

DESIGN PROJECTS 1 AND 2: SAMPLE TRANSMISSION SYSTEM DESIGN COSTS

Transmission lines (69 kV and 138 kV) New transmission lines include a fixed cost and a variable cost. The fixed cost is for the design work, the purchase/installation of the three-phase circuit breakers, associated relays, and changes to the substation bus structure. The fixed costs are **\$200,000** for a 138-kV line and **\$125,000** for a 69-kV line.

The variable costs depend on the type of conductor and the length of the line. The assumed cost in \$/km are given here.

Conductor Type	Current Rating (Amps)	138-kV Lines	69-kV Lines
Rook	770	\$250,000/km	\$200,000/km
Crow	830	\$270,000/km	\$220,000/km
Condor	900	\$290,000/km	\$240,000/km
Cardinal	1110	\$310,000/km	

Lined impedance data and MVA ratings are determined based on the conductor type and tower configuration. The conductor characteristics are given in Table A.4 of the book. For these design problems assume a symmetric tower configurations with the spacing between the conductors student specific. To find your specific value consult the table at the end of this design project.

Transformers (138 kV/69 kV) Transformer costs include associated circuit breakers, relaying and installation.

101 MVA \$950,000

187 MVA \$1,200,000

Assume any new 138/69 kV transformer has 0.0025 per unit resistance and 0.04 per unit reactance on a 100-MVA base.

Bus work

Upgrade 69-kV substation to 138/69 kV \$200,000

DESIGN PROJECT 3: SYSTEM PLANNING*

Time given: 11 weeks

Approximate time required: 40 hours

Additional references: [10, 11]

*This case is based on a project assigned by Adjunct Professor Leonard Dow at Northeastern University, Boston, Massachusetts.