INTER-BUILDING & INTRA-BUILDING COMMUNICATIONS CABLING SYSTEM

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ARTICLE I
INTER AND INTRA-BUILDING COMMUNICATIONS CABLING SYSTEM

PART 1 – GENERAL RELATED DOCUMENTS

The general provision of the Contract, including General and Supplementary Conditions and General Requirements apply to the work specified in this section.

The latest revision of the National Electrical Code shall be followed in every case except where local regulations are more stringent, in which case local regulations shall govern.

PART 2 – FIBER OPTIC CABLING SYSTEM

A. INSTALLATION OF FIBER OPTIC CABLING

1. The contractor shall at all times install the fiber optic cable in complete accordance with the recommended practices of the cable manufacturer, and shall not exceed the tensile ratings, minimum bending radius or any other fiber cable installation restrictions of the manufacturer. Excessive pulling tensions that might damage the inter-building cable shall be avoided at all times. Bends of small radii and twists that might damage the inter-building cables shall be avoided at all times.

2. All equipment shall be secured plumb and square with consideration being given not only to operational efficiencies, but also to overall aesthetic factors.

3. All exposed cable shall be prominently labeled with a securely fastened warning tag stating that the equipment contains fiber optic cable and is transmitting potentially hazardous wavelengths of light if broken or exposed. A stenciled or anodized label shall be applied to the fiber termination equipment denoting a like message.

4. All fiber optic cable shall be prominently and permanently labeled at building entrance/exit and cable termination points with to and from destinations. The fiber count of each cable is to be included on the labels.

5. Upon completion of installation of fiber optic cable thru existing conduit and inner-duct, the contractor shall install one (1) Tyco Corp. Simplex Plug around the cable and into the inner-duct at all manhole and building entrance locations.

6. The inter-building cable facilities must not be trampled upon, run over by vehicles, pulled along the ground, over fences, metal fittings, or cross-arms.

7. All metallic shielded or metallic strength member cabling shall be properly grounded and bonded at the building entrances as per applicable sections of the National Electrical Code.

8. During all placements, a breakaway swivel set for the appropriate short term tensile rating suggested by the manufacturer for the cable shall be employed. When using a winch, a clutch and dynamometer shall control and monitor the pulling power.

9. The Contractor is to note that the term "loaded" is the minimum allowable bend radius for the cable during maximum tensile loads during installation, and that the term "unloaded" refers to the minimum allowable bend radius during residual installed tensile loads (after installation).

10. Every instance of damaged fiber optic cable observed at any time prior to installation, during installation, or after installation, shall be immediately called to the attention of the University. The method of repair or correction of such damage shall be in accordance with the University's written instructions. The Contractor shall promptly repair such damage or make such corrections accordingly.

11. In manholes which have horizontal duct offsets, the Contractor shall ensure that sufficient cable guides are placed to allow for as straight a pull through as possible.

12. As the fiber optic cables are played off the reel, the Contractor shall carefully inspect the cable assemblies for any and all jacket defects. The pulling operation shall stop immediately if any substantial defects are observed. The Contractor shall then inform the University of defects and will require the University's instructions on what corrective action shall be taken before continuing the placement operation.

13. The Contractor shall immediately stop all cable placement operations if the cable becomes bound, entangled, or in any way does not pay off freely from the reel. Upon notifying the University, the cause of the binding must be cleared to the University's satisfaction before continuing the pulling operation.

14. All regulations and procedures as set forth by the University Department of Occupational Health and Safety must be strictly adhered to when entering Confined Spaces, such as manholes. Copies of procedures are available upon request.

B. TERMINATION OF FIBER OPTIC CABLING

1. The Contractor shall perform all terminations of the fiber optic cable at terminal points.

2. All cables terminating in Siecor WIC products shall be installed according to SRP-003-207 Issue 4 September 1994. A minimum of 6 ft. of color coded buffer tubing or fibers must be prepped into the WIC Panels shall be installed from top to bottom, back to front, as per standard buffer tube color coded sequence.

3. All cables terminating in Siecor CMH products shall be installed according recommended practices, and have a minimum 6 ft. of color coded fiber prepped in the CMH.

4. All fiber optic cable entering or leaving any and all fiber terminal equipment shall be securely fastened thereto and dust sealed.

C. FIBER OPTIC CABLE TESTING

1. The Contractor shall perform continuity tests on every fiber in each fiber optic cable both before and after installation of the cable. If any fibers are found to be non-continuous BEFORE installation, the Contractor shall inform the University of such a condition immediately. It will then be the University's responsibility to determine the method of repair and or replacement.

2. If non-continuous fibers are found AFTER installation, the Contractor shall inform the University of such a condition immediately. The University will then decide the method of repair or replacement, but the Contractor shall be responsible for repairing or replacing the damaged fiber optic cable unless given other written instruction from the University.

3. It may be possible that improper installation, i.e. non-compliant bend radius or other form of stressing of the fiber cable may not be determined by this testing. The University's acceptance of the initial testing from end to end does not release the Contractor from their obligation in the proper installation of the fiber as outlined in these specifications.

4. Upon completion of the construction and terminations, the Contractor shall perform two OTDR tests on every fiber and shall supply to the University the original trace taken from the OTDR. Detail of the loss, distance, date and time, OTDR operators name, cable, buffer tube color and fiber color shall be made a part of the record. For multimode fiber, each fiber shall be tested at 850nm and 1300nm. For single mode fiber, each fiber shall be tested at 1310nm and 1550nm.

5. Upon completion of the construction and terminations, the Contractor shall perform an end-to-end loss test on every fiber that has been connectorized on both ends. The tests shall be taken from fiber distribution panel to fiber distribution panel, or other appropriate fiber terminal equipment, using calibrated light sources and optical power meters.

6. Testing shall be conducted in both directions (forward and rearward) and with the light sources operating at 850 and 1300 nanometers for multimode and 1310 and 1550 for single mode. The Contractor shall provide the University with certified verification of the light sources and optical power meters' calibration dates, which must be within the manufacturer's calibration interval. The Contractor shall use the following procedure to perform these tests and shall record all measured data on the End-To-End (ETE) Loss Record.

7. The Contractor shall give the University of Delaware's Network & Systems Services personnel five (5) working days notice of all fiber optic cable testing dates so that representatives may be present if so elected.

D. MATERIALS AND EQUIPMENT

1. The equipment and components included in this specification are manufactured and/or distributed by the Corning Cable Systems, Reliance Comm/Tec, and the AT&T Corporations.

2. All materials and equipment supplied shall be new and shall meet or exceed the latest published specifications of the manufacturer in all respects, and shall be UL (Underwriters Laboratory) approved.

3. A complete information package of all materials and equipment shall be submitted to the University of Delaware for review by the Department of Network & Systems Services for approval four (4) weeks prior to installation. Equipment shall include, but may not necessarily be limited to, the following:

E. FIBER OPTIC CABLING PRODUCTS, MATERIALS AND EQUIPMENT

1. FIBER OPTIC CABLE

   a. All fiber optic cables, including inter-building and riser applications, shall be manufactured by Corning Cable Systems, and shall meet the below performance characteristics. Inter-building cables shall be ALTOS or FREEDM cables as indicated in the scope of work section, and riser cables shall be CMR or CMP rated as required.

   b. The MULTI-MODE fiber optical performance and characteristics are defined as follows:

CORE/CLADDING:	62.5/125um
WAVELENGTH OPERATION:	850nm/1300nm
MAXIMUM ATTENUATION:	3.75/1.50 dB/km
MINIMUM BANDWIDTH:	160/500 MHz/km

All multi-mode installations shall meet or exceed the above specifications.

   c. The dual window SINGLE-MODE fiber optical performance and Characteristics are defined as follows:

CORE:	8.3um
WAVELENGTH OPERATION:	1310/1550nm
MAXIMUM ATTENUATION:	0.4/0.4 dB/km

All single mode installations shall meet or exceed the above specifications.

2. FIBER OPTIC CONNECTORS

   a. For multi-mode ST terminations: Corning Cable Systems #95-000-50 Unicam ST Type connectors.

b. For multi-mode SC terminations: Corning Cable Systems #95-000-40 Unicam SC Type connectors.

c. For single-mode ST terminations: Corning Cable Systems #95-200-51 Unicam ST Type connectors.

d. For single-mode SC terminations: Corning Cable Systems #95-200-41 Unicam SC Type connectors.

3. FIBER FAN-OUT KITS

a. 6-Fiber Fan-out Kit, 36", Corning Cable Systems #FAN-BT-36-06

4. FIBER DISTRIBUTION CENTERS

a. Corning Cable Systems #WIC-024 Wall-mountable fiber interconnect center with a capacity of 24 fibers.

b. Corning Cable Systems #WIC-012 Wall-mountable fiber interconnect center with a capacity of 12 fibers.

c. Corning Cable Systems #CCH-02U Rack-mountable fiber interconnect center with a capacity of 24 fibers.

d. Corning Cable Systems #PCH-01U Rack-mountable fiber interconnect center with a capacity of 12 Fibers.

e. Corning Cable Systems #FDC-CMH-072 Wall/Rack-mountable fiber termination enclosure with a capacity of 72 fibers.

5. FIBER CONNECTOR PANELS

a. Corning Cable Systems #CCH-CP06-25T - Connector Panel for Closet Connector Housing, with a capacity of six (6) ST compatible connectors and sleeves for the termination of multi-mode fibers.

b. Corning Cable Systems #CCH-CP06-19T - Connector Panel for Closet Connector Housing, with a capacity of six (6) ST compatible connectors and sleeves for the termination of single mode fibers.

c. Corning Cable Systems #WIC-CP1-25 - Connector Panel for WIC-024, with a capacity of 6 ST compatible connectors and sleeves for the termination of multimode fibers.

d. Corning Cable Systems #WIC-CP1-19 - Connector Panel for WIC-024, with a capacity of 6 ST compatible connectors and sleeves for the termination of single mode fibers.

e. Corning Cable Systems #FDC-CP1P-25 – Connector Panel for FDC Termination Enclosures with a capacity of 6 ST compatible connectors and sleeves for the termination of multi-mode fibers.

f. Corning Cable Systems #FDC-CP1P-19 – Connector Panel for FDC Termination Enclosures with a capacity of 6 ST compatible connectors and sleeves for the termination of single-mode fibers.

g. Corning Cable Systems #CCH-CP06-25T – Connector panel for CCH or PCH Termination Enclosures with a capacity of 6 ST compatible connectors and sleeves for the termination of multi-mode fibers.

h. Corning Cable Systems #CCH-CP06-19T – Connector Panel for CCH or PCH Termination Enclosures with a capacity of 6 ST compatible connectors and sleeves for the termination of single-mode fibers.

6. FIBER CABLE INNERDUCT PLUGS

a. Tyco Corp. #JM-SIM-10S035S – For use in 1” inner-ducts used for routing of cables with an O.D. of .20-.35.

b. Tyco Corp. #JM-SIM-10S057SB – For use in 1” inner-ducts used for routing of cables with an O.D. of .35-.57.

c. Tyco Corp. #JM-SIM-10S070SB – For use in 1” inner-ducts used for routing of cables with an O.D. of .50-.70.

d. Tyco Corp. #JM-SIM-12S057SB – For use in 1-1/4” inner-ducts used for routing of cables with an O.D. of .35-.57.

e. Tyco Corp. #JM-SIM-12S070SB – For use in 1-1/4” inner-ducts used for routing of cables with an O.D. of .57-.70.

f. Tyco Corp. #JM-SIM-12S090SB – For use in 1-1/4” inner-ducts used for routing of cables with an O.D. of .70-.90.

PART 3 – COAXIAL CABLING SYSTEM

A. INSTALLATION OF COAXIAL CABLING

1. The contractor shall at all times install the coaxial cable in complete accordance with the recommended practices of the cable manufacturer, and shall not exceed the tensile ratings, minimum bending radius or any other coaxial cable installation restrictions of the manufacturer. Excessive pulling tensions that might damage the inter-building cable shall be avoided at all times. Bends of small radii and twists that might damage the inter-building cables shall be avoided at all times.

2. All equipment shall be secured plumb and square with consideration being given not only to operational efficiencies, but also to overall aesthetic factors.

3. Upon completion of the installation of coax cable thru existing conduit and inner-duct, the contractor shall install one (1) Tyco Corp. Simplex Plug around the cable and into the inner-duct at all manhole and building entrance locations.
4. The inter-building cable facilities must not be trampled upon, run over by vehicles, pulled along the ground, over fences, metal fittings, or cross-arms.

5. All metallic shielded or metallic strength member cabling shall be properly grounded and bonded at the building entrances as per applicable sections of the National Electrical Code.

6. During all placements, a breakaway swivel set for the appropriate short term tensile rating suggested by the manufacture for the cable shall be employed. When using a winch, a clutch and dynamometer shall control and monitor the pulling power.

7. The Contractor is to note that the term "loaded" is the minimum allowable bend radius for the cable during maximum tensile loads during installation, and that the term "unloaded" refers to the minimum allowable bend radius during residual installed tensile loads (after installation).

B. TERMINATION OF COAXIAL CABLING RISERS

All splicing and terminations of the coaxial riser cable will be performed by the University of Delaware.

C. TERMINATION OF COAXIAL CABLING HORIZONTALS

All terminations of the coaxial horizontal cable will follow the recommended practices of the connector manufacturer.

D. COAXIAL CABLE TESTING

All testing of the coaxial cable will be performed by the University of Delaware.

E. MATERIALS AND EQUIPMENT

1. All materials and equipment supplied shall be new and shall meet or exceed the latest published specifications of the manufacturer in all respects, and shall be UL (Underwriters Laboratory) approved.

2. A complete information package of all materials and equipment shall be submitted to the University of Delaware for review by the Department of Network & Systems Services for approval four (4) weeks prior to installation. Equipment shall include, but may not necessarily be limited to, the following:

F. COAXIAL CABLING PRODUCTS, MATERIALS AND EQUIPMENT

1. COAXIAL CONNECTORS & OUTLET HARDWARE

   a. COAXIAL HORIZONTAL CONNECTORS
   1) Connector to be used for Belden #1189A, PVC Quad-shield Cable shall be F-type RG-6 connector manufactured by the Thomas & Betts Corp. #SNS6QS, Snap-N-Seal, to terminate both ends of cable.

   2) Connector to be used for Belden #1189AP, Plenum Rated, Quad-shield cable shall be F-type RG-6 connector manufactured by the Thomas & Betts Corp. #SNS1P6U, Snap-N-Seal, to terminate both ends of cable.

   3) F-type coax bulkhead for outlet faceplates as manufactured by Siemon Co., Inc. #CT-FA-02.

2. COAXIAL RISER CABLE

   a. For RISER application, the cable to be used shall be .500 riser rated coaxial trunk cable with .111copper clad aluminum center conductor, .125" Outer jacket (CMR rated), 15.3 pf/ft capacitance, 75 ohm impedance, 87%Velocity of Propagation. Loss shall be no greater than 0.52 dB/100' at 50 MHZ and 1.63 dB/100' at 450 MHZ. CommScope #P3500-JCAR cable is required.

   b. For PLENUM application, the cable to be used shall be .500 plenum rated coaxial trunk cable with .111 copper clad aluminum center conductor, .125” Outer jacket (CMP rated), 15.3 pf/ft capacitance, 75 ohm impedance, 87% Velocity of Propagation. Loss shall be no greater than 0.52 dB/100’ at 50 MHZ and 1.63 dB/100’ at 450 MHZ. CommScope #2312 cable is required.

3. COAXIAL INTER BUILDING TRUNK CABLE

    a. Cable to be used shall be gel filled outside plant rated .500 coaxial trunk cable with .111 copper clad aluminum center conductor, .125" Outer jacket (CMR/CMP rated), 15.3 pf/ft capacitance, 75 ohm impedance, 87% Velocity of Propagation. Loss shall be no greater than 0.52 dB/100' at 50 MHZ and 1.63 dB/100' at 450 MHZ. CommScope #P3500-JCASS cable is required.

4. COAXIAL HORIZONTAL CABLE

For General Purpose and RISER applications, the cable to be used shall be Belden Wire and Cable Corp. #1189A – Riser Rated RG-6 coaxial 60-40 cable (2 braids 1 @ 60%, 1 @ 40%). The center conductor shall be 18 gauge copper clad steel with polyethylene jacket and a maximum signal loss of 4.2 DBMV at 450 MHz.

For PLENUM applications, the cable to be used shall be Belden Wire and Cable Corp. #1189AP – Plenum Rated RG-6 coaxial 60-40 cable (2 braids 1 @ 60%, 1 @ 40%). The center conductor shall be 18 gauge copper clad steel with polyethylene jacket and a maximum signal loss of 4.2 DBMV at 450 MHz.

5. COAX CABLE INNERDUCT PLUGS

    a. Tyco Corp. #JM-SIM-10S057SB – For use in 1" inner-ducts used for routing of cables with an O.D. of .35-.57.

    b. Tyco Corp. #JM-SIM-12S057SB – For use in 1-1/4" inner-ducts used for routing of cables with an O.D. of .35-.57.

PART 4 – TWISTED PAIR CABLING SYSTEM

A. INSTALLATION OF TWISTED PAIR CABLING

1. Installation shall include delivery, unloading, setting in place, fastening to walls, floors, ceilings, or other structures where required, interconnecting wiring of system components, equipment alignment and adjustment, and all other related work whether or not expressly defined herein. Installation shall be performed in accordance with applicable standards, codes, requirements and recommendations of National, State, and Local authorities having jurisdiction, and the N.E.C. (National Electrical Code). All boxes, equipment, etc., shall be installed plumb and square, and firmly secured in place unless requirements of portability dictate otherwise.

2. In the installation of equipment and cable, consideration shall be given not only to operational efficiency, but also to overall aesthetic factors.

3. Upon completion of the installation of inter-building telephone trunk cable thru existing conduit, the contractor shall install one (1) Tyco Corp. Simplex Entry Seal around the cable and into the conduit at all manhole and building entrance locations.

4. If there are areas where sleeves are required through walls or in concrete slabs, the contractor is responsible for providing those sleeves as required to accommodate his work. All holes must be core bored. After completion of the Communications Cabling System, the contractor shall fire seal all communications sleeves with a UL approved fire stop in accordance with the NFPA (National Fire Protection Agency).

5. All conduit and cabling raceway required is to be coordinated by this contract, but is the responsibility of the electrical contractor.

B. TERMINATION OF TWISTED CABLING PAIR RISERS

1. Pair assignments of all connections shall be uniform from the originating cross-connect blocks to remote cross-connect blocks in the communications equipment rooms. Pair integrity must be maintained; split pairs are unacceptable.

C. TERMINATION OF TWISTED PAIR CABLING HORIZONTALS

1. Pair assignments of all connections shall be uniform at all communications outlets and match those at terminations in cross-connect blocks in the communications equipment rooms. Pair integrity shall be maintained; split pairs are unacceptable.

2. Horizontal cable runs on each floor SHALL NOT EXCEED 295 ft.

3. All outlet cables shall be punched down on cross-connect blocks using a University of Delaware provided punch-down sequence list which shall indicate onto which block/lug each cable is to be landed.

4. All cabling shall be run above the ceiling in cable trays, cable rings and/or J Hooks. The cable shall be fastened to the building structure at regular intervals of no more than six (6) feet until reaching the station outlet location. No cable shall be exposed on any ceiling or wall.

5. In areas where the exterior finish of walls is disturbed, the Contractor shall repair and refinish damaged areas so as to restore the area to its original condition.

6. In areas where ceiling tiles are removed for cable pulling, or ceiling tiles are damaged as a result of cable pulling, the Contractor shall replace tiles with like tile.

7. All communications outlets shall be 18" above finished floor to the center line of the device, unless otherwise indicated on the Contract Documents.

D. TYPICAL COMMUNICATIONS OUTLET MODULE/JACK TO CROSS-CONNECT BLOCKCONDUCTOR ASSIGNMENT FOR VOICE APPLICATION ONLY

"Siemon" Cross-Connect Block Position		“Siemon” or “Interlink” Communications Outlet Module/Jack Pin Position
1 - WHITE/BLUE		WHITE/BLUE, Pin 4, Jack 1
2 – BLUE/WHITE		BLUE/WHITE, Pin 3, Jack 1
3 - WHITE/ORANGE		WHITE/ORANGE, Pin 2, Jack 1
4 - ORANGE/WHITE	CABLE #1/MODULE #1	ORANGE/WHITE, Pin 5, Jack 1
5 - WHITE/GREEN	"VOICE"	WHITE/GREEN, Pin 4, Jack 2
6 – GREEN/WHITE		GREEN/WHITE, Pin 3, Jack 2
7 - WHITE/BROWN		WHITE/BROWN, Pin 2, Jack 2
8 - BROWN/WHITE		BROWN/WHITE, Pin 5, Jack 2
49 – UNUSED		
50 – UNUSED		

E. TYPICAL COMMUNICATIONS OUTLET MODULE TO CROSS-CONNECT BLOCK CONDUCTOR ASSIGNMENT FOR ONE (1) FOUR PAIR CABLE

"Siemon" Cross-Connect Block Position		“Siemon” or “Interlink” Communications Outlet Module/Jack Pin Position
1 - WHITE/BLUE		WHITE/BLUE, Pin 1, Jack 1
2 – BLUE/WHITE		BLUE/WHITE, Pin 2, Jack 1
3 - WHITE/ORANGE		WHITE/ORANGE, Pin 3, Jack 1
4 - ORANGE/WHITE	CABLE #1/MODULE #1	ORANGE/WHITE, Pin 6, Jack 1
5 - WHITE/GREEN	"DATA"	WHITE/GREEN, Pin 1, Jack 2
6 – GREEN/WHITE		GREEN/WHITE, Pin 2, Jack 2
7 - WHITE/BROWN		WHITE/BROWN, Pin 3, Jack 2
8 – BROWN/WHITE		BROWN/WHITE, Pin 6, Jack 2
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.		
49 – UNUSED		
50 – UNUSED		

F. TWISTED PAIR CABLING TESTING

1. Before Acceptance Tests are scheduled, the Contractor shall perform his own system checkout. The Contractor shall furnish all required test equipment and shall perform all work necessary to determine and/or modify performance of the system to meet the requirements of this specification. This work shall include the following.

    a. End-to-End tests of the wiring of each communications outlet shall include continuity and anti-continuity, pair integrity, attenuation, polarity, NEXT, and operation at 100MHz tests. Complete Category 5E tests are required for data links. Complete Category 3 tests are required for voice links. The Microtest Omni Scanner is the required test device capable of providing these tests, as the Network and Systems Services Department utilizes a database that will accept these results. Test results shall be verified by letter and by supplying the University Department of Network and Systems Services with documentation of the test results upon completion by way of submittal of two (2) electronic data files. The first file should be readable by the Fluke Linkware Program provided by Fluke and have an .FLW extension. The second file is exported from the Linkware program and will be a test result summary report in the form of a Microsoft Excel, comma-delimited file. These test results shall be submitted thru the General Contractor.
    b. Maintain documentation of all performance tests for reference by the Owner during the System Acceptance Tests.

G. TWISTED PAIR CABLING AND SPLICE CASE TESTING – INTER-BUILDING CABLE & INTRA-BUILDING VOICE RISERS

1. The contractor shall utilize a 4-pair test set to verify end-to-end wire map and continuity of newly installed inter-building trunk cables. All results shall be saved and submitted to the University of Delaware department of Network & Systems Services thru the General Contractor.

2. The contractor shall utilize a 4-pair test set to verify end-to-end wire map and continuity of newly installed voice data riser cables. All results shall be saved and submitted to the University of Delaware department of Network & Systems Services thru the General Contractor.

3. All inter-building trunk cable splice cases shall be air tested per 3M Closure System 2-Type Installation instructions. There shall be a University of Delaware department of Network & Systems Services representative present at the time of test.

H. MATERIALS AND EQUIPMENT

1. A complete information package of all materials and equipment shall be submitted to the University of Delaware for review by the Department of Network & Systems Services for approval four (4) weeks prior to installation. Equipment shall include, but may not necessarily be limited to, the following.

2. The equipment and components included in this specification are manufactured and/or distributed by the Siemon Co, Mohawk Cable Corp., Graybar, Anixter, or similar.

3. All materials and equipment supplied shall be new and shall meet or exceed the latest published specifications of the manufacturer in all respects, and shall be UL (Underwriters Laboratory) approved.

4. Equipment shall include, but may not be limited to, the following.

I. TWISTED PAIR CABLING PRODUCTS, MATERIALS AND EQUIPMENT

1. TWISTED PAIR CROSS-CONNECT BLOCKS AND WALLMOUNT TERMINATION EQUIPMENT

    a. #S66M1-50, 50-pair cross connect blocks as manufactured by Siemon Co. Inc.

    b. #50M-2000W, Wall mounted termination modules as manufactured by Homaco Co., Inc. Each wall mounted termination module shall be mounted upon two (2) 40” vertical sections of 1-5/8” Unistrut for the purpose of offsetting the module from the wall for additional cable routing capacity behind the module itself.

    c. #50M-600W, Wall mounted termination modules as manufactured by Homaco Co., Inc. Each wall mounted termination module shall be mounted upon two (2) 40” vertical sections of 1-5/8” Unistrut for the purpose of offsetting the module from the wall for additional cable routing capacity behind the module itself.

2. TWISTED PAIR HORIZONTAL COMMUNICATIONS CABLE

    a. Mohawk Cable Corp. #M56167-Riser Rated. Communications cable consisting of four twisted pairs of (4) 100 ohm, #24 AWG, solid, unshielded twisted pair wires. Written certification must be received four (4) weeks prior to installation that the cable conforms to the TIA/EIA 568-A CAT5 and DRAFT CATEGORY 5e specification for electrical characteristics including attenuation, crosstalk, capacitance, PS-Next, PS-ACR, PS-ELFEXT, SRL and RL.

    b. Mohawk Cable Corp. #M56168-Plenum Rated CAT5E cable.

c. Krone #CM-00224CAG-5 –Riser Rated. Communications cabling consisting of two-twisted pairs of two (2) 100 ohm, #24AWG, solid, unshielded twisted pair wires, meeting the TIA/EIA CAT5 standard. This cable shall be used for UD Cisco Switch Harness manufacturing only. Utilize RJ45 connector's #5-554720-3.

3. TWISTED PAIR OUTSIDE PLANT COMMUNICATIONS CABLE

a. Superior Essex #ANMA-900/#09-118-77, 900-pair, Filled-PIC, Foam-Skin Insulation w/80 C Filling Compound, 24AWG, Bonded ASP.

b. Superior Essex #ANMA-600/#09-116-77, 600-pair, Filled-PIC, Foam-Skin Insulation w/80 C Filling Compound, 24AWG, Bonded ASP.

c. Superior Essex #ANMA-400/#09-112-77, 400-pair, Filled-PIC, Foam-Skin Insulation w/80 C Filling Compound, 24AWG, Bonded ASP.

d. Superior Essex #ANMA-300/#09-110-77, 300-pair, Filled-PIC, Foam-Skin Insulation w/80 C Filling Compound, 24AWG, Bonded ASP.

e. Superior Essex #ANMA-200/#09-108-77, 200-pair, Filled-PIC, Foam-Skin Insulation w/80 C Filling Compound, 24AWG, Bonded ASP.

f. Superior Essex #ANMA-100/#09-104-77, 100-pair, Filled-PIC, Foam-Skin Insulation w/80 C Filling Compound, 24AWG, Bonded ASP.

g. Superior Essex #ANMA-50/#09-100-77, 50-pair, Filled-PIC, Foam Skin Insulation w/80 C Filling Compound, 24AWG, Bonded ASP.

h. Superior Essex #ANMA-25/#09-097-77, 25-pair, Filled-PIC, Foam Skin Insulation w/80 C Filling Compound, 24AWG, Bonded ASP.

i. Superior Essex #09-094-02, Seal-PIC-FSF (RUS PE-89), 12-Pair, duct-rated, aluminum shielded, 24AWG, with Filling Compound.

j. Superior Essex #09-092-02, Seal-PIC-FSF (RUS PE-89), 6-Pair, outside/duct rated, aluminum shielded, 24AWG, with Filling Compound.

k. Mohawk Cable Corp. #M57561- 4-Pair, outside/duct rated CAT5E cable for Campus or Emergency Phones located in the outside environment.

4. SIMPLEX ENTRY SEALS FOR TELEPHONE TRUNK CABLES IN CONDUIT

a. Tyco Corp. #JM-SIM-40S136S – For use in 4" conduits used for routing of cables with an O.D. of 1.19-1.36.

b. Tyco Corp. #JM-SIM-40S196SB – For use in 4" conduits used for routing of cables with an O.D. of 1.38-1.96.

c. Tyco Corp. #JM-SIM-40S256SB – For use in 4" conduits used for routing of cables with an O.D. of 1.92-2.56.

d. Tyco Corp. #JM-SIM-40S291SB – For use in 4" conduits used for routing of cables with an O.D. of 2.56-2.91.

e. Tyco Corp. #JM-SIM-40S327SB – For use in 4" conduits used for routing of cables with an O.D. of 2.91-3.27.

5. SPLICE CASES AND ASSESSORIES FOR OUTSIDE PLANT COMMUNICATIONS CABLE

a. 3M Corp. #2D2A-510 Outside/Underground Splice Case, 9.5" x 27.5", 2-Type Closure.

b. 3M Corp. #2C2A-510, Outside/Underground Splice Case, 8" x 27.5", 2-Type Closure.

c. 3M Corp. #8983-8882, Outside/Underground Splice Case.

d. 3M Corp. #R-5, Inside-Rated, Fire-Retardant Splice Case. Utilize #R-5-Kit with this splice case for end-caps, clamps, etc.

e. 3M Corp. #R-9, Inside-Rated, Fire-Retardant Splice Case. Utilize #R-9-Kit with this splice case for end-caps, clamps, etc.

f. 3M Corp. #2D2-2E-510, endplates for use with 2D2A-510 enclosure, two-entry holes.

g. 3M Corp. #2C2-1E-510 endplates for use with 2C2A-510 closure, one-entry hole.

h. 3M Corp. #3M710-TC-1-25 Splice Modules, 25-pair, filled, straight/half-tap, for outside/underground splice cases.

i. 3M Corp. #3M710-SD-1-25 Splice Modules, 25-pair, dry, straight/half-tap, for inside use in fire-retardant splice cases.

j. Splice Case Hanger – Marconi Comm. Corp #R51-B to be used for mounting of each splice case located within buildings.

6. LIGHTNING PROTECTION AND TERMINATION MODULES

a. Porta-Systems Corp. #26100-ST-MSTP, 100-pair Building Entrance Terminal, fully loaded with 100 gas-tube protector modules. 100-pair, 26 awg. Fusible-link stub-in on **top** of module. 100-pair, 24 awg. Stub-out on **bottom** of module.

b. Porta-Systems Corp. #26100-ST-MSTRP, 100-pair Building Entrance Terminal, fully loaded with 100 gas-tube protector modules. 100-pair 26 awg. Fusible-link stub-in on **bottom** of module. 100-pair, 24 awg. Stub-out on **top** of module.

c. Porta-Systems Corp. #26050-ST-MSTP, 50-pair Building Entrance Terminal, fully loaded with 50 gas-tube protector modules. 50-pair, 26 awg. Fusible-link stub-in on **top** of module. 50-pair, 24 awg. Stub-out on **bottom** of module.

d. Porta-Systems Corp. #26050-ST-MSTRP, 50-pair Building Entrance Terminal, fully loaded with 50 gas-tube protector modules. 50-pair, 26 awg. Fusible-link stub-in on **bottom** of module. 50-pair, 24 awg. Stub-out on **top** of module.

e. Porta-Systems Corp. #504PX26GT, 6-pair Protector Pack – to be installed on all Assist phone cables that serve phones located outside the footprint of the building (exterior).

7. BLACKBOARD SYSTEM CONTROL CABLE

a. Belden Cable Corp. #8719, 1-pair, 16-AWG tinned copper conductors, twister pair, and polyethylene insulation with overall 100% Beldfoil shield.

b. Belden Cable Corp. #9540, 10-pair, 24-AWG stranded conductors, tinned copper, tinned copper drain wire, and PVC jacket.

8. TWISTED PAIR RISER COMMUNICATIONS CABLE

a. Mohawk Cable Corp. #M58141, 25-Pr. CAT5E, data grade riser rated cable.

b. Mohawk Cable Corp. #M58142, 25-Pr. CAT5E, data grade plenum rated cable.

c. Mohawk Cable Corp. #M55216, 50-Pr. CAT3, voice grade riser rated cable.

d. Mohawk Cable Corp. #M56126, 50-Pr. CAT3, voice grade plenum rated cable.

e. Mohawk Cable Corp. #M55211, 100-Pr. CAT3, voice grade riser rated cable.

f. Mohawk Cable Corp. #M56128, 100-Pr. CAT3, voice grade plenum rated cable.

g. Mohawk Cable Corp. #M57098, 300-Pr. CAT3, voice grade riser rated cable.

h. Mohawk Cable Corp. #M57211, 300-Pr. CAT3, voice grade plenum rated cable.

9. TWISTED PAIR OUTLET JACKS

a. Double gang quad faceplate as manufactured by Siemon Co. Inc. #CT8-FP-02.

b. Single gang faceplate as manufactured by Siemon Co. Inc. #CT4-FP-02. This faceplate is only to be used in special situations as indicated by The University of Delaware.

c. Voice Module - 3-pair USOC as manufactured by Siemon Co. Inc. #CT-U3-U3-02.

d. Data Module - 4-pair, 8 position T568B as manufactured by Siemon Co. Inc. #CT-C5-C5-02.

e. Single gang faceplate as manufactured by Siemon Co. Inc. #CT4-FP-20 (ivory). Use this faceplate for systems/modular furniture unless otherwise specified. Utilize ivory termination hardware and blank modules for this application.

f. Blank modules as manufactured by Siemon Co. Inc. #CT-BLNK-20. Ivory blanks shall be used for systems/modular furniture unless otherwise specified.

g. White telephone icons shall be used with #CT-U3-U3-02 modules.

h. White data icons shall be used with #CT-C5-C5-02 modules.

i. Wall jack assembly with mounting lugs as manufactured by Suttle Co., Inc. #SE-630A6.

10. EMERGENCY PHONE EQUIPMENT AND PRODUCTS

a. Emergency Phone, Gaitronics S.M.A.R.T. Phone #293-03, shall be supplied by the University of Delaware Department of Network & Systems Services. UD-NSS will provide the back boxes/enclosures to the contractor so that the conduit stub into the bottom of the enclosure for 4-pair cable routing can be coordinated and installed. The Emergency Phone shall be mounted to a mounting bracket, which will also be supplied by UD-NSS. There shall be no holes drilled thru the Emergency Phone back box/enclosure. The use of the mounting bracket will allow proper mounting of the phone to the Hubbell pole.

b. Hubbell Pole for locations outside the footprint of the building shall utilize #SSS-10-40-1-AX-DB (Square, Straight, Steel, 10ft long, 4” shaft, 11 gauge, single sided, bronze in color).

11. LOBBY ENTRANCE PHONE EQUIPMENT AND PRODUCTS

    a. Entrance Phone, Ceeco Corp, hands-free model #SSP-561-F with enclosure shall be supplied by the University of Delaware department of Network & Systems Services. UD-NSS will provide the back boxes/enclosures to the contractor so that the conduit stub into the bottom of the enclosure for the 4-pair cable routing can be coordinated and installed. The entrance phone shall be mounted to a mounting bracket within the wall cavity.

PART 5 – GROUNDING AND BONDING SYSTEM

A. INSTALLATION OF GROUNDING AND BONDING

1. The contractor shall install the Telecommunications Grounding Bus Bar and grounding and bonding system in complete accordance with the recommended practices of the manufacturers and in accordance with the latest revision of the National Electrical Code.

2. For the non-TBB (Telecommunications Bonding Backbone) bonding to the TGB (Telecommunications Grounding Busbar) within Intermediate Telecommunications Rooms, the first choice of the approved bond shall be structural steel.

3. The grounding and bonding system shall not rely on the plumbing systems of any type.

4. All bonding conductors shall be routed to the approved ground/bond location utilizing the shortest possible, and shall be routed with a minimum number of bends.

5. All bonding connections shall be accomplished utilizing u.l. listed bolts, crimp pressure connectors, clamps and lugs.

B. MATERIALS AND EQUIPMENT

1. A complete information package of all materials and equipment shall be submitted to the University of Delaware for review by the Department of Network & Systems Services for approval four (4) weeks prior to installation. Equipment shall include, but may not necessarily be limited to, the following.

2. All materials and equipment supplied shall be new and shall meet or exceed the latest published specifications of the manufacturer in all respects, and shall be UL (Underwriters Laboratory) approved.

C. GROUNDING AND BONDING PRODUCTS, MATERIALS AND EQUIPMENT

1. Grounding Bus Bars

    a. Telecommunications Main Grounding Busbar and Telecommunications Grounding Bus Bars shall be B-Line Systems Inc. #SB477K – Kits that include the wall mounted bus bar, support brackets, lugs, and related hardware.

    b. Insulated #6 Braided Wire as specified by the National Electrical Code.

PART 6 – CABLE TRAY, J-HOOK RACEWAYS, CONDUIT, SLEEVES AND RELAY RACKS

A. INSTALLATION OF CABLE TRAY AND/OR J-HOOK RACEWAYS

1. The contractor shall at all times install the cable tray in complete accordance with the recommended practices of the cable tray manufacturer, and shall be installed true and plumb. Support hardware shall be installed at 4 ft. intervals.

2. There shall be no cable tray installed thru walls of any sort. The installed cable tray shall be terminated on both sides of walls. Penetrations thru said walls shall take place by way of 4" sleeves.

3. The contractor shall at all times install the J-Hook raceways in complete accordance with the recommended practices of the J-Hook manufacturer.

4. J-Hooks that are installed as the primary raceway in hallways shall be installed at 4 ft. intervals. For primary raceways in hallways, the contractor shall install four-inch J-Hooks, Erico Corp. #CAT64. At no time shall there be more than three-hundred 300 CAT5E cables installed in a single four-inch J-Hook pathway. For primary pathways where walls of a hallway can be used, an appropriately sized section of unistrut shall be installed as the mounting base for all four-inch J-Hooks, so as to allow a secondary pathway to be installed below the primary pathway, for future use. Attach all J-Hooks to unistrut with unistrut spring nuts and screws.
5. J-Hooks installed as the secondary raceway, including individual outlet cable pathways to/thru various rooms within the building, the contractor shall install 2-inch J-Hooks, Erico Corp. #CAT32. At no time shall there be more than eighty (80) CAT5E cables installed in a single two-inch J-Hook pathway.

B. MATERIALS AND EQUIPMENT

1. A complete information package of all materials and equipment shall be submitted to the University of Delaware for review by the Network & Systems Services Department for approval four (4) weeks prior to installation.

2. All materials and equipment supplied shall be new and shall meet or exceed the latest published specifications of the manufacturer in all respects, and shall be UL (Underwriters Laboratory) approved.

3. All cable tray shall be installed as per Cablofil recommended practices and directions, using Cablofil cutting tools, with no sharp edges left behind to compromise the cable system to be installed.

4. All cables that exit cable tray in Telecommunications Rooms shall be supported with one (1) Cablofil Cable Drop-Down Assembly #CABLEXIT at each cable drop-down location.

5. All corners/90's/T's shall utilize Cablofil #EZT90 corner fittings.

6. Equipment shall include, but may not be limited to, the following:

    a. A #6 AWG green-insulated ground wire shall run the entire length of the cable tray. This wire shall be installed inside the cable tray and secured by way of cable ties to the front/bottom corner of the tray itself.

    b. Bond the #6 green insulated ground wire at each 10 feet section of cable tray utilizing grounding lug (Cablofil Inc. EZ-Tray #GTA 2-2). The grounding lugs shall attach to the front side-rail of the tray.

    c. The last cable tray section at each of the Telecommunications Rooms shall be bonded to the TGB's (Telecommunications Grounding Busbar's) or the TMGB (Telecommunications Main Grounding Busbar) by way of #6 green insulated ground wire.

7. Cable Tray materials to be used are as follows:

    a. 4" Cable Tray shall be Cablofil Inc. EZ-Tray #CF54/100-EZ

    b. 6" Cable Tray shall be Cablofil Inc. EZ-Tray #CF54/150-EZ

    c. 8" Cable Tray shall be Cablofil Inc. EZ-Tray #CF54/200-EZ

    d. 12" Cable Tray shall be Cablofil Inc. EZ-Tray #CF54/300-EZ

    e. 18" Cable Tray shall be Cablofil Inc. EZ-Tray #CF54/450-EZ

    f. Splicing assemblies shall be Cablofil Inc. EZ-Tray #PRECLICK. Utilize two (2) #PRECLICK at each splice location on side rails. Utilize two (2) #EZ-BN-1/4 Nut/Bolt/Clamp Assemblies on bottom of tray at each splice location.

    g. All corners/90 shall utilize Cablofil Inc. EZ-Tray #EZT90.

h. 4" Wall Brackets shall be Cablofil Inc. EZ-Tray #FAS-U100

i. 6" Wall Brackets shall be Cablofil Inc. EZ-Tray #FAS-U150

j. 8" Wall Brackets shall be Cablofil Inc. EZ-Tray #FAS-U200

k. 12" Wall Brackets shall be Cablofil Inc. EZ-Tray #FAS-U300

l. 20" Wall Brackets shall be Cablofil Inc. EZ-Tray #FAS-U500

m. 12" Center Hanger Assemblies shall be Cablofil Inc. EZ-Tray #FAS-P300

n. 18" Center Hanger Assemblies shall be Cablofil Inc. EZ-Tray #FAS-P500

o. Trapeze Hanging kits shall be Cablofil Inc. EZ-Tray #AS-B

p. Cable Drop-Down Assemblies shall be Cablofil Inc. EZ-Tray #CABLEXIT

8. J-Hooks to be used are as follows:

a. Two-Inch (2") shall be Erico Corp. #CAT32

b. Four-inch (4") shall be Erico Corp. #CAT64

c. Where hallway walls cannot be used for the primary pathway and for secondary pathways, utilize appropriate threaded rod assemblies and associated parts of beam clamp assemblies as the project dictates. These individual parts will be factored into the specifications during the design process.

9. Relay Racks for Telecommunications Rooms:

a. Relay Racks shall be Chatsworth Products, Inc. #55053-503, 7 ft. H, x 19 in. W., brushed aluminum in color.
b. Vertical Cable Management Assemblies shall be the Chatsworth Products, Inc. #30092-503 Vertical Cable Management Assembly.

c. Horizontal Cable Management Assemblies shall be the Chatsworth Products, Inc #130-70-719 Horizontal Management Assembly.

d. Relay Rack Wall-mount shelves shall be Chatsworth Products, Inc. #40074-500.

e. Rack mount surge suppressor shall be Isobar #IBAR12.

f. Each relay rack shall be bonded back to the Telecomm Room Grounding Busbar by way of green insulated #6 ground wire; utilizing one (1) Chatsworth Products, Inc. #40167-001 Two Mounting Hole Ground Terminal Blocks to be installed on the relay rack itself.

C. INSTALLATION OF CONDUIT, SLEEVES, AND FIRESTOPPING

1. The contractor shall at all times install the conduits and sleeves in complete accordance with the National Electrical Code and NFPA, and shall be installed true and plumb. Support hardware shall be installed at 4' intervals.

2. For conduit installed to transport outside rated inter-building cables, the conduit shall carry the IMC rating. For all other conduits the EMT rating shall be acceptable.

3. All conduits installed for Telecommunications Cable routing, including, convenience outlet locations, riser conduits, and horizontal conduits of all sizes shall have one (1) nylon Greenlee Poly-line #502-1481.0 installed upon completion of the conduit installation.

4. All riser and horizontal sleeves installed between floors shall be manufactured by the Unique Fire Stop Corp., and be installed as per recommended practices. There shall be protective plastic bushings installed on both sides of each sleeve. **The Electrical Contractor installing the sleeves shall leave the supplied fire-stop putty within the sleeves in the plastic packaging for use by the Telecommunications Contractor all cabling has been installed**.

D. MATERIALS AND EQUIPMENT

1. A complete information package of all materials and equipment shall be submitted to the University of Delaware for review by the Network & Systems Services Department for approval four (4) weeks prior to installation.

2. All materials and equipment supplied shall be new and shall meet or exceed the latest published specifications of the manufacturer in all respects, and shall be UL (Underwriters Laboratory) approved.

3. CONDUIT – Install standard IMC-Rated conduit for transport of outside rated, inter-building cables that route beyond 50 feet within a building, as per NEC. Install standard EMT conduit for other applications, including transport of horizontal cables in special applications.

4. SLEEVES – One-inch (1") for gypsum wallboard assemblies where telecommunications cables will be installed – STI Fire-Stop Corp. #FS-100 sleeve assembly. The U.L. approved fire-stop System to be used for this application shall be #WL-3275. The cable fill capacity for these sleeves shall not exceed 48%. The Telecommunications contractor shall use the supplied fire-stop putty to satisfy this System requirement.

5. SLEEVES - One-inch (1") for concrete and block wall assemblies where telecommunications cables will be installed – STI Fire-Stop Corp. #FS-100 sleeve assembly. The U.L. approved fire-stop System to be used for this application shall be #WJ-3141. The cable fill capacity for these sleeves shall not exceed 48%. The Telecommunications contractor shall use the supplied fire-stop putty to satisfy this System requirement.

6. SLEEVES – Two-inch (2") for gypsum wallboard assemblies where telecommunications cables will be installed – STI Fire-Stop Corp. #FS-200 sleeve assembly. The U.L. approved fire-stop System to be used for this application shall be #WL-3275. The cable fill capacity for these sleeves shall not exceed 48%. The Telecommunications contractor shall use the supplied fire-stop putty to satisfy this System requirement.

7. SLEEVES – Two-inch (2") for concrete and block wall assemblies where telecommunications cables will be installed – STI Fire-Stop Corp. #FS-200 sleeve assembly. The U.L. approved fire-stop System to be used for this application shall be #WJ-3141. The cable fill capacity for these sleeves shall not exceed 48%. The Telecommunications contractor shall use the supplied fire-stop putty to satisfy this System requirement.

8. SLEEVES – Four-inch (4") for gypsum wallboard assemblies where telecommunications cables will be installed – STI Fire-Stop Corp. #FS-400 sleeve assembly. The U.L. approved fire-stop System to be used for this application shall be #WL-3275. The cable fill capacity for these sleeves shall not exceed 48%. The Telecommunications contractor shall use the supplied fire-stop putty to satisfy this System requirement.

9. SLEEVES – Four-inch (4") for concrete and block wall assemblies where telecommunications cables will be installed – STI Fire-Stop Corp. #FS-400 sleeve assembly. The U.L. approved fire-stop System to be used for this application shall be #WJ-3141. The cable fill capacity for these sleeves shall not exceed 48%. The Telecommunications contractor shall use the supplied fire-stop putty to satisfy this System requirement.

10. SLEEVES – Four-inch (4") for horizontal/gypsum wallboard assemblies where telecommunications cables **will not** be installed (spare sleeves) – STI Fire-Stop Corp. #FS-400 sleeve assembly. The U.L. approved fire-stop System to be used for this application shall be #WJ-0009. The Telecommunications contractor shall use the supplied fire-stop putty to satisfy this requirement.

11. SLEEVES – Four-inch (4") for concrete **floor and concrete and/or block wall** assemblies where telecommunications cables will be installed – STI Fire-Stop Corp. #FS-400 sleeve assembly. The U.L. approved fire-stop System to be used for this application shall be #C-AJ-0101. The Telecommunications contractor shall use the supplied fire-stop putty to satisfy this System requirement.

12. INNERDUCT – For riser cable routing in continuous, long riser conduit runs (other than normal sleeves), install four (4) 1" ENDOT Industries Inc. #IRI-100 riser-rated, corrugated inner ducts with preinstalled pull tape. For areas that are plenum rated, install four (4) 1" ENDOT Industries Inc. #IPR-100 plenum-rated, corrugated inner ducts with preinstalled pull tape.

ARTICLE II
INTER-BUILDING
COMMUNICATIONS CABLING SYSTEM

PART 1 – INTER-BUILDING SCOPE OF WORK

A. SCOPE OF WORK AND RESPONSIBLITIES FOR THE TELECOMMUNICATIONS CONTRACTOR:

1. The scope of work for the Telecommunications Contractor shall include all labor, materials, equipment, and services necessary for the installation of a complete inter-building fiber optic, multi-twisted pair and coaxial communications cabling system including, but not limited to, new cabling, termination hardware, lightning projection modules, and other related equipment as required. The scope of work shall also include termination, testing, and labeling of the entire systems. The contractor shall contact the University Department of Network & Systems Services prior to terminating any cabling within the Telecommunications Rooms , so that proper layout of all equipment is coordinated and verified.

2. FIBER OPTIC CABLE TRUNK INSTALLATION

    a. Install one (1) XX multimode/XX single mode fiber optic cable from the Main Telecommunications Room XXX of the XXX Building to the Main Telecommunications Room XXX of the XXX Building.

3. COAX CABLE TRUNK INSTALLATION

    a. Install one (1) .500" coax cable from Main Telecommunications Room XXX of the new building to the Main Telecommunications Room XXX of the XXX Building.

    b. All splicing and termination of coax shall be performed by UD.

4. TWISTED PAIR (VOICE) CABLE TRUNK INSTALLATION

    a. Install XX (XX) 100 twisted pair trunk cable from Main Telecommunications Room XXX of the new building to Main Telecommunications Room XXX of the XXXXX Building.

5. BLACKBOARD SYSTEM CABLING FOR OUTSIDE ENTRY/EXIT GATES

a. Install at each entry/exit gate control enclosure one (1) Belden Cable Corp. #8719 cable for the gate control itself. Home run cable back to Telecommunications Room XXX, utilizing 1" conduit to be installed as part of the building construction.

b. Install at each entry/exit gate Blackboard System Swipe pedestal one (1) Belden Cable Corp. #9540 cable for card swipe control. Home run cable back to Telecommunications Room XXX, utilizing 1" conduit to be installed as part of the building construction.

c. Two (2) 1" conduits will be installed to each gate control enclosure for routing of the above cables. Two (2) 1" conduits will then be installed from the gate control enclosure, to the Blackboard System Swipe pedestal location. When installing the above cables, both cables shall be run together, within one (1) of the 1" conduits. The second 1" conduit shall remain spare for future use.

6. EXTERIOR BUILDING EMERGENCY PHONE LOCATIONS

a. Locations for Emergency Phones shall be accessible by wheelchair that would travel on a paved sidewalk surface. The coordination of the installation of the phone shall be such that the face of the Emergency Phone enclosure shall be flush with the edge of the sidewalk, so that proper forward reach to the phone can be made from a wheelchair and all existing ADA requirements are met.

b. Locations for Emergency Phones on buildings shall include one (1) 3/4-inch EMT sleeve installed thru the exterior wall for routing of AC power conductors for the installed blue-light. The installation shall also include one (1) 3/4-inch EMT sleeve installed thru the exterior wall for routing of the 4-pair telecommunications cable for dial tone to the phone itself. For 4-pair cable routing to the emergency phone, install a ¾" metallic stub-out below the emergency phone, then into the **bottom** of the emergency phone enclosure. This penetration into the emergency phone enclosure must be done off-center because of the physical location of internal phone electronics within the enclosure. No other penetrations of the enclosure shall be acceptable. If other penetrations are attempted without UD-NSS approval, the contractor shall be responsible for the cost of a new emergency phone.

c. For Emergency Phones mounted directly on buildings, the back enclosure of the phone itself shall be secured to the building exterior wall via the four supplied screw mounting holes. No other penetrations of the enclosure shall be acceptable. If other penetrations of the emergency phone enclosure are attempted, the contractor shall be responsible for the cost of a new emergency phone.

d. For Emergency Phone locations beyond the footprint of the building (not on exterior wall), install Hubbell Inc. Steel-Straight-Square poles for mounting of the emergency phone and the blue light assembly.

e. For pole mounted locations, install two (2) one-inch schedule 40 conduits to be used for AC power and the 4-pair cable installation. Install an 18" diameter concrete tube/base for the conduits to be routed up into, and the pole to be mounted upon. All underground conduits to be installed shall be installed as per most current UD Network & Systems Services PVC conduit specifications.

f. Upon completion of the Hubbell pole, the Blue Light shall be installed at a height of 8ft. – 0" to the bottom of the light fixture from finished grade/paving. The blue light circuit shall be controlled by an installed photo cell unit.

g. All pole mounted emergency phones shall be installed to the poles using a UD Network & Systems Services provided Emergency Phone mounting bracket. This mounting bracket shall be installed so that the top of the bracket is at 48" above grade. When the Emergency Phone is installed, the call button shall be at the height of 47-1/14" above the pavement, satisfying ADA requirements. The mounting bracket shall be secured to the pole by way of screws that shall be installed in the middle of the bracket. The emergency phone back enclosure shall be installed onto the bracket using the four supplied screw mounting holes. No other penetrations of the enclosure shall be acceptable. If other penetrations of the emergency phone enclosure are attempted, the contractor shall be responsible for the cost of a new emergency phone.

h. For 4-pair cable routing to the Emergency Phone, install a ¾" metallic conduit stub-out below the emergency phone mounting plate on the face of the pole, then into the **bottom** of the emergency phone enclosure. This penetration into the emergency phone enclosure must be done off-center because of the physical location of internal phone electronics within the enclosure. No other penetrations of the enclosure shall be acceptable. If other penetrations are attempted without UD-NSS approval, the contractor shall be responsible for the cost of a new emergency phone.

i. Utilize 4-pair CMR or EMP CAT5E rated Mohawk cable for phones mounted directly on exterior walls of buildings.

j. Utilize Mohawk 4-pair outside rated CAT5E cable for locations outside the footprint of the building at Hubbell Pole locations.

k. All emergency phone cabling that serves locations outside the footprint of the building shall be installed with lightning protection within the building itself, and shall be bonded/grounded accordingly. The lightning protection module shall be the Porta-Systems #504PX26GT, as per the products section of this specification.

l. The 4-pair cable routed into the phones at all locations shall terminate in an Allen-Tel #AT-468-6, surface mount jack with a single RJ-11 jack, which the internal emergency phone RJ-11 cord shall be connected to for dial-tone.

ARTICLE III
INTRA-BUILDING
COMMUNICATIONS CABLING SYSTEM

PART 1 – INTRA-BUILDING SCOPE OF WORK

A. SCOPE OF WORK AND RESPONSIBLITIES FOR CARPENTRY CONTRACTOR:

1. Install 3/4" AC rated plywood on ALL walls of Telecommunications Rooms XXX. All plywood shall extend from 6” above the floor to ceiling in each room, and shall be painted with two (2) coats of fire-retardant paint on ALL sides and ALL edges to match the interior color of the room BEFORE any and all equipment is installed within the rooms.

B. SCOPE OF WORK AND RESPONSIBILITIES FOR ELECTRICAL CONTRACTOR:

1. The scope of work for the Electrical Contractor shall include all cable pathways including individual outlet conduit and junction boxes, conduit and/or sleeves between all communications rooms, conduit and/or sleeves from communications rooms to hallway cable path locations, sleeves in walls from all rooms for individual station cable routing to hallway cable path locations, and all cable tray for horizontal and riser cable routing. All conduits and sleeves within the system shall be installed with protective bushings on all exposed/cut ends.

2. All AC power outlets shall be installed in telecommunications rooms as flush mount outlets, with junction boxes and conduits shall be roughed into the wall, junction boxes shall be installed and sized to accommodate the ¾” plywood on the walls. No surfaced mounted outlets or conduit shall be mounted to the plywood.

3. The scope of work for the electrical contractor shall also include installation of the entire Telecommunications Grounding and Bonding System.

4. GROUNDING AND BONDING

    a. Provide a Telecommunications Grounding Main Grounding Bus bar (TMGB) on the 3/4" plywood within Telecommunications Room XXX of the building. The exact location for the TMGB will be determined by the University Department of Network & Systems Services, and shall be identified on contract drawings within the design for all equipment within the room. The TMGB shall be bonded to the electrical service ground at the electrical service entrance within the building utilizing insulated #6 AWG braided wire, as per the NEC. Label the bonding conductor at both ends of wire as to it’s from/to destination by room number, and specify that it is for the “Telecommunications Grounding and Bonding System”. See Article I Part5 for TMGB product description and order number.

b. Provide and install a Telecommunications Grounding Bus bar (TGB) on the 3/4" plywood within Telecommunications Room XXX. The TGB shall then be bonded to the nearest approved building ground utilizing #6 AWG braided wire, as per the National Electrical Code. Structural Steel shall be the first choice for this approved bond. See Article I Part 5 for TGB description and order number.

c. Provide, install, and bond an insulated #6 AWG Braided Telecommunications Bonding Backbone (TBB) wire from the TMGB within Telecommunications Room XXX of the building, to the TGB within the Intermediate Telecommunications Room XXX.

d. Utilize all connector fittings within the B-Line Bus bar kit as called out in the Article I Part 5 of this specification.

5. COMMUNICATIONS OUTLET BOXES

a. At indicated locations install one (1) 4" wide by 2 1/4" deep square box with two (2) 3/4" conduits (standard EMT) stubbed off above the ceiling. Attach one (1) 4" two device ring to the front of the box for proper installation of the double-gang faceplate.

b. Install Fire Alarm Panel Enclosure and conduits as defined below in section 17 (b).

6. CABLE TRAY SYSTEM

a. Install XX" Cablofil EZ-Tray in all corridors of the building, as per contract drawings. Height of cable tray is to be XXft-XX".

b. Install XX" Cablofil EZ-Tray on all walls of Telecommunications Rooms XXX and XXX as per contract drawings.

c. Install #XXXX Cablofil Wall mount or other bracket mounting assembly for cable tray.

d. Install #6 green insulated bonding wire from TMGB and route around the entire cable tray installation, then bond with Cablofil #GTA-2-2 bonding assemblies at each section of tray.

7. CONDUIT AND SLEEVES

a. Install XXX (X) 4" EMT conduits from Telecommunications Room XXX to Telecommunications Room XXX.

b. Install XXX (X) 4" STI Corp. #FS400 sleeves with bushings from Telecommunications Room XXX into hallway corridor for horizontal cable routing from cable tray, into the Telecommunications room itself.

c. Install XXX (X) 4" STI Corp. #FS400 riser sleeves with bushings from Telecommunications Room XXX to Telecommunications Room XXX for riser cable routing between floors.

d. Install a minimum of one (1) 1" STI Corp. #FS100 sleeve with bushings from every room in the building thru the common corridor wall, for routing of all horizontal cabling from outlets to the corridor cable tray.

e. All 4" conduits installed for Telecommunications Riser Cable transport that are not sleeves (longer than a length to transition thru a wall or floor penetration), shall have four (4) 1", riser-rated or plenum-rated innerducts installed for cable pathways.

f. All Riser conduit sleeves installed between floors shall be installed so that there is 3" of conduit stub/protrusion above and below each floor. There shall be protective plastic bushings installed on both sides of each sleeve.

C. SCOPE OF WORK AND RESPONSIBILITIES FOR THE TELECOMMUNICATIONS CONTRACTOR:

1. The scope of work for the Telecommunications Contractor shall include all labor, materials, equipment, and services necessary for the installation of a complete fiber optic, unshielded twisted pair and coaxial communications cabling system including, but not limited to, new cabling, termination hardware, and cable rings or J-Hooks as required. The scope of work shall also include termination, testing, and labeling of the entire systems. The contractor shall contact the University Department of Network & Systems Services prior to terminating any cabling within the Telecommunications Rooms , so that proper layout of all equipment is coordinated and verified.

2. Triangular symbols in the "Symbol Legend" indicate a variety of "communications" point of use outlets for wiring provided under this contract.

3. The communications cabling system to be furnished shall consist of individual unshielded twisted pair cables home run from each communications outlet and punched down on cross-connect blocks with a 4-6" behind the Homaco wall-mount termination racks in the Telecommunications Rooms. Utilize pathways (cable tray, sleeves, etc.) for cable bundles and room routing as per building drawings.

4. The coaxial cabling system to be furnished shall also consist of individual RG-6 coaxial cable from each communications outlet, terminated with RG-6 connector at the outlet locations, with 15 ft. of termination loop at the defined splitter location in each Telecommunications room. Termination at the splitters will be by others. Utilize pathways (cable tray, sleeves, etc.) for cable bundles and room routing as per building drawings.

5. All work relating to communications wiring shall be provided under this contract. The contractor is required to provide reasonable cooperation with other contractors during installation of the communications cabling system.

6. When procuring communications wiring, the Owner shall require such wiring to be UL listed for use in "Plenum" or “Riser” space if necessary and require such wiring to be routed only via conduit and wiring cable trays provided under the construction documents and provide additional support and protection as required to keep such wiring from interfering with the removal of ceiling tiles or ceiling supports.

7. All outlet cabling must be run above ceiling and within walls, except where noted on the building drawings, where cabling raceway shall be used. There shall be no cable installed in ceiling areas that do not have cable raceway or pathways installed, such as non-accessible drywall ceilings. All pathways shall be designed with conduit, cable tray, or other raceways that are accessible for future access for cable installation.

8. Wiring Backboards (WB) in communications equipment rooms shall be 3/4" AC-rated plywood painted with two (2) coats of fire-retardant paint applied to ALL sides and ALL edges, and provided on ALL walls of Telecomm Rooms from 6” above the floor to ceiling and will be installed by the general contractor.

9. All cables within building, including riser/tie cabling shall be XXXXX rated.

10. TWISTED PAIR CABLE HORIZONTAL INSTALLATION

    a. For Communications Cabling Outlets install at each designated area on the building drawings, 18"above the finished floor, one (1) 4" square box with two (2) 3/4" conduits, which shall stub off above the ceiling. Protective bushings shall be installed on the ends of the conduits above the ceiling.

    b. Install four-pair cables to outlets as indicated on drawings from the appropriate communications room thru one of the 3/4" conduits, then terminate onto twisted-pair modules for voice and data. The modules shall be inserted into a double gang quad flush faceplate. Unused modules shall have blank covers installed.

    c. At systems furniture locations, the furniture manufacturer will provide standard single gang openings in the telecomm channels of the furniture itself. Utilize single gang Siemon Co. Faceplates and associated hardware for this application. Install cabling as indicated on the building drawings.

    d. Each outlet faceplate shall have one (1) identification label for each module (with cable) installed. The label shall contain the room number and outlet number within the room, followed by a "1" designating the first cable within the outlet, or a "2" for the second cable in the outlet. The information on the label shall be typed, not handwritten. For example, the first quad outlet shall have labels reading 100-1-1 and 100-1-2. If there are

multiple quad outlets, the next would be 100-2-1 and 100-2-2, following an ascending numerical sequence for the outlet numbers. All labels shall be placed on the provided white tags within the label holders above and below each outlet module location. All labels shall be of "Brother P-Touch" system quality or equivalent.

e. Each twisted pair module shall have two (2) white plastic Siemon Co. Icon identification tags installed, which shall identify the jacks as either "voice" or "data. The Icons are included within the module packaging.

f. The first four-pair cable shall be terminated and installed in the upper left position in the quad faceplate, and be identified with the white "voice" Icon, which illustrates a standard telephone set. The second four-pair cable shall be terminated and installed in the lower left position in the quad faceplate, and be identified with the white "data" Icon, which illustrates a standard Computer Terminal.

g. All UTP cables must be permanently marked with a wrap-around vinyl self-laminating printable marker label (Thomas & Betts E-Z-CODE WSL or accepted equivalent) at both ends. All Existing and new RG-6 coax cables shall be labeled using Panduit Corp., PAN-TY “Flag Type” Nylon Marker Ties at splitter locations. There shall be no unmarked cables at any place in the system. Labels shall contain the room number, drop number, and cable number within the room. All labeling shall be typed onto the label, not handwritten.

h. Cables shall not be run in close proximity to, in the same bundle as, or parallel with power cables or fluorescent lighting, in order to reduce signal contamination. A minimum separation of 2 feet from these sources of EMI is required.

i. No cable shall be installed with a bend radius less than that recommended by the cable manufacturer.

11. COAX CABLE HORIZONTAL INSTALLATION

a. Run one (1) RG-6 quad shield coax cable to specific outlets thru the second 3/4" conduit as indicated on the building drawings.

b. The RG-6 coax cable shall be terminated and installed in the upper right position in the quad faceplate.

12. TWISTED PAIR (VOICE) CABLE RISER INSTALLATION

a. Install XX (XX) 100 pair CAT3 twisted pair cable from Main Telecommunications Room XXX to Intermediate Telecommunications Room XXX.

13. TWISTED PAIR (DATA) CABLE RISER INSTALLATION

    a. Install XX (XX) Mohawk 25 pair CAT5E twisted pair cable from Main Telecommunications Room XXX to Intermediate Telecommunications Room XXX.

14. COAX CABLE (RISER) INSTALLATION

    a. Install one (1) .500" coax cable from Main Telecommunications Room XXX to Intermediate Telecommunications Room XXX.

    b. All splicing and termination of coax shall be performed by UD.

15. FIBER OPTIC CABLE INSTALLATION

    a. Install a composite 12 multimode/6 single mode fiber optic cable from the Main Telecommunications Room XXX to the Intermediate Telecommunications Room XXX.

16. VOICE PAY PHONE, CAMPUS PHONE, AND EMERGENCY PHONE OUTLETS

    a. Interior Locations: Install at each outlet one (1) single gang outlet junction box with one (1) 3/4" conduit to accessible ceiling area. The junction box shall be positioned on the wall so that the top of the box is no more than 48" above the finished floor.

    b. Install one (1) four-pair cable terminated onto a 6 position, 4 wire jack. The spare pairs shall be wrapped back for future use.

    c. For exterior Emergency Phone locations, see information in previous section of this specification, Inter-Building Scope of Work.

17. FIRE ALARM PANEL (FAP) OUTLET FOR DIALER'S LOCATION

    a. RJ31X blocks shall be installed within an enclosure at this location.

    b. Electrical Contractor Responsibility - Install one (1) #ASE8X6X3 Hoffman Corp. painted pull-box enclosure with screw-cover and knockouts next to the main/primary fire alarm panel to be installed for the building. Install one (1) ¾" conduit from top of box, thru the mechanical room, and into the nearby corridor to cable tray or J-Hook pathway location. Install one (1) ¾" conduit from the side of this enclosure, into the fire alarm panel itself, for station/patch cable routing to the dialers themselves.

    c. Install two (2) four-pair category 5E cables from floor Telecomm Room, to this enclosure and terminate on two (2) #AT635C1 Allen-Tel RJ31X style jacks. Each cable shall be terminated onto the jacks as per EIA/TIA 568B standard.

18. BLACKBOARD SYSTEM CABLING FOR INSIDE DOOR ENTRY

    a. Install at each door/swipe location one (1) Belden Cable Corp. #8719 cable for the door strike control. Home run cable back to Telecommunications Room XXX.

    b. Install at each door/swipe location one (1) Belden Cable Corp. #9540 cable for card swipe control. Home run cable back to Telecommunications Room XXX.

    c. Final connections of the Blackboard System will be performed by the University of Delaware Department of Network & Systems Services.

19. TWISTED PAIR CROSS-CONNECT BLOCKS AND WALL RACK INSTALLATION

    a. Mount XX (XX) Homaco #50M-2000 wall mount termination rack in Main Telecommunications Room XXX. All Homaco Racks shall be installed to the walls with two (2) 40" sections of unistrut, to allow for additional space behind the rack for cable routing.

    b. Mount XX (XX) Homaco #50M-2000 wall mount termination rack in Intermediate Telecommunications Room XXX. All Homaco Racks shall be installed to the walls with two (2) 40" sections of unistrut, to allow for additional space behind the rack for cable routing.

    c. For termination of cables and for cross-connect purposes in all building Telecommunications Rooms, install the required number cross-connect blocks onto the Homaco wall mount termination racks.

    d. All outlet cables shall be punched down on cross-connect blocks using a University of Delaware provided punch-down list which will indicated onto which block/lug each cable is to be landed. This punch-down list shall be a part of this contract.

    e. For horizontal and riser cross-connect blocks in all Telecommunications Rooms, punch down the horizontal cables onto the outside lugs of the blocks. The inside lugs will be used for cross-connect jumpers to the network electronics.

    f. All Telecommunications Room equipment to be installed shall be laid out and coordinated by way of a meeting with representatives from the Department of Network Services. Telecommunications Room layout drawings shall be a part of this contract.

20. RELAY RACK AND CABLE MANAGEMENT INSTALLATION FOR TELECOMMUNICATIONS ROOMS

    a. Install XX (XX) Chatsworth Products Inc. #55053-503 Relay Rack in Main Telecommunications Room XXX. Install one (1) Chatsworth Products Inc. #30092-503 Vertical Management Assembly onto each Relay Rack to be installed per drawing.

b. Install XX (XX) Chatsworth #30092-503 7 ft. vertical cable management assemblies on to each of the installed relay racks in Telecommunications Room XXX.'

c. Install XX (XX) Chatsworth #13070-719 horizontal cable management assemblies onto the relay rack in Telecommunications Room XXX.

d. Install XX (XX) Chatsworth #40074-500 wall mount shelf on wall of newly installed Telecommunications Room XXX.

e. Install one (1) Isobar #IBAR-12 rack mount surge suppressor in the newly installed relay rack in Telecommunications Room XXX.

21. NETWORK SWITCH AND HARNESS INSTALLATION

a. Install XX (XX) UD Network & Systems provided Cisco-3560G 10/100 Mbps Switches with relay racks in Telecommunications Room XXX, as indicated on contract drawings.
b. Manufacture and install XX (XX) 48-cable (two-pair) harnesses from each of the above XX (XX) Cisco Switches, via installed cable tray or pathway from relay rack to the wall mount Homaco Termination Rack field, for termination onto cross-connect blocks. Harnesses shall be built, dressed, routed, and terminated as per UD standards defined within these specifications. For 48-port switches, the harnesses shall be built as 24 two-pair cables, twice the length as is needed to route from relay rack to Homaco termination rack, terminated on both sides with RJ45, 8-pin connectors on each side. The two pairs shall terminate in each of the RJ45 connectors as per the 10/100BaseT standard using the Blue and Orange Pairs terminated in positions 1, 2, 3, & 6. All cables shall be tested to ensure continuity and to ensure that no pair swaps or reversal exist. The cables can then be cut in half, with 48 pigtails remaining for installation onto each switch. UD NSS personnel will provide labeling information for each switch pigtail at time of installation. Switch numbering shall follow a pattern of 1-48 for the first switch, 49-96 for the second switch, etc. There shall be a label on each side of the pigtail (block and switch end). To aid in manufacturing of the pigtails, UD NSS will provide a custom made "jig" for manufacturing and sorting all pigtail assemblies. The 48 port pigtail assembly shall be terminated on each of two (2) 66-blocks, stacked, with port 1 of the switch terminated at the block #1, lug #1 position. Ports 2-24 shall terminate continuously on the left sides of block #'s 1&2, with port 24 ending on lugs 45-48 of block #2. Ports 25-48 shall be terminated on the right sides of block #'s1&2 in similar order.

22. DATA CROSS-CONNECT INSTALLATION

a. Perform XX (XX) active data circuits upon installation of network electronics and termination of switch harnesses, and termination and testing of all horizontal data circuits.
b. All cross-connects shall be punched down on cross-connect blocks using a UD NSS provided punch-down list, which will indicate which block/lug each wire is to be landed. This punch down list shall be a part of this contract.

23. VOICE CROSS-CONNECT INSTALLATION

    a. Perform XX (XX) active voice circuits upon installation of inter-building telephone cabling or Verizon cable feed, and termination and testing of all horizontal voice cables.

    b. All cross-connects shall be punched down on cross-connect blocks using a UD NSS provided punch-down list, which will indicate onto which block/lug each wire is to be landed. This punch down list shall be a part of this contract.

24. EXISTING CABLE AND OUTLET DEMOLITION

    a. All horizontal cabling, riser cabling, outlet hardware, and termination hardware that exists in the area to be renovated shall be un-terminated and removed. Total number of outlets and associated cables estimated shall be XX.

PART 2 – SUBMITTALS

A. GENERAL SUBMITTAL INFORMATION

1. At the completion of the installation, the Contractor shall provide one (1) copy of each of the following.

2. Equipment manufacturer's operation and maintenance manuals for each piece of equipment.

3. "As built" drawings for all equipment installed, including cross-connect block layout.

4. "As built" drawings on contract blueprint of all wire and cable placement throughout the building and conduits.

5. Samples of proposed equipment may be required by the University of Delaware prior to any contracts.

6. The Bidder shall include a statement of warranty on the entire system and on the individual pieces of equipment. The system warranty shall be for a minimum of one (1) year from the date of system acceptance by the Owner. This warranty shall obligate the Contractor to provide all equipment, material and labor, at no charge to the Owner, during the warranty period in the event of system or equipment malfunction. All manufacturers' equipment warranties shall be activated in the Owner's name and shall commence on the date of system acceptance. In the case of Contractor modified equipment, the manufacturer's warranty is normally voided. In such cases, the Contractor shall provide the Owner with a warranty equivalent to that of the original manufacturer.

-- END OF SECTION--

APPENDIX A
UNIVERSITY OF DELAWARE
DEPARTMENT OF NETWORK AND SYSTEMS SERVICES
APPROVED TELECOMMUNICATIONS CONTRACTORS
FOR INTRA-BUILDING SCOPE OF WORK

THE NETWORKS
262 East North Street
Smyrna, DE. 19977
Attn: Kevin Coursey
Telephone: 302-653-6599
FAX: 302-653-6591
Email: Kevin@thenetworks.cc

TRI-M NETWORK SERVICES
204 Gale Lane
P.O. Box 69
Kennett Square, PA., 19348
Attn: Kurt Albrecht
Telephone: 610-444-6200 Ext. 256
FAX: 610-444-6135
Email: kalbrecht@tri-mns.com

NETVERSAND
4009 Market St.
Aston, PA., 19014
Attn: Scott Wells
Telephone: 610-348-8407
FAX: 610-364-3250
Email: swells@netversant.com

OLIVER COMMUNICATIONS GROUP
2457 Old York Road
Bordentown, NJ. 08505
Attn: Phil Oliver
Telephone: 609-324-1750
FAX: 609-324-1760
Email: phil@olivercomm.com

PRIMENET
16221 Rte. 13 Sussex Highway
Bridgeville, DE, 19968
Attn: Wayne DeMarco
Telephone: 302-337-9370
866-314-4848
FAX: 302-337-9377
Email: wdemarco@primenetworks.com

VISION TECHNOLOGIES
530 J McCormick Drive
Glen Bernie, MD., 21061
Attn: Joe Congdon
Telephone: 410-424-2183
FAX: 410-424-2208
Email: jcongdon@visiontech.biz

APPENDIX B
UNIVERSITY OF DELAWARE
DEPARTMENT OF NETWORK AND SYSTEMS SERVICES
APPROVED TELECOMMUNICATIONS CONTRACTORS
FOR INTER-BUILDING SCOPE OF WORK

TRI-M NETWORK SERVICES
204 Gale Lane
P.O. Box 69
Kennett Square, PA., 19348
Attn: Kurt Albrecht
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FAX: 610-444-6135
Email: kalbrecht@tri-mns.com

LAYNE COMMUNICATIONS
133 Den Road
Lincoln University, PA. 19352
Attn: Tom Layne
Telephone: 610-255-0806
FAX: 610-255-0510
Email: laynecommunications@kennet.net

NETVERSANT
4009 Market St.
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Email: swells@netversant.com

OLIVER COMMUNICATIONS GROUP
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