VERRIGTINGS 1970
Deel 2

Tegniese Vergadering

4 en 5 MEI 1970

Potchefstroom

Die Vereniging van Munisipale Elektrisiteits-ondernemings van Suidelike Afrika

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PRESIDENT:
H. T. Turner (Umtali).

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J. K. von Ahlften (Springs).

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R. M. O. Simpson (Durban).
A. C. T. Frantz (Cape Town).
R. W. Barton (Welkom).
G. C. Theron (Vanderbijlpark).
E. E. de Villiers (Rustenburg).

CITIES OR TOWNS REPRESENTED:
Umtali — Springs — Johannesburg — Durban
Cape Town — Welkom — Vanderbijlpark —
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REPRESENTATIVES
OF THE REGIONAL BRANCHES:
Natal: R. A. Paull (Empangeni).
Cape Eastern: M. P. P. Clarke (Somerset East).
Highveld: F. J. van der Merwe (Stilfontein).
Good Hope: W. P. Rattey (Strand).
Rhodesia: H. T. Turner (Umtali).

SECRETARIES:
Davidson & Ewing (Pty.) Ltd.,
P.O. Box 7462,
JOHANNESBURG.

STANDING COMMITTEE:
H. T. Turner, J. K. von Ahlften, G. C. Theron.

SUB-COMMITTEES:

Papers:
H. T. Turner, J. K. von Ahlften.

Finance:
J. K. von Ahlften (Convenor).
G. C. Theron.

Technical Training:
R. M. O. Simpson (Convenor).
D. C. Plowden.
K. G. Robson.
R. W. Barton.
E. E. de Villiers.
A. C. T. Frantz.

Rights of Supply:
R. W. Barton (Convenor).
R. M. O. Simpson.
A. C. T. Frantz.
E. E. de Villiers.

Constitution Sub-Committee:
G. C. Theron (Convenor).
H. T. Turner, J. K. von Ahlften, F. J. van der Merwe, Clr. M. P. Kotze, Clr. J. Tyers.
E. de C. Pretorius, P. J. Botes (Co-opted members)

Customs Duties:
C. Lombard, E. A. McWilliam (Alternate).

UITVOERENDE RAAD 1969—1971

PRESIDENT:
H. T. Turner (Umtali).

AANGEWESE PRESIDENT:
J. K. von Ahlften (Springs).

INGENIEUR-LEDE:
D. C. Plowden (Johannesburg).
R. M. O. Simpson (Durban).
A. C. T. Frantz (Kaapstad).
R. W. Barton (Welkom).
G. C. Theron (Vanderbijlpark).
E. E. de Villiers (Rustenburg).

STEDE OF DORPE VERTEENWOORDIG:
Umtali — Springs — Johannesburg — Durban
Kaapstad — Welkom — Vanderbijlpark —
Rustenburg.

VERTEENWOORDIGERS
VAN STREEKTAKKE.
Natal: R. A. Paull (Empangeni).
Oos-Kaapland: M. P. P. Clarke (Somerset-Oos).
Höeveld: F. J. van der Merwe (Stilfontein).
Goeie Hoop: W. P. Rattey (Strand).
Rhodesië: H. T. Turner (Umtali).

SEKRETARIAAT:
Davidson en Ewing (Edms.) Beperk,
Posbus 7462,
JOHANNESBURG.

DAGBESTUUR:
H. T. Turner, J. K. von Ahlften, G. C. Theron.

ONDERKOMITEES:

Verhandelinge:
H. T. Turner, J. K. von Ahlften.

Geldsake:
J. K. von Ahlften (Sameroeper).
G. C. Theron.

Tegniese Opleiding:
R. M. O. Simpson (Sameroeper).
D. C. Plowden.
K. G. Robson.
R. W. Barton.
E. E. de Villiers.
A. C. T. Frantz.

Voorsieningsregte:
R. W. Barton (Sameroeper).
R. M. O. Simpson.
A. C. T. Frantz.
E. E. de Villiers.

Grondwet:
G. C. Theron (Sameroeper).
H. T. Turner, J. K. von Ahlften, F. J. van der Merwe, Rdl. J. Tyers, Rdl. M. P. Kotze, E. de C. Pretorius, P. J. Botes (gekoöpteerde lede).

Doeaneregte:
C. Lombard, E. A. McWilliam (Plaasvervanger).

Co-ordination of services:

G. C. Theron (Convenor).
R. M. O. Simpson, A. C. T. Frantz.

Proposed amendments to the Electrical Wiremen and Contractors Act 1939 as amended:
R. W. Barton (Convenor).
J. K. von Ahlften, R. M. O. Simpson, J. C. Waddy (co-opted member).

REPRESENTATIVES:

Electrical Wiremens Registration Board:
J. K. von Ahlften.

Wiring Regulations Committee:
D. C. Plowden, E. E. de Villiers.

Co-ordinating Representative on S.A.B.S. Sub-Committees:

G. C. Theron.

Sub-Committee for High Voltage Laboratory Facilities:

The General Manager of the Johannesburg Electricity Department.

S.A. National Committee of the International Electro-Technical Commission:
J. K. von Ahlften.

World Energy Conference:
R. W. Barton.

Electrolysis:
The Town or Electrical Engineer in such areas where the Main and Sub-Committees are established:

S.A. National Committee on Illumination:
R. W. Barton.

Recommendations Committee for new Electrical Commodities:
R. W. Barton (Convenor).
F. J. van der Merwe.

Standing Advisory Committee on Electrical Safety:
G. C. Theron.

C.S.I.R. Advisory Committee for Electrical Engineering:
G. C. Theron.

Past Presidents/Oud-Presidente :

1915-17 J. H. Dobson (Johannesburg)*
1917-19 J. Roberts (Durban)*
1919-20 B. Sankey (Port Elizabeth)*
1920-22 T. C. W. Dod (Pretoria)*
1922-24 G. H. Swingler (Cape Town)*
1924-26 J. Roberts (Durban)*
1926-27 B. Sankey (Johannesburg)*
1927-29 J. M. Lambe (East London)*
1929-31 R. Macauley (Bloemfontein)*
1931-33 L. L. Horrell (Pretoria)*
1933-34 L. F. Bickell (Port Elizabeth)*
1935-36 G. G. Ewer (Pietermaritzburg)*

Koördinasie van dienste:

G. C. Theron (Sameroeper).
R. M. O. Simpson, A. C. T. Frantz.

Voorgestelde wysiging van die Wet op Elektrotegniese Draadwerkers en Kontrakteurs van 1939, soos gewysig:
R. W. Barton (Sameroeper).
J. K. von Ahlften, R. M. O. Simpson, J. C. Waddy (gekoöpteerde lid).

VERTEENWOORDIGERS:

Registrasieraad vir Elektrotegniese Draadwerkers:
J. K. von Ahlften.

Komitee vir Bedradingsregulasies:
D. C. Plowden, E. E. de Villiers.

Ko-ordinerende verteenwoordiger op Subkomitees van die S.A.B.S.

G. C. Theron.

Subkomitee vir Hoogspanningslaboratiumgeriewe:
Die Algemene Bestuuder van die Johannesburgse Elektrisiteitsdepartement.

S.A. Nasionale Komitee van die Internasionale Elektrotegniese Kommissie:
J. K. von Ahlften.

Wêreld-konferensie insake Energie:
R. W. Barton.

Elektrolise:
Die Stads- of Elektrotegniese Ingenieur in dié gebiede waar die Hoof en Onderkomitees gevestig is.

S.A. Nasionale Komitee vir Verligting:
R. W. Barton.

Komitee vir Aanbevelings insake Nuwe Elektriese Ware:
R. W. Barton (Sameroeper).
F. J. van der Merwe.

Vaste advieskomitee insake Elektriese Beveiliging:
G. C. Theron.

Die W.N.N.R. se Advieskomitee insake Elektrotegniese Ingenieurwese:
G. C. Theron.

Secretary and Treasurer/Sekretaris en Tesourier:

F. T. Stokes, E. T. Price
E. Poole*
E. Poole*
L. L. Horrell*
H. A. Eastman
E. Poole*
R. G. Tresise
P. Adkins*
E. Poole*
E. Poole*
F. A. P. Perrow
E. Poole*

1936-37	A. Rodwell (Johannesburg)*
1937-38	J. H. Gyles (Durban)*
1938-39	H. A. Eastman (Cape Town)
1939-44	I. J. Nicholas (Umtata)
1944-45	A. Rodwell (Johannesburg)*
1945-46	J. S. Clinton (Salisbury)
	J. W. Phillips (Bulawayo)*
1946-47	G. J. Muller (Bloemfontein)
1947-48	C. Kinsman (Durban)
1948-49	A. Foden (East London)
1949-50	D. A. Bradley (Port Elizabeth)
1950-51	C. R. Hallé (Pietermaritzburg)
1958-59	C. G. Downie (Cape Town)
1952-53	A. R. Sibson (Bulawayo)
1953-54	J. C. Fraser (Johannesburg)*
1954-55	G. J. Muller (Bloemfontein)
1955-56	D. J. Hugo (Pretoria)
1956-57	J. E. Mitchell (Salisbury)
1957-58	J. L. van der Walt (Krugersdorp)
1958-59	C. G. Downie (Cape Town)
1959-60	R. W. Kane (Johannesburg)
1960-61	R. M. O. Simpson (Durban)
1961-62	C. Lombard (Germiston)
1962-63	P. A. Giles (East London)
1963-64	J. C. Downey (Springs)
1964-65	R. W. Barton (Welkom)
1965-67	D. Murray-Nobbs
1967-69	G. C. Theron
1969-71	H. T. Turner

*Deceased/Oorlede.

All correspondence to be addressed to :
The Secretaries,
Davidson & Ewing (Pty.) Ltd.,
P.O. Box 7462, Johannesburg.
Telegrams : "Minute" Phone 834-3021

E. Poole*
E. Poole*
E. Poole*
E. Poole until 31/12/40*
L. L. Horrell, 1/1/41*
L. L. Horrell*
L. L. Horrell to 30/11/45*
A. T. Taylor, 31/12/45*
A. T. Taylor*
A. T. Taylor*
A. T. Taylor*
A. T. Taylor*
A. T. Taylor*
A. T. Taylor*
A. T. Taylor*
A. T. Taylor*
A. T. Taylor to 30/6/55*
Arthur Tingey, Ewing & Co., 1/7/55
Davidson & Ewing (Pty.) Ltd., 1/7/56
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*Deceased/Oorlede.

Rig alle korrespondensie aan :
Die Sekretariaat,
Davidson en Ewing (Edms.) Bpk.,
Posbus 7462, Johannesburg.
Telegramme : „Minute". Foon 834-3021.

LIST OF MEMBERS / LYS VAN LEDE 30-9-69

Honorary Members/Ere-Lede:

1967 Beesley, W., Box/Bus 40, Lusaka, Zambia
1949 Bradley, D. A., 9 Target Kloof Road, Port Elizabeth.*
1960 Castelyn, F. J. C., la Arboretum Avenue, Bloemfontein.*
1963 (1944) Downey, J. C. 10 Jessop Road, Selection Park, Springs.*
1963 (1947) Downie, C. G., 25 Rectory Gardens, Broadwater, Worthing, Sussex.*
1951 (1922) Eastman, H. A., Torwood, Parel Vallei, Somerset West, C.P.*
1948 (1938) Foden, A., 4 Hardy Road, Selborne, East London.*
1969 (1939) Giles, P. A., Box/Bus 384, Pretoria.*
1958 (1944) Hallé, C. R. Box/Bus 399, Pietermaritzburg.*
1969 (1938) Hugo, D., 252 Olivier Street, Brooklyn, Pretoria.*
1956 Jaffray, A. Morton (Alderman), 8 Fairbridge Avenue, Salisbury.
1964 (1946) Kane, R. W., 21 Kernick Avenue, Melrose North, Johannesburg.*
1954 (1938) Kinsman, C., 7 Highgate Place, Durban North.*
1967 Marais, J. D., 101 Gravenhage, Illovo, Johannesburg.
1956 (1939) Milton, W. H., c/o Electricity Supply Commission, Box/Bus 1091, Johannesburg.
1962 (1948) Mitchell, J. E., Box/Bus 487, Johannesburg.*
1964 (1934) Muller, G. J., 35 Wilcocks Road, Bloemfontein.*
1969 (1955) Murray-Nobbs, D., 4 Ascot Road, Kemsley Park, Port Elizabeth.*
1968 (1937) Smith, E. L. 23 Kellan Court, Amamzimtoti.

1962 (1935) Sibson, A. R. Box/Bus 9074, Hillside, Rhodesia.*
1967 Telles, J., Box/Bus 1861, Lourenco Marques.
1962 (1949) van der Walt, J. L., Box/Bus 1091, Johannesburg.*
1969 (1938) Wilson, J., 89 River Street, Sunnyside, Pretoria.

* Past President * Uitgetrede President

Retired Members/Afgetrede-Lede :

Campbell, A. R., Box/Bus 3, Impendhle, Natal.
Clinton, J. S., Box/Bus 4648, Johannesburg.
Marchand, B., 19 Elizabeth Avenue, Witbank.
Nicholas, I. J., c/o Municipality of Pearson.
Rossler, A., 3 Greenwood Road, Pietermaritzburg.
Rossler, W., 109 Amershan Street, Lynwood Manor, Pretoria.

Council Members/Raadslede :

1962 (1935) Adelaide, Box/Bus 38.
1946 (1917) Aliwal North, Box/Bus 46.
1948 (1934) Alberton, Box/Bus 4.
1948 Barberton, Box/Bus 33.
1935 (1926) Beaufort West, Box/Bus 9.
1961 Bedfordview, Box/Bus 3.
1935 (1917) Benoni, Box/Bus 45.
1950 (1919) Bethal, Box/Bus 3.
1944 (1915) Bethlehem, Box/Bus 130.
1939 (1917) Bloemfontein, Box/Bus 288.
1964 Bloemhof, Box/Bus 18.
1936 (1915) Boksburg, Box/Bus 215.
1945 (1927) Brandfort, Box/Bus 13.
1938 (1927) Bulawayo, Box/Bus 591.
1948 Brakpan, Box/Bus 15.
1948 Brits, Box/Bus 106.
Burgersdorp, Box/Bus 106.
1949 Bothaville, Box/Bus 12.
1966 Bredasdorp, Box/Bus 51.
1935 (1915) Cape Town, Box/Bus 298.
1935 (1916) Cradock, Box/Bus 24.
1960 Carletonville, Box/Bus 3.
1964 Carolina, Box/Bus 24.
1949 Ceres, Box/Bus 44.
1970 Delmas, Box/Bus 6.
1953 (1933) De Aar, Box/Bus 42.
1935 (1915) Durban, Box/Bus 147.
1953 Dewetsdorp, Box/Bus 13.
1962 Dundee, Box/Bus 76.
1935 (1919) East London, Box/Bus 134.
1957 Empangeni, Box/Bus 2.
1967 (1916) Ermelo, Box/Bus 48.
1948 Edenvale, Box/Bus 25.
1935 Eshowe, Box/Bus 37.
1952 Estcourt, Box/Bus 15.
1935 (1927) Fort Beaufort, Box/Bus 36.
1969 (1934) Graaf-Reinet, Box/Bus 71.
1936 (1922) George, Box/Bus 19.
1952 Germiston, Box/Bus 145.
1964 Gobabis, Box/Bus 33.
1936 (1924) Grahamstown, Box/Bus 176.
1947 (1915) Greyton, Box/Bus 71.
1970 Glencoe, Box/Bus 10.
1963 Gwelo, Box/Bus 278.
1969 Gordon's Bay, Box/Bus 3.
1948 (1915) Harrismith, Box/Bus 43.
1949 Heidelberg, Box/Bus 201.
1959 Hermanus, Box/Bus 20.
1935 (1915) Johannesburg, Box/Bus 1049.
1965 Kakamas, Box/Bus 174.
1964 Keetmanshoop, Box/Bus 25.
1952 Kempton Park, Box/Bus 13.
1935 (1917) Kimberley, Box/Bus 194.
1968 Howick, Box/Bus 5.
1935 (1916) Klerksdorp, Box/Bus 160.
1935 (1934) Kokstad, Box/Bus 8.
1951 Komga, Box/Bus 21.
1965 Koppies, Box/Bus 14.
1945 (1916) Kroonstad, Box/Bus 302.
1935 (1917) Krugersdorp, Box/Bus 94.
1954 Kenhardt, Box/Bus 15.
1960 Knysna, Box/Bus 21.
1935 (1915) Ladysmith, Box/Bus 29.
1945 Louis Trichardt, Box/Bus 96.
1937 (1927) Ladybrand, Box/Bus 64.
1970 Lichtenburg, Box/Bus 7.
1959 Lydenburg, Box/Bus 61.
1963 Makwassie, Box/Bus 2.
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1935 Matatiele, Box/Bus 35.
1964 Meyerton, Box/Bus 9.
1965 Messina, Box/Bus 44.
1939 (1929) Middelburg, C.P., Box/Bus 55.
1935 (1926) Middelburg, Tvl., Box/Bus 14.
1954 (1929) Mossel Bay, Box/Bus 25.
1945 Nelspruit, Box/Bus 45.
1948 (1915) Newcastle, Box/Bus 21.
1936 Nigel, Box/Bus 23.
1948 Odendaalsrus, Box/Bus 21.
1959 Orkney, Box/Bus 34.
1944 (1915) Oudtshoorn, Box/Bus 255.
1935 (1926) Paarl, Box/Bus 12.
1969 Phalaborwa, Box/Bus 67.
1935 (1920) Pietersburg, Box/Bus 111.
1935 (1915) Pietermaritzburg, Box/Bus 321.
1936 Piet Retief, Box/Bus 23.
1936 (1934) Port Alfred, Box/Bus 13.
1935 (1915) Port Elizabeth, Box/Bus 116.
1936 Port Shepstone, Box/Bus 5.
1948 (1915) Potchefstroom, Box/Bus 113.
1944 Potgietersrust, Box/Bus 34.
1935 (1915) Pretoria, Box/Bus 440.
1951 Parys, Box/Bus 39.
1953 Postmasburg, Box/Bus 5.
1959 Peri-Urban Areas Health Board, Box/Bus 1341, Pretoria.
1935 (1915) Queenstown, Box/Bus 113.

1935 (1929) Randfontein, Box/Bus 139.
1935 (1929) Roberston, Box/Bus 52.
1935 (1926) Roodepoort-Maraisburg, Box/Bus 217, Roodepoort.
1944 (1920) Rustenburg, Box/Bus 16.
1956 Riversdale, Box/Bus 29.
1965 Saldanha, Box/Bus 22.
1935 (1926) Salisbury, Box/Bus 1680.
1956 Sasolburg, Box/Bus 60.
1935 (1916) Somerset East, Box/Bus 21.
1948 (1927) Somerset West, Box/Bus 19.
1935 (1916) Springs, Box/Bus 45.
Stanger, Box/Bus 72.
1938 (1916) Stellenbosch, Box/Bus 17.
1935 (1915) Standerton, Box/Bus 66.
1959 Stilfontein, Box/Bus 20.
1959 (1927) Tarkastad, Box/Bus 21.
1949 The Strand, Box/Bus 3.
1957 Tzaneen, Box/Bus 24.
1963 Thabazimbi, Box/Bus 90.
1936 (1920) Uitenhage, Box/Bus 45.
1936 (1927) Umtata, Box/Bus 57.

Dates in brackets initial membership as or by Egineer. Membership not necessarily continuous.

1935 (1927) Umtali, Box/Bus 121.
1970 Upington, Box/Bus 17.
1960 Vanderbijlpark, Box/Bus 3.
1949 Ventersdorp, Box/Bus 15.
1935 Vereeniging, Box/Bus 35.
1955 Virginia, Box/Bus 156.
1947 (1929) Vrede, Box/Bus 155.
1935 Vryburg, Box/Bus 35.
1948 (1920) Vryheid, Box/Bus 57.
1960 White River, Box/Bus 2.
1955 Warmbaths, Box/Bus 48.
1956 Wellington, Box/Bus 12.
1953 Welkom, Box/Bus 708.
1953 Westonaria, Box/Bus 19.
1946 Willowmore, Box/Bus 15.
1944 (1919) Winburg, Box/Bus 26.
1945 (1924) Windhoek, Box/Bus 59.
1955 (1927) Witbank, Box/Bus 3.
1936 (1922) Worcester, Box/Bus 37.
1960 Walvis Bay, Box/Bus 2.
1964 Wolmaransstad, Box/Bus 17.

Datums in Hakies verteenwoordig eerste lidmaatskap as of deur bemiddeling van Ingenieur, Lidmaatskap nie noodwendig aaneenlopende nie.

Engineer Members/Ingenieurslede :

1947 Aalbers, C., Municipal Electrical Engineer, Box/Bus 12, Wellington, C.P.
1933 Adams, C. H., Municipal Engineer, Box/Bus 19, Somerset West, C.P.
1964 Bailey, R. V., Electrical Engineer, Box/Bus 55 Middelburg, Cape.
1965 Barnard, H., Town Electrical Engineer, Box/Bus 15, Brakpan, Tvl.
1948 Barratt, V. E. O., Municipal Electrical Engineer Box/Bus 113, Queenstown.
1970 Barnard, P. J., Electrical Engineer, Box/Bus 6, Delmas.
1971 Bamber, F. W., Deputy City Electrical Engineer Box/Bus 1803, Bulawayo.
1948 Barton, R. W, Electrical Engineer, Box/Bus 708, Welkom, O.F.S.
(Past President).
1959 Beard, G. R., Town Electrical Engineer, Box/Bus 176, Grahamstown.
1969 Bernhardi, J. L., Borough and Electrical Engineer, Box/Bus 72, Stanger.
1970 Briers, D. B., Electrical Engineer, Box/Bus 302, Kroonstad.
1970 Boyack, I. F., Deputy City Electrical Engineer, Box/Bus 423, Pretoria.
1957 Booysens, L., Town and Electrical Engineer, Box/Bus 155, Vrede, O.F.S.
1960 Boshoff, J. J., Assistant Electrical Engineer, Box/Bus 3, Vanderbijlpark.
1959 Botes, P. J., Municipal Electrical Engineer, Box/Bus 217, Roodepoort.
1958 Brown, D. C., Electrical Engineer, Box/Bus 130, Bethlehem.
1970 Brummer, J. G., Electrical Engineer, Box/Bus 17, Stellenbosch.
1959 Carpenter, B. F., Town Electrical Engineer, Box/Bus 45, Umtata.
1948 Cherry, J. R., Municipal Electrical Engineer, Box/Bus 139, Randfontein.
1956 Craig, J. S., Borough Electrical Engineer, Box/Bus 21, Newcastle.
1969 Chappell, M. J. W., Deputy City Electrical Engineer, Box/Bus 369, Port Elizabeth.
1965 Cronje, W. F., Electrical Engineer, Peri-Urban Areas Health Board, Box/Bus 1341, Pretoria.
1970 Cosser, C. L., Electrical Engineer, Box/Bus 591, Bulawayo.
1969 Catchpole, T. D., Borough Engineer, Box/Bus 5, Howick.
1956 Dawson, J. D., Municipal Electrical Engineer, Box/Bus 45, Uitenhage.
1955 De Villiers, E. E., City Electrical Engineer, Box/Bus 16, Rustenburg.
1964 De Villiers, S. de V., Municipal Electrical Engineer, Box/Bus 44, Ceres.
1957 Dreyer, H. C., Electrical Engineer, Box/Bus 12, Paarl.
1950 Dreyer, L., Municipal Electrical Engineer, Box/Bus 19, Westonaria.

1963 Du Plooy, D. P., Electrical Engineer, Box/Bus 45, Nelspruit.

1963 Du Plessis, G. C., Deputy Town Electrical Engineer, Box/Bus 113, Potchefstroom.

1963 Du Toit, A. A., Municipal Electrical Engineer, Box/Bus 19, George.

1970 Forbes, G., Electrical Engineer, Box/Bus 628, Kimberley.

1957 Fohren, H., Borough Electrical Engineer, Box/Bus 37, Eshowe, Zululand.

1966 Fortman, A. H. L., Town Electrical Engineer, Box/Bus 215, Boksburg.

1961 Frantz, A. C. T., City Electrical Engineer, Box/Bus 82, Cape Town.

1952 Futcher, L., Municipal Electrical Engineer, Box/Bus 13, Kempton Park.

1965 Fraser, D. H., Deputy City Electrical Engineer, Box/Bus 147, Durban.

1968 Foden, H., Deputy City Electrical Engineer, Box/Bus 73, Salisbury.

1970 Gamble, J. S., Electrical Engineer, Box/Bus 255, Oudtshoorn.

1968 Gerber, A., Assistant Electrical and Mechanical Engineer, Box/Bus 94, Krugersdorp.

1945 Gericke, J. M., Municipal Electrical Engineer, Box/Bus 99, Klerksdorp.

1949 Halliday, K. W. J., Municipal Electrical Engineer, Box/Bus 5, Port Shepstone, Natal.

1927 Harvey, A. Q., Town Electrical Engineer, Box/Bus 96, Louis Trichardt.

1953 Hatwich, A. H. J., Town & Electrical Engineer, Box/Bus 13, Dewetsdorp, O.F.S.

1970 Hess, I. H., Senior Assistant Electrical Engineer Box/Bus 82, Cape Town.

1965 Heydenrych, J. E., Electrical Engineer, Box/Bus 14, Middelburg.

1956 Hobbs, I. L., Town Electrical Engineer, Box/Bus 45, Uitenhage.

1944 Inglis, J. I., Town Electrical & Water Engineer, Box/Bus 111, Pietersburg.

1949 Kirberger, M. N., Town Electrical Engineer, Box/Bus 3, Bethal, Tvl.

1959 Koeslag, H. J., Electrical Engineer, Box/Bus 52, Robertson.

1949 Kruger, M. J. C., Municipal Electrical Engineer Box/Bus 13, Port Alfred.

1956 Lewis, L., Town Electrical Engineer, Box/Bus 59, Windhoek, S.W.A.

1947 Lombard, C., City Electrical Engineer, Box/Bus 145, Germiston,. (Past President).

1944 Lotter, G. A., Town Electrical Engineer, Box/Bus 34, Potgietersrust, Tvl.

1966 Louw, H. A. L., Asst. Electrical Engineer, Box/Bus 12, Paarl, C.P.

1970 Loubser, J. A., Electrical Engineer, Box/Bus 1014, Benoni.

1955 Lynch, E. C., City Electrical Engineer, Box/Bus 73, Salisbury, Rhodesia.

1948 McIntyre, H. A., Assistant Town Electrical Engineer, Box/Bus 35, Vereeniging.

1954 McNeil, J. L., Town Electrical Engineer, Box/Bus 8, Kokstad.

1968 McWilliam, E. A., City Electrical Engineer, Box/Bus 423, Pretoria.

1945 Meintjies, P. A., Municipal Electrical Engineer, Box/Bus 16, Rustenburg, Tvl.

1952 Millen, T. J., Town and Electrical Engineer, Box/Bus 24, Tzaneen, Tvl.

1929 Mocke, T. M., Town and Electrical Engineer, Box/Bus 23, Piet Retief, Tvl.

1969 Mostert, S. A., Electrical Engineer, Box/Bus 9, Beaufort West.

1968 Murphy, K. J., Municipal Electrical Engineer, Box/Bus 24, Cradock.

1964 Odendaal, M. W., Town Electrical Engineer, Box/Bus 4, Alberton, Tvl.

1957 Paull, R. A., Borough and Electrical Engineer, Box/Bus 2, Empangeni.

1963 Peters, A. G., Town Electrical Engineer, Box/Bus 278, Gwelo, Rhodesia.

1951 Pretorius, D. R., Town Electrical Engineer, Box/Bus 39, Parys, O.F.S.

1952 Pretorius, E. de C., Electrical Engineer, Box/Bus 113, Potchefstroom, Tvl.

1960 Pretorius, J. W., Assistant Electrical Engineer, Box/Bus 23, Nigel, Tvl.

1969 Phillips, F. W., Town Electrical Engineer, Box/Bus 25, Mossel Bay.

1968 Psotta, K. U., Elektrotegniese Ingenieur, Box/Bus 25, Keetmanshoop.

1969 Plowden, D. C., Deputy General Manager, Box/Bus 699, Johannesburg.

Potgeiter, N. A., Electrical Engineer, Box/Bus 66, Standerton.

1961 Rattey, W. P., Electrical Engineer, Box/Bus 3, Strand.

1957 Rautenbach, G. F., Electrical Engineer, Box/Bus 99, Klerksdorp.

1948 Reyneke, G. M., Town Electrical Engineer, Box/Bus 26, Winburg.

1966 Robertson, F. H., Electrical Engineer, Box/Bus 19, George, C.P.

1968 Robson, K. G., City Electrical Engineer, Box/Bus 529, East London.

1944 Rush, W., Borough Electrical Engineer, Box/Bus 76, Dundee.

1953 Simpson, R. M. O., City Electrical Engineer Box/Bus 147, Durban, Natal. (Past President).

1934 Stevens, F., Borough Electrical Engineer, Box/Bus 29, Ladysmith, Natal.

1965 Strauss, J. C., Town Electrical Engineer, Box/Bus 60, Sasolburg, O.F.S.

1956 Sulter, F. J., Assistant Electrical Engineer, Box/Bus 145, Germiston, Tvl.

1962 Surtees, E. H., Assistant Electrical Engineer, Box/Bus 215, Boksburg.

1968 Snyman, J. C., Town Electrical Engineer, Box/Bus

1962 Te Brugge, E. J., Town Electrical Engineer, Box/Bus 42, Mafeking, C.P.

1970 Ten Cate, J. I., Town Electrical Engineer, Box/Bus 7, Lichtenburg.

1946 Theron, G. C., Town Electrical Engineer, Box/Bus 3, Vanderbijlpark, Tvl.

1945 Theron, W. C., Municipal Electrical Engineer, Box/Bus 37, Worcester, C.P.

1966 Trautmann, E. P. E. W., Town Electrical Engineer, Box/Bus 15, Estcourt.

1950 Turnbull, A. F., Town Electrical Engineer, Box/Bus 35, Vereeniging, Tvl.

1931 Turner, H. T., Town Electrical Engineer, Box/Bus 121, Umtali, Rhodesia.

1964 Van den Berg, A. J., Town Electrical Engineer, Box/Bus 94, Krugersdorp, Tvl.

1964 Van der Merwe, D. S., Electrical Engineer, Box/Bus 3, Witbank.

1955 Van der Merwe, F. J., Municipal Electrical Engineer, Box/Bus 3, Carltonville.

1957 Van Heerden, W. J., Electrical Engineer, Box/Bus 201, Heidelberg, Tvl.

1956 Van Meerdervoort, J. K. L. Pompe, Town Electrical Engineer, Box/Bus 33, Barberton.

1967 Van Schalkwyk, A. P., Deputy City Electrical Engineer, Box/Bus 288, Bloemfontein, O.F.S.

1965 Van Wyk, A. A., Town Electrical Engineer, Box/Bus 9, Meyerton, Tvl.

1966 Van Wyk, Schoombee, Electrical Engineer, BoxBus

1945 Vergottini, P. L., Town and Electrical Engineer, Box/Bus 48, Warmbaths.

1951 Verschoor, D. R., Town & Electrical Engineer, Box/Bus 36, Fort Beaufort, C.P.

1957 Von Ahlften, J. K., Town Electrical Engineer, Box/Bus 45, Springs, Tvl.

1954 Waddy, J. C., City Electrical Engineer, Box/Bus 399, Pietermaritzburg.

1952 Williams, A. H., Assistant Electrical Engineer, Box/Bus 45, Springs.

Technical Associates / Tegniese-Geassosieerders :

1965 Barnard, W., Assistant General Manager, (Technical Administration) Electricity Department, Box/Bus 699, Johannesburg.

1968 Brink, H. J., Section Engineer, Generation, Box/Bus 288, Bloemfontein.

1968 De Vries, G. S., Section Engineer, Distribution, Box/Bus 288 Bloemfontein.

1968 Reichert, W. J., Assistant Electrical Engineer, Box/Bus 20, Stilfontein.

1970 Leigh, R. A., Assistant Manager, Electricity Department, Box/Bus 699, Johannesburg.

Associates / Geassosieerders :

1970 Buisset, J. A., Electrical Engineer, Box/Bus 34, Orkney.

1968 Dauth, W. J., Town Electrical Engineer, Box/Bus 5, Postmasburg.

1965 De Bryn, Town Electrical Engineer, Box/Bus 17, Willowmore, C.P.

1962 De Witt, F., Electrical Engineer, Box/Bus 38, Adelaide, C.P.

1969 Goussard, P. J., Hoof Eliktrisiën, Box/Bus 14, Koppies.

1966 Hugo, J. C., Electrical Engineer, Box/Bus 51, Bredasdorp.

1962 Huysamen, G. A., Electrical Engineer, Box/Bus 13, Victoria West.

1969 Jantzen, G. H., Town Electrical Engineer, Box/Bus 206, Aliwal North.

1966 Jooste, P. M., Electrical Engineer, Box/Bus 44, Messina.

1959 Laas, C. P., Electrical Engineer, Box/Bus 15, Kenhardt.

1969 Louw, A., Town Electrical Engineer, Box/Bus

Lochner, J. van S., Electrical Engineer, Box/Bus 106, Brits.

1956 McNamara, A. B., Electrical Engineer, Box/Bus 21, Komga, C.P.

Munro, J. A., Town Electrical Engineer, Box/Bus 18, Bloemhof.

1970 Neuwenhuis, J., Electrical Engineer, Box/Bus 17, Wolmaransstad.

1969 Nieuwenhuis, J. F., Electrical Engineer, Box/Bus 17, Wolmaransstad.

1969 Opperman, D. J., Deputy Electrical Engineer, Box/Bus 45, Springs.

1970 Pagel, P. V. E., Electrical Engineer, Box/Bus 174, Kakamas.

1969 Pretorius, P. J. R., Town Electrical Engineer, Box/Bus 35, Vryburg.

1969 Pieterse, A. C., Electrical Engineer, Box/Bus 64, Ladybrand.

1969 Pollock, T., Electrical Engineer, Box/Bus 3, Gordon's Bay.

1970 Small, C. T. R., Electrical Engineer, Box/Bus 29, Riversdale.

1970 Smith, F. H., Electrical Engineer, Box/Bus 42, Despatch.

1970 Swart, T. L., Electrical Engineer, Box/Bus 10, Glencoe.

1962 Van der Schyff, G. W., Town Electrical Engineer, Box/Bus 3, Bedfordview.

Associate Members / Verbonde Lede :

1946 Andrew, W. N., 7 Tainton Avenue, Bonnie Doon, East London.

1951 Attridge, W. H., Box/Bus 412, Sasolburg, O.F.S.

1964 Barrie, J. J., 82 First Avenue, Dunvegan, Edenvale.

1944 Burton, C. R., 54 Memorial Road, Kimberley.

1960 Bozyczko, W. B., 2 Hans Merensky Street, P.O. Swartklip, Tvl.

1955 Clarke, M. P. P. Deputy Borough Electrical Engineer, Box/Bus 21, Newcastle.

1948 Conradie, D. J. R., Box/Bus 1009, Bloemfontein

1954 Coetzee, F. J., Box/Bus 3, Vanderbijlpark.

1934 Dawson, C., Electricity Supply Commission, Box/Bus 2408, Durban.

1957 Dunstan, R. S., P.O. Box 5001, Walmer, C.P.

1950 Erikson, J. G. F., Box/Bus 24, Margate.

1960 Ford, W. P., Box/Bus 40, Lusaka, Zambia.

1953 Haig-Smith, D., Assistant Municipal Electrical Engineer, Box/Bus 113, Queenstown. (Previously of Cradock).

1936 Heasman, G. G., Box/Bus 77, Fort Victoria, Rhodesia.

1962 Honiball, G. T., 111 Church Street, Kempton Park, Tvl.

1970 Jones, J. N., P.O. Box 1803, Bulawayo.

1962 Liebenberg, S. J., Electrical and Mechanical Engineer, Department of Bantu Administration and Development, Box/Bus 384, Pretoria.

1960 McGibbon, J., Box/Bus 164, Carltonville.

1948 Matthews, J. A., Box/Bus 616, Kimberley.

1946 Mole, E. W., Box/Bus 118, Bramley, Johannesburg.

1926 Muller, H. M. S., Box/Bus 112, Upington, C.P.

1961 Magowan, J. M., Rhodesia Electricity Supply Commission, Box/Bus 377, Salisbury.

1966 Thackewray, W. G., c/o Golden Crest Hotel, 57 Abel Road, Berea, Johannesburg.

1948 Woolridge, W. E. L., Box/Bus 24, Harding, Natal.

1947 Williams, J. T., Box/Bus 1617, Pretoria.

1946 Wylie, R. J. S., c/o E.S.C. Rand Undertaking, Box/Bus 103, Germiston.

1957 Zeederberg, T. D., 43 Jack Hindon Street, Pretoria North.

Affiliates/Geaffileerders :

1959 AEG South Africa (Pty.) Ltd., Box/Bus 10264, Johannesburg.

1957 Aberdare Cables (Africa) Ltd., Box/Bus 494, Port Elizabeth.

1957 Adams, Ripley and Dürr, Box/Bus 31126, Braamfontein.

1957 African Cables, Ltd., Box/Bus 9909, Johannesburg.

1969 Amalgamated Power Engineering S.A. (Pty.) Ltd., Box/Bus 38196, Booysens, Johannesburg.

1959 African Explosives & Chemical Industries, Ltd., Box/Bus 1122, Johannesburg.

1962 African Wire Ropes, Ltd., Box/Bus 72, Cleveland.

1957 Allenwest S.A. (Pty.) Ltd., Box/Bus 6168, Johannesburg.

1957 Alcan Aluminium of S.A. Ltd., Box/Bus 2430, Johannesburg.

1957 Arthur Trevor Williams (Pty.) Ltd., Box/Bus 2873, Johanntsburg.

1959 Asea Electric (Pty.) Ltd., Box/Bus 691, Pretoria

1970 Austevens Enterprises (Pty.) Ltd., Box/Bus 172, Florida.

1957 Aycliffe Cables Ltd., Box/Bus 5244, Johannesburg.

1965 Ballenden and Robb, Box/Bus 4648, Johannesburg.

1963 Bell, Harold E. (Pty.) Ltd., Box/Bus 6906, Johannesburg.

1957 Babcock & Wilcox of Africa Ltd., Box/Bus 4561, Johannesburg.

1957 Brian Colquhoun O'Donnell & Partners (Rhodesia), 10th Floor, Chester House, Speke Ave., Salisbury.

1959 British Insulated Callender's Cables S.A. Ltd., Box/Bus 2827, Johannesburg.

1936 W. R. Burnett (Pty.) Ltd., Box/Bus 358, Johannesburg.

1969 Biderman, Finn, Beekhuizen & Preen, Box/Bus 1339, Johannesburg.

1970 Carst, Walker Chemicals (Pty.) Ltd., Box/Bus 5500, Johannesburg.

1970 Chemilite (Pty.) Ltd., Box/Bus 25720, Johannesburg.

1957 Chloride Electrical Storage Co. S.A. (Pty.) Ltd., Box/Bus 39264, Bramley, Tvl.

1957 C.M.B. Engineering Co. (Pty.) Ltd., Box/Bus 25655, Denver, Johannesburg.

1959 Construction Electric Co. (Pty.) Ltd., Box/Bus 10100, Johannesburg.

1964 Clinksales, Maughan-Brown & Partners, Box/Bus 196, Port Elizabeth.

1957 Crompton Parkinson S.A. (Pty.) Ltd., Box/Bus 4236, Johannesburg.

1965 Cullinan Refractors Ltd., P.O. Olifantsfontein, Tvl.

1957 Davidson & Co. (Africa) (Pty.) Ltd., Box/Bus 616, Springs.

1957 Dowson & Dobson Ltd., Box/Bus 7764, Johannesburg, Tvl.

1959 Ian Drewett, Box/Bus 35, Johannesburg, Tvl.

1970 Dulmison Preformed Line Products S.A. (Pty.) Ltd., 37 Carbis Road, Scottsville, Pietermaritzburg.

1969 Eberhard-Martin (Pty.) Ltd., Box/Bus 128, Roosevelt Park.

1959 Electrical Contractors Association (South Africa), Box/Bus 5327, Johanntsburg.

1966 Electrical Protection Co., Box/Bus 570, Benoni.

1957 Enfield Cables (S.A.) Ltd., Box/Bus 5289, Johannesburg, Tvl.

1961 Farad (Pty.) Ltd., Box/Bus 31220, Braamfontein, Transvaal.

1957 First Electric Corp. of S.A., Box/Bus 13024, Knights, Tvl.

1968 Fluorescent Lighting Corp. S.A. (Pty.) Ltd., Box/Bus 7148, Johannesburg.

1957 Fuchs Electrical Industries Ltd., Box/Bus 758, Alberton, Transvaal.

1969 G.E.C.—English Electric of S.A. (Pty.) Ltd., Box/Bus 2387, Johannesburg.
(named changed).

1958 G.E.C.—A.E.I. of S.A. (Pty.) Ltd., Box/Bus 2406, Johannesburg, Transvaal.

1957 W. T. Glover & Co. Ltd., Box/Bus 1386, Johannesburg, Transvaal.

1957 E. Green & Son S.A. (Pty.) Ltd., 402 Gloucester House, Rissik Street, Johannesburg.

1960 Hawker Siddeley Brush (Southern Africa) Ltd., Box/Bus 67, Germiston.

1970 Hawker Siddeley Electric A.T.W. (Pty.) Ltd., Box/Bus 417, Roodepoort.

1957 Heinnemann Electric (S.A.) Ltd., Box/Bus 99, Bramley, Tvl.

1957 Hopkinsons S.A. (Pty.) Ltd., Box/Bus 11029, Johannesburg, Tvl.

1957 Hubert Davies & Co. Ltd., Box/Bus 1386, Johannesburg, Tvl.

1962 A. Jackson, Box/Bus 4814, Cape Town, C.P.

1957 John Thompson (S.A.) (Pty.) Ltd., Box/Bus 31660, Braamfontein.

1957 R. T. Jones, Esq., 43 The Avenue, Orchards, Johannesburg.

1968 Kantey, Templar, Loteryman and de Kroon, Room 2, Tudor Court, 4 St. Matthew's Road, East London.
(name changed).

1967 Keen's Electrical Distributors (Pty.) Ltd., Box/Bus 2656, Johannesburg.

1957 Harold Marthinusen & Co. (Pty.) Ltd., Box/Bus 469, Johannesburg, Tvl.

1957 L. H. Marthinusen Ltd., Box/Bus 25664, Denver Tvl.

1967 Marthinusen & Coutts (Pty.) Ltd., Box/Bus 469, Johannesburg, Tvl.

1957 Merz & McLellan, Box/Bus 31012, Braamfontein.

1959 N.V. Nederlandsche Kabelfabrieken Ltd., Box/Bus 494, Port Elizabeth.

1957 Oerlikon S.A. (Pty.) Ltd. Box/Bus 27072, Johannesburg.

1957 C. A. Parsons & Co. (S.A. (Pty.) Ltd., Box/Bus 3425, Johannesburg, Tvl.

1963 Pratley Manufacturing and Engineering Co. (Pty.) Ltd., Box/Bus 55, Luippaardsvlei, Tvl.

1957 Reunert & Lenz Ltd., Box/Bus 92, Johannesburg.

1957 A. Reyrolle & Co. Ltd., Box/Bus 8080, Elandsfontein.

1960 A. Reyrolle & Co. (Rhodesia) Ltd., Box/Bus 1975, Salisbury, Rhodesia.

1957 Rice and Diethelm Ltd., Box/Bus 930, Johannesburg.

1967 G. S. Rogers (Pty.) Ltd., Box/Bus 3667, Johannesburg.

1969 Simplex Electric of S.A. (Pty.) Ltd., Box/Bus 7035, Johannesburg.

1957 Scottish Cables (S.A.) Ltd., Box/Bus 2882, Johannesburg.

1961 Simon Lodge (Pty.) Ltd., Box/Bus 9599, Johannesburg.
(name changed).

1960 Siemens S.A. (Pty.) Ltd., Box/Bus 4583, Johannesburg.

1970 Steam and Mining Equipment (Pty.) Ltd., Box/Bus 1039, Johannesburg.

1957 Stone-Stamcor (Pty.) Ltd., Box/Bus 50292, Randburg, Tvl.

1957 Superconcrete Pices (Pty.) Ltd., Box/Bus 92, Roodepoort, Tvl.

1957 Switchcraft (Pty.) Ltd., Box/Bus 6444 Johannesburg.

1960 South Wales Electric (Pty.) Ltd., Box/Bus 426, Kempton Park.

1957 Southern African Cable Makers' Association, Box/Bus 2258, Johannesburg.

1967 S.A. National Committee on Illumination, Box/Bus 395, Pretoria.

1960 Thorn Lighting S.A. (Pty.) Ltd., Box/Bus 43075, Industria.

1969 Wardle & Simpson, 3rd Floor, South West House, Main Street, Port Ellzabeth.

1965 G. D. Wiehahn, Box/Bus 664, Bethlehem.

1957 Wilson & Herd (Pty.) Ltd., Box/Bus 3093, Johannesburg.

1957 Yarrow Africa (Pty.) Ltd., Box/Bus 6918, Johannesburg.

1959 Yorkshire Transformers (S.A.) (Pty.) Ltd., Box/Bus 43, Bedfordview.

LIST OF MEMBERS, COUNCIL MEMBERS AND VISITORS ATTENDING THE 1970 TECHNICAL MEETING OF THE ASSOCIATION OF MUNICIPAL ELECTRICITY UNDERTAKINGS AT POTCHEFSTROOM

LYS VAN LEDE, RAADSLEDE EN BESOEKERS — 1970 TEGNIESE VERGADERING VAN MUNISIPALE ELEKTRISITEITSONDERNEMINGS NA POTCHEFSTROOM

COUNCIL AND ENGINEER MEMBERS

(Name of Councillor appears first except where only Engineer attended).

RAAD EN INGENIEUR-LEDE

(Die naam van die Raadslid verskyn eerste, behalwe waar slegs die Ingenieur die vergadering bygewoon het).

BRAKPAN
H. Barnard.

BETHAL:
M. N. Kirberger.

BLOEMFONTEIN:
A. P. van Schalkwyk.

BOKSBURG:
A. H. L. Fortman.

BULAWAYO:
C. L. Cosser.

CRADOCK:
K. L. Murphy.

CAPE TOWN:
A. C. T. Frantz.

CARLTONVILLE:
F. J. van der Merwe.

DE AAR:
C. P. du Plessis.

DURBAN:
D. H. Fraser.

DUNDEE:
W. G. Rush.

EMPANGENI:
R. A. Paull.

EAST LONDON:
K. G. Robson.

EDENVALE:
J. J. Barrie.

ESTCOURT:
E. Trautman.

HEIDELBERG:
W. J. B. van Heerden.

GERMISTON:
C. Lombard.

JOHANNESBURG:
D. C. Plowden.

KEETMANSHOOP:
K. U. Psotta.

KEMPTON PARK:
L. Futcher.

KLERKSDORP:
F. G. Rautenbach.

KIMBERLEY:
J. A. Loubser.

KROONSTAD:
D. Briers.

KRUGERSDORP:
A. J. van der Berg.

LADYBRANDT:
A. C. Pieterse.

LADYSMITH:
F. Stevens.

MAFEKING:
E. J. te Brugge.

MEYERTON:
S. Hewitt,
A. A. van Wyk.

MIDDELBURG:
J. E. Hëydenrych.

NEWCASTLE:
J. S. Craig.

ORKNEY:
J. A. Buisset.

PRETORIA:
I. Boyack,
E. A. McWilliam.

PORT ELIZABETH:
M. J. W. Chappel.

POSTMASBURG:
W. J. Dauth.

POTGIETERSRUS:
G. A. Lotter.

POTCHEFSTROOM:
C. de Kock,
E. de C. Pretorius,
G. C. du Plessis.

PIETERMARITZBURG:
J. C. Waddy.

PERI URBAN AREAS:
W. F. Cronjé.

QUEENSTOWN:
V. E. O. Barratt.

RANDFONTEIN:
J. A. Cherry.

ROODEPOORT:
P. J. Botes.

RUSTENBERG:
E. E. de Villiers.

STRAND:
L. P. Rattey.

SASOLBURG:
J. C. Strauss.

SALISBURY:
E. C. Lynch.

STANDERTON:
N. A. Potgieter.

SPRINGS:
J. K. von Ahlften.

STILFONTEIN:
W. J. Reichert.

SOMERSET EAST:
M. P. P. Clarke.

UMTALI:
H. T. Turner.

VANDERBIJLPARK:
L. Jamneck,
G. C. Theron.

VIRGINIA :
I. L. Hobbs.

VILJOENSKROON :
J. I. Schoombie,
N. S. Botha.

VEREENIGING :
A. F. Turnbull.

WELKOM :
Clr. H. S. C. A. v. d. Merwe,
Clr. D. R. de Wet,
R. W. Barton.

WALVIS BAY :
C. Vosloo.

WITBANK :
D. S. van der Merwe.

WESTONARIA :
L. Dreyer.

WINBURG :
G. M. Reyneke.

AFFILIATES/GEAFFILEERDES :

Organisation/Organisiasie	**Name/Naam :**	**Town/Stad**
Alcan Aluminium of S.A. Ltd.	A. H. W. Hugo	Johannesburg
African Cables Ltd.	W. N. Randell D. A. W. Holt D. F. Wills	Johannesburg
Adams, Ripley and Dürr	K. Adams H. A. Dürr	Braamfontein
A.E.G. South Africa (Pty.) Ltd.	A. Brown	Johannesburg
Ballendon and Robb	L. B. Ballendon	Johannesburg
Carst and Walker Chemicals (Pty.) Ltd.	H. Rausch	Johannesburg
Dowson and Dobson Ltd.	R. C. Foxcroft	Johannesburg
Electrical Protection Co. (Pty.) Ltd.	J. A. Pryke H. P. Smith	Benoni
Eberhardt-Martin (Pty.) Ltd.	E. B. Martin	Johannesburg
Farad (Pty.) Ltd.	G. Gerber	Braamfontein
Fuch's Electrical Industries (Pty.) Ltd.	V. Cohen N. Cornish	Alberton
G.E.C.-A.E.I. South Africa (Pty.) Ltd.	T. E. Wilkinson H. Frankel	Johannesburg
G.E.C.-English Electric of S.A. (Pty.) Ltd.	M. M. Widman P. Capra	Johannesburg
E. Green and Son	H. S. Phillips	Johannesburg
Hawker Siddeley Electric A.T.C. (Pty.) Ltd.	D. W. Crammond	Roodepoort
Heineman Electric (S.A.) Ltd.	R. G. Middlecote	Johannesburg
Hopkinsons S.A. (Pty.) Ltd.	A. D. Sayers	Johannesburg
Hubert Davies and Co. Ltd.	F. Parker	Johannesburg
A. G. Jorgensen (Pty.) Ltd.	R. G. Middlecote	Johannesburg
Merz and McLellan	T. R. J. Bishop C. E. R. Langford	Johannesburg
A. Reyrolle and Co. Ltd.	N. Kirschner	Elandsfontein
South Wales Electric (Pty.) Ltd.	I. J. Woods J. W. Bates	Johannesburg
Scottish Cables S.A. Ltd.	D. G. Sutherland P. M. H. Walter	Pietermaritzburg Johannesburg
Steam Mining Equipment (Pty.) Ltd.	J. E. Pontin	Johannesburg
Simplex Electrical of S.A. (Pty.) Ltd.	J. A. Morrison	Johannesburg
Siemens S.A. (Pty.) Ltd.	A. Biehler H. R. Menzel	Johannesburg
Thorn Lighting S.A. (Pty.) Ltd.	D. W. Young H. Hewitt	Johannesburg

VISITORS / BESOEKERS

Name/Naam :	Organisation/Organisasie :	Town/Stad :
R. B. Anderson J. D. N. van Wyk	Council for Scientific and Industrial Research/ W.N.N.R.	Pretoria
T. H. Baillie	Dept. of Public Works/Dept. van Nywerheidswese.	Pretoria
C. H. Hillis K. A. Lewis	Dept. of Posts and Telegraphs/ Dept. van Pos-en-Telegraafwese.	Pretoria
W. W. Lehmann	S.A. Railways/S.-A. Spoorweë	Johannesburg
A. A. Middlecote F. J. Prins	S.A. Bureau of Standards/S.-A. Buro van Standaarde	Pretoria
G. F. Stegman J. H. Smith J. H. Haarden	Electricity Supply Commission/ Elektrisiteitsvoorsieningkommissie	Johannesburg
J. G. Truter	Electricity Control Board/Elektrisiteitsbeheerraad	Pretoria
J. G. Wannenburg	Dept. of Labour/ Dept. van Arbeid	Pretoria
Prof. D. Midgley	Author of Paper/ Skrywer van Referaat	
H. Hewitt, Esq.	Author of Paper/ Skrywer van Referaat	
D. Hogg, Esq.	Author of Paper/ Skrywer van Referaat	

A.M.E.U. OFFICIALS / V.M.E.O. OFFISIEËLE

Name/Naam :		Town/Stad :
R. G. Ewing	Representing the Secretaries/Verteenwoordiger van die Sekretariaat	East London
H. B. Ewing	Representing the Secretaries/Verteenwoordiger van die Sekretariaat	East London
Miss E. R. Brewin	Representing the Secretaries/Verteenwoordiger van die Sekretariaat	Johannesburg

LADIES / DAMES

(Read Mrs. unless otherwise indicated) (Lees Mev. behalwe waar ander aangetoon)

Name/Naam :	Town/Stad :	Name/Naam :	Town/Stad :	Name/Naam :	Town/Stad :
T. H. Baillie	(Pretoria)	E. B. Martin	(Johannesburg)	A. P. van Schalkwyk	(Bl'mf'tein)
J. W. Bates	(Johannesburg)	K. J. Murphy	(Cradock)	W. J. B. van Heerden	(Heid'b'g)
E. E. de Villiers	(Rustenburg)	A. G. Peters	(Gwelo)	H.S.C.A. v. d. Merwe	(Welk'm)
Miss de Villiers	(Rustenburg)	H. S. Phillips	(Johannesburg)	D. S. v. d. Merwe	(Witbank)
D. H. Fraser	(Durban)				
C. Lombard	(Germiston)	W. G. Rush	(Dundee)	I. J. Woods	(Johannesburg)

APOLOGIES / VERSKONINGS

COUNCIL AND ENGINEER MEMBERS	RADE- EN INGENIEURSLEDE
Municipality of Beaufort West	Beaufort-Wes Munisipaliteit
Municipality of Dewetsdorp	Dewetsdorp Munisipaliteit
Town Board of Eshowe	Eshowe Stadsraad
Municipality of Kokstad	Kokstad Munisipaliteit
Municipality of Messina	Messina Munisipaliteit
Municipality of Mossel Bay	Mosselbaai Munisipaliteit
Municipality of Piet Retief	Piet Retief Munisipaliteiet

Municipality of Port Shepstone
Municipality of Riversdale
Municipality of Robertson
Municipality of Vryburg

Port Shepstone Munisipaliteit
Riversdale Munisipaliteit
Robertson Munisipaliteit
Vryburg Munisipaliteit

RETIRED MEMBER

I. J. Nicholas

AFTREDE LID

I. J. Nicholas

AFFILIATES

James Howden and Safanco (Africa) (Pty.) Ltd.
A. Reyrolle and Co. (Rhodesia)

GEAFFILIEERDES

James Howden and Safanco (Afrika) (Edms.) Bpk.
A. Reyrolle and Kie (Rhodesië)

VISITORS

Armaments Board — Pretoria
Atomic Energy Board — Pretoria

BESOEKERS

Krygstuidraad — Pretoria
Raad of Atoomkrag — Pretoria

The 1970 Technical Meeting of the Association was held in the Town Hall, Potchefstroom, on Monday and Tuesday, 4th and 5th May, 1970. Attendance at the Meeting was as follows: 59 Councils, represented by 7 Councillors and 60 Engineers and Associates; 39 representatives of 27 Affiliates; 16 Visitors (representing Government Departments, Public utilities and other organisations); 3 A.M.E.U. Officials—a total of 125 persons.

Die 1970 Tegniese Vergadering van die Vereniging was gehou in die Stadsaal, Potchefstroom, op Maandag en Dinsdag, 4 en 5 Mei 1970. Bywoning by die Vergadering was soos gevolg: 59 Munisipaliteite verteenwoording deur 7 Raadslede en 60 Ingenierslede en geassosieerde lidmate; 39 Verteenwoordigers van 27 ge-affilieerde ledemate; 16 Besoekers (Verteenwoordigers van Regerings-departemente, Nutsmaatskappye en ander Organisasies); 3 V.M.E.O. Amptenare—'n totaal van 125 persone.

FIRST DAY

OPENING SESSION

The proceedings were opened by the minister of the Methodist Church, Potchefstroom, with prayer.

The President, Mr. H. T. Turner (Umtali) introduced His Worship the Mayor of Potchefstroom, Cr. J. C. Oosthuizen.

In his opening address, Cllr. Oosthuizen welcomed all delegates and expressed appreciation of the choice of Potchefstroom as the venue for this Technical Meeting.

The President thanked His Worship the Mayor for his kind words and expressed appreciation to the Town Electrical Engineer, Mr. E. de C. Pretorius, for the great assistance rendered to the Association in the arrangements for the the meeting.

EERSTE DAG

OPENINGSSITTING

Die verrigtinge is met gebed geopen deur die predikant van die Metodiste Kerk, Potchefstroom.

Die President, Mnr. H. T. Turner (Umtali) stel Sy Agbare die Burgemeester van Potchefstroom, Raadslid J. C. Oosthuizen, aan die woord.

In sy openingsrede verwelkom Raadslid Oosthuizen al die afgevaardigdes en spreek sy waardering uit die feit dat Potchefstroom as vergaderplek van hierdie Tegniese Vergadering gekies is.

Die President bedank Sy Agbare die Burgemeester vir sy vriendelike woorde en spreek sy waardering uit teenoor die Elektrotegniese Stadsingenieur, Mnr. E. de C. Pretorius, vir sy groot hulp aan die Vereniging met betrekking tot die reëlings vir die vergadering.

The meeting proceeded to deal with the Members' Forum questions, as follows:

Question 1: The effect of high inductance on overhead line voltage is appreciable with disadvantageous effects on power factor coupled with a high inductance drop. The high capacitance of cables on the other hand draws a correspondingly large capacitance (leading) current, and kVA of which is roughly proportional to the system voltage and route length. To what extent do these differences in electrical characteristics, apart from any other considerations, influence the choice between overhead and underground primary and secondary transmission system?

Introduced by Mr. H. T. Turner (Umtali).

Voortgaande behandel die vergadering die vrae van die lede-forum soos volg:

Vraag 1: Hoë induktansie oefen 'n merkbare invloed op die spanning in bogdondse lyne uit, wat op sy beurt die kragfaktor nadelig beïnvloed en 'n groot induktansie-afname meebring. Aan die ander hand trek die hoë kapasitansie van kabels 'n ooreenstemmende groot kapasitansiespanning van die stelsel en die lengte van die roete. Afgesien van ander oorweginge, watter invloed oefen hierdie verskille in elektriese eienskappe 'n invloed uit op die keuses tussen bogrondse en ondergrondse primêre en sekondêre verspreidingstelsels?

Ingelei deur Mnr H. T. Turner (Umtali).

Mr H. T. Turner (Umtali) introduced the question saying:

"The effect of the high inductance on overhead line, in these days of modern expansions the difficulties of getting blocks of power in and out of areas due to the difficulty of way-leaves it is becoming more and more difficult. One has to rely greater on the method of using cable on the low voltage, high voltage and extra high voltage cable. The cost as you know of cable far exceeds the cost of overhead lines. Capital costs are initially high for cables but such installations could be based on a 40 year period as against a 30 year period for overhead lines. The way-leave problem is easier for underground cables than overhead installations. To get a really objective value of comparison, one has to consider the characteristics of the two systems.

Consideration must be given to what extent do the characteristics of current carrying of overhead lines compare to cables with their virtue of a high capacitance against the drawbacks of high inductance of overhead lines."

Mnr. H. T. Turner (Umtali) lei die vraag in en sê:

Mr. D. C. Plowden (Johannesburg) continued :

The reactance voltage of an 88kV overhead transmission line is of the order of 1% per mile at full load whereas that of a cable is considerably less, about one tenth of a per cent per mile for a typical 88kV cable. At loads near unity power factor, the difference in regulation between an overhead line and a cable is very little but the difference may be significant for systems with a lagging power factor of less than 0.8 and having long transmission distances.

In addition to the smaller voltage drop with cable transmission, there is a power factor improvement at the sending end due to the charging current of the cable, leading amongst other considerations to better utilisation of generating plant. At very high voltages the charging currents of an extensive cable system can result in a leading power factor at light loads, which might prove embarrassing in a self generating system, possibly necessitating provision for switching in reactors to counter the effect of the charging current.

At a secondary transmission voltage of 11kV the very small charging currents (1.2 amps per mile for 0.3 square inches × 3 core cable) would have a negligible effect on voltage or power factor, bearing in mind the comparatively short runs usually involved. The inductive voltage drop of an 11kV cable is only about 0.5% per mile at full load, as compared with 3% per mile for a typical 11kV overload line. This difference in inductance might, in some systems, influence the choice between an overhead or underground system.

Mnr. D. E. Plowden (Johannesburg) gaan voort deur te sê:

However, compared with economic and geographic considerations, e.g., cost of servitudes, high installation costs of cables, transmission through built up areas or rocky terrain, the influence of the electrical factors on the choice of the underground or overhead transmission is unimportant in the average municipal system.

The following table gives a comparison of the characteristics of an 88kV overhead line and the equivalent underground cable system when transmitting the same load :

10 mile long	88 kV Overhead Line	88 kV Oil Filled Cable
Conductor Size	0.15 sq. ins.	0.45 sq. ins.
Load Current	400 amps	400 amps
Load Power Factor	0.8	0.8
Sending End Voltage	88 kV	88 kV
Inductive Voltage Drop	7.95 kV	0.96 kV
Resistive Voltage Drop	2.04 kV	0.64 kV
Charging Current	2.5 amps	112 amps
Receiving End Voltage	81.6 kV	87 kV
Sending End Power Factor	0.77	0.98

Mr D. H. Fraser (Durban) referred to financial considerations. He said :

In the low tension field the cost of underground would be 1½ to 2 times that of overhead lines. When you get up to 142 kV it would be 5 or 6 times the cost of an overhead circuit and for say 275kV it could be up to 10 times.

As far as the high capacitance of underground circuits compared with overhead is concerned it is significant that in the high voltage transmission the high charging current places a definite limitation on the maximum circuit length that may be used. It may be of interest to note that the charging current on a .5 sq. inch 3 core 132kV in a cable circuit in Durban is about 12 amps per mile or about 36 amps that is 8 230kVA for the 3 mile route length. So it could be seen if the route length were about 36 miles the cable would be fully loaded carrying its over

Met verwysing na finansiële oorweginge sê Mnr. D. H. Fraser (Durban):

charging current. Where overhead line routes are not available for the transfer of large blocks of power one is then forced in all probability to go to D.C. for the cable circuits.

This high charging current with the high voltage cables can also introduce problems when you're using balanced current protection schemes at high voltage circuits.

I will agree with the previous speaker that the normal distribution voltages of 6.6 kV or 11 kV, the high cable capacitance is not likely to influence the choice.

In the low voltage range, low voltage distribution circuits where the voltage drop is an important consideration the much higher inductance of overhead circuits could influence the choice between overhead and underground and this would be particularly say where a low P.F. load would be supplied.

Another point of interest and one which has to be considered is the effect of a symmetrical conductor spacing which is normally used on low voltage circuits and this can cause serious asymmetry in the receiving end voltages and cause appreciable problems with motor phase and balance currents. This factor is also one of significance in the use of rising mains.

Mr E. E. de Villiers (Rustenburg) said:

"In die eerste plek wil ek nie praat oor ekstrahoogspanningstransmissie soos wat EVKOM en van die groter plekke het nie, maar meer van die oogpunt van die kleiner voorsiener, kleiner munisipaliteite wie se hoogspannings gewoonweg beperk is tot 6.6 of 11 kV. Die meeste plekke het ook landelike verspreiding, nie net die groter plekke nie, selfs by die kleiner plekke ook is daar 'n taamlik uitgebreide landelike verspreiding teen 11 kV. Daarom moet ek vir u sê, dit is geheel- en -al uitgesluit om ondergrondse verspreiding daar in ag te neem. Die afstande is taamlik lank en dit is geheel-en-al onekonomies, wat 'n mens ookal daar doen. Normaalweg is die tipe verbruiker wat 'n mens daar het, tipiese lanndelike verbruikers, d.w.s 'n boeregemeenskap, en daar is gewoonlik nie groot probleme nie. Wat die binnestedelike verspreiding betref, is dit my ervaring dat, van alle oogpunte beskou, is hoogspanningsverspreiding ondergrond verreweg die beste, uiteindelik ekonomies ook, as 'n mens instandhoudingskoste op die lang duur in ag neem. Ek het persoonlik nog geen groot probleme ondervind wat betref die spanningslewering aan die verbruikers nie. Die uiteindelike kragfaktor van die totale voorsiening word as gevolg van die kapasitansie van die kabels, tot 'n baie groot mate weer uitgebalanseer. U weet, daar is al vir my gesê 'n mens behoort 'n beperking te plaas op fluoriserende beligting deur verbruikers, asook op straatligte, maar ek het weer gevind dat met ondergrondse kabelverspreiding, (hoog- en laagspanning), dit eintlik 'n verkieslike tipe vrag is om te hê. Dan kry jy uiteindelik 'n baie goeie kragfaktor—tot .95 by jou kragvoorsieningspunt. Ek dink werklikwaar dat, alhoewel 'n mens hier en daar enkele probleme mag ondervind as gevolg van óf hoë induktansie of hoë kapasitansie, kan 'n mens vir uitsonderlike gevalle wel die onkoste aangaan, wanneer 'n mens al die ander voordele in ag neem. Vir my is dit dan basies 'n kwessie van die uiteindelike finansiële voordele van ondergrondse verspreiding, hoogspanning en laagspanning."

Mnr. E. E. de Villiers (Rustenburg) sê:

With reference to the position in Roodepoort Mr P. J. Botes said:

"Eerstens ons het baie min industrieë in Roodepoort en daar is nie 'n groot verskil tussen toestande vyf jaar gelede en vandag nie: nou praat ek persentasiegewys. Die 6.6 kV-stelsel en die 33 kV-stelsel was alles ondergrond, met die laagspanningsverspreiding in die vorm van bogroendse lyne. Ongeveer vyf jaar gelede het ons 'n arbeidsfaktor van .95 drywend gehad, en teen spitstye het die gestyg na 'n eenheidsarbeidsfaktor. Sedert ongeveer 5 jaar gelede het ons begin met laagspanningsverspreiding en heelwat dorpsgebiede is volgens hierdie stelsel geretikuleer. Die huidige arbeidsfaktor bly nog .95. Dit sak nie laer nie. In verband met die keuse van die tipe retikulasie op die 6.6 kV-stelsel glo ek nie dat dit so 'n groot invloed sal hê op jou keuse nie."

Met verwysing na die posisie in Roodepoort sê Mnr. P. J. Botes:

Question 4.—Many Engineers are reluctant to accept the use of I.V. underground cable with aluminium conductors in concentric neutral construction even on P.M.E. systems and in spite of the economic advantages. Is this due to conservatism, an overstressing of the possible corrosion problems or a

Vraag 4.—Baie ingenieurs is traag om die gebruik van L.S. ondergrondse kabel met aluminium geleiers in die samestelling met konsentriese neutrale geleier te aanvaar selfs in stelsels met menivuldige aarding vir beskerming en ten spyte van die ekonomiese voordele. Is dit as gevolg van konserwatisme, 'n oorbeklemtoning van die moontlike wegvretings-

lack of knowledge of new construction methods to minimise the possibility of corrosion of the aluminium forming the concentric neutral conductor?

Introduced by G. C. Theron (Vanderbijlpark).

probleme of 'n gebrek aan kennis van die nuwe vervaardigings-metodis wat bedoel is om die moontlikheid van die wegvreting van die aluminium wat die konsentriese neutrale geleier vorm, te verminder.

Ingelei deur G. C. Theron (Vanderbijlpark).

Introducing this question, Mr. G. C. Theron (Vanderbijlpark) said:

Ter inleiding van hierdie vraag sê Mnr. G. C. Theron, (Vanderbijlpark):

"There is no doubt, that the use of aluminium conductors, particularly on the larger sections, has very definite economic advantages. Savings in the order of 20% can be achieved by using aluminium conductors with thermoplastic insulation in a concentric neutral construction. And yet, this type of cable has received very limited support in South Africa.

Three reasons for this are posed in the forum question.

Six years ago it was decided to reticulate a new residential township at Vanderbijlpark using low voltage P.V.C. insulated and sheathed cable with aluminium conductors in concentric neutral construction in a P.M.E. system. This network has now been in operation for 5 years without any known troubles except in cases where the outer P.V.C. sheath had been mechanically damaged. But let us be realistic, when the outer lead sheath of a paper insulated cable is mechanically punctured, the cable also fails!

At the time the principals of the firm who did the contract were very critical of the use of aluminium and yet six months later the chairman predicted that within three years 50% of the output of this very large firm would be aluminium! It is interesting to quote a few lines from recent British technical publications.

1. **Vimpany & Woodward — Electrical Distribution:**
   "The development of the solid aluminium cable has increased the Area Board's use of aluminium to the extent that nearly all L.V. and 11kV cables now bought for Area Boards have solid or stranded aluminium conductors."

2. **Jones—Electrical Review:**
   "Much interest is now being shown in possible cable designs for use on P.M.E. systems. Possibilities are either a three-core paper insulated solid aluminium conductor cable with P.V.C. protected straight sided aluminium sheath or a three-core aluminium conductor plastic insulated cable with a concentric wave-form neutral."

The Schulmann press used in the first design is not available in this country and the second design is from France, where aluminium is exclusively used for cables.

Engineers must be discriminating particularly in these days of high pressure salesmanship, but development in the technical field is at an ever increasing pace and we should not allow our natural reluctance to change to retard the use of new techniques and materials.

It is well known that corrosion of alumnium can be very rapid under certain circumstances and in the presence of moisture. Sad stories are told in South Africa of aluminium conductors in cables distintegrating after six months. One can immediately ask whether the metal was of recognised standard and if contamination with copper had not occurred in the manufacturing process.

As far as the moisture which must be present to start corrosion is concerned the French design is such that even if the outer P.V.C. sheath is punctured a soft P.V.C. or bituminous layer surrounding the individual wires constituting the concentric neutral localises the moisture and there is no danger of losing the neutral by corrosion.

It is my view that the problems associated with aluminium conductor cables are being emphasised without due regard to the economic advantages.

There is undoubtedly as with all equipment, even an Apollo 13, a calculated risk to be taking in using aluminium conductor cables in concentric neutral construction but, when loans for reticulation schemes must be raised at rates of interest of 8 to 8½% over periods of 25 years, one must consider very carefully whether the capital savings do not outweigh the possible higher maintenance costs, if any.

Mr. H. Barnard (Brakpan) went on to say:

Voortgaande sê Mnr. H. Barnard (Brakpan):

We have recently decided that we are going to do a complete township with aluminium cables, varying in size and construction. We are going to use solid cables as well as standard aluminium cables for high tension. When you come to the actual laying of the cables you find that you have to make through joints and ending of the cables in terminations in a mini-sub and so on, and we have had very much diffi-

culty in obtaining lugs and ferrules for these types of cable.

He referred to the problem of adapting different hydraulic tools to the various manufacturers' lugs.

Voorts verwys hy na die probleem wat met betrekking tot die aanpassing van die verskillende soorte hidroliese masjiengereedskap by die verskillende vervaardigers se kloue ondervind is.

Mr. E. E. Villiers (Rustenberg) referred to a problem which had been experienced in Bloemfontein when it was believed that puncturing of the PVC sheath of concentric aluminium cable had resulted in extensive corrosion and a large footage of this cable being unusable.

Mnr. E. E. de Villiers (Rustenburg) verwys na 'n probleem wat in Bloemfontein ondervind is toe daar gegloeis dat 'n breuk in die P.V.C.-skede van konsentriese aluminiumkabel tot uitgebreide verwering gelei het, wat 'n aansienlike lengte van hierdie kabel onbruikbaar gemaak het.

Mr. A. P. van Schalkwyk (Bloemfontein) continued the discussion and stated that so far as larger sizes of aluminium cable were concerned, there had been few problems in Bloemfontein. However, it was with the smaller diameters with PVC sheath which he did not think was really intended for the type of handling it received that the major problems had been encountered.

Mnr. A. P. van Schalkwyk (Bloemfontein) sit die bespreking voort deur te sê dat daar met betrekking tot die groter groottes aluminiumkabel betreklik min probleme in Bloemfontein ondervind is. Dit is egter by die kleiner groottes kabel met P.V.C.-skedes, wat na sy mening nie werklik bedoel is vir die soort behandeling wat dit ontvang nie, waar die groot probleme ondervind is.

Mr P. J. Botes (Roodepoort) contributed to the discussion by stating the position in Roodepoort.

Mnr. P. J. Botes (Roodepoort) lewer 'n bydrae tot die bespreking deur die posisie in Roodepoort te skets.

Mr. E. B. Martin (Johannesburg) went on to say:

Mnr. E. B. Martin (Johannesburg) gaan voort deur te sê:

"The question as I see it relates to the security of these concentric neutral cables. The danger being that if you lose your neutral through corrosion and under conditions of unbalanced phase load the iron work to be installed in the houses and so on, could become live. This is a possibility and it depends upon various circumstances, the type of soil the construction of the cable and also the size of the cable. Now firstly on the question of the size of the cable. Bloemfontein have quoted two extremes, the one cable which they have been using is a .2 sq. inch cable which has a concentrate neutral of flat aluminium strip armour and if I understood Mr. Van Schalkwyk correctly, they have had a little or no trouble with large cable. The other cable was a very small cable. Now this small cable consists of one central conductor with aluminium armouring made up of a number of wires which I think are only something like .026 inches in diameter. Now this question of the size of the wire is an important fact in corrosion. The smaller the wire, the larger your surface area in relation to your cross section and when aluminium corrodes it tends to corrode in the form of deep pits. So, you have a small wire that can corrode through by the pitting action before this pitting action has a chance to arrest itself and if the wire is larger, then you have a proportionally larger cross section in relation to your surface area. So the first thing is, if you are likely to have corrosion you should not use small diameter wires, they are far more likely to break than large diameter wires. There are various methods which have been developed to try and prevent corrosion on the aluminium. Aluminium does corrode in certain types of soil and this is something which should be taken into account.

P.M.E. has been extensively used in Germany and this started off during the war of course the method that they use there is that they use a paper insulated cable with an extruded aluminium sheath. There they feel that they have the security because if the aluminium sheath were to corrode, you'd get moisture in the cable, your cable would fail and in other words it would fail safe because you wouldn't get the iron work and so on, becoming live. This idea has been pushed in Germany where they have done more work than anyone else on aluminium sheathed cables. In South Africa there is no extrusion press able to produce paper insulated cables with aluminium sheath and the tendency has been to use P.V.C. cables with aluminium armouring. The aluminium armouring can be protected by wrapping it with bitumen impregnated tape or by putting the wires in a type of bitumen plastic. The main thing is to try and use some sticky bitumen to stop moisture from running along the cable but tests which have been done on corrosion have been very inconsistent. There have been certain cases where aluminium sheaths have been fractured where there has virtually been no trouble with corrosion. Aluminium is extensively used in the soil; farmers use millions of feet of aluminium irrigation tubing which lies on the wet soil and generally speaking this stands up very well.

But I would say that as far as using the concentric wire armouring one should firstly stick to the larger sizes of cable where one has a larger wire which is going to be less liable to corrosion, one should use a cable which has some sort of corrosion inhibiting tape over the armour wires and of course one should take a little bit of extra care that this cable is not damaged while it is being laid. As far as the economics of aluminium cables are concerned, I come back to this question of the smaller sizes. There is not much cost difference on the smaller sizes of cable and one should, in thinking of aluminium, concentrate on the larger sizes. The standard practice in France where aluminium has been used extensively for power cables is that on .04 sq. inches and larger they use aluminium and on the smaller sizes they still use copper. On the big sizes one really gets a larger saving. As regards cable connectors, lugs and so on, aluminium has got certain problems. Aluminium is not a type of white copper, it is a completely different metal that has characteristics of its own. The oxide film makes jointing much more difficult. Aluminium is softer, it is not as tough as copper, and in making crimp joints, methods have been devised to overcome these problems. This has resulted in lugs of a rather larger size and of a special design and is the reason why one cannot put on crimp lugs with various types of tools. In aluminium you do have to be more careful but this is offset by the tremendous economic advantages that you do have in using aluminium cable.

Mr. J. J. Barrie (Edenvale) raised the point that of the total cost of supplying electricity, interest on capital expenditure of cables was a comparatively small proportion and he therefore favoured the use of copper.

Mnr. J. J. Barrie (Edenvale) spreek die mening uit dat die rente op die kapitale koste van kabels 'n betreklik klein gedeelte van die totale koste van die voorsiening van elektrisiteit uitmaak en dat hy derhalwe ten gunste van die gebruik van koper is.

Question 9.—Supertension schemes for small undertakings—choice of voltage.

Introduced by Mr. E. de C. Pretorius (Potchefstroom).

Vraag 9.—Super-spanningskemas vir klein ondernemings—keuse van soort spanning.

Ingelei deur Mnr. E. de C. Pretorius (Potchefstroom).

In introducing this question, Mr E. de C. Pretorius (Potchefstroom) said:

Ter inleiding van hierdie vraag sê Mnr. E. de C. Pretorius (Potchefstroom):

That the smaller undertakings (20-30 MVA) sooner or later are faced with the inevitable situation that further expansion is dependent on a super voltage reticulation.

Until fairly recently 33 kV was a very popular voltage for such a scheme. However, a number of undertakings have lately chosen 66 kV, and 88 kV is also to be considered. The question is what are the advantages and disadvantages of each of the voltages mentioned?

Mr. E. E. de Villiers (Rustenburg) said:

Mnr. E E. de Villiers (Rustenburg) sê:

Jare gelede was die gedagte as 'n kleiner voorsiener 'n hoër spanning wil retikuleer, dan gaan hy na 2.2 of 3.3 kV en dit was, (en nou praat ek van 20-25 jaar gelede) 'n taamlike hoë spanning. Eintlik as hy uitbrei na so 'n 10-12 mega-watt, dan dink hy ernstig aan 11kV of miskien 'n bietjie laer, sê 6.6. Omstandighede het egter verander en die vragte, veral verhittingsvragte, in kleiner ondernemings word al hoër. Die mense het naderhand begin wakker skrik. Dit is nie net 'n elektriese strykyster wat jy kan gebruik nie, maar elektriese stowe en ander apparaat en dan natuurlik 'n sekere mate van nywerheidsvrag wat bykoms. Die vragte het dus al hoër gestyg en ook die afstande waaroor die krag vervoer word, het al groter geword. Onder huidige omstandighede glo ek, by die kleiner ondernemings, dat as 'n mens op 'n stadium gekom het wat jy sê 6.6kV het en jy wil uitbrei, is vir my die logiese volgende stap, 22kV en daarna, indien nodig, sou ek aan die hand doen 88. U sal sien die verhouding is naastenby, wat spanning betref, sê 3½ maal na 4 maal wat 'n mens elke slag opgaan. Waar jy op 11kV begin het, gaan jy dan, wat my betref, logies na 33kV en daarna 132. Ek glo dat teen die tyd dat 33kV te laag is vir 'n munisipaliteit se doeleindes en hy moet na 'n hoër spanning gaan, kan jy hom nie meer klein noem nie. Dan is hy alreeds 'n groot plek. Dit is net die paar gedagtes en ek glo dat daardie verhouding uiteindelik as u dit in ekonomiese faktore moet omsit, dit beste sal uitwerk.

Mr. L. Futcher (Kempton Park) said that :

Approximately two years ago it was decided that our 11kV system had reached its maximum capacity and that something had to be done for the future of the rapid expansion taking place in the area. We then went ahead with the planning of a super tension scheme. The first voltage that we considered was, of course, 33, being the next voltage to 11 and we went fully into the economics of such a scheme and it was estimated that to install a 33kV scheme, the capital cost would be roughly 1,500,00. The development taking place in the area is such that our annual load growth is roughly 29% per annum, which of course gives one much food for thought and examining this, it was found that should we go to a 33kV scheme, we are not providing sufficiently for the future. We were then asked to consider a 42kV, and unfortunately when you weigh up the economics of a 42kV as opposed to a 33, one does find that 42 is non-standard so you have to buy 66kV, here anyway, you're not getting very much advantage out of that. We then considered 66. Now 66 being a standard voltage, swithgear being available it's continental standard and swi:chgear is redaily available at a reasonable price. In designing the scheme we did find that in going to 66 virtually doubling our capacity over the 33, the increase in price was from 1½ to 1.9 million. So in order to get the additional capacity from a 66kV scheme, we found that the additional R400,000 was money well spent and as a result of that we have now gone in for the 66kV scheme. We found that the continental suppliers of switchgear and cables are all very keen to quote on this voltage and I think that we have done very well. The scheme eventually will come out at very much less than 1.9 million rand. I think it will be in the order of 1.7 and we are also getting the added capacity which will see Kempton Park well supplied over a long time, well until I retire anyway.

In reply to a question, Mr. Futcher advised that they were utilising pressurised oil filled cables of roughly 2.5 sq. in. cross section.

Mnr. L. Futcher (Kempton Park) sê:

In antwoord op 'n vraag sê Mnr. Futcher dat hulle olie-gevulde drukkabel van ongeveer 2.5 vk. dm. dwarsdeursnee gebruik.

Advising the position in Roodepoort, Mr. Botes said :

In Roodepoort het ons ongeveer 1960 'n 33kV stelsel in werking gestel. Wanneer 'n mens eers gewoond is aan 6.6kV en jy skakel oor na 33kV dan dink jy jy is nou ook tussen die groot mense en dan beplan jy aan die begin, as gevolg van onkunde, vir 5 MVA transformatore. Gou-gou vind jy dat die 5 MVA transformatore onvoldoende is, en dan skakel jy oor na 10 MVA-krageenhede. Nie lank nie, dan vind jy uit hulle is ook onvoldoende en jy skakel naderhand oor na 22½ MVA-eenhede. Nou, wanneer jy daardie perke bereik, het jy 'n klomp oortollige 5 MVA-transformatore, wat by tye baie gerieflik is, maar partykeer weet jy nie wat om daarmee te doen nie. Dan ook nog, soos jou 33 kV-stelsel uitbrei terwyl jy gewoond is aan 'n 6.6 kV-stelsel, brei jy uit en jy brei uit en jy voeg by en dan het jy naderhand 'n 33 kV netwerk, wat, amper net soos jou 6.6kV, orals heen loop. Ek noem 33kV 'n gemiddelde spanning, wat egter vir ons dorpsgebied te laag is. Dit hang natuurlik ook af hoe groot jou dorpsgebied is en hoe gekonsentreerd hy is. In die geval van Roodepoort, wat van die een punt van die dorp na die ander punt ongeveer 12 myl is, vind ons dat 33kV soos die dorp op die huidige oomblik is, aan die doel beantwoord maar met die verdere uitbreidings vind ons probleme. Die gevolg is dat ek die kwessie van 'n hoër spanning ondersoek het en, sê 88 kV teenoor 33 kV opgeweeg het en ten eerste het ek die koste van oliegevulde kabels bepaal. Ek het 'n dubbelkabel beplan, lengte ongeveer 42,000 voet en wat teen 88 kV 'n 60 MVA vrag per kabel sal oordra, en gevind dat die koste ongeveer R300,000 sal wees. Ten 33 kV is die koste net vir die kabel alleen R520,000 want jy moet groter geleiers gebruik, jy moet enkelaardkabels gebruik en ek dink die geleiers moet 12 voet uitmekaar gespasieer wees. Daarom voel ek dat waar jou dorp nie gekonsentreerde dorp is wat jy met 33 kV goed kan bedien nie, is 'n hoër spanning soos 66 kV en 88kV, nodig. Dit forseer jou om in die begin groter kragsentrums daar te stel wat jou die moeite spaar om met later geleenthede weer te vergroot sodat jy naderhand weer met 'n klomp spaar transformatore sit. Ek voel dus dat 66 kV miskien 'n baie beter spanning is om mee te begin. Die groot fout wat natuurlik in Roodepoort gemaak is, is dat ons 'n 6.6 kV sekondêre stelsel het. Eerstens voel ek dat voordat met 'n 33 kV-stelsel 'n aanvang geneem was, daar net 11,000 volt oorgeskakel moes word waarna jou 88 of 66 kV-stelsel daar gestel moes word wat dan direk na 11 kV afgebring moes word. Ongelukkig besit ons nou die 6.6 kV-stelsel wat ek vir die ou dorpsgebied saam met die 6.6/33 kV-stelsel gebruik en in die nuwe stelsel be-oog ek om 88 kV direk na 11 kV daar te stel.

Mnr. Botes lig toestande in Roodepoort toe en sê:

Mr. A. A. Middlecote (S.A. Bureau of Standards) referred to the desirability of having a set of standard voltages which would fit in best both internationally and nationally.

Mr. C. E. R. Langford (Johannesburg) considered that the choice of voltage depended to a great extent upon the rate of growth of the undertaking:

With an extraordinarily high rate of growth then the higher voltages one can go to, the better. With a normal rate of growth shall we say 6% to 8% then it is a question of how long the high next higher voltages is going to last. Presuming that an undertaking has an 11kV reticulation system, this will be good to distribute between 20 and 30 MVA. When purchasing 30 MVA you've got to go higher voltage. Economically the next higher voltage probably is 33kV. With 33kV at a single point of supply, you can distribute possibly enconomically and within fault levels and so on, approximately 9O MVA. If you're going to grow into 90 MVA, in other words, triple your load in under 10 years, then obviously you discard that voltage and go to something higher. If on the other hand it's going to take you 15 to 20 years to grow into the 90 MVA then obviously it's much more economical to go ahead with an intemediary voltage. When an intermediary voltage can be avoided it should be done.

Mr. C. L. Cosser (Bulawayo) gave his opinion that the prime considerations were to look 20 years ahead, have regard to the standard voltages in use and so enable standard plant to be used to the greatest advantage.

The following written contribution by Mr. D. C. Plowden (Johannesburg) was subsequently submitted:

In introducing his question, Mr. Pretorius asked why Johannesburg, for instance, had adopted a primary transmission voltage of 88kV. The adoption of this voltage was dictated entirely by the system interconnection between Johannesburg and the Victoria Falls and Transvaal Power Co., which was already operating an 88kV transmission. But for this consideration, 132kV might have been a better choice, bearing in mind particularly the resultant increased power transfer capability per unit width of expensive transmission line servitude.

Speaking generally, the principal factors influencing a decision on system voltages are :

(a) **Voltage drop.** The statutory voltage limits are plus and minus 5%, giving a total range of 10%, which must cover the voltage drop in the E.H.V. cables or overhead lines, plus that in the distribution transformer plus that on the LV network. In Johannesburg, we find it necessary to limit the drop in E.H.V. cables to 2%, which limits the radius of distribution at 6.6kV to approximately 1½ to 2 miles. If greater distances are involved, 11kV or a higher voltage must be used, or on-load tap changers must be provided on the distribution transformers.

Mnr. A. A. Middlecote (S.A. Buro van Standaarde) verwys na die wenslikheid daarvan om 'n stelsel van Standaard stroomspannings te hê wat sowel landswyd as internasionaal die beste sal inpas.

Mnr. C. E. R. Langford (Johannesburg) is van mening dat die keuse van stroomspanning in 'n groot mate van die groeikoers van die onderneming afhang, en in hierdie verband sê hy:

Mnr. C. L. Cosser (Bulawayo) spreek die mening uit dat 'n mens 20 jaar vooruit moet kyk, oorweging moet verleen aan die standaard stroomspannings wat gebruik word en sodoende die beste gebruik van standaard-toerusting moet maak.

Die volgende geskrewe bydrae van Mnr. D. C. Plowden (Johannesburg) word vervolgens ingedien :—

(b) **Load growth.** Generally speaking, it is wise to choose the highest voltage which can economically be justified at the time a decision must be made, bearing in mind that the loads of most municipal undertakings double every 10 years or less, and that the voltage chosen should be adequate for at least the next 20 years without the need for recourse to a higher voltage. Alternative schemes should be costed comparatively over a 20-30 year period.

(c) **Standard Voltages.** Certain voltages have become more generally used than others and the cost of equipment designed for these voltages is lower per KVA transmitted than for less popular voltages. This applies in the Republic to 11kV and 33kV as compared with6.6kV, 22kV and 44kV.

(d) **Interconnection with other systems.** The possibility of long term interconnection with adjoining systems for mutual benefit may favour a particular voltage.

(e) **Land use.** For large loads, land use may be a relevant factor, e.g., 11kV overhead lines can be erected in road reserves, but at higher voltages, special servitudes may be required.

Question 8—Economics of Industrial Supply Tariffs when purchasing in bulk.

Introduced by Mr. F. Turnbull (Vereeniging).

Introducing the topic, Mr. F. Turnbull (Vereeniging) said :

In some areas Escom undertakes the supply and distribution of electricity to industry leaving supply of minor industry, commerce and domestic consumers to the local authority. In other areas the local authority undertake all supply and distribution at tariffs generally higher than those of Escom on the ground that the local authority provide non-profit making services such as streets, storm water or street pipes and parks, recreation and house services. It is interesting to note that his Worship the Mayor of Potchefstroom commented on this, this morning. Surplus from electricity trading accrues to the local authority as a contribution for the relief of rates. There are, however, areas where Escom and the local authority share supply and distribution to large industries. Is it reasonable

The President commented on the danger of subsidising industrial consumers by way of low tariffs at the expense of domestic consumers.

Referring to consumers purchasing in bulk from Escom and reselling, Mr. E. E. deVilliers (Rustenburg) confirmed the views of Mr. Turner.

He continued :—

"We should face the fact that we are interested in the load and power factors. A demand charge should be based on kVA and not on kilowatts. If a consumer

Vraag 8—Die ekonomie van tariewe vir nywerheidsvoorsiening wanneer daar by grootmaat aangekoop word.

Ingelei deur Mnr F. Turnbull (Vereeniging).

Ter inleiding van die onderwerp sê Mnr. F. Turnbull (Vereeniging) :—

for a local authority to impose a higher tariff on an industry than the competitor across the road receive from Escom? A local authority supplying such industries at a tariff which is not obtained from Escom make gain by way of diversity in maximum demand. The same general working hour with an increased load factors diversity in demand is not always evident. Commerce and domestic consumers therefore claim that the subsidised industry by paying higher tariff than the Escom tariff enjoyed by the industry. It is true that industry brings employment and increased spending power to an area, conversely it may be said that industry also increases the financial commitments of the local authority. It will be very interesting to hear reviews of the delegates.

Die President lewe kommentaar oor die gevaar verbonde aan die subsidiëring van nywerheidsverbruikers by wyse van lae tariewe ten koste van huishoudelike verbruikers.

Met verwysing na verbruikers wat krag by grootmaat van Evkom koop en dit dan weer verkoop, vereenselwig Mnr. E. E. de Villiers (Rustenburg) hom met die sienwyses deur Mnr. Turner uitgespreek.

Hy gaan voort deur te sê :

is charged a certain minimum kVA demand charge monthly this does not encourage the improving of his load factor."

Question 3—The cost of erven in residential townships is a very topical subject at present and has caused the responsible minister to appoint a commission of enquiry.

Rightly or wrongly the cost of services is sometimes blamed for the alleged high prices of the erven.

What is considered to be the most equitable manner to finance the provision and installation of elecity in residential townships?

Can an acceptable standard formula for the Republic be evolved?

Introduced by Mr G. C. Theron (Vanderbijlpark)

Vraag 3—Die prys van woonerwe in dorpsgebiede is tans 'n baie aktuele vraagstuk en het gelei tot die aanstelling van 'n kommissie van ondersoek deur die betrokke minister.

Ten regte of ten onregte word die koste van die aanbring van noodsaaklike dieste soms aangevoer as die rede vir the beweerde hoë pryse van die erwe.

Wat word beskou as die mees regverdige manier om die voorsiening en aanbring van elektrisiteit in woongebiede te finansier?

Kan 'n aanvaarbare standaard-formule vir die Republiek uitgewerk word ?

Ingelei deur Mnr. G. C. Theron (Vanderbijlpark)

Question 14 was dealt with in the same discussion.

Question 14—Municipal Electricity Undertakings are facing serious problems of rising costs, continuing demands on available capital resources and the intensive development of private townships within Municipal areas. Should not the Association set up a study group to examine the problems of private township development, with special reference to the present differing policies and opinions on the financial responsibilities of the township developers?

Introduced by Mr. K. G. Robson (East London)

Vraag 14 word tydens dieselfde bespreking behandel.

Vraag 14—Munisipale elektrisiteitsondernemings ondervind ernstige probleme met betrekking tot stygende koste, voortdurende eise wat aan die beskikbare kapitaalbronen gestel word en die intensiewe ontwikkelling van privaat dorpsgebiede binne munisipale gebiede. Behoort die Vereniging nie 'n studiegroep in die lewe te roep nie, om ondersoek in te stel na die probleme van privaat dorpsontwikkeling, met spesiale verwysing na die wyd-uiteenlopende beleidsrigtinge en opvattinge in verband met die finasiële verantwoordelikhede van die dorpsontwikkelaars?

Ingelei deur Mnr. K. G. Robson (Oos-Londen)

Mr. G. C. Theron (Vanderbijlpark), in introducing question 3, said :—

„Dit is seker nie nodig om op die vraag soort te borduur nie, te meer nog aangesien 'n ander ingenieur 'n soortgelyke probleem het, maar antwoorde op 'n paar strikvrae word gesoek.

1. Dit word vandag algemeen aanvaar, en is reeds standaard-praktyk, dat die dorpstigter verantwoordelik is vir die interne waterbenetting in nuwe dorpsgebiede volgens 'n standaard wat vir die plaaslike bestuur aanvaarbaar is. Waarom moet dieselfde beginsel nie ook vir elektrisiteit geld nie?

2. In een skema word die uitgawe om elektrisiteit aan die verbruikers in 'n nuwe dorpsgebied beskikbaar te stel, deur die voorsiener teen heersende pryse beraam en die inkomste op grond van afgekondigde tariewe bepaal, met inagneming van moontlike prysstygings en 'n persentasiebenutting.

Enige tekort in die beraamde handelsrekening word deur die dorpstigter aangesuiwer by wyse van

Ter inlligting van vraag 3, sê Mnr. G. C. Theron (Vanderbijlpark) :—

'n kapitale bydrae of deur die kapitaal vir die skema te voorsien teen 'n rentekoers wat laag genoeg is om die handelsrekening te laat klop.

Die skema is eenvoudig en sonder kinkels en die dorpstigter weet vooraf wat sy verpligtinge sal wees.

Daar is dus geen rede om die verkoopsprys van erwe te laai ten einde homself oor 'n tydperk van jare teen verliese te dek nie.

Is daar enige besware teen dié formule?

3. Plaaslike besture en nhullle ingenieurs probeer altyd om die beste diens teen die laagste koste te lewer. Is daar enige manier om te verseker dat net die werklike koste van die voorsiening van die noodsaaklike dienste aan die kopers van erwe oorgedra word wanneer die verkoopsryse bepaal word?

Is dit raadsaam om die winsmotief op hierdie wyse aan bande te lê?"

Continuing, Mr. Theron referred to a statement made in evidence on behalf of the Town Treasurers to the Commission appointed to consider the high prices of residential sites, to the effect that "the local authority regards the provision of electricity either by generating or purchasing it and its distribution as a pure municipal non-profit trading undertaking and operates it as such.

He expressed surprise that the Treasurers should have made such a statement and this view was supported by others.

Voortgaande verwys Mnr. Theron na 'n stelling wat namens die Stadstesouriers tydens die getuienis voor die Kommissie van Ondersoek na die hoë pryse van woonerwe gemaak is, naamlik dat „die plaaslike owerheid die voorsiening van elektrisiteit, hetsy deur dit te koop of self op te wek, en die verspreiding daarvan, suiwer as 'n nie-winsgewende munisipale handelsonderneming beskou en dit as sodanig bestuur."

Hy spreek sy verbasing uit oor die feit dat die Stadstesouriers so 'n stelling kon gemaak het, en hy word deur andere in hierdie meing gesteun.

Having requested permission to deal with Question 14 simultaneously with Question 3, Mr K. G. Robson (East London) said :—

Nadat hy toestemming gevra het om Vraag 14 tesame met Vraag 3 te behandel, sê Mnr K. G. Robson (Oos-Londen) :

I was interested to note the comments made at the technical meeting at Vanderbijlpark in 1968 in this connection. This question is of special interest to me as in East London we are faced with dramatic development. This situation calls for careful study of the financial responsibility of township developers. We are faced with the problem of a large number of applications for very large township extensions far removed from the existing development. In the past it has been the responsibility of the electricity undertaking to accept all the capital costs in relation thereto. To me this seems to be incorrect. We are faced with increasing capital cost burdens and with the limited avenues of revenue that local authorities face these days I think we have to accept that it must be considered fair and reasonable that some portion at least of the capital cost of electricity reticulation of private townships which are to be sold for gain, should be allocated to the developer. It is evident that there are serious differing opinions on this question of the allocation of capital costs.

In conclusion, Mr Robson appealed for further consideration of this difficult question by the A.M.E.U. with a view to some basis of uniform policy.

Ten slotte lewer Mnr Robson 'n pleidooi vir verdere oorweging van hierdie moeilike probleem deur V.M.E.O., met die oog op die formulering van die een of ander basis vir 'n eenvormige beleid.

Mr H. T. Turner (Umtali) asked what the policy was in regard to water supplies and sewerage services in the Republic.

Mnr. H. T. Turner (Umtali) vra wat die beleid in die Republiek is in verband met watervoorsiening en rioleringsdienste.

Mr. Robson indicated that in East London the tariff charge for these services was the only recovery made.

Mnr. Robson sê dat die enigste vorderings wat in hierdie verband in Oos-Londen gemaak word, die normale tariefheffings vir hierdie dienste is.

Mr. E. A. McWilliam (Pretoria) referred in some detail to the work of the Niemand and Nell Commissions and various proposals which had been put to them.

Mnr E. A. McWilliams (Pretoria) verwys in bebesonderhede na die Niemand- en Nel-kommissies en na die verskillende voorstelle wat aan hulle voorgelê is.

Discussion continued with the President, Mr. P. J. Botes (Roodepoort), Mr. J. J. Barrie (Edenvale), Mr. E. E. de Villiers (Rustenburg) and Mr. D. H. Fraser (Durban) all contributing.

Die bespreking word voorgesit en die President, Mnr. P. J. Botes (Roodeport), Mnr. J. J. Barrie (Edenvale), Mnr. E. E. de Villiers (Rustenburg) en Mnr. D. H. Fraser (Durban) neem almal daaraan deel.

Summing up, Mr. C. Lombard (Germiston) said :

Mnr. C. Lombard (Germiston) som die posisie op deur te sê :—

I have listened with great interest to the discussion on this topic this morning. I think I am probably the only Electrical Engineer who has attended a meeting of the Nell Commission. As a matter of fact, I gave certain evidence for this Commission. I also heard the views of the township developers, etc. I would like to refer to the one aspect that has not been touched on this morning and that is the cost of providing street lighting. At the meeting of the Commission the township developers threw up their hands in horror when they heard that many agreements which are entered into between Councils and developers, include provisions for street lighting. This is quite an important aspect. At the last meeting, it was decided on the evidence that was presented that the City Treasurers would prepare a memorandum and I think the outcome was this document to which Mr Theron referred this morning. One aspect which perturbs me is the fact that municipal electrical engineers who are not only responsible for the engineering of their undertakings, but also for their managment, have not been asked for their views. There is another meeting on the 13th and as I see it, on the basis of this memorandum, eventually there will be a recommendation of some standard form of agreement which initially would probably not be compulsory as far as local authorities are concerned. However, this may be adopted by the Department of Local Government and then forced on us.

After further discussion, it was resolved that the Executive Council be requested to endeavour to submit a memorandum embodying the basic views of

Na verdere bespreking word besluit dat die Uitvoerende Raad versoek word om 'n memorandum te probeer opstel waarin die basiese standpunte van

views of city and town electrical engineers for consideration by the Commission.

elektrotegniese dorps- en Stadsingenieurs uiteengesit word en dit vir oorweging aan die Kommissie voor te lê.

Question 7—Cables in roof space—factors for current rating.

Introduced by Mr. E. de C. Pretorius (Potchefstroom).

Vraag 7—Kabels in die dakruimte—faktore vir stroom aanslag.

Ingelei deur Mnr. E. de C. Pretorius (Potchefstroom).

Introducing the subject, Mr. E. de C. Pretorius (Potchefstroom) said :

Ter inleiding van die onderwerp sê Mnr E. de C. Pretorius (Potchefstroom) :

„Hier in Potchefstroom is gedurende die afgelope somer in sink- en selfs teëldak-spasies temperatuur van so hoog as 45°C gemeet, terwyl die maksimum-temperatuur buite in die skaduwee 33°C was. Dit is 'n gemiddelde maksimum-somertemperatuur in Potchefstroom.

In Tabel I van die Standaard-regulasies vir die Bedrading van Persele word 'n toelatingsfaktor van .47 aangegee vir kabels met isolering van rubber of P.V.C. by 'n omgewingstemperatuur van 45°C.

Die vraag is dit : It dit iets waaroor ons ons moet bekommer, en, indien nie, wat is dan die doel van die toelatingsfaktore ?

Daar mag aangevoer word dat die belasting van kabels in huishoudelike installasies gedurende die somermaande en bedags selde of ooit eers naastenby die verminderde veilige stroomdravermoë bereik, of dit dan slegs vir baie kort tydperke oorskry. Hierdie argument sou tot enkele jare gelede stand gehou het—deesdae egter nie, weens die toenemende gewildheid van lugversorging.

Mr A. A. Middlecote (Pretoria) continued :

Mnr A. A. Middlecote (Pretoria) sê vervolgens :

I think the present derating tables must just be adhered to. We have certain criteria for a maximum operating temperature of the insulation and if the ambient goes up the rating must come down. We will, no doubt, be looking into this matter over the next year or so, but as the Regulations stand I don't think you can do anything more than accept a set of tables which give a derating factor for a higher ambient.

Messrs. F. Stevens (Ladysmith) and C. Lombard (Germiston) indicated that little attention was, in practice, paid to the tables and Mr. Lombard and Mr. Pretorius made the point that maximum load normally only occurred in the evenings, when the roof temperature was much reduced.

Mnre. F. Stevens (Ladysmith) en C. Lombard (Germiston) sê dat daar in die praktyk weinig aandag aan die tabelle geskenk word en sowel Mnr. Lombard as Mnr. Pretorius spreek die mening uit dat die maksimumvrag normaalweg slegs saans getrek word, wanneer die dak-temperature reeds baie gedaal het.

Question 13—Are three phase switching, single phase switching or no switching facilities recommended on the High Voltage feeders in miniature substations.

Introduced by Mr. K. G. Robson (East London).

Vraag 13—Word daar aan driefasige, enkelfasige of geen skakelgeriewe voorkeur by die hoogspanningsvoergeriewe in miniatuur-substasies?

Ingelei deur Mnr. K. G. Robson (Oos-Londen).

Mr. Robson (East London) commented as folllows

Mnr Robson (Oos-Londen) lewer soos volg kommentaai :

There seems to be no doubt that considerable savings in substation costs are obtained by the use of the compact miniatures substations for residential areas This reduction in costs, however, has been accompanied by a reduction in the flexibility of operation and/or the reliability of the HV switching equipment of the miniature substations. The manufacturers of the miniature substations have tended to offer either HV switchgear where each phase is individually switched

or to provide no switchgear at all, the two ends of the HV ring being solidly linked and connected to the transformer by means of teed-off fuse links.

In East London, the 11,000 volt networks comprise bulk supply switch houses (up to 18 MVA) from which the substation 11kV feeder cables radiate out. These feeder cables, which may feed up to 10 substations, either form a ring, connected at the two extremities to the same switch house or are connected between two switch houses situated in neighbouring load zones. In all cases, the aim in the planning of the routes of these cables is to obtain the maximum utilisation of the capacity of each cable with the shortest route length. Because industrial, commercial and residential loads in some areas are found intermingled in East London, it appears neither practicable nor economical to provide separate 11kV feeders to the different types of loads — hence there is the essential requirement that switchgear in residential area substations should have the same flexibility and reliability as the switchgear in industrial area substations.

With the solidly linked ring and teed-off fuse links to the transformers, experience at the coast has shown that not only are the fused links potentially dangerous but are prone to flashovers, due to coastal high humidity conditions. Operationally, all the consumers fed from a solidly linked ring will experience more and longer outages when the ring is broken for maintenance or load-balancing purposes or during faults on the 11kV feeder cables.

With miniature substations featuring switchgear where each phase is individually switched, there is a burden being placed on the operating staff to avoid single phasing industrial loads, plus the fact that more time is required to restore supply after a fault.

While the solidly linked ring with teed-off fuse links is undoubtedly the cheapest method, it is interesting to note that the cost of an individual phase-switching ring main unit with fuses costs approximately R700.00 and a three-phase oil immersed ring main unit, featuring two incoming three-phase isolators and a teed-off three-phase isolator with striker pin fuses costs approximately R800.00. The main disadvantage of the three-phase oil immersed ring main unit is its size, which requires that the overall width of the "standard" miniature substation be increased from .6 metres to .9 metres the length increased by about .5 metres, the height remaining the same. From preliminary discussions held with manufacturers, the change from the "standard" size would increase the overall cost because new fibre glass moulds would have to be made. This cost would not be substantial provided it could be spread over a large number of units. Other disadvantages of using the three-phase oil immersed ring main unit in miniature substations is that more maintenance will be required on the switchgear and more space will be occupied on sidewalks. Offset against the disadvantages of the larger size of substation shell, is the advantage that larger sizes of transformers, i.e., possibly 500KVA, could possibly be used, which in turn should result in a lower substation cost per KVA capacity.

In East London, the maximum substation capacity for optimised distribution costs of a purely residential area, has been found to be between 200 and 300 KVA. Where there are small blocks of flats and shopping centres attached to the residential area, it is considered that a 500 KVA unit would be most suitable. For loads above this, separate substations might become necessary to feed such blocks of flats and/or shops and office complexes.

Other three-phase switchgear, which it is understood is on the market or coming onto the market in the near future, features totally encapsulated plastic air-break or minimum oil-break or vacuum-break equipment. In view of these anticipated developments and in view of the remarks above concerning presently available equipment, there appears to be a need to indicate to the manufacturers the operational or system requirements of miniature substations, which requirements, would be acceptable to a fairly large number of local authorities in the country. For this reason, the following questions are posed for the consideration of the delegates:

(1) Do local authorities favour three-phase switching as against single-phase switching or no switching facilities at all in miniature substations?

(2) What do local authorities consider to be the most economical size of substation to feed residential and residential-cum-commercial areas?

The President said that:

"In Umtali the practice was that once 500 kVA was exceeded it was time to seek a further load centre. I am not too clear on the particular problem that you have, Mr. Robson, on the switching of your mini subs. The ones we have are supplied with three-phase switching by the manufacturers."

Die President sê dat:

Mr. Robson (East London) responded:—

Mnr Robson (Oos-Londen) antwoord soos volg:

I think that in this country the type being offered has no switching at all other than the linked type and HRC fuses, and it is a single-phase type of mini substation and my question basically is, whether it is in fact to make an economical proposition to provide mini sub, reticulation purely for residential areas. Our studies indicate that it is not an economic proposition at all and it seems to us that we are running into difficulties, because we seem to be in our undertakings standardising on this kind of reticulation, which is purely for residential and it seems to us that it is not probably the most economic method of reticulation.

Responding to question, he continued by saying that :

In aantwoord op 'n vrag gaan hy voort deur te sê:

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mini substations should have three-phase switching with protection.

Mr. E. E. de Villiers (Rustenburg) said :—

Mnr. E. E. de Villiers (Rustenburg) sê :

„Baie van ons kollegas maak 'n baie groter probleem van hierdie tipe van elektrisiteitsverspreiding as wat daar werklik is. In die eerste plek moet ek vir u stel dat as ons eerste oor die ekonomiese aspek moet praat, 'n mens dit so eenvoudig en goedkoop moontlik moet doen, binne redelike perke van goeie ontwerp, veral ook die foutstrome waarvoor toegelaat moet word en dan as gevolg daarvan die groottes van kabels wat geïnstalleer word. Indien 'n mens dit verstandig doen, ook op 'n drie-fase stelsel, is dit heel-wat goedkoper as die gewone laagspanningsverspreiding, wat met baie dik kabels gedoen word. Eintlik kom die besparing te pas by die grootte van kabels wat gebruik word. Die basiese ontwerp behoort te wees (as dit met betrekking tot 'n klein dorpsgbied is), dat jy een hoofverspreidingspunt het waarnatoe jou basiese toevoer aangelê word (wat moontlik dan ook op 'n basiese ringverspreiding van die res van jou stelsel is) en daarvandaan verskeie hoogspanningsringe na jou verskillende mini-subs. 'n Mens moet in ag neem dat daar wel foute kan voorkom en die tydsduur om die foute op te spoor en om skakeling te doen op die stelsel hang af van die metode waarof jy die skakeling gaan doen in die mini-sub self. My ervaring is dat 'n ingewikkelde skakeling en beveiling by die mini-sub self nie wenslik is nie. Dit s heeltemal voldoende om individuele lugklemskakeling by elke mini-sub op die hoogspanning te hê. Die tyd wat in beslag geneem word indien jy 'n kabelfout opdoen, om af te skakel by jou hoofsubstasie, jou fout te isoleer en weer terug te skakel, is betreklik klein, mits jy so min as moontlik verbruikers op elke mini-sub het en so min as moontlik mini-subs op elke ring. Dit kan heel gemaklik bereken word vir elke individuele geval. Waar 'n mens ander verbruikers soos woonstelblokke, winkelblokke, en moontlike klein nywerheidsaanlegte in so 'n gebied het of dit kan verwag, behoort jy nie, myns insiens, voorsiening te maak om vanaf mini-subs dié mense te voer nie. U het tog die reg om aan te dring op substasieakkommodasie. Al wat u dus in so 'n geval doen is om vir die dravermoë van die betrokke ring, die kabels so 'n bietjie dikker te maak om daardie vrag te neem en u lê dan die substasies aan namate daardie verbruikers ook op die stelsel bykom. Normaalweg gesproke sal 'n mens vind dat jou huishoudelike verbuikers die eerste is wat op jou stelsel inskakel en daaran volg die groter geboue en moontlike ander verbruikers wat groter vrag dra. Ek dink eerlik waar dat 'n mens geen probleme behoort te hê nie. Ek het nog nooit probleme daarmee gehad nie, wat betref lang tye wat verbruikers sonder krag sit nie en ook nie beveiligingsprobleme nie. Ek dink dit is een aspek wat ek weer wil beklemtoon, nl. dat 'n mens moet baie oppas om hoë koste aan te gaan vir beveiliging van jou toevoere as jy miskien eenmaal in 20 jaar 'n hoogspanningsfout gaan kry in so 'n stelsel."

Referring to the practice in Roodepoort, Mr. P. J. Botes indicated that simultaneous three-phase switching had been found to be the most satisfactory.

Met verwysing na die prosedure wat in Roodepoort gevolg word, sê Mnr. P. J. Botes dat gelyktydige driefase-skakeling daar die mees doeltreffende gevind is.

Responding to a comment by Mr. G. C. Theron (Vanderbijlpark), Mr. F. G. Rautenbach (Klerksdorp) said :—

In antwoord op kommentaar deur Mnr. G. C. Theron (Vanderbijlpark) sê Mnr. F. G. Rautenbach (Klerksdorp) :

„Ons het in twee gevalle wel probleme gekry waar ons gevind het dat ons hierdie huminisasie in hierdie skakelare gekry het waar die skakelaar wel getrek was op vrag. In die een geval het die skakelaar uitgekom en, toe die eerstefase getrek was het ons geval nog steeds die korona-effek gehad. Nadat

die tweede een getrek was, het dit die korona baie verminder in die derde geval het hy heeltemal verdwyn. In 'n ander geval met 'n ander tipe skakeltuig het ons die ongelukkige ondervinding gehad waar ons, selfs nadat die derde een getrek was, nog korona in hierdie skakelaar ondervind het. Die elektrisiëns moes baie haastig na die skakelaar gaan om te kyk in watter posisie die krag onderbreek."

Referring to Durban, Mr. D. H. Fraser said :—

Mnr. D. H. Fraser verwys na Durban en sê :

We have gone in extensively for this type of unit for domestic consumers. The average size of unit is 300 kVA — we do have application for smaller load centres, particularly where development is taking place more gradually but in tenders we have received for smaller size transformer units we found that it is not an economic proposition to go for the smaller size transformer. This is departing from the question that was raised regarding the switching facilities but we are not in favour of the development of the small compact switching unit. As far as we are concerned, the mini sub wouldn't have been accepted to the extent that it has been, because we certainly would not favour the lack of a switching facility on a ring main circuit because of the time taken to isolate a faulty section in the ring and the attendant problems and perhaps dangers involved in the unvolting of solid connections. The type that we use embodies single-phase switching and and this has presented absolutely no problem. The question of whether three-phase switching is essential or indeed whether protection is essential on individual transformers is one which has been considered but the high cost of the conventional three-phase switching one has to consider whether the unit to be protected warrants the expenditure.

Mr. J. J. Barrie (Edenvale) said that local authorities favoured three-phase switching. He indicated that with the larger units the original concept of the mini sub was being departed from. He considered a 50kVA mini sub the most desirable size and stated that in his undertaking an additional voltage had been introduced into its distribution system, i.e., 11,000 volts. This enabled the use of three-phase switching on load isolators.

Mnr. J. J. Barrie (Edenvale) sê dat plaaslike beture aan driefase-skakeling voorkeur gee. Hy sê dat daar by die groter eenhede van die oorspronklike opvatting van die miniatuur-substasie afgewyk word. Hy is van mening dat 50 kVA die mees geskikte grootte vir 'n mini-sub is en sê dat, in sy onderneming, daar 'n bykomstige spanning van 11,000 volts in die verspreidingstelsel ingevoer is. Dit het dit moontlik gemaak om driefase-skakeling in vrag-isolators toe te pas.

Referring to the second question posed by Mr. Robson, Mr. Barrie said :

Met verwysing na die tweede vraag wat deur Mnr. Robson gestel is, sê Mnr. Barrie :

The answer as I see it is that the mini subs as such should not exceed 75 kVA and the load centres could rise from their present level of 500 kVA to something approaching 1,500.

By way of elucidation, Mr. E. E. de Villiers (Rustenburg) explained that :

By wyse van verduideliking sê Mnr. E. E. de Villiers (Rustenburg) :

When I spoke earlier of using air break links, I did not intend this to refer to switching but only isolation—switching being done at the load centre where the different mini sub rings start and terminate.

He supported the contention that the size of mini subs should be kept down as otherwise the entire basis of cost structure could be adversely affected. He regarded units of 300 kVA not as mini subs but as load centres.

Hy ondersteun die mening dat die grootte van die mini-substasies beperk moet word, anders kan hele grondslag van die kostestruktuur nadelig beïnvloed word. Hy beskou eenhede van 300 kVA nie meer as mini-substasies nie, dog wel as vragsentrums.

Mr. A. H. L. Fortman (Boksburg) supported switching facilities, preferably three-phase.

Mnr. A. H. L. Fortman (Boksburg) spreek homself uit ten gunste van skakelgeriewe, verkieslik driefase.

Mr. L. Futcher, (Kempton Park) stated that his

Mnr. L. Futcher (Kempton Park) sê dat daar in

undertaking had now standardised on three-phase switching and three-phase protection for mini subs. Referring to the ecomics of mini subs, he pointed out that the saving on utilisation of ground should be taken into account.

sy onderneming nou driefase-skakeling en driefase-beskerming vir mini-substasies as standaard aanvaar is. Wat die ekonomieese aspek van mini-substasies betref, wys hy daarop dat daar rekening gehou moet word met die besparing in die benutting van grond.

Mr. G. C. Theron (Vanderbijlpark) said that :

Mnr. G. C. Theron (Vanderbijlpark) sê :

"The original concept of miniature sub-stations and high voltage distribution, as put for by Mr. Barnard in connection with the Rooseveldt Park Scheme many years ago, was for sub-stations up to about 75 kVA with, say, 100 consumers fed directly from the transformer bus-bars and single-phase high voltage distribution. Surely there is no difficulty about single-phase switching on that?"

Mr. A. P. van Schalkwyk (Bloemfontein) asked various questions.

Mnr. A. P. van Schwalkwyk (Bloemfontein) stel verskeie vrae.

In response thereto, Mr. A. H. L. Fortman (Boksburg) indicated that Boksburg had followed the Johannesburg concept of single-phase reticulation. He pointed out that this was very satisfactory with domestic consumers but as soon as a shopping centre or block of flats appeared there were problems in giving a three-phase supply.

In antwoord daarop sê Mnr. A. H. L. Fortman (Boksburg) dat sy dorp die Johannesburgse opvatting van enkelfase-verspreiding nagevolg het. Hy wys daarop dat dit by huishoudelike verbruikers baie goed werk, dog, sodra 'n winkelsentrum of 'n block woonstelle opgerig word, word daar probleme met die verskaffing van 'n driefasige toevoer ondervind.

Mr. D. C. Plowden (Johannesburg) explained as follows :

Mnr D. G. Plowden (Johannesburg) verstrek die volgende verduideliking :

"This conception of high voltage reticulation in townships is Mr. Leishman's. Mr. Barnard did read the paper on it. I think that essentially the idea is for use in residential areas and not in business areas at all. In residential areas you do get shopping centres and there are places that want a three-phase supply. This has not caused any real difficulty. We either site the main sub-station in the business centre or if we can't do that it is easy enough to run a three-phase cable to that point and then distribute to people who want three-phase supplies. I can't agree with Mr. Fortman that this single-phase high tension distribution is not a very good one. We have had this operating in Rooseveldt Park for several years and our experience has been that we have had no complaints whatever from any consumer about bad voltage. We keep very well within the limits that are laid down and we have had virtually no complaints about loss of supply. Electrical equipment is essentially reliable these days. If we do lose supply it is usually an individual consumer."

Question 5—Thermal vs. Block Demand metering.

Vraag 5—Termiese vs. Blok-aanvraag-metertelling

Introduced by Mr. E. de C. Pretorius (Potchefstroom).

Ingelei deur Mnr. E. de C. Pretorius (Potchefstroom.

Mr. E. de C. Pretorius (Potchefstroom) introduced the subject and said :

Mnr. E. de C. Pretorius (Potchefstroom) lei die onderwerp in en sê :

There apparently exists a sharp divergence of opinion amongst electricity supply engineers on this subject — even Escom as far as I know applies thermal demand metering in all its undertakings except the major one, i.e., the Rand and O.F.S. Undertaking.

In my opinion thermal metering is the more obvious as it (1) reflects the effect of maximum demand on a distribution system more correctly, and (2) is independent of specific time intervals.

What is the opinion of the Forum?

A closely related question is : Should one meter kW or kVA? Again I maintain that it should be kVA for the same reason as (1) above, as I said it reflects the effect of maximum demand distribution system more correctly.

By way of clarification, Mr. Pretorius stated that the question applied not only to metering for industrial purposes, but to any consumer taking more than, say, 50 kVA. He further stated that block metering was the thermal vs. the integrating kW hour measured over a specific time which gave the average kW over that of a specific thermal.

Mr J. H. Harden (Escom) explained that in the Rand and O.F.S. undertaking Escom used thermal metering extensively on the smaller consumer up to 50-75 kVA. He continued :

Larger than that we go to the normal kW hour meter which we feel is essential from that point onwards where accuracy is or becomes more important but for the smaller consumer it does, I agree with Mr. Pretorius, give a better type of representation of what is actually happening on the system. Regarding the second question kVA vs kW. As far Rand undertaking is concerned, of course this is a historical thing, we

By wyse van verduideliking sê Mnr. Pretorius dat die vraag nie net op metertellings vir nywerheidsverbruikers van toepassing is nie, maar op enige verbruiker wat meer as, sê, 50 KVA neem. Hy se verder dat blok-metertelling bestaan uit die termiese teenoor die intergrerennde KW-uur gemeet oor 'n spesifieke tydperk, waardeur die gemiddelde KW, oor dié van 'n spesifieke.

Mnr. J. H. Haarden (Evkom) verduidelik dat Evkom in die Randse en Oranje-Vrystaatse onderneming op groot skaal van termiese metertelling ten opsigte van kleiner verbruikers tot by 50-75 KVA gebruik maak. Hygaan voort deur te sê :

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are with it on the kW hour basis for ever, as far as I could see, whereas all the other undertakings do measure on kVA which again gives a far better representation to takes to the question of power factors, I mean on our undertaking power factor is a questionable thing, there are people who get away with power factors of .5, others with .99. There should be no real benefit to either.

Mr. E. C. Lynch (Salisbury) entered the dicussion and said :

I think the answer to this question depends on the circumstances of the particular supply. Certainly for consumers with loads up to perhaps 50kV or kVA the thermal demand meter would be quite suitable. But I hate to think of the result of thermal demand meters being used for supplies to undertakings of 50 Megawatts or more. First of all the suppliers generally come from more than one source. You may have a number of generators plus bulk supply fee and I don't think any acceptable accuracy could be obtained with a thermal demand meter on that title supply. It is also rather dangerous of us who are consumers to be obligating this sort of thing because just imagine how difficult it would be to load control with a thermal demand meter. With the half hour indicating integrating type of meter you have got a change to do something, but I think the thermal demand meter would be a much more difficult trick in to getting a few extra kV out of the demand tariff without paying for it. You do know when a period begins and when it ends. You can buy integrating computor devices which will tell you of the amount of load to be shed if you

Mnr. E. C. Lynch (Salisbury) tree tot die bespreking toe en sê :

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want to keep to within a set figure by the end of your half hour period. So I think as consumers we should be rather happier to have an integrated half hour meter rather than a thermal type. Should one meter kW or kVA of course the answer is, kVA does reflect more accurately with demand on the supplier and on the consumer's system, but we do get again art cases and I would like to mention the circumstances of Salisbury left where that would be very little advantage in metering the bulk supply in kVA rather than kW. At present the bulk supply from the Central African Power Corporation is based on a kW tariff. The reason being of course that the 330kV system has a very large capacitance and therefore the Power Corporation has to install reactors in a number of positions over its system to absorb the excess capacitance current on this system and they are only too happy to have undertakings like Salisbury with a power factor of possibly .95 or something like that. There would be no point in charging us extra to correct that power factor and then the Power Corporation having to install extra reactors to absorb the current.

The President interpolated the question of whether :

"kVA demand charges or kilowatt maximum demand charges should be based on annual demand or maximum demand".

By wyse van tussenvoeging stel die President die vraag of kWA-aanvraagtariewe of Kilowatt-maksimum aanvraagtariewe op jaarlikse aanvraag of maksimum-aanvraag bebaseer moet word.

By way of explanation, Mr. F. Stevens (Ladysmith) advised that whilst Escom had indicated that they were using thermal for "smaller" consumers, the term "smaller" was comparative and related to consumers above 8 or 12 megawatts.

Mr K. Adams (Johannesburg) referred to the unfavourable position of the user of an arc furnace when thermal metering is adopted.

Discussion took place concerning the practice of Escom relating to monthly or annual demand metering charging.

Mnr. F. Stevens (Ladysmith) verduidelik dat, alhoewel Evkom aangedui het dat hulle termiese metertellings ten opsigte van „kleiner" verbruikers gebruik, die term „kleiner" 'n relatiewe een is en op verbruikers bokant 8 of 12 megawatts van toepassing is.

Mnr. K. Adams (Johannesburg) verwys na die ongunstige posisie van die verbruiker wat 'n boogoond gebruik wanneer termiese metertelling toegepas word.

Voorts vind daar bespreking plaas oor die prosedure wat Evkom ten opsigte van maandelikse of jaarlikse aanvraagtariewe volg.

Question 2: It is frequently found difficult to adhere to a laid down maintenance programme when checking with inverse-definite-minimum-time delay relays because of the demand for services elsewhere or commissioning tests on new equipment.

Also it is questionable if the routine testing of i.d.m.t. relays is necessary on the ground that their reliability in service might well equal that of kWH service meters.

Is there any method or scheme of relay inspection and testing which could be done by non-specialist staff concurrently with o.l. trip testing and without having to remove the relay covers?

Introduced by Mr. H. T. Turner (Umtali).

Vrag 2: Daar word dikwels moeilikheid ondervind om by 'n voorafneergeledge instandhoudingsprogram te hou wanneer relês met afhanklike vasgestelde tydsvertraging negegaan word, vanweë die vraag na dienste elders of inwerkingstellingstoetse vir nuwe toerusting. Dit val ook te betwyfel of dit nodig is om hierdie relê's gereeld te toets, aangesien hulle moontlik net so betroubaar as kwh-diensmeters is.

Is daar enige metode of skema vir die inspeksie en toetsing van relê's wat deur nie-deskundige personeel uitgevoer kan word gelyktydig met bogrondse uitklinktoetse en sonder om die bedekkings van die relê's af te haal?

Ingelei deur Mnr. H. T. Turner (Umtali).

Mr. Turner opened discussion on this question by referring to the laborious task of removing relay covers for test purposes. He asked for thoughts on the matter.

Mnr. Turner lei die bespreking oor hierdie vraag in deur te verwys na die moeisame taak verbonde aan die verwydering van die bedekkings van relê's vir totsdoeleindes. Hy vra die aanwesiges om hul menings hieromtrent te lug.

The only view was expressed by Mr E. Trautman (Estcourt) who said :

I would recommend an unskilled man to carry out secondary injection tests on relays. They can be left in circuit and the variac connected to the relay connections. The trip fuse, of course, must be removed.

Die enigste reaksie kom van Mnr. E. Trautman (Estcourt) wat hom volg uitlaat :

Question 12: With the increasing gravity of the labour shortage situation, what steps can or should be taken by the Association, as a National body, to encourage the recruitment of professional and technical staff into the Local Government service?

Introduced by Mr. K. G. Robson (East London).

Vraag 12: Met die oog die toenemende ernstigheid van die arbeidstekort, watter stappe kan of behoort daar deur die Vereniging, as 'n landswye liggam, gedoen te word om die werwing von professionele en tegniese personeel vir die plaaslike bestuurdiens aan te moedig?

Ingelei deur Mnr. K. G. Robson (Oos-Londen).

On this question, Mr. K. G. Robson (East London) addressed the meeting as follows :

Mnr. K. G. Robson (Oos-Londen) spreek die vergadering soos volg oor hierdie vraag toe :

May I be permitted just to suggest some of my thoughts about this problem and it is interesting that I prepared this question some months ago and find now that it seems to be among the most topical and certainly the most widely discussed problem at every level with various bodies. I don't intend to discuss the question of salaries. Why is it that Local Government is finding it so extremely difficult to attract professional and technical staff? I think that it can be said that one of the reasons is that we now have Escom, huge in comparison with even the largest electricity undertakings, as one of our main competitors in the labour market. Against this we have to sell Local Government as offering a greater attraction to an organisation like Escom. One of the things that struck me recently in endeavouring to attract staff and interviewing people was the almost complete lack of understanding of the careers that Local Government offers to engineers and technicians. The question is what are we as engineers doing about it? The image of service in the Local Government service appears to be very low. What I would like to see is positive action from this Association to rebuild the image of service in our undertakings amongst future potential staff and I hope some positive suggestions will be forthcoming from the floor at this meeting.

Mr K. Adams (Johannesburg) stressed the importance of the salary factor in attracting staff and indicated that an all-round proportionate increase in remuneration was necessary.

Mr J. J. Barrie (Edenvale) thought that remuneration was not the only factor. He supported Mr Robson in contending that the A.M.E.U. should actively pursue, along with other organisations associated with Municipal activity, the encouragement of suitable personnel to join Municipal undertakings through a realistic and adequate campaign designed to explain the opportunities offered by Municipalities to suitable staff.

Mr H. T. Turner (Umtali) referred to the difficulties brought about by the blanket grading system. He thought that remuneration was of prime importance.

Mr E. Trautman (Escourt) agreed that the grading system caused difficulties. He stressed the reality of the shortage of staff of all grades.

Mr A. A. Middllecote (S.A.B.S.) spoke of the importance of producing sufficient technicians and not utilising more highly qualified staff to do work that a technician could undertake. He felt that the A.M.E.U. should concentrate on the problems of training of technicians as its contribution to the problem. He also considered that recruitment to the engineering profession as a whole was a key to the problem.

Mr D. H. Fraser (Durban) supported the last contention of Mr Middlecote and also urged that local authorities pay realistic attention to salaries and other benefits for staff.

Mr H. Barnard (Brakpan) contended that there

Mr K. Adams (Johannesburg) lê klem op die belangrikheid van die salarisfaktor by die werwing van personeel en spreek die mening uit dat 'n algemene proporsionele verhoging van salarisse nodig is.

Mnr J. J. Barrie (Edenvale) is van mening dat besoldiging nie die enigste faktor is nie. Hy steun Mnr Robson se mening dat die V.M.E.O., tesame met ander organisasies wat met munisipale bedrywighede te doen het, homself behoort te beywer om bevoegde personeel aan te moedig om by munisipale ondernemings aan te sluit. Dit kan gedoen word deur middel van 'n realistiese en toereikende veldtog wat daarop gemik is om die geleenthede wat die munisipale diens aan geskikte personeel bied, te propageer.

Mnr H. T. Turner (Umtali) verwys na die probleme wat deur die omvattende gedaderingskemas veroorsaak word. Hy is van mening dat besoldiging van primêre belang is.

Mnr. E. Trautman (Escourt) stem dat die graderingskemas probleme meebring. Hy lê klem op die feit dat daar inderdaad in alle grade 'n tekort aan personeel bestaan.

Mnr. A. A. Middlecote (S.A.B.S.) praat oor die noodsaaklikheid daarvan om 'n genoegsame aantal tegnici te produseer en om nie hoogs gekwalifiseerde personeel te gebruik vir werk wat deur tegnici gedoen kan word nie. Hy is die mening toegedaan dat die V.M.E.O., as sy bydrae tot die oplossing van die probleem, op die probleme verbonde aan die opleiding van tegnici behoort te konsentreer. Hy is ook van mening dat die oplossing van die probleem in die werwing van personeel vir die ingenieursbedryf as 'n geheel geleë is.

Mnr. D. H. Fraser (Durban) steun die laaste stelling van Mnr. Middlecote en spoor plaaslike besture aan om realistiese aandag aan die salarisse en ander voordele van hul personeel te wy.

Mnr. H. Barnard (Brakpan) spreek die mening

was not such a shortage of personnel as was generally maintained but that available personnel, in general, was inefficient and not prepared to do a full day's work.

Mr. E. C. Lynch (Salisbury) spoke of the problems his Council had had in attracting staff even on the promise of university bursaries — these in many cases had been simply capped by more attractive offers from the commercial and industrial sectors.

On the proposal of Mr G. C. Theron (Vanderbijlpark) this problem was referred to the Executive Council for further action.

uit dat daar nie so 'n groot tekort aan personeel as wat algemeen aangevoer word nie, dog dat die beskikbare personeel oor die algemeen onbevoeg is en nie bereid is om 'n volle dag se werk te lewer nie.

Mnr. E. C. Lynch (Salisbury) verwys na die probleme wat sy Raad ondervind het om personeel te werf, ten spyte selfs van beloftes van beurse vir universitêre opleiding—hierdie aanbiedinge is in baie gevalle eenvoudig oortref deur meer aantreklike geleenthede wat deur die handels- en nywerheidssektore gebied is.

Op voorstel van Mnr. G. C. Theron (Vanderbiljpark) word hierdie probleem vir verdere optrede na die Uitvoerende Raad verwys.

At this stage of the proceedings, Mr. H. Hewitt, C. Eng., F.I.E.E., F. Illum E.S., presented his paper on "An International Approach to Lantern Performance", as follows :

In hierdie stadium van die verrigtinge lewer Mnr. H. Hewitt, C. Eng., F.I.E.E., F. Ilum. E.S., sy referaat oor "An International Approach to Lantern Performance" soos volg :

(1) INTRODUCTION

In recent years it has been apparent that the British Streetlighting Code of Practice should be reviewed in the light of the international recommendations which are now emerging.

The lantern specification BS.1788 of 1964 is concerned with many aspects of Street Lantern design and construction, but this paper is concerned with only one-lantern performance, mainly light distribution. Light distribution was specified to ensure adequate installations when Code of Practice recommendations regarding lantern light flux, spacing and mounting height etc. were followed; it was a means of squeezing out poor light distribution from severe price competition. At that time investigations were made into the accuracy of photometric methods, the variability of lanterns, and a review of current lantern performance, but there was inevitably an element of experimentation in formulating this part of the specification. After five years, the time is ripe for review. We need also to look ahead to consider whether the system is adequate for the future in view of the new light sources that have been developed, whose characteristics are not finalised.

(2) IMPORTANCE OF THE ROAD SURFACE

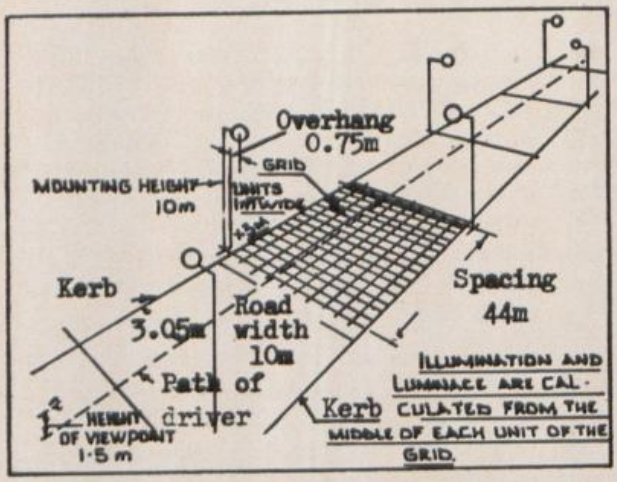
Britain's early leadership in the development of streetlighting technique was mainly due to the work of J. M. Waldram and other members of the Experimental Panel of the M.O.T. Departmental Committee in the period 1935—1937. Implementation of the Report was made possible by developments in lamps and electricity supply but the key step forward from the Street Lighting Specification B.S.301, 1931, was the recognition of the importance of road surface luminance rather than illumination. Since then, recommendations regarding installation, geometry and lantern light distribution have been based on providing adequate road surface luminance at an economic price —a balance between what we need and what we can afford. However, the design of individual installations on the basis of road surface luminance was then too complex.

Until a few years ago, we have been talking about road surface BRIGHTNESS. Those concerned with the technicalities of lighting will know that nowadays we differentiate between the sensation of brightness from looking at a light surface and the light emission from the surface, which we call its luminance. Luminance, measured in candelas per square metre, is what gives rise to the sensation of brightness. However, if we are to consider road surface luminance we must start by considering the road itself.

In the 1950's the Road Research Laboratory in the U.K., measured the full reflection characteristics of twenty-two different road surfaces and the average characteristics of a much larger number. This information helped in formulating the tables of the Code of 1963 but no allowance was made for the big difference in road surfaces. In adverse conditions the Code suggested that the lighting engineer could use either more than the minimum recommended lantern light output, or a closer spacing. He had no guidance in this except one clause, the last paragraph of which reads :

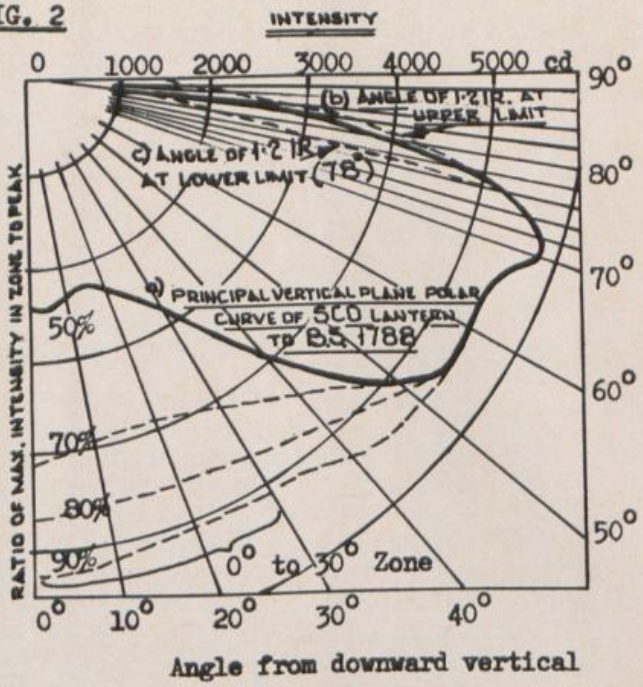
> It is economically unreasonable to recommend for general use a standard of lighting which would be adequate for surfaces which are both extremely matt and extremely dark. In such cases, the standard of lighting required may need

FIG. 1



STANDARD INSTALLATION FOR WHICH CALCULATIONS WERE MADE REGARDING INTENSITIES IN THE 0° TO 30° ZONE AND ANGLE OF RUN-BACK TO 1.2 IR.

FIG. 2



VERTICAL PLANE POLAR CURVES USE IN CALCULATIONS FOR TABLE 1 (0° TO 30° ZONE COMPARISON) AND TABLE 2 (1·2 IR ANGLE.)

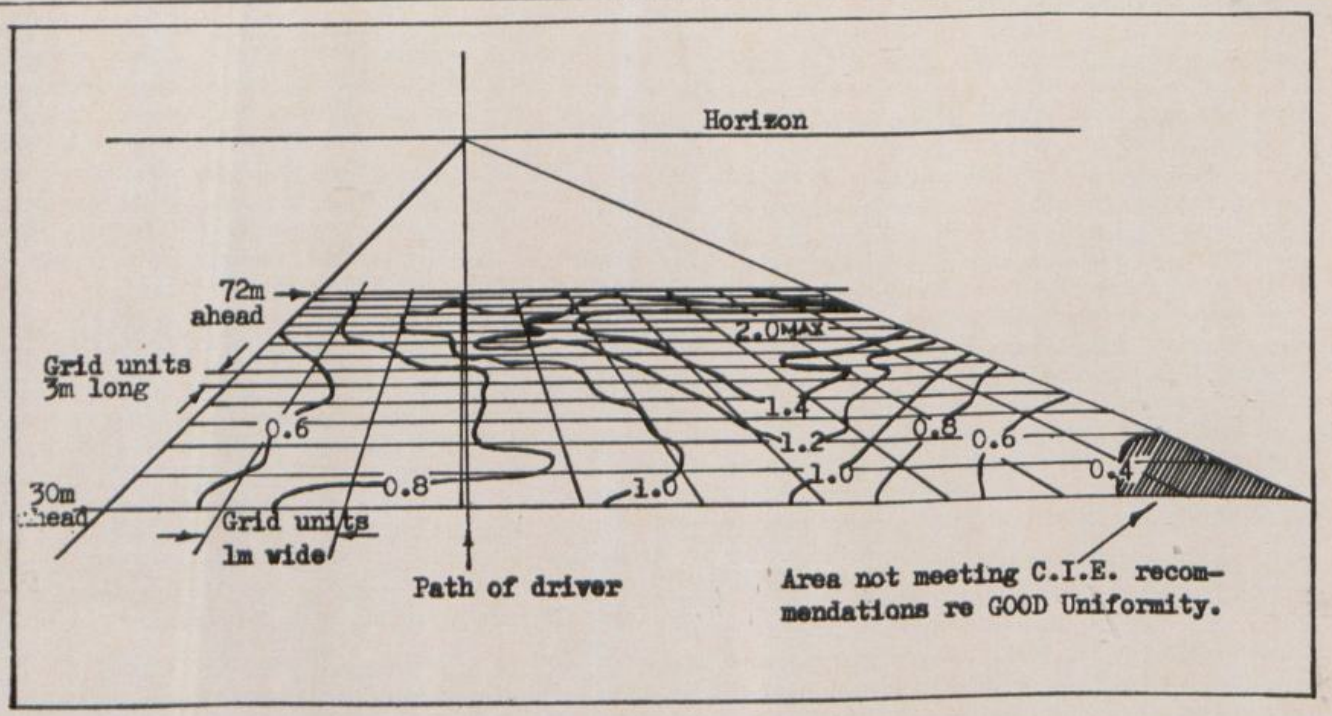


FIG. 3. ROAD SURVICE LUMINACE CONTOURS FROM CALCULATED DATA OF TABLE 1

to be considerably in excess of the minimum values. The minimum recommendations of this Code will usually provide good results on surfaces which give bright patches of moderate length, and which are not unduly dark in colour. If a choice exists, it is better to avoid the use of dark-coloured aggregates in the wearing course of the surface.

This lack of quantitative guidance has often resulted in no allowance being made for the road surface reflectivity which has two effects on our lighting. **Firstly,** if the road is of poor reflectance the road is less bright. How important is this ? To get a general picture we have chosen three of the surfaces measured in detail by Road Research Laboratory, as representative of British roads.

Firstly, a rolled asphalt with precoated chippings According to a Road Research Laboratory report of 1961, 10% of British roads in built-up areas were of this grade of texture.

Secondly, a medium textured surface, a non-skid rock asphalt. According to the Road Research Laboratory report, 50% of British roads in built-up areas were of this texture.

Thirdly, a granite surface dressing. The Road Research Laboratory report estimates that 40% of British roads in built-up areas were of this texture.

For this range of common surfaces (not very dark nor very light, not very glossy or very rough) and with a semi-cut-off installation, the medium and rough surfaces need respectively 50% and 120% more light than the smoother surface in order to achieve the same road surface luminance. So, because of lack of guidance on road surfaces, rough roads often appear less bright.

Secondly, if the same light distribution is used, glare intensities will increase as more light is provided and subjectively glare will be worse on the medium and rough surfaces because the contrasts are greater.

Now the concept of road surface luminance as a basic quantity in street-lighting design has been pursued actively in Europe and elsewhere and the International Recommendations for the lighting of Public Thoroughfares are based on it. Publication C.I.E. No. 12 by the Streetlighting Committee E-3.3.1 was published in 1965. Its recommendations are based on provision of a dry road surface luminance of a level depending on the road classification. Many countries have already revised their national codes on this basis; others are collecting road reflectivity data with a view to basing a future code on this system.

Obviously consideration is necessary before such a radical change is made, and in the meantime the detailed provisions of B.S.1788 could well be improved.

(3) APPRAISAL OF B.S.1788

Light distribution was not easy to specify in 1963 — in addition to knowing what was wanted, it was necessary to know how closely it could be acheived, taking into account the accuracy with which angle and intensity can be measured and what would be a reasonable allowance for variability in manufacture.

In the U.K. two types of lower hemisphere light distribution were specified, cut-off and semi-cut-off, the latter being modified slightly when the light is from low pressure sodium lamps.

Three regions of the light distribution were specified :

(1) the beam peak in terms of the vertical plane polar curve through the beam centre, the direction of this plane and an angle controlling the elevation of the beam.

(2) the region directly below the lantern, including all directions at up to 30° from the downward vertical.

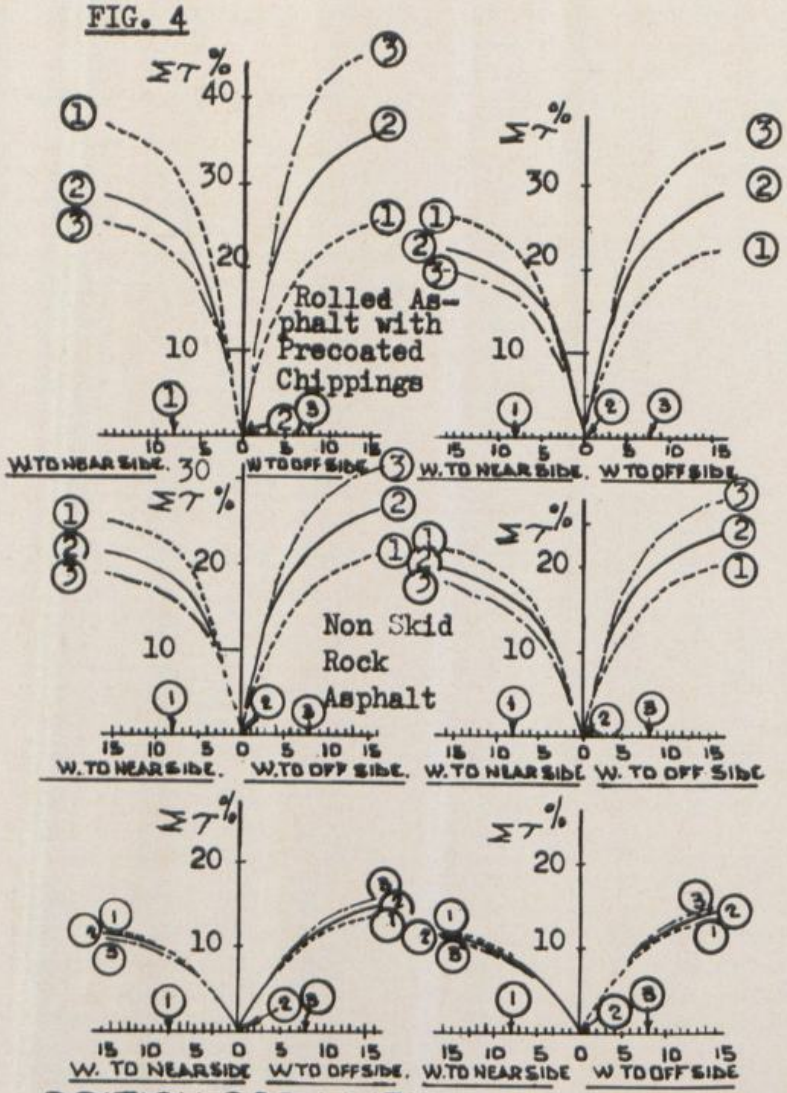
(3) the run back above the beam in terms of intensities in the vertical plane parallel to the road axis.

3.1 — Beam : As far as the specification of the Beam is concerned, the light distribution requirements of the specification were expressed in general terms which disregarded the size, shape and luminance of light sources. If there were no restrictions on lantern size or complexity, any reasonable light distribution could be acheived. But with practical lanterns there **are** limitations. For instance, only a limited re-direction or concentration of light in the transverse plane is possible with long sources monuted horizontally — for example the L.P. Sodium Lamps.. Again to acheive satisfactory control a larger lantern is required for the MBF/U lamp than would have been thought economically possible some 20 years ago. On the other hand with the new compact high brightness lamps quite a small lantern could be used — this could be intolerably glaring and still comply with B.S.1788.

It was as well that the compilation of B.S.1788 did not wait for all these questions to be resolved, because it was urgently needed at the time. However, today a more fundamental approach is possible and work has commenced in the U.K. on the study of its implications.

3.2 — 0°-30° Zone Now as regards intensities in directions from the downward vertical up to 30° in all

FIG. 4



BRITISH SCO LANTERN CIE CUT OFF LANTERN

W IS IN METRES, FOR 10m MOUNTING HEIGHT. FIGURES IN CIRCLES INDICATE POSITIONS ACROSS ROAD OF VIEWPOINT.

AVERAGE ROAD LUMINANCE $\bar{L} = \frac{\text{LAMP lm } \Phi \times \text{ROAD REFLECT. } q_0 \times \tau \times \text{SERVICE FACT.}}{\text{ROAD WIDTH} \times \text{LANTERN SPACING IN ROW.}}$

τ IS READ FROM CURVE INTERPOLATING FOR VIEWPOINT, AND SUMMED FOR EACH LINE OF LANTERNS.

FOR THE INSTALLATION OF TABLES 5a $\tau = 23{\cdot}12$ (NEAR SIDE LANTERNS) $+ 26{\cdot}512$ (OFFSIDE ROW)

$$\bar{L} = \frac{21500 \times 0{\cdot}078 \times 0{\cdot}535}{10 \times 44 \times 2} \times \text{SERVICE FACTOR}$$

LUMINACE DIVERSITY AND GLARE SHOULD BE TAKEN INTO ACCOUNT

directions of azimuth, it is suggested that there is a clear case for immediate relaxation of one of the restrictions.

Intensities in this zone must be not less than 0.3 IR (Intensity Ratio) and not greater than 1.7 IR for semi-cut-off or 2 IR for cut off distribution. This has given no trouble. An additional restriction was added, however, that the maximum intensity should not exceed 70 per cent of the peak intensity; this has led to difficulty with large reflector lanterns for MBF/U lamps, and unsightly white patches have often been applied to the bowls to reduce the downward light. The restriction was thought necessary because otherwise the peak intensity might be only a little greater than the downward intensity. It was an attempt to guide the designer towards a "flat bottomed" polar curve, which had been desirable with pre-war road surfaces and longer spacings — an attempt to prevent wastage of light flux due to projecting too much light down; also to improve the uniformity of road surface luminance by restricting the road luminance under the lantern. However, the location of the bright patch, as seen by a driver, depends on the road surface reflection characteristics and usually, but not always, occurs in front of the area directly below the lantern, i.e., towards the driver.

In some cases, it needs careful observation to judge this due to perspective foreshortening at the distances concerned. At 30-ft. mounting height the 0° to 30° zone extends to 17-ft. from the point below the lantern, whereas the beginning of the bright patch is often at about 50-ft., extending from there towards the observer. Thus, the restriction could act in the opposite way from that intended.

In March, 1967, a trial was carried out with the help of Leicester Corporation to assess the importance of this in practice. It took place in Welford Road, a main four-lane one-way traffic route where streams of traffic merge and reform. The lighting is by 400 watt MBF/U lamps in semi-cut-off lanterns at 30-ft. mounting height, in 50-ft. staggered arrangement. The trial comprised 12 lanterns, all carefully photometered. Six had white patches on the bowls which reduced the downward intensities to comply with B.S.1788.

The six beyond, where the downward intensities reached 75% of the value of the peak give **a noticeably more uniform** road surface luminance. However, we must consider whether the same effect will occur on rougher surfaces than this and with a narrower road and longer spacing.

Having shown practically that the effect of a change is noticeable and beneficial, we can rely on calculations to check the effect in others of the many permutations of road and installation. A fairly common and therefore important range of conditions is represented by the case shown in Fig. 1. The road is 10m wide with lanterns at 10m mounting height, overhang 0.75m and spacing 44m. For simplicity calculations were made for one typical viewpoint, 1.5m above the road surface, 3m from the nearside kerb and 30m set back from a nearside lantern. This is known to give representative results. Also, we are considering one span only; in practice we would probably work on two. The calculation of road surface luminance has been made for the centre points of the grid units, for the three road surfaces and a range of light distributions in the downward directions.

Fig. 2 shows the vertical plane light distribution used. They are based on the curve of a 400 watt MBF/U lantern with the proposed variations.

Table 1, detailed below, summarises the calculated road surface luminance values:

Road Surface	Road Surface Luminance (cd/m²)	Ratio of Maximum Intensity in 0° to 30° Zone to Peak Intensity			
		50%	70%	80%	90%
Rolled Asphalt with Precoated Chippings	— average	1.35	1.43	1.47	1.50
	— maximum	2.35	2.35	2.35	2.37
	— minimum	0.29	0.35	0.37	0.39
	Ratio min./average	0.21	0.24	0.25	0.26
Non-Skid Rock Asphalt	— average	0.92	1.00	1.05	1.09
	— maximum	2.04	2.05	2.11	2.28
	— minimum	0.20	0.26	0.29	0.31
	Ratio min./average	0.22	0.26	0.27	0.28
Granite Surface	— average	0.63	0.72	0.76	0.80
	— maximum	1.11	1.25	1.45	1.60
	— minimum	0.19	0.25	0.28	0.31
	Ratio min./average	0.30	0.35	0.37	0.38

TABLE 1

Effect on Road Surface Luminance of Limitation of Intensities in 0° to 30° Zone

(12,250 1m lanterns on 10m wide road, at 10m mounting height, 44m spacing. Polar curves in vertical plane as shown in Fig. 2).

Fig. 3 is a diagram of road surface luminance, based on similar calculations, shows that the dark area is opposite the first lantern in the installation — which is on the left, level with the start of the area for which the calculations were done. The calculations show that for the smooth, medium and rough surfaces, increasing the downward intensities brings up the luminance of this dark area and makes the uniformity better.

3.3 — Run-back Zone : As regards the control of run-back above the beam, calculations were made for the three road surfaces assuming that in each case the 1.2 IR occurred at the mean, the maximum and the minimum elevation allowed by B.S.1788, in order to assess the glare conditions which are produced throughout the range. These calculations were not conclusive, but subjective judgements of recent U.K. installations suggest that the specification of the run-back zone is about right for smooth surfaces but leads to too much glare on rougher or darker surfaces.

(4) TOWARDS A NEW SPECIFICATION

So much then for B.S.1788. It has served us well for some years, but it specifies light distribution regardless of lamp characteristics and the new lamps now emerging are not amenable to control in this way. The B.S.I. Committee has, therefore, commenced a review of the specification and of streetlighting technique generally, taking account of present practice, overseas practice and also new approaches which have been made. What follows summarises some of these considerations.

No quantitative allowance is made in the present British Code for road surface reflectivity, which swamps differences, e.g., between Group A1 and Group A2 lighting and leads to aggravating glare effects on darker, rougher surfaces. We might well consider revision of our practice on the basis of road surface luminance, taking into account the International Recommendations. Different methods of installation design can be studied. Practice should be established based on consistent standards of average luminance and diversity, with glare control.

Apart from underdeveloped areas where traffic requirements are not difficult to meet and the economy cannot afford more than simple but robust lanterns at long spacing, modern traffic route lighting practice is in general based on one of three systems :

The American Code, which is also used in Canada and most of South America. This requires a specified average illumination according to the classification of the road. Light distributions are elaborately classified according to their suitability for different road widths and lantern arrangements. Intensities above the beam peak are restricted but not severely; in fact, restriction of glare in the present code rates low in importance. (We should remember that in general American practice is to drive on headlights). A code revision is currently at an advanced stage but road surface reflectivity data is being collected with the intention of basing a future code on luminance.

The British Code was the basis of Australian and New Zealand practice, and some similarly situated countries. The Australian Code divides the British semi-cut-off light distribution into high SCO and low SCO, the former for use at somewhat longer spacings where circumstances permit and economy is necessary.

South Africa, Japan, East European and some Middle East countries, as well as most Western countries have codes based on the International Recommendations. The C.I.E. Code was intended as a basis for National Codes and is becoming widely adopted in this way.

The International Recommendations are summarised below :

Class A1 is for Motorways, Rural Roads with Heavy Traffic and Urban Throughways and By-passes. For these an average of 2 cd/m² road surface luminance is recommended, with very good uniformity and strictly reduced glare preferably using cut-off lanterns.

Class A2 is for Rural Roads with Considerable Traffic. (Rural Roads with Light Traffic are not recommended to be lit). Class A2 lighting should provide 1 cd/m² dry road surface luminance with good uniformity defined as no dark area having less than 40% of the average. Cut-off light distribution is preferred but semi-cut-off accepted.

Class B1 for Urban Principal local traffic routes is similar to Class A2 but semi-cut-off and cut-off lanterns are equally preferred, with non-cut-off permitted and control of glare less stringent.

Class B2 for Urban Secondary roads with local traffic is similar but requires only 0.5 cd/m² average road luminance.

There are thus three levels of average luminance increasing by a factor of 2 from one to the next. The lowest of these compares approximately with an earlier target for British lighting — at least 0.2 ftL over most of the road surface; the next is often acheived by modern British installations on good road surfaces, but requires twice as much light on dark or rough

surfaces. Moreover, these are service values, and possibly 30% needs to be added in design to allow for deterioration before cleaning and relamping.

The recommendations also suggest how the **performance** can be acheived but are in a way provisional and may be elaborated on lines already proposed.

The three types of light distribution, cut-off, semi-cut-off and non-cut-off can have their peak intensity direction anywhere over the ranges indicated. Only the runback above the beam is strictly controlled; intensities at the horizontal and at 80° to the downward vertical, in directions along the road in which a motorist may be viewing a lantern, are limited to a value of intensity expressed in candelas per 1000 lm of lamp output. For instance the cut-off distribution can have not more than 30 cd/1000 lamp lm at 80°. For a 20,000 lm lamp the intensity in this direction must not exceed 20 x 30 or 600 cd. Similarly the intensity at the horizontal must not exceed 20 x 10 or 200 cd for a 20,000 lm lamp. But whatever the lamp light output the intensity at the horizontal must not exceed 1,000 cd.

It is expected that a lantern mounting height of 8 or 10 metres will normally be used, or 12 for wide roads or lanterns of high lumen output. This in line with the latest table of the British Code, which is based on these same mounting heights. The maximum spacing along the road is given in terms of these heights. For the cut-off light distribution spacing should be not less than 3 x mounting height, 3½ for semi-cut-off and 4 x for non-cut-off. These compare with the British Group A1 where the same spacing is used for cut-off and a slightly greater (4 x mounting height) for semi-cut-off. Longer spacings by 10% are permitted for Group A2.

In 1965 Lambert and Simons indicated a process of synthesising a theoretical optimum light distribution that would give the highest and most uniform road surface luminance. Further work indicated that the difficulty with such a method is in postulating the restrictions as regards what is practical and economic with the different types of light source. It is more useful to work with practical lanterns, comparing the performance of one with another and gradually evolving the best for given conditions.

It is probable that the optimum will be different for each type of light source and road surface, but it is not expected to be too sharply defined, leaving room for compromise for each type of light source. Of course, much more than just light distribution is involved. The aim should **not** be to get the maximum performance from least lamp lumens, but least overall cost over the life of the installation. The path is long, involving collection of data on maintenance cost, lantern deterioration, etc., but as a start on light distribution two lanterns can be compared on the basis of de Boer and Vermeulen's curves, just as over many years in America practice they would have been compared on the basis of Utilisation curves.

Fig. 4 shows pairs of curves for a 400 watt MBF/U lantern, on the left for a British SCO light distribution, on the right a C.I.E. cut-off light distribution. The base of the graphs is road widths in metres. The ordinates are relative to road luminance. Generally the higher the curve the greater average road luminance, and it is seen that in general the British lantern produces higher figures.

The curves show again how much lower the road luminance is with the rougher surfaces. With these curves it is only roughness, not total reflectivity, which counts. But this approach applied to lanterns already in use, lanterns in course of development and lantern designs now being considered, is a possible means of ensuring that the various criteria of good streetlighting are met.

At present we try to decide carefully between Group A1, A2 and A3 standards for a particular traffic route whilst largely ignoring considerable differences in the nature of the road and its surrounds. Because of differences in road reflectivity, indentically similar installations give widely different road surface luminance values.

Since the effectiveness of an installation depends so much on road surface luminance it seems logical that this should be the basic quantity in streetlighting planning. If this is accepted the next step is to decide whether we should aim for the levels of luminance of the International Recommendations. For the U.K. this would present no difficulty with "good" road surfaces, but on dark, rough surfaces the lighting would undoubtedly be more expensive and this alone calls for early work on the revision of the specication.

So far the light distribution specifications included in B.S.1788 have been successful although relaxation of one restriction in the 0° to 30° zone is possible and desirable. However, for high brightness sources such as high pressure sodium lamps with a clear outer bulb, the control of glare is inadequate.

The British lighting engineer might consider adopting the approach of the International Recommendations, without necessarily changing to the Continental cut-off light distribution. Ideally it should be possible for the installation designer to choose the best distribution for a particular road, instead of being limited by a rigid specification. As a compromise, studies on optimisation of light distribution, taking full account of the nature of road surfaces and lamp and lantern characteristics, should lead to a situation in which light distributions used in various countries can be brought together.

In making our re-appraisals we should recognise that exacting distribution specifications would be less necessary if more light were used, providing control of glare is strictly maintained. In the past the British tecnique has been successful in "making a little light go a long way" but the true cost of doing this has never been fully assessed. The use of larger lamps, possibly of longer life, may make for simple light distributions, and therefore simpler lanterns, and call for less frequent maintenance. More light would not only make things easier for the road user — it would also make things easier for the streetlighting designer.

At the conclusion of the paper, Mr. Hewitt was sincerely thanked for his contribution and then questions followed.

Na afloop van die referaat, word Mnr. Hewitt van harte vir sy bydrae bedank en daarna word geleentheid vir vrae gebied.

Mr. E. E. de Villiers asked :

Mnr. E. E. de Villiers (Rustenburg) vra :

Had any success been attained in Britain to secure the co-operation of the civil engineering sector in the provision of road surfaces most suitable from the point of view of lighting requirements?"

Mr. Hewitt replied :

Mnr. Hewitt antwoord :

I am afraid that we have been unsuccessful. Certain attempts have been made but we are told that the most important requirements for a surface are non-skidding and good wearing characteristics. Apparently these do not go hand in hand with a good road surface from the lighting point of view.

Mr. G. C. Theron drew attention to the fact that the majority of major roads in South Africa utilised a pre-mix surface which appeared to differ considerably from those illustrated in slides shown by Mr. Hewitt. He asked :

Mnr. G. C. Theron (Vanderbijlpark) vestig die aandag daarop dat daar op die meeste hoofpaaie in Suid-Afrika 'n voorafvermengde oppervlakte gebruik word dat skynbaar aansienlik verskil van dié wat op die skyfies wat deur Mnr. Hewitt vertoon is. Hy vra :

Has Mr. Hewitt any knowledge of this pre-mix surface used in South Africa and probably elsewhere?

Mr. Hewitt regretted that he had no experience of this type of surface.

Mnr. Hewitt antwoord dat hy tot sy spyt geen ondervinding van hierdie soort oppervlakte het nie.

Mr. A. F. Turnbull (Vereeniging) asked for Mr. Hewitt's thoughts on preference between high pressure mercury and high pressure sodium lamps.

Mnr. A. F. Turnbull (Vereeniging) vra Mnr. Hewitt se mening in verband met voorkeur óf hoëdruk-kwik of hoëdruk-natriumlampe.

Mr. Hewitt replied :

Mnr. Hewitt aantwoord :

These two lamps have their rival support and I think at the present time it is about a draw. There are some people that are attracted by the colour appearance of high pressure sodium, and there are others who are impressed by the colour appearance but are not happy about the colour rendering of this source compared with the colour rendering of the mercury. The latter has most support in our country.

Mr. D. H. Fraser (Durban) asked :

Mnr. D. H. Fraser (Durban) vra :

What factors should be taken into consideration in deciding whether or not a road should be lit and I include in this question high speed arterial roadways or freeways, which are not within urban areas?

Mr. Hewitt replied :

Mnr. Hewitt antwoord :

On freeways, or motorways as we call them, either you light them properly or you don't them at all. Our economy at the moment does not allow for the lighting of motorways throughout their length but slowly we are beginning to light the sections of motorways which are urban in character, that is, where they enter the cities, and here we are adopting a higher level than our present code, in other words, that lighting outside the present bounds of the code standards are being adopted. I think on less important roads there have been suggestions made in the past that occasional lighting, that is, as indicators rather than as means of lighting the road surface, can be of value, and a number of installations of this kind have occurred some years ago in England. In general, they are condemned as being rather liable to cause more harm than good.

SECOND DAY

Mr. H. T. Turner (Umtali) introduced Professor D. C. Midgley, Professor of Hydraulic Engineering at the University of the Witwatersrand, Johannesburg, who presented his paper on "Water — Its Role in South Africa's Power Supplies".

At the conclusion, The President thanked Prof. Midgley for his comprehensive paper and discussion followed, with contributions by Messrs. E. B. Martin (Johannesburg), E. E. de Villiers (Rustenburg), R. W. Barton (Welkom), C. E. R. Langford (Johannesburg) and J. A. Loubser (Kimberley).

At this stage, the meeting proceeded with the consideration of Question 6 of the Members' Forum Questions.

Question 6: Interpretation of certain sections of the Factories Act given by Mr. Wannenburg at the Umtali Convention including reference to Department of Labour circular.

Introduced by Mr. C. Lombard (Germiston).

Mr. Lombard said :

At the last convention Mr. Wannenburg presented a short paper on the interpretation of certain sections of the Factories and Building Workers Act, the Electrical Wiremen and Contractors Act and the regulations framed under these Acts. I think we all agree that this paper and the notes which were subsequently published in Volume 2 of the proceedings have been of great value to municipal electrical engineers.

The first part of the paper dealt with the inspection of wiring work in factory premises and according to Mr. Wannenburg's interpretation, where a factory is supplied through a transformer the supplier is not required to inspect and test the wiring installations before it can be connected to the supply. On the other hand in the case of a small factory such as a laundry, dry cleaning concern, and so on, supplied from a distribution line, the supplier has to inspect, test and pass the installation prior to the latter being connected to the supply. The question now is, what is the position regarding the inspection and testing of the wiring installations in a factory supplied direct from a communal substation. Such a substation generally serves two or even more factories and a cable connection is taken direct from the substation to each individual

TWEEDE DAG

Mnr. H. T. Turner (Umtali) stel Prof. D. C. Midgley, Professor in Hidrouliese Ingenieurswese aan die Universiteit van die Witwatersrand, Johannesburg, aan die vergadering voor, en Prof. Midgley lewer sy referaat oor "Water — Its role in South Africa's Power Supplies".

Hierna bedank die President Prof. Midgley vir sy omvattende referaat, wat gevolg word deur bespreking waaraan Mnre. E. B. Martin (Johannesburg), E. E. de Villiers (Rustenburg), R. W. Barton (Welkom), C. E. R. Langford (Johannesburg) en J. A. Loubser (Kimberley) deelneem.

In hierdie stadium gaan die vergadering voort met die oorweging van Vraag 6 van die Lede-forum se vrae.

Vraag 6: Die vertolking van sekere klousules van die Fabriekswet, soos deur Mnr. Wannenburg by die Umtali-konvensie uiteengesit, met inbegrip van 'n verwysing na die omsendbrief van die Departement Arbeid.

Ingelei deur Mnr. C. Lombard (Germiston).

Mnr. Lombard sê :

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factory, in other words such a factory is not supplied from a distribution line.

The next question concerns the painting of poles and replacement of streetlighting lamps. At Umtali Mr. Wannenburg also dealt with the painting of streetlighting poles carrying live electrical conductors. Subsequently letters were sent by the Department of Labour to various municipalities advising them that exemption from the provisions of Regulations C51(1) and (2), had been granted for persons other than competent persons to render the following services subject to certain conditions :

1. Replacement of supply authority's fuses on consumer's premises.
2. Replacement of supply authority's fuses on consumer's overhead services connected to the overhead distribution system.
3. Disconnection and reconnection of a consumer's supply by removing or replacing either or both of the above type of fuses.
4. Replacement of lamps in streetlighting fittings.
5. Reading of electricity meters for certain types

of consumers.

6. Painting of distribution poles.

I propose to confine my remarks and questions to the painting of poles and replacement of lamps in streetlighting fittings.

In the first place, according to the letter, persons other than competent persons are inter alia, required to be given instruction by and (b) under the constant supervision of a competent person for the period of not less than 3 months. This means in effect, if my interpretation is correct, that an artisan will have to accompany a pole painter or lampman at all times during the three months instruction period. Apart from the fact that artisans are in short supply and that it is therefore impossible to make the services of an artisan available to such person for such a period of time, the cost would be prohibitive. Furthermore, it is submitted that after the first two or three days it would merely be a waste of the artisan's time.

A further requirement is that the names of the instructors and their qualifications be filed with the Divisional Inspector of Labour. In practice it will be extremely difficult to assign a particular instructor to a pole painter or lampman for a period of 3 months at a time due to staff changes, leave periods, exigencies of the service, difference in working hours, etc. It should also be borne in mind that pole painters and lampmen are inclined to move around from one job to another and it would entail a considerable financial loss to a local authority if such a person were to resign soon after completing the instruction period. For these reasons, it would be of interest to members to know if it would not be possible to have a mire practical approach to this problem.

A further point is that some pole painters now have many years of experience painting poles and I think the same would apply to a lampman and is it really necessary that they should now receive a further 3 months instruction?

Mr. J. G. Wannenburg (Department of Labour) replied :

(It is regretted that the recording of the contribution by Mr. Wannenburg failed. Arrangements are being made for Mr. Wannenburg to clarify questions further submitted to him in writing prior to the 1971 Convention and these will be contained in Volume 2 of the 1971 Proceedings.)

Mnr. J. G. Wannenburg (Departement van Arbeid) antwoord :

(Tot ons spyt bandopname van Mnr. Wannenburg se toespraak nie geslaagd nie. Reëlings word nou getref dat Mnr. Wannenburg verdere vrae wat aan hom gestel is, skriftelik sal beantwoord voor die 1971-Konvensie. Hierdie antwoorde sal in Deel 2 van die Verrigtinge vir 1971 verskyn.)

Mr. P. J. Botes (Roodepoort) spoke of a serious case of contravention with which he had had to deal and also on the problems relating to the replacement of street lamps.

Mr. J. K. von Ahlften (Springs) asked, in the case of a small factory, whether the Inspector of Machinery would advise the name of the responsible person.

In his reply, Mr. Wannenburg (Dept. of Labour) made it clear that, if any person should be killed in a factory as a result of bad wiring which had not been inspected in terms of the provisions he had reiterated earlier in this discussion, there would no responsibility on the municipality or the municipal electrical engineer. Referring to wiring undertaken by others than those in possession of a licence, he pointed out that it made no difference whether the person responsible had any degrees in electrical engineering or was a pure amateur. An unlicensed person could not carry out the work.

A general discussion on problems relating to the

Mnr. P. J. Botes (Roodepoort) praat oor 'n ernstige geval van oorteding waarmee hy te doen het, sowel as oor die probleme verbonde aan die vervanging van Straatlampe.

Mnr. J. K. von Ahlften (Springs) vra of die Inspekteur van Masjinerie, in die geval van 'n klein fabriek, die naam van die verantwoordelike persoon sal bekend maak.

In sy antwoord stel Mnr. J. G. Wannenburg (Departement van Arbeid) dit duidelik dat, indien 'n persoon in 'n fabriek gedood sou word as gevolg van swak bedradingswerk wat nie ingevolge die bepalinge waarna hy vroeër in die bespreking verwys het, geïnspekteer is nie, daar geen verantwoordelikheid op die munisipaliteit or die munisipale elektrotegniese ingenieur sal rus nie. Met verwysing na bedradingswerk wat deur iemand anders as 'n gelisensieërde persoon onderneem word, wys hy daarop dat dit geen verskil maak of die verantwoordelike persoon 'n handvol grade in die elektrotegniese ingenieurswese het, dan wel of hy 'n gewone amateur is nie. 'n Ongelisensieërde persoon mag nie die werk uitvoer nie.

Hierop 'n algemene bespreking van probleme wat

matters under discussion took place, in which Mr. E. A. McWilliam (Pretoria), Mr. E. E. de Villiers (Rustenburg), Mr. A. F. Turnbull (Vereeniging), Mr. D. H. Fraser (Durban), Mr. F. Stevens (Ladysmith), Mr. J. C. Waddy (Pietermaritzburg) and Mr. C. Lombard (Germiston) took part.

met die sake onder oorweging verband hou, aan welke bespreking Mnr. E. A. McWilliam (Pretoria), Mnr. E. E. de Villiers (Rustenburg), Mnr. A. F. Turnbull (Vereeniging), Mnr. D. G. Fraser (Durban), Mnr. F. Stevens (Ladysmith), Mnr. J. C. Waddy (Pietermaritzburg) en Mnr. C. Lombard (Germiston) deelneem.

Question 11 : Is the time granted by Municipalities for tenderers to submit tenders for electric cables always reasonable?

Vraag 11 : Is die tydperk wat deur Munisipaliteite aan tenderaars toegelaat word vir die indiening van tenders altyd billik?

In introducing the question on behalf of the Cable Makers Association of South Africa, Mr. D. G. Sutherland (Pietermaritzburg) said :

Toe hy die vraag namens die Vereniging van Kabelvervaardigers van Suid-Afrika inlei, sê Mnr. D. G. Sutherland (Pietermaritzburg) :

I think the answer to the question must be no. The time given to us is not always reasonable. Obviously it takes time for the Electricity Departments to prepare their own documents and I think that having done that, the closing date for tenders is often determined by the date of the next meeting of the Electricity Committee of the Council. From our point of view, however, there are undoubtedly occasions when we have insufficient time to do the job properly and if we could just consider the sequence of events leading up to the lodging of a tender. This usually starts with the publication in the Press of the tender notice. Usually that notice appears in a local paper and with the best will in the world it is impracticable to pick up these notices as soon as they appear, so we have to rely very largely on the agents which produce this sort of tender, particularly those relating to far away places. Then we are required to apply for the tender documents and in some cases a tender deposit is required, so that rules out the application for the documents by telephone or by telegram as it must be sent by post. Then it is the time taken for the documents to come by post to our headquarters and, unfortunately, the postal services we find very unreliable nowadays and it may take as long as five days for documents to reach us. Having received the documents, these then have to be studied and quite a number of them are quite involved. Further, there are differences in conditions of tender between most municipalities so that it is essential that these documents be scrutinised extremely carefully by responsible people. Next, the prices have to be worked out, schedules have to be filled up in draft then typed complete with covering letters. So you can see that quite a lot of time is necessary in the preparation of a tender and, of course, staff are not always waiting for tenders to arrive. We would like to suggest that consideration be given to the automatic sending of tender documents to our members just as is done by all government departments and Escom. On the point of payment of deposits on tenders, I think that the members of our Association be treated as responsible manufacterers and the payment of tender deposits should be waived. If this could be done, this would cover about ninety percent of the manufacturing capacity in the country and it would save much time. Alternatively they could be sent to our secretaries who would be willing to act as a clearing point. Turning now to the question of conditions of purchase, some members will recall that in 1959 a suggestion was put forward that standard conditions be devised but for some reason or other nothing transpired. We have had the S.A.B.S. for a long time now and we have standard specifications and surely the time has come when the standard specifications could be accepted as being adequate and correct for most of the users of electric cable in the country. I would again put a plea forward that members should confine their requirements to standard specifications as issued by the Bureau where there is a specification available for the particular type of cable required and I think 95% of the cables called for are covered by these specifications. One other point is the requirement frequently put to us to fill up fully detailed technical schedules. I don't think that tenders are very often adjudiacted on the basis of these schedules. They are usually adjudicated on basis of price and delivery. So I suggest that these are usually unnecessary at the time of tendering. The successful tenderer would in due course be required to provide these particulars. That again would save a considerable amount of time and labour. One final plea that while we do appreciate that the industry is passing through a transitional stage with the changing of copper conductors to aluminium, from paper insulation to synthetics, etc., nevertheless, could not purchasers be persuaded not to ask for too many altertives, as this makes the work far more onerous than it need be.

Mr. H. T. Turner (Umtali) thanked Mr. Sutherland for the tactful manner in which he had submitted

Mnr. H. T. Turner (Umtali) bedank Mnr. Sutherland vir die taktvolle wyse waarop hy die Kabelver-

the case of the Cable Manufacturers. He felt that with the possible exception of standardisation of cables, the other points were for each and every municipality to decide upon.

In reply to Mr. J. C. Waddy (Pietermaritzburg) Mr. Sutherland indicated that it was impossible to specify a reasonable time as geographical situation of the town and the complexity of the documents were factors which had to be considered in individual cases.

In reply to Mr. K. G. Robson (East London), Mr. Sutherland stated that not withstanding the fact that there were several agents of particular manufacturers in some centres, one set of documents sent to the head office would be sufficient.

Mr. W. N. Randell (Johannesburg) said that individual municipalities or the A.M.E.U. were always welcome to have discussions with the Cable Manufacturers Association to work out details in particular of the distribution of tender documents.

Mr. A. A. Middlecote (S.A.B.S.) commended Mr. Sutherland's plea as an earnest effort to promote the productivity of the country. He continued :

I would like to stress the need for each municipality to honour the agreement of ordering as rigorously as possible to standard specifications in S.A. This is not always done. The government appreciates this and has in fact issued a directive that local authorities should try and follow these standards in order to increase the productivity. In addition to this any form of standard approaches are something to be

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In reply to a question by Mr E. E. de Villiers (Rustenburg), Mr Sutherland said :

Our association has adopted standard conditions of sale which we use in our normal commercial business with the gold mines, with customers such as Iscor, big industrial undertakings that are coming

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Referring back to Mr Robson's query, he stated :

"that a period of three weeks is reasonable, but in cases where the tender is a simple one, shorter

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Mr P. J. Botes (Roodepoort) and Mr A. H. L. Fortman (Boksburg) also contributed to this discussion

vaardigers se saak gestel het. Hy spreek die mening uit dat, met die moontlike uitsondering van die standardisering van kabels, die ander punte wat opgehaal is, sake is waaroor elke munisipaliteit afsonderlik moet besluit.

In antwoord op 'n vraag van Mnr. J. C. Waddy (Pietermaritzburg) sê Mnr. Sutherland dat dit onmoontlik is om 'n redelike tydperk te spesifiseer, aangesien die geografiese ligging van die dorp en die ingewikkelheid van die dokumente faktore is wat in indiwiduele gevalle in aanmerking geneem moet word.

In antwoord op 'n vraag van Mnr. K. G. Robson (Oos-Londen) sê Mnr. Sutherland dat, alhoewel daar in sommige sentra verskeie agente van een besondere vervaardiger mag wees, dit genoegsaam sal wees om een stel dokumente aan die betrokke vervaardiger se hoofkantoor te stuur.

Mnr. W. N. Randell (Johannesburg) sê dat indiwiduele munisipaliteite of die V.M.E.O. self te eniger tyd welkom is om samesprekinge met die Vereniging van Kabelvervaardigers te voer teneinde besonderhede uit te werk, in die besonder met betrekking tot die verspreiding van tenderdokumente.

Mnr. A. A. Middlecote (S.A.B.S.) prys Mnr. Sutherland se pleidooi aan as 'n eerlike poging om die produktiwiteit van die land te bevorder. Hy gaan voort deur te sê :

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encouraged and therefor I think that you should take this matter seriously and refer it back to your executive. Finally, I must warn you that the cable industry is in for an even more difficult year than Mr. Sutherland implied. Over the next year they will be changing over to the metric system and this is going to be an additional difficulty imposed on the industry.

Mnr Sutherland antwoord soos volg op 'n vraag van Mnr E. E. de Villiers (Rustenburg) :

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into being, but we accept the municipalities' tender conditions as over-riding. If they depart too much from our own conditions, we usually draw attention to these in our covering letters.

Met verdere verwysing na Mnr Robson sê hy :

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period would be acceptable."

Mnnr P. J. Botes (Roodepoort) en Mnr A. H. L. Fortman (Boksburg) lewer ook bydraes tot hierdie bespreking.

The meeting next proceeded to consider the reports of sub-committees and representatives which were published in Volume (1) of the 1970 Proceedings.

Die vergadering gaan hierna voort met die oorweging van die verslae van die subkomitees en verteenwoordigers wat in Volume (1) van die Verrigtinge vir 1970 gepubliseer is.

Contributing to discussion on the reports, Mr A. A. Middlecote (S.A.B.S.) referred to the completely new approach to the whole question of the wiring regulations which was being initiated. He also mentioned that in the international field it was anticipated that he would be taking over the chairmanship of the International Committee on Wiring of Buildings. In the field of earth leakage protection, South Africa was very advanced and research was continuing.

In sy bydrae tot die bespreking oor die verslae verwys Mnr A. A. Middlecote (S.A.B.S.) na die heeltemal nuwe benadering tot die hele kwessie van bedragingsregulasies wat tans gevolg word. Hy meld ook dat, op internasionale vlak, daar verwag word dat hy die voorsitterskap van die Internasionale Komitee vir die Bedraging van Geboue sal oorneem. Wat beskerming teen aardlekke betref, het Suid-Afrika baie ver gevorder, terwyl daar nog met navorsing voortgegaan word.

At this stage Mr P. J. Botes (Roodepoort) said :

In hierdie stadium sê Mnr P. J. Botes (Roodepoort) :

Ek wil nie praat oor die voorgaande verslae nie. Wat ek nou wil sê, is wat ek reeds genoem het by die Umtali-kongres oor die skending van Afrikaans en ek bly by my standpunt, nl. dat ek voel dat iets wat in Engels gelewer is, net in Engels in ons boeke moet voorkom. Los hierdie vertaling van Engels na Afrikaans. As dit dan nodig is om Afrikaanse stukke wel in Engels te vertaal, laat ons dit doen, maar as u nou kyk na hierdie lede-forum, hierdie Afrikaans wat hier is. Ons vat byvoorbeeld hierdie vraag nommer 2.

Die klassieke geval daar van "routine testing of relays". Die Afrikaanse vertaling daarvan verskyn "op die roete te toets". Ek dink hier is heelwat foute hierso. Aktuele, hoe dit gespel is, "woonerwen", "menivuldige": al hierdie probleme. Kan ons nie liewers waar iets in Engels gelewer is, dit in Engels hou nie? Ek dink meeste Afrikaansprekendes is Engels magtig. Maar die referate in Afrikaans, kan ons hulle maar net in Engels vertaal nie?

Mr Turner (Umtali) introduced Mr D. Hogg of the Radio Research Station at Hartebeesthoek who presented a paper and slides on "Aspects of Space Research". At the conclusion of this he was suitably thanked by the President.

Mnr Turner (Umtali) stel Mnr D. Hogg van die Radio-navorsingstasie te Hartebeeshoek aan die vergadering voor en laasgenoemde dra 'n referaat, met skyfies geillustreer, oor „Aspekte van Ruimtenavorsing" voor. Na afloop hiervan word hy op gepaste wyse deur die President bedank.

Reverting to Members Forum, Question 10 was introduced by Mr D. C. Austen.

Om tot die lede-forum terug te keer, word Vraag 10 deur Mnr D. C. Austen ingelei.

Question 10 : Cross-linked Polyethylene cables.

Vraag 10 : Kruisgebonde Poli-etileenkabel.

Mr Austen said :

Mnr Austen sê :

Perhaps I should open this discussion by explaining that XPE (cross-linked polyethylene), PEX (as it is commonly known in the Republic) and VPE (vulcanisable polyethylene) all are synonymous. For the purpose of this talk, we will refer to it as VPE.

It has long been recognised that polyethylene (sometimes referred to as polythene), had fantastic dielectric properties coupled with excellent mechanical strength, but the problem hitherto was its comparitively low melting point and the power cable industry for this reason were hesitant to use this material. Of course, for high frequency operations, such as television, telecommunications etc., polyethylene has been used for nearly 30 years, and in fact radar during the early stages of the 2nd World war was only possible because of the advent of this remarkable dielectric.

Acknowledging polyethylene's inherent low softening point, scientists set about to change its physical structure from a thermoplastic (i.e. a product that can be resoftened by the application of heat) to a thermoset (one which becomes an infusable mass and cannot be resoftened). This they achieved by adding a dicumyl peroxide radical to the polyethylene chemical

structure which addition when subjected to temperatures above 300F causes molecular structure to cross link, thereby producing a product with a very large molecule of complex form. This operation changed polyethylene to VPE, bringing with it excellent physical and electrical properties, combined with certain thermoset characteristics, and consequently higher operating temperatures. Stress cracking associated with certain grades of polyethylene were now completely overcome, and VPE's increased abrasion resistance coupled with its phenomenal water resistance made it suitable for primary insulation in single and multicore high voltage cables without the necessity of a jacket or sheath.

Much has been written and said for and against VPE in power cables, and we feel that the apparent reluctance to adopt a relatively new material in high power cable insulation is due to two major reasons :

(a) Proven ability of existing insulation over long periods—e.g. Impregnated paper lead HV cable was introduced over 70 years ago, and

(b) Prejudice by the end user to switch to another product due to lack of knowledge of the product itself, and scant information on just how it will perform in service.

Lets take the case of p.v.c. for house-wiring some 18 years ago; proven ability of VIR in service did not halt the advance of perhaps the first synthetic insulation to be used commercially, but this advance was comparatively slow, despite strenuous efforts by local cable manufacturers to persuade end users to change over to a better and lower cost product. This despite the fact that the Germans had successfully used p.v.c. during and after the 2nd World War—some 8 to 10 years prior to its introduction to this market. Today it is a different story, and p.v.c. has established itself to such an extent that the archaic insulators are virtually non-existant. Here, of course, a synthetic material was ousting an organic one, and unfortunately synthetic was almost a four letter word which most people considered a sophisticated simile for "artificial", implying a cheap and nasty replacement for a product used and proved by our grandfathers. By synthetic of course, we mean a product which is synthesised by men—scientists and chemists—where all along the line of production, precise and accurate control can be maintained to ensure a virtually perfect product specifically designed for a particular end use.

Whilst in South Africa VPE in terms of power cables is a new material; in fact the newest of the synthetics to roll off the production units which have given the world insulations such as p.v.c., EPR., BR etc.; VPE is by no means a stranger in this field in other countries, for example :

In Japan X linked polyethylene cables has been performing satisfactorily since 1960—some ten years, and there they have gone up to voltages as high as 110 kV.

In Switzerland 10 kV cables have operated under extraordinarily severe conditions with temperatures varying from -50 to $+40^{\circ}C$ with exposure to extremely strong Ultra Violet rays. 70 kV industrial feeder cables have been in continuous use for over 8 years.

In Canada almost all secondary distribution and house wiring cables; 15 kV 600 V is in VPE, and

In U.S.A. the growth pattern is 80% in the overall picture, i.e. house-wiring right up to Transmission line projects with the major growth in sub transmission cables from 23 to 138 Kv.

It takes something like 10 years from the advent of a new material for it to reach full production as a cable insulator and this is true of VPE. Today this material has been thoroughly researched and has largely replaced BR, and PIL, and has basically assisted in stabilising manufacturing costs, despite general inflationary conditions. According to statistics VPE will be used world wide in about 80% of cables up to 110 kV in about 5 years time.

What are the advantages of VPE cables ?

(a) Better dielectric strength than existing insulating materials.

(b) Better power factor.

(c) Better mechanical strength.

(d) Better chemical resistance.

(e) Better thermal resistance.

(f) Smaller cable diameters.

(g) Economically better.

In fact, compared with formidable competitive products such as Ethylene propylene rubber, Butyl rubber, Poly vinyl chloride and Paper lead, VPE with exception of flexibility is infinitely superior. e.g.

EPR, due to its high power factor has a practical working limit of about 35 kV, and is not stable in water at $90^{\circ}C$. VPE has virtually no voltage limit, and is unaffected by water and meets the relevant water test specification.

VPE like all other synthetics, performs best when free from dirt and other foreign particles, but since it is impossible to eliminate all such tiny impurities in production, stabilisers have been developed for VPE which not only negate this problem, but improve its thermal stability and performance under high voltage impulse stress as well as overcoming the ionisation problem. The addition of flame retarders required

in some cables degrades the electrical properties of both VPE and Rubber compounds, but VPE can tolerate these additives more readily without prohibitive sacrifices in properties.

What are our conclusions ?

(a) Because of its inherent advantages, viz: excellent dielectric properties, resistance to chemicals, low and high operating temperatures, moisture and abrasion resistance, mechanical strength, and other environmental factors, VPE is eminently suitable for high voltage cable insulation. It represents in many ways the ideal high voltage dielectric. It has high dielectric strength, a high volume resistivity, and a very low dielectric constant, and power factor. Its physical properties are outstanding, and because of these it can be used in thick sections and although its softening point of 113°C is closer to cable operating temperatures than might possibly be desired empirically this poses no problem since VPE cables can operate continuously at 90°C with emergency overload at 135°C, and short circuit at 250°C.

(b) Prognostications indicate that in 5 years time VPE will be used in about 80% of cables worldwide up to 110 kV.

In Europe 75 kV cables have been operating satisfactorily for years, and in Japan they are already using VPE cables of 110 kV. The U.S.A. are now concentrating on sub-transmission lines of up to 138 kV, where the major expansion is taking place.

In Canada a similar pattern is developing to that in the U.S.A.

(c) Because of VPE's outstanding properties, smaller diameter cables can now be used to give a similar voltage capacity to the insulators now being used, and finally :

(d) Another important and compelling reason why VPE insulated and sheathed high voltage power cables will be increasingly used in U.S.A., Canada Europe and Japan, is their economic advantages for both the cable manufacturer and the cable user.

Mr P. J. Botes (Roodepoort) raised certain points and Mr C. L. Cosser (Bulawayo) continued as follows:

With regard to the last speaker who said that municipal undertakings were guinea-pigs, I think we are the biggest guinea-pig of the crosslink polyethylene. We've put in 33 kV PEX cable at Bulawayo. I don't think we are taking much of a risk because these cables are made in a similar manner to cables which are made overseas. We put in 5 miles of .3 sq. in. cable. There are reasons for doing this, because we want to run it in parallel with .2 sq.in. paper cables and we get the higher current capacity with the PEX than we get when we put in the paper cables. We run into 400 amps with the .3 sq. in. We have no problems in the laying of them, we have no trouble in commissioning—admittedly they have only been in service for 5 months but we are quite pleased with the prospect of using them in the future.

Mr Austen replied :

Mr Botes mentioned two major points. The first was the guinea-pig. This was also the case when PVC was introduced some 18 to 20 years ago. Municipalities, the mines, the railways and Escom were very reluctant to switch from VIR. I was working for a company who was primarily responsible for introducing PVC into this country and we found this prejudice because certain engineers regarded themselves as being used as guinea-pigs. However, once PVC took on, it took on like wild-fire.

He continued by dealing with the question of size of cable and said that this was a question for cable manufacturers to decide in the future.

Mnr P. J. Botes (Roodepoort) haal sekere punte op en Mnr C. L. Cosser (Bulawayo) gaan soos volg voort :

Another reason why we put them in is that they are easily recoverable. This particular route we've put them on is not a permanent one and at some time we will dig up the cables and use this 33 kV in different parts of Bulawayo through the 33kV system. We hope they will make 88 kV cables because we're putting in 88 Kv cable system in Bulawayo and I'd like to try the 88 kV locally made cables. I don't think that I can tell you of any disadvantages. The laying is extremely simple, they are very flexible, we roll them in 4000 foot lengths which simplify jointing and the jointing itself is extremely simple. We do 3 phase joint with 3 single phase joints in about 5 hours. So the costs were very low and the total cost of installation as well as the overall cost was much less than with paper insulated cable.

Mnr Austen antwoord :

Hy gaan voort deur die kwessie van die groottes van kabel te behandel en sê dat dit 'n saak is waaroor die vervaardigers van kabel in die toekoms sal moet besluit.

In response to questions raised by Mr E. E. de Villiers (Rustenburg), Mr Austen indicated that these were concerned with the manufacturers, except that relating to overload tests with this material, and in this connection he advised that he understood tests had been carried out using the same methods as on paper insulated cables with magnificent results. Referring to guarantees, he said :

In antwoord op vrae wat deur Mnr E. E. de Villiers gestel word, dui Mnr Austen aan dat, behalwe die vraag van die toetsing van kabels vir oorbelading, dit sake is waarby die vervaardigers betrokke is, en in hierdie verband sê hy dat hy verneem het dat toetse wel uitgevoer is, waarby dieselfde metodes gebruik is as by papier-geisoleerde kabels en dat die resultate uitstekend was. Met verwysing na waarborge, sê hy :

We, as suppliers of the material, guarantee it for the purpose for which it is intended and manufacturers would be reluctant to give long term guarantees, for the simple reason that they do not instal the cable.

Mr A. H. L. Fortman (Boksburg) stated :

Mnr A. H. L. Fortman (Boksburg) sê voorts :

We have been using crosslinked polyethylene cables in Boksburg for 3 or 4 years now and up to date we have installed .04 sq. in. 11 kV, I suppose 16,000 feet or more, with probably hundreds of ends and many joints, and up to date we have had no trouble. We've changed over completely to crosslinked polyethylene cables for the larger sizes as well, and up to now it is satisfactory.

In response to questions raised by Mr L. P. Rattey (Strand), Mr Austen said :

Mnr Austen antwoord op sekere vrae van Mnr L. P. Rattey (Strand) en sê :

The question of ageing has always been the problem of polyethylene mainly because of its vulnerability in so far as infra red rays is concerned. For this reason polythylene, even unvulcanised polythylene types, such as is used for water piping, and which is exposed to the elements, is always put into carbon black, which acts as a prohibitor. But, as I mentioned earlier, certain additives have been developed in conjunction with vulcanised polythylene which prevent ultra violet rays penetration. In addition to this, if it is crosslinked, it moves out from the family of some thermal plastics into the family of thermal sets. The ageing properties of polythylene are such that we feel it should withstand up to 20 years service and in excess of that—as long as EPR or PVC.

Mr D. H. Fraser (Durban) queried the 20 year life as being short and Mr Austen replied :

Mnr D. H. Fraser (Durban) spreek die mening uit dat die lewensduur van 20 jaar redelik kort is, en Mnr Austen antwoord :

The 20 years that I mentioned is a loose term. When we talk of the life of the cable, we assume that when this cable is properly installed below ground or in conduits whichever way it is installed, it is not directly thought of as a life time—20 years is a hypothetical example.

The meeting terminated with thanks to all who attended being expressed by the President and a vote of appreciation to him for conducting the proceedings.

Ter afsluiting van die vergadering bedank die President almal wat dit bygewoon het, en 'n mosie van dank aan die President vir die wyse waarop hy die verrigtinge gelei het, word eenparig aanvaar.

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