Case Study Paper

HEALTH DISTRICTS

Creating healthy cities

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Abstract

This paper addresses trends in research related to health in urban environments. It is focused on how regulations control development and the resulting public health outcomes. Regulations significantly impact public health and as such there should be legal and scientific mechanisms to monitor the efficacy of adopted regulations.

Cities are critical to the efficient operation of society. Beyond just issues of quality of life, they are large consumers of natural resources. There is a growing concern that the form of cities may have a profound effect on public health: chronic diseases related to obesity, heart disease, and asthma, among many others. But in general, governments are making decisions about their development in the absence of critical data and analysis that provides direction for these actions. There is a clear need to establish research that provides a scientific basis for rationalizing city planning and urban design. This is an opportunity to use the protocols driving research to inform the methodology of urban and city design.

An internationally supported system of testing and evaluation protocols, both for proposed regulations and adopted regulations, is still absent from planning and urban design processes. Jurisdictions continue to rely on theory and precedents alone when adopting new regulations. Because of the significant impact that the built environment has on the health, safety and well-being of the general population, it seems logical that the profession would adopt scientific research protocols.

In addition, this paper will examine several specific cases across the globe, regulated and designed by a diverse group of professionals, that articulate the issues outlined above and provide methodologies to frame a scientific method for planning and urban design at a consistent, international level.

Keywords

public health, development regulations, health, safety, welfare, zoning,

1. Introduction

1.1. Analytical Rigor

We have, for the past eighty years, used a quasi-scientific set of criteria to direct and regulate the design and construction of our cities and districts towns and suburbs. From the very beginning, pseudo-scientific measures formed the foundation of the professional planning movement. In this process, however, the rigors of basic research and scientific methods have been remarkably absent in reflection on the efficacy of planning's impact on the built environment. Abstract planning principles are translated into operational regulations without a basic protocol for testing, evaluating, and modifying assumptions based on the results of evidence. The reticence of the profession to test and evaluate is further complicated by the fact that planning is ultimately implemented through a series of legal documents – regulations. Once adopted, regulations are notoriously difficult to change, both due to the precedential nature of the legal system itself and the seemingly inherent credibility bestowed upon regulation by virtue of its own adoption.

At its core, the planning profession is charged with creating rules and guidelines for the development of urban and suburban places through constitutional police powers: to provide for the health, safety and welfare of the general public. Ultimately, effectiveness of planning means, such as zoning, can and should be measured. For example, Justice George Sutherland states that plans and their regulations must "expand or contract to meet the new and different conditions which are constantly coming within the field of their operation" in the seminal Supreme Court case, Village of Euclid, Ohio v. Ambler Realty Co. (Village of Euclid, Ohio v. Ambler Realty CO, 1926). He went on to say that, "in a changing world it is impossible that it should be otherwise." What Sutherland knew as a fact, and the planning profession seems unwilling to address, is that planning is only as good as its ability to positively affect the health, safety and welfare of the people in places it impacts. And, if our impacts are not positive, we are obligated by the law to improve our regulations.

The creation of an internationally supported system of testing and evaluation protocols, both for proposed regulations and adopted regulations, is still absent from planning and urban design processes. Jurisdictions continue to rely on theory and precedents alone when adopting new regulations. Because of the significant impact that the built environment has on the health, safety and well-being of the general population, it seems logical that the profession would adopt scientific research protocols. To avoid doing this would be analogous to the pharmaceutical industry, in the absence of the Food and Drug Administration, releasing new drugs to the public without trials and then turning a blind eye to potentially negative outcomes.

2. Regulations

2.1. The Birth of Regulations

The impetus for regulating the built environment came from conditions that we can hardly imagine today. In the second half of the nineteenth century, people were living in conditions that were extremely unhealthy. For example, extreme population density grew in the Tenth Ward of lower Manhattan without infrastructural support – population densities were as high as 1000+ people per acre, or roughly 50 times the density of Manhattan today. (Allen, 2010) Most of this population lived in tenement houses with little natural light, open pit latrines, and no air circulation. With the publication of books such as Jacob Riis's "How the Other Half Lives,' the public began demanding reform through regulation and local jurisdictions responded. (Riis, 1970) One of the most important steps forward was New York State's adoption of the 1901 Tenement House Act. Figure 1 illustrates the impact of regulations as demonstrated by the evolution of houses themselves. The Tenement House Act served to open living quarters to light and air, and set the conditions for healthier living environments.

While the 1901 Tenement House Act is representative of the changes that were affecting individual building form and execution, it was with the adoption of the 1916 Building Zone Resolution of the City of New York that the role of regulations addressed what is commonly understood as zoning. The catalyst for this action was the completion of the Equitable Building in the financial district of the city. The building was reputed to cast a seven-acre shadow across the district at certain times of the day and year, with significant detrimental effect upon those other buildings in the affected area, and upon the general health and welfare of residents and office workers in the district. As a response, the city of New York adopted the Building Zone Resolution. The resolution provided for a number of requirements, including the zoning of the city into areas for residential, commercial and unrestricted uses, the requirements of yards for light and air, and restrictions on the height and form of buildings to ensure natural light and air for the district in general, not solely for the individuals occupying the buildings. The regulation had a significant impact on the quality of the city as demonstrated in Figure 2, the height and setback requirements for buildings permitted under the new resolution. Further, the regulations were easily tested and evaluated to determine the efficacy of their providing more light and air into the city streets and parks. (Building Zone Resolution, 1916)

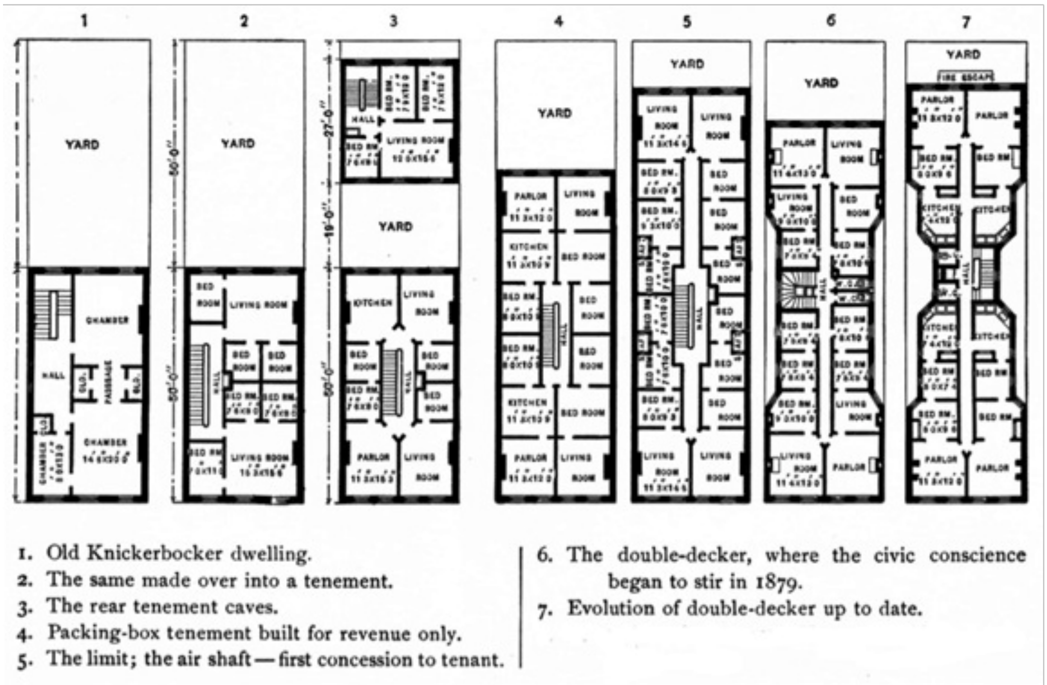

Figure 1 Tenement Transformation

Figure 1 above shows the evolution of the Knickerbocker tenement house type leading up to the 1901 Act and subsequent to the Act. The transformation from 5 to 6 demonstrates the direct, positive effect the Act had on the living conditions of the residents; in this case, the diagram illustrates shafts for natural light and air included on sidewalls between the buildings, which were lined up in rows.

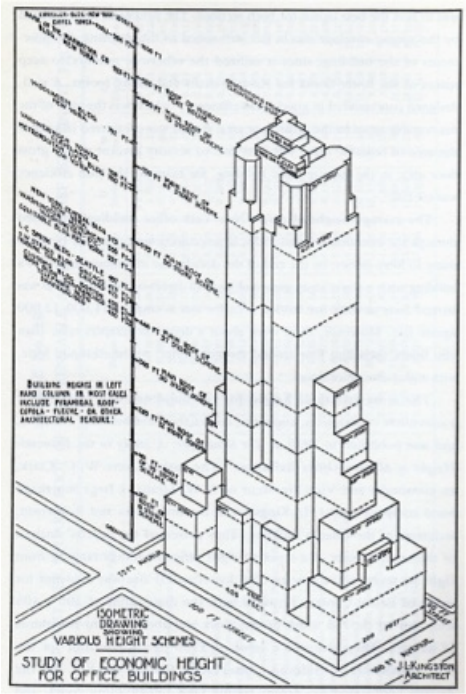

Figure 2 Diagram, 1916 Building Zone Resolution

Figure 2 above demonstrates the logic and application of new building design from the 1916 Building Zone Resolution. It specifically describes the setback requirements for new buildings to ensure light and air reaches the streets below. (Building Zone Resolution, 1916)

This original ordinance was updated and modified thousands of times over the course of 45 years until the 1961 Zoning Resolution superseded it. The adoption of this ordinance signaled the acceptance of a radically transformed understanding of the way regulations operated. Instead of relying on simple, straightforward guidelines that were easily tested, the newly adopted regulations were much more reliant on formula-driven criteria for development. This transformation created a scenario in which it was almost impossible to project the physical outcome resulting from the regulations because each project was easily manipulated based on local and site-specific conditions. This is demonstrated in Figure 3, a seemingly simple calculation to determine building massing and spacing that opened the process to infinite possible results, most of which led to unintended consequences such as degradation of the surrounding public space in terms of light and ventilation at the street level. In addition, there was almost no incremental testing of the proposal to ensure that it would garner the desired results and that those results would meet the constitutional guarantees of health, safety and welfare. While the specifics of the 1961 Resolution were not copied verbatim into other ordinances across the country, the logic of regulating the development of cities and towns and suburbs was predicated on this Resolution almost universally. The following section demonstrates two very specific regulations that were adopted, generally, throughout the country without testing and evaluation, and the impact they have had and continue to have on the built environment. (1961 Zoning Resolution, 1961)

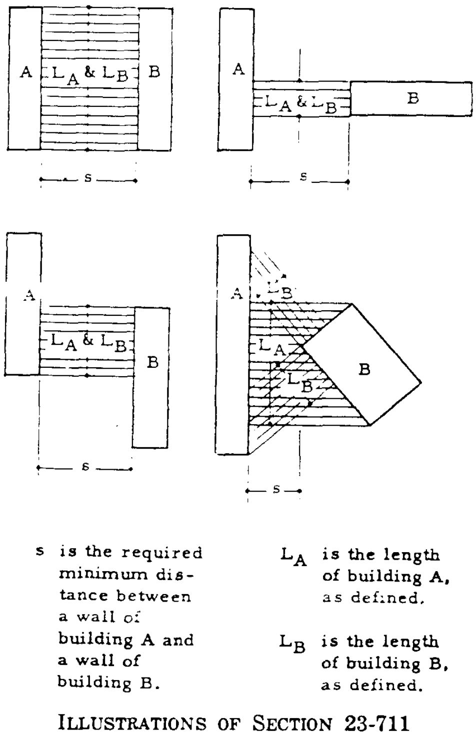

Figure 3 Diagram, 1961 Zoning Resolution

Figure above illustrates the fundamental change with the adoption of the 1961 Zoning Resolution. It describes the calculations for meeting building spacing requirements. (1961 Zoning Resolution, 1961)

The 1961 Zoning Resolution had profound impacts on the way we plan and construct cities. At the time, none of the assumptions upon which the new Resolution was based were tested; not prior to the adoption of the new code, nor after its adoption.

The impact this and other regulations had on the built environment and ultimately on public health can be demonstrated through numerous examples, two of which are outlined below.

2.2. Regulating Local Streets

In the seminal United States zoning case, Euclid v. Ambler, the core issue before the court was the question of protection of single-family neighborhoods. The case was brought to the court in a time, the 1920's, when questions of appropriate uses in these neighborhoods were critical. It was not uncommon to find toxic uses, such as rendering plants, slaughterhouses and tanneries, interspersed with people's dwellings. At the time of the case, there was a clear need to separate these extremely unhealthy operations from the districts where families lived. (Village of Euclid, Ohio v. Ambler Realty CO, 1926) Over the course of subsequent decades, however, the protection of single-family neighborhoods expanded greatly. This is demonstrated in a number of regulations adopted, especially through the 1950s, that include minimum lot sizes for single-family homes, and extreme restrictions on corner groceries, neighborhood restaurants and other uses that had historically been a part of the rich mixture of a healthy neighborhood. While there are many examples of regulations that were adopted that have, and continue to have, negative impacts on the health, safety and welfare of the general public, there are some that stand out especially as clearly demonstrating the need for scientific study to determine the true impact they have. Further, they demonstrate the legal implication of the enactment of such regulations.

A specific example of this can be found in the subdivision ordinance adopted by the City of Atlanta in 1957. It included, as did many other ordinances adopted throughout the country at the time, a seemingly simple, clear and intelligent requirement that cut-through traffic (traffic moving through a particular geographic area with no intention of stopping in that area) should be minimized, or if possible, eliminated from single-family developments. The statement, "Local streets shall be so laid out that their use by through traffic will be discouraged," was a prominent element of the Atlanta Ordinance. (Part 15 Subdivision Regulations, 1957) The requirement has led to a very particular development pattern as demonstrated in Figure 4. Individual suburbs are designed and developed in such a way that there is absolutely no connectivity between the subject development and other contiguous or proximate developments (residential or commercial). This seemingly benign requirement has had enormous impact on the lives of the inhabitants of the communities developed under this ordinance.

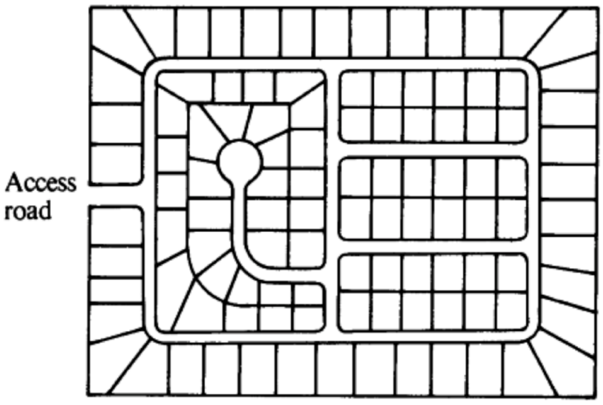

Figure 4 Diagram, Typical Street Pattern

When this ordinance was originally adopted, it was not tested or evaluated, and so no determination could be made about its ability to actually provide a healthy and safe environment for its occupants. Today there is mounting evidence that instead of being a healthy and safe development strategy, it is actually causing unhealthy and unsafe results for the inhabitants of the areas developed under the regulation. (Ewing, R., et al, 2003) Certainly further investigation is warranted to expand and verify the initial research, but this expanded research is extremely slow in coming. As with all regulations and laws, changing these ordinances is extraordinarily difficult.

It is here, in the evaluation of regulations, that the practice of following a scientifically dictated protocol for research would prove beneficial. If basic research provided the data and subsequent interpretation to correlate a regulation with specific health or safety issues, including obesity, asthma, heart disease, pedestrian and vehicular deaths and injuries, elevated crime rates, or even long-term house values (an issue of welfare), the professionals charged with creating and adopting such regulations would have much greater certainty that they were creating healthier, safer and more economically vibrant developments, and they would be fulfilling their professional obligation to ensure the constitutional guarantees upon which Justice Sutherland based the ruling that made the regulations constitutional in the first place. Further, from a legal standpoint, it would be much easier to modify existing regulations if there was compelling scientific research to back up the proposed modifications.

2.3. Regulating Block Size

Current research indicates that walking provides health benefits; that areas of cities with more pedestrians (people walking) are safer; (Ozbil, A., et al, 2015) and that areas of cities with more pedestrian traffic, particularly commercial, are more economically robust. (Boarnet, M. G., et. al, 2008) (Litman, T. A., 2017) As with most current information regarding cities, towns and suburbs, and the efficiency of their operation, more research is needed to understand correlations between walking and urban planning. But taking the premise that more people walking in cities promotes the health, safety and welfare of the general population, current regulations can be evaluated based on their efficiency in producing developments that are conducive to pedestrian activity.

Throughout the United States, the single most difficult element to incorporate into new development, redevelopment, and other forms of modifications to a jurisdiction's physical layout is the creation of new streets. This difficulty stems from several issues: maintenance costs borne by the jurisdiction, a pre-conceived notion that more streets are less environmentally beneficial, and, as demonstrated in Section 2.0, a general belief that more streets lead to more traffic. Each of these issues demands additional research, but it is extremely difficult to replicate the highly connected street systems of cities and towns constructed in the pre-regulatory era. In this specific case we are focusing on expanding pedestrian activity, and the effect the street system and the regulations that drive street locations have on the efficacy of providing pedestrian activity.

Figure 5 Block Dimensions New York, Crosstown and Uptown

As a basis for researching the correlation between street layout and pedestrian activity, the first step is to identify areas that seem to promote pedestrian activity and those that seem to suppress it. An example of the former is New York, arguably one of the most pedestrian cities in the world. In New York, specifically Manhattan, the streets are highly connected, with resulting block sizes of 200 feet in the north-south direction, and block sizes generally between 500 and 800 feet in the east-west direction. In this system, there appears to be a correlation between the size of the block face and the level of comfort in walking similar distances. As demonstrated in Figure 5, a walk in the north south direction of 10 blocks is perceptually different from a walk in the east-west direction of the same distance. This begins to identify the possibility that the physical distribution of streets has a direct effect on the comfort of the pedestrian, and further on the efficacy of the system to produce the desired result, more pedestrian activity. It is generally perceived to be easier to walk the half-mile uptown than the same half-mile crosstown. A similar observation was made by Jane Jacobs in her book *The Death and Life of Great American Cities*, in which she advocated for the use of short blocks to increase the number of potential route choices for pedestrians and to avoid monotonous streets. (Jacobs, 1961)

The research on block dimensions and its correlation to a supportive system for pedestrian activity is not the end, however. It is merely an analytical method for providing cities with the tools to create more energy-efficient and healthier overall systems. The increased number of people who walk due to myriad factors will have a direct impact, we assume, on the reduced use of fossil fuels for automobiles. It should also create a more efficient overall system for distribution of utilities and a more resilient infrastructure layout, which minimizes rebuilding when single buildings are reconstructed or newly constructed. In addition, increased walking should correlate, again, we assume, to decreased numbers of health problems such as early onset diabetes, heart disease and asthma. However, the basic research to prove or disprove this is currently almost nonexistent. Cities are, in aggregate, among the largest users of energy, and home to the greatest number of people, yet the national planning community and the funded research within which it is engaged, is minimal. There is a clear need for an increase in research in these areas.

The physical layout and efficiency of the pedestrian system in this case is tied directly to the original regulation that dictated where and how streets would be laid out as Manhattan developed. In this case, it was the Commissioners' Plan of 1811, a survey and plan that identified the location of streets as the city grew. The power of the regulation in this case was in the certainty of the outcome, and, in retrospect, the value of the plan for producing (or allowing) significant pedestrian activity. (Bridges, 1811)

Throughout the twentieth century, however, the methodology for the laying out of streets changed radically. As indicated in Example 1, connected streets were discouraged or prohibited. (Part 15 Subdivision Regulations, 1957) (Ozbil et al, 2011) (Peponis et al, 2008) (Peponis et al, 1997) (Peponis et al, 1998) (Christova et al, 2012) Further, streets were no longer identified in a specific plan, which might guarantee short block faces and highly connected system, but instead were placed project-by-project based on capacities of individual projects and the demands those projects would place on the vehicular efficiency of the system. The resulting pattern of development is indicated in Figure 6. It clearly shows the physical implications of the regulations, including limited intervening public streets, expanded parking requirements, and significant building setbacks, among other requirements that led to the disappearance of the connected system of pre-regulatory cities. The outcome of these regulations is development patterns that deter inhabitants from walking. There appears to be a direct correlation between the sizes of blocks (or the frequency of streets) and the level of pedestrian activity. This is further indication of the need for a rigorous research platform for the investigation of these issues.

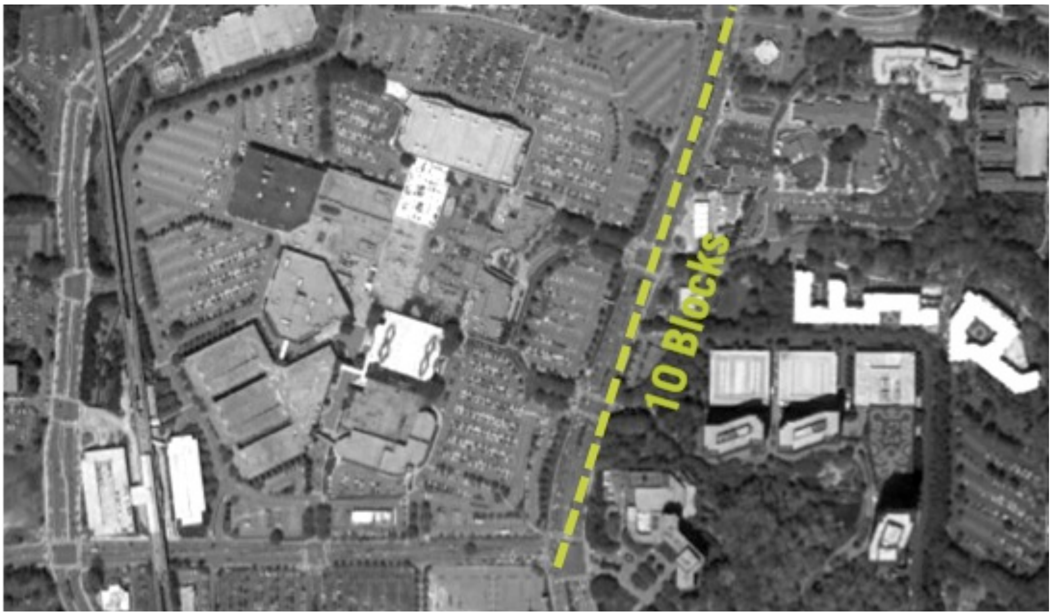

Figure 6 Block Dimensions Suburban Atlanta, Perimeter Center

2.4. Correlation Between Regulations and Development Patterns

The first trajectory is exemplified through a simple analysis of the relationship between regulations in place and block sizes. Assuming the hypothesis offered in the previous section that "walking provides health benefits" is accurate, then what was the correlation between regulations in place and the resulting block sizes, and by extension frequency of streets? Figure 7 below indicates the results of a cursory investigation into the relationship between the existence of subdivision regulations and the size of blocks. In this statistically limited sampling, the data suggests that there is potentially a significant correlation between the mere presence of a regulation and the efficacy of creating small, consistent block sizes.

The conclusion derived from this limited investigation is that there is an inverse correlation between the degree to which regulations are implemented and the efficiency of creating consistency; the stated goal of the regulation. If this is verified through further research, it implies that the regulations adopted to provide for health, safety and welfare are resulting in development patterns that are inconsistent with the goals of the regulations.

Looking more closely at a sub-set of projects, we can start to see how recent design and planning work compares to these more broad findings. A look at over 50 projects completed around the world within the last 10 years demonstrates that, despite the best intentions of the designers, the average block size for these modern district and campus plans is even larger the post-1928 block size, at 7.71 acres. When only research district projects are taken into account, the average block size is similar, at 7.59 acres (Table 1). This could be the result of the traditional "buildings in a park" typology, only recently falling out of favor for a more urban format, or it could be influenced by something else entirely. Without a rigorous analysis process it is very difficult to understand the causes and effects of design decisions.

This early work supports the proposal that there should be regional, and even national, systems in place to track these issues. The computing power and much of the data already exists, but the planning profession is slow in making moves to identify critical data that would form the foundation for a more rigorous and directed national research agenda. (Allen, 2010)

Observation 2: the standard deviation of average block size in the following selected cities has increased from .79 to 6.14 from pre-1928 subdivision to post -1928 subdivision.

	Pre 1928 Block Size					Post 1928 Block Size		
		avg.	max				avg	max
		acres	acres				acres	acres
1	Atlanta, GA	3.70	8.26		1	Atlanta, GA	22.87	44.49
2	Boston, MA	3.09	4.13		2	Boston, MA	9.45	14.46
3	Baltimore, Md	3.29	5.78		3	Baltimore, Md	14.93	22.72
4	Charleston, S.C.	4.12	6.07		4	Charleston, S.C.	16.89	25.25
5	Chicago, Illinois	3.51	4.96		5	Chicago, Illinois	14.74	19.10
6	Los Angeles, CA	4.41	7.89		6	Los Angeles, CA	8.01	16.08
7	New York, N.Y. (Manhattan)	2.60	3.67		7	New York, N.Y. (Manhattan)	7.72	13.31
8	Omaha, Nebraska	4.34	8.26		8	Omaha, Nebraska	8.27	13.42
9	Portland, Oregon	1.92	3.72		9	Portland, Oregon	2.69	4.24
10	Philadelphia, Pennsylvania	3.07	6.33		10	Philadelphia, Pennsylvania	5.03	5.88
	Average	3.41	5.91				11.06	17.90
	Median	3.40	5.93				8.86	15.27
	Std. Dev	0.79	1.80				6.14	11.42

Figure 7 Statistical analysis provided by Douglas Allen, Georgia Tech. (Allen, 2010)

2.5. Tracking and Projecting Data

Once we begin to understand the interaction of regulations and development historically, the next step is applying this knowledge to current and future projects and places. To do this involves first developing a method of recording baseline data for such projects. Perkins+Will have recently undertaken such a program for all of their urban design-scale projects. The program, called PlanMetrics, lays out 9 key metrics captured for each project greater than 5 acres. The associated data (figure 8) is then collected, compared, contrasted, and subjected to further inquiry.

The database grows as more projects are completed. In this way, Perkins+Will have begun a system of testing whether or not their own projects meet their stated intent, both defined by the clients, planners, and designers involved, but also by the regulatory context in which they are created. Data collected and referenced in Table 1 includes project area, right of way area, total public blocks, and number of intersections, for example, along with other vital statistics. With more advanced analysis, information such percentage of park area or intersection density, can be recorded and compared. An example of this level of analysis on both a single project, as well as cross multiple projects, can be seen in figures 9 and 10.

D	E	F	G	H	I	J	K	L
Project Are	Total Block Are	Total RoW Are	Total Public Block Are	Total Roadway Are	Total Building Are	Total Length of Centerline	Total Number of Intersection	Total Number of Block
7546.22	5575.18	1971.03	2092.53	1795.51	1101.17	241.61	1813	1277
4061.10	3755.87	305.22	76.95	229.17	712.70	34.61	87	70
3343.48	2610.57	732.91	0.00	345.92	331.34	40.57	146	120
3301.89	2905.78	396.11	1286.77	287.70	374.04	89.66	211	105
1161.64	1011.92	149.72	660.41	107.42	154.42	40.34	505	359
1007.92	587.74	420.18	308.63	255.06	187.45	26.38	83	73
879.00	536.00	343.01	45.00	75.00	123.01	16.60	86	78
876.78	669.70	207.08	206.88	103.59	889.11	6.37	42	34
840.01	719.99	119.99	418.99	46.01	48.41	12.40	77	82
782.71	612.80	169.91	10.16	132.62	242.24	21.56	103	89
659.99	254.30	405.70	52.19	349.51	156.59	12.90	94	77
636.27	484.38	151.90	187.11	123.21	58.61	14.63	71	167
617.71	518.60	99.11	232.35	75.91	125.38	17.85	144	96

Figure 8 Sample Project Datasets from PlanMetrics

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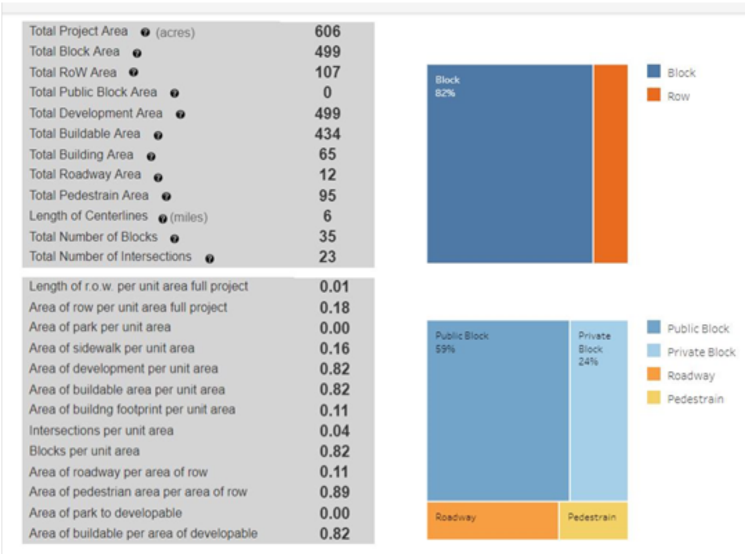
This method is not limited to Perkins+Will projects – any district, neighborhood, city, or region around the world can be analyzed using the same method of metric collection, thereby establishing a comparable set of baseline information for projects that are anecdotally deemed “successful” or “unsuccessful.”



Total Project Area (acres)	606
Total Block Area	499
Total RoW Area	107
Total Public Block Area	0
Total Development Area	499
Total Buildable Area	434
Total Building Area	65
Total Roadway Area	12
Total Pedestrain Area	95
Length of Centerlines (miles)	6
Total Number of Blocks	35
Total Number of Intersections	23
Length of r.o.w. per unit area full project	0.01
Area of row per unit area full project	0.18
Area of park per unit area	0.00
Area of sidewalk per unit area	0.16
Area of development per unit area	0.82
Area of buildable area per unit area	0.82
Area of buildng footprint per unit area	0.11
Intersections per unit area	0.04
Blocks per unit area	0.82
Area of roadway per area of row	0.11
Area of pedestrian area per area of row	0.89
Area of park to developable	0.00
Area of buildable per area of developable	0.82

Figure 9 Sample Project Analysis from PlanMetrics

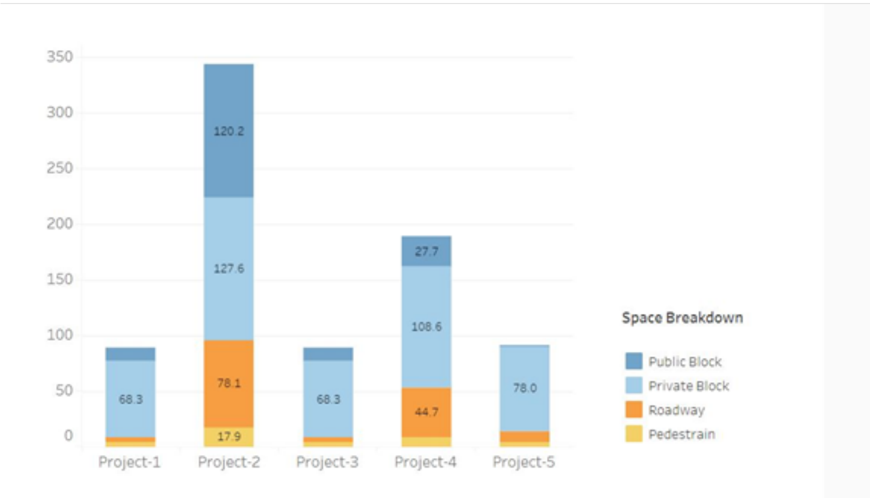


Figure 10 Project Analysis from PlanMetrics

One particular project type that lends itself to this analysis method is the research environment. Often owned (or at least operated) by a single entity, these projects are complex districts with multiple building types, public (or publicly accessible) streets and open spaces, and often their own set of governing regulations. Increasingly, research environments are districts integrated seamlessly into the larger city and thus have many of the same opportunities and challenges as the neighborhoods outlined in previous sections. Beyond the practical advantages, these places of research should be laboratories for understanding the impacts of the design standards and regulations that create them.

An example of this approach of collecting baseline data and projecting project performance is the infrastructure plan for Innovation Square in Gainesville, Florida (figure 11). The research and innovation district is located at the heart of downtown Gainesville, and is owned and operated by the University of Florida. This complex interaction of municipal and institutional interests led to challenges in project coordination, but also interesting opportunities for learning from the project. A key concern for the stakeholder group was understanding the potential for energy efficiency onsite, as well as coordinating a complex system of utilities and public realm features. First, the team developed a coordinated strategy for they physical layout of utility infrastructure based on project goals as well as site constraints. An analysis of baseline and efficient utility use in comparable buildings was then performed to create a framework of understanding for project performance (figures 12-13). While not directly related to testing of regulations per se, this example serves as a powerful precedent of a methodology to test potential impacts of design and policy decisions before final construction has taken place.

3. Case Study One

3.1. Innovation Square

One particular project type that lends itself to this analysis method is the research environment. Often owned (or at least operated) by a single entity, these projects are complex districts with multiple building types, public (or publicly accessible) streets and open spaces, and often their own set of governing regulations. Increasingly, research environments are districts integrated seamlessly into the larger city and thus have many of the same opportunities and challenges as the neighborhoods outlined in previous sections. Beyond the practical advantages, these places of research should be laboratories for understanding the impacts of the design standards and regulations that create them.

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From this, the project team created a system for projecting energy use based on various options, in this case both block-by-block, and by different phasing scenarios. The resulting dashboard compares these potential build-out scenarios to conventional and energy-efficient baselines, as well as the various options to each other. (Figures 14-16)

By projecting and analyzing this information in context (Figures 11-13) the project team was able to make better decisions about the balance of building types and the importance of an energy efficient scenario based on actual data, rather than intuition or standard practice.

In this situation, the scenarios tested were independent from regulation, and were limited to shifts in the balance of building typologies. However, the process of defining success, testing scenarios, and ultimately adapting design and policy based on observed outcomes in this smaller controlled environment demonstrates one potential method for developing similar tools to evaluate these and other metrics as a more comprehensive research protocol evolves.

The proactive approach to understanding utility capacity led to a unique investment model specific to this site, based on the evidence provided by rigorous analysis of the various options and the resulting detailed understanding of the preferred design scenario. Scaled up, this type of approach has the potential to influence our understanding and thus design of many aspects of research environments that we currently take for granted, as well as district and neighborhood planning and design more broadly.

4. Conclusion

4.1. Future Research Plan

Moving forward it will be key to incorporate lessons learned from the methods outlined above into a comprehensive research strategy. The approach of such a strategy should be three-fold: first, no progress can be made until there is a consistent and reliable way to gather and record data about existing and planned places. A well-defined but simple data set should be the base for informed decision-making. Second, for both society and the profession, there needs to be further study into what constitutes "success" in the various aspects of the built environment. This can include health, safety, comfort, energy consumption, and any number of other metrics which have value for the lives of people in cities and towns. Data without a contextual metric is essentially meaningless. Finally, to fully capture the power of the data, tools and systems for projecting impacts of planned designs and regulatory changes, as well as tracking progress in real time after they are realized, are crucial to verifying hypotheses about "success." In this way a system of trial and adjustment can be created to ensure that regulations are indeed having the impact they are intended. To this end, regularizing a key set of questions about the performance of place in relation to the regulations that shaped that place is imperative in creating better laws and guidelines. While there may not yet be a mechanism for a national or international research program, individual jurisdictions and the designers and planners who work with them can begin to ask these questions and build the database that will eventually inform a larger conversation, as well as adopt and further develop tools such as those presented in Section 3. The more data that is collected and shared, the easier it will be to make the case for more universal participation in research activities, as well as changes to law and regulations that shape our physical environment.

4.2. Concluding Remarks

This paper examined the current and future trends in research as it pertains to city planning and urban design. It is intended to demonstrate the need to reconsider the methodology used in planning cities, towns, districts, and suburbs. There is a significant lack of scientific rigor in the research protocols, and further a lack of research in general, in these arenas. The paper poses questions and identifies potential fundamental problems with the current system, and further identifies the need for support for these efforts.

Regulations drive the pattern of development almost to the exclusion of all other influences. They are legally binding and not easily susceptible to change. However, the method through which current and future regulations, and the environment in which they are created, can change is through the implementation of stringent protocols for basic research. The built environment affects our health, safety and welfare, and the rigor with which we investigate the effects on the public should be commensurate with those efforts.

Many of the questions that need to be addressed such as the relationship between urban form, pedestrian movement, and public health cannot be adequately addressed because we do not have a database of sufficient size and depth on the variables of urban configuration to adequately research the issues. Is there a relationship between energy consumption, public health, and the configuration of urban infrastructure? The same questions remain unanswered for energy consumption, and especially re-use of existing infrastructure in light of land use changes over time. What configurations offer the greatest accommodation of change? The aim of this paper is to propose that these efforts are in the national interest of the citizenry, and that as we regulate for the development of cities, we should create a research base to align the regulations that dictate our actions with scientific evidence.

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