TELECOMMUNICATION SYSTEM

TECHNICAL DESIGN GUIDELINES – REV. 1 SEPT. 26, 2012

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# Compliance Checklist:

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Electrical Consultant Name: ____________________________________________

Electrical Consultant Signature: _______________________________________

Date: __________________________________________________________________

C: Compliant
NC: Non-Compliant
NA: Not Applicable

*If the guidelines or part of the guidelines cannot be attained or fulfilled (i.e. NC) during the design process, the Consultant shall provide reason(s) why such Guidelines are NOT met. Any modification or alteration to the design guidelines will need to be agreed / accepted by Networks and Systems / Facilities Management prior to inclusion in the design.*
OBJECTIVE:

The objective of this technical guideline is to provide a comprehensive design guideline for consultants when preparing construction documents for Dalhousie University.

REFERENCES:

- Canadian Electrical Code
- Nova Scotia Building Code
- National Building Code of Canada
- ANSI/EIA/TIA 568-B: Commercial Building Telecommunications Cabling Standard
- ANSI/EIA/TIA 569: Commercial Building Standards for Telecommunications Pathways and Spaces
- ANSI/EIA/TIA 607: Commercial Building Grounding and Bonding Requirements for Telecommunications
2. General Specification Guidelines

2.1. All new cabling installations and wiring retrofits to existing cable plant at the Dalhousie University campus should follow the current EIA/TIA cabling standards.

2.2. Dalhousie Network and Systems (N&S) bases its requirements on ANSI/EIA/TIA standards including but not limited to the following:
   2.2.1. 568-B: Commercial Building Telecommunications Cabling Standard
   2.2.2. 569: Commercial Building Standards for Telecommunications Pathways and Spaces
   2.2.3. 607: Commercial Building Grounding and Bonding Requirements for Telecommunications

2.3. N&S staff normally terminates and tests all telecommunications fiber optic and copper cabling which are supplied and installed by Electrical contractors.

2.4. For Major Projects the termination and testing of the copper cabling is to be completed by Electrical contractors. The termination of copper cabling must be completed by a Belden Certified CSV. Coordinate termination responsibilities with the project manager.

2.5. All cable installers must have a valid Nova Scotia Cabling Specialist Certificate.

2.6. By default all outlets specified as Data on the design drawings are connected by N&S to the default LAN for the building at 100 MB/sec. Specialty devices that require a network connection such as HVAC, Vending, Lighting Controls, Access and Security, cameras, electrical meters must be identified to N&S for proper VLAN and other special network requirements such as POE. Coordinate with Project Leader and Networks and Systems for further technical details.

3. Entrance Conduits

3.1. New buildings must have a cabling pathway that enables cables to be installed and tied in to one of the two Data Centers. The data centers are located in the basement of the Killam Library and in the basement of Sexton A-building. Coordinate with Dalhousie Networks and Systems on a project by project basis.

3.2. Provide at least three 4” conduits, one equipped with a 3 cell Maxcell innerduct installed to any new building. A 3/8” nylon pull rope (not pull string) with 200 lbs minimum tensile strength must be provided in each conduit. No more than two 90 degree bends are allowed between pull boxes. A mandrel inspection shall be performed on the conduits after conduit installation with a mandrel one trade size less than the conduit to ensure that there are no blockages.

3.3. Pull boxes shall be located in accessible locations and identified on record drawings.

3.4. J-Hooks are not acceptable for entrance pathways.

4. Telecommunication Space Requirements

4.1. Location

4.1.1. There must be at least one telecommunications equipment room (T-E-R) in a single-story building. For multi-story buildings, one T-E-R on the first floor (or basement) is required and at least one smaller telecommunications room (TR) is required on each floor above. T-E-Rs and TRs must be designed so that they are within 295 "cable feet" (90 meters) of every telecommunications outlet (TO) on that floor. If this is not possible, more than one TR per floor.
is required. Cable length (295 feet) includes cable lengths through vertical walls, conduits, cable trays and other pathways between the patch panels in the TR and the TO.

4.1.2. The preferred location for T-E-Rs or TRs is the center of the building, equidistant from the furthest TO in opposite directions. The rooms shall be vertically aligned or stacked from the lowest room to the highest room. They must be accessible either from the building exterior, public hallway or other common areas. They shall not be located inside office spaces, class rooms or auditoria.

4.1.3. T-E-Rs and TRs must be dedicated to voice, video, data, security devices and Dalcard equipment. They shall not contain electrical and mechanical equipment; fire alarm panels, slop sinks for janitors, etc. Equipment not related to the T-E-R and TR such as piping, duct work, building column and distribution of building power must not be located in or pass through the T-E-R or TRs.

4.1.4. If there are any other systems or devices requiring space in the TER or TR, these additions must be approved by Dalhousie N&S and Facilities Management. The room size for the TER or TR shall increase based on the additional equipment to be added.

4.1.5. Audio-visual (AV) systems, intercoms and similar in-house paging devices shall not be located in any TR/TER

4.2. Doors

4.2.1. The doors to the telecommunications rooms must open 180 degrees outward unless restricted by building code. They must be a minimum of 36" wide and 80" high with no door sills. Where doors must open into the room, set the door so that there is a minimum of 9" behind the opened door - this space can be utilized for risers and sleeves between rooms.

4.2.2. Telecommunications rooms shall not have windows.

4.2.3. To minimize dust infiltration TERs and TRs should be under positive air pressure. If positive air pressure cannot be accomplished, door sweeps and door seals shall be installed.

4.3. Floors

4.3.1. Carpet is not permitted in any telecommunications spaces.

4.3.2. Floors and ceilings should be treated/painted and sealed to eliminate dust accumulation.

4.3.3. Floor shall be covered with non-slip paint.

4.4. Walls

4.4.1. All walls must be lined with ¼" void free A-C grade (or better) plywood. The plywood must be fire retardant or treated with at least two coats of fire retardant paint. Use a light colored (white) paint to aid with lighting in the rooms. No electrical conduits, junction boxes or any other equipment may be mounted on or across any backboard.

4.4.2. Walls behind rack locations shall be complete with blocking to allow for mounting of wall mounted racks. Blocking shall be installed to allow for both installed and future racks as noted in the communication room layouts. Racks should not rely on the plywood lining for support.

4.5. Ceiling

4.5.1. Drop ceiling or suspended ceiling is not permitted in the telecommunications spaces. The minimum acceptable ceiling height is 8'-6". It should be unobstructed to provide space over the equipment racks for suspended cable trays, horizontal ladder racks or wire basket. Where ceilings are required due to building code regulations (fire rating) the structure shall be wrapped with sufficient drywall to provide the desired fire rating.

4.5.2. Sprinkler heads must be provided with cages to prevent accidental operations.

4.6. Electrical Power
4.6.1. A minimum of four dedicated non-switched 20A, 120 volt AC quad outlets are required for equipment power, each on a separate branch circuit. Branch circuits for equipment power shall be protected and wired for 20A capacity using a CSA 5-20R receptacles. Two of the four outlets are dedicated to voice and data and must be located on the same wall as the data field. Additional dedicated circuits are required for CCTV racks, door access control system, and intrusion alarm system. Refer to Appendix "A" for typical room layouts and circuit requirements.

4.6.2. When available these circuits should be connected to an emergency power system.

4.6.3. Top of power outlets should be mounted at 6" above finished floor to allow for access under installed racks and wire management.

4.7. Lighting

4.7.1. Lighting must have uniform intensity of 30 foot candles when measured 3 feet from the finished floor. Lighting fixtures must be on separate electrical circuits separate from the circuit the feeds the electrical outlets in the room. Fixtures shall be fitted with wire guards.

4.7.2. Emergency battery units shall be installed in the TER and TRs.

4.8. Environmental Control

4.8.1. The temperature inside telecommunications rooms shall be maintained at 72°F +/- 3°F with relative humidity between 30% and 55%.

4.8.2. The TER and TRs should have a minimum of four (4) air changes per hour.

4.8.3. The TER and TRs are to be maintained at a positive pressure.

4.9. Grounding

4.9.1. The telecommunications grounding and bonding infrastructure shall be designed and routed through each telecommunications space as per the latest edition of the CEC and ANSI/EIA/TIA-607 requirements.

4.9.2. The TER shall be equipped with a Main Telecommunications Grounding Busbar (TMGB) tied directly to the building electrical ground. The TMGB shall be pre-drilled for two hole compression lugs, minimum 24" in length, 4" in width and 1/4" thick. Standard of acceptance: Panduit GB40624TPI-1 series.

4.9.3. Each telecommunication room shall be equipped with a Telecommunications Grounding Busbar (TGB) bonded directly to the Telecommunications Bonding Backbone (TBB). The TGB shall be pre-drilled for two hole compression lugs, minimum 24" in length, 2" in width and 1/4" thick. Standard of acceptance: Panduit GB2B0314TPI-1 series.

4.10. Telecommunications Equipment Room (TER)

4.10.1. Typical TER dimensions are 12' x 14' (minimum) for a building serving fewer than 200 work areas. A typical work area (WA) is defined as 10'x10' or 100 sq. ft..

4.10.2. Sizing of the TER shall be coordinated on a building by building basis and must include space for Access Control and Security equipment, DalCard System equipment and CATV equipment (where required).

4.10.3. Entrance conduits entering the TER shall be located as close to a corner of the TER as possible to minimize wasted wall space.

4.10.4. Refer to Appendix "A" for typical Telecommunication Equipment Room layout.

4.11. Telecommunications Rooms (TRs)

4.11.1. Minimum size of a TR is 10'x8'. The room must be free of columns or obstructions.

4.11.2. Sizing of these rooms is dependent on various factors and shall be decided on a building by building basis and must include space for Access Control and Security equipment, DalCard System equipment and CATV equipment (where required).
4.11.3. A minimum of three 4-inch vertical riser conduits or sleeves are required from the TR to the TER and between TRs. These conduits or sleeves shall be located as close to a corner of the TR as possible to minimize wasted wall space.

4.11.4. Refer to Appendix "A" for typical Telecommunication Room layout.

4.12. Shallow TRs or Closets

4.12.1. For existing buildings communication closets may be used. These closets must have double doors. The minimum inside width is 8' and minimum depth is 36''.

4.12.2. Refer to Appendix "A" for typical Telecommunication Closet layout.

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**HORIZONTAL PATHWAYS:**

5. Horizontal Pathways

5.1. The Horizontal Pathway System is the route through which cables are pulled from the TER or TR to the outlets on the respective floor. Outlets must be connected to a TR on the same floor.

5.2. Cable Management

5.2.1. Tie wraps shall not be used as cable support or management. Velcro wraps are the preferred method of bundling cables.

5.3. Surface Mount Raceway System

5.3.1. In a surface mount raceway, power and telecommunications cables must be in separate compartments and must comply with applicable electric codes. When metallic barrier is provided, it must be bonded to ground. The barrier must run continuously throughout the length of the raceway.

5.4. Cable Trays

5.4.1. Wire basket or ventilated solid type cable trays are acceptable. Ladder trays are not acceptable inside the TRs or TERs.

5.4.2. There must be at least 4 inches of vertical space between the suspended ceiling tile and the bottom of the cable tray or wire basket, 12 inches of vertical clearance from the top of the cable tray to the underside of the structure or any item running parallel with the wire basket and 24" clearance to one side of the cable tray or basket, as required by the CEC.

5.4.3. Access ceiling panels must be provided where needed wherever a cable tray passes through a hard-lid ceiling. The panels should be within 12" of the cable tray and shall not be mounted directly underneath the cable tray. Access doors shall be flush mounted 24" x 24" for body entry and 12" x 12" for hand entry, unless otherwise noted. Doors shall open 180 degrees, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps. Access doors shall be minimum 14 gauge steel.

5.4.4. Cable trays or wire basket shall be used for installations over 25 cables. The cable trays or wire basket shall include appropriate accessories to ensure installed cables maintain their minimum bending radius, including bend radius adapters and cable drop outs.

5.4.5. Cable trays and wire baskets shall be sized as per the CEC for maximum fill and shall include for 25% spare cable capacity. Where door access control or security systems share the same cable tray or wire basket, the systems shall be bundles separately using velcro straps.

5.5. J-Hooks

5.5.1. J – Hooks are an acceptable installation method for projects involving legacy wiring and retro fits.

5.5.2. J-hooks can be used for installations of less than 25 cables.

5.5.3. The recommended distance between J hooks shall be 39" to 46".

5.6. Conduits
5.6.1. Where the use of cable tray, wire basket or J-hooks is not permitted, telecommunications outlets (TOs) should be connected to the TR with a minimum 1" conduit. No more than two 90 degree bends between pull boxes are allowed. The use of "condutees" or "LB" type fittings is not allowed unless they are designed to provide proper bend radius for cable being installed.

5.6.2. Where wire basket and J-hooks are utilized, TOs shall have a 1" conduit from the backbox, run vertically within the wall space and stubbed into the accessible ceiling space.

5.6.3. The use of flexible conduit is not acceptable. If deemed necessary (upon consultation with the Project Manager and N&S) to use a flexible conduit, the conduit diameter shall be increased by one trade size.

5.6.4. Conduits ends shall be reamed and fit with an insulated bushing to prevent cable damage.

5.7. Service Loops

5.7.1. The cable installer contractor will leave a 36" minimum of extra cable on the room end, coiled in the accessible ceiling space above the drop location.

5.7.2. The cable installer contractor will create a minimum 72" service loop at the TR site.

**TELECOMMUNICATIONS OUTLETS (TO):**

6. Telecommunications Outlets (TO)

6.1. Wall Outlets

6.1.1. Belden telecommunications outlets (TO) shall be used for voice, data and video communications where required. The outlet requires a double gang box, 4 11/16" x 4 11/16" x 2 1/8" deep, equipped with a single gang plaster ring. It shall be mounted flush in the wall at same height as the adjacent electrical outlet. There shall be no more than 4 cables per double gang box.

6.2. Floor-mounted or Desk mounted outlets

6.2.1. Enclosures for floor and desk mounted TOs must have 1" knock-outs to accept the station conduits. These devices must accommodate Belden standard or keystone TO outlets. They must include space for cable slack.

6.3. Pack Poles

6.3.1. The pack pole must have a physical divider between the power and data as per the CEC. This pack pole must have grommets on entry and exit points and must be capable of accepting Belden standard or keystone TOs

6.4. Devices:

6.4.1. RJ45 jacks for communication outlets and modular patch panels shall be Belden/Nordx MDVO Cat.6+ series as listed below:

   6.4.1.1. Data: Grey, Belden Cat. No. AX101063
   6.4.1.2. Voice: Blue, Belden Cat. No. AX101071
   6.4.1.3. CATV: Coax Video-F, Belden Cat. No. A0407001
   6.4.1.4. Telephone Riser: Green, Belden Cat. No. AX101070

6.4.2. Faceplates (provide and install blank module covers where required):

   6.4.2.1. Two Port MDVO faceplate, Belden Cat. No. AX101433
   6.4.2.2. Four port, MDVO faceplate, Belden Cat. No. AX101437

**CABLING SPECIFICATIONS:**

7. Cabling Specifications
7.1. Copper Cable Supported - as per EIA/TIA and CSA standards, Category 6, FT4 or FT6 rated as per the NBCC and CEC, Belden Gigaflex 2400 Series.

7.2. Cabling color identifications shall be as follows:
   7.2.1. Blue for Data (Includes cabling for IP Based CCTV Cameras and Building Automation data outlets)
   7.2.2. Grey for Voice
   7.2.3. Yellow for Dalcard
   7.2.4. White for Access Control
   7.2.5. Green for Building Automation system cabling. (Excluding the data connections)

7.3. A minimum of two Cat. 6 (one voice and one data) cables shall be provided at each TO except at computer labs; data only to be provided at workstations

7.4. Dalhousie uses fiber optic cabling to connect all new buildings back to the network core and as riser cables from the TER to the TRs. Fiber cables are supplied and installed by the electrical contractor and terminated by Network and Systems. Fibre cables shall loop once around the perimeter of the TER and TRs for future flexibility. Provide 72" slack at identified termination location for termination by owner.

7.5. Entrance cable:
   7.5.1. Single mode 72 fiber with FT4 rated indoor / outdoor jacket, dielectric , Corning Part Number 072EUF-T4101D20.

7.6. Building risers:
   7.6.1. Single mode 24 fiber FT4 jacket, Corning Part Number 024E81-33131-24
   7.6.2. Multimode laser optimized 24 fiber, FT4 jacket, Corning Part Number 024T81-33180-24

7.7. Labeling requirements: shall be carried out as per ANSI/EIA/TIA 606 standards with the following exceptions
   7.7.1. TO’s and corresponding patch panel location shall be labeled with the room number plus an identifying number. (example 4106-1) Identifying number shall be in order starting at 1 and increasing by one as you move from left to right around the room.
   7.7.2. TO’s with multiple jacks shall be labeled at the patch panel using the room number, identifying number and a TO location letter (example 4106-1A) The letter is in alphabetical order starting at the top, left to right, then bottom left to right.

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**EQUIPMENT RACKS AND CABLE MANAGEMENT:**

8. Equipment racks and cable management
   8.1. Fixed equipment racks shall be heavy duty, fixed style racks, Belden Cat. No. XWR-3618NS-S001, black c/w all required hardware for wall mounting.
   8.2. 6" vertical cable managers shall be Belden Cat. No. XWR-36-VCM-S006 c/w two slack spool kits for 6" vertical cable manager, Belden Cat. No. XWR-36-VCM-S009
   8.3. 12" vertical cable managers shall be Belden Cat. No. XWR-36-VCM-S007 c/w two slack spool kits for 12" vertical cable manager, Belden Cat. No. XWR-36-VCM-S010
   8.4. Horizontal cable managers shall be Belden Cat. No. XWR-36-VCM-S008
   8.5. Refer to Appendix "B" for typical rack and cable management layouts.

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**PATCH PANELS:**

9. Patch Panels
   9.1. All telephone, voice, and data patch panels shall be EIA/TIA-568B Category 6 c/w RJ45 jacks, mounting brackets, and all associated hardware.
9.2. All patch panels shall be fully populated with jacks, regardless of quantity terminated.
9.3. Telephone patch panels shall be 48-port, 2U, black, flex patch panel, Belden Cat. No. AX101458, c/w 48 MDVO modular jacks (green) Cat. No. AX101070.
9.4. Voice patch panels shall be 48-port, 2U, black, flex patch panel, Belden Cat. No. AX101458 c/w 48 MDVO modular jacks (blue) Cat. Co. AX101071.
9.5. Data patch panels shall be 48-port, 2U, black, flex patch panel, Belden Cat No. AX101458 c/w 48 MDVO modular jacks (gray) Cat. No. AX101063.
9.6. CATV patch panels shall be 48-port, 2U, black, flex patch panel, Belden Cat No. AX101458 c/w 48 MDVO modular jacks (white) Cat. No. A0407001

PAYPHONES:

10. Payphones
10.1. Payphones are ordered by N&S who also arranges for their installation. A conduit with pull rope shall be provided to the required location. All payphone spaces must comply with the regulations set out in the Canadians with Disabilities Act.
10.2. All payphone locations shall be provided with two Cat6 cables (one voice and one data).

ELEVATOR PHONES:

11. Elevator Phones
11.1. There must be at least one TO in the elevator equipment room that is cabled to the elevator controllers to allow for the actual connection of the phone in the elevator cab. There must be an adequate number of jacks in the equipment room to accommodate all elevators in the building.

NETWORK CONNECTIONS FOR ELECTRICAL METERS:

12. Network Connections for Electrical Meters:
12.1. Network cables shall terminate in a 6" square electrical box which acts as a demarcation point between Network and Systems and Electrical staff. A 1" conduit is to be run from this backbox to the electrical meter. Provide and install a Category 6 patch cable from this box to the meter communication jack. Terminate an MDVO in a 2 port surface mount box. Belden Cat No. A0645273 connector on the Category 6 horizontal cable running from the data patch panel.

WIRELESS EQUIPMENT (WI-FI):

13. Wireless Equipment (Wi-Fi)
13.1. Dalhousie has standardized on an Aruba Networks Wireless system which is comprised of controllers located in the Killam Data Center and Access Points (APs) located throughout the campus. One Access Point covers approximately 3000 sq ft. Areas such as auditoriums and large classrooms may require APs installed at a higher density. (One per 60 users).
13.2. The location of the APs are determined by Networks and Systems. A CAD drawing for each floor is required showing room layouts, wall construction materials and any large metal objects. A separate drawing of each floor showing the reflected ceiling plan is also required.
13.3. The APs are connected to the network with a Cat6 cable which supplies power for the AP using Power over Ethernet (POE).
13.4. In areas of accessible ceiling (T-bar), provide and install a two-port side entry MDVO surface adapter, Belden Cat. No. AO645273 complete with one blue MDVO jack and one blank off plate as per specifications. The adapter shall be mounted in the ceiling space above the AP location, supported to a J-hook.

13.5. In areas of drywall ceiling provide and install a 4" square backbox complete with single gang tile ring, flush mounted in the ceiling. Terminate the MDVO jack directly to the cable without the use of a faceplate. Provide 10' slack cable coiled at the last accessible location for on-site adjustment. Provide 6" slack cable within the 4" backbox.

13.6. In exposed areas without a ceiling provide and install a 4" square backbox complete with flat single gang tile ring, flush wall mounted 8'-0" a.f.f.. Terminate the MDVO jack directly to the cable without the use of a faceplate. Provide 10' slack cable coiled at the last accessible location for on-site adjustment. Provide 6" slack cable within the 4" backbox.

13.7. Leave a 10 foot cable slack loop at the Access point end coiled on a J-hook for on-site adjustment.

**TESTING:**

14. Testing:

14.1. Test horizontal UTP cables as specified below and correct deficiencies provide record of results electronic record on CD.

14.1.1. Perform tests for Permanent Link on installed cables, including spares:


14.1.1.2. Provide test results using Fluke Linkware files (.FLW)

14.2. Test backbone UTP cables as specified below and correct deficiencies: provide record of results electronic record on CD.

14.2.1. Perform tests for Permanent Link on 4-pair cables:


14.3. Colour code and identify all work in accordance with CAN/CSA-T528-97. Provide complete administrative records in accordance with the recommended practice for this Standard.

14.4. N&S reserves the right to check and verify all installation performed by non-N&S personnel. In case of failure to meet certification standards, reinstallation of any non-compliant cabling shall be done at installer’s expense.
APPENDIX "A": TYPICAL ROOM LAYOUTS
TELEPHONE ROOM

SCALE: 1/4"=1'-0"

OFFSET 4" FROM WALL TO ALLOW FOR RISER CABLES TO PASS THROUGH.

12" WIDE X 4" DEEP WIRE BASKET MOUNTED AT 8'-6" A.F.F.

TELEPHONE ROOM WIRE BASKET

SCALE: 1/4"=1'-0"
TELECOMMUNICATION CLOSET

SCALE: 1/4"=1'-0"

NOTES:

PROJECT: COMMUNICATION DESIGN GUIDELINES
DRAWING: TELEPHONE ROOM
APPENDIX "B": TYPICAL RACK LAYOUTS
NOTES:
1. ALLOW FOR 6U OF RACK SPACE FOR OWNER'S FIBRE EQUIPMENT.
2. REFER TO TYPICAL RACK ELEVATIONS FOR MOUNTING HEIGHTS.
3. REFER TO TYPICAL ROOM LAYOUTS FOR LOCATION.
4. QUANTITY OF PATCH PANELS AND RACKS TO BE DETERMINED ON A PROJECT BY PROJECT BASIS.
NOTES:

1. ALLOW FOR 4U OF RACK SPACE FOR OWNER’S FIBRE EQUIPMENT.

2. REFER TO TYPICAL RACK ELEVATIONS FOR MOUNTING HEIGHTS.

3. REFER TO TYPICAL ROOM LAYOUTS FOR LOCATION.

4. QUANTITY OF PATCH PANELS AND RACKS TO BE DETERMINED ON A PROJECT BY PROJECT BASIS.
ELEVATION — TYPICAL RACK SPACING

SPACE FOR OWNER SUPPLIED VERTICAL CABLE MANAGEMENT. REFER TO COMMUNICATION RACK LAYOUTS.
LEVEL 0

LEVEL 1

WALL MOUNTED VOICE RACK

WALL MOUNTED DATA RACK(S)

ARMORED TELEPHONE BACKBONE CABLE

ONE 24 STRAND SINGLE MODE AND ONE 24 STRAND MULTIMODE FIBER CABLES, PLUS TWO CATEGORY 6 CABLES (BLUE) PER FLOOR FOR BACKUP COPPER BACKBONE TO EACH LEVEL, TYPICAL.

ARMORED TELEPHONE BACKBONE CABLE SUPPLIED AND INSTALLED BY ALIANT. RACEWAY FOR BACKBONE CABLE (CONDUIT, PULL BOXES, TRAY, ETC. TO BE SUPPLIED AND INSTALLED BY ELECTRICAL CONTRACTOR.

OWNER'S TELEPHONE BIX MOUNTS, SUPPLIED, INSTALLED AND TERMINATED BY ELECTRICAL CONTRACTOR

ALIANT TELEPHONE BIX MOUNTS

MAIN COMMUNICATION ROOM

TELEPHONE

FIBER

DATA CENTRE

72 STRAND SINGLE MODE FIBRE

TYPICAL COMMUNICATION RISER

SCALE: N.T.S.