

CONNECTING CAMBRIDGESHIRE PROGRAMME - FULL FIBRE TARGET

To: Economy & Environment Committee

Meeting Date: 14 March 2019

From: Graham Hughes, Executive Director - Place & Economy

Electoral division(s): All

Forward Plan ref: n/a Key decision: No

Purpose: To consider the overall approach and target for “full fibre” to support better digital connectivity for Cambridgeshire

Recommendation: The Committee is recommended to :

- a) Approve the recommendation to set a new full fibre target to achieve over 30% coverage across Cambridgeshire and Peterborough by 2022, within the existing Connecting Cambridgeshire budget.
- b) Note the approach to the Government’s Local Full Fibre Network (LFFN) Programme delivery, including use of Council assets to support better connectivity.
- c) Approve the creation of a *Fibre Ducting in Transport Schemes* policy for the Council, to include design and delivery of fibre ducting in all infrastructure schemes going forward.
- d) Delegate to the Executive Director - Place & Economy in consultation with the Chairman & Vice-Chairman of the Committee, authority to finalise the detailed wording and oversight of implementation of *Fibre Ducting in Transport Schemes* policy.

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1. BACKGROUND

“Digital connectivity is now a utility, and modern life is increasingly impossible without it. Connectivity drives productivity and innovation, and is the physical underpinning of a digital nation” UK Government Digital Strategy 2017

- 1.1 The UK Government’s 2017 strategy set out why connectivity is a vital element of the nation’s digital strategy which provides a foundation for economic strength, thriving communities and successful localities. Following the conclusion of its *Future Telecoms Infrastructure Review* (FTIR) in the summer of 2018, the government has restated and refined its ambitions – underlining the importance of full fibre (“fibre to the premise”) connectivity in supporting better connectivity and facilitating the development of next generation mobile 5G services for a world leading digital economy.
- 1.2 Much like the development of the railways or electrification, digital technology is seen as a “game-changer” that significantly impacts the economic strength of an area and ultimately will impact the future prospects for the UK. The importance of fibre ducting is analogous to that of laying physical rails when steam trains were first developed. The availability of ubiquitous fibre is the pre-cursor for ubiquitous connectivity, as fixed, wireless and mobile connectivity all require a fibre “backhaul” as a minimum, with increasing requirements for end-to-end fibre for “ultrafast” connectivity. The faster speeds and greater capacity of 4G and forthcoming 5G services will increasingly rely on fibre backbones to connect the mobile infrastructure and deliver the reliability, speed and capacity offered by fibre-optic technology.
- 1.3 Full fibre connectivity is considered to be a future oriented technology as well as providing connectivity for the needs of today. It offers greater reliability than copper broadband infrastructure and provides significant capacity for expansion to cope with anticipated future demand. In 2010, the mean download speed across the County was 3mbps. By the end of 2018, that had increased to 37mbps and it is reasonable to assume this will increase by a factor of ten at least over the next decade.
- 1.4 In March 2017, the E&E Committee approved the “Connectivity Blueprint” for the County and in August 2018 endorsed the expansion of the programme and approved a partnership approach with the Cambridgeshire and Peterborough Combined Authority (CPCA) to support new targets for mobile and full fibre coverage. This included a threefold increase in the full fibre footprint coverage target for Cambridgeshire & Peterborough which would take coverage to just over 12% by the end of 2022.
- 1.5 Following on from the publication of the FTIR, the Government have set a revised target of achieving almost 50% (15m premises) full fibre coverage across the UK by 2025, with ubiquitous coverage by 2033. It anticipates that much of the coverage will be delivered commercially, with the more challenging “final 10%” requiring significant levels of public subsidy. Government budgets and delivery plans to ensure that the 50% target is met are not yet clear, but it is anticipated that further challenge funds may become available from late 2019/2020 onwards.

2. MAIN ISSUES

Full Fibre Coverage Target

- 2.1 Last year the Council set a target to triple the County's full fibre footprint, to take it from 4% coverage in January 2018 (in line with the UK average) up to 12% by 2022. As part of the expanded plans agreed in 2018, the Connecting Cambridgeshire Programme has been pursuing a multi-faceted approach to improving full fibre coverage, including facilitating private investment from commercial providers and combining EU and Government funding streams to deliver work streams which will collectively increase the fibre footprint across the county. This has included the establishment of the "Enabling Digital Delivery" (EDD) function which undertakes a liaison role with local authority teams and telecommunications providers to help resolve wayleaves, street works and planning issues – speeding up deployment activities and reducing the barriers to telecommunications infrastructure rollout.
- 2.2 By January 2019 the fibre coverage for Cambridgeshire and Peterborough had risen to 8.29%, edging above the England coverage of 5.69%. Over the next four years, it is anticipated that the following initiatives/funding streams will help facilitate a further increase in fibre coverage across the county:
- i. Over the last year the Phase 2 and 3 Superfast Broadband rollout contracts have had an increasing focus on full fibre delivery and all Phase 3 Superfast Broadband rollout will be full fibre to the premise (FTTP) going forward. The combination of contract clawback and additional funding from the Government's Department for Rural Affairs (DEFRA) Rural Broadband Scheme will help to contribute up to 5000 additional full fibre premises as part of the Phase 4 Superfast Broadband rollout, including to some of the more hard to reach rural areas.
 - ii. The early successes of the EDD team have been complemented by commercial investment announcements over the last 12 months from City Fibre, Hyperoptic, Cambridge Fibre Networks and others – primarily in the dense urban areas of the county. The combined investments will make a significant contribution to the fibre footprint across the county.
 - iii. The successful bid into the Government's Local Full Fibre Network Programme (LFFN) as outlined in Section 2.2 will also increase the fibre coverage across the county by developing the Council's fibre assets and extending access to fibre by connecting public buildings, particularly in the more rural locations of Huntingdonshire, East Cambridgeshire and Fenland where there is a currently low fibre availability.
- 2.3 Given the extensive plans to date and the success in drawing together additional funding streams it is considered that a more ambitious target would more properly reflect the needs of homes and businesses in the coming years. Therefore, the full fibre coverage target should be increased from the current 12% with an aim to achieve over 30% coverage across Cambridgeshire and Peterborough by the end of 2022. This would represent a challenging stretch target, requiring a strong focus on successful commercial as well as market intervention deployment. However, with

the funding streams secured from multiple sources it is anticipated this can be achieved within the existing Connecting Cambridgeshire budget.

Local Full Fibre Networks Programme (**LFFN**) Programme

- 2.4 The Department for Digital, Culture, Media and Sport (DCMS), alongside its delivery arm Broadband Delivery UK (BDUK) is responsible for UK government digital policy and associated intervention and support funding. The LFFN was set up in 2017 to disperse funding to support the UK's full fibre targets on a competitive basis to local areas. The Council was successful in the initial round of funding with a £4m bid.
- 2.5 The LFFN programme encompasses several interlinked funding streams to support "gigabit capable" infrastructure delivery, including:
1. Connectivity vouchers for small businesses and associated residential communities (known as the Gigabit Voucher Scheme - run as part of a national scheme by DCMS).
 2. Support for full fibre connectivity for public sector buildings (known as LFFN PSBU – public sector building upgrades)
 3. Support for the development of public sector digital connectivity assets, including fibre ducting (known as LFFN PSAR – public sector asset re-use).
- 2.6 The Connecting Cambridgeshire LFFN bid encompasses both PSBU and PSAR. The LFFN PSBU will provide funding for fibre upgrades to c.150 public buildings across Cambridgeshire, primarily in parts of Huntingdonshire, East Cambridgeshire and Fenland in areas where there is currently a lack of full fibre available to support gigabit capable services. This work stream will dovetail with the recent procurement exercise for collaborative public sector connectivity (known as Eastnet) which the County Council led on behalf of the sub region and for which the contract was awarded to MLL Telecom in 2018.

LFFN Public Sector Assets Re-use (PSAR)

- 2.7 There are two discrete sections of the Cambridgeshire Guided Busway, comprising of the Northern section, from Milton Road in Cambridge through to St Ives and the Southern section from Cambridge central station through to Trumpington Park and Ride, with a spur to the Addenbrookes Biotech Campus.
- 2.8 When construction of the Cambridge Guided Busway commenced in 2007, fibre ducting was incorporated into the design, potentially providing digital connectivity across Cambridge and out towards the rural areas. However, the fact that the two sections of busway are not linked and do not have any capacity to offer "break-out" chambers means that the two sections of fibre ducting are essentially "stranded", and are currently providing limited connectivity for the busways own operational management.
- 2.9 The LFFN PSAR bid is focused on the development of the Council's fibre duct assets in the Northern and Southern sections of the busway. It includes plans to link and extend the ducts in the busway by deploying additional fibre ducting and access

chambers as part of the Chisholm Trail and the Linton Greenway walking and cycling scheme to provide a 40km fibre corridor from St. Ives to Linton.

- 2.10 LFFN PSAR funds of up to £800k are available to support the development of the Council's assets, provided certain criteria are met. These include the requirement to market the assets on a commercial basis in a manner which is state aid compliant. In order to meet these criteria and to provide a more commercially viable offering, the PSAR project includes a proposition to build on recent collaborative working with the University of Cambridge. This will link the University's 60km fibre network with the County's assets and establish a commercial joint venture to market the fibre ducting for use on a wholesale basis by local telecommunications providers and provide "dark fibre" services directly to businesses.
- 2.11 Making these assets available on a commercial basis will offer a range of benefits, which include:
- a. Contributing to the increased full fibre targets for the area and improving connectivity for residents, businesses and public services.
 - b. Providing a long term commercial return to the Council from assets which are currently underused.
 - c. Helping to deliver "connected transportation routes" which will provide digital infrastructure to underpin anticipated developments in autonomous vehicles and infrastructure to vehicle, infrastructure to infrastructure and vehicle to vehicle communications over the next decade or two.
- 2.12 A report outlining more detail about the proposed collaboration with the University of Cambridge is being considered by the Council's Commercial and Investment Committee, which makes a recommendation to proceed with the establishment of a joint venture arrangement for the commercial development of the Council's fibre duct assets.

Fibre ducting in transport infrastructure schemes

- 2.13 The opportunities presented by digital technology all ultimately rely on the physical deployment of fibre ducting and mobile networks. Whilst the requirements for electricity or water are well understood and infrastructure and new build housing schemes have been incorporating these utilities in a manner which has evolved over more than a century, the provision of fibre ducting has only become common over the last few decades. To date there has been a lack of a standard national approach to ensuring that appropriate fibre ducting is included in all infrastructure schemes.
- 2.14 The impact of this is significant as it is estimated that 90% of the civils costs for the deployment of fibre ducts are linked to retrofitting, even without taking into account the disruption, congestion and lost productivity caused by digging up roads and pavements to lay fibre ducting.

- 2.15 Market forces as well as national planning policy are increasingly driving the delivery of full fibre infrastructure for new homes, however this does not happen by default for transport infrastructure schemes.
- 2.16 Fibre ducts have a long life (estimated to be 30+ years) and whilst new developments are expected in future years with regards to the manufacture and configuration of fibre-optic networking technology, current fibre installations are anticipated to have a very long lifespan. With the ducts in place, in the event that fibre needs to be replaced or augmented “pulling” or blowing new fibre is a relatively low cost operation, as long as the relevant construction standards are adhered to.
- 2.17 As a high growth area, with a significant number of planned transport schemes as well as a high reliance on digital technology, Cambridgeshire is a natural location to be at the forefront of developing new practises and policies to ensure that leading edge digital connectivity is available to support the local economy and underpin flourishing communities over the next decades. In addition to supporting better connectivity for businesses, residents and public services, incorporating digital connectivity in all new transport schemes will help to ensure that our road, cycling and pedestrian routes are able to take advantage of emerging and next generation transport technology such as autonomous vehicles, Artificial Intelligence (AI) driven decision making and dynamic highways management.
- 2.18 Given that 90% of the cost of fibre ducting is associated with retrofitting, deploying ducting as part of transport infrastructure schemes is not only a significantly lower cost, it also minimises the disruption and potential damage to new roads/pathways as well as the additional congestion associated with retrofitting ducting.
- 2.19 A policy is proposed which will require all new transport infrastructure schemes (whether delivered by the County Council or external bodies such as Highways England) to incorporate fibre ducting design and deployment within the scheme design. A similar policy will be proposed for other commissioning bodies such as the Greater Cambridge Partnership and the Cambridgeshire and Peterborough Combined Authority (CPCA). This will complement planning conditions which currently require fibre ducting or fibre provisions to be made for new housing developments.
- 2.20 The policy should apply to all new schemes, and existing schemes already underway should incorporate fibre ducting design and deployment where possible.
- 2.21 Duct design and deployment costs (anticipated at less than 0.25% depending on scheme size) should be incorporated into the overall budget for new schemes going forward. Existing schemes should be examined to determine whether it is viable to incorporate fibre ducting and funding to cover any incremental costs should be sought from the relevant Connecting Cambridgeshire Programme LFFN/CPCA funding streams where possible. Funds are currently allocated up to March 2022 for this purpose.
- 2.22 An outline Fibre ***Ducting in Transport Schemes*** policy with a draft technical specification is included in Appendix One.

3. ALIGNMENT WITH CORPORATE PRIORITIES

3.1 Developing the local economy for the benefit of all

The report above sets out the implications for this priority in Section One above

3.2 Helping people live healthy and independent lives

The report above sets out the implications for this priority in Section One above

3.3 Supporting and protecting vulnerable people

There are no significant implications for this priority

4. SIGNIFICANT IMPLICATIONS

4.1 Resource Implications

The report above sets out details of significant implications in Section 2 above. As outlined, following successful bids to the government's LFFN programme as well as funding support from the Cambridgeshire and Peterborough Combined Authority the full fibre target can be extended within the existing programme budget and no additional funding will be required from the County Council, beyond the existing planned investment.

4.2 Procurement/Contractual/Council Contract Procedure Rules Implications

There are no significant implications for this priority.

4.3 Statutory, Legal and Risk Implications

There are no significant implications for this priority

4.4 Equality and Diversity Implications

There are no significant implications for this priority.

4.5 Engagement and Communications Implications

There are no significant implications for this priority

4.6 Localism and Local Member Involvement

There are no significant implications for this priority.

4.7 Public Health Implications

There are no significant implications for this priority

Implications	Officer Clearance
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Have the resource implications been cleared by Finance?	Yes Name of Financial Officer: Sarah Heywood
Have the procurement/contractual/ Council Contract Procedure Rules implications been cleared by the LGSS Head of Procurement?	n/a
Has the impact on statutory, legal and risk implications been cleared by LGSS Law?	n/a
Have the equality and diversity implications been cleared by your Service Contact?	n/a
Have any engagement and communication implications been cleared by Communications?	Yes Name of Officer: Jane Sneesby
Have any localism and Local Member involvement issues been cleared by your Service Contact?	n/a
Have any Public Health implications been cleared by Public Health	n/a

SOURCE DOCUMENTS GUIDANCE

Source Documents	Location
<i>Future Telecoms Infrastructure Review</i>	https://www.gov.uk/government/publications/future-telecoms-infrastructure-review

Appendix One Fibre Ducting in Transport Schemes *Draft Policy February 2019*

Objective

All County Council commissioned transport schemes will include an evaluation of the feasibility of incorporating fibre ducting as part of scheme implementation and where possible include ducting design and deployment as part of scheme delivery.

Introduction

Market forces as well as national planning policy are increasingly driving the delivery of a full fibre infrastructure for new homes, however this does not happen by default for transport infrastructure schemes. Fibre ducts have a long life (estimated to be 30+ years) and whilst new developments are expected in future years with regards to the manufacture and configuration of fibre-optic networking technology, current fibre installations are anticipated to have a very long lifespan. With the ducts in place, in the event that fibre needs to be replaced or augmented “pulling” or blowing new fibre is a relatively low cost operation, as long as the relevant construction standards are adhered to.

As a high growth area, with a significant number of planned transport schemes as well as a high reliance on digital technology Cambridgeshire is a natural location to be at the forefront of developing new practises and policies to ensure that leading edge digital connectivity is available to support the local economy and underpin flourishing communities over the next decades.

In addition to supporting better connectivity for businesses, residents and public services, incorporating digital connectivity in all new transport schemes will help to ensure that our road, cycling and pedestrian routes are able to take advantage of emerging and next generation transport technology such as autonomous vehicles, AI driven decision making and dynamic highways management.

Approach

The incorporation of fibre ducting to support wider connectivity is a new approach for the County Council and is not known to be common practise anywhere in the UK, so a staged approach to the introduction of this policy is proposed.

Within the Connecting Cambridgeshire team, the new Enabling Digital Delivery Team (EDD) has a remit to support both commercial and public funded digital infrastructure deployment, liaising between local authority teams and suppliers. It is suggested that for the first two years of the operation of the policy all fibre duct plans are reviewed by the EDD Manager who will operate as the Technical Design Authority (TDA) for ducting on behalf of the County Council.

This will help to test the design specification and ensure the most effective approach is adopted going forward. Following this initial period the policy will be reviewed and revised as appropriate.

Scope

Applies to all schemes commissioned by CCC, GCP or CPCA and all schemes run by external agencies (eg Highways England) should be asked to comply as well. Where schemes incorporate land not owned by the County Council any easement/wayleave agreements should incorporate fibre ducting.

Ducting Design

It is important to consider fibre duct requirements as early as possible in the scheme design. Feasibility studies being carried out for new scheme proposals must include discussions with the Connecting Cambridgeshire Team to identify early duct and access requirements.

Final duct requirements, together with number of ducts, location of ducts, number, location and type of access chambers will be confirmed during the full scheme design in conjunction with the Connecting Cambridgeshire team as the Technical Design Authority. Final fibre duct design agreement will sit with the Connecting Cambridgeshire Team.

Specification

All ducting and civils work to be completed in line with the specification Appendix A. The minimum requirement will be for 2 x 96mm UPVC ducts laid for the length of the development with the minimum number of access chambers being at each major junction, at intervals of 180m max on straight runs or arranged suitably to allow changes in duct direction.

Duct location within the development will be sited suitably to provide easiest access possible. Access Chamber locations will ideally be within non vehicular traffic locations (i.e. beneath the footpath rather than the road). Where the ducting is laid to one side of a road, cross ducts to access major junctions on the other side of the road will be laid with suitable access chambers. Access Chambers will have blank spurs installed at the time of installation, where possible ending at soft dig locations.

Appendix A – Technical Specification for Installation of Fibre Ducts and associated Jointing Chambers for Cambridgeshire County Council, the Cambridgeshire and Peterborough Combined Authority and the Greater Cambridge Partnership (the commissioning authorities)

Contents

- 1.0 Quality of Materials
- 2.0 Excavation – General
- 3.0 Duct Laying
- 4.0 Jointing Chambers
- 5.0 Concreting
- 6.0 Brickwork
- 7.0 Modular Chambers
- 8.0 Frames and Covers
- 9.0 Reinstatement
- 10.0 Points not covered by this Specification

1.0 Quality of Materials

1.1 *Specifications*

Where British Standards or other specifications are quoted these will be the issues adopted by the British Standards Institution or other Authority equivalent European Standards, to those quoted exist, then the European Standards must be adhered to insofar as they are deemed to apply.

All Materials not otherwise specified shall be in accordance with the above.

1.2 *Aggregates*

- i. All aggregates used shall comply with the requirements of BSEN 12620:2002 Aggregates from natural sources for concrete.
- ii. Course aggregate shall be in accordance with the requirements of BSEN 12620:2002.
- iii. Unless otherwise stated grading should be up to and including 20mm.
- iv. Sand shall be in accordance with the requirements of BSEN 12620:2002 Table D1:0/4 Concrete Sand MP or FP.
- v. All aggregate supplied must be supported by supplier information as defined within BSEN 12620:2002.

1.3 *Cement.* All cement used shall comply with the requirements of the following;

- i. [BSEN197-1](#) Specification for ordinary and rapid hardening Portland cement.
- ii. [BSEN197-4](#) Specification for Portland-blast furnace cement.
- iii. BS4027 Specification for sulphate-resisting Portland cement.
- iv. BS3892 Part Specification for Pulverised-Fuel Ash for use as a cementitious component in structural concrete.
- v. BS6588 Specification for Portland Pulverised-Fuel Ash cement.

- vi. BS6699 Specification for Ground Granulated Blast furnace Slag for use with Portland cement.
- vii. The use of High Alumina (HA) cement shall not be permitted.
- viii. The contractor may employ rapid hardening Portland cement in lieu of ordinary Portland cement for his own convenience and acceleration of progress.
- ix. Cements of different types shall not be mixed one with another
- x. Where cement is kept on site it shall be stored according to BSEN 197-1

1.4 *Concrete.* All concrete used shall comply with the requirements of, BSEN 206-1:2000;

- i. Guide to specifying concrete mixes.
- ii. Methods for specifying concrete mixes.
- iii. Specification for the procedures to be used in producing and transporting concrete.
- iv. Specification for the procedures to be used in sampling, testing and assessing compliance of concrete.
- v. Unless otherwise specified all concrete used for the construction of Concrete Jointing Chambers shall be ready mixed to mix designation as defined within BSEN 206-1:2000 / BS8500-2.
- vi. Where the use of site mixed concrete is specified for Joint box construction, as an allowed alternative to the preferred use of ready mix, it shall be of minimum grade C35 or equivalent.
- vii. The minimum cement content shall be 300 kg/m³; the maximum aggregate size shall be 20mm; the maximum free water/cement ratio shall be 0.6 and slump limits shall be 50mm □ 25mm.
- viii. All site mixed concrete shall be mixed by machine.
- ix. All ingredients shall be put into the machine dry, without prior mixing. The water may be inserted first or last. Care must be taken prior to, and after mixing to ensure that the concrete or mortar ingredients, collectively or separately, are not allowed to enter gullies or drains.
- x. Sand and aggregate, shall be stored separately on site. All materials must be kept dry and free from any deleterious materials.
- xi. Test Cubes or Test Cores shall be taken by the contractor and, at commissioning organisations discretion, shall be tested by a NAMAS approved testing authority.
- xii. All testing shall be carried out in accordance with BSEN 12350-2:2009 – Testing Concrete.
- xiii. Test certificates are to be retained by the commissioning organisation.

- xiv. Where test results indicate that the concrete is non-compliant, the contractor will be instructed to remove all non-compliant material and to replace it with material of suitable quality according to this specification.
- xv. Where the integrity of a structure is impaired due to non-compliant materials the structure shall, at the discretion of the commissioning organisation, be completely demolished and replaced.
- xvi. Unless otherwise specified all concrete used for ancillary work shall be Grade C10 ready mixed to mix designation GEN 1 as defined within Designated Mixes of BSEN 206-1:2000 replacing BS 5328 Part 2. Table 6. The standard of cleanliness of water for mixing is that it shall conform to BSEN 1008: 2002 and be fit for drinking.

1.5 *Bricks*

- i. Bricks shall in accordance with BSEB 771-1:2003 BS EB 772-3:1998 and BSEN 772-7:1998.
- ii. Bricks shall be Class A or B Engineering Bricks in accordance with BS EN 771:2003 (BS 3921). They shall be type FL in accordance with BS EN 771-1:2003 9BS 3921).
- iii. Bricks shall be marked in accordance with clause 10 of BS 3921. (BS EN 771-12003)

1.6 *Mortar*

- i. Unless otherwise specified materials and workmanship shall be in accordance with BS5628-Parts 1 & 3:2005 – Use of Masonry.
- ii. Mortar shall be as designated within BS5628-1:2005, - Requirements for Mortar Table 1 Type (i)

1.7 *Reinforcement*

- i. All reinforcement shall comply with the requirements of BS 4449:2005 + Amendment 2: 2009 (– Specification for Carbon Steel bars for the reinforcement of concrete.
- ii. Unless otherwise specified all main reinforcement to be Type 2 with a specified characteristic strength of 460 N/mm². Secondary reinforcement to be a plain round steel bars with a specified characteristic strength of 250.N.mm².
- iii. All reinforcement material supplied must be supported by test certificates, which certify compliance to BS 4449:2005 + Amendment 2 2009.

2.0 Excavation

2.1 General

- i. The contractor shall excavate in the Highway, in strict accordance within the requirements of the New Roads and Street Works Act 1991 (and where

applicable as amended by the Traffic management Act 2004), and, in accordance where applicable to BS6031:1981; (Code of practice for Earth Works). The contractor shall also make excavations in positions as agreed by commissioning organisation's representative. The work has to be carried out by certified operatives and supervised by certified supervisor.

- ii. The edges of all trenches shall be cut to a neat and uniform line, parallel with the edge of the path where possible.
- iii. Level changes should be minimised and should only take place gradually.
- iv. The various types of excavated material shall be kept separate. i.e. blacktop fragments from sub-base, from topsoil.
- v. The Contractor shall be responsible for the design, erection maintenance and subsequent removal of all necessary support to the sides of any excavation as are necessary for the Works. The depth of excavation shall not exceed that recommended to require support or when the local ground conditions deem it necessary. When required the Contractor shall submit his detailed proposals to the commissioning organisation's representative for approval.
- vi. Each gang shall not open more than 20 metres of trench at any one time and the site must be kept to within 30 metres. Backfilling should wherever possible be carried out within the same day.
- vii. The depths of cover to crown of duct will normally be a minimum of 350 mm in footways and 600 mm in roadways. However, the Contractor shall allow in the rates for laying at covers of up to 450 mm in footways and 700 mm in roadways in isolated areas to negotiate established services or as the commissioning organisation's representative dictates.
- viii. The width of the trench shall be not less than the width of the duct or duct nest plus 80 mm, but should be kept to a reasonable minimum.
- ix. The cost and risk of bringing to Site or use of any approved mechanical aids shall be borne by the Contractor.
- x. The Contractor must also ensure that all Operatives are trained to use the Mechanical Aids they are required to use in their work and keep appropriate record as proof.
- xi. It is the Contractor's responsibility to ascertain the precise positions of all other Utilities plant prior to the commencement of Works. Without prejudice to this obligation, the commissioning organisation's representative will supply the Contractor with all available information relative to plant as is available, where this information is unavailable the contractor will obtain all necessary utility drawings as applicable, which shall be interpreted subject to the conditions and/or notes provided by the issuing Local Authority/Utility.
- xii. *Installing new ducts into existing concrete chambers.* It is essential that any cables are protected from damage including, but not restricted to, falling objects or material, cutting, bending, crushing (e.g. by standing on the cable). The

contractor will be held liable for damage during the works; any damage will be made good by the commissioning organisation or its contractors to their satisfaction and charged to the contractor. The contractor shall not impede the making good of such damage. The Contractor must also:-

- a) Take all reasonable measures to locate and protect all other underground apparatus and plant and use cable location devices before any excavation takes place. Make all necessary enquiries from local Authorities and Statutory Undertakers concerning the possible existence of live services on the site.
 - b) Ensure that minimum clearance detailed in this Technical Specification are adhered to.
 - c) Ensure that all operatives comply with the Health and Safety guidance reference HS (G) 47 Avoiding Danger from Underground Services.
 - d) Ensure that all teams are issued with and trained in the use of cable location devices. They must be trained and be able to read and understand cable plans and drawings.
 - e) Ensure that at each work location a 'nominated member' of each working gang shall be trained as per the requirement of section 67 of the New Roads & Street Works Act 1991.
 - f) All cable location devices shall be inspected and recorded at least once a week by the contractor.
 - g) Ensure that all Plant and equipment used by their Operatives are tested and maintained in accordance with the manufacturer specification and recorded under a quality Plan.
- ix. *Safety and tidiness.* The contractor shall, at all times, ensure that the works are safe, signed and barriered and that the appropriate traffic management measures are undertaken. The working area and its surrounds are to be kept in a clean and tidy state and left so at the end of the works.
- ix. *Notices & Compliance;* The contractor shall give notice to, and abide by, any instructions given by the relevant Highways Authorities and parties having an interest in any excavations in existing public footpaths. Consideration of notice, possibly in the form of a letter, will also be given to residence living near to any proposed excavations, warning of possible noise disruption.
- iiix. The Contractor shall provide, install and maintain all necessary traffic control equipment, as required and necessary.

2.2. Reinstatement

- i. The Contractor will reinstate using materials and methods compliant with the NRSWA 1991 Specification for the Reinstatement of Openings in Highways (SROH-Current edition). The contractor shall provide a warranty for two years from the date of the completion Notice for the final reinstatement.

- ii. Providing the works and tests are carried out to the SROH-Current edition the warranty will be the same for works in Private Property, namely 2 years from completion of the works.

2.3 Clearances from Other Plant

- i. Clearances from other services. All types of ducts and cables laid direct in the ground shall be kept well clear of gas or water mains, service pipes, sewers, subways, manholes, joint boxes or other plant belonging to other undertakers. At least 150mm clearance shall be given wherever possible. Where two sets of plant cross each other, the minimum vertical clearance shall be 150mm with gas mains and 50 mm in the case of other plant. In no case shall the clearance be less than 25mm.
- ii. Clearances from Electricity Supplies. Clearances of plant from electricity supplies shall be as follows:-
 - a. As much clearance as is practicable shall be given to the bases of trolley wire standards, electric lamp standards, traffic signal posts and other similar plant. Where it is not practicable to provide a clearance of 150mm, a pre-cast slab, or a layer of concrete C10 not less than 50mm thick, shall be placed between the two sets of plant to provide a minimum tracking path of 75mm.
 - b. High voltage single-core cables for electricity supply, electric tramway or electric railway systems, EXCEEDING 1000 VOLTS, shall have a standard minimum clearance of 450mm.
 - c. High voltage multi-core cables for the same systems referred to in (ii) above and EXCEEDING 1000 VOLTS, shall have a standard minimum clearance of 300mm. In difficult cases reduced separation will be permitted provided that where a separation of more than 150mm is impracticable, a pre-cast concrete slab or a layer of concrete C10, not less than 50mm thick shall be inserted between the two sets of plant. The concrete shall not be less than 50mm thick, have an overlap on each side and for the whole length where the clearance is 150mm or less, such that at every point the shortest path between the two sets of plant round the concrete shall exceed 200mm.
 - d. Low voltage cables for supply systems NOT EXCEEDING 1000 VOLTS, shall have a standard minimum clearance of 50mm. Where difficulties arise, a reduced clearance down to 25mm will be permitted in which case the space between the two sets of plant shall be filled with a pre-cast slab, or a layer of concrete C10 not less than 25mm thick and of such width and length that at every point the shortest path between the two sets of plant, round the concrete, shall exceed 75mm.

3.0 Duct Laying

3.1 *Duct.*

PVC Duct to be used is a black duct 96mm external diameter, 90mm internal diameter. The Contractor can supply pre-formed bends. The duct has a socket formed at one end such that the opposite, i.e. spigot, end forms an engineering interference fit in the socket. The ducts are to be joined such that the spigot end is inserted into the socket end for the full length of the socket. The spigot end is marked to indicate how far it should be inserted into the socket. To achieve the interference fit, align the socket and spigot ends of adjacent sections of duct, place a short plank across the remote, free end of the duct and tap the plank gently with a heavy mallet to force the spigot end into the socket; the plank avoids the mallet damaging the free end of the duct. The joining can be made easier by lubricating the outside of the spigot end and/or the inside of the socket end with water and/or a little domestic detergent (e.g. Washing up Liquid). Where it is necessary to join two spigot ends (this should not normally be required) a collar, having two socket ends, can be used.

3.2 *Installation & Line of Duct.*

- i. The trench is to be backfilled with selected stone-free material and compacted by a mechanical compactor such as a *Wacky Rammer*. Where the trench is in the public highway, it is to be backfilled and reinstated to the satisfaction of the Highways Authority and according to their specification.
- ii. The line of duct shall be kept as straight as possible subject to the agreed line and the need to avoid other services/utilities. A 6 metre length of 96mm PVC duct is normally flexible enough for it to be formed into a minimum radius of 5 metres; on no account should it be bent to a smaller radius as this will cause flattening/damage to the cabling space.

3.3. *Route of Duct.*

The line and levels of the Duct route shall be as shown on the Job Pack Drawing supplied by The Contractor and/or as agreed and set out on site or as directed by the commissioning organisation's representative.

3.4 *Duct Formation*

The duct formation shall be as shown below:-

No of Ducts	Formation
2	2 Flat
3	1 on 2 (or 3 flat for building entry or to rise or go below obstruction), subject to agreement with commissioning organisation's representative
4	2 on2
Above 4	Subject to agreement with commissioning organisation's representative

3.5 *Duct leading into Buildings and Jointing Structures (chambers).*

- i. All Duct leading into Customers buildings & structures shall be sealed inside and out against the entry of gas, water and vermin both around and through the incoming duct. The method of sealing inside the duct is to be approved by commissioning organisation's representative and will normally be manufactured by Tyco. They are known as the TDUX inflatable duct seal and must be installed fully to the manufacturer's instructions. The seals are to be of the size specified by Tyco and must be replaced with a new one immediately after cabling, or if the existing is removed for duct inspection. If there is a jointing chamber adjacent to the building/structure, this also can be sealed with the suitable approved duct seal.
- ii. All holes drilled into buildings shall only be diamond drilled (core drilled) methods and sized to accommodate 54mm OD or 96mm OD PVD ducts. Multiple ducts (96mm OD) are to be no closer than 140 mm, centre to centre, to allow sufficient clearance for inserting the sealing material around each duct. This sealing material shall be of approved water resistant resin or equivalent inserted between the duct and building/wall, to completely fill the void to the inside of the structure. All excess material shall be removed from around the duct mouth to provide a clean and clear cable access.

All duct entries into existing chambers must be by diamond drilled (core drilled) methods.

3.6 *Cleaning and Testing.*

Unless otherwise specified on completion of the duct line (including compaction of the backfill) between any two jointing chambers, or sites thereof, a cylindrical brush and an iron test mandrel shall be passed once through each "way" to test the duct and to remove any foreign matter which may have entered. The size of the test mandrel and brush shall be specified for the particular duct. The mandrel shall follow the brush to minimise possible scoring of the duct. When any defect is discovered during the cleaning and testing operations The Contractor shall be notified and the defect shall be rectified s witnessed by the commissioning organisation's representative.

3.7 *Marker Tape/Protection Boards*

A PVC/Plastic marker tape with the warning "Fibre Network" will be laid immediately a minimum of 50mm above the duct. Protection Tiles – will be placed over the duct as per the duct drawing or as directed by commissioning organisation's representative. The warning tape will be supplied as free issue.

3.8 *Draw Ropes*

4 mm diameter polypropylene or rope to agreed specification is to be installed in all non-cabled ducts. Rope is not to be installed in any cabled duct. The rope is to be secured at each end so that the ends of the rope cannot be pulled into the duct. The rope must not be secured by tying it to any cable. At least 1 m of slack is to be left in each run of rope.

4.0 Jointing Chambers

- 4.1 All chambers will normally be provided either in plastic type, Quad Modular, reinforced or un-reinforced Concrete. Plastic or Quad Modular type chambers must not be installed in the carriageway. Only with agreement from commissioning organisation's representative will the provision of Brickwork be permitted. No brickwork jointing chambers will be constructed in the carriageway.
- 4.2 Where a sump is provided the floor shall have a slight fall thereto. The grating shall be located squarely over the sump, adequately fitted and easily removable, from a pre-formed recess in the floor screed, in the position indicated on the relevant drawing. Where the drawing shows a square sump, a circular sump of 100mm internal diameter may be constructed at the contractor's discretion.
- 4.3 The depth of each chamber is to suit the depth to which the ducts are laid, with 150 mm clear below the lowest duct although, in special cases, a lesser clearance may be allowed by the commissioning organisation's representative. Where applicable, the chambers are to be fitted with step-irons, cable bearers, frame and cover, and, for the JRC12, sump grille and anchor irons.
- 4.4 In cases where special covers are required, the design must be approved by the commissioning organisation's representative and, if the covers require lifting keys which differ from the usual telecommunications lifting keys, 4 no. keys must be supplied free of charge to the commissioning organisation's representative. In the carriageways or where heavy vehicular traffic is expected, all chambers and drawpits shall be of reinforced concrete construction of equivalent type to BT JRC12 with cast-iron or steel covers suitable for the load.

5.0 Concreting

5.1 *Low Temperatures*

Concrete for jointing shall not be mixed or placed, when the concrete temperature is below 5° C. Where the air temperature is likely to fall below 3°C the contractor shall provide a method statement detailing the materials, placing and curing methods, to be agreed by commissioning organisation's representative.

When concrete has already been placed, and the air temperature unexpectedly falls below 3°c. at any time during the period before removal of shuttering, the concrete shall be protected from freezing. The period of time that the temperature remains below 3 shall be added to the minimum period time of 5 days or 20N.mm2 for Portland cement or 2 days or 20N/mm2 for Rapid Hardening Portland for carriageway boxes. For footway boxes the shuttering shall not be struck in less than 24 hours or 10Nmm2.

- 5.2 *Drying.* Concrete, when placed and if subject to rapid drying out by sun and/or wind, shall be protected to prevent it becoming dry during the minimum curing period.
- 5.3 *Handling,* from the mixer to the workplace must, whatever method is adopted, ensure that the mix remains cohesive and that segregation does not occur.
- 5.4 *Placing of concrete* must be carried out in a manner such that the concrete is deposited as close as practicable to its final position. The use of chutes or tremmie pipes must be adopted throughout the placing process to ensure that segregation does not occur:

- i. Concrete must be placed in even layers and must not be moved into position with the poker or vibrator.
- ii. Layer thickness must be compatible with the tools and methods to remove entrapped air; each layer must be thoroughly compacted before the placing of the next layer.
- iii. Formwork must be filled with concrete in such a manner as to avoid the formation of cold joints.

- 5.5. *Construction joints* shall be provided where shown on the relative construction drawing. A minimum of 12 hours shall elapse between the construction stages thus indicated. The construction joint shall be affected by lightly wire brushing the existing concrete surface to remove the laitance and expose the aggregate, then cleaning and wetting before new concrete is cast. The use of jack hammers or picks to hack away the existing surface is not permitted. Such construction joints shall be sited at least 150mm from any anchor iron position. Where a construction joint is shown on a drawing at floor level, a kicker may be constructed at the contractor's discretion.
- 5.6 *Concrete Walls* shall be completed in one operation, whenever possible. Where this is not practicable construction joints shall be made after the existing concrete has set but not hardened, the joint being cleaned with a stiff brush to remove the laitance to expose but not disturb, the larger aggregate.
- 5.7 In *wet situations* the Contractor must implement such methods as are necessary to prevent damage to freshly placed concrete or mortar and to ensure a correctly constructed jointing chamber.
- 5.8 *Compaction* of all concrete slabs shall be performed until a dense solid mass without voids is obtained to meet the requirements for strength and durability. Un-reinforced concrete floor slabs may be compacted by hand tamping methods. All unreinforced concrete wall slabs shall be compacted by the use of a poker type vibrator.
- 5.9 *Timber shuttering* shall be oiled or lime-washed prior to concreting. In all cases the shuttering used shall be of such dimensions, and so constructed, as to remain rigid and unyielding to weight and vibration during the laying and tamping of the concrete. No shaking or jarring shall be permitted during setting.
- 5.10 *Proprietary spacers* shall be placed at 0.6 metre maximum centres, to ensure the minimum cover shown on the relevant construction drawing, is maintained from the shuttering prior to and during, the placing of concrete.
- 5.11 *Plastic sheeting*, 1000 or 1200 gauge shall be positioned between the excavation or rear shuttering and the concrete of the jointing chamber. It shall also be placed over the roof before commencing the back-fill. Where the floor of the excavation has been well compacted and a binding placed to prevent the contamination of the structural concrete, there is no requirement for the Plastic sheet to be laid on the floor.

- 5.12 *Duct entries* into a jointing chamber shall, when required by GBN, be fitted with a duct seal.
- 5.13 The Contractor must ensure that soil or other deleterious material is not allowed to collect between the inner faces of the internal and external shuttering or contaminate the structural concrete. Where this has been shown to occur the contractor will be responsible for the complete renewal of the structure. Repair of the affected area will not be accepted.
- 5.14 *Concrete Quality and Finish* – All concrete used for the construction of jointing Chambers shall be ready mixed Grade C35, in accordance with BS EN 206-1:2000 (Table 6 BS532:Part 2), except where the quality of concrete is detailed on the construction drawing . For Carriageway and Footway boxes the use of site mix concrete in accordance with is allowed.
- 5.15 Where *ready mixed concrete* is used the commissioning organisation's representative will require to see and retain a copy of the delivery certificate supplied with the concrete.
- 5.16 Where site mixed concrete is used the contractor shall supply a copy of test report to the commissioning organisation's representative within 14 days of the cubes being tested. Work will not normally be delayed for the result of any test to be ascertained. The making, curing and testing of all cubes of concrete for compressive strength tests shall be in accordance with BS EN 12390-1&2 :2000, 12390-7:2000 AND 12390-3:2000 (formerly BS1881, Parts 108, 111, 114 and 116).
- 5.17 On completion of a concrete jointing chamber the floor shall be rendered with cement mortar in accordance with the relevant drawing. The walls of concrete jointing chambers shall have a smooth finish; any slight cavities exposed when the shuttering is removed shall be made good with cement mortar, and any projections removed. Note: Under no circumstances shall the walls be coated with a cement or cement sand wash.
- 5.18 *Concrete Curing Times* – The minimum concrete strength or curing periods after completion of any construction or modification work using cement mortar or concrete, which must elapse before:-
- I. The shuttering of jointing chambers is removed:

Portland cement	- 5 days or 20N/mm ²
Rapid Hardening Portland	- 2 days or 20N/mm ²
 - II. Traffic is allowed to pass:

Portland cement	-7 days or 24N/mm ²
Rapid Hardening Portland	-3 days or 24N/mm ²

6.0 Brickwork Chambers

- 6.1 Unless otherwise specified Grade C35 Concrete shall be used for the floors of all brickwork jointing chambers. The floor must be allowed to set for at least 12 hours

before commencing brickwork. On completion of the jointing chamber the floor shall be rendered with cement mortar in accordance with the relevant drawing.

6.2 All Brickwork shall be constructed with a 10mm joint thickness of cement mortar and shall be of English Bond with the exception of 102.5 mm brickwork BS EN 772-3:1998 (formerly BS3921) which shall be of Stretcher Bond. In dry weather the bricks, shall be immersed in water before they are laid. The inside of all brickwork shall be flush jointed.

7.0 Modular Chambers. Installation of prefabricated modular type chambers must be as per the Stakkabox Quad Installation guide by manufacturer CUBIS

8.0 Frames and Covers

8.1 A minimum period of 12 hours shall elapse after placing in-situ concrete or laying brick prior to the installation of frames and covers.

8.2 A minimum of 12 hours shall elapse after the installation of the frame before the placing of the covers, unless a suitable rapid hardening cement mortar or resin has been used. Suitable is taken to mean that either pedestrians or traffic can now pass over the covers without any displacement of the mortar/resin bed.

9.0 Reinstatement.

9.1 The Contractor shall execute the interim and permanent reinstatement in accordance with the provisions of The New Roads and Street Works Act 1991 and associated HAUC current Specification for the Reinstatement of Openings in Highways.

9.2 *Compaction.* The Contractor shall Compact all backfill in accordance with the provisions of The New Roads and Street Works Act 1991 and associated HAUC Specification for the Reinstatement of Openings in Highways (Appendix A8).

9.3 *Backfill.* All spaces around the and above the duct shall be filled and well compacted with "earth free from stones" to a thickness of not less than 75mm above the duct unless otherwise stated.

If "earth free from Stones" is unavailable then the Contractor shall supply and install sharp Sand as a direct replacement compacted as per 5.0 b above. The periods of time / or minimum concrete strength between the placing of concrete and the commencement of backfilling for chambers built in the carriageway shall be 7 days or 24N/mm² and footway boxes 24 hours or 10N/mm². All spaces outside the walls of jointing chambers shall be carefully filled in with granular material or concrete and rammed, care being taken to ensure that the ramming does not disturb the recently completed work.

10.0 Points not covered by this Specification

Should any part of this Specification be unclear or disputed by the Contractor the point requiring clarification should be outlined in writing to the Connecting Cambridgeshire EDD Manager at the following address:- Box no etc and address for CCC.