Pre-Final Report
Confidential

International Copper Association India

Study on Wire & Cable Costs in Residential & Commercial Buildings

November 10, 2022

StratWon Business Consulting Pvt. Ltd.

Table of Contents

Contents	
1	**Executive Summary and Key Takeaways**
2	Background
3	**W&C Cost Analysis-Commercial Buildings**
	- Summary Across Samples Studied
	- Individual Sample Analysis
	- Commercial Buildings-Additional Analysis
4	**W&C Cost Analysis-Residential Buildings**
	- Summary Across Samples Studied
	- Individual Sample Analysis
	- Residential Buildings-Additional Analysis
5	**General Observations and Al v/s Cu Cost Comparisons**

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EXECUTIVE SUMMARY AND KEY TAKEAWAYS

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W&C Costs Study in Buildings: Executive Summary and Key Takeaways

Message #1

- Wire & Cable Costs form a very small % of total construction costs of a building:
  - 1.0% to 1.5% for most commercial buildings and 1.5% to 2.0% for most residential buildings.
  - W&C Costs typically ranges from Rs 30 to 75 per sq ft BUA across building types which is a very small % of the total construction cost …….and even smaller compared to the prevailing selling price (for example only 0.1% to 0.3% in an expensive property market like Mumbai).

Message #2

- Hence trying to economize on Wire & Cable Costs should ***not*** be a stated objective…….instead the focus should be on using good quality wires and cables that provide superior conductivity, protection and fire safety.

Message #3

- Copper W&C are widely used across sizes in residential and commercial buildings and is the preferred conductor upto 10 sq mm W&C. Increasingly, real estate promotional literature, brochures, etc. especially for residential projects specifically emphasize `100% copper internal wiring used in the project' given the perceived benefits of copper wiring.

Message #4

- The main driver for **not** using copper in certain applications is solely cost, not technical parameters.
- Yet, the *additional* cost of using 100% Copper in a building is usually insignificant (typically only Rs 25 to 60 of *additional* cost per sq ft BUA for commercial buildings and Rs 15 to Rs 80 of *additional cost* per sq ft BUA for residential buildings).
- This incremental cost is insignificant in the context of the property price and the benefits and `peace of mind' derived by using 100% copper wiring.

Message #5

- The realization (through this study) that using copper W&C throughout the building will add only incrementally to the overall construction cost (and insignificantly in terms of the property selling price) but give significant perceived benefits and `peace of mind' to the consumer from a fire and safety angle is the main finding of this study.

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Summary: Commercial Buildings-all samples

Sr No	Sector	Project/Building Type	Project Name/Location	Selling Price (Rs/ SqFt) *(Similar Building at the Location)*	Built Up Area (BUA Sq Ft)	Cu v/s Al share % in Cu Eqv. (Gms)		Est. Building Construction Cost at Current Price (Rs/ Sq Ft BUA)	W&C Material Costs at Current Price (Rs/ Sq Ft BUA)	Additional W&C Material Costs for 100% Cu (Rs/ Sq Ft BUA)	Additional Cost (for 100% Copper) as % of Total Building Construction Cost	Main Areas of W&C for Replacement to Copper
						Cu Share %	Al Share %					
1	Commercial	High Rise, 22 Floors Office Building	Rupa Renaissance, Vashi	10-15,000	1,300,000	88%	12%	4,500	48.46	25.84	0.66%	LV Panels to Sub Panels, Rising Main, Common Areas
2	Commercial	Mid Rise 13 Floors	MCGM Super Speciality Hospital at Kandivali West	NA	484,272	45%	55%	5,349	48.01	44.05	0.82%	LV Panels to Sub Panels
3	Commercial	Low Rise, 3 Floors Office Building	Incubation Centre, Kota	4,500	40,000	70%	30%	2,800	46.98	23.80	0.85%	LV Panels to Sub Panels, Rising Main
4	Commercial	Low Rise, 10 Floors Office Building	TDI Centre, Mohali	7,000	299,193	54%	46%	3,100	52.80	29.34	0.95%	LV Panels to Sub Panels, Rising Main, Common Areas
5	Commercial	Low Rise, 8 Floors IT Office Building (incl interiors work)	Nielsoft, Pune	11,000	115,483	37%	63%	6,150	49.45	59.78	0.97%	LV Panels to Sub Panels, Rising Main, Common Areas
6	Commercial	Low Rise B+G+5 Floors Office Building	Bhagalpur Smart City Command Centre Building	3,000	40,410	56%	44%	5,500	43.74	30.10	1.08%	LV Panels to Sub Panels, Rising Main
7	Commercial	Low Rise G+7+Terrace IT Office Building	Tirupur Tidel Park Ltd	3,500-5,000	60,000	56%	44%	5,333	87.55	53.46	1.67% *Outlier*	LV Panels to Sub Panels
8	Commercial	Low Rise Complex with 297 shops	POLO Market of Shillong Municipal Board	NA (Municipal Building)	104,762	54%	46%	2,100	77.68	47.02	1.68% *Outlier*	LV Panels to Sub Panels, Rising Main

Based on the Commercial samples studied, Al cables are used largely in the LV Panel to Sub Panels including cabling of the common utilities and in the rising main up to the floor DB. Most of the commercial office projects are given as a bare shell to the users.

The additional cost due to the conversion of all Al cables/ wires into Cu cables/ wire is in the range of 0.70% to 1.0% of the construction cost. In exceptional cases (Outliers), the additional cost of conversion is higher at 1.6% largely due to the usage of Al in smaller size LT cables of 10/16 Sq Mm which is rare in an overall context (mostly Copper cables are used for such sizes across most samples studied).

In few projects, it was observed that instead of using cables in the rising main, the builder/developer has provided Air Insulated Busbars system even for low to mid rise commercial buildings

Note: All Costs at are current prices (May 2022)

Commercial Buildings: Incremental Cost with 100% Copper-Comparison of BoQ v/s Density Method (Select Samples)

Sr.No.	Sample Projects (Residential Buildings)	Cu Eqv. By Weight			Incremental Costs for 100% Copper-Density method			Incremental Costs for 100% Copper-BoQ method	Comments
					Al (CU Eqv Weight)	Cost of Wire & Cables Fixed (Rs/ Gm of Conductor Weight)	Additional W&C Material Costs for 100% Cu (Derived)		
		Total Cu Eqv.Gms/ Sq Ft	Cu Share%	Al Share%	Gms/ Sq Ft	Rs/ Gm	(Rs/ Sq Ft BUA)	(Rs/ Sq Ft BUA)	
1	**Rupa Renaissance, Vashi**	19.21	88%	12%	2.31	1.5	3.46	25.84	Outlier Case–density norm is low due to scope exclusions
2	**MCGM Super Speciality Hospital at Kandivali West**	93.72	45%	55%	51.55	1.5	77.32	44.05	Outlier Case-Hospital building
3	**Incubation Centre, Kota**	59.33	70%	30%	17.80	1.5	26.70	23.80	Both methods yield similar results
4	**TDI Centre, Mohali**	47.44	54%	46%	21.82	1.5	32.73	29.34	Both methods yield similar results
5	**Nielsoft Technologies: G+8 Floors IT Office Building, Pune (Low Rise)**	78.12	37%	63%	49.22	1.5	73.82	59.78	Both methods yield range bound results
6	**Bhagalpur Smart City Command Centre Building**	51.53	56%	44%	22.67	1.5	34.01	30.10	Both methods yield similar results
7	**Tirupur Tidel Park Ltd**	86.6	56%	44%	38.10	1.5	57.16	53.46	Both methods yield similar results
8	**POLO Market of Shillong Municipal Board**	74.41	54%	46%	34.23	1.5	51.34	47.02	Both methods yield similar results

Barring exceptions, both the BOQ method and the Density methods yield similar results regarding the incremental costs of using 100% Copper

Note: All Costs at are current prices (May 2022)

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Summary: Residential Buildings-all samples

Sr No	Sector	Project/Building Type	Project Name/Location	Selling Price (Rs/ SqFt)	Built Up Area (BUA Sq Ft)	Cu v/s Al share % in Cu Eqv. (Gms)		Est. Building Construction Cost at Current Price (Rs/ Sq Ft BUA)	W&C Material Costs at Current Price (Rs/ Sq Ft BUA)	Additional W&C Material Costs for 100% Cu (Rs/ Sq Ft BUA)	Additional Cost (for 100% Copper) as % of Total Building Construction Cost	Main Areas of W&C for Replacement to Copper
						Cu Share %	Al Share %					
1	Residential	2B+G+2P+ 18 Floors + Terrace: 23 SLABS (3 wings)	Sumer Life Chandivali	17,000	134,228	49%	51%	3,500	51.47	37.83	1.08%	LV Panels to Sub Panels, Common areas
2	Residential	High Rise G+22	Residential Hostel in the Hospital Campus	CAPTIVE	174,956	86%	14%	2,041	44.85	14.54	0.48%	LV Panels to Sub Panels
3	Residential	Low Rise, 10 Floors	MIG Classic Apt., New Town, Kolkata	5,000	221,760	55%	45%	2,200	27.4	19.27	0.88%	LV Panels to Sub Panels, Rising Main
4	Residential	Mid Rise G+10 Residential Building	Aurangabad	8,000-9,000	76,389	76%	24%	2,500	56.63	24.88	1.00%	LV Panels to Sub Panels
5	Residential	Mid Rise, 3 Wings, 13 Floors	Madgul Antra, Kolkata	7,000	353,380	48%	52%	3,000	43.96	44.65	1.49%	LV Panels to Sub Panels, Rising Main, Common Area
6	Residential	High Rise Luxury 3B+GF+1P+18 Floors	Navroze, Mumbai	90,000	84,300	43%	57%	4,300	62.03	68.30	1.59%	LV Panels to Sub Panels, Rising Main
7	Residential	High Rise, Single Tower (27 Floors+5 Parking Slabs)	UK Iridium, Mumbai	20,000	142,300	33%	67%	3,800	72.63	81.78	2.15% *Outlier*	LV Panels to Sub Panels, Rising Main, Lift Cables

Based on the Residential samples studied, the use of Al cables have been largely for the main LV Panel to Sub Panels and in the rising main (up to the flat isolators).

The additional cost if all the Al Cables and Wires used were replace by Copper is coming in the range of 0.5% to 1.6% of the construction cost. There was one exception sample (outlier) where this figure was 2.1%, mainly due to the usage of 4C 150 Sq Mm **Al** cables in the sub panels and 4C 16 Sq Mm **Al** cables in the lift.

For the samples having a high Al Eqv share in the 50 to 55%, the additional cost to covert all Al into Cu is around 1.4-1.5% of the construction cost.

Note: All Costs at are current prices (May 2022)

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Residential Buildings: Incremental Cost with 100% Copper-Comparison of BoQ v/s Density Method (Select Samples)

Sr.No.	Project/Building Type	Sample Projects (Residential Buildings)	Cu Eqv. By Weight			Incremental Costs for 100% Copper-Density method			Incremental Costs for 100% Copper-BoQ method	Comments
						Al (CU Eqv Weight)	Additional W&C Material Costs for 100% Cu (BoQ Method)	Additional Cost of Wire & Cables Fixed (Rs/ Gm of Conductor Weight)		
			Total Cu Eqv.Gms/ Sq Ft	Cu Share%	Al Share%	Gms/ Sq Ft	(Rs/ Sq Ft BUA)	Rs/ Gm	(Rs/ Sq Ft BUA)	
1	2B+G+2P+ 18 Floors + Terrace: 23 SLABS (3 wings)	**Sumer Life Chandivali**	61.49	49%	51%	31.36	37.83	1.8	56.45	Range bound but BoQ method yields higher results
2	High Rise G+22	**Residential Hostel in the Hospital Campus**	40.98	86%	14%	5.74	14.54	1.8	10.33	Both methods yield similar results
3	Low Rise, 10 Floors	**MIG Classic Apt., New Town, Kolkata**	32.42	55%	45%	14.59	19.27	1.8	26.26	Both methods yield similar results
4	Mid Rise G+10 Residential Building	**Aurangabad**	54.43	76%	24%	13.06	24.88	1.8	23.51	Both methods yield similar results
5	Mid Rise, 3 Wings, 13 Floors	**Madgul Antra, Kolkata**	60.3	48%	52%	31.36	44.65	1.8	56.44	Both methods yield similar results
6	High Rise Luxury 3B+GF+1P+18 Floors	**Navroze, Mumbai**	71.8	43%	57%	40.93	68.3	1.8	73.67	Both methods yield similar results
7	High Rise, Single Tower (27 Floors+5 Parking Slabs)	**UK Iridium, Mumbai**	71	33%	67%	47.57	81.78	1.8	85.63	Both methods yield similar results

Barring exceptions, both the BOQ method and the Density methods yield similar results regarding the incremental costs of using 100% Copper

Note: All Costs at are current prices (May 2022)

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BACKGROUND

Background

Background

- ICAI has recently completed various studies to determine the copper usage/density of Wire & Cables used in Residential and Commercial Buildings
- As an extension of these studies, ICAI now wishes to quantify, in monetary terms, the W&C costs in Rs per sq ft and as a % of total construction cost as well as the incremental cost of using Copper instead of Al throughout the building.
- This analysis was carried out at prevailing W&C and building construction costs for a specified sample of projects (mix of samples from previous studies and a few fresh samples). For ensuring uniformity in interpretation v/s previous reports:

  - The wire & cable usage in a building will include all wiring within the physical building premises

  - Total building construction costs will *exclude* land costs across all building types

Scope of Work

- For each sample, to determine the total cost of W&C used in the building at current prices in terms of:
  a) Total W&C Cost in Rs for the building
  b) Total W&C Cost in Rs per sq ft BUA for the building
  c) W&C Cost Mix (Copper v/s Aluminum) in Rs and Rs per sq ft BUA for the building
- To determine, based on a dipstick field survey amongst builders of residential and commercial buildings, the following:
  a) Total building construction cost (excluding land) in Rs per sq ft at current prices in the project area.
  b) W&C Costs as % of Total building construction cost for the building
  c) Perceived benefits of using copper wire & cables instead of Aluminum particularly with respect to safety, fire, reliability, etc.
- Based on the above to determine, for each sample, the incremental cost if 100% copper was used for W&C throughout the building (i.e. all Aluminium W&C were replaced with copper) in terms of:
  a) Increase in building construction cost in Rs per sq ft BUA
  b) Increase in W&C Costs as % of total construction costs

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Approach & Methodology

Overall Approach adopted for this Study

Identify BOQs already analysed in the previous study and addition of few fresh sample in the mix.

Determine Building Construction Current Cost (excl. Land) (in Rs per SQ Ft BUA) and Cost Structure as per the Cost Heads
(Material + Labour/ Service)

Determine W&C Material Costs at Current Price across usage areas such as Main LV panel to Sub Panels; Rising Main; Last Mile; Common Area and determine W&C cost per Sq Ft BUA (for Cu and Al W&C)

Determine Additional W&C Material Costs (At Current Prices) if 100% Copper Usage For The Project.

Additional Cost (for 100% Copper) as % of Total Building Construction Cost

Source/ Inputs

- Inputs from the field based research conducted in the key cities of India such as Mumbai/ Pune/ Jaipur/ Kolkata/ Bengaluru.
- Analysis of Engineer's Cost Report, where available, through RERA of respective states.
- Recalculation of construction costs at current prices wherever required.

- Wire & Cable Costs are based on prices as of May 2022.

Sample Mix of Projects by Region

Region	No. of sample projects studied		Total
	Residential	Commercial	
West	5	3	8
North	-	2	2
South	-	1	1
East	2	2	4
Total	**7**	**8**	**15**

Sample Mix of Projects by Building Height

Category	No. of sample projects studied		Total
	Residential	Commercial	
Low Rise	1	6	7
Mid Rise	2	1	3
High Rise	4	1	5
Total	**7**	**8**	**15**

Low Rise: upto 9 floors, Mid-Rise: 9 to 19 floors, High Rise: 20 floors and above

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Key Points to Note

- For the sake of uniformity, the total building area is expressed in terms of Square Feet of Built Up Area (BUA) across projects.
- Only Wires & Cables used within the physical building have been considered and all **external** areas that are physically outside the building like street or compound lights, garden and landscape lighting, main gate and security cabin, etc. are **excluded.**
- The starting point for calculating cable usage in the building is the main LT building panel of the building. Thus all `mains' power cables used for the supply from the utility to main LT panel (if LV supply) or, in case of MV/HV supply, from utility-transformer-main LT panel **are excluded**.
- Wherever Aluminium is used, all such usage has been converted into Copper Equivalent terms based on the cable specifications required for the particular application/current rating. Hence copper density norms and Cu v/s Al % shares wherever reported are directly comparable across projects.
- The methodology adopted for determining W&C usage is BOQ (Bill of Quantity) approach based on actual BOQ's provided by the technical consultant containing application area, wire size and length and conductor used.
- All data, cable and telephone and communication cables are **excluded** in the W&C calculations.
- All cost like building construction costs, Wire & Cable costs etc are reported at current prices (as of May 2022) and are hence directly comparable across projects. Cost data of previous years wherever used has been appropriately extrapolated for current prices using the appropriate inflation adjustment and feedback received from the field study.
- The findings of this study are directional in nature given the limited sample size and further research with a larger and more diverse sample will help in finetuning the conclusions of this study.

COMMERCIAL BUILDINGS: INDIVIDUAL SAMPLE BUILDINGS ANALYSIS

Summary: Commercial Buildings-all samples

Sr No	Sector	Project/Building Type	Project Name/Location	Selling Price (Rs/ SqFt) *(Similar Building at the Location)*	Built Up Area (BUA Sq Ft)	Cu v/s Al share % in Cu Eqv. (Gms)		Est. Building Construction Cost at Current Price (Rs/ Sq Ft BUA)	W&C Material Costs at Current Price (Rs/ Sq Ft BUA)	Additional W&C Material Costs for 100% Cu (Rs/ Sq Ft BUA)	Additional Cost (for 100% Copper) as % of Total Building Construction Cost	Main Areas of W&C for Replacement to Copper
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1	Commercial	High Rise, 22 Floors Office Building	Rupa Renaissance, Vashi	10-15,000	1,300,000	88%	12%	4,500	48.46	25.84	0.66%	LV Panels to Sub Panels, Rising Main, Common Areas
2	Commercial	Mid Rise 13 Floors	MCGM Super Speciality Hospital at Kandivali West	NA	484,272	45%	55%	5,349	48.01	44.05	0.82%	LV Panels to Sub Panels
3	Commercial	Low Rise, 3 Floors Office Building	Incubation Centre, Kota	4,500	40,000	70%	30%	2,800	46.98	23.80	0.85%	LV Panels to Sub Panels, Rising Main
4	Commercial	Low Rise, 10 Floors Office Building	TDI Centre, Mohali	7,000	299,193	54%	46%	3,100	52.80	29.34	0.95%	LV Panels to Sub Panels, Rising Main, Common Areas
5	Commercial	Low Rise, 8 Floors IT Office Building (incl interiors work)	Nielsoft, Pune	11,000	115,483	37%	63%	6,150	49.45	59.78	0.97%	LV Panels to Sub Panels, Rising Main, Common Areas
6	Commercial	Low Rise B+G+5 Floors Office Building	Bhagalpur Smart City Command Centre Building	3,000	40,410	56%	44%	5,500	43.74	30.10	1.08%	LV Panels to Sub Panels, Rising Main
7	Commercial	Low Rise G+7+Terrace IT Office Building	Tirupur Tidel Park Ltd	3,500-5,000	60,000	56%	44%	5,333	87.55	53.46	1.67% *Outlier*	LV Panels to Sub Panels
8	Commercial	Low Rise Complex with 297 shops	POLO Market of Shillong Municipal Board	NA (Municipal Building)	104,762	54%	46%	2,100	77.68	47.02	1.68% *Outlier*	LV Panels to Sub Panels, Rising Main

Based on the Commercial samples studied, Al cables are used largely in the LV Panel to Sub Panels including cabling of the common utilities and in the rising main up to the floor DB. Most of the commercial office projects are given as a bare shell to the users.

The additional cost due to the conversion of all Al cables/ wires into Cu cables/ wire is in the range of 0.70% to 1.0% of the construction cost. In exceptional cases (Outliers), the additional cost of conversion is higher at 1.6% largely due to the usage of Al in smaller size LT cables of 10/16 Sq Mm which is rare in an overall context (mostly Copper cables are used for such sizes across most samples studied).

In few projects, it was observed that instead of using cables in the rising main, the builder/developer has provided Air Insulated Busbars system even for low to mid rise commercial buildings

Note: All Costs at are current prices (May 2022)

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Commercial Building: 22 Floors Modern Office Building, Vashi (High Rise)

PROJECT DETAILS						
Type	**Rise and Segment**	**Project Name**	**Location**	**BUA in Sq Ft**	**Configuration**	**Other Details**
Commercial	Office Building	**Rupa Renaissance**	Vashi	1,300,000	1 Wing, 22 Floors	**Shell Building**
Supply from Utility	NA	Distribution Transformer Details	NA	DT to Main LV Panel Cable	3.5 300 Sq Mm Al Cables	

EST. CONSTRUCTION COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc. and land cost						
Unit	**Cement/RMC (Material Cost Only)**	**Steel (Material Cost Only)**	**MEP (Material Cost Only)**	**Other Materials**	**Labour, Contracting Services and All Other Services**	**Total Construction Cost**
In Rs per sq ft BUA	675	855	720	900	1350	**4500**
%	15%	19%	16%	20%	30%	**100%**

EST. WIRE & CABLE MATERIAL COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc.%							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Type and Length of W&C Used (Internal to Building Only) and Cu/Al share%	Cu		51%, 4C 10/6 Sq mm, 1000mtrs		100%; 1.5/2.5/4.0/6.0 Sq Mn Wires; 5000-20,000 mtr	100%	88% in Cu Eqv.
	Al		49%, Al 4C 16/25/35/150 sq. mm, 200 to 800 mtrs	100%; 4C 50, 35 to 16 Sq Mm 60-400 mtr	0%	0%	12% in Cu Eqv.
W&C Material Costs at Current Prices	Cu W&C	Rs Lakhs	10.23	0.00	500.50	3.71	**514.44**
	Al W&C	Rs Lakhs	20.62	94.90	0.00	0.00	**115.52**
	Total	**Rs Lakhs**	**30.85**	**94.90**	**500.50**	**3.71**	**629.96**
		In Rs per sq ft BUA	***2.37***	***7.30***	***38.50***	***0.29***	***48.46***

ADDITIONAL WIRE & CABLE MATERIAL COSTS (AT CURRENT PRICES) WITH 100% COPPER USAGE FOR THE PROJECT: For Building Only, excludes external areas like gardens, street lighting, etc.							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Size and Length of Copper W&C required to replace Aluminum W&C (assuming 100% Cu scenario)	Cu		3.5C 120/70/50/16/10 Sq Mm		No Replacement	No Replacement	
Total cost of W&C for replacing from Al to Cu	Cu	Rs Lakhs	122.56	328.90	0.00	0.00	
Additional W&C Material Costs for 100% Copper	Additional Cost for 100% Cu	Rs Lakhs	101.94	234.00	0.00	0.00	**335.94**
		In Rs per sq ft BUA	7.84	22.00	0.00	0.00	**25.84**
Additional Cost (for 100% Copper) as % of Total Building Construction Cost		**%**	0.17%	0.49%	0.00%	0.00%	**0.66%**

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Commercial Building: MCGM Super Speciality Hospital (Mid Rise)

PROJECT DETAILS						
Type	**Rise and Segment**	**Project Name**	**Location**	**BUA in Sq Ft**	**Configuration**	**Other Details**
Commercial	Hospital Building	**MCGM Hospital**	Kandivali West	484,272	Mid Rise- 13 Floors	**Total Building Work**
Supply from Utility	11 kV, Al 3C 300/400 Sq Mm	Distribution Transformer Details	11kV/433V 2000 kVA	DT to Main LV Panel Cable	3C 185/ 120 Sq Mm Al	

EST. CONSTRUCTION COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc. and land cost						
Unit	**Cement/RMC (Material Cost Only)**	**Steel (Material Cost Only)**	**MEP (Material Cost Only)**	**Other Materials**	**Labour, Contracting Services and All Other Services**	**Total Construction Cost**
In Rs per sq ft BUA	802	588	1758	750	1710	**5608**
%	14%	10%	31%	13%	30%	**100%**

EST. WIRE & CABLE MATERIAL COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc.%							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Type and Length of W&C Used (Internal to Building Only) and Cu/Al share%	Cu		0%	100%	100%	100%	45% in Cu Eqv.
	Al		100%	0%	0%	0%	55% in Cu Eqv.
W&C Material Costs at Current Prices	Cu W&C	Rs Lakhs	0.00	63.55	124.98	5.73	**194.26**
	Al W&C	Rs Lakhs	38.24	0.00	0.00	0.00	**38.24**
	Total	**Rs Lakhs**	**38.24**	**63.55**	**124.98**	**5.73**	**232.50**
		In Rs per sq ft BUA	**7.90**	**13.12**	**25.81**	**1.18**	**48.01**

ADDITIONAL WIRE & CABLE MATERIAL COSTS (AT CURRENT PRICES) WITH 100% COPPER USAGE FOR THE PROJECT: For Building Only, excludes external areas like gardens, street lighting, etc.							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Size and Length of Copper W&C required to replace Aluminum W&C (assuming 100% Cu scenario)	Cu			No Replacement	No Replacement	No Replacement	
Total cost of W&C for replacing from Al to Cu	Cu	Rs Lakhs	251.56	0	0	0	
Additional W&C Material Costs for 100% Copper	Additional Cost for 100% Cu	Rs Lakhs	213.32	0.00	0.00	0.00	**213.32**
		In Rs per sq ft BUA	44.05	0.00	0.00	0.00	**44.05**
Additional Cost (for 100% Copper) as % of Total Building Construction Cost		**%**	0.82%	0.00%	0.00%	0.00%	**0.82%**

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Commercial Building: G+3 Floors Office Building, Kota (Low Rise)

PROJECT DETAILS						
Type	**Rise and Segment**	**Project Name**	**Location**	**BUA in Sq Ft**	**Configuration**	**Other Details**
Commercial	Office Building	**Incubation Hub Office Building**	Kota	40,000	3 Floor Single Building	**Basic Wiring Done**
Supply from Utility	11kV, 3 C 185 Sq Mm	Distribution Transformer Details	500 kVA Cu Wound (11/0.433 kV)	DT to Main LV Panel Cable	3C 185 Sq Mm Al Cables	

EST. CONSTRUCTION COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc. and land cost						
Unit	**Cement/RMC (Material Cost Only)**	**Steel (Material Cost Only)**	**MEP (Material Cost Only)**	**Other Materials**	**Labour, Contracting Services and All Other Services**	**Total Construction Cost**
In Rs per sq ft BUA	420	364	700	616	700	**2,800**
%	15%	13%	25%	22%	25%	**100%**

EST. WIRE & CABLE MATERIAL COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc.%							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Type and Length of W&C Used (Internal to Building Only) and Cu/Al share%	Cu		0%	0%	100%, 1.5 to 16.0/Sq Mm Wires & UPS Wiring 70/50/35/25 Sq Mm Wires, 30000 Mtr	0%	70% in Cu Eqv.
	Al		100%; 3.5C 185/35/16 Sq Mm, Avg. 70 Mtr	100%, 3.5C 120 Sq Mm, 180 Mtr	0%	0%	30% in Cu Eqv.
W&C Material Costs at Current Prices	Cu W&C	Rs Lakhs	-	-	15.9	-	**15.9**
	Al W&C	Rs Lakhs	1.3	1.6	-	-	**2.9**
	Total	**Rs Lakhs**	**1.3**	**1.6**	**15.9**	**-**	**18.8**
		In Rs per sq ft BUA	***3.2***	***4.0***	***39.8***	**-**	***47.0***

ADDITIONAL WIRE & CABLE MATERIAL COSTS (AT CURRENT PRICES) WITH 100% COPPER USAGE FOR THE PROJECT: For Building Only, excludes external areas like gardens, street lighting, etc.							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Size and Length of Copper W&C required to replace Aluminum W&C (assuming 100% Cu scenario)	Cu		4C 10/25, 3C 120 Sq Mm	3.5C 70 Sq Mm			
Total cost of W&C for replacing from Al to Cu	Cu	Rs Lakhs	5.74	6.65	No Replacement	No Replacement	
Additional W&C Material Costs for 100% Copper	Additional Cost for 100% Cu	Rs Lakhs	4.46	5.06	0.00	0.00	**9.52**
		In Rs per sq ft BUA	11.15	12.65	0.00	0.00	***23.80***
Additional Cost (for 100% Copper) as % of Total Building Construction Cost		**%**	0.40%	0.45%	0.00%	0.00%	**0.85%**

Commercial Building: 2B+GF+P1+10 Floors Office Building, Mohali (Mid Rise)

PROJECT DETAILS						
Type	**Rise and Segment**	**Project Name**	**Location**	**BUA in Sq Ft**	**Configuration**	**Other Details**
Commercial	Office Building + Shops on GF	**TDI Centre**	Mohali	299,193	2B+GF+ P1+10 Floors	**Shell Office & Shop with Basic wiring**
Supply from Utility	11kV, 3C 240 Sq Mm Al	Distribution Transformer Details	2 x 2000 kVA	DT to Main LV Panel Cable	3.5C 300/240 Sq Mm Al	

EST. CONSTRUCTION COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc. and land cost						
Unit	**Cement/RMC (Material Cost Only)**	**Steel (Material Cost Only)**	**MEP (Material Cost Only)**	**Other Materials**	**Labour, Contracting Services and All Other Services**	**Total Construction Cost**
In Rs per sq ft BUA	465	403	775	682	775	**3100**
%	15%	13%	25%	22%	25%	**100%**

EST. WIRE & CABLE MATERIAL COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc.%							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Type and Length of W&C Used (Internal to Building Only) and Cu/Al share%	Cu		0%	0%	100%; 1.5/2.5/4.0/6.0 Sq Mn Wires; 5000-20,000 mtr	79%; 1.5/2.5/4.0/6.0 Sq Mm Wire, 4C/3C 1.5 Sq Mm cables - 4000 mtr	54% in Cu Eqv.
	Al		100%; 3.5C 50/70/95/120 Sq Mm 1500 mtr	100%; 4C 35/25/16/10/6 Sq Mm 9,000 mtr (to shops & offices)	0%	21%; 4C 10/16 Sq Mm cables - 500 mtr	46% in Cu Eqv.
W&C Material Costs at Current Prices	Cu W&C	Rs Lakhs	-	-	115.1	9.4	**124.4**
	Al W&C	Rs Lakhs	10.3	21.9	-	1.4	**33.5**
	Total	**Rs Lakhs**	**10.3**	**21.9**	**115.1**	**10.7**	**157.9**
		In Rs per sq ft BUA	***3.4***	***7.3***	***38.5***	***3.6***	***52.8***

ADDITIONAL WIRE & CABLE MATERIAL COSTS (AT CURRENT PRICES) WITH 100% COPPER USAGE FOR THE PROJECT: For Building Only, excludes external areas like gardens, street lighting, etc.							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Size and Length of Copper W&C required to replace Aluminum W&C (assuming 100% Cu scenario)	Cu		3.5C 70/50/35 Sq Mm	4C 25/26/10/6/4 Sq Mm	No Replacement	4C 10/6 Sq Mm	
Total cost of W&C for replacing from Al to Cu	Cu	Rs Lakhs	47.22	70.57	-	3.48	
Additional W&C Material Costs for 100% Copper	Additional Cost for 100% Cu	Rs Lakhs	36.97	48.72	-	2.12	**87.80**
		In Rs per sq ft BUA	12.36	16.28	-	0.71	***29.34***
Additional Cost (for 100% Copper) as % of Total Building Construction Cost		**%**	0.40%	0.53%	0.00%	0.02%	**0.95%**

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Commercial Building: G+8 Floors IT Office Building, Pune (Low Rise)

PROJECT DETAILS						
Type	**Rise and Segment**	**Project Name**	**Location**	**BUA in Sq Ft**	**Configuration**	**Other Details**
Commercial	IT Office	**Nielsoft Technologies**	Pune	115,483	2 Wings	**Complete Building including Interiors Work Done**
Supply from Utility	MSEDCL 22 KV, 3C 240 Sq Mm Al	Distribution Transformer Details	NA	DT to Main LV Panel Cable	3.5 300 Sq Mm Al Cables	

EST. CONSTRUCTION COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc. and land cost						
Unit	**Cement/RMC (Material Cost Only)**	**Steel (Material Cost Only)**	**MEP (Material Cost Only)**	**Other Materials** *(incl. Interior work)*	**Labour, Contracting Services and All Other Services**	**Total Construction Cost**
In Rs per sq ft BUA	923	800	1108	1784	1538	**6153**
%	15%	13%	18%	29%	25%	**100%**

EST. WIRE & CABLE MATERIAL COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc.%							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Type and Length of W&C Used (Internal to Building Only) and Cu/Al share%	Cu		0%	22% Cu: 4C 16/10/6: 1227 meters	100%: 10, 6, 4, 2.5. 1.5 Wires: 60,603 mtrs	81%, 1.5, 2C 1.5, 3C 2.5, 3C 4, 4C 2.5, 2C 1: 21,131 meters	37% in Cu Eqv.
	Al		100% Al: Al Cables 3.5C 300/240/185/150/120 Sq Mm: 1232 meters	88% Al: Cables of Al 4C 240, 120, 95/70/35/25	0%	19%: 3.5 C x 35 , 4C 4, 4C 6: 1,725 meters	63% in Cu Eqv.
W&C Material Costs at Current Prices	Cu W&C	Rs Lakhs	0	7.18	14.98	11.74	**33.89**
	Al W&C	Rs Lakhs	14.42	6.04	0.00	2.76	**23.22**
	Total	**Rs Lakhs**	**14.42**	**13.22**	**14.98**	**14.49**	**57.11**
		In Rs per sq ft BUA	***12.49***	***11.45***	***12.97***	***12.55***	***49.45***

ADDITIONAL WIRE & CABLE MATERIAL COSTS (AT CURRENT PRICES) WITH 100% COPPER USAGE FOR THE PROJECT: For Building Only, excludes external areas like gardens, street lighting, etc.							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Size and Length of Copper W&C required to replace Aluminum W&C (assuming 100% Cu scenario)	Cu		3.5C 185, 150, 120, 95 Sq. mm Cu Cables: 1232 m	4C 185, 95, 70, 50, 25 and 3.5C 70, 50,35, 25,16 :1219 meters	No Replacement	3.5 C 25, 4C 2.5, 4C 4	
Total cost of W&C for replacing from Al to Cu	Cu	Rs Lakhs	54.43	32.20	0	11.74	98.36
Additional W&C Material Costs for 100% Copper	Additional Cost for 100% Cu	Rs Lakhs	40.01	26.16	0.00	5.24	71.41
		In Rs per sq ft BUA	34.64	22.65	0.00	2.49	59.78
Additional Cost (for 100% Copper) as % of Total Building Construction Cost		**%**	0.56%	0.37%	0.00%	0.04%	**0.97%**

Commercial Building: Bhagalpur Smart City Command Centre Building (Low Rise)

PROJECT DETAILS						
Type	**Rise and Segment**	**Project Name**	**Location**	**BUA in Sq Ft**	**Configuration**	**Other Details**
Commercial	IT Office Building	**Smart City Command Centre Building**	Bhagalpur	40,410	G + 3 Low Rise Structure	**Complete Building including Basic Interiors Work Done**
Supply from Utility	11 KV	Distribution Transformer Details	NA	DT to Main LV Panel Cable	3Cx185 Al. XLPE	

EST. CONSTRUCTION COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc. and land cost						
Unit	**Cement/RMC (Material Cost Only)**	**Steel (Material Cost Only)**	**MEP (Material Cost Only)**	**Other Materials**	**Labour, Contracting Services and All Other Services**	**Total Construction Cost**
In Rs per sq ft BUA	420	364	504	812	700	2,800
%	15%	13%	18%	29%	25%	100%

EST. WIRE & CABLE MATERIAL COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc.%							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Type and Length of W&C Used (Internal to Building Only) and Cu/Al share%	Cu		0%	0%	100%, 1.5 to 16.0/Sq Mm Wires & UPS Wiring 70/50/35/25 Sq Mm Wires, 30000 Mtr	0%	56% in Cu Eqv.
	Al		100%; 3.5C 50/35/16 Sq Mm, 1400 Mtr	100%; 800A Al Bus Bars, 80 Mtr	0%	0%	44% in Cu Eqv.
W&C Material Costs at Current Prices	Cu W&C	Rs Lakhs	0.00	0.00	13.66	0.00	**13.66**
	Al W&C	Rs Lakhs	3.91	0.11	0.00	0.00	**4.02**
	Total	**Rs Lakhs**	**3.91**	**0.11**	**13.66**	**0.00**	**17.67**
		In Rs per sq ft BUA	***9.67***	***0.27***	***33.79***	***0.00***	**43.74**

ADDITIONAL WIRE & CABLE MATERIAL COSTS (AT CURRENT PRICES) WITH 100% COPPER USAGE FOR THE PROJECT: For Building Only, excludes external areas like gardens, street lighting, etc.							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Size and Length of Copper W&C required to replace Aluminum W&C (assuming 100% Cu scenario)	Cu		3.5C 35/25 Sq Mm; 4C 10 Sq Mm	To Cu Busbars			
Total cost of W&C for replacing from Al to Cu	Cu	Rs Lakhs	14.98	1.20	No Replacement	No Replacement	
Additional W&C Material Costs for 100% Copper	Additional Cost for 100% Cu	Rs Lakhs	11.07	1.09	0.00	0.00	**12.16**
		In Rs per sq ft BUA	27.40	2.71	0.00	0.00	***30.10***
Additional Cost (for 100% Copper) as % of Total Building Construction Cost		**%**	0.98%	0.10%	0.00%	0.00%	**1.08%**

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Commercial Building: Tirupur Tidel Park Ltd (Low Rise)

PROJECT DETAILS						
Type	**Rise and Segment**	**Project Name**	**Location**	**BUA in Sq Ft**	**Configuration**	**Other Details**
Commercial	IT Office Building	**Tidel Park Ltd**	Tirupur	60,000	G+7+Terrace	**Complete Building including Interiors Work Done**
Supply from Utility	11 kV, Al 3C 185 Sq Mm	Distribution Transformer Details	11kV/ 433V 500kVA Oil Type	DT to Main LV Panel Cable	Al 3.5C 300/ 185 Sq Mm	

EST. CONSTRUCTION COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc. and land cost						
Unit	**Cement/RMC (Material Cost Only)**	**Steel (Material Cost Only)**	**MEP (Material Cost Only)**	**Other Materials**	**Labour, Contracting Services and All Other Services**	**Total Construction Cost**
In Rs per sq ft BUA	480	416	576	928	800	**3200**
%	15%	13%	18%	29%	25%	**100%**

EST. WIRE & CABLE MATERIAL COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc.%							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Type and Length of W&C Used (Internal to Building Only) and Cu/Al share%	Cu		23% , Cu Cable 4 to 16 Sq Mm, 2500 mtr	100%, Cu Air Insulated Bars, 300 mtr	100%,1.5/2.5/4.0 Sq Mm Wires, 35,000 mtr	100%, 1.5/2.5/4.0 Sq Mm Wires, 9600 mtr	56% in Cu Eqv.
	Al		77%, 3.5/4C of 16/25/35/50/95/120 Sq Mm, 5000 mtr	0%	0%	0%	44% in Cu Eqv.
W&C Material Costs at Current Prices	Cu W&C	Rs Lakhs	15.57	1.85	20.96	3.61	**42.00**
	Al W&C	Rs Lakhs	10.53	0.00	0.00	0.00	**10.53**
	Total	**Rs Lakhs**	**26.10**	**1.85**	**20.96**	**3.61**	**52.53**
		In Rs per sq ft BUA	***43.51***	***3.09***	***34.94***	***6.01***	***87.55***

ADDITIONAL WIRE & CABLE MATERIAL COSTS (AT CURRENT PRICES) WITH 100% COPPER USAGE FOR THE PROJECT: For Building Only, excludes external areas like gardens, street lighting, etc.							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Size and Length of Copper W&C required to replace Aluminum W&C (assuming 100% Cu scenario)	Cu						
Total cost of W&C for replacing from Al to Cu	Cu	Rs Lakhs	42.61	No Replacement; Air Insulated Cu Busbars	No Replacement	No Replacement	
Additional W&C Material Costs for 100% Copper	Additional Cost for 100% Cu	Rs Lakhs	32.08	0.00	0.00	0.00	**32.08**
		In Rs per sq ft BUA	53.46	0.00	0.00	0.00	***53.46***
Additional Cost (for 100% Copper) as % of Total Building Construction Cost		**%**	1.67%	0.00%	0.00%	0.00%	**1.67%**

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Commercial Building: POLO Market of Shillong Municipal Board (Low Rise)

PROJECT DETAILS						
Type	**Rise and Segment**	**Project Name**	**Location**	**BUA in Sq Ft**	**Configuration**	**Other Details**
Commercial	Shopping Complex	**POLO Market of Shillong Municipal Board**	Shillong	104,762	G+3 297 shops	**Complete Building including Shop with Basic wiring**
Supply from Utility	11kV 3.5 185 Sq Mm	Distribution Transformer Details	NA	DT to Main LV Panel Cable	Al 3.5 X 300 Sq Mm	

EST. CONSTRUCTION COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc. and land cost						
Unit	**Cement/RMC (Material Cost Only)**	**Steel (Material Cost Only)**	**MEP (Material Cost Only)**	**Other Materials**	**Labour, Contracting Services and All Other Services**	**Total Construction Cost**
In Rs per sq ft BUA	420	364	504	672	840	**2800**
%	15%	13%	18%	24%	30%	**100%**

EST. WIRE & CABLE MATERIAL COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc.%							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Type and Length of W&C Used (Internal to Building Only) and Cu/Al share%	Cu		3%, 1C 50/25 Sq Mm, 150 mtr	37%; 4C 16/10 Sq Mm, 400 mtr	100%, 10/6/4/2.5/1.5 Sq Mm wire, 5000 mtr	100%, 2C 1.5 Sq Mm 5000 mtr	54% in Cu Eqv.
	Al		97%; 3.5C 25 to Sq Mm, 300 mtr	63%; 4C 16/10/6 Sq Mm, 1200 mtr	0%	0%	46% in Cu Eqv.
W&C Material Costs at Current Prices	Cu W&C	Rs Lakhs	1.55	28.89	28.40	2.80	**61.64**
	Al W&C	Rs Lakhs	12.84	6.89	0.00	0.00	**19.74**
	Total	**Rs Lakhs**	**14.39**	**35.79**	**28.40**	**2.80**	**81.38**
		In Rs per sq ft BUA	***13.73***	***34.16***	***27.11***	***2.67***	***77.68***

ADDITIONAL WIRE & CABLE MATERIAL COSTS (AT CURRENT PRICES) WITH 100% COPPER USAGE FOR THE PROJECT: For Building Only, excludes external areas like gardens, street lighting, etc.							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Size and Length of Copper W&C required to replace Aluminum W&C (assuming 100% Cu scenario)	Cu		3.5C 120/70/50/16/10 Sq Mm	4C10/6/4 Sq mm	No Replacement	No Replacement	
Total cost of W&C for replacing from Al to Cu	Cu	Rs Lakhs	51.83	17.18	0.00	0.00	
Additional W&C Material Costs for 100% Copper	Additional Cost for 100% Cu	Rs Lakhs	38.98	10.28	0.00	0.00	**49.26**
		In Rs per sq ft BUA	37.21	9.81	0.00	0.00	**47.02**
Additional Cost (for 100% Copper) as % of Total Building Construction Cost		**%**	1.33%	0.35%	0.00%	0.00%	**1.68%**

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COMMERCIAL BUILDINGS: ADDITIONAL ANALYSIS

- Cu v/s Al W&C Share by Weight (in Cu Equivalent terms) and by Cost
- Incremental Cost of 100% Copper-Comparison of BoQ v/s Density methods
- Split of MEP (Mechanical-Electrical-Plumbing) Costs for select samples only (where data was available)

W&C Share by Weight and Share by Cost: Commercial Buildings (Select Samples)

Sr.No.	Sample Projects (Residential Buildings)	Cu Eqv. By Weight		W&C Cost Mix		Any Comments
		Cu%	Al%	Cu W&C	Al W&C	
1	**Rupa Renaissance, Vashi**	88%	12%	82%	18%	Outlier sample
2	**MCGM Super Speciality Hospital at Kandivali West**	45%	55%	84%	16%	
3	**Incubation Centre, Kota**	70%	30%	85%	15%	
4	**TDI Centre, Mohali**	54%	46%	79%	21%	
5	**Nielsoft Technologies: G+8 Floors IT Office Building, Pune (Low Rise)**	37%	63%	59%	41%	Cables external/ internal are mostly in Aluminium.
6	**Bhagalpur Smart City Command Centre Building**	56%	44%	77%	23%	
7	**Tirupur Tidel Park Ltd**	56%	44%	80%	20%	
8	**POLO Market of Shillong Municipal Board**	54%	46%	76%	24%	

Barring one sample (Rupa Renaissance, Vashi) which is an outlier, Cost share of Al Wire & Cables is always lower than its Share in Cu Equivalent by weight.

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Commercial Buildings: Incremental Cost with 100% Copper-Comparison of BoQ v/s Density Method (Select Samples)

Sr.No.	Sample Projects (Residential Buildings)	Cu Eqv. By Weight			Incremental Costs for 100% Copper-Density method			Incremental Costs for 100% Copper-BoQ method	Comments
					Al (CU Eqv Weight)	Cost of Wire & Cables Fixed (Rs/ Gm of Conductor Weight)	Additional W&C Material Costs for 100% Cu (Derived)		
		Total Cu Eqv.Gms/ Sq Ft	Cu Share%	Al Share%	Gms/ Sq Ft	Rs/ Gm	(Rs/ Sq Ft BUA)	(Rs/ Sq Ft BUA)	
1	Rupa Renaissance, Vashi	19.21	88%	12%	2.31	1.5	3.46	25.84	Outlier Case–density norm is low due to scope exclusions
2	MCGM Super Speciality Hospital at Kandivali West	93.72	45%	55%	51.55	1.5	77.32	44.05	Outlier Case-Hospital building
3	Incubation Centre, Kota	59.33	70%	30%	17.80	1.5	26.70	23.80	Both methods yield similar results
4	TDI Centre, Mohali	47.44	54%	46%	21.82	1.5	32.73	29.34	Both methods yield similar results
5	Nielsoft Technologies: G+8 Floors IT Office Building, Pune (Low Rise)	78.12	37%	63%	49.22	1.5	73.82	59.78	Both methods yield range bound results
6	Bhagalpur Smart City Command Centre Building	51.53	56%	44%	22.67	1.5	34.01	30.10	Both methods yield similar results
7	Tirupur Tidel Park Ltd	86.6	56%	44%	38.10	1.5	57.16	53.46	Both methods yield similar results
8	POLO Market of Shillong Municipal Board	74.41	54%	46%	34.23	1.5	51.34	47.02	Both methods yield similar results

Barring exceptions, both the BOQ method and the Density methods yield similar results regarding the incremental costs of using 100% Copper

Note: All Costs at are current prices (May 2022)

MEP Breakup by Cost: Commercial Buildings (Select Samples)

Sr. No.	Sample Projects (Wherever Data was Available)	Estimated Break-up of MEP Cost (Material Cost Only) (Rs per BUA SQFT)				Total Project Construction Cost (Rs per BUA SQFT)	Comments	Share in Total MEP Cost			*MEP Share in the Total Cost*
		Mechanical (HVAC, Fire, Elevators)	Electrical (Internal & External)	Plumbing (Pipes/Drainage/Sewrage System/ Fittings)	MEP Total			M	E	P	
1	**Nielsoft Technologies: G+8 Floors IT Office Building, Pune (Low Rise)**	410	518	180	**1108**	6153	Complete Building including Interiors Work Done. Electrical includes external sub-station work and the internal work.	37%	47%	16%	*18%*
2	**IT Office Building Tirupur Tidel Park Ltd.- G+7+Terrace**	160	288	128	**576**	3200	Internal electrical includes all wiring except work-station related.	28%	50%	22%	*18%*
3	**Incubation Center at Kota - Low Rise (3 Floors)**	224	308	168	**700**	2800	Internal electrical includes all wiring including workstations in the buidling.	32%	44%	24%	*25%*
4	**MCGM Super Speciality Hospital at Kandivali West**	990	588	180	**1758**	5608	Mechanical incl. HVAC, Pumps, Fire, Elevators, Medical Gas, Pneumatic System; Electrical system also includes Substation Work, BMS & DG Set. And complete building wiring.	56%	33%	10%	*31%*

Mechanical	Electrical	Plumbing
inclusions	*inclusions*	*inclusions*
HVAC Work (if Given), Pumps & Accessories, Fire Fighting System, Elevators, Medical Gas & Pneumatic System (only in the case of a Hospital)	Internal Electrical Work (Complete work including Wiring/ Cable/ Switches/ MCB etc.) Any External work including Sub-Station/ Transformer/ DG Sets/ Cablings/ UPS/ Emergency Panels	Pipes & Accessories/Drainage System/Sewerage System/ Faucet Fittings/ Sanity ware, etc.

Barring a special case (Hospital Building), the Electrical share of MEP Costs is fairly range bound (44% to 50%).

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RESIDENTIAL BUILDINGS: INDIVIDUAL SAMPLE BUILDINGS ANALYSIS

Summary: Residential Buildings-all samples

Sr No	Sector	Project/Building Type	Project Name/Location	Selling Price (Rs/ SqFt)	Built Up Area (BUA Sq Ft)	Cu v/s Al share % in Cu Eqv. (Gms)		Est. Building Construction Cost at Current Price (Rs/ Sq Ft BUA)	W&C Material Costs at Current Price (Rs/ Sq Ft BUA)	Additional W&C Material Costs for 100% Cu (Rs/ Sq Ft BUA)	Additional Cost (for 100% Copper) as % of Total Building Construction Cost	Main Areas of W&C for Replacement to Copper
						Cu Share %	Al Share %					
1	Residential	2B+G+2P+ 18 Floors + Terrace: 23 SLABS (3 wings)	Sumer Life Chandivali	17,000	134,228	49%	51%	3,500	51.47	15.96	0.46%	LV Panels to Sub Panels, Common areas
2	Residential	High Rise G+22	Residential Hostel in the Hospital Campus	CAPTIVE	174,956	86%	14%	2,041	44.85	14.54	0.48%	LV Panels to Sub Panels
3	Residential	Low Rise, 10 Floors	MIG Classic Apt., New Town, Kolkata	5,000	221,760	55%	45%	2,200	27.4	19.27	0.88%	LV Panels to Sub Panels, Rising Main
4	Residential	Mid Rise G+10 Residential Building	Aurangabad	8,000-9,000	76,389	76%	24%	2,500	56.63	24.88	1.00%	LV Panels to Sub Panels
5	Residential	Mid Rise, 3 Wings, 13 Floors	Madgul Antra, Kolkata	7,000	353,380	48%	52%	3,000	43.96	44.65	1.49%	LV Panels to Sub Panels, Rising Main, Common Area
6	Residential	High Rise Luxury 3B+GF+1P+18 Floors	Navroze, Mumbai	90,000	84,300	43%	57%	4,300	62.03	68.30	1.59%	LV Panels to Sub Panels, Rising Main
7	Residential	High Rise, Single Tower (27 Floors+5 Parking Slabs)	UK Iridium, Mumbai	20,000	142,300	33%	67%	3,800	72.63	81.78	2.15% *Outlier*	LV Panels to Sub Panels, Rising Main, Lift Cables

Based on the Residential samples studied, the use of Al cables have been largely for the main LV Panel to Sub Panels and in the rising main (up to the flat isolators).

The additional cost if all the Al Cables and Wires used were replace by Copper is coming in the range of 0.5% to 1.6% of the construction cost. There was one exception sample (outlier) where this figure was 2.1%, mainly due to the usage of 4C 150 Sq Mm **Al** cables in the sub panels and 4C 16 Sq Mm **Al** cables in the lift.

For the samples having a high Al Eqv share in the 50 to 55%, the additional cost to covert all Al into Cu is around 1.4-1.5% of the construction cost.

Note: All Costs at are current prices (May 2022)

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Residential Tower: Sumer Life Chandivali (High Rise)

PROJECT DETAILS						
Type	**Rise and Segment**	**Project Name**	**Location**	**BUA in Sq Ft**	**Configuration**	**Other Details**
Residential	Residential Tower	**Sumer Life**	**Chandivali, Mumbai**	134,228	B1+B2+G+P1+P2+ 18 Floors + Terrace: 23 SLABS	3 Towers
Supply from Utility	Adani Power 11KV 3Cx300 sq mm, Al cable	Distribution Transformer Details	NA	DT to Main LV Panel Cable	3.5 C 240 sq.mm XLPE-AL	

EST. CONSTRUCTION COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc. and land cost						
Unit	**Cement/RMC (Material Cost Only)**	**Steel (Material Cost Only)**	**MEP (Material Cost Only)**	**Other Materials**	**Labour, Contracting Services and All Other Services**	**Total Construction Cost**
In Rs per sq ft BUA	700	490	700	770	840	**3500**
%	20%	14%	20%	22%	24%	**100%**

EST. WIRE & CABLE MATERIAL COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc.%							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Type and Length of W&C Used (Internal to Building Only) and Cu/Al share%	Cu		0%	24%; 2x6 Sq Mm+ 1x2.5 Sq Mm Wires from Isolator to Flat DB	100%; 1.5/2.5/4.0 sq mm Wire	83%; 2.5/1.5 Sq Mm Cu Wire, Cu 4C 16/ 10 sqmm; 4C 4/4/2.5 Sq Mm	49% in Cu Eqv.
	Al		100%; 3.5C 240/185/90/35/25 Sq Mm; 50-400 mtrs	76%; Al 2C 10 Sq Mm from Meter to Isolator	0%	17%; Al 1C 70 Sq Mm	51% in Cu Eqv.
W&C Material Costs at Current Prices	Cu W&C	Rs Lakhs	0.00	5.35	17.93	15.77	**39.04**
	Al W&C	Rs Lakhs	9.41	18.94	0.00	1.69	**30.04**
	Total	**Rs Lakhs**	**9.41**	**24.29**	**17.93**	**17.46**	**69.09**
		In Rs per sq ft BUA	***7.01***	***18.09***	***13.36***	***13.01***	***51.47***

ADDITIONAL WIRE & CABLE MATERIAL COSTS (AT CURRENT PRICES) WITH 100% COPPER USAGE FOR THE PROJECT: For Building Only, excludes external areas like gardens, street lighting, etc.							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Size and Length of Copper W&C required to replace Aluminum W&C (assuming 100% Cu scenario)	Cu		3.5C 185 to 16 Sq Mm	2C6 Sq Mm		1C 50 Sqmm Earthing Cable	
Total cost of W&C for replacing from Al to Cu	Cu	Rs Lakhs	26.86	19.63	No Replacement	4.98	
Additional W&C Material Costs for 100% Copper	Additional Cost for 100% Cu	Rs Lakhs	17.45	0.69	0.00	3.28	**21.42**
		In Rs per sq ft BUA	13.00	0.51	0.00	2.45	***15.96***
Additional Cost (for 100% Copper) as % of Total Building Construction Cost		**%**	0.37%	0.01%	0.00%	0.07%	**0.46%**

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Residential Tower: Residential Hostel in the Hospital Campus (High Rise)

PROJECT DETAILS						
Type	**Rise and Segment**	**Project Name**	**Location**	**BUA in Sq Ft**	**Configuration**	**Other Details**
Residential	Residential Tower	**Hostel in Hospital Campus**	Kandivali	174,956	G+22	
Supply from Utility	11 kV, Al 3C 300/400 Sq Mm	Distribution Transformer Details	11kV/433V 2000 kVA	DT to Main LV Panel Cable	3C 185/ 120 Sq Mm Al	

EST. CONSTRUCTION COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc. and land cost						
Unit	**Cement/RMC (Material Cost Only)**	**Steel (Material Cost Only)**	**MEP (Material Cost Only)**	**Other Materials**	**Labour, Contracting Services and All Other Services**	**Total Construction Cost**
In Rs per sq ft BUA	600	360	570	600	870	**3000**
%	20%	12%	19%	20%	29%	**100%**

EST. WIRE & CABLE MATERIAL COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc.%							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Type and Length of W&C Used (Internal to Building Only) and Cu/Al share%	Cu		51%, 4C 10/6 Sq mm, 1000mtrs	100%, 3C4 sq mm + 4 Sq Mm PVC Wire, 12000 mtrs	100%, 2..5/1.5 Wires, 60,000 mtrs	100%, 3C 16/25/120 & 1.5 Wires, 4C 16	86% in Cu Eqv.
	Al		49%, Al 4C 16/25/35/150 sq. mm, 200 to 800 mtrs	0%	0%	0%	14% in Cu Eqv.
W&C Material Costs at Current Prices	Cu W&C	Rs Lakhs	3.99	36.12	17.35	13.09	**70.55**
	Al W&C	Rs Lakhs	7.91	0.00	0.00	0.00	**7.91**
	Total	**Rs Lakhs**	**11.91**	**36.12**	**17.35**	**13.09**	**78.47**
		In Rs per sq ft BUA	***6.81***	***20.64***	***9.92***	***7.48***	***44.85***

ADDITIONAL WIRE & CABLE MATERIAL COSTS (AT CURRENT PRICES) WITH 100% COPPER USAGE FOR THE PROJECT: For Building Only, excludes external areas like gardens, street lighting, etc.							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Size and Length of Copper W&C required to replace Aluminum W&C (assuming 100% Cu scenario)	Cu		3.5C 25/95/185; 4C 10/16 sq mm				
Total cost of W&C for replacing from Al to Cu	Cu	Rs Lakhs	33.35	No Replacement	No Replacement	No Replacement	
Additional W&C Material Costs for 100% Copper	Additional Cost for 100% Cu	Rs Lakhs	25.43	0.00	0.00	0.00	**25.43**
		In Rs per sq ft BUA	14.54	0.00	0.00	0.00	***14.54***
Additional Cost (for 100% Copper) as % of Total Building Construction Cost		**%**	0.48%	0.00%	0.00%	0.00%	**0.48%**

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Residential Tower: G+10 Floors Kolkata (Mid Rise)

PROJECT DETAILS						
Type	**Rise and Segment**	**Project Name**	**Location**	**BUA in Sq Ft**	**Configuration**	**Other Details**
Residential	Residential Tower	**WB Housing Board MIG**	Kolkata	221,760	G+10	2 BHK Only
Supply from Utility	CESC 3.5Cx300 sq mm, Al cable	Distribution Transformer Details	NA	DT to Main LV Panel Cable	3.5 240 Sq Mm Al	

EST. CONSTRUCTION COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc. and land cost						
Unit	**Cement/RMC (Material Cost Only)**	**Steel (Material Cost Only)**	**MEP (Material Cost Only)**	**Other Materials**	**Labour, Contracting Services and All Other Services**	**Total Construction Cost**
In Rs per sq ft BUA	440	264	550	396	550	**2200**
%	20%	12%	25%	18%	25%	**100%**

EST. WIRE & CABLE MATERIAL COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc.%							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Type and Length of W&C Used (Internal to Building Only) and Cu/Al share%	Cu		0%	60%, 10/6 Sq Mm Wires	100%; 4.0/2.5/1.5 Sq Mm Wires	100%	55% in Cu Eqv.
	Al		100%, 4C 240/185/50/16/10 Sq Mm	40%, 4C 10 Sq Mm	0%	0%	45% in Cu Eqv.
W&C Material Costs at Current Prices	Cu W&C	Rs Lakhs	-	15.2	29.4	0.8	**45.4**
	Al W&C	Rs Lakhs	8.3	7.1	-	-	**15.5**
	Total	**Rs Lakhs**	**8.3**	**22.3**	**29.4**	**0.8**	**60.8**
		In Rs per sq ft BUA	***3.8***	***10.1***	***13.3***	***0.3***	***27.4***

ADDITIONAL WIRE & CABLE MATERIAL COSTS (AT CURRENT PRICES) WITH 100% COPPER USAGE FOR THE PROJECT: For Building Only, excludes external areas like gardens, street lighting, etc.							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Size and Length of Copper W&C required to replace Aluminum W&C (assuming 100% Cu scenario)	Cu		4C 150/120/35/10/6 Sq Mm	4C 6 Sq Mm			
Total cost of W&C for replacing from Al to Cu	Cu	Rs Lakhs	41.28	16.93	No Replacement	No Replacement	
Additional W&C Material Costs for 100% Copper	Additional Cost for 100% Cu	Rs Lakhs	32.93	9.80	-	-	**42.73**
		In Rs per sq ft BUA	14.85	4.42	-	-	***19.27***
Additional Cost (for 100% Copper) as % of Total Building Construction Cost		**%**	0.67%	0.20%	0.00%	0.00%	**0.88%**

Residential Tower: Mid Rise G+10 Aurangabad

PROJECT DETAILS						
Type	**Rise and Segment**	**Project Name**	**Location**	**BUA in Sq Ft**	**Configuration**	**Other Details**
Residential	Residential Tower	**NA**	Aurangabad	76,389	G+10	
Supply from Utility	11KV	Distribution Transformer Details	11/0.433 KV 50 Hz 630 kVa Oil Cu	DT to Main LV Panel Cable	3.5C 185 Sq.mm XLPE Al Ar. Cable	

EST. CONSTRUCTION COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc. and land cost						
Unit	**Cement/RMC (Material Cost Only)**	**Steel (Material Cost Only)**	**MEP (Material Cost Only)**	**Other Materials: Finishing**	**Labour, Contracting Services and All Other Services**	**Total Construction Cost**
In Rs per sq ft BUA	375	325	450	725	625	2,500
%	15%	13%	18%	29%	25%	100%

EST. WIRE & CABLE MATERIAL COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc.%							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Type and Length of W&C Used (Internal to Building Only) and Cu/Al share%	Cu		49% 2C, 3C and 4C XLPE CU	100% 4C 10 Sq. mm XLPE CU (1690 MTR) 10 sq. mm and 6 sq. mm FRLSH CU (1200 Mtr)	100% 1.5 sq. mm, 2.5 sq. mm and 4 sq. mm (75000 Mtr)	0%	76% in Cu Eqv.
	Al		51% 3C, 3.5C and 4C XLPE Al Cables	0%	0%	0%	24% in Cu Eqv.
W&C Material Costs at Current Prices	Cu W&C	Rs Lakhs	9.88	10.41	18.17	0.00	**38.46**
	Al W&C	Rs Lakhs	4.80	0.00	0.00	0.00	**4.80**
	Total	**Rs Lakhs**	**14.68**	**10.41**	**18.17**	**0.00**	**43.26**
		In Rs per sq ft BUA	***19.22***	***13.62***	***23.79***	***0.00***	***56.63***

ADDITIONAL WIRE & CABLE MATERIAL COSTS (AT CURRENT PRICES) WITH 100% COPPER USAGE FOR THE PROJECT: For Building Only, excludes external areas like gardens, street lighting, etc.							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Size and Length of Copper W&C required to replace Aluminum W&C (assuming 100% Cu scenario)	Cu			To Cu Busbars			
Total cost of W&C for replacing from Al to Cu	Cu	Rs Lakhs	23.81	0.00	No Replacement	No Replacement	
Additional W&C Material Costs for 100% Copper	Additional Cost for 100% Cu	Rs Lakhs	19.01	0.00	0.00	0.00	**19.01**
		In Rs per sq ft BUA	24.88	0.00	0.00	0.00	**24.88**
Additional Cost (for 100% Copper) as % of Total Building Construction Cost		**%**	1.00%	0.00%	0.00%	0.00%	**1.00%**

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Residential Tower: B+G+13 Floors Kolkata (Mid Rise)

PROJECT DETAILS						
Type	**Rise and Segment**	**Project Name**	**Location**	**BUA in Sq Ft**	**Configuration**	**Other Details**
Residential	Residential Tower	**Madgul Antra**	Kolkata	353,380	3 Wings 13 Floor	3 BHK only 283 Flats
Supply from Utility	CESC 3.5Cx300 sq mm, Al cable	Distribution Transformer Details	NA	DT to Main LV Panel Cable	3.5 400 Sq Mm Al	

EST. CONSTRUCTION COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc. and land cost						
Unit	**Cement/RMC (Material Cost Only)**	**Steel (Material Cost Only)**	**MEP (Material Cost Only)**	**Other Materials**	**Labour, Contracting Services and All Other Services**	**Total Construction Cost**
In Rs per sq ft BUA	540	300	750	660	750	**3000**
%	18%	10%	25%	22%	25%	**100%**

EST. WIRE & CABLE MATERIAL COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc.%							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Type and Length of W&C Used (Internal to Building Only) and Cu/Al share%	Cu		0%	65%, 6/10/16 sqmm wires; 6,000-48,000 mtrs	100%, 4.0/2..5/1.5 sqmm Wires, 35,000 mtrs	90% 1.5/2.5/4.0/ 10.0 sqmm wires; 6,000 mtrs	48% in Cu Eqv.
	Al		100%, Al 3C 185; 3.5 240/150/70; 4C 16/25 sqmm, 500-1000 mtrs	35%, 4C 10 sqmm - 6,800 mtrs	0%	10%; 4C 16 sqmm, 500 mtrs	52% in Cu Eqv.
W&C Material Costs at Current Prices	Cu W&C	Rs Lakhs	0.00	34.81	59.01	13.37	**107.18**
	Al W&C	Rs Lakhs	34.98	12.14	0.00	1.05	**48.18**
	Total	**Rs Lakhs**	**34.98**	**46.95**	**59.01**	**14.42**	**155.36**
		In Rs per sq ft BUA	***9.90***	***13.29***	***16.70***	***4.08***	***43.96***

ADDITIONAL WIRE & CABLE MATERIAL COSTS (AT CURRENT PRICES) WITH 100% COPPER USAGE FOR THE PROJECT: For Building Only, excludes external areas like gardens, street lighting, etc.							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Size and Length of Copper W&C required to replace Aluminum W&C (assuming 100% Cu scenario)	Cu		3.5 C 50/95/120 sqmm; 4C 6/10/16 sqmm	4C 6.0 Sq Mm		4C 10 Sq Mm	
Total cost of W&C for replacing from Al to Cu	Cu	Rs Lakhs	173.97	28.80	No Replacement	3.19	
Additional W&C Material Costs for 100% Copper	Additional Cost for 100% Cu	Rs Lakhs	138.99	16.65	0.00	2.14	**157.78**
		In Rs per sq ft BUA	39.33	4.71	0.00	0.60	***44.65***
Additional Cost (for 100% Copper) as % of Total Building Construction Cost		**%**	1.31%	0.16%	0.00%	0.02%	**1.49%**

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Residential Tower: 3B+GF+1P+18 Floors Mumbai (High Rise)

PROJECT DETAILS						
Type	**Rise and Segment**	**Project Name**	**Location**	**BUA in Sq Ft**	**Configuration**	**Other Details**
Residential	Residential Tower	**Navroze Bandra**	Mumbai	84.305	Single Tower: 3B+GF+1P+18 Floors	2/3/4/BHK Units Luxury
Supply from Utility	Adani Power 11KV 3C 300 sq mm Al	Distribution Transformer Details	NA	DT to Main LV Panel Cable	3.5x300/240 Sq Mm to the Panel	

EST. CONSTRUCTION COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc. and land cost						
Unit	**Cement/RMC (Material Cost Only)**	**Steel (Material Cost Only)**	**MEP (Material Cost Only)**	**Other Materials: Finishing**	**Labour, Contracting Services and All Other Services**	**Total Construction Cost**
In Rs per sq ft BUA	861	603	861	947	1033	**4,300**
%	20%	14%	20%	22%	24%	

EST. WIRE & CABLE MATERIAL COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc.%							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Type and Length of W&C Used (Internal to Building Only) and Cu/Al share%	Cu		4%, 4C 10/6/2.5 Sq Mm	66%, 10 /16 Sqmm Wires	100%, 1.5/2/5/4.0 Sq Mm Wires	100%, 1.5/2.5 SqMm wires; 4C 2.5/4.0 sqmm Cables	43% in Cu Eqv.
	Al		96%, 3.5C 240/185/35/16 Sq Mm	34%, 4C 25/35 Sq Mm	0%	0%	57% in Cu Eqv.
W&C Material Costs at Current Prices	Cu W&C	Rs Lakhs	2.52	17.42	14.66	3.36	**37.97**
	Al W&C	Rs Lakhs	11.41	2.91	0.00	0.00	**14.32**
	Total	**Rs Lakhs**	**13.93**	**20.34**	**14.66**	**3.36**	**52.29**
		In Rs per sq ft BUA	***16.53***	***24.12***	***17.39***	***3.98***	***62.03***

ADDITIONAL WIRE & CABLE MATERIAL COSTS (AT CURRENT PRICES) WITH 100% COPPER USAGE FOR THE PROJECT: For Building Only, excludes external areas like gardens, street lighting, etc.							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Size and Length of Copper W&C required to replace Aluminum W&C (assuming 100% Cu scenario)	Cu		3.5C 185/120/25/10; ~400 mtrs	3.5C 16/25; ~600 mtrs			
Total cost of W&C for replacing from Al to Cu	Cu	Rs Lakhs	60.44	11.46	No Replacement	No Replacement	
Additional W&C Material Costs for 100% Copper	Additional Cost for 100% Cu	Rs Lakhs	49.03	8.55	0.00	0.00	**57.58**
		In Rs per sq ft BUA	58.16	10.14	0.00	0.00	***68.30***
Additional Cost (for 100% Copper) as % of Total Building Construction Cost		**%**	1.35%	0.24%	0.00%	0.00%	**1.59%**

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Residential Tower: B+G+P1+P2+P3+P4+27 Floors Mumbai (High Rise)

PROJECT DETAILS						
Type	**Rise and Segment**	**Project Name**	**Location**	**BUA in Sq Ft**	**Configuration**	**Other Details**
Residential	Residential Tower	**UK Iridium Kandivali**	Mumbai	142,300	Single Tower: B+G+P1+P2+P3+P4+27 FLR	Studio+1BHK+2BHK Units
Supply from Utility	Adani Power 11KV 3Cx300 sq mm, Al cable	Distribution Transformer Details	NA	DT to Main LV Panel Cable	3.5x300/240 Sq Mm to the Panel	

EST. CONSTRUCTION COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc. and land cost						
Unit	**Cement/RMC (Material Cost Only)**	**Steel (Material Cost Only)**	**MEP (Material Cost Only)**	**Other Materials: Finishing**	**Labour, Contracting Services and All Other Services**	**Total Construction Cost**
In Rs per sq ft BUA	760	456	722	760	1102	**3800**
%	20%	12%	19%	20%	29%	**100%**

EST. WIRE & CABLE MATERIAL COSTS FOR THE PROJECT (AT CURRENT PRICES): For Building Only, excludes external areas like gardens, street lighting, etc.%							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Type and Length of W&C Used (Internal to Building Only) and Cu/Al share%	Cu		0%	9%, 2.5/6/10 sqmm wires; 300-1000 mtrs	100%, Cu Wires of 1.5/2.5/4.0 Sq Mm, 1,63000 mtr	44%, 2.5/1.5 Cu Wires, Cu 4C2.5/10/6 Sq Mm., ~300 mtrs	33% in Cu Eqv.
	Al		100%, 4 or 3.5C 25/70/150 Sq Mm; 2200 mtrs	91%, 2C 16 sqmm - 4000-5000 mtrs	0%	56%, Al 4C 16 Sq Mm , 700 mtrs	67% in Cu Eqv.
W&C Material Costs at Current Prices	Cu W&C	Rs Lakhs	0.00	4.04	40.51	6.59	**51.14**
	Al W&C	Rs Lakhs	17.40	33.33	0.00	1.48	**52.21**
	Total	**Rs Lakhs**	**17.40**	**37.37**	**40.51**	**8.06**	**103.35**
		In Rs per sq ft BUA	***12.23***	***26.26***	***28.47***	***5.67***	***72.63***

ADDITIONAL WIRE & CABLE MATERIAL COSTS (AT CURRENT PRICES) WITH 100% COPPER USAGE FOR THE PROJECT: For Building Only, excludes external areas like gardens, street lighting, etc.							
Parameter	**Conductor**	**Unit**	**Main LV Panel to Sub-Panels**	**Rising Main (Sub-Mains) incl Isolators if any**	**Last Mile (Circuit and Point Wiring)**	**Common Areas (Internal to Building only)**	**Total**
Size and Length of Copper W&C required to replace Aluminum W&C (assuming 100% Cu scenario)	Cu		3.5/4C16/ 50/95 Sq Mm	2C10 Sq Mm	No Replacement	4C 10 Sq Mm	
Total cost of W&C for replacing from Al to Cu	Cu	Rs Lakhs	85.33	78.78	0	4.47	
Additional W&C Material Costs for 100% Copper	Additional Cost for 100% Cu	Rs Lakhs	67.92	45.45	0.00	2.99	**116.36**
		In Rs per sq ft BUA	47.73	31.94	0.00	2.10	***81.78***
Additional Cost (for 100% Copper) as % of Total Building Construction Cost		**%**	1.26%	0.84%	0.00%	0.06%	**2.15%**

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RESIDENTIAL BUILDINGS: ADDITIONAL ANALYSIS

- Cu v/s Al W&C Share by Weight (in Cu Equivalent terms) and by Cost
- Incremental Cost of 100% Copper-Comparison of BoQ v/s Density methods
- Split of MEP (Mechanical-Electrical-Plumbing) Costs for select samples only (where data was available)

W&C Share by Weight and Share by Cost: Residential Buildings (Select Samples)

Sr.No.	Sample Projects (Residential Buildings)	Cu Eqv. By Weight		W&C Cost Mix		Any Comments
		Cu%	Al%	Cu W&C	Al W&C	
1	**Sumer Life Chandivalli Residential Project B1+B2+G+P1+P2+ 18 Floors**	49%	51%	57%	43%	
2	**Residential Hostel in Hospital - High Rise: Doctors Residential Tower (GR+22 Floors) 24 Slabs**	86%	14%	90%	10%	Higher usage of Copper Wire and Cables in the Buidling
3	**G+10 Floors Kolkata (Mid Rise)**	55%	45%	66%	22%	
4	**Mid Rise G+10 Aurangabad**	76%	24%	89%	11%	Higher usage of Copper Wire and Cables in the Buidling
5	**Madgul Antraa B+G+13 Floors Kolkata (Mid Rise)**	48%	52%	69%	31%	
6	**PALI HILL NAVROZE PREMISES CHS LIMITED 3B+GF+1P+18 Floors**	43%	57%	73%	27%	
7	**UK Iridium Kandivali B+G+P1+P2+P3+P4+27 Floors**	33%	67%	49%	51%	Higher usage of Aluminium Wire and Cables in the Building, hence a higher conversion cost to Copper

For all samples listed above for Residential buildings, the Cost share of Al Wire & Cables is lower than its Share in Cu Equivalent by weight.

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Residential Buildings: Incremental Cost with 100% Copper-Comparison of BoQ v/s Density Method (Select Samples)

Sr.No.	Project/Building Type	Sample Projects (Residential Buildings)	Cu Eqv. By Weight			Incremental Costs for 100% Copper-Density method			Incremental Costs for 100% Copper-BoQ method	Comments
						Al (CU Eqv Weight)	Additional W&C Material Costs for 100% Cu (BoQ Method)	Additional Cost of Wire & Cables Fixed (Rs/ Gm of Conductor Weight)		
			Total Cu Eqv.Gms/ Sq Ft	Cu Share%	Al Share%	Gms/ Sq Ft	(Rs/ Sq Ft BUA)	Rs/ Gm	(Rs/ Sq Ft BUA)	
1	2B+G+2P+ 18 Floors + Terrace: 23 SLABS (3 wings)	**Sumer Life Chandivali**	61.49	49%	51%	31.36	37.83	1.8	56.45	Range bound but BoQ method yields higher results
2	High Rise G+22	**Residential Hostel in the Hospital Campus**	40.98	86%	14%	5.74	14.54	1.8	10.33	Both methods yield similar results
3	Low Rise, 10 Floors	**MIG Classic Apt., New Town, Kolkata**	32.42	55%	45%	14.59	19.27	1.8	26.26	Both methods yield similar results
4	Mid Rise G+10 Residential Building	**Aurangabad**	54.43	76%	24%	13.06	24.88	1.8	23.51	Both methods yield similar results
5	Mid Rise, 3 Wings, 13 Floors	**Madgul Antra, Kolkata**	60.3	48%	52%	31.36	44.65	1.8	56.44	Both methods yield similar results
6	High Rise Luxury 3B+GF+1P+18 Floors	**Navroze, Mumbai**	71.8	43%	57%	40.93	68.3	1.8	73.67	Both methods yield similar results
7	High Rise, Single Tower (27 Floors+5 Parking Slabs)	**UK Iridium, Mumbai**	71	33%	67%	47.57	81.78	1.8	85.63	Both methods yield similar results

Barring exceptions, both the BOQ method and the Density methods yield similar results regarding the incremental costs of using 100% Copper

Note: All Costs at are current prices (May 2022)

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MEP Breakup by Cost: Residential Buildings (Select Samples)

Sr. No.	Sample Projects (Wherever Data was Available)	Estimated Break-up of MEP Cost (Material Cost Only) (Rs per BUA SQFT)				Total Project Construction Cost (Rs per BUA SQFT)	Comments	Share in Total MEP Cost			MEP Share in the Total Cost
		Mechanical (HVAC, Fire, Elevators)	Electrical (Internal & External)	Plumbing (Pipes/Drainage/Sewerage System/ Fittings)	MEP Total			M	E	P	
1	**Residential Hostel in Hospital - High Rise: DoctorsResidential Tower (GR+22 Floors) 24 Slabs**	185	315	130	**630**	3000	Higher usage of Copper W&C. Also include work for HT/LT side Cabling, DG Set, UPS, Earthing, Light Protection System	29%	50%	21%	21%
2	**PALI HILL NAVROZE PREMISES CHS LIMITED 3B+GF+1P+18 Floors**	340	300	220	**860**	4300	Multiple Elevators, Premium Plumbing Fittings & Pumping System – STC, Fire & Water Includes cost of HT cabling & transformer installation work.	40%	35%	26%	20%
3	**Madgul Antraa B+G+13 Floors Kolkata (Mid Rise)**	250	200	300	**750**	3000	Multiple Elevators, Premium Plumbing Fittings & Pumping System. Electric Sub-station work cost not included.	33%	27%	40%	25%
4	**3 Nos. of G+10 Aptt. "CLASSIC" - Rajarhat Area, West Bengal Housing Board (80 2BHKs per Tower, 240 2BHKs in Total) MIG Category**	182	190	178	**550**	2200	Includes cabling from the substation but do not have transformer installation cost.	33%	35%	32%	25%

Mechanical	Electrical	Plumbing
inclusions	*inclusions*	*Inclusions*
HVAC Work (if Given), Pumps & Accessories, Fire Fighting System, Elevators, Medical Gas & Pneumatic System (only in the case of a Hospital)	Internal Electrical Work (Complete work including Wiring/ Cable/ Switches/ MCB etc.) Any External work including Sub-Station/ Transformer/ DG Sets/ Cablings/ UPS/ Emergency Panels	Pipes & Accessories/Drainage System/Sewerage System/ Faucet Fittings/ Sanity ware, etc.

Unlike commercial, the share of Electrical Costs in total MEP costs varies widely (27% to 50%) due to the type of the building design, building amenities and feature, number of lifts, type of fire fighting system, etc.

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GENERAL OBSERVATIONS

General Observations

Commercial Buildings

- LV Panel to Sub-panels iincluding cabling of the common utilities is largely an Aluminum dominated area, while copper cables/ wires is used in fire electricals and lifts.
- Though not part of the scope (since outside the physical building), Utility side HT Cabling and LV Cabling to the feeder is almost always Aluminium, governed by the specifications of the concerned electricity board.
- Commonly , the main area of Al usage is for the rising mains where 4Cx120/50/35 Sq Mm Al Cable is mostly used. Occasionally, Al busbar rising main is also used.
- But everything from floor DB onwards to office is usually only Copper, barring a few instances of Al cable used in HVAC system.
- Many of the contacts met preferred to have some technical study and life cycle cost analysis of adopting Copper vis a vis Aluminium conductors in the commercial buildings segment.
- In Commercial buildings, for Critical wiring like UPS, Labs, Chillers, etc. copper is generally used while for Non-Critical Wiring like storerooms, water pumping for non-critical use, etc. Al is generally used.

Residential Buildings

- In mid-rise and high-rise buildings, Meter Room to Flat Isolator is normally Al Cable and thereafter everything is in Cu.
- As a general norm, all wire & cable upto 10 sq mm is usually copper while 16 Sq Mm and above usually Al conductor is preferred. Though not in study scope, Utility side HT Cabling and LV Cabling to the feeder is largely an Aluminium territory, governed by the specifications of the concerned electricity board.
- Unlike larger cities, in smaller cities, the builder's margin is quite thin (only Rs 500-800 per Sq Ft of Saleable Area) and selling prices are lower, hence there is a greater resistance in incurring the higher costs linked with usage of 100% copper.
- There is a lot of variety in design, construction and W&C usage in residential buildings compared to commercial:
    - For example, in one of the luxury residential projects studied, the developer is providing Al air insulated rising mains even though the residential tower is only a 12 floors (mid-rise) building. In another, the rising mains for lower floors is in Copper but for higher floors is in Al and so on. One prominent builder in Bengaluru have standardised on Aluminium cables in rising mains, over 5 years back, for all their residential construction projects.

Al v/s Equivalent Copper Cable: Cost comparison on Rs per Mtr and Rs/kg basis

Conductor Material	Cable Size	Conductor Weight	Cost of the Cable after Considering Discount (As of May 2022)	Ratio (by Rs/Mtr)	Cost of Cable (by Conductor Weight)	Ratio (by Rs/Kg)
	Sq Mm	*Kg/Km*	*Rs/Mtr*	*Cu:Al*	*Rs/Kg*	*Cu:Al*
Al	4C 16 Sq Mm	173	210.8		1218	
Cu	4C 10 Sq Mm	356	637.98	3.03	1792	1.47
Al	3.5C 35 Sq Mm	331	318.68		963	
Cu	3.5C 25 Sq Mm	780	1412.36	4.43	1811	1.88
Al	3.5C 185 Sq Mm	1748	1298.9		743	
Cu	3.5C 120 Sq Mm	3742	6567.66	5.06	1755	2.36
Al	3.5C 240 Sq Mm	2268	1653.54		729	
Cu	3.5C 185 Sq Mm	5769	10097.32	6.11	1750	2.40

For cable sizes above 10 Sq Mm, the cost per Kg of Cu cable (in conductor weight terms) is almost 1.5 to 2.5 times the Al cable, while the cost in Rs per meter terms for Cu cables is almost 3 to 6 times higher.


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