

Smart Plot Division

A Plot-based Strategy for the Refurbishment of Chinese Historic Urban Areas

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Keywords: plot division; historic urban area; urban refurbishment; plot pattern.

Abstract: Chinese historic cities have experienced drastic transformations since the socialist revolution of 1949, in which an essential change is the reconstruction of the plot pattern. The historic plot pattern in a majority of Chinese cities was heavily damaged by constant urban renewals, while the renewed plot pattern lost its historically morphological identity. The transformation of plot pattern is directly influenced by plot division which serves as not only a planning apparatus but also a key link in the land development system. The damage of historic plot pattern has shown that the current plot division mechanism is not necessarily in favor of the conservation and continuation of historic cities. Taking Nanjing Old South area as an example, this research analyzes the plot division mechanism which is widely applied in the renewal of Chinese historic urban areas. The current plot division mechanism, established under the land banking system is in favor of generating megaplot. In many cases, plot division is made based on specific projects, typically accompanied by deficient control on urban form. In this sense, it is necessary to establish a set of smart plot division strategy to promote the refurbishment of the historic urban area. Smart plot division aims at not only protecting and continuing the historically morphological characteristics but also fulfilling diversified land development needs in the historic urban area. The essence of the strategy is five patterns of plot division, corresponding to different land development intensity and morphological characteristics.

1. Introduction

Plot division is not only the foundation for establishing the index system of regulatory planning but also the main element in constituting the urban space. According to Conzenian urban morphology (Conzen M.R.G, 1960; Whitehand J.W.R, 2001), street pattern, plot pattern and building footprint constitute three main morphological elements of a town plan. On the other hand, plot division has a direct influence on the creation of good urban space, as practically the zoning plan or regulatory plan take control of three-dimensional urban form through plot based control indexes. Therefore, plot subdivision should not be left to chance, or determined by the particular market pressures of the moment, but should be planned intelligently, deftly and judiciously as an integral part of master planning and with the positive intent of generating place diversity (Adams, 2013).

Nanjing South Historic Urban Area, also known as Old South area, is located in the south of Nanjing old city. Covering an area of 6.9 km², it was long in history the main civil life area and industrial and commercial center of Nanjing (Zhou and Zhang, 2010), preserving a large number of historic sites, monuments as well as the traditional cityscape. Since the 1980s this area experienced a large scale urban renewal, leading to a great transformation of historic urban form, especially the plot pattern. As most historic urban areas have been heavily damaged in the urban renewal, an urban refurbishment is considered increasingly urgent. Consequently, National Housing and Construction Department launched the Program of Ecological Rehabilitation and Urban Refurbishment in 2017, in which historic urban area is the main focus for urban refurbishment¹. Taking Nanjing Old South Historic Urban Area as an example, this research makes a reflection on the plot division mechanism under growth supremacism. Under this background, the main issue is discussed that how a smart plot division strategy can be established to promote the refurbishment of the historic urban area.

2. Megaplot mode: a plot division mechanism for growth

Chinese cities established the state-owned land system in the 1950s, urban development in that period was generally based on specific projects which were determined by the unified governmental development plan. In a long time, there was not a developed plot division mechanism in Nanjing. The construction land of urban development could only be obtained from administrative land allocation. A typical case is two large scale industrial plots located in the southwest corner of the Old South area. Above all, the plot of Nanjing Cotton Mill is as large as 11.4ha, while the plot of Nanjing Printing and Dyeing Mill is 8.5ha. As both the factories were developed by the municipal government as key projects, the construction land was allocated through specific administrative approval. In this sense, most considerations were taken on practical requirements of industrial development, rather than the protection and continuation of historic urban form.

The rapid economic growth of China started from the 1990s. Since then the growth itself has become an imperative for governance, and it largely depended on land development. Under the Land Use Rights System, land supply is a powerful tool for local government to intervene in land markets, and proceeds from land supply greatly contribute to local revenue and financing of infrastructure construction. Under this background, urban planning was regarded as a tool to promote growth, and land leasing has become a major goal of making regulatory planning. The Technical Regulation of Nanjing Regulatory Planning in 2005 proposed three principles for plot division, including (1). The integrity and coordination of land use; (2). Clear land property; and (3). The convenience of land leasing. The third principle especially shows a trend of growth supremacism.

Megaplot mode as the core of the growth supremacist land development has three aspects of connotations: (1) the generation of the megaplot; (2) setting fewer control indexes on the urban form; and (3) project based plot division (Table 5.14). In order to attract investment, regulatory planning exerts minimum control on the spatial form of the urban (re)development. Compared with the zoning system of the United States, Chinese regulatory planning does not establish a developed standard of plot division. For example, there lack regulations on key indexes like

1. National Housing and Construction Department launched the Program of Ecological Rehabilitation and Urban Refurbishment in 2017, in which historic urban area is the main focus for urban refurbishment.

plot size, plot width as well as the rules of plot arrangement. In the 1990s, the Land Use Right system (LURs) regulates four ways of land leasing, including negotiation, auction, bidding, and listing. However, in a majority of cases, the municipal government tended to lease the land to developers in the way of negotiation which generally required much less land transferring fee than the other ways. On this condition, plot division was actually a compromise between the local government and the developers, which also explains the reason why developers sometimes can get large-scale land through the negotiation with the government.

It is since 2002 when Nanjing established the Land Banking system that plot division truly became a specific institutional procedure in regulatory planning. The municipal government makes the annual plan for land expropriation. In cooperation with regulatory planning, the expropriated land is redivided and released to the land market. Despite an improvement of the governmental control on the land market, Land Banking system has further promoted the megaplot mode. According to the statistics, more than 90% of plots redivided in the historic urban area since 2002 are larger than 5000m², in which 9 plots are larger than 10000 m².²

3. The disintegration of the historic plot pattern

The plot division mechanism under growth supremacism, lacking effective protection of the historic urban form, has led to a radical transformation of plot pattern in the historic urban area. Megaplot becomes the dominant type in the land structure, while the traditional pattern of plot subdivision is eliminated.

The traditional plot pattern of the Old South area is composed of a large number of small scale plots. For example, a typical two-courtyard compound covers an area of about 600m² (Figure 1). Above all, the plot width is an important morphological index. The traditional plot has a small plot width, generally ranging between 10m and 16m. They are arranged along the street, forming a rhythmic plot series. Several plot series are filled in a block, constituting the subdivided plot pattern which is a typical feature of historic urban form.

Taking fewer considerations on the morphological integration with the historical environment, plot division under growth supremacism brings about a radical growth of plot size. According to the statistics, a majority of renewed plots are larger than 5000m², which becomes the threshold value in defining the megaplot in the historic urban area. What's more, the trend of the megaplot is reinforced over the years. Taking the commercial plots as an example, the commercial redevelopment in the 1980s and 1990s was usually characterized by low-rise and mid-rise buildings with relatively low development intensity. A typical commercial plot during that period was about 3000 m². By 2000, the size of the commercial plot had a remarkable growth because of the prevalence of tower mode. Even so, a minimum plot subdivision in a block could still be kept. By the late 2000s when the commercial complex mode became popular, commercial redevelopment was completely based on the megaplot. For example, the Plot G4 along Zhongshan Road South, deriving from an amalgamation of three traditional blocks, reached an area of 38000 m² (Figure 1).

The growth of plot size results in a continuous reduction of plot number in one block, finally leading to the elimination of plot subdivision. Actually, plot series is important in keeping plot subdivision. It preserves the small plot scale and similar plot shape, and it also provides specific rules for the arrangement of plots. However, the plot division mechanism under growth

2. The statistics are from Nanjing Land and Resource Bureau (<http://www.landnj.cn/LandBargainInfo.aspx>).



Figure 1. Growth of commercial plots in the historic urban area. Source: Own figure.

supremacism cannot effectively preserve and continue plot series. Taking Mendong historic district as an example, a majority of its north section has been renewed due to the road reconstruction. The renewed plots range from 4000 m² to 6000 m², measured in the block without subdivision. The refurbishment of Plot Changledu in the southwest part was made after 2010, aiming at refurbishing historic urban ground plan and recover the traditional building scale. However, the refurbishment did not result in the plot subdivision. Instead, a megaplot was created in the demolition of the historic district. It is clear to see the big difference between the southern traditional plot pattern and the northern renewed one (Figure 2). In fact, this fragmented and megaplot-based land structure has been a typical morphological characteristic of contemporary historic urban areas, which not only undermines the traditional urban form but also suppresses the optimization of land structure and the quality of urban space.

4. The inefficient control on the spatial form

As Chinese regulatory planning system takes control of spatial form through plot-based indexes, plot division has a direct influence on the spatial form. However, the current plot division mechanism under growth supremacism leads to an inefficient control on the spatial form, obstructing the protection and continuation of historic urban form. Above all, inefficient control is mainly shown in two aspects: the building siting and the building form.

Traditionally, the building siting depends on the relative position of the building to the street frontage (Figure 3). Buildings are positioned on the street frontage, and share a common wall with adjoining buildings. This close plot-building relationship is the main reason to form the continuous street corridor which is a prominent morphological feature of the historic ur-

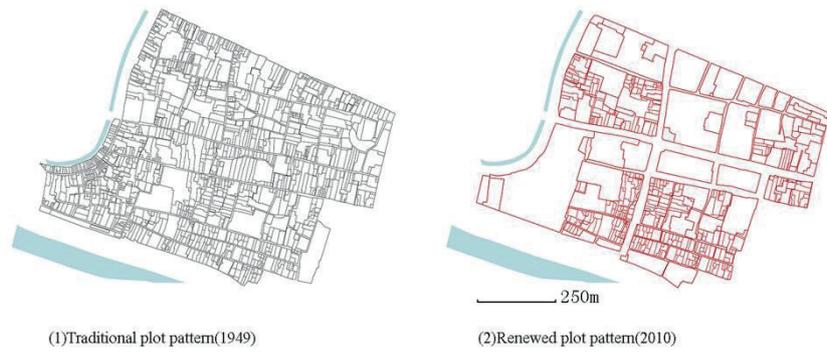


Figure 2. Transformation of plot pattern in Mendong historic district.
Source: Own figure.

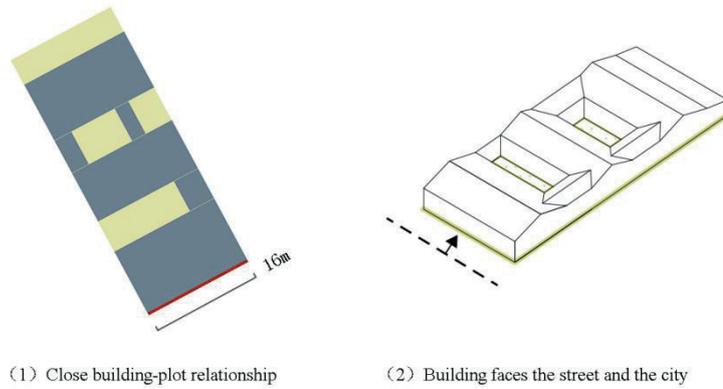


Figure 3. Building siting under the traditional urban form.
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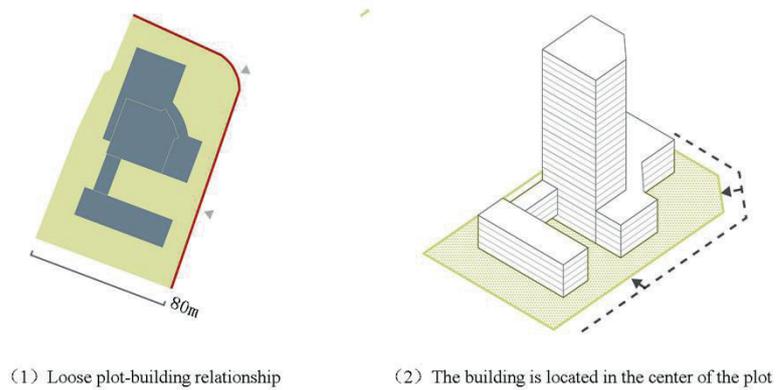


Figure 4. Building siting of a commercial megaplot (Plot ICBC along Zhongshan Road South).
Source: Own figure.

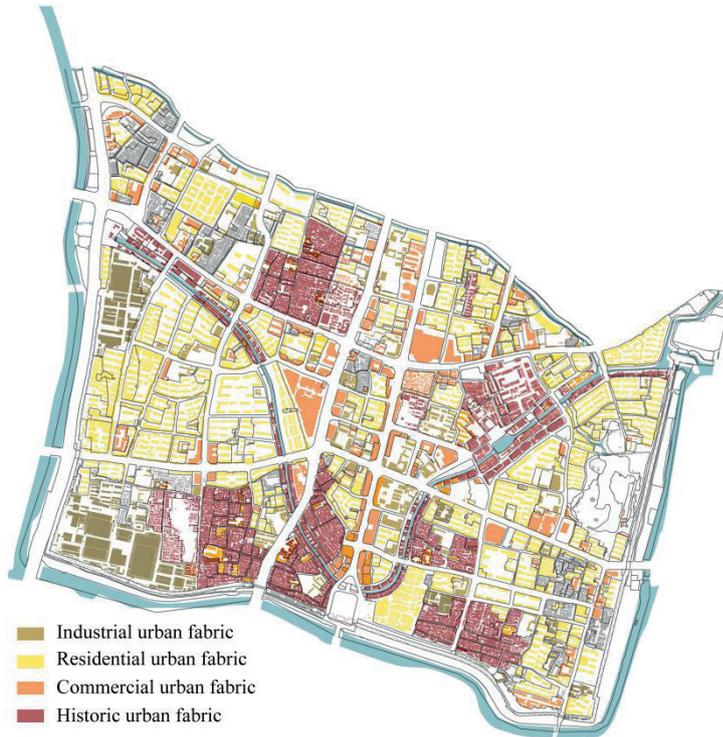


Figure 5. *Fragmented urban fabric of Old South area(Overlapping of the plot pattern and the building footprint).*
 Source: Own figure.

ban area. However, current regulatory planning only delimits the buildable area in the plot by setting the building setback line. As there is no compulsory build-to line set in the plot, the building siting becomes very ambiguous (Figure 4). For example, the current regulations on building siting don't answer questions like whether the buildings should be positioned on the street frontage, or which proportion of building facade should be positioned on the street frontage. In fact, the ambiguous building siting despite giving more flexibility to architecture design neglects the control and protection of historic urban form. Instead, more consideration is taken on functional issues. Buildings are more sited on the center of the plot rather than facing the street, which can be seen in many cases in the Old South area.

The control on the building form should cooperate closely with the urban design. However, the Old South area lacks an overall urban design for a long time. Within the individual plot, the architecture design is only regulated by basic planning conditions, including the building height limit and the building setback distance, taking a few considerations on the integration with the overall urban form. As a result, a fragmented urban fabric is formed (Figure 5). Currently, many different building types coexist in the historic urban area, but some of them can not fit for the historic urban form, including the highrise buildings, commercial complex, as well as industrial buildings. This problem is mainly manifested in the building height and the building layout. The regulation on building height limit was not established in the Old South area until 2000, and it has been readjusted for several times due to the changeable development orientation of the historic urban area. Thus, the practical control effect has been weakened. As a result, building layout has nothing to do with plot division, not mention with the street pattern (Frick, 2015).

Regulatory planning was originally established to solve problems of vast new development and constructions during the urban sprawl. Targeting the development of new towns, many regulations emphasize the flexibility instead of the rigidity so that the construction efficiency could be increased. However, these regulations are not necessarily fit for the protection and

renewal of historic urban area where a large number of morphological elements should be protected and transformed into compulsory plot-based morphological regulations in the regulatory planning.

5. The smart plot division strategy

In short, the plot division under growth supremacism damages the historic urban area in three aspects: (1) The prevalence of the megaplot leads to the elimination of the traditional plot subdivision, one basic morphological characteristics of the historic urban form; (2) The project-based plot division and land allocation mechanism fail to improve the land structure and the quality of urban space; (3) The rough control on spatial form aggravates the fragmentation of urban form. After 2010 the Old South area witnessed a change of development principle and started the overall conservation of the historic urban area. Under this background, the refurbishment of the historic urban form has become the main goal of urban development. It becomes more urgent to establish a smart plot division strategy to promote urban refurbishment (Table 1).

5.1. Principle 1: Protecting and continuing the morphological characteristics

Smart plot division strategy follows two principles. It should foremost protect and continue the morphological characteristics of the historic urban area. In order to integrate the smart plot division strategy with the existing regulatory planning system, the control of urban form should also be taken through a plot-based index system. Above all, this system includes three main indexes including plot shape, building siting, and building form, and each of them has subordinated indexes.

The primary goal of plot shape control is to protect and continue plot subdivision, the essential historically morphological feature. However, as the historic urban area is an evolving organism, apart from a few historic districts that should be strictly protected, vast general areas need to be refurbished or renewed. Due to the difference in development requirements,

Table 1. Comparison of two modes of plot division. Source: Compiled by the author.

Main characteristics	Plot division for growth	Smart plot division
Background	Redevelopment of the historic urban area	Refurbishment of the historic urban area
Plot-scale	Megaplot based(5000m ²)	Medium and small plots based
Control of urban form	Minimum control on urban form	Conservation of historic urban form
Principle	Project-based	A balance between the historic conservation and the diversified development

the intensity of control on plot shape varies in different districts. Therefore, it is necessary to establish a multi-level strategy for the protection of the historic plot pattern.

In the Old South area, a three protection levels of historic plot, plot series and plot subdivision should be established, corresponding to different morphological zones in the historic urban area. Above all, the historic plot is the most strict protection level, emphasizing the protection of plot width, plot shape, and plot size. Plot series is key to form a regular plot pattern. In this sense, the protection of the historic plot pattern is based on the continuation of the historic plot series. Plot subdivision is the basic prerequisite in keeping the morphological feature of the historic plot pattern. Thus it is required to remain the plot subdivision as much as possible in the redevelopment of the historic urban area.

The other goal for the refurbishment of the historic urban area is to create a continuous street corridor, making buildings face the street again instead of being self-centered. The key to realizing this goal is to establish a proper way of building siting. Learning from the tradition, building siting in the historic urban area should depend on the relative position of the building to the plot frontage. This principle can be further translated into three control indexes, including the setback distance, the proportion of the building facade that should be located on the building line, and the building interval.

Apart from the building siting, building type is also an important element to create a continuous street corridor. Building type contains two subordinated indexes, including building height and building (ground plan) type. The current conservation planning of the Old South area has already made strict regulations on the building height limit. But more considerations should be taken on the appropriateness of the building types if they can be integrated into the historic urban area. Especially, each morphological zone of the historic urban area should be designated with acceptable building types.

5.2. Principle 2: Fulfilling diversified land development requirements

Different from the historic districts which are relatively small scale and emphasize more a strict conservation, the development of the historic urban area should take full consideration of the functional and spatial diversity. As most of the Chinese historic urban areas range from 10km² to 20km², it means that apart from the historic conservation areas, a large proportion of the historic urban area needs to be renewed. Faced with the diversified development requirements, it is not encouraged to recover the nostalgic urban ground plan. Instead, it is better to establish a smart plot division strategy which has several plot patterns in meeting diversified land development requirements.

American Smart Code provides an important reference to Nanjing historic urban area on how to establish a multi-type plot division strategy. In recent years, more and more American cities have adopted Form-based Codes to replace the traditional zoning system in order to improve the control of spatial form (Talen, 2009). Above all, the Smart Code originally developed by Duany and Plater-Zyberk is the most representative Form-Based Code. It is a unified land development ordinance template designed to create walkable neighborhoods across the full spectrum of human settlement, from the most rural to the most urban, incorporating a transect of character and intensity within each. The essence of Smart Code is the Transect Zone. Based on ecological theory, it segments the rural-to-urban continuum into discrete categories that fit within the language of the current approach to land regulation (Duany, *et al.* 2009; Wang, 2013) (Figure 6). The standards of categories ensure that each zone has appropriate morphological characteristics and development intensity for its location.

Learning lessons from the Form-based Codes, the Old South area can be divided into four types of urban space, including historic districts, traditional areas, general redeveloped areas, and commercial centers. Besides the differences in urban function, development intensity, as well as building form, four types of urban space have different plot patterns, constituting a gradual transition from the traditional small scale plot pattern to the megaplot pattern. Meanwhile, each type of urban space has its own focus on the protection of the historic plot pattern:

(1) Historic districts: Protecting the historic plot pattern;
 (2) Traditional areas: Respecting and protecting small scale plots and the morphological feature of plot subdivision, and encouraging the refurbishment of damaged plot pattern in traditional areas.

(3) General redeveloped areas: urban redevelopment should promote the development of medium scale based plot pattern. Plot subdivision as a basic morphological characteristic should be kept as much as possible in the plot redivision.

(4) Commercial center: Megaplot is also necessary for the development of the historic urban area, but its proportion should be strictly controlled. Meanwhile, it is encouraged to make a subordinate subdivision of the megaplot, creating small blocks to confine the building volume in the megaplot.

5.3. Strategy: Transect of Plot Pattern

Smart plot division strategy aims at not only protecting and continuing the morphological characteristics of the historic urban area but also fulfilling the diversified requirements of urban redevelopment. The former principle requires to establish a three-layer strategy for the protection of plot pattern, including historic plot, plot series, and plot subdivision. The latter requires to establish a multi-type plot division strategy in meeting the different development requirements. Under this background, a transect of plot pattern is proposed. It consists of five scenarios from the conservation area to the redevelopment area, including (1) Historic plot pattern; (2) Hybridization pattern; (3) Redivision pattern; (4) Megaplot based refurbishment and (5) Megaplot based redevelopment (Figure 7, Figure 8, Table 2).

The five types of plot pattern correspond to different locations, development intensity, and morphological characteristics, reflecting the requirements of developing a mixed and comprehensive urban area. Above all, Historic pattern and Hybridization pattern, characterized by the small scale plot, are mainly located in areas with traditional cityscape. Historic plot pattern with the highest protection level should protect the historic plot pattern strictly. Hybridization pattern should protect the morphological characteristics of plot series.

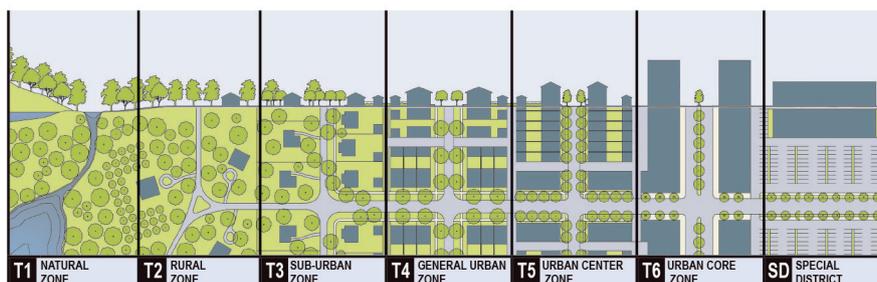


Figure 6. Rural-to-urban Transect proposed by Smart Code. Source: Duany et al. 2009.

As their plot patterns don't need to be redivided, the main ways of intervention are protection and minor readjustment. In comparison, the other three patterns of Redivision, Megaplot based refurbishment and Megaplot based redevelopment are located in redevelopment areas. They all derive from plot redivision but have different development intensities. Redivision pattern mainly developing medium scale plots, should maintain the characteristics of plot subdivision. Thus it is a preferred plot pattern for the redevelopment of the historic urban area. In addition, megaplot is still necessary for the redevelopment of the historic urban area, especially the renewal of a commercial center. But its proportion and size should be strictly controlled. What's more, five types of plot pattern have specific building siting and building form. Taking the building siting as an example, Historic pattern and Hybridization pattern should respect and preserve the historic frontage line, while the other three types of plot pattern should also endeavor to keep a continuous street frontage. This morphological control can be realized through three important indexes, including the setback line, building line, and the side building interval.

Historic pattern (P1)

Historic plot pattern refers to the plot pattern formed before 1949 and characterized by a traditional scale. It is mainly distributed in historic conservation areas. As one of the most typical morphological characteristic of the historic district, the historic plot pattern should be strictly protected, which indicates that very few plot amalgamation or changes are allowed in this pattern. Generally, the width of a traditional residential plot in Nanjing Old South area ranges from 8m to 16m. Thus the reference value (maximum value) of traditional plot width is set as 16 m. The historic frontage line should be respected and preserved. It means that the front and side setbacks are not permitted. As the historic plot pattern is almost located in historic districts, the eaves building height is limited under 7 m (no more than two stories). According to conservation regulation, traditional courtyard building is the preferred building type.

Hybridization pattern (P2)

Hybridization pattern, almost distributed in areas with traditional cityscape, refers to plot patterns with a mix of existing plots and redivided plots. The main goal of this pattern is to keep the existing subdivided plots as much as possible and respect the existing land property structure. Despite permission of a minor plot amalgamation, this pattern emphasizes the protection of historic plot series. Thus a typical plot width after amalgamation is 30 m, while the maximum plot width is 50 m. The width and shape of new plots on important street frontages, e.g, plot on the corner, should be carefully controlled. Considering the protected plot series and existing buildings, the townhouse is a recommended building type. Buildings are required to stand side by side and joined by common walls, so that a continuous street frontage can be formed.

Table 2. Morphological index system of five patterns of plot division in the Old South area. Source: Compiled by the author. Above all, Building building limit is based on the regulations in Conservation Plan of Nanjing South Historic Urban Area.

	Historic pattern	Hybridization	Redivision	Megaplot(Refurbishment)	Megaplot(Redevlopment)
General principle					
Protection focus	Historic plot pattern	Plot series	Plot subdivision	Small blocks, Renewal Units	Small blocks
Development intensity	Low	Medium	Medium-high	Low	High
Change of plot pattern	Little	Readjustment, Minor amalgamation	Renewal	Renewal	Renewal
Distribution	Historic district	Traditional cityscape area	General cityscape area	Traditional cityscape area	Commercial center, residential area
Plot form					
Plot size	Small	Small-medium	Medium	Small-medium	Large
Plot width	16	50	70	16	---
Building siting					
Setback	not permitted	not permitted	shallow	shallow	---
Building line	100%	100%	80%	100%	80%
Side building interval	not permitted	not permitted	permitted	not permitted	permitted
Building form					
Height limit zoning	10 m	18 m	12m-24 m	10 m	24 m
Building type	Traditional courtyard building	Townhouse	Townhouse, detached buildings	traditional courtyard building; townhouse	Microdistrict, complex, detached building

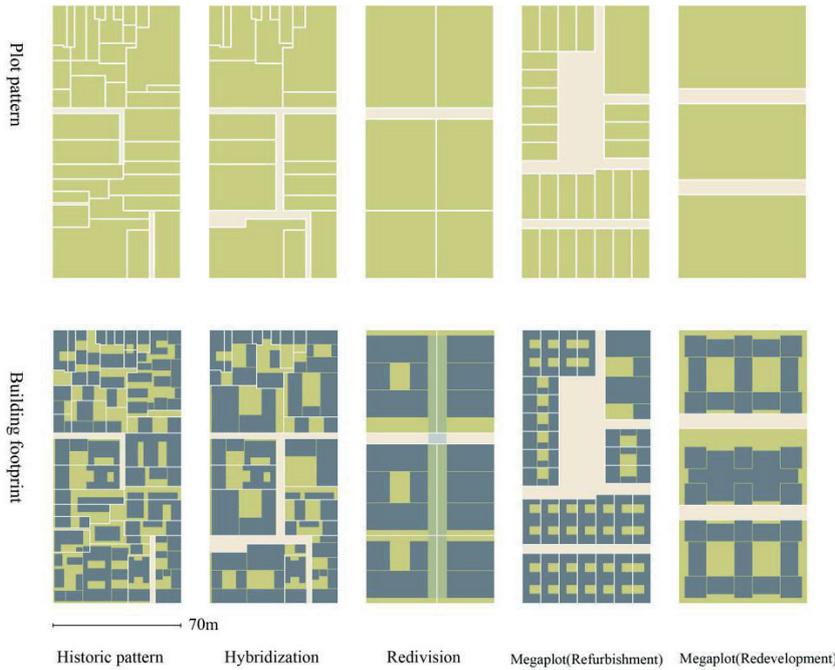


Figure 7. Five patterns of smart plot division.
Source: Own figure.

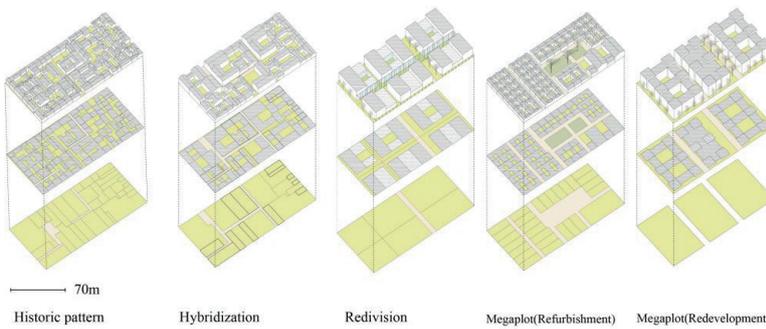


Figure 8. Spatial form of five patterns of smart plot division
Source: Own figure.

Redivision pattern (P3)

Redivision pattern refers to plot patterns that are totally redivided but still keeps the plot subdivision as a critical morphological feature of the historic urban area. It can be seen as a direct means of “learning from history” or better, learning from previous experience. This pattern is widely distributed in redevelopment-oriented areas where the contemporary cityscape is needed. Redivision pattern is characterized by medium-sized plots. In order to keep the plot subdivision, a typical plot width is defined as 50m, while the maximum plot width is 70m. The largest plot is not allowed to take up more than 50% of a block. Big plots are suggested to be located in the interior of a block so that more plot subdivision can be generated on the block boundary. As Redivision pattern corresponds to a mid-high development intensity, the building height is generally controlled between 12 m-24 m. As an intensive development mode, a shallow setback and side building interval are permitted. But at least 80% of the building line should be covered by buildings so that a continuous street corridor can be ensured. Redivision pattern regards plot subdivision as essential morphological elements that are in need of protection. But meanwhile, a mid-high development intensity can still be

achieved, with a highly mixed use in the vertical direction. Thus it is a suggested plot pattern for urban redevelopment.

Megaplot based refurbishment (P4)

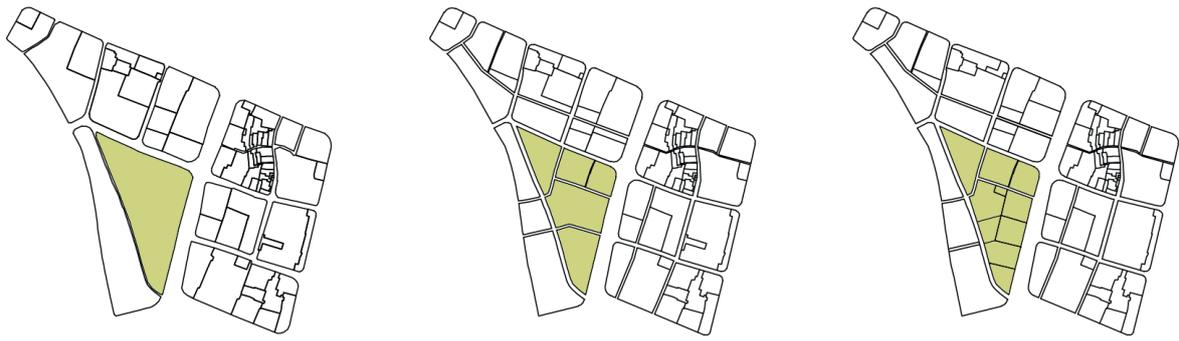
Megaplot based refurbishment, typically distributed in the historic core, refers to the plot pattern with traditional scale and morphological features but being subordinately redivided in a megaplot. This kind of megaplot, having been damaged by large scale demolitions or renewals, is considered necessary to recover the traditional cityscape. Megaplot based refurbishment pattern is characterized by traditional plot size which ranges from 8m to 16m, in accordance with the traditional plot size. In order to meet contemporary living and traffic demands, a structure of small blocks should be developed within the megaplot so that better accessibility and more open spaces can be made. As a reconstructed plot pattern, a shallow setback is permitted. But side building interval is not permitted so that a continuous street frontage can remain. As the megaplot based refurbishment pattern is almost located in the historic core, the eaves building height is limited under 10m. Despite a low development intensity, megaplot based refurbishment pattern encourages mixed use of residence, commerce, and culture. In order to integrate well with the historical context, traditional courtyard and townhouse are considered as the preferred building types.

Megaplot based redevelopment (P5)

Megaplot based redevelopment refers to the block that is completely redeveloped without plot subdivision. With the highest development intensity in the historic urban area, megaplot based redevelopment is mainly distributed in the commercial center or residential area. As megaplot mode eliminates the plot subdivision, its proportion in the historic urban area must be strictly controlled.

Creating a structure of small-scale blocks is a basic requirement of Megaplot based redevelopment. On the one hand, it provides more pedestrian and open spaces inside the megaplot; on the other hand, the buildable areas are confined by small blocks. Thus the building volume can be reduced on the megaplot. Based on the practical situation of Nanjing Old South area, the reference value of the small-scale block is set as 70 m. The building height of this pattern can reach 24 m about six stories so that a relatively high development intensity can be realized. Typical building types of this plot pattern include microdistrict, complex, and detached buildings. It should be mentioned that historic buildings located within the megaplot shall be preserved as much as possible.

The selection of the five plot patterns is sometimes a balance between the ideal plan and the practical development conditions. Taking Plot G₄ of Zhongshan Road South as an example (Figure 9), this is a megaplot with an area of 38600 m², deriving from an amalgamation of several original blocks and leading to the elimination of historic alleys and plot subdivision. Under the growth based plot division scheme and land development plan, a new massive commercial complex will cover the megaplot. However, there are two possibilities of plot redivision if the smart plot division strategy is applied in this case, Redivision pattern and megaplot based redevelopment. These two options are simulated. Megaplot based redevelopment pattern preserves and optimizes the historic street pattern. The megaplot is divided into five blocks(plots) with the average area of 7700 m². In contrast, Redivision pattern makes further subdivision, creating 10 medium scale plots which have the average size of 3850 m² and average plot width of 74 m. Comparing the three ways of plot



– Amalgamation of historic streets and plots

– Protection and optimization of historic street pattern;
– Creation of small blocks in order to confine the size of megaplot

– Protection and optimization of historic street pattern;
– Creation of small blocks in order to confine the size of megaplot
– Development of mid-small plots and protection of historic plots

(1) Plot division under growth supremacism

(2) Megaplot based redevelopment

(3) Redivision pattern

Figure 9. Comparison of three patterns of plot division (G_4 plot along Zhongshan Road South). Source: Own figure.

redivision, it is clear that Redivision pattern can preserve a maximum of plot subdivision and is more in favor of the mixed land use. The suboptimal choice is the Megaplot based redevelopment, which effectively confines the plot scale and the building volume through creating small block structure. This kind of rational control is still obviously better than a rough plot division under growth supremacism.

5.4. Institutional guarantee: Establishment of a dual control system

The realization of the smart plot division depends on the optimization of the land development system. Currently there are mainly two institutional difficulties: First, how can the amalgamation of small scale historic plots be prevented; Secondly, how can new plots of proper scale be created. Under this background, a dual control mechanism is proposed as an institutional guarantee. It is composed of Renewal Unit system (RUs) and Land Banking system. Renewal Unit system aims at the protection of small scale historic plots and the promotion of self-led renewal. Land Banking system aims at creating new plots of proper scale, guiding the organic renewal of the historic urban area.

The authorization of Renewal Unit system is based on the block level. In the regulatory plan, each block should be designated with the permitted plot patterns. In the Transect of Plot Pattern, the Historic pattern (P₁) and Hybridization pattern (P₂) belong to the mid-small plot pattern and are suitable for the Renewal Unit system. The other three plot patterns in need of thorough redivision are still controlled by the current land banking system.

The realization of the smart plot division is based on the protection of small scale historic plots. The current land banking system, led by the local government, encourages large scale urban renewal. On the other hand, it's difficult for small landowners to obtain the land development right of their own property, indicating that self-led renewal is almost impossible.

Under this background, it is necessary to establish the Renewal Unit system for the protection of mid-small scale plots. The principle of this system is to loosen the restriction of land redevelopment on the local scale. In the form of individual declaration and governmental approval, the development right of small plots is authorized to property owners. Plots smaller than 5000 m² are all qualified to apply Renewal Unit system.

The procedure of Renewal Unit system has five main steps. (1) Personal declaration. Property owners or developers who are willing to make self-directed renewals make the application to the planning bureau. (2) Definition of Renewal Units. If the application is approved, the plots to be renewed are defined as Renewal Units. The plan of Renewal Units should also meet planning requirements determined in the regulatory planning. (3) Approval of renewal plan and coordination with the regulatory plan. The renewal plan should meet the requirements of urban refurbishment and regulations of regulatory plans, including the development goal, development intensity, building functions, and morphological regulations. According to the planning requirements, some plots could be renewed only after it provides some proportion of land for public service. The changes of property and control conditions brought about by the renewal should be readjusted in the regulatory plan. (4) Compensation of land value. The government and the renewal applicants should propose a compensation plan for the change of land value brought about by the renewal. (5) Finally, the applicants are authorized with the land redevelopment right of the Renewal Units.

Despite the establishment of Renewal Unit system, Land banking system is still indispensable for the redevelopment of the historic urban area. However, the current land banking system should be improved in order to promote the plot subdivision. Firstly, it is necessary to establish a specific procedure to integrate the regulatory planning, development requirements and appeal of existing property owners so that the scheme of plot division can be optimized. Secondly, the generation and allocation of mid-small plots should be promoted through joint allocation policy. There are two forms of joint allocation: (1) The joint allocation of a small plot in the historic urban area and a meg-

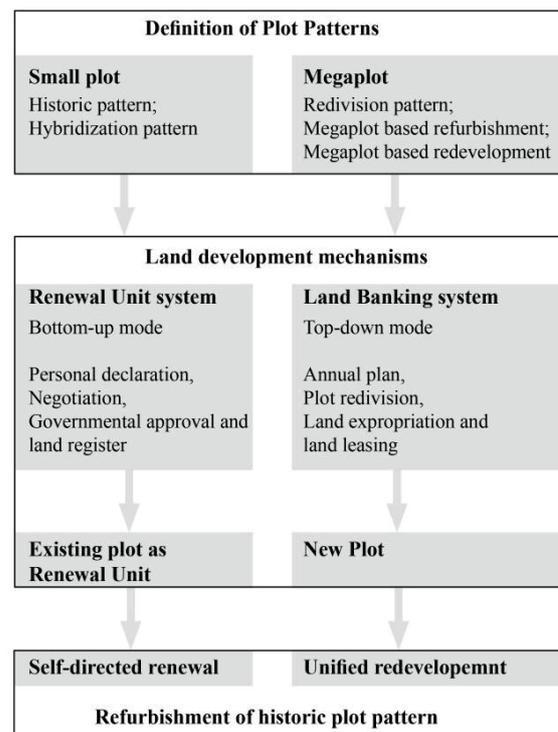


Figure 10. Optimization of smart plot division mechanism. Source: Own figure.

aplot outside the old city. In order to guarantee the morphological requirements of the small plot, the development intensity of the megaplot could be improved through the operation of Transferable Development Rights (TDR). (2) The joint allocation of several independent small plots which are not located next to each other not only ensures the scale of land allocation (so that the demand of land finance can be met) but also guarantees the continuation of plot subdivision.

6. Conclusion

The vitality of an urban area largely depends on the sustainability of urban fabric. The urban fabric serves as a gene element and a texture, connecting the macro and the micro, past and future (Tong, 2014). Despite invisible, plot division reflects the land property structure of a city, which is the basis on forming the urban form (Stimmann, 2009). The current plot division mechanism under growth supremacism is in favor of the production of megaplot and is in lack of control on the spatial form, failing to protect and continue the morphological characteristics of the historic urban area. As a result, the historic plot subdivision is damaged.

The refurbishment of the historic urban area means neither a large scale reconstruction of the old city nor a recovery of the nostalgic urban ground plan. The historic urban area is a developing organism. In this sense, urban refurbishment should not only continue the historically morphological features but also fulfill the diversified development requirements. The smart plot division strategy proposes five patterns of plot division, corresponding to different land development requirements and morphological zones. It emphasizes the protection and continuation of medium and small scale plots but also affirms the necessity of the megaplot in the redevelopment of the historic urban area. What's more, it endeavors to realize the integration of various plot types, aiming at creating a new structure of plot subdivision.

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