PLANNING A DEMONSTRATING NEW COMMUNITY FOR NORTHERN TAIWAN REGION: THE PLANNING FOR LINKOU NEW TOWN

by

APOLLO TE-CHENG TENG

B.Arch., Chung Yuan College of Science and Engineering (1965)
M.C.P., College of Chinese Culture (1968)

Submitted in Partial Fulfillment of the Requirements for the Degree of Master of City Planning at the MASSACHUSETTS INSTITUTE OF TECHNOLOGY June, 1972

Signature of Author

Department of Urban Studies & Planning, June 2, 1972

Certified by

Thesis Supervisor

Accepted by

Chairman, Departmental Committee on Graduate Students
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ABSTRACT

This thesis is concerned with planning and devel-
oping a new town on Linkou plateau in order to effectively 
accommodate a large amount of the future urban population 
which is estimated 4.2 million by the end of the century 
for the Northern Region on Taiwan.

The first chapter reviews the population explosion 
and the rapid urbanization on Taiwan. It also reviews the 
problems face today's Taiwan urban areas. Then it points 
out the need for a coordinated islandwide and regional 
planning and development in the course to attack those prob-
lems and guide the future urban development. It also indi-
cates that new community or new town development as an 
alternative to the future urban development on the island.

The second chapter describes the Northern Taiwan 
Region and its problems. Then points out the significances 
of developing Linkou as a new town. Following that, a de-
tailed analysis of why Linkou is superior among the eight 
potential sites in the region. A rating scale was designed 
to evaluate the development priorities of these sites.

Chapter 3 deals with assuring an economic base 
for the proposed new town. Linkou, envisioned as a self-
contained new town, would have both goods-producing and 
service-producing industries. A host of incentives were 
designed to attract industries into the new town.
Chapter 4 deals with the physical planning of the new town. A brief analysis of the site precedes the structuring of the new town. The planning itself is divided into: residential units, industrial estates, community centers, community facilities, and transportation system. Relevant planning and design criteria have been included.

Chapter 5 deals, very briefly, with calling for a development corporation to implement the development plans. A full range of powers is suggested to be vested with such a development corporation in order to effectively carry out the plans.

Chapter 6 evaluates, mainly, the planning idea, the plans and the implementation mechanism designed to cope with the task.

Thesis Supervisor: Kevin Andrew Lynch
Title: Professor of Urban Studies and Planning
ACKNOWLEDGMENTS

Many and many thanks to Professor Kevin Lynch, my thesis supervisor as well as academic adviser, who, with great patience, read through this thesis and gave me many valuable suggestions and insights. He also has been so kind as to correct my mistakes with English writing here and there. Due to the time limitation, the text as well as the plans were done in a hurry. It has not been possible for Professor Lynch to read through the text very carefully. The author takes full responsibilities of possible errors and mistakes.

Professors Tunney Lee and Gary Hack also took interest in reading the thesis and provided me with valuable comments. Mr. Sumer Gurel, a SPURS fellow in the Department, also rendered much helps to me. To all of them I owe many thanks.
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1. A Review of the Population Explosion and Rapid Urbanization

A. Population Growth and Prediction

The population on Taiwan has been continuously increasing at a rather rapid pace. It was doubled from 3 million to 6 million in a period of 36 years (1906-1941). The figure was again doubled in the following 22 years (1942-1963). And it is very likely that the figure of 12 million in 1963 will be two-folded by the end of the century—a span of 36 years. The population growth rate during the sixties was 3.23% per year.

The exact population on this tiny island with an area of 35,961 square kilometers (sqkm) (or 13,885 square miles) was 15,039,093 by February 29, 1972. The overall density nearly doubled from 218 persons per sqkm in 1951 to 423 persons per sqkm in February 1972. (End of 1971 density was 408 persons per sqkm.) The density leads the Netherlands' 387 and stands the highest among the world community. Furthermore, with only one fourth of the island (8,999 sqkm) arable, the arable-land density is 1671 persons per sqkm. The figure outrates Japan's 1489 and also leads the world.

1 In the latter part of 1949, nearly a million mainland Chinese withdrew to Taiwan as the Communists took over the Mainland.
2 For comparison, Taiwan is slightly larger than Massachusetts and Connecticut combined; but slightly smaller than the Netherlands. The government on Taiwan releases population statistics each month.
The government on Taiwan has been trying very hard to cut down the birth rate through series of family planning programs since the early sixties. The average growth rate during the period 1960-64 was 3.32%, while during the latter half of the decade (1965-69) the figure was 3.18%. The natural growth rate was further cut down to 2.09% in 1971.1

A review of the age-structure of the population makes one pessimistic about the possibility to further cut down the birth rate to a significant level--say 1.0%--in the near future. Women between the ages 15 to 49 would increase from 3.03 million in 1968 to 4.27 million (an increase of 41%) by 1978. Among them women in the age group 20-29, which is the most fertile group, will increase from 0.93 million to 1.64 million during the same period--an increase of 76%. This constitutes a big threat to the overall family planning effort. It has been less successful for the women in this group to reduce the birth rate mainly because they are somewhat less eager to control the birth and they are less informed of family planning idea and less assisted than their counterpart in the 30-39 group.

Consequently, the family planning agencies can only expect that the natural growth rate could be slowed down to 1.8% by 1980 and further down to 1.2% by the end of this century. This means that the average reduction of the natural growth rate compares unfavorably with those of other Asian countries. During the same decade the figure decreased from 2.9% to 1.8% in Korea; 2.98% to 1.5% in Hong Kong; 3.24% to 1.78% in Singapore. The average annual growth rate of the US population was 1.33% in 1960-70 period.
growth rate will be 0.03% per year in the next 29 years. In this context, the population for the next three decades is projected as shown on Appendix A. The projection is solely based on the natural growth rate set as the goal for family planning and birth control task.\(^1\) The result is quite close to a projection done by the Urban and Housing Development Committee (UHDC) in 1967:

<table>
<thead>
<tr>
<th>Year</th>
<th>Population (projected by UHDC)</th>
<th>My projected figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976</td>
<td>16,272,200</td>
<td>16,556,000</td>
</tr>
<tr>
<td>1986</td>
<td>20,054,200</td>
<td>19,740,000</td>
</tr>
<tr>
<td>1996</td>
<td>23,174,200</td>
<td>22,853,000</td>
</tr>
</tbody>
</table>

Another population projection set the 5-year period population for Taiwan:\(^2\)

<table>
<thead>
<tr>
<th>Year</th>
<th>Population (projected by CCDP)</th>
<th>My projected figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>16,506,000</td>
<td>16,240,000</td>
</tr>
<tr>
<td>1980</td>
<td>18,612,000</td>
<td>17,826,000</td>
</tr>
<tr>
<td>1985</td>
<td>20,831,000</td>
<td>19,422,000</td>
</tr>
<tr>
<td>1990</td>
<td>22,936,000</td>
<td>21,005,000</td>
</tr>
</tbody>
</table>

which are somewhat larger than my estimation. In any event, it is very likely that the island will see increases of 2.8 million, 3.2 million, and 3 million of people by 1980, 1990, and 2000 respectively. It would certainly be a great task to accommodate the future nine million population on this already overloaded island effectively and rationally.

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\(^1\)The population growth by migration will not be significant on this island because, for one hand, not many overseas Chinese go and settle on Taiwan; on the other hand, the policy is still not so encouraging as to induce any significant outflow of the islanders.

B. Urbanization Trend and Prediction

Parallel to the population boom, urbanization on this island has also been quite fast. In the year 1958, slightly over half (51%) of the island population made their living in cities or towns with population of 50,000 or more. The percentage of population living in urban areas reached 56% in 1968. The figure is estimated at 60% now. It is projected that there will be 15 million people living in urban areas by 1990—70% of the 21 million people projected for.

With the limited amount of arable land, countryside all over the island can no longer accommodate more people. Rather, population continuously migrate to urban areas as the agricultural technology develops and hence requires less and less manpower. Consequently, at least 75% of the 2000 population must be accommodated in non-agricultural areas. (18 million urban dwellers as compared to 6 million rural population.) If the gross urban density be 120 persons per hectare (or 50 per acre), there would be a need of 75,000 hectares of new urban land for the 9 million new urban dwellers in the next 28 years. The total urbanized land would be in the order of 150,000 Ha.—one sixth of the total arable land on the island—by the year 2000.

A serious problem arises when, on the one hand, more agricultural land is needed to grow enough (or at least a certain amount of) food for the ever-growing population; while, on the other hand, those good farming land around existing cities and towns along the west coastal plain is being 'eaten' up by waves of new population both resulted from
rural outmigration and the rapid growth among the cities and towns themselves.

C. Economic Growth, Industrial Development and Land Consumption

The economy of Taiwan has been growing rapidly since the mid-fifties. The government has been launching series of programs to expedite the economic growth. The average annual growth rate of economy during 1953-1960, the period in which the first two four-year economic development plans were implemented, was 7.2%. The figure for the period 1961-1970 was 9.9%, while the figures for 1970 and 1971 were 10.1% and 11.4% respectively.

As a consequence of the rapid economic development, the gross national product (GNP) of 1970—$5.4 billion—was twelve times that of 1952, the year before the first four-year economic development plan started. The $5.4 billion represents an actual increase of 10.1% over 1969. (14.95% if calculated at 1970 current value.) Per capita income was $329 in 1971, which was nearly three times that of 1960 ($114); the figure also represents a 12.5% increase over the 1970 per capita income of $292. The 1971 GNP was $6.2 billion—an actual increase of 11.4% over the 1970 figure, or 14.2% increase if calculated at 1971 current value.

During the process of fast economic growth, the rapid process of industrial development has been most spec-

---

1 Five successive 4-year (1953-56; 1957-60; 1961-64; 1965-68; 1969-72) Economic Development Plans have been successfully implemented. The sixth such plan will be started in 1973.
tacular. The industrial growth rate averaged 18.1% annually during the 1966-1971 period and reached 21.2%, a record high, in 1971. Consequently, the share of industrial output in the net domestic product has been increasing year after year. The share was 34.2% in 1971, while the figure for the year 1965 was only 28.2%. On the other hand, the agricultural growth rate averaged only 4.1% annually during the 1966-1971 period and the share of agricultural product in the net domestic product dropped from 27% in 1965 to 17.7% in 1971. This is the clear evidence that the economy of Taiwan is shifting from a structure based on agriculture to one based on industry and that the country is gradually becoming industrialized.

As of 1970, there were 62 industrial zones with a total of 2,894 hectares inland. With the addition of 2,165 hectares of industrial land in the coastal areas, the total area will be 5,059 hectares.

The demand for industrial land is estimated at 700 hectares per year. Industry authority within Taiwan Provin-cial Government has made surveys of potential sites for indus-trial development and concluded that at this stage there are 55 sites with a total area of 4,600 hectares which are suitable for industrial park developments.

The agencies which are responsible for industrial park development are currently involved in projects of developing ten new industrial parks which have either been started or will be started within two years.¹ Another source

¹The total area of the ten industrial parks will be 2,370 Ha. Central Daily News, March 28, 1972.
discloses that over the next ten years, the government plans to invest some $225 million to develop 6,000 hectares of industrial land across the island.¹

All of these intensive industrial park development programs manifest the fast pace of industrial land consumption. It is likely that an additional 15,000 hectares of land will have to be converted to be industrial land in order to cope with the pace of population and economic growth.

Both the central government and the provincial government assume big powers in choosing and developing industrial parks.² Yet, without a comprehensive approach and consultation with the Committee for Comprehensive Development Planning, some of the industrial zones have been placed on previously good agricultural lands. Furthermore, nearly all of the industrial zone development plans do not call for the provision of housing and other facilities needed by residents who would live in such housing, not mentioning the idea of developing new communities to incorporate these proposed industrial parks. Long commuting time has been a serious problem for present-day workers in industrial parks across the island. This also adds to the traffic jams in areas nearby the industrial parks or zones.

A careful selection of sites on less agriculturally productive land for new community development could avoid the

---

¹ Free China Weekly, March 19, 1972, p. 4.
² Agencies involved in industrial land development: (in central government level) Industry Bureau of the Ministry of Economic Affairs; Agricultural Development Division of the Veteran Administration; and China Petroleum Company. (in provincial government level) Industrial Promotion Committee; Taiwan Land Development Corporation; and Taiwan Land Bank.
endless consumption of good farming land. By incorporating industrial parks with neighborhood, this approach could also add the convenience of the industrial employees who choose to live in such new communities.

2. Issues Facing Today's Taiwan Urban Areas

A. Unbalanced Islandwide and Regional Development

Polarization has been the trend of development on the island. Both the Northern Region and the Southern Region (or Kaohsiung-Tainan Region) have been gaining most of the growth momentum, while leaving the rest of the island (namely Taichung Region, Hsinchu Sub-region, Chiayi Sub-region, the East Sub-region, and Ilan Sub-region) way behind them.

The following table reveals the fast pace of population growth of the Northern Region as compared to the rest of the island:

<table>
<thead>
<tr>
<th>Region</th>
<th>Average Annual Population Growth Rate, 1951-1966</th>
</tr>
</thead>
<tbody>
<tr>
<td>Islandwide</td>
<td>3.40%</td>
</tr>
<tr>
<td>Northern Region</td>
<td>4.77</td>
</tr>
<tr>
<td>Kaohsiung-Tainan Region</td>
<td>3.37</td>
</tr>
<tr>
<td>Taichung Region</td>
<td>2.73</td>
</tr>
</tbody>
</table>

The result of this unbalanced growth and development is that outmigration from the lagging regions continues and that the living standards in these lagging regions are even worse as compared to the leading regions.

Within each region, the growth is also somewhat concentrated in one or two leading cities. In the case of Kaohsiung-Tainan Region, the growth is happened mostly in the
two provincial municipalities—Kaohsiung and Tainan. All the other three counties have been experiencing negative population growth by migration. The following table reveals the growth trend among the cities and counties of Kaohsiung-Tainan Region during the period 1951-1966:

<table>
<thead>
<tr>
<th></th>
<th>Total Population Growth Rate</th>
<th>Natural Population Growth Rate</th>
<th>Rate of Growth by Migration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaohsiung City</td>
<td>5.45%</td>
<td>3.70</td>
<td>+1.75</td>
</tr>
<tr>
<td>Tainan City</td>
<td>3.99</td>
<td>3.27</td>
<td>+0.72</td>
</tr>
<tr>
<td>Kaohsiung County</td>
<td>3.09</td>
<td>3.50</td>
<td>-0.41</td>
</tr>
<tr>
<td>Tainan County</td>
<td>2.34</td>
<td>3.29</td>
<td>-0.95</td>
</tr>
<tr>
<td>Pingtung County</td>
<td>3.08</td>
<td>3.32</td>
<td>-0.24</td>
</tr>
<tr>
<td>The Region</td>
<td>3.37</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


In the case of the Northern Region, the biggest share of growth has been in Taipei City itself and its suburban townships. One statistics (Taipei-Keelung Metropolitan Regional Plan Report) shows that during the period 1950-1960 Taipei City grew 78.7%; suburban towns grew 126.2%, while the Region as a whole only grew 68.2%. The other statistics (Linkou Special District Report) indicates that during the period 1955-1968 Taipei City grew 80.90%; suburban towns grew 162.70%, while the Northern Region as a whole grew 55.30%.

All of these statistics suggest the big gap between the leading cities (and its immediate surrounding towns) within a certain region and their hinterlands. In general, the larger the conglomeration of a city is, the more the concentration of resources of the region will be.
The too fast growth of regional centers--Taipei and Kaohsiung for example--has resulted in many problems:
The over-crowdedness in the squatter sections with no direct sunshine and no open space--unhealthy living environment; insufficient public facilities--water shortage, no sewerage or primitive sewers, crowded schools, etc.; frequently congested traffic as a consequence of too many people and too many cars on networks which are not capable to accommodate; and continuous urban sprawl which has been paving up hundreds of hectares of good farm land around the big cities.

In order to alleviate the situation, efforts should be given to slow down the growth pace in such metropolises. This inevitably brings up the need to direct a great percentage of the future growth to other suitable sites--be it existing towns or primarily vacant land which can be developed as new growth centers. It is thus one of the main goals for the future urban development strategy to achieve a somewhat more balanced islandwide and regional development. Measures dealing with the future urban development should be evaluated in this respect.

B. Continuous Intrusion into Surrounding Farm Land

As shown on Figure 1, the growth pattern of Taipei City is a good example of the continuous intrusion into surrounding farm land. The built-up area had been doubled between 1945-1967, a period of 22 years. The existing land use plan of the Taipei-Keelung Metropolitan Region also indicates a large amount of rice paddies has been built up either for
Growth Pattern of Taipei, 1897–1967

YEAR | 1897 | 1920 | 1945 | 1967  
Popsulation | 47,000 | 80,000 | 335,397 | 1,221,076

SOURCE
MAP & EVOLUTION OF CITY GROWTH AND DEVELOPMENT OF "MASTER PLAN, TAIPEI CITY"
urbanization or for manufacturing industries. And the rate for such urban sprawling is even faster nowadays since more and more people who come to the large cities for jobs cause the continuous expansion of cities besides the expansion due to the natural population growth. It has been worried that, before long, the whole Taipeibasin, which had once been the "rice barn" for the Northern Taiwan Region, will be built up if no effective measures to alleviate the development pressure on the Basin is implemented.

Islandwide, a total of 4,586 hectares of rice paddies had been converted to non-agricultural uses during the 1957-1966 ten-year period. The ten industrial parks under development represent another significant intrusion into farming land since the present practice is simply purchasing the paddies from farmers and developing them to be industrial lands.

The intrusion not only means the loss of prime farming land, but indicates the lack of comprehensive planning. As a matter of fact, the unplanned urban sprawl brings up many problems as have been discussed before. The incompatibility between the pollution-causing industries and settlements, the traffic jam caused by commercial and industrial developments along the major highways, the controversy between urban development and flood plain conservation are some of the problems deserve more attentions.1

1Housing and commercial development have sprung up around such polluter-industries as oil refinery, cement, etc., in the metropolitan Kaohsiung area.
C. Environmental Deterioration of Large Urban Areas

As in the other parts of the world, people living on the island are suffering from water and air pollution to a level that cannot be disregarded. Water and air pollution have been the two main causes of environmental deterioration. The pollution is especially serious in two large metropolitan areas--Taipei-Keelung Metropolitan Region to the north and Kaohsiung-Tainan Metropolitan Region to the south. These two metropolitan regions are the centers of the Northern Taiwan Region and Kaohsiung-Tainan Region respectively.

Within Kaohsiung-Tainan Metropolitan Region, natural drainage systems, harbors, beaches, and canals have all been seriously polluted mainly by main settlements and factories. The Tainan Canal and the Ai-ho in Kaohsiung are polluted by the waste water of these two cities respectively. The Hochin Creek to the north of Kaohsiung is polluted by the waste water of the oil refinery of the Chinese Petroleum Corporation. The lower part of the Kaoping Creek is polluted by the Yung-feng-yu paper factory. The pollution of the rivers is an increasingly serious problem because many people living downstream depend on the water of these rivers for potable water as well as for irrigation.

Many resources are already destroyed, or at least disturbed, by water pollution: extensive paddy field areas, fish ponds, the only beach resort in southern Taiwan--Hsih-tze-wan near Kaohsiung harbor, the Lien-tze-tan near Tsoying, and other places. In addition the present shortage in the region of public water and irrigation will be increased if
more and more water is polluted in this careless way.

Air pollution in big cities is also very serious. According to a recent statistics released by the Division of Environmental Sanitation of the national Bureau of Health, Kaohsiung City leads the island with its average dustfall of 17.19 tons per sqkm per month in 1971. (20.43 tons in December was the highest.) Taipei City placed second with 16.77 tons per sqkm per month, but the heaviest dustfall of 24.56 tons per sqkm in January outrated that of Kaohsiung City.

Kaohsiung City also leads the island with its average particle containment of 354.09 milligrams per cubic meter in 1971. (December average 569.71 milligrams/M³ was the highest in the year.) Taipei County, which surrounds Taipei City with its industrial towns, stood second with 274.16 milligrams/M³/month, although the average within Taipei City itself stood fourth on the island (267.27 milligrams/M³).

As for smog density-density of smog up to 1000 feet in the sky, Taipei County also leads the island with its 2.9 in 1971. Kaohsiung City and Keelung City tied for the second with the measure 2.3. (Taichung: 2.1, Taipei: 1.6.)

It is thus very apparent that the air in leading cities--Taipei (and its satellite towns in Taipei County), Kaohsiung, Keelung, and Taichung--is much more worse than that in the smaller cities or counties.

On the other hand, the water of the Hsin-tien Creek has been so seriously polluted that it has been the center of controversy--to improve the water quality of Taipei Water Works or to let the polluters keep on polluting the water. There
are about 40,000 residents and 40 factories along the Wanshen Creek in Chinmei, a southern district of Taipei. Large amount of waste water from both the domestic sources and factories (especially 34 of them) seriously pollute the creek water.\footnote{Free China Review, October 1971, p. 8.}

According to the investigation conducted by the Sewer System Planning Committee for Greater Taipei, the PH value of the creek water mostly reads 11. There are also elements which are poisonous (mercury, As) and with bad odor. The Wanshen Creek merges with the Hsintien Creek at Kungkuan, the southern part of the core Taipei City. The intersection is just upstream to the intake of Taipei Water Works. The heavily polluted water not only increases the treatment cost, but constitutes a great threat to the health of residents served by the Works.\footnote{A news article on page 3 of March 18, 1972 Central Daily News discloses that in order to eliminate the threat, the Sewer System Planning Committee completed a proposal in November 1971. The essence of the proposal is to stop the water of the Wanshen Creek before it merges with the Hsintien Creek and pump the water into a duct (80 cm in diameter, 1000 meters long), which brings the polluted water into the Hsinshen Ditch, the main drain with a total length of 2900 meters, runs through the center of Taipei City and connects with the Keelung River, which runs on the northern boundary of the core Taipei City. The Ditch runs parallel to Hsinshen Road and cuts the Road into two parts. (cont.)}

Other large urban areas such as Keelung, Taichung, Changhua, and Chiayi are also facing the problem of environmental deterioration although it might not as serious as in the cases of metropolitan areas.
D. Insufficient Infrastructures

In efforts to industrialize the economy some sectors have been permitted to fall behind. The most important is the construction industry. Public facilities (also termed as infrastructures) in the fields of transportation, flood control, potable water, storm drainage, and sanitary sewers have not kept pace with either population or industrial growth. Most of the infrastructures are overloaded; and some others saturated.

The existing West Longitudinal Highway is the most important artery connecting the whole island. It assumes one fourth or even one third of the total traffic volume on Taiwan. During 1954-1961, a period of 8 years, the volume was doubled; it was again doubled during the following four years--1962-1965. After that, the volume has been doubled in less than three years, or even in two years. In 1969 the average daily traffic on the Taipei-Chungli section of the Highway, a two-lane highway, was 22,000 vehicles. Assuming a minimum speed and absence of jams, this load was definitely in excess of its capacity. According to a conservative precast, the volume will be 171,000 vehicles per day by 1990. If factors such as

(continues) A construction project to cover the Ditch will start in June and scheduled to be finished by next June. The Keelung River merges with the Tamsui River at the northwest corner of the core Taipei City--a point far below the intake of Taipei Water Works.

1According to a survey conducted by Urban and Housing Development Committee in March 1969, the traffic volume on the southern section (Tainan-Kaohsiung-Pingtung) of the Highway was 25,000 to 29,000 vehicles per day. (The figure would be higher if converted to passenger car unit.)
new community development, harbor construction, the construction of Taoyuan International Airport, and the growth in manufacturing, commerce, agriculture, and mining are counted, the expected volume would even be 275,000 vehicles per day by the same year.

The rapid increase in international trade requires a considerable amount of harbor facilities.\(^1\) There are three international harbors on the island: Keelung and Kaohsiung ports on the west coast, and Hualien port on the somewhat isolated east coast. Keelung Harbor to the north of the island is just about to be saturated with its limited capacity. Kaohsiung Harbor to the south of the island handles two thirds of the total harbor loads. Congestion has been the constant problem although continuous expansion programs have been executed. The insufficient transportation network between the west and the east makes the Hualien Harbor unable to share the heavy demands.

As for the water supply, only 38.85\% of the island population were served by the public water supply systems. This exemplifies the insufficiency of infrastructures in other dimension.\(^2\)

\(^1\)The total volume of international trade in 1971 was \$4,084 million (with a surplus of \$186 million), which represents an increase of 32.2\% over the 1970 figure of \$3,089 million. With a population slightly over 15 million, this figure suggests how heavily the island depends on the international trade it compared with mainland China's \$4,200 million (with a population of 760 million) of international trade in 1971.

\(^2\)By 1976, 49\% of the island population will be served by public water supply systems.
3. THE NEED FOR A COORDINATED ISLANDWIDE AND REGIONAL DEVELOPMENT

A. Regional or Islandwide Efforts to cope with the Problems

The four problems facing today's Taiwan urban areas discussed above are either regional or islandwide in nature. It follows that any measure designed to solve the problems should be in a regional or islandwide framework.

For example, to alleviate the heavy population pressures on the leading regions and to inject new impulses into the lagging regions, an islandwide effort is desperately needed. To divert the heavy population and economic development pressures on leading cities to the outlying suitable sites, an effective regional plan and implementation mechanism is also needed. To control the air or water pollution, it is apparent that islandwide or regional efforts are required. To preserve prime agricultural lands from urbanization and to provide desirable sites for future development, a regional and islandwide consideration is critical. Infrastructures, used to cope with the economic and population growth or to stimulate growth in existing smaller towns, should also be planned and constructed within the regional or islandwide context.

B. Regional Plans

In response to the need of such coordinated regional development, the Taiwan Provincial Government started the preparation of regional plans as early as in 1961. The Division of Town and Country Planning (DTCP) of the Taiwan Public Works Bureau (TPWB) assumed the responsibilities of carrying out series of regional planning studies. The Taipei-Keelung
Regional Planning Report was first published by the Bureau in 1965. A second report for the Taichung Regional Planning study was also published at that time. Some of the data-gathering work for the Kaohsiung-Tainan Region had also been done by the Division before the Central Government decided to shift the regional planning function from the Division to a new agency in 1966.

Under the assistance of the United Nations Development Programme (UNDP), the Chinese Government set up the Urban and Housing Development Committee (UHDC) within the Cabinet Council for International Economic Cooperation and Development (CIECD) in early 1966. UHDC identified seven planning regions for Taiwan: three major ones—Taipei-Keelung Metropolitan Region, Taichung Region, and Kaohsiung-Tainan Region—and four sub-regions—Hsinchu, Chiayi, Ilan, and the East. It then engaged in series of re-studies of the three major regions. The Kaohsiung-Tainan Regional Planning Report was published in July 1969. Report on the Taichung Regional Plan was published in March 1969. The Taipei-Keelung Metropolitan Regional Plan

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1 Kaohsiung-Tainan Region comprises 3 counties (Tainan, Kaohsiung, and Pingtung) and two provincial municipalities which have the same juridical status as the counties (Tainan and Kaohsiung), while the planning region excludes a total of 14 mountain townships.

2 Taichung Region comprises 3 counties (Changhua, Taichung and Nantou) and one provincial municipality (Taichung), while the planning region excludes a total of three mountain townships.

0 Figure 2 on page 20 shows the 3 main and 4 minor regions of Taiwan.
FIGURE 2
DISTRIBUTION OF PLANNING REGIONS IN TAIWAN

SOURCE:
MAP I-1 DISTRIBUTION OF PLANNING REGIONS IN TAIWAN, "TAIPEI-KAOSHING REGIONAL PLAN" (UHDC/CIECD, MARCH 1970)
was released in early 1968 and revised as the Northern Taiwan Regional Plan in early 1969.\(^1\)

Following the termination of UHDC in April 1971, the agency was evolved as the Division of Urban Development (DUD), which is still under the jurisdiction of CIECD. DUD succeeded most of the UHDC's functions and continued the planning for the remaining sub-regions of Taiwan.

Preliminary plan for Hsinchu Sub-Region was finished recently.\(^2\) Planning for Chiayi and the East Sub-Regions were also started early this year. A regional planning study for the remaining subregion (Ilan) will be launched soon. Thus the whole island will be covered by the regional plans once the plans for the sub-regions are completed. All of these efforts emphasize the idea of solving urban problems and guiding the future development in regional scales.

C. The Islandwide Development Plan

The Central Government began to develop plans for a comprehensive islandwide development in January 1971, when a special Committee for Comprehensive Development Planning (CCDP) for Taiwan was set up within CIECD. CCDP works closely with DUD on the planning for a comprehensive islandwide development

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\(^1\)The original boundaries of the Taipei-Keelung Metropolitan Region was established by a group of planners and provincial and local government officials called together in an ad hoc committee by the Provincial Commissioner of Reconstruction in 1961-62. The Region was then made up of portions of two counties (Taipei and Taoyuan) and two cities (Taipei, a national city, and Keelung, a provincial municipality). In late 1968, the Region was enlarged to include the rest of the two counties and thus renamed as the Northern Taiwan Region. The Northern Taiwan Regional Plan was approved by the Cabinet in May 1969.
plan. The goals delineated by CCDP for such a plan are:

i. to maximize the benefits of various capital investment;
ii. to slow down the polarization of population on the island and achieve a stable distribution of population among the regions;
iii. to cure the mis-uses of land resources and lead to an efficient land use pattern;
iv. to improve the living environment;
v. to promote the welfare of the general public.

CCDP had just finished drafting the plan in late March 1972. The plan is aimed at achieving the above goals. With the full implementation of the plan, it is hoped that a rational, balanced islandwide development pattern could be achieved.

4. NEW COMMUNITY AS ALTERNATIVE TO FUTURE URBAN DEVELOPMENT

On the issue of urban development of the island, the just completed Islandwide Comprehensive Development Plan emphasize the creating of satellite towns to form balanced metropolitan regions and the development of new towns or new communities to accommodate the surplus urban population in each region.

A. Growth Center Concept

Growth center concept is one of the guiding concepts in the regional planning for Taiwan. Generally, growth centers can be classified into expanded towns and new towns or new communities.

\(^2\)(for the preceding page) Incidentally, this sub-region was planned by DTCP rather than UHDC (or DUD) because the limitation of resources of the latter.

\(^1\)Appendix B is the outline of the Islandwide Comprehensive Development Plan.
In the completed regional studies, UHDC had suggested both sites for new towns and certain existing towns to be greatly enlarged, often to several times their present population. These sites should be officially designated as growth centers and given priority in planning, infrastructure investment, the location of industrial estates, and social housing development. Rather than use the very few planners in trying to draft master plans (kind of 701 plans) for several hundred urban areas in Taiwan by an arbitrary deadline, and scattering investment throughout all these towns, it would be more efficient and would expedite development to concentrate the limited resources in new towns and carefully chosen towns to be enlarged to moderate size cities within a regional framework of cities.  

The Northern Taiwan Regional Plan proposes as a principle of urban development growth centers be planned which would integrate industrial development with housing and other urban land uses. In the growth center plan for the Northern Taiwan Region, of the 24 designated growth centers 9 can be considered new towns or new communities. The total increase of 1,700,000 persons allocated to these 24 growth centers is 68% of the total anticipated population between 1968 and 1988 for the Region.

1A surveying and Planning Team was set up within the Provincial Public Works Bureau in late 1969 in order to launch a huge paper-work planning for the 216 major urban settlements throughout the island within a period of five years.  
2Chinsuan, Sanchih, Newputzu, Peitou, Tapinglin, Hsishen, Linkou, Nankan, and Jenshen.
The Kaohsiung-Tainan (or the Southern Taiwan) Regional Plan also suggests that eight of the existing towns be expanded to accommodate a large amount of the future urban population. In addition to the town expansion proposals, two sites within Kaohsiung Metropolitan Area (Chenchinhu and Tapinting) were proposed for new communities; one site between Tainan and Kaohsiung metropolitan areas (Luchu) was proposed to be developed as a new town accommodating some 450,000 people by the end of the century. Tapinting is planned for 200,000 residents; Chenchinhu for 32,000 by 1989.

Taichung Regional Plan suggests that most of the existing towns be expanded to accommodate most of the future urban population. However, for the regional center (Taichung), a new community with the capacity of 150,000 residents is proposed on the Tatushan plateau to the west of Taichung. Another new town is also proposed in adjacent to the new Taichung Harbor which is under construction.

It can be clearly seen that because the limited capacity for the existing cities or towns to be expanded, the urgent need to preserve good farming lands, to control the floods, and pollution, new community or new town development can be an alternative for the future urban development if a rational and balanced development is to be aimed at. New town development is a fresh start, avoiding most of the mistakes of the existing cities and incorporating advanced planning techniques and development technologies.
5. The Rise and Fall of Linkou Project

As early as February 1967, UHDC, studying the Taipei area flood control plan, recommended the Linkou plateau to be a substitute development site for the Zone III (west bank of the Tamsui River) in order to save more than NT$2,000 million ($50 million) of flood control cost. Later, in its "New Community Site Study" for the Northern Taiwan Region, UHDC located 30 sites that could accommodate the additional urban population expected by the year 2000. Of the 30 sites that were analyzed Linkou plateau was selected as one of the possible inner ring satellite towns around Taipei City.

With the publishing of the Taipei-Keelung Metropolitan Regional Plan in October 1968, UHDC further proposed as an urban land development policy that new towns be planned to be relatively self-contained and economically balanced. They should be limited in size and surrounded by permanent functional greenbelts. These policies called for the integration of industrial development with housing and other urban land uses. Linkou plateau because of its size, location, and amount of vacant land is placed in the highest priority for development.

In December 1968 the Executive Yuan (the Cabinet) designated the plateau and its surrounding slopeland (18,750 hectares) as the Linkou Special District, prohibiting land sales and new construction in the District for two years ending 30 November 1970. Also in December 1968 the Ministry of the Interior requested UHDC to prepare an urban plan for
Linkou, and in March 1969 the Provincial Government established the Linkou Development Authority (LDA) to implement the plans. In August 1969 the Executive Yuan approved the acquisition of the plateau by compulsory purchase. However, as the project neared implementation, it began to run into difficulties.

First, in regard to financing, the City of Taipei declined to help pay for the project, even though it was the major intended beneficiary. Taipei City's reluctance was based on the grounds that Linkou was not within the City's administrative boundaries. The central government declined to help pay for the project on the grounds that the project was a local matter within the administrative boundaries of the Province.¹

Second, in regard to administration, evidence began to accumulate that the Linkou Development Authority was unable to coordinate the many agencies and activities involved. On the technical side, LDA did not have experienced urban planners on its staff. Moreover, when doing the land assessment, rather than consult the land offices of both Taipei County and Taoyuan County—the two counties that administrate the plateau—about the details which might be considered in arriving at a purchase price for the various

¹After the withdrawal from the mainland in 1949, the central government had been administering the Taiwan Province and two islands—Kinmen and Matsu—near the Fukien Province of the Communist China. In July 1967, the government elevated Taipei from a provincial municipality to a national municipality—the same status as the Taiwan Province. In many cases, this action has caused much complications and duplications to the island political system.
types and locations of land on the plateau, LDA made its own assessment. It entered into negotiations with the local landlords unequipped with a detailed knowledge of what particular pieces of land were really worth. As a result, LDA was unable to take a firm negotiating position in regard to the landowners, inadvertently encouraging them to assume that the acquisition prices could be forced upward indefinitely. It was by no means clear that from its position as an agency of the provincial government LDA would be able to achieve the tight coordination of the other provincial agencies of essentially equal status that the success of the project required. The difficulty of any agency being able to coordinate the work can be seen from the fact that some 30 different agencies which were involved in the planning and development of Linkou.

Not only did LDA appear to be unable to cooperate with UHDC of the central government, but it also unable to secure the cooperation of the Taipei County Government and the local people. The county government, the county assembly, the county party committee, and the Linkou township office all complained that LDA had neither explained to them what it was doing nor asked for their advice and assistance. On a number of grounds, LDA should have anticipated difficulty in obtaining the cooperation of the county government. From the county's point of view, the Linkou project was an invasion of its territory and an upsetting of the administrative status quo. Finally, if local government agencies neither understood nor assisted the Linkou project, so much the less did the people of Linkou understand or support it.
Even the outlines of the plan and its implementation policies remained confidential, and the direct and indirect benefits which development would bring to the plateau were not advertised. In the absence of information, the local people feared the worst. LDA admitted that its public relations were inadequate but did little to remedy the situation.

The financial and administrative difficulties of the project eventually came to a focus on land acquisition. Despite the freeze on land transactions on the plateau, land speculators moved in and began bidding up land prices. In the eight months between July 1968, when information about the project began to circulate, and February 1969, when the ban on land sales went into effect, 675 transactions involving some NT$25.8 million had occurred, as many as the total for the previous three years. Sale and resale of land undoubtedly continued in private after the freeze on publicly registered transactions with each new purchaser expecting a higher acquisition price than the purchaser before. Meanwhile, the government decided that at the time of acquisition land owners would be paid partly in cash and partly in bonds, but the provision that the bonds could be exchanged for cash when people were actually asked to move was not made explicit. The government also briefly considered moving everyone off the land at the date of acquisition, and failed to broadcast the assistance and compensation it was prepared to offer people in the course of moving their homes and changing their jobs.
Uncertainty over these matters led to intense and widespread anxiety on the plateau, and focused the attention of local people almost exclusively on the question of the amount of cash they would receive upon losing title to their land. As a result of both the manipulations and the anxieties of local people, political pressure built up on the provincial government to pay high prices for the land to be acquired. This put the provincial government in a difficult position since it was under instructions from the central government to acquire the land at reasonably low prices in accordance with the development plan. After March 1970, when the provincial government asked the support of the provincial assembly for compulsory purchase, delegations of local landowners were repeatedly dispatched to township, county and provincial governments and assemblies to demand higher prices and higher ratios of cash to bonds. Nevertheless, in October 1970, although the delegation from Linkou set new attendance records in the visitors gallery, the provincial assembly disregarded a subcommittee report stating the landowners' case and approved substantially the system of compensation submitted by the provincial government. The question now became, "Could agreement on purchase prices be negotiated with the landowners and if not, at what prices would the land be assessed by the county government for compulsory purchase?"

Negotiations with land owners began in the spring of 1970. According to the 1968 assessment by the Taipei
county government, land of the type most common in Linkou (tea farms) should have been worth about NT$23 per ping. Since the normal market price, in the absence of speculation induced by the development project itself, would be two or three times the assessed prices, Linkou dry land might have been worth between NT$100,000 and NT$200,000 per hectare (or $1000 and $2000 per acre) according to its quality. LDA's initial offering prices was NT$198,000, which was accepted by the landowners in the part of the Special District which overlaps into Taoyuan county. As for Taipei county, according to one newspaper story, LDA opened negotiations by writing NT$131,000 on the blackboard. After protests from the floor, this was increased to NT$198,000 per hectare or about NT$65 per ping. According to this, from the alacrity with which LDA was willing to go from twice the official price (the assessed price) to three times the official price, some landowners drew the conclusion that LDA could be induced to pay several more times the official price. Thus a significant number of landowners turned down NT$198,000, and subsequent offers of NT$268,000 and NT$320,000 which were approximately four and five times the officially assessed value.

Regardless of whether LDA's bargaining tactics were faulty or not, the landowners acted as though they were in a strong bargaining position. Apparently they believed that the government was committed to this project, and to a particular time table for executing it. Judging from the boldness with which they acted, it may be that they believed
they had political support and protection from within the
government. The landowners appeared to have obtained the
tacit support of both the county government and the county
assembly. The county government, for example, did not assume
the role of an implementor of the project in the land pur-
chase negotiations, but rather the role of mediator, implying
that the landowners were free to get any price from LDA they
could, as though it were a private profit-making corporation.

According to the township office, the great major-
ity of landowners were willing to accept LDA's final offer
of NT$320,000 per hectare (NT$107 per ping) and might have
accepted less. It was a small minority of speculators who
held out for higher prices.

All of those problems and difficulties came to a
head in November 1970 as the date for expiration of the freeze
on land transactions and building construction neared. Al-
though technically it would be possible to extend the freeze,
in practice it was assumed that purchase prices would be
announced and the land formally acquired before the end of
November. According to newspaper reports, the county asses-
sed the land several times, the assessed prices being rejected
each time by the provincial government. In fact there were
several bases on which the land could be assessed, and since
these did not give the same results, there was considerable
room for uncertainty about the proper prices. The process
was complicated by the fact that land in two counties was
involved. As already noted, landowners in Taoyuan county
agreed easily and early to moderate acquisition prices, according to the newspapers NT$318,000 per hectare. Then Taipei county threw a bombshell into the situation by announcing an extremely high assessed price for a small piece of land on the Linkou plateau that was being acquired by the Ministry of National Defense. Strictly speaking, this purchase was not part of the Linkou project, although in fact it was closely related to it.

Because of the plans to build a new city on the plateau, the route of an expressway connecting the north and south ends of the island were changed so that it would run across the plateau. This made the expressway somewhat more expensive, but would provide Linkou with ten minute access to Taipei City to the north and a new international airport scheduled for construction in Taoyuan to the south. The proposed route of the expressway across the plateau passes through several hectares of antennas maintained by the American Air Force for monitoring mainland Chinese radio broadcasts. The Chinese Ministry of National Defense agreed to purchase a nearby piece of land which it would in turn lend to the American Air Force as a new location for its antennas. The new antennas field was to be 6.5 hectares in size, of which 0.3 hectares were in Taoyuan. The landowners in Taoyuan at first agreed on a purchase price of around NT$56,000 per hectare. The Taipei county assessment was NT$560,000 per hectare. The Taipei county assessment was thus nearly twice the NT$318,000 agreed to by LDA Taoyuan landowners for dry
land in Taoyuan, nearly twice the NT$320,000 stated as a final offer by LDA to landowners in Taipei county, and ten times the NT$56,000 agreed to between the Ministry of National Defense and owners of the 0.3 hectares of useless slopeland, being purchased by the Ministry of National Defense simply to protect the approaches to the relatively level plateau land in Taipei county on which the antennas were actually going to be placed. Accordingly, it may not be as peculiar as it seems that adjacent pieces of land in Taipei and Taoyuan counties should differ in value by a factor of ten. In any case the purchase of land for NT$560,000 per hectare in Lin-kou for the antenna field would set a precedent which could not but influence the not yet announced prices assessed for land to be acquired for the Linkou project itself. Accordingly, the Executive Yuan ordered the province to order the county to rescind its assessment. A second assessment of NT$321,600 was announced, computed from a different base period during most of which no legal transactions occurred, and therefore apparently arrived at by averaging a price of more than NT$370,000 per hectare negotiated by LDA with brick factory owners with LDA's earlier and lower base negotiating prices. The owners of the prospective antenna field, unwilling to sell their tea farms even at the higher price, were enraged at the lowering of the price, and swore that they would never allow the antennas to be moved onto their land.

When the government acquires land for military purpose it is legally entitled to begin construction before
actually paying for the land. The fact that they did not know when they would receive their money or when they would be asked to move made the owners all the more adamant in their refusal to allow such construction to begin. In this they were supported by people from the entire plateau, who did not draw the fine distinction between land being acquired for the American Air Force and land being acquired for the new city of which they would be a part, and who perceived that what was happening was a harbinger of what might happen in the future to them. Construction of the antenna field was obstructed and then postponed for two weeks at the request of the county and local police forces, who said they could not guarantee order. When work was resumed on 23 November it proceeded slowly and under heavy police guard, resulting in the dispatch of yet more delegations and protests to the township and county governments. The county magistrate telephoned the Governor about the situation, and on Wednesday 25 November the Governor requested a special meeting of the Linkou Supervisory Committee of the Executive Yuan for Saturday the 28th.

The Linkou Supervisory Committee had been formed by the Executive Yuan in September 1970 to oversee the implementation of the project. In response to the difficulties being experienced by LDA, the supervisory committee had made LDA directly subordinate to the Executive Yuan. This move was intended to strengthen supervision, raise LDA's status relative to the agencies it was attempting to coordinate,
and improve LDA's communications with UHDC.

At this meeting, the Governor strongly opposed proceeding with compulsory purchase of large tracts of land when attempts to purchase a small plot for the antenna field had resulted in such a furor. Moreover he questioned the economic and administrative feasibility of executing the development plan at all. The issue was discussed at length, this being the longest session of the Executive Yuan since it discussed the elevation of Taipei City to a national city in 1967. Aside from financial and administrative problems, it seems likely that an important consideration was the undesirability of the government's coming into open conflict with local citizens during the current crisis in its international relations. Some people even maintained that building a city on the plateau would be an easy objective for the enemy, thus the city would not be safe. An additional factor may have been the disappointment of some who had underestimated the costs and overestimated the benefits of the project while it was in the planning stage, and were now faced with the realities of implementation. In any case, strong support for the project was not forthcoming. On the motion of the Vice-President, it was cancelled.

More precisely, the Executive Yuan announced only that it had referred the matter to the Linkou supervisory committee for further study. However the Executive Yuan had definitely decided to abandon compulsory purchase of land. Under public criticism for abandoning a valuable project,
the government denied that the project had been cancelled, arguing that only the method of acquiring the land and the schedule of implementation had been changed. Land is to be acquired under a standard procedure whereby the people assess the land themselves, and basically Linkou is to be developed through the normal procedure under the supervision of the provincial government. On 28 December the Governor announced that the provincial government was proceeding with plans for construction of infrastructure, and attraction of industrialists. Rather than process Linkou along with the 216 other city plans being prepared by the provincial Department of Reconstruction (Surveying and Planning Team), the provincial government has requested professors from Tunghai University to prepare a plan by the end of 1971. Construction of infrastructure would then be carried out by the county government with its own funds. The area of the special district has been drastically contracted from 18,750 to 3,625 hectares, the size of the urban core of the district remaining the same as before, but the surrounding greenbelt and reserved land being sheared off. The special district is now confined to Taipei County, the part in Taoyuan having been eliminated. After considerable vacillation as to whether the Linkou Development Authority should be abolished or not, LDA is to be reduced in size, renamed the Linkou Development Committee, and reorganized with the head of the provincial Department of Reconstruction as its chairman. Land purchase negotiations are to be handled in the future by the Taiwan Develop-
The Taiwan Employment Center has been requested to train an interviewing team to continue the work of canvassing for industries began in the summer of 1970. At that time 317 industrialists had been found who were interested in moving to Linkou, requiring some 400 hectares of land. In general, the strategy appears to be to acquire a minimal amount of land at high prices, and to bring to bear a minimal amount of financial resources, political power and technical expertise on the development of the plateau.

On July 23, 1971, the City Planning Commission of the Ministry of the Interior decided that, in view of that the Executive Yuan had instructed the Taiwan Provincial Government to continue the development of Linkou by way of promulgating its town plan, enforcing equalization of land rights and imposing public construction benefit fee, but not of land acquisition by block or district (i.e. compulsory purchase), the Linkou Special District Plan, which was originally approved by the Commission on November 30, 1970, be abolished.

As to date, 16 months after the sudden suspension of the Linkou project, a new city plan, which the Taiwan Provincial Government contracted to the Urban Design Center of Tunghai University, has not been released. The plan is intended to be the basis for the implementation of Linkou plans under the new 'respond-to-happening' scheme. Not a bit of infrastructure has been added to the plateau; nor is
the Linkou township office ready to assume the leadership on carrying out the plans. This implies that new job-seekers keep packing the already congested core Taipei City; urban sprawl continues on the fringes of Taipei; and industrialists keep built new factories or expand the existing facilities on the west bank of the Tamsui River—the part of the basin which is subject to floods, yet no control measures is in effect.

However, the construction of the Shanchung-Chungli section of the North-south Expressway started in August 1971. It is scheduled to be finished by May 1974. (Shanchung is a "county" city just across the Tamsui to the west of Taipei.) Upon completion of the section and two interchanges on the plateau, Linkou will be within 10 minute drive from Taipei; 15 to 25 minute from Taoyuan and Chungli, the two leading "county" cities in Taoyuan County. It is then very likely that the plateau will soon face the development pressure when the high accessibility is achieved upon the completion of the Expressway.

As the government now suggests, if Linkou is going to be developed in the traditional way, many shortcomings could be anticipated:

A. It is very likely that, without coordinated effort, construction will be frog-leaping over the plateau—a typical development procedure in the existing cities. This kind of development represents three major problems:

1). The small scale construction is more expen-
sive than a large scale development. It is quite apparent that building 100 units of houses under one management on the same block would be cheaper than building 10 units on ten different sites under ten different managements.

2). It would be more difficult for the public sector to provide infrastructure--road, water, power, gas, drainage, and sewers; and community services--nurseries, schools, playgrounds, and parks, for somewhat scattering development resulted from the frog-leaping development.

3). Nuisances--noise, dust, vibration, traffic inconvenience--caused by the constructions here and there throughout years would be a great disturbance to the residents or businesses already there.

B. With each landowner or developer build his own houses or shop, it would be very hard to control the architectural design. Low-quality architectural design and site planning would degrade the total new town environment.

C. Controlled by the traditional zoning ordinances or building codes, the result of such development is likely a typical patchwork appearance city, rather than a nice city such as Tapiola (Finland) or Senri (Japan).

6. Restarting the Linkou Project

As the development climate on the plateau is ripening, the author would strongly urge the government to resume the leadership for such an unprecedented new town development project. The experiences--be it in planning, designing, financing, land purchasing, land disposing, and general ma-
nagement--gained from such a project would be invaluable to the future development of new towns or expansion towns throughout the island. The climate for new community or new town development in other regions of the island is also ripening as a consequence of many vast industrial estate development programs nearby the regional centers in these regions.

Under the assumption that, in the near future, the whole question of a new city on the Linkou plateau will be reconsidered and full scale comprehensive planning for development plans will be resumed on this important growth center, this thesis is devoted to the initial physical planning for the new town. It is hoped that the framework laid down here would be one of the guidelines to the future comprehensive planning and development process when the venture is resumed.

For the first part following this introductory chapter, a review of the growth trend of the Northern Taiwan Region will be given to see how important it is to develop a series of expansion towns and new towns in order to effectively accommodate the future urban population in the region. Following that, an analysis on how Linkou is superior to other potential sites will be handled. And a discussion of the potential economic base for the new town will then be tackled to insure the development is a feasible venture. Then lengthier pre-planning analysis and actual town planning will focus on the physical aspects of the new town. A discussion on the implementation mechanism will also be briefly touched upon. The last is to evaluate the study to see its fitness within the regional framework.
1. Northern Taiwan Region and Its Problems

A. Description of the Region

The Northern Taiwan Region is made of a Taipei Basin, which is walled to the north by the slopes of the Tatun Volcanic Mountains with peaks over 1,000 meters, to the west by the slopes of Linkou Plateau, and to the south and east by the northern ridges of the Hsue-shan Mountain Range, which is the northern part of the whole Central Mountain Range. Beyond the 220 meter high Linkou Plateau is the Taoyuan Terrace, which drops gently from an elevation of around 150 meters in the south to almost sea level in the north.

Administratively, the Region comprises a national city, a provincial city (Keelung), and two counties (Taipei and Taoyuan). Taipei City is under the Executive Yuan's jurisdiction, while the latter three are under the provincial jurisdiction. The total area of the Region is 3,678 sqkm—slightly more than one tenth of that of the island.

The floor of the Taipei basin itself is generally less than 20 meters above the sea and is drained northward by the Tamsui River through a gorge in the Tatun Range. The Tamsui is formed by three rivers meeting in the basin: 1)

1Taipei has been the capital of the Republic of China although it was only a provincial city before July 1967. The elevation incorporated six new districts to Taipei and the city territory was enlarged from 71 sqkm to 276 sqkm.
the Keelung River, which rises near the sea and flows through a narrow valley between the Tatun and Hsue-shan Ranges, finally merges with the Tamsui at the northwest corner of Taipei; 2) the Hsintien Creek, which flows north from the Hsue-shan Mountain Range, (the Wanshen Creek merges with it in Chinmei, the southern district of Taipei City.) and 3) the Tahan, which is the outlet of the Shihmen Dam and has cut a channel along the foot of the Hsue-shan Range and enters the basin between Linkou Plateau and the Hsue-shan range. (The Hsintien Creek merges with it to the west of Taipei, and starts the Tamsui.)

The region has a humid sub-tropical climate, with an average rainfall of 2,118 millimeters annually. The rain can come in heavy down-pours whose violence is reflected in the variation of flow in the Tamsui River from an average low water flow of $38 \text{ m}^3/\text{second}$ to a maximum recorded flow of $20,050 \text{ m}^3/\text{second}$, a flow which flooded most of the basin.

B. Growth Trend and Prospect

The region is not only the administrative and cultural center, but economic center of Taiwan. For example, as of 1966, with a total of 13,709 industrial and commercial enterprises of Taiwan, the region accounts for 8,927—a share of 65%. The employment provided within the region accounts

\[1\text{ Half (12) of the total 23 universities or independent colleges are located in the region with an area one tenth of the total island area.}\]
for 41% of the island.

As a consequence of the fast economic development of the region, it has been experiencing the fastest population growth among the regions on this island. In 1955 the region had a population of 2,019,574--22.25% of the then island population. The figure in 1964 was 3,064,960--25.01% of the then island population. And by 1970 the share was 27.6% (or 4,057,000 people). Table 1 shows how rapidly the region grows in comparison with the rest of the island, namely two other main regions and four sub-regions.

TABLE 1
REGIONWISE AVERAGE ANNUAL POPULATION GROWTH RATE, 1959-1969

<table>
<thead>
<tr>
<th>Region</th>
<th>1959</th>
<th>1964</th>
<th>1969</th>
<th>59-64</th>
<th>65-69</th>
<th>59-69</th>
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<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
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<td>4.66</td>
<td>4.90</td>
<td>4.77</td>
</tr>
<tr>
<td>Taichung</td>
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<td>19.89</td>
<td>19.12</td>
<td>2.64</td>
<td>2.37</td>
<td>2.50</td>
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<td>27.22</td>
<td>27.37</td>
<td>3.20</td>
<td>3.29</td>
<td>3.25</td>
</tr>
<tr>
<td>Ilan Seb-region</td>
<td>3.18</td>
<td>3.04</td>
<td>2.84</td>
<td>2.36</td>
<td>1.77</td>
<td>2.06</td>
</tr>
<tr>
<td>Hsinchu &quot;</td>
<td>8.41</td>
<td>8.07</td>
<td>7.64</td>
<td>2.42</td>
<td>2.08</td>
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</tr>
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<td>Chiayi &quot;</td>
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<td>12.34</td>
<td>11.47</td>
<td>2.33</td>
<td>1.67</td>
<td>2.01</td>
</tr>
<tr>
<td>East &quot;</td>
<td>4.25</td>
<td>4.43</td>
<td>4.35</td>
<td>4.10</td>
<td>2.80</td>
<td>3.47</td>
</tr>
</tbody>
</table>


Though the government has realized the heavy concentration of new urban population in this region and has begun to try to reverse the trend by implementing the Islandwide Comprehensive Development Plan, the tendency cannot be stopped until 1986 according to a detailed population

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1Unless otherwise indicated, population figures are that of the end of the year.
distribution study. A projection done by UHDC in May 1970 put the 1999 population for the region at 7.8 million with 7.1 million of them living in urban areas. Population in 1990 is estimated at 6,982,000—30.44% of the total island population anticipated by the same year. Among which 4.2 million new urban inhabitants would need 333 sqkm of new urban land.¹

It is a vivid question how to and where to put these enormous new urban population within the region?

During the past years the rapid increase of urban population has been mostly occurring within the Taipei basin, or more specifically, in the core Taipei City and its six newly incorporated suburban districts (Peitou, Shihlin, Neihu, Nankang, Chinmei, and Musha), and suburban townships such as Shanchung, Hsinchuang, Panchiao, Chungho, Yungho, and Hsintien in the Greater Taipei. There are ten districts within the core Taipei City. As of 1967, there were three districts with gross densities near 900 persons per hectare (or 360 persons per acre); two, over 600 persons per hectare; four, over 400 persons per hectare; and the last one district with 370 persons per hectare. Speaking of the net residential density, two of the ten districts were over 2,400 persons per

¹The gross density for the new urban area is assumed to be 120 persons per hectare. It will need an additional 150 sqkm if the existing overall urban density of the region (300 persons per hectare) is to be reduced to 120 persons per hectare. The total new urban land needed is then 483 sqkm, which is 11.8% of the region area, or 29.3% of the land with slopes below 30%. 1 sqkm=100 hectares.
hectare (960 per acre); three, over 1200 persons per hectare (480 per acre).

The Taipei Sketch Plan suggests that 500 persons per hectare to be the maximum allowable density inside the core city and that 400 persons per hectare to be the maximum allowable density for the six new districts. Under these density limitations, there are only three districts inside the core city which can be allowed to accommodate 155,000 additional population; an additional 841,000 people could be accommodated in the new districts. The upper limit of the total city population is 2.55 million; and as of February 29, 1972, the city had a total of 1,851,581 people—an increase of 0.3 million over the March 1968 figure of 1,545,249. It follows that the city can accommodate only 0.7 million additional population rationally.¹

A reconnaissance and analysis study of the Northern Taiwan Regional Planning Study indicates that there are 30 sites with a total area of 16,622 hectares outside Taipei City, could be developed to accommodate nearly 2 million (1,923,400) more urban population.² These sites are either existing median or small size towns or mostly vacant lands. It can thus be seen that the expansion of some of the existing towns and the development of some new towns are two of the most important measures for the region in the future.

¹ Gaining about 70,000 people each year, the City is likely to be saturated in ten years.
² This figure plus the 0.7 million which could be accommodated within Taipei City itself is 2.7 million. There will be another 1.5 million new urban population need to be taken care of before the end of the century in the region.
C. Flood Control Versus Urban Development

Flood Control in the Taipei basin plays an important role on deciding where should the future urban population go. The Urban sprawl of the Greater Taipei had caused lots of development on areas subject to flooding. The three rivers (the Tahan, the Hsintien, and the Keelung) which run to the basin and form the Tamsui bring lots of troubles to the residents on the basin. The heavy rainfall during typhoon seasons (usually late August through early September) collected by these rivers and creeks made the Tamsui unable to discharge efficiently. The situation is worsen by the fact that the basin is only 20 meters above sea level on average. (The Tamsui runs about 20 kilometers from the point the Tahan and the Hsintien meet to form the Tamsui to the Tamsui Harbor. The overall slope of the Tamsui is about 0.1\%). A high tide on the Taiwan Strait and a strong north or northeast wind will make the situation even worse since it will be more difficult for the river to discharge the big flow.

Floodings, big or small, each year have been causing serious damages to lives and properties of residents on areas subject to floods. Flooding caused by Typhoon Gloria in 1963 virtually covered the entire basin and indeed the damages were enormous.

There have been two schemes dealing with the flood control controversy. But none of them has been adopted and implemented. Yet residents on the basin keep suffer from the
floods. One scheme is to officially designate the areas to the west of the Tamsui River which are subject to floods as flood plains. Two levels of development control is considered: for areas most likely to be flooded no construction of any kind will be allowed, while for other parts of the flood plains a strict control of development will be imposed.

The second measure is to deepen and widen an existing ditch (Wentze Ditch) which runs through the central part of the flood plain. It is hoped that this enlarged ditch will have the capacity to take certain amount of water from the Tahan and discharge it to the downstream of the Tamsui besides serving as the main drain of the flood plain. If the scheme is effective, the plain could then be open for continuous urban development. But the hydraulic model test indicates that the ditch is not reliable again because the elevation of the basin is too low. The estimated enormous construction cost also causes the delay of a final decision on the flood control measures.

While the government officials are arguing about the cost and effect of these two flood control measures during the past 15 years or so, enormous construction have been going on in areas subject to floods. And residents and industries in the area have been suffering from many major floods and numerous minor ones.

Pressures have come up from residents and industries of the west bank of the Tamsui, where no effective flood control mechanism has been created. They urged the government
to build dikes along the rivers to protect them. The core 
Taipei City to the east of the Tamsui is protected by con-
tinuous dikes along the Tamsui and the Keelung.

If the west bank is also to be diked, the dike 
would have to be very high. The existing dikes on the east 
bank would also have to be heightened and strengthened since 
the water flow during typhoon seasons is incredibly big. 
This will not only be very expensive, but raise the difficulty 
of pumping out the water accumulated within the urban areas.¹

A concentration of 1.3 million people within the core Taipei 
City to the east of the Tamsui seems to assume higher priority 
for any flood control measure than the west bank where some 
0.3 million people are making their living in a number of 
satellite towns.

As suggested in the earlier Taipei-Keelung Metropo-
litan Regional Plan and the later Northern Taiwan Regional 
Plan, the development on areas (they are good rice paddies) 
subject to floods to the west of the Tamsui should be stopped 
and future development should be directed to areas free from 
floods or to highlands, such as Linkou plateau and Taoyuan 
Terrace.²

¹Water table on the Tamsui is mostly higher than that of the 
ditches or drains within the core Taipei city during typho-
on seasons.

²The most recent development of the issue of flood control 
is that the Ministry of Economic Affairs has organized an 
ad hoc committee comprising the related agencies to draft 
a new set of measures. They pledged to finish the task 
by the end of 1972. It is almost certain that there will 
be floodings on the basin (when 1972 typhoon season arrives 
) before any decision is made, not mentioning the imple-
mentation.
2. The significances of the Development of Linkou as a New Town

A. Will provide a large amount of accommodation for future urban population

According to the Northern Taiwan Regional Plan, there will be more than 1.9 million new urban population which have to be accommodated in urban areas outside Taipei and Keelung, two major cities in the Region, by the year 1988. With a buildable land of 3,000 hectares (30 square kilometers), Linkou could be developed to accommodate 360,000 residents*. This means that the proposed new town would ultimately absorb nearly 20 per cent (18.5%) of the future urban population in areas outside two major cities by 1988. This indeed is a major and indispensable task for the Region if it is to see to accommodate new waves of urban population rationally and sufficiently.

B. Will divert the pressure on the core Taipei City

The unplanned urban sprawl on the Taipei Basin has been the trend of development during the last two decades. Virtually no effective flood control installations have been set up on the west bank of Tamsui River. It would cost enormously to build series of dikes or to construct a ditch capable to divert the floods during typhoon seasons.** Linkou Plateau is 200 meters above sea level and 180 meters above the

* The gross town density is assumed to be 120 persons per hectare, a density recommended by UHDC/CIECD.
** Even the dikes are dangerous since they will cause the water table on Tamsui River even higher—a treat to the east bank where more than 1.3 million residents live.
Basin, which itself is 20 meters above the regular high tide sea level. The development on this flood-free plateau would divert the pressure of development on the undesirable Basin.

9. Will divert the pressure on the core Taipei City

Both the core Taipei City and its suburban districts have been growing very fast during the last two decades. The average annual population increase during 1959-1968 had been 62,592 persons. The figure for 1969-1971 was 78,546. It is estimated that a total of 700,000 new inhabitants could be accommodated on the undeveloped or underdeveloped parts of the City*. With the trend of growth, it is very likely that the City will be fully 'packed' by 1980. A further observation reveals that the provision of infrastructures is far behind what a modern metropolis should have done. It would be more desirable for the city to concentrate its efforts on projects such as flood control, drainage, sewer system, and housing for those inadequately housed before it can absorb any significant amount of new immigrants from areas outside the metropolis. This leads to the need of an urban area which are at least capable to absorb 80,000 residents from the Basin in order to alleviate the population pressure on the core Taipei City. The City then could improve its infrastructures effectively. The development of Linkou would definitely contribute to the efforts.

* End of 1971 population of Taipei City was 1,839,640. The optimal capacity is estimated at 2.5 million residents.
D. Will Provide Residential Land or Housing at Reasonable Prices

Land price in Taipei City has been rocketing in recent years. The average land price in 1968 was 3.5 times that of 1962. Enormous demand of land has been the main reason for this phenomenon, although many other factors also cause the rocketing. As the land price goes up to a level beyond the means of average moderate income families, it is not feasible for a housing agency to acquire large parcels of land and dispose it at reasonable price for housing development in order to meet the enormous housing demand.

It would be much more cheaper to acquire land on Linkou plateau and develop it for residential use to meet the needs of moderate income families. This created competition for Taipei City might hold down the land price within the City—-an important step for the City to alleviate the serious housing problem.

E. Will Accommodate Factories or Installations incompatible with the core Taipei City

There are many large-scale factories and public buildings which occupy prime areas in the core Taipei City. Most of these installations are incompatible with their surroundings. They are in a sense hindrance to the planned development of the City. Carefully selected sites for these installations on the new town would materialize the removal of such buildings from core Taipei City to make room for more 'profitable' and desirable developments.
F. Will provide large site for urbanization while doesn't threaten the prime agricultural land

The total of 531,800 hectares of rice paddies, generally considered prime agricultural land among the total 882,000 hectares of agricultural land, are the most precious assets of Taiwan in terms of food production. Yet recent developments such as factories and houses have been mostly on these precious rice paddies surrounding the existing urban areas. According to a statistics disclosed by the Provincial Food Bureau, the amount of rice paddies converted to non-agricultural uses, namely housing, commercial, or industrial uses, was 4,586 hectares during the period 1957 - 1966. This represents a considerable percentage of the total rice fields.

Furthermore, as stated before, the 75,000 hectares of land needed for future urbanization accounts for one twelfth of the total agricultural land. It is very clear that the food demand will be nearly doubled by the end of the century when another 9 to 11 million population is likely to reside on this Island. It seems reasonable to advocate at this stage to protect the prime agricultural land from further development. There are many sites on hilly land with gentle slope or on marginal agricultural land could be used for future urbanization. Most of the land on Linkou Plateau is either unattended bushes or tea-plants which are with low productivity. To develop such a plateau would be a very good example for the island to solve the imperative problem of the controversy between urban development and prime agricultural land conservation.
G. Will be a demonstrating project for the future course of new community development

A large quantity of new towns and new communities have to be started sooner or later across the island in order to help accommodate the enormous new urban population. Within the Northern Taiwan Region, the task would be a total of 30 new communities or expansion towns to be developed for the future urban population before the turn of the century. Problems confronted with the development of new communities or expansion towns would be pretty much the same, although the sizes for these growth centers vary from 20 hectares (Pa-tov-tzu) to 3,000 hectares (Linkou).

The experiences gained from the development of Linkou, the most desirable site among these 30 sites, would be an invaluable demonstrating example for the course of new community development on Taiwan.

3. The Selection of Linkou as the First New Town Site

There are 8 sites which could be developed as new communities or new towns in the Northern Taiwan Region. Figure 3 shows the locations of these sites in the region.

The reason why Linkou is selected as the first new town site could be generalized from the following rating of a list of 10 factors against the 8 sites. For each factor, sites with the most desirable factor would be assigned "1", less desirable, "2," and so on.

For the factor "size," (or the area of the site) it is generally true that the bigger the better; for the
REGIONAL RELATIONS

POTENTIAL NEW TOWN SITE

EXISTING BUILT-UP AREA

FLOOD PLAIN

SLOPES ABOVE 30%

Expressway under construction
Taiwan N-S Highway
Taiwan N-S Railway
Civilian Airport
International Port

SOURCES:
1. Map 2-1 Regional Relations of "Linkou Special District Plan".
2. Map 2 Taipei-Keelung Metropolitan Regional Plan (Part) of "Master Plan, Taipei City".
factor present-level of development, it is considered that a substantially vacant site would be better than a site with lots of existing developments; for the factor agricultural value, high agricultural productivity land is less desirable for urban development; for the factor of whether the site is subject to floods, it is self-explanatory; the same is the factor climatic condition; for the factor 'access to expressway,' sites which could be served by the north-south Expressway assume superiority; for the factor general accessibility, it is also quite self-explanatory; for the factor 'relation to regional center,' sites which have close relation with regional centers are easier to be developed and thus economically viable; for the factor 'utility availability,' easy utility installation would require less front-end investment; for the factor economic potential, it is also quite apparent that sites in an economically viable region would be easier to grow.

The rating which appears on the next page shows that Linkou is the most desirable site for new town development in the Northern Taiwan Region. Its favorable factors could be further analyzed as follows:

A. Large Enough to be Developed as a Sufficient Town

For countries with enormous potential future population, but with very limited land resources, such as Taiwan, the size of a new town (which presumably will have a sound economic base) is very much decided by the amount of the buildable land on the site and the maximum allowable
density.

Surrounded by slope land of 15% or more, the Linkou plateau itself comprises a total of buildable land of 3,000 hectares. Assuming the overall town density be 120 persons per hectare (or 48 per acre), the site can eventually provide accommodation (and employment for the labor force) for

RATING OF THE DESIRABILITY OF THE 8 POSSIBLE SITES FOR NEW TOWN OR NEW COMMUNITY DEVELOPMENT, NORTHERN TAIWAN REGION

<table>
<thead>
<tr>
<th>Rating Factor</th>
<th>Possible Site</th>
<th>Linkou</th>
<th>Newputzu</th>
<th>Nankan</th>
<th>Jenshen</th>
<th>Neihu</th>
<th>Shihmen</th>
<th>Chinshan</th>
<th>Sanchih</th>
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<td>Size</td>
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<td>2</td>
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<td>3</td>
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<tr>
<td>Vacant?</td>
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<td>2</td>
<td>2</td>
<td>3</td>
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<td>8</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

Note: For size, accommodation capacity, see Appendix C

360,000 projected population.

There has been many discussions about the sizes of new towns or new communities. Early British new towns limited the size to 60,000 people, the reaction to the gigantic and overgrown dimensions of 19th century London. Later new towns put the sizes at much larger in order to support the variety of modern urban amenities. Milton Keynes, for example, will have a total of 135,000 inhabitants by 1990; while a new town in Wales was designed to have a population ceiling of 500,000, since land could be allowed for urban development, as in Taiwan, is very limited. Therefore, it is advisable to use the sites to maximum advantage.

Most of the US new towns or new communities, on the other hand, are somewhat smaller than the recent British examples. With a total of 14,000 acres of land, Columbia New Town, Maryland, is designed for 125,000 people. Jonathan New Town, Minnesota, is projected to have 50,000 residents in 20 years of development (on a total of 8,194 acres of land).

The US National Committee on Urban Growth proposed in 1969 that the Federal Government build 100 new cities, each with a population of 100,000 and 10 more cities, each with one million people. It seems that the US prototypical new town is that which contains 70,000 to 100,000 people.

However, the size consideration for Taiwan's new towns would be somewhat different. Urban areas with sizes between 300,000 to 500,000 is quite efficient on the island.

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1 Three new towns which will be built around metropolitan Tokyo, Japan, will each have a population of about 1.5 million.
Cities smaller than this range would be unable to efficiently provide infrastructures and other modern urban amenities; while metropolis larger than 1.5 million would likely induce many present-day urban problems. There is a close relationship between city bus systems and the city sizes. No towns of less than 200,000 can provide bus services within the cities successfully. Virtually none of the 12 cities which under county jurisdiction has city bus system. City sizes for this group of cities vary from 100,000 to 200,000. (Some of the larger 'county' cities are serviced by county bus lines or multi-county lines.) But, on the other hand, provincial cities, such as Keelung (1965 population: 278,320), Taichung (380,505 people in 1966), and Tainan (416,009 people in 1966) are all serviced by independent city bus systems, not mentioning the big provincial city--Kaohsiung (1966 population: 632,662) and the then big provincial city --Taipei (mid-1967 population: 1,199,937).1

It is likely that Linkou can run its own bus system successfully with its projected population of 360,000. The situation is quite the same with the other kinds of urban amenities and public utilities. Cultural institutions (colleges, libraries, museums, galleries, music halls, zoos, etc.), financial institutions (banking, insurancing, etc.), recreational facilities (parks, playfields), and shopping conveniences (department stores, cinemas, and theaters) could generally be efficiently provided for towns of 250,000 or more although it varies with the economies of the cities.
Linkou Plateau, which is the largest among the nine potential sites, seems to be superior to other sites.

B. The Plateau is Substantially Vacant

One of the great advantages of developing new towns is that it is more free to plan, to design, and to develop the towns according to what the planners, government officials, developers, and the local people believe to be the best way at the time of planning and at each stage of development.

This advantage exists with the Linkou plateau. As of July 1968, only 337 hectares (or 11.7%) of the total buildable 3,000-hectare land are presently built up. Among which military (3.7%) and industrial (3.0%) uses constitute the majority. 85% of the plateau is used for agriculture--mostly tea farms and some scattering rice fields. Table 2 (Existing Land Uses, Linkou Plateau, July 1968) of Page 82 shows the distribution of existing land uses on the plateau.

The tea farms could be easily converted for urban development. Thus it would be, physically, no major barriers to the development of a new town on the plateau. A more 'ideal' new town could be anticipated accordingly.

C. Low Agricultural Value of the Site

Being a plateau with the elevation varying from 200 to 250 meters, Linkou virtually has no irrigation systems. A few ponds used to accumulate rainfall for irrigation can

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1 The total area of the plateau is 3,625 hectares. The Ministry of National Defense requested a reserve of about 600 hectares; thus reduced the area for the new town to 3,000 Ha.
sustain only a very small amount of rice fields scattering on the southern part of the plateau. In the absence of applying fertilizer heavily, the red top soil yields very little crops. Most of the agricultural land is used for tea-plantation or just left idle. Tea crops are also considered marginal as compared with the prime tea-plant areas on Taoyuan Terrace, and hilly lands in Hsinchu and Miaoli counties.

The development of Linkou will not represent a major loss of agricultural productions of the island as a whole. It is therefore much more desirable to convert the plateau for urban development than allow the present-day urban sprawl chops off hundreds of hectares of prime farming lands around the metropolises.

Through appropriate control measures—such as freezing the transactions of land, and limiting any new constructions on the plateau—before the new town development agency acquires the land—these low-value raw land means lower land-purchasing expenditures for the development agency. Accordingly, the leasing or selling prices of the developed land would be comparatively low. This certainly contributes to the whole new town development financing in general and low-cost housing development in particular.

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1In late 1966, the UHDC staff reported land values on Linkou plateau as: Tea-farm land, NT$30/ping or 80,000/Ha.; paddy land, 40/ping or 120,000/Ha.; wooded areas, 20/ping or 60,000/Ha. Land price of newly developed area within the core Taipei City was 32,000/ping or 96,000,000/Ha., which was 1200 times the average agricultural raw-land value on the Linkou plateau in late 1966.
D. Excellent Topographical Features

As stated before in this thesis, the present urban sprawl occurring on the Taipei basin to the west of the Tam-sui River not only constitutes a major threat to the high-productivity rice fields, but also brings the development with constant threat of floodings. However, this would never be the case with a new town on Linkou plateau. The plateau is generally 250 meters above sea level at the southern part and gradually levels out to 200 meters at the northern part. This is indeed a great attraction to the industrialists who have been suffering from numerous floods on the basin.

On the top of the plateau, most of the land is with slopes below 4%; while a small amount of land is either in 4-7% or in 7-15% slope category. Slopes of the foot of the plateau vary from 15% to 45%. The general terrain of the plateau will facilitate both the sewer system and drainage system, and water supply system by gravity very easily.1 With an appreciation of the gentle slopes of the plateau, it could be designed and developed to be a pretty 'hill' city.

E. High Accessibility to Regional Center (Taipei) and the Other Towns in the Region

Linkou is not a plateau in the wilds, rather it dominates an important position in the Northern Taiwan Region. Five highways which connect the plateau with Taipei and the smaller towns at both sides of the plateau make the plateau

1However, the water should first be pumped from the foot of the plateau to the southern point of the plateau, and then be distributed on the plateau.
highly accessible. It is only 15 kilometers (8.5 miles) from Taipei, and 15 to 20 kilometers apart from Panchiao to the east and Taoyuan to the west—both are important industrial towns in the region. Accessibility to the future Taoyuan International Airport, via the North-south Expressway which is under construction, and to the proposed second harbor (Tamsui) to the northeast is superior to any other potential new town site or expansion town.¹

The high accessibility assured by the highway, air, and sea networks will definitely be an encouraging factor towards the attraction of potential industrialists. Choosing Linkou as their industrial estates, they will be ensured enough skilled and unskilled labor forces from this economically vital region. To the least they will have to worry about the moving of materials inbound and products outbound.

F. Comfortable Climatic Condition

The micro-climate on the plateau is much more better than that prevailing on the basin. People living on the basin who constantly suffer from the extraordinary high humidity will find the living on the plateau a relief.² The plateau compares favorably with the other potential new town sites in this regard.

G. Easy Utility Installation

¹In order to bring development stimulus to the plateau, the North-south Expressway has been strategically aligned to cut through the lower part of the plateau.
²For climatic data of the plateau, please see "iii. Climate" on page 80 of this thesis.
The main items of utilities—power, gas, and water—are already available on the plateau. They all can be expanded to serve the new population at each stage of development easily.

One thermal power plant is already in operation; a nuclear power plant is under construction. Both the plants are located on the shore to the north of the plateau. Taiwan Power Company has set up a distribution station on the plateau. It could be expanded as demands build up.

Shihmen Water Works has been servicing the plateau (mainly the military institutions on the southern part of the plateau). It has the capacity to be expanded to meet the future demands from the new town.¹

The China Petroleum Company had also installed a main gas pipeline cutting through the southeastern corner of the plateau. It is almost ready to supply gas to the plateau.

All of these features compare favorably with any other potential site for new town or new community development. The readiness of utilities would help promote the growth of the new town, especially the manufacturing industries. This also means less front-end investment for the new town as well as the utility sectors.

H. Attractiveness to All Income Groups

With the only exception of railroad linkage, Linkou

In an effort to relieve the Taipei basin from continuous sinking due to the excessive exploitation of underground water, the Provincial Department of Reconstruction is coordinating the Shihmen Water Works and Taoyuan Irrigation Association to channel the current daily surplus of 309,312 tons of water to the Panchiao Water Works to be distributed.
possesses advantages on highway, air, and ocean-going transportation. It is a great attraction to the medium and light industry investors. A well-known Linkou Golf Course on the northern part of the plateau would definitely contribute to the drawing of the well-off families including the potential industrialists.\footnote{At present the Golf Course is mostly patronized by business executives and high ranking government officials from Taipei, and the US military personnel stationing on the plateau.} By incorporating governmental public housing programs, it would be easier for the development agency to provide the low-cost housing for low or moderate income bread-earners and their families. (Low land prices on the plateau is one of the advantages for large-scale low-cost housing development.) Young couples or singles would also likely settle in this new town due to the excellent working environment—a condition which is foreseeable in new towns—and the adequate diversity of urban amenities.

In conclusion, since the Linkou plateau is the largest vacant area close to Taipei city which can be economically urbanized, it is advisable to develop the plateau as a new town. The plateau is close enough to Taipei for new industries to continue close contacts with their subcontractors and suppliers and to continue to draw from the Taipei labor pool. The topographical, meteorological, and climatic superiorities also warrant the site to be developed as a new urban center in the Northern Taiwan Region.
CHAPTER III ASSURING AN ECONOMIC BASE FOR LINKOU NEW TOWN

1. The necessity of Having a Sound Economic Base

New towns, unlike most of the dormitory new communities, must have a sound economic base throughout the development stages in order to assure the development a success. A high percentage of the new town labor forces will have to work within the new town if it is to be self-sufficient. As a matter of fact, the only way to attract people from the congested metropolis or to absorb those just about to leave countryside is by providing employments for them. This follows that a well-staged inflow of industries and businesses is imperative on achieving the goal of balanced distribution of population within the region.

For those new communities created mainly as "residential dormitories" for central cities in metropolitan regions, employment seems not to be a critical issue. The main task for such new communities is to provide houses for those who hold jobs in central cities or new employment centers nearby. Commercial and community facilities within these new communities would definitely create some additional jobs for the community labor force. New industry, compatible to the surrounding land uses in the communities, might be accepted; but it is not so critical as it would be to new communities that must be relatively self-sufficient. This is even true with new town development.

Assuring an economic base—that is attracting in-
industries and businesses into new towns--has two important implications to the success of new town projects. Traditionally, revenue from industrial and business land sales accounts for a high percentage of the total land sale revenues. The profit from such land sales could even pay for the total community land development costs.\(^1\) Furthermore, such profits from land sales could be a significant resources to be used to subsidize housing for the less-well-to-do category of new town residents as well as for other kinds of socially-oriented programs.

The second implication of attracting industries and businesses is to provide ample employments and to draw labor forces and their families from congested metropolis and lagging rural areas with surplus of workers. Adequate employment for the new townspeople at each stage of development would assure higher level of aggregated family income which in turn prospers the economy of the new town.

Furthermore, a full range of prospering industries and businesses would definitely contribute to the local revenues. Affluent revenues are critical for the locality to provide adequate services and invest in capital construction for the benefit of the town residents.

2. Elements of An Economic Base

The structure of economies of cities and towns

\(^1\)A feasibility analysis indicates that the industrial land sales in the proposed Lysander new community, New York, will account for 50% of the total land sale revenues.
vary with the characteristics and scales of these cities and towns. Generally, the economic base can be classified as goods-producing industries and service-producing industries.

A. Goods-producing Industries

Goods-producing industries include agriculture, mining, construction, and manufacturing industries. Among these sectors manufacturing industries have been the most important sector for most of the cities on Taiwan. The jobs created by these industries often support a large portion of the local residents.

It is highly recognized that the success of attracting industries—especially manufacturing industries—into the new town is the most important factor for the Columbia venture to be successful. Among the industries which have been opened or started development in Columbia, General Electric's Appliance Park East will employ 12,000 workers by 1975. This is quite a significant employer for a new town with a planned population of 110,000.

B. Service-producing Industries

As the town grows, the structure of the town economy also tends to diversify. This would mean the increases of people employed in the service-producing industries. Statistics show that for cities of 250,000 or more, services sector would provide some 55 percent of the total jobs created within the cities.
Service-producing industries include: Transportation, communications, and public utilities; trade; banking, insurance, and real estate; business, professional, and personal services; and governmental services.

3. Structuring An Economic Base For Linkou New Town

A sound economic base for Linkou could be assured based on its diversified functions it will serve in the Northern Taiwan Region. These functions are characterized by the different roles it will assume in the region.

A. Linkou Will be the Sub-center of the Northern Region

By a concerted effort, Linkou could be developed to be a new town of 360,000 in 20 years. It will be the second largest city in the region. With its geographical superiority—being in the central position with Taipei to the east, the proposed Tamsui Harbor to the northeast, the proposed Taoyuan International Airport (which is under planning and designing) to the west, and the Taoyuan-Chungli-Yangmei industrial corridor to the southwest. It will not only have a close relationship to Taipei, but maintain a strong influence upon the towns on the basin and to the west of the plateau. Industrialists to the west of the basin could be attracted to set up their headquarters on the plateau; not less likely are the trading, banking, and other business service institutions.

B. Linkou Will Be An Industrial City

Besides providing homes for the future urban population, the development of Linkou represents a response to
the continuous industrial boom. Carefully-selected industries--such as light industries, non-polluting or less-polluting industries, and high-technology industries--would not only provide employments for a substantial portion of the labor force, but induce a wide spectrum of businesses and services to the new town and thus help prosper the new town.

C. Linkou Will Be A Concourse of Research Institutions

With many industries involving high technologies established, there will be a need to create research institutions to promote the technologies for industries on the plateau and those in the Northern Region.

D. Linkou Will Be A Tourists' and Regional Recreational Center

The plateau dominates several scenic spots: the Kuanyinshan Regional Park to the northeast, the Taipei basin to the east, and the shore to the north. It is also close to many recreational areas in the region--the Shihmen Reservoir, the Chuwei Beach, the Tamsui Golf Course, and the Chinshan Beach. Being a new town next to the future Taoyuan International Airport, Linkou has a high potential to be the tourists' center as well as the regional recreational center. Hotels, convention centers, theaters, music halls, mass media networks, vacation estates, and arena could be developed to be an important sector of the new town economy.

Accordingly, it would be the development agency's task to assure an economic base for the new town through attracting manufacturing firms, business firms, service institutions such as research, governmental, and military
installations. A diversified, yet balanced industries would easily create a self-sufficient new town.

4. Building An Economic Base For Linkou New Town

Manufacturing industries play a very important role in the course of new town development, especially at the earlier stages of development. Hence, an analysis of the prospect of building an economic base in terms of manufacturing industries in certainly of merit.

A. Regional Manufacturing Industry Inventory

A somewhat detailed analysis of the regional manufacturing industries will facilitate the prediction of growth for the coming decades; and a reasonable prediction will provide us a clear picture of to what level could manufacturing industries be drawn to the new town and how many jobs could be provided by the industries themselves and businesses and services thus induced.
Data compiled from city, county, and township statistics indicate that, as of December 1966, there were 2,285 manufacturing firms, employing 157,829 workers in the Northern Taiwan Region. These factories, as located in four main parts of the region, are as follows:

<table>
<thead>
<tr>
<th>Location</th>
<th>Factories</th>
<th>%</th>
<th>Employees</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>2,285</td>
<td>100.0</td>
<td>157,829</td>
<td>100.0</td>
</tr>
<tr>
<td>Taipei County</td>
<td>1,158</td>
<td>50.7</td>
<td>80,791</td>
<td>51.2</td>
</tr>
<tr>
<td>Taipei City</td>
<td>792</td>
<td>34.7</td>
<td>46,375</td>
<td>29.4</td>
</tr>
<tr>
<td>Taoyuan County</td>
<td>226</td>
<td>9.9</td>
<td>21,369</td>
<td>13.5</td>
</tr>
<tr>
<td>Keelung City</td>
<td>109</td>
<td>4.7</td>
<td>9,294</td>
<td>5.9</td>
</tr>
</tbody>
</table>


The most probably future industries, as seen from the existing types of factories, are textile, chemical, food, and electrical equipment. Other kinds of industries which are also likely to develop include machinery, ceramic, metal, transportation equipment, and haberdashery. The number of employees and factories in the first group of industries above in relation to the total number of industries may be shown as follows:

<table>
<thead>
<tr>
<th>Types of Industry</th>
<th>Employees</th>
<th>%</th>
<th>Number of Factories</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>157,829</td>
<td>100.0</td>
<td>2,285</td>
<td>100.0</td>
</tr>
<tr>
<td>Textiles</td>
<td>50,014</td>
<td>31.7</td>
<td>355</td>
<td>15.5</td>
</tr>
<tr>
<td>Chemical</td>
<td>19,858</td>
<td>12.6</td>
<td>454</td>
<td>19.9</td>
</tr>
<tr>
<td>Food</td>
<td>10,997</td>
<td>7.0</td>
<td>238</td>
<td>10.4</td>
</tr>
<tr>
<td>Elect'1 Equi't</td>
<td>9,881</td>
<td>6.2</td>
<td>107</td>
<td>4.7</td>
</tr>
<tr>
<td>Others</td>
<td>67,079</td>
<td>42.5</td>
<td>1,131</td>
<td>49.5</td>
</tr>
</tbody>
</table>

The most likely types of industries to develop in the future, as seen from the recent trends, are not much different from those obtained from the tabulation of all existing factories and the number of their employees: textile, chemical, electrical equipment, and food. Other kinds of industries which are also likely to develop are machinery, ceramic, metal, and haberdashery. The distribution of the average annual 1961-66 increase in the number of employees and factories in the most numerous industrial groups is as follows:

Average Annual Increase of the Most Numerous Industrial Groups, The Northern Taiwan Region, 1961-1966

<table>
<thead>
<tr>
<th>Types of Industry</th>
<th>Employees</th>
<th>%</th>
<th>Number of Factories</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>11,187</td>
<td>100.0</td>
<td>197</td>
<td>100.0</td>
</tr>
<tr>
<td>Textiles</td>
<td>2,787</td>
<td>25.0</td>
<td>32</td>
<td>16.0</td>
</tr>
<tr>
<td>Chemical</td>
<td>1,691</td>
<td>15.0</td>
<td>45</td>
<td>23.0</td>
</tr>
<tr>
<td>Elect'1 Equip't</td>
<td>1,458</td>
<td>13.0</td>
<td>13</td>
<td>7.0</td>
</tr>
<tr>
<td>Food</td>
<td>1,185</td>
<td>11.0</td>
<td>16</td>
<td>8.0</td>
</tr>
<tr>
<td>Others</td>
<td>4,066</td>
<td>36.0</td>
<td>91</td>
<td>46.0</td>
</tr>
</tbody>
</table>


The greatest growth in the average annual increase in both numbers of employees and factories took place in the suburbs and outlying towns of the region rather than in Taipei City or Keelung City. A greater growth took place in Taipei County, which contains the suburbs and towns closest to the core of the region (Taipei City), than took place in Taoyuan County, which contains the towns farther from the regional core.* The numbers and distribution of the average annual growth are as follows:

* 70 percent of the Linkou plateau falls in Taipei County, while the remaining 30 percent falls in Taoyuan County.
Distribution of the Average Annual Increase of the Most Numerous Industrial Groups, The Northern Taiwan Region 1961-1966

<table>
<thead>
<tr>
<th>Locality</th>
<th>Employees</th>
<th>%</th>
<th>Number of Factories</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>11,187</td>
<td>100.0</td>
<td>197</td>
<td>100.0</td>
</tr>
<tr>
<td>Taipei County</td>
<td>5,271</td>
<td>47.1</td>
<td>102</td>
<td>51.8</td>
</tr>
<tr>
<td>Taoyuan County</td>
<td>2,657</td>
<td>23.7</td>
<td>34</td>
<td>17.3</td>
</tr>
<tr>
<td>Taipei City</td>
<td>2,086</td>
<td>18.7</td>
<td>46</td>
<td>23.3</td>
</tr>
<tr>
<td>Keelung City</td>
<td>1,173</td>
<td>10.5</td>
<td>15</td>
<td>7.6</td>
</tr>
</tbody>
</table>


Since the economy growth in the latter part of the sixties was bigger than that of the first half of the decade, it is conservative to predict that the region will have some 200 new factories, employing some 11,250 workers, annually.

B. Alloting New Industries to Linkou New Town

If it were assumed that 15 percent of the total annual average increase of manufacturing industries in the Northern Taiwan Region were developed in Linkou, about 30 factories, employing some 3,500 workers, would be built annually.

Since railway transportation facilities will not be available, all of these would be medium and light industries, such as textile, chemical, machinery, food, and electrical equipment industries. Other industrial categories might be introduced later if linkages and markets so indicate.

In fifteen years, Linkou "New Town" would thus have over 50,000 industrial employees.* Assuming the industrial workers to comprise about 13.5% of the total population, these jobs

* There will be a need of 300 hectares of industrial land for these 50,000 workers. The average number of employees per hectare for manufacturing industries in this region is about 170.
could support a total population of about 370,000 within fifteen years.

C. Attracting University or Research Institutions to Linkou

Many prominent examples of that higher-education institutions constitute the main part of the local economy can be found in the US. A new community at Amherst, New York, is planned to absorb some 25,000 people by 1985—a large portion of the 44,000 new population which will be directly caused by the construction of a State University new campus at Amherst. The proposed program calls for 7,900 residential units aimed at absorbing the demand to be generated by the new campus faculty, staff and "indirect" employees—off-campus service jobs generated by the new campus. The new campus, which will ultimately serve 40,000 students and 10,000 faculty and staff, is indeed a big "industry" to the town of Amherst as well as the new community.

As the island population grows and economy advances, more universities or colleges will be needed to meet the demand of ever-growing high-school graduates.* Currently, the Ministry of Education is planning a polytechnique college in order to help promote the industrial technology. Such a college could well be located on the plateau. The industrial firms would be an excellent "laboratory" for the college, while the college could render valuable technological know-how to the industries.

The National Sciences Council is also adding research institutes to the Central Research Academy. With the limited

* Currently, about 40% of a total of 80,000 high-school graduates who take part in the Joint College Entrance Examination can be admitted each year.
amount of land, the Academy cannot expand significantly on its present site in Nankang, a newly incorporated district of Taipei. It is thus suggested that the new town development agency, through the help of the Ministry of Education and other decision-making bodies in central government, should try hard to attract such research institutions to the plateau.

D. Locating New Governmental Buildings on the Plateau

By setting up governmental buildings on the new town, it is easily to draw a considerable amount of the government employees to settle on it. Expenditures from these offices on office supplies and household expenditures of those employees residing on the new town would have a big impact on the local economy. Convention center and arena which are likely to be financed by the public sector should also be drawn to the new town in order to help build the new town economy.

5. Incentives Designed to Attract Industries

Although Linkou possesses many geographical, transportation, and land price superiorities, it still is advisable to design some incentives to attract the industrialists to set up their factories and headquarters on the plateau. These incentives could include the following items.

A. Better Infrastructures

A familiar process for the industrial investors is that they have to struggle over the leveling of the site, the installing of power supply, water supply, and drainage system before the construction of factories could actually start.
Thus well-developed sites with sufficient infrastructures—access, power, gas, and water supplies, and drainage system would be very attractive to industrialists who value the time.

B. Better Services Center

Services Center set up by the development agency nearby industrial estates in the new town could extend services such as licensing, registering, patenting, marketing, financing, and even distributing, or warehousing. Such services would be particularly attractive to smaller enterprises since the latter usually don't have such capacities.

C. Longer-term and Lower-interest-rate Loans

Industries authorities of the Cabinet are in good positions to coordinate the public banking institutions—the Central Bank, The Taiwan Bank, and the Bank of Communications (and perhaps private banks)—to provide loans with lower-than-market interest rates and longer amortization period for industries which need capital and could thus be drawn to the plateau.

D. Taxation and Customs Incentives

Measures designed to exempt or to lower tax rates at the early stages of operation for industrialists would be another significant incentive to them. Lowering or eliminating customs for certain materials would also serve the purpose.

E. Labor Training Programs
Public sectors could initiate labor training programs to train newcomers from rural areas, or semi-skilled labor forces drawn from congested urban areas. Industries agencies could also finance such programs sponsored by the industries. Ample adequately trained labor forces are definitely critical to industrialists when they choose the sites for operation.

F. Ready-built Standard Plants

The new town development corporation could even provide standard plants or shell buildings on proper industrial zones ready for moving-in in order to attract smaller firms whose operation and space requirements could be generalized and standardized. The elimination of the frustration from land purchasing, plant construction, and utility installation represents high advantages for these smaller firms.
CHAPTER IV  THE PLANNING FOR LINKOU NEW TOWN

This chapter deals with the physical planning for Linkou New Town. Physical planning is the part of the total planning process which is concerned with the preparation of physical plans; and the physical plans will be the basis for the development of the new town to fulfill the following purposes: i. To provide prepared land at reasonable prices for housing and industry in order to accommodate a portion of the urban population which can be expected in the region. ii. To develop an urban environment which is socially satisfactory and capable of sustaining the allocated population with appropriate facilities and services. iii. To provide for optimum environmental conditions that allow for growth and change.

The plans are drawn with a base on assumptions, goals, and objectives derived from pre-planning studies. The pre-planning studies is divided into site analysis and socio-economic analysis.

1. Pre-planning Studies
   A. Site Analysis

1). The Linkou Special District covers the plateau (3625 hectares) and all the slope land surrounding the plateau (15,125 Ha.), totaling 18,750 Ha. Administratively, the District falls in Taipei County (the whole Linkou town and parts of Pali, Wuku, Taishan, and Hsinchuang towns) and Taoyuan County (parts of Kueishan, Luchu, and Taoyuan towns). For the plateau itself, nearly three fifths fall in Linkou
town of Taipei County, with the rest two fifths fall in Kueishan town of Taoyuan County.

According to the Linkou New Town Site Study, the whole special district would be disposed as:

**DISTRIBUTION OF PROPOSED LAND USES, LINKOU SPECIAL DISTRICT**

<table>
<thead>
<tr>
<th>Area (Ha.)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linkou New Town</td>
<td>3,625</td>
</tr>
<tr>
<td>Future Development*</td>
<td>660</td>
</tr>
<tr>
<td>Kuanyinshan Regional Park</td>
<td>1,970</td>
</tr>
<tr>
<td>Coastal Recreational Area</td>
<td>280</td>
</tr>
<tr>
<td>Slope land Park</td>
<td>527</td>
</tr>
<tr>
<td>Forests Preservation</td>
<td>11,688</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18,750</strong></td>
</tr>
</tbody>
</table>

*Three sites with gentle slopes on the periphery of the plateau could be used for future town expansion.

2). Natural Features of the Plateau

The Linkou Plateau looks like "8," with a narrow 'neck' (2 km. in width) connecting two large pieces of generally flat lands. The widest part of the plateau is about 5 km., while the longest portion is about 9 km. long.

i. Topography: Most of the plateau is of slopes under 4%. A small amount of the land with slopes 4-7% or 7-15% scatter over the edges of the plateau; and the land with slopes over 15% forms the foot of the plateau. Appendix D indicates the limitations of different slope categories on land uses and activities. This is one of the important factors affecting the land use plan.

ii. Geology: The plateau was formed in the Pleistocene period. Top soils, with a depth varying from several meters to ten meters, are made of laterites—a kind of
red soil. A deep layer of gravel lies underneath the top soil. Thus the plateau is generally suitable for construction with no need for an excessive foundation enforcement.

iii. Climate: The year-round average temperature on the plateau is 20.7 degree centigrade (or 69.5 degree Fahrenheit), which is two degrees below that of Taipei. The average rainfall is 1,757 millimeters per year--345 mm less than that of Taipei. Average monthly wind velocities are higher than that of Taipei. Year-round average of 4 M/sec is one unit higher than that in Taipei. All of these contribute to a more desirable climatic condition than that on the Taipei basin.

3). Existing Land Uses (Figure 4)

All the slope land surrounding the plateau is forest land, while on the plateau itself the land is mostly in agricultural uses. Tea farms and some scattering rice paddies account for 85% of the plateau. The majority of dwellings cluster in the three main settlements--Linkou, Kulinglin and Tinghu; however farm houses scatter over the plateau. Strip commercial developments coincide with the three main settlements, while military uses concentrate on both sides of the highway linking Linkou south to Kueishan. The existing land use pattern suggests that the initial stages of new town development will have to be close to the existing leading settlement--Linkou--on the plateau.

Table 2 summarizes the existing land uses on plateau.
Existing Land Uses, Linkou Plateau
(as of July 1969)

Source: Map 2-6 Existing Land Use, Linkou Terrace "Linkou Special District Plan" (UHDC, May 1970)

Note: The construction of the N-S Expressway started in Aug. 1971 and the Taipei-Chungli section will be finished in May 1974.
TABLE 2
EXISTING LAND USES, LINKOU PLATEAU, JULY 1968

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Area (Ha.)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>70</td>
<td>1.9</td>
</tr>
<tr>
<td>Industrial</td>
<td>106</td>
<td>3.0</td>
</tr>
<tr>
<td>Commercial</td>
<td>10</td>
<td>0.2</td>
</tr>
<tr>
<td>Institutional</td>
<td>2</td>
<td>0.1</td>
</tr>
<tr>
<td>Military</td>
<td>133</td>
<td>3.7</td>
</tr>
<tr>
<td>Golf Course</td>
<td>81</td>
<td>2.3</td>
</tr>
<tr>
<td>Schools</td>
<td>15</td>
<td>0.4</td>
</tr>
<tr>
<td>Ponds</td>
<td>55</td>
<td>1.5</td>
</tr>
<tr>
<td>Temple</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Cemetery</td>
<td>26</td>
<td>0.7</td>
</tr>
<tr>
<td>Forests</td>
<td>44</td>
<td>1.2</td>
</tr>
<tr>
<td>Agricultural</td>
<td>3057</td>
<td>85.0</td>
</tr>
<tr>
<td>Total</td>
<td>3600</td>
<td>100.0</td>
</tr>
</tbody>
</table>


4). Existing Population and Employment

During the period 1952-1962 the annual population growth rate fluctuated between the range 2.30-2.97%. Later in 1965-1966 the population grew rapidly (average 7.67% per year) because of big inflows of military families as a consequence of the large-scale military off-base housing on the southern part of the plateau. As of 1968 the total population on the plateau was about 22,000.

Residents on the plateau mainly group in the three major settlements and the commercial strips nearby. Linkou, with a population of 8,500 in 1968, leads the other two settlements—Kulinglin (1,700) and Tinghu (1,100).

Agriculture has been the major part of the plateau economy. But, because the recent significant increase of factories—mainly brick yards—people employed in industrial and commercial sectors has been growing accordingly.
Statistics shows that the share of agricultural employment dropped from 66% in 1956 to 57.5% in 1966, while the percentage of manufacturing industries employment to the total employment increased from 3.3% to 6.1% during the same period.

5). Existing Industries and Commerces

The majority of factories are brick yards. There are also some small-scale tea factories and chemical plants. The construction boom in Taipei and its satellite towns increases the demand of bricks; this in turn causes the rapid growth of brick-making industry on the plateau due to its unique conditions, such as easy earth excavation, easy drain, and the abundance of electric power. As of the end of 1968, there were more than 30 brick yards, and more than half of them were set up after 1966. The whole larger factories employed a total of 1,700 workers in 1968. Most of them were from the central or southern Taiwan and resided near the factories. This inflow of workers contributed to the urbanization of the plateau in recent years.

Most of the commercial establishments, which increased significantly as the brick-making industry grew, are retail shops serving the people on the plateau. By the end of 1968, there were 350 shops serving 22,000 people.

6). Existing Settlement Pattern

Farm house clusters constituted the main part of settlement before fast urbanization of the three commercial strips took place. Urbanization has been expedited by the rapid growth of brick yards, shops, and military units.
Settlements on the plateau can be classified into two categories—market centers and farm-house clusters—according to population size, access roads, and public facilities. Linkou, with a population of 8,500 in 1968, is the leading market center on the plateau. Facilities range from shops, primary schools, health station to town office, post office, police station, and farmers' association. Kulinglin and Tinghu are the other two market centers, servicing the residents nearby and military establishments in the area.

Farm house clusters vary in their sizes from some tens to many hundreds of people. The main function of these clusters is apparently residential, although a few shops may be found here and there among these clusters.

In general, public facilities are provided in accordance with the distribution of population on the plateau. With 22,000 people living on the plateau, the facilities—one junior high school, four primary schools, two police stations, and one health station—are considered modest.

7). Existing Transportation System

Linkou is the transportation center for the entire plateau. There are six highways connecting Linkou with regional center or smaller communities around the plateau. (Among which the eastward Linkou-Taishan-Taipie route, the northward Linkou-Taipinglin route, and the southward Linkou-Kueishan route are the major links for the plateau; Linkou-Hsialiao, Linkou-Chuwei, and Linkou-Kuanyinshan routes are the minor ones.) (Figure 6, Existing Roads & Water Supply)
FIGURES ALONG THE ROADS INDICATE TRAFFIC VOLUME (VEHICLES/DAY) SURVEYED BY TAIWAN HIGHWAY BUREAU IN APRIL 1968.

SOURCE: 1. MAP 2-9 EXISTING ROAD CONDITION; 2. MAP 2-11 EXISTING PUBLIC UTILITIES OF "LINKOU SPECIAL DISTRICT PLAN".

Existing Roads & Water Supply
These routes function as both inter- and intra-community links. They are all asphalt-paved except a small section linking the golf course with Pali, a small community on the shore to the north of the plateau.

Traffic volume survey of April 1968 shows that the average daily volume of 3200 vehicles on the Linkou-Taishan-Taipei route outrated the Linkou-Kueishan (1,200 vehicles per day) and the Linkou-Taipinglin lines. This indicates the close relation between Linkou and the regional center.

The plateau is currently serviced by bus lines of Taiwan Highway Bureau with 96 dispatches bothway originated in Taipei and of Taoyuan Bus Company with 64 dispatches originated in Taoyuan.

3). Existing Public Utilities

Three kinds of utilities--power, gas, and water--are already available on the plateau. There is a Taiwan Power Company thermal power plant at Hsiafu on the shore to the northwest of the plateau. First generator with a capacity of 300,000 kilowatts began in operation in July 1968; the second one joined the production in March 1972, generating 350,000 kilowatts. A distribution station has already been set up on the plateau; thus all the settlements, factories, and military installations are serviced by the system. A nuclear power plant which is under construction is also located on the shore to the northeast of the plateau. The future new town can easily be serviced by power generated by both plants.
As for water supply, some 1,000 households on the upper part of the plateau are currently serviced by the Lin-
kou Water Works with a daily capacity of 1,300 tons drawn
from the underground. The Shihmen Water Works also supplys
2,000 tons of water a day to the military institutions on the
southern part of the plateau through its Kueishan Service Sta-
tion. The Shihmen Water Works, using the water from the Shih-
men Reservoir, has plenty capacity to be developed to meet
the demands from the New Town. A new reservoir can be built
in the valley of the Shanhsia Creek just to the south of the
plateau if the future situation justifies. (Figure 6, p. 84)

Thirdly, the China Petroleum Company had installed
main gas pipeline through the southeastern corner of the pla-
台阶. The whole new town can easily be serviced by building
a distribution network according to the town layout.

9). Scenic Spots and Recreational Resources

Linkou, with its unique terrain, domains potential
for recreational development. A reconnaissance identified
the following scenic spots and recreational resources.

i. The plateau terrain: The plateau overlooks the Taipei
basin to the east, the Taoyuan Terrace to the west, and
the Taiwan Strait to the north. The plateau itself de-
clines from an elevation of about 250 meters at the
south to 200 meters at the north. The rolling land can
be so utilized as to add the beauty to the new town.

ii. Kuanyinshan Mountain: Kuanyinshan lies at the north-
eastern part of the Linkou Special District.
It is a scenic mountain overlooks Taipei basin to the southeast, the Tatunshan Vocanic Mountains to the northeast. It was named after the goddess Kuanyin who was believed protecting the immigrants from the coastal provinces of the mainland to Taiwan in the 17th century. The mountain is a favorite spot for mountain-climbing for the people in the region. The Northern Taiwan Regional Plan proposes it to be developed as a regional park. The new town would be benefited from such a development.

iii. The slope land surrounding the plateau: Reinforced with intensive forestation, it could serve as the natural boundaries of the new town.

iv. Edges of the plateau which domain excellent views: These areas should be used skillfully lest the views be destroyed. Tourists' hotels, luxurious houses and selective public institutions could be built here.

v. Coastal area to the northwest of the plateau: It could be developed as coastal recreational belt. Facilities for swimming, fishing, yatching, and camping would be the main features for such an area.

vi. Ponds: There are four larger ponds and 16 smaller ones on the plateau. They function as reservoirs for irrigating the scattering rice paddies now. Many of them could be incorporated and further developed as a part of the whole town park and recreational system.

vii. Existing recreational resources: Kuanyin Temple on the
eastern edge of the plateau domains excellent views. It would be an ideal spot for hiking and sight-seeing. The Linkou Golf Course is already well-developed and thus should be fabricated into the future recreational system of the new town.

viii. Historical or well-designed buildings: Buildings such as Hsinwu Junior College of Commerce, houses for the Taiwan Power Company employees, and some old buildings with historical or esthetic values should be preserved.

ix. Existing woods and Bamboo fields: Efforts should be made to preserve as much of the existing prime vegetations as possible. This would enhance the greenishness of the new town. (Figure 7, Existing Landscape)

10) Restraints to Urbanization

Restraints due to the natural environment and existing development would affect the physical planning of the new town and its development programs. Major restraints are found as follows:

i. Areas with slopes over 15% could not be economically developed. They should be used as the natural boundaries of the new town.

ii. Areas which aren't sewerable by gravity would induce higher costs. Thus they are not suitable for intensive construction.

iii. Tea-plant Test Station, brick yards, military installations, and market centers should either be incorporated into the plans or programmed for later demolition,
allowing then to be used for a longer period before demolition.

iv. Existing high voltage power lines, oil pipeline, and gas pipeline should be carefully studied when deciding which could be preserved and which should be shifted.

B. Socio-economic Analysis

1). Age Structure: It is very likely that the population structure--age group distribution, to name one--in the new town will not be stable within some 50 years after the development takes place. This is mainly because the continuous inflows of immigrants to the new town before it saturates or reaches the population ceiling set forth by planners. Linkou, which is conceived to be developed in 20 years to the optimum size of 360,000, would gain 20,000 people per year in average. In general, it will have more people in the 15-49 age groups than the average existing 'old' cities or towns. Enormous employment created through years would draw large waves of people in the labor force category and their families. Correspondingly, Linkou will have a smaller percentage of children and old people than the 'mature' towns. Furthermore, most of the children are in the same age-group, requiring educational facilities of a particular type and level. Figure 5 shows the age-group distribution of Linkou population as compared to the island as a whole.

2). Occupational Structure: Being a new town, Linkou would see a higher percentage of employed labor force than the rest of the island. There were only 29.8% of the popula-
FIGURE 5

THE COMPARISON OF AGE GROUP PYRAMIDS, LINKOU & TAIWAN

Source: UHDC/CIECD, Linkou Special District Planning Report, May 1970, Figure 4-1.

Age Group

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Male</th>
<th>Percentage</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-54</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>55-59</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65+</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Taiwan, 1968

Linkou, projected
tion holding jobs in 1966 on the island, while the projected figure for Linkou would be 32.5%. Among the occupational categories, manufacturing industries will provide 35% of the total jobs for Linkou. (The whole industry will provide 45% of the total jobs.) A comparison to that of Taipei City reveals the characteristics of the occupational structure on Linkou: OCCUPATIONAL DISTRIBUTION, LINKOU and TAIPEI*

<table>
<thead>
<tr>
<th></th>
<th>Industries</th>
<th>Trades</th>
<th>Military &amp; Civil Services</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linkou</td>
<td>45.0%</td>
<td>20.7</td>
<td>23.7</td>
<td>10.6</td>
</tr>
<tr>
<td>Taipei</td>
<td>32.4</td>
<td>25.0</td>
<td>18.6</td>
<td>24.0</td>
</tr>
</tbody>
</table>

*For Taipei, the figure were calculated for the year 1966; for Linkou, the figures are projected.


3). Family Size: The projected average family size --4.6 persons per family--is much less than the current figure of 5.6 persons per family for the entire island's non-agricultural families. The projection is based on the following three factors:

i. The continuous drop of birth rates;

ii. The tendency that the traditional extended families give way to the smaller families; and

iii. Smaller families are more likely to move into the new town.

A detailed population study for the new town projects that there will be 2,482 school-age children per 10,000 new town population. This figure compares favorably with that of the Taiwan average--2,472 school-age children per
10,000 island population in the 1968-1969 academic year. Although the percentage of school-age children in Linkou would be lower than that of the mature towns, the enrollment rate of the school-age children of the former is expected to be higher than that of the latter.

Socially, three problems could be anticipated throughout the development stages:

i. The problem of adjustment for the immigrants to the new town environment: They only have the occupational relation to the new town at the beginning. How to create the neighborhoodness and enhance the feeling of belonging to the community is thus very important.

ii. The problem of relocating existing residents: Throughout the development stages a certain amount of farming families will have to be relocated to make room for development. The relocation and job-training programs are particularly important in this case.

iii. The problem of providing employment for the second generation and the arrangement for the retired first-generation immigrants: Appropriate provision would keep the second generation from being expelled from the new town. Smaller dwellings or nursing homes are needed to accommodate the retired couples whose grown-up children choose to live separately.

Accordingly, the following measures are designed to stabilize the new town to achieve a more balanced society.

i. Building a sound economic base: Selecting those industries which will offer higher-pay jobs is a good way to
ensure the new immigrants with a decent living. This would in turn help stabilize the new town society.

ii. Reasonably-priced Housing: Efforts—controlling the land price, mass production of houses, public subsidies, or mortgage financing—should be made to provide the majority of new families with dwellings within their financial means.

iii. Social Programs: A host of social programs such as community development, recreational programs, organizing societies and clubs, counseling for the new arrivals, and media programs should be held to familiarize the immigrants with the new environment and the new way of life, thus enhance the feeling of belonging to the community.

iv. Mixing the different types, sizes, and income levels of dwellings in a residential sector: By appropriate layout planning, this will not only prevent the social segregation, but help to enhance the adhesion of the community.

v. The existing major settlements should be preserved and incorporated into the new town plans as much as possible. It is advisable to minimize the social dislocation caused by the new town development.

vi. Flexibilities in the physical plans: Flexibilities should be built into the physical plans to ensure that they could be revised and modified throughout the development stages. One of the considerations along this
line is to preserve a certain amount of land within each residential area and on the perimeters of the plateau for future expansion.

vii. New schooling system: Beginning in the 1968-69 academic year, the Chinese government extended the compulsory education for school-age children from six years (primary school) to 9 years (primary and junior high schools). Because the past practice, the nine year education has to be completed in two different schools--the first 6 years in primary schools and the next 3 years in junior highs. Comparatively, this means that each junior high would cover a larger area in order to draw sufficient amount of students. Larger area means the longer distance for the students come back and forth from school. It is thus suggested that a new schooling system be implemented in Linkou new town. By combining the 6 year primary school and the 3 year junior high school, the new primary school will have a larger enrollment and thus can afford to have facilities such as libraries, auditorium, gynasium. etc., which can in turn be shared with the local residents. This new schooling system would also balance off the effect of unbalanced composition of school classes, i.e. a large enrollment of certain grades at a certain period of time as a consequence of the immigration pattern and family-formation pattern.

4). Family Income: Table 3 on page 95 shows the family income structure projected for the new town families.
### TABLE 3
INCOME STRUCTURE PER 10,000 POPULATION, LINKOU NEW TOWN

<table>
<thead>
<tr>
<th>Item</th>
<th>Household Heads Work in Linkou</th>
<th>Single Worker</th>
<th>Household Heads Work Outside Linkou</th>
<th>Total Workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income NT$/Month</td>
<td>No. of Households</td>
<td>Employed Workers</td>
<td>No. of Households</td>
<td>Employed Workers</td>
</tr>
<tr>
<td>&lt;1,000</td>
<td>93</td>
<td>96</td>
<td>569</td>
<td>0</td>
</tr>
<tr>
<td>1,000- 1,999</td>
<td>321</td>
<td>411</td>
<td>252</td>
<td>22</td>
</tr>
<tr>
<td>2,000- 2,999</td>
<td>531</td>
<td>754</td>
<td>26</td>
<td>105</td>
</tr>
<tr>
<td>3,000- 3,999</td>
<td>292</td>
<td>491</td>
<td>-</td>
<td>76</td>
</tr>
<tr>
<td>4,000- 4,999</td>
<td>182</td>
<td>335</td>
<td>-</td>
<td>40</td>
</tr>
<tr>
<td>5,000- 5,999</td>
<td>124</td>
<td>252</td>
<td>-</td>
<td>22</td>
</tr>
<tr>
<td>6,000- 7,999</td>
<td>100</td>
<td>228</td>
<td>-</td>
<td>19</td>
</tr>
<tr>
<td>8,000- 9,999</td>
<td>38</td>
<td>95</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>10,000-14,999</td>
<td>24</td>
<td>60</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>&gt;15,000</td>
<td>14</td>
<td>35</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Workers</strong></td>
<td>1,719</td>
<td>2,757</td>
<td>847</td>
<td>298</td>
</tr>
</tbody>
</table>


It is generally agreed that the average family income in a new town would be higher than the existing towns due to the fact that the employment rate and the average pay schedule are both higher in the former than in the latter. Housing development programs will have to be closely related to this family income picture in order to produce dwellings within the resources of the most of the new town families.
5). The Principle of Economy: For Taiwan, a country with a per capita income not much over US$330 in 1971, this should be one of the major principles governing the planning and development of the new town. It is undoubtful that the demand for public investment in infrastructures would be enormous. Every effort should be made to avoid waste and extravagance in the use of land or construction. Skillful planning and programming would make it possible to incorporate part of the existing facilities--such as roads--and thus economize the total development cost. It would in turn be possible to invest on the other essential projects of the new town development.

2. Structuring the New Town

Urban area is a place where people reside, work, go school, shop, and recreate. New town is no exception and should basically provide places for such activities as living, working, schooling, and recreation for the townspeople. Hence, physically, it should have the following land use classes in order to fulfill the functions: a). Residential units for people to live; b). Industrial estates for industrial workers to work; c). Community centers for people to socialize, to work, to shop, and to be serviced; d). Community facilities to provide the residents with the opportunities to be educated, to be medicared, etc.; and e). Transportation systems to move the people or goods out and into the new town.

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Rough estimates place the investment required to finance the initial land acquisition and construction at NT$500 million. This sum would cover payment for acquisition of the land required for initial construction, three years interest on the land bonds for the remainder of the plateau, the construction of an access road, and the first stages of the water and sewer systems. (Memorandum, July 1, 1967, Linkou New Town Report, UHDC, May 1969.)
A review of the relationships between these functions reveals that they are correlated in different levels. The relationships could be summarized as in the following diagram:

1. It could be seen that the residential areas are closely related to schools, especially kindergartens and primary schools. The proximity of dwellings to schools would enable the school children go and back from school by walking rather than packing in the crowded city buses for long distances as the most of the present larger cities on Taiwan. Commercial establishments and community facilities—the two main elements of community centers—are also closely related. For a town on Taiwan retail shops and grocery markets should also be close to residential areas since most of the housewives go shopping for food daily. For a new town with manufacturing industries as its main suppliers of employment, industrial estates should also be close to the residential sectors; but be buffered by transition zones. Somewhat less close are the residential sectors and community facilities, or shopping centers and industrial estates.

1 This diagram is designed using the similar one on page 28 of Kevin Lynch's "Site Planning" as a base. One residential item is used here rather than dividing it into houses and apartments.
Bearing this analysis in mind, the basic land use classes for Linkou New Town could be arranged to show, diagrammatically, the different levels of relationships between the basic land use classes.

Figure 8

BASIC LAND USE CLASSES

- Industrial
- Town Center
- Community Facilities
- Military Reserve
- Green Belt, Green Wedges, Town Park
- Residential

Among which military reservation is an element imposed by the Northern Taiwan Regional Development Committee upon the request of the Ministry of Defense. Green belt is the vast forest area (11,700 hectares) which surrounds the plateau (3,600 hectares) and forms the 'foot' of the plateau. These elements together form the Linkou New Town.
figure 12
Sketch Plan,
Linkou New Town

INDUSTRIAL ESTATE
INDUSTRIAL SERVICE CENTER
VILLAGE CENTER & PRIMARY SCHOOL
SECTOR CENTER
DISTRICT CENTER
SUB-TOWN CENTER
CENTRAL BUSINESS DISTRICT
PUBLIC FACILITY
RESIDENTIAL VILLAGES
SECONDARY OR VOCATIONAL SCHOOL
UNIVERSITY
OPEN SPACE OR GREEN WEDGE
BUS STATION

SCALE 1:40,000
May 1972
Following the analysis above, the new town plan proposed here (Figure 12 Sketch Plan, Linkou New Town, page 99) is basically derived from designing a transportation network to connect the different town elements to ensure the convenience, to promote the safety, to provide the better living environment, and above all, to fulfill the requirement of the principle of economy.

A. Transportation System

A well-planned and developed transportation network would facilitate the new town with adequate inter- and intra-city transportation. The adequate development of transportation network in each stage of new town development is vital to the success of the new town. Furthermore, transportation network would, to a large degree, shape the urban pattern of the new town.

The planning of the major transportation network on Linkou is very much based upon: 1) the existing roads and trails; 2) the envisioned role of the plateau in the Region; and 3) the envisioned urban pattern for the new town.

The existing road network is very much shaped by the major market center--Linkou--and some army institutions on the west of the lower part of the plateau. The existing roads are by no means well-planned. The new road system for the new town would have to abandon some sections of the existing roads while adopting some other sections of the existing roads. Furthermore, the abandoned sections could be incorporated into the bicycle route system, which would be used mainly for bicycles although it could be opened to the emergency vehicles. This would be an important step toward economizing the development cost. The relative flatness of the plateau permits a great flexibility for route alignment.
1). The Taiwan North-South Expressway

The Taiwan North-south Expressway is one of the powerful determinant affecting the eventual pattern of the new town. Back in the latter part of the sixties, the provincial Highway Bureau had long been convinced by the UN advisors to align the Expressway across the plateau in order to provide higher accessibility for the plateau to be a major urban development site. The action would have inevitably increased the cost of the Expressway. But, in the long run, it would service the island as well as the Northern Region better than it would otherwise. The Expressway would provide the plateau with convenient access east to Taipei (the regional center) and Keelung, the only existing international port in the Northern Taiwan, and southwest to Chungli, Yangmei and the central and southern Taiwan. (Figure 3, page 54.)

This pre-determined feature would have to be incorporated into the new town transportation network. The road network designed for Linkou should take advantage of the high accessibility already provided by the Expressway.

2). Two North-south Arteries Planned

Two North-south arteries (the East Artery and the West Artery) were planned to be the backbone of the vehicular road network for the new town. They would connect town center, sub-town centers, residential sectors, and employment centers--mainly the in-

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The construction of the northern section (Taipei-Yangmei) of the Expressway is quite underway. It started in August 1971 and is scheduled to be finished by May 1974.
dustrial estates—as well as recreational facilities such as town park and golf course. Each connects with the Expressway via interchange, thus assuming high accessibility to the rest of the region. (Figure 10)

The West Artery would be extended northeast to the proposed Tanshui harbor and the proposed Neuputzu new community (projected for 300,000 residents) when the development of the new town and the latter two justifies. It would also connect with the existing North-south Highway, which runs to the south of the plateau, at Kueishan to the southwest of the plateau. The East Artery merges with the west one at the northern end of the plateau although it would also connect with the North-south Highway at the southeast of the plateau. Thus it is likely that the West Artery would somewhat assume more traffic than the east one.

For the smaller piece of land (the East Wing) to the east of the plateau, an existing road leading to the Kuanyinshan Regional Park would be improved—straightening on some portions—and be extended southward to the area proposed for a polytechnique college. It would thus be the artery for this portion of the plateau as well as the potential site for future expansion. It is also the only link to the Kuanyinshan Regional Park for the entire new town.

3). Secondary Roads

The rest of the major road network is the ten secondary roads which mostly perpendicular to the arteries. They are so planned as to incorporate some portions of the existing roads or to upgrade some existing gravel roads. They connect the residential sectors with the arteries. The secondary roads would also be extended beyond the arteries in order to service
the irregularly-shaped peripheral areas of the plateau. These extensions of the secondary roads, however, should be viewed as local distributors.

Five of the secondary roads would also be used as linkages to the surrounding smaller communities or recreational area. One would link with the seashore recreational area to the north of the plateau; one with the Linkou Power Plant to the northwest of the plateau; one with the proposed Nankan New Community to the west of the plateau; one with Taoyuan to the southwest of the plateau; and one with Taishan (and then Taipei) to the east of the plateau. The convenient connection to these smaller communities would enhance the new town as the sub-regional center in the region.

The intersection of a secondary road and an artery, or in a few cases the intersection of two secondary roads, would be the sector center of a residential sector. (Figure 9) This would give higher accessibility to the sector center in addition to service the villages more evenly. This kind of structuring the residential sectors and the vehicular roads differs from the earlier schemes proposed by the Urban and Housing Development Committee. The UHDC plan uses the roads as the boundaries of the residential sectors. (Figure 15, Master Plan, Linkou Plateau)

4). Town Bus System

For the movement of people, a city bus system could be easily set up on the road network to serve the residential sectors and the different sections of the new town. Public transportation system in the form of a town bus network would be emphasized in the new town in view of the following considerations: i) Level of economic Growth: The recently finished "Taiwan Area
Comprehensive Development Plan" projects that the per capita income will reach US$1,800 by the year 1990 from the 1971 figure of $329. In the year 1968, there was one passenger car for every 651 persons in the Kaohsiung-Tainan Region, a region which resembles the island in many ways. It is reasonable to predict that the car ownership ratio will not be up any significantly in the coming two decades. Thus urban areas throughout the island will still have to depend on public transportation systems. ii) Judging the situations around the leading cities in the world, one will find that an effective public transportation system is much more desirable than the system which is intended for majorly the private automobiles. A public transportation-oriented system will take less land; service wider spectrum of residents; and be less polluting, aggregatedly, than the car-jammed system. iii) With a relatively high residential densities, Linkou will see its public transportation with higher patronage rate, the system would be financially successful.

The bus lines would pass through all the residential sectors. This means that no one needs to walk more than 700 meters from where he lives to a bus stop.

5). Bicycle Way and Pedestrian Path System

A bicycle route system would be developed, using the village centers, employment centers, and town center as the linking nodes. A fair amount of these routes would be using the existing paved local roads. As a matter of fact, most of the village centers were placed along the local roads in order to be accessible through this bicycle route system. By doing this, it would avoid abandoning the existing local roads; rather to convert them to be bike routes.

A major pedestrian path system would be along the
continuous green wedge system, although paths would also be provided for intra-sector or intra-village movement. The local streets within the sector or village could have sidewalks; there is no need to have separate pedestrian ways independent to the local streets.

This walk/bike system would be an effective way to economize the total road construction cost since fewer roads will be needed than a town which is designed to be vehicular movement-oriented. The safety of children and pedestrian could also be improved under this separated pedestrian-bicycle system and road system for powered vehicles.

B. Open Space System

Landscape survey (Figure 7 Existing Landscape, page 106) indicates that the area south of the Expressway has the potential to be developed as a park. It is an area comprising two existing irrigation ponds. The area is in the relatively central position of the whole plateau. It is thus suggested that the town park be developed in an area south of the expressway, taking the advantage of the existing three ponds, which are of great recreational value. (Figure 12, page 99)

A smaller scale parks is planned to the north of town center. It is composed of two connected parts: one between the residential sectors and the town center, the other part is to the east of the proposed public facility area. The former one is what now an area with well-grown trees and the site for the Linkou Tea-plant Test Station. The wooded area could be converted into a park quite easily; and the Tea-plant Test Station could be conserved as long as there is still fair amount of tea-plant farming on the plateau before the plateau is fully developed. The latter one is part of the area which is surveyed to be a potential site for park deve-
figure 7

Existing Landscape

NOTE: THIS MAP IS COMPILED FROM MAP 2-12 LANDSCAPE SURVEY MAP OF "LINKOU SPECIAL DISTRICT PLAN" & A LINKOU TOPOGRAPHICAL MAP (SCALE 1:50,000).
development. It is the smaller part which is cut apart by
the construction of the Expressway. This park would be
very accessible to the residents living in sectors north
of the Expressway. People could reach the park through
the green wedge system.

The existing golf course at the northern end of
the plateau would be preserved and be expanded a little
bit in order to cope with the increasing demand of using
the facility as the town is growing. The course would
be bounded by the West Artery, the East Artery, a sec-
dary road and a secondary school.

A town athletic field (20 hectares) is planned
at the southern tip of the East Wing. It is so located
as to be shared by the polytechnique college which is
proposed to be developed nearby.

The rest of the town is linked by continuous
green wedges with a width varying from about 40 meters
to 300 meters. For most of the cases, these green
wedges are planned along either existing rice paddies or
strips with greater slopes. Obviously, rice paddies are
those low lands on the plateau. Construction on these
lands require extensive piling. Hence it is more de-
sirable to conserve these lands for green wedges. Fur-
thermore, these low lands on the plateau would likely be
flooded when there is big storm. It is thus of great
ecological significance to designate these lands as
green wedges.

The continuous green wedges would also be used
for pedestrian paths. Many of the industrial workers
would be able to walk to work through these paths;
likewise, most of the high school children would be
able to go school by using these pedestrian paths along
the green wedges. And a large amount of the residents
could even get to the town center and town parks by
walking. In addition, these continuous green wedges
furnish a direct contact with the vast forested area around the plateau, thus providing an easy access to the forested or wooded area for the new town residents. It is anticipated that the new town would be much more greenish than the existing towns and cities across the island.

Wherever width permits, playgrounds, playlots, and even small-scale parks would be planned along the green wedge system. It would thus be an invaluable supplement to the recreational facilities within the residential sectors. Finally, for most of the cases, these green wedges would also serve as the natural boundaries of residential sectors. A total of 20 residential sectors--the basic planning unit--is thus formed by designating the overall green wedge system.

In addition, the Kuanyinshan Regional Park to the northeast of the plateau and the seashore to the north of the plateau would be the other amenities for the new town residents.

C. Industrial Estates

As the economic base study for the new town (page 73) indicates, the whole new town would need a total of 300 hectares of industrial land in order to provide jobs for 50,000 industrial workers, and in turn to support the whole 360,000 new town residents.

The ultimate distribution and location of these industrial lands is based on the following considerations: 1) Industrial estates should be evenly distributed over the plateau in order to facilitate workers with short walking of bicycling distances; 2) Each estate should be on site with sufficient amount of land to enable gathering of the similar industries and to permit future expansion; 3) The site should be generally flat; 4) Avoid locating industrial estates on areas with high
scenic value; 5) Industrial estates should be close to the two arteries for the higher accessibility provided by the arteries and the Expressway; and 6) Somewhat isolated from other new town elements such as residential sectors, commercial, and educational institutions.

There are a total of eight industrial estates planned on the plateau: five to the north of the Expressway and the other three to the south of the Expressway. The northern five comprises a total of 175 hectares of land, while the southern three 125 hectares. It is somewhat proportionate to the land areas on both sides of the Expressway.

The green wedge system connects the industrial estates with the rest of the new town, namely residential sectors, town center, public facility areas, etc. Workers would be able to walk to work for most of the cases. Each estate is buffered by green area from the adjacent residential sectors. However, an adequate control over the industrial performance standard is necessary in order to minimize the adverse environmental effects.

An industrial service center is planned at the area south of the Expressway and west of the West Artery. It would provide services such as warehousing, distributing, industrial tools, and provide spaces for truck yards. A public facility area is planned to the right of the service center. This area could be used as power distribution station, gas distribution station, and telephone interchange headquarter.

D. Residential Units

Obviously, residential areas constitute the largest portion among the land use classes in a town. The structure, distribution, and physical layout of these areas thus is a very important part of the total physi-
cal planning process.

It seems to the author that the administrative hierarchy Ch'd-Li-Lin (or District-Sector-Village) in cities on Taiwan could well be adopted to the structuring of residential units on Linkou New Town. The hierarchy is used in provincial cities (usually with a population over 300,000) and national cities (having a population of at least one million is one of the criteria to be designated as a national city.) "Ch'ds" are usually divided by thoroughfares of the cities, while "Lis" are bounded by secondary distributors. "Lins" generally coincide with the boundaries of larger blocks or comprise several smaller blocks. "County" municipalities (with the same status as townships within a county) are administered under the "Li-Lin" hierarchy since their sizes are generally within the range 100,000 to 250,000.

Linkou New Town, with its ultimate population of 360,000 to 400,000, will eventually be a provincial municipality. Hence, it is advisable to structure the new town with the District-Sector-Village hierarchy at the very beginning.

It has been the author's observance that the "Ch'd-Li-Lin" has a fair amount of community implications although it is basically an administrative measure. Residents within the same Lin or the same Li could easily generate the feeling of belonging and neighborhoodness. This is particularly true in the suburban Lis or Lins where more casual contacts between the neighbors are found. Incidentally, the term "Li-Lin" means neighborhood in Chinese.

1). Sectors

As Figure 10 (Residential Sectors and Road Network) on the next page shows, the 20 residential sectors are connected by two arteries and ten secondary roads.
Residential Sectors and Road Network
Each sector is enclosed by the green wedges and the designated forest land around the plateau. The longitudinal green wedges parallel to the arteries forms the backbone for the whole town, while the two arteries connect 12 sectors and the secondary roads connect the rest eight sectors.

Most of the sectors have a share of the central strip—an area bounded by the two arteries and is suitable for higher density development—in addition to the peripheral land outside the arteries. The latter is more suitable for lower density development. Thus each sector is somewhat harmonious in character. Socially balanced sectors could be more easily anticipated under this kind of physical layout.

The continuous green wedges would provide convenient, pleasant pedestrian paths for the sector residents, while the arteries or secondary roads would enable a fast connection to the employment centers, town center and the other parts of the new town. Such a structure would ensure the sectors with quick vehicular connection with other parts of the town, while not jeopardize the safety of the movement along the green wedges.

Each sector would be about the size of one kilometer by one kilometer. The actual layout dimension of the sectors would depend upon the green wedges which are pre-determined by the topography and the existing land uses. Four of the 20 sectors would be somewhat smaller
than the majority of sectors. This is due to the pre-determined green wedges which act as the boundaries for the sectors. In order to accommodate a total of 360,000 population (overall town density is thus 100 persons per hectare), a typical sector would have to accommodate about 20,000 residents.

Sector centers are placed at the intersections of arteries and secondary roads with a few exceptions in which the sector centers are placed at the intersections of two secondary roads. (Figure 9, A Residential Sector, page 114) Sector center, along with the three or four village centers within the sector, would provide quite a range of goods and services for the residents, thus to make the sector more or less an environmental unit rather than merely a housing area.

2). Districts

Generally three sectors form a district, which would correspond to "ch'ü" in the municipal administration hierarchy. A district would have about 55,000 to 60,000 people. It is large enough to support governmental services such as district (Ch'ü) office, police, fire, and health station; a major shopping center and a high school.

The development phasing of the new town would, in some cases, be designed according to the district lines.
figure 9

A Residential Sector (diagramatic)
3). Villages

Three or four villages constitute a sector. With 20,000 residents for a typical sector of three or four villages, the size for a village would then be 5,000 to 6,600. For planning purpose, a typical village would be assumed to have a population of 6,000 people.

Most of the villages are placed with two sides facing the green wedges and the other two sides in adjacent to the arteries or the secondary roads, but buffered by vegetation strips. This would give the village residents the choice between vehicular movement mode and pedestrian/bicycle mode. A proposed public transportation system along the road network would provide the villagers with convenient access to the other parts of the new town. On the other hand, the pedestrian paths and bicycle routes along the green wedges or the local streets would also provide convenient links for the pedestrians and bike riders. For the potential town bus riders, the maximum walking distance from houses to the bus stop would be 700 meters, which is about 7 to 10 minute walk.

Village centers are, for the most of cases, placed in the centers of the villages. However, a few villages would continue to develop the existing market centers as their village centers, which might not be in the central position of the villages. The village centers
would include convenient shops, food markets, village office, kindergartens, and primary school, etc.

To conclude, Figure 11 (Residential Unit Hierarchy) on page 117 shows how the whole plateau is divided into seven districts with each district comprises three to four sectors. And each sector comprises three to four villages. This is the hierarchy reflecting the "Ch'ü-Li-Lin" system. It could serve the basis for organizing the administrative districts for the new town.

E. Educational Facilities

1). Kindergartens

The percentage of pre-school children (ages 3-5) attending kindergarten to the whole population varies with the age-group pyramid, the economical situation of the community and the employment characteristics of the labor force. When the Malan New Community—a new district of the 'county municipality' Taitung of the southeast of Taiwan—was planned in 1965, it was taken that the kindergarten enrollment be one thirtieth of the community population. But, on the other hand, a preliminary planning for Neihu New Community—a newly incorporated rural district in northern Taipei City—in 1967 put the ratio at one sixtieth. In the case of Linkou, a new town with conceivable higher economical viability and higher percentage of residents in the labor force,
FIGURE 11

RESIDENTIAL UNIT HIERARCHY

- VILLAGE
- SECTOR
- DISTRICT

- INDUSTRIAL ESTATE
- TOWN CENTER
- PARK OR GOLF COURSE

SCALE 1:40,000
it is advisable to take the figure one fifteenth as the design criterion. Hence, for a village of 5,000 to 6,600 residents, there would be 330 to 440 children who need the facilities of kindergartens. With 100 as the maximum enrollment per kindergarten, there would be a need of three to four kindergartens in each village.

Figure 9 (page 114) shows how would the kindergartens be located within the villages. It is possible to locate a kindergarten within the maximum walking distance of 150 meters (or 3 minute walk for the children) for most of the dwellings under such an arrangement. For a kindergarten of 80-120 children, it needs 1,700 square meters (1,200 for the buildings; and 500 for the playground) of land. Appendix E shows the land requirements for kindergartens in different sizes. It is suggested, however, that the playgrounds should be available for the children in the neighborhood, especially during off-kindergarten hours.

2). Primary Schools

As suggested in Chapter IV-B, Socio-economic Analysis, (page 94) Linkou would have a new schooling system for the 6-18 school-age children. This means that the primary school in each village would provide education for the first graders through the ninth graders, and the children in the 10th-12th grades would get their education in a separate secondary school.
It is thus very important to estimate the number of the children in the 6-15 age-group in order to decide the capacity of a typical primary school--the school to service the village with 5,000-6,600 residents. According to the standards set by the Ministry of Education, the design capacity of a primary school (1-6 grades) should be 13.3% of the residents of the neighborhood serviced. However, statistics shows higher percentage of primary school enrollments to the total population in the city of Taipei:

<table>
<thead>
<tr>
<th>Year</th>
<th>1957</th>
<th>1958</th>
<th>1959</th>
<th>1960</th>
<th>1961</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>16.7</td>
<td>16.7</td>
<td>16.8</td>
<td>17.1</td>
<td>17.0</td>
</tr>
</tbody>
</table>

These higher percentages were, to the author's mind, due to the higher fertility rate and better economic situations in large cities.

In planning new communities on Taiwan, it is the general practice to use the figure 13-17% (of the projected community population) as the basis for designing the capacity for primary schools (1-6 grades). Min-shen-tung-lu New Community--a new development area within the core Taipei City--was planned using one sixth (16.6%) of the projected population as the total primary school enrollment (1-6 grades). Neihu New Community planning project employs 15-18% as the design capacity for primary schools.

In view of the continuing decrease of natural population growth rate (Taiwan recorded the lowest natural
population growth in two decades in 1971, 2.086% compared with 2.23% in 1970.), it would be reasonable to use the Ministry of Education standard--enrollment of primary schools (1-6 grades) should be 13.3% of the community residents serviced--for estimating the total enrollment of 1-6 graders.

For the junior high section (7-9 grades), statistics gathered before the implementation of the extension of compulsory education for school-age children from six years to nine years shows that, in the City of Taipei, the total enrollment of junior high schools accounted for 24% to 29% of the total enrollment of primary schools during the period 1958-1964 (which implies that around 48%-58% of the primary school graduates went junior highs in the period), and the figure was ever growing during the period. This brought to the employing 3.5-5.0% of community population as the design capacity of junior high school.

However, the percentage of the primary school graduates attending junior highs has been growing up dramatically since the implementation of the new educational program. The figures were 68%, 76%, 80%, and 81% for 1967, 1968, 1969, and 1971 respectively. For the potential residents at Linkou, this figure could be expected at 90% since, in general, they would be in better economic situation than the existing cities.
Consequently, for primary schools which offer education for 1-6 graders, the total enrollment could be expected at 20% of the population served. It follows that, for a primary school (1-9 grades) in a village of a population of 5,000-6,600, the size would be 1,000-1,320. This is quite an ideal size for primary schools with three classes of each grade, totaling 27 classes. Such a school would need about 33,000 square meters of land for buildings and 12,000 for the athletic field, totaling 45,000 square meters. (Appendix F)

3). Secondary Schools (10-12 grades)

Using the standard set by the Ministry of Education, the enrollment of primary schools accounts for 13.3% of the community population. And assuming 90% of the primary school graduates attend junior highs, the enrollment in 7-9 grades would be 6.0% of the community population. Educational statistics gathered in 1971-72 academic year shows that 72% of the junior high graduates enrolled in senior highs. In planning senior highs for Linkou New Town, this figure could be set at 75%. It follows that the total high school enrollment would ac-

1According to a study by the Graduate School of Design, Harvard University, a sampling survey of the 100 families (with average family size of 3.37 persons per family) within the Boston metropolitan area shows that 14.0% of the 337 persons were in the 6-15 age-group and attended kindergartens, elementary schools, and junior highs. The figure for the 100 families (with a total population of 359) sampled outside the BMA was 16.6%.
count for 4.5% of the total new town population.\textsuperscript{1} For a new town of 360,000, the total high school enrollment would be 16,200 (360,000\times0.045). Among these, one fourth would be vocational school students; and the other three quarters general high school students who seek higher education after finishing high schools.\textsuperscript{2} A high school with 2,100 students is believed to be efficient. Thus a total of eight high schools, each with the capacity of 2,200, is planned for Linkou: six general high schools and two vocational schools.

A high school of this scale would need 50,000 square meters of land for buildings and 15,000 for an athletic field. It totals 65,000 square meters (or 6.5 hectares).

As the Figure 12 shows, these eight schools were all located in the periphery of the plateau. They were so located that almost all of the high school students could reach a high school within 2,500 meters of walking distance.\textsuperscript{3} And these high schools are accessible through the green wedge system. It is worthwhile to point out that, by locating high schools on the periphery, land not

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\textsuperscript{1}Which compares favorably with the Harvard GSD study which sampled 100 families within and outside Boston metropolitan area and found the percentages of children enrolled in high schools (10-12 grades) were 4.2\% and 3.9\% to the total persons of the families surveyed respectively.

\textsuperscript{2}In the 1971-72 academic year, 75.3\% of the high school graduates entered universities, colleges, or junior colleges for higher education.

\textsuperscript{3}Which is about 40 minute walk, or 20 minute bike-ride. The GSD study suggests the maximum walking distance for high school students be 1.5 miles (2,414 meters).
sewerable by gravity could thus be used for athletic fields for the high schools. Again, these fields should be accessible for community residents.

4). Colleges

There is an existing institution for higher education on the plateau. Hsinwu Junior College of Business lies at the 'neck' which connects the East Wing with the main plateau. It admits graduates from junior highs for a five year training in business-related fields. The sketch plan allocates more land for the College to expand in order to cope with the anticipated demands from the new town. The College would contribute to the new town in the latter's seeking to be a sub-regional center of the Northern Taiwan Region.

A college, especially a polytechnique college, would not only add to the prosperity of Linkou, but expedite the industrial development on the plateau. Hence, a piece of land of 40 hectares is designated for a college at the southern tip of the East Wing. The College would share the town athletic field (20 hectares) to the north of the campus. It is strongly suggested that the Ministry of Education consider this site for the home of the proposed polytechnique college. This action would certainly be an important step toward the development of the new town.
F. Community Centers

Four classes of community centers would be planned in Linkou: i) Village Centers; ii) Sector Centers; iii) District Centers; and iv) Town Center and Sub-town Centers. Each with different catchment area and provide different level of goods and services.

1). Village Centers

Village centers consist two parts; commercial section and civic section. And the commercial section is mainly composed of a market place and a few shops, supplying food and other household items needed daily. It should have an area of 1,660-2,200 square meters for a village of 5,000-6,600 residents.

The civic center would be located in the central place of each village, preferably in adjacent to the primary school in order to share some of the latter's facilities. The civic center would mainly be a group of public buildings used for meeting hall, small exhibition hall, reading room, playroom and classroom for short-term vocational training classes or non-vocational training classes such as cooking, tailoring, and flower arranging. There would be a need of 1,200-1,500 square meters of land for these civic institutions in each village center.1

The maximum walking distance for housewives going to market in the village center would be 300 meters, which is about 4-5 minute walk. This is no great distance for housewives. However the design of the market place should be of flexibility since the buying habit might be change in the years to come when more and more low-income families can afford the refrigerators. Higher percentage of housewives employed might also extend the food-shopping frequency.

2). Sector Centers

Most of the sector centers are located at or in adjacent to the intersection of the arteries and secondary roads. They would be within 700 meters of walking distance (about 7-10 minute walk) for most of the homes. Sector centers would also be accessible through the town bus system.

As a village center, a sector center is also composed of two main parts: civic section and commercial section, with the only difference that the latter is somewhat in larger scale than the former.

Commercial section would include shops and markets. Foods and household items needed less often than daily could be found in a sector center. Shops providing personal services such as barber shop, beauty salon, shoe repairshop, laundary could also be included. For a sec-
tor of 20,000 residents in average, it would need about one hectare (or 8,780 square meters to be specific) of land for these commercial facilities.

Civic section would include facilities for governmental services such as Li office, branch postoffice, police precint, fire station, health station; social facilities such as activity center, library branch, exhibition hall, church or temple, etc. Land requirement for such facilities would be 0.8-1.0 hectare for a sector of 20,000 residents. The total land required for a sector center would thus be 1.6-1.8 hectares.

3). District Centers

A district center would not be a separate center, rather the expansion of a certain sector center within each district. It would provide civic and commercial functions for that specific district in addition to the sector center functions for the sector in which it lies.

For the commercial section of a district center, it would have shops and markets providing a wide range of occasional (weekly or less often) needs as well as daily needs for the residents of the district. A supermarket, cinema, and even a junior department store could be set up here. Bank or trust company branches could also be found in a district center.

Civic section of a district center would have facilities such as church/temple, clinic/infirmary, distri-
ct office, post office branch, police station, fire station, library, power and water service station, etc. Athletic field and related facilities would be shared by the district residents.

Larger type of service establishments such as automobile repair, laundries, bakeries could be set up adjacent to a district center. These operations are generally not suitable in a retail area.

The UHDC study suggests that it needs 0.5 hectares for every 10,000 population for the district center.\(^1\) For a district of 50,000 or more, it is suggested that 2.5-3.0 hectares of land be set aside for district center. The service radius of a district center is about 2,000 meters. It is thus likely that residents living more than 1,000 meters apart the district center would take a bus or ride a bike to the district center.

4). Sub-town Centers

Three district centers, those in Districts 3, 6, and 7, could be expected to grow as sub-town centers of the new town. They will henceforth be named sub-centers 1, 2, and 3 respectively for the convenience of referring. The area around sub-center 1 would be developed first; thus sub-center 1 would be a mini-town center in

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\(^1\)UHDC, Growth Centers: The Planning For Linkou New Town, April 1971, p. 94.
the earlier stages of town development. Sub-center 2 lies at the central point of the southern half of the plateau (using the Expressway as the dividing line). It would be accessible for the residents in the southern half. Sub-center 3, at the midway of the East Wing, would be smaller in size since it would serve less people than the other two sub-centers.

Sub-centers would provide goods and services similar to those of the district centers, but with wider varieties and selections. A major department store could be found here as well as some entertainment establishments such as cinemas, and music hall. Restaurants, office buildings, post office, telephone and telegram offices might also be set in the sub-centers.

Nevertheless, the extent to which a sub-center is allowed to expand should be skillfully limited, lest it would compete with the town center and cause the latter unable to be developed to its full capacity. This would jeopardize the chance for the town center to be the sub-regional center in the Northern Region. (Figure 12)

5). Town Center

Linkou Town Center includes two areas each of about 100 hectares on both sides of the Expressway. The area to the north of the Expressway is divided into three major parts by the East Artery and a green wedge. Among these three parts, the central one would be the
main central business district of the whole new town. Retail shops, department stores, entertainment establishments--cinemas, theaters, music halls, for example--could be found here. Goods provided here would be those not needed daily, but rather casual, seasonal, or even less often. A section of it would be the area for office buildings, banking facilities, providing business and professional services. The part to the right would be an area for social facilities. General hospital, town auditorium and activity center, gallery, exhibition hall, museum, library, concert hall, etc. will be the main features here.

A smaller town park would be located at the northern and eastern sides of this area. A general bus terminal for the city bus system and inter-city bus lines would be set at the northwestern corner of this area, i.e. to the south of the intersection of the East Artery and the secondary road leading west to the proposed Nankan New Community (projected for 100,000 residents) to the west of the plateau.

The part to the left would be divided into two sections. The east section would be for governmental buildings--Town Hall, Town Assembly Chamber, city agencies, police and fire headquarters, Tax Bureau, Court House, etc. would be set here. Many of the existing U.S. Communication Station buildings should be conserved when the institution ceases its operation on the plateau.
These buildings could be converted to be governmental buildings. It would be a significance saving for the public sector. The west section is conceived to be the expansion area for the C.B.D. As analyzed before, it is likely that the Linkou Town Center would not only serve the new town, but acts as a sub-regional center for the region. In this light, more C.B.D. area should be reserved.

Area to the south of the Expressway is also divided into three major parts. (Figure 12, page 99) Those two parts adjacent to the East Artery together form the town park. Two large ponds within the site could be developed as major recreational facilities in the park. The part to the east of the West Artery would be reserved for future town center development.

3. Development Phasing

An effective control over the development phases is very important to develop the town orderly. In the absence of an effective control, development might frog-leap all over the plateau; and land speculation drives up the land prices. It would be impossible for the public sector to provide basic public utilities for the developments scattering over the plateau in a short period of time. The excessive land prices would jeopardize some very important social objectives of developing the new town. One obvious example would be the difficulties
on providing public housing or subsidized housing at a reasonable price due to the high land prices.

The phasing of the development is a complicated process. The final proposal would be a compromised solution to different factors considered. In general, the phasing of development would be based on the following considerations: i) The earlier development would have to be on those areas close to the leading market center --Linkou. The existing commercial establishments in this market center could support the initial some 20,000 residents. ii) The earlier development would have to depend heavily on the existing road system and public transportation means. This would also lead the initial development to the area northwest of the market center. However, areas in the immediate proximity to the Expressway (to be finished in 1974) would face heavy development pressure in the near future. But, the fact is that the land at both sides of the Expressway is most suitable for a town center. And the development of the town center should not be started until the new town has gained some 70,000 population. Development of the town center in the early stage of new town development would cause the area underused. This is not economical and not desirable to the course of town growth. iii) The provision of sewers and drainage system: Since the plateau is generally declining from the south to the north, the main sewer interceptors would run from the south
to the north. Thus, beginning the development on the northern part of the plateau is economical. The construction of sewer lines could thus be staged in cope with the development of the town. Long sewer lines from the southern end to the northern plateau-foot would be needed if the development of the new town starts at the lower portion of the plateau. The case of constructing main drain lines is very much the same as the sewer lines.

iv) Water Supply: The capacity of the Linkou Water Works, using the water drawn from underground, could not be expected to service all the future residents to the north of the Expressway. However, the initial a couple of ten thousand residents could be serviced by the Works. The latter stages of development would have to be serviced by the Shihmen Water Works, which uses the water from the Shihmen Reservoir some 25 kilometers southwest of the plateau. This brings the need to construct water storage and distribution facilities at the southwestern corner of the plateau, which is on the major ridge line, at an early stage. Thus from the water supply point of view, starting the development at the southern part of the plateau would be more desirable.

v) The level of existing development: It would be easier to start the development on areas with little existing development. Much more freedom could be ensured on planning, developing, and construction. The existing Linkou market center is very much developed; and the developments are not
under a sound planning. To this end, the area northwest to the market center would be more appropriate to be chosen as the first development area.

Figure 13 shows the development phasing of the new town; and the succeeding five figures indicate the development of each stage. What are the new roads to be constructed? And how are these roads connected with the existing road system? Which well-built up areas would be conserved? Where would the industrial estates be developed? Which villages are designated for higher density development; and which others for lower density development? Where would the different community centers be? All these questions would be answered by the stage development plans.

The town center is not included in the phasing. But its development stages would be closely related to the other sectors of the new town. Should the Ministry of Education be convinced to locate the proposed polytechnique college in the new town, the site, at the southern tip of the East Wing, could be developed in the first ten years. At phase 2, the Shihmen Water Works storage and distribution station, planned to be at the southwestern tip of the plateau, would have to be constructed to service the new development from this phase on. The industrial service center south of the Expressway and west of the West Artery would also be developed at phase 2.
Development Phasing

- **NOT INCLUDED IN PHASING**
- **FUTURE EXPANSION**

Scale 1:50,000
Development Phase 1

- Residential Development, Higher Density
- Residential Development, Lower Density
- Village Center & Primary School
- Sector Center
- District Center
- Sub-Town Center
- Secondary School
- Industrial Development
- Bus Station
- Green Wedges
- Conserved Built-Up Area
- College
- New Road
- Existing Paved Road
- Existing Gravel Road
- Pedestrian/Bicycle
Development Phase 2

- NEW ROAD
- EXISTING PAVED ROAD
- EXISTING GRAVEL ROAD
- PEDESTRIAN/BICYCLE

Legend:
- RESIDENTIAL DEVELOPMENT, HIGHER DENSITY
- RESIDENTIAL DEVELOPMENT, LOWER DENSITY
- VILLAGE CENTER & PRIMARY SCHOOL
- SECTOR CENTER
- DISTRICT CENTER
- SUB-TOWN CENTER
- SECONDARY OR VOCATIONAL SCHOOL
- COLLEGE
- INDUSTRIAL DEVELOPMENT
- INDUSTRIAL SERVICE CENTER
- BUS STATION
- PUBLIC FACILITY
- C.B.D. DEVELOPMENT
- GREEN WEDGES
- PREVIOUS DEVELOPMENTS

Residential Development
- Higher Density
- Lower Density

Village Center & Primary School

Sector Center

District Center

Sub-Town Center

Secondary or Vocational School

College

Industrial Development

Industrial Service Center

Bus Station

Public Facility

C.B.D. Development

Green Wedges

Previous Developments

Military Reservation
Development Phase 4

- New Road
- Existing Paved Road
- Existing Gravel Road
- Pedestrian/Bicycle

Legend:
- Residential Development, Higher Density
- Residential Development, Lower Density
- Village Center & Primary School
- Sector Center
- District Center
- Sub-Town Center
- Secondary or Vocational School
- Industrial Development
- Bus Station
- Public Facility
- C.B.D. Development
- Green Wedges
- Previous Developments

Figure d 138
1. Need for An Implementation Mechanism

The new town plan (or an urban plan in general) can only be translated into reality if an effective implementation mechanism exists, or can be created, which is capable of implementing its main outlines and in a position to adapt the details to changing circumstances. Such an implementation mechanism would inevitably include dimensions such as organizational, legal, financing, marketing, and community development. With the limitation of time and energy, this chapter will focus, mainly, on the organizational aspect of the mechanism. This is to say that the discussion will be on the management structure for new town development.

The unsuccessful ventures of Metropolitan Tokyo, Japan; Colombo, Ceylon; and Delhi, India to limit the overgrown of the metropolises by creating series of satellite towns around the parent cities were mainly due to the management failure. On the contrary, Metropolitan Singapore has been quite successful in this regard through the effective new town (Jurong, Woodlands, and Yio-chu-kang) development management.¹

¹Economic Commission for Asia and the Far East (ECAFE)/UN, Physical Planning and Design Principles in the Development of New and Satellite Towns in the ECAFE Region, october 1966, pp. 41-44.
The sudden drop of the Linkou project in late 1970 by the Executive Yuan as discussed in earlier section indicate the complexities of organization, implementation and administration. For a new town project when the potential problems are not adequately resolved at the beginning through the designation of authority and responsibility these conflicts will continue endlessly.

Such a managerial structure must be much more than a mere collection of technicians and bureaucrats (as the case with the Linkou Development Authority). It must possess motivations, powers and skills sufficient to deal with opposition of speculators and absentee landlords, with the fears, real and imaginary of land owners and tenants and with the ignorance and prejudice of others. The management of the new town development must combine political astuteness with professional competence, firmness on major policy issues; with flexibility on negotiable matters. And in all cases it must be comprehensive in scope. As will become clear, in addition to the administrative difficulties it encountered at the level of local government, the Linkou plan did not have the good fortune of being in the hands of such an administration.

Accordingly, if the government is to resume the responsibility to see that the future development of Linkou will follow a course leading to the establishment of a balanced new town of several hundreds inhabitants, an effective administrative arrangement should be set up at the very beginning.
2. An Administrative Structure for Linkou Project

Mirrored by the failure of the Linkou Development Authority, it can be seen that, as in any major effort by a government, be it local, provincial or national, a central requirement is a firm policy of who is responsible and who is in charge. The success of the Joint Commission for Rural Reconstruction (JCRR) in its rural reconstruction program could well be emulated in the organization for new town development, by giving one agency such as a Development Corporation full authority for financing, developing, planning and management of the new town.

The formation of an optimal administrative entity for the new town development is no simple or easy matter. This is especially so in the Republic of China where the legal and administrative framework pertaining to local units of government is somewhat nebulous. It does little good to devise an administrative entity that, however logical and neat in conception, can either not be enacted or, if enacted, is destined to flounder in a sea of confusion, ill-will or sheer force of circumstances. On the other hand, guidelines need to be provided for administrative and managerial organization which can both cope with realities, and at the same time, be capable of getting the job done.

Hence, it is further manifested that these problems call for administrative solution. An efficient physical plan for the new town must, initially at least, disregard the existing jurisdictions of local units of government. Both
the geography and the economics of Linkou do not mesh with the existing boundaries of these units. This has been the main cause of conflicts and hardships.

Another problem has to do with the governmental powers necessary to insure the successful implementation of a plan. These powers, in many instances, seem to exceed those given to existing units of government including the counties. They range from those of land acquisition, through powers to tax and borrow, to those related to the supervision of orderly development and participation in infrastructure investment. Many of these powers are implicit in the plan, in the financial provisions and in the discussions of land acquisition and disposal.

What should be the nature and composition of the administrative entity which is to develop such a new town? What should be its status in relation to the central government, the provincial government, and the county government? What should be the future of the administration as related to the phasing of the development of the new town?

3. Organization for New Town Planning and Development

Planning should be comprehensive and include all pertinent information from many disciplines. There is no institution on Taiwan capable of assuming such a task. Coupled with the fact that the planning and development of new towns cuts across the responsibility of many agencies, this makes a complex management job. The present problem of compart-
mentalization and lack of effective communication between agencies make it impossible to effectively carry out the planning for growth centers—not mentioning the new town.

The British practice concerning the organization of new town corporations deserves reviewing. To carry out the tasks, the development corporations (normally one for each project), appointed and financed by the Ministry of Town and Country Planning (or the Secretary of State for Scotland), have an administrative staff ranging in size from about sixty to seventy-five for towns like Aycliffe (projected to house 45,000 people) and Cwmbran (55,000 people) to approximately 300 for larger towns such as Hemel Hempstead (planned for 80,000 people), Harlow (for 90,000 people), and Crawley (projected to accommodate 120,000 people).

Usually the key administrative officials are the general manager who is the chief executive officer responsible directly to the chairman of the development corporation, plus the chief architect, the engineer, the estate officer, and the legal officer. The staff serves the corporation members who are responsible for the basic policy decisions.

On the other hand, as for the powers that a development corporation needs to be vested, the New York State Urban Development Corporation (UDC) created under the New York State Urban Development Acts of 1968 enjoys a lot of powers and exemptions:

i. to purchase, lease, or condemn real property;
ii. to override local zoning and building codes;
i.iii. to create subsidiary corporation;
iv. to be relieved of certain local property taxes and other local and state taxes;
v. to exercise the full range of development powers;
vi. to be authorized to issue bonds (up to one billion dollars) for start-up funds;
vii. to be administratively flexible.

It is generally agreed that the fair success of UDC has been mainly due to such administrative flexibilities.

The above two examples would have some implications on organizing a development entity for Linkou new town. Present diffusion of responsibility for new town development policy, planning, and program could be ended by designating a single agency as the overall executive and coordinating responsibility. And then organizing and staffing it to do the job. It should include experts from many specialities who can provide an overview of planning activities and their implications.

It seems that the most effective method would be to begin by establishing a corporate form of organization with a link to the Executive Yuan (the Cabinet) as the board of directors to handle all financing, planning, development and management of the new town. Under the board should be a director who controls the technical staff. In such an organizational structure responsibility would be concentrated and decisions could be made promptly. Thus ensure the success of
the new town development.

The actual structure of the corporation, its financing measures, and operational procedures are not in the scope of this discussion, again because the limitation of time and energy. However, it is worth to mention here that it should not be assumed that each new town project should have a separate corporation in turn subject to a regional agency or the provincial government. Separate corporations are, as previously mentioned, the practice in Britain and other countries but may not be suitable in Taiwan. It would be impossible to find enough trained and knowledgeable individuals for each new town or town extension to have a separate board. The best approach seems to be to have a board to direct several or all such projects within a region. As more new towns come under development, the corporation would be expanded or reorganized as required.

In any event, Linkou should be developed first and the experiences gained from such a project would be invaluable for the future ventures of new town development.
1. A Regional Approach to New Community Programming

New community development has been a vital path on alleviating the high pressures of population growth and industrial development from the leading regional centers. But, unfortunately, many of the undertakings have not only unable to relieve the pressures, but, to some extent, have magnified the problems. It is the author's belief that, through a regional planning approach, the past failure could be remedied. An effective regional planning would identify sites which are suitable for new community development or smaller towns could be expanded to accommodate a large amount of future population within the region. By doing so, the overgrown and over-loaded regional centers will have the chance to slow down its pace and begin to remedy its near dilapidated environment and revitalize the long-jammed city centers. Carefully programmed regional development schemes would also achieve the goals such as preserving prime agricultural land, avoiding the continuous encroachment along the transportation arteries.

The selection of Linkou plateau is thoroughly under these considerations in mind. Its high accessibility to regional centers and leading towns, its sufficient amount of buildable land, the economic potential in the region, and the scenic features of the site, all of these constitute a superiority for Linkou to be chosen for the first new town develop-
ment on the island. To assure its every success, the government should assume the leadership on the implementation of the project. This effort would not only serve as the demonstration project in the Northern Taiwan Region, but set a precedent for the whole island.

2. An appreciation of the Life Style

As for the structuring of such a new town, the author has been in full awareness of the prevailing life style of Chinese on the island, especially in the Northern Region. The "Ch'ü-Li-Lin" (or District-Sector-Village) system is adopted for the purpose of promoting the effectiveness of current administrative system on enhancing the neighborhoodness among residents within the same Lis or the same Lins.

The food-purchasing habit of housewives has also been reflected on the layout of village centers. Farmers' markets, butchers' stands, for example, are conveniently located in the village centers. However, as the per capita income (or more precisely the family income) grows, more and more refrigerators will be used even by lower income families. This implies the food-purchasing habit might be modified in the near future. Accordingly, adaptability should be built in such facilities which are likely subject to modification as time goes on.

The proposal to aggregate the different types of dwellings within a residential square (the village) or a residential sector would enable the housewives in the poorer families pursue house service-type of work in the well-to-
do families, thus add to the total family income. This has been the long-traditioned practice among cities throughout the island.

Extended families are still quite accepted lifestyle on Taiwan. Provisions should be made when programming and designing housing for the new immigrants. The idea of convertible rooms seems to be an effective way to handle the problem. In general, the new town would be an acceptable and somewhat 'familiar' environment for the newcomers rather than a bewilderess.

3. A more Appropriate Urban System

As the following two sketches (Figures 14 & 15) reveal, the new design (Figure 12) would be more appropriate for a new town on the plateau and within the context of Taiwan. First of all, it more or less employs the principle of economy, which is desperately needed in Taiwan. Less roads are needed with the new scheme; more economical is the new utility system.

The sectors are so designed as to allow the maximum use of bicycle or to enable residents get to most of the destinations--schools, local centers ans sector center, industrial estates--by walking. The separate paths and roads systems would enhance the safety of pedestrians as well as economize the development cost.

Industrial estates are so laidout as to allow close staging with the residential development. The planning of circulation system and residential sectors bears the advantage that the development could be easily staged, thus
reduce the front-end investment.

Flexibility has also been provided with the plan. Industrial estates as well as residential areas could be easily expanded to areas reserved for future expansion along the perimeter of the plateau.

With a high accessibility to the surrounding cities and towns, the town center could be expected to become the sub-center of the region, serving the new town itself and the communities on both sides of the plateau. This would bring the prosperity and enhance urban amenities for the new town as a whole.

The three existing settlements would be fabricated into the new town system with the provision that they could be easily remodelled or upgraded to fit the whole environment.

4. Postscript

This by no means has been a satisfactory undertaking. First of all, the time and energy allocated to each chapter of the thesis are very much unbalanced; too much, comparatively, has been put in the earlier chapters, while the chapter on "Implementation Mechanism for the New Town Project" bears so little effort although the latter is no less important when talking about new town development. For this particular chapter, however, the author is mainly concerned with the issue of development corporation rather than the whole question of implementation of new town project. It is hoped that, by pinpointing the failure of the
Linkou Development Authority, a strong organization could emerge out to take the responsibility of developing the new town. So many aspects have been left on this institutional aspect of new town development.

The physical planning itself is by no means complete. The sketch plan presented is only the composition of many important ideas pertinent to the planning and design of a new town on Taiwan. The absence of detailed studies on the criteria formulation has been the most serious shortcoming. Nevertheless, the author sincerely hopes that the goals and objectives setup in the study, the strategies or policies designed to achieve the goals and objectives, and this mere academic exercise of the physical plans for Linkou will be one of the guidelines for the whole Linkou venture when it is to be resumed by the government, to which the author would like to call the attention to this significant task again.
FIGURE 14

PRELIMINARY SKETCH PLAN
LINKOU PLATEAU

UHDC/CIECD
1966

LEGEND

MAJOR ROAD
SECONDARY ROAD
LOCAL ROAD
RESIDENTIAL LANE
PEDESTRIAN-WAY
INDUSTRIAL ESTATE

HIGH DENSITY RESIDENTIAL NEIGHBORHOOD
LOW DENSITY RESIDENTIAL NEIGHBORHOOD
CENTRAL & SECONDARY BUSINESS DISTRICTS
PUBLIC OPEN SPACE — PARKS, PLAYFIELDS
TEMPLE
PRIMARY SCHOOL
MIDDLE SCHOOL
COLLEGE
EXISTING MILITARY INSTALLATIONS
### PROJECTION OF POPULATION GROWTH ON TAIWAN, 1972-2000

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Outline of the Comprehensive Islandwide Development Plan

I. Industry

a. To distribute the industrial zones, estates, or parks in accordance with the distribution of population and resources.
b. To cluster the highly related industries.
c. To locate industries (or rather factories) which are potential pollutants to the air in special areas.
d. To locate fine machinery and instrument industries within metropolitan regions.
e. To disperse textile and electronic industries to the outskirt of metropolitan regions.
f. To locate lumber, glass, cement, paper, and food processing industries in areas near the raw materials.
g. To locate heavy industries, and heavy chemical industrial in coastal industrial zones.

II. Agriculture

a. To create areas for special cropings. To mechanize the agricultural production process in order to further increase the unit yielding.
b. Forestry—To improve the plantation pattern; To assure the balance between harvesting and planting.
c. Fishery —To create bases for both ocean-going and coastal fishing.
d. Cattle Raising—To develop marginal land, such as slope land for cattle and sheep raising.
e. To create distribution and saling network in accordance with the transportation systems.

III. Urban and Housing Development

a. To distribute urban population rationally through the creation of satellite towns to form metropolitan regions and the development of new towns or new communities to accommodate surplus urban population.
b. To increase the investment on housing to 3 per cent of the Gross National Product to facilitate the provision of 3,035,000 housing units in the next twenty years.

IV. Transportation

a. To construct the North-South Expressway to connect regional centers along the west plain.
b. To construct a branch expressway in Taichung Region to link Taichung Harbor, Fengyuan, Nantou, and Sun-Moon Lake.
c. To electrify the island railroad network.
d. To expand the existing harbors and airports.
e. To assure any of the regional center be within 2-hour drive from the main expressway.
V. Water Resources and Energy

a. To expand the water recycling programs.
b. To construct reservoirs at appropriate sites to provide enough water for agriculture, industry, and urban uses.
c. Energy Development--
   To build nuclear and thermal power plants.
   To extract natural gas from underground or continental shelf.
## POPULATION DISTRIBUTION PROGRAM, AS OF 1988
THE NORTHERN TAIWAN REGION

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<td>Shih-men</td>
<td>N.A.</td>
<td>233</td>
<td>69</td>
<td>50,000</td>
<td>50,000</td>
</tr>
<tr>
<td><strong>Other Urban Areas</strong></td>
<td>747,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agricultural Area</td>
<td>650,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3,652,752</td>
<td>15,246</td>
<td></td>
<td>2,547,800</td>
<td>6,200,552</td>
</tr>
</tbody>
</table>

Sources: UHDC/CIECD, The Northern Taiwan Regional Plan, April 1969.
### Appendix D

**LAND USES, ACTIVITIES, AND LAND SLOPES, LINKOU PLATEAU**

<table>
<thead>
<tr>
<th>Item</th>
<th>Land use</th>
<th>Bldg Type</th>
<th>Activity</th>
<th>Road</th>
<th>(5) Speed Km/Hr.</th>
<th>(6) M/minum Walk'g Speed</th>
<th>Land Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3%↑</td>
<td>Any Kind</td>
<td>Any Type</td>
<td>Any Activity</td>
<td>Regional Road</td>
<td>70↑</td>
<td>60-70</td>
<td>450</td>
</tr>
<tr>
<td>4%</td>
<td>Any Kind</td>
<td>Any Type</td>
<td>Any Activity</td>
<td>Artery</td>
<td>60-70</td>
<td>50-60</td>
<td>450</td>
</tr>
<tr>
<td>5%</td>
<td>Housing</td>
<td>Any Type</td>
<td>Informal Activity</td>
<td>Primary</td>
<td>60</td>
<td>40-50</td>
<td>450</td>
</tr>
<tr>
<td>5-7%</td>
<td>That faces E., S., or W. Can be used for Housing</td>
<td>Any Type</td>
<td>Informal Activity</td>
<td>Secondary</td>
<td>35-50</td>
<td>30-35</td>
<td>400</td>
</tr>
<tr>
<td>7-10%</td>
<td>Not Suitable for large-scale Development</td>
<td>Luxurious Houses</td>
<td>Hill Sports or Free Play</td>
<td>Access Pedestrian Path</td>
<td>25-30</td>
<td>25</td>
<td>350</td>
</tr>
<tr>
<td>10-15%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Short Ramp</td>
<td>Not Suitable</td>
<td>Not Suitable</td>
<td>Not Suitable for Long Dist.</td>
<td>&quot;</td>
</tr>
<tr>
<td>15-25%</td>
<td>&quot;</td>
<td>Terrace Houses</td>
<td>Not Suitable</td>
<td>Not Suitable</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Grass Paving</td>
</tr>
<tr>
<td>25-45%</td>
<td>&quot;</td>
<td>Not Buildable</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>45%↑</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Difficult to Manage</td>
</tr>
</tbody>
</table>

Appendix E

LAND REQUIREMENTS - KINDERGARTEN

<table>
<thead>
<tr>
<th>Enrollment</th>
<th>Building Site (square meter)</th>
<th>Playground (square m.)</th>
<th>Aggregate Area (square meter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;40</td>
<td>700</td>
<td>300</td>
<td>1,000</td>
</tr>
<tr>
<td>41-80</td>
<td>900</td>
<td>400</td>
<td>1,300</td>
</tr>
<tr>
<td>81-120</td>
<td>1,200</td>
<td>500</td>
<td>1,700</td>
</tr>
<tr>
<td>121-160</td>
<td>1,500</td>
<td>600</td>
<td>2,100</td>
</tr>
<tr>
<td>161-200</td>
<td>1,800</td>
<td>700</td>
<td>2,500</td>
</tr>
</tbody>
</table>


Appendix F

LAND REQUIREMENTS - COMMUNITY JUNIOR HIGH SCHOOL

<table>
<thead>
<tr>
<th>Enrollment</th>
<th>Building Site (M²)</th>
<th>Athletic Field (M²)</th>
<th>Aggregate Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;600</td>
<td>20,000</td>
<td>9,600</td>
<td>29,600</td>
</tr>
<tr>
<td>601-900</td>
<td>26,000</td>
<td>11,000</td>
<td>37,000</td>
</tr>
<tr>
<td>901-1200</td>
<td>33,000</td>
<td>12,000</td>
<td>45,000</td>
</tr>
<tr>
<td>1201-1500</td>
<td>40,000</td>
<td>13,000</td>
<td>53,000</td>
</tr>
<tr>
<td>1501-1800</td>
<td>46,000</td>
<td>14,000</td>
<td>60,000</td>
</tr>
</tbody>
</table>

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