Research Paper

A 21ST CENTURY NATIONAL ORDINANCE

Planning the physical disposition and use distribution of a Nation

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Abstract

This paper outlines the implementation of a National Ordinance across the country of Kuwait. The ordinance is a platform that is based on a seximal system of measurement for spatial and data driven planning. This system simultaneously provides a spatial framework for optimized connectivity as well as an analytical platform for projecting and tracking development across an entire nation.

The national master plan for the country of Kuwait, the Fourth Kuwait Master Plan 2040, utilizes a National Ordinance that serves as the planning and development platform for the country. The ordinance is based on the Land Ordinance of 1785, Jefferson's plan for most of the United States, however, it is restructured to address changes in context, technology and operation. In this case the Ordinance provides parallel Geographic Information Systems for both spatial implementation and data analytics. The intention is to use the Ordinance to address the difficulty in planning for the future of a complex system such as an entire country.

This paper provides 1) a brief introduction to the idea of an Ordinance, 2) the historical context for the idea of a national planning platform, or ordinance, 3) historic examples and analyses, 4) the underlying concepts and methodology for the proposed ordinance, and 5) a detailed analysis of the proposed Kuwait National Ordinance.

Keywords

Land Subdivision, National Ordinance, Master Plan, Smart Planning, Resilience

1. National Ordinance

1.1. Introduction to the National Ordinance

In the scales of human development, the largest scale tends to have the largest impact. A Nation's constitution affects everyone, while a local ordinance is limited in scope. It is the built-in tenacity at the largest scales that make the influence of broad efforts worthy of more intense study. As such, this paper begins at the scale of the country of Kuwait with the proposed National Ordinance.

In general, a National Ordinance is a regulatory and guiding document to facilitate the distribution of land across an entire country. It is comprehensive by necessity. It comprises methodologies, maps, principles, and policies for subdividing vast territories. While it is prescriptive in its methods, it can materialize incrementally and is typically flexible and adaptable. It has broad impact on the country, but it can also provide guidance and direction for finer details that are to be applied later. Thus, it has the potential to impact everything from the general distribution of uses across a large area to the character of the local

areas that emerge in the development of the country. From a planning perspective, it is a document and methodology that breaks down vast dimensions into manageable and workable units.

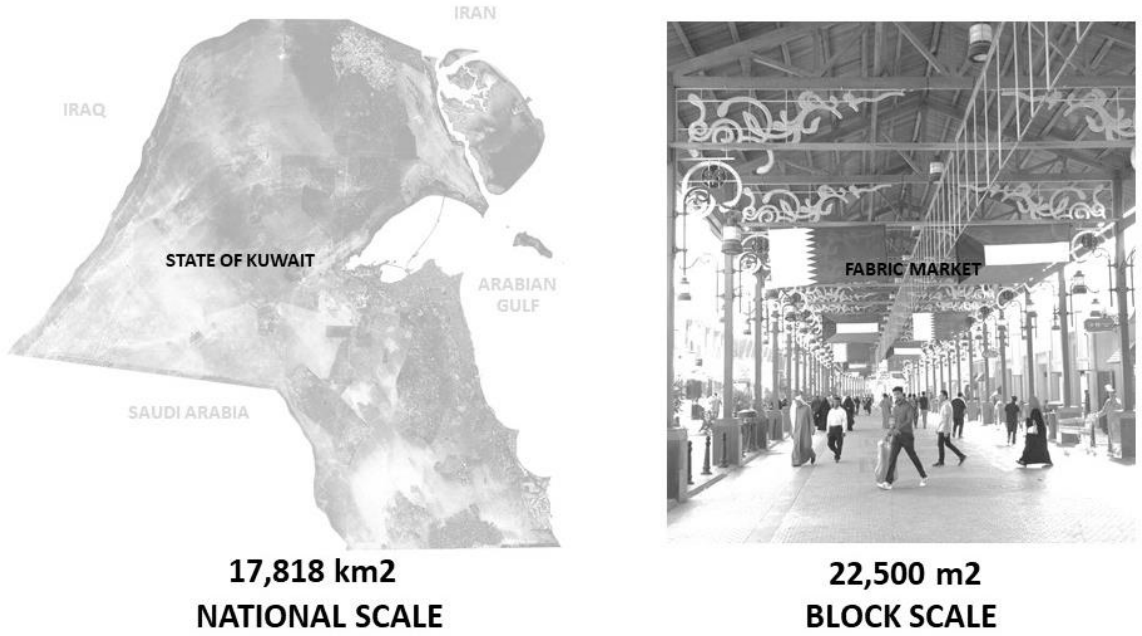


Figure 1 Scales comparison (©Fourth Kuwait Masterplan)

1.2. Introduction to the Kuwait National Ordinance

The national master plan for the country of Kuwait, the Fourth Kuwait Master Plan 2040 (4KMP), utilizes a National Ordinance that serves as the planning and development platform for the country. The ordinance is loosely based on the concepts and applications underpinning the Land Ordinance of 1785, Jefferson's plan for most of the United States, however, it is restructured to address changes in context, technology and operation. In this case, the Ordinance provides two parallel Geographic Information System (GIS) platforms based on a grid system. The first platform is for physical spatial implementation and is structured around a dimensional system that facilitates particular outcomes relative to connectivity and the physical disposition of the public and private realms. The second platform is for the collection, organization and analysis of data to facilitate timely and relevant management of the development and monitoring process. The intention is to use the Ordinance to address the difficulty in planning for the future of a complex system such as an entire country.

Figure 2 demonstrates the parallel platforms, with the grid providing a physical, dimensional structure that precipitates future development that is connected and adaptable, while simultaneously providing an updatable and analytical platform for the distribution of uses and supporting resources for the expanding city and new cities and towns that will emerge in the coming decades.

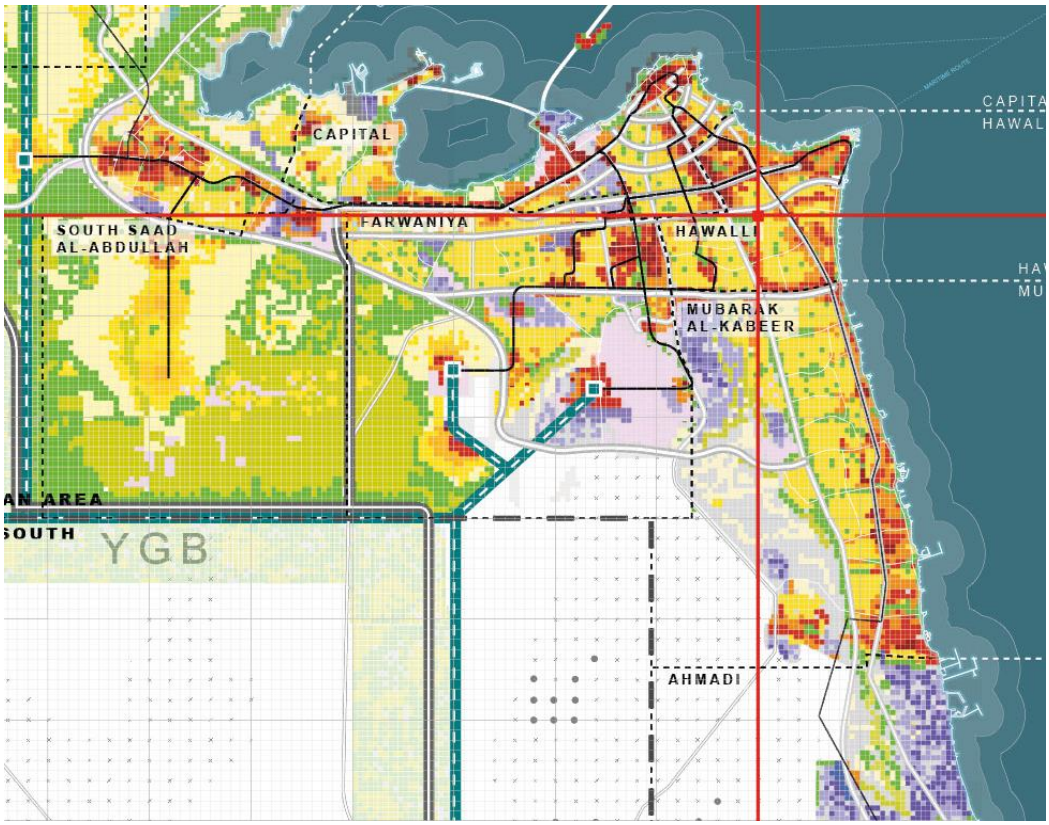


Figure 2 4KMP National Plan (©Fourth Kuwait Masterplan)

2. Historical Context for a National Ordinance

2.1. The evolution towards the 21th Century National Ordinance

A National Ordinance is fundamentally a subdivision program for an entire country. It is a way of organizing the patterns of settlement and development in a growing and changing city, town or other inhabitation. The context and history of these efforts are critical to understanding the opportunities a contemporary national ordinance afford. They are also critical to our understanding of how these efforts evolved over time, and how they were, or were not, successful.

In the process of examining past examples, two scales are discussed, the national (or large-scale) and the city (or small-scale). There is a relationship between the two that is critical to the operation of the Kuwait National Ordinance, and as such, both should be clearly explained.

The examples include, from the ancient world, Miletus (small-scale) and the Roman Centuriation (large-scale), and from the Colonial world, Philadelphia (small-scale) and the U.S. Land Ordinance of 1785 (large-scale).

2.2. The Ancient World

A very early urban planner, Hippodamus of Miletus, was charged with laying out a new Greek settlement along the Aegean Sea in what is today Turkey. To do this, he utilized a grid structure that projected a future city comprised of streets at regular intervals, organized perpendicular to each other. The result was a regular grid pattern that showed public streets and the resulting blocks. In addition, he indicated where specific public buildings and places would be located in the city.

The city plan is shown in Figure 3. It is strikingly simple for a city plan in relation of the complex, multi-volume planning documents that are used to plan cities today, however, it is an early representation of the general way cities would be planned from its inception to the early 20th century. The planning of cities remained little changed for 2500 years, and this simple system produced some of the most liveable, adaptable, sustainable and resilient settlements that we still know and enjoy today.

Miletus is not an example of a successful city, rather an early example of the process of planning cities as simple projections of the public and private realms, devoid of uses, other than the critical public buildings and places that supported the cities. It demonstrates the lasting process more than the lasting city itself. It also represents a structure that provided a backdrop for the emergence of civilization over the past two and a half millennia.

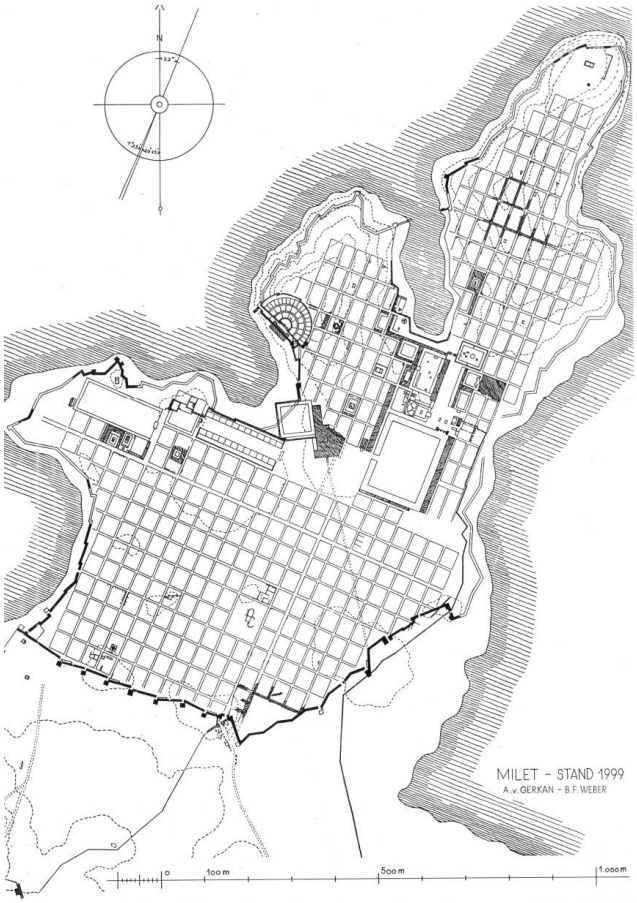


Figure 3 Plan of Miletus around 470 BC (Magli, 2007)

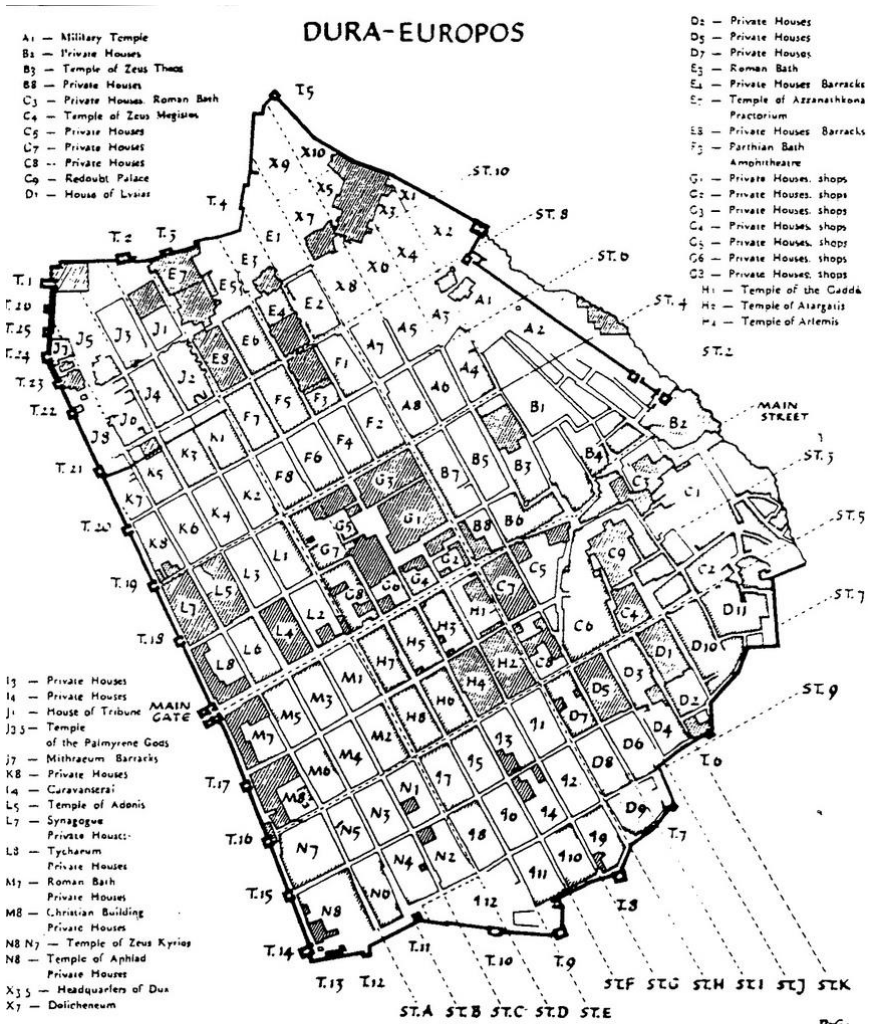


Figure 4 Plan of Dura-Europos (Quadralectic Architecture, 2016)

From Greece, such methodology for city planning and land organisation was taken up by the Romans and their emerging conventions for planning new cities, as evidenced by the diagram below in Figure 5. The city is conceived of with a sacred point of departure, the Axis Mundi, at the intersection of the *cardo* and the *decumanus*, but the execution of the plan is essentially the same as that of Hippodemus at Miletus, a projection of the public realm as streets and the resulting blocks, some of which are identified as important public buildings and places.

The Romans, however, were expanding into an empire, and this necessitated a broader, larger-scale effort to organize land that was both captured and restructured according to Roman principles, but also land that was to be developed as everything from farmland to new urban centers. The key element in this effort was the Roman Centuriation, a system that supported the initial laying out of the two main streets.

Figure 5 Plan of Timgad (Finley, 1977)

The specific process began with the surveyor identifying a central viewpoint, the Umbilicus Agri, through the gates of the city into expansion territory. Two main perpendicular roads, the *cardo maximus* and the *decumanus maximus* were laid out at the designated intersection to form the backbone of the emerging series of streets and roads. In many cases these roads still exist as primary roads linking local villages to main towns, illustrating the lasting presence of public rights of way once they are put in place. The territory would then be subdivided to create a system of parallel and perpendicular streets, *limites quitarii*, dividing the territory into square resultant plots, called saltus and further subdivided into *centuria*. At the most local, granular level, the subdivision process resulted in *heredia*, and further *jugera*. In all this system provided a method for organizing land on a large scale, creating connections between settlements and resulting in highly connected, dense networks of streets and blocks.

As with Miletus, the Roman Grid provided a system of dimensional organization that resulted in boundaries and street centerlines that projected what was public (the streets) and what was private (the resulting parcels of land).

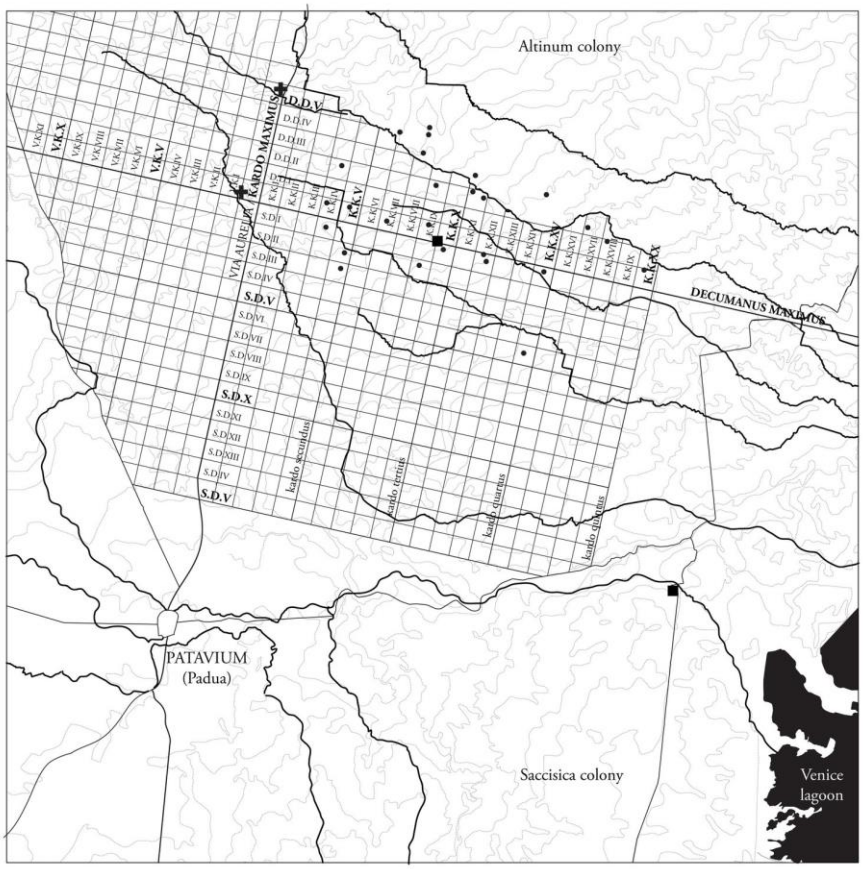


Figure 6 The Roman centuriation between Padua and Venice (Tavone, 2018)

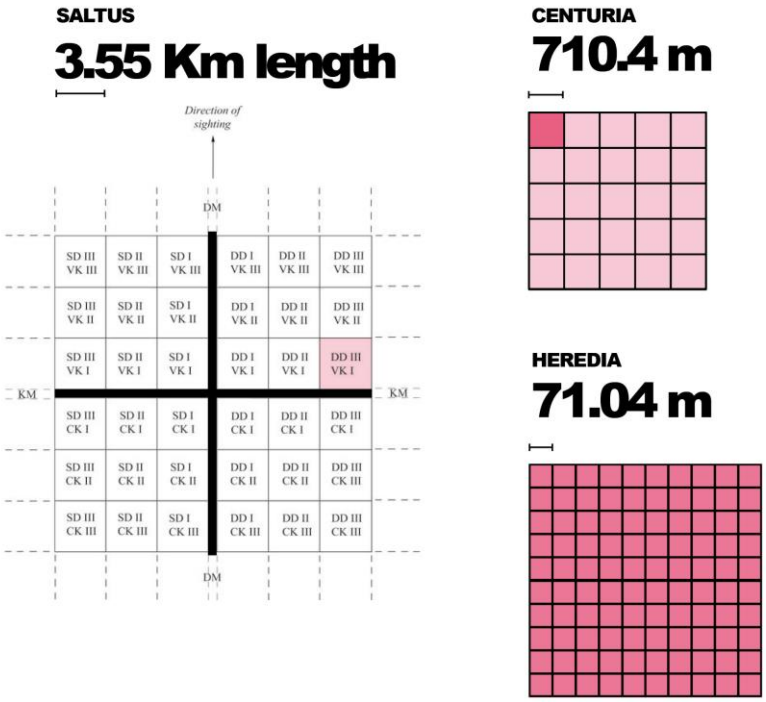


Figure 7 The Roman centuriation between Padua and Venice (Pasquinucci, 2014)

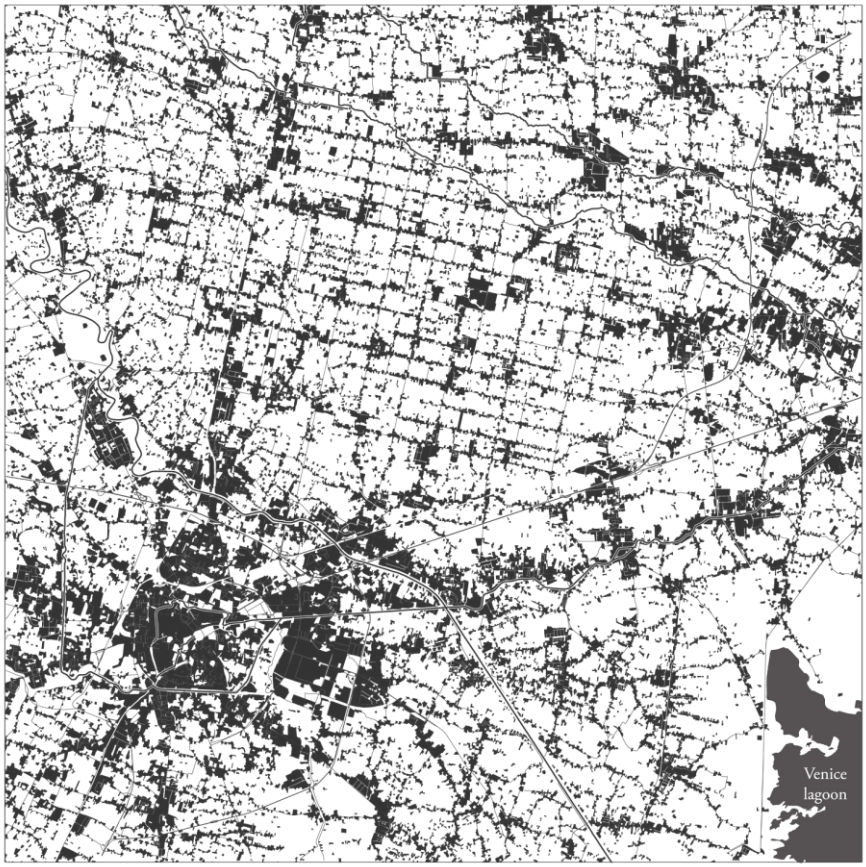


Figure 8 The territory of the Roman Centuriation between Padua and Venice today (Tavone, 2018)

The two preceding examples describe the underlying logic embedded in the subdivision process and the scalar impact of the system. Miletus describes the beginnings of the planned city and the intentional construction of a physical settlement based on the political structure that, spatially at least, balances the obligations of the collective and the rights of the individual. Roman expansion builds on this logic to enact a system that organizes not only the local distribution of land but also the organization of a nation, or an empire.

This methodology continued as the foundation of the subdivision of land throughout the first and second millennia, to a greater or lesser extent, including as it was adopted by the colonies in North America, and then the emerging nation, the United States. These are exemplified by Penn's plan for Philadelphia and the Land Ordinance of 1785, outlined in the following section.

2.3. The Colonial World

While Miletus and the Roman planning process exemplified a logical systemization of land subdivision, the remoteness in time of both belies the impact of the systems. It is difficult to see what the future held for Miletus, or for the Roman systems, because much of the ancient world has been lost. However, through more recent efforts, primarily in the Colonial World, it is possible to track and understand the additional value these systems had on the development of human settlements.

In the case of William Penn's plan for Philadelphia, the underlying logic of Miletus is clear. Penn lays out a very simple plan for the founding of the colonial town, straddling the land between the two rivers. In it, he places a central square, that was originally intended to remain an open space, and is, at least spatially and hierarchically, reminiscent of the Axis Mundi of ancient Rome. It locates a point of departure for the survey and subdivision of land into two distinct categories, public streets and squares, and private blocks and a parcel system for private development.

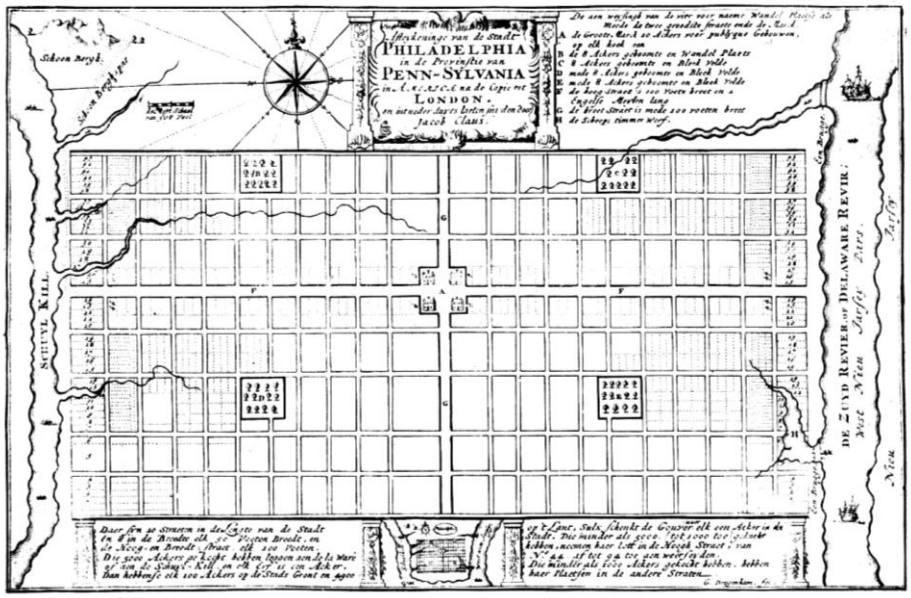


Figure 9 A Portraiture of the city of Philadelphia in the Province of Pennsylvania in America (Penn and Holme, 1684)

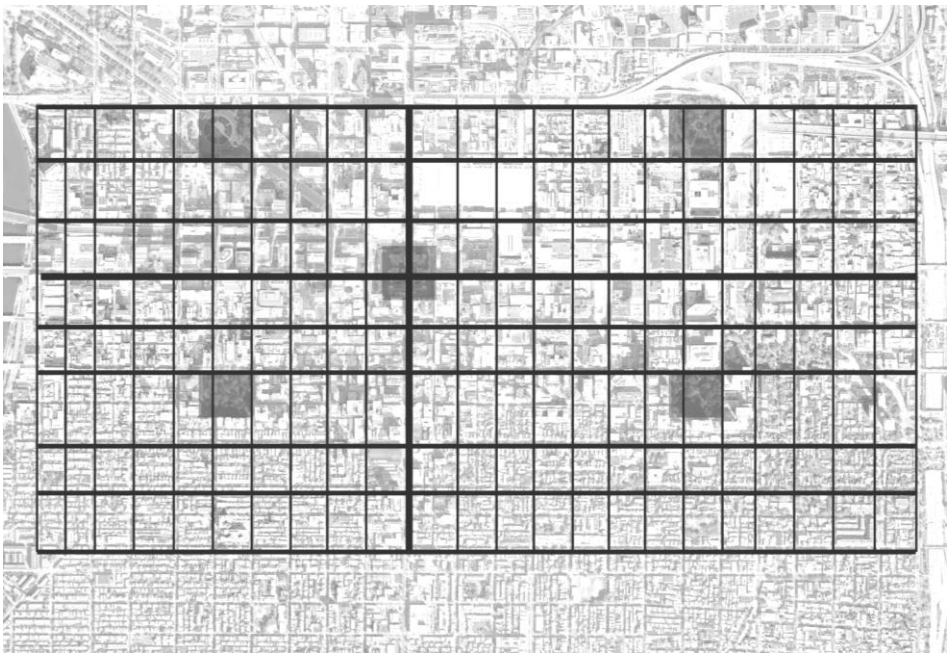


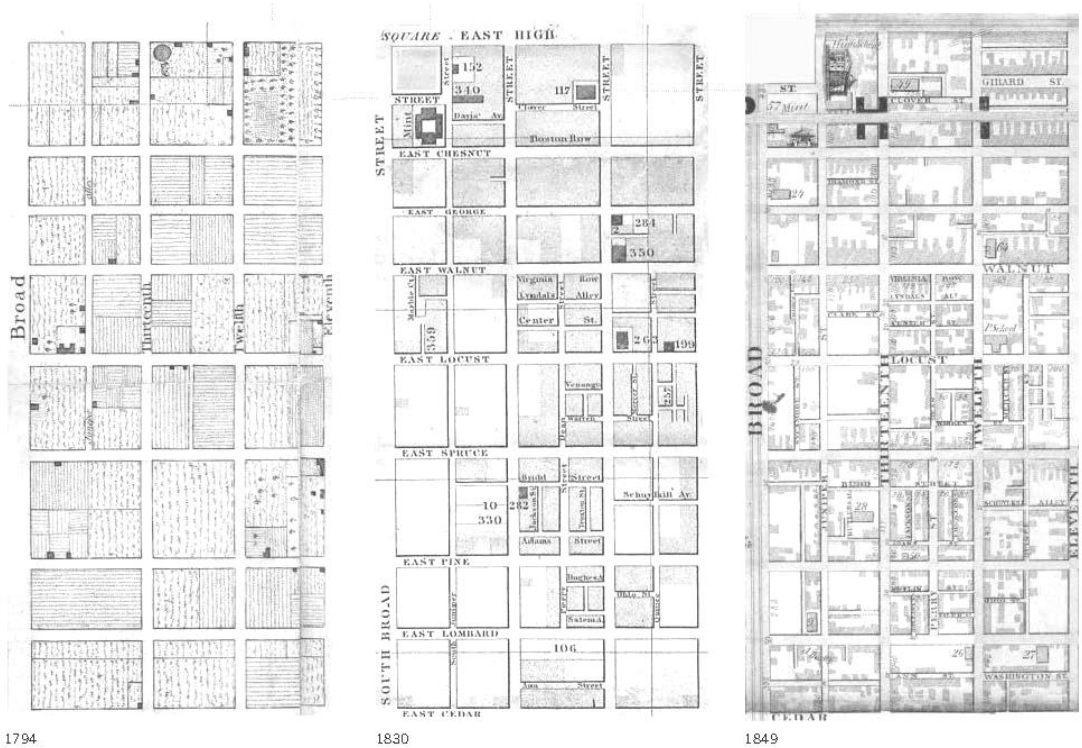
Figure 10 Penn's plan still visible in Philadelphia today (Google Earth, 2019)

Unlike Miletus and the ancient Roman world, we don't have to speculate to understand the outcome of this planning platform over time. It exists today, in a form that could never have been conceived by Penn at the time of its original implementation. The series of public rights-of-way that his plan laid out are still in existence today; not as excavated ruins but as thriving streets in a large, dense city.

Figure 10 demonstrates the resilience of the simple subdivision plan, and its ability to accommodate, or adapt to, a future that could not have been contemplated at its outset. However, the basic characteristics of the plan remain. The city is a dense network of public rights-of-way that provide an environment that facilitates diversity of projects, walkability and efficiency of resource distribution. The same streets that once carried horse and buggy are now carrying automobiles and, beneath the surface, power, water and other utilities that keep the city running.

Understanding the city as it exists today, and the significant difference in uses and development from its original time is a clear demonstration of the adaptability of the system, but even more demonstrative is the tracking and analysis of the development process over time, understood at intervals, and clearly illustrating not just the ability to adapt to the 21st century, but to adapt to all changes across the more than 330 years since the plan was put to paper.

Figure 11 indicates a series of plans that identify development at different stages of the city's existence. From this, it is possible to understand how the system of subdivision (highly connected streets and small blocks) could originally be occupied as agricultural plots, then move through a series of continued redevelopment from small residential buildings to more dense, more diverse buildings and projects, finally ending up, today, as an extremely dense, high-rise laden city, accommodating far more people, activities and technological advances than could have ever been conceived of at its inception.



1794 1830 1849

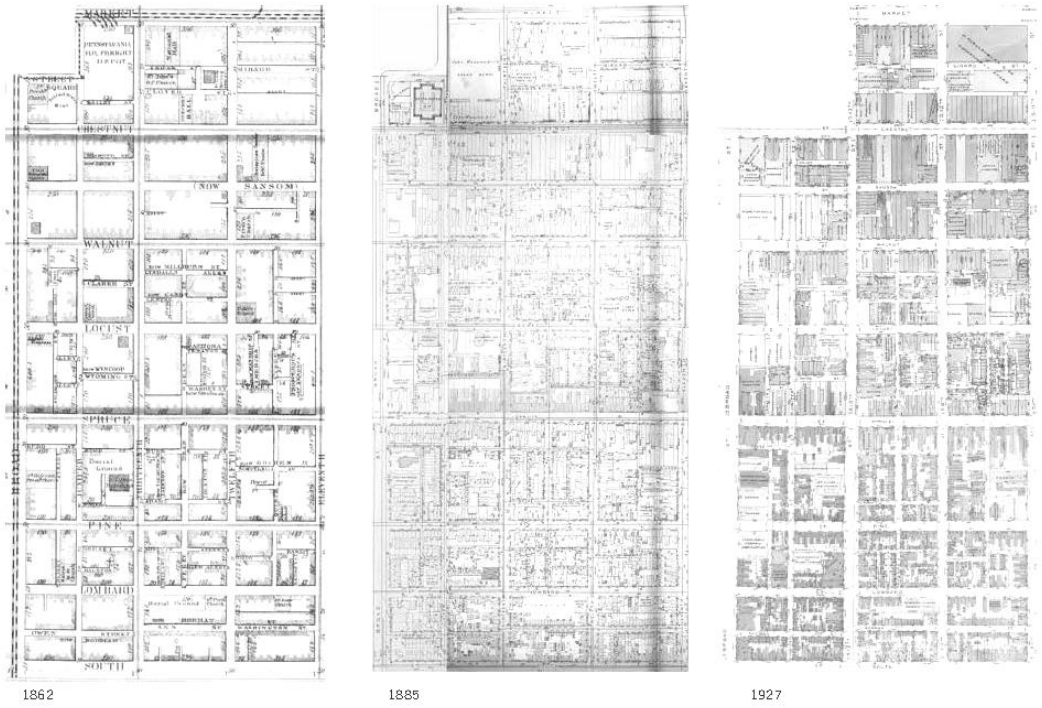


Figure 11 Philadelphia's evolution 1794-1927 (Allen, D., Green, D., Knight, P. 2013)

This series demonstrates the adaptability of the system of subdivision that was the bedrock of city organization and planning for more than two-thousand years. In forms more or less the same, cities such as New York, Buenos Aires, Delhi, Sydney, and Alexandria, Egypt have carried these basic characteristics in their initial conception and execution. But it is the Land Ordinance of 1785 that recaptures the larger-scale intention of the Romans and reconceives of it as a method for large-scale organization and subdivision of land at the national level.

Prior to the Revolutionary War between the United States and England, land in the colonies was allocated through the process of surveying parcels, staking a claim to those parcels, and then working or developing the land. Cities in the colonies, as with other cities at the time, were planned, but the general larger-scale surveying was performed by companies engaged in the speculative selling of staked claims.

After the war however, it was necessary for the nascent federal government to raise money to pay the debts of war, particularly to the soldiers who had fought in it. This resulted in a conceptual leap in terms of the subdivision of land in the country's expansion. Instead of requiring land to be surveyed prior to identification and sale, the Land Ordinance of 1785 and the Northwest Ordinance provided a method for projecting a system of subdivision and organization into territories that had yet to be surveyed. This system was derived from the ancient Roman system discussed above, however the system itself was structured to provide for the particulars of post-colonial America.

The challenge was simple at the time; how does one organize and manage land that had yet to be mapped or occupied. The specific solution was innovative and provided a surveying and organizational method that resulted in a geometric grid to guide the future growth of the nation, which continues today as the major organizational structure for the country.

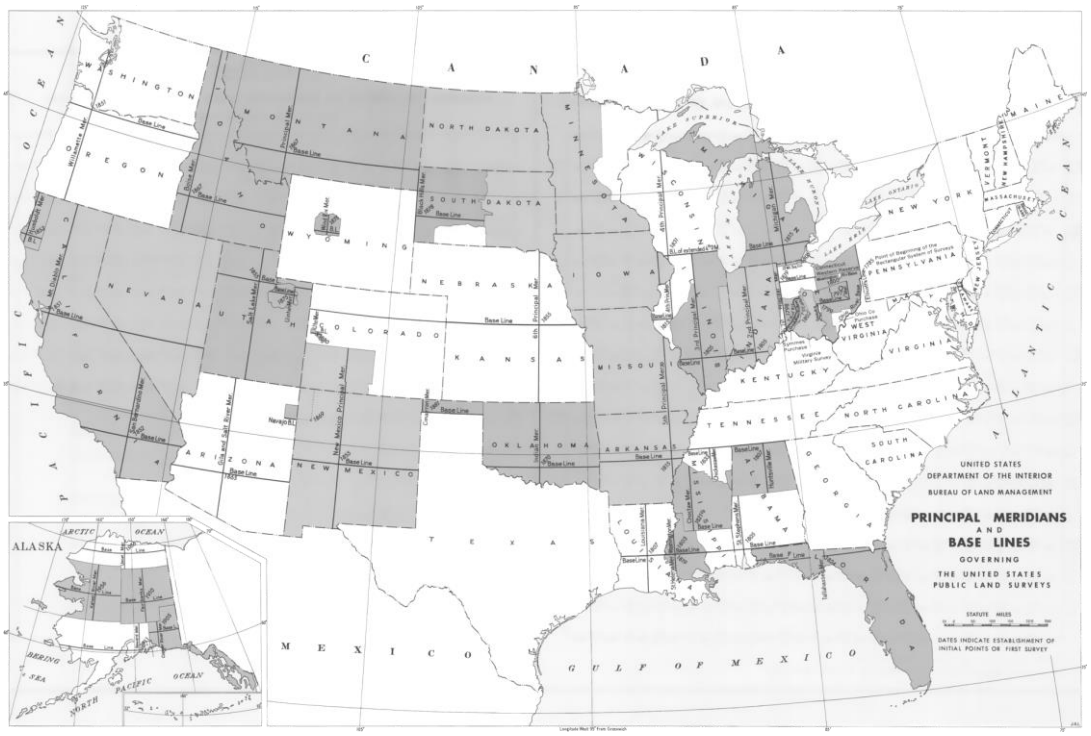


Figure 12 Principal Meridians and Base Lines governing the United States Public Land Survey System (United States Geological Survey, 1988)

One of the primary outcomes from the 1785 Ordinance is its capacity to divide the scale of the country into manageable units. By linking a system of measure with a system of survey, occupation, and development, the Ordinance provided a highly adaptable system for future growth. This resulted in the Public Land Survey System, a system that provided a national framework, the Principal Meridians and Base Lines, townships, sections and subdivisions of land to 2.5 acres.

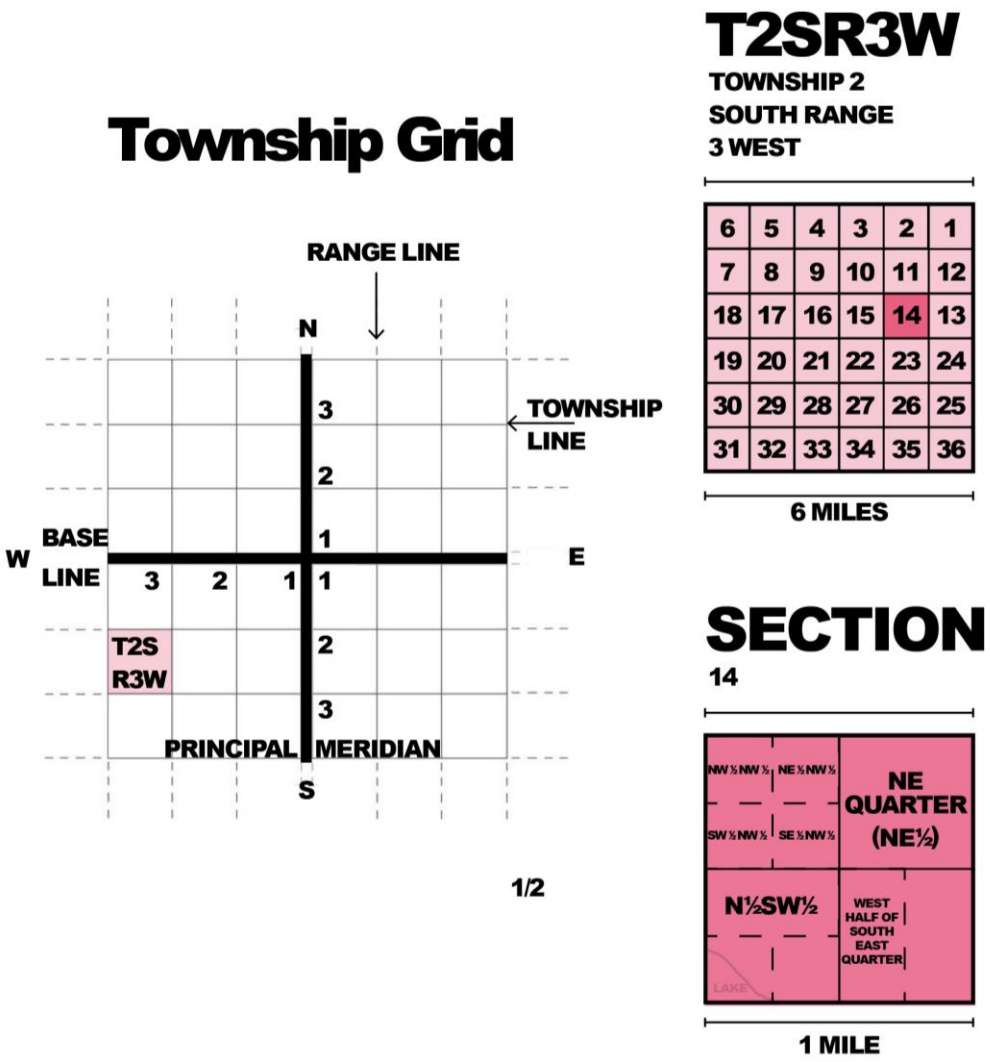


Figure 13 The Public Land Survey System (United States Geological Survey, 1988)

The United States has changed dramatically over the intervening 232 years since, yet the Ordinance still provides an adequate framework. Because its divisions were based on a set of dimensions that have proven to be flexible and useful over time (within the Imperial measurement system), any development that has occurred since the first survey has been successfully accommodated into the framework.

As with Philadelphia, the US Land Ordinances are still present in the development and operation of the nation. And as with Philadelphia, the system can be analysed and understood based on its ability to accommodate change across over more than two hundred years, and its impact can be evaluated based on its implementation.

The system has accommodated and impacted everything from agricultural uses to the form of cities across the country. However, it is important to note that, as with the Roman Grid, the Ordinance had limited discussion of land uses and instead focused on land subdivision. In fact, the only designations of use were tied to the requirement for certain sections of new townships to provide for public places, such as schools and a courthouse, much as Miletus restricted its designation of land uses to those public facilities required for the proper functioning of the city.

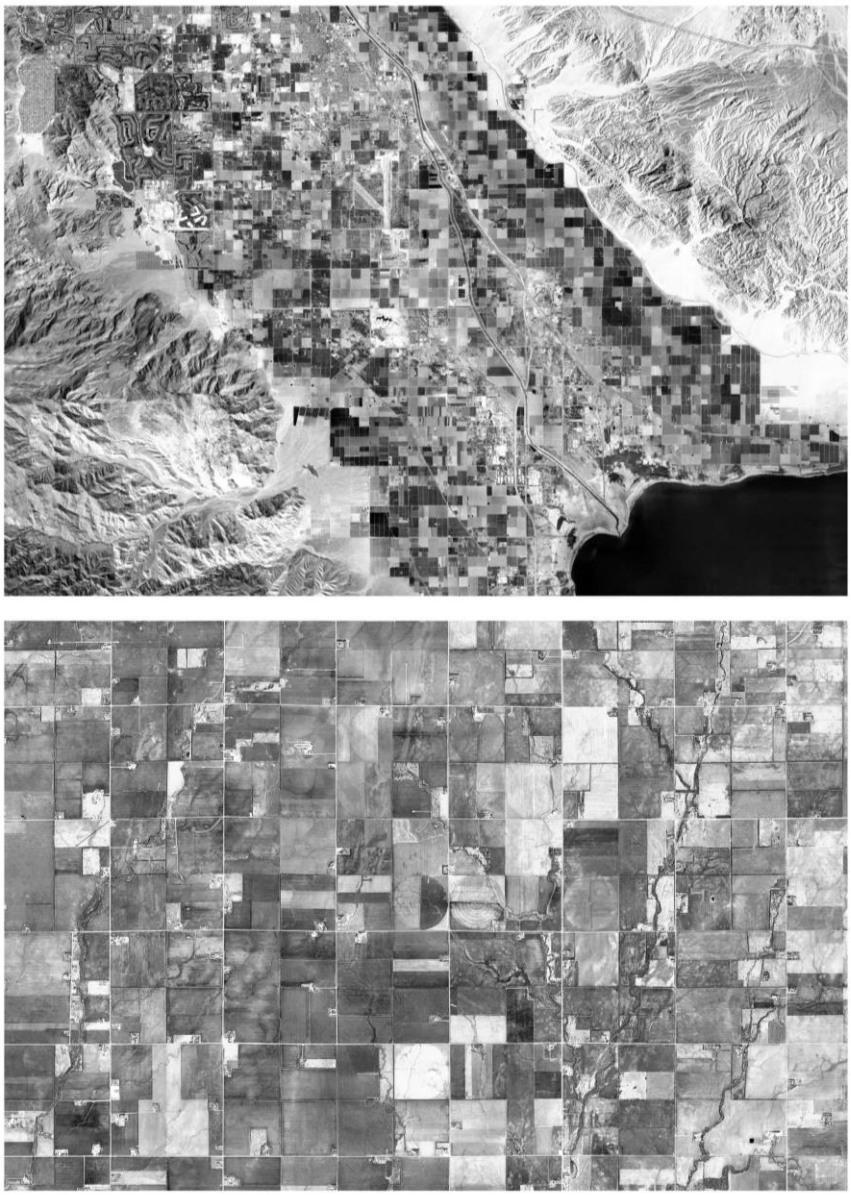


Figure 14 Results of PLSS today (Google Earth, 2019)

In practice, as the Ordinance informed land development and use, the quarter section emerged as the primary dimensional unit, a square a half mile on each side. This had the consequence of providing a development pattern that was connected at least at this scale, from agricultural use to the suburban expansion of cities. This proved beneficial in areas developed within the context of the Ordinance because it reduced the probability of extremely large, disconnected patterns of development that led to the suburbs of the east coast that weren't under the dimensional constraints of the Ordinance.

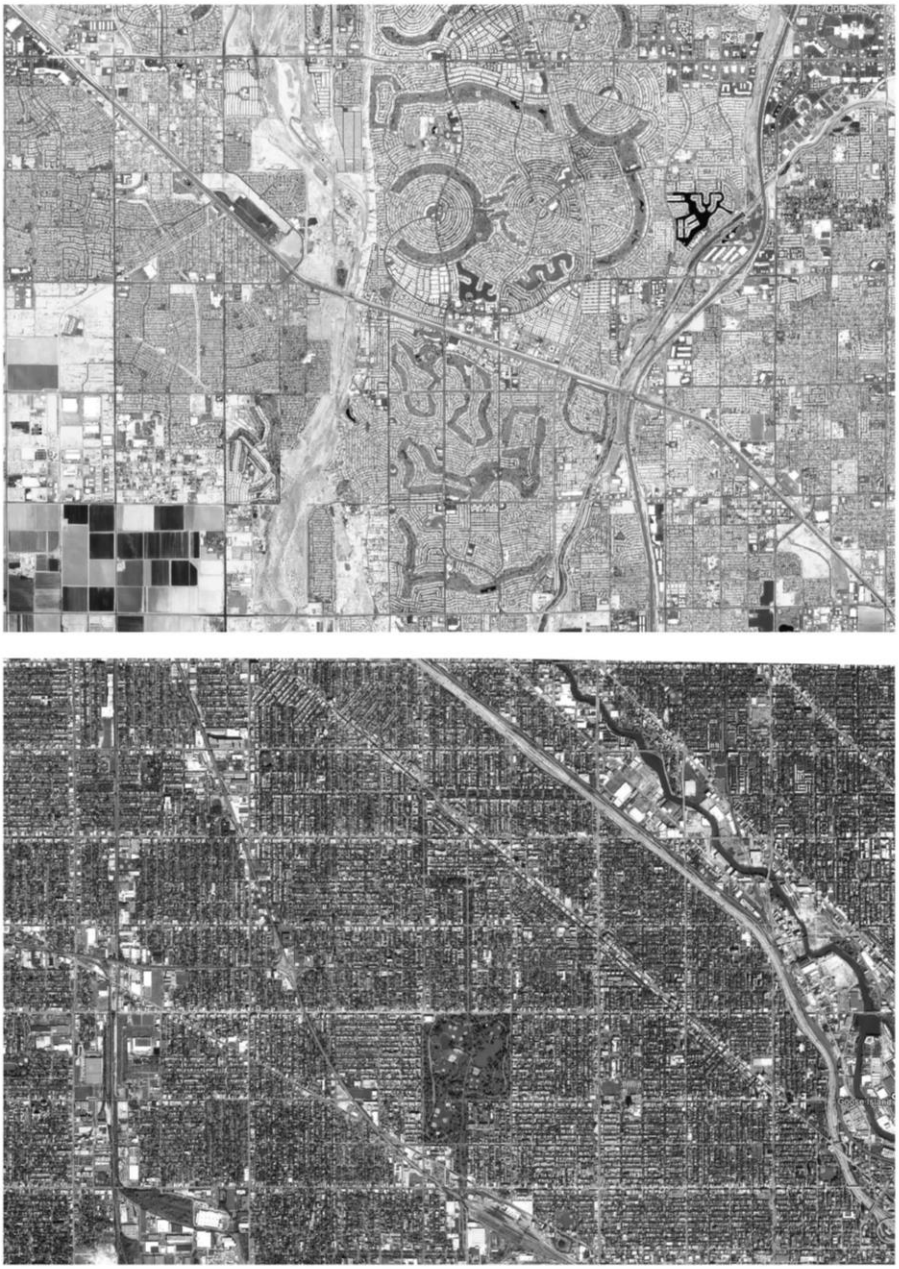


Figure 15 Results of PLSS today (Google Earth, 2019)

Figures 14 and 15 above demonstrate the impact the Ordinance had on development patterns. While the developments internal to the quarter sections are in many cases disconnected developments that follow the twentieth century model of dendritic suburbs, the strength of the section subdivision provides a level of connectivity that would have otherwise been compromised even further, as evidenced in Figure 16.

Figure 16 Suburbs in Georgia today (Google Earth, 2019)

Both Penn's plan for Philadelphia and the Land Ordinance of 1785 had practical applications and benefits to the planning and settlement process. However, they also provide a basic conceptual framework for understanding the methodology and impact of the process, and this is illustrated below.

3. Concept and Methodology for a National Ordinance

3.1. The Concept of Constitutional and Economic Orders

While the notion of a national ordinance seems to pertain to primarily large-scale planning actions it also has its roots in the physical planning of cities. Because of this relationship it is necessary to address the fundamental structure of cities to be able to more fully understand the underlying logic and application of the National Ordinance.

As evidenced in both Miletus and Philadelphia, cities that were planned, prior to the twentieth century were constituted through a simple projection of the streets and blocks that would define the physical attributes of the emerging city. At its core this action provided direction in determining the areas of the city that were to be public (streets, parks, public buildings and other parts of the city that are held by the collective) and those that were to be private (blocks and parcels for houses, offices, shops and other parts of the city that are held by the individual).

In this structure there is further identification of the two orders of land areas that are created with the constitution of a city, town or settlement. The first, aligned with the public realm, is the Constitutional Order, which is political in nature. The second, aligned with the private realm, is the Economic Order.

Every city has this a Constitutional Order and an Economic Order. They are each comprised of certain elements of the city. The Constitutional Order includes boundaries, streets, public gathering places, monuments and other collectively held, public elements of the city. The Economic Order includes development parcels, houses, farms, offices, restaurants, heavy industry, and other privately held elements of the city.

The Constitutional Order brings the collective structure of cities into being with elements that connect the past and future of the city and its inhabitants. These elements are permanent and last through time and through the changes in the city. In most parts of the developed world, the Constitutional Order is controlled by Subdivision Regulation, or some similar regulatory framework.

The Economic Order brings the individual structure of cities into being with elements that provide the operations of the city. These elements are much more transitory and tend to follow market and other external fluctuations. These elements are generally referred to as uses and are controlled by Zoning Regulations, or some similar regulatory framework charged with use allocation and distribution.

This is a series of important distinctions that illustrate the difference between these two basic elements of human settlement.

The figure below describes a diagrammatic interpretation of the two Orders and their relationship. It also demonstrates the need for the Constitutional Order, that which is made up of the permanent elements of the city, to precede the Economic Order.

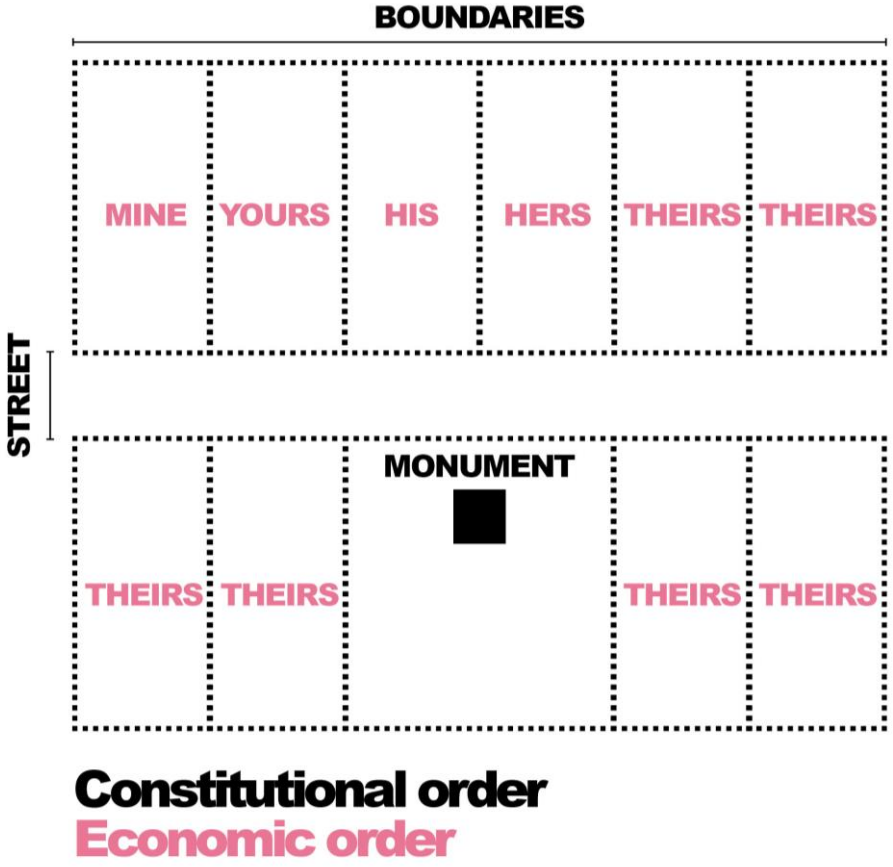


Figure 17 Constitutional and Economic Order of the city (Allen, D., Green, D., Knight, P. 2013)

3.2. Subdivision Dimensional Methodology

The dimensional construct and mathematical logic of a system of subdivision have significant impact on the functionality and efficacy of the system. This is evidenced by the adoption of the Gunther's Chain as the primary tool for surveying from the late sixteenth Century through to the early twentieth century. This simple tool with the parallel 10-based and 4-based measurement system set a course for much of the United States to be subdivided on a 66-foot module (which gives us the dimensional basis for everything from the Public Land Survey System to the Commissioners Plan of 1811 for the city of New York.

As a precursor to adoption of the dimensional construct for the Kuwait National Ordinance, two base numbers were analysed to determine the value of each as the foundation for the Ordinance. Both a 6-base system and a 10-base system were analysed to determine the most highly composite numbers.

Firstly, the number '10' is not as flexible or as fungible as '12'. '10' has four divisors and can only be divided wholly by 1, 2, 5, and 10. Any and all other divisions will result in a remainder. '12', on the other hand, has six divisors and can be divided wholly by 1, 2, 3, 4, 6, and 12. Because of these additional divisors, '12' is a more workable and fungible number than '10'; '12' has more utility than '10'. More divisors result in a number that is able to adapt to more situations, making it easier to respond to a range of needs.

Figure 18 below outlines the spatial implications of the analysis.

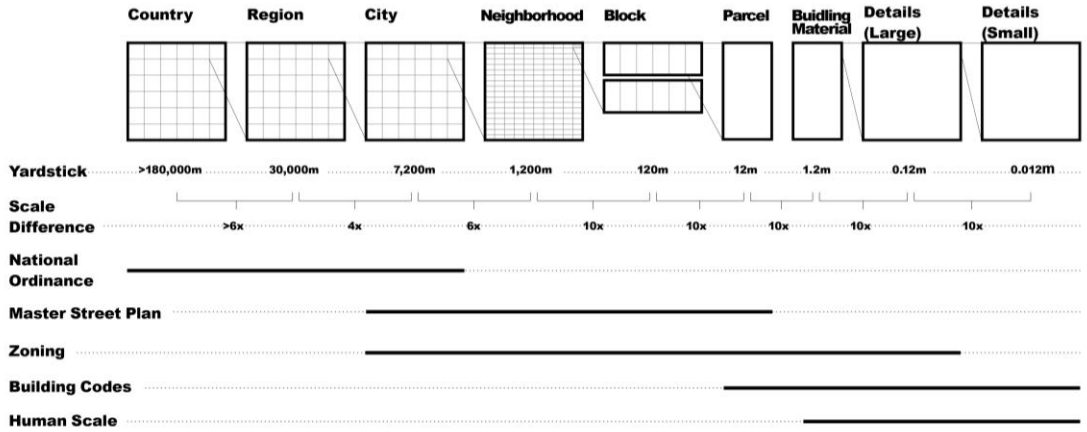


Figure 18 Theoretical subdivision based on the logic of 12 (©Knight, P.)

Numbers are repeatedly subjected to multiple subdivisions. Halving, for example, is perhaps most common; in fact, it is embedded in our own DNA. Twelve-hundred and its resultants can be halved four times before encountering fractions (1200 to 600 to 300 to 150 and finally to 75) while 1000 can be halved only three times (1000 to 500 to 250 to 125). But halving is not the only common method of subdivision. Thirds and fourths make frequent appearances throughout our daily lives. With this in mind, the numbers have been analyzed to determine their behavior when subjected to successive iterations of subdivisions by quarters, thirds, and halves. That exercise is shown in the two diagrams below (note that the "censor bars" are covering fractional numbers; only whole numbers are counted in this exercise).

COMMON DIVISIONS	1/4	1/3	1/2	2/3	3/4
1,000	250	-	500	-	750
750	-	250	375	500	-
500	125	-	250	-	375
375	-	125	-	250	-
250	-	-	125	-	-
125	-	-	-	-	-

COMMON DIVISIONS	1/4	1/3	1/2	2/3	3/4
1,200	300	400	600	800	900
900	225	300	450	600	675
800	200	-	400	-	600
675	-	225	-	450	-
600	150	200	300	400	450
450	-	150	225	300	-
400	100	-	200	-	300
300	75	100	150	200	225
225	-	75	-	150	-
200	50	-	100	-	150
150	-	50	75	100	-
100	25	-	50	-	75
75	-	25	-	50	-
50	-	-	25	-	-
25	-	-	-	-	-

Figure 19 Generational subdivision (Allen, D., Green, D., Knight, P. 2013)

Generational subdivision is defined here as subsequent divisions of both a number and its resultant "offspring" (e.g., 600 is an offspring of 1,200, being half of 1200; 600 itself can then be subdivided further). The diagrams above reveal the superiority of 1200 over that of 1000: 1000 only has 5 generations of subdivisions, while 1200 has 14 (i.e., 1200 is almost three times more flexible than 1000). Additionally, the "offspring" of 1200 are themselves superior to the "offspring" of 1000. The numerical fungibility of "twelveness" passes from generation to generation. This is a simple observation and characteristic of mathematics and nothing more; however, it can be readily utilized in planning.

4. The 21st Century Kuwait National Ordinance

4.1. The Vision for Kuwait

Livable places are those where people want to live, work, visit and are attractive for development. The most livable countries in the world are ones that people are drawn to because of economic opportunity

and the high quality of the living environment. Livable cities are vibrant and diverse and they have evolved over time to create complex and compelling environments rich with economic and cultural interactions and expansion. Livable places are more prosperous and their populations happier.

To deliver the vision for Kuwait's future, creating livable places in Kuwait is fundamental and the challenge is to move away from a lifestyle that has become internalized and embrace the external spaces between the buildings.

In order to realize the full potential of the country, the urban areas must be more livable using the rich cultural and urban history, diverse and complex population, strong economic foundation, and collective desire to foster transformation. Kuwait as a country has a strong foundation upon which to build this future vision. The metropolitan area of Kuwait is already a diverse and vibrant place, and by 2040 it will have a higher quality built environment with a human-focused public realm and improved connectivity.

Locating jobs close to where people live is an important part of the 4KMP vision for a livable Kuwait. To this end new settlements outside of the KMA are planned to have economic activities and drivers to support local populations and to give each area an identity and individual character.

To create livable places, the Plan will promote a higher mix of activities in our urban areas generating higher levels of street activity and increase development density around transport nodes. More optimal use of the land will occur, with the many undeveloped plots within the metropolitan area being prioritized for development. As we grow outwards from the metropolitan area into new settlements in the north and south there will be a greater emphasis on placemaking – that is, creating places where people want to live and work.

The National Ordinance is a critical component to the 4KMP2040 because it is the mechanism through which the State can ensure that future development is highly connected and adaptable, as well as to ensure that resources and efforts are being directed in the most efficient and beneficial way possible. In order to do this, it must operate within two parallel constructs. The first is the spatial construct which is concerned with the physical disposition of the subdivision of land while the second is the analytical construct, which is concerned with the management and analysis of data across the country as it develops and redevelops.

4.2. The Spatial Construct

From a spatial perspective, the entire country has been organized around a GIS-based grid set on a 6-kilometer square pattern. This specific dimensional pattern allows for subdivision to 1.2 x 1.2, .6 x .6, .3 x .3 and .15 x .15 kilometer cells that provide a spatial construct down to the scale of the individual block.

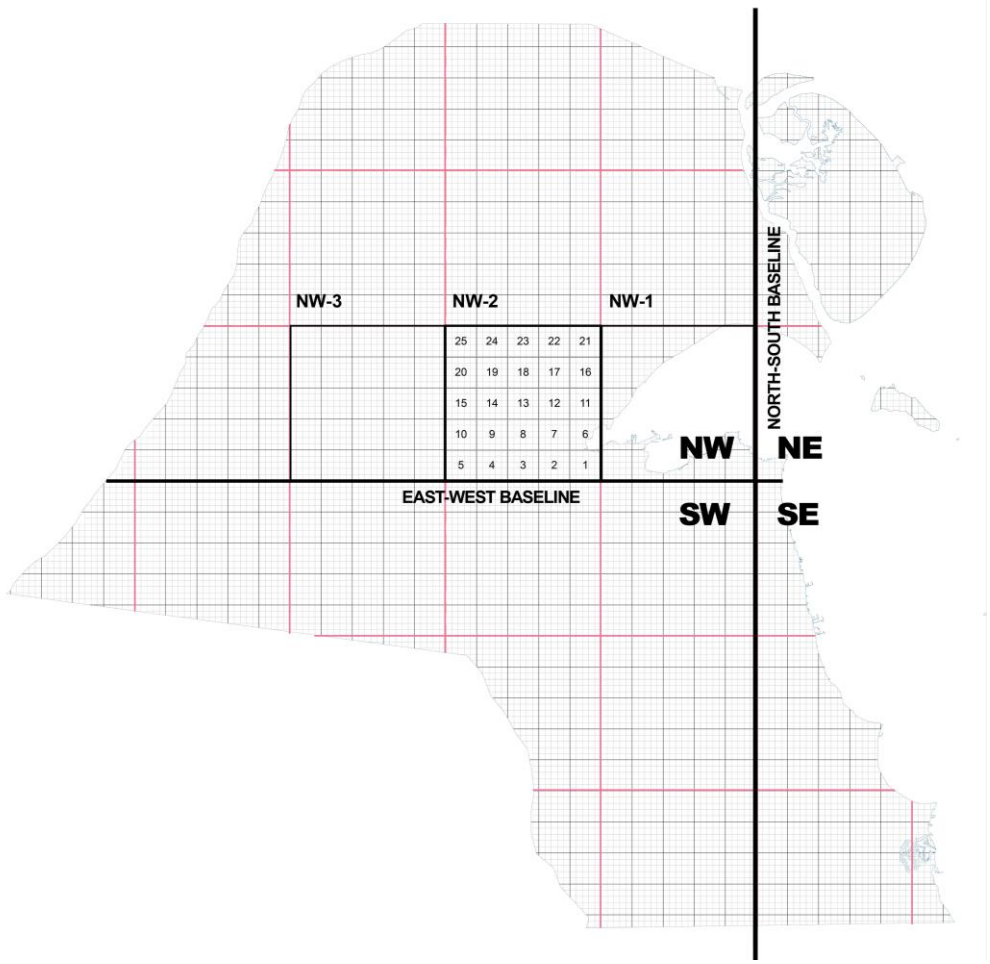


Figure 20 Kuwait National Ordinance and Coordinate System (©Fourth Kuwait Master Plan)

Figure 21 Kuwait National Ordinance – Planning Scales (©Fourth Kuwait Master Plan)

In terms of the spatial structuring of future development, the National Ordinance projects a grid across the entire land area of the country, with the smallest cells in the grid structure set at 150 meters square. The notion behind this is that the grid is a projection of future street centrelines that, when implemented in this fashion, result in development patterns that are highly connected and produce block sizes that are dictated by the Zoning Code. It is not the intention that all new planning and development follow this specific spatial pattern, rather that the logic with which the spatial pattern is structured should be incorporated into all new development. And, to the greatest extent possible, new development should follow the grid pattern, without compromising the quality of the places resulting from future planning processes.

It is incumbent upon future planners and designers to make the case for breaking the logic of the National Ordinance, and this should only be done when it can be shown to more successfully support the Principles upon which this Plan is based, primarily connectivity and adaptability. It is also necessary that future plans support the National Ordinance as the vehicle through which a consistent development pattern across the entirety of the country will emerge.

The series of diagrams below explain the planning structure in terms of its scalar implications and the resultant physical disposition in the planned areas.

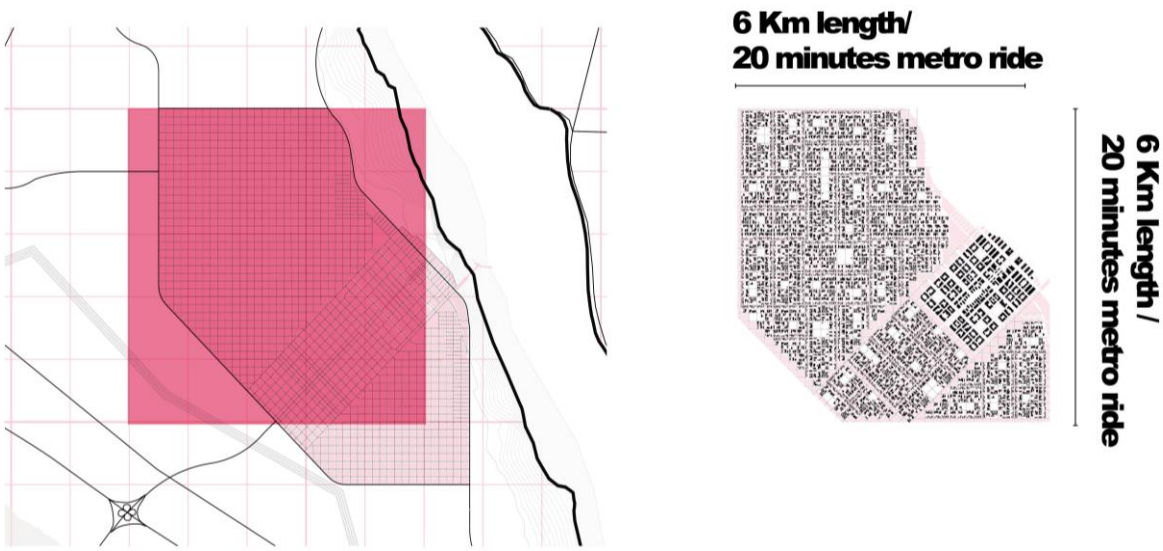


Figure 22 6Km x 6Km grid (©Fourth Kuwait Master Plan)

Figure 22 demonstrates the six-kilometer scale that is used to plan larger areas such as new towns and cities and larger areas of agricultural or other broad uses. The plan indicates a general conformance to the underlying grid, while also providing an example of discontinuity to foreground a contextual issue, in this case alignment with the coast.

Figure 23 1.2Km x 1.2Km grid (©Fourth Kuwait Master Plan)

Figure 23 demonstrates the district level planning framework at the 1.2 x 1.2 kilometer scale. This scale is generally aligned with the maximum walkable distances to perform daily tasks as well as reaching the limits of walkability to a transport stop.

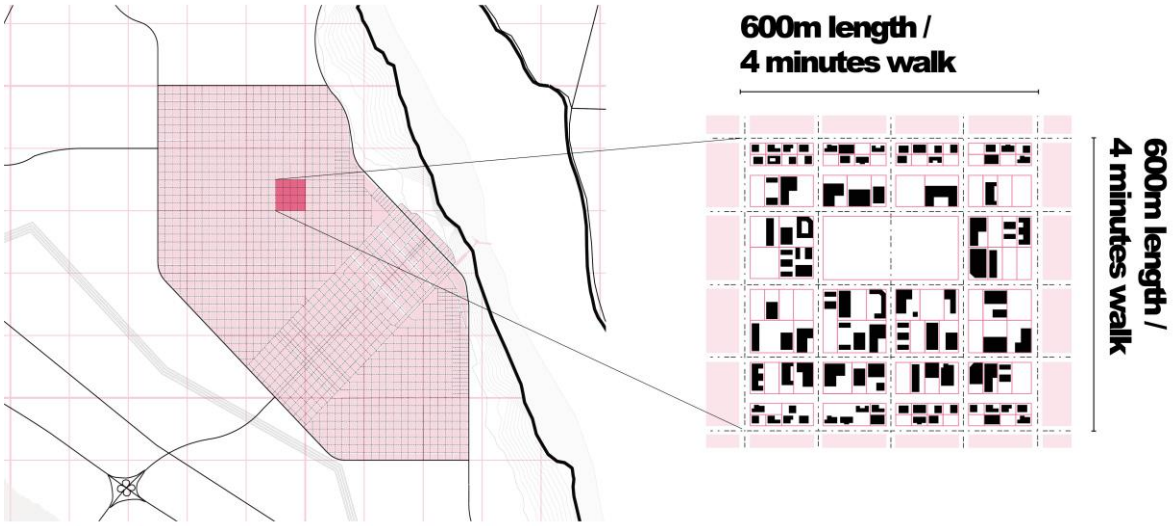


Figure 24 1.2Km x 1.2Km grid (©Fourth Kuwait Master Plan)

Figure 24 demonstrates the small neighbourhood level planning framework at the 600 x 600 meter scale. This scale is generally aligned with comfortable and convenient walking throughout the neighbourhood and to reach transport stops.

Figure 25 150m x 150m grid (©Fourth Kuwait Master Plan)

Figure 25 demonstrates the most granular scale, 150 x 150 meter cell size, which also correlates directly to city blocks. It provides an opportunity to follow the dimensional criteria of the Ordinance, utilizing the cell lines as centrelines of projected future streets. The resulting block size has a perimeter that is generally in the range of +/- 480 meters, or 120 meters on each side. This block size is adaptable, walkable and in line with benchmark cities that are described in section 2.

The series above clearly demonstrates the nested dimensional logic of the system. Whether working from a broad regional strategy at the 6 kilometer scale planning for a small neighbourhood, or even the individual block, the system facilitates consistent planning to ensure that decisions made at one scale do not adversely affect the planning structure at either larger or smaller scales.

4.3. The Analytical Structure

In terms of data analytics and management, the National Ordinance provides a neutral platform to objectively evaluate characteristics and indicators across various scales throughout Kuwait. The scalar structure is parallel to the structure of the spatial planning construct.

For analytical purposes, the same grid that is superimposed over the country for spatial subdivision is also used for data management. All accessible data is incorporated into the GIS database and grid platform upon which the National Ordinance is structured. The data is aggregated and disaggregated at scales from 6 kilometer square cells to 150 meter square cells. The data is then used for analysis and management of development according to the information and outputs required in the processes. This process allows for a much more rigorous analysis of decisions regarding all aspects of the planning and development process, ensuring appropriateness of planning actions.

It is also critical to the parallel system outlined in sections 3.1 and 3.2 that provide a platform for both spatial distribution as well as analytical analysis; management of assets across the country and projections and tracking of future development. Figure 26 below is a projection of the future development in a new town in the northern part of the country (Subiyah). The cells represent both the projected physical structure of the new town as well as the use types and intensity distribution in the initial projections. In this scenario the entire new town is highly connected, but the distribution of

residential, commercial, green spaces and industrial uses are spread throughout the area, indicating nodes of highly intense development and areas of less intense development.

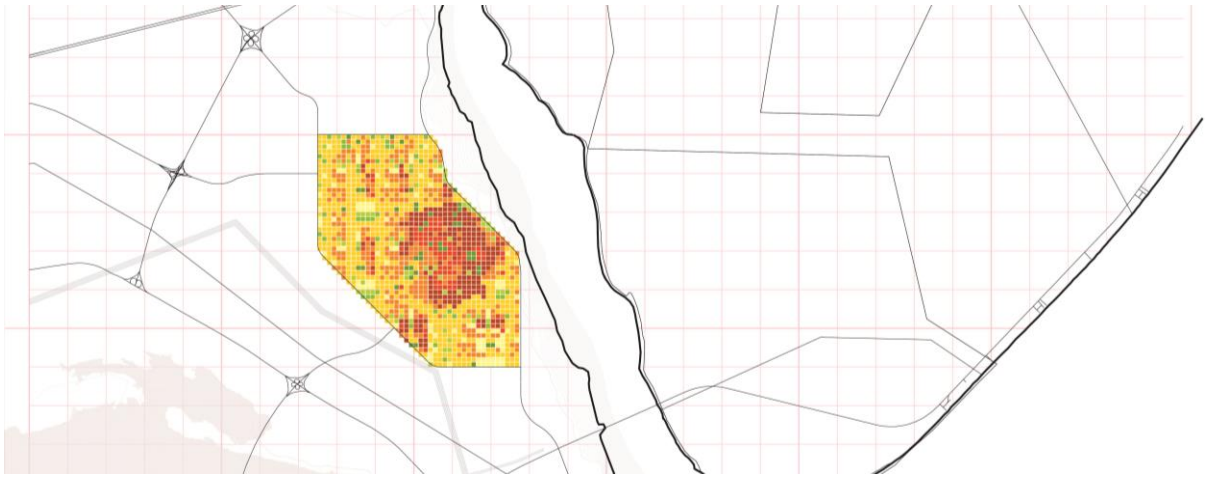


Figure 26 Example of Data Aggregation at Block Scale 150m x 150m (©Fourth Kuwait Master Plan)

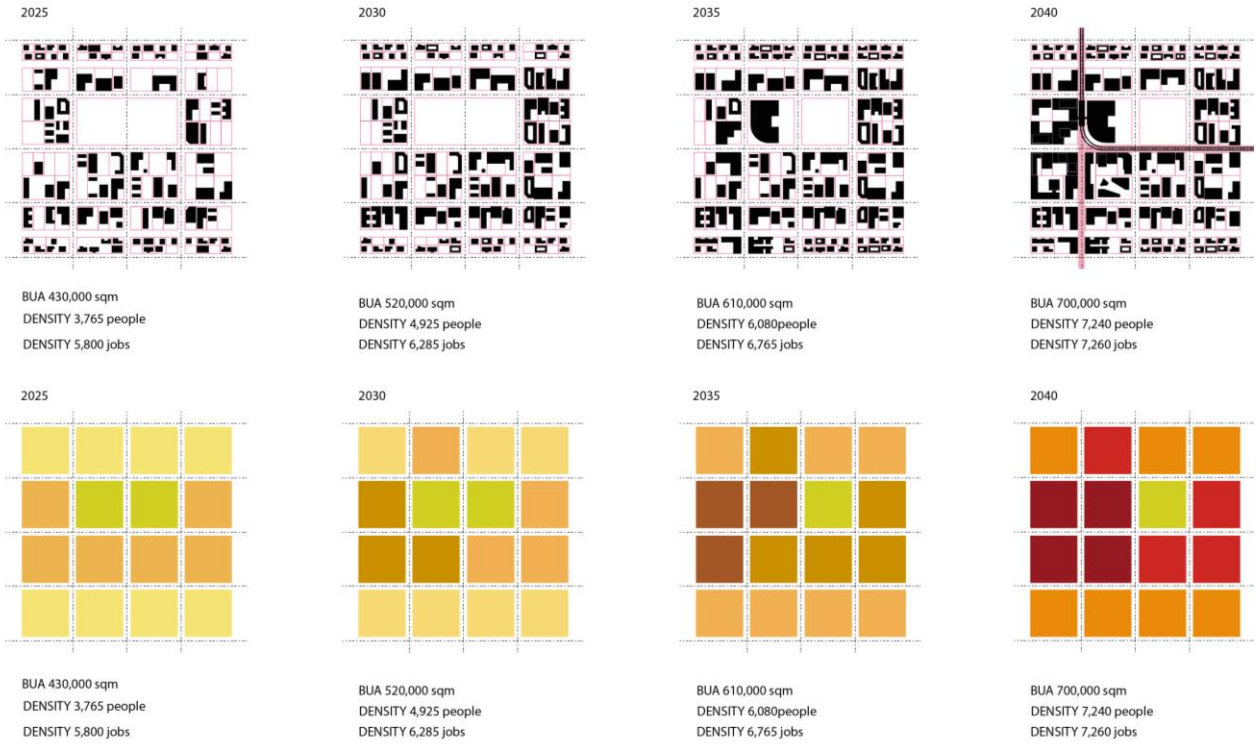
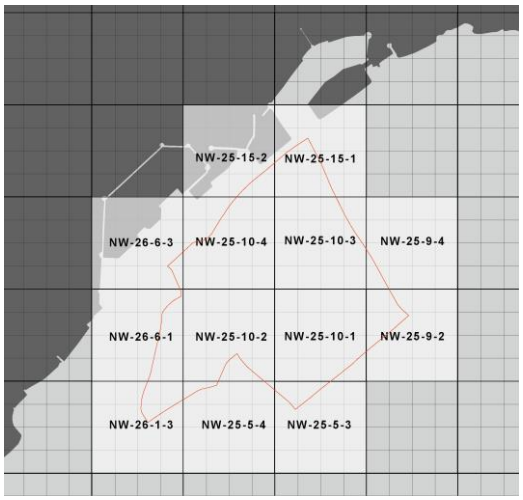


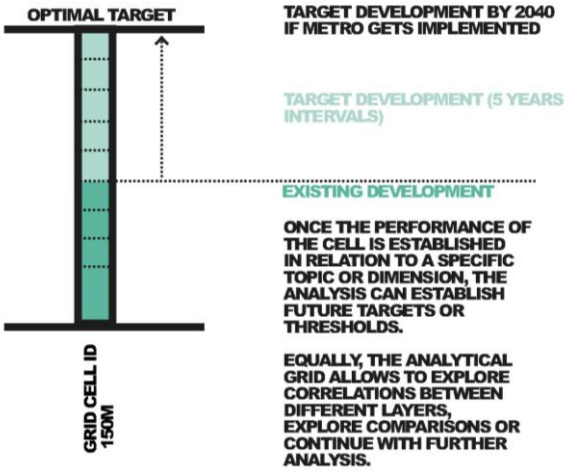
Figure 27 Example of neighbourhood performance and trackability, 5 years interval targets (©Fourth Kuwait Master Plan)

Figure 28 below introduces the format for communicating data around the key indicators for connectivity, although there are also similar formats for economic activity, place development and supporting systems (utilities, legal, resources). The charts provide specific data around modes of transportation, including auto, metro, bus, cycle and pedestrian trips. These data are derived from an existing conditions analysis that sets the current gross number and percentage of trips that can be attributed to each mode. The lower charts show the same information, in matrix format, for each 600 meter x 600 meter cell, or portion of cell that is included within the area boundary. In each cell the current quantum is indicated as a percentage of overall projected, targeted quantum at year 2040.

This demonstrates both the quantum needed to fulfil the projections as well as the relative percent increase across all cells. The intent is to identify those modes of transport, in this case, that require the highest level of additional investment, or those that have otherwise increased in the baseline indicator data. This system works as both a detailed projecting and tracking platform for indicators across all sectors as well as a graphic representation to clarity intensity of existing and projected conditions. It further allows for analysis at both the study area scale as well as across larger municipal or metropolitan areas.

Finally, it provides a system to balance the relative successes and failures to attain targets across sectors and draw correlations between sector projects and initiatives that are tending to drive change consistent with the overall master plan and those that are performing counter to the projections.





2040		NW-25-15-2	NW-25-15-1	NW-26-6-3	NW-25-10-4	NW-25-10-3	NW-25-9-4
MODAL SPLIT	Walking Trips	70	135	28	697	972	34
	Bus Trips	187	361	73	1,857	2,592	92
	Cycle Trips	47	90	18	464	648	23
	Metro Trips	234	451	92	2,322	3,240	115
	Vehicular Trips	1,804	3,474	707	17,877	24,951	883
TOTAL	Total Trips	2,343	4,511	918	23,217	32,404	1,147

NW-25-9-2	NW-25-10-1	NW-25-10-2	NW-26-6-1	NW-26-1-3	NW-25-5-4	NW-25-5-3
111	639	1,058	99	16	7	28
295	1,704	2,821	264	44	20	75
74	426	705	66	11	5	19
369	2,130	3,526	330	55	25	94
2,844	16,401	27,149	2,538	421	190	725
3,694	21,300	35,259	3,296	547	247	941

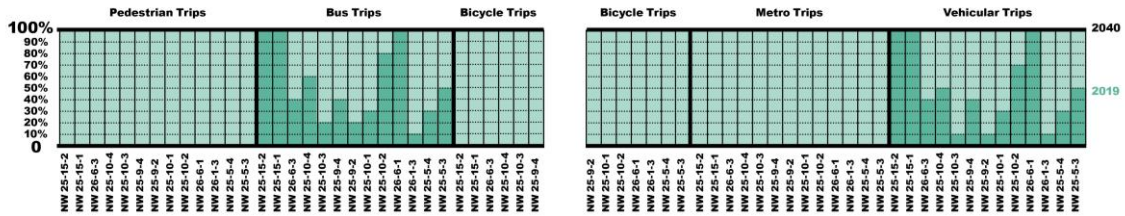
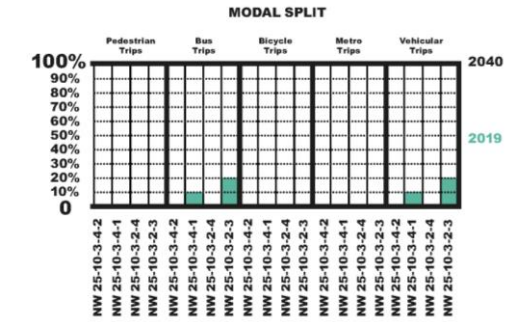


Figure 28 Data and Graphic Indication at 600 meter scale (©Fourth Kuwait Master Plan)

Figures 29-31 below increases the scale of analysis to 150 x 150 meters. The specific area is selected due to the projection of a future metro station which is critical to the overall performance of area and is set up as the key trigger for development in the area. In this scenario, a specific connectivity methodology for identifying metro catchment areas was used to determine the area of impact due to construction of the metro station. This area will have a significantly higher level of both gross trips as well as percentage of metro trips due to its proximity to the station. While the remainder of the Action Area can be evaluated at the broader, 600 meter x 600 meter scale, it is critical to understand a more granular distribution of trips and movements to more accurately plan for the future metro and to manage development in the catchment area to ensure it positively supports the performance of the metro station and broader public transportation system. This area will have the biggest impact and as such should have the highest level of accuracy in analysis. This also demonstrates the capacity of the system to operate at the national and extremely local levels simultaneously.



2019		NW-25-10-3-4-2	NW-25-10-3-4-1	NW-25-10-3-2-4	NW-25-10-3-2-3
MODAL SPLIT	Pedestrian Trips	0	0	0	0
	Bus Trips	24	77	64	71
	Bicycle Trips	0	0	0	0
	Metro Trips	0	0	0	0
	Vehicular Trips	216	696	573	640
TOTAL		240	773	636	711

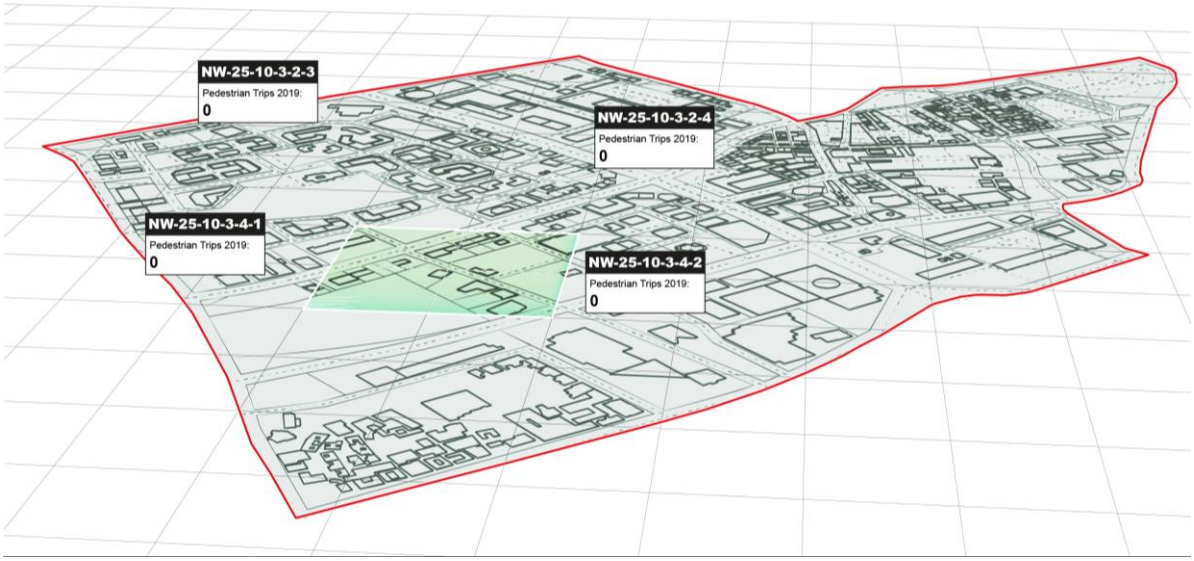
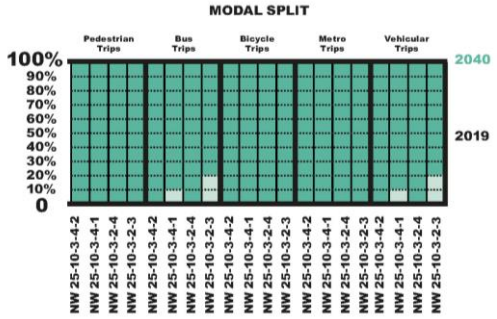


Figure 29 Data and Graphic Indication of Existing Conditions at 150 meter scale (©Fourth Kuwait Master Plan)



2040		NW-25-10-3-4-2	NW-25-10-3-4-1	NW-25-10-3-2-4	NW-25-10-3-2-3
MODAL SPLIT	Pedestrian Trips	100	195	291	93
	Bus Trips	266	519	776	247
	Bicycle Trips	67	130	194	62
	Metro Trips	333	649	969	309
	Vehicular Trips	2,563	4,994	7,464	2,382
TOTAL		3,328	6,486	9,694	3,093

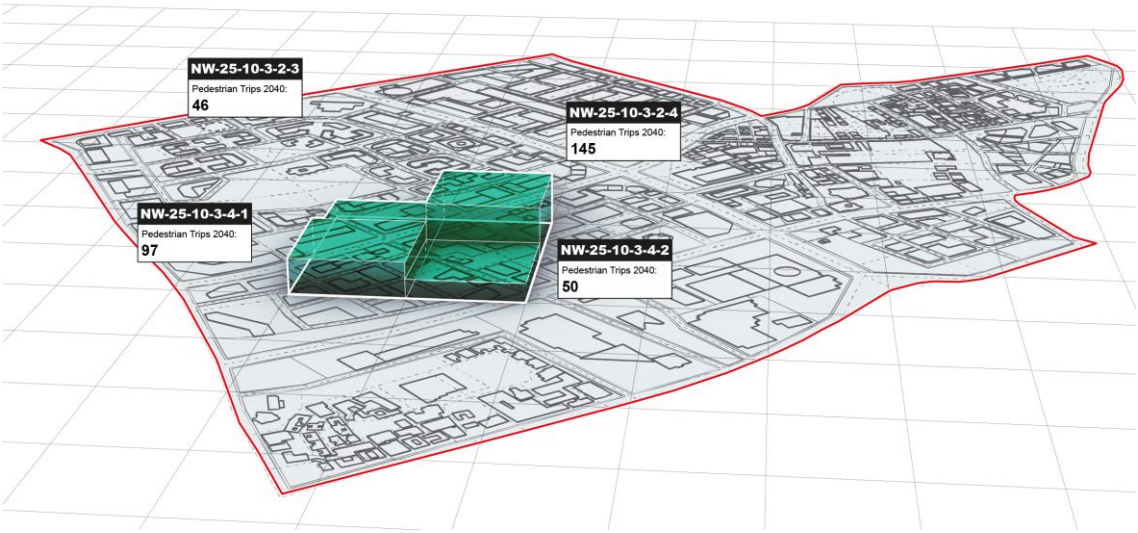


Figure 30 Data and Graphic Indication of Projected Conditions at 150 meter scale (©Fourth Kuwait Master Plan)

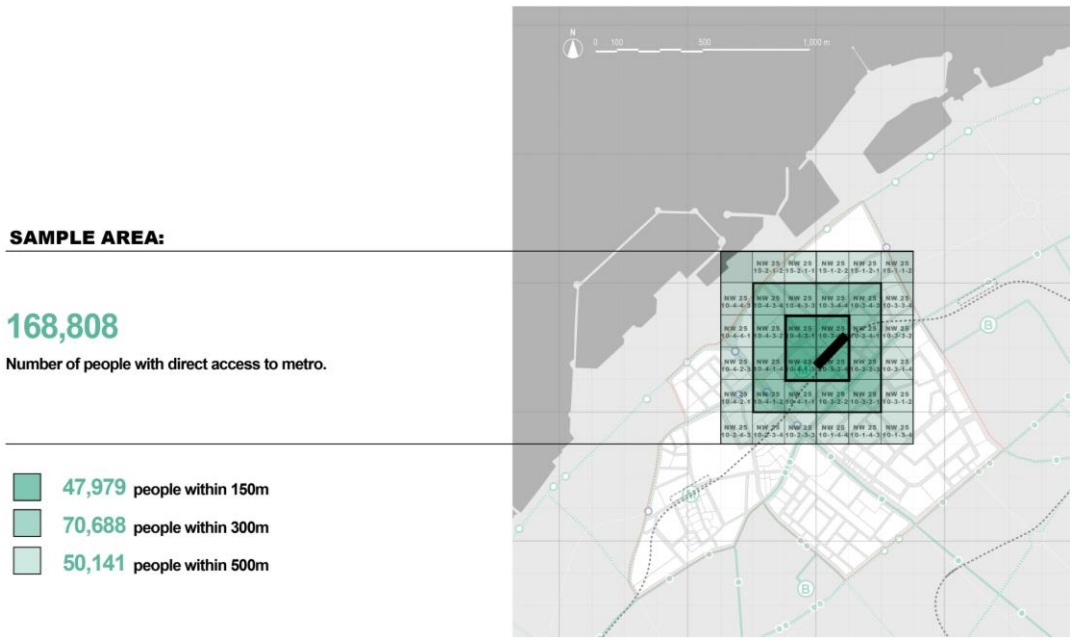


Figure 31 Cellular Distribution Evaluating Increased Development Spread Resulting from Metro Trigger (©Fourth Kuwait Master Plan)

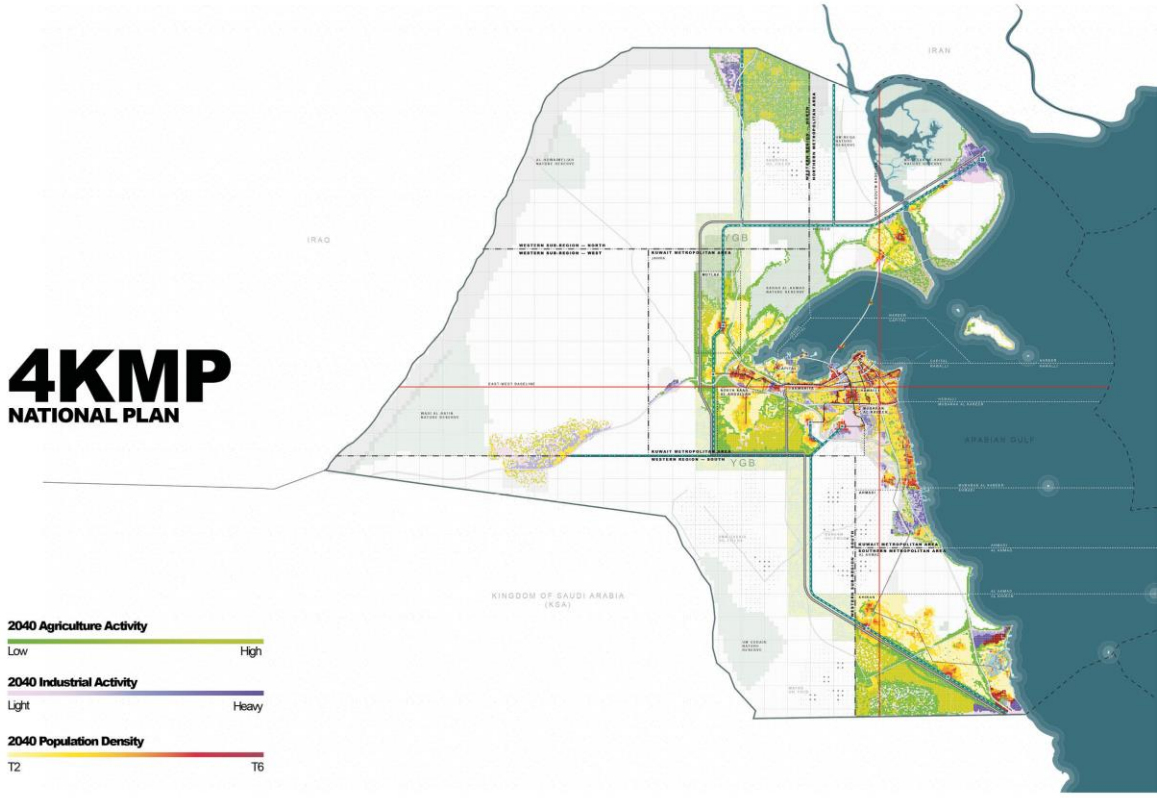


Figure 32 National Plan indicating Geographic location and intensity of uses distributed across the Country (©Fourth Kuwait Master Plan)

5. Conclusion and Next Steps

The world is currently facing challenges that are significantly more complex than at any time in its history. The impact of the decisions that the planning and affiliated professions make in the coming decade have the potential fundamentally alter for the better the current course the planet is following. However, this can only succeed with a shift to a more objective and cross-sectoral planning and analysis process. Effects of these decisions on climate change, public health, resource management, and myriad other elements of human inhabitation must be considered within a balanced and interrelated platform. Planning must move closer to the dispassionate practices of the scientific community.

The research and work demonstrated above is represents a significant move in this direction. The underlying analytical and spatial platforms are agnostic towards outcomes and supportive of a rigorous methodology in determining existing conditions and resultant projections stemming from future targets, themselves derived through a deep analytical process.

Further, the platform provides an opportunity to move beyond static regulatory practices and implement a much more progressive, adaptable and updatable system that is highly responsive to changes occurring across all sectors. The notion that a master plan, or more accurately, a comprehensive plan, should be a static document and set of regulations is no longer tenable. Looking to guidance from twenty or thirty

years, or even longer, ago will not provide planners today with the information required to make necessary and accurate decisions.

Figure 32 above represents the balanced spatial and analytical information and projections for an entire country, as is most beneficial at the current time. However, built into this plan is the necessity for modifying the projections as new information emerges.

As we plan for the future of the planet, and the cities we inhabit, one thing is certain. In the coming decades much of the information we have, and the decisions based on that information, will be found to be inaccurate. The Fourth Kuwait Master Plan demonstrates a clear path to addressing this circumstance and providing direction for future planning and development.

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