Frankfort Plant Board

Infrastructure Improvements Feasibility Study

Prepared by:
Engineering Associates, LLC
& Kersey Consulting Services, LLC
August 13, 2017

Project Team

Engineering Associates, LLC
Thomas Grigg, P.E.

Kersey Consulting Services, LLC
Kim Kersey

Initial Findings of FPB Cable/Telecom Operation

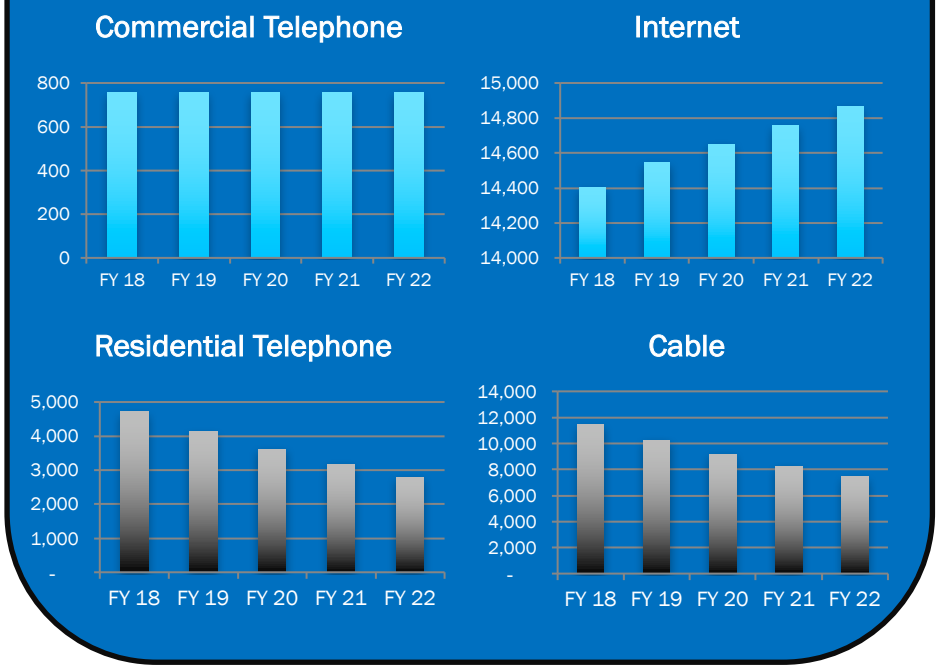
- Solid History of Cable/Telecom operations
- Extensive service offerings in all categories
- Experienced, qualified staff
- Sound financial operations with ability to retire debt
- Recent reliability and Internet speed issues caused by aging plant and limited electronics capabilities

State of Cable/Telecom

- Online Video Service
- Cell Phone Service
- Data Services
- Bandwidth Traffic

- Traditional Video Service
- Residential Phone Service

FPB Five Year Customer Growth Projections



Challenges to Future Growth

Coaxial copper plant showing age

750 MHz. electronics limit channel capacity and bandwidth growth

Amplifiers and Line Extenders have reliability/quality issues

HFC design has limitations for future bandwidth capacity

Improvement Options Considered

HFC Maintenance Upgrade

- Expand Capacity by 40 Channels and Improve Quality/ Reliability
- Rapid Deployment
- Relative Low Cost
- Extend HFC Plant Life 5-10 Years

DOCSIS 3.1 Upgrade

- Substantial Bandwidth Increase
- Requires Significant increase in Node splitting and Amp/L.E. Re-Spacing. More fiber built to Nodes.
- Frequent/Sustained Service Interruptions during deployment
- Commitment to Copper-based HFC for Future

4G Wireless/5G Wireless

- 4G Bandwidth not as robust as HFC or Fiber
- Reach/Reliability not consistent
- Not suited for FPB RF Video
- 5G Not Ready for at least 5 Years
- Unknown Capability
- FPB has limited Wireless experience/expertise
- FPB would be a “Me, too” provider

Fiber-to-the-Home

- Long useful life– 30 years or more
- Best option for bandwidth capacity, easy bandwidth upgrades
- Unique, differentiated service
- Flexible to deliver a variety of services/ modes (i.e. FPB RF Video)
- Stable platform for superior signal quality and reliability
- Most Expensive Option

Recommendations for Infrastructure Improvements

Interim Solution:

HFC Maintenance Upgrade

- FPB needs to operate the HFC System for 5-10 more years
- FPB should replace end-of-life equipment NOW to address reliability/quality issues
- Leverage 40 new channels to expand bandwidth speeds to maintain and grow Internet customers
- Maintain customer satisfaction and protect revenue needed for FTTH deployment

Long-Term Solution:

Fiber-to-the-Home

- Best option for quality, reliability, and bandwidth capacity
- FPB prefers to deploy in Phases over several years with internal funding
- Internet only offered initially, Video and Phone remain on HFC and brought over to FTTH later

High-Level FTTH Design

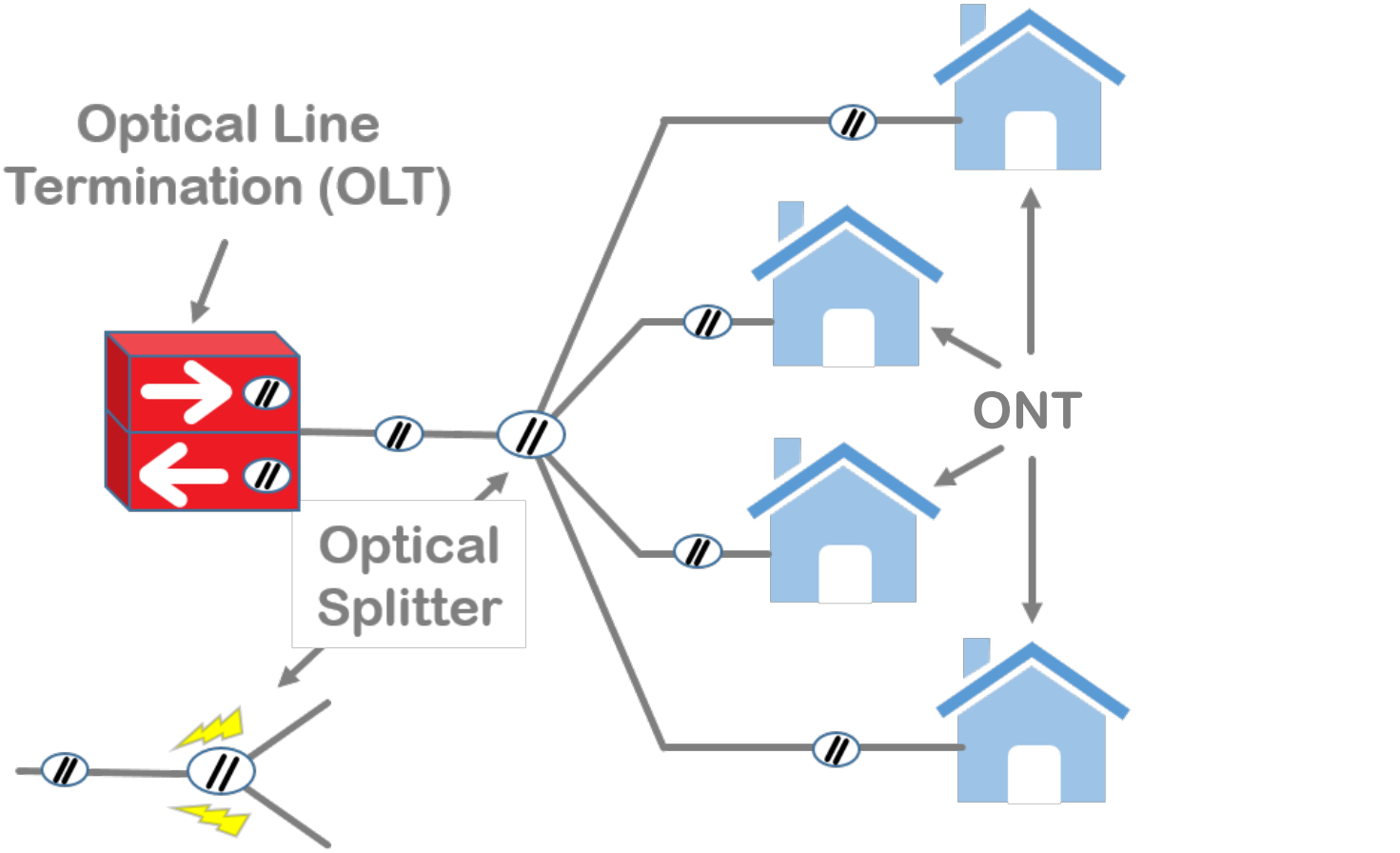
- Existing Hybrid Fiber Coax service area designed for Gigabit Passive Optical Network (GPON) architecture
- Fiber Distribution Hub proposed at each existing fiber node
- Feeder network sized based on typical design assumptions
  - –Residential: 32/1 splitters
  - –Business: 8/1 splitters
  - –High Density Residential: dedicated fiber to building with distributed architecture to living units
- Distribution Fibers designed as dedicated fiber to each single family or Low Density living unit, each business, and each High Density multifamily building

Fiber Distribution Hub

High-Level FTTH Design

- Each Node designed separately for FTTH Design
  - Distribution cable lengths and sizes estimated for each Node to provide estimate of cost per Node
- Feeder cable requirements determined at each Fiber Distribution Hub
  - Cost estimated based on cable lengths and size to provide backhaul to Headend
- Proposed FTTH network is a totally separate network from the existing Hybrid Fiber Coax (HFC) network

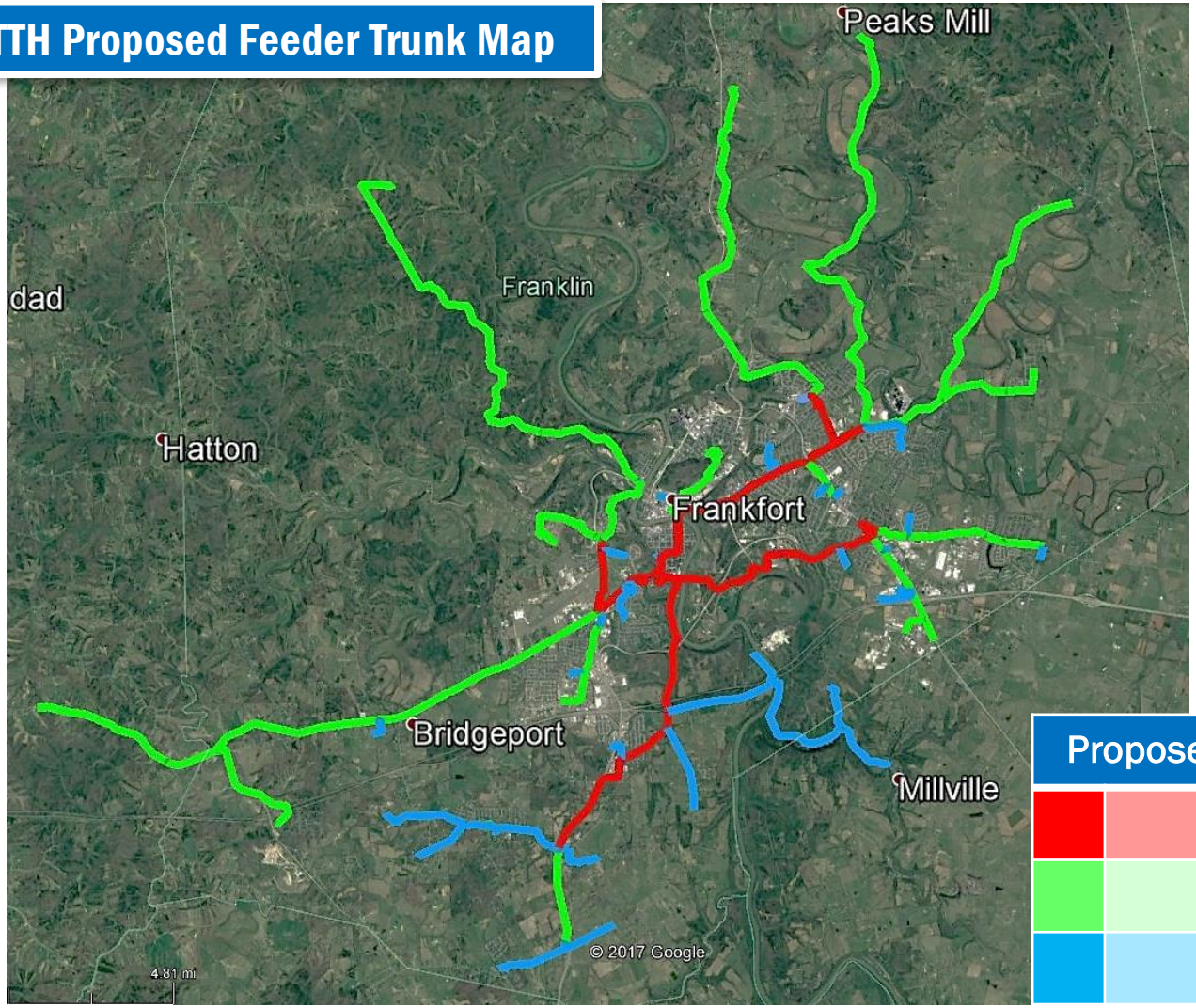
Passive Optical Network (PON)



ONT = Optical Network Terminal

FPB FTTH Planning Maps

FTTH Proposed Feeder Trunk Map

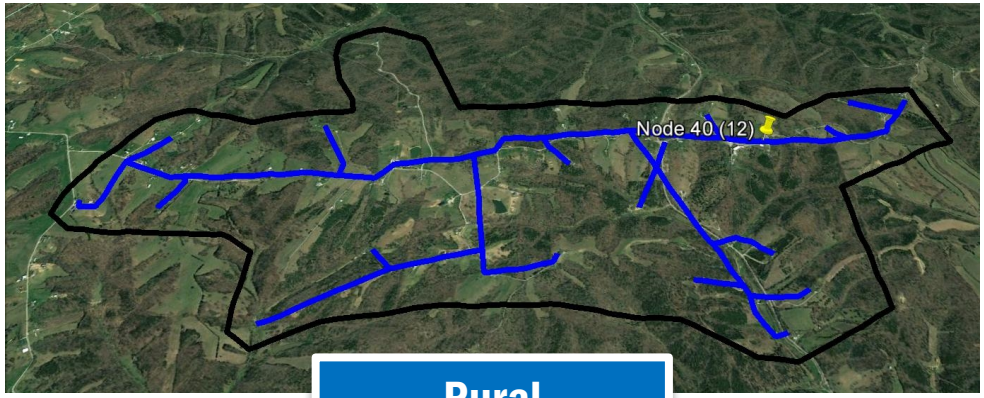


Proposed Fiber Size
288 F
144 F
72 F

Typical FTTH Distribution Node Designs

Dense Suburban

Urban



Rural

High Level FTTH Cost

Network Component/Activity	Estimated Cost
Engineering and Design	$2,927,966
Make-Ready Pole Replacement/Attachment Relocation	$9,504,000
Feeder Trunk Fiber Cable Construction	$2,554,678
Distribution Fiber Cable Construction	$18,194,416
Network GPON Access Equipment	$1,587,940
Customer Installations	$9,814,500
Total FTTH Network Estimated Cost	**$44,583,500**

Pole Make-Ready Requirements

- **All attachments require adequate safety clearance space from:**
  1. Other attachments
  2. Power lines
  3. Ground and road clearance

- **When adequate clearance not available, existing attachments are moved or pole is replaced with a taller pole**

- **Estimated cost to replace FPB pole: $4,000**
  - Other providers' poles may cost more

Multiple Attachments

Potential Opportunities to Reduce Project Costs

1. **In-House Design**
   Later phases designed by FPB Engineering

2. **Stand-off Brackets**
   Alternative to changing out poles, clearance achieved horizontally

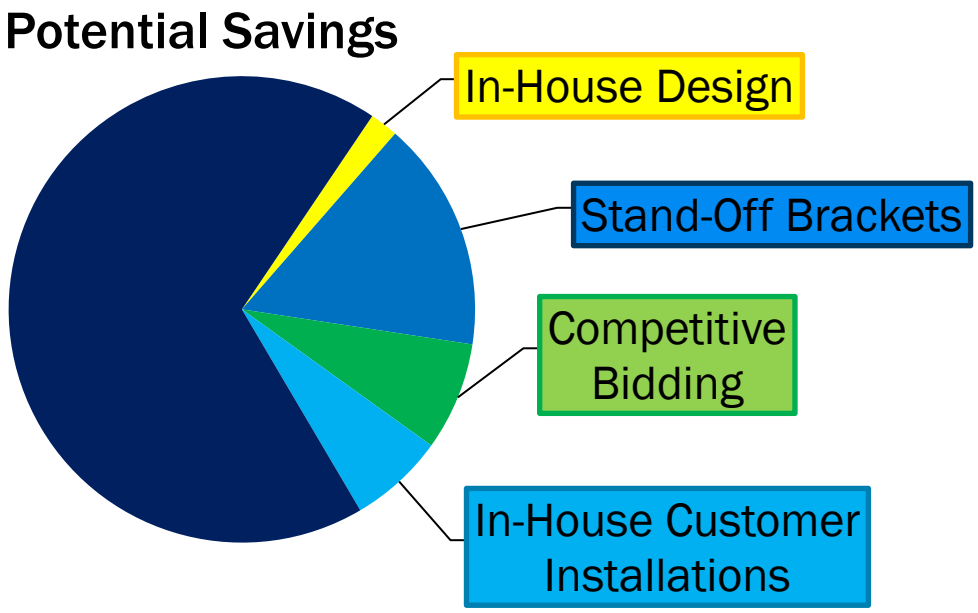
3. **Competitive Bidding for Plant Labor and Materials**

4. **In-House Customer Installations**
   FPB service staff perform inside wiring and use indoor ONT devices

Stand-Off Brackets

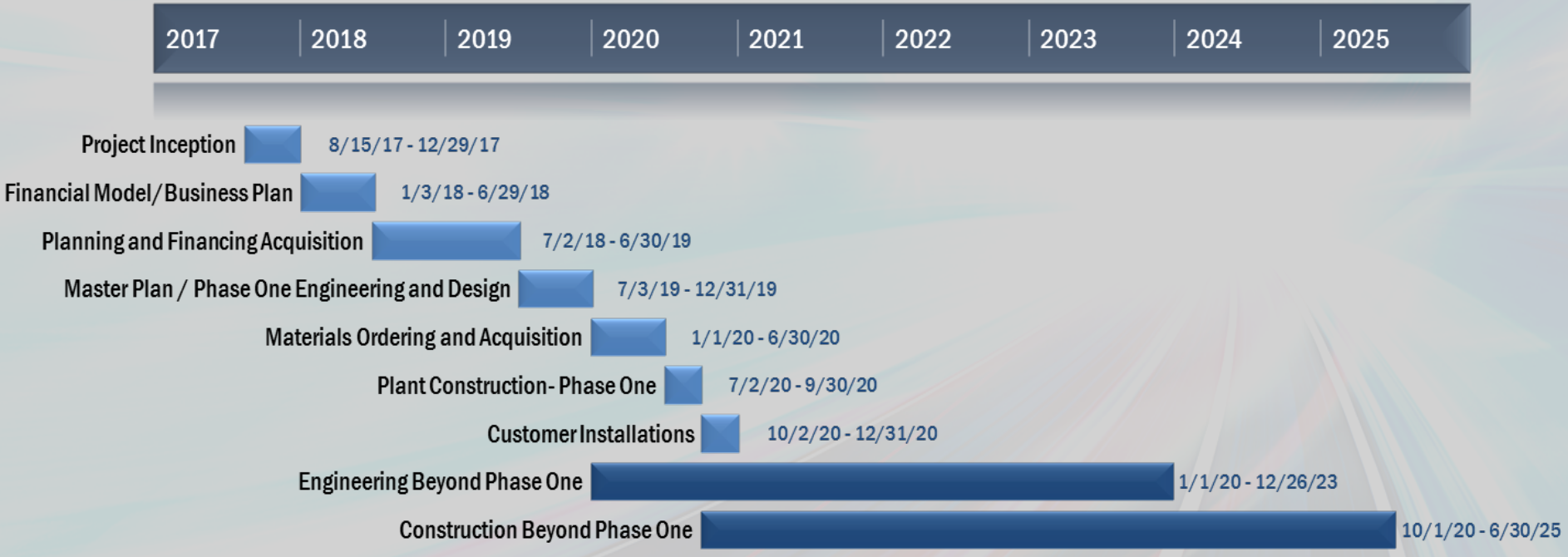
Reduced FTTH Network Project Cost Estimate

Network Component/Activity	Estimated Cost	Savings Opportunities	Potential Savings
Engineering and Design	$2,927,966	**In-House Design**	30%
Make-Ready Costs	$9,504,000	**Stand-Off Brackets**	75%
Construction and Equipment	$22,337,034	**Competitive Bidding**	15%
Customer Installations	$9,814,500	**In-House Customer Installations**	30%
FTTH Network Estimated Cost	**$44,583,500**		



Estimate 15-25% cost savings if FPB is able to implement even a portion of these suggested actions

Typical Project Activities and Implementation Timeline



Frankfort Plant Board

Infrastructure Improvements Feasibility Study

Questions?