TORBAY COUNCIL

WIRELESS TRANSMISSION FEASIBILITY STUDY OF TORBAY COUNCIL CCTV SYSTEM (PHASE 2) ADDITIONALLY, ICT BUILDINGS, PUBLIC SPACE WI-FI (TOWN-CENTRES) / SYSTEM UPGRADE OPTIONS

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APPENDICES

1.0 Executive Summary

Following on from the first phase review, Global MSC Security (MSC) has, in conjunction with UK Broadband carried out CCTV Line of Sight (LOS) wireless transmission assessments around the remaining required areas (St. Marychurch, Paignton, and Brixham), along with 3 x UTC camera sites. We have been able to prove LOS is possible for the majority of public space surveillance (PSS) cameras to reduce reliance on BT analogue fibre optic cabling and thus reduce the annual (c£80,000) expenditure. This would enable the council to transmit CCTV images over IP (Internet Protocol) and eventually create a migration path to change all its camera hardware from analogue to IP with numerous advantages, including the use of High Definition (HD) images and analytics together with other benefits.

In addition, similar LOS wireless transmission assessments have been carried out in relation to Torbay Council remote sites that currently utilise different transmission mediums for provision of ICT LAN services. Migrating these sites onto a wireless network, as for CCTV, provides an adaptable, cost effective alternative to the existing mediums.

We have further evaluated the feasibility of Public Space Wi-Fi provision within the 3 x Town Centre locations of Torquay, Paignton, and Brixham. The design / budget costs for this element are based upon “High Street” and Seafront / Harbour areas.

With regard to the CCTV systems overall, as was previously detailed in the first phase review, other transmission options are possible, including improving on some ‘self-provide’ fibre optic cabling. These were previously discounted as not being as cost effective.

Having evaluated the existing Torbay CCTV system, both transmission and camera / control elements, it is evident that the current equipment is both outdated and lacking the technical flexibility / stability that an IP system would provide, and incurs substantial BT fibre optic rental costs, as well as maintenance challenges.

Budget costs (separated into Torquay, Paignton, and Brixham areas) to upgrade the Torbay system, providing a wireless IP network, replacing the BT circuits, and installing new cameras, control, and recording software / hardware are:

- *Torquay:* *£341,002 (excluding VAT, including installation)*
- *Paignton:* *£159,486 (excluding VAT, including installation)*
- *Brixham:* *£ 68,484 (excluding VAT, including installation)*

Provision of Public Space Wi-Fi can offer great benefit for both residents and visitors, with the potential to attract sponsors in order to offset revenue costs: Budget costs for Wi-Fi provision (again, separated)

- *Torquay:* *£ 28,436 (excluding VAT, including installation)*
- *Paignton:* *£ 19,128 (excluding VAT, including installation)*
- *Brixham:* *£ 12,170 (excluding VAT, including installation)*

Section 8 provides fuller detail of these costs along with additional (to Borough CCTV) optional elements

for including within the overall project (e.g. Torbay Council ICT LAN connectivity to remote sites). Appendix 9 provides an overall budget costs schedule.

This review document (and associated appendices) covers:

- Feasibility of Wireless Transmission for all Public Space CCTV / 3 x UTC Cameras.
- Feasibility of Wireless Transmission for Torbay Council (ICT LAN) Remote Sites.
- Feasibility of Town Centre Public Space Wi-Fi.
- CCTV Camera, Control, and recording systems upgrade.
- Recommendations / Budget Costs for the above, including installation.

2.0 Overview

The South Devon Borough of Torbay, consists broadly of three towns / districts: Brixham, Paignton, and Torquay. Similarly, the Borough CCTV system is comprised of three different areas, as above.

The Torbay Council CCTV system has been in operation since 1993. The overall system comprises c193 cameras, which are a combination of traditional 'town – centre' cameras, plus stand – alone sites (e.g. car parks), many of which have remote matrix links, with local DVR (digital video) recording.

Included in the above, are a number of Urban Traffic Cameras (UTC) not currently linked with the main CCTV System.

Photo-Scan Ltd installed the original CCTV system on a lease agreement, the system ownership subsequently transferred to Torbay Council.

Over a number of years, the system has grown / developed, with various system control equipment types (as well as cameras) being added. The control system comprises a mix of Photoscan and Synectics Matrices, with Digital Video Recording utilising Bosch, Samsung, DM Net-Vu, and Siemens DVRs.

This has resulted in a largely disparate system, much of which is effectively obsolete, difficult to maintain, inflexible, and highly challenging from an operational / management perspective.

Particularly in light of the above, Torbay Council have identified the need to update and upgrade its CCTV system. The use of new technology will enable a flexible, streamlined, more cost efficient service, which will create opportunities for income generation to offset revenue costs.

In addition to the above, are a number of Torbay Council remote sites, which currently have Torbay Council LAN connections provisioned by a combination of basic VPN / ADSL, or dedicated 10 Mb/s / 100 Mb/s circuits, all of which are assumed to be provided by BT

3.0 Existing Transmission (CCTV)

Currently, transmission of Torquay CCTV cameras back to the control room, are by a combination of:

- Self – Provision Copper Cabling / Duct Infrastructure direct to Town Hall
- Self – Provision Copper Cabling / Duct or (where close local system, e.g. car park), Conduit Infrastructure to collection point, BT Fibre to Town Hall

- BT Fibre to Secondary Collection Point, BT Fibre to Town Hall
- BT Fibre direct to Town Hall, with additional BT Fibre to Beacon Quay, BT Fibre to Town Hall (dual links)
- Self – Provision Copper Cabling / Duct or Conduit Infrastructure to collection point, Self – Provision Fibre Optic / Duct Infrastructure direct to Town Hall (Site 5 – Lower Union Lane Car Park)
- Self – Provision Copper Cabling / Duct Infrastructure to nearby (Torbay) Street Cabinet, Self – Provision Fibre Optic / Duct Infrastructure direct to Town Hall (S6 / C12)

Currently, transmission of Paignton CCTV cameras back to the control room, are by a combination of:

- Self – Provision Copper Cabling / Duct or (where close local system, i.e. Victoria Car Park), Conduit Infrastructure to collection point, BT Fibre to Town Hall
- Self – Provision Copper Cabling / Duct or (where close local system, i.e. Roundham Car Park), Conduit Infrastructure to collection point, BT Fibre Victoria Car Park, then BT Fibre to Town Hall
- BT Fibre (S7/C13 – 16) to Secondary Collection Point (Victoria Car Park), BT Fibre to Town Hall
- Self – Provision Copper Cabling / Duct Infrastructure to nearby Camera (S1/C49 – S1/C32), Both then BT Fibre to Town Hall.
- BT Fibre direct to Town Hall

Currently, transmission of St. Marychurch CCTV cameras back to the control room, are by:

- BT Fibre direct to Town Hall

Currently, transmission of 3 x UTC CCTV cameras back to the Town Hall, are by:

- BT Fibre direct to Town Hall

Currently, transmission of Brixham CCTV cameras back to the control room, are by:

- Self – Provision Copper Cabling / Duct or (where close local system, i.e. Brixham Central Car Park – Cameras 1 & 2), Conduit Infrastructure to collection point, BT Fibre to Town Hall
- BT Fibre (S8/C2 & 3) to Secondary Collection Point (Brixham Central Car Park), BT Fibre to Town Hall
- BT Fibre direct to Town Hall

All of the current BT leased fibre circuits are analogue, a high proportion of these utilise the out-dated TTL Data (telemetry) protocol type, being the protocol that the Photo-Scan equipment uses. TTL (Transistor-to-Transistor Logic), whilst being efficient, and reliable, it has many limitations, and has long since been superseded by the RS485 protocol.

RS485 is currently the standard data protocol for analogue CCTV camera telemetry, allowing a wider range of information / commands to be transmitted. This enhances the functionality of cameras and associated equipment.

Site 5 / Torquay (Lower Union Lane Car Park) utilises Multi-Mode (MM) Fibre Optic Cabling (as does S6 Torquay / C12 – single camera link);

3.1 Existing Transmission (Torbay Council Remote Sites)

Currently, remote Torbay sites *(See Appendix 8)* that have Torbay Council LAN connections are by a combination of:

- VPN (Virtual Private Network) / ADSL
- Dedicated 10 Mb/s service
- Dedicated 100 Mb/s service

It is assumed that the 10 Mb/s & 100 Mb/s circuits are legacy BT LES (LAN Extension Services) circuits. This type of circuit provides a dedicated point-to-point fibre optic connection between customers' Local Area Networks (LANs), up to 25 Kilometres.

BT LES circuits are no longer available for new supplies, having been superseded by other circuit types. Typically, annual rental costs (per circuit) are £2,900 p.a. + £0.70 per metre circuit length – LES 10, and £4,000 + £2.00 per metre circuit length – LES 100

Appendix 8 lists, in categories 1 – 5, the remote sites. We have included within this review, sites listed in categories 1 – 4, category 5 noted as “not worth considering”.

4.0 Wireless Network Summary

Following the Phase 1 review, where a wireless survey was undertaken by UK Broadband / Global MSC to determine the suitability of the Torquay area for migration to a Wireless IP solution, a similar follow on survey has been carried out for the areas of St. Marychurch, Paignton, and Brixham. In addition, this has included the remote sites as detailed in Appendix 8, categories 1 – 4, and 3 x UTC cameras.

The following is a link to the interactive Google Earth proposed (overall Torbay) wireless system topology:

Google Earth Wireless Network KMZ

Appendix 3 provides a JPEG static image of the Google Earth overall proposed Wireless system topology for the Torquay area.

Appendix 4 provides a JPEG static image of the Google Earth proposed Wireless system topology, for the Paignton area.

Appendix 5 provides a JPEG static image of the Google Earth proposed Wireless system topology, for the Brixham area.

The survey is based upon the retention of the existing node locations, i.e., those sites that have a single collection point (car parks, etc.). Included within the overall survey / design, is a link to Torquay Police Station, which will then provide direct connectivity of the Torbay system to the Police service. This will enable access to live and / or recorded images, with restriction to certain cameras only, view, but not control, or full access / control, however it is required and defined in any MOU (Memorandum of Understanding).

As can be seen, the design includes the creation of Beacon Quay in Torquay, Victoria Car Park, Paignton (via Harbour), and Brixham Harbour as strategic node / backhaul links.

Primarily, the existing columns / camera locations / buildings are utilised, with a small number of additional lighting columns where necessary for intermediate links (secondary link where direct line of sight cannot be achieved). All of the Street Furniture (that was viewed) utilised for CCTV (both lighting and CCTV columns), from a visual inspection, appear sound and in good condition, with no corrosion evident or 'leaning'. However, it should be appreciated that there is a legislative requirement for Street Furniture (with power) to be tested and inspected every six years (under BS 7671). This covers electrical and structural. It should be checked and verified as to whether this has been carried out for the CCTV columns. If not, this will need to be taken into account. There will need to be liaison with Torbay Council Highways / street lighting section as regards this, and any additional load to be added. In reality, where old 'large' Photo Scan cameras are replaced, the loading will be less anyway.

Liaison should similarly take place with Torbay Council Structural Engineers in relation to buildings mounted cameras / equipment, to verify no concerns as to the structural integrity of the building, or need for spreader plates etc.

5.0 Recommendations (Transmission)

We have undertaken site surveys / LOS exercise with UKB to establish an outline system architecture design and budget costs, upon which the following is based.

5.1 Town Centre CCTV

Having now carried out wireless surveys to the remaining Torbay CCTV areas (not carried out in the Phase 1 review), and evaluated the options available, it remains our opinion that migration to IP wireless provides the most cost effective, and flexible solution for Torbay Council.

The (CCTV) wireless surveys undertaken for Paignton and Brixham, have verified the feasibility of a wireless solution, with full coverage achievable for both areas.

The remote site video recording (DVR's located at car parks etc.), apart from Victoria Car Park, are believed have network links to the control room. Details of these links are unknown at this stage, but are likely to be ADSL (Broadband) circuits. These circuits, as a consequence of the proposed network, will also no longer be required.

The (CCTV) wireless survey undertaken for St. Marychurch, has identified that there is no achievable LOS from this location to any other part of the proposed network. The proposals do though, include for the *local* linking of the 3 x cameras (101 – 103), which would mean the requirement for only 1 x BT circuit, instead of 3. However, this would mean the remaining retained single BT Fibre circuit would require to be upgraded to include IP connectivity (BT RS1000D). Whilst LOS is not achievable, it may be feasible to utilise a tall structure / building as an intermediate link, to overcome the trees that are blocking. This element can be investigated at a later stage if required.

As in Phase 1 review, the survey undertaken was based upon the retention of the existing system topology and existing collection points that will be retained as existing (e.g. Victoria Car Park).

As previously noted, the vast majority of the radio links are license free. The larger (backhaul) 80GHz,

60GHz, and XG links, however, are subject to OFCOM licensing. This will equate to:

- Torquay: £600 (£100 per link – 6 no.) in year 1, and £50 per link, per annum thereafter (£300 per annum).
- Paignton: £100 (£100 per link – 1 no.) in year 1, and £50 per link, per annum thereafter (£50 per annum).
- Brixham: £100 (£200 per link – 2 no.) in year 1, and £50 per link, per annum thereafter (£100 per annum).

The licensed link requirement for Torquay remains at 6 no., as identified previously in the Phase 1 review.

The Paignton licensed link requirement has been revised down to 1 no.

The Brixham licensed link requirement has now increased to 2 no. The additional surveys and evaluation carried out under this phase, and the overall planning has enabled the inclusion of a second back-haul link, there now being one between Brixham and Paignton, and one between Brixham and Torquay. This enables the formation of a resilient wireless ring across Torbay (between the 3 locations). In addition to the benefit a back-bone ring provides for traffic management, this also means that if one of the main back-haul links (Brixham or Paignton to Torquay) encounters problems, the network is maintained, thus enabling remedial action for the failed link. It should be appreciated though, that the proposed equipment is based upon not just performance / cost, but equally, robustness and reliability.

5.2 UTC Cameras

We have included the 3 x UTC cameras identified for optional inclusion, and all are feasible for connection as follows:

- UTC/C90 (Abbey Gates). Can be included, but would be reliant upon Torre Abbey being included within the scheme, since connection to the network would require an intermediate link connection from this site. ***Note:*** *This location has challenging access conditions. It would most certainly require Traffic Management to undertake these works. However, since this is an existing camera location, it can be clearly achieved, but may require out of peak hours working.*
- UTC/C91 (Torbay Road / Belgrave Road). Straight forward.
- UTC/C92 (Torbay Road / Palace Avenue). This location has been included within the overall Paignton CCTV proposals, since it is utilised as an intermediate link anyway.
- UTC/C95(?) (Windy Corner). Whilst this location is excluded from the Phase 2 schedule of locations, it would be required for utilisation as an intermediate link connection for Churston Library connectivity. Therefore, if the Churston Library option is included within the project, moving forward, the Windy Corner UTC camera location would achieve connectivity also.

5.3 Remote Sites

We have reviewed the requirements detailed within Appendix 8, and evaluated accordingly. We can therefore recommend those elements, as detailed feasible below, be included within the Torbay upgrade programme.

Of the sites detailed in *Category 1*, Appendix 8, the following have been surveyed / evaluated, and are feasible for inclusion within the overall network:

- Torquay Harbour
- Paignton Harbour
- Brixham Harbour
- Paignton Library
- Brixham Library
- Torre Abbey
- Parkfield*

*There are a large number of trees surrounding Parkfield. Whilst we are not *wholly* certain at this stage whether LOS to this location can be achieved, it is felt probable, and has therefore been included. This element can be further investigated at a later stage, if necessary.

Of the sites detailed in *Category 2*, the following have been surveyed / evaluated, and are feasible for inclusion within the overall network:

- Chestnut
- Churston Library
- ERTB
- Halswell

LOS cannot be achieved for the remaining Category 2 site - Cockington Court.

Aspen Way, (the single site listed in *Category 3),* is surrounded by trees, does not have LOS to any other network points, and is therefore excluded. Aspen Way is likely to be decommissioned anyway.

The following *Category 4* sites can be easily added, at relatively low cost, and have therefore been included.

- Coroner's Office
- Paignton Beach Manager
- Palace Theatre

The Nest and Torbay Velopark, (the remaining Category 4 sites), do not have direct LOS, and are therefore excluded.

Whilst Oldway Mansion is not included within Appendix 8, we have identified its suitability for inclusion in the network, and have shown as an additional budget costed option.

5.4 Town-Centre Wi-Fi

As part of the survey and review process, we have evaluated the 3 x Town Centre areas of Torquay, Paignton, and Brixham. It is a viable option to provision this service across these areas.

We have based our proposals on coverage as follows:

- Torquay: Fleet Walk / Main Harbour area (Cary Parade / Victoria Parade)
- Paignton: Torbay Road / Victoria Street / Seafront (Esplanade)
- Brixham: Fore Street / Harbour

Whilst it is felt beneficial to include the Seafront / Harbour areas, as well as the "High Street" locations, the budget cost proposals are based upon the number of Wi-Fi Access Points, which can be reduced (or of course increased), according to the required coverage / budgetary constraints.

Since the provision of Public Space Wi-Fi to the above would very likely benefit Torbay, and its offering to visitors / residents, we recommend consideration be given to this option.

As previously identified, there are potential opportunities to offset revenue costs, e.g., sponsorship (splash screen adverts, sponsored links etc.). In addition, accessing the Public Space Wi-Fi would require registering / logging on (in keeping with all other such systems), which would itself create a valuable database of visitors.

The budget cost proposals are based upon the front-end hardware and network infrastructure. They do not include network back-end and (internet) service provision, which would need more detailed consideration / input from Torbay ICT Services, since this facility would be incorporated into the main Borough Domain / Hosting Servers.

6.0 Camera / Control / Recording System Recommendations

We have made enquiries of a specialist CCTV hardware/software company who could provide a solution to replace the obsolete cameras, provide a dispersed network recording solution, and a software Graphical User Interface (GUI) platform across the three towns. The budgetary costs provided, and system design proposals are based upon their input.

As previously identified, the existing Torbay system comprise a largely disparate mix of equipment types, all analogue based.

A large proportion of the control system equipment and cameras are effectively obsolete, and no longer supported, with spares likely to become wholly unobtainable which may render parts of the system unusable where a critical component suffers failure.

Whilst the issue of a camera failure is less critical, if there is a matrix failure, then that whole system will become unusable, typically up to 32 x cameras. The majority of matrices utilised across the various Torbay sites (collection / remote sites – e.g., car parks etc.) are Photoscan which are totally obsolete, and utilise long since replaced telemetry protocol type.

In addition to Photoscan, there are a smaller number of (newer than Photoscan) Synectics matrices utilised, which are maintainable to a degree. *However,* Synectics as a manufacturer, have withdrawn (in keeping with other manufacturers) analogue solutions from their product range / offering. As of 31st May 2016, Synectics designated their analogue solution range "end of life". Whilst it is possible in the shorter term to obtain spare components, below is an extract from the Synectics FAQ (frequently asked questions) section relating to legacy analogue equipment:

- Q: "Will I still be able to submit analogue equipment for repair?"
- A: "You can submit a ticket to the Global Support Portal for support and request for repair.

Synectics will make best endeavours to provide repair support but this will be dependent upon availability of replacement parts."

As well as the matrix, in any given analogue control system, there are various additional hardware "boxes" that form a part of the overall system. E.g.:

- Video Distribution Amplifier
- Network Expander
- Text Overlay Generator
- Telemetry Receiver Interface / Converter
- Alarm Interface
- RS 232 Serial Interface

Similar to the matrix itself, these essential system elements are also subject to the same obsolescence constraints. These additional components are manufacturer specific, with the exception of the Video Distribution Amplifier, for which alternative manufacturer products would be able to be used.

Although the existing DVR's are operational, they are also, in many respects, obsolete for this type of system, where migrating to an integrated IP system. They do not allow the level of integration / interfacing that a fully integrating front-end system will, and precludes the ability to take advantage of HD camera technology, and provide system flexibility.

Whilst the Torbay CCTV system overall, is limited in its efficient flexibility of use, and (as already determined) effectively obsolete, the existing architecture, (separate collection point / control & recording systems), does lend itself to a more manageable upgrade process, and an excellent basis for an IP system.

To ensure the most efficient and cost effective network transmission design, continuing to use this existing arrangement of dispersed recording is the obvious, and ideal, solution. It enables a more effective use of the network, reducing traffic, but, in no way limiting control functionality / flexibility. Longer term, the recording network can be configured so that if an NVR fails (disk failure etc.), camera images can be routed across the network and be recorded at other site NVR's. NVR's are always sized with (typically 20%) redundancy. This solution would provide an efficient cost effective failover solution.

Certain sites have a number of newer, more up to date cameras (e.g. Bosch MIC). Where this is so, the recommended option is to retain, and simply encode the analogue signal to digital IP. These can always be subsequently changed to IP HD cameras as and when an upgrade is required (age of camera / degradation, or camera failure). Similarly, in car parks where there are elevator cameras, these can also be (assuming they are working / performing as they should be) retained / encoded. This is especially useful in the elevator camera scenario, since replacing may also mean replacement of trailing flat-form cabling within the lift shaft, which of course will require joint works with the elevator maintenance company, etc.

Whilst currently functional and operational, the existing DVR's do not allow the level of integration / interfacing that a full integrating front-end system will. To take advantage of HD camera technology, and provide system flexibility, it is recommended these be replaced with an ONVIF compliant Network Video Recorder (NVR) / integrating front end solution, such as IndigoVision or similar manufacturer, which will provide a flexible, reliable and well supported system perfectly suited to this application, in preference to

a cheaper DVR solution.

Adopting an (ONVIF) compliant NVR system, will afford a high degree of flexibility, with the ability (subject to bandwidth / network) to directly access a camera IP stream, with fairly simple low cost integration into third party (e.g. stakeholders – Devon and Cornwall Police, etc., other Borough Control Rooms) integrating front-end systems.

In order to ensure operational flexibility, the proposed system would take account of the diverse network, and finite capacity. The ability to automatically adjust stream bandwidth at times of heavier traffic provides a high degree of overall resilience. Utilising analytics encoding / efficient compression, equates to a lower bandwidth requirement whilst minimising latency / jitter.

For certain camera locations, where at certain times, there is very little activity, the use of Video Motion detection (VMD), particularly useful at night, can be useful. This feature can be used to maximise recording capacity. This is affected by the lower frame rate recording, which accelerates upon activity. Since there is a small element of buffer recording, where activity occurs, a degree of pre and post activity recording at the accelerated rate is also retained.

This type of system would make (subject to system training), the reviewing of recordings a more efficient and streamlined process by using advanced search functionality.

The recording system should be based upon any additional planned cameras, plus the integration of the existing. Subject to available budget, the existing could be retained and effectively operate stand-alone side by side, with a subsequent upgrade programme when budget becomes available.

We have made enquires of IndigoVision (a specialist CCTV software / hardware manufacturer) in order to test the market and obtain indicative prices of their products that the council requires. These prices are shown later in this document, and at Appendix 7. Although we appreciate the benefits their products can bring, there are other systems on the market that may offer similar solutions. That said, should this council requirement eventually be tendered, we would compile a 'performance' tender specification in order to achieve the best solution for Torbay Council and it will be for CCTV integrators / installers to select the best, cost effective product based on the minimum criteria.

6.1 Upgrade Options

System Upgrade (Car Parks)

Although Car Parks are linked to / monitored by Torbay Control Room, they are deemed as not being Town Centre. However, whilst they are not town centre, two of the Car Parks do actually have Town Centre cameras linked into their respective systems.

Even where Car Parks do not have any Town Centre cameras incorporated, and are therefore considered for exclusion from the upgrade programme, almost all are strategic node points (due to their geographical locations / LOS abilities), that irrespective of inclusion will still require the radio network links, which are either back-bone or other town centre camera links.

Summary of the strategic status of the Torbay Car Parks:

- *Beacon Quay Car Park:* No Town Centre Cameras as a part of the Car Park System. Main

backhaul links from Paignton and Brixham. Main backhaul link to Union Square Car Park. Backbone link from Terrace Car Park. Links from 15 x Town Centre cameras.

- *Terrace Car Park:* No Town Centre Cameras as a part of the Car Park System. Backbone link to Beacon Quay Car Park. Links from 3 x Town Centre Cameras. Link from *Meadfoot Car Park* (2 x cameras).

- *Union Square Car Park:* No Town Centre Cameras as a part of the car park System. Main backhaul link from Beacon Quay Car Park. Main backhaul link to Lower Union Square Car Park.

- *Lower Union Square Car Park:* Main backhaul link from Union Square Car Park. Link from 1 x Town Centre camera. Links from Shedden Hill car Park. Camera S5/C29 (Factory Row) is effectively a Town Centre Camera. MM Fibre Optic link to Town Hall.

- *Victoria Car Park:* Effectively, all Paignton cameras are linked to this Car Park. Main backhaul link to Beacon Quay. Resilient backhaul link to Brixham. Links from Roundham car park, and Crown and Anchor car park. Cameras S7/C4 (Victoria Square / Lidl), and S7/C5 (Victoria Park pathway) are effectively Town Centre cameras, and are part of the Victoria car park system.

- *Brixham Central Car Park:* Camera S8/C2 (Middle Street) is effectively a Town Centre camera. Links from Freshwater car park, and Oxen Cove car park. *This car park does not form any part of the backbone network infrastructure.*

As can be seen, the main car parks require wireless infrastructure whether the car park systems themselves are upgraded or not.

With regard to the car park systems, these can be considered in several ways.

- *Leave as is (Analogue local matrix)* – (Not Recommended). This would mean in order for these sites to remain linked to, and controlled from, the control room, the existing BT analogue fibre circuits would still be required. The wireless infrastructure would (under the radio network design / architecture), be ready for the car park systems to be upgraded at a later stage if, and when required.

  In itself, this is a relatively simple solution, but does mean that the majority of the existing BT revenue costs will still be applicable until upgrades take place.

  It is not feasible to transmit the existing matrix systems over the radio network. To enable this to be done would require substantial cost increases to the network, creating effectively a parallel network to the planned IP one. Since the existing equipment is ageing anyway, this only compounds the negatives of that as an option.

  Whilst, in theory, it is possible to interface the existing matrix systems into a new integrating front end system (thereby enabling IP transmission / cessation of BT circuits), this could prove quite costly in itself. Apart from anything else, this would mean a temporary short-term expense is required to write software that will not be used in the long term, and we believe that trying to create a bespoke solution to delay a proper upgrade is a poor investment.

Assuming this option was considered, it would mean that the system would be highly bespoke and difficult to support.

- *Leave as is (Analogue local matrix) – encode video only* – (Not Recommended). This option would retain the existing local cameras / infrastructure, possibly removing the matrix, and encoding the cameras (video only). This would mean that the existing BT fibre circuits could be ceased.

  This means that there would no longer be telemetry control of the majority of local cameras. Even if it were possible to obtain / develop protocol converters, (Photoscan / Mark Mercer TTL to RS 485), there would still require further data encoding to (for instance) Pelco D protocol as part of the overall encoding process, creating at best latency, and at worst, unstable camera control.

  As well as the cost of encoders / protocol converters, there would *probably* be a requirement for Video Distribution amplifiers (V.D.A.s), as well as Quad units / power supply units etc.

- *Leave as is (Analogue local matrix) – DVR Link Only* (Not Recommended). This option would retain the existing local cameras / infrastructure, possibly removing the matrix, and simply enabling camera access via the local DVR. This would mean that the existing BT fibre circuits could be ceased.

  Whilst access would be available, it would be very limited, restricted to a single camera or multi-screen image at any given time. Whilst it may be possible to enable telemetry control (of any newer cameras where existing), again it is highly unlikely this could be achieved with the Photoscan / Mark Mercer cameras. Telemetry control in this manner will not be ideal, and there will be latency.

  This option can be achieved relatively simply, and at little cost, but is less than ideal, and would mean a separate web–browser type interface, creating further logistical control room difficulties when moving between sites / cameras.

  However, whilst not recommended, an evaluation of each site could be undertaken to establish strategically important cameras (and of course, this would include the system-linked town centre cameras where applicable). Any cameras that are determined of importance (for pro-active monitoring), could be separated, and upgraded accordingly. Thus, the applicable site would have a combination of local DVR, and upgraded cameras / NVR. Since the existing matrix / control equipment would be removed, there would be no rack space implications.

  This approach would provide a more viable alternative, reducing capital spend at this stage, but without incurring substantial costs that would effectively be wasted, when at a later stage the overall upgrade takes place.

We have concluded therefore, that on the assumption that the car parks are to remain pro-actively linked to / controlled by, the Town Hall control room, there is very little realistic choice but to upgrade as proposed in the original phase 1 document, unless the existing BT circuits are to remain.

We would therefore recommend that the car parks be included in the (staged) upgrade programme.

- A further consideration with regard to the car parks, is that the existing PTZ cameras (where actually in the car parks themselves, as opposed to external linked to) be replaced with strategically "aimed" static cameras, typically 2 (or possibly more) at the existing PTZ camera position. This is a more common scenario for this type of application, where wide area monitoring may not be required. Strategic points are usually vehicle entry / exit points, ticket machines, barriers, staircase entrances, lift cars, possibly ramps.

System Upgrade (Brixham Harbour, Paignton Harbour, Harbourmaster - Beacon Hill)

As with the Car Parks, these location systems are linked to / monitored by Torbay Control Room, and are deemed as not being Town Centre. However, of these 3 x locations, the Brixham Harbour system has two cameras that could be construed as realistically being Town Centre (B/H C7 – Inner Harbour / New Quay Lane, and B/H C8 – Shoalstone).

- Whilst the Wireless connectivity is included for Brixham Harbour system, the control / recording system upgrade itself can be excluded, since there is local control / monitoring. On the basis that there is local monitoring, it is recommended that simple and straightforward enabling of camera access via the local DVR be considered, with minimal cost. This would mean that the existing BT fibre circuits could be ceased. The B/H C7 and B/H C8 have been included in the upgrade, enabling these to be accessed / added to Town Centre system.

- Wireless connectivity for Paignton Harbour has been included, but, as above, the control / system upgrade can be excluded.

- Wireless connectivity for the Harbourmaster has been included, but, as above, the control / system upgrade can be excluded.

System Upgrade (linked direct to Town Hall / Town Hall elements)

In light of the budgetary constraints, it is proposed that in the short to medium term, the existing cameras / infrastructure / control, and recording systems remain.

Since there are no transmission revenue costs (beyond maintenance / ad–hoc cable section replacements, where damage / degradation occurs), this is a feasible option. However, it should be appreciated that longer-term, these elements will realistically need to be upgraded also. If, as, and when upgrade does take place, (depending upon the current transmission cabling type), it may be possible to utilise the existing cabling, rather than pull in new.

System Upgrade (Other Elements)

Where other Torbay sites are not proactively managed / monitored by the control room, they can be excluded from this project. Budget costs are provided where practical / feasible to include, for informational purposes.

It is understood that Abbey Road Children's Services, and Tor Hill House, whilst locally managed, have Torbay fibre provision, and could be considered for system upgrade / linking in future, if required. With the existing system, It would be relatively simple to effect remote DVR access (both sites utilising

Samsung DVR's) at the control room via the borough fibre.

Undertake as a complete Scheme

Whilst to upgrade the whole of the Torbay system in one programme would in some respects, be the ideal solution, project management of a scheme this size becomes more difficult. Undertaking in this manner also requires the necessary capital funding to be in place, rather than in stages. It should also be appreciated that even if undertaking as one scheme, the project would realistically be carried out stage by stage (area by area) anyway.

Staged Upgrade

Having already established that it is not realistically feasible to try to incorporate car parks (existing systems) etc. into the new transmission (and control) system, without difficulty and substantial costs, It is therefore proposed that the two main elements being considered, camera / control / recording upgrade, and transmission system upgrade to wireless, be undertaken in three phases.

Logically, this would be based upon the three main geographical areas of Torquay, Paignton, and Brixham, and the budget costing are formed accordingly.

Depending upon the budget allocation across the three financial periods, some "fine tuning" to the three stages could be made. However, whilst this would mean possibly (for instance) moving one of the Torquay car park systems into a later stage, it would not be feasible to do the same with the radio network, since the design forms an overall network, with an overall inter – dependency. Therefore removing part of the radio network would have implications on other elements.

Whilst delaying system upgrade elements, as described above, is not ideal, it is feasible. However, this would of course mean the existing BT transmission costs would remain, until such time, that they were upgraded also.

It is highly probable that the existing disparate mix of analogue systems / cameras will become increasingly difficult to maintain, leading to increased down – time, maintenance costs, and critical failure, in turn leading to large numbers of cameras being out of service. The majority of the cameras, and the matrix systems are all effectively end of life (much of the equipment several generations since), and unsupported.

A significant advantage of staged upgrade means that the removed equipment can be retained / utilised to maintain the *remaining* Torbay system elements that are yet to undergo upgrade. This is a particularly important factor when considering the (hard – wired direct into Control Room) cameras / matrix system, where retention is likely to exceed the three upgrade stage period. This will enable reasonably fast turn – around where faults occur without the increasing difficulty of obtaining long since obsolete spares / components. This of course will not mitigate the frequency of faults (bearing in mind the age of the equipment), but does extend the system maintainability in the medium term.

It should be appreciated that until the whole of the Torbay system is upgraded, it will mean a requirement for separate keyboards / monitors / recording for the concurrent systems in operation. However, since that is already the case (Synectics / Photoscan), whilst never ideal, it should not present any real difficulties.

7.0 Network Security

Network Type Segregation

Utilising a combined radio network infrastructure for both Security (CCTV / Alarm Monitoring / Access Control etc.), along with ICT services is very feasible, and a method that has been adopted by various Local Authorities (and similar Public Bodies, e.g. Education / Health service) elsewhere.

For Torbay Council to utilise the combined radio network, which incidentally has the same implications as a physical (e.g. fibre optic) network, then effective separation of the different traffic types is an absolute requirement.

There are two main methods of achieving this requirement, and the methodology adopted (including procedural) must comply with the requirements of CoC. (Code of Connection)

Government Connect (CoCo) is a pan-government programme providing an accredited and secure network between central government and every local authority in England and Wales. The network is known as GCSx (Government Connect Secure Extranet). GCSx is part of the wider Government Secure Intranet (GSi) and provides connectivity to almost all Central Government departments.

Torbay Council will have an officer within ICT that assumes responsibility for ensuring (CoCo) compliance.

The ***first method*** to achieve the required level of separation (between the two elements), is by the formation of Virtual Local Area Networks (v-LANs).

A v-LAN is any broadcast domain that is partitioned and isolated in a computer network, at the data link layer, OSI (Open Systems Interconnection) layer 2. To subdivide a network into virtual LANs, network equipment is configured accordingly.

Configuration can include switch port locking / segregation etc., but typically (in this scenario – i.e. Borough security / ICT), strict protocols would be in place regarding network switches that carry both ICT and CCTV network traffic (mainly Back-Haul / Control Centre). Whilst the different v-LANs cannot “see” each other, they are managed via a combined switch. Commonly, these switches can only be accessed / configured by (or in close conjunction with) ICT. This however, does not realistically create issues or problems with CCTV maintenance, especially where a good and close working relationship exists between ICT and the Borough CCTV systems integrator / maintainer.

This method is easier to achieve than the second method, and is accepted / adopted by most local authorities.

The *second method* would require a separate FSP (Flexible Service Provider) for both network elements. This separates the network traffic end to end – effectively mimicking physical separation, and unlike the (method 1) v-LAN solution requires a *separate* network switch architecture.

Additionally, radio units that transmit *both CCTV and ICT* traffic will require multiple FSPs. Predominantly; this will affect the back-haul links. The proposed main back-haul links within this review are all SIKLU, which are designed to incorporate this type of application, and have multiple FSP

capability. A small number of secondary links also carry both traffic types. In these cases, should Multiple FSP be an ICT requirement, this may possibly mean parallel links. There would also be a requirement for a small number of additional network switches.

An advantage of the second method is that the two network types are wholly separate (in so far as management / configuration) is concerned, in the same way as actually being physically separate.

Whilst it is highly likely that the v-LAN method will be acceptable to ICT, should they require to go down the separate FSP route, the Wireless Network design would require some minor changes (to reflect the above), with some additional equipment costs accordingly. These costs however, would not be dramatic.

As would be expected anyway, it is strongly recommended that should this project progress, and include the ICT elements, close liaison with, and input from, ICT should commence at the earliest opportunity, and continue throughout the project.

Network Broadcast Security

To ensure the security of all broadcast traffic, which by virtue of its nature is sensitive, it is vitally important that protection against unauthorised access be provided. The ICT elements will include data that is sensitive, and as part of the requirement for CoCo, as already mentioned, steps must be taken to prevent unauthorised interception / data breaches.

Similarly, with CCTV traffic, it is of the utmost importance to maintain the secure integrity of images, both live and recorded. This is especially so, where Data Protection Act breach charges could be brought, bearing in mind that the CCTV network is Public Space.

The proposed network / equipment types utilise 128 / 256 bit AES encryption feature, with the encryption license costs included within the budget costings. Configuration would include the disabling of SSID (Service set Identifier) broadcast.

The Advanced Encryption Standard (AES), also known by its original name Rijndael, is a specification for the encryption of electronic data established by the U.S. National Institute of Standards and Technology (NIST) in 2001. It is the standard method of data encryption adopted where network security is crucial.

Whilst there may be no plans currently, Torbay Council may, at some point in the future (in line many other Local Authorities) utilise Borough PSS CCTV for the detection of Parking contraventions, which to do so, would require overall system compliance with the Civil Traffic Enforcement CoAD (Certification of Approved Devices). The encryption methodology described above is fully compliant with the CoAD. The radio network equipment proposed comply with the other technical requirements (EMC compliance etc.) of the CoAD as well.

8.0 Budget Costs

Budget Costs have been compiled and based upon three CCTV system upgrade phases, (Torquay, Paignton, Brixham), and are detailed as two elements:

- Camera / integrating front end control / recording

- Wireless transmission.

In addition, costs have been compiled for Torbay ICT network connectivity to various Torbay Council sites, and for Public Space Wi-Fi provision to Torquay, Paignton, and Brixham Town Centres.

8.1 Budget Costs (Wireless System - CCTV)

The budget costs for the wireless system are inclusive of year 1 OFCOM license (for the back – bone links), and are based upon all required equipment, and a number of strategic component spares.

Also included within the budget costs are:

- Site surveys and radio planning works (but excludes cherry picker rental)
- Pre – staging
- Project management
- Installation (budgetary £500 per link end)
- Configuration
- Commissioning

These costs also include 12 months' remote technical support, as well as 12 months' advance replacement for all radio units (except the smaller Ubiquity units).

It was identified that there will be a requirement for a 10m column at Beacon Quay Car Park, for which budget costs are also included for the column, Civils, erection, and associated steel works.

With regardsto the system design, and equipment proposed, the radio unit / antenna types are all tried, trusted, and will provide a robust and resilient network. The radio unit manufacturers are:

- Ubiquity (small single point to point). Relatively inexpensive, lightweight yet robust, perfect for lighter bandwidth links

- InfiNET (larger point to point / point to multi – point). A highly robust, reliable solution for multiple links, higher bandwidth links, with very sophisticated configuration / network management capabilities. Similar to Motorola, but less expensive.

- Siklu Main Backhaul links. Widely used, powerful / robust and resilient. Utilised for licensed main back - haul links.

There is an important feature that InfiNET offers, which is iDFS (instant Dynamic Frequency Selection), that results in the radio switching immediately there is a potential interference / DFS event.

Budget Cost for (Torquay) - Wireless: £115,590 (Exclusive of VAT and delivery charges).

Torquay costs include St Marychurch, but for linking the cameras together only. There is no achievable LOS from this location to any of the overall network points. Therefore, there would still be a BT fibre connection required, but to only one of the 3 x cameras. However, this would need to be upgraded to RS1000 / RS1000D to enable IP transmission. An advantage of this is that there would be the ability to add cameras (or other network connectivity), subject to LOS, since the BT RS1000D circuit provides

100 Mb/s.

10 Mb/s provision has also been included for Beacon Hill Harbourmaster.

Budget Cost for (Paignton) - Wireless: £ 77,538 (Exclusive of VAT and delivery charges).

Paignton costs include connectivity of the 3G camera that is currently deployed within Victoria Park.

10 Mb/s provision has also been included for Paignton Harbourmaster

Budget Cost for (Brixham) - Wireless: £ 46,636 (Exclusive of VAT and delivery charges).

Brixham costs include system linking of Brixham Harbour cameras C7 and C8.

10 Mb/s provision has also been included for Brixham Harbour

Total Budget Costs (including installation) for all 3 areas – Wireless: £239,764 (Exclusive of VAT and Delivery Charges)

8.2 Budget Costs (Wireless System – Additional Elements)

The following costs are for those elements deemed as optional. However, it should be appreciated that in order for these sites to be connected, relies upon the overall CCTV network architecture. If these options are required to be included within this project, they would be subject to separation into their relevant areas, and undertaken as part of the respective CCTV network phase.

Remote Sites:

Brixham Harbour (10 Mb/s):
Torquay Harbour: (10 Mb/s):
Paignton Harbour: (10 Mb/s):
ERTB: (10 Mb/s)

Included within CCTV Wireless Network Costs.

Brixham Library (10 Mb/s):

Budget Cost for Brixham Library - Wireless: £ 2,000 (Exclusive of VAT and delivery charges).

Paignton Library: (100 Mb/s)

Budget Cost for Paignton Library - Wireless: £ 8,000 (Exclusive of VAT and delivery charges).

Churston Library: (10 Mb/s)

Budget Cost for Churston Library - Wireless: £ 4,264* (Exclusive of VAT and delivery charges).

**To enable connectivity of Churston Library to the overall network, the Windy Corner UTC camera column (12m) would need to be utilised. Therefore, the library's budget costs include connectivity for the (Windy Corner) UTC camera.*

Parkfield (10 Mb/s)
Chestnut (10 Mb/s)
Halswell (10 Mb/s)
Torre Abbey (10 Mb/s)

Budget Cost (combined) for above centres - Wireless: £ 10,900 (Exclusive of VAT and delivery charges).

Coroner's Office (10 Mb/s)

Budget Cost for Coroner's Office - Wireless: £ 1,200 (Exclusive of VAT and delivery charges).

Paignton Beach Manager (10 Mb/s)

Budget Cost for Paignton Beach Mgr - Wireless: £ 1,200 (Exclusive of VAT and delivery charges).

Palace Theatre (10 Mb/s)

Budget Cost for Palace Theatre - Wireless: £ 1,200 (Exclusive of VAT and delivery charges).

Oldway Mansion (10 Mb/s)

Budget Cost for Oldway Mansion - Wireless: £ 2,800 (Exclusive of VAT and delivery charges).

Total Budget Costs (including installation) for all (feasible) Remote Sites – Wireless: £31,564 (Exclusive of VAT and Delivery Charges)

UTC Cameras

UTC/C90 (Abbey Gates). Reliant upon Torre Abbey being included within the scheme, since connection to the network would require an intermediate link connection from this site.

Budget cost for UTC/90 – Wireless: £ 1,200 (Exclusive of VAT and delivery charges).

UTC/C91 (Torbay Road / Belgrave Road).

Budget cost for UTC/91 – Wireless: £ 700 (Exclusive of VAT and delivery charges).

UTC/C92 (Torbay Road / Palace Avenue). This location has been included within the overall Paignton CCTV proposals, since it is utilised as an intermediate link anyway.

Budget cost for UTC/92 – Wireless: Cost incorporated / included within main Paignton CCTV costs.

UTC/C95(?) (Windy Corner).

Budget cost for UTC/92 – Wireless: Cost incorporated / included within Churston Library Remote Site costs (as detailed above).

Total Budget Costs (including installation) UTC Cameras – Wireless: £1,900 (Exclusive of VAT and Delivery Charges)

Wi–Fi

Torquay, based upon 15 x Access Point locations @ 10 Mb/s each

Budget Cost for Torquay – Wi-Fi: £ 28,346 (Exclusive of VAT and delivery charges).

Paignton, based upon 10 x Access Point locations @ 10 Mb/s each

Budget Cost for Paignton – Wi-Fi: £ 19,128 (Exclusive of VAT and delivery charges).

Brixham, based upon 6 x Access Point locations @ 10 Mb/s each

Budget Cost for Brixham – Wi-Fi: £ 12,170 (Exclusive of VAT and delivery charges).

Total Budget Costs (including installation) Wi-Fi Network: £59,644 (Exclusive of VAT and Delivery Charges)

These costs are based upon, (and take into account), the direct-to-partner costs plus partner margin thereby commensurate with end – user costs.

Where budget costs are provided for remote sites, (optional elements), they include all applicable adaptations / capacity upgrades upstream as necessary.

The costs for Paignton and Brixham (main CCTV network) are inclusive of their respective back–haul links to Torquay, and an additional link between Paignton and Brixham, thereby creating a resilient wireless ring across Torbay.

Some of the installation costs will effectively be mitigated by the camera upgrade elements, which will be undertaken simultaneously.

It is recommended that an additional contingency sum of £20,000 be added to the combined overall cost.

Appendix 6 details budgetary costs for the Wireless system.

**Since the original budget costings (phase 1 review), there have been price increases due to £ / $ exchange rate changes (weakening of the pound sterling). These changes are reflected in these costs accordingly.*

8.3 Budget Costs (CCTV Front End / Recording System / Cameras)

Budget Cost for (Torquay) – Front End / Recording / Cameras: £225,412 (Exclusive of VAT).

Torquay costs include:

- *St. Marychurch*
- *Site 1 – Torquay Town Centre (but exclude cameras 7 & 8 - wired direct to Town Hall)*
- *Site 2 - Beacon Quay Car Park*
- *Site 3 - The Terrace Car Park*
- *Site 4 - Union Square Car Park*
- *Site 5 - Lower Union Lane Car Park*
- *Torre*
- *Torre Station*

**The Torquay costs include all of the Control elements, including network switches, Monitoring workstations / Review suite, monitor wall software, plus NVR solution (with capacity for all 3 x areas, and in readiness for the directly cabled into / local control room cameras)*

Budget Cost for (Paignton) – Front End / Recording / Cameras: £81,948 (Exclusive of VAT).

Paignton Costs include:

- *Site 1 – Paignton Town Centre*
- *Site 7 – Victoria Car Park*

Budget Cost for (Brixham) – Front End / Recording / Cameras: £21,848 (Exclusive of VAT).

Brixham Costs Include:

- *Site 1: Brixham Town Centre*
- *Site 8: Brixham Central Car Park*

Budget Cost for U.T.C. Cameras: £7,600 (Exclusive of VAT).

UTC cameras:

- *UTC/C90 (Abbey Gates).*
- *UTC/C91 (Torbay Road / Belgrave Road).*
- *UTC/C92 (Torbay Road / Palace Avenue).*
- *UTC/C95(?) (Windy Corner).*

The recording system should be based upon the integration of the existing plus the additional planned cameras, subject to the available budget. The existing cameras could be retained and effectively operate 'stand-alone' side by side, with a subsequent upgrade programme when budget becomes available.

Appendix 7 - Provides detail of budgetary costs from IndigoVision for the potential solution for Torbay. This details a complete and full new recording / integrating front-end control system that could provide

access to all sites, camera control and configuration, including recording access and review, etc., from a single platform. Of course, other providers could provide a solution but this gives a guide as to the potential costs to be aware of.

This document has 2 x fields, one of which lists equipment as existing, with the proposed upgrade options. This includes for all cameras that are effectively now obsolete / unsuitable, whilst retaining newer types that can be integrated into the upgraded system (utilising encoders where applicable).

The budget costs / Proposals include all required for upgrade sites, and certain additional sites that are not included in this project, at this stage, but are included for indicative purposes.

These costs are inclusive of installation, and as already mentioned, of which some of the installation cost element could be mitigated by being undertaken at the same time as the transmission works.

The Total Budget Costs (including installation) for all 3 areas of Torquay, Paignton and Brixham – New Control and Recording System and Camera replacement: £329,208 (Exclusive of VAT)

These costs are based upon Manufacturer list prices, which would of course be subject to system-integrator partner discounts, which would therefore offset / balance out partner margins.

The costs include all applicable (one–off) licenses, as well as year 1 Support Licenses.