World Construction Forum 2019
BUILDINGS AND INFRASTRUCTURE RESILIENCE
Ljubljana, Slovenia
8 – 11 April 2019
WFEO / FMOI
IZS
Univerza v Ljubljani
Fakulteta za gradbeništvo in geodezijo

Power Transmission Mode for Building

Authors: Yiqing YUAN[1], Yicheng YUAN[2]

[1] 1 Huachang Operating Team of Dalian Power Supply Company Operation Work Area, Dalian, China, yyqing627@163.com

Forum topics		
	☒ Energy in 21st Century	☐ Cultural Heritage in Digital World
	☐ Engineering Capacity Building	☐ Disaster Risk Management & Governance for Resilient Communities
	☐ Construction 4.0	☐ BIM Lifecycle, Facility & Asset Management

Abstract: (250 to 500 words: for each heading use the bullet points or narrative - the submission including graphics should not exceed one page)

Problems - Issues / Challenges-Needs

The abundant space resources at 50-150 meters from ground surface shall be utilized for power transmission, high-rise building can still be constructed below the transmission corridor and transmission line, and it is safer. Urban land can be saved for constructing compact city, and it is energy-saving for reasonable planning of city and town.

Solutions - Methods / Results - Findings

The pole tower of high-voltage distribution line, high-voltage transmission line, extra high voltage transmission line and ultra high voltage transmission line (except AC 1000kV pylon tower and angle tower of double-circuit transmission line on the same tower) in city and town can be selectively fixed onto the top of high-rise building which is about 50-150 meters high. The strength of transmission facilities and high-rise building shall both be appropriately strengthened.

Violating the regulations in force, but is scientific and feasible. Since:

- Reliable and safer. The 1150 kV ultra high voltage of former Soviet Union operated for six years with a total length of 11112 km, and the transmission was interrupted for four times (accounting for 80%) because of the line trip off caused by lightning. Therefore, the probability of trouble at transmission line that might threaten the safety of personnel below the transmission line is ≤0.045*(1-80%)=0.009 time/(hundred km*year), and that is acceptable; in addition, closed management is performed to the top of high-rise building, equipotential bonding is integrally implemented to building, and it is well grounded, once the transmission line is broken, it would firstly contact the high-rise building, since the pace voltage and touch voltage are zero, the personnel inside the high-rise building is absolutely safe, i.e., having high-rise building below the transmission line is safer than vacant land; the building of civil structure and brick-timber structure is unsafe.
- Environmental protection. The environmental protection indexes in high-rise building, such as electric field, magnetic field and sound, etc., are all lower than the standard in force of each country in the world, and non-work personnel are prohibited from going up to top of high-rise building; there is no radiation.
- For the transverse load (which seldom exceed 1500 tons, most being less than 500 tons) produced by most transmission towers, so long as it is taken into consideration at the time of design, high-rise building can easily bear, and the increased cost is very low.
- Radio interference can be overcome and solved by wired means.
- Existing operation, maintenance, galloping prevention, lightning protection, shock-proof and flame-proof techniques (etc.) are mature.
- Conductor with carbon fiber composite core is adopted.
- The electric substation with voltage grade of 330kV and below can be constructed inside high-rise building, and power supply can be led in through cable from top of high-rise building, and it seems more economical to adopt 22-25kV as the rated voltage for medium voltage power distribution.
- It had better avoid famous scenic area;
- The economic benefit will be at least 3-5 times of investment, and very great benefit can be brought about to city, town and even countryside, the benefit is far greater than the disadvantage.
- Fear and worry more come from the subjective aspect (psychological factor) of populace. For the 66kV and above overhead transmission line, objective probability of personal danger occurrence is far less than the probability of traffic accident, it is estimated to be less than 0.01% of probability of traffic accident, but we have not abandoned automobile for the probability of traffic accident.

Novelty - Value / Relevance to ...

Saving urban land, improving urban efficiency, constructing compact city, reducing investment on urban infrastructure, it is safer below the transmission corridor, the selection of transmission route is relatively easy, energy-saving and low carbon. Med-term, long-term and even ultra long-term planning of city and power transmission and transformation engineering needs to be strengthened, and it needs support from government and relevant laws and regulations. Shortcoming: impacting landscape, initial investment is relatively great, misunderstanding by populace. This thesis belongs to the domain of building and city planning.

Forum statement

Saving urban land, improving urban efficiency, constructing compact city, reducing investment on urban infrastructure, it is safer below the transmission corridor, the selection of transmission route is relatively easy, energy-saving and low carbon. Med-term, long-term and even ultra long-term planning of city and power transmission and transformation engineering needs to be strengthened, and it needs support from government and relevant laws and regulations.

Keywords: (up to 5 keywords)

developing power transmission line corridor; high-rise building; urban efficiency; conductor with carbon fiber composite core; optimizing resource configuration;

Graphics: (please use the gray area bellow for *representative graphics* or *graphical summary*: select the gray area bellow and paste your graphics)

Table 1 Former Soviet 500, 750kV and 1150kV lines failure rate data

Voltage Class (kV)	500	750	1150
Total length of each line (km)	57314	15519	11112
Average break rate of each line (including successful reclosing)	0.574	0.206	0.144
Average interruption rate of each line	0.201	0.097	0.045

Chart 1 LCC Comparison of high and large-scale office buildings (Reference)