicable material specifications. Contractor shall furnish five (5) copies of material list and two (2) copies of catalog data to Owner and obtain approval therefore before beginning construction.

The first part of the document discusses the importance of maintaining accurate records in a business setting. It emphasizes that proper record-keeping is essential for legal compliance, financial reporting, and operational efficiency. The text outlines various methods for organizing and storing records, including digital databases and physical filing systems. It also addresses the challenges of data security and privacy, particularly in light of recent regulatory changes.

The second section focuses on the role of technology in modern business operations. It explores how automation and artificial intelligence can streamline processes, reduce errors, and improve decision-making. The author provides examples of successful implementations and offers practical advice for businesses looking to adopt new technologies. The discussion also touches on the need for employee training and change management to ensure a smooth transition to digital workflows.

The final part of the document discusses the importance of continuous learning and professional development in a rapidly changing market. It highlights the benefits of staying up-to-date on industry trends and acquiring new skills. The author suggests various resources, such as online courses and conferences, and encourages a growth mindset. The text concludes by emphasizing that ongoing education is not just a luxury but a necessity for long-term success in today's competitive environment.

## **BASIC PAVING**

## **BASIC PAVING SPECIFICATIONS**

### **1. Scope**

#### **A. General**

Contractor shall furnish all labor, materials, and equipment and perform all operations necessary for construction of pavement surfacing and resurfacing in all areas of construction as specified by the Owner or as shown by the Drawings. Drawings shall consist of construction drawings, standard drawings, and clarifying diagrams or sketches.

Whenever pavement surfacing or resurfacing is to be constructed in rights-of-way not under jurisdiction of the Owner (public highways, thoroughfares, streets), it shall be constructed in accordance with permits issued by the agency having jurisdiction (State, County, City).

Whenever pavement surfacing or resurfacing is to be constructed in rights-of-way over which the Owner has jurisdiction (pumping plants, reservoirs, service yards, access roads), it shall be constructed in accordance with the specifications.

Whenever the words "Standard Specifications" are used herein, they shall mean the Standard Specifications for Public Works Construction as published by Building News, Inc., Los Angeles, California, latest edition. The Standard Specifications shall augment, not supersede, these specifications. As used herein, the Standard Specifications shall not apply to measurement, payment, schedule, delays, or extra work.

### **2. New Pavement Surfacing**

New pavement surfacing shall be asphalt concrete or Portland cement concrete placed on a prepared surface in accordance with the specifications and in conformance with the lines, grades, and dimensions as specified in the Drawings.

#### **a. Subgrade Preparation**

Subgrade shall be brought to proper grade, prepared, and compacted in conformance with the requirements of Subsection 301-1 of the Standard Specifications. All organic material shall be removed and discarded at legal disposal site(s), at Contractor's expense. The top 12 inches of such subgrade material shall be scarified, cultivated and then compacted to not less than 95 percent relative compaction (ASTM D1557).

#### **b. Aggregate Base**

##### **1) General**

Aggregate base material shall be furnished, placed, and compacted at the locations and thickness as specified in the Contract Documents.

##### **2) Materials**

Aggregate base material shall consist of crushed aggregate base conforming to requirements of Subsection 200-2.2 of the Standard Specifications.

3) Placement of Aggregate Base

Aggregate base material shall be spread and compacted in conformance with the requirements of Subsection 301-2.3 of the Standard Specifications. Aggregate base material shall be compacted to a relative compaction of not less than 95 percent (ASTM D1557).

c. Asphalt Concrete Pavement

1) General

Asphalt concrete pavement shall be furnished, placed, and compacted at the locations and thicknesses specified.

2) Materials

a) Asphalt

Asphalt to be mixed with mineral aggregate shall conform to Subsection 203-6.2.1 of the Standard Specifications. The viscosity grade shall be AR-4000 unless specified otherwise.

b) Aggregate

Aggregate shall conform to the requirements in Subsection 203-6.2.2 of the Standard Specifications. Course aggregate shall be crushed rock.

The grading of combined aggregates and percentage asphalt shall be in accordance with Subsection 203-6.3 of the Standard Specifications. Unless otherwise specified the following asphalt concrete mixtures shall be used:

All asphalt concrete except overlays shall be C1-AR-4000

Overlays (2" maximum, leveling courses and overlaps) DI-AR-4000

3) Placement of Asphalt Concrete

a) General

All construction methods shall conform to the requirements of Subsection 302-5 of the Standard Specifications. Along all pavement edges which will not abut existing concrete paving, building foundations, curbs, gutters, or other similar structures, a firmly staked 2 inch x 4 inch redwood header shall be placed unless specified otherwise.

b) Weed Killer

Week killer, "SPIKE" (manufactured by Dow Elanco) or equal shall be applied to the area to be paved at the rate of 100 gallons per 10,000 square feet. The mixture applied shall consist of 1 pound of chemical per 100 gallons of water or per manufacturer's recommendations. Contractor shall obtain a permit to use "SPIKE" weed killer prior to its application.

c) Prime Coat

A prime coat consisting of grade SC-250 liquid asphalt shall be applied at a rate between 0.10 and 0.25 gallons per square yard. Grade SC-70 liquid asphalt may be used when approved by the Owner. Unless otherwise specified prime coat shall be required on all aggregate base material or untreated subgrade on which asphalt concrete pavement is to be directly placed. The prime coat shall be allowed to cure 24 hours and any excessively oily areas shall be blotted with sand in preparation for application of asphalt concrete.

d) Tack Coat

A tack coat shall be required at all joints, overlays and overlaps. Tack coat shall conform to the requirements of Subsection 302-5.4 of the Standard Specifications and shall be Grade SS-1h emulsified asphalt. Tack coat shall be applied at approximate rates of 0.05 gallon per square yard for leveling courses and overlays, and 0.10 gallon per square yard for asphalt concrete roll berms and dikes.

e) Geotextile Fabric

Geotextile fabric shall conform to the requirements in Subsections 213 and 302-7 of the Standard Specifications. Geotextile fabric shall be placed such that wrinkles large enough to cause laps do not occur. Geotextile fabric shall be placed in accordance with manufacturer's recommendations.

f) Fog Seal Coat

A seal coat shall be applied to surface of all asphalt concrete no sooner than 24 hours nor later than 14 days after placement. Seal coat shall consist of an emulsion paving asphalt (Grade SS-1h) conforming to test requirements of Subsection 203-3.2 of the Standard Specifications. Seal coat shall be applied to provide a coverage of 0.10 gallon per square yard. Seal coat shall not be applied when weather conditions are unsuitable or when atmospheric temperature is below 40°F. Seal coat shall be applied to only one traffic lane at a time and the entire width of the lane shall be covered in one operation. The cut off of asphaltic emulsion shall be made on building paper or similar suitable material spread over the surface. Traffic shall not be allowed on seal coat until emulsion breaks and seal coat is sticky to the touch and will not be picked up by traveling vehicles.

g) Rolling

Unless specified otherwise, at least 2 operational steel drum pavement rollers shall be present during all paving operations.

4) Temporary Surfacing

Unless permanent pavement is to be placed immediately, temporary surfacing 2 inches thick, or as otherwise specified, shall be placed and properly maintained as determined by the Owner until the permanent pavement is placed at locations specified. In any event, in paved streets where immediate access is required to provide for public or private use, Contractor shall place and maintain said temporary pavement. Temporary pavement shall be placed at all locations which are not

barricaded and are open to traffic. When Contractor delays the placing or repairing of temporary pavement, Owner reserves the right to have such pavement placed or repaired at Contractor's expense.

Temporary resurfacing shall conform to Subsection 306-1.5.1 of the Standard Specifications and shall be placed as soon as trench backfill is 95% compacted and shall remain in place until permanent resurfacing is placed. Prior to permanent resurfacing, temporary resurfacing shall be removed and discarded at legal disposal site(s) at Contractor's expense. The cost of furnishing, placing, maintaining, removing and disposing of temporary resurfacing shall be included in the Contractor's bid price for related work if no bid item is specifically called out in the bid sheets.

At the end of each day, temporary striping shall be placed complying with the Drawings and State, County, or City requirements. Temporary striping shall conform with Section 214 of the Standard Specifications.

5) Permanent Resurfacing

Unless otherwise specified, all permanent resurfacing shall be 1" or greater in thickness than the original surfacing removed. Contractor shall remove all loose pieces of existing pavement prior to placing any pavement. Said pavement shall be replaced in accordance with requirements of the agency (State, County, City) having jurisdiction over the roadway.

d. Portland Cement Concrete Pavement

1) General

Portland cement concrete shall comply with the Basic Concrete Specifications unless specified otherwise. Construction methods shall comply with Subsection 302-6 of the Standard Specifications. Portland cement concrete shall be furnished and placed at the locations and thicknesses specified.

2) Concrete Design Mix

All concrete shall be 520-C-2500 concrete in accordance with Subsection 201-1.1.2 of the Standard Specifications. Design mix shall be approved by the Owner prior to purchase or placing of concrete.

3) Reinforcement

Replacement concrete pavement shall have equal or better reinforcement than original concrete pavement. Reinforcement shall be provided whenever and wherever specified. Grade 60 reinforcing steel shall be used unless specified otherwise.

4) Admixtures

Admixtures shall conform to Subsection 201-1.2.4 of the Standard Specifications. Unless otherwise specified, concrete mixtures shall have airentrainment of  $5\% \pm 1\%$ .

5) Placing Concrete

Concrete shall be placed on an aggregate base sufficiently dampened to ensure that no moisture will be absorbed from the newly placed concrete. Concrete shall be placed on the aggregate base to specified uniform depth.

6) Finishing

Concrete shall be distributed uniformly between forms as soon as it is placed, struck off, and tamped. Tamping shall continue until concrete is thoroughly consolidated into the specified cross-section and sufficient mortar for finishing purposes has been brought to the surface. After tamping, surface of concrete shall be floated and finished. Where the concrete placed is to abut existing concrete surfaces, it shall be finished to match existing concrete as nearly as practical. Vat black or other approved pigments shall be added to concrete to obtain required result. Edges which do not abut existing concrete shall be rounded to a 1/2 inch radius. Upon completion of final finishing, work surface shall be free of any unevenness greater than 1/8 inch when checked with a 10-foot straightedge placed on the surface.

7) Curing

Pavement shall be cured by a pigmented sealing compound method. Curing shall commence as soon as free water leaves the concrete surface but no later than 3 hours following initial placement of concrete upon aggregate base. Curing compound shall be applied to the entire surface by spraying at the rate of one gallon per 200 square feet. All curing compounds shall be approved by the Owner. Curing compound shall conform to the requirements of Subsection 201-4 of the Standard Specifications.

8) Temporary Striping

At the end of each day, temporary striping shall be placed complying with the Drawings and State, County, or City requirements. Temporary striping shall conform with Section 214 of the Standard Specifications.

**3. Pavement Removal**

Pavement removal shall be limited to the maximum trench width as shown by the standard drawings plus a reasonable allowance for sloping sides of trench as required by appropriate safety standards or as otherwise specified.

Pavement shall be removed to clean straight lines. Pavement edges shall be saw cut unless an acceptable alternative method is permitted. Contractor shall discard all removed pavement at legal disposal site(s) at Contractor's expense. Removal and disposal of materials shall conform to the requirements of Subsection 300-1.3 of the Standard Specifications.

**4. Finishing Pavement Surfaces**

a. General

Upon completion of all construction operations the entire roadway area or newly surfaced areas shall be finished, cleaned, and left in a neat, presentable condition.

b. Shoulders

The shoulders around paved surfaces shall be trimmed and shaped to produce a smooth uniform cross section. Shoulders shall be finished, graded, and compacted so as to match the finish grade of the newly paved surfacing. Excess earth, debris, or other waste material shall be removed and discarded at legal disposal site(s) at Contractor's expense.

c. Paved Surfaces

All finished paved surfaces shall be clean of all dirt, debris, and foreign material. All manholes, boxes, and covers, shall be raised to finished grade. All curbs, gutters, and cross gutters shall be broomed clean and flushed with water to insure proper drainage. All street signs and striping shall comply with the construction drawings, specifications, and Section 214 of the Standard Specifications.

d. Survey Monuments

Prior to construction, Contractor shall have a registered civil engineer or licensed land surveyor set at least 4 ties for each monument within the construction area. After construction, Contractor shall have the same civil engineer or licensed land surveyor use the aforementioned ties to replace any monuments which have been disturbed or destroyed. Contractor shall file a corner record for all replaced monuments. Contractor shall also place monument wells in compliance with City or County standards over all monuments in the construction area.

the 1990s, the number of people aged 65 and over in the United States is projected to increase from 20 million to 35 million.

As the number of people aged 65 and over increases, the number of people aged 75 and over is also projected to increase. In 1990, there were 10 million people aged 75 and over in the United States. By 2010, this number is projected to increase to 15 million.

As the number of people aged 75 and over increases, the number of people aged 85 and over is also projected to increase. In 1990, there were 3 million people aged 85 and over in the United States. By 2010, this number is projected to increase to 5 million.

As the number of people aged 85 and over increases, the number of people aged 95 and over is also projected to increase. In 1990, there were 1 million people aged 95 and over in the United States. By 2010, this number is projected to increase to 2 million.

As the number of people aged 95 and over increases, the number of people aged 100 and over is also projected to increase. In 1990, there were 0.5 million people aged 100 and over in the United States. By 2010, this number is projected to increase to 1 million.

As the number of people aged 100 and over increases, the number of people aged 105 and over is also projected to increase. In 1990, there were 0.2 million people aged 105 and over in the United States. By 2010, this number is projected to increase to 0.5 million.

As the number of people aged 105 and over increases, the number of people aged 110 and over is also projected to increase. In 1990, there were 0.1 million people aged 110 and over in the United States. By 2010, this number is projected to increase to 0.2 million.

As the number of people aged 110 and over increases, the number of people aged 115 and over is also projected to increase. In 1990, there were 0.05 million people aged 115 and over in the United States. By 2010, this number is projected to increase to 0.1 million.

As the number of people aged 115 and over increases, the number of people aged 120 and over is also projected to increase. In 1990, there were 0.02 million people aged 120 and over in the United States. By 2010, this number is projected to increase to 0.05 million.

As the number of people aged 120 and over increases, the number of people aged 125 and over is also projected to increase. In 1990, there were 0.01 million people aged 125 and over in the United States. By 2010, this number is projected to increase to 0.02 million.

As the number of people aged 125 and over increases, the number of people aged 130 and over is also projected to increase. In 1990, there were 0.005 million people aged 130 and over in the United States. By 2010, this number is projected to increase to 0.01 million.

As the number of people aged 130 and over increases, the number of people aged 135 and over is also projected to increase. In 1990, there were 0.002 million people aged 135 and over in the United States. By 2010, this number is projected to increase to 0.005 million.

## **BASIC SEWER**

## BASIC SEWER SPECIFICATIONS

### 1. Scope

Contractor shall furnish all pipe, fittings, materials, equipment, and labor and perform all operations necessary to construct sewers (force mains and gravity sewers) and appurtenances as specified by the Owner as shown by the Drawings. Drawings shall consist of construction drawings, installation drawings, laying drawings, standard drawings, detailed drawings, layout drawings, fabrication drawings, shop drawings, and clarifying diagrams or sketches.

The Work shall consist of all traffic control (including furnishing and installing all barricades, signs, delineators, arrow boards, and flagmen); all utility location and verification (excavating, exposing, and verifying locations, depths, and dimensions of utility facilities); all pavement removal and disposal; all earthwork (including trenching, shoring, dewatering if required, blasting if required, bedding, backfilling, and compacting); furnishing and installing all pipe, fittings, appurtenances, and making all related connections; protecting in place or removing and replacing all existing utilities and public and private improvements; removing and replacing all asphalt and Portland cement concrete pavement; pavement striping and restriping as required; testing all sewers; disposing of excess soil and rock material; and restoring all areas and improvements to pre-construction conditions.

Contractor shall, upon completion of sewer construction and appurtenances required herein, initially operate all components of the Work installed or furnished and installed by him, and make any additional adjustments, corrections, repairs, replacements, and reconstructions necessary to provide the Owner with complete, correctly operating sewers and appurtenances.

"Standard Specifications" shall mean the Standard Specifications for Public Works Construction, latest edition, as published by Building News, Inc., Los Angeles, California. The Standard Specifications shall augment, not supersede, the "Construction Specifications". As used herein the Standard Specifications shall not apply to measurement, payment, schedule, delays, or extra work.

### 2. Survey Monuments and Construction Stakes

Contractor shall not disturb or destroy any existing monuments or bench marks. If any survey monuments or bench marks need to be removed and replaced, Contractor shall have all necessary services performed by a registered civil engineer or a licensed land surveyor. If Contractor fails to comply, the Owner will have said services performed at Contractor's expense.

Before removing any monuments in preparation for construction, Contractor shall have a registered civil engineer or licensed land surveyor set at least four ties minimum for each monument to be removed and replaced; after construction Contractor shall have the same registered civil engineer or licensed land surveyor replace each monument using the aforementioned ties and file a corner record for each replaced monument.

Unless specified otherwise, Contractor shall use construction stakes and cut sheets for sewer construction and the Owner will use them for construction inspection. All construction stakes shall be set by a registered civil engineer or licensed land surveyor. The Owner must approve cut sheets before actual construction. Contractor shall protect all construction stakes set for construction and he shall restore any construction stakes destroyed or disturbed. If Contractor fails to comply, the Owner will have services performed at Contractor's expense.

### 3. Traffic Control

Contractor shall prepare, submit, and provide traffic control drawings for construction. Said traffic control drawings shall be approved by the Owner and agencies having jurisdiction over highways, thoroughfares, and streets prior to starting construction.

Traffic control requirements may be modified by the Owner or said agencies as conditions warrant. Contractor shall modify traffic control as required by the Owner or said agencies at no additional cost. Throughout the Work, Contractor shall inspect traffic control equipment (signs, barricades, arrowboards, and delineators) and shall maintain same in accordance with said traffic control drawings.

All construction signing, lighting, and barricading shall comply with State of California, Department of Transportation "Manual of Traffic Controls, Warning Signs, Lights, and Devices for Use in Performance of Work Upon Highways", latest edition.

#### **4. Underground Utilities**

Where underground utility facilities (conductors or conduits for water, gas, sewer, telephone, electric power, cable television, or other utilities) are shown on Construction Drawings, Contractor shall assume that service facilities (services or laterals for water, gas, sewer, telephone, electric power, cable television, or other utilities) extend from each utility facility to each parcel or property whether or not service facilities are shown.

At least two working days and up to ten working days before commencing any excavation on each segment of the Work, Contractor shall request Underground Service Alert (1-800-422-4133) and non-member companies or utilities to mark or otherwise indicate the locations of their subsurface facilities including, but not limited to, structures including vaults, main conductors or conduits, and service connections or facilities.

Contractor shall comply with applicable laws pertaining to subsurface installations, especially with respect to excavations and permits. Contractor shall specifically comply with applicable provisions of Sections 4215 and 4216.9 of the Government Code. Contractor shall take all actions necessary to maintain a valid inquiry identification number during the Work.

At least ten days in advance, or 1,000 feet minimum ahead of sewer trenching, Contractor shall excavate, expose, and determine ("pothole") the exact locations, depths and dimensions of each and every potential interference, including, but not limited to, all facilities shown specifically (depth and location) on Construction Drawings, or which have been marked by their respective owners.

Upon learning of the existence or location of any utility facility omitted from or shown incorrectly on Construction Drawings, or improperly marked or otherwise indicated, Contractor shall immediately notify the Owner, providing full details as to depth, location, size, and function. Contractor shall immediately notify utility having jurisdiction over facility.

Contractor shall not interrupt or disturb any utility facility without written permission from the Utility or written order from the Owner. Where protection is required to ensure integrity of utility facilities located as shown on Construction Drawings or visible to Contractor or marked or otherwise indicated as stated herein, Contractor shall, unless otherwise provided, furnish and place all necessary protection at his expense.

Contractor is advised that the Owner has no knowledge or information about trench backfill conditions of utility facilities adjacent to or parallel with sewer being constructed pursuant to these specifications; therefore, Contractor shall protect against adjacent or parallel trench backfill failure. If adjacent or parallel trench fails, Contractor shall, at his expense, remove and replace said backfill material in accordance with trench backfill requirements herein and remove and replace asphalt concrete pavement and any other improvements damaged in connection therewith.

#### **5. Storage of Equipment and Materials**

Contractor shall not store equipment or materials on private or public property without written permission from property owner(s) approving such use. Said permission shall be submitted to and approved by the Owner before Contractor moves equipment or materials onto site.

Contractor shall not park equipment or store materials in public right-of-way except while performing Work. Contractor shall remove equipment from public right-of-way and place it in Contractor's storage or construction yard by the end of each work day. Contractor shall keep materials in Contractor's storage or construction yard until they are needed for the Work.

Storage site or construction yard shall be completely fenced prior to moving any equipment or materials onto site or into yard. Contractor shall control dust in construction yard at all times, from establishing construction yard through construction, and until all Work has been completed and Contractor has moved all equipment, materials, and fencing from site.

## 6. Trench Excavation

### A. General

Unless specified otherwise, excavation for sewers and appurtenances shall be open trench to the depth and in the direction specified by the Construction Drawings. Excavation for trenches shall include removal of all material of any nature as required for installation of pipe, fittings, or appurtenances and shall include blasting, either sloping or shoring, and all necessary dewatering, if any, all at Contractor's expense.

Contractor is advised that unsuitable earth may be encountered during trenching operations. Where such material is encountered, Contractor shall, at his expense, remove such material, discard it at legal disposal site(s), and thereafter replace it with approved backfill material.

### B. Trench Protection Drawings

Before excavating any trench 5 feet or more in depth, Contractor shall submit to the Owner detailed drawings showing design of shoring, bracing, sloping, or other provisions to be made for worker, individual, or property protection.

Said trench protection drawings shall be prepared by a registered civil or structural engineer, engaged by Contractor at his expense, who shall certify that the detailed drawings comply with OSHA Construction Safety Orders (CAL OSHA or FED OSHA, whichever is applicable at time of construction). Said engineer shall affix his signature and seal to each sheet of said detailed drawings. Contractor shall not excavate until the Owner has received and acknowledged properly certified detailed drawings.

### C. Trench and Bell Hole Sloping or Shoring

Trenches and bell holes shall be adequately sloped or shored so that earth will not slide or settle into trench, so that all existing improvements and utilities (above and below ground) will be fully protected from damage, and so that workers and individuals are protected from injury. At minimum, Contractor shall keep toe of trench spoil at least 5 feet from top of trench. Contractor shall assume full responsibility for all damages caused by inadequate sloping or shoring. Contractor shall make all necessary repairs or perform all reconstruction at his expense and he shall bear all other expenses resulting from such damages.

### D. Trench Length, Width, and Depth

Unless specified otherwise, trenches shall be excavated not more than 1,000 feet in advance of pipe laying and open trenches shall be properly barricaded and signed as required for individual and property protection. Trenches shall not be excavated or left open nights, weekends, or holidays.

Unless specified otherwise, all sewer trenches within pipe zone shall, wherever possible, have vertical sides and minimum widths as specified on the Drawings, however, trenches shall be sloped or shored as required for worker, individual, and property protection.

Whenever maximum allowable trench width, as shown by the Drawings, is exceeded for any reason, the Owner may, at its discretion, require Contractor, at his expense, to cradle pipe (Class B Portland cement concrete) or to provide higher class bedding and relative compaction to support pipe as required to limit load on pipe to allowable supporting strength. The Owner shall approve method of support prior to its use.

Trenches shall be excavated to depths specified by or shown on Construction Drawings or as otherwise directed by the Owner. If trench excavation is carried below grade without direction or permission, Contractor shall, at his expense, refill trench to proper grade with crushed rock, moist clean sand, sand and gravel, or other suitable material as approved by the Owner, tamped in place to 90 percent relative compaction minimum. Excess excavated material shall be incorporated in backfill or discarded at legal disposal site(s) by Contractor at his expense.

E. Excavated Materials

All material excavated from trench shall be placed for minimum obstruction to traffic (automobile and pedestrian). Gutters shall be kept clear and other provisions shall be made for street or road drainage. Excess excavated material, including material rejected by the Owner for use as backfill, shall be discarded at legal disposal site(s) by Contractor at his expense.

If pipe, fittings, or appurtenances belonging to the Owner are uncovered or removed during excavation, they shall be salvaged and deposited as directed by the Owner. If the Owner determines that certain materials need not be salvaged, said materials shall be discarded at legal disposal site(s) by Contractor at his expense.

F. Blasting

Blasting for excavation will be permitted only with approval of the Owner and only after proper precautions have been taken for protection of persons and property, provided Contractor has secured all necessary permits. Blasting shall be limited to specific periods as approved by the Owner. Any damage caused by blasting shall be repaired by Contractor at his expense. Contractor's blasting methods and procedures shall conform with State and local laws and County and municipal ordinances. Contractor shall post signs warning radio equipment operators that blasting operations are in progress and advising that radio transmissions are prohibited during blasting operations.

7. **Trench Bedding**

A. General

Bedding for gravity sewers shall be as shown on the Drawings for bedding factor specified and as specified herein.

Unless specified or shown otherwise, trenches shall be overexcavated to accommodate crushed rock bedding material having 9 inch minimum thickness between bottom of excavated trench and pipe bell for gravity sewers. For force mains or gravity sewers, trenches shall have flat bottoms conforming with grades to which pipe is to be laid. Trench bottoms shall be uniform and provide firm and uniform bearing for pipe or bedding material.

Pipe shall be laid so that pipe barrel bears evenly on the trench bottom or on bedding material. Bell holes shall be excavated in trench bottom and sides as necessary to permit satisfactory construction and inspection of pipe joints.

**B. Unsuitable Soil**

Where unsuitable soil consisting of loose, soft, spongy, or organic earth is encountered, it shall be removed from trench bottom to depth determined in field by the Owner and trench shall be refilled to proper grade with moist clean sand, sand and gravel, or other suitable material as approved by the Owner, tamped in place to 90 percent relative compaction minimum, all at no additional cost to Owner. Trench bottom shall be graded flat and prepared to provide firm and uniform bearing for pipe or bedding material.

Where unyielding soil consisting of rock, rocky earth, or cemented earth is encountered, it shall be removed from trench bottom to at least 9 inches below pipe bell and trench shall be refilled to proper grade with crushed rock, moist clean sand, sand and gravel, or other suitable material as approved by owner, tamped in place to 90 percent relative compaction, minimum. Trench bottom shall be graded flat and prepared to provide firm and uniform bearing for pipe or bedding material.

Unless specified otherwise, Contractor shall, at his expense, remove unsuitable soil, replace it with suitable soil, and discard unsuitable soil at legal disposal site(s). Contractor shall not deposit or store unsuitable soil on private or public property without written permission of property owner(s) and without applicable governmental permits pertaining to earthwork, including compaction, and the environment. Before placing any material on private or public property, Contractor shall provide the Owner with evidence of written permission to do so and he shall then obtain the Owner's written approval for same.

**8. Trench Backfill**

**A. General**

In addition to meeting backfill requirements specified herein, Contractor shall also comply with backfill requirements established through permits issued by jurisdictions (State, County, City) having control over rights-of-way in which construction is taking place. Whenever the separate requirements conflict with one another, the more stringent shall apply. Backfill shall not commence without prior approval of the Owner.

Backfill material shall be either select excavated material, screened or washed if necessary, or commercially processed material. Backfill material shall meet separate specific requirements for backfill within pipe zone and backfill above pipe zone. Backfill material meeting pipe zone requirements may be used for above pipe zone backfill material but not the reverse.

After sheeting, shoring, or shields have been removed, all backfill material including pipe zone backfill material shall be compacted to 90 percent relative compaction minimum except that the upper 12 inches of backfill material (excluding pavement section) shall be compacted to 95 percent relative compaction minimum, as verified by field compaction tests. Relative compaction shall be determined in accordance with ASTM D-1557, latest, modified to three-layer curve in lieu of five-layer curve. The Owner will specify where (number & location) compaction tests are to be taken.

Unless specified otherwise, the Owner will have all necessary compaction tests performed by soils engineer of its choosing. The Owner will pay for all passing tests; Contractor shall pay for all failing tests. Contractor shall notify the Owner when any segment of backfill has been compacted and is ready for compaction testing and the Owner will then have such tests performed.

Unless determined otherwise, compaction tests will be taken along the sewer, in the pipe zone, above the pipe zone, and at ground surface or subgrade at 300 foot intervals maximum and along all lateral and sewer extensions. Contractor shall assist, at no additional cost to the Owner, soils engineer in taking all compaction tests. Contractor shall furnish all equipment (including shoring),

labor, and materials needed for such assistance. Compaction testing shall be completed and accepted by the Owner prior to leakage testing of sewers and appurtenances.

Within highways, thoroughfares, and streets, Contractor shall, at the end of each work day and by 5:00 PM, unless permitted otherwise, completely backfill trenches with material sufficiently compacted to support traffic. Contractor shall then place 2 inch minimum thickness temporary asphalt concrete pavement over trench; it shall be compacted, rolled smooth with a steel wheeled pavement roller and placed flush with adjacent pavement. Contractor shall maintain and repair backfilled and paved areas to prevent potholes or pavement failures. Highways, thoroughfares, and streets shall be completely open to traffic at night (after 5:00 PM), on weekends, on holidays, and whenever Contractor is not actively working in specific area.

Contractor shall not excavate trenches or install pipe on weekends and holidays. Holidays include union holidays, Owner holidays, and County and municipal holidays. Contractor shall not leave any excavation open overnight or on weekends or holidays.

**B. Backfill Within Pipe Zone**

Backfill for gravity sewers within pipe zone shall be as shown on the Drawings for the trench load factor specified and as specified herein.

Unless specified or shown otherwise, 3/4 inch crushed rock and select excavated material, screened or washed if necessary, shall be used for sewers (gravity and force main). Said select excavated material shall consist of moist clean, loose earth, sand, or gravel (1 inch maximum size) free of clay and silt as well as brush, roots, and organic substances.

Initial backfilling shall be performed as soon as possible after pipe has been laid. 3/4 inch crushed rock or approved backfill material shall be placed in trench simultaneously on each side of pipe to a depth not greater than pipe centerline (springline) or 12 inches (loose measurement), whichever is less, and it shall then be tamped under pipe so that all voids are eliminated and material is compacted to 90 percent relative compaction minimum.

Subsequent backfilling shall be performed immediately following initial backfilling. Crushed rock or approved backfill material shall continue to be placed in trench simultaneously on each side of pipe in lifts not exceeding 12 inches in thickness (loose measurement), if required, with each lift being tamped, until the pipe has been covered by at least 12 inches of well compacted material. Alternatively, backfill material may be densified by water settlement until the pipe has been covered by at least 12 inches of well densified material. Backfilled material shall be tamped or settled to 90 percent relative compaction minimum.

Regardless of compaction or densification technique, care in backfilling shall be exercised to avoid any damage to pipe, fittings, and appurtenances, to avoid any damage to persons or property, and to achieve relative compaction of backfilled material of at least 90 percent minimum.

**C. Backfill Above Pipe Zone**

Backfill material shall consist of moist clean loose earth, sand, gravel, or rock free of clay and silt as well as brush, roots, and organic substances. From the top of selected backfill in the pipe zone to within 1 foot of ground surface or pavement subgrade, backfill material shall be free of material exceeding 8 inches in greatest dimension. It shall also be compacted to 90 percent relative compaction minimum. Within 1 foot of ground surface or pavement subgrade, backfill material shall be free of material exceeding 2 inches in greatest dimension and it shall be compacted to 95 percent relative compaction minimum. Rocks shall be mixed with suitable soil to eliminate voids; they shall not be nested. Backfill material shall be well graded.

Backfill material shall be placed in lifts not exceeding 12 inches in thickness (loose measurement) and each lift shall be compacted to 90 percent relative compaction minimum by hand tampers, pneumatic tampers, or mechanical compactors except that the upper 12 inches of backfill shall be compacted with mechanical compactors or compaction equipment, excluding stompers, to 95 percent relative compaction. Alternatively and except for the upper 12 inches of backfill, sandy, granular soils may be densified by water settlement. Trench to be backfilled by water settlement shall be diked at suitable intervals not exceeding 100 feet. Impounded water shall be of sufficient depth so that earth pushed or shoveled into trench will at all times fall into water, becoming completely saturated. If necessary, jetting may augment flooding. Backfill densified by water settlement shall be densified to 90 percent relative compaction minimum. Contractor shall use mechanical compactors or compaction equipment, excluding stompers, to achieve required compaction if required densification is not achieved by water settlement.

D. Imported Backfill Material

Whenever excavated material is unsuitable as backfill material and Contractor is unable to process or screen such material for backfill material or whenever excavated material is insufficient to accomplish backfill and Contractor must secure additional material, Contractor shall import such material and the material and its source shall be approved by the Owner.

Unless specified otherwise, imported backfill material shall be commercially processed and it shall be selected, clean, loose earth, sand, or gravel (1 inch maximum size). Said material shall be granular and it shall be free of clay, silt, and fine sand. It shall be suitable for compaction with minimum effort.

E. Backfill Completion

Where pavement is not required, trench backfill shall be brought to grade of existing surface and dressed to provide firm, stable, and even surface without ruts or irregularities. It shall conform with grades of existing surface. Where pavement is required, trench backfill shall be brought to subgrade for pavement structure. Pavement shall then be placed in accordance with Paving Specifications.

9. **Sewers and Appurtenances**

A. Construction Materials

Contractor shall furnish only approved materials as listed in the Owner's Approved Material List.

All materials shall be new and of the best quality for their intended use. All like materials shall be of one manufacture for any particular project.

Contractor shall, in addition to submitting other data herein required, submit six signed and dated copies of shop drawings, cut sheets and specification data for materials to be used in installation (force mains and gravity sewers) and appurtenance construction including gravity sewer installation, force main installations, air valve installations, manhole installations, cleanout installations, and related appurtenances for Owners approval.

B. Sewer Construction

1) Sewer and Appurtenances

Sewers (force main and gravity sewer) and appurtenances shall be constructed in accordance with these Specifications and the Drawings and as specified by the Owner.

2) Valves and Appurtenances

Force main valves at force main intersections shall be connected directly to force main intersection fittings (cross or tee) unless specified otherwise.

Unless specified otherwise, air valve installations shall be constructed at all force main high spots. Contractor shall construct, at his expense, air valve installations in addition to those specified, if necessary to accommodate his work and schedule.

3) Sewer Length

All sewer lengths noted by the Construction Drawings or otherwise specified or referenced shall mean net horizontal constructed lengths and said lengths shall extend through all fittings and appurtenances including manholes, bends, outlets, tees, flanges, and valves. Contractor shall provide all pipe necessary to accommodate any vertical alignment of the sewer and said pipe shall be represented by the net horizontal constructed length.

4) Sewer Alignment

All sewers shall be constructed with no basic variation in horizontal alignment as shown by the Drawings or as specified by the Owner. Sewers shall be constructed parallel with centerlines of streets or rights-of-way and appurtenances shall be constructed perpendicular thereto unless the Construction Drawings specify otherwise. Sewers may be constructed by the use of pulled joints, short joints, bevels, bends, and elbows, provided sewers are constructed in conformance with the Drawings.

In all non-critical areas and subject to the Owner's approval, force mains may be constructed at variance with vertical alignment as shown by the Construction Drawings by the use of pulled joints, short joints, bevels, bends, and elbows provided force mains are constructed as specified at force main connections and underground interferences, and where force main cover is limited. The Owner will not approve any variation in vertical alignment until it has determined that proposed alignment is proper and modifications are in order.

5) Sewer Tolerances

a. Force Mains

With regard to vertical alignment, force mains shall be constructed so that actual flow line elevations, measured at pipe joints, are within 0.1 foot of design flow line elevations. Force mains, when installed, shall have continuous slope upgrade or downgrade, corresponding with design slope, without any high spots or low spots.

With regard to horizontal alignment, force mains shall be constructed so that actual force main centerlines, measured at pipe joints, are within 0.1 foot of design force main centerlines. Pipelines, when installed, shall closely follow specified horizontal alignment.

Force main construction shall conform with Construction Drawings and layout, installation, or laying drawings (design drawings which show flow line elevations and force main centerlines) in accordance with the above specified tolerances. Contractor shall make or assist the Owner in making all necessary measurements, as determined by the Owner, to confirm or verify compliance with construction tolerances.

b. Gravity Sewers

With regard to vertical alignment, gravity sewers shall be constructed so that actual flow line elevations, measured at pipe joints, are within 0.02 foot of design flow line elevations. Gravity sewers, when installed, shall have continuous slope upgrade corresponding with design slope.

With regard to horizontal alignment, gravity sewers shall be constructed so that actual gravity sewer centerlines, measured at pipe joints, are within 0.1 foot of design sewer centerlines. Gravity sewers, when installed, shall closely follow specified horizontal alignment.

Gravity sewer construction shall conform with Construction Drawings in accordance with the above specified tolerances. Contractor shall make or assist the Owner in making all necessary measurements, as determined by the Owner, to confirm or verify compliance with construction tolerances.

6) Sewer Cover

a. Force Main

Force main cover as shown by the Construction Drawings is hereby defined as design cover over force main. If field conditions determined during construction staking show that pipe grade changes are required to provide design cover, Contractor shall, at his expense, make required changes in force main grade and construct force main accordingly.

Force main cover from top of pipe to ground surface over force main shall not be less than 36 inches. Where future ground surface elevation over force main has been established and where actual ground surface is greater, force main cover shall be referenced to future (established) ground surface elevation, not actual ground surface elevation.

b. Gravity Sewer

Gravity sewer cover as shown by the Construction Drawings is hereby defined as design cover over gravity sewer. If field conditions determined during construction staking show that pipe grade changes are required to provide design cover, Contractor shall, at his expense, make required changes in gravity sewer grade and construct gravity sewer accordingly.

Gravity sewer cover from top of pipe to ground surface over gravity sewer shall not be less than 84 inches, unless otherwise specified. Where future ground surface elevation over gravity sewer has been established and where actual ground surface is greater, gravity sewer cover shall be referenced to future (established) ground surface elevation, not actual ground surface elevation.

## 10. Pipe Materials and Pipe Installation

### A. Force Mains (Ductile Iron Pipe)

#### 1) Scope

Ductile iron pipe and fittings shall conform with applicable provisions of AWWA C104, C105, C110, C111, C115, C150, C151, and C153, latest, as modified herein, by the Drawings, or by the Owner.

All ductile iron pipe shall be manufactured by organizations which have had not less than ten years successful experience in the manufacture of the type of pipe specified. The Owner shall approve manufacturer's product before its use.

#### 2) Data to be Submitted by Contractor

Contractor shall furnish three copies of an Affidavit of Compliance in accordance with Section 51-5, AWWA C151, latest. Contractor shall also furnish certifications, three copies each, of the following:

##### a. Material Certification

- (1) Grade of iron (chemical requirements)
- (2) Flanges
- (3) Nuts and bolts
- (4) Flange gaskets
- (5) Rubber Gaskets

##### b. Manufacturing Certification

- (1) Hydrostatic Test Reports
- (2) Tensile Test Reports
- (3) Impact Test Reports

Unless specified otherwise, Contractor shall furnish detailed installation or laying drawings showing pipe, fittings, appurtenances, station, and elevation for each fitting, and each change in alignment or slope. Contractor shall submit the installation or laying drawings to the Owner for approval in all cases in time sufficient to allow review and approval as hereinafter specified and to accommodate the Contractor's construction schedule.

Installation or laying drawings shall be submitted in triplicate. Owner will return one (1) set of drawings to Contractor within fifteen (15) days marked either "Accepted", "Rejected", "Revise and Resubmit", "Submit Specified Item", or "Furnish as Corrected". In the last case, all revisions will be clearly shown on the returned set of drawings which shall be considered the accepted drawings and only drawings or prints so corrected shall be used for installation. Contractor shall furnish Owner five (5) sets of all accepted drawings.

#### 3) Pipe

All pipe shall be ductile iron and shall conform with AWWA C151 (ANSI A21.5, and applicable portions of ASTM A536, Grade 60-42-10), latest, as modified herein by the Drawings, or by the Owner.

- a. Pipe, including standard, random, and special short lengths, shall be Class 150 minimum and, unless specified otherwise, shall have push on joints. Minimum

pipe wall thickness shall be as noted by the Construction Drawings or specified by the Owner; it shall not be less than noted by the Standard Drawings. Pipe wall thickness shall be increased if necessary to accommodate threads or grooves or if required for extremely shallow (less than 2.5 feet) or excessively deep (more than 14 feet) pipeline cover. 90 percent of all pipe of any specific class and size, excluding special short lengths, shall be furnished in standard lengths. The remaining 10 percent may be furnished in random lengths.

- b. Standard lengths shall have nominal lengths of 18 feet up to 36 inches in diameter and 20 feet above 36 inches in diameter, plus or minus 1 inch. Random lengths of pipe may be up to 2 feet shorter than standard lengths. Special short lengths shall only be furnished where needed to accommodate specified fittings.
- c. Pipe shall have an interior cement mortar lining of standard thickness and shall be seal coated with asphaltic material or other approved material in accordance with AWWA C104 (ANSI A21.4), latest. Said lining shall be full thickness throughout pipe except for bell which shall be cleaned and lightly sprayed or brushed with an asphaltic or bituminous coating in accordance with AWWA C151 (ANSI A21.51). The interior cement mortar lining shall be moisture cured for at least two days before shipment. To prevent moisture loss during the curing period, ends of pipe shall be kept closed with plastic caps or covers which shall remain in place until installation.

Steam curing may be substituted for moisture curing, providing one hour of steam curing is equivalent to six hours moisture curing and ambient vapor is maintained at relative humidity of 85 percent with temperature ranging between 110 degrees Fahrenheit and 150 degrees Fahrenheit for minimum steam curing period of six hours, after which exterior coating may be applied. The lining shall then be cured for another twelve hours before shipment. Other methods of curing the cement mortar lining may be used providing they are acceptable to the Owner.

Temperature and shrinkage cracks in cement mortar lining less than 1/16 inch in width or 24 inches in length need not be repaired. Cracks wider than 1/16 inch or longer than 24 inches shall be repaired unless it can be demonstrated to the satisfaction of the Owner that the cracks will heal autogenously under continuous soaking in water.

- d. Pipe shall have an exterior asphaltic or bituminous coating in accordance with AWWA C151 (ANSI A21.51), latest.
- e. All pipe shall be furnished with rubber gasketed push-on type joints unless mechanical joints or flanged joints are otherwise specified or permitted. Joint restraints may be required as specified by the Owner. All joints shall comply with AWWA C111 (ANSI A21.11), latest, as approved by the Owner.
- f. Rubber gaskets shall conform AWWA C111 (ANSI A21.11) latest.
- g. Each pipe shall be marked with the weight, class, or nominal thickness and casting period. The manufacturers mark, year in which pipe was produced and the letters "DI" or "ductile" shall be cast or stamped on the pipe. All required markings shall be clear and legible and all cast marks shall be on or within 2 feet of bell ends.
- h. Where restrained joints are required, they shall be accomplished with boltless restrained joint gaskets or components, unless otherwise specifically approved by Owner. Restrained joints shall be ductile iron in accordance with applicable

provisions of AWWA C111 and C151 (ANSI A21.11 and A21.51, respectively), latest, except as to manufacturer's proprietary dimensions. Set screws shall not be utilized for any application.

Each restrained joint for pipe 4 inches through 12 inches shall consist of a gasket system where stainless steel locking segments molded within the gasket provide restraint for pipe joints or fitting joints.

Each restrained joint for pipe 14 inches through 24 inches shall consist of a gasket system where stainless steel locking segments molded within the gasket provide restraint for pipe joints or fitting joints, or alternatively, a boltless restrained push-on joint system where ductile iron locking segments inserted through slots in the bell face provide positive axial lock between the bell interior surface and the spigot retainer weldment or gripper ring.

Each restrained joint for pipe 27 inches and larger shall consist of a boltless restrained push-on joint system where ductile iron locking segments inserted through slots in the bell face provide positive axial lock between the bell interior surface and the spigot retainer weldment or gripper ring.

All restraining components must make full contact around the circumference of the pipe, even if it has deflected. Field cut kits shall be composed of full ring gripper rings with serrated edges and shall be compatible with the pipe joints and fittings joints.

4) Fittings

Ductile iron fittings shall conform with AWWA C110, C111, and C153 (ANSI A21.10, A21.11, and A21.53, respectively), latest. Unless specified otherwise, fittings shall be push-on joint and comply with AWWA C111 (ANSI A21.11).

Fittings shall have an asphaltic outside coating in accordance with AWWA C110 or C153 (ANSI A21.10 or A21.53), latest, and cement mortar lining in accordance with AWWA C104 (ANSI A21.4), latest. Fittings shall have standard lining thickness and shall be seal coated with asphaltic material or other approved material. The lining process must produce a dense, compacted lining that shall be bonded to the interior of the fitting and have a smooth surface.

Where restrained joints are specified, they shall be accomplished with boltless restrained joint gaskets or components and shall comply with all requirements of Section 10.A.3.h. of the Basic Sewer Specifications. Restrained joint fittings shall be of same joint design as the restrained joint pipe. Restrained joints shall be ductile iron in accordance with applicable provisions of AWWA C110 and C153 (ANSI A21.10 and A21.53), latest, except as to manufacturer's proprietary dimensions.

5) Special Lining

Where "special lined" ductile iron pipe is specified on the Drawings, Special Requirements, or where ductile iron pipe is specified as gravity sewer; pipe and fittings shall be lined with a system to provide special corrosion resistance in accordance with the owner's approved material list.

6) Testing

All pipe, including standard, random, and special short lengths, furnished shall be tested in the United States in accordance with AWWA C151, latest.

7) Manufacturing Inspection

The Owner shall at all times have the right to inspect all Work and materials during the course of manufacture. Manufacturer shall furnish the Owner reasonable facility for obtaining such information as he may desire regarding the progress and manner of the Work and the character and quality of materials used.

8) Loading, Transporting, and Unloading

After the pipe has been tested in accordance with Section 5 above, it shall be loaded on rubber-tired vehicles, and adequately supported and chocked to prevent any damage during transportation, and delivered to the Work site. During loading, unloading, and stringing operations, pipe and fittings shall be moved with care to prevent damage thereto. Unloading shall be accomplished in a workmanlike manner as directed by the manufacturer. Under no circumstances are pipe and fittings to be dropped or bumped in handling.

9) Defective or Damaged Material

Pipe and fittings shall be carefully inspected for defects. Any pipe found to be defective in workmanship or materials or so damaged as to make repair and use impossible shall be rejected and removed from the Work site.

In the event that pipe is damaged, damaged portions may be removed, as approved by the Owner, and discarded. Remaining sound portions may be used with ductile iron fittings. Contractor shall be responsible for any and all damage to material and he shall stand the expense of repairing or replacing same. Contractor shall take proper precautions to assure that rubber gaskets are protected from oxidation or undue deterioration.

10) Installation

Pipe manufacturer, fitting manufacturer, and material supplier, in addition to the Owner and the Owner's representative, shall have access to the Work during installation. Contractor shall use assistance provided by either manufacturer or supplier where required for proper installation of pipe, fittings, or materials; however, Contractor shall limit role of either manufacturer or supplier to advisory service.

All pipe shall be laid true to line and grade and at the locations shown by the Construction Drawings or as specified. Pipe shall be installed in accordance with applicable provisions of AWWA C600, latest, applicable provisions of Ductile Iron Pipe Research Association "Guide for the Installation of Ductile Iron Pipe", latest, and manufacturer's directions. Bell ends shall be placed uphill unless otherwise permitted.

After pipe has been set in trench, exterior of spigot and interior of bell shall be thoroughly cleaned. Lubricant recommended by pipe manufacturer and as approved by the Owner shall be applied to rubber gasket. Lubricant shall be water soluble, nontoxic, and shall have no deteriorating effects on the rubber gaskets, and shall not support growth of bacteria. Excess lubricant shall be removed. Pipe ends shall be aligned, and spigot shall be pulled into bell with come-along devices, or hoists with chains and slings, unless permitted otherwise. If either the pry bar or the backhoe bucket method is permitted, a timber header

shall be placed between the pipe and the pry bar or backhoe bucket before the spigot is pushed into bell. The receiving pipe section shall be adequately braced or backfilled to springline to prevent alignment deflection.

Curved alignment by use of pulled joints will be permitted. Maximum joint deflection shall be 3 degrees. For purposes of reducing angular deflections at pipe joints, Contractor may install pipe sections of less than standard length.

Whenever cutting of pipe is required, it shall be done with a special cutting tool specifically made for cutting and machining ductile iron pipe. Cut ends and rough edges shall be ground smooth and beveled for push-on joints.

Whenever specified, pipe shall be encased with 8 mil (0.2 mm) thick minimum polyethylene tube lapped 1 foot minimum, and valves and fittings shall be wrapped with polyethylene tube or with polyethylene sheets lapped 1 foot minimum. Polyethylene tube and polyethylene sheets shall be secured in place with suitable adhesive tape. All polyethylene tube and polyethylene sheet encasements shall be installed in accordance with AWWA C105, latest.

As Work progresses, a pipe cleaning tool as approved by the Owner shall be drawn through pipe to remove dirt, rocks, or other foreign material. At the end of each day's work, all openings in the pipeline shall be plugged with watertight expandable plugs or approved equal.

**B. Gravity Sewer (Vitrified Clay Pipe)**

**1) Scope**

All vitrified clay pipe shall conform with applicable provisions of ASTM C700, latest, as modified herein, by the Drawings, or by the Owner.

All vitrified clay pipe shall be manufactured by organizations with at least ten years successful experience in manufacturing, and fabrication of the type of pipe specified. The Owner shall approve manufacturer's product before its use.

**2) Data to be Submitted by Contractor**

Contractor shall furnish three copies of an affidavit of compliance in accordance with ASTM C700, C425, and C301, latest. Contractor shall also furnish certifications, three copies each, of the following:

**a. Material Certification**

- (1) Pipe
- (2) Type "G" Joints

**b. Manufacturing Certification**

- (1) Pipe Three (3) Edge Bearing Test Reports
- (2) Hydrostatic Test Reports

**c. Contractor shall submit shop drawings for manholes, covers, concrete, and appurtenances.**

3) Pipe and Fittings

Pipe and fittings shall be extra strength vitrified clay pipe (VCP) in accordance with ASTM C700, latest, and the "Standard Specifications", latest, as modified herein, by the Drawings or by the Owner.

a. Straight Pipe

Pipe diameter shall not vary from a true circle by more than 3 percent nominal diameter. Standard pipe length, excluding socket depth, shall be 40 inches and shall not deviate from straight by more than 1/16 inch per foot. All fabricated bends and bevels shall be manufactured from pipe meeting all specified requirements. Pipe and fittings shall not contain blisters, cracks, and chips. Pipes and fittings failing to meet these requirements will be rejected and shall be removed from the job site immediately.

b. Pipe Fittings

Fittings shall have dimensions that will accommodate Type G joints. Wye and tee branch fittings shall be furnished by manufacturer with spurs securely fastened to pipe barrels. Branches shall not project beyond pipe barrel inner surface.

Tee branch fittings shall have axes perpendicular to the longitudinal axis of the pipe. Wye branch fittings shall have axes 45 degrees from the longitudinal axis of the pipe. Spur barrel shall be of sufficient length to permit proper joining of connecting pipe.

c. Pipe Stoppers

Stoppers for branch fittings and pipe ends left unconnected shall be strong enough to sustain all applied construction and in-place loads, including field pressure tests. Stoppers for pipe shall be one of the following: polyethylene (PE), polyurethane, polypropylene, acrylonitrile-butadiene-styrene (ABS), polyvinyl chloride (PVC), ozone-resistant synthetic rubber, or vitrified clay.

d. Marking

Each length of pipe and each fitting shall be clearly marked with the name or trademark of the manufacturer, the location of the plant, and the strength designation of the pipe. Each standard length of straight pipe shall also be marked with manufacturer's date code.

4) Pipe Joints

Pipe joints shall be Type G (polyurethane). Type G joints shall consist of polyurethane elastomer sealing components, one bonded to the outside of the spigot and the other bonded to the inside of the socket. The sealing components shall be shaped, sized, bonded, and cured to uniform hardness so as to form a tight seal of the joint when assembled. The sealing components shall resist attack by bacteria and chemicals or combinations of chemicals normally present in domestic or industrial waste sewage.

Each joint within vertical and horizontal curves shall be constructed using factory fabricated mitered or beveled pipe or by deflecting joints. Ends may be beveled up to 4 degrees. In no case shall joints be deflected more than 1 degree.

5) Manufacturing Inspection

Owner shall at all times have the right to inspect all materials and work in the course of manufacture. Manufacturer shall furnish Owner reasonable facility for obtaining such information as he may desire regarding the progress and manner of the Work and the character and quality of materials used. Manufacturer shall furnish, upon request, certified test reports on manufactured pipe.

6) Loading and Transporting

Pipe shall be loaded on rubber-tired vehicles, adequately supported and chocked to prevent any damage during transportation, and delivered job site. During the unloading and stringing operations, the pipe shall be moved in such a manner as to prevent injury to the pipe. Unloading shall be accomplished in a workmanlike manner as directed by the manufacturer. Under no circumstances are pipe sections to be bumped or dropped in handling.

7) Defective or Damaged Material

All pipe and fittings shall be carefully inspected for defects. Any pipe, fitting, or joint found to be defective in workmanship or material or so damaged as to make repair and use impossible, shall be rejected and removed from the job site immediately.

8) Installation

Sewers shall be installed with bedding and backfill as specified herein and as shown on Drawings for the trench load factor specified.

All sewers shall be laid true to line and grade and at the locations as shown by Construction Drawings or as specified. Pipe shall be installed in accordance with the manufacturer's directions, applicable provisions of "Clay Pipe Engineering Manual" as published by the National Clay Pipe Institute and as specified herein.

Before lowering and while suspended at trench side, the pipe shall be inspected for defects. Vitrified clay pipe (VCP) shall be rung with a light hammer to detect cracks. Any defective material shall be rejected and removed from the site. Trench bottom shall be inspected and adjustments made in line and grade. All pipe shall be laid without break, upgrade from structure to structure, with bell end of pipe upgrade.

As the Work progresses, interior of the sewer shall be cleaned of all dirt and deleterious and superfluous materials with a procedure approved by Owner. At the end of each days work, all openings in the sewer shall be plugged with water-tight expandable plugs or approved equal.

Prior to joining pipe sections, the mating surfaces shall be cleaned, and lubricated with a lubricant recommended by the pipe supplier. The pipe shall be joined spigot into socket.

The pipe and fitting manufacturer shall have free access to the Work during laying, backfilling, and testing. Manufacturer shall be free to observe and verify all tests. Any improper act or operation by Contractor which is observed by manufacturer shall be reported to Owner.

9) Manholes and Appurtenances

a. Scope

Manholes shall be constructed of precast reinforced concrete in accordance with the requirements of ASTM C-478 (latest edition) and shall be designed for H-20 loadings. Dimensions and details of manholes and appurtenances shall be as shown on Construction Drawings, Standard Drawings, or as specified. After final pavement has been placed, manhole covers shall be adjusted to grade.

b. Manhole Bases

Unless specified otherwise, manhole base shall be constructed of Class A (3500 psi) concrete. Unless specified otherwise, manhole bases shall be cured twenty-four hours minimum prior to manhole shaft placement.

c. Concrete and Mortar for Manholes

Concrete shall be of the class specified on the Drawings and shall comply with the Basic Concrete Specifications.

Cement mortar shall consist of one part Portland cement and two and one half parts clean, well graded sand of such size that all will pass a number 8 sieve. Cement and sand shall first be combined in proper proportions, and then thoroughly mixed with only that quantity of water necessary to produce a mixture sufficiently workable for the purpose intended.

Mortar shall be used as soon as possible after mixing and shall shown no visible signs of setting prior to use. Mortar shall not be retempered.

d. Manhole Frames and Covers

Manhole frames and covers shall be furnished in accordance with the Drawings. Castings shall conform to ASTM, A-48, Class 35. Bearing surfaces of the frames and covers shall be machined and covers shall seat firmly into frames without rocking. Frames and covers shall be thoroughly cleaned and coated with commercial quality asphalt paint. Unless specified otherwise, covers shall have raised letter identification as specified on the Drawings.

10) Laterals

Laterals shall be in accordance with the Drawings. Laterals shall be located at least 10 feet from any potable water service.

II. Valves

A. General

Valves shall be as shown on the Drawings and specified herein.

B. Air Valves

Unless specified otherwise, air valves shall be combination sewage air and vacuum valves (air, vacuum, and automatic release). They shall permit automatic escape of large quantities of air from

force main when it is being filled, permit large quantities of air to enter force main when it is being emptied, and allow accumulating air to escape while force main is in operation and under pressure.

Air valves shall be single body double orifice with elongated ductile iron bodies and covers, stainless steel floats, stainless steel internal working parts (including guides), stainless steel pressure seats (Buna N), seat hardness shall be selected by the manufacturer for actual operating pressure for the system, and white Viton "O" rings or seats. Unless specified otherwise, air valves shall be service rated at cold water working pressure of 150 psi minimum. Unless specified otherwise, resilient seats shall be service rated for 150 psi maximum operating pressure.

Air valve interiors shall be completely fusion bonded epoxy coated (12 mils minimum) in accordance with AWWA C550, latest. The Owner shall approve epoxy coating material and methods before application. Completed coating shall be free from all defects and shall be inspected by use of low voltage holiday detectors and non-destructive thickness gauges.

Air valve inlets shall be flanged. Air valves shall be subjected to factory hydrostatic test at pressure equal to 200 percent rated working pressure with no harmful deflections or other defects.

Air valve outlets shall be screened as specified to prevent entrance of foreign substances or materials.

Air valves shall be tagged or labeled with the manufacturer's name, size, model number, pressure rating and other specialty features as listed above or as specified by the Owner.

Unless otherwise specified, each unit shall be supplied with isolation valve (solid wedge gate), blowoff valve, 1/2 inch back flushing shutoff valve, and 5 foot rubber supply hose with disconnect couplings.

Air valves shall be kept clean and free from dirt, earth, debris, and other deleterious materials prior to, during, and after installation and construction. Until in operation, each valve shall be protected by the use of an approved canvas or plastic bag or sack completely covering valve and securely fastened to valve riser.

#### C. Gate Valves

Gate valves shall be manufactured in accordance with AWWA C509, latest, except as specified herein or as shown by the Standard Drawings. Gate valves shall be suitable for above grade or buried service as shown on Drawings. Above grade valves shall be equipped with hand wheel operator. Below grade valves shall be equipped with valve boxes in accordance with Standard Drawings.

Gate valves shall have ductile iron bodies, resilient seats, and ANSI B16.1 Class 125 flanges. Valve disc shall be permanently bonded with resilient material to ensure drip tight shut off. Valve stems, each with hand wheel or 2 inch square operating nut, shall be nonrising and shall turn counterclockwise to open. Gate valves shall have "O" ring seals, non-shock cold water working pressure of 200 psi, minimum.

Gate valves shall be fusion bonded epoxy coated (12 mils minimum) inside and outside in accordance with AWWA C550, latest. The Owner shall approve epoxy coating materials and methods before application. Completed coating shall be free from all defects and shall be inspected by use of low voltage holiday detecting and non-destructive thickness gauges.

Gate valves shall be tagged or labeled by the manufacturer with the manufacturer's name, size, model number, pressure rating and other specialty features as listed above or as specified by the

Owner. Contractor shall provide manufacturers certification that all materials used in valves produced under AWWA C509, latest, conform with Section 2.1 of said standard.

D. Eccentric Plug Valve

Eccentric plug valves shall be of the non-lubricated eccentric type with round or rectangular port, unless otherwise specified. The valve body and plug shall be constructed of cast iron meeting the requirements of ASTM A-126, Class B. The valve body shall be furnished with a welded overlay raised nickel seat. The valve plug shall be of one piece construction and shall be completely encapsulated with Buna N rubber. Unless otherwise shown or specified on the Drawings, the valves shall be flanged with dimensions, facing, and drilling in full conformance with ANSI B 16.1, Class 125. With plug in full open position, valve shall have no cavities where debris can collect, have minimal head loss, and be capable of passing a clean out pig with the same nominal diameter as the adjacent pipe. Valves shall be equipped with operators as shown on the Drawings and as specified herein. Valves 4 inches and larger shall be provided with enclosed worm gear operators and hand wheels. Buried valves shall have square nut and be designed for buried service. All eccentric plug valves shall have a working pressure rating of not less than 150 psi, for drip tight shut off. All interior ferrous surfaces shall be coated with 10 mils (minimum) of a two part high build epoxy. Valves shall be the product of a single manufacturer and shall be Val-Matic, Clow, or DeZurik

12. **Field Hydrostatic Test and Leakage Test**

A. Hydrostatic Test for Ductile Iron Pipe

Upon completion of force main construction and at least seven days after last concrete thrust device has been placed, force mains and appurtenances constituting the Work shall be filled with water for twenty-four hours minimum. During filling, Contractor shall see that all air valves are open and operating. After force mains have been completely filled, they shall be allowed to stand for twelve hours minimum under slight pressure for sufficient time to permit all air to escape. During that same period, Contractor shall examine all fittings, flanges, and connections for leaks. If any leaks are found, they shall be eliminated.

Unless otherwise specified, test pressure shall be 225 psi minimum for Class 150 pipe and 150 percent of pipe class for other classes of pipe. Test pressure shall be applied to test sections as directed by the Owner. Test pressures shall be maintained for four hours minimum. Test sections will be selected which give, as nearly as possible, constant pressure throughout section being tested. Normally test pressures will be measured at lowest elevations.

B. Leakage Test for Ductile Iron Pipe

After pressure test has been satisfactorily completed, force main and appurtenances shall be tested for leakage at pressure equal to the pressure class of pipe. Contractor shall test force mains and appurtenances in test sections as designated by the Owner and required pressures shall be maintained for two hours minimum during which time leakage shall be accurately measured.

Measured leakage shall not exceed the limits set by the following formula unless otherwise specified by the Construction Drawings.

$$L = \frac{ND(P)^{1/2}}{5000}$$

L is the allowable leakage in gallons per hour for section of pipeline being tested; N is the number of joints (rubber gasket, flanged, or mechanical joints) where leakage could occur in the section of pipeline being tested; D is the nominal diameter (inches) of the pipeline being tested; and P is the

weighted average test pressure (psi gauge) within the section of pipeline being tested during the leakage test.

**C. General Requirements**

- 1) Required test pressures shall be applied by pump connected to force main sections being tested. The Owner shall approve pump connections to force main before testing begins. As part of the Work, and unless specified otherwise, Contractor shall install, at his expense, top outlets required for testing.

Contractor shall provide calibrated meters for measurement of leakage, and all pumps, piping, fittings, bulkheads, plugs, valves, gages, power equipment, additional outlets for pressure and flow verification, and manpower necessary for conducting all tests required, all at his expense. Contractor shall furnish the Owner three copies of all records of all tests performed.

- 2) Contractor, at his expense, shall locate and repair leaks or other defects which may develop or become apparent during test. Contractor shall excavate, including removal of backfill already placed, and make all repairs necessary for required water tightness, and then replace all excavated material, after which Contractor shall retest repaired force main section. Force main sections shall be repeatedly repaired and tested until they meet requirements set forth herein.
- 3) Pipe manufacturer and fitting manufacturer shall have free access to the Work during testing. Any improper act on the part of Contractor which the pipe and fitting manufacturer may observe shall be reported to the Owner. Pipe and fitting manufacturer shall be free to observe and verify all tests.
- 4) After completed force main and appurtenances or test sections have successfully met test requirements to the satisfaction of the Owner, the entire force main or each test section shall be filled or shall remain filled with clean water until completion of the Work, unless otherwise ordered by the Owner.

**13. Leakage Test and Visual Inspection for Gravity Sewer**

**A. General**

Contractor shall, upon completion of sewer and appurtenances, including backfill (prior to final paving), perform leakage tests on sewers and laterals. Contractor shall furnish all labor and equipment necessary to perform testing, including calibrated meters for measurement of the leakage, necessary bulkheads, piping, gages, pumps, power, and plugs. Contractor shall furnish to Owner copies of all tests performed.

Contractor, at his own expense, shall do all excavation necessary to locate and eliminate leaks or other defects which may develop under test, including removal of backfill and sewer line necessary to achieve the required water tightness. After repair the required test shall be repeated until the sewer main and appurtenances meet the requirements set forth herein. Refer to Section 13 herein for repair.

**B. Leakage Test**

The leakage test to be performed by the Contractor shall be either the water exfiltration test or the air pressure test in accordance with Section 306-1.4.1, 306-1.4.2 and 306-1.4.4 of the Standard Specifications. The water infiltration test (in accordance with Section 306-1.4.3) will be required

only when specified in the Special Requirements, on the Drawings, or where ground water is encountered.

C. Water Exfiltration Test

Test shall be in accordance with Section 306-1.4.2 of the Standard Specifications as modified herein. The total leakage shall be the decrease in volume of water in the upper structure. The leakage shall not exceed 200 gallons per day per inch of nominal diameter of pipe per 1 mile of sewer pipe being tested. The length of house connections shall not be used in computing the length of sewer main being tested. The minimum test duration period shall be two hours.

If ground water is encountered and the Owner requires the infiltration test in accordance with Sections 306-1.4.3, the Contractor will be required to also perform the air pressure test, and the exfiltration test will not be required.

D. Air Pressure Test

The air pressure test shall be in accordance with Section 306-1.4.4 of the Standard Specifications.

E. Inspection of Pipeline Interior

Sewer line 21 inches and larger will be visually inspected by the Owner after successful completion of acceptable leakage tests. The Contractor shall furnish all necessary equipment, safety apparatus, and labor to permit said inspection including gas detector ventilation fans, pipe cart, and ropes to permit crawling the line. Ventilation fans (exhaust) shall be provided at manholes upstream and downstream of the manhole being entered.

Sewer line smaller than 21 inches will be visually inspected by sewer video taping after completion of acceptable leakage tests. The Contractor shall furnish all necessary labor and equipment to complete said video taping. Contractor shall provide video tape and video tape log to Owner for review.

For either inspection method, Owner shall check for cracked or damaged pipe, excessive joint gap, and debris in line. The Contractor shall remove any debris. Any pipe which is cracked or damaged shall be removed and replaced.

F. Pipe Repair and Replacement

Where it is determined that pipe must be replaced due to damage or excessive leakage, said replacement may be performed by installing new pipe and connecting to existing pipe utilizing rubber Calder type couplings with stainless steel bands. For pipe larger than 12 inches, said couplings shall be encased in concrete as directed by the Owner.

Upon approval of Owner, pressure applied sealants may be used to repair joints where structural integrity of pipe is not altered; however, numerous leaking joints evidencing material or installation defects shall form basis for prohibiting repair with sealant. Under such circumstances, pipe shall be removed and replaced as necessary.

14. **Conductor Casings and Carrier Pipes**

Wherever required, conductor casings shall be installed. Said casings shall be comprised of either welded steel pipe or reinforced concrete pipe, as specified. Conductor casings shall be bored and jacked into place unless open trench installations are permitted; conductor casings shall not be sluiced or jetted into place. Conductor casings shall be bored and jacked into place from one direction only.

Conductor casings shall be installed to the lines, grades, and depths specified. Unless specified otherwise, Contractor will be permitted a tolerance from horizontal alignment and from vertical alignment of 0.5 percent of conductor length but no more than 1 foot maximum regardless of conductor length.

Unless specified otherwise, methods and equipment used shall be as selected by Contractor and as approved by the Owner. Said approval shall not relieve Contractor of any responsibility with regard to conductor casing construction. Conductor casings shall have minimum inside diameters at least 12 inches larger than maximum outside diameters of carrier pipes.

Prior to any boring and jacking operations, Contractor shall submit to the Owner a construction plan consisting of a schedule of operations, details of methods of construction, types of equipment to be used, details of boring and jacking pit including lengths, widths and depths, and shoring and bracing. Said construction plan shall be approved as to sufficiency by the Owner before any construction is commenced.

Boring and receiving pits shall be shored in accordance with OSHA standards. A 6 foot high chain link fence with posts at 10 foot intervals shall be erected around said pits and said pits shall be protected on all sides with Type K barriers and lighted barricades. Barriers shall be placed to direct traffic around the pits.

Prior to constructing pits, Contractor shall excavate both sides of each crossing to determine exact locations of facilities to be crossed (horizontal and vertical). Contractor shall adjust casing locations to accommodate crossings based on Contractor's field measurements.

Contractor shall schedule his operation to prevent pits from being open on weekends or holidays. Contractor shall provide traffic control around the pits in accordance with Contractor's approved traffic control drawings.

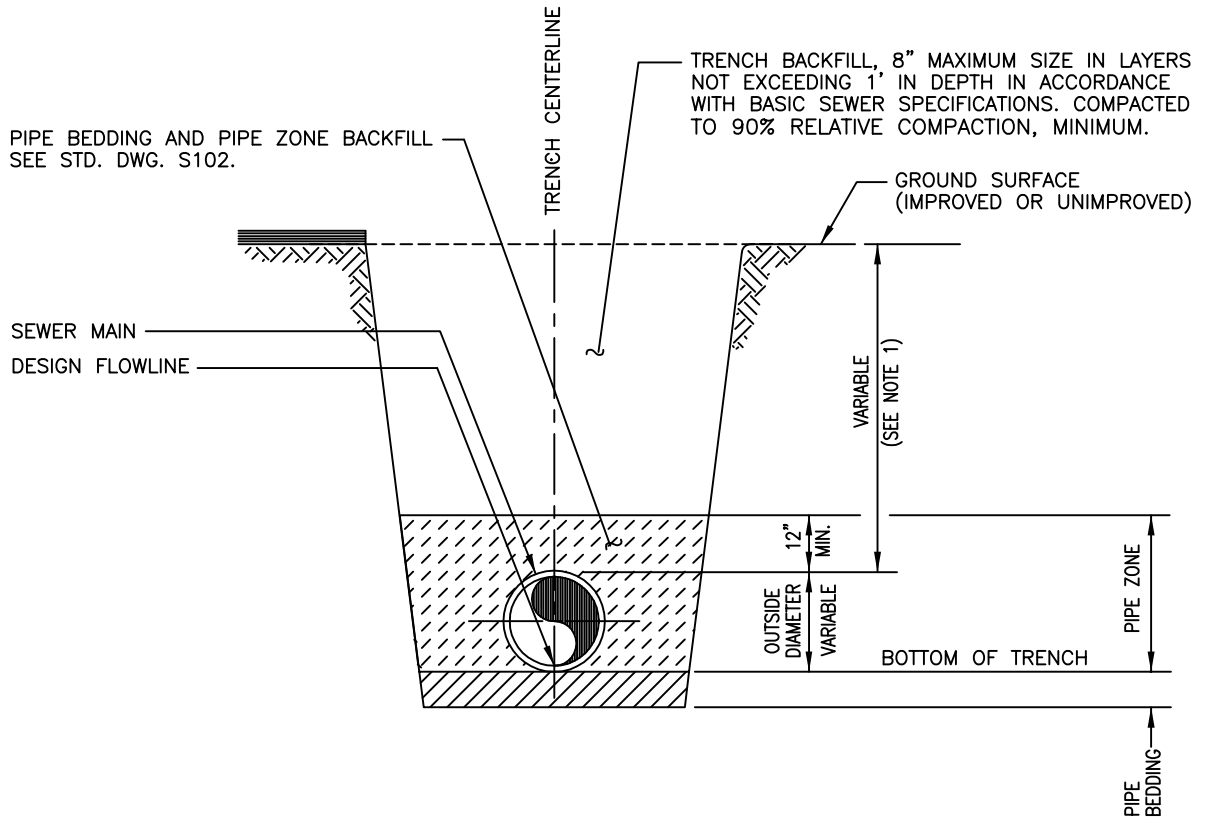
Contractor shall take all necessary precautions to prevent subsidence of or lifting of existing roadbeds, roadways, and pavements during or following installation of conductor casings. Material excavated during boring and jacking operations shall be removed carefully so as to avoid caving. Voids created during boring and jacking shall be grouted with an approved grout from within the casing once the casing has been installed. Couplings shall be welded to steel casing to permit grouting. Following grouting, threaded plugs shall be inserted into said couplings.

After conductor casing has been constructed, carrier pipe shall be equipped with approved plastic or steel casing insulators uniform size and spacing and then installed in conductor casing in accordance with aforementioned construction plan as approved by the Owner. Annulus between conductor casing and carrier pipe shall be filled with sand and the ends shall be capped with plastic or steel end seals or plugged with brick and mortar. Weepholes shall be placed in the bottoms of the end seals or brick and mortar plugs.

Contractor shall backfill boring and jacking pits with material specified for sewer backfill. Said backfill material shall be compacted to the relative compaction specified which shall be not less than 90 percent. Contractor shall remove conductor casing and carrier pipe remnants, shoring materials, asphalt, concrete and all other Work related debris. Contractor shall restore paved surfaces, if required.

## **15. Field Painting**

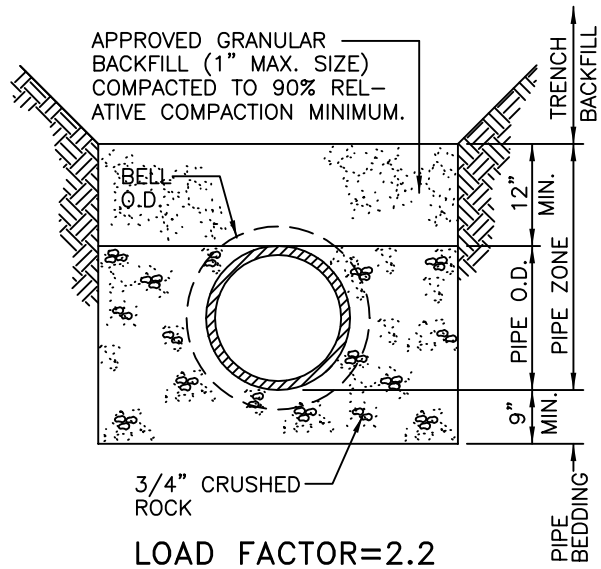
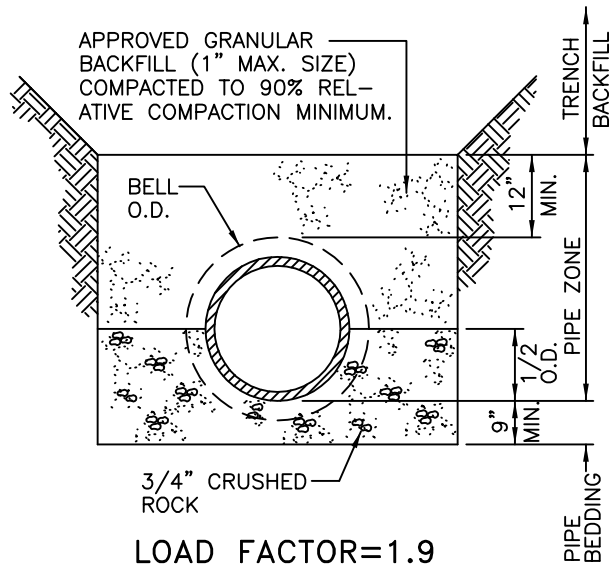
Contractor shall field paint all aboveground, bare, or exposed piping and appurtenances in accordance with the applicable specifications and drawings.



NOTES:

- 1) SEWER COVER SHALL BE 7'-0" MINIMUM FOR SEWER LINES.
- 2) TRENCH SIDES SHALL BE SLOPED OR SHORED IN ACCORDANCE WITH CAL OSHA CONSTRUCTION SAFETY ORDERS FOR TRENCH DEPTHS 5' AND GREATER.
- 3) ALL EXISTING PAVEMENT SHALL BE SAWCUT PRIOR TO TRENCHING, AND WHERE TRENCH SIDES SLUFF AND PAVEMENT BREAKS AWAY, IT SHALL BE SAWCUT, NORMAL OR PARALLEL TO TRENCH, PRIOR TO PERMANENT PAVEMENT REPAIR.
- 4) WHENEVER EXISTING UTILITY FACILITIES, EXCEPT WATERLINES, ARE ENCOUNTERED, SEWERS SHALL CLEAR THEM BY 12" MINIMUM, BOTH HORIZONTALLY AND VERTICALLY, CONSISTENT WITH ABOVE SEWER REQUIREMENTS. SEWERS SHALL CLEAR WATERLINES IN ACCORDANCE WITH STANDARD DRAWING S103. SPECIFIED CLEARANCES OR SEPARATIONS SHALL NOT BE REDUCED UNLESS ORDERED OR PERMITTED BY AGENCY. SEWERS SHALL NOT BE IN CONTACT WITH OR REST AGAINST OTHER UTILITY FACILITIES.

APPROVED	DATE _____	<b>DESERT WATER AGENCY</b> PALM SPRINGS, CALIFORNIA	
_____ ASSISTANT GENERAL MANAGER/OPERATIONS	RCE NO. <u>36810</u>	<b>SEWER TRENCH</b>	
		<b>STANDARD DRAWING S101</b>	
REVISION	BY	DATE	



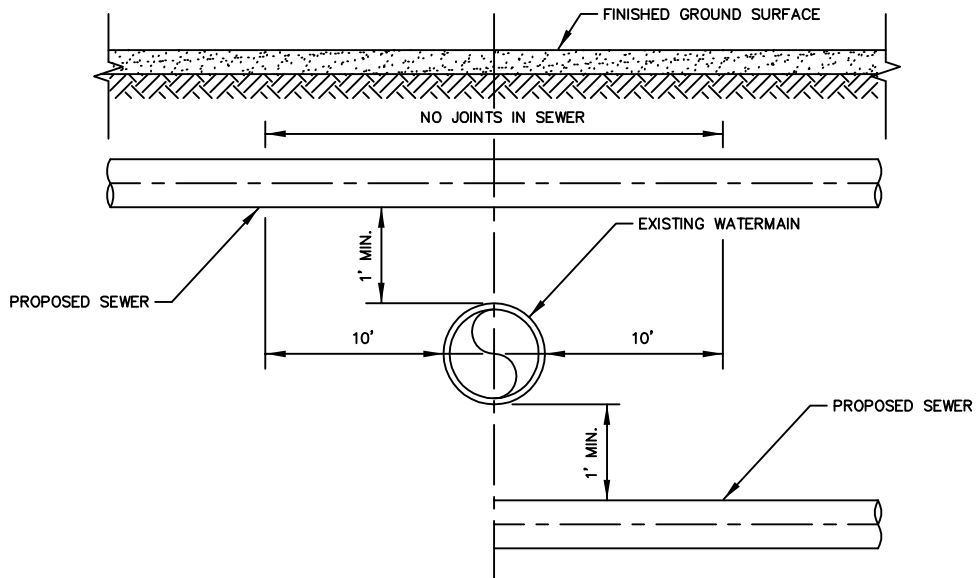
MINIMUM LOAD FACTOR—UNLIMITED TRENCH WIDTH							
SEWER DIAMETER (INCHES)	DEPTH OF COVER (FEET)						
	6	8	10	12	14	16	18
8	1.9	1.9	1.9	1.9	1.9	1.9	2.2
10	1.9	1.9	1.9	1.9	1.9	2.2	
12	1.9	1.9	1.9	1.9	2.2		
15	1.9	1.9	1.9	2.2			
18	1.9	1.9	1.9	2.2			

**NOTES:**

- AS A MINIMUM, ALL SEWERS SHALL BE CONSTRUCTED WITH A LOAD FACTOR OF 1.9.
- 3/4" CRUSHED ROCK SHALL BE PER STANDARD SPECIFICATIONS, SECTION 300 WITH THE FOLLOWING GRADATIONS:

SIEVE	% PASSING
1"	100%
3/4"	90-100%
1/2"	20-55%
3/8"	0-15%
No.4	0-5%
- FOR SEWER DIAMETERS DIFFERENT THAN SHOWN AND FOR DEPTHS OF COVER DIFFERENT THAN SHOWN, AGENCY SHALL APPROVE PIPE BEDDING AND PIPE ZONE BACKFILL PRIOR TO CONSTRUCTION.

APPROVED _____	DATE _____	<b>DESERT WATER AGENCY</b> PALM SPRINGS, CALIFORNIA	
_____ ASSISTANT GENERAL MANAGER/OPERATIONS	RCE NO. <u>36810</u>	<b>PIPE BEDDING FOR</b> <b>VITRIFIED CLAY PIPE</b>	
		<b>STANDARD DRAWING S102</b>	
REVISION	BY	DATE	



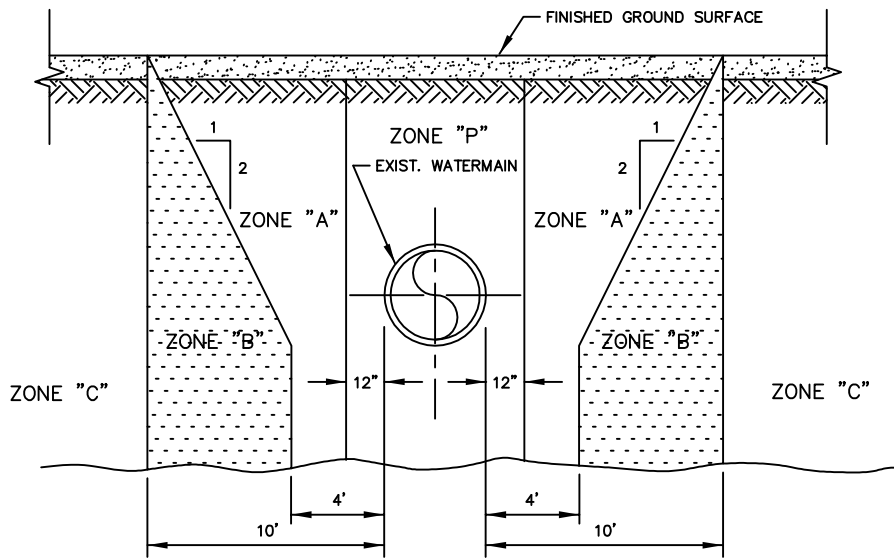
**CROSSING CONDITION**

PROPOSED SEWER ABOVE EXISTING WATERMAIN

PROPOSED SEWER BELOW EXISTING WATERMAIN

- 1) SEWER SHALL BE DUCTILE IRON PIPE WITH HOT DIP BITUMINOUS COATING AND MECHANICAL JOINTS OR SEWER SHALL BE WITHIN A CONTINUOUS SLEEVE.
- 2) CROSSINGS AT OTHER THAN 90° ANGLES SHALL BE AS SPECIFIED BY AGENCY.

- 1) IF ONE FOOT MINIMUM CLEARANCE IS MAINTAINED AT A 90° CROSSING, NO SPECIAL CONSTRUCTION CONDITIONS ARE REQUIRED.



**PARALLEL CONDITION**

ZONE "A" - NO SEWERS SHALL BE CONSTRUCTED WITHOUT SPECIAL PERMISSION FROM STATE DEPARTMENT OF HEALTH SERVICES AND THE AGENCY.

ZONE "B" - SEWER SHALL BE EXTRA-STRENGTH VITRIFIED CLAY PIPE WITH COMPRESSION JOINTS AND SHALL BE APPROVED BY AGENCY.

ZONE "P" - NO SEWER CONSTRUCTION ALLOWED.

ZONE "C" - NO SPECIAL CONDITIONS REQUIRED.

APPROVED

DATE \_\_\_\_\_

\_\_\_\_\_  
ASSISTANT GENERAL MANAGER/OPERATIONS

RCE NO. 36810

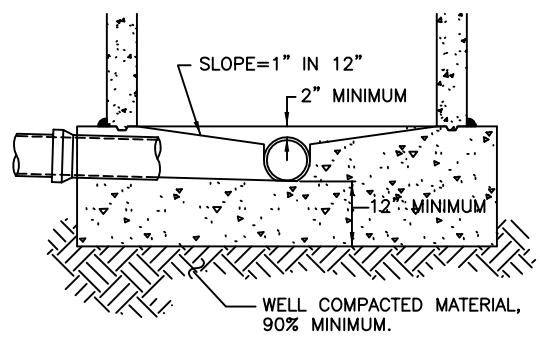
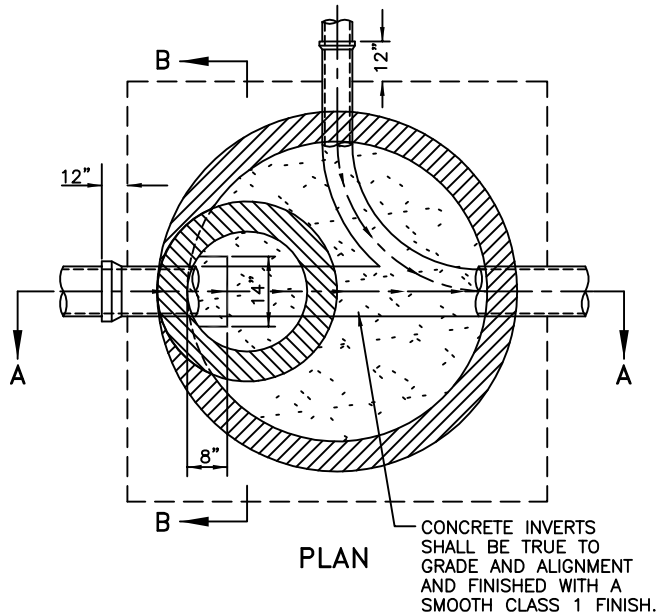
**DESERT WATER AGENCY**  
PALM SPRINGS, CALIFORNIA

**SEWER CROSSING  
EXISTING WATERMAIN**

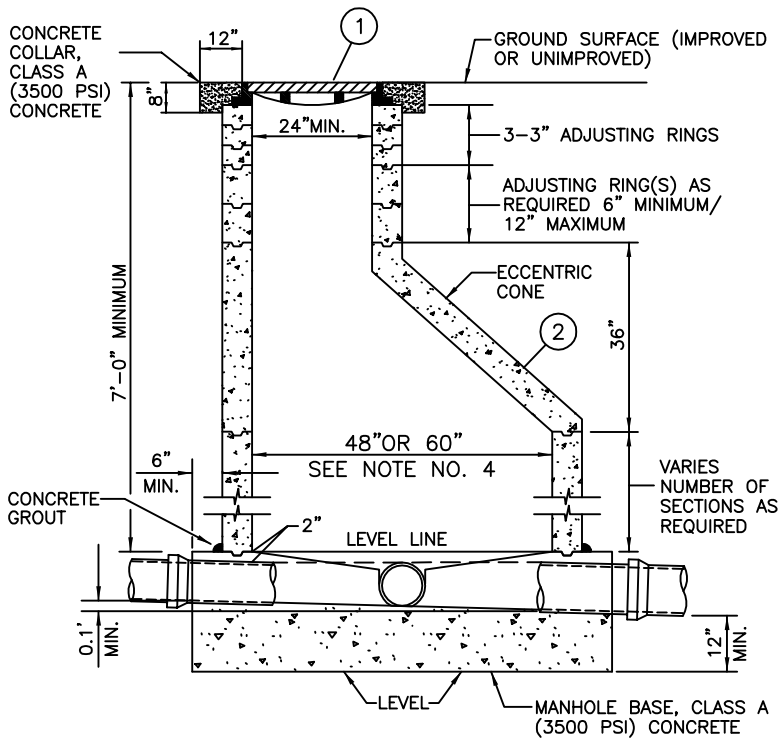
**STANDARD DRAWING S103**

REVISION

BY DATE



SECTION "B-B"



SECTION A-A

NOTES:

1. PRECAST REINFORCED CONCRETE MANHOLES SHALL CONFORM TO THE REQUIREMENTS OF ASTM C478, LATEST AND SHALL BE DESIGNED FOR H-20 LOADING.
2. ALL MANHOLE SECTIONS SHALL BE JOINED WITH 3/8" THICK CEMENT MORTAR NEATLY STRUCK AND POINTED.
3. VERTICAL WALL OF CONE SHALL BE ON UPSTREAM SIDE OF MANHOLES.
4. MANHOLE DIAMETER SHALL BE 48" FOR SEWER DIAMETERS 24" AND LESS, AND 60" FOR SEWER DIAMETERS 27" AND LARGER.
5. WHEN MANHOLE IS IN STREET TO BE PAVED, MANHOLE FRAME SHALL BE SET AFTER PAVEMENT HAS BEEN PLACED. TOP OF MANHOLE SHALL BE FLUSH WITH PAVEMENT.
6. MANHOLE SHALL BE SPACED AT 300 FOOT INTERVALS, MAXIMUM, UNLESS SPECIFIED OTHERWISE,

ITEM	No. REQ'D.	DESCRIPTION	APPROVED MATERIAL LIST NO.
1	1	CAST IRON MANHOLE FRAME AND COVER. COVER SHALL BE MARKED "DWA SEWER".	SEE DWG S105
2	1	REINFORCED CONCRETE MANHOLE SHAFT.	S-02

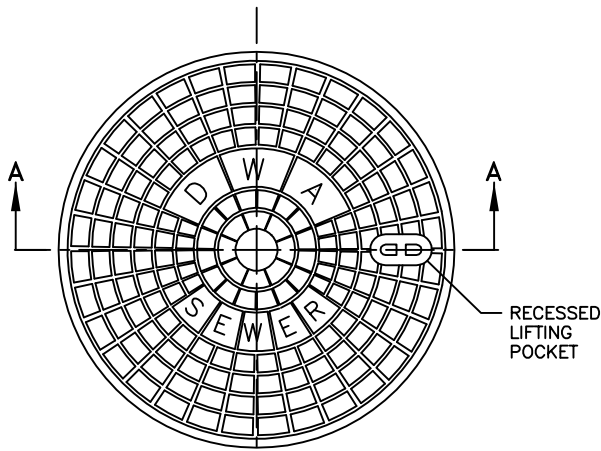
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 \_\_\_\_\_ RCE NO. 36810  
 ASSISTANT GENERAL MANAGER/OPERATIONS

REVISION	BY	DATE

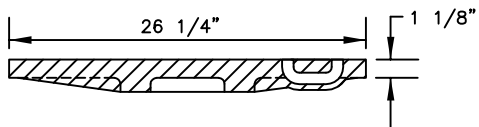
DESERT WATER AGENCY  
 PALM SPRINGS, CALIFORNIA

PRE-CAST ECCENTRIC  
 CONCRETE MANHOLE

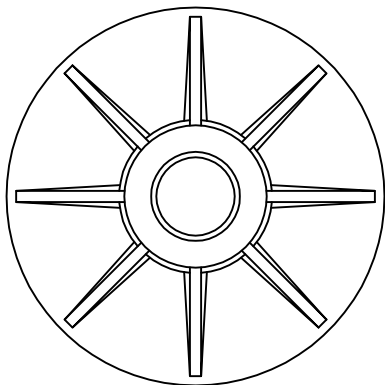
STANDARD DRAWING S104



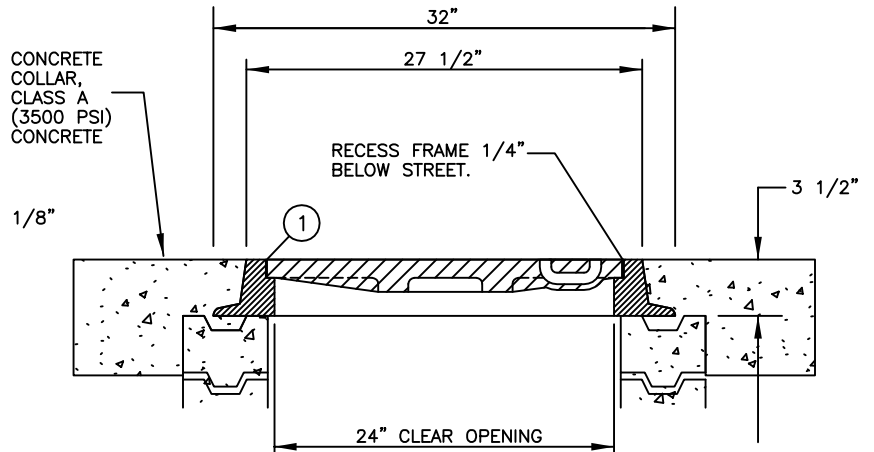
COVER  
TOP VIEW



SECTION A-A



COVER  
BOTTOM VIEW



TYPICAL INSTALLATION

NOTES:

1. THE CAST IRON USED SHALL HAVE A TENSILE STRENGTH OF 30,000 LBS PER SQUARE INCH.
2. LETTERING SHALL BE CAST IN COVER AND SHALL BE 2" HIGH, MINIMUM.
3. COVER SHALL INCLUDE A 3/4" DIAMETER MONITORING HOLE.

ITEM	No. REQ'D.	DESCRIPTION	APPROVED MATERIAL LIST NO.
1	1	CAST IRON MANHOLE FRAME AND COVER.	S-01

APPROVED

DATE \_\_\_\_\_

\_\_\_\_\_  
ASSISTANT GENERAL MANAGER/OPERATIONS

RCE NO. 36810

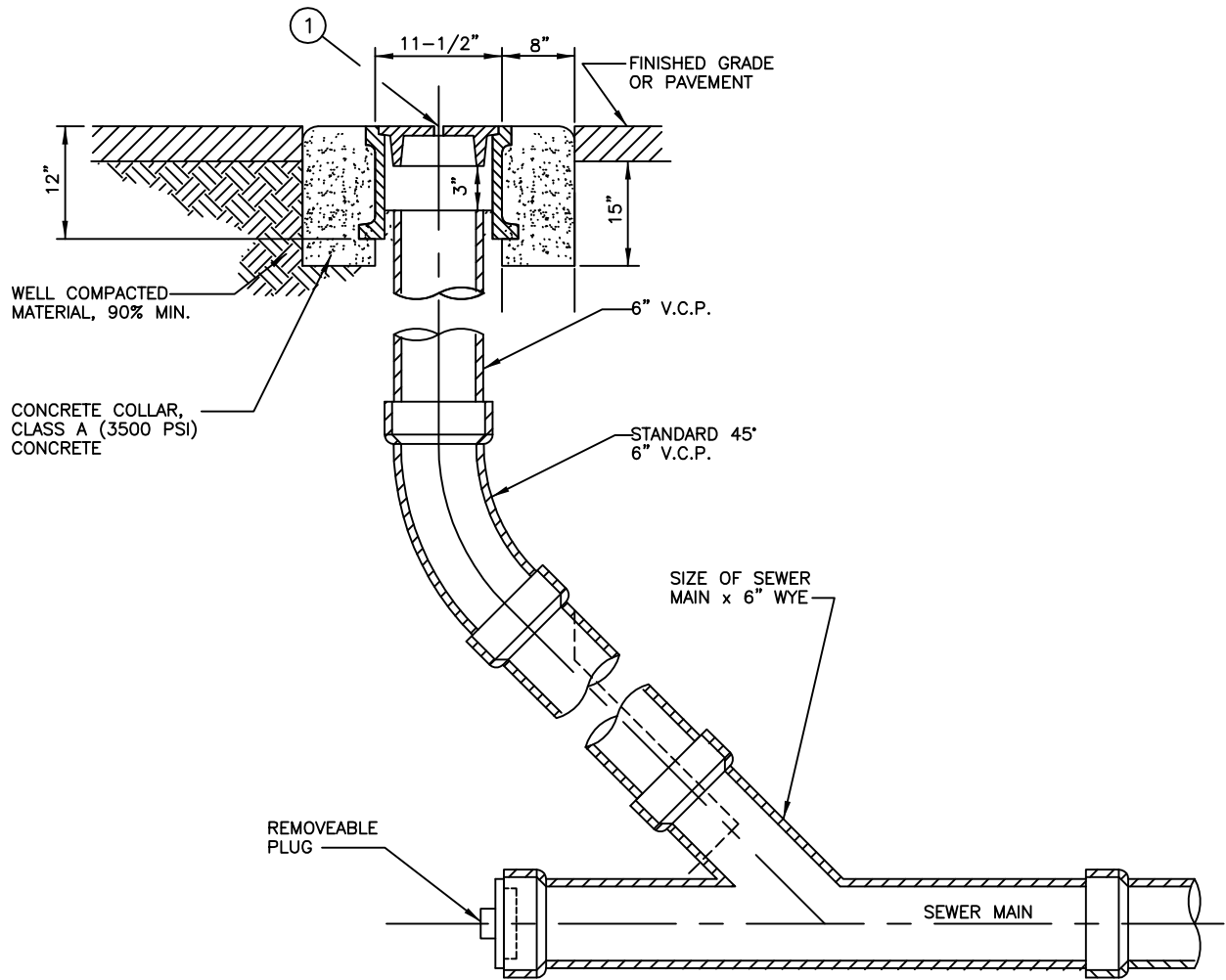
DESERT WATER AGENCY  
PALM SPRINGS, CALIFORNIA

MANHOLE  
FRAME AND COVER

STANDARD DRAWING S105

REVISION

BY DATE



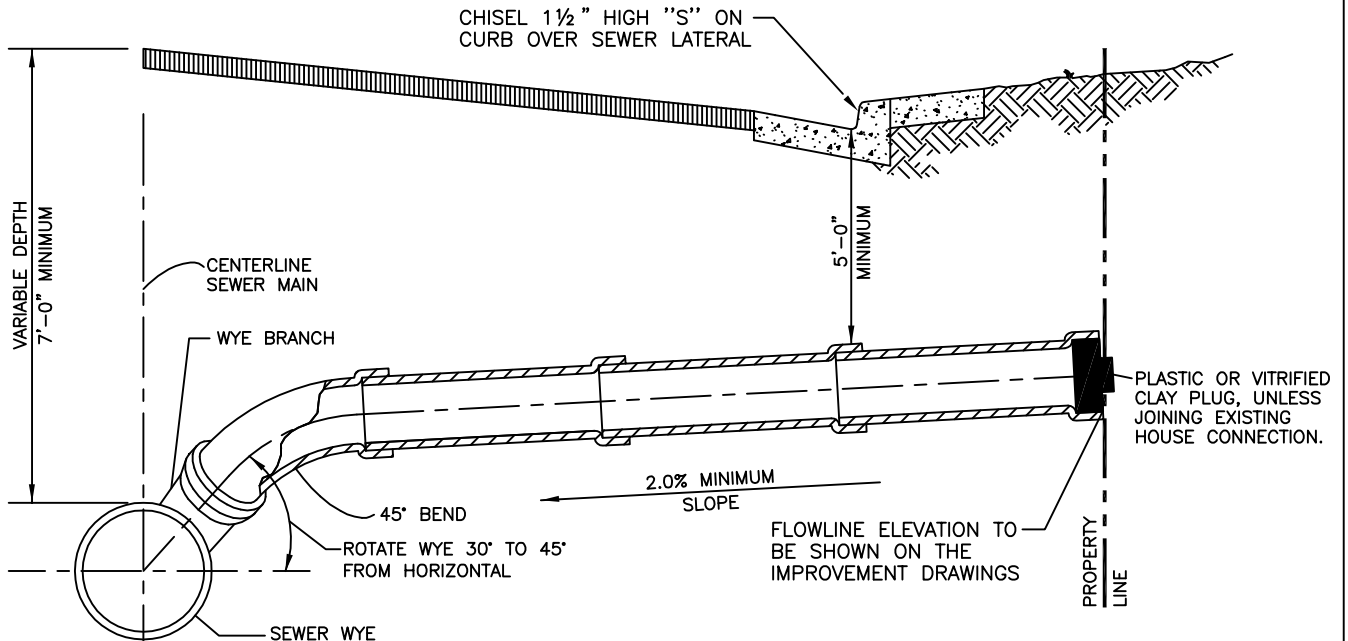
ELEVATION

ITEM	No. REQ'D.	DESCRIPTION	APPROVED MATERIAL LIST NO.
1	1	CAST IRON CLEAN-OUT FRAME AND COVER. COVER SHALL BE MARKED "SEWER".	S-03

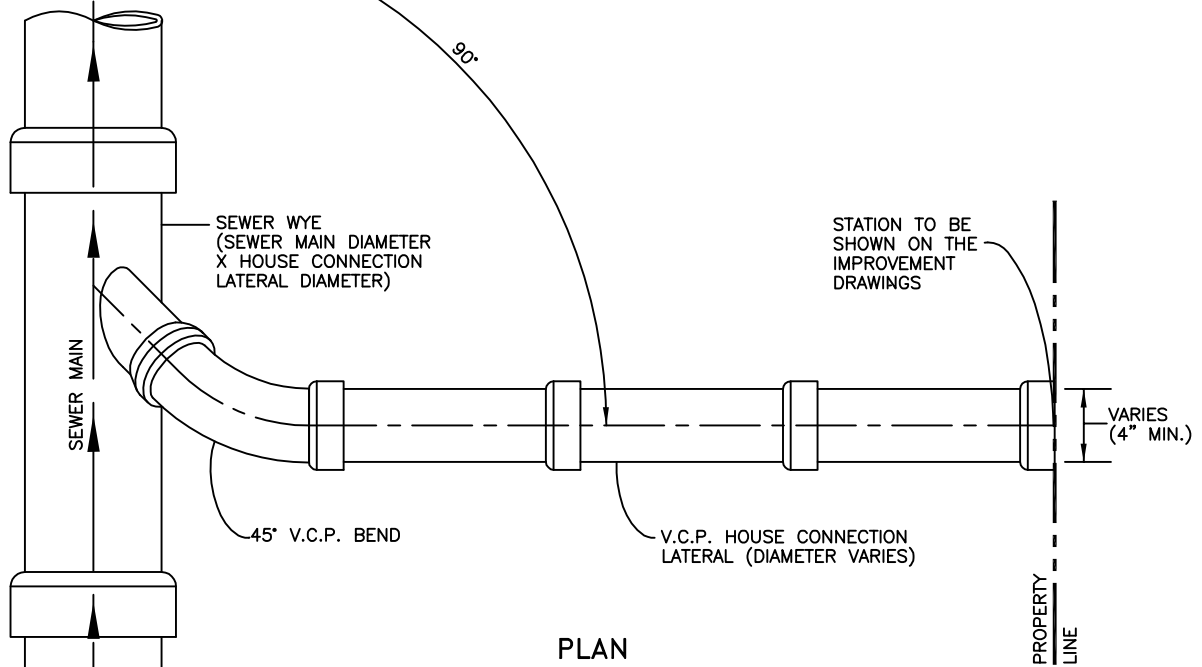
**NOTE:**

1. CLEANOUTS SHALL BE INSTALLED AT THE END OF THE SEWER MAIN IF WITHIN 200 FEET OF A MANHOLE.
2. LETTERING SHALL BE CAST IN COVER.

APPROVED	DATE _____	DESERT WATER AGENCY PALM SPRINGS, CALIFORNIA
_____ ASSISTANT GENERAL MANAGER/OPERATIONS	RCE NO. <u>36810</u>	
		SEWER CLEAN-OUT
		STANDARD DRAWING S106
REVISION	BY	DATE



PROFILE



PLAN

NOTES:

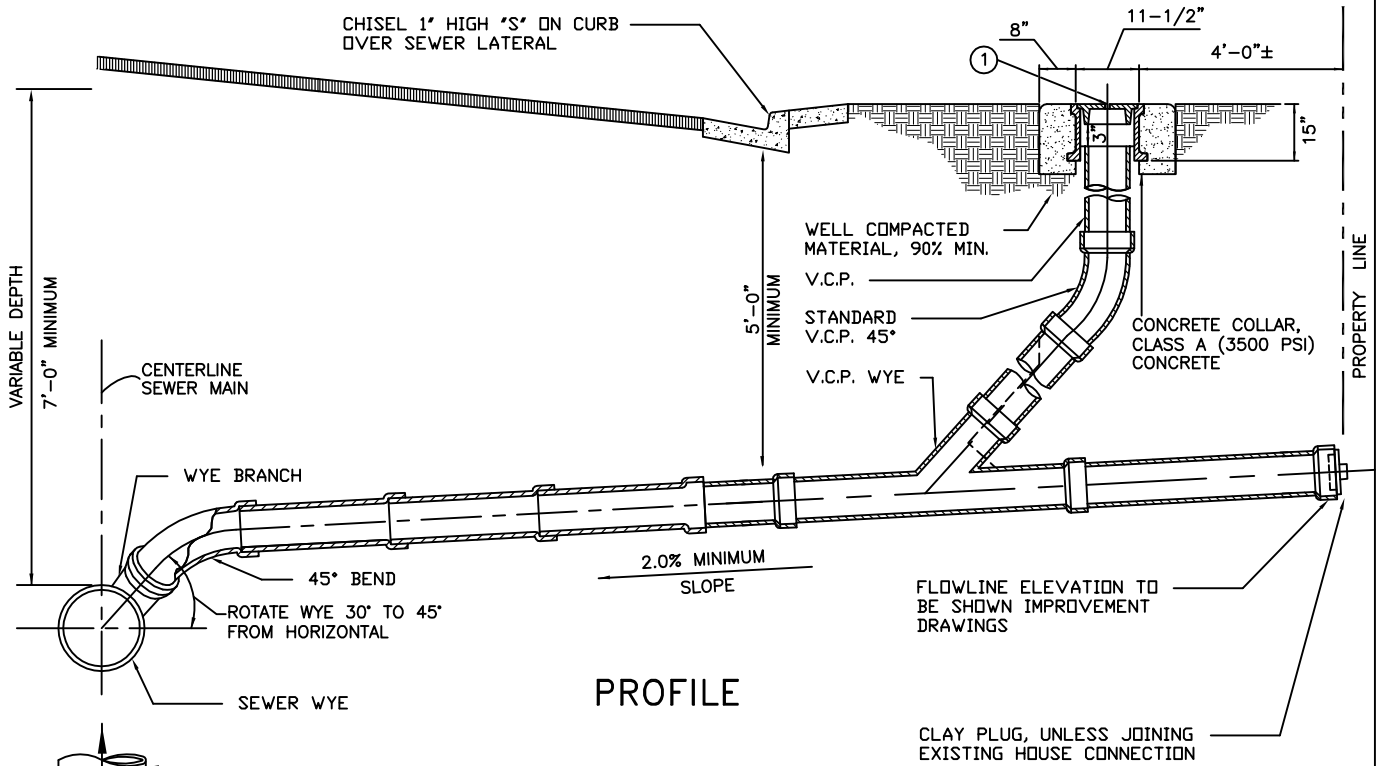
1. SEWER LATERALS FOR RESIDENTIAL USE SHALL BE 4" DIAMETER, MINIMUM.
2. SEWER LATERALS FOR ALL OTHER USES SHALL BE 6" DIAMETER, MINIMUM.

APPROVED	DATE _____
_____ ASSISTANT GENERAL MANAGER/OPERATIONS	RCE NO. <u>36810</u>
REVISION	BY DATE

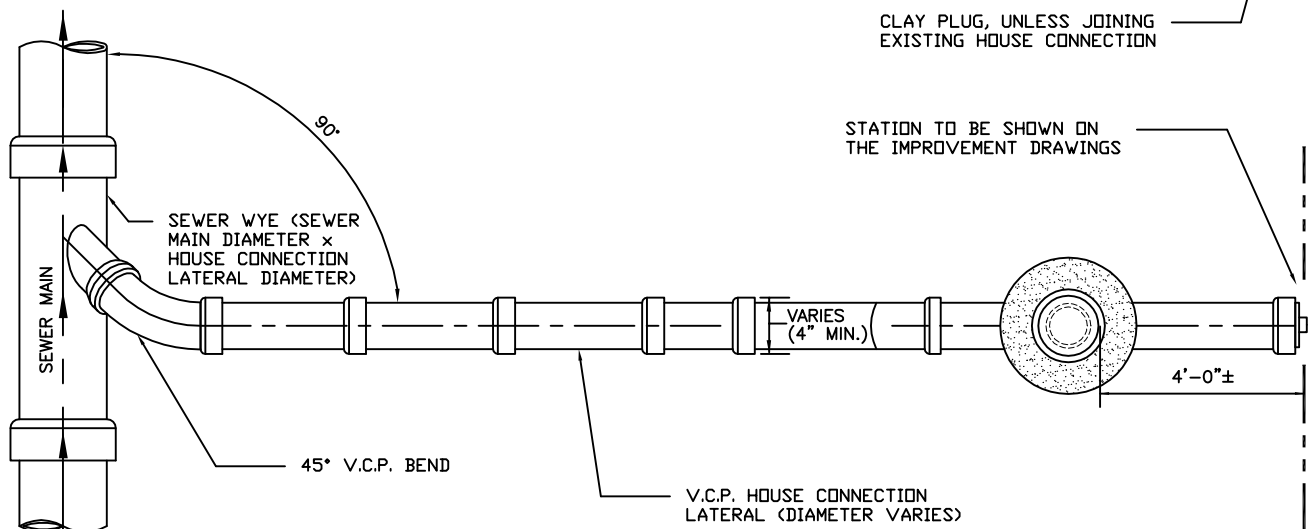
DESERT WATER AGENCY  
PALM SPRINGS, CALIFORNIA

**SEWER LATERAL  
(NEW MAIN)**

STANDARD DRAWING S107



**PROFILE**



**PLAN**

**NOTES:**

1. SEWER LATERALS FOR RESIDENTIAL USE SHALL BE 4" DIAMETER, MINIMUM.
2. SEWER LATERALS FOR ALL OTHER USES SHALL BE 6" DIAMETER, MINIMUM.
3. SEWER LATERAL CLEANOUT DIAMETER SHALL MATCH LATERAL SIZE.

ITEM	No. REQ'D.	DESCRIPTION	APPROVED MATERIAL LIST NO.
1	1	CAST IRON CLEAN-OUT FRAME AND COVER. COVER SHALL BE MARKED "SEWER".	SD-06

APPROVED

DATE \_\_\_\_\_

RCE NO. 58514

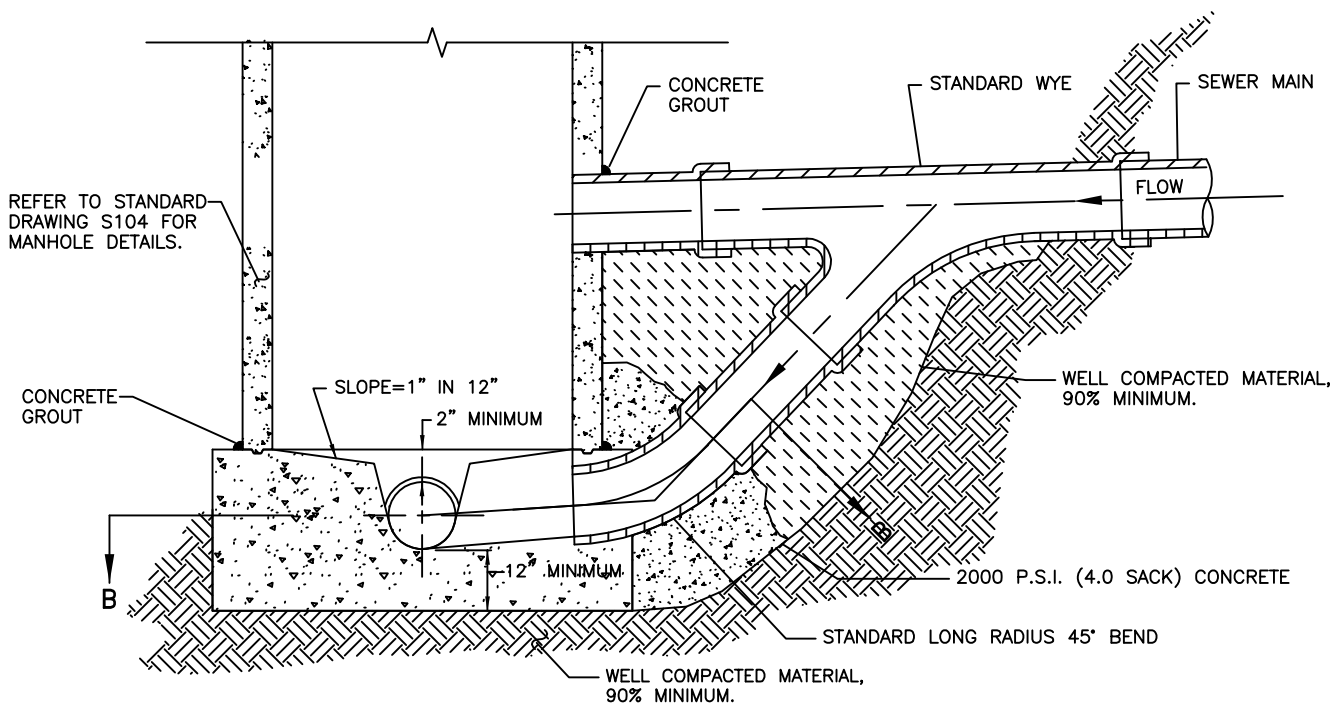
OPERATIONS ENGINEER

DESERT WATER AGENCY  
PALM SPRINGS, CALIFORNIA

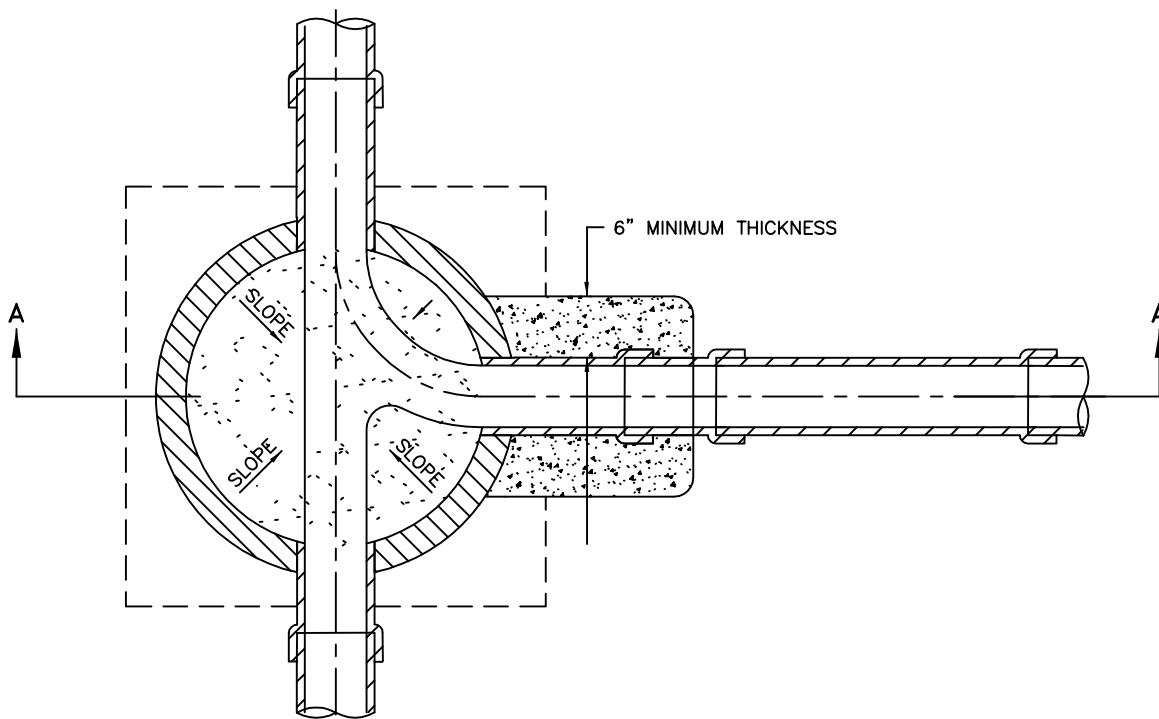
SEWER LATERAL  
(NEW MAIN)

STANDARD DRAWING S107A

REVISION	BY	DATE
SIDEWALK ADDED AND LATERAL SLOPE MADE CONSTANT	JDT	6/1/05
C.O. O/S 4' FROM P.L.; LAT. EXTENDING TO P.L.	JDT	6/1/05



SECTION "A-A" SECTION



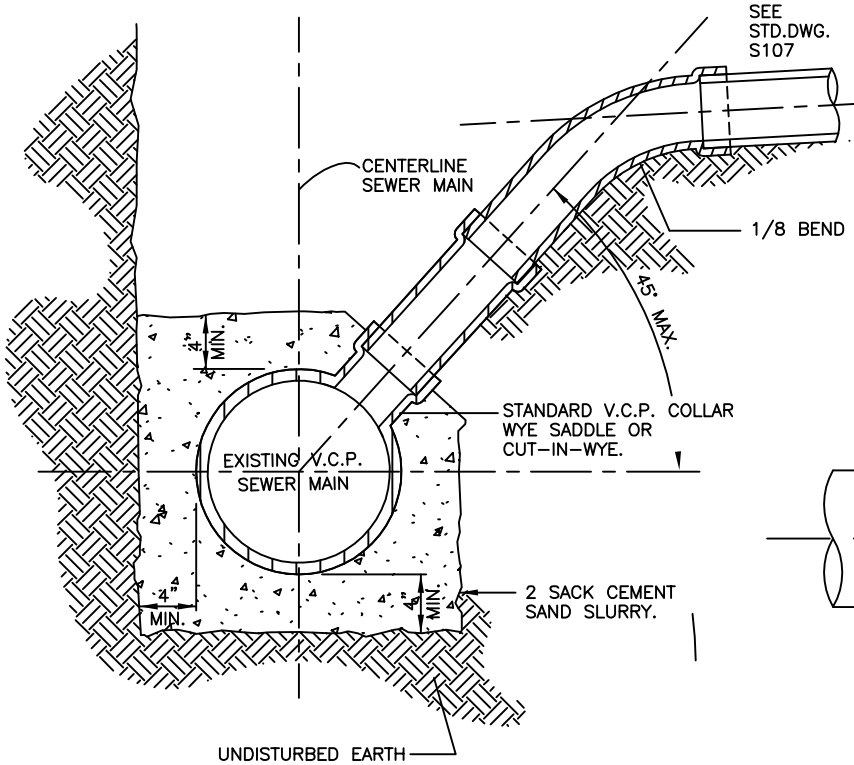
PLAN

APPROVED	DATE _____
_____ ASSISTANT GENERAL MANAGER/OPERATIONS	RCE NO. <u>36810</u>
REVISION	BY DATE

DESERT WATER AGENCY  
PALM SPRINGS, CALIFORNIA

**DROP MANHOLE**

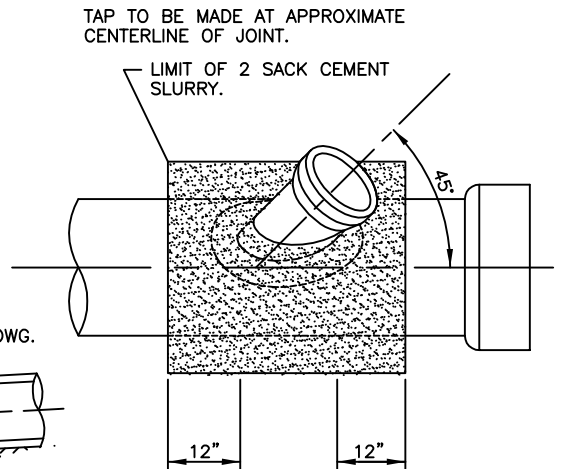
STANDARD DRAWING S108



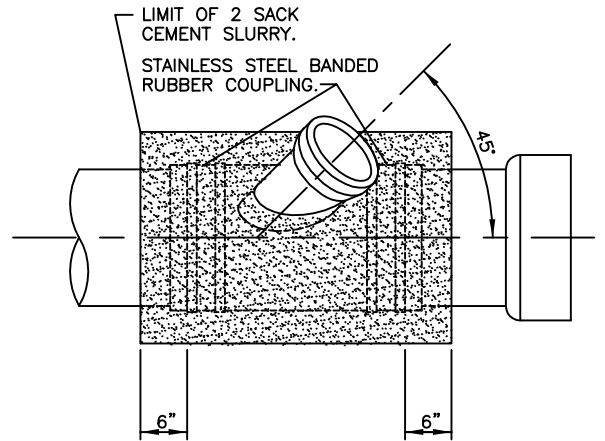
**SECTION - SEWER LATERAL**

**NOTES:**

- 1) SEWER LATERALS FOR RESIDENTIAL USE SHALL BE 4" DIAMETER, MINIMUM.
- 2) SEWER LATERALS FOR ALL OTHER USES SHALL BE 6" DIAMETER, MINIMUM.
- 3) THE OPENING FOR THE COLLAR WYE SADDLE SHALL BE MADE WITH A TAPPING MACHINE AND SHALL BE SANDED TO PROVIDE A CLEAN, NEAT OPENING FOR THE COLLAR WYE.
- 4) CONTRACTOR SHALL SECURE THE COLLAR WYE SADDLE TO THE SEWER WITH AN APPROVED EPOXY RESIN.
- 5) CONTRACTOR SHALL KEEP ALL CHIPS, DIRT, EPOXY, MORTAR, AND CONCRETE OUT OF THE SEWER. CONTRACTOR SHALL CLEAN AND BALL THE EXISTING SEWER MAIN AS DIRECTED BY THE AGENCY.
- 6) CONTRACTOR SHALL REPAIR OR REPLACE ANY DAMAGED PIPE AS DIRECTED BY THE AGENCY.

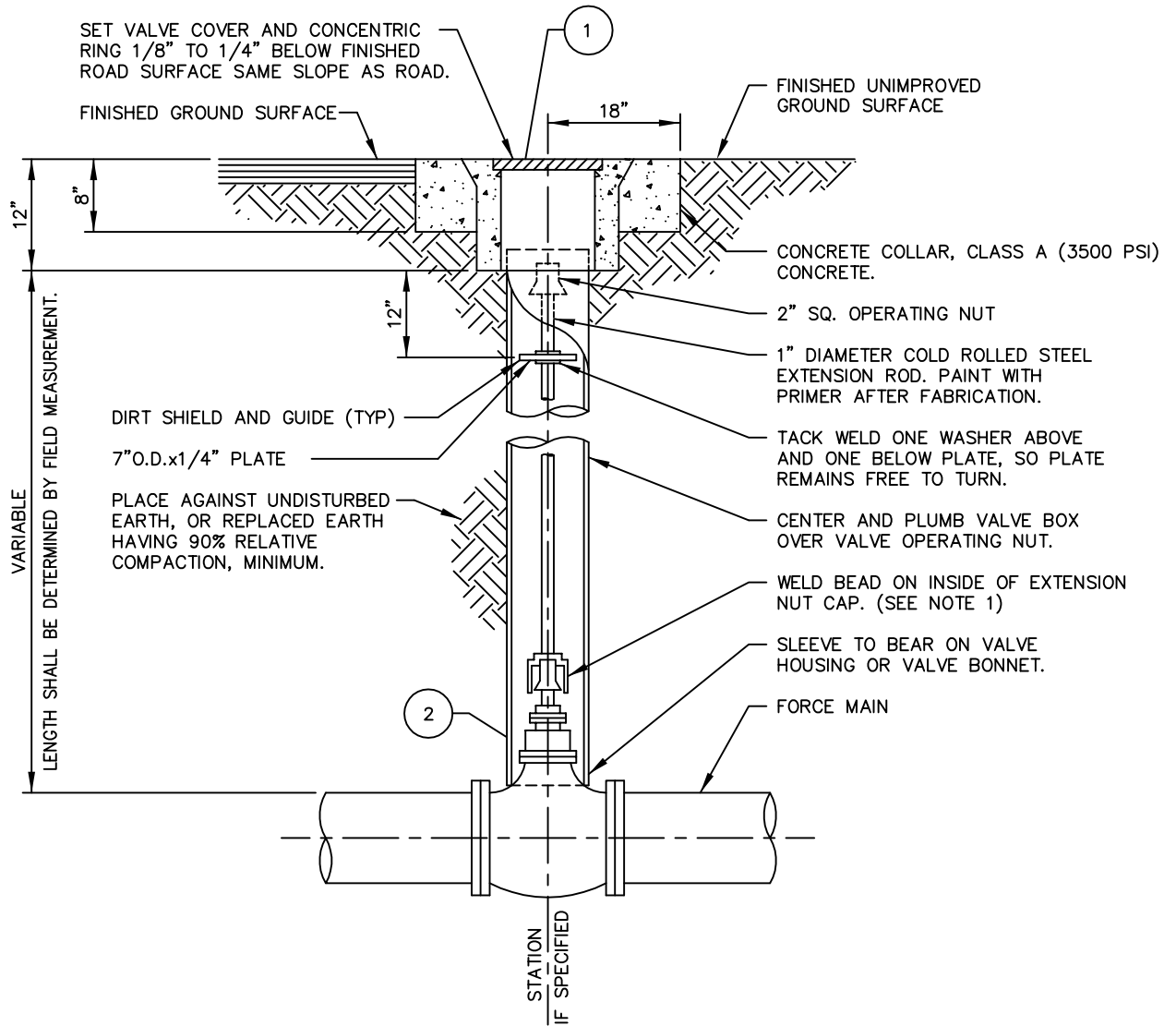


**COLLAR WYE SADDLE**  
(FOR SEWER MAINS 12" AND LARGER)



**CUT IN WYE**  
(FOR SEWER MAINS LESS THAN 12")

<p>APPROVED _____</p> <p>ASSISTANT GENERAL MANAGER/OPERATIONS</p>	<p>DATE _____</p> <p>RCE NO. <b>36810</b></p>	<p><b>DESERT WATER AGENCY</b> PALM SPRINGS, CALIFORNIA</p> <p><b>SEWER LATERAL SADDLE CONNECTION (EXISTING MAIN ONLY)</b></p> <p><b>STANDARD DRAWING S109</b></p>
<p>REVISION</p>	<p>BY</p>	<p>DATE</p>

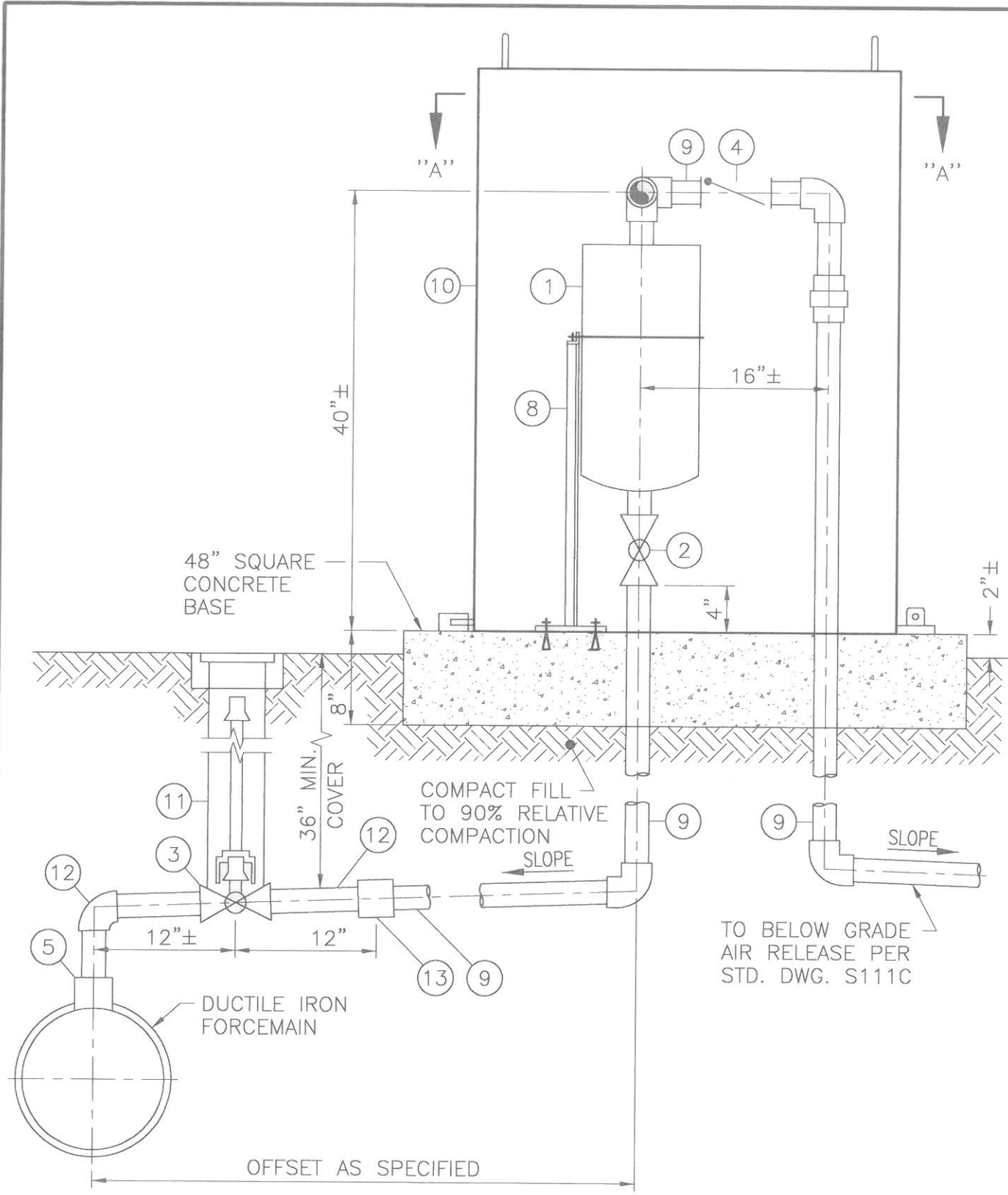


ITEM	DESCRIPTION	APPROVED MATERIAL LIST NO.
1	TRAFFIC BOX – COVER MARKED "SEWER". LETTERING SHALL BE CAST IN COVER.	S-04
2	VALVE BOX EXTENSION.	S-05

**NOTES**

- EXTENSION ROD REQUIRED WHENEVER TOP OF VALVE IS 3' OR MORE BELOW FINISHED GROUND SURFACE. WHEN EXTENSION ROD IS REQUIRED, OPERATING NUT SHALL BE 12" BELOW TOP OF TRAFFIC BOX. REQUIRED LENGTH FOR EXTENSION ROD SHALL BE DETERMINED BY FIELD MEASUREMENT. EXTENSION ROD SHALL BE SECURED TO VALVE OPERATING NUT BY WELDING A BEAD ON THE INSIDE OF THREE WALLS OF THE EXTENSION NUT CAP.

APPROVED _____	DATE _____	<b>DESERT WATER AGENCY</b> PALM SPRINGS, CALIFORNIA
_____ ASSISTANT GENERAL MANAGER/OPERATIONS	RCE NO. <b>36810</b>	
		<b>SEWER VALVE BOX</b> <b>INSTALLATION</b>
		<b>STANDARD DRAWING S110</b>
REVISION	BY	DATE

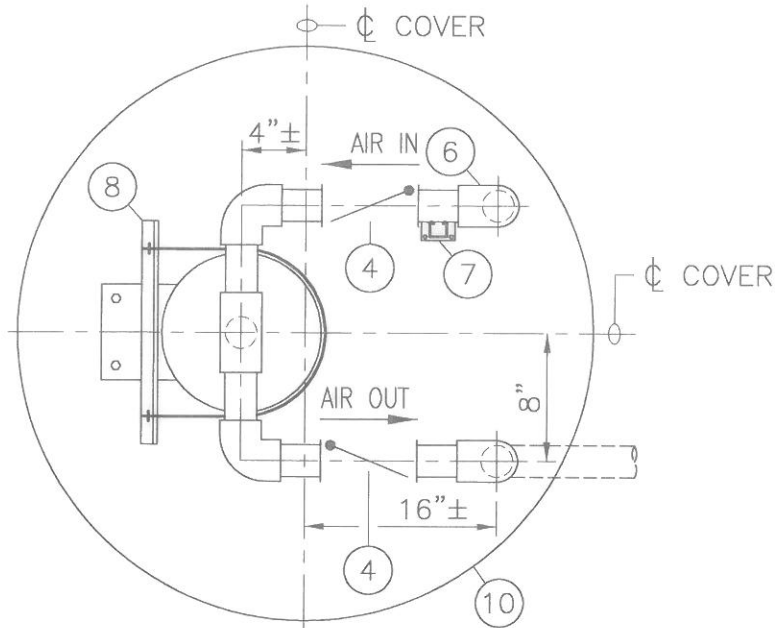


APPROVED	DATE	6/10/97
<i>T. David G. Rubin</i>	RCE NO.	36810
ASSISTANT GENERAL MANAGER/OPERATIONS		
REVISION	BY	DATE

DESERT WATER AGENCY  
 PALM SPRINGS, CALIFORNIA

2" COMBINATION SEWAGE  
 AIR/VACUUM VALVE INSTALLATION  
 SECTION

STANDARD DRAWING S111A




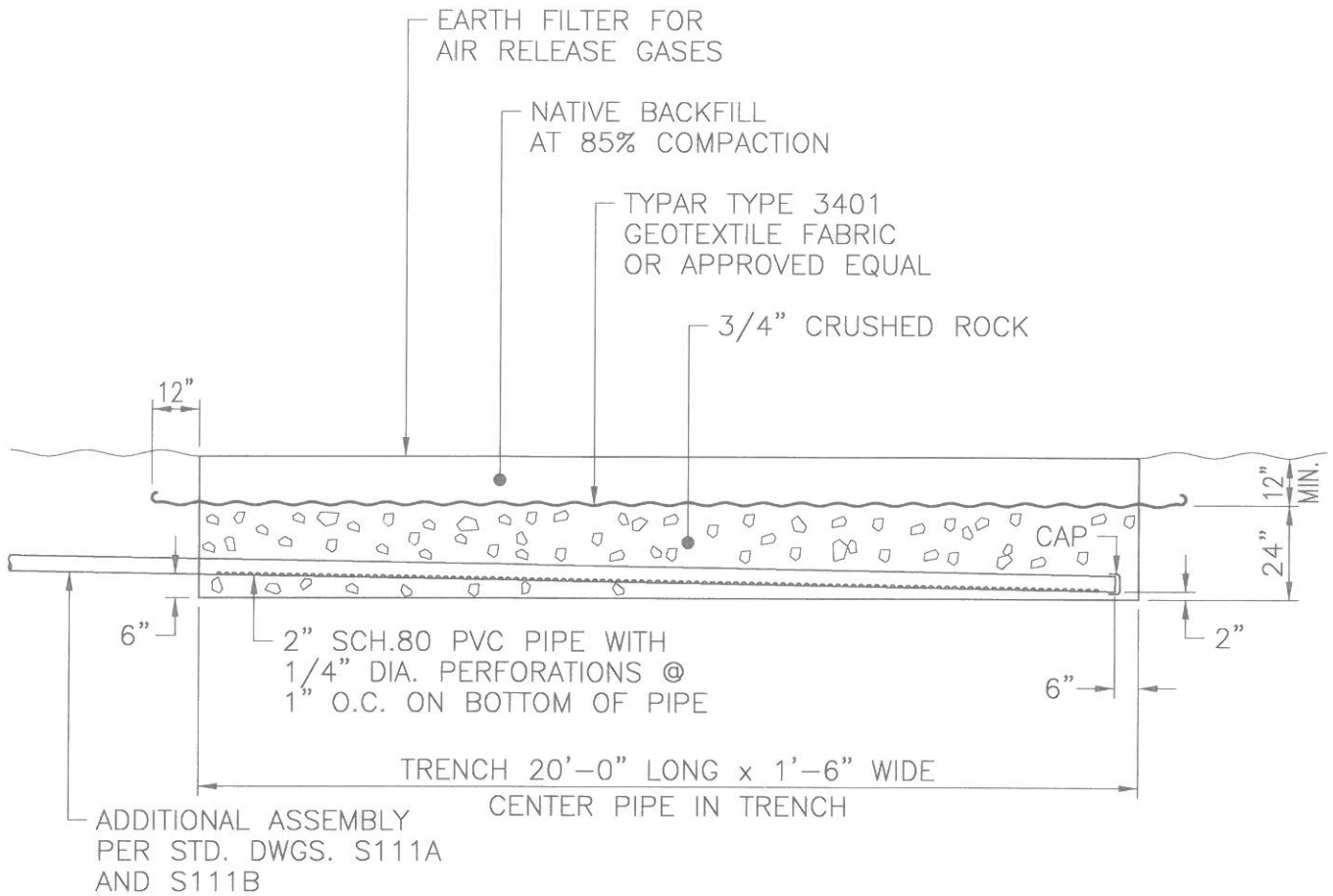
PLAN SECTION "A-A"

ITEM	DESCRIPTION	APPROVED MATERIAL LIST NO.
1	2" COMBINATION SEWAGE AIR AND VACUUM VALVE.	SB-08
2	2" THREADED STAINLESS STEEL BALL VALVE WITH LEVER OPERATOR.	SEE SPEC.
3	2" THREADED STAINLESS STEEL BALL VALVE FOR BURIED SERVICE WITH STEM EXTENSION TEE AND HANDLE.	SEE SPEC.
4	2" THREADED STAINLESS STEEL SWING CHECK VALVE.	SEE SPEC.
5	EPOXY COATED DOUBLE STRAP SERVICE SADDLE WITH STAINLESS STEEL BOLTS AND NUTS AND 2" THREADED CONNECTION.	
6	2" THREADED SCH.80 PVC 90° ELBOW WITH 2" NIPPLE x 2" LONG, POINTED DOWN WITH MODEL F-16 NUT STYLE SUCTION STAINER BY FLOW EZY FILTERS, INC..	
7	NON-METALLIC CORROSION RESISTANT AICKINSTRUT PIPE SUPPORT, ATTACHED TO 2" NIPPLE WITH PIPE CLAMP, PROVIDE POST BASE CONNECTED TO CONCRETE FOUNDATION WITH 4- 1/4" EXPANSION ANCHORS.	
8	VALVE SUPPORT, FABRICATED WITH 1"x1"x1/4"x14"L HORIZONTAL ANGLE WELDED TO 1"x1"x1/4"x24"L VERTICAL ANGLE WITH 6"x6"x1/4" BASE PLATE. ANCHOR BASE PLATE TO CONCRETE FOUNDATION WITH 4- 3/8" EXPANSION ANCHORS (STAINLESS STEEL). ATTACH AIR VALVE WITH U-BOLT.	
9	2" SCH.80 PVC PIPE AND FITTINGS, SOLVENT WELDED. PROVIDE THREADED NIPPLES AND FITTINGS WHERE CONNECTING TO VALVES.	
10	36" DIA. x 48" HIGH AIR VALVE COVER. SEE STANDARD DRAWING S-112.	
11	VALVE BOX INSTALLATION PER STANDARD DRAWING S-110. PROVIDE TEE HANDLE CONNECTION AT VALVE, SQUARE NUT AT TOP OF EXTENSION.	
12	2" SCH.40 STAINLESS STEEL THREADED PIPE AND FITTING.	
13	2" SCH.40 STAINLESS STEEL THREADED COUPLING.	

NOTE

EXPOSED PIPING, AIR VALVE, AIR VALVE COVER, AND AIR VALVE SCREEN, EXCEPT STAINLESS STEEL, SHALL BE PAINTED IN ACCORDANCE WITH AGENCY APPROVED PAINT SYSTEMS.

APPROVED  ASSISTANT GENERAL MANAGER/OPERATIONS	DATE <u>6/18/97</u> RCE NO. <u>36810</u>	<b>DESERT WATER AGENCY</b> PALM SPRINGS, CALIFORNIA <b>2" COMBINATION SEWAGE          AIR/VACUUM VALVE INSTALLATION          PLAN SECTION AND MATERIAL LIST</b>
REVISION	BY	<b>STANDARD DRAWING S111B</b>



APPROVED  
*David K. Palm*  
 ASSISTANT GENERAL MANAGER/OPERATIONS

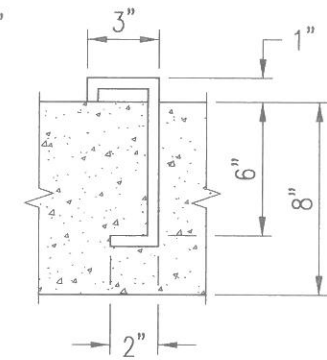
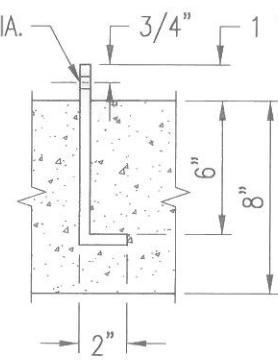
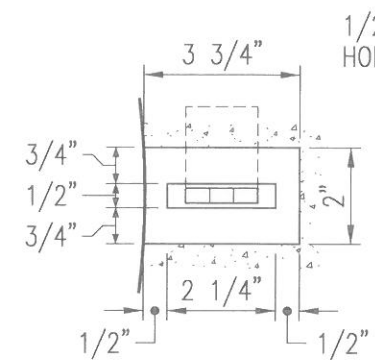
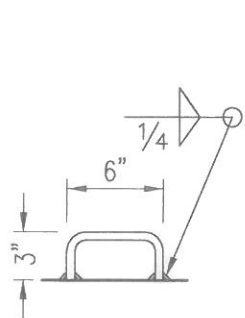
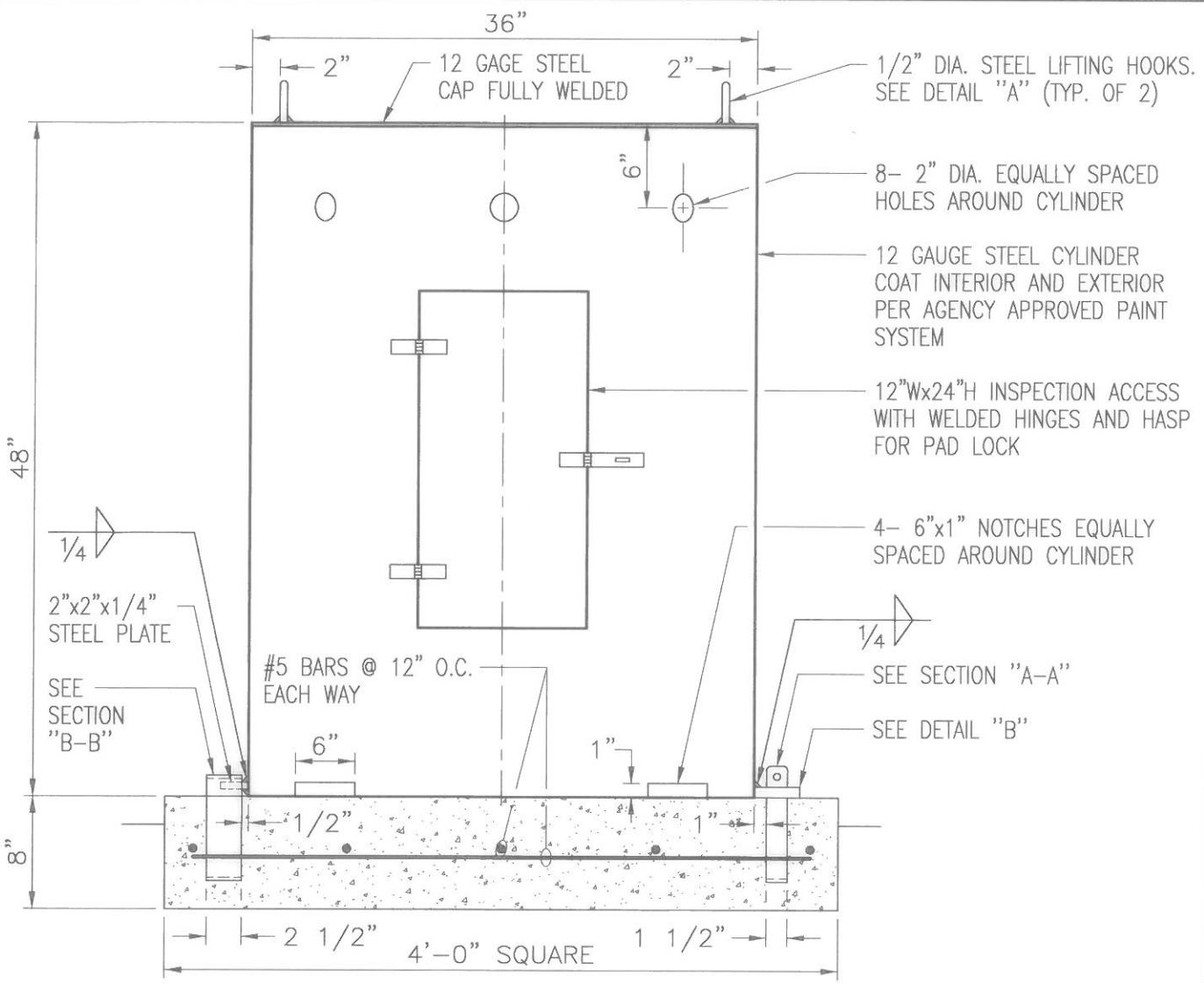
DATE 6/18/97  
 RCE NO. 36810

DESERT WATER AGENCY  
 PALM SPRINGS, CALIFORNIA

2" COMBINATION SEWAGE  
 AIR/VACUUM VALVE INSTALLATION  
 BELOW GRADE AIR RELEASE

STANDARD DRAWING S111C

REVISION	BY	DATE



ALL BRACKETS SHALL BE CONSTRUCTED OF 1/4" STEEL PLATE

APPROVED *David K. Fisher* DATE 6/18/97  
 ASSISTANT GENERAL MANAGER/OPERATIONS RCE NO. 36810

DESERT WATER AGENCY  
 PALM SPRINGS, CALIFORNIA

**AIR VALVE COVER**

REVISION	BY	DATE

STANDARD DRAWING S112

the 1990s, the number of people in the UK who are aged 65 and over has increased from 10.5 million to 13.5 million (19.5% of the population).

There is a growing awareness of the need to address the needs of the ageing population. The Department of Health (1999) has published a strategy for ageing people, which sets out the government's commitment to improve the lives of older people.

The strategy is based on the following principles: older people should be able to live independently, safely and comfortably; they should be able to participate in the life of their community; and they should be able to access the services and support they need.

The strategy also sets out a number of key objectives, including: to reduce the number of older people who are in care; to improve the quality of care for older people; and to ensure that older people have access to the services and support they need.

The strategy is a key document for the development of services for older people. It provides a framework for the development of services and for the evaluation of their effectiveness.

The strategy is also a key document for the development of research into the needs of older people. It provides a framework for the development of research and for the evaluation of its effectiveness.

The strategy is a key document for the development of practice for older people. It provides a framework for the development of practice and for the evaluation of its effectiveness.

The strategy is a key document for the development of policy for older people. It provides a framework for the development of policy and for the evaluation of its effectiveness.

The strategy is a key document for the development of legislation for older people. It provides a framework for the development of legislation and for the evaluation of its effectiveness.

The strategy is a key document for the development of standards for older people. It provides a framework for the development of standards and for the evaluation of their effectiveness.

The strategy is a key document for the development of indicators for older people. It provides a framework for the development of indicators and for the evaluation of their effectiveness.

The strategy is a key document for the development of targets for older people. It provides a framework for the development of targets and for the evaluation of their effectiveness.

The strategy is a key document for the development of action plans for older people. It provides a framework for the development of action plans and for the evaluation of their effectiveness.

The strategy is a key document for the development of budgets for older people. It provides a framework for the development of budgets and for the evaluation of their effectiveness.

The strategy is a key document for the development of reports for older people. It provides a framework for the development of reports and for the evaluation of their effectiveness.

The strategy is a key document for the development of audits for older people. It provides a framework for the development of audits and for the evaluation of their effectiveness.

The strategy is a key document for the development of reviews for older people. It provides a framework for the development of reviews and for the evaluation of their effectiveness.

The strategy is a key document for the development of inquiries for older people. It provides a framework for the development of inquiries and for the evaluation of their effectiveness.

The strategy is a key document for the development of investigations for older people. It provides a framework for the development of investigations and for the evaluation of their effectiveness.

The strategy is a key document for the development of proceedings for older people. It provides a framework for the development of proceedings and for the evaluation of their effectiveness.

The strategy is a key document for the development of judgments for older people. It provides a framework for the development of judgments and for the evaluation of their effectiveness.

The strategy is a key document for the development of orders for older people. It provides a framework for the development of orders and for the evaluation of their effectiveness.

The strategy is a key document for the development of directions for older people. It provides a framework for the development of directions and for the evaluation of their effectiveness.

The strategy is a key document for the development of decisions for older people. It provides a framework for the development of decisions and for the evaluation of their effectiveness.

The strategy is a key document for the development of findings for older people. It provides a framework for the development of findings and for the evaluation of their effectiveness.

The strategy is a key document for the development of conclusions for older people. It provides a framework for the development of conclusions and for the evaluation of their effectiveness.

The strategy is a key document for the development of recommendations for older people. It provides a framework for the development of recommendations and for the evaluation of their effectiveness.

The strategy is a key document for the development of proposals for older people. It provides a framework for the development of proposals and for the evaluation of their effectiveness.

The strategy is a key document for the development of plans for older people. It provides a framework for the development of plans and for the evaluation of their effectiveness.

The strategy is a key document for the development of policies for older people. It provides a framework for the development of policies and for the evaluation of their effectiveness.