

CITY OF BOULDER

ADVERTISEMENT FOR BIDS

BOULDER RESEARCH AND ADMINISTRATIVE NETWORK

Bid No. 11-99

Sealed bids will be received by the City of Boulder, Colorado, at the office of the Director of Purchasing, 1777 Broadway, Boulder, Colorado 80302 until **10:00 A.M. APRIL 6, 1999** for the project called **Boulder Research and Administrative Network**

A mandatory PRE-BID conference will be held at the Park Central Building, 1739 Broadway, Room 401, at 3:00 p.m. March 30, 1999.

Bids will be in a sealed envelope, plainly marked "**Bid No. 11-99, City of Boulder, Boulder Research and Administrative Network**", and addressed to:

City of Boulder
Purchasing Division
1777 Broadway
P.O. Box 791
Boulder, Colorado 80306

Hand carried bids will be delivered to the Director of Purchasing, 1777 Broadway, Boulder, Colorado, 80302.

All bids shall be signed, enclosed in a sealed envelope, and filed as stated in this advertisement. No bidder shall submit more than one bid.

Bid documents will be available for pickup on March 19, 1999, in the City's Purchasing Office. A \$40.00 non-refundable deposit is required for each set of Bid Documents. Checks should be made payable to the City of Boulder Utilities Division.

Bid Documents may be inspected at the following location:

City of Boulder
1739 Broadway
Boulder, Colorado

The work for which the bids are requested consists of:

The construction of approximately 15,000 feet of various configurations of buried conduit, placement of associated handholes and manholes, and pulling of approximately 80,000 feet of fiber optic cable in new and existing conduit as well as in steam tunnels. The work will also involve the splicing and patching of the fiber optic cable at various locations within the City of Boulder.

Bidders shall submit prices on the base bid and all alternatives as provided for in the Bid Form.

The City is not required to take the lowest bid. Bid proposals will be evaluated on a combination of criteria including demonstrated ability to meet bidder qualification and cost.

Each bid shall be accompanied by a money order, certified check, or bid bond payable to the City of Boulder, Colorado, in the amount of not less than five percent (5%) of the total amount of the bid. No bid will be considered unless accompanied by such deposit. Such check or bid bond shall be forfeited to the City if the bid is accepted and the bidder fails to sign a contract within fifteen days of acceptance.

Bids and Qualification Statements shall be prepared at the bidder's expense and become a City record and therefore a public record.

The City reserves the right to reject any and all bids and to waive any informality or irregularities therein.

Bids not submitted by the required deadline are ineligible for consideration and will not be opened, but the City may change the deadline at any time.

Bidders may inspect the bids after they are opened in accordance with provision of the Colorado Public Records Act. However, if the City determines that all bids should be rejected and a rebid may be necessary, the manager may hold the bid in confidence until the rebid has been completed.

Confidential data, if identified as such, will be held confidential upon request, if the request is made as part of the bid and if the City Attorney determines the data meets the requirements of the Colorado Public Records Act.

The City may reject any and all bids but otherwise shall accept the lowest bid satisfying the minimum bid requirements and qualification criteria prescribed below. If the City determines the lowest bidder does not meet the minimum bid requirements the bid may be rejected.

Responsibility criteria include the following:

- Bidder's integrity
- Financial responsibility

- Skill
- Relevant technical expertise
- Ability to complete the contract promptly and satisfactorily
- Whether the bidder maintains a permanent place of business
- Whether the bidder has adequate plant, equipment, and support services to perform the contract
- Whether the bidder has previously perform similar work satisfactorily
- Whether the bidder is likely to be engaged in work that may impair the ability to finance the work covered by the bid or provide equipment for its proper execution
- Whether the bidder proposed a reasonable approach to achieve the objectives of the project
- Whether there have been or are presently any claims raising a substantial question about the bidder's ability to perform the contract.

Bidders/General Contractors (including all parties of a joint venture, each completing a separate Qualification Statement, but submitting all forms together) are required to submit evidence that they have a practical knowledge of and the financial resources to complete the Work by completing Form 17, Contractor Qualification Statement.

No bids may be withdrawn within a period of forty five (45) days after the date set for opening bids, but a bid may be withdrawn up to twenty four (24) hours prior to expiration of the deadline for submitting bids.

Technical irregularities in the bid requirements may be waived if the City determines that such a waiver does not compromise the integrity of the bidding process.

The bidder shall furnish the City a completed copy of Proposed Subcontractors form with the bid proposal.

The bidder shall furnish the City a completed copy of Schedule of Manufacturers and Suppliers form with the bid proposal.

The bidder to whom a contract is awarded will be required to furnish a separate "Performance Bond" and "Labor and Material Bond" to the City of Boulder, Colorado. The Performance Bond and the Labor and Material Bond shall be furnished in the amount of one hundred percent (100%) of the Contract, in conformity with the requirements of the Contract Documents.

CITY OF BOULDER, COLORADO
A MUNICIPAL CORPORATION

By _____

For the
Director of Finance and Record

Ex-officio City Clerk

[The following text is extremely faint and largely illegible. It appears to be a list of names and dates, possibly a record of council members or a similar official document. The text is organized in a tabular or list-like format with multiple columns.]

TABLE OF CONTENTS

SPECIAL CONTRACT CONDITIONS

	<u>Page No.</u>
SCC-1	Drawings and Contract Documents for Contractor Use 1
SCC-2	Notice to Affected Parties 1
SCC-3	Standards 1
SCC-4	Utility Verification 1
SCC-5	Contract Time 3
SCC-6	Holiday Work 3
SCC-7	Adverse Weather 3
SCC-8	Partial Utilization 4
SCC-9	Substantial Completion 4
SCC-10	Liquidated Damages and Incentive Payments 5
SCC-11	Extra Work 5
SCC-12	Licenses and Permits 6
SCC-13	City Sales and Use Tax 6
SCC-14	Additional Insurance 7
SCC-15	Supervision at the Work Site 8
SCC-16	Conduct at the Work Site 8
SCC-17	Survey Work and Materials Testing 9
SCC-18	Salvage of Materials and Equipment 9
SCC-19	Connections to Existing Facilities 10
SCC-20	Federal Provisions 10
SCC-21	Project Identification 10
SCC-22	Application for Payment 11
SCC-23	Resident Project Representative 11
SCC-24	Groundwater Discharge Permit 11
SCC-25	Cutting and Patching 11
SCC-26	Cleaning Up 12
SCC-27	Tree Protection Requirements 12
SCC-28	Traffic Signal and Signage Restoration 13
SCC-29	Contractor's Guarantee 14
SCC-30	Protection of Private Property 14
SCC-31	Work on Colorado University Property 14
SCC-32	Work in ICG Manholes and Handholes 15

SPECIAL CONTRACT CONDITIONS

SCC-1 DRAWINGS AND CONTRACT DOCUMENTS FOR CONTRACTOR USE

No charge documents. The City will furnish the Contractor, upon award of the Contract for Construction, five (5) sets of the Contract Documents.

Additional Contract Documents are available at a cost of twenty-five dollars (\$25.00) per set.

SCC-2 NOTICE TO AFFECT PARTIES

The Contractor shall notify the Project Manager and any other approval authorities at least 48-hours prior to beginning excavation near existing utilities, ditch crossings, highway crossings, road crossings, and railroad crossings.

City of Boulder, Water Systems Utilities Supervisor, Rubin Zamudio, 303-413-7134
City of Boulder, Gravity Systems Utilities Supervisor, John Campagnola, 303-413-

7133

Boulder & Lefthand Ditch, Henry Later, 303-653-2781

When it is necessary to temporarily deny access to owners or tenants to their property, or when any utility service connection must be interrupted, the Contractor shall give notices sufficiently in advance to enable the affected persons to provide for their needs.

Except in those cases mentioned above, the Contractor shall maintain continuous utility service to all property owners, tenants, and customers during the length of the project.

SCC-3 STANDARDS

All work shall be done in accordance with the city of Boulder's "Design Criteria and Standard Specifications", except as herein modified. Copies of these standards are available for purchase at the City's Engineering Division, 2nd Floor, 1739 Broadway, Boulder, Colorado.

SCC-4 UTILITY VERIFICATION

The locations of utilities shown on the drawings are approximate. It is specifically the Contractor's responsibility to call for locates and field locate all utilities that may conflict with this project as to both line and grade (this includes, but is not limited to, water lines, sewer lines, storm sewer lines, manholes, water valve boxes, survey

monuments, gas, electric, telephone, cable TV, etc.). The Contractor shall verify the location and depth of all tie-in points and utilities potentially affected by the work prior to beginning construction. This shall include obtaining field location marking from designated utility locating services. Any deviations from the drawings shall be reported immediately to the Project Manager.

The Contractor shall be responsible for the repair of any damage to utilities and sprinkler/irrigation systems that have been properly located by the designated utility locating service or to utilities for which the Contractor has not obtained the proper field location marking.

Protection of Existing Utilities:

Any information concerning underground utilities shown on the Drawings is intended to be merely an aid to the Contractor. The accuracy of information furnished with respect to underground utilities is not guaranteed and the Contractor must independently verify any such information. The Contractor shall notify all utility companies or privately owned organizations who may have installations in the area where the work is to be performed and solicit their aid in locating utilities including, but not limited to, water, sanitary and storm sewer, gas or other fuel, electrical, telephone, communication, cable television and other installations. All utilities encountered must be kept in operation by the Contractor and must be protected and/or repaired at his own expense.

The Contractor shall inform the Engineer of existing utility installations which need relocation other than those identified in the project construction documents.

If the Contractor requests that utility companies relocate their utilities for his convenience in construction of any portion of the work, the cost of such shall be at the Contractor's expense.

The Contractor shall determine the actual location of all existing utilities prior to starting any work that may cause damage to such utilities. The Contractor shall be liable for all damages done to existing utilities in the performance of his work. All work required for the relocation of existing utilities, as noted on the drawings, shall be completed by the owner of the utility. The Contractor shall be responsible for coordination with these utility owners and providing them with the required information to move the utilities as required so that they do not interfere with the final constructed improvement, 30 working days or more prior to performing any work in the affected area of work. The owner of the existing utilities that will be relocated as noted on the drawings are as follows:

1. City of Boulder, Utility Division, Phone No. 441-3266
2. US West Communications, Phone No. 441-7113

3. Public Service Company, Phone No. 938-2233
4. TCI of Colorado, Phone No. 447-1107

The Contractor shall initiate meetings with the necessary utility owners, to be held at the project site with the Owner's representative present, to coordinate relocation work sufficient time in advance of the Contractor's work in these areas.

SCC-5 CONTRACT TIME

- A. The work shall be substantially complete as defined in the Special Conditions within 120 calendar days of the notice to proceed.
- B. Final completion shall be 30 days after substantial completion.

SCC-6 HOLIDAY WORK

Construction will not be permitted on the following dates unless the Contractor makes prior arrangements with the Project Manager and receives written approval before the work commences:

- * May 31
- * July 5
- * September 6

SCC-7 ADVERSE WEATHER

Section 405, paragraph C (4), of the General Conditions is hereby modified as follows. The Contract time shall include an allocation for the following anticipated number of calendar days lost due to adverse weather conditions for each month based on National Oceanic and Atmospheric Administration (NOAA) data for the Boulder area as listed below:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
7	4	4	4	6	3	4	2	3	3	4	5

The schedule of anticipated adverse weather will constitute the base line for monthly (or portion thereof) weather time evaluations. Upon acknowledge of the Notice to Proceed and continuing throughout the contract on a monthly basis, actual adverse weather days and the impact of adverse weather days which delay the work will be recorded on a day-to-day basis. It is assumed that the work will be carried out Mondays through Fridays (holidays excepted) unless an approved construction schedule or written authorization from the Project Manager indicates otherwise. The number of days of delayed work due to adverse weather or the impact thereof will then be compared to the monthly adverse weather schedule above.

An actual adverse weather day must prevent work for 50 percent or more of the Contractor's workday, delay work critical to the timely completion of the project, and be documented by the Contractor. The City's representative observing the construction shall determine on a daily basis whether or not work can proceed or if the work is delayed due to adverse weather or the effects thereof. The Contractor shall notify the City's representative in writing of any disagreement as to whether or not work can proceed on a given date, within 2 calendar days of that date. The City will use the above written notification in determining the number of working days for which work was delayed during each month.

Requests by the Contractor for contract time extensions due to adverse weather conditions exceeding the above allocations shall be submitted in writing to the Project Manager within seven (7) calendar days from the date of adverse weather. If a request is not made within this time period, no contract time extensions will be allowed. The number of workdays delayed due to adverse weather or the impact thereof will then be converted to Calendar Days basis on the Substantial Completion day and date. This conversion assumes a five day work week, Mondays through Fridays, holidays excepted; should the Contractor have authorization to work weekends and/or holidays then the method of conversion of workdays to calendar days would take this into consideration. The Contract Time period will then be increased by the number of calendar days calculated above and a new Substantial Completion day and date will be set.

SCC-8 PARTIAL UTILIZATION

The City has the right to take possession of or use any completed or substantially completed portions of the Work at any time, but such taking possession or use will not be deemed an acceptance of any Work not completed in accordance with the Contract Documents.

The City's use of any facilities so identified in the Contract Documents will not be grounds for extension of the Contract Time or change in the Contract Price.

The City's use of any facilities not specifically identified in the Contract Documents will be in accordance with conditions agreed to prior to such use, and any extra costs or delays in completion incurred and properly claimed by Contractor will be equitably adjusted with a Change Order.

Guarantee periods for accepted or substantially completed Work, including mechanical and electrical equipment, will commence upon the start of continuous use by Owner.

SCC-9 SUBSTANTIAL COMPLETION

When Contractor considers the Work ready for full occupancy or utilization by the

City, Contractor shall declare in writing to the Project Manager that the Work is substantially complete and request that a Notice of Substantial Completion therefore be issued. For Work to be considered substantially complete, the conduit, the fiber optic cable, and equipment must be installed; the cable spliced, terminated, final acceptance testing complete and surface restoration completed.

Within a reasonable time thereafter, the Project Manager and Contractor shall make an inspection of the Work to determine the status of completion. If the Project Manager does not consider the Work substantially complete, the Contractor shall be notified in writing giving reasons therefore. If the Project Manager considers the Work substantially complete, the Contractor shall receive a Certificate of Substantial Completion, Form 9 which will fix the date of Substantial Completion. The certificate shall include a tentative list of items to be completed or corrected before final acceptance.

"Substantial Completion" means that the facilities are completed to the point that the City may occupy and fully utilize the facilities and no nuisance is created, to the satisfaction of the City. All equipment shall be installed and operational, or temporary arrangements satisfactory to the City shall have been made. All performance testing need not have been completed prior to the date of substantial completion.

Portions of the Work not essential to the City's operation, and which can be completed without interruption of the City's operation, may be completed after the Work is accepted as substantially complete.

SCC-10 LIQUIDATED DAMAGES AND INCENTIVE PAYMENTS

Except for delays specified in Section 405 of the General Conditions, if the contractor fails to perform the work within the period set forth in SSC-5 or as adjusted by written Change Order, the contractor shall be liable for Liquidated Damages in the amount stipulated in Section 406 of the General Conditions for each and every day substantial completion of the work is delayed.

SCC-11 EXTRA WORK

Any extra work authorized by the Project Manger shall be performed and compensated for under the general provisions of Article 8 of the General Conditions or by mutually satisfactory negotiation, whichever the City deems most appropriate. Once an agreement has been reached between the Contractor and Project Manager regarding extra work, the Project Manager shall issue a Work Directive Form (Form 8a) authorizing the Contractor to proceed with the extra work. Work directives shall serve as the basis for negotiation of subsequent change orders.

In case any order or instructions, either oral or written, appear to the Contractor to

involve extra work for which, in his opinion, he should receive extra compensation and/or time extension, the Contractor shall, within seven (7) days of receiving the order or instruction, submit a written request for extra compensation with the Project Manager. This written request should include the costs the Contractor feels, in his opinion, he should be compensated. If a request is not made within this time period, the Contractor shall be deemed to waive any right to compensation and/or time extension for the extra work and no compensation for the work will be made by the City. No extra work shall be performed by the Contractor until approved by the Project Manger.

Equipment rates shall be charged only for the time the equipment is operating. Standby time shall only be paid when the Project Manager determines the equipment is needed at the site, but is not operating. Labor rates shall be determined based on the work performed.

Non-listed equipment needed for specific jobs will be paid for at hourly rates for operating time only if agreed to in writing before the work begins.

Labor rates will be paid only for performance hours, not standby hours. Operators, when not operating equipment but involved in the work, will be paid at laborer rates.

SCC-12 LICENSES AND PERMITS

The Contractor shall obtain the necessary licenses and permits as required in Section 204 and 907 of the General Conditions. All Contractors and Subcontractors are required to have a valid City of Boulder Right-of-Way license. An approved traffic control plan will also be required for this project.

SCC-13 CITY SALES AND USE TAX

Change the first sentence of paragraph 216, page 13, of the General Conditions as follows:

“All tangible personal property used in the construction process or incorporated into work in the city is subject to the current city sales and use tax pursuant to Chapter 3-2, B.R.C. 1981.”

Change the third sentence of paragraph 216, page 13, of the General Conditions as follows:

“**As a general matter**, the city use tax is imposed upon tangible personal property and taxable services used in the city purchased outside of the city which have not already been subjected to a tax equal to the city sales tax.”

SCC-14 ADDITIONAL INSURANCE

The Contractor shall provide additional insurance while working within the right-of-way of the Colorado Department of Transportation or the Burlington Northern Railroad as described below. Contractor shall also provide certificates of insurance for the additional required insurance.

Colorado Department of Transportation Insurance Requirements.

The State requires a Certificate of Insurance prior to commencing any work on Highway right-of-way. All vendors, contractors, and utility companies shall procure, at their own expense, and maintain for the duration of work period, the following minimum insurance coverage. Insurance policy should be at least \$450,000 per occurrence.

1. Standards Workmen's Compensation and Employer's Liability, including occupational disease, covering all employees engaged in performance of the work at the site, in the amount required by State Statutes.

2. Comprehensive General Public Liability and Property Damage Insurance:

Bodily Injury --	\$150,000 each occurrence
Property Damage --	\$600,000 each occurrence
	\$600,000 aggregate

3. Comprehensive Auto Liability and Property Damage Insurance

Bodily Injury --	\$150,000 each occurrence
	\$600,000 aggregate
Property Damage --	\$600,000 each occurrence

Burlington Northern Railroad Insurance Requirements.

The Burlington Northern Railroad requires the Contractor to obtain the following insurance prior to commencing work within the railroad right-of-way as follows:

1. Commercial General Liability Insurance against claims arising out of bodily injury, illness and death and from damage to or destruction of property of others, including loss or use thereof, and including liability of Burlington Northern Railroad Company, with minimum limits for bodily injury and property damage of \$1,000,000 for each occurrence.

2. Business Automobile Policy Insurance, including owned, non-owned, and hired vehicles with minimum limits for bodily injury and property damage of \$1,000,000 per occurrence, on all vehicles which the Permittee or any of its agents or employees may use at any time in connection with the performance of this Agreement.
3. Worker's Compensation Insurance or coverage as required under the Worker's Compensation Act of the applicable state. The policy should include occupational disease to required statutory limits, employer's liability of \$1,000,000 to include FELA, if appropriate, and an "all states" endorsement.
4. A Railroad Protective Liability Insurance Policy in the amount of Two Million Dollars each for bodily injury and property damage with an aggregate of Six Million Dollars for work with 50 feet of the tracks. This policy is paid for by the Contractor but is issued in the name of Burlington Northern Railroad Company.
5. Burlington Northern Railroad Company has a Blanket Railroad Protective Liability Insurance Policy which is available to permittees and contractors. Coverage is provided during the construction phase of the permit or contract when work is performed within fifty (50) feet of the railroad tracks. The insurance is purchased by the permittee or contractor for a specific permit or contract. Contact the Burlington Northern representative about this optional insurance policy.

SCC-15 SUPERVISION AT THE WORK SITE

The Contractor shall assign an employee to be responsible for all aspects of this project after normal working hours and over weekends in case of an emergency or loss of utility service. Telephone numbers, including pager and mobile phone, for this individual shall be submitted to the Project Manager during the pre-construction meeting. A call to any one of these numbers shall constitute notice by the City. The Contractor shall be responsible for remedying all aspects of the work that created the emergency or loss of utility service and respond to notice of the emergency or loss of utility service within 2 hours. If the Contractor does not respond within 2 hours, the Contractor shall be responsible for any and all costs incurred by the City including, but not limited to, deployment of public safety personnel and any labor and materials required to remedy the emergency or loss of utility service.

SCC-16 CONDUCT AT THE WORK SITE

The Contractor's employees will be expected to maintain a civil decorum throughout the term of this contract. Any workers who fail to act in a professional and workmanlike manner toward the Project Manager, other City representative or citizens

shall be IMMEDIATELY and PERMANENTLY removed from the job site by the Contractor upon direction from the Project Manager. If the Contractor fails to heed the City's order in such an instance, the City, at its sole discretion, may immediately terminate this contract and offer it to the next lowest bidder.

SCC-17 SURVEY WORK AND MATERIALS TESTING

The City will provide basic horizontal and vertical control points. These points shall be used as datum for the work. All additional survey, layout, and measurement work shall be performed by the Contractor as a part of the work.

Contractor shall provide an experienced instrument person, competent assistants, and such instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement Work. In addition, Contractor shall furnish, without charge, competent persons from his force, and such tools, stakes, and other materials as City may require in establishing or designating control points, or in checking survey, layout, and measurement Work performed by Contractor.

The Contractor is responsible for protecting any survey stakes or monuments installed. The cost of any re-staking necessitated by the Contractor's operations, or the cost of any retesting necessitated by the Contractor's work not meeting project specifications, will be withheld from monies due the Contractor. The Contractor is required to notify the Project Manager at least two (2) working days in advance of any survey work or testing needed.

SCC-18 SALVAGE OF MATERIALS AND EQUIPMENT

Unless otherwise indicated, existing materials and equipment removed, and not reused, as a part of the Work shall become Contractor's property.

Contractor shall carefully remove, in a manner to prevent damage, all materials and equipment specified or indicated to be salvaged and reused or to remain the property of City. Salvaged items shall be stored and protected as specified or indicated to be reused in the Work.

Salvaged items not to be reused in the Work, but to remain City's property, shall be delivered by Contractor in good condition to City at the City Yards, 5050 Pearl Street, Boulder, Colorado.

Any items damaged in removal, storage, or handling through carelessness or improper procedures shall be replaced by Contractor in kind or with new items.

Contractor may, at his option, furnish and install new items in lieu of those specified or indicated to be salvaged and reused, in which case such removed items will become Contractor's property.

Existing materials and equipment removed by Contractor shall not be reused in the Work except where so specified or indicated.

SCC-19 CONNECTIONS TO EXISTING FACILITIES

Unless otherwise specified or indicated, Contractor shall make all necessary connections to existing facilities, including manholes, handholes, conduit, buildings, building conduit, and cable pull boxes. In each case, Contractor shall receive permission from the City or the owning utility prior to undertaking connections. Contractor shall protect facilities against deleterious substances and damage.

Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

SCC-20 FEDERAL PROVISIONS

The Federal Contract Requirements of Article 10 of the General Conditions do not apply.

SCC-21 PROJECT IDENTIFICATION

Project identification as stipulated in Section 505 of the General Conditions will not be required for this project.

SCC-22 APPLICATION FOR PAYMENT

Form 19 - Application for Payment shall be used for all progress and final applications for payment made by the contractor. Contractor's Applications for Payment shall be accompanied by the documentation specified herein and in the General Conditions.

Each Application for Progress Payment shall be accompanied by Contractor's updated schedule of operations, or progress report, with such shop drawing schedules, procurement schedules, value of material on hand included in application, and other data specified in Division 1 through 16 or reasonably required by Project Manager.

SCC-23**RESIDENT PROJECT REPRESENTATIVE**

The Resident Project Representative is a representative of the City employed to act as advisor and consultant to the City in construction matters related to the work. The City has delegated its authority to the Resident Project Representative to make initial decisions regarding technical questions which may arise as to the quality or acceptability of materials furnished and work performed and as to the manner of performance and rate of progress of the work under the contract. The Resident Project Representative shall interpret the intent and meaning of the contract, including drawings and specifications, and make initial decisions with respect to quality, workmanship and materials and the Contractor's fulfillment of the contract and the Contractor's entitlement to compensation. The Contractor shall consult with the Resident Project Representative in all matters relating to the contract where any questions arise regarding technical aspects of the contract. The Resident Project Representative's decisions are subject to review by the Project Manager.

SCC-24**GROUNDWATER DISCHARGE PERMIT**

It shall be the responsibility of the Contractor to obtain a groundwater discharge permit from the Colorado State Health Department if any dewatering operations will be discharged into any drainageways, open channels, or irrigation ditches.

SCC-25**CUTTING AND PATCHING**

As provided in General Conditions, Contractor shall perform all cutting and patching required for the Work and as may be necessary in connection with uncovering Work for inspection or for the correction of defective Work.

Contractor shall perform all cutting and patching required for and in connection with the Work, including but not limited to, the following:

- Removal of improperly timed Work.
- Removal of samples of installed materials for testing.
- Alteration of existing facilities.
- Installation of new Work in existing facilities.

Contractor shall provide all shoring, bracing, supports, and protective devices necessary to safeguard all Work and existing facilities during cutting and patching operations. Contractor shall not undertake any cutting or demolition which may affect the structural stability of the Work or existing facilities without Engineer's concurrence.

Materials shall be cut and removed to the extent indicated on the Drawings or as required to complete the Work. Materials shall be removed in a careful manner, with no damage to adjacent facilities or materials. Materials which are not salvable shall be removed from the site by Contractor.

All Work and existing facilities affected by cutting operations shall be restored with new materials, or with salvaged materials acceptable to Engineer, to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, entire surfaces shall be patched and refinished.

SCC-26

CLEANING UP

Contractor shall keep the work site free at all times from accumulations of waste materials and rubbish. Contractor shall provide adequate trash receptacles about the site and shall promptly empty the containers when filled.

Construction materials such as conduit, handholes, manholes, cable reels and other related materials shall be neatly stacked or stored by Contractor when not in use. Contractor shall promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.

Volatile wastes shall be properly stored in covered metal containers and removed daily.

Wastes shall not be buried or burned on the site or disposed of into storm drains, sanitary sewers, streams, or waterways. All wastes shall be removed from the site and disposed of in a manner complying with local ordinances and antipollution laws.

Adequate cleanup will be a condition for recommendation of progress payment applications.

SCC-27

TREE PROTECTION REQUIREMENTS

Chapter 6-6, BRC 1981, prohibits removing, damaging, or destroying trees within the public right-of-way, easements, or City owned property without the permission of the City Manager.

If desirable public trees are removed, damaged, or destroyed by the Contractor, the loss shall be mitigated. The City Forester shall determine the degree of damage and whether the tree(s) can be restored or must be replaced.

To prevent tree root smothering no soil stockpiles, supplies, equipment, or any other material shall be placed or stored within a tree dripline or, for columnar-shaped trees, within fifteen feet of a tree trunk.

For root protection, tree roots shall not be cut unless it is unavoidable. The City Forester, 441-3406, shall be notified prior to any cutting of roots greater than one inch in diameter. Service trenches outside of the pavement shall be hand dug when within the tree dripline and when in close proximity to low branching trees. Exposed roots shall be covered immediately to prevent desiccation with burlap and kept moist.

When root cutting is unavoidable, a clean sharp cut shall be made to avoid shredding and mashing. Root cuts should be made back to a lateral root and protected as mentioned above. Within the trench, damaged roots one inch in diameter or greater shall be cut back to the edge of the trench by the appropriate method. No power tools shall be used to prune roots, with the exception of row approved root cutting equipment and under the supervision of the City Forester. Only scissor type hand pruners and loppers (anvil type unacceptable) and arborist type pruning saws will be acceptable.

When more than one root with a diameter of two inches or greater is cut, supplemental watering is necessary if tree lacks an operational sprinkler system. Watering shall be provided by the Contractor or adjacent home owner at their expense.

The attachment to trees of any metal material, sign, cable, wire, nail or any other material foreign to the natural structure of the tree is prohibited. No heavy objects shall lean against or come into contact with any tree trunk.

No pruning shall occur, without approval of the City Forester, during or after construction activities. The City Forester shall hire a certified arborist to properly trim trees potentially affected by the project prior to construction at the City's expense. Damage which compromises the tree health or structure shall be mitigated.

SCC-28 TRAFFIC SIGNAL AND SIGNAGE RESTORATION

Prior to proceeding with the work in this contract, the Contractor shall identify any and all existing traffic signal installations, signage and pavement markings that will be affected by his work. If any of these installations will be interrupted or temporarily removed during the course of the work, the Contractor shall restore such installations to their original conditions at his expense.

The following specifications for the provision of traffic signal and lighting installations are intended to provide a set of minimum standards that shall be followed when work is done for the City of Boulder. These standards, plans, and any special provisions shall apply to all materials supplied, methods and procedures of work to be followed, and other general minimum requirements that shall be complied with before work is accepted by the City. The following standard specifications shall apply:

Standard Specifications for Road and Bridge Construction (current edition),

Colorado Department of Transportation, and all amendments and revisions pertaining thereto.

Manual on Uniform Traffic Control Devices (current edition), Federal Highway Administration, and the Colorado Supplement thereto.

Design Criteria and Standard Specifications (current edition), City of Boulder.

The standard specifications outlined in this document are revisions and amendments to the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction. In situations where there is a conflict or question of interpretation, these specifications and any special provisions will prevail.

SCC-29 CONTRACTOR'S GUARANTEE

The contractor's guarantee shall continue for a period of two (2) years after the date of substantial completion, not one (1) year as specified in the General Conditions.

SCC-30 PROTECTION OF PRIVATE PROPERTY

The contractor shall immediately notify the Project Manager of all proposed uses of private property that are directly related to the project. The contractor shall provide written verification that the use of the private property has been negotiated with and approved by the private property owner prior to the use of the property. Verification shall include Boulder County records related to property ownership, and signed and notarized agreement(s) between the property owner and the contractor. Uses of private property that are considered directly related to the project include, but are not limited to, material storage, equipment or manpower access, material disposal, and material borrow.

SCC-31 WORK ON COLORADO UNIVERSITY PROPERTY

Only the following Pre-qualified Contractors shall be allowed to work on the University of Colorado at Boulder property and the manholes in between the Main Campus and East Campus. The pre-qualified contractors are:

National Network Services Inc.
7808 Cherry Creek S Drive
Suite 104
Denver, Co. 80231
David Hansen (303-696-1120)

Henkles and McCoy
15551 E. Batavia Dr.
Suite B.
Aurora, Co. 80011
Lyle Shaw (303-340-2502)

Rainbow Electric Inc.
1110 Boston Ave.
Longmont, Co. 80501
Charles Synder (303-682-5300)

SCC-32 WORK IN ICG MANHOLES AND HANDHOLES

The contractor shall notify Mr. Bob Carter, ICG Project Manager, 48 hours prior to starting any work in ICG's manholes, handholes and conduit.

Form 8a

WORK DIRECTIVE FORM

Work Directive No. _____

Date _____ Project Name _____

Project No. _____ P.O. Number _____

OWNER: CITY OF BOULDER, COLORADO

CONTRACTOR: _____

The Contractor is directed to proceed promptly with the following change(s):

Description: _____

Attachments: _____

If a claim is made that the above change(s) have affected the Contract Price or Contract Time, any claim for a Change Order based thereon will involve one of the following methods of determining the effect of the change(s).

Method of determining change in Contract Price:

Method of determining change in Contract Time:

Time and Materials

Contractor's records

Unit Prices

Engineer's records

Cost plus fixed fee

Other _____

Other _____

Estimated (increase) (decrease) in Contract Price: \$_____.

If the change involves an increase, the estimated amount is not to be exceeded without further authorization.

Estimated (increase) (decrease) Contract Time: _____ days.

If the change involves an increase, the estimated time is not to be exceeded without further authorization.

APPROVED: _____
Contractor

APPROVED: _____
Project Manager

DIVISION 1 - REQUIREMENTS

SECTION 01010 SUMMARY OF THE WORK 01010-1
SECTION 01014 WORK SEQUENCE 01014-1
SECTION 01016 CONTRACTOR'S USE OF PREMISES 01016-1
SECTION 01060 SAFETY AND HEALTH..... 01060-1
SECTION 01071 STANDARD REFERENCES 01071-1
SECTION 01150 MEASUREMENT AND PAYMENT..... 01150-1
SECTION 01200 PROJECT MEETINGS 01200-1
SECTION 01300 SUBMITTALS 01300-1
SECTION 01410 MATERIALS TESTING..... 01410-1
SECTION 01510 TEMPORARY FACILITIES 01510-1
SECTION 01560 ENVIRONMENTAL CONTROLS..... 01560-1
SECTION 01570 TRAFFIC REGULATION 01570-1
SECTION 01600 MATERIAL DELIVERY, STORAGE AND HANDLING..... 01600-1
SECTION 01640 SUBSTITUTIONS AND PRODUCT OPTIONS 01640-1
SECTION 01720 RECORD DRAWINGS 01720-1

SECTION 01010

SUMMARY OF THE WORK

PART 1: GENERAL

1-1 Location:

The location of the work is within The City of Boulder, from the NCAR Foothills Laboratory on Mitchell lane through the downtown area of Boulder to the NCAR Table Mesa Laboratory at the end of Table Mesa Drive. A Boulder Key Plan, showing the fiber optic cable route and associated cable construction plans are included in the project drawings.

1-2 Description:

The Boulder Research and Administrative Network (BRAN) project includes the construction of approximately 15,000 feet of various configurations of buried conduit, placement of associated handholes and manholes, and pulling of approximately 80,000 feet of fiber optic cable in new and existing conduit as well as in steam tunnels. The project also includes the splicing and patching of the fiber optic cable at various locations within the City of Boulder.

1-3 Site Access:

This project is within the City of Boulder street right-of-way and can be accessed for the various streets the project occupies. There are numerous locations where the project occupies private property, these are identified on the construction drawings with the appropriate contact names and phone numbers. They are as follows:

NCAR Foothills Laboratory	Marla Meehl	303-497-1301
NCAR Table Mesa Laboratory	Marla Meehl	303-497-1301
NOAA Property	Jerry Jensen	303-497-6647
NIST Property	Mike Ting	303-497-7890
University of Colorado	Larry Warner	303-492-2935
City of Boulder Project Manager	Bob Harberg	303-441-3124
W.W. Reynolds Property	Chris Riley	303-442-8687
City of Boulder ROW Permit	Larry Ferguson	303-441-4237
CDOT Permit		
BNRR Permit		

**END OF SECTION
SECTION 01014**

WORK SEQUENCE

PART 1: GENERAL

1-1 Sequence of Construction:

The contractor shall be responsible for the work sequence and scheduling in order to meet the required substantial completion date for this project.

END OF SECTION

SECTION 01016

CONTRACTOR'S USE OF PREMISES

PART 1: GENERAL

1-1 Contractor Use of Premises:

The Contractor may use property designated for equipment and materials as long as he confines his operations to those permitted by local laws, ordinance and permits and meets the following requirements:

- Do not unreasonably encumber site with materials or equipment.
- Assume full responsibility for protection and safekeeping of products stored on premises.
- Move any stored products which interfere with operations of the City.
- Obtain and pay for use of additional storage or work areas needed for operations.

The location and extent of the areas so used shall be as follows:

Designated areas of City of Boulder Right-of-Way

Designated areas of the NOAA Site (Contact Jerry Janssen at 303-497-6647)

Designated areas of the Department of Commerce South Broadway Site

Designated areas of the City of Boulder Goose Creek Property (Contact Bob Harberg at 303-441-3124)

Designated areas of the City of Boulder Valmont Park Site (Contact Russ Driskill at 303-441-7220)

Designated areas of the City of Boulder Municipal Airport (Contact Ray Grundy at 303-440-7065)

1-2 Limits of Construction:

The Contractor must maintain all of his construction activities within the City property and/or construction easements of the project, or other stated areas, unless permits/and or written permission are obtained by the Contractor, from appropriate authorities or private property owners, outside of these areas. The temporary permits must be secured and paid for by the Contractor at no extra cost to the Owner.

1-3 Security:

The Contractor shall at all times be responsible for the security of his facilities and equipment. The City will not take any responsibility for the Contractor's missing or damaged equipment,

tools, or personal belongings of the Contractor.

END OF SECTION

SECTION 01060

SAFETY AND HEALTH

PART 1: GENERAL

1-1 Contractor Responsibilities:

The Contractor shall conduct his operations in a safe manner at all times. All OSHA regulations, and all other regulations pertaining to the safe operation of construction equipment, workers, methods and the job-site shall be strictly adhered to by the Contractor.

In accordance with the requirements of State and Federal Safety Regulations, the Contractor will be solely and completely responsible for conditions of the job-site, including safety of all persons and property during performance of work. This requirement will apply continuously and not be limited to working hours. The duty of the Project Manager to conduct construction observation of the Contractor's performance is not intended to include review of the adequacy of the Contractor's and Subcontractor's safety measure, in, on, or near the construction site.

The Contractor shall at all times, whether or not so specifically directed by the Project Manager, take necessary precautions to insure the protection of the public. The Contractor shall furnish, erect, and maintain all necessary barricades, fences, cones, suitable and sufficient construction signs, provide a sufficient number of watchmen and take all necessary precautions for the protection of the work and safety of the public through or around his construction operations. City crews and representatives will not enter a trench that appears unsafe. It is the Contractor's responsibility to provide a safe trench.

The Contractor shall maintain a safe and clean job-site at all times. Construction debris on traveled road surfaces, temporary detours, access driveways, etc., shall be cleaned away daily. Where applicable (in the opinion of the Project Manager), pedestrians and bicyclists shall be furnished with a safe and unobstructed route through the job-site. If the Contractor's operations cause there to be nuisance dust on the road surface, the Contractor must sweep away such dust when so ordered by the Project Manager. All costs for maintaining a clean and safe job-site will be considered incidental to the contract and will not be paid for separately. No open excavations will be allowed overnight.

1-2 Potential Job-Site Hazards:

Potential job-site hazards include the following:

- Construction related occupational injury; including the use of tools and heavy equipment; slips, trips and falls; buried gas and power lines, weather and traffic.
- Excavations

-
- Confined spaces associated with manholes and handholes
 - Asbestos Insulation (Boulder University)

1-3 Safety and Health Regulations:

The Contractor shall comply with Safety and Health Regulations for Construction, promulgated by the Secretary of Labor under Section 107 of the Contract Work Hours and Safety Standards Act, as set forth in Title 29, C.F.R. Copies of these regulations may be obtained from Labor Building, 14th and Constitution Avenue NW, Washington, D.C., 20013.

The Contractor shall also comply with the provisions of the Federal Occupational Safety and Health Act, as amended.

1-4 Safety and Health Submittal:

Before commencing Work on-site, the Contractor shall submit, in accordance with Section 1300 - Submittal Procedure, a Health and Safety Plan outlining methods and procedures to be implemented to protect worker safety and contingency plans in the event of an accident. The health and Safety Plan shall address all regulatory and site-specific health and safety requirements, including, but not limited to the following:

- Excavation safety
- Confined space safety
- Traffic safety
- Other safety issues identified in paragraph 2.0 above

END OF SECTION

SECTION 01071

STANDARD REFERENCES

PART 1: GENERAL

Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, or laws or regulations in effect at the time of opening of Bids, except as may be otherwise specifically stated. However, no provision of any referenced standard, specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of Owner, Contractor, or Engineer, or any of their Consultants, agents, or employees from those set forth in the Contract Documents, nor shall it be effective to assign to Engineer, or any of Engineer's Consultants, agents, or employees, any duty or authority to supervise or direct the furnishing or performance of the Work.

Wherever used in the Contract Documents, the following abbreviations will have the meanings listed:

AASHTO	American Association of State Highway and Transportation Officials 444 North Capital Street, N.W., Suite 225 Washington, D.C. 20001
ACI	American Concrete Institute P.O. Box 19150 Detroit, MI
AIEE	American Institute of Electrical Engineers
AISC	American Iron and Steel Institute 150 East 42nd Street New York, New York 10017
AISI	American Iron and Steel Institute 150 East 42nd Street New York, New York 10017
ASCE	American Society of Civil Engineers 345 East 47th Street New York, New York 10017
BICSI	Building Industry Consulting Service International
CSI	Construction Specifications Institute

EIA Electronic Industries Association
 2001 Eye Street N.W.
 Washington, D.C. 20006

EPA Environmental Protection Agency

FED SPEC Federal Specifications
 General Services Administration
 Specification and Consumer Information
 Distribution Branch
 Washington Navy Yard, Bldg. 197
 Washington, D.C. 20407

ICEA Insulated Cable Engineers Association
 P.O. Box P
 South Yarmouth, MA 02664

IEEE Institute of Electrical and Electronics Engineers, Inc.
 345 East 47th Street
 New York, New York 10017

ISA Instrument Society of America
 400 Stanwix Street
 Pittsburgh, PA 15222

NEC National Electric Code
 National Fire Protection Association
 470 Atlantic Avenue
 Boston, MA 02210

NECA National Electrical Contractors' Association

NEMA National Electrical Manufacturers' Association
 155 East 44th Street
 New York, New York 10017

NESC National Electric Safety Code
 American National Standards Institute
 1430 Broadway
 New York, New York 10018

NIST National Institute of Standards and Technology

OSHA Occupational Safety and Health Act
 U.S. Department of Labor
 Occupational and Health Administration
 San Francisco Regional Office
 450 Golden Gate Avenue, Box 30617

PCA Portland Cement Association

UL Underwriter's Laboratory

207 East Ohio Street
Chicago, IL 60611

END OF SECTION

SECTION 01150

MEASUREMENT AND PAYMENT

PART 1: GENERAL

1-1 Scope:

This section covers methods of measurement and payment for items of Work under this contract.

1-2 Requirements:

The total bid price shall cover all Work required by the Contract Documents. All costs in connection with the proper and successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction plant, equipment, tools; and performing all necessary labor and supervision to fully complete the Work, shall be included in the unit and lump sum prices bid. All Work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices bid.

1-3 Estimated Quantities for Unit Price Bid Items:

All estimated quantities stipulated in the Bid Form for unit price bid items are approximate and are to be used only (a) as a basis for estimating the probable cost of the Work and (b) for the purpose of comparing the bids submitted for the Work. The actual amounts of work performed and materials furnished for unit price bid items may differ from the estimated quantities. The basis of payment for work and materials bid as a unit price will be the actual amount of work done and materials furnished. The Contractor agrees that he will make no claim for damages, anticipated profits, or otherwise on account of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts for unit price bid items.

1-4 Alternative "A" - Base Bid- Unit Prices:

Bid alternative "A" - Base Bid requires unit pricing for the following bid items along with the work and materials included, but not limited to, in the unit price for each bid item:

Construction Unit Definitions

A-1) Trench Dirt (per foot)

Trench dirt shall be paid on a lineal foot basis and shall include traffic control; opening of trench in dirt (non landscaped areas); install conduit; warning tape; locating existing pipelines and utilities; removal and disposal of spoil and/or surplus trench excavation material; dewatering; sheeting, shoring and/or bracing; bedding; backfilling of job excavated material; compaction; site clean up; traffic control; and other items as needed to complete the work except as called out separately in other bid items. Field measurement will determine the final pay quantities for this item. .

A-2) Trench Landscape (per foot)

Trench landscape shall be paid on a lineal foot basis and shall include traffic control; opening of trench in grass or other landscape materials; (landscaped areas); install conduit; warning tape; locating existing pipelines and utilities; removal and disposal of spoil and/or surplus trench excavation material; dewatering; sheeting, shoring and/or bracing; bedding; removal and disposal of spoils and/or surplus trench excavation material; back filling of job excavated material; compaction; supply and install replacement sod or other landscape materials; site clean up; traffic control; and other items as needed to rehabilitate the site to the original condition except as called out separately in other bid items. Field measurement will determine the final pay quantities for this item.

A-3) Cut and Restore Concrete Curb & Gutter (per foot)

This item shall be paid on linear foot basis and shall include; traffic control; all labor, materials and equipment necessary to replace the existing curb and gutter. The unit price shall include all work necessary to remove existing concrete; place and strip forms; transport, dowel, place, finish, and cure concrete; saw cutting and/or form joints; site clean up and protect from traffic. Field measurement will determine final pay quantities for this item.

A-4) Trench Asphalt (per foot)

Trench asphalt shall be paid on a lineal foot basis and shall include traffic control; opening of trench with rock saw or other mechanical means paralleling the curb or crossing an intersection; install conduit; locating existing pipelines and utilities; removal and disposal of spoil and/or surplus trench excavation material; dewatering; sheeting, shoring and/or bracing; the furnishing, placement and vibration (if required) of flowable fill; supply and install

temporary cold mix patch; saw cutting, excavation and disposal of existing asphalt, priming, and installation of new asphalt; and site clean up. Rotomilling will be allowed in lieu of sawcutting and removing existing asphalt if approved by the Project Manager. Field measurement will determine the final pay quantities for this item.

A-5) Additional Asphalt Replacement (per sq. foot)

In areas immediately adjacent to the trench or manhole excavation where existing asphalt conditions require the replacement of additional asphalt, payment shall be made on a square foot basis. This work shall include all labor and materials required to saw cut; remove existing asphalt; excavation; disposal of existing asphalt and placement of new asphalt. Field measurement shall determine the final pay quantities for this item.

A-7) Cut and Restore Concrete Crosspan (per sq. foot)

This item shall be paid on a square foot basis and shall include traffic control; all labor, materials and equipment necessary to replace the existing crosspan. The unit price shall include all work necessary to remove existing concrete; place reinforcing steel, transport, place, finish and cure concrete; saw and/or form joints; site clean up and protect from traffic. Field measurement will determine final pay quantities for this item.

A-8) Cut and Restore Concrete Sidewalk (per sq. foot)

This item shall be paid on a square foot basis and shall include all labor, materials and equipment necessary to replace the existing sidewalk. The unit price shall include all work necessary to remove existing sidewalk; place and strip forms; transport, place, finish and cure concrete; saw and/or form joints; site clean up and protect from traffic. Field measurement will determine final pay quantities for this item.

A-9) Cut and Restore Concrete Sidewalk Access Curb Ramp (per sq. foot)

This item shall be paid on a square foot basis and shall include all labor, materials and equipment necessary to replace the existing sidewalk access curb ramp. The unit price shall include all work necessary to remove existing sidewalk; place and strip forms; transport, place, finish, score and cure concrete; saw cutting and/or form joints; site clean up and protect from traffic. Field measurement will determine final pay quantities for this item.

A-10) Place Handhole 48"x 30"x 18" (per each)

Placing handholes shall be paid for on an each basis and shall include locating existing pipelines and utilities; excavation to accept handhole; excavation shoring if necessary; supply and install bedding material; removal and disposal of spoil and /or surplus material; installation of handhole and all applicable components; placing a ground rod; compaction and restoration of the area around the vault and site clean up. Field count will determine the final

pay quantities for this item.

A-11) Place Manholes 4' x 4' round (per each)

Placing manholes shall be paid for on an each basis and shall include locating existing pipelines and utilities; excavation; removal and disposal of spoils and/or surplus excavation material; dewatering; sheeting; shoring and /or bracing; supply and install bedding material; installation of precast manhole and all applicable components; grounding; restoration of the area around the manhole and site clean up. Field count will determine the final pay quantities for this item.

A-12) Pull fiber cable (per foot)

Pulling fiber optic cable shall be paid on a per foot basis and shall include pulling of fiber cable in existing and new HDPE/PVC/innerduct/EMT conduit; figure eight of cable where necessary; racking and securing cable; sealing cable in conduit; placing fiber optic identification tags and site clean up. Field measurements will determine the final pay quantities for this item.

A-13) Pull fiber cable & locate wire (per foot)

Pulling fiber optic cable and locate wire shall be paid on a per foot basis and shall include pulling of fiber cable and locate wire in existing and new HDPE/PVC/innerduct/EMT conduit; figure eight of cable where necessary; racking and securing cable and wire; sealing cable in conduit; placing fiber optic identification tags and site clean up. Field measurements will determine the final pay quantities for this item.

A-14) Pull Fiber Cable CU Property (per foot)

Pulling fiber optic cable on CU property shall be paid on a per foot basis and shall include pulling of fiber cable in existing and new Colorado University HDPE/PVC/innerduct/EMT conduit and steam tunnels; figure eight of cable where necessary; racking and securing cable; sealing cable in conduit; placing fiber optic identification tags and site clean up. Field measurements will determine the final pay quantities for this item.

A-15) Jack and Bore Steel (per foot)

This item shall be paid for on a lineal foot basis and shall include traffic control; the steel casing pipe; all labor and materials necessary to install casing pipe including excavation; bore/jacking pit, receiving pit, bore machine and boring if specified; end seals; and carrier pipe skids; backfilling of send and receive pits, compacting of backfill and site clean up. Also included are all time, equipment, material, and material handling required to place small conduits inside the bored casing pipe. Field measurement will determine final pay quantities for this item.

A-21) Directional Bore 4- 1.25" HDPE Conduits (per foot)

Directional boring shall be paid on a per foot basis where the specified conduit depth is achieved, and shall include; traffic control; locating existing pipelines and utilities; opening and restoration of receive and send pits; boring under specified areas utilizing directional boring equipment; pulling the conduits through the bore hole; connecting the conduits; removal and disposal of spoil and/or surplus material; and site clean up. Field measurements will determine the final pay quantities for this item.

A-22) Directional Bore 8- 1.25" HDPE Conduits (per foot)

Directional boring shall be paid on a per foot basis where the specified conduit depth is achieved, and shall include traffic control; locating existing pipelines and utilities; opening and restoration of receive and send pits; boring under specified areas utilizing directional boring equipment; pulling the conduits through the bore hole; connecting the conduits; removal and disposal of spoil and/or surplus material; and site clean up. Field measurements will determine the final pay quantities for this item.

A-24) Place 2" EMT conduit: (per foot)

Placing 2 inch EMT conduit shall be paid on a linear foot basis and shall include the cost for obtaining the conduit; couplings; clevis hangers; other appurtenances; shipping/handling and receiving; applicable taxes; and installation of the conduit and appurtenances; thereto after placement and all conduit is proven to be continuous between termination points. All conduit shall be meet the standards as identified in the Conduit EMT Specification Section 02581. Field measurement will determine the final pay quantities for this item.

A-27) Place Pull Box 24" x 24"x 12": (per each)

Placing the pull box shall be paid on an each basis and shall include the cost of obtaining the pull box; hangers; other appurtenances; shipping/handling and receiving; applicable taxes; and installation of the pull box and appurtenances. The pull box shall meet the standards as identified in the Pull Box Section Specification 02582. Field count will determine the final pay quantities for this item.

A-50) Pull 1.25" I-Duct (per foot)

Pulling inner duct shall be paid on a per foot basis and shall include pulling the inner duct in new or existing HDPE/PVC/EMT conduit; or in the ceiling area of buildings; racking; sealing; placement of pipe hangers; unistrut material; and other materials required to support the inner duct. Field measurements will determine the final pay quantities for this item.

A-55) Place Manhole 4' x 7 'x 6' (per each)

Placing manholes shall be paid for on an each basis and shall include locating existing pipelines and utilities; excavation; removal and disposal of spoils and/or surplus excavation material; dewatering; sheeting; shoring and/or bracing; supply and install bedding material; installation of precast manhole and all applicable components; grounding; restoration of the area around the manhole and site clean up. Field count will determine the final pay quantities for this item.

A-57) Intercept Existing Conduit: (per each)

Intercepting existing conduit shall be paid for on an each basis by the number of conduit ends terminated and shall include locating existing pipelines and utilities; excavating to expose the existing conduit and or removal of existing handhole; removal and disposal of spoils and/or surplus excavation material; dewatering; sheeting; shoring and /or bracing; ring cutting the existing conduit or cutting the existing conduit; installation of conduit and sweeps; and all applicable components to terminate the conduit in the handhole or manhole. The cost of placing a handhole or manhole shall be paid for separately for that unit. Field count will determine the final pay quantities for this item.

A-66) Core Bore (per each)

Core boring through concrete walls shall be paid for on an each basis and shall include boring of holes with a boring machine appropriate for the material and depth to be bored. Field count will determine the final pay quantities for this item.

A-68) Cable Preparation: (per each)

Cable preparation shall be paid for on an each basis and shall include labor, tools, and any materials required to facilitate; opening the sheath; cleaning of buffer tubes and fiber stands; and placing fiber strands in splice or storage trays in preparation for splicing or storing. Field count will determine the final pay quantities for this item.

A-69) Splice fiber: (per each)

Fiber splicing shall be paid on an each basis; a spliced fiber shall be one bare fiber fused to one bare fiber resulting in one fiber splice.

A-70) Mid Sheath Preparation: (per each)

Mid sheath Cable preparation shall be paid for on an each basis and shall include labor, tools, and any materials required to facilitate; opening the sheath by ring cutting the sheath; cleaning of buffer tubes and fiber stands; and placing fiber strands in splice or storage trays in preparation for splicing or storage. Field count will determine the final pay quantities for this item.

A-71) Mobilization: (Lump Sum)

The lump sum bid price shall include all costs, including labor, material, and any incidental work and equipment necessary for mobilization of personnel, equipment and supplies to the project site. This item shall also include the establishment of the Contractor's and Engineer's offices, buildings and other necessary facilities, and all other costs incurred by labor and operations which must be performed prior to beginning the other items under this contract. The removal of the Contractor's equipment, supplies and excess materials, and cleanup of the site is also included.

Material Unit Definitions

A-101) Conduit 1.25" I-Duct: (per foot)

Conduit 1.25" I-Duct shall be paid on a lineal foot basis through fittings and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; joints and jointing materials and appurtenances thereto; after placement and all conduit is proven to be continuous between termination points. All conduit shall be meet the standards as identified in the Telecommunications Conduit Specification Section 02580. Field measurement will determine the final pay quantities for this item.

A-102) Conduit 2"HDPE/40: (per foot)

Conduit 2"HDPE shall be paid on a lineal foot basis through fittings and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; joints and jointing materials and appurtenances thereto; after placement and all conduit is proven to be continuous between termination points. All conduit shall be meet the standards as identified in the Telecommunications Conduit Specification Section 02580. Field measurement will determine the final pay quantities for this item.

A-104) Conduit 8-1.25" HDPE/80 (per foot)

Conduit 8-1.25" HDPE/80 shall be paid on a lineal foot basis through fittings and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; joints and jointing materials and appurtenances thereto; after placement and all conduit is proven to be continuous between termination points. All conduit shall be meet the standards as identified in the Telecommunications Conduit Specification Section 02580. Field measurement will determine the final pay quantities for this item.

A-105) Conduit 8-1.25" HDPE/40: (per foot)

Conduit 8-1.25" HDPE/40 shall be paid on a lineal foot basis through fittings and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; joints and jointing materials and appurtenances thereto; after placement and all conduit is continuous

between termination points. All conduit shall meet the standards as identified in the Telecommunications Conduit Specification Section 02580. Field measurement will determine the final pay quantities for this item.

A-108) Conduit 4" PVC/40: (per foot)

Conduit 4" PVC/40 shall be paid on a lineal foot basis through fittings and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; joints and jointing materials and appurtenances thereto; after placement and all conduit is proven to be continuous between termination points. All conduit shall meet the standards as identified in the Telecommunications Conduit Specification Section 02580. Field measurement will determine the final pay quantities for this item.

A-109) Conduit 4-1.25" HDPE/40: (per foot)

Conduit 4-1.25" HDPE/40 shall be paid on a lineal foot basis through fittings and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; joints and jointing materials and appurtenances thereto; after placement and all conduit is proven to be continuous between termination points. All conduit shall meet the standards as identified in the Telecommunications Conduit Specification Section 02580. Field measurement will determine the final pay quantities for this item.

A-110) Conduit 4-1.25" HDPE/80: (per foot)

Conduit 4-1.25" HDPE/80 shall be paid on a lineal foot basis through fittings and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; joints and jointing materials and appurtenances thereto; after placement and all conduit is proven to be continuous between termination points. All conduit shall meet the standards as identified in the Telecommunications Conduit Specification Section 02580. Field will determine the final pay quantities for this item.

A-113) Handholes 48"x 30"x 18": (per each)

Handholes shall be paid on a per each basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each manhole. All manholes shall meet the standards as identified in the Telecommunications Handhole Specification Section 02516. Field count will determine the final pay quantities for this item.

A-114) Manholes 4'x4' Round: (per each)

Manholes shall be paid on a per each basis and shall include the cost of obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each manhole. All manholes shall meet the standards as identified in

the Telecommunications Manhole Specification Section 02515. Field count will determine the final pay quantities for this item.

A-115) Manholes 4' x 6' x 7': (per each)

Manholes shall be paid on a per each basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each manhole. All manholes shall meet the standards as identified in the Telecommunications Manhole Specification Section 02515. Field count will determine the final pay quantities for this item.

A-119) Splice Closures: (per each)

Splice closures shall be paid on a per each basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each closure. All closures shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field count will determine the final pay quantities for this item.

A-124) Fiber Optic Equipment Bay: (per each)

The Fiber Optic equipment bay shall be paid on a per each basis and shall include labor to place the bay; the cost of obtaining; shipping/handling and receiving; applicable taxes; equipment frame; jumper troughs; blank frame panels; connector panels; splice housing; buffer tube breakout kits; jumper management housing; connector housing; cable management; labeling; in-rack management panels and all other associated materials for the complete installation of the Fiber Optic equipment bay. All fiber optic interconnection hardware shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field count will determine the final pay quantities for this item.

A-125) Fiber Optic Patch Panels 72 position: (per each)

Fiber optic patch panels shall be paid on a per each basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each fiber optic patch panel. All fiber optic patch panels shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field count will determine the final pay quantities for this item.

A-128) Fiber Optic Pigtails:

Fiber optic pigtails shall be paid on a per each basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each fiber optic pigtail. All fiber optic pigtails shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field

count will determine the final pay quantities for this item.

A-131) Cable 60 fiber: (per foot)

Cable 60 fiber shall be paid on a lineal foot basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes and successful acceptance testing after placement. All cable shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field measurement will determine the final pay quantities for this item.

A-133) Cable 96 fiber (per foot)

Cable 96 fiber shall be paid on a lineal foot basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes and successful acceptance testing after placement. All cable shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field measurement will determine the final pay quantities for this item.

1-5 Alternative "B" - 144 Strand Fiber Cable Alternative:

This alternative provides unit prices for 144 Strand Fiber cable and appurtenances as an option to the 96 Fiber cable provided in the base bid. Provide unit prices for the difference in cost between the base bid item and the item associated with the 144 strand fiber cable alternative.

Construction Unit Definitions

B-12) Pull fiber cable (per foot)

This shall be the difference in cost between the base bid item and pulling the 144 Fiber Optic cable; shall be paid on a per foot basis; shall include pulling of fiber cable in existing and new HDPE/PVC/innerduct/EMT conduit; figure eight of cable where necessary; racking and securing cable; sealing cable in conduit; placing fiber optic identification tags and site clean up. Field measurements will determine the final pay quantities for this item.

B-13) Pull fiber cable & locate wire (per foot)

This shall be the difference in cost between the base bid item and pulling the 144 Fiber Optic cable and locate wire; shall be paid on a per foot basis; shall include pulling fiber cable and locate wire in existing and new HDPE/PVC/innerduct/EMT conduit; figure eight of cable where necessary; racking and securing cable and wire; sealing cable in conduit; placing fiber optic identification tags and site clean up. Field measurements will determine the final pay quantities for this item.

B-14) Pull Fiber Cable CU Property (per foot)

This shall be the difference in cost between the base bid item and pulling the 144 Fiber Optic cable on CU property; shall be paid on a per foot basis; shall include pulling of fiber cable in existing and new Colorado University HDPE/PVC/innerduct/EMT conduit and steam tunnels; figure eight of cable where necessary; racking and securing cable; sealing cable in conduit; placing fiber optic identification tags and site clean up. Field measurements will determine the final pay quantities for this item.

B-68) Cable Preparation: (per each)

This shall be the difference in cost between the base bid item and cable preparation for the 144 Fiber Optic cable and shall be paid for on an each basis; shall include labor, tools, and any materials required to facilitate; opening the sheath; cleaning of buffer tubes and fiber stands; and placing fiber strands in splice or storage trays in preparation for splicing or storing. Field count will determine the final pay quantities for this item.

B-69) Splice Fiber: (per each)

This shall be the costs for splicing the additional fibers associated with the 144 Fiber Optic cable. Fiber splicing shall be paid on an each basis; a spliced fiber shall be one bare fiber fused to one bare fiber resulting in one fiber splice.

B-70) Mid Sheath Preparation: (per each)

This shall be the difference in cost between the base bid item and the Mid Sheath Cable preparation of the 144 Fiber Optic cable; shall be paid for on an each basis; shall include labor, tools, and any materials required to facilitate; opening the sheath by ring cutting the sheath; cleaning of buffer tubes and fiber stands; and placing fiber strands in splice or storage trays in preparation for splicing or storage. Field count will determine the final pay quantities for this item.

Material Unit Definitions

B-119) Splice Closures: (per each)

This shall be the difference in cost between the base bid item and for the cost of splice closures and appurtenances to accommodate the 144 Fiber Optic cable. Splice closures shall be paid on a per each basis; shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each closure. All closures shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field count will determine the final pay quantities for this item.

B-124) Fiber Optic Equipment Bay: (per each)

The Fiber Optic equipment bay shall be paid on a per each basis and shall include labor to place the bay; the cost of obtaining; shipping/handling and receiving; applicable taxes; equipment frame; jumper troughs; blank frame panels; connector panels; splice housing; buffer tube breakout kits; jumper management housing; connector housing; cable management; labeling; in-rack management panels and all other associated materials for the complete installation of the Fiber Optic equipment bay. All fiber optic interconnection hardware shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field count will determine the final pay quantities for this item.

B-126) Fiber Optic Patch Panels 144 position: (per each)

This shall be the difference in cost between the base bid item and the cost to provide the 144 Fiber optic patch panels; shall be paid on a per each basis; shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each fiber optic patch panel. All fiber optic patch panels shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field count will determine the final pay quantities for this item.

B-128) Fiber Optic Pigtails: (per each)

This shall be the additional cost to provide additional pigtails for the termination of the 144 Fiber Optic cable. Fiber optic pigtails shall be paid on a per each basis; shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each fiber optic pigtail. All fiber optic pigtails shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field count will determine the final pay quantities for this item.

B-133) Cable 144 Fiber: (per foot)

This shall be the difference in cost between the base bid item and the cost of providing the 144 Fiber Optic cable; shall be paid on a lineal foot basis; shall include the cost for obtaining; shipping/handling and receiving; applicable taxes and successful acceptance testing after placement. All cable shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field measurement will determine the final pay quantities for this item.

B-140) Other Associated Costs: (Lump Sum)

This shall be any costs associated with the change from Alternative "A" (96 Fiber) to the Alternative "B" option (144 Fiber) not covered in items in the construction units and material units (B-12 to B-140).

1-6. Alternative "C" - Table Mesa Alternative Alignment:

Alternative "C" provides an alternate route for a portion of the route 1A along Table Mesa Drive. The alternative route leaves Table Mesa Drive at Ithaca Drive, goes north-east on Ithaca Drive to Baylor Drive, north on Baylor Drive to Gillaspie Drive then south on Gillaspie Drive to Table Mesa Drive. This new route passes through a residential area. Provide unit prices for the items below as defined in the unit descriptions in the Alternate "C" bid definitions.

Construction Unit Definitions

C-1) Trench Dirt (per foot)

Trench dirt shall be paid on a lineal foot basis and shall include opening of trench in dirt (non landscaped areas); install conduit; warning tape; locating existing pipelines and utilities; removal and disposal of spoil and/or surplus trench excavation material; dewatering; sheeting, shoring and/or bracing; bedding; backfilling of job excavated material; compaction; site clean up; traffic control; and other items as needed to complete the work except as called out separately in other bid items. Field measurement will determine the final pay quantities for this item.

C-4) Trench Asphalt (per foot)

Trench asphalt shall be paid on a lineal foot basis and shall include traffic control; opening of trench with rock saw or other mechanical means paralleling the curb or crossing an intersection; install conduit; locating existing pipelines and utilities; removal and disposal of spoil and/or surplus trench excavation material; dewatering; sheeting, shoring and/or bracing; the furnishing, placement and vibration (if required) of flowable fill; supply and install temporary cold mix patch; saw cutting, excavation and disposal of existing asphalt, priming, and installation of new asphalt; and site clean up. Rotomilling will be allowed in lieu of sawcutting and removing existing asphalt if approved by the Project Manager. Field measurement will determine the final pay quantities for this item.

C-5) Additional Asphalt Replacement (per sq. foot)

In areas immediately adjacent to the trench or manhole excavation where existing asphalt conditions require the replacement of additional asphalt, payment shall be made on a square foot basis. This work shall include all labor and materials to saw cut; remove existing asphalt; excavation; disposal; of existing asphalt and replacement of new asphalt. existing asphalt. Field measurement shall determine the final pay quantities for this item.

C-7) Cut and Restore Concrete Crossspan (per sq. foot)

This item shall be paid on a square foot basis and shall include traffic control; all labor, materials and equipment necessary to replace the existing crossspan. The unit price shall

include all work necessary to remove existing concrete; place reinforcing steel; transport, place, finish and cure concrete; saw and/or form joints; site clean up and protect from traffic. Field measurement will determine final pay quantities for this item.

C-11) Place Manholes 4' x 4' round (per each)

Placing manholes shall be paid for on an each basis and shall include locating existing pipelines and utilities; excavation; removal and disposal of spoils and/or surplus excavation material; dewatering; sheeting; shoring and/or bracing; supply and install bedding material; installation of precast manhole and all applicable components; restoration of the area around the manhole and site clean up. Field count will determine the final pay quantities for this item.

C-13) Pull fiber cable & locate wire (per foot)

Pulling fiber optic cable and locate wire shall be paid on a per foot basis and shall include pulling fiber cable and locate wire in existing and new HDPE/PVC/innerduct/EMT conduit; figure eight of cable where necessary; racking and securing cable and wire; sealing cable in conduit; placing fiber optic identification tags and site clean up. Field measurements will determine the final pay quantities for this item.

C-21) Directional Bore 4- 1.25" HDPE Conduits (per foot)

Directional boring shall be paid on a per foot basis where the specified conduit depth is achieved, and shall include traffic control; locating existing pipelines and utilities; opening and restoration of receive and send pits; boring under specified areas utilizing directional boring equipment; pulling the conduits through the bore hole; connecting the conduits; removal and disposal of spoil and/or surplus material; and site clean up. Field measurements will determine the final pay quantities for this item.

Material Unit Definitions

C-109) Conduit 4-1.25" HDPE/40: (per foot)

Conduit 4-1.25" HDPE/40 shall be paid on a lineal foot basis through fittings and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; joints and jointing materials and appurtenances thereto; after placement and all conduit is proven to be continuous between termination points. All conduit shall meet the standards as identified in the Telecommunications Conduit Specification Section 02580. Field measurement will determine the final pay quantities for this item.

C-110) Conduit 4-1.25" HDPE/80: (per foot)

Conduit 4-1.25" HDPE/80 shall be paid on a lineal foot basis through fittings and shall

include the cost for obtaining; shipping/handling and receiving; applicable taxes; joints and jointing materials and appurtenances thereto; after placement and all conduit is proven to be continuous between termination points. All conduit shall meet the standards as identified in the Telecommunications Conduit Specification Section 02580. Field will determine the final pay quantities for this item.

C-133) Cable 96 fiber (per foot)

Cable 96 fiber shall be paid on a lineal foot basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes and successful acceptance testing after placement. All cable shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field measurement will determine the final pay quantities for this item.

C-134) Cable 144 fiber (per foot)

Cable 144 fiber shall be paid on a lineal foot basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes and successful acceptance testing after placement. All cable shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field measurement will determine the final pay quantities for this item.

1-7 Alternative "D-96" Lump Sum:

Bid alternative "D - 96" Lump Sum requires a lump sum bid for the entire project using 96 strand fiber cable including the assumption of all obligations, duties and responsibilities necessary to the successful completion of the contract and the furnishing of all materials and equipment required to be incorporated in and form a permanent part of the Work; permits, easements, tools, equipment, supplies, transportation, facilities, labor, superintendence and services required to perform the Work; and Bonds, insurance and submittals; all as indicated or specified in the Contract Documents.

The lump sum bid shall include the procurement of all required permits, including but not limited to City, State and Federal environmental and right-of-way permits. The lump sum bid shall also include all costs associated with deviations from the alignments shown on the drawings based on permit conditions or other requirements, including but not limited to traffic, underground utilities, subsurface conditions, groundwater and contamination.

1-8 Alternative "D-144" Lump Sum:

Bid alternative "D - 144" Lump Sum requires a lump sum bid for the entire project using 144 strand fiber cable including the assumption of all obligations, duties and responsibilities necessary to the successful completion of the contract and the furnishing of all materials and equipment required to be incorporated in and form a permanent part of the Work; permits, easements, tools, equipment, supplies, transportation, facilities, labor, superintendence and services required to perform the Work; and Bonds, insurance and submittals; all as indicated or specified in the Contract Documents.

The lump sum bid shall include the procurement of all required permits, including but not limited to City, State and Federal environmental and right-of-way permits. The lump sum bid shall also include all costs associated with deviations from the alignments shown on the drawings based on permit conditions or other requirements, including but not limited to traffic, underground utilities, subsurface conditions, groundwater and contamination.

1-9. Alternative “E” - City of Boulder Municipal Building:

Alternative “E” provides for the placement of a 96 Fiber optic cable into the City Municipal Building utilizing existing conduit from a handhole located next to the Municipal Building. The construction of conduit, manholes and placement of 24 Fiber Optic cable from Canyon Boulevard north on 11 th. Street to Pine street. Splicing and patching the 96 Fiber optic cable in the Municipal Building and the splicing of the 24 fiber optic cable to the 96 fiber in the handhole next to the municipal building. Provide unit prices for the items below as defined in the unit descriptions in the Alternative “E” bid definitions.

Construction Unit Definitions

E-2) Trench Landscape (per foot)

Trench landscape shall be paid on a lineal foot basis and shall include opening of trench in grass or other landscape materials; (landscaped areas); install conduit; warning tape; locating existing pipelines and utilities; removal and disposal of spoil and/or surplus trench excavation material; dewatering; sheeting, shoring and/or bracing; bedding; removal and disposal of spoils and/or surplus trench excavation material; back filling of job excavated material; compaction; supply and install replacement sod or other landscape materials; site clean up; traffic control; and other items as needed to rehabilitate the site to the original condition except as called out separately in other bid items. Field measurement will determine the final pay quantities for this item.

E-3) Cut and Restore Concrete Curb & Gutter (per foot)

This item shall be paid on linear foot basis and shall include all labor, materials and equipment necessary to replace the existing curb and gutter. The unit price shall include all work necessary to remove existing concrete; place and strip forms; transport, dowel, place, finish, and cure concrete; saw cutting and/or form joints; site clean up and protect from traffic. Field measurement will determine final pay quantities for this item.

E-4) Trench Asphalt (per foot)

Trench asphalt shall be paid on a lineal foot basis and shall include traffic control; opening of trench with rock saw or other mechanical means paralleling the curb or crossing an intersection; install conduit; locating existing pipelines and utilities; removal and disposal of spoil and/or surplus trench excavation material; dewatering; sheeting, shoring and/or bracing; the furnishing, placement and vibration (if required) of flowable fill; supply and install temporary cold mix patch; saw cutting, excavation and disposal of existing asphalt, priming, and installation of new asphalt; and site clean up. Rotomilling will be allowed in lieu of sawcutting and removing existing asphalt if approved by the Project Manager. Field measurement will determine the final pay quantities for this item.

E-5) Additional Asphalt Replacement (per sq. foot)

In areas immediately adjacent to the trench or manhole excavation where existing asphalt conditions require the replacement of additional asphalt, payment shall be made on a square foot basis. This work shall include all labor and materials to saw cut; remove existing asphalt; excavation; disposal; of existing asphalt and replacement of new asphalt. existing asphalt. Field measurement shall determine the final pay quantities for this item.

E-11) Place Manholes 4' x 4' round (per each)

Placing manholes shall be paid for on an each basis and shall include locating existing pipelines and utilities; excavation; removal and disposal of spoils and/or surplus excavation material; dewatering; sheeting; shoring and /or bracing; supply and install bedding material; installation of precast manhole and all applicable components; restoration of the area around the manhole and site clean up. Field count will determine the final pay quantities for this item.

E-12) Pull fiber cable (per foot)

Pulling fiber optic cable shall be paid on a per foot basis and shall include pulling of fiber cable in existing and new HDPE/PVC/innerduct/EMT conduit; figure eight of cable where necessary; racking and securing cable; sealing cable in conduit; placing fiber optic identification tags and site clean up. Field measurements will determine the final pay quantities for this item.

E-13) Pull fiber cable & locate wire (per foot)

Pulling fiber optic cable and locate wire shall be paid on a per foot basis and shall include pulling fiber cable and locate wire in existing and new HDPE/PVC/innerduct/EMT conduit; figure eight of cable where necessary; racking and securing cable and wire; sealing cable in conduit; placing fiber optic identification tags and site clean up. Field measurements will determine the final pay quantities for this item.

E-22) Directional Bore 8- 1.25" HDPE Conduits (per foot)

Directional boring shall be paid on a per foot basis where the specified conduit depth is achieved, and shall include traffic control; locating existing pipelines and utilities; opening and restoration of receive and send pits; boring under specified areas utilizing directional boring equipment; pulling the conduits through the bore hole; connecting the conduits; removal and disposal of spoil and/or surplus material; and site clean up. Field measurements will determine the final pay quantities for this item.

E-24) Place 2" EMT conduit: (per foot)

Placing 2 inch EMT conduit shall be paid on a linear foot basis and shall include the cost for obtaining the conduit; couplings; clevis hangers; other appurtenances; shipping/handling and receiving; applicable taxes; and installation of the conduit and appurtenances; thereto after placement and all conduit is proven to be continuous between termination points. All conduit shall be meet the standards as identified in the Conduit EMT Specification Section 02581. Field measurement will determine the final pay quantities for this item.

E-27) Place Pull Box 24" x 24"x 12": (per each)

Placing the pull box shall be paid on an each basis and shall include the cost of obtaining the pull box; hangers; other appurtenances; shipping/handling and receiving; applicable taxes; and installation of the pull box and appurtenances. The pull box shall meet the standards as identified in the Pull Box Section Specification 02582. Field count will determine the final pay quantities for this item.

E-57) Intercept Existing Conduit: (per each)

Intercepting existing conduit shall be paid for on an each basis by the number of conduit ends terminated and shall include locating existing pipelines and utilities; excavating to expose the existing conduit and or removal of existing handhole; removal and disposal of spoils and/or surplus excavation material; dewatering; sheeting; shoring and /or bracing; ring cutting the existing conduit or cutting the existing conduit; installation of conduit and sweeps; and all applicable components to terminate the conduit in the handhole or manhole. The cost of placing a handhole or manhole shall be cover by that unit. Field count will determine the final pay quantities for this item.

E-66) Core Bore (per each)

Core boring through concrete shall be paid for on an each basis and shall include boring of holes with a boring machine appropriate for the material and depth to be bored. Field count will determine the final pay quantities for this item.

E-68) Cable Preparation: (per each)

Cable preparation shall be paid for on an each basis and shall include labor, tools, and any materials required to facilitate; opening the sheath; cleaning of buffer tubes and fiber stands; and placing fiber strands in splice or storage trays in preparation for splicing or storing. Field count will determine the final pay quantities for this item.

E-69) Splice fiber: (per each)

Fiber splicing shall be paid on an each basis; a spliced fiber shall be one bare fiber fused to one bare fiber resulting in one fiber splice.

E-70) Mid Sheath Preparation: (per each)

Mid sheath Cable preparation shall be paid for on an each basis and shall include labor, tools, and any materials required to facilitate; opening the sheath by ring cutting the sheath; cleaning of buffer tubes and fiber stands; and placing fiber strands in splice or storage trays in preparation for splicing or storage. Field count will determine the final pay quantities for this item.

E-71) Mobilization: (Lump Sum)

The lump sum bid price shall include all costs, including labor, material, and any incidental work and equipment necessary for mobilization of personnel, equipment and supplies to the project site. This item shall also include the establishment of the Contractor's and Engineer's offices, buildings and other necessary facilities, and all other costs incurred by labor and operations which must be performed prior to beginning the other items under this contract. The removal of the Contractor's equipment, supplies and excess materials, and cleanup of the site is also included.

Material Unit Definitions

E-104) Conduit 8-1.25" HDPE/80 (per foot)

Conduit 8-1.25" HDPE/80 shall be paid on a lineal foot basis through fittings and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; joints and jointing materials and appurtenances thereto; after placement and all conduit is proven to be continuous between termination points. All conduit shall be meet the standards as identified in the Telecommunications Conduit Specification Section 02580. Field measurement will determine the final pay quantities for this item.

E-105) Conduit 8-1.25" HDPE/40: (per foot)

Conduit 8-1.25" HDPE/40 shall be paid on a lineal foot basis through fittings and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; joints and jointing materials and appurtenances thereto; after placement and all conduit is continuous between termination points. All conduit shall be meet the standards as identified in the Telecommunications Conduit Specification Section 02580. Field measurement will determine the final pay quantities for this item.

E-114) Manholes 4'x4' Round: (per each)

Manholes shall be paid on a per each basis and shall include the cost of obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each manhole. All manholes shall meet the standards as identified in the Telecommunications Conduit Specification Section 02580. Field count will determine the

final pay quantities for this item.

E-119) Splice Closures: (per each)

Splice closures shall be paid on a per each basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each closure. All closures shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field count will determine the final pay quantities for this item.

E-126) Fiber Optic Patch Panels 96 position: (per each)

Fiber optic patch panels shall be paid on a per each basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each fiber optic patch panel. All fiber optic patch panels shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field count will determine the final pay quantities for this item.

E-128) Fiber Optic Pigtails: (per each)

Fiber optic pigtails shall be paid on a per each basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each fiber optic pigtail. All fiber optic pigtails shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field count will determine the final pay quantities for this item.

E-130) Cable 24 fiber: (per foot)

Cable 24 fiber shall be paid on a lineal foot basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes and successful acceptance testing after placement. All cable shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field measurement will determine the final pay quantities for this item.

E-133) Cable 96 fiber (per foot)

Cable 96 fiber shall be paid on a lineal foot basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes and successful acceptance testing after placement. All cable shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field measurement will determine the final pay quantities for this item.

1-10. Alternative "F" - East Boulder Recreation Center:

Alternative "F" provides for the construction of conduit, handholes and placement of 24 Fiber Optic placement form Baseline Road and 55 th street south on 55 th street to South Boulder Road. The placement of a 12 Fiber optic cable into the East Boulder Recreation Center. Provide unit prices for the items below as defined in the unit descriptions in the Alternative "F" bid definitions.

F-1) Trench Dirt (per foot)

Trench dirt shall be paid on a lineal foot basis and shall include opening of trench in dirt (non landscaped areas); install conduit; warning tape; locating existing pipelines and utilities; removal and disposal of spoil and/or surplus trench excavation material; dewatering; sheeting, shoring and/or bracing; bedding; backfilling of job excavated material; compaction; site clean up; traffic control; and other items as needed to complete the work except as called out separately in other bid items. Field measurement will determine the final pay quantities for this item. .

F-2) Trench Landscape (per foot)

Trench landscape shall be paid on a lineal foot basis and shall include opening of trench in grass or other landscape materials; (landscaped areas); install conduit; warning tape; locating existing pipelines and utilities; removal and disposal of spoil and/or surplus trench excavation material; dewatering; sheeting, shoring and/or bracing; bedding; removal and disposal of spoils and/or surplus trench excavation material; back filling of job excavated material; compaction; supply and install replacement sod or other landscape materials; site clean up; traffic control; and other items as needed to rehabilitate the site to the original condition except as called out separately in other bid items. Field measurement will determine the final pay quantities for this item.

F-3) Cut and Restore Concrete Curb & Gutter (per foot)

This item shall be paid on linear foot basis and shall include all labor, materials and equipment necessary to replace the existing curb and gutter. The unit price shall include all work necessary to remove existing concrete; place and strip forms; transport, dowel, place, finish, and cure concrete; saw cutting and/or form joints; site clean up and protect from traffic. Field measurement will determine final pay quantities for this item.

F-4) Trench Asphalt (per foot)

Trench asphalt shall be paid on a lineal foot basis and shall include traffic control; opening of trench with rock saw or other mechanical means paralleling the curb or crossing an intersection; install conduit; locating existing pipelines and utilities; removal and disposal of spoil and/or surplus trench excavation material; dewatering; sheeting, shoring and/or bracing;

the furnishing, placement and vibration (if required) of flowable fill; supply and install temporary cold mix patch; saw cutting, excavation and disposal of existing asphalt, priming, and installation of new asphalt; and site clean up. Rotomilling will be allowed in lieu of sawcutting and removing existing asphalt if approved by the Project Manager. Field measurement will determine the final pay quantities for this item.

F-5) Additional Asphalt Replacement (per sq. foot)

In areas immediately adjacent to the trench or manhole excavation where existing asphalt conditions require the replacement of additional asphalt, payment shall be made on a square foot basis. This work shall include all labor and materials to saw cut; remove existing asphalt; excavation; disposal; of existing asphalt and replacement of new asphalt. existing asphalt. Field measurement shall determine the final pay quantities for this item.

F-8) Cut and Restore Concrete Sidewalk (per sq. foot)

This item shall be paid on a square foot basis and shall include all labor, materials and equipment necessary to replace the existing sidewalk. The unit price shall include all work necessary to remove existing sidewalk; place and strip forms; transport, place, finish and cure concrete; saw and/or form joints; site clean up and protect from traffic. Field measurement will determine final pay quantities for this item.

F-10) Place Handhole 48"x 30"x 18" (per each)

Placing handholes shall be paid for on an each basis and shall include the excavation to accept handhole; excavation shoring if necessary; supply and install bedding material; removal and disposal of spoil and /or surplus material; installation of handhole and all applicable components; compaction and restoration of the area around the vault and site clean up. Field count will determine the final pay quantities for this item.

F-12) Pull fiber cable (per foot)

Pulling fiber optic cable shall be paid on a per foot basis and shall include pulling of fiber cable in existing and new HDPE/PVC/innerduct/EMT conduit; figure eight of cable where necessary; racking and securing cable; sealing cable in conduit; placing fiber optic identification tags and site clean up. Field measurements will determine the final pay quantities for this item.

F-13) Pull fiber cable & locate wire (per foot)

Pulling fiber optic cable and locate wire shall be paid on a per foot basis and shall include pulling fiber cable and locate wire in existing and new HDPE/PVC/innerduct/EMT conduit;

figure eight of cable where necessary; racking and securing cable and wire; sealing cable in conduit; placing fiber optic identification tags and site clean up. Field measurements will determine the final pay quantities for this item.

F-16) Concrete Reinforced Conduit: (per foot)

Concrete reinforced conduit shall be paid on a per foot basis and shall include all labor, materials and equipment necessary to provide reinforcement for the conduit line. The unit price shall include the reinforcing steel; steel wire ties; concrete; the extra trench width if required; place and strip forms; place and cure the concrete. The unit for trenching in either dirt, asphalt or landscape shall be paid for then length of the reinforcement. Field measurements will determine the final pay quantities for this item.

F-21) Directional Bore 4- 1.25" HDPE Conduits (per foot)

Directional boring shall be paid on a per foot basis where the specified conduit depth is achieved, and shall include traffic control; locating existing pipelines and utilities; opening and restoration of receive and send pits; boring under specified areas utilizing directional boring equipment; pulling the conduits through the bore hole; connecting the conduits; removal and disposal of spoil and/or surplus material; and site clean up. Field measurements will determine the final pay quantities for this item.

F-57) Intercept Existing Conduit: (per each)

Intercepting existing conduit shall be paid for on an each basis by the number of conduit ends terminated and shall include locating existing pipelines and utilities; excavating to expose the existing conduit and or removal of existing handhole; removal and disposal of spoils and/or surplus excavation material; dewatering; sheeting; shoring and /or bracing; ring cutting the existing conduit or cutting the existing conduit; installation of conduit and sweeps; and all applicable components to terminate the conduit in the handhole or manhole. The cost of placing a handhole or manhole shall be cover by that unit. Field count will determine the final pay quantities for this item.

F-68) Cable Preparation: (per each)

Cable preparation shall be paid for on an each basis and shall include labor, tools, and any materials required to facilitate; opening the sheath; cleaning of buffer tubes and fiber stands; and placing fiber strands in splice or storage trays in preparation for splicing or storing. Field count will determine the final pay quantities for this item.

F-69) Splice fiber: (per each)

Fiber splicing shall be paid on an each basis; a spliced fiber shall be one bare fiber fused to one bare fiber resulting in one fiber splice.

F-70) Mid Sheath Preparation: (per each)

Mid sheath Cable preparation shall be paid for on an each basis and shall include labor, tools, and any materials required to facilitate; opening the sheath by ring cutting the sheath; cleaning of buffer tubes and fiber stands; and placing fiber strands in splice or storage trays in preparation for splicing or storage. Field count will determine the final pay quantities for this item.

F-71) Mobilization: (Lump Sum)

The lump sum bid price shall include all costs, including labor, material, and any incidental work and equipment necessary for mobilization of personnel, equipment and supplies to the project site. This item shall also include the establishment of the Contractor's and Engineer's offices, buildings and other necessary facilities, and all other costs incurred by labor and operations which must be performed prior to beginning the other items under this contract. The removal of the Contractor's equipment, supplies and excess materials, and cleanup of the site is also included.

Material Unit Definitions

F-105) Conduit 8-1.25" HDPE/40: (per foot)

Conduit 8-1.25" HDPE/40 shall be paid on a lineal foot basis through fittings and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; joints and jointing materials and appurtenances thereto; after placement and all conduit is continuous between termination points. All conduit shall meet the standards as identified in the Telecommunications Conduit Specification Section 02580. Field measurement will determine the final pay quantities for this item.

F-108) Conduit 4" PVC/40: (per foot)

Conduit 4" PVC/40 shall be paid on a lineal foot basis through fittings and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; joints and jointing materials and appurtenances thereto; after placement and all conduit is proven to be continuous between termination points. All conduit shall meet the standards as identified in the Telecommunications Conduit Specification Section 02580. Field measurement will determine the final pay quantities for this item.

F-109) Conduit 4-1.25" HDPE/40: (per foot)

Conduit 4-1.25" HDPE/40 shall be paid on a lineal foot basis through fittings and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; joints and jointing materials and appurtenances thereto; after placement and all conduit is proven to be continuous between termination points. All conduit shall meet the standards as identified in

the Telecommunications Conduit Specification Section 02580. Field measurement will determine the final pay quantities for this item.

F-110) Conduit 4-1.25" HDPE/80: (per foot)

Conduit 4-1.25" HDPE/80 shall be paid on a lineal foot basis through fittings and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; joints and jointing materials and appurtenances thereto; after placement and all conduit is proven to be continuous between termination points. All conduit shall meet the standards as identified in the Telecommunications Conduit Specification Section 02580. Field will determine the final pay quantities for this item.

F-113) Handholes 48"x 30"x 18": (per each)

Handholes shall be paid on a per each basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each manhole. All manholes shall meet the standards as identified in the Telecommunications Handhole Specification Section 02516. section. Field count will determine the final pay quantities for this item.

F-119) Splice Closures: (per each)

Splice closures shall be paid on a per each basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each closure. All closures shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field count will determine the final pay quantities for this item.

F-120) Fiber Optic Patch Panels 12 position: (per each)

Fiber optic patch panels shall be paid on a per each basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each fiber optic patch panel. All fiber optic patch panels shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field count will determine the final pay quantities for this item.

F-128) Fiber Optic Pigtails: (per each)

Fiber optic pigtails shall be paid on a per each basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes; and all associated materials required for complete installation of each fiber optic pigtail. All fiber optic pigtails shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field count will determine the final pay quantities for this item.

F-129) Cable 12 fiber: (per foot)

Cable 12 fiber shall be paid on a lineal foot basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes and successful acceptance testing after placement. All cable shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field measurement will determine the final pay quantities for this item.

F-130) Cable 24 fiber: (per foot)

Cable 24 fiber shall be paid on a lineal foot basis and shall include the cost for obtaining; shipping/handling and receiving; applicable taxes and successful acceptance testing after placement. All cable shall meet the standards as identified in the Outside Plant Communications Circuits Section 16711. Field measurement will determine the final pay quantities for this item.

1-11 Basis of Bid

The Bid Form format is based on a total bid price contract using "Basis of Bid" major equipment, products and subcontractors which have been identified and described in the Contract Documents. Major equipment, products and subcontractor identified in the Major Product and Subcontractor Schedule in the Bid Form are considered "Basis of Bid" items. Contract Document sections defining "Basis of Bid" major equipment, products and subcontractors include:

- * Fiber Optic Cable
- * Work on University of Colorado Property

The Base Bid price noted in the Bid Form shall include the prices of only "Basis of Bid" major equipment, products and subcontractors.

Bidders desiring to quote a price for a substitute major equipment item or product in lieu of a "Basis of Bid" item may, at their option, write in the name of one manufacturer in the Bid Form Major Equipment Schedule. The Bidder shall note the installed price reduction for the proposed substitute major equipment item in the space provided.

The Bidder shall not use the price for any proposed substitute major equipment, product or subcontractor in preparing the Base Bid price.

If the Bidder writes in the name of a proposed substitute manufacturer or subcontractor and fails to note the price reduction or writes in the price reduction and fails to identify the name of the proposed substitute manufacturer or subcontractor, the Bidder shall furnish the "Basis of Bid" item at the Base Bid price noted in the Bid Form.

The City shall be the sole authority for determining conformance of a proposed substitute major equipment, product or subcontractor with the Contract Documents. Under no circumstances will the City be required to prove that a substitute major equipment, product or subcontractor is not equal to the "Basis of Bid" major equipment item or product.

If a proposed substitute major equipment, product or subcontractor is accepted by the City, the substitute major equipment, product or subcontractor listed in the Bid Form shall be furnished and the Base Bid price shall be reduced accordingly.

In the event that a proposed substitute major equipment, product or subcontractor is not accepted by the City, the "Basis of Bid" major equipment, product as specified shall be furnished without adjustment to the Base Bid price.

The city reserves the right to evaluate the bids using the base bid equipment cost or the substitute bid equipment cost, whichever is in the best interests of the City.

1-12 Payment:

The Application for Payment Form (Form 19) shall be used by the Contractor to request payment. The Contractor shall submit the application for payment with an updated construction schedule. The application for payment shall be submitted at the end of each month and shall cover work completed in the preceding month time period.

**BID FORM
BOULDER RESEARCH AND ADMINISTRATIVE NETWORK**

The undersigned Bidder does hereby declare and stipulate that his Proposal is made in good faith, without collusion or connection with any other person or persons bidding for the same work, and that it is made in pursuance or and subject to all the terms and conditions of the bid documents entitled "Boulder Research and Administrative Network", all of which have been examined by the undersigned.

The bidder also agrees that construction shall start within ten (10) days after issuance of the Notice to Proceed. Submittal of this proposal also serves as a binding covenant that construction shall start within ten (10) days after issuance of the Notice to Proceed, that substantial completion shall be achieved within 120 calendar days after issuance of the Notice to Proceed and that final completion shall be achieved within 30 calendar days after issuance of the Notice to Proceed.

Bidders shall submit prices on the base bid and all alternatives as provided for in the Bid Form.

The City of Boulder reserves the right to make the award on the basis of the bid deemed most favorable to the City, to waive any informalities or to reject any or all bids.

The Bidder proposes to perform all work and provide all labor, materials, and equipment in full accordance with the bidding documents for the following unit and lump sum prices:

The bidder shall complete the attached Form 20, Proposed Subcontractors, with the bid proposal. Failure to provide this information may be sufficient cause for rejection of the bid.

The bidder shall complete the attached Form 21, Schedule of Manufacturers and Suppliers, with the bid proposal. Failure to provide this information may be sufficient cause for rejection of the bid.

Addendum No.(s)_____ have been received.

Attached is an unconditional letter of credit, money order, certified check, or bid bond payable to the City of Boulder in an amount not less than five percent (5%) of the total amount of the bid.

If this bid is accepted, the Bidder agrees to sign the contract agreement without qualifications and to furnish the performance bond, labor and material bond and the required evidences of insurance within 10 calendar days after notification of award.

All proposals shall be submitted on this form. The lowest responsible bid will be accepted; provided, however, that the City shall have the right to reject any and all bids and to waive any informalities or irregularities contained in said bid. The following quantities are an estimate only

and may be altered to meet actual City of Boulder requirements.

Submit firm unit prices for the type of construction listed below. Overhead shall not be priced and bid separately, but shall be included in each bid item as required. All prices are for furnishing and installing the described item.

A. ALTERNATIVE "A" Base Bid

	<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>TOTAL</u>
A-1.	Trench Dirt	5,070	FT	\$ _____	\$ _____
A-2.	Trench Landscape	1,222	FT	\$ _____	\$ _____
A-3.	Cut & Res Curb & Gutter	30	FT	\$ _____	\$ _____
A-4.	Trench Asphalt	4,992	FT	\$ _____	\$ _____
A-5.	Additional Asphalt	100	SQ FT	\$ _____	\$ _____
A-7.	Cut & Res. Crosspan	80	SQ FT	\$ _____	\$ _____
A-8.	Cut & Restore Sidewalk	265	SQ FT	\$ _____	\$ _____
A-9.	Cut & Res. S/W Ramp	45	SQ FT	\$ _____	\$ _____
A-10.	Place Handhole	16	EA	\$ _____	\$ _____
A-11.	Place Manhole 4' x 4'	6	EA	\$ _____	\$ _____
A-12.	Pull Fiber	2,619	FT	\$ _____	\$ _____
A-13.	Pull Fiber & Wire	60,033	FT	\$ _____	\$ _____
A-14.	Pull Fiber CU Property	17,399	FT	\$ _____	\$ _____
A-15.	Jack & Bore Steel	72	FT	\$ _____	\$ _____
A-21.	Direct Bore 4-1.25"	1,569	FT	\$ _____	\$ _____
A-22.	Direct Bore 8-1.25"	1,563	FT	\$ _____	\$ _____
A-24.	Place 2" EMT Conduit	335	FT	\$ _____	\$ _____

A-27. Place Pull Box	4	EA	\$ _____	\$ _____
A-50. Pull 1.25" I- Duct	7,498	FT	\$ _____	\$ _____
A-55. Place Manhole 4' x 7' x 6'	2	EA	\$ _____	\$ _____
A-57. Intercept Existing Cond.	5	EA	\$ _____	\$ _____
A-66. Core Bore	4	EA	\$ _____	\$ _____
A-68. Cable Preparation	21	EA	\$ _____	\$ _____
A-69. Splice Fiber	1822	EA	\$ _____	\$ _____
A-70. Mid. Sheath Preparation	1	EA	\$ _____	\$ _____
A-71. Mobilization	1	LS	\$ _____	\$ _____
A-101. Conduit 1.25" I- Duct 7,498		FT	\$ _____	\$ _____
A-102. Conduit 2" HDPE/40	69	FT	\$ _____	\$ _____
A-104. Conduit 8-1.25"HDPE/80	1,563	FT	\$ _____	\$ _____
A-105. Conduit 8-1.25"HDPE/40	4,235	FT	\$ _____	\$ _____
A-108. Conduit 4" PVC/40	107	FT	\$ _____	\$ _____
A-109. Conduit 4-1.25" HDPE/40	7,014	FT	\$ _____	\$ _____
A-110. Conduit 4-1.25" HDPE/80	1,569	FT	\$ _____	\$ _____
A-113. Handhole	16	EA	\$ _____	\$ _____
A-114. Manhole 4' x 4'	6	EA	\$ _____	\$ _____
A-115. Manhole 4' x 7 x 6'	2	EA	\$ _____	\$ _____
A-119. Splice Closure	2	EA	\$ _____	\$ _____

A-124. Fiber Optic Equip. Bay	9	EA	\$ _____	\$ _____
A-125. Fiber Patch Panel 72 Pos.	1	EA	\$ _____	\$ _____
A-128. Fiber Optic Pigtaills	1,000	EA	\$ _____	\$ _____
A-131. Cable 60 Fiber	2,063	FT\$	_____	\$ _____
A-133. Cable 96 Fiber	77,988	FT\$	_____	\$ _____

TOTAL BID ALTERNATIVE "A" BASE BID
 (Total of all items (A-1 through A-133))

TOTAL \$ _____

D. ALTERNATIVE "D-96" - Lump Sum

TOTAL BID ALTERNATIVE "D-96"

TOTAL \$ _____

B. ALTERNATIVE "B" - 144 Strand Fiber Cable Alternative

This alternative provides unit prices for 144 Strand Fiber cable and appurtenances as an option to the 96 Fiber cable provided in the base bid. Provide unit prices for the difference in cost between the base bid item and the item associated with the 144 strand fiber cable alternative.

<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
B-12. Pull Fiber	2,619	FT	\$ _____	\$ _____
B-13. Pull Fiber & Wire	60,033	FT	\$ _____	\$ _____
B-14. Pull Fiber CU Property	17,399	FT	\$ _____	\$ _____
B-68. Cable Preparation	21	EA	\$ _____	\$ _____
B-69. Splice Fiber	672	EA	\$ _____	\$ _____
B-70. Mid. Sheath Prep.	1	EA	\$ _____	\$ _____
B-119. Splice Closure	2	EA	\$ _____	\$ _____
B-126. Fiber Optic Equip. Bay	9	EA	\$ _____	\$ _____
B-128. Fiber Optic Pigtails	824	EA	\$ _____	\$ _____
B-134. Fiber Cable 144	77,988	FT	\$ _____	\$ _____
B-140. Other Associated Costs	N/A	LS	\$ _____	\$ _____

TOTAL BID ALTERNATIVE "B" **TOTAL** \$ _____
 (Total of all items B-12 through B-140)

D. ALTERNATIVE "D-144" - Lump Sum

TOTAL BID ALTERNATIVE "D-144" **TOTAL** \$ _____

C. ALTERNATIVE "C" - Table Mesa Alternative Alignment

Alternative "C" provides an alternate route for a portion of the route 1A along Table Mesa Drive. The alternative route leaves Table Mesa Drive at Ithaca Drive, goes north-east on Ithaca Drive to Baylor Drive, north on Baylor Drive to Gillaspie Drive then south on Gillaspie Drive to Table Mesa Drive. This new route passes through a residential area. Provide unit prices for the items below as defined in the unit descriptions in the Alternate "C" bid definitions.

	<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
C-1.	Trench Dirt	24	FT	\$ _____	\$ _____
C-4.	Trench Asphalt	2811	FT	\$ _____	\$ _____
C-5.	Additional Asphalt	50	SQ FT	\$ _____	\$ _____
C-7.	Cut & Res Crosspan	240	SQ FT	\$ _____	\$ _____
C-11.	Place Manhole 4'x4'	4	EA	\$ _____	\$ _____
C-13.	Pull Fiber & Wire	3,225	FT	\$ _____	\$ _____
C-21.	Direct Bore 4-1.25"	150	FT	\$ _____	\$ _____
C-109.	4-1.25" HDPE/40	2,835	FT	\$ _____	\$ _____
C-110.	4-1.25" HDPE/80	150	FT	\$ _____	\$ _____
C-133.	Cable 96 Fiber	3,225	FT	\$ _____	\$ _____
C-134.	Cable 144 Fiber	3,225	FT	\$ _____	\$ _____

TOTAL BID ALTERNATIVE "C"
(Total of all items C-1 through C-134)

TOTAL \$ _____

E. ALTERNATIVE "E" - City of Boulder Municipal Building

Alternative "E" provides for the placement of a 96 Fiber optic cable into the City Municipal Building utilizing existing conduit from a handhole located next to the Municipal Building. Also the construction of conduit, manholes and placement of 24 Fiber Optic cable from Canyon Boulevard north on 11 th. Street to Pine Street. Splicing and terminating of the 96 Fiber optic cable in the Municipal Building and the splicing of the 24 fiber optic cable to the 96 fiber in the handhole next to the municipal building. Provide unit prices for the items below as defined in the unit descriptions in the alternate "E" bid definitions.

	<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
E-2.	Trench Landscape	5	FT	\$ _____	\$ _____
E-3.	Cut & Res Conc. C& G	7	FT	\$ _____	\$ _____
E-4.	Trench Asphalt	948	FT	\$ _____	\$ _____
E-5.	Additional Asphalt	50	SQ FT	\$ _____	\$ _____
E-11.	Place Manhole 4' x 4'	4	EA	\$ _____	\$ _____
E-12.	Pull Fiber	220	FT	\$ _____	\$ _____
E-13.	Pull Fiber & Wire	1,948	FT	\$ _____	\$ _____
E-22.	Direct Bore 8-1.25" Cond.	520	FT	\$ _____	\$ _____
E-24.	Place 2" EMT Conduit	157	FT	\$ _____	\$ _____
E-27	Place Pull Box	2	EA	\$ _____	\$ _____
E-57	Intercept Existing Cond.	4	EA	\$ _____	\$ _____
E-66	Core Bore	1	EA	\$ _____	\$ _____
E-68	Cable Preparation	5	EA	\$ _____	\$ _____
E-69	Splice Fiber	216	EA	\$ _____	\$ _____
E-70	Mid Sheath Prep.	1	EA	\$ _____	\$ _____
E-71	Mobilization	1	LS	\$ _____	\$ _____
E-104.	Conduit 8- 1.25" /80	520	FT	\$ _____	\$ _____

E-105 Conduit 8- 1.25"/40	953	FT	\$ _____	\$ _____
E-114 Manholes 4' x 4'	4	EA	\$ _____	\$ _____
E-119 Splice Closures	3	EA	\$ _____	\$ _____
E-126 Patch Panel 96 Pos.	1	EA	\$ _____	\$ _____
E-128 Fiber Optic Pigtails	96	EA	\$ _____	\$ _____
E-130 Cable 24 Fiber	2,048	FT	\$ _____	\$ _____
E-133 Cable 96 Fiber	457	FT	\$ _____	\$ _____

TOTAL BID ALTERNATIVE "E"
 (Total of all items E-2 through E-133)

TOTAL \$ _____

F. ALTERNATIVE "F" - East Boulder Recreation Center

Alternative "F" provides for the construction of conduit, handholes and placement of 24 Fiber Optic placement form Baseline Road and 55 th Street south on 55 th Street to South Boulder Road and the placement of a 12 Fiber optic cable into the East Boulder Recreation Center. Provide unit prices for the items below as defined in the unit descriptions in the alternate "F" bid definitions.

	<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
F-1.	Trench Dirt	3,614	FT	\$ _____	\$ _____
F-2.	Trench Landscape	1,279	FT	\$ _____	\$ _____
F-3.	Cut & Res. Curb & Gutter	40	FT	\$ _____	\$ _____
F-4.	Trench Asphalt	1,820	FT	\$ _____	\$ _____
F-5.	Additional Asphalt	100	SQ FT	\$ _____	\$ _____
F-8.	Cut & Res. Sidewalk	48	SQ FT	\$ _____	\$ _____
F-10.	Place Handhole	9	FT	\$ _____	\$ _____
F-12.	Pull Fiber	40	FT	\$ _____	\$ _____
F-13.	Pull Fiber & Wire	8,781	FT	\$ _____	\$ _____
F-16.	Concrete Reinforcement	34	FT	\$ _____	\$ _____
F-21.	Direct Bore 4-1.25"	1,236	FT	\$ _____	\$ _____
F-57	Intercept Existing Cond.	1	EA	\$ _____	\$ _____
F-68	Cable Preparation	5	EA	\$ _____	\$ _____
F-69	Splice Fiber	30	EA	\$ _____	\$ _____
F-71	Mobilization	1	LS	\$ _____	\$ _____
F-108.	Conduit 4" PVC	52	FT	\$ _____	\$ _____
F-109	Conduit 4- 1.25"/40	7,006	FT	\$ _____	\$ _____
F-110	Conduit 4- 1.25"/80	1,216	FT	\$ _____	\$ _____

F-113 Handholes	9	EA	\$ _____	\$ _____
F-119 Splice Closures	2	EA	\$ _____	\$ _____
F-120 Patch Panel 12 Pos.	1	EA	\$ _____	\$ _____
F-128 Fiber Optic Pigtails	12	EA	\$ _____	\$ _____
F-129 Cable 12 Fiber	322	FT	\$ _____	\$ _____
F-130 Cable 24 Fiber	8,499	FT	\$ _____	\$ _____

TOTAL BID ALTERNATIVE "F"
 (Total of all items F-1 through F-130)

TOTAL \$ _____

CORPORATION

ATTEST:

Secretary

Corporation

President

Date

Address

City

State

ZIP

Telephone Number

FAX Number

PARTNERSHIP

Company Name

Company Partner

Date

Address

City

State

ZIP

Telephone Number

FAX Number

SOLE PROPRIETOR

Company Name

Individual

Date

Address

City

State

ZIP

Telephone Number

SECTION 01200

PROJECT MEETINGS

PART 1: GENERAL

1-1 Pre-Construction Conference:

A preconstruction conference will be held after Notice of Award and before the Notice to Proceed. The date, time and location will be determined after Notice of Award.

The conference shall be attended by:

- Contractor and Contractor's superintendent
- Architect/Engineer
- Project Manager
- Others as requested by the Contractor, City or Architect/Engineer

Unless previously submitted to the City, the Contractor shall bring to the conference a tentative schedule for the construction project, including shop drawings and other submittals.

The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda will include:

- Contractor's tentative schedule
- Transmittal, review, and distribution of Contractor's submittals
- Processing applications for payment
- Maintaining record documents
- Critical work sequencing
- Field decision and change orders
- Use of premises, office and storage areas, security, housekeeping, and City's needs
- Contractor's assignment for safety and first aid

The Project Manager will preside at the meeting and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

1-2 Construction Progress Meetings:

Progress meetings will be conducted weekly or at some other frequency, if approved by the Project Manager. These meetings shall be attended by the Project Manager, the Resident Project Representative, the Architect/Engineer, the Contractor's representative

and any others invited by these people.
The meeting will be conducted by the Project Manager and the Project Manager will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

The agenda of these project meetings will include construction progress, the status of submittal reviews, the status of information requests, critical work sequencing, review of strategies for connections into existing facilities, status of field orders and change orders, and any general business.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1: GENERAL

1-1 Requirements:

- A. Where required by the Specifications, the Contractor shall submit descriptive information that will enable the Project Manager to determine whether the Contractor's proposed materials, equipment, or methods of work are in general conformance to the design concept and in accordance with the Drawings and Specifications. The information submitted may consist of drawings, specifications, descriptive data, certificates, samples, test results, product data, and such other information, all as specifically required in the Specifications. In some instances, specified submittal information describes some, but not all, features of the material, equipment, or method of work. Features not requiring submittals shall be as specified.
- B. Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment, or method of work shall be as described in the submittal. The Contractor shall verify that all features of all products conform to the requirements of the Specifications and Drawings. The Contractor shall ensure that there is no conflict with other submittals and notify the Project Manager in each case where its submittal may affect the Work of another Contractor or the City. The Contractor shall ensure coordination of submittals among the related crafts and subcontractors.
- C. Submittals will be reviewed for overall design intent and returned to Contractor with action to be indicated by the Project Manager. It shall be the Contractor's responsibility to assure that previously accepted documents are destroyed when they are superseded by a resubmittal as such.
- D. It shall be the Contractor's responsibility to insure that required items are corrected and resubmitted. Any work done before approval shall be at the Contractor's own risk.

1-2 Submittal Procedure:

- A. Unless a different number is called for in the individual sections, three copies of each submittal and sample is required, all of which will be retained by the Project Manager. Contractor shall submit in addition, whatever copies he wants returned to him.
- B. Submittals that are related to or affect each other shall be forwarded simultaneously as a package to facilitate coordinated review. Uncoordinated submittals will be rejected.
- C. If the items or system proposed are acceptable but the major part of the individual drawings or documents are incomplete or require revision, the submittal will be returned with requirements for completion.
- D. The right is reserved for the Project Manager to require submittals in addition to those called for in individual sections.
- E. Submittals regarding material and equipment shall be submitted directly to the Project Manager and will be accompanied by a transmittal form. A separate form shall be used for each specific item, class of material, equipment, and items specified in separate, discrete Sections, for which the submittal is required. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole.
- F. A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted. Original submittal numbers shall have the following format: "XXX-Y;" where "XXX" is the originally assigned submittal number and "Y" is a sequential letter assigned for resubmittals (i.e., A, B, or C being the first, second, and third resubmittals, respectively). Submittal 25-B, for example, is the second resubmittal of Submittal 25. Submittals containing operating and maintenance information shall include the letters "O&M" following the submittal number.
- G. If the Contractor proposes to provide material, equipment, or method of work that deviates from the Contract Documents, it shall indicate so under "deviations" on the transmittal form accompanying the submittal copies.
- H. Submittals that do not have all the information required to be submitted, including deviations, are not acceptable and will be returned without review.

1-3 Review Procedure:

- A. Submittals are specified for those features and characteristics of materials, equipment,

and methods of operation that can be selected based on the Contractor's judgement of their conformance to the requirements of the Drawings and Specifications. Other features and characteristics are specified in a manner that enables the Contractor to determine acceptable options without submittals. The review procedure is based on the Contractor's guarantee that all features and characteristics not requiring submittals conform to the Drawings and Specifications. Review shall not extend to means, methods, techniques, sequences, or procedures of construction, or to verifying quantities, dimensions, weights or gages, or fabrication processes (except where specifically indicated or required by the Specifications) of a separate item, and as such, will not indicate approval of the assembly in which the item functions.

- B. Unless otherwise specified, within 14 calendar days after receipt of the submittal, the Project Manager shall review the submittal and return copies. The returned submittal shall indicate one of the following actions:
1. If the review indicates that the material, equipment, or work method complies with the Specifications, submittal copies will be marked "NO EXCEPTIONS TAKEN." In this event, the Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.
 2. If the review indicates limited corrections are required, copies will be marked "EXCEPTIONS AS NOTED." The Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in Operation and Maintenance data, a corrected copy shall be provided.
 3. If the review indicates that the submittal is insufficient or contains incorrect data, copies will be marked "REVISE AND RESUBMIT." Except at its own risk, the Contractor shall not undertake work covered by this submittal until it has been revised, resubmitted, and returned marked either "NO EXCEPTIONS TAKEN" or "EXCEPTIONS AS NOTED."
 4. If the review indicates that the material, equipment, or work method do not comply with the Specifications, copies of the submittal will be marked "REJECTED." Submittals with deviations that have not been identified clearly may be rejected. Except at its own risk, the Contractor shall not undertake the work covered by such submittals until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "EXCEPTIONS AS NOTED."

1-4 Shop Drawings:

- A. The term "shop drawings" includes drawings, diagrams, layouts, schematic, descriptive literature, illustrations, schedules, performance and test data, and similar

materials furnished by Contractor to explain in detail specific portions of the work required by the Contract.

- B. Contractor shall coordinate all such drawings, and review them for legibility, accuracy, completeness and compliance with contract requirements and shall indicate his approval thereon as evidence of such coordination and review. Shop drawings submitted to the Engineers without evidence of Contractor's approval will be returned for resubmission.
- C. Shop drawings shall be clearly identified with the name and project number of this contract, and references to applicable specification paragraphs and contract Drawings. When catalog pages are submitted, applicable items shall be clearly identified.
- D. Contractor shall stamp his approval on Shop Drawings prior to submission to the Project Manager as indication of his checking and verification of dimensions and coordination with interrelated items. Stamp shall read:

"(Contractor's Name) represents that we have determined and verified all field dimensions and measurements, field construction criteria, materials, catalog numbers, and similar data, and that we have checked with the requirements of the Specifications and Drawings, the Contract Documents, and General Conditions".

Marks on drawings by Contractor shall not be in red. Any marks by Contractor shall be duplicated on all copies submitted.

- E. If shop drawings show variations from contract requirements, Contractor shall describe such variations in writing, separate from the drawings, at time of submission. All such variations must be approved by the Project Manager. If Project Manager approves any such variations, he shall issue an appropriate Contract modification, except that, if the variation is minor and does not involve a change in price or in time of performance, a modification need not be issued.
- F. Should the Contractor propose any item on his Shop Drawings, or incorporate an item into the work, and that item should subsequently prove to be defective or otherwise unsatisfactory, (regardless of the Engineer's preliminary review), the Contractor shall, at his own expense, replace the item with another item that will perform satisfactorily.

1-5 Certificates:

For those items called for in individual sections, furnish three certificates of compliance from manufacturers or suppliers certifying that materials or equipment being furnished under the Contract comply with the requirements of these specifications.

1-6 Samples:

Samples shall be sufficient size to clearly illustrate functional characteristics and full range of color, texture, and pattern.

1-7 Effect of Review of Contractor's Submittals:

Review of Drawings, data, methods of work, or information regarding materials or equipment the Contractor proposes to provide, shall not relieve the Contractor of its responsibility for errors therein and shall not be regarded as an assumption of risks or liability by the Engineer or the City, or by any officer or employee thereof, and the Contractor shall have no claim under the Contract on account of the failure, or partial failure, of the method of work, material, or equipment so reviewed. A mark of "NO EXCEPTIONS TAKEN" or "EXCEPTIONS AS NOTED" shall mean that the City has no objection to the Contractor, upon its own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.

END OF SECTION

SECTION 01410

MATERIALS TESTING

PART 1: GENERAL

1-1 Requirements:

- A. Provide such equipment and facilities as are required for conducting field tests and for collecting and forwarding samples. Do not use any materials or equipment represented by samples until tests, if required, have been made and the materials or equipment found to be acceptable. Any product which becomes unfit for use after approval thereof shall not be incorporated into the work.
- B. Tests shall be made by an accredited testing laboratory selected by the City. Except as otherwise provided, sampling and testing of all materials and the laboratory methods and testing equipment shall be in accordance with the latest standards and tentative methods of the American Society for Testing Materials (ASTM).
- C. Where additional or specific information concerning testing methods, sample sizes, etc., is required, such information is included under the applicable sections of the Specifications. Any modification of, or elaboration on, these test procedures which may be included for specific materials under their respective sections in the Specifications shall take precedence over these procedures.

1-2 City's Responsibilities:

- A. The City shall be responsible for and shall pay all costs in connection with the following testing:
 - 1. Soil tests, except those called for under Submittals thereof.
 - 2. Tests not called for by the Specifications of materials delivered to the site but deemed necessary by Owner.
 - 3. Concrete tests, except those called for under submittals thereof.
 - 4. Pavement tests.

1-3 Contractor's Responsibilities:

- A. In addition to those inspections and tests called for in the General Conditions, Contractor shall also be responsible for and shall pay all costs in connection with testing required for the following:
 - 1. Concrete materials and mix designs.

2. Design of asphalt mixtures.
3. Gradation tests for embedment, fill and backfill materials.
4. All performance and field testing specifically called for by the specifications.
5. All retesting for work or materials found defective or unsatisfactory, including tests covered under 1-2 above.

1-4 Transmittal of Test Reports:

Written reports of tests and engineering data furnished by Contractor for Engineer's review of materials and equipment proposed to be used in the work shall be submitted as specified for Shop Drawings.

The testing laboratory retained by the City will furnish three copies of a written report of each test performed by laboratory personnel in the field or laboratory. Two copies of each test report will be transmitted to the Resident Project Representative and one copy to Contractor within three days after each test is completed.

END OF SECTION

SECTION 01510

TEMPORARY FACILITIES

PART 1: GENERAL

1-1 Office at the Work Site:

During the performance of this Contract, the Contractor shall maintain a suitable office at or near the site of the Work which shall be the headquarters of his representative authorized to receive drawings, instructions, or other communication or articles. Any communication given to the said representative or delivered at Contractor's office at the site of the Work in his absence shall be deemed to have been delivered to Contractor.

Copies of the drawings, specifications, and other Contract Documents shall be kept at the Contractor's office at the site of the Work and available for use at all times.

1-2 Water:

Water in reasonable amounts required for and in connection with the work to be performed may be furnished at existing fire hydrants by the City at the request of the Contractor. Contractor shall furnish necessary pipe, hose, nozzles, and tools and shall perform all necessary labor. The Contractor shall obtain from the City Water Department a hydrant water meter (\$1200 deposit required) to be installed on the fire hydrant being used for water. Contractor shall make arrangements with the City Water Department (who will fix the time, rate, and duration of each withdrawal from the distribution system) as to the amount of water required and the time when the water will be needed. Unnecessary waste of water will not be tolerated. Special hydrant wrenches shall be used for opening and closing fire hydrants. In no case shall pipe wrenches be used for this purpose.

1-3 Power:

Power for heating, lighting, operation of Contractor's plant or equipment, or for any other reasonable use by Contractor will be furnished by the Contractor. The Contractor shall furnish necessary cable and connections and shall perform all necessary labor. Temporary heat and lighting shall be maintained until the Work is accepted.

1-4 Telephone Service:

The Contractor shall make all necessary arrangements and pay all installation charges for telephone lines in his offices at the site and a separate telephone line in the office of the Resident Project Representative and shall provide all telephone instruments.

The telephone service and instrument in the office of the Resident Project Representative shall be a touch-tone system if locally available. The telephone service shall be in the name of the Engineer, and all charges after installation shall be billed to and paid by the Resident Project Representative.

1-5 Sanitary Facilities:

The Contractor shall furnish temporary sanitary facilities at the site, as provided herein, for the needs of all construction workers and others performing work or furnishing services on the Project.

Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 men. The Contractor shall enforce the use of such sanitary facilities by all personnel at the site.

1-6 Damage to Existing Property:

The Contractor will be held responsible for any damage to existing structures, work, materials, or equipment because of his operations and shall repair or replace any damaged structures, work, materials, or equipment to the satisfaction of, and at no additional cost to, the City.

The Contractor shall protect all existing structures and property from damage and shall provide bracing, shoring, or other work necessary for such protection.

The Contractor shall be responsible for all damage to streets, roads, curbs, sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property, which may be caused by transporting equipment, materials, or men to or from the work. Contractor shall make satisfactory and acceptable arrangements with the agency having jurisdiction over the damaged property concerning its repair or replacement.

1-7 Security:

The Contractor shall be responsible for protection of the site, and all work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons.

No claim shall be made against the City by reason of any act of an employee or trespasser, and the Contractor shall make good all damage to the City's property resulting from his failure to provide security measures as specified.

Security measures shall be at least equal to those usually provided by the City to protect its existing facilities during normal operation, but shall also include such additional security fencing, barricades, lighting, and other measures as required to protect the site.

END OF SECTION
SECTION 01560

ENVIRONMENTAL CONTROLS

PART 1: GENERAL

1-1 Description:

The work of this section consists of providing environmental controls.

PART 2: MATERIALS

2-1 Dust Control:

Dust control agents may be necessary in addition to wetting down with water. Dust control agents may be used only after prior approval by the City.

PART 3: EXECUTION

3-1 Dust Control Application:

- A. The Contractor shall execute Work by methods to minimize raising dust from construction operations.
- B. The Contractor shall provide and apply dust control at all times, including holidays and weekends, as required to abate dust nuisance on and about the site that is a direct result of construction activities. The use of chemicals, oil, or similar palliatives will not be allowed. The Contractor shall be required to provide sufficient quantities of equipment and personnel for dust control sufficient to prevent dust nuisance on and about the site.
- C. The City will have authority to order dust control Work whenever in its opinion it is required, and there shall be no additional cost to the City. The Contractor shall be expected to maintain dust control effectively whether the Owner or Engineer specifically order such Work.

3-2 Preservation of Natural Features:

Confine operations as much as possible. Exercise special care to maintain natural surroundings in an undamaged condition. Within the work limits, barricade trees, rock outcroppings, and natural features to be preserved. Do not remove, injure, or destroy trees or other plantings without prior approval. Do not fasten ropes, cables or guys to existing trees

for anchorage. Restore or replace damaged trees and shrubs or natural features as nearly as possible to original condition at no additional expense to City. The City shall determine if restoration or replacement is required.

3-3 Housekeeping:

- A. Keep project neat, orderly, and in a safe condition at all times. Store and use equipment, tools, and materials in a manner that does not present a hazard. Immediately remove all hazardous rubbish. Do not allow rubbish to accumulate. Provide on-site containers for collection of rubbish and dispose of it at frequent intervals during progress of work. When excavations are made and if suitable, immediately utilize resultant earth with filling and compacting in place, or dispose of unsuitable materials off-site.
- B. Wet down dry materials and rubbish to prevent blowing dust.
- C. Keep volatile wastes in covered containers.

3-4 Disposal:

- A. Disposal of Waste (Unsuitable) Materials: All material determined by the Project Manager to be waste will be disposed of in approved landfill in a manner meeting all regulations. Dispose of waste materials, legally, at public or private dumping areas. Do not bury wastes inside of the limits of construction.
- B. Disposal of Garbage and other Construction Materials: Provide sanitary containers/dumpsters and haul away contents such that no overflow exists.
- C. Excess excavation shall become the property of the Contractor and shall be legally disposed of by him outside the limits of construction. Excess sand, and excess excavated material not used on-site shall be hauled from the site to an approved disposal site. Excess excavated material suitable for backfill shall not be disposed of until all backfill operations are complete.
- D. Immediately remove any hazardous materials.
- E. All salvaged materials become the property of the City unless the Project Manager deems the material to be waste. The Contractor shall haul salvaged material to the location designated by the Project Manager.

3-5 Burning:

No burning of debris will be permitted.

3-6 Air and Water Pollution Control:

- A. Take all necessary reasonable measure to reduce air and water pollution by any material or equipment used during construction. Blowing dust and airborne particulates shall be controlled and utilized agents, if approved by Project Manager, shall be applied in accordance with manufacturer's recommendations.
- B. Do not dispose of volatile wastes or oils in storm or sanitary drains, nor allow such materials to reach drainageways.
- C. Do not allow waste materials to be washed into streams or bodies of water.
- D. Do not allow fill materials to be washed downstream.

3-7 Erosion Control:

- A. Prevent erosion and sedimentation. Plan and execute construction to control surface drainage from cuts and fills, and from borrow and waste disposal areas.
- B. Minimize amount of bare soil exposed at any one time.
- C. Sod or seed slopes as specified as soon as possible to prevent water pollution, erosion and/or deposition of earth into drainageways or streams.
- D. Construct fill-in waste areas by selectively placing fill material to avoid erosion of surface silts or clays.
- E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

3-8 Fire Prevention and Protection:

- A. Hazard Control: Take all necessary precautions to prevent fire during construction. Provide adequate ventilation during use of volatile or noxious substances.
- B. Spark Arresters: Equip all gasoline or diesel powered equipment used in potential grass fire locations with spark arresters approved by the U.S. Forest Service.
- C. Locate internal combustion equipment so that exhausts discharge well away from combustible materials.
- D. Locate service areas a minimum of 100 feet from buildings. Shut down equipment before refueling.

- E. Smoking: Smoking within buildings or temporary storage sheds is prohibited. Smoking in potential grass fire locations shall be prohibited.
- F. Welding: Cutting by torch or welding shall be performed only when adequate fire protection is provided and maintained for the duration of the work in the area of operations.
- G. Familiarize all work crews with grass fire potential and methods of reporting fires to the proper authorities. Take immediate action with sufficient personnel from the project crew or with tools and equipment to suppress fires.

3-9 Water Control:

- A. The Contractor shall conduct his operation in such a manner that storm or other waters may proceed uninterrupted along their existing drainage courses. By submitting a bid, the Contractor acknowledges that he has investigated the risk arising from such waters and has prepared his bid accordingly, and assumes all of said risk.
- B. The Contractor is responsible for all groundwater level control.

3-10 Noise Control:

All mechanical equipment shall be equipped with the best available mufflers to reduce noise. The Contractor shall be responsible for obtaining all necessary permits and shall limit noise to the permitted levels. Noise level monitoring shall be performed by the Contractor as necessary to show that the permitted levels are not being exceeded.

END OF SECTION

SECTION 01570

TRAFFIC REGULATION

PART 1: GENERAL

1-1 Requirements:

The Contractor shall follow the traffic requirements of the MUTCD Manual, for signage, barricades, cones, flagging and traffic control.

1-2 Work Hours:

No work shall be performed nor shall any traffic lane be closed to traffic during the hours of 7:00 a.m. to 8:00 a.m. or 4:30 p.m. to 6:00 p.m. on streets designated collector or greater including:

- o Table Mesa Drive
- o Broadway
- o 27 th Way
- o Colorado Ave.
- o Arapahoe Ave.
- o 30th St.
- o Pearl St.
- o Canyon Blvd.
- o Valmont RD..
- o Folsom St.
- o 28th St.

without the approval of the Project Manager. Construction hours may be further restricted by the City to minimize construction impacts on traffic flow along arterial and collector roadways, or to address environmental and safety concerns. No work can take place on the road system if the road is wet, icy, snow packed, foggy, cloud covered, or if there is not enough light to safely work the area.

Work hours for all other locations shall be as required in Section 404 of the General Conditions.

1-3 Road Closures:

- A. Traffic: Access, maintenance and emergency traffic shall not be disrupted by construction operations. If a temporary lane closure is necessary along any thoroughfare, the Contractor shall obtain any permits required for such activity

from the appropriate jurisdictional agency in advance of the work.

- B. All roads shall be open to at least one lane of traffic at all times. For one lane activities, properly equipped radio controller, state certified flaggers will be required. No open trenches shall be allowed overnight. If explosives are used, road closures both ways can occur; however, the closure can last no more than 5 minutes. If this is not a sufficient amount of time for a closure, the Contractor shall notify the Project Manager.

1-4 Traffic Control:

Traffic control and barricading is the responsibility of the Contractor and shall be done in accordance with the City of Boulder's Work Area Traffic Control and Safety Handbook and the most recent additions of the MUTCD. All traffic control and barricading shall be maintained on a daily basis by the Contractor. Failure to maintain all traffic control shall cause Contractor operations to be suspended until all traffic control devices are installed and operating correctly in accordance with the approved traffic control plan. Work in the City streets, county roads and State Highways ROW shall require a traffic control plan. This plan shall meet the requirements of the city, County and State. No work shall commence until this plan has been submitted to and approved by the appropriate agency. The traffic control plan shall be prepared by an ATSSA certified traffic control engineer.

END OF SECTION

SECTION 01600

MATERIAL DELIVERY, STORAGE AND HANDLING

PART 1: GENERAL

1-1 General:

Equipment, products and materials shall be shipped, handled, stored, and installed in ways which will prevent damage to the items. Damaged items will not be permitted as part of the work except in cases of minor damage that have been satisfactorily repaired and are acceptable to the Project Manager.

1-2 Conduit:

Conduit and appurtenances shall be handled, stored, and installed as recommended by the manufacturer. Conduit shall be stored to protect it from physical damage or other deterioration. Conduit shipped with interior bracing shall have the bracing removed only when recommended by the manufacturer.

1-3 Fiber Optic Cable:

The fiber optic cable shall be handled, stored, and installed as recommended by the manufacture.

The fiber optic cable shall be stored to protect it from physical damage and reels shipped with protective wrappings shall have the wrapping removed only if access is required for testing the cable; or it is to be pulled into the conduit system.

1-4 Equipment:

- A. **PACKAGING AND MARKING:** All equipment shall be protected against damage from moisture, dust, handling, or other cause during transport from manufacturer's premises to site.
- B. **SHIPPING:** Equipment damaged during shipping shall be promptly replaced or corrected to conform to the requirements of the contract before the assembly is incorporated into the work. The contractor shall bear all costs arising out of such replacement or corrections including any necessary dismantling, inspection, repair, and reassembly.
- C. **STORAGE:** During the interval between the delivery of equipment to the site and installation, all equipment shall be stored in an enclosed space affording protection from weather, dust, and mechanical damage and providing favorable temperature, humidity, and ventilation conditions to ensure against equipment

deterioration. Manufacturer's recommendations shall be adhered to in addition to these requirements.

**END OF SECTION
SECTION 01640**

SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1: GENERAL

1-1 Description:

A. General:

1. This section describes the procedure required by the Contractor for product substitutions.

B. Requests for substitution -- General:

1. Base all bids on materials, equipment and procedures specified.
2. Certain types of equipment and kinds of material are described in specifications by means of trade names and catalog numbers, and/or manufacturer's names. Where this occurs, it is not intended to exclude from consideration such types of equipment and kinds of material bearing other trade names, catalog numbers and/or manufacturer's names, capable of accomplishing purpose of types of equipment or kinds of material specifically indicated.
3. Other types of equipment and kinds of material may be acceptable to the City and Engineer.
4. Types of equipment, kinds of material and methods of construction, if not specifically indicated must be approved in writing by Engineer and the City.

C. Submission of requests for substitution:

1. After Notice to Proceed, the City will consider written requests for substitutions of products, materials, systems or other items.
2. Engineer reserves the right to require substitute items to comply color and pattern-wise with base specified items, if necessary to secure "design intent."

3. Submit three copies of request for substitution. Include in request:

- a. Complete data substantiating compliance of proposed substitution with Contract Documents.
 - b. For products:
 - (1) Product identification, including manufacturer's name.
 - (2) Manufacturer's literature, marked to indicate specific model, type, size, and options to be considered: Product description. Performance and test data, Reference standards. Difference in power demand. Dimensional differences for specified unit.
 - (3) Name and address of similar projects on which product was used, date of installation, and field performance data:
 - c. For construction methods:
 - (1) Detailed description of proposed method.
 - (2) Drawings illustrating methods.
 - d. Itemized comparison of proposed substitution with product or method specified.
 - e. Data relating to changes in construction schedule.
 - f. Relation to separate contracts.
 - g. Accurate cost data on proposed substitution in comparison with product or method specified.
4. In making request for substitution, or in using an approved substitute item, Supplier/Manufacturer represents:
- a. He has personally investigated proposed product or method, and has determined that it is equal or superior in all respects to that specified, and that it will perform function for which it is intended.
 - b. He will provide same guarantee for substitute item as for product or method specified.
 - c. He will coordinate installation of accepted substitution into work, to include building modifications if necessary, making such changes as may be required for work to be complete in all respects.
 - d. He waives all claims for additional costs related to substitution

which subsequently become apparent.

D. Substitutions:

1. Request sufficiently in advance to avoid delay in construction.

E. Contractor's option:

1. For products specified only by reference standards, select any product meeting standards, by any manufacturer, indicate selected type in submission.
2. For products specified by naming several products or manufacturers, select any product and manufacturer named, indicate selected type in submission.
3. For products specified by naming one or more products, but indicating option of selecting equivalent products by stating "or equal" after specified product, Contractor must submit request, as required for substitution, for any product not specifically named.

F. Rejection of substitution or optional items:

1. Substitutions and/or options will not be considered if:
 - a. They are indicated or implied on shop drawings, or project data submittals, without formal request submitted in accordance with this section.

END OF SECTION

SECTION 01720

RECORD DRAWINGS

PART 1: GENERAL

1-1 Requirements:

The Contractor shall provide the Project Manager one neatly and legibly marked set of red line drawings showing the final location of all improvements. Marking of the drawings shall be kept current and shall be done at the time the materials and equipment are installed. These drawings shall be available to the Project Manager.

One set of red line full-size record drawings shall be provided to the Project Manager prior to submitting progress payments for amounts in excess of 95 percent of the project's total cost.

The City shall have the right to withhold progress payments if record drawings are not kept current or do not meet the submittal requirements of this section.

END SECTION

DIVISION 2 - REQUIREMENTS

SECTION 02200 EXCAVATION AND TRENCHING.....	02200-1
SECTION 02513 HOT BITUMINOUS PAVEMENT.....	02513-1
SECTION 02515 MANHOLES	02515-1
SECTION 02516 HANDHOLES	02516-1
SECTION 02520 SIDEWALK, CURB AND GUTTER.....	02520-1
SECTION 02580 TELECOMMUNICATIONS CONDUIT	02580-1
SECTION 02581 CONDUIT EMT	02581-1
SECTION 02582 PULL BOXES.....	02582-1

DIVISION 2 - SITE WORK

SECTION 02200

EXCAVATION AND TRENCHING

PART 1: GENERAL

1-1 Description:

This section covers excavation work and shall include the necessary clearing, grubbing, and preparation of the site; removal and disposal of all debris; stripping and stockpiling topsoil; excavation and trenching as required; the handling, storage, transportation, and disposal of all excavated material; all necessary sheeting, shoring, and protection work; preparation of subgrades; pumping and dewatering as necessary or required; protection of adjacent property; backfilling; pipe embedment; construction of fills and embankments; surfacing and grading; and other appurtenant work.

1-2 Submittals:

Samples of all materials specified in this section shall be submitted to the Project Manager in accordance with Section 01300. The quantity of material samples required will be specified by the Project Manager. Where gradations or other material properties are specified, information certifying these properties shall also be submitted. All gradation and samples of materials submitted must be approved by the Project Manager before incorporated into the work.

1-3 Reference Standards:

American Association of State Highway and Transportation Officials (AASHTO), American Society for Testing and Materials (ASTM), Colorado Department of Transportation (CDOT) Standard Specifications for Road and Bridge Construction.

1-4 Safety:

With reference to the terms and conditions of the construction standards for excavations set forth in the OSHA "Safety and Health Regulations for Construction", Chapter XVII of Title 29, CFR, Part 1926, the Contractor shall employ a competent person and, when necessary, a registered professional engineer, to act upon all pertinent matters of the work of this section.

1-5 Quality Assurance:

All tests required for preliminary review of materials shall be made by an acceptable independent testing laboratory at the expense of the Contractor. Two initial gradation tests shall be made for each type of pipe bedding, fill, or backfill material, and one additional gradation test shall be made for each additional 500 tons of each material. Initial moisture-density (Proctor) tests and relative density tests on the materials, and all in-place field density tests, shall be made at the expense of the City. Retests of samples failing initial tests shall be at the expense of the Contractor.

Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.

Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the Project Manager. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill, fill, or embankment.

PART 2: MATERIALS

2-1 General:

All bedding and backfill material shall have the approval of the Project Manager and shall be included in the unit price for the pipe unless otherwise specified and indicated in the Proposal. All bedding and backfill material shall be free of frozen material, organic material and debris.

2-2 Pipe Bedding:

Pipe bedding shall be flowable fill as specified in Section 2-7.

2-3 Manhole and Handhole Bedding:

A. Granular Bedding Material. Granular bedding material shall consist of washed chips, nominal size 3/8" meeting the following gradation:

Sieve Size	Percent Passing by Weight
1/2-inch	100
3/8-inch	85-100
No. 4	10-30
No. 8	0-10
No. 16	0-5

Bedding material must cover the entire bottom excavation to a depth of 2" to 3" deeper than required, to bring frame and cover to grade with grout or gasket

2-4 Trench Backfill:

Trench backfill refers to material placed above the pipe bedding and shall flowable fill as specified in Section 2-7 for all paved areas; or granular backfill material as specified in Section 2-8 for other landscaped and dirt areas.

2-5 Stabilization Material:

Stabilization material shall be placed on suitably prepared subgrades and compacted by vibration. Stabilization material shall be crushed rock or gravel; shall be free from dust, clay, or trash; and shall be graded 1-1/2 inch to No. 4 as defined in ASTM C33 and shall be compacted to not less than 70 percent relative density as determined by ASTM D4253 and D4254.

2-6 Groundwater Barrier Material:

Groundwater barrier material shall meet AASHTO soil classification SC or CL, free from stones, organic material or debris or flowable fill as specified in Section 2-7.

2-7 Flowable Fill:

Flowable fill shall meet the following requirements and shall be used for trench backfill when specified in the contract or by the Project Manager, or as a groundwater barrier.

<u>Ingredients</u>	<u>Lbs./C.Y.</u>	<u>Kg/m³</u>
Cement	50	30
Coarse Aggregate (AASHTO No. 57 or 67)	1700	1009
Fine Aggregate (AASHTO M 6)	1845	1095
Water (39 Gallons) (147 L)	325 (or as needed)	193 (or as needed)

The amount of water shall be such that the flowable fill flows into place properly without excessive segregation. Approximately 39 gallons of water per cubic yard (193 L per m³) of flowable fill is normally needed.

The contractor may use aggregate which does not meet the above specifications if the cement is increased to 100 pounds per cubic yard (lbs./C.Y.) (60 kg./m³) and the aggregate conforms to the following gradation:

<u>Sieve Size</u>	<u>% Passing</u>
1 inch (25.0 mm)	100
No. 200	0 - 10

The contractor may substitute 30 lbs./C.Y. (18 kg/m³) of cement and 30 lbs./C.Y. (18 kg/m³) of fly ash for 50 lbs./C.Y. (30 kg/m³) of cement or may substitute 60 lbs./C.Y. (36 kg/m³) of cement and 60 lbs./C.Y. (36 kg/m³) of fly ash for 100 lbs./C.Y. (60 kg/m³) of cement.

The City reserves the right to review the use of recycled broken glass (glass cullet) as part or all of the aggregate. Proposed mix design must be submitted in accordance with Section 01300, Submittals.

Compaction of flowable fill shall be done by means of vibration. The flowable fill shall be vibrated until the fill has lost sufficient moisture to be walked on without indenting more than 2 inches (50 mm).

The maximum depth of trench in which flowable fill may be used shall be 3 feet (1 m). With trench depths greater than 3 feet, a combination of backfill materials may be used. An aggregate base course material, compacted by traditional methods and equipment, may be used for depths exceeding the flowable fill limits, and topped off with a flowable fill cap of 3 feet in depth. The flowable fill shall be placed so that it heaps over the top edge of the trench.

This is required so that, when the fill is vibrated, the excess water can rise to the surface and flow away from the trench. Any damage resulting from the placing of the flowable fill, or from not providing sufficient consolidation shall be repaired at the contractor's expense.

2-8 Granular Backfill Material:

Granular backfill material shall be an imported graded material meeting the 57/67 size requirements of ASTM C33 or the requirements for stabilization material as specified in Section 2-4.

If approved by the Project Manager, granular backfill material may be finely divided job excavated material free from debris, rubbish, clods, roots, brush, frozen lumps of earth, organic material and stones larger than 6 inches and with no more than 50 percent by weight passing the No. 200 sieve.

PART 3: EXECUTION

3-1 Working Conditions:

Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the Project Manager. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill, fill, or embankment.

3-2 Site Preparation:

All sites to be occupied by permanent construction or embankments shall be cleared of all logs, trees, roots, brush, tree trimmings, and other objectionable materials and debris. All stumps shall be grubbed. Subgrades for fills and embankments shall be cleaned and stripped of all surface vegetation, sod, and organic topsoil. All waste materials shall be removed from the site and disposed of by and at the expense of the Contractor.

In natural areas where excavation will occur, strip all topsoil, or in the absence of topsoil, strip the top 6 inches of surface material and store separately from other excavated materials.

For concrete walks, roadways, parking areas and road crossings, cut existing pavement full depth to a true line before excavation.

3-3 Classification of Excavated Materials:

No classification of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work, regardless of the type, character, composition, or condition thereof.

3-4 Unauthorized Excavation:

Except where otherwise authorized, indicated, or specified, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations shall be replaced, by and at the expense of the Contractor, with concrete placed at the same time and monolithic with the concrete above.

3-5 Stabilization of Subgrades:

Subgrades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen.

Subgrades for concrete structures or trench bottoms which are otherwise solid, but which

become mucky on top due to construction operations, shall be reinforced with crushed rock or gravel. The stabilizing material shall be spread and compacted to a depth of not more than four inches; if the required depth exceeds four inches, the material shall be furnished and installed as specified for stabilization material. The finished elevation of stabilized subgrades shall not be above subgrade elevations indicated on the drawings.

3-6 Blasting:

Blasting or other use of explosives for excavation will not be permitted.

3-7 Shoring:

As needed, all excavations shall be properly sheeted and braced to meet Federal, State and local laws in regard to safe working conditions. The shoring shall be arranged so as not to place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide ample strength. Any damage to pipes or structures resulting from settlements, heaving, water or earth pressures, slides, caving, or other causes, due to lack of shoring, sheeting, or bracing, or due to failure of shoring, or due to improper shoring, or due to any other negligence on the part of the Contractor, shall be repaired by the Contractor at his own expense.

Shoring shall be removed as the work progresses, unless left in place by written order of the Project Manager. The Contractor will be paid for shoring so ordered left in place on the basis of invoice material cost only. Trench sheeting shall not be pulled before backfilling unless the pipe strength is sufficient to carry trench loads based on trench width to the back of sheeting, nor shall sheeting be pulled after backfilling. Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

3-8 Water Control and Dewatering:

Dewatering equipment shall be provided to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level beneath such excavations 12 inches or more below the bottom of the excavation.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

The Contractor shall be responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipe or conduit shall be left clean and free of sediment.

3-9 Trench Excavation:

Trenches shall be excavated so that pipes can be laid in accordance with the profiles, grades, elevations and minimum cover as shown on the drawings or specified herein. No trenches or excavation shall be left open after working hours.

- A. Excavation in Streets and Other Paved Surfaces. The excavation in streets with asphalt paving must be confined to a minimum width as required to maintain a safe trench condition. The pavement shall be cut vertical and on a straight line.
- B. Trench Preparation. The trench shall be excavated only so far in advance of conduit laying as permitted by the Project Manager. The trench wall shall be so braced that the workmen may work safely and efficiently. All trenches shall be drained so that conduit laying may take place in unwatered conditions. Trench preparation shall also conform to the details shown on the Drawings.

3-10 Installation of Trench Backfill:

Unless accurate results cannot be obtained, the compaction requirements shall conform to maximum dry density according to ASTM D698, Moisture-Density Relations of Soils (Standard Proctor). When the ASTM D698 test is not applicable, the percentage compaction requirements shall conform to ASTM D2049 Test for Relative Density of Cohesionless Soils.

When required by the Project Manager the Contractor shall excavate backfilled trenches for purposes to perform compaction tests at locations and depths determined by the Project Manager. The Contractor shall be responsible for reinstalling and compacting the test excavations at no additional cost to the City.

All backfill above the bedding installation shall be carefully placed and compacted. Compaction shall be achieved with mechanical equipment suitable for the material being compacted, in 8-inch maximum loose lifts. Tamping equipment such as "hydro-hammer" or "drop-hammer" that creates excessive vibration outside of the area being compacted shall not be used in areas adjacent to existing structures and utilities. All compaction means must be approved in writing by the Project Manager. All backfill shall be compacted to 95% of maximum laboratory dry density or 70 percent relative density. The material shall be within 2.0 percent of optimum moisture content.

The Contractor may request approval of alternate means of compaction. Such request must be submitted to the Project Manager in writing. Approval of the compaction method will be made by the Project Manager only in writing. Use of specified or approved compaction

methods does not relieve the Contractor from providing a complete project meeting the intent of this Specification.

3-11 Storage of Excavated Material:

Excavated material shall be stockpiled near the immediate construction area in a confined configuration. For storage of excess excavated material suitable for backfill, Contractor shall obtain and pay for a storage site. All transportation to and from (including loading) storage site and temporary land/site acquisition is included in the work.

All excess excavated material at the completion of the work and all debris, stones, logs, stumps, roots, and other unsuitable materials shall be removed from the site and disposed of by, and at the expense of, the Contractor.

3-12 Restoration:

- A. Streets and Roadways. Any pavements disturbed during construction shall be repaired in accordance with Detail Drawings and Specifications Section 02513 for Aggregate Base Course, Bituminous Prime Coat and Hot Bituminous Pavement.

All streets and paved surfaces shall be restored within two (2) weeks of their excavation. All dirt and debris, including dust shall be removed from streets and paved surfaces within three (3) days of the restoration of streets and paved surfaces. Initial removal of dirt and debris shall be made using a vacuum sweeper, after which the paved surfaces shall be cleaned using water hoses.

- B. Concrete Walks, Curb and Gutter, Fencing and Culverts. Restore all existing structures to conditions equal to or exceeding existing structures and according to local requirements.

- C. Landscape. After other outside work has been finished, and backfilling and embankments completed and settled, all areas which are to be graded shall be brought to grade at the indicated elevations, slopes, and contours. All cuts, fills, embankments, and other areas which have been disturbed or damaged by construction operations shall be surfaced with topsoil to a depth of at least 4 inches. Topsoil shall be of a quality at least equal to the existing topsoil in adjacent areas, free from trash, stones, and debris, and well suited to support plant growth.

Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and equivalent to hand work. All surfaces shall be graded to secure effective drainage. Unless otherwise indicated, a slope of at least one percent shall be provided.

Final grading and surfacing shall be smooth, even, and free from clods and stones larger than one inch in greatest dimension, weeds, brush, and other debris.

The top portion of backfill beneath established lawn areas shall be finished with at least 12 inches of topsoil corresponding to, or better than, that underlying adjoining lawn areas.

- D. Other Items. The Project Manager will clarify restoration of other minor items as construction proceeds. Such items must be restored to equal or exceed existing conditions.

3-13 Cleanup:

Prior to final inspection and acceptance, the Contractor shall remove all rubbish and excess materials and leave area in a neat, satisfactory condition.

3-14 Maintenance of Backfill:

All backfill shall be maintained in a satisfactory condition and all places showing signs of settlement shall be filled and maintained during the life of the Contract and for a period of two years following the date of final acceptance of all work performed under the Contract. When the Contractor discovers or is notified by the City that any backfill is not in compliance with the provision of this Contract, the Contractor shall correct such conditions. Any utilities and road surfacing damaged by such settlement shall be repaired by the Contractor to the satisfaction of the City. In addition, the Contractor shall be responsible for the cost to the Owner of all claims for damages due to settlement of backfilled areas.

END OF SECTION

SECTION 02513

HOT BITUMINOUS PAVEMENT

PART 1 - GENERAL

1-1 Scope:

This section covers new and replacement hot bituminous pavement, base course and subgrade preparation.

1-2 Governing Standards:

Except as otherwise specified or indicated herein, materials, equipment, details, and construction methods shall comply with the latest edition of the State Department of Transportation, Division of Highways, State of Colorado, Standard Specification for Road and Bridge Construction (CDOT).

1-3 Submittals:

Information certifying the materials meet the specification requirements shall be submitted to the Project Manager in accordance with Section 01300. Information shall include, but shall not be limited to, the following:

- Gradation and moisture-density curves for aggregate base course
- Hot bituminous pavement job-mix formula and gradations
- Marshall test results of job-mix formula
- Maximum density of laboratory specimen of job-mix formula
- Certificate of Compliance and certified analysis of all bituminous materials
- Hydrated lime content
- Percentage of wear test results
- Deleterious material test results

PART 2: MATERIALS

2-1 Materials:

The sources of materials shall be acceptable to the Project Manager. Except as modified herein, materials shall conform to the requirements of the sections of the governing specifications stipulated herein. In case of conflicts between this section and the governing specifications, the requirements of this section shall govern.

Aggregate Base Course

Section 304

Aggregate

Section 703, Class 6

Hot Bituminous Surface Course

Aggregate

Section 703

Bituminous Materials

Section 702, AC-10. Grade and type as stated in the AASHTO Standard Specifications for Viscosity Graded Asphalt Cement M226, Table 1, current edition.

Tack Coat

Emulsified asphalt conforming to AASHTO M140 or M208 and diluted one part water to one part asphalt emulsion, CSS1-h.

2-2 Hot Bituminous Pavement:

The hot bituminous pavement shall be hot mixed at a central plant. It shall consist of mineral aggregates, uniformly mixed with asphalt cement and laid upon the prepared base to the finished thickness as specified herein.

One percent hydrated lime by weight of the combined aggregate shall be added to the aggregate. The following Marshall Design Criteria shall be used to establish the design mix:

TABLE 02513-1
MARSHALL DESIGN CRITERIA

Design Method	Laboratory Compaction	Street Classification
Marshall Method, ASTM D 1559 Asphalt Institute MS-2	50 blows per side	Local, Collector, & Minor Arterial
Marshall Method, ASTM D 1559 Asphalt Institute MS-2	75 blows per side	Major Arterial and Greater

The design mix for hot bituminous pavement shall conform to the following:

PROPERTY	TEST METHOD	VALUE
Voids, Percent	MS-2 AASHTO T269	3-5
Stability, Minimum	MS-2 AASHTO T245	1800
Flow (0.01")	MS-2 AASHTO T245	8-16
Aggregate retained on the No. 4 Sieve with at least 2 Fractured Faces % Min.	CP-45	70
Accelerated Moisture Susceptibility Tensile Strength Ratio (Lottman) Min.	AASHTO T283	80
Minimum Dry Split Tensile Strength, PSI	AASHTO T283	30
Voids in Mineral Aggregate, VMA, % Min.	MS-2	See Table 403-2
Grade of Asphalt Cement		AC-10

TABLE 02513-2
 MINIMUM VOIDS IN THE MINERAL AGGREGATE
 (VMA)

Nominal Maximum Size*, Inches (mm)**	Design Air Voids **		
	3.0%	4.0%	5.0%
1-1/2 (37.5)	10	11	12
1 (25.0)	11	12	13
3/4 (19.0)	12	13	14
1/2 (12.5)	13	14	15
3/8 (9.5)	14	15	16
* The Nominal Maximum Size is defined as one sieve larger than the first sieve to retain more than 10%. ** Interpolate specified VMA values for design air voids between those listed.			

The aggregate from individual sources shall have a percentage of wear of not more than 40 when tested in accordance with AASHTO T96 after 500 revolutions. The aggregate from individual sources shall contain no more than 1 percent deleterious material including clay lumps, vegetable matter, friable particles and other deleterious substances tested in accordance with AASHTO T112. The aggregate shall meet the sodium or magnesium sulfate test in accordance with AASHTO M29.

Design mixes for hot bituminous pavement, based upon the aggregates to be furnished, shall be determined by an independent testing laboratory at the expense of the Contractor and submitted to the Project Manager for review. The design mixes shall include gradations, the percentage of asphalt cement to be used per unit weight of dry aggregate, and properties listed in Table 02513-1. The design mixes, upon acceptance by the Project Manager, shall be the basis for the field mixes to be used in asphalt pavement construction hereunder.

The addition of any recycled material must be approved by the Project Manager prior to use in any asphalt mix. Mixes including recycled material must meet all specifications. No more than 10 percent recycled material shall be used.

2-3 Preparation of Mixtures:

Preparation of construction mixtures shall be in conformity with Section 401 of the governing specifications.

PART 3: EXECUTION

3-1 Weather Limitations:

Minimum temperature under which permanent hot mix bituminous pavements may be constructed shall be as stipulated in the governing standards. No materials shall be placed when the underlying surface is muddy, frozen, or has frost or water thereon. The mixture shall be laid only when the base is dry and only when weather conditions are suitable. The mixture shall be laid only when the ambient temperature is above 50° F and rising unless different placement temperature limitations are provided in Table 401-3 of the governing specifications.

3-2 Temporary Patching:

Temporary aggregate base course material or bituminous cold mix street surfacing 2 inches thick shall be placed in the backfilled trench in paved streets and drives and leveled with existing paving whenever favorable weather conditions do not exist. This surfacing shall be removed by the Contractor at a later date when weather conditions permit and replaced with permanent hot mix bituminous paving. The permanent paving work shall not be started until favorable weather conditions exist. It shall be the Contractor's responsibility to monitor these temporary patches and, until they are replaced with permanent paving, maintain them in such a condition that traffic will not be slowed or impeded. As the temporary surface settles or is displaced by traffic, it shall be replaced immediately until such time as the Contractor is permitted to place the permanent paving.

3-3 Equipment:

Equipment for storage, transporting, spreading, compacting, and other operations shall be in accordance with the applicable requirements of the governing standards. Improved or modernized equipment which will produce results equal in quality to those which would result from the specified equipment will be considered for use. All equipment and facilities shall be acceptable to the Project Manager.

3-4 Construction:

- A. Subgrade Preparation. Preparation of the subgrade, including compaction thereof, shall be completed for the full width of the new construction. Prior to placing base course or hot bituminous paving, the subgrade shall be proof-rolled with a fully loaded

dump truck or equivalent piece of equipment to identify any soft or unsuitable material. Unsuitable material shall be removed to the satisfaction of the Project Manager and replaced with approved granular fill.

- B. Placing Asphalt Mixture. The mixture shall be delivered on the work site at a temperature of $\pm 15^{\circ}$ F of the mixing temperature, but in no case shall the temperature be below 250° F.

Unless otherwise permitted by the Project Manager, the mixture shall be spread by means of a mechanical, self-powered paver. Hand-placing and spreading shall be permitted in areas where it is impractical to use a paving machine. The hot bituminous surface course shall be applied as soon as possible after mixing and compacted over the full width of the section under construction on each day's run. The governing standard, Section 403, shall apply for hot bituminous surface course.

The vertical surfaces of existing pavement and concrete against which the hot bituminous pavement are to be placed, and the edges of all existing joints, shall be given a uniform coating of tack coat before placing the adjoining mixture. The tack coating shall be applied by methods which will ensure a uniform coating.

If lifts of hot bituminous pavement are not placed in the same day then a tack coat shall be applied over the horizontal surface of the lower lift at a rate of 0.10 gallons per square yard.

All operations of the Contractor in construction of drives and parking areas shall be such that existing structures will not be damaged or discolored. Any damage or discoloration shall be satisfactorily repaired and cleaned by the Contractor.

- C. Compaction of the Mixture. The mixture shall be compacted with self-propelled rollers. Each course shall be uniformly compacted to a density of between 92-96 percent of the maximum density possible to obtain a voidless pavement composed of the same materials in like proportions. After compaction, the surface shall be true to cross section and grade as shown on the drawings.
- D. Opening to Traffic and Protection. The pavement shall be opened to traffic when approved by the Project Manager. In addition to the requirements for protection set forth in the governing specifications, the Contractor shall protect all work covered herein so that no damage will occur as the result of subsequent construction operations. All damage or other irregularities shall be repaired to the satisfaction of the Project Manager before final acceptance.

Special care shall be taken to prevent bituminous materials from marking concrete or other Work. Where there is any possibility of bituminous material contacting concrete, the concrete shall be protected from marking by covering the surface with a suitable fabric or paper.

3-5 Repair and Patching of Existing Asphalt Paving:

Existing asphalt pavement shall be patched where it is cut by a new trench or where it is damaged by the Contractor's operations. Where pavement is patched over new trenches, the existing pavement shall be cut to expose 6 inches of undisturbed subgrade on either side of the trench.

Hot bituminous pavement for the repair and patching of existing asphalt paving shall be Grading C or CX. Grading G may be used for the bottom lift or as directed by the Project Manager. All asphalt drives and parking areas cut by a trench line or otherwise damaged during the construction operation shall be repaired as specified herein. All asphalt cutting shall be done by wheel or saw cut. All edges of existing asphalt shall be tack coated prior to placement of hot plant-mixed, bituminous pavement.

The hot bituminous pavement shall be placed in lifts not to exceed 3 inches with a maximum finished compacted thickness of 6 inches or the thickness of the existing pavement, whichever is greater. Aggregate base course is not required. Compacted trench backfill is covered in Section 02200 - Excavation and Trenching. Subgrades shall be as specified above. The minimum patch width shall be 42 inches.

END OF SECTION

SECTION 02515

MANHOLES

PART 1: GENERAL

1-1 Description:

This section covers the furnishing and installation of precast concrete manholes and appurtenances.

1-2 Reference Standards:

American Society for Testing and Materials (ASTM) and American Association of State Highway and Transportation Officials (AASHTO).

1-3 Submittals:

In accordance with Section 01300, furnish manufacturer's certificates of compliance and installation recommendations.

PART 2: MATERIALS

2-1 Manholes:

Manholes shall be constructed of pre-cast concrete sections, meeting AASHTO HS-20 loading requirements and concrete sections shall conform to ASTM C858 and shall be Amcor precast or equivalent.

To bring the manhole cover to the correct elevation, the adjustment section of each manhole shall be precast adjusting rings (H-20 rated) or shall be constructed of brick which is sound and true in shape and size and shall be Grade S-W from clay or shale.

Manhole 4' x 4' Round (Amcor 48" Dia. Fiber Optic Vault)

The manhole shall be equipped with a vault base; vault lid; 6" grade ring; sump; pulling irons; waffle board knockouts; manhole ring and cover and a racking package. The racking package shall include; 4 each 15 hole cable racks; 4 each 10" cable hooks; 1 each galvanized step; 10 each ½" bolts and 10 each ½" washers.

Manhole 4' x 6' x 7' (Amcor 4' x 6' Communication Vault - U.S. West Standard)

The manhole shall be equipped with a vault top; a vault bottom; 4" term-a-ducts; sump; bonding ribbon; pulling irons; ladder; manhole ring and cover; 2' 0" of grade adjusting rings;

and a racking package. The galvanized racking package shall include 8 each "L" brackets; 9 each 47 hole racks 8 each "S" brackets; hook ladder and a bolt on ladder bracket.

2-2 Manhole Frame and Cover:

Manhole frames and covers shall be of heavy duty traffic lids round base, 30 inch opening lids 1 inch thick, non locking type with frame and cover weighing approximately 327 pounds. Cover and frame seat shall be machine finished to prevent any rocking of cover in its associated frame. Covers shall be marked with the word "Communications". Frames and covers shall be CASTINGS, INC. MH 310 COVER B or approved equal.

2-3 Manhole Steps and Ladders:

Manhole steps for the 4' x 4' round manhole shall be a bolt-on manhole step of 3/4 inch galvanized rebar 16 inches wide built into and thoroughly anchored to the walls at time of fabrication. The manhole hooked ladder for the 4' x 6' x 7' manhole shall be 3/4 inch diameter rungs on 12 inch centers, the side rails shall be 1 1/2 inch x 3/8 inch flat hot dipped galvanized. The material for extruded aluminum steps shall conform to Federal Specifications QQ-A-200/8 for aluminum alloy 6061 T6510 or T6511. The material for cast aluminum steps shall conform to ASTM B26 for aluminum alloy 535.0-F and be equal to ALCOA No. 12653B. Aluminum steps shall have plastic inserts or be coated with bituminous paint to protect against corrosion with cement. Copolymer polypropylene coated steel steps Model PS-2-PF, as manufactured by M.A. Industries, are also approved.

2-4 Grout:

Grout shall be non-shrink type with aluminum filings; grout with iron filings is not acceptable. Grout shall be "Five Star Grout," "Embeco Grout" or equal.

PART 3: EXECUTION

3-1 Manhole Location:

Manholes shall be installed as shown on the drawings or as directed by the Project Manager.

3-2 Manhole Excavation and bedding:

The excavation shall allow for the overall dimensions of a complete assembled manhole and an addition 12 inches around the structure for ease of installation. The bedding material must cover the entire bottom of the excavation to a minimum depth of 12 inches. The manhole shall

be installed according to the ASTM specification C-891-83 (Standard Practice for Installation of Underground Precast Concrete Utility Structures) . The immediate area surrounding the manhole shall be restored according to the Excavation and Trenching Specifications in Section 02200.

3-3 Adjusting Frames and Covers:

When grade adjustment of an existing structure is specified, remove frames and covers and reconstruct as required. Reset cleaned frames at the indicated elevation. Prior to final acceptance, clean structures of accumulations of silt, debris, or foreign matter.

3-4 Miscellaneous:

All steel inside manholes shall be galvanized and bared spots shall be treated with zinc rich paint.

Conduits shall be sealed after cable has been installed using Johns-Manville "Duxseal", Inmont Corporation "Permagum" or equal. Sealant shall be forced into conduits to a minimum depth equal to the conduit diameter.

The locate wire shall be bonded to a ½" x 5' copper bonded pointed ground rod driven 4' into undisturbed earth at each new manhole. The locate shall be wire bonded to the ground rod (in and out of the manhole) with a bronze ground rod clamp suitable for direct burial.

END OF SECTION

SECTION 02516

HANDHOLES

PART 1: GENERAL

1-1 Description:

This section covers the furnishing and installation of precast handholes and appurtenances.

1-2 Reference Standards:

American Society for Testing and Materials (ASTM) and American Association of State Highway and Transportation Officials (AASHTO).

1-3 Submittals:

In accordance with Section 01300, furnish manufacturer's certificates of compliance and installation recommendations.

PART 2: MATERIALS

2-1 Handholes:

Handholes shall be constructed of polymer concrete and reinforced by a heavy-weave fiberglass and shall be Quazite Compositolite. The handhole shall be 49 5/8" long, 32" wide and 18" deep with a cover measuring 47 5/8" long, 30 1/8" wide and 3" thick. The cover shall be a heavy duty flat slab and shall have a service load of 15,000 lbs over a 10" square and shall have a communication logo attached to the top.

PART 3: EXECUTION

3-1 Handhole Location:

Handholes shall be installed as shown on the drawings or as directed by the Project Manager.

3-2 Miscellaneous:

The handhole excavation shall have bedding material of 6 Inches covering the entire bottom of the excavation and the handhole shall be placed so the top of the handhole is level with the existing grade. The immediate area surrounding the handhole shall be restored according to the Excavation and Trenching Specifications in Section 02200.

Conduits shall be sealed after cable has been installed using Johns-Manville "Duxseal", Inmont Corporation "Permagum" or equal. Sealant shall be forced into conduits to a minimum depth equal to the conduit diameter.

The locate wire shall be bonded to a 1/2" x 5' copper bonded pointed ground rod driven 4' into undisturbed earth at each new handhole. The locate shall be wire bonded to the ground rod (in and out of the handhole) with a bronze ground rod clamp suitable for direct burial.

END OF SECTION

SECTION 02520

SIDEWALK, CURB AND GUTTER, AND MISCELLANEOUS CONCRETE

PART 1: GENERAL

1-1 Description:

The work of this section shall consist of the construction of the sidewalk, and curb and gutter, in accordance with these specifications and in close conformity with the lines and grades shown on the Drawings.

1-2 Reference Standards:

All City work shall be done in accordance with this specification and the City of Boulder Design Criteria and Standard Specifications.

1-3 Submittals:

A concrete mix design shall be submitted to and approved by the Engineer prior to the installation of any sidewalk, or curb and gutter. The mix design used shall be previously approved and currently used by the Colorado Department of Transportation.

PART 2: MATERIALS

1-1 The following concrete classes shall be used.

- Curb and Gutter: Class B
- Sidewalk: Class B

PART 3: EXECUTION

3-1 General Requirements:

- A. Excavation. Excavation shall be made to the required depth and to a width that will permit the installation and bracing of the forms. The foundation shall be shaped and compacted to a firm, even surface conforming to the section shown on the drawings or as staked. All soft and unsuitable material shall be removed and replaced with acceptable material.
- B. Forms. Forms shall be of wood material only along curved sections, and wood, metal, or other suitable material along straight sections. All forms shall extend for the full depth of concrete. All forms shall have sufficient strength to resist the pressure of the

concrete without springing. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal. All forms shall be clean and shall be oiled immediately before concreting. Care shall be taken in removing forms to prevent marring or spalling of the concrete.

- C. Placing Concrete. The foundation shall be thoroughly moistened immediately prior to the placing of the concrete. The proportioning, mixing, and placing of the concrete shall be in accordance with the requirements for the class of concrete specified.
- D. Finishing. For the purpose of matching adjacent concrete finishes, the Project Manager shall approve methods of sidewalk finishing.
- E. Joints. The sidewalk shall be divided into sections by dummy joints formed by a jointing tool or other acceptable means as directed. These dummy joints shall extend into the concrete for a least 1/4 of the depth and shall be approximately 1/8 inch wide. Dummy joints shall be installed every 10 feet along sidewalk.

Construction joints shall be formed around all appurtenances such as manholes, utility poles, etc., extending into and through the sidewalk. Pre-molded expansion joint filler 1/4 inch thick shall be installed in these joints. Expansion joint filler of the thickness indicated shall be installed between concrete sidewalks and any fixed structure such as a building or bridge. This expansion joint material shall extend for the full depth of the walk.

All joints shall be sealed with an approved joint sealing compound, as directed by Owner.

- F. Curing. Immediately upon completion of the finishing, the concrete bike path and sidewalks shall be cured for 7 days.

During the curing period, all traffic, both pedestrian and vehicular, shall be excluded. Vehicular traffic shall be excluded for such additional time as the Engineer may direct.

3-2 Concrete Curb and Gutter:

- A. Excavation. Excavation shall be made to the required depth and to a width that will permit the installation and bracing of the forms. The foundation shall be shaped and compacted to a firm, even surface conforming to the section shown on the Drawings or as staked. All soft and unsuitable material shall be removed and replaced with acceptable material.
- B. Forms. Forms shall be of wood material only along curved sections, and wood, metal, or other suitable material along straight sections. All forms shall extend for the full

depth of concrete. All forms shall have sufficient strength to resist the pressure of the concrete without springing. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal. All forms shall be clean and shall be oiled immediately before concreting. Care shall be taken in removing forms to prevent marring or spalling of the concrete.

- C. Mixing and Placing. Concrete shall be proportioned, mixed and placed in accordance with the requirements for the class of concrete specified. Compaction of concrete placed in the forms shall be by vibration or other acceptable method. Forms shall be left in place until the concrete has set sufficiently so that they can be removed without injury to the curbing. Upon removal of the forms, the exposed curbing face shall be immediately finished to a uniform surface. For the purpose of matching adjacent concrete finishes, or for other reasons, the Engineer shall approve methods of finishing. No plastering will be permitted.
- D. Sections. Curbing shall be constructed in sections having a uniform length of 10 feet, unless otherwise specified. Sections shall be separated by dummy joints 1/8 inch wide, except at expansion joints.
- E. Joints. Expansion joints shall be formed at the intervals shown on the Drawings using a preformed expansion joint filler having a thickness of 1/2 inch. When the curb is constructed adjacent to or on concrete pavement, expansion joints shall be located opposite or at expansion joints in the pavement.

Expansion joints shall be installed between concrete curb and fixed structure, sidewalk, or bridge. Expansion joint material shall extend the full depth of the contact surface.

Contraction joints shall be formed by a jointing tool and shall be at least 1/4 of the concrete thickness in depth and approximately 1/8 inch wide.

All joints shall be sealed with an approved joint sealing compound as directed by the Engineer.

- F. Curing. Immediately upon completion of the finishing, all surfaces shall be cured for a period of 7 days.

3-3 Concrete Pavement and Crosspans:

The Contractor shall perform all cutting and patching of concrete paving and all concrete crosspans in accordance with the Colorado Department of Transportation (CDOT) Standard Specification for Road and Bridge Design, Sections 412 and 601, with the following revisions.

- A. Section 601.02 shall be revised as follows:

The desired compressive strength for each class of concrete is a specification.

- B. Section 601.05 is revised as follows:

It shall be the responsibility of the Contractor to furnish the mix design for the classes of concrete specified. The mix designs used shall be ones that have been previously approved and are currently used by the Colorado Department of Transportation. The Contractor shall submit the design mix proposed for each class of concrete to be used on the project for approval by the Project Manager. The Contractor shall not place any concrete without an approved design mix.

3-4 Slip-Form Machine:

A slip-form paving machine will be permitted for curb and gutter or sidewalk provided it has been approved prior to use and that the construction conforms to the following requirements:

- A. The machine shall form concrete that is uniform in texture, shape and density.
- B. Any cost associated with over excavation or compaction necessary to prepare the subgrade for the paving machine tracks shall be borne by the Contractor.
- C. Concrete finishers shall follow the machine to form joints and correct any imperfections in finish.
- D. The concrete edges shall be straight, smooth, and true. The concrete shall be a stiff (low slump) mix.

END OF SECTION

SECTION 02580

TELECOMMUNICATIONS CONDUIT

PART 1: GENERAL

1-1 Description:

The work of this section consists of providing and installing telecommunications conduit. Manholes and handholes are covered in Section 02515 and Section 02516.

1-2 Reference Standards:

American National Standards Institute, Inc. (ANSI)
Electronic Industries Association (EIA)
Telecommunications Institute of America (TIA) Standards

1-3 Submittals:

In accordance with Section 01300 submit certificates of compliance and manufacturer's literature.

1-4 Product Handling:

Handle conduit and cable carefully to ensure delivery in a sound, undamaged condition. Inspect conduit for cracks, dents, abrasions or other flaws. Project Manager will reject damaged conduit on site. Contractor shall replace damaged conduit at no additional expense to the City. Do not store materials directly on ground.

PART 2: MATERIALS

2-1 Conduit:

Telecommunications conduit may be either polyvinyl chloride (PVC), outside diameter-controlled polyethylene (PE) or high density polyethylene (HDPE).

- A. Buried Polyvinyl Chloride Conduit. Unless revised on the Drawings the polyvinyl chloride (PVC) conduit shall be similar and equal to Schedule 40. Unless otherwise specified the conduit joint shall be the "push-on" type, made from clean, virgin, NSF Approved Class 12454-A or 12454-B PVC conforming to requirements of ASTM 1785 (latest revision).

B. Outside Diameter Polyethylene (PE) Schedule 40 - ASTM D2447.

<u>Nominal Duct Size</u>	<u>Diameter</u>		<u>Minimum Wall</u>	<u>Weight /100 ft.</u>
	<u>Outside</u>	<u>Inside</u>		
1"	1.315	1.049	0.133	22.0
1¼"	1.660	1.380	0.140	30.0
1½"	1.900	1.610	0.145	35.9
2"	2.375	2.067	0.154	48.3
2½"	2.875	2.469	0.203	76.7
3"	3.500	3.068	0.216	100.3
4"	4.500	4.026	0.237	142.8
6"	6.625	6.065	0.280	251.1

Conduit shall be supplied in laying lengths of 20 feet. 4" SDR 17 may be substituted for 4" Schedule 40 when conduit is supplied on reels. All conduit and fittings shall be assembled with a non-toxic lubricant. Each length of conduit shall have marked on the exterior the following:

- Nominal size and OD base
- Material Code Designation
- Name or Trademark of Manufacturer

C. High Density Polyethylene (HDPE) Conduit. Unless revised on the Drawings high density polyethylene (HDPE) conduit shall be similar and equal to Schedule 40. All conduit shall meet the minimum dimension requirements of SDR11 or SDR 13.5, ASTM D-3035 for conduit 6-in. and smaller.

PART 3: EXECUTION

3-2 Installation of Conduit:

Except as specified herein or unless specifically authorized by the Project Manager, all conduit shall be laid as follows:

A. Conduit Laying. PVC conduit shall be laid with bell ends facing in the direction of laying. No deflection in the joints shall be allowed. Whenever it is necessary to deflect PVC conduit from a straight line, either in the vertical or horizontal plane, to avoid obstructions, the conduit itself may be uniformly curved. Conduit deflection for

curvature shall not be permitted at temperatures less than 32°F ambient temperature.

When conduit laying is not in progress, the open ends of conduit shall be closed by a watertight plug or other means approved by the Project Manager.

The cutting of conduit for closure pieces shall be done in a neat and workmanlike manner without damage to the conduit so as to leave a smooth end at right angles to the axis of the conduit. The flame cutting of conduit by means of an oxyacetylene torch will not be allowed. Bevel the end of the conduit with a beveling tool after the conduit is field cut. Place a clearly visible position mark at the correct distance from the end of the field cut conduit.

- B. Conduit Joints. Sections of the PVC conduit shall be assembled and joined together prior to insertion into the bore hole. Assembly shall be accomplished above ground, either at the job site or a remote location.

Joining of PE and HDPE conduit shall be accomplished by the thermal butt fusion method, in strict accordance with the manufacturer's recommendations and in accordance with applicable specifications of ASTM D-3261. All fusion joining shall be performed by trained personnel with equipment designed for butt fusion of thermoplastic conduit.

- C. Conduit Terminations. Conduits terminating in concrete manholes, tunnels, and other concrete or masonry structures shall be neatly grouted into the openings. Conduit terminating in handholes shall extend 2 inches above the handhole bedding.

- D. Polyethylene Bend Radius. Polyethylene conduit bend radius shall not be less than 4 feet.

- E. Conduit Draining. All conduit shall drain from buildings to handholes or manholes. Where this is not possible, a handhole or manhole shall be constructed adjacent to the building so that water cannot drain into the building.

- F. Pull Rope. All ducts not scheduled to have fiber cable installed shall contain a continuous length of 1/4" yellow three-strand copolymer polyolefin pull rope from conduit termination access points (manholes or handholes) and shall be tied off to avoid creeping back into the conduit.

- G. Warning Tape. A standard 3" orange colored cable warning tape with (Caution Fiber Optic Cable Buried Below) on it shall be placed 12 to 18 inches above the conduit in the trench.

- H. Depth of Cover. The minimum depth of cover over the conduit shall be 30 inches in

City right-of-way, 48 inches in state right-of-way or as specified on the drawings.

3-2 Conduit Acceptance:

The contractor shall provide a pull rope in all conduit placed by the contractor. The contractor shall mandrel prove conduit placed by the contractor with a mandrel designed for the specific conduit. Any defective conduit placed by the contractor shall be replaced at the contractors expense. The contractor shall also mandrel prove the existing conduit to be used for the new fiber cable with a mandrel designed for the specific conduit and place a pull rope, where such conduit does not have a jet line or pull rope.

END OF SECTION

SECTION 16130

ELECTRICAL METALLIC TUBING

PART 1: GENERAL

1-1 Description:

This section covers the furnishing and installation of electrical metallic tubing type conduit and appurtenances.

1-2 Reference Standards:

National Electrical Code (NEC) requirements

1-3 Submittals:

In accordance with Section 01300, furnish manufacturer's certificates of compliance and installation recommendations.

PART 2: MATERIALS

2-1 Electrical Metallic Tubing:

All conduit placed in buildings shall be Electrical Metallic Tubing.

PART 3: EXECUTION

3-1 Conduit Arrangement and Support:

- A. The specified conduit paths provided by the Owner shall be followed and any deviation shall require the Project Managers approval and a submitted shop drawing.
- B. Arrange conduit supports to prevent alignment distortion by pulling the fiber optic cable. Fasten conduit using clevis hangers; 3/8" threaded rod; and expansion anchors in the concrete ceiling.
- C. No more than 270 degrees total of conduit sweeps per manufacture's specification shall be allowed in the conduit path before an accessible pull box shall be installed.
- D. Cut conduit square using a saw or pipe cutters and de-burr ends.

SECTION 16131

PULL BOXES

PART 1: GENERAL

1-1 Description:

This section covers the furnishing and installation of 24" X 24" X 12" Pull boxes and appurtenances.

1-2 Reference Standards:

National Electrical Code (NEC) requirements

1-3 Submittals:

In accordance with Section 01300, furnish manufacturer's certificates of compliance and installation recommendations.

PART 2: MATERIALS

2-1 PULL BOXES :

The Pull Box shall be the screw cover style, 14 gauge junction box, with knock outs for 2" EMT conduit and with an opening of a minimum 22" x 22".

PART 3: EXECUTION

3-1 Pull Box Placement and Support:

- A. The specified locations for the pull boxes shall be followed and any deviation shall require the Projects Managers approval and a submitted shop drawing.
- B. Support pull boxes independent of the conduit with two 3/8" threaded rods anchor in the concrete ceiling with expansion
- D. Pull box locations on the drawings are approximate unless located in specific detailed drawings.

END OF SECTION

SECTION 16711

OUTSIDE PLANT COMMUNICATIONS CIRCUITS

INDEX

- 1-1 References**
- 1-2 Work Included**
- 1-3 Related Work**
- 1-4 Definitions**
- 1-5 Summary**
 - Outside Plant Cabling System Overview
 - Cable Media Installed
 - Cable Pathway
 - Hardware
 - Fire Stopping
 - Contractor Responsibility
 - Installation Accuracy
 - Quality Control
- 1-6 Work Sequence**
- 1-7 Submittals**
 - Provisioning Section
 - Project Submittals
 - Product Data
 - Manufacturer's Instructions
 - Pre-Qualification Certificate
 - Factory Test
 - Material Guarantee
 - Material Provided
 - Resume of Qualification
 - Test Equipment
 - Test Results
 - Sample Materials
 - Installation Progress Summary
 - Closeout Materials
 - Supporting Hardware
 - Cable Breakdown By Organization
 - Splice/Termination of Fiber Cable
- 1-8 Qualifications**
 - Contractor
 - Installer
- 1-9 Warranty**
 - Product Warranty

- 2-1 Materials Condition**
- 2-2 Equivalent Products**
- 2-3 Fiber Optic Cabling**
 - Single Mode Fiber Specifications (dispersion unshifted)
- 2-4 Fiber Splicing and Closures**
 - Splice Closure
 - Fiber Splice modules
 - Fusion Splice Protection Components
- 2-5 Fiber Distribution Center (FDC):**
 - FDC Frame
 - Connector and Splice Case
 - Fiber Splice Module
 - Connector Module
 - Connector Pigtail
- 2-6 Equipment Racks**
 - Rail Rack
- 2-7 Grounding System and Conductors**
 - Bonding and Grounding
- 2-8 Identification Materials**
 - Inside Plant Identification
 - Outside Plant Identification
- 3-1 Workmanship**
- 3-2 Installation, Support and Routing of Cables**
 - General Requirements
 - Cable Installation
 - Cable Splice/Termination Organization
 - Cable Splicing
 - Fiber Splice Enclosure
 - Fiber Distribution Center (FDC)
- 3-3 Safety**
- 3-4 Fire and Smoke Partition and Penetration**
- 3-5 Quality Assurance and Control**
- 3-6 Testing of Cable Installation Accuracy**
- 3-7 Identification of System**
 - General Identification
 - Outside Plant Identification
 - Inside Plant Identification
- 3-8 Inspection**

PART 1: GENERAL

1-1 References:

- A. Electronic Industries Association/Telecommunications Industry Association (EIA/TIA).
EIA/TIA 568A-Commercial Building Telecommunications Wiring Standards.
EIA/TIA-569-Commercial Building Standard for Telecommunications Pathways and Spaces.
EIA/TIA-606- Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
EIA/TIA-607- Commercial Building Grounding and Bonding Requirements for Telecommunications.
EIA/TIA-72-Centralized Optical Fiber Cabling Guidelines, October 1995.
- B. International Standards Organization/International Electrotechnical Commission (ISO/IEC) DIS 11801, January 6, 1994.
- C. Underwriters Laboratories (UL®) Cable Certification and Follow Up Program. UL Testing Bulletin.
- D. National Electrical Manufacturers Association (NEMA).
- E. American Society for Testing Materials (ASTM).
- F. National Electric Code (NEC®).
- G. Institute of Electrical and Electronic Engineers (IEEE).
- H. American National Standards Institute (ANSI).
- I. Building Industry Consulting Services, International (BISCI).
- J. Occupational Safety and Health Administration (OSHA).

1-2 Work Included:

- A. Outside plant data communications cable installation.
- B. Structured cabling system requirements.

1-3 Related Work:

- A. Division 1 - General Requirements
- B. Division 2 - Site Construction

1-4 Definitions:

- A. MC - Main Cross-connect: The main cabling distribution center for a building. All telecommunications closets are fed from a single MC.

1-5 Summary:

- A. Outside Plant Cabling System Overview

The outside plant cabling systems will be used to connect separate facilities together. This will be accomplished through the use of single mode optical fiber cable. Each facility will use splice and connector housings to make the attachments to the optical fiber strands within the cable. All fiber strands shall be fusion spliced to connector cable pigtails or to the other cables installed by this project at the facility. Approximately 60% of the entire project's cable end points will be fusion spliced with connector pigtails.

Four organizational entities will use the cabling system to intercommunicate between their own sites and the other organizations. Each organization has been allotted a percentage of the optical fiber strands within each cable to be installed in the system. Additionally, each organization will retain that same percentage throughout the system. The percentage breakdown is as follows: The City of Boulder - 12.500%, CU at Boulder - 29.167%, NOAA/NIST - 29.167% and NCAR/UCAR - 29.167%. Each organization's fiber strands shall be grouped by full loose-tube fiber bundles with any leftover fiber strands organized into a single loose-tube group. Any loose-tube bundle color assigned to an organization shall remain that organization's color throughout the project.

Four installation types exist in this project. They are all indicated on the over-view drawing and are: facilities which are considered a splice and connector housing point, mid-splice points, the single outside plant tri-cable junction, and the single tri-cable junction at a facility. Each point or junction shall follow the appropriate installation procedures.

The cabling system must meet or exceed the requirements of the EIA/TIA - 568A Commercial Building Telecommunications Wiring Standard as well as the other standards as referenced.

The Contractor is required to install all outside plant cabling for this project. Installation, termination, and identification of cabling between facilities and other designated points on the plan is considered part of the Contractors work. Optical fiber cable and all associated hardware and components shall be furnished, installed and tested by the Contractor.

The Contractor is not required to provide or connect patch cables to active equipment at any facility.

B. Cable Media Installed

All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code (NEC®) article 760 and the appropriate local codes. All cabling shall bear CMP (Plenum Rated) or CM/CMR (Riser Rated) and/or appropriate markings for the environment in which they are installed.

All cable used must be identified with the original manufacturer's information containing at least the following information on the cable sheath:

1. Cable part number
2. Fire rating codes
3. Length markings
4. Cable category compliance, if applicable, must be printed on cable jacket
5. Underwriters Laboratories (UL®) certification stamp

C. Cable Pathway

Extension of all data cables shall be within raceway, conduit, cable tray or other designated cable delivery system as specified on the project drawings. Any pathways designated as new on the drawings shall be provided and installed by the Contractor.

D. Hardware

Required hardware includes, but is not limited to, termination blocks, fastening devices, data outlets, voice outlets and all required accessories to comply with this specification.

E. Fire Stopping

Sealing of openings between floors or through rated fire and smoke walls, existing or created by the Contractor for cable pass through, shall be the responsibility of the Contractor.

Sealing material and application of this material shall be accomplished in such a manner which is acceptable to the local fire and building authorities.

Creation or usage of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the Contractor's work.

Any openings created by or for the Contractor and left unused shall also be sealed as part of this work.

F. Contractor Responsibility

The Contractor shall be responsible for damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including but not limited to patching and painting, shall be included as necessary.

G. Installation Accuracy

The installation of fiber optic cables requires exact precision for cable installation and termination, therefore, all installers shall meet specific qualifications. The qualifications required by the Owner ranges from the installer being a manufacturer certified installer to physically demonstrating proficiency with the tools and materials required to complete a task.

H. Quality Control

The Contractor shall be required to monitor the project for proper quality control. Additionally, field testing will be performed by the Contractor on all cables.

1-6 Work Sequence:

- A. The work sequence shall be arranged by cable segment and area.
- B. All work areas shall be coordinated with the Owner's designated staff prior to the beginning of work.

1-7 Submittals:

A. Provisioning Section

Submit under provisions of Division 1.

B. Project Submittals

Complete fabrication, assembly, and installation drawings; wiring and schematic

diagrams; and details, specifications, and data covering the materials used and the parts, devices, and accessories forming a part of the equipment furnished shall be submitted in accordance with the submittals section. Submittal data shall be grouped and submitted in three separate stages. The submittal for each stage shall be substantially complete. Individual drawings and data sheets submitted at random intervals will not be accepted for review. Instrument tag numbers indicated on the contract drawings shall be referenced where applicable. Submittal data for multi-functional instruments shall include complete descriptions of the intended functions and configurations of the instruments.

1. First Stage Submittals: The first stage submittal shall include the following items:
Product catalog cut sheets clearly marked to show the model number, optional features, and intended service of the device.

A detailed list of any exceptions, functional differences, or discrepancies between the supplier's proposed system and the contract requirements.

2. Second Stage Submittal: The second stage submittal shall include the following items:

System wiring and installation drawings for all interconnecting cabling between components of the systems furnished and for all interconnecting cabling between the related equipment and the equipment furnished under this section. Cabling circuits shall show complete circuits and indicate all connections and splice points.

If termination designations, interdevice connections, device features and options, or other features are modified as a result of the fabrication process or factory testing, revised drawings shall be resubmitted.

At the supplier's option, and for projects with very few fabrication drawings, the first and second stage submittals may be combined.

3. Third Stage Submittal:

Complete system documentation, in the form of operation and maintenance manuals, shall be provided. Manuals shall include complete product instruction books for each item of equipment furnished.

Where instruction booklets cover more than one specific model or range of instrument, product data sheets shall be included which indicate the instrument model number, calibrated range, and all other special features. A complete set of "as-built" cabling, fabrication, interconnection, conduit, and termination drawings shall be included with the manuals.

C. Product Data

Provide manufacturer's catalog information showing dimensions, colors, and configurations.

D. Manufacturer's Instructions

Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.

Include instructions for storage, handling, protection, examination, preparation, operation and installation of product.

E. Pre-Qualification Certificate

Submit a letter of approval to the customer indicating completion of pre-qualification requirements.

F. Factory Test

The Contractor shall submit all factory test information prior to installation to the Project Manager. If equivalent product(s) are substituted, the equivalent product(s) must show demonstrated and documented equivalence to the product(s) specified.

G. Material Guarantee

The cabling Contractor (installer) shall guarantee at the time of the project that all cabling and components are new, unused, prime, current and meet or exceed specifications (including installation) of TIA/EIA-568A, 569 and any other referenced specification.

H. Material Provided

The Contractor shall be certain that all the correct parts and components necessary for a correct installation are ordered and installed. The Contractor shall submit a complete parts and part numbers list to the Owner's designated staff at least two weeks prior to the installation of the equipment.

I. Resume of Qualification

A resume of qualification shall be submitted with the Contractor's proposal indicating the following:

1. A list of no more than six recently completed projects of similar type and size with contact names and telephone numbers for each.

2. A technical resume of experience for the Contractor's Project Manager and for the on-site installation supervisor who will be assigned to this project.
3. Any sub-Contractor who will assist the main Contractor in performance of this work, shall have the same training and certification as the main Contractor and provide all the same submittals as required for the main Contractor.

J. Test Equipment

The specifications, purchase date, last software update, last hardware update, and last certification date of the test equipment to be used for the project shall be provided to the Owner before the use of the device.

A copy of the cable testing equipment's presently active certificate of calibration.

K. Test Results

The Contractor shall provide test results for all cable tests.

Both printed and electronic forms of test results will be required from the Contractor.

All test results shall be bound in three ring binders with the corresponding electronic media of the test results contained in the same binder.

The electronic media shall be 3-1/2" 1.44MB or higher density media and shall be stored in plastic media envelopes in the same binder as the printed test results.

Any software required to view the test result data shall be purchased by the Contractor and given to the Owner.

L. Sample Materials/Products

Submittals will be of new quality and display at least one full unaltered manufacturer's identification label. The quantity of the product sample will be given in the product's definition section.

The Contractor shall provide all materials and supplies as necessary to demonstrate each installer's ability to perform their assigned task to the Owner.

The Contractor shall develop a list of all materials used to splice, support, group, label, terminate, and test the optical fiber cable to the Owner.

The Contractor shall provide the following samples to the Owner at least two weeks before the project begins. Samples given to the Owner shall become the property of the Owner and shall not be used in the project. Submittals shall include but not be limited to:

1. Two splice trays completed with splices and 5' of cable protruding from each end demonstrating splice quality and fiber cable routing within the tray
2. A 100 meter sample of all cable to be used in the project
3. One partially configured Fiber Distribution Center with 1m of cable coming into the box, all loose-tubes broken-out in the box, two fully completed splice trays, and two connector panels worth of connectorized pigtailed properly installed in the box.
4. Ten samples of each cable securing (cable tie and velco) type.
5. Five samples of each cable or component identification styles to be used in the project.

M. Installation Progress Summary

The Contractor shall provide an Installation Progress Summary report at least every two weeks on the progress of the project. The summary report shall list cable segment, date started and completed, percent completed, and when the work was reviewed. The reported shall be distributed to the Owner in both paper, email, and electronic form.

N. Closeout Materials

Submittals shall be delivered to the Owner's Project Manager before submission of the final invoice.

1. Operation & Maintenance (O&M) Manual. The Contractor shall prepare 3 professionally configured copies of an O&M manual assembled in 3 ring notebooks and labeled with printed title sheets inserted into transparent plastic covers in both the spine and front of the books.
2. Title sheets shall include the following:
 - The Owner's project name
 - The Owner's Engineering Project Number
 - Copy number
 - Completion Date
3. Contents shall include:
 - Index
 - Tabs for each division

Cover sheet with Contractor names and addresses
Catalog sheets and manufacturer's maintenance manuals for all equipment
Catalog sheets for all submitted materials
Tab for reduced B size as-built drawings provided by Owner
Project Specifications

4. Test data binders. (1 set only)
5. As-built drawings.
6. Warranty documentation and final dated acceptance.

O. Supporting Hardware

The Contractor shall install a complete set of cable supporting hardware for this system as part of the cabling contract. All supporting hardware information shall be submitted to the Owner's designated staff for approval prior to installation.

P. Cable Breakdown By Organization

The Contractor shall submit a sheet representing the breakdown plan of buffer tubes by organization.

The submitted breakdown plan, once approved by the Owner's engineers shall be observed throughout the entire project.

The buffer tube breakdown plan shall be submitted to the Owner's engineers at least two weeks before construction of the project begins.

Q. Splice/Termination of Fiber Cable

The Contractor shall submit a plan for review by the Owner's engineers of each splice point or termination of the cable. The plan shall be broken down by organization, buffer tube, and fiber strand.

The plan shall be submitted to the Owner's engineers at least two weeks before construction of the project begins.

The Owner's engineers shall review and return the plan to the Contractor with approval or required changes.

R. Manufacturer Design of System

The Contractor shall be required to obtain and submit a component and part number design from the manufacturer of the optical fiber components. This design developed by the manufacturer shall be complete and list all components and part numbers needed at each fiber end location. The design shall be given to the Owner's designated staff at least two weeks prior to the installation of any components.

1-8 Qualifications:

A. Contractor

The Contractor selected to provide the installation of this system must demonstrate familiarity with the manufacturing company's products in all aspects of design, installation and testing procedures of the products described herein.

The Contractor must utilize the authorized manufacturer components and distribution channels in provisioning this Project.

The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size and provide contact names and telephone numbers for each installed system reference.

The Contractor shall have used or own and maintain tools and equipment necessary for successful installation and testing of optical fiber cable. The Contractor shall also have personnel who are adequately trained in the use of such tools and equipment.

The Contractor shall supply a technical resume of experience for the Contractor's Project Manager and on-site installation supervisor who will be assigned to this project.

Any sub-Contractor who will assist the main Contractor in performance of this work, shall have the same training and experience as the main Contractor.

B. Installer

1. Each installer of the components necessary for the designed cabling system must be familiar with the manufacturing company's products as to the proper use, installation, and testing of the products.
2. Each cable installer and terminator shall demonstrate installation proficiency by performing sample cable installation and termination.

C. Supplier

1. The Contractor's suppliers shall be qualified by the manufacturer.

D. Testing

The Contractor shall supply a list of test equipment proposed for use in verifying the installed integrity of fiber optic cable systems on this project.

The Contractor shall supply samples of testing reports from similar installations.

Resumes of the personnel who will be performing the testing shall be supplied to the Owner.

The testing personnel shall demonstrate their proficiency in cable installation examination and testing in accordance to industry standards and manufacturer's recommendations prior to testing installed cables.

1-9 Warranty:

A. Extended Product Warranty

A manufacturer's Extended Product Warranty shall ensure against product defects, that all approved cabling components exceed the specifications of TIA/EIA 568A and ISO/IEC IS 11801, exceed the attenuation and NEXT requirements of TIA/EIA TSB 67 and ISO/IEC IS 11801 for cabling links/channels, that all components installed will exceed the loss and bandwidth requirements of TIA/EIA TSB 67 and ISO/IEC IS 11801 for fiber links/channels, for at least a five (5) year period. The warranty shall apply to all passive components.

The manufacturer's Product Warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s).

The Contractor shall warrant the installation of the cabling systems for at least a period of two (2) years after completion.

Any warranty period shall begin at the time of project completion.

PART 2: PRODUCTS

2-1 Materials Condition:

All materials used in this project are to be new and installed in accordance with manufacturer's instructions.

The materials purchased must be of original manufacturer's quality, no outdated, "seconds", or

substandard parts may be used.

2-2 Equivalent Products:

Equivalent cable product(s) may be considered for substitution for those cable products specified, however, the equivalent product(s) must be approved and show demonstrated and documented equivalence to the product(s) specified. The request for product substitution, and supporting documentation, must be submitted, in writing, prior to submitting the bid. Written approval for product substitution must be submitted with the bid.

All products selected for a particular use shall be consistent throughout the entire project. The same manufacturer and product type shall be used for all similar products.

2-3 Fiber Optic Cabling:

A. Single Mode Fiber Specifications (dispersion unshifted)

1. General Considerations

- a. Fiber optic cabling shall be provided between facilities and furnished with the quantity of fibers as designated on the contract drawings or other specification sections.
- b. The cable shall meet all requirements stated in this specification. The cable shall be listed and accepted by the United States Department of Agriculture Rural Utilities Service (RUS) as compliant with 7 CFR 1755.900 and meet the requirements of ANSI/ICEA Standard for Fiber Optic Outside Plant Communications Cable, ANSI/ICEA S-87-640-1992. The supplier shall provide evidence of the USDA RUS listing.
- c. Each optical fiber shall consist of a doped silica core surrounded by a concentric silica cladding. The fiber shall be matched clad design and comply with the requirements of ANSI/TIA/EIA 492-CAAA, *Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers*.
- d. The cable manufacturer and type selected and approved for use in the project shall be consistent throughout the entire project.

2. Specific Cable Requirements

The Sincor 096RW4-14101A20 (96 strand), 144RW4-14101A20 (144 strand) or a cable which meets the following specifications and has Owner approval shall be used.

Cladding Diameter: $125.0 \pm 1.0 \mu\text{m}$.

Core-to-Cladding Offset: $\leq 0.6 \mu\text{m}$.

Cladding Non-Circularity: $\leq 1.0\%$.

Defined as: $1 - \frac{\text{Minimum Cladding Diameter}}{\text{Maximum Cladding Diameter}} \times 100$

Coating Diameter: $245 \pm 10 \mu\text{m}$.

Colored Fiber Diameter: nominal $250 \mu\text{m}$.

Attenuation Uniformity: No point discontinuity greater than 0.10 dB at either 1310 nm or 1550 nm.

Attenuation at the Water Peak: The attenuation at $1383 \pm 3 \text{ nm}$ shall not exceed 2.1 dB/km.

Cutoff Wavelength: The cabled fiber cutoff wavelength

(

) shall be $< 1260 \text{ nm}$.

Mode-Field Diameter: $9.30 \pm 0.50 \mu\text{m}$ at 1310 nm and $10.50 \pm 1.00 \mu\text{m}$ at 1550 nm.

Zero Dispersion Wavelength (λ_0): $1301.5 \text{ nm} \leq \lambda_0 \leq 1321.5 \text{ nm}$.

Zero Dispersion Slope (S_0): $\leq 0.092 \text{ ps}/(\text{nm}^2 \cdot \text{km})$.

Fiber Polarization Mode Dispersion (PMD): ≤ 0.5

Fiber Curl: $\geq 4.0 \text{ m}$ radius of curvature.

The coating shall be a dual layered, UV-cured acrylate applied by the fiber manufacturer. The coating shall be mechanically strippable.

3. Fiber Specification Parameters

The maximum attenuation shall be 0.4 dB/km at 1310 nm and 0.3 dB/km at 1310/1550 nm. The maximum dispersion shall be $\leq 3.2\text{ps}/(\text{nm.km})$ from 1285 nm to 1330 nm and shall be $< 18\text{ps}/(\text{nm.km})$ at 1550 nm.

All optical fibers shall be proof tested by the fiber manufacturer to a minimum load of $0.7\text{GN}/\text{m}^2$ (100 kpsi).

4. Specification for Cable Construction

Optical fibers shall be placed inside a filled loose buffer tube. The nominal outer diameter of the buffer tube shall be 3.0 mm for all cables, regardless of fiber count.

Each buffer tube shall contain up to 12 fibers. The buffer tubes shall be resistant to external forces and shall meet the buffer tube cold bend and shrinkback requirements of 7 CFR 1755.900. The buffer tubes should not kink when a 360 degree loop is freely bent to a diameter of 10 mm.

Buffer tubes shall be stranded around the dielectric central member using the reverse oscillation, or "S-Z", stranding process. Water blocking yarn(s) shall be applied longitudinally along the central member during stranding. The cable core will not contain a gel flooding compound.

For single layer cables, a water blocking tape shall be applied longitudinally around the outside of the stranded tubes/fillers. The tape shall be held in place by a single polyester binder yarn. The water blocking tape shall be non-nutritive to fungus, electrically non-conductive and homogenous. It shall also be free from dirt and foreign matter.

For dual layer cables, a second (outer) layer of buffer tubes shall be stranded over the original core to form a two layer core. A water blocking tape shall be applied longitudinally over both the inner and outer layer with each being held in place with a single polyester binder yarn. The water blocking tape shall be non-nutritive to fungus, electrically non-conductive and homogenous. It shall also be free from dirt and foreign matter.

Tensile strength shall be provided by dielectric yarns helically stranded evenly around the cable core.

All-dielectric cables (non-armored) shall be sheathed with medium density polyethylene (MDPE). The minimum nominal jacket thickness shall be 1.4 mm. Jacketing material shall be applied directly over the tensile strength members and water blocking tape. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

The maximum pulling tension shall be 2700 N (608 lbf) during installation (short term) and 890 N (200 lbf) long term installed.

The shipping, storage, and operating temperature range of the cable shall be -40 °C to +70 °C. The installation temperature range of the cable shall be -30 °C to +70 °C.

5. Quality Assurance Provision

All cabled optical fibers greater than 1000 meters in length shall be 100 % attenuation tested. The attenuation value measured after cabling for each fiber shall be provided on a data sheet with each cable reel. Cables less than or equal to 1000 meters in length will be 100 % tested for fiber continuity, and the specification value for attenuation will be reported on the data sheet.

The cable manufacturer shall be ISO 9001 registered.

6. Fan-out Kits

All buffer tube filled cables shall be provided with fan-out kits which are at least 40" of 900um buffer tubes to breakout each buffer tube at each connector housing point.

2-4 Fiber Splicing and Closures:

A. Splice Closure

1. The fiber splice closure shall seal, bond, anchor and protect fiber optic cable splices.
2. The splice closure shall be a stand-alone closure that does not require an outer closure.
3. The splice closure shall provide for a maximum of six (6) cable entries in a butt-end configuration.
4. The splice closure shall be usable in underground and direct buried applications.
5. The closure shall use individually removable mechanical and fusion splice trays.
6. The splice closure shall have the capacity of at least 1.5 times the number of fiber strands designed to come into the box for splices.
7. The closure shall be fully moisture, water and dirt contamination proof in a

temperature range of at least -50 to +120 degrees Fahrenheit.

B. Fiber Splice Modules

1. Only fusion splice modules may be used.
2. The module shall be designed to be used with the enclosure it is placed in.
3. The fiber splice module shall meet the following specifications:
 - a. Accept 250 and 900 micron fibers
 - b. Accept heat shrinkable fiber splice splints
 - c. Reenterable, rearranagable and reusable
 - d. Require no adhesives
 - e. No loose parts
 - f. Accepts a maxium of 12 (twelve) fibers per splice tray

C. Fusion Splice Protection Components

1. Only heat shrinkable fusion splice protection sleeves may be used.
2. The protection sleeve shall provide a complete moisture resistant barrier for the fused fibers.
3. The length of the protection sleeve shall be at least 2" in length.

2-5 Fiber Distribution Center (FDC):

A. FDC Frame

1. The Fiber Distribution Center shall have the capacity for at 400 fiber terminations in a single rack or bay.
2. The FDC shall be designed with ample jumper-routing capacity to allow 100% vertical, top and bottom jumper routing, and easy administration of reassignments and to avoid congestion.

3. The FDC shall provide a termination and cross-connection point for fiber optic circuits.
4. The FDC shall also be designed for cable termination and grounding, ribbon or individual fiber splicing, and fiber and patch cord storage.
5. The Fiber Distribution Center shall be usable in either a 19" or 23" wide 7 foot high frame and the associated raceways, brackets retainers and components for field mounting.
6. The FDC shall have both vertical and horizontal cable management. The vertical cable management shall provide patch cable vertical support

B. Connector and Splice Case

1. The Siecorm cases FDC-CMN-024-L, FDC-CMN-072-L, FDC-SMN-3-L or product(s) which meets the following specifications and has Owner approval must be used.
2. Each fiber case will house both fiber splices and connector terminations or shall be manufactured to integrate the two case types together.
3. The case(s) shall be rack (19" or 23") or wall mountable.
4. The case(s) shall house at least enough connectors and splices to accommodate 1.25 times the number of fiber strands entering the case.
5. The connector and splice trays shall be accessible from the front of the case.
6. The splice trays shall not be covered by the connector mounting area.
7. Dust protection grommets shall be used at each location a cable may enter or exit the box.
8. The box shall secure buffer tubes with nylon cable ties.
9. At any time 250um or 900 um fibers must be secured, they shall be secured using Velcro cable securing devices.
10. The box(es) shall use a key locking mechanism for any entry into the box. The key mechanism shall use the following:
 - a. Each organization's boxes shall be keyed the same at all locations.

- b. Each organization will have a unique key.
- c. At least 6 keys shall be provided to each organization.

C. Fiber Splice Modules

- 1. The Sincor part number M67-048 or a product that meets the following specifications and has Owner approval must be used.
- 2. Only fusion splice modules may be used.
- 3. The module shall be designed to be used with the enclosure it is placed in.
- 4. The fiber splice module shall meet the following specifications:
 - a. Accept 250 and 900 micron fibers
 - b. Accept heat shrinkable fiber splice splints
 - c. Reenterable, rearranagable and reusable
 - d. Require no adhesives
 - e. No loose parts
 - f. Each splice tray may hold a maximum of 12 splices

D. Connector Module

- 1. The module shall be designed to be used with the enclosure it is placed in.
- 2. The connector panel shall house either 6, 8, or 12 FC couplers.
- 3. The connector panel may have factory installed FC connector pigtailed. If connector pigtailed are installed, they shall meet all the specifications, as described in the Connector Pigtail section.

E. Connector Pigtail

- 1. The Sincor part number FDC-CM06-58 or a product that meets the following specifications and has Owner approval must be used.

2. Each connector pigtail shall use FC connectors and have at least 36" of 900um buffered single mode cable attached.
3. The connector ferrule shall be made of Zirconia.
4. Each connector shall have a flexible strain relief boot of at least 1" or longer.
5. The guaranteed insertion loss shall be 0.5dB or less.
6. The FC connector polish shall be an Ultra PC finish with a guaranteed return loss of 55dB or better.
7. The connector face shall have no visible imperfections in either the fiber core or cladding using a 100x power microscope.
8. All connectors must be free of surface contaminants when completed.
9. Any buffer and strength members present shall be properly secured to the connector body.
10. All connectors shall be capped during and after installation to protect them from dust contamination.

2-6 Equipment Racks:

A. Rail Rack

The equipment frame shall conform to EIA (Electronics Industry Association) standards.

The frame shall be 7' tall with 19" horizontal spacing and forty-four 1-3/4" rack spaces. One EIA rack space (RMS) is defined as being 1-3/4" in height with mounting holes on each side of the rack and center to center hole spacing. The center to center distance of the bottom hole in a rack space to the top hole in the next lower rack space is 1/2".

The frame shall come equipped with a service loop (cable slack) holding box. The box shall have the following characteristics:

1. All excess sheathed cable for the room shall be held in this device.
2. The cable shall be held with Velcro cable ties.
3. The box shall be mounted at the top of the rack.

The frame shall come equipped with a top jumper trough for distributing jumpers between equipment bays. Additional jumper troughs shall be available in single and double rack space versions for transitioning jumpers between bays.

Blank frame panels shall be used to fill unused housing space.

2-7 Grounding System and Conductors:

A. Bonding and Grounding

1. Communication bonding and grounding shall be in accordance with the NEC® and NFPA.

2-8 Identification Materials:

A. Inside Plant Identification Labels

1. Stick-on: Permanent reinforced vinyl, computer printed label with 3/16" black letters on white background.
2. Cable Pull Markers: Preprinted shrink tubing or adhesive numbering tape.
3. Felt Tip Pen with Indelible Ink: Temporary labeling only. Remove from exposed surfaces before attaching permanent labeling.
4. Embossed Tape - Not allowed.

B. Outside Plant Identification Labels

1. Stick-on: Permanent reinforced vinyl, computer printed label with at least 1/2" black letters on white background.
2. Cable Pull Markers: Preprinted shrink tubing or adhesive numbering tape.
3. Felt Tip Pen with Indelible Ink: Temporary labeling only. Remove from exposed surfaces before attaching permanent labeling.
4. Embossed Tape - Not allowed

C. Outside Plant Locator Wire

1. All locator wires shall be #12 solid copper, thin green insulated wire.

2-9 Unspecified Equipment and Materials:

Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional PDS installation shall be provided in a level of quality consistent with other specified items.

PART 3: EXECUTION

3-1 Workmanship:

- A. Components of the cabling system shall be installed in a neat, work person like manner.
- B. Cabling color codes shall be strictly observed.
- C. Cabling termination shall be uniform throughout the system.
- D. The installation of like components shall be consistent throughout the project.

3-2 Installation, Support and Routing of Cables:

A. General Requirements

- 1. Cable installation shall be uniform throughout the project.
- 2. Cable installation shall follow the EIA/TIA and BISCII codes.
- 3. The cable shall be handled per manufacturer's and applicable standards.
- 4. All cable shall be OTDR tested before cable installation using the outline procedures.

B. Cable Installation

- 1. All cable shall be installed using the manufacturer's or standards based cable pull tension or less.
- 2. All pulled cable shall use a breakaway cable pulling eye.
- 3. A locator wire marker line shall be pulled in with the cable when it is installed in non-metallic conduit or interduct in the ground.
- 4. Each run of the cable will be continuous between designated locations (no splice points are allowed).

5. In a multi-cable conduit run, all cables will be pulled together.
6. The full run length of all pulls will be determined and provided to the Owner's engineers before the cable is pulled.
7. The cable shall not be pulled through or secured to any device which will not meet the manufacturer and applicable standards.
8. Each cable segment will have the following service loop lengths unless otherwise specified:
 - a. A minimum of a 40' service loop in all handholes or as identified.
 - b. A minimum of a 60' service loop in all manholes or as identified.
 - c. A minimum of a 40' service loop at all cable termination points. This service loop does not include any lengths required for cable splicing or termination.
9. The service loops must be properly supported in at least two locations with either cable ties or hook and loop (Velcro) cable fasteners and be securely attached to the box or support member with metal corrosion resistant screws.
10. No tape or epoxy attachment of cable ties is allowed.
11. In locations where cables traverse floors of a building or the cable has a vertical drop of more than 1', the cable bundles must be supported by the use of woven retention clamps (finger trap style) and hook and loop (Velcro) cable ties.
12. The service loop at cable termination points inside buildings shall be organized in a rack mounted box as close to the termination point as possible.
13. Any cable pulled through metallic conduit shall be protected during the pull process so cable sheath damage will not occur.
14. No cable sheath damage shall be allowed during the cable installation process. If cable sheath damage does occur, the Owner must inspect the damage and determine if new cable shall be installed.
15. The cable shall be properly secured in devices and in room locations.
16. Cable routing within the buildings shall follow the Owner provided plans or be approved by the Owner's designated staff at installation time.

17. The Contractor shall install a complete set of cable supporting hardware for this system as part of the cabling contract. All supporting hardware shall be submitted to the Owner's designated staff for approval prior to installation.

C. Cable Splice/Termination Organization

1. Since four separate organizations own each fiber cable bundle, each fiber cable shall be separated whenever it is spliced or terminated. The percentage breakdown is as follows: The City of Boulder - 12.500%, CU at Boulder - 29.167%, NOAA/NIST-29.167% and NCAR/UCAR - 29.167%.
2. The cable shall be grouped by full loose-tube fiber bundle with any leftover fiber strands from each organization placed into a single loose-tube group. Any loose-tube bundle color assigned to an organization shall remain that organization's color through the project.
3. The Contractor shall submit a sheet representing the breakdown of buffer tubes by organization at least two weeks before construction of the project begins.

D. Cable Splicing

1. The cable shall be spliced per manufacturer's and applicable standards.
2. Throughout the cable splicing process the cable shall be organized and kept free of dust and contaminants.
3. All spliced fibers shall be spliced together using a Local Injection and Detection (LID) fusion splicer.
4. All splice trays shall be properly mounted.
5. Within a splice tray, all fibers shall be at least 3' long and be looped as per manufacturer's instructions before the strand is spliced. No "piano wire" or "rat nests" shall be installed or approved.
6. Each fiber strand splice shall be encased in a heat shrinkable splint which shall also protect it from moisture and contaminates.
7. Each splice shall be power meter tested as the splicing process is performed.
8. All fiber splices shall be tensile tested to BICSI and other standards before it is placed into the splice tray.

9. All splices shall have less than a 0.1dB splice loss.

E. Fiber Splice Enclosure

1. All cables entering the splice enclosure shall be labeled on the inside and outside of the box. The labels shall display each end point of the cable and the label of the next manhole or hand hole closest to the enclosure.
2. All buffer tubes shall be labeled inside the enclosure with the organization the tube belongs to.
3. At least 10' of each buffer tube shall be routed in the splice enclosure before the tube enters a splice tray.
4. Buffer tubes routed to the trays shall be installed in such a manner as to make each individual tray easily accessible.
5. The splice enclosure shall be free of dirt, dust, debris, cable waste, or any other object which should not be in the enclosure.
6. Before any splice enclosure is sealed, the Owner's engineers must inspect its installation quality.

F. Fiber Distribution Center (FDC)

1. At each designated cable termination location there shall be a series of boxes that will be organized to produce a fiber distribution center.
2. The fiber distribution center shall be composed of the following boxes from top to bottom:
 - a. Fiber service loop enclosure
 - b. Common Splice/Patch enclosure
 - c. City of Boulder Splice/Patch enclosure
 - d. CU at Boulder Splice/Patch enclosure
 - e. NOAA/NIST Splice/Patch enclosure
 - f. NCAR/UCAR Splice/Patch enclosure

3. Each splice/patch enclosure shall house the buffer tubes, splices, and connector terminations for that organization.
4. The common splice/patch enclosure has the following characteristics:
 - a. The enclosure shall be used to separate the buffer tubes from the cable jacket.
 - b. Each buffer tube shall have 10' of service loops in the box.
 - c. Each service loop shall be individually labeled and secured in two places in the box.
 - d. Each buffer tube shall be labeled at the breakout point of the cable and at the point where the tube exits from the box.
5. Each organization and common splice/patch enclosure shall have the following characteristics:
 - a. Each buffer tube shall have 10' of service loops in the box.
 - b. Each service loop shall be individually labeled and secured in two places in the box.
 - c. Each buffer tube shall be labeled at the entrance of the box.
 - d. Each buffer tube shall be secured to a 900um fan-out kit which is at least 36" in length.
 - e. Each 900um buffer tube shall be color coded to the fiber color it contains.
 - f. Splice trays within the box shall be organized into two sections: Connector pigtail and spliced through splice trays.
 - g. Each splice tray shall be clearly labeled with the section that it serves.
 - h. The cable routing to splice trays or connector panels shall be performed in such manner as to allow easy access to individual splice trays or connector panels. The tray or panel shall have enough cable slack to be removed 12" away from the box without cable damage.
 - I. Each connector panel shall be organized into groups based on the cable it came from.

- j. Each connector shall be labeled with the tube and strand color.
- k. The front, back, and two locations on the inside of the box shall be labeled stating the organization's ownership and contact information.
- l. At any point where a buffer tube leaves a box or cabinet, the buffer tube or tubes shall be protected with spiral wrap, conduit, or similar product.

3-3 Safety:

- A. The Contractor will be responsible for complying with all safety standards.
- B. Any equipment or tools necessary to comply with any safety standard shall be the responsibility of the Contractor.
- C. All work within a building shall require the use of safety cones and caution tape specifying the construction zone.

3-4 Fire and Smoke Partition Penetrations:

- A. Openings in sleeves and conduits used for the system cables and those which remain spare (empty) shall be sealed with an approved fireproof, removable safing material.
- B. Sleeves which pass vertically from floor to floor shall be sealed in a similar manner using an approved re-enterable system.
- C. All fire ratings shall be maintained in all areas of the building.

3-5 Quality Assurance and Control:

- A. All cable installers will be asked to demonstrate their knowledge in cable installation and installation requirements.
- B. Cable termination personnel shall demonstrate knowledge of termination specifications.
- C. During installation, the Owner's engineers may require installers to demonstrate cable installation and termination knowledge.

3-6 Testing of Cable Installation Accuracy:

- A. All cables shall be formally tested on the reel, by each cable segment, and in their final and completely installed location.

- B. All cable tests will be performed with calibrated test equipment that has a presently active certificate of calibration.
- C. The instruments used to test the cables shall be less than two years old.
- D. The most recent software and firmware available for the test instruments shall be used.
- E. All transmission components of a cable must be tested. This includes each wire or fiber within a cable.
- F. OTDR tests shall be performed prior to any cable installation.
 - 1. The tests performed shall include the following but not limited to: Cable length, cable attenuation, and wavelength tested.
 - 2. All tests shall be performed at 1300um and 1510um.
 - 3. The test results shall be stored on electronic media and given to the Owner's engineers prior to cable installation.
- G. OTDR tests shall be performed after any cable segment installation.
 - 1. All tests shall be performed at 1300um and 1510um.
 - 2. Each test shall be performed for both directions of the cable.
 - 3. The printed and electronic media test results of the Optical fiber testing shall contain at a minimum the following information for each fiber:
 - a. Cable, buffer tube, and strand identifier
 - b. Wavelength of test
 - c. Highest degree of resolution which will contain the entire length of the cable.
 - d. OTDR graph of entire cable length
 - e. Attenuation of fiber under test (dBm of only the single fiber with a calibrated reference zero)
 - f. Both printed and electronic media test documentation shall be required for all cable tests.

reports, and electronic media containing the test result data in 3 ring binders. The table shall include a simple list of identifier name, cable end points, installed length, cable or fiber attenuation, pass/fail identification, and comments.

- h. The table shall indicate all defective pairs or fibers. Cables not complying with appropriate standards, shall be identified to the Project Manager for corrective action which will include replacement at no additional expense to the Owner.
 - I. All test results shall be organized by cable and organization.
 - j. All electronic test results shall be organized into a database or Microsoft Excel spreadsheet so that each fiber test (graphical and text) may be easy viewed.
4. Each spliced cable shall also follow the OTDR testing procedures from each end point of the splice fiber strand.

3-7 Identification of System:

A. General Identification

- 1. The mechanically printed identification markings and systems shall be uniform, no hand written labels shall be permitted.
- 2. The TIA/EIA 606 cabling identification codes as shown on the drawings shall be standardized across all cabling.

B. Outside Plant Identification

- 1. All cables in hand/man holes shall be identified with end point information as well as the next access point in either direction.
- 2. All conduits entering a hand/man hole shall be labeled with the next access point in either direction.

C. Inside Plant Identification

- 1. All cables in pull boxes shall be identified with end point information as well as the next access point in either direction.
- 2. All conduits entering a pull box shall be labeled with the next access point in either direction.

3-8 Inspection:

- A. On-going inspections shall be performed during construction by the Owner's designated staff. All work shall be performed in a high quality manner and the overall appearance shall be clean, neat and orderly. The following points will be examined and must be satisfactorily complied with:
1. Is the cabling installation documentation complete?
 2. Are all cables properly labeled?
 3. Have all terminated cables been properly tested in accordance with the specifications?
 4. Is the cable type suitable for its pathway?
 5. Are the cables bundled in parallel?
 6. Have the pathway manufacturer's guidelines been followed?
 7. Are all cable penetrations installed properly and fire stopped according to code?
 8. Have the Contractors avoided excessive cable bending?
 9. Is Cable Fill correct?
 10. Are inside plant hangers to code?
 11. Have Patch Panel instructions been followed?
 - a. Jacket removal point
 - b. Termination positions
 - c. All cable termination tight with minimal distortions
 - d. Standards followed for the cable termination