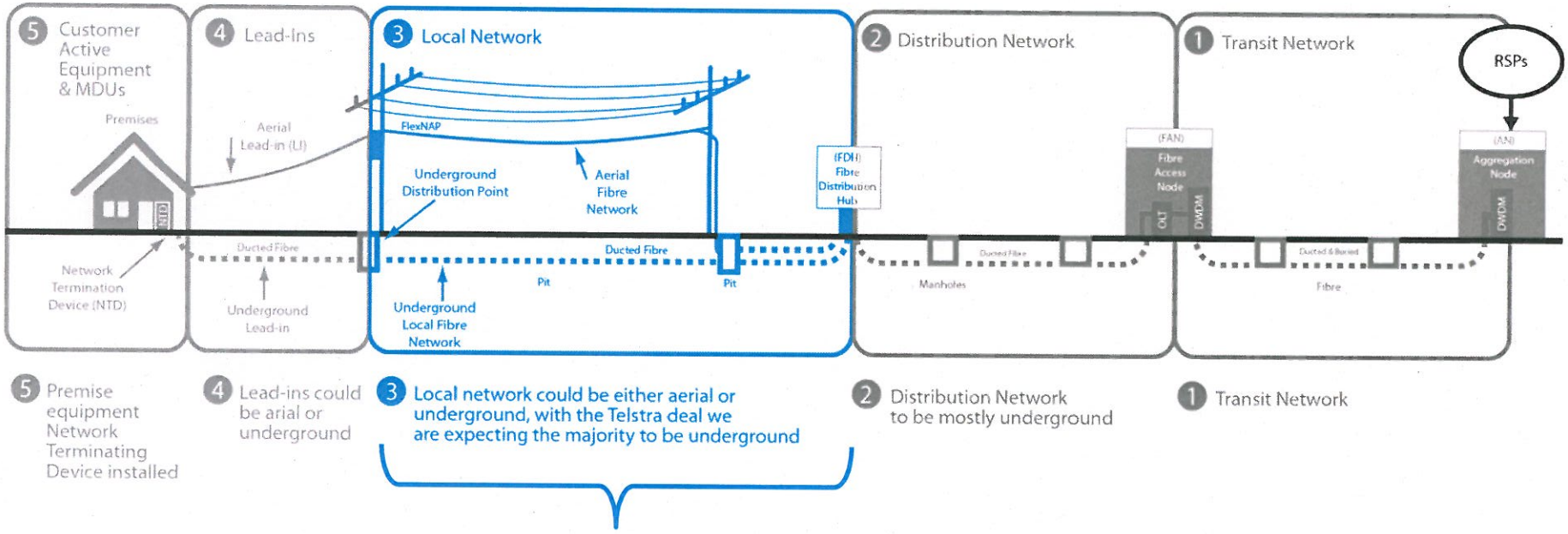
CTO Briefing: Multi Technology – Local Fibre Network (MT-LFN)

INTERNAL USE

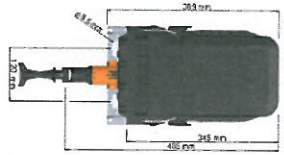
F0020-21-24 // Rev 7.0 I // 08-07-2015

Network Context



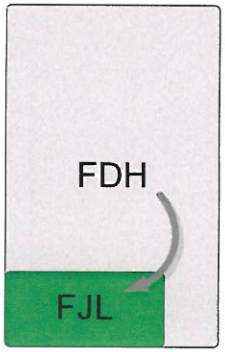
Local Fibre network (LFN)

Multi-Technology Local Fibre Network



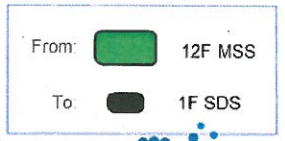
Opportunity: High Cost of fibre in the local network

- Civil cost & time of current LFN – Pit & Duct augmentation, FDH siting & install, reinstatement
- Fibre connectivity required for MTM: FTTN 'micronodes', FTTB, Technology on Demand, FTTdp



Solution : Multi-Technology LFN (MT-LFN)

- New LFN architecture optimised for MTM & variety of fibre connectivity requirements in Local Network
- Zero civils LFN build:
  - Reduce cable size to minimise duct congestion & augmentation
  - Reduce size and quantity of closures to minimise pit congestion & augmentation
  - Remove FDH cabinet, replaced with small underground closure
- Designed for 'build on demand' fibre in LN
- Single fibres rather than ribbon fibre for cable size reduction & handling
- Technology agnostic optical connectivity in Local Network



Objectives – MT-LFN

Objectives:

- Reduced day-one capital cost of building fibre 'deep' into the LN
- Reduce the chance of pit & duct congestion & civil works (duct and pit augmentation) to the absolute minimum
- Support 1% - 100% flexible density
- Technology agnostic LFN
  - Support any P2P or P2MP technology requiring fibre in LN. E.g. CSDs, FTTB, FTTdp, HFC, FOD, CSAS (Mobile backhaul), …
- Provide connectivity for the MTM demand points.
- Hand over pre-proven MT-LFN Architecture & business case to delivery teams (via NFDR)

Progress:

- CTO has been working in conjunction with our passive and active vendors to investigate methods of providing a suitable Multi-Technology LFN.
- Multiple FTTP and small FTTdp architectures were overlaid on a DA in Gosford to assist in the understanding of the architectures in an NBN Co environment.

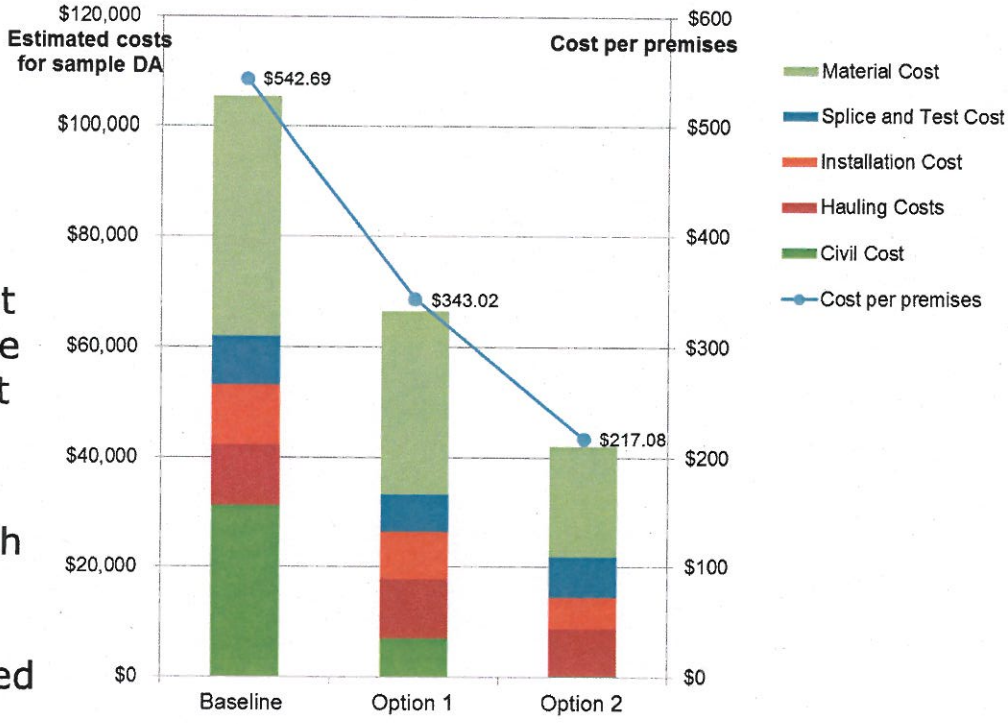
MT-LFN development - Test DA

There were two main methods investigated for supplying MTM connectivity:

- Variants of the FDH cabinet, both above and below ground
- Cascaded split for GPON

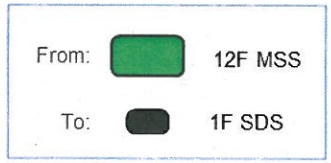
Generally each approach reduced the cost of the network from the baseline, with the most flexible approach (a smaller variant FDH) showing the least savings.

CTO have used a "best of breed" approach to combine the hardware proposed to provide a flexible MT-LFN, a strategy for technology upgrades, and is also expected to significantly reduce costs.



MT-LFN Overview

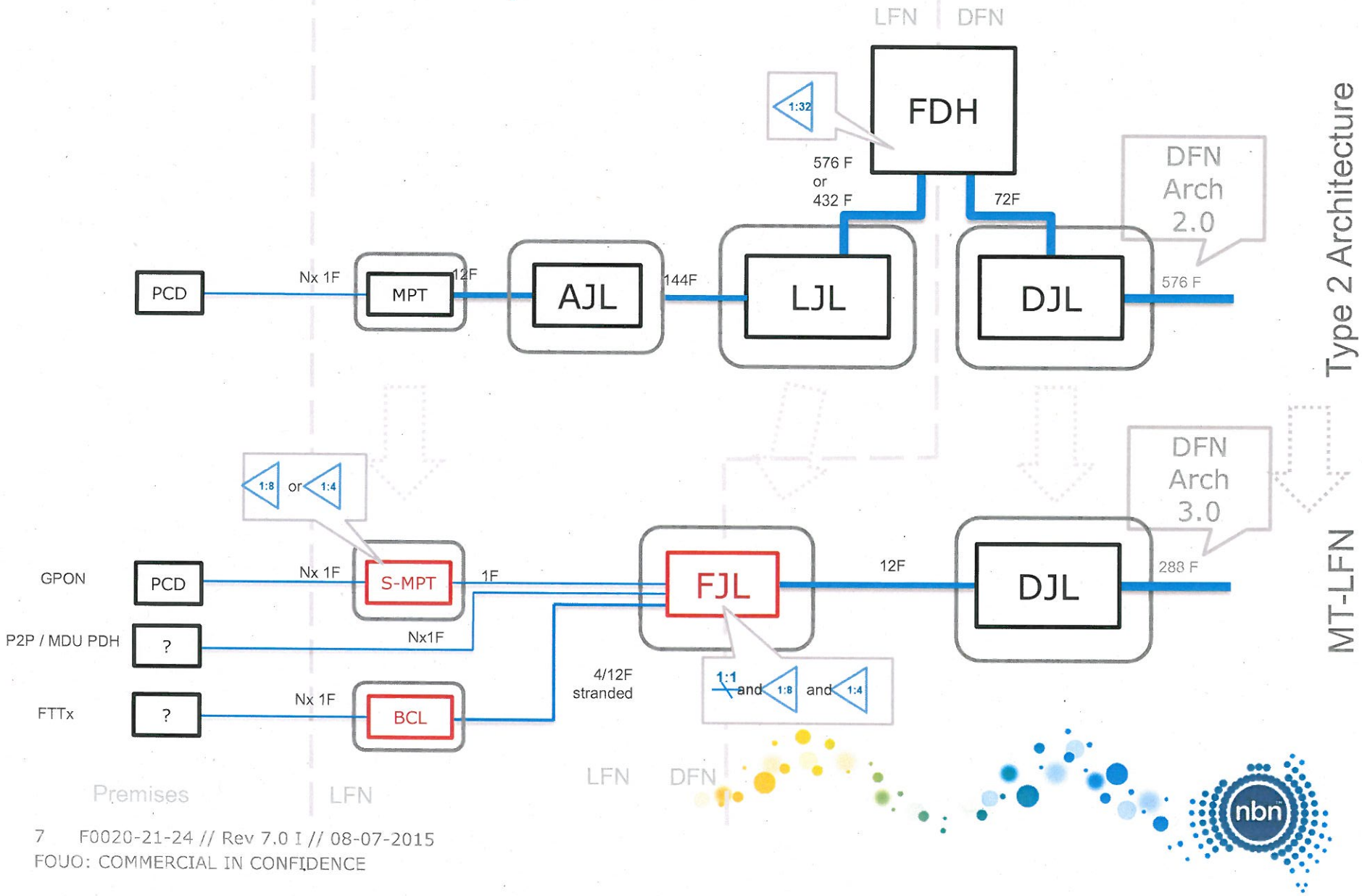
- Support mixture of fibre connectivity types
  - Point to multipoint (e.g. GPON, xPON, FTTdp)
    - Centralised split
    - Cascaded split
  - Point to point (e.g. micronode/CSD backhaul, FTTB, business services, HFC optical nodes etc)
- Flexible capacity to allow changing LN fibre requirements over time
- Future connections leverage off the initial install to allow for:
  - Copper remediation avoidance
  - Fibre / bandwidth on demand
  - Infill Greenfields
  - Cost effective FTTP



Comparative Cable Size

- **No Fibre Distribution Hubs** (FDH), eliminating the need for large pits and street cabinet siting
- **No Local Joints** (LJL), **No Access Joints** (AJL) – replaced by small form factor **Flexibility Joint Location (FJL)**
- **Single fibre connectorised cables** (connectorised at multi-port or FTTdp end only) used between FJL and SFM/dp to drastically reduce duct augmentation.
- **Small footprint multi-ports with integral splitters** used to provide connection capacity closer to demand points and minimise large fibre count cables traversing through DAs. Split ratio at 1:32 maintained.
- Allows for a consistent and flexible **upgrade path** for higher speed demand (FTTdp, FTTP).

Architecture comparison



MT-LFN Overview – Flexibility Joint

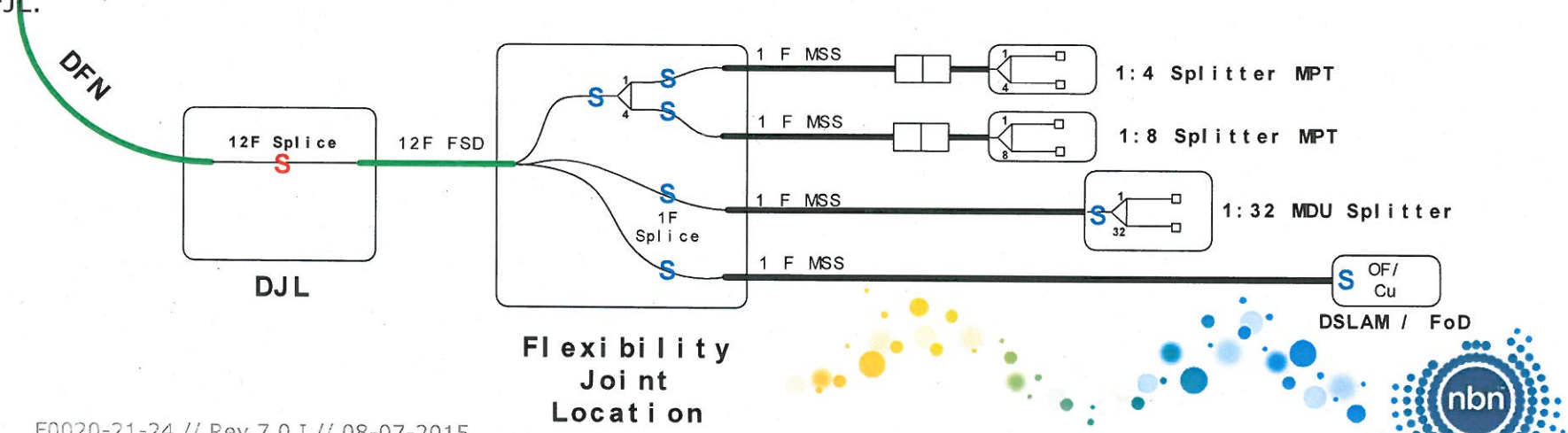
The demarcation between the DFN and the LFN is a new **Flexibility Joint Location** (FJL).

Flexibility Joint Location

- Optical connectivity between DFN and LFN fibres
- Breaking DFN ribbons into individual fibres
- Support direct **point-to-point** splicing
  - 12F to 12F or 12F to 12x1F connections
- Support **Point-to-multi-point** via passive optical splitters (xPON technologies)
  - Tray mounted 1:4 or 1:8 **first-stage** splitters for cascaded PON splitting
  - Tray mounted 1:32 splitters for cascaded

Splittered Small Form Factor Multiport

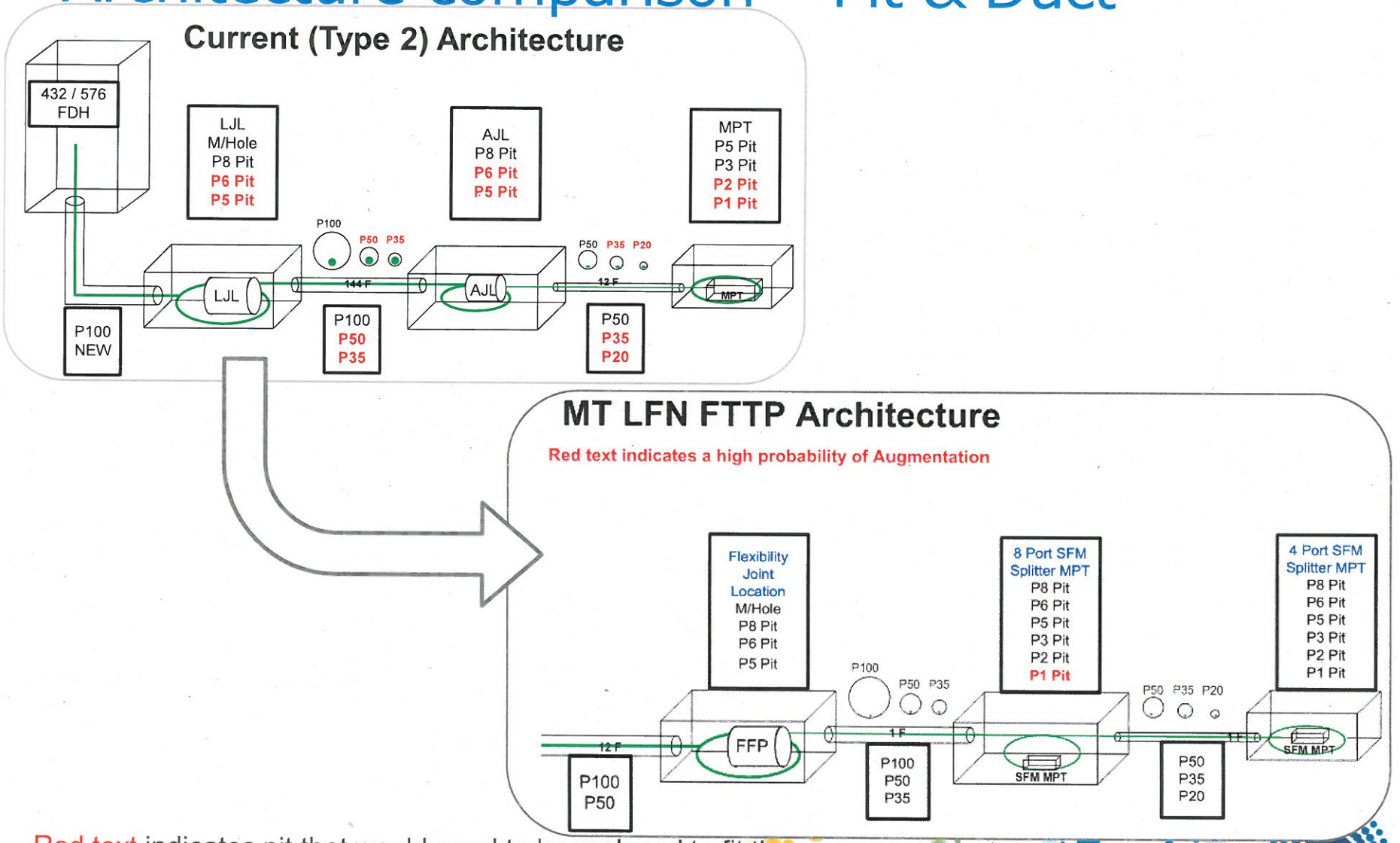
A second stage split is located in the Small Footprint Multi-ports (S-MPT) and these are connected via single fibre cables (using the existing SDS cables with OptiTap / HFOC connector at the S-MPT) to the splitter at the FJL.



Hardware Changes

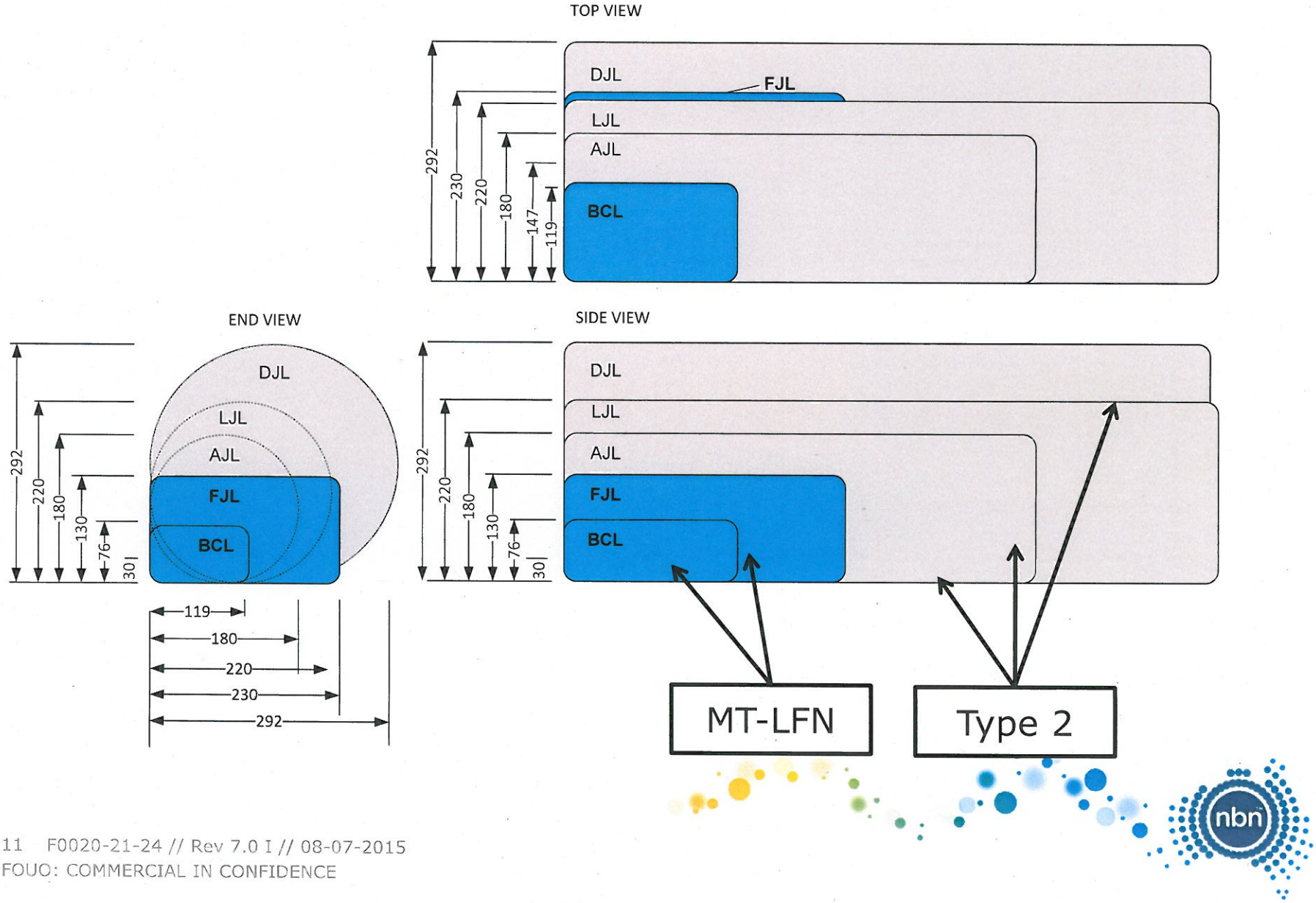
	Architecture 3.0 LFN	MT-LFN
DFN / LFN Demarcation	576 / 432 FDH	Flexibility Joint Location
HSD Cables	72 Fibre Ribbon	12 Fibre Ribbon
LJL	Corning ORS	_
AJL	Corning ORS	Breakout Joint (BCL)
LSS Cables	144 and 72 Fibre Ribbon	Single Fibre Cables (SDS)
MSS Cables	12 Fibre Ribbon	_
Premises Connection	Multi-ports	Multi-ports with splitter (S-MPT)

Architecture comparison – Pit & Duct



Red text indicates pit that would need to be replaced to fit the new components

Material size comparisons



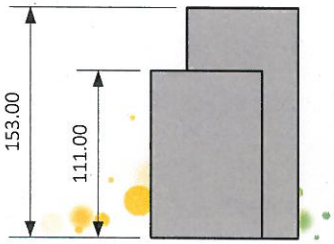
New components: Splitter Multiport

CORNING

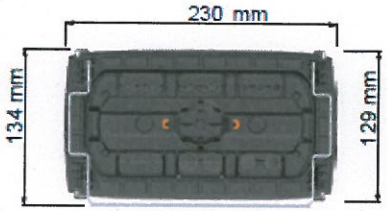
- No change to existing width & depth
- Length increase to 120mm
- MPT Input changed from integrated connector to connector on cable tail (like existing TE SFM)
- Input tail length to be determined by sample testing
- Differentiation of input by connector labelling & colour
- Input 'Female' OptiTap
- Outputs 'Female' OptiTap
- Trial SFM unit price
  - 4P $319 (Type 2 $150)
  - 8P $415 (Type 2 $215)

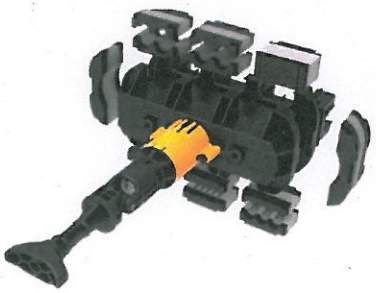
TE connectivity

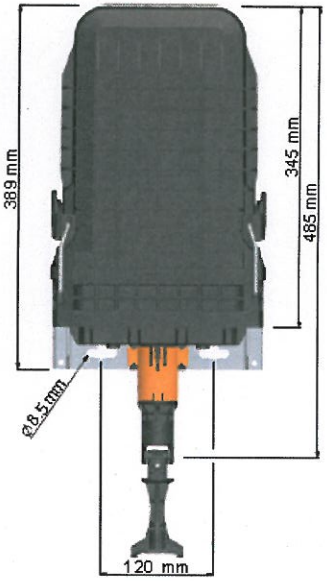
- No change to body width & depth
- Body extra 39mm in length
- No change to output tail length
- Input tail length to be determined by sample testing (100 or 400mm)
- Input 'Female' OptiTap
- Outputs 'Female' OptiTap
- 4P $266 (Type 2
- 8P $400 (Type 2 $215)

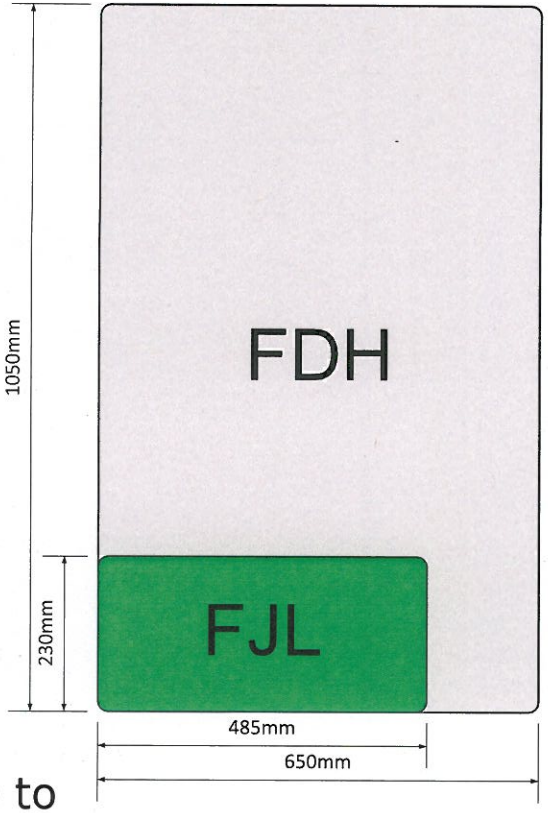


New components: FJL -





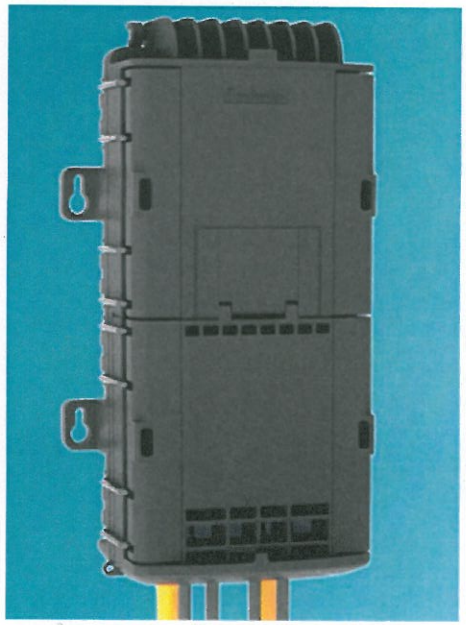


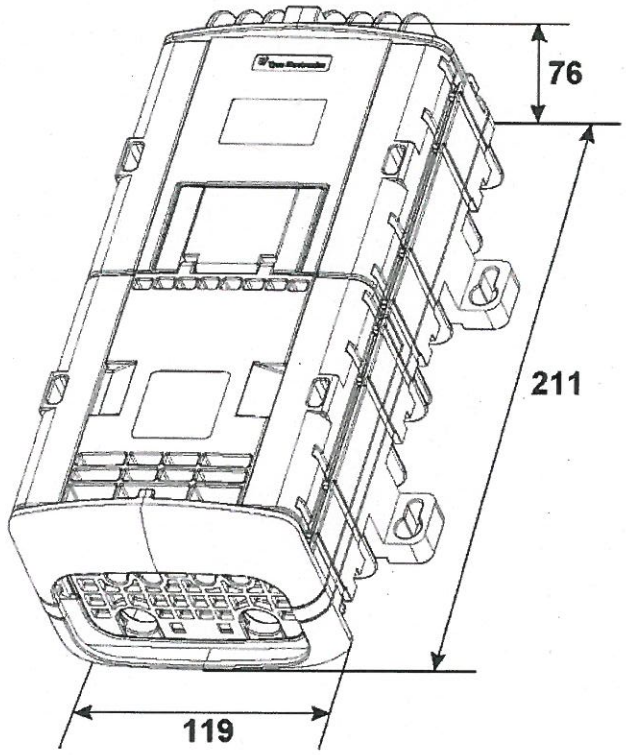


Flexibility Joint Location (FJL)

- TE 'Tenio' Closure
- Compact size with a splice capacity of 144 single fibre splices
- 8 'off tray' splitter positions within closure accepting up to 1:64 splitters
- Supports direct point-to-point and PON connections
- Supports minimal first install with splitters and cables added when required for growth
- Modular base accepting multiple cable types
- Gel technology to seal cable entry

New components: BCL – Breakout closure

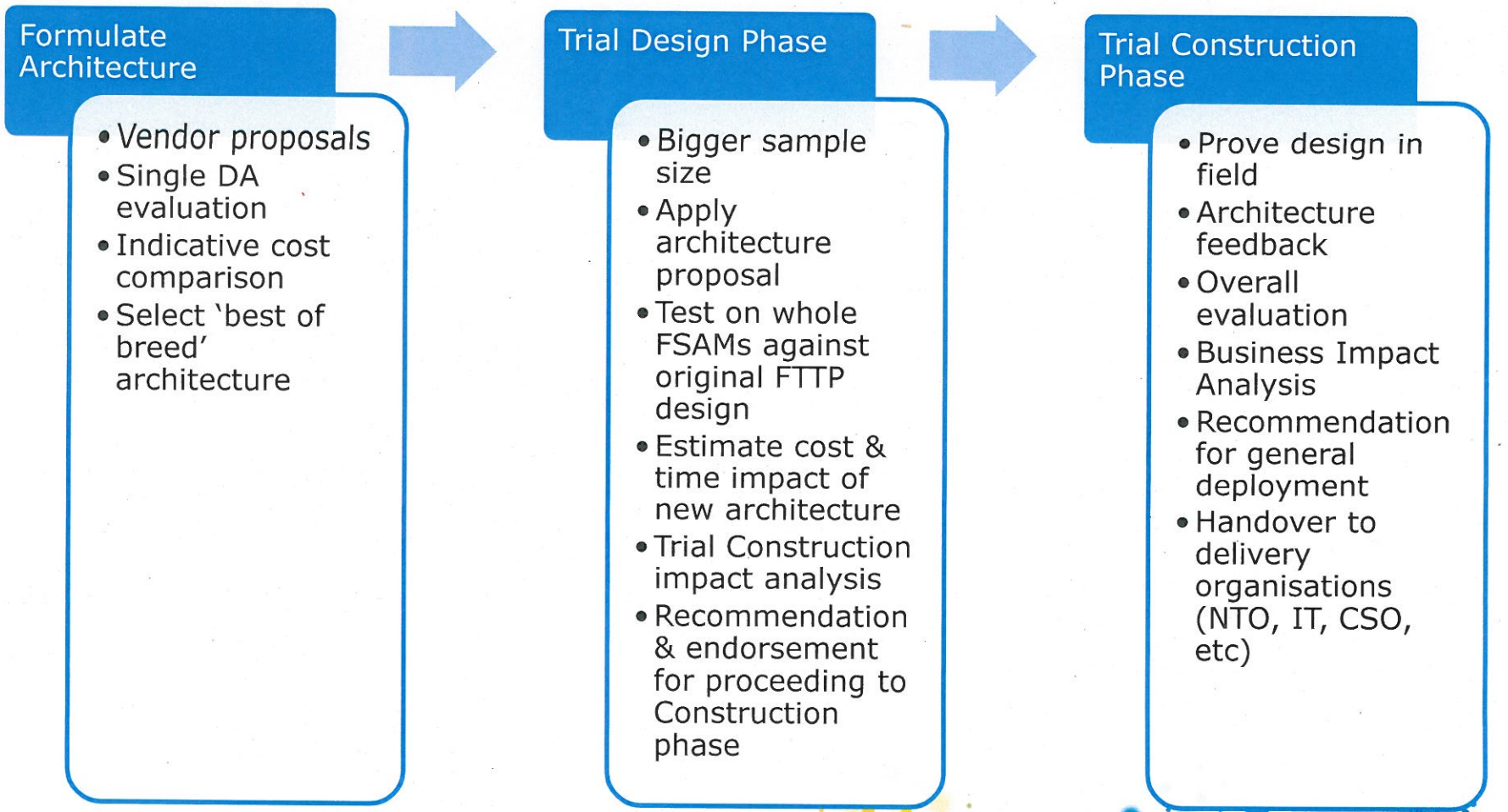




Breakout Closure Location (BCL)

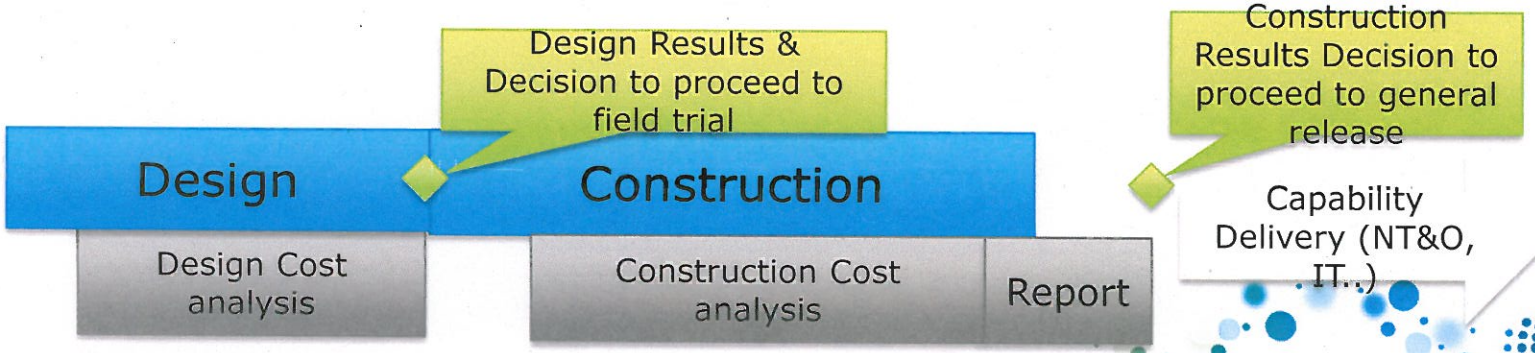
- Breakout of stranded multi fibre cable to smaller fibre count sheaths
- Very compact size with a splice capacity of up to 12 single fibre splices
- Supports main stub or looped cable applications
- Can support splitters if required
- Gel technology to seal cable entry

MT-LFN Evaluation Methodology



Trial : Scope & purpose

- Scope
  - 100% FTTP FSAMs
  - Underground only (aerial architecture not ready yet)
  - FTTB supported
  - Construction trial only; does not require service activation
    - *But will need a plan to support service activation (IT, SOPS)*
  - Predicted capability delivery tasks & costs (E&DS, IT, Construction Operations)
- Purpose
  - Measure cost benefits of MT-LFN vs current LFN architecture



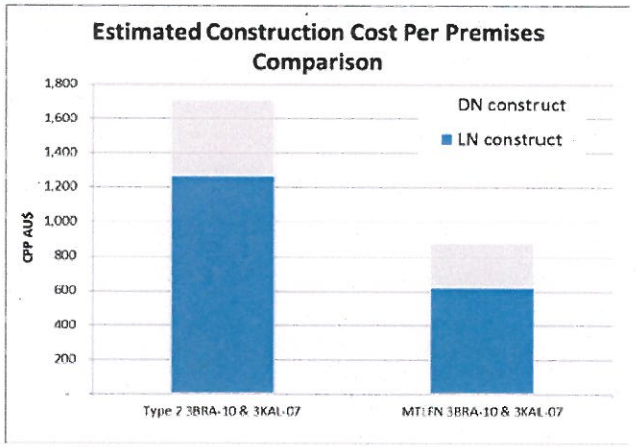
Multi Technology-Local Fibre Network trial

New LFN architecture

- Optimised for MTM
- Reduced cost and time to build

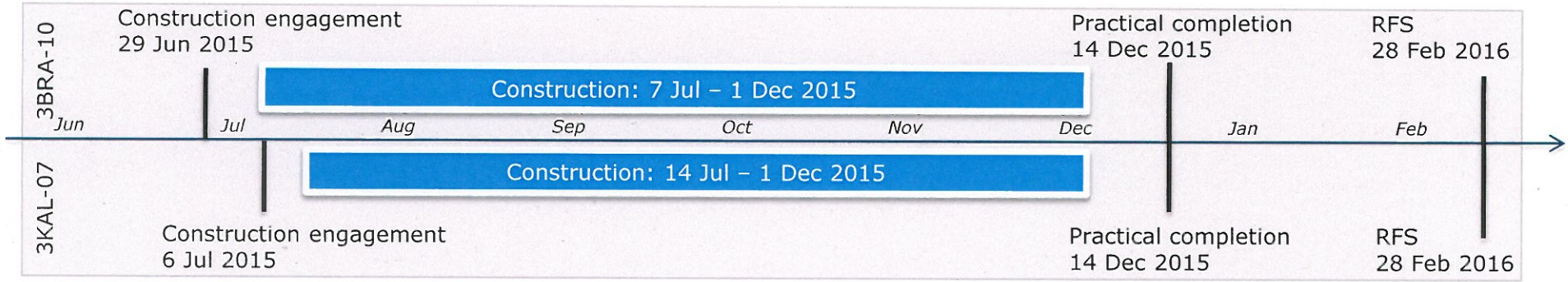
Architecture trial

- Completed:
  - Redesign of Type 2 FTTP FSAMs to confirm cost savings predicted in design trial
- Underway:
  - Regional Deployment leading construction of redesigned FSAMs, to validate suitability of architecture and expected savings
  - Metrics will be collected and reviewed regularly throughout construction with CS&P



Design trial results

Construction trial timeline



3BRA-10 Ballarat Vic SAM 10

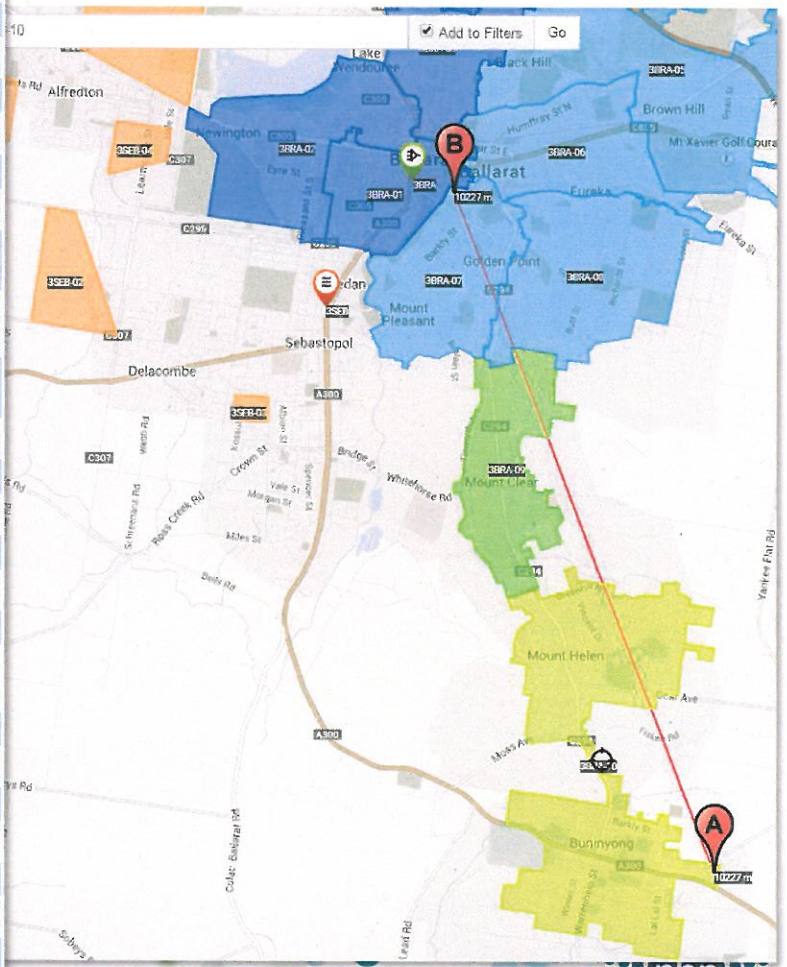
- Construction: Decon
- RFP executed, kick-off meeting held, Remediation walkout complete

3KAL-07 Karingal Vic SAM 7

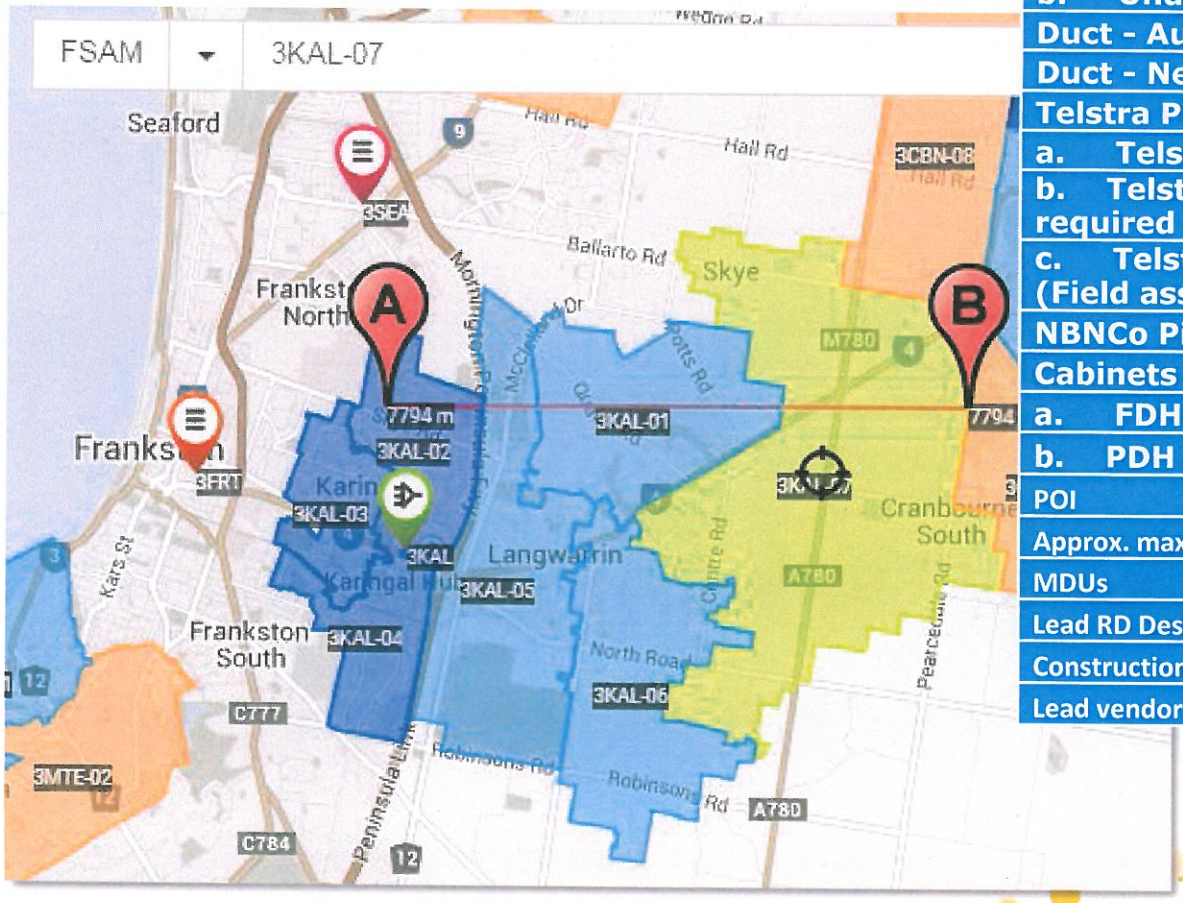
- Construction: Transfield
- RFP submitted. Remediation walkout 22 June 15

Trial FSAM 1: 3BRA-10 (Ballarat, VIC)

3BRA-10 (NDD data)	
Total GNAFs (a+b)	2294
a. Aerial GNAF	0
b. Underground GNAF	2294
Telstra duct - total conduit used (km) (a+b)	58.6
a. Telstra duct - total used - occupied (km)	53.4
b. Telstra duct - total used - unoccupied (km)	5.3
Distribution Fibre - total (km) (a+b)	31.5
a. Distribution Fibre - outside FSAM Boundary (km)	19
b. Distribution Fibre - inside FSAM Boundary (km) (i+ii)	12.5
i. Distribution Fibre - inside FSAM Boundary - underground (km)	12.5
ii. Distribution Fibre - inside FSAM Boundary - aerial (km)	0
Duct - Remediation (km)	0
Duct - Augmentation (km)	1
Duct - New Build (km)	9.1
Telstra Pits - total used (a+b+c)	1439
a. Telstra Pits - utilised	1270
b. Telstra Pits - remediation required	100
c. Telstra Pits - OH&S Impact (Field assessment required)	69
NBNCo Pits - new build	95
Cabinets - total (a+b)	15
a. FDH Cabinets (external)	15
b. PDH Cabinets (internal)	0
POI	3BRA
Approx. max straight line OLT-ONT distance	11km
MDUs	72 (12 >4)
Lead RD Designer	[redacted]
Construction Partner	Transfield
Lead vendor	Corning



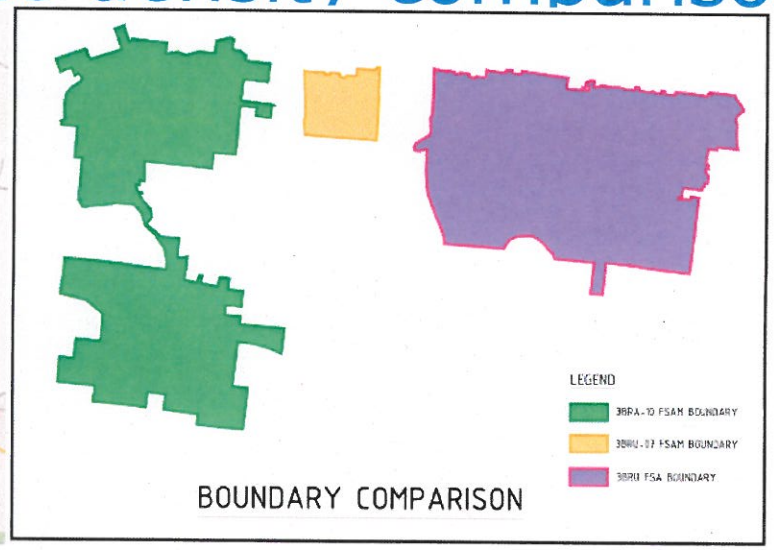
Trial FSAM 2: 3KAL-07 (Karingal, VIC)



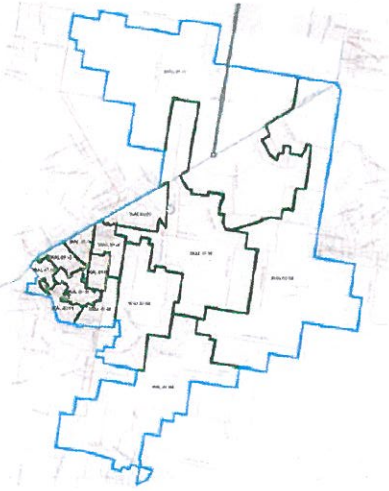
3KAL-07 (NDD data)	
Total GNAFs (a+b)	2160
a. Aerial GNAF	502
b. Underground GNAF	1658
Duct - Augmentation (km)	2.5
Duct - New Build (km)	7.2
Telstra Pits - total used (a+b+c)	1759
a. Telstra Pits - utilised	1583
b. Telstra Pits - remediation required	78
c. Telstra Pits - OH&S Impact (Field assessment required)	98
NBNCo Pits - new build	32
Cabinets - total (a+b)	14
a. FDH Cabinets (external)	14
b. PDH Cabinets (internal)	0
POI	3KAL
Approx. max straight line OLT-ONT distance	8km
MDUs	26 (4 > 4)
Lead RD Designer	[redacted]
Construction Partner	Transfield
Lead vendor	Corning

Trial sites density comparison

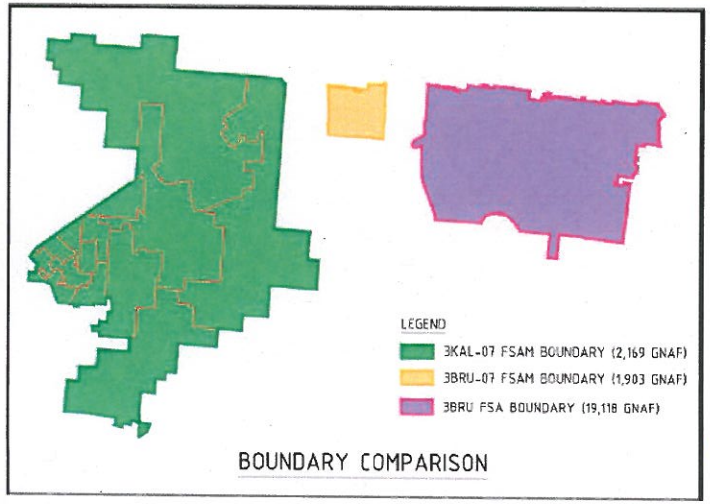
*3BRA-10 FSAM



*3BRA-10 comparison against 3BRU 07 FSAM and Brunswick FSA.



*3KAL-07 FSAM



*3KAL-07 comparison against 3BRU 07 FSAM and Brunswick FSA.

- Outside of HFC footprint – low density
- Cover significantly more area than same serviceable premises in metro
- Each FSAM (2000 SP) is same area as entire Brunswick FDA (20,000 SP)
- Requires longer cable runs
- More direct buried copper

Next Steps

- Path to General deployment
  - Network Release
    - Construction Trial support - manual
    - Formalisation into Passive Network Architecture (Candidate NR10)
  - IT Support
    - PNI / spatial: Recording,
    - Fulfilment: network resource reservation, allocation logic
- Use cases
  - MT-LFN for Greenfields SDU
  - MT-LFN for Greenfields MDU
  - MT-LFN + FTTdp
    - CSD alternative

- Other support required…
  - Construction
  - Build drop
  - Testing
  - Operational acceptance
  - Complex premises & MDUs?