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ANALYSIS OF TRANSMISSION LOSSES USING GRID SYSTEM

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ABSTRACT:

Transmission loss and fair allocation of power is Essential in the present restricted electricity markets. This Project describes the direct method to analyse the loss allocation. In consequence, power losses of distribution network must be fairly allocated among all the distributed stations and customers. This is done by erecting feeders by replacing the Aluminium conductor steel reinforced(ACSR) by Aluminium conductor composite reinforced(ACCR). Loss allocation is an important aspect in the determining thecost of transmission. This methodology of finding the losses is vital. This method will provide more efficient network operation.

INTRODUCTION:

In physics and electrical design, a conductor is a kind of material that permits the stream of an electrical current in at least one direction. Materials made of metal are regular electrical conductors. Electrical current is produced by the stream of charged electrons, and positive or negative particles copper conductor was used in earlier days for transmission lines later it was replaced by aluminum conductors namely All Aluminum conductor(AAC) which was successful but the aluminum will get oxidized after few years. To overcome this disadvantage ACSR is used in grid system which is better in sag when compared to other conductors and the strength of this conductor is better.

In the blink of an eye before the turn of the century, aluminum started to replace copper as the metal of decision for transmission and distribution on account of its cost and different cons.

At the very early establishments, the usage of aluminium material has expanded relentlessly until the point when it is the material of decision for the transmission line configuration designs today. For over 90 years aluminum has been utilized by electric utilities for the transmission and distribution of electrical power. Nearly aluminum has swapped copper for overhead applications. Of all the known non-valuable metals, aluminum positions second just to copper in volume conductivity. Aluminum has a conductivity-to-weight proportion twice that of copper and its strength to-weight proportion is 30% more noteworthy than copper.

The four major types of overhead transmission conductors used for transmission as well distribution are:

- AAC - All Aluminum Conductor
- AAAC - All Aluminum Alloy Conductor
- ACSR - Aluminum Conductor Steel Reinforced
- ACAR - Aluminum Conductor Aluminum-Alloy Reinforce

ACSR - Aluminum Conductor Steel Reinforced:

At the point when aluminum conductor came into general wide use in the mid 1900's, the encounter demonstrated the requirement for a conductor with a more noteworthy strength to-weight proportion. Along these lines, in 1907 another aluminum-steel composite link was taken into account. This new conductor consolidated the light weight and high current carry limit of aluminum with the high quality of a galvanized steel.

The center can be single wire or stranded relying upon the size. Steel wire is accessible in Class A , B or Class C galvanization for rust protection. Extra erosion security is accessible through the use of oil or mixture of the finished conductor with oil.

The composition of steel and aluminum in an ACSR conductor can be chosen as per mechanical rigidity and current limit requested by every application.

ACSR conductors are perceived for their record of economy, trustworthiness and great strength/weight proportion. ACSR conductors blend the light weight and great conductivity of aluminum with the high elasticity and toughness of steel. In line plan, this can give higher strains, less sag, and longer traverse lengths than possible with most different sorts of overhead conductor.

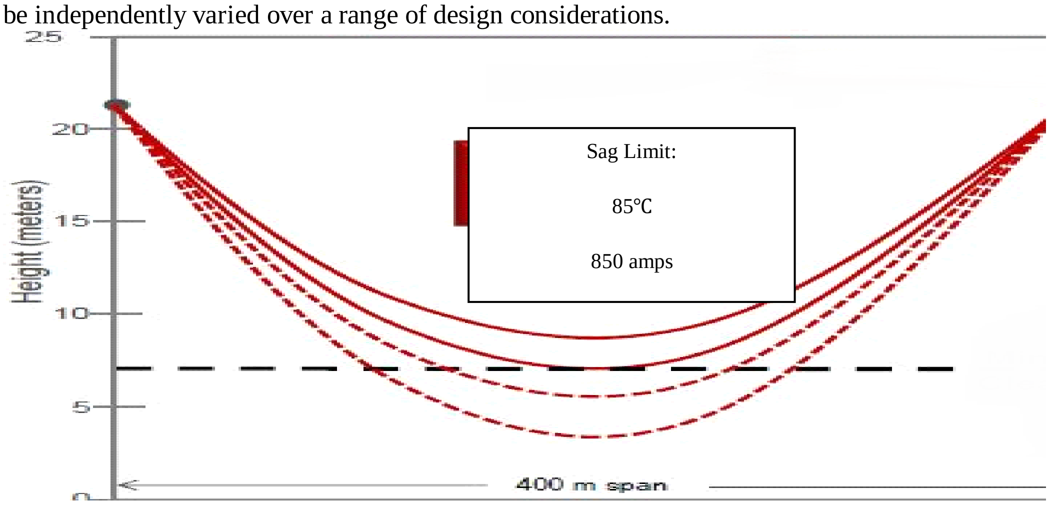
The choice of the ideal conductor and size for a given line comprises of finding that which conductor brings about the most reduced present total assets cost spread over the life of the line.By choosing a conductor type from among this bewildering assortment is confronted by the transmission line design . This decision is taken based on the material parameters.It is clear that all the major cost components of a transmission line depend upon conductor physical, mechanical and electrical parameters.

A list of these basic parameters are:

- modulus of elasticity
- maximum unloaded design tension
- resistance to vibration and/or galloping
- surface shape/drag coefficient
- coefficient of thermal expansion
- cost of material

- fatigue resistance
- conductor diameter
- weight per unit length
- conductivity of material
- cross-sectional area

The basic parameters above is not needed independent of one another. But still however, some parameters can be independently varied over a range of design considerations.



The above graph shows the general sag characteristics of a ACSR conductor.

FUTURE OF TRANSMISSION LINE

Power is the fundamental key for development of any nation's economy. The expanded request of power, need to improve power generation and increment in the interconnections are the significant issues with which control area is facing. Energy utilization per individual is additionally rising massively in developing nations immense exchange of energy from producing plants to the load located at long separation with massive transmission lines is causing to update voltage class to Extra High Voltage (EHV) from High Voltage (HV).

There are signs that EHV system will develop at a quick rate worldwide when contrasted with past couple of decades. Increment in transmission separate with greatest conceivable reduction in the financial expenses of transmission lines is the significant lift worldwide for moving from HV to EHV.

There is a requirement for data on the endeavors of EHV transmission and encounters at the time of installation. Sharing new plan ideas, tower development thoughts, task and support parts of these EHV lines will help in dodging duplication of endeavors.

Why EHV

The world will require expanded vitality supply in the following 20 years. The usage of power is expanding twice as quick as general vitality utilize and is probably going to ascend by more than 66% till 2035.

In 2012, 42% of essential vitality utilized was changed into power. With the United Nations anticipating total populace development from 6.7 billion in 2011 to 8.7 billion by 2035, interest for energy should have increased by finished that period. Both populace development and expanding ways of life for some individuals in developing nations will cause solid development in power demand. More than 70% of the expanded power request is from creating nations, drove by China and India – China surpassed the USA as best CO2 producer in 2007. Development of Power Sector framework in India since its Independence has been important in making India the third biggest power producer in Asia. Producing limit has developed complex.

The separation between producing stations and load focuses is getting expanded with the increase in power demand. The measure of energy to be dealt with in India has expanded from 11kV to 765 kV. This need is the fundamental reason behind development of EHV. EHV transmission has risen up out of different favorable circumstances like decrement in line drop and increment in transmission efficiency.

ACSR

Aluminum Conductor Composite Reinforced

This high-capability transmission conductor has a high-capacity, lightweight aluminum lattice center. The external, current-conveying strands are made out of a solidified aluminum-zirconium combination. ACCR's center furthermore, external wires are both helically stranded for more noteworthy quality, strength and conductivity.

ACCR is comparative in development and measurements to ACSR. ACCR, in any case, has a higher strength to-weight proportion and lower thermal expansion than similarly estimated steel center conductors –

It is lighter and provides less sag, even at high working temperatures. This permits higher ampacities at comparable tension and clearances. ACCR holds steady in an extensive variety of ecological conditions.

Material Properties

The Composite Conductor is a non-homogeneous material with aluminum-zirconium strands that can withstand high-temperature covered with fiber strengthened composite wires. Both the composite center and the external aluminum-zirconium (Al-Zr) strands add to the general conductor rigidity

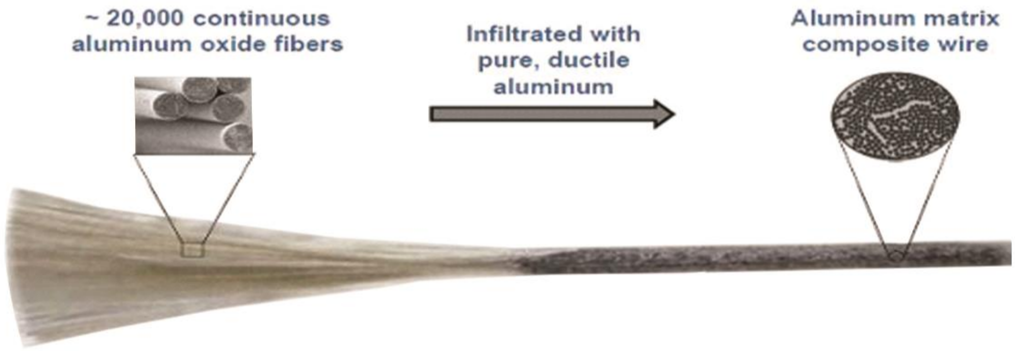
Property Comparison :ACCR (vs) ACSR/ACSS

Parameters	3M ACCR	ACSR/ACSS
Strength(ksi)	200	185
Density(lbs/in^3)	0.119	0.282
Strength/Density	1681	656
Coefficient of Thermal Expnasion(10^{-6}/°c)	3.5	6.7

Composite Core:

The composite material contains lattice composite wires with diameter between **1.87 mm to 2.94 mm**. The core wires have the strength and solidness of steel, however with much lower weight and higher conductivity. Each core wire contains numerous thousand, ultra-high-quality, micrometer-sized filaments. The strands are constant, situated toward the wire, and completely inserted inside pure aluminum. Visually, the composite wires show up as regular aluminum wires, but it shows mechanical and physical properties far better than those of aluminum and steel. For instance, the composite wire gives almost 8 times the quality of aluminum and 3 times the solidness. It weighs not as much as half of an identical section of steel, with more conductivity and not as much as a large portion of the warm extension of steel.

ACCR Composite Core Wire:



PROPERTIES OF COMPOSITE WIRE

Property	**Value**
Tensile strength	200ksi
Density	0.12lbs/in^3
Stiffness	31 Msi(215 GPa)
Conductivity	27% IACS
Thermal expansion	6×10^{-6}
Endurance	>10 million cycles at 100 ksi
Emergency Use Temperature	>300°c

COMPARISSON BETWEEN ACSR OVER ACCR

Maximum ampacity with less sag
Compared to the same diameter ACSR , ACCR can offer:
• Up to 2 times the ampacity or more
• Less thermal expansion, for **less sag** at high energy levels
• Higher strength-to-weight ratio
• Operating temperatures up to 210°C continuous and 240°C emergency*
*Emergency operating temperature for up to 1,000 hours cumulative.

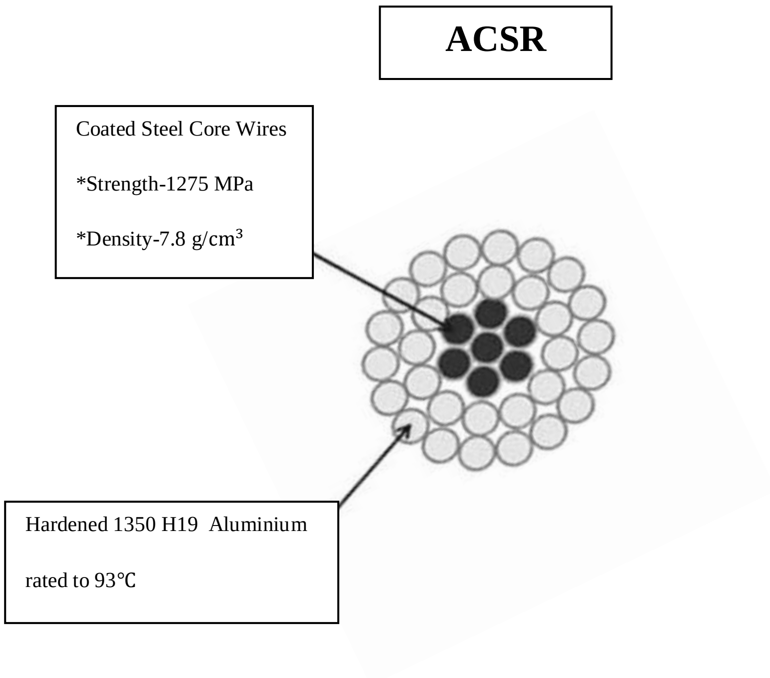
Long-term reliability
With 3M ACCR, you make no compromises on your tension and clearance standards.
Its reliability has been demonstrated around the world, with:
• Large capacity increases at the same clearances, tensions and mechanical loads

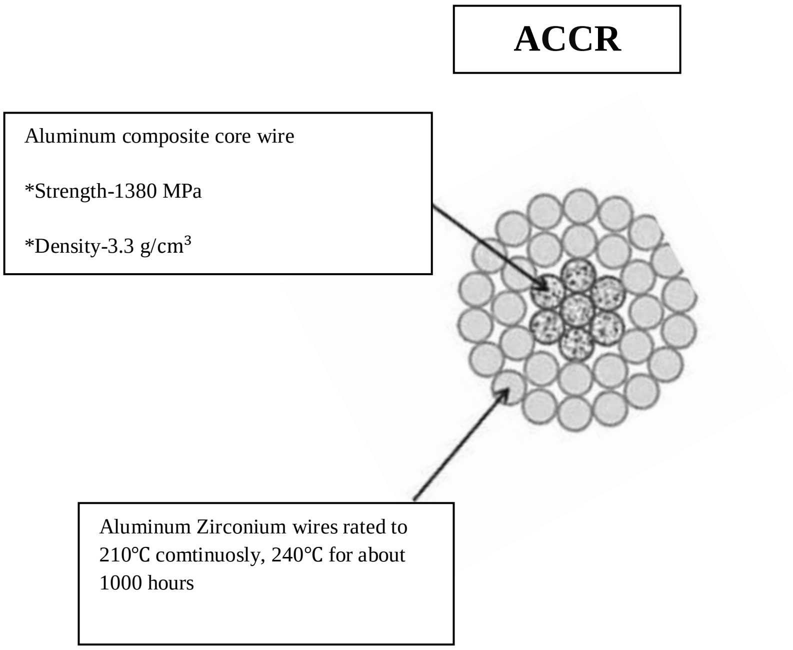
• Corrosion resistance without coatings or barriers around the core
• Durability similar to ACSR, even when operated at high temperatures over long periods in extreme environments
• Over a decade of successful, reliable operations

Fast and easy to use

ACCR was designed as a replacement for ACSR and ACSS to quickly and dramatically increase capacity on existing structures – while minimizing lengthy construction and permitting processes. Core stranding, hardware and construction procedures are similar to those for ACSR and are familiar to installers. And with small installation time, it makes easy to bring back the service as fast as possible.

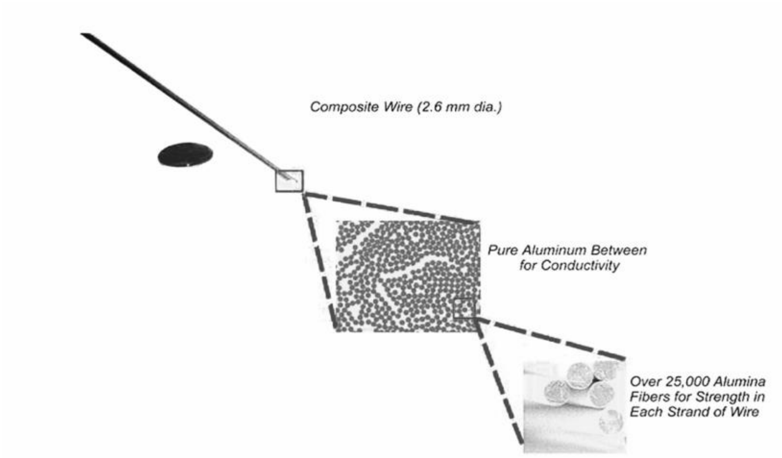
<u>Improving Performance of a Proven Conductor Design</u>





<u>Outer Strands Of an ACCR Conductor</u>:

The external strands are made from aluminum-zirconium alloy that is temperature resistant which allows operation at high temperatures between the range 210-240 degree celcius. The Al-Zr compound is a hard aluminum mix with properties and hardness like those of standard 1350-H19 aluminum however its structure is designed with the intention to keep up quality in the wake of working at high temperatures; that is, it opposes annealing. Interestingly, 1350-H19 wire quickly toughens and loses its rigidity with trips over 120– 150ºC. The Al-Zr combination wire has comparable strength and stress-strain properties compared to standard 1350-H19 aluminum



ACCR and its components have been thoroughly tested and checked to pass the standards set by ASTM, IEEE and ANSI. Test conditions included outrageous temperatures, substantial icing, overwhelming stacking and destructive airs. In all cases, 3M ACCR performed up to particulars and demonstrated that the plan coefficients precisely executed in the field.

<u>FORMULAE</u>:

Losses=$i^2 r$

$i = v/r$

$$i = \left(\frac{load}{1.1 * 11 * \sqrt{3} * 0.95}\right)$$

Where v=load

$$r = \left(\frac{distance}{1000} * resistance\ constant * 8760 * \frac{0.525}{1000}\right)$$

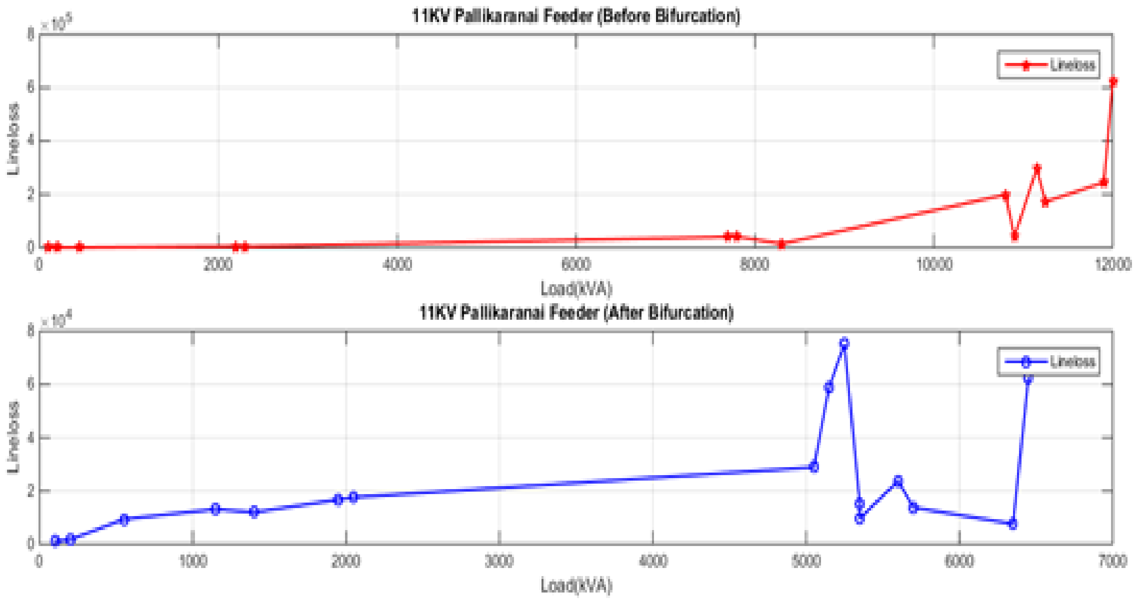
8760=hours in year

Line losses

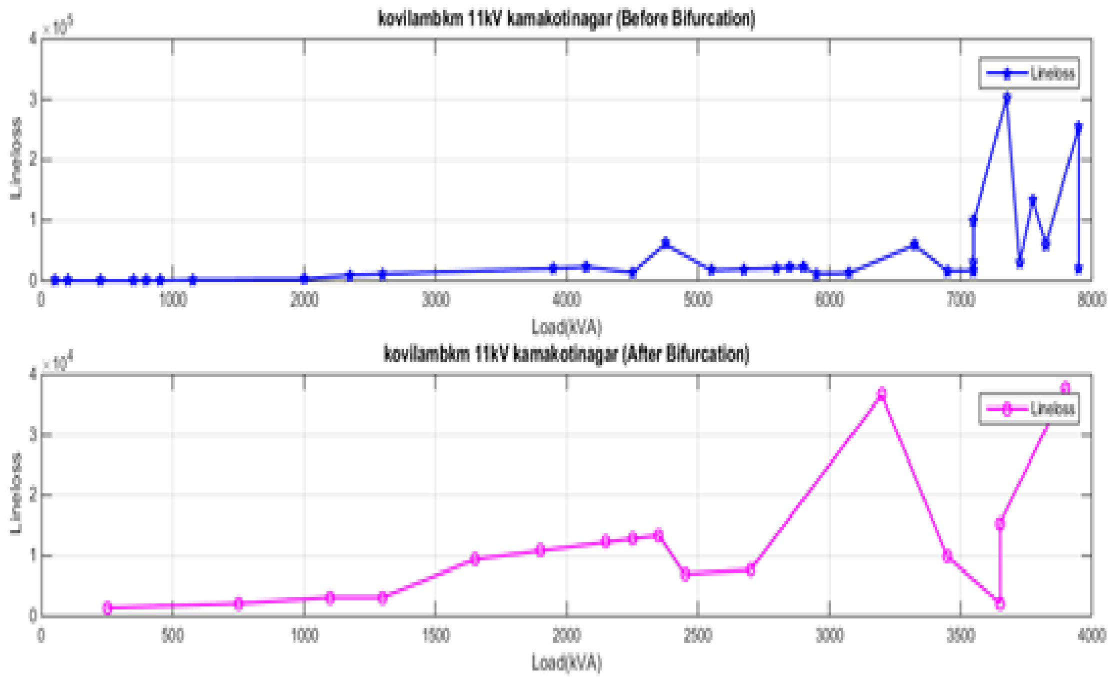
$$=\left(\frac{load}{1.1*11*\sqrt{3}*0.95}\right)^2 * \left(\frac{distance}{1000} * resistance\ constant * 8760 * \frac{0.525}{1000}\right)$$

MODEL GRAPH

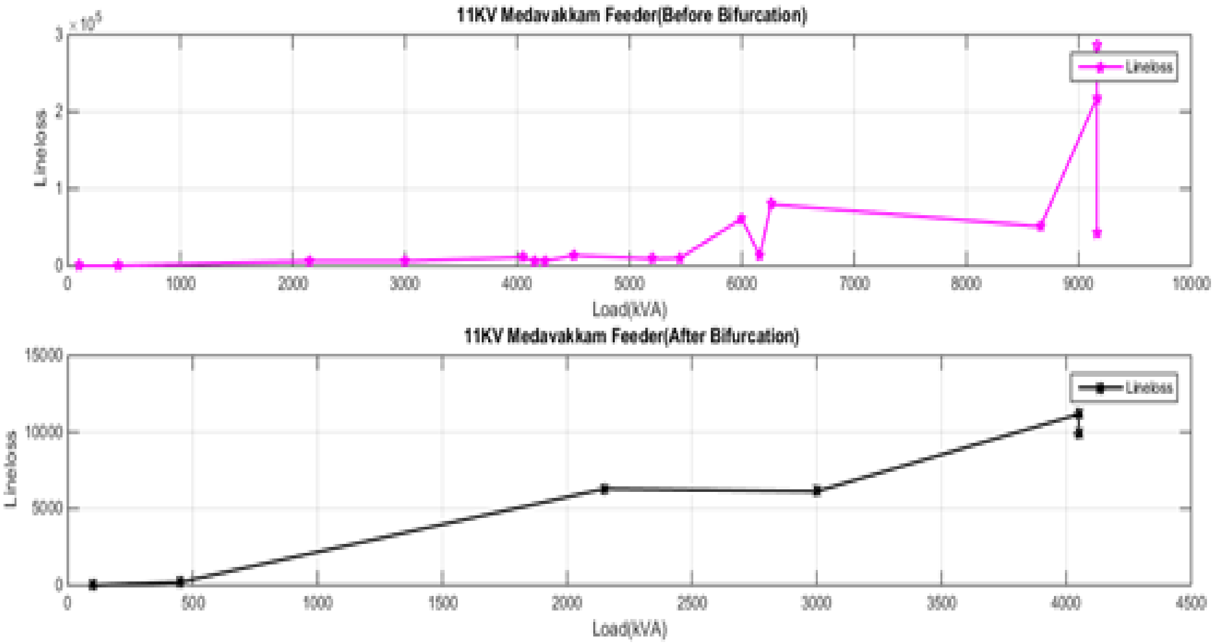
PALLIKARNAI AREA COMPARISSON



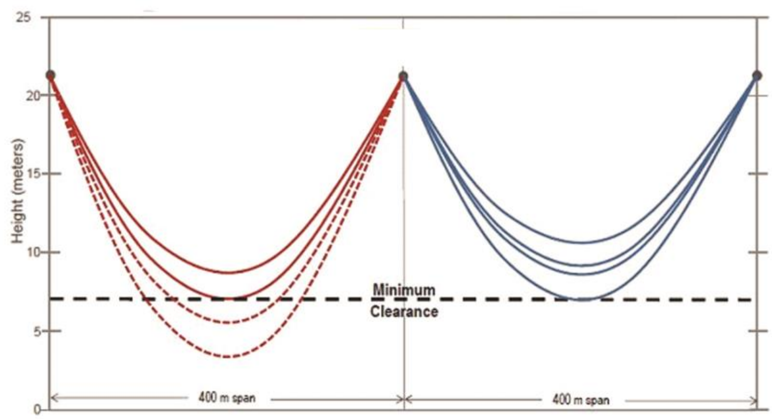
KAMAKOTINAGAR COMPARISON



MEDAVAKAM COMPARISON



Sag characteristics of ACCR when compared to ACSR



CONCLUSION:

- ACCR is found to be more efficient when compared to ACSR
- The maintenance cost of ACCR is lesser than ACSR
- Maximum ampacity when compared to ACSR with minimum sag and low thermal expansion
- Quick installation than ACSR
- ACCR can tolerate high temperatures for several hours at demanding conditions

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