

APPENDIX B:
CONSTRUCTION PROCESS FOR TRANSMISSION LINES AND
SUBSTATIONS

1. Construction Camps

The entire construction workforce is usually accommodated on a “construction camp” that will be situated at some point along the Transmission line route (refer to Photographs B1 and B2). The location is selected by the contractor who will take into account such aspects as access to the construction site, access to services, access to materials, etc. The contractor will enter into an agreement with a landowner for the establishment of the construction camp. The various teams will travel from the camp to the construction site each day. The site moves continuously with the progression of the line, so the teams will perhaps travel a greater distance to the site each time. All materials are stored at the construction camp with the exception of the steel towers (which may come direct from the factory) and concrete (unless the site is very remote, when concrete may be mixed on site). As a rule, there is usually one construction camp per 100 km of Transmission line.

2. Construction Process for Transmission Lines

The following construction process will be followed for the entire route of the new Transmission lines. Each activity will follow the previous one, such that at any one point an observer will see a chain of events with different working teams involved. At any one time, some or all of the different teams may be working at different points along the line. Construction of this line will take approximately 12 months to complete, and is anticipated to begin before the end of 2002.

Activity	Approx team size	Approx duration of activity at a point
1. Survey of the route	By air	-
2. Determination of the conductor type and Selection of best-suited conductor, towers, insulators, foundations <ul style="list-style-type: none"> • Define final centre line • Determine co-ordinates of each bend in the line • Undertake aerial survey to obtain an accurate profile of the area • Identify optimal tower sizes and positions 	-	-
3. Final design of line and placement of towers	-	-
4. Issuing of tenders, and award of contract to construction companies	-	-
5. Vegetation clearance -centre line (light vehicle access required) <ul style="list-style-type: none"> • Clear vegetation along centre line, with the aid of a surveyor • Undertake vegetation clearing in accordance with the minimum standards to be used for vegetation clearing for the construction of the proposed new Transmission lines (Eskom, 2000) 	5 - 15	1 - 2 days depending on local site conditions

Activity	Approx team size	Approx duration of activity at a point
6. Centre line pegging and identification of requirements and locations for new gate (light vehicle access required)	3	1 day
7. Access negotiations (light vehicle access required) <ul style="list-style-type: none"> • Develop and agree on an access plan (Eskom, contractor and landowner) • Agree to rehabilitation measures • Take photographs of pre-construction conditions of site • Establish access roads (where required) 	1	1 day
8. New gate installation (light vehicle access required)	5	1 day
9. Vegetation clearance (tower positions) <ul style="list-style-type: none"> • Clear four strips (40 m x 40 m square for CRS towers and 20 m x 20 m for the self-supporting towers) for assembling and erection purposes at each tower position marked 	5 - 15	1 - 2 days depending on local site conditions
10. Foundation nominations for main structure and anchors (heavy vehicle access required) <ul style="list-style-type: none"> • Check soil types to determine foundation requirements • Dig trial pits at main foundation points (usually using mechanical back-actor/auger method, although manual labour may be used) 	5	2 days
11. Excavation of foundations (heavy vehicle access required) <ul style="list-style-type: none"> • Excavate foundations of up to 4 m x 4 m square and up to 4 m deep depending on soil conditions (mechanically where access to tower sites is readily available (refer to Photograph B3), and dug by hand where access is poor) • Cover or fence off foundation pit until foundation is poured (refer to Photograph B4) 	15	2 days
12. Foundation steelwork –reinforcing (heavy vehicle access required) <ul style="list-style-type: none"> • Make up steelwork at base camp and transport to site by truck • Undertake fitting and wiring on site (limited welding on site) 	10	2 days
13. Foundation (concrete) pouring (heavy vehicle access required) <ul style="list-style-type: none"> • Shuttering • Use of standard concrete truck • Where access problems exist, mix concrete on site • 28 day period required after concrete has been laid • Heavy usage of access/service roads during this stage 	20	2 days
14. Delivery of tower steelwork (heavy vehicle access; extra long trucks used) <ul style="list-style-type: none"> • Deliver steelwork in sections and assemble on site (refer to Photograph B5) 	5	1 day

Activity	Approx team size	Approx duration of activity at a point
<ul style="list-style-type: none"> Mark access roads clearly to ensure the correct tower is delivered to each site (as towers are individually designed for each location) 		
<p>15. Assembly team/punching and painting (light vehicle access required)</p> <ul style="list-style-type: none"> Assemble steelwork on the ground Punch nuts and paint with non-corrosive paint 	10	3 days
<p>16. Erection (abnormal load vehicle access required)</p> <ul style="list-style-type: none"> Final assembly of towers by cranes (minimum of 50 tons; refer to Photograph B6) 	20	2 days
<p>17. Stringing (abnormal load vehicle access required)</p> <ul style="list-style-type: none"> Place cable drums within servitude (refer to Photograph A6) Undertake stringing in both directions (5 – 10 km can be strung from one station) Working area at each drum will be as long as 130 m, but will be within the servitude area Intensive vehicle activity is likely within the working area Pilot tractor cable will place cable on the ground Pull up cable through use of a pulley Ensure conductors never touch the ground 	50	7 days
<p>18. Sag and tension (heavy vehicle access required)</p> <ul style="list-style-type: none"> Tension the line from each station to ensure that minimum ground clearance heights are achieved (i.e. 8,4 m for 400 kV lines) 	10	3 days
<p>19. Rehabilitation (heavy and light vehicle access required)</p> <ul style="list-style-type: none"> Continuous process throughout the construction phase Will typically only commence after the first 100 towers are constructed There is a one year guarantee on the contractors work during which rehabilitation must be concluded 	5 - 15	2 – 10 days depending on local site conditions



Photograph B1: Typical construction camp



Photograph B2: Typical construction camp



Photograph B3: Drilling of foundations



Photograph B4: Cover over foundations



Photograph B5: Towers are erected on site



Photograph B6: Erection of towers by crane

3. Construction Process for Substations

The proposed extension to Grassridge Substation would be constructed in the following simplified sequence:

- Step 1:** Determination of technically feasible substation site
- Step 2:** EIA input
- Step 3:** Negotiation with affected landowners
- Step 4:** Survey of the site
- Step 5:** Design of substation
- Step 6:** Issuing of tenders and award of contract
- Step 7:** Vegetation clearance and construction of access roads (where required)
- Step 8:** Construction of terrace and foundations
- Step 9:** Assembly and erection of equipment
- Step 10:** Connection of conductors to equipment
- Step 11:** Rehabilitation of any disturbed areas and protection of erosion sensitive areas
- Step 12:** Testing and commissioning
- Step 13:** Continued maintenance