Cost model for a 5G smart light pole network

Landertshamer, O., Benseny, J., Hämmäinen, H., & Wainio, P. (2019). *CTTE-FITCE Conference : Smart Cities and ICT.*

1. We propose a **model for the total greenfield deployment cost (TDC)** of a 5G smart light pole network, including:
   - four pole hardware configurations
   - a grid-based deployment structure
   - cost forecasting method based on prototype improvement, volume sale discounts, and price erosion.

2. We estimated **TDC for two deployment scenarios**, considering the effect of cost evolution.

3. We identify **cost reduction options**:
   - The pole costs have a larger cost reduction potential than infrastructure costs, due to the benefits of prototype improvement.
   - Cost items with the higher potential are the small cell base station and the RTK positioning.

4. **Recommendations**:
   - Cities should promptly start civil works, enabling a fiber-based backhaul for present and future poles.
   - Cities should select upgrade-able pole designs accepting new components as soon as become affordable.

Pole hardware configurations

	Prototype (P) / Market (M)	**Lights Only (LO)**	**Lights + 5G (L5G)**	**Lights + 5G + Sensors (L5GS)**	**Full**
Pole shaft	M	x	x	x	x
Pole base	M	x	x	x	x
Utility box	P	x	x	x	x
Common radome unit	P		x	x	x
Smart lights	M	x	x	x	x
Weather & air quality sensor	M			x	x
External camera system	M				x
Integrated camera system	M			x	x
Sound sensing & speaker	M			x	x
External information display	P				x
RTK positioning	P			x	x
EV charger	M				x
Drone station	P				x
28 GHz 5G base station	P		x	x	x
Today's cost		**7 000 €**	**15 000 €**	**31 000 €**	**60 000 €**
Future cost range		**4 500 € - 7 000 €**	**8 000 € - 15 000 €**	**20 000 € - 31 000€**	**34 000 € - 60 000 €**

TDC for minimum and massive deployments

Input parameters	**Minimum**	**Massive**
Area	10 km^2	
Pole-to-pole distance	50 m	
α	70 %	
Prototype impr. (p)	0.4	
Volume discounts (v)	0.1	
Price erosion (e)	0.2	
Zone alloc.	unif.	33% each zone
Pole configurations		
Total	2890	2890
LO	2526	1060
L5G	182	1060
L5GS	164	694
Full	18	77
TDC results		
Today TDC	48.4 M€	65.7 M€
Future TDC	32.3 M€	40.5 M€
Cost evolution reduction	34.1%	38.4%
Today Min-Mass diff	28.5 %	
Future Min-Massdiff	20.0 %	

Minimum deployment: Today TDC = 4.84 M€/km^2 , Future TDC = 3.23 M€/km^2
Massive deployment: Today TDC = 6.57 M€/km^2 , Future TDC = 4.05 M€/km^2

Reference/contact: jaume.benseny@aalto.fi; Link to full article: Here