radial freeways from Johannesburg) will further improve the linkages of the East Rand with other areas in the P-W-V, and consolidate the present locational advantages of the region.

Land

Land has been one of the main locational advantages of the East Rand in the past, with the large, flat and cheap sites, competing more than favourably with any other zones of the P-W-V. Although with the de-proclamation of most of the mining land of the region in sight, the gold mines will leave their legacy in the region in that much of the surface will be 'paralysed' for any future economic activity. As this 'paralysed land' will form a fair proportion of the de-proclaimed land, it is worth considering the forms of 'paralysis' before considering the effects on future patterns of growth in the region.

Forms of 'Paralysed Land'

Both coal and gold mining have rendered large tracts of land useless by their mining activities. This 'paralysed land' is of five types, and the spatial expression of these types is shown in Figure 20.

I. Undermined Land. Undermined land, which is liable to subsidence and hence unsuitable for building developments, has largely been the result of coal mining in the East Rand. Due to the deepness of the gold seams there has been no shallow undermining by gold mining in the East Rand, in contrast to the area along the Reef outcrop. The undermined areas are almost all near the town centres and have resulted in the 'spoke' development of the towns of Brakpan and Springs. Little use can be made of this land except for parkland, as in the case of Springs Country Club, to the south of Springs.

/ 2. Sand Dumps ....

2. Sand Dumps. Sand dumps represent an early form of disposing of waste material. Consequently they are not widespread in the East Rand, being confined to the older gold mining areas to the north-west and south of the region.

3. Slimes Dams. This form of waste disposal has been in use since the introduction of the Cyanide Process in I922. They are hence the main form of gold mining waste mound to be found in the East Rand. The method of waste disposal gives the slimes dams a highly characteristic shape, of relatively low height (50-I00 feet), outer slope of between 25° and 45° and a flat top, a form which enables them to be of much greater extent than sand dumps (Gregory, I969).

With both sand dumps and slimes dams there are few possibilities of re-utilisation except at great cost. The Atmosphere Pollution Prevention Act (Act No.45, I965), will however ensure that the slimes dams are grassed, and in time when self-supporting plant communities are established on the dumps, they will blend into the landscape. At present however grassing has hardly started and the dust from the dumps provides an unpleasant feature in winter.

4. Water Areas. The gold mines dispose of their surplus underground water by discharging it, either into streams, or natural depressions known as 'pans'. This effluent load is composed of dissolved solids, particularly sulphates, which, when discharged into the very still waters of the pan, give off a slight but characteristic smell. Pans are scattered throughout the region in relation to the occurence of gold mines. Again, in time, it is hoped that these can be cleaned up, and perhaps used as recreation facilities.

/ 5. Mine Infrastructure ..

Figure 20 'PARALYSED LAND' IN THE EAST RAND

Source: Index of Sand Dumps and Slimes Dams

5. Mine Infrastructure. On closure gold mines will sell most of their mine equipment. The headgear, other surface buildings, electricity sub-stations, reservoirs and rail facilities usually remain, providing an austere reminder of the past mining age. Although the mine infrastructure doesn't provide a permanent paralysis to the land use, it nevertheless is an expression of the dereliction of mining land.

Effects on Future Spatial Development

Figure 20 shows the spatial pattern of 'paralysed mining land', showing how economic activities in the region have developed according to the mining land, and indicating several possible areas for development.

The area to the north of Brakpan has been rendered almost completely useless for any form of future economic activity, the area being dominated by all forms of 'paralysed mining land'. To the south of Brakpan however, the land at present being utilised as agricultural holdings, is relatively unaffected, and also further south around Van Eck Park is another area for possible future developments. Springs is bounded by the features of mine dereliction and its present spatial pattern has already been moulded by these. Further developments are possible east of Casseldale, and west of Geduld extension. The likely axis of growth will be that along the Springs-Nigel road, between Dunnotar and Nigel.

Despite the spatial restrictions that the 'paralysed land' will impose, sufficient land will be available for industrial purposes, as little land in extent is required for the industrial economic base of the region.

Expansion and Industrial Township Proclamation

Although land is available there is great difficulty

/ in ....

in getting industrial townships approved. The procedure for the proclamation of industrial townships, in which plans are circularised to government departments, has always led to difficulties in obtaining this approval, as the Department of Bantu Affairs in the past has objected to any further industrialisation of the Witwatersrand. This difficulty has been accentuated under the Physical Planning and Utilisation of Resources Act (Act No. 88, 1967), which under section 2 necessitates the prior written approval of the Minister before any industrial townships can be zoned.

As this section of the Act was only introduced in July 1967 the actual effects of its application are difficult to ascertain. Taking figures for the Transvaal and South Africa, in Table 24, it can be seen that 79 % of the applications have been approved in the Transvaal. In the East Rand the only application for an extension so far, to Vorsterskroon Industrial Township, has just been refused on the grounds that sites are still vacant in industrial townships in Nigel. Perhaps when the application was made this was the case, but not now, so further applications will have to be made before approval is given, if the sole criterion is, as stated at the Department of Planning, whether any vacant sites are available in the municipality.

TABLE 24

APPLICATIONS FOR EXTENSIONS TO, & NEW INDUSTRIAL TOWNSHIPS UNDER THE PHYSICAL PLANNING & UTILISATION OF RESOURCES ACT 1967

	Received	Passed	Rejected	Under Consid
Transvaal	851	611	184	56
South Africa	1438	1089	253	96

Up until 30.9.69

Source : Department of Planning

/ At ....

At present most firms still have plenty of land for future expansion programmes. Of the firms interviewed for the Industrial Questionnaire, they were together utilising 429 acres at present, with 410 acres being held in reserve for future expansion. This ratio of almost I : I was the same for all three municipalities.

Hence there is sufficient land for expansion for firms already established in the area for at least the next decade, whilst the deproclamation of mining land will provide other suitable sites, although restricted in location by 'paralysed mining land', on which, given the present criterion of the Physical Planning and Utilisation of Resources Act, industrial townships should be proclaimed in the next decade.

Labour

Labour presents the greatest unknown of the factors considered in this section. Although there is at present a shortage of skilled white labour this is not all that serious, and the increasing overseas migration to the Witwatersrand is likely to overcome this shortage. The unknown, due to government policy, is the availability of Bantu labour in the region for work in industry.

The Government policy towards Bantu labour, and industrial growth on the Witwatersrand has gradually developed in the last eighteen years. Policy regarding future development on the Witwatersrand is closely related to the policy of Border Area Development which originated in I952 (Eiselen Report, I952), and was further emphasised in the Viljoen Report of I958. Between these dates and I966, Government policy was aimed at providing positive incentives to industrialists to move to the Border Areas. After I966 however policy statements began to emphasise

/ negative ....

negative planning in the Witwatersrand, to force industry to Border Areas and prevent over-concentration in the P-W-V, these policy statements culminating in the Physical Planning and Utilisation of Resources Act of 1967.

Section 2 of this Act has already been studied in relation to the setting up and expansion of industrial townships. This, as stated, was no real departure from the previous difficulties of proclamation procedure. Section 3 however (see Appendix 5), was specifically aimed at curbing industrial growth in the P-W-V, and other industrial centres, by requiring ministerial approval for the establishment or extension of 'factories' [I], 'extension' meaning any increase in the number of Bantu employed in these factories. Hence, any firm which wanted to increase its Bantu labour force above that it had employed on the I8th January 1968 (when the Act came into force) had to obtain approval from the Minister of Planning.

The application of the Act implies a certain arbitrariness as each case is treated on its own merits Table 25 gives figures for its application so far, in the country as a whole. As seen I0 % of the applications have been rejected outright, with more being amended, representing a 'saving' of 22,382 Bantu that would have been employed in the 37 magisterial districts to which the Act applied (23 in the P-W-V, I2 in the Western Cape, and 2 in the O.F.S.).

Two main factors are considered upon application for an increase in Bantu labour. Firstly, the nature of

/ the ....

I. 'Factories' . Defined as incorporated in :-
Factories, Machinery and Building Work Act, I94I includes, service industries e.g. garages, bakeries and laundries.

the firm, and whether it could be decentralised to a Border Area. Generally speaking, the type of firm that is considered suitable for decentralization is a Bantu labour intensive firm which is not transport sensitive e.g. textiles, motor assembly, and furniture . Secondly, the degree to which mechanisation is being introduced into the firm, to reduce its labour intensiveness. If no attempts are being made to further mechanisation, the Department of Planning is very hesitant to grant an extension of the Bantu labour force.

TABLE 25

APPLICATIONS FOR BANTU LABOUR

UNDER THE PHYSICAL PLANNING & UTILIZATION OF RESOURCES ACT

	Applic.	Applic. Rejected	No. Bantu Wanted	No. Bantu Given	No. Bantu 'Saved'
Expansion	I593	I5I	47,964	32,592	I5,372
New Level.	9I4	9I	27,527	20,562	7,0I0
Total	25I2	242	75,536	53,I54	22,382

Up until 30.9.69

Source : Department of Planning

Because of the arbitrariness of its application it is hence difficult to estimate exactly the effects of Section 3 upon industrial growth in the East Rand. Although many firms expressed concern over future growth because of the Act, only one, a textile firm, thought that, to expand, it would have to move to a Border Area. As Table 26 shows few of the forms in the East Rand are Bantu labour-intensive. the overall ratio of sampled firms being I : I.70, with only one firm having a ratio exceeding I : I0.

/ Table 26 ....

TABLE 26

RATIO WHITE : BANTU EMPLOYEES IN SAMPLED FIRMS OF THE EAST RAND : INDUSTRIAL SURVEY

	I : I		I:I - I:5		I:5 - I:9		I:IO +	
No. of Firms	IO		24		9		I	
	W	B	W	B	W	B	W	B
Employ. in Groups	3858	2883	1868	4704	593	3079	II	II5

	W	B	
Total Employ. of sampled Firms in East Rand	6330	10781	Ratio I : I.70

The main growth firms in the region, metals and engineering, are further suited to the greater introduction of mechanisation, which in the long-run will increase profitability. Another facilitating feature of the East Rand for industrial growth is the availability of Coloured and Asian labour, to which the Act does not apply, who are being increasingly used by firms when an expansion of their labour force is necessary.

Despite the legacy of gold mining in 'paralysing' much of the land of the East Rand, and hence controlling future spatial developments in the region, land will be available for new development and expansions of industrial townships. Communications, water, and power developments will further facilitate growth. Whilst the Physical Planning and Utilization of Resources Act in its application to the proclamation of industrial townships, and the increase of Bantu labour, is likely to act as a 'brake' upon growth in the region, industrial growth is certain to continue due to the present room for expansion and the suitability of the main type of industry in the region for mechanisation.

/ CONCLUSIONS

CONCLUSIONS

Contrary to the gloomy forecasts of the 'economic fate' of the East Rand put forward in the early I960's (N.R.D.C., I957, I960 ; M.M.R.U., I964), the East Rand has survived the bulk of closures of the gold mines and the transition of the local economic base to manufacturing. Far from declining absolutely in the I960's the local economy has shown more signs of prosperity than in the previous decade when gold mining was at its peak.

The smooth transition of the economic base of the region has been facilitated by two factors. Firstly, the national economic conditions of the period of transition, in the economic upsurge between I962 and I965, when, with the expanding national economy many firms looking for sites in the Witwatersrand were attracted to the East Rand. Secondly, the qualitative change in the economic base, in the higher wage rates paid by manufacturing, more than countering the quantitative decline in economic base employment.

Hence by the mid I960's the new manufacturing economic base of the region was more than merely supporting the local economy created by the gold mines, it was stimulating further growth in non-basic activities. Since I963/64 the position of manufacturing in the region has been consolidated, and the closures of the remaining gold mines in the region, culminating in the closure of Marievale (forecast for I975), will have no serious repercussions on the economic health of the region.

With the development of new gold mining areas in South Africa, in the Orange Free State, Klerksdorp, and Kinross-Evander, the study of a declining gold mining economy is relevant to future developments in these areas.

/ What ....

What future can be expected for these local economies with the forecast closure of the gold mines in twenty-five years time ?

Their future will depend upon the degree to which industry can be attracted to these areas before closure of the gold mines, and whether or not there are self-curative processes accompanying the decline of the gold mining base, that is, whether other basic activities can utilise the infrastructure established in the region. This study of the East Rand has shown that little industry is automatically attracted to a gold mining area, gold mining possessing few locational attractions for associated industry. Similarly, the infrastructure provided by gold mining has few attractions to industrial development and in the land 'paralysed' by gold mining actual dis-incentives to industrialisation. Only through the East Rand's proximity and integration into the P-W-V Industrial Region have locational forces attracted industry into the region. It was this integration into the industrial location pattern of the P-W-V, not the local gold mining activities, that have ensured the 'survival' of the local economy. Hence, if the new gold mining areas, being more isolated from centres of economic development than the East Rand, are not to 'die' upon mine closures, government and municipal action must be taken now to broaden their economic base.

The East Rand today forms a separate yet integrated, industrial zone of the P-W-V, still physically separated by the surrounding gold mining land, and yet integrated into the spatial industrial economy of the P-W-V Region both in terms of market and locational factors. The manufacturing base is closely integrated into the regional economy, being complementary to much of the manufacturing

/ in ....

in other zones of the region. Future industrial growth of the East Rand is therefore strongly linked to future growth of the P-W-V Industrial Region. The East Rand in fact in its present manufacturing composition has a large share of the 'growth industries', especially metals and engineering firms, from which growth can be expected in the future. Further, the locational advantages of the East Rand, as in the past, will attract firms from the 'seedbed' of Johannesburg and cause additional growth in the region. Even with the difficulties presented to expansion in the P- -V by the Physical Planning and Utilisation of Resources Act, the region is assured of future manufacturing growth, in which the East Rand, because of its locational advantages and more capital-intensive based firms, is likely to fare relatively better than most zones.

Within the East Rand itself, the spatial expression of this growth, in terms of industrial and residential townships, will be governed by the legacy of gold mining. Just as present patterns of development have been controlled by gold mining activities and restrictions by gold mining company owned land, so too, will future developments be controlled by 'paralysed land' left by gold mining activities. The future development of Springs will continue in a 'spoke' like manner due to its surrounds of 'paralysed land'. Because of the smaller amount of industrialisation at present, and the larger amount of potential land for industrial and residential developments in Brakpan and Nigel, these two municipalities are likely to have relatively higher growth rates than Springs in the near future.

In terms of the economic health of the region the gold mining era no longer plays an important role, having

/ been ....

been superseded by manufacturing. For many years to come however the industrial landscape of the East Rand will be dominated by the aura of gold mining, the legacy of an economic base which has shaped, and continues to shape, the spatial pattern of development in the region.

APPENDIX I

DERIVATION OF LOCATION QUOTIENTS

The location quotient aims at substituting for the direct measure of 'export' orientation of a local industry, obtained in an industry-by-industry survey, by the derivation of an index of local specialisation reflecting the importance of the locality to the industry, relative to the importance of the industry to the nation (Hattila and Thomson, I955). It achieves this by a simple ratio of an industry's share of local employment relative to the industry's share of national employment.

Employment in the various sectors has been set out in Table 27 for the years I95I, I960, and I963/64. Taking agriculture in I95I as an example of the derivation of location quotients :-

$$\text{Location Quotient} = \frac{e / E}{p / P}$$

when,

p = Total economically active population in the East Rand.
e = Number employed in sector in the East Rand.
P = Total economically active population in South Africa.
E = Number employed in sector in South Africa.

hence, substituting figures for agriculture in I95I :-

$$\text{L.Q.} = \frac{2,I93 / I,503,642}{I60,970 / 4,592,557} = 0.04$$

For those employment sectors with a location quotient of less than I it is assumed that employment is in service to the locality. For those sectors with a location quotient exceeding I, a proportion of employment, determined by the extent unity is exceeded is considered to be basic

/ (or ....

Table 27

DERIVATION OF LOCATION QUOTIENTS

FOR SECTORS OF EMPLOYMENT IN THE EAST RAND

1951, 1960, 1963/64.

	1951			1960			1963/64		
	E. Rand	S. A.	L. Q	E. Rand	S. A.	L. Q	E. Rand	S. A.	L. Q
Agriculture	2198	1,508642	0.04	6094	1,689252	0.13	6094*	1,786090*	0.14
Mining	111517	510019	6.23	84329	615149	1.52	67334	622434	2.05
Manufacturing									
Food	967	93434	0.29	1314	117169	0.41	2030	129582	0.66
Textiles	120	97409	0.63	131	50007	0.04	285	160930	0.09
Furniture	690	45347	0.43	1362	119146	1.01	1123	59866	0.36
Paper	2045	26064	2.24	2249	39498	2.12	3303	50096	2.80
Rubber		N/A			N/A		80	14643	0.23
Chemicals		N/A			N/A		200	50773	0.16
Non-Metal Min.	1289	51611	0.71	3095	59643	1.93	3429	70072	2.08
Metal Prod's.	2733	107513	0.72	3730	105780	1.31	5516	150660	1.55
Machinery	1003	40361	0.70	2931	54482	0.86	5864	76079	3.26
Transport Equip.		N/A		1865	29247	2.37	2564	45600	2.39
Misc. Manufac.	572	9545	1.71	579	13567	0.77	600	31399	0.81
Construction	3695	240139	0.43	3187	276144	0.42	3187*	171207	0.79
Electricity	858	25380	0.96	1120	39586	0.77	1120*	33536	0.95
Wholesale & Retail	6927	252644	0.78	7142	363057	0.73	7142*	399838*	0.75
Other Commerce	650	74995	0.26	2641	454893	0.21	2641*	418688	0.61
Transport	2329	202866	0.32	3153	205131	0.57	3153*	246735	0.54
Service	22568	1,073605	0.59	20666	1,249699	0.56	20666*	1,417257	0.62
Other	769	202125	0.10	8381	483380	0.64	8381*	408168	0.87
Ec. Active Population	160970	4592587		153970	5726688		144694	6,153987	
Total Population	190713	12671452		269263	15994181		257868	17457000	

Statistics from - Industrial Censuses 1951, 1960, 1963/64 , and unpublished statisics from the Bureau of Census and Statistics.

* Extrapolations

(or export orientated).

Hence, taking the paper industries in I95I with a location quotient of 2.24, the number of surplus workers is derived by dividing the location quotient into the total number of workers employed and subtracting the result from the total :-

$$2045 - \frac{2045}{2.24} = II33$$

The division of employment between basic and non-basic in the paper industry is therefore II33 : 9I2.

Gold mining provides the only acception to the application of this index, the industry being obviously basic, in that gold, generally speaking, is not a usable commodity and hence for the purposes of segregation of basic and non-basic, gold mining employment has been taken as totally basic.

/APPENDIX 2

APPENDIX 2

INDUSTRIAL QUESTIONNAIRE

Firm .....
Nature of Product .....
(According to classification of Industrial Census)

I. Date Firm Set Up In Location .....

2. Present Employment

(i)

White		Non-White	
Male	Female	Male	Female
....	....	....	....

(ii) Any change in recent years in groups of employment ? .....

3. Industrial Land

(i) Acreage of land engaged in actual production .....

(ii) Acreage held in reserve against future expansion .....

4. Transportation

(i) Inputs

% Value	
Road	Rail
....	....

(ii) Outputs

% Value	
Road	Rail
....	....

/ 5. .....

5. Location Factors

Either in relation to - Setting up of firm
or - Possible expansion of firm

N.B. (i) Trying to evaluate factors basic to the economies of the particular industry which vary between alternative locations.
(ii) Consideration of factors in relation to costs.

Main Factor Groups	Location Factors	Ranking in order of importance (1-4)
1. Labour		
	(i) Availability of labour.	...
	(ii) Availability of skilled labour.	...
	(iii) Availability of unskilled labour.	...
2. Market		
	(i) Access to markets.	...
	(ii) Anticipation of market growth.	...
	(iii) Low freight costs to market.	...
3. Site		
	(i) Low price of land or building.	...
	(ii) Scope for expansion.	...
	(iii) Presence of suitable building.	...
	(iv) Transport facilities available.	...
4. Materials		
	(i) Availability of raw materials and components.	...
	(ii) Availability of water.	...
	(iii) Availability of electricity.	...
	(iv) Low cost of water and/or electricity.	...
5. Municipal Incentive		...
6. Residence of Owner		...
7. Others		...

/ 6. .....

6. Input-Output Patterns of Manufacture

Inputs

	E.Rand	P-W-V	Tvl.	O.F.S.	Cape	Natal	Imports
% Value	...	...	...	...	...	...	...

Additional notes in relation to specific areas and/or inputs .....

Total Costs of Firm

	Salaries & Wages	Raw Materials	Intermediate goods	Transport	Energy
% Costs	...	...	...	...	...

Outputs

(i) Sectors

	Gold Mining	Other Industry	Government Sector	Household	Export
% to Sectors	...	...	...	...	...

(ii) Relationship with the Gold Mines as a market

	% Output by Value
East Rand	...
P-W-V	...
Rest of South Africa	...

(iii) Areas

	E.Rand	P-W-V	Tvl.	O.F.S.	Cape	Natal	Imports
% Value	...	...	...	...	...	...	...

/ APPENDIX 3

APPENDIX 3

FIRMS INTERVIEWED

Ace Engineering (Pty.) Ltd. Nuffield,Springs.
African Zinc Mills (Pty.) Ltd. Vulcania,Brakpan.
Baldwins Ltd. Vulcania,Brakpan.
Brakpan Engineering Works (Pty.) Ltd. Vulcania,Brakpan.
Coca-Cola Bottling Co. Vulcania,Brakpan.
Consolidated Brass Foundry (Pty.) Ltd. New Era,Springs.
Crabtree.J.A. (Pty.) Ltd. New Era,Springs.
Daihatsu South Africa (Pty.) Ltd. Vulcania,Brakpan.
Dalview Engineering (Pty.) Ltd. Vulcania,Brakpan.
Davidson & Co.(Africa) (Pty.) Ltd. Nuffield,Springs.
Esse (Pty.) Ltd. Nuffield,Springs.
Fimat Engineering (Pty.) Ltd. Vorsterskroon,Nigel.
Flather Bright Steel (Pty.) Ltd. Nuffield,Springs.
Gillette South Africa (Pty.) Ltd. New Era,Springs.
Halstead,B. & Co. (S.A.) (Pty.) Ltd. Nuffield,Springs.
Hammond & Christy's Engineering Works (Pty.) Ltd. Selection Pk, Springs.
Hard Metals Limited Nuffield,Springs.
Irvings Welding Works Brakpan.
Lambull Engineering (Pty.) Ltd. Brakpan.
Liebherr-Africa (Pty.) Ltd. New Era,Springs.
Marley (S.A.) (Pty.) Limited Pretoriusstad,Nigel.
Moconchie Brothers (Pty.) Ltd. Nuffield,Springs.
Nigel Bottling Industries (Pty.) Ltd. Nigel.
Nigel Milling Co. (Pty.) Ltd. Nigel.
Nigel Plen (Pty.) Ltd. Vorsterskroon,Nigel.
Nigel Textile Works (Pty.) Ltd. Pretoriusstad,Nigel.
Nigel Timber & Hardware Co. (Pty.) Ltd. Vorsterskroon,Nigel.
Non-Ferrous Tube Co. (Pty.) Ltd. New Era,Springs.
Pegasus Engineering (Pty.) Ltd. Brakpan.
Pilkington Brothers (S.A.) (Pty.) Ltd. New Era,Springs.
Powerlines Limited Pretoriusstad,Nigel.
Raleigh Cycles (South Africa) Limited Nuffield,Springs.

/ South .....

South African Board Mills Ltd. New Era, Springs.
South African Pulp & Paper Industries Ltd. Enstra, Springs.
Springs Technical Engineering (Pty.) Ltd. Nuffield, Springs.
Telephone Manufacturers of South Africa (Pty.) Ltd. New Era, Springs.
Transvaal & O.F.S. Mining Material Supplies (Pty.) Ltd. Selection Pk.
Trojan Engineering Co. (Pty.) Ltd. Vulcania, Brakpan. Springs.
Union Carriage & Wagon Co. (Pty.) Ltd. Vorsterskroon, Nigel.
Van Leer Packaging (Pty.) Ltd. New Era, Springs.
Watkins, J.R. Co. (Africa) (Pty.) Ltd. New Era, Springs.
Watt & Wilkinson (Pty.) Ltd. New Era, Springs.
Wickman (S.A.) (Pty.) Ltd. Vulcania, Brakpan.
Woodhead-Kempo Springs (Pty.) Ltd. Nuffield, Springs.

/ APPENDIX 4