2017 URBAN DESIGN STUDIO
Perry Yang
School of City and Regional Planning, College of Design
Georgia Institute of Technology
Executive Summary

In the face of critical concerns about climate change and explosive urban population growth, cities worldwide are beginning to explore how “Smart City” approaches can address these challenges. The 2017 Urban Design Studio explores how the design, planning, and management of cities can create a resilient urban fabric, flexible enough to accommodate ongoing growth and capable of absorbing inevitable future environmental shocks.

The studio investigates one of 2020 Summer Olympic Game sites, Urawa Misono, a satellite town of Tokyo’s metropolitan region, as a pilot for this approach. Working with partners at the University of Tokyo, the National Institute for Environmental Studies (NIES) and the Global Carbon Project (GCP) we explore the role of smart city technologies, ecological performance modeling, and third-party sustainability certifications in designing an alternative future for Urawa Misono.

Our resulting proposal is an ecologically responsive, disaster-resilient, and human-sensing urban environment. A highly interdisciplinary effort, this studio was led by Dr. Perry Yang (Georgia Institute of Technology), Dr. Yoshiki Yamagata (Global Carbon Project and National Institute for Environmental Studies), and Dr. Akito Murayama (University of Tokyo). Studio participants include Georgia Tech graduate and undergraduate students from architecture, city planning, energy performance modeling, and environmental studies.

Conversion of grey infrastructure to green infrastructure

Creation of a central green promenade that improves public experience and creates a sense of place

Maximization of thermal comfort by avoiding clustering of tall buildings to ensure adequate solar capture

Understanding the tradeoff between building height and footprint in relation to energy consumption and solar capture

Expand transit and mobility options by extending the Saitama railway north to include a new transit station and providing a bus rapid transit strip from Saitama City to Koshigaya

Continue to monitor congestion as new development occurs and identify under-utilized roads for potential pedestrian and bicycle uses

Attract new investment that enables a denser, more walkable central activity center

Recommendations

Use of performance zoning as a planning support system (PSS) that enables smarter, more sustainable development

Development of smartphone apps that enable community engagement in planning and encourage exercise and use of alternative transportation modes

Installation of sensors to enable transformation of and multi-use of parking lots and other public spaces

Use of smart street lighting to reduce energy consumption and cost

Conversion of grey infrastructure to green infrastructure

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Urawa Misono is a sub-center of Saitama City, the most populous city in Saitama Prefecture, Japan. While Saitama City boasts a population of 1.26 million, Urawa Misono has remained largely rural. Only 45 minutes from Tokyo by rail, it is the final stop on the Saitama Rapid Railway Line. Every two weeks, thousands of soccer fans arrive at the stadium and walk or drive to the Saitama Stadium, constructed in 2002 to host the FIFA World Cup. Saitama Stadium is an important site for the 2020 Summer Olympic Games, prompting local and regional officials to consider how they will accommodate the massive influx of event spectators and maximize the impact of this influx for broader development goals. Even without the Olympics, Urawa Misono’s current population is projected to triple in size to over 32,000 by 2030.

Simultaneously, Urawa Misono recently became a certified Comprehensive Special Zone. The main strategic imperative of this designation is to bring large-scale investment in the area by major corporations, such as Mitsubishi and IBM. To meet this objective, smart development, there may be increased business energy implementation. With site potential for further technologies, next-generation automobiles, and smart energy, Urawa Misono is well positioned to provide and enable the next generation of urban living.

With the population growth and traffic in the area is going to increase. The current population makeup of the people living in the smart city is not linked to the diffusion of ICT, but also commonly includes people. Unlike related concepts such as the digital city, the intelligent city and the ubiquitous city, the smart city is not limited to the use of alternative forms of transportation? How can we design the city in a way that encourages the use of alternative forms of transportation?
Co-Design Process

**PHASE I: Initial Design and Development of Performance Analytics**

A more traditional studio practice begins with a client and a site. Designers devise a series of alternative proposals, which are then analyzed and evaluated by planners. These conventional urban design techniques emphasize a completed urban form, ignoring the constant evolution of cities. By contrast, our Urban Systems Design (USD) method develops an integrated design model that nurtures interaction, synergy of constant evolution of cities. By contrast, our Urban planners. These conventional urban design techniques are then analyzed and evaluated by planners. These conventional urban design techniques

- **PHASE I: Initial Design and Development of Performance Analytics**
  - **Objective 1:** Establish connectivity between the ecosystem network and strategies for sustainable urban mobility and energy consumption.
  - **Objective 2:** Create adaptable and flexible infrastructure for technologies without excluding surrounding communities.

Our performance modeling team began to consider which metrics would be most important for evaluating the performance modeling techniques. Situating our work within the history of postwar Japanese planning and the trends that came out of the studio brainstorm. These three concepts focused on transit-oriented development, neighborhood metabolism, and city-as-jardin. In addition to considering what directions our studio site would most readily embrace, each of these three visions also explored particular performance parameters of Misono’s metrics. These designs were then evaluated based on their impacts on energy, food, water, and mobility.

**PHASE II: Tokyo Co-Design Workshop**

In March, we traveled to Japan to present our most recent design and analysis to our partners and local stakeholders. On our first day, we met our partners at the Urban Design Center of Misono (UDCM) and obtained on-site field data to inform our design. We also visited Kawage, a city in Saitama which exhibits patterns of Japanese urban form dating to the Edo Period.

The next two days comprised a Smart City Symposium at the University of Tokyo, where we presented our initial studio work, and an online symposium and Internet of Things (IoT) workshops. During these workshops, we worked with students from the University of Tokyo and Diet University to improve our design and consider how to better incorporate IoT into our proposal. We spent the following day executing urban reconnaissance exercises: active observations of social, cultural, behavioral, spatial and temporal patterns in Central Tokyo.

In response to this new data and feedback, we spent two days at the National Institute for Environmental Studies (NIES) in Tsukuba, modifying our design and conducting additional performance evaluation analyses to strengthen our proposal. On our final day in Japan, our team presented our revised design (CD-2) to local government officials, academics, and business stakeholders at the Community Center in Urawa Misono. After our presentation we facilitated a discussion between the stakeholders and the studio participants to gain a deeper understanding of their vision for Urawa Misono.

**PHASE III: Plan Making and Final Production**

Our final phase of studio remains an adaptive process, synthesizing the abundance of knowledge obtained with prior design and analysis work. After returning to Atlanta, we dedicated the last several weeks of studio to designing and conducting additional performance evaluation analyses to strengthen our proposal. On our final day in Japan, our team presented our revised design (CD-2) to local government officials, academics, and business stakeholders at the Community Center in Urawa Misono. After our presentation we facilitated a discussion between the stakeholders and the studio participants to gain a deeper understanding of their vision for Urawa Misono.
Planning Support System

Many previous products of urban design work have been presented as, either implicitly or explicitly, the final masterplan that the future planning process needs to actualize. Presenting urban design plans as a fixed image of the future and not allowing unpredictability or changeability has often been responsible for the gap between the proposed urban design plans and the outcomes – actual cities. Typically the agents who carry out the making of a city are private developers. Current planning-related regulatory tool sets do not have the means to mandate that developers follow a proposed urban design plan to every detail down to the architecture image of the future and not allowing unpredictability. Presenting urban design plans as a fixed masterplan that the future planning process needs to actualize. Presenting urban design plans as a fixed image of the future and not allowing unpredictability or changeability has often been responsible for the gap between the proposed urban design plans and the actualized city in all dimensions. We hope Urawa Misono stakeholders to make data-driven decisions, interested in specific dimensions of performance, enabling them to make more nuanced decisions. Presenting urban design plans as a fixed image of the future and not allowing unpredictability or changeability has often been responsible for the gap between the proposed urban design plans and the actualized city in all dimensions. We hope Urawa Misono stakeholders to make data-driven decisions, interested in specific dimensions of performance, enabling them to make more nuanced decisions.

Structure of Planning Support System

The PSS consists of two parts: the presentation layer and evaluation layers (Figure 3). These layers differ in purpose. The purpose of the presentation layer is to provide a simple and intuitive illustration of zonal performances. The performance zoning maps shown in the next section of this document is an example of the presentation layer. Because this layer is a simplified translation of more complex calculations beneath it, it is easy to understand and thus accessible for non-expert stakeholders. This layer serves as a major input to the planning processes. Beneath the presentation layer are multiple evaluation layers. These are the layers where actual performance metrics are calculated. The outputs from these layers provide information based on which the presentation layer is created. Due to the complexity, these layers may be presented to stakeholders who are interested in specific dimensions of performance, enabling them to make more nuanced decisions.

The separation of the presentation layer and evaluation layer is necessary because of the potential spillover effect. Urban design influences the performance of not only the zone in which the modification occurs but also other zones. The separation of the presentation layer and evaluation layer is necessary because of the potential spillover effect. Urban design influences the performance of not only the zone in which the modification occurs but also other zones. The separation of the presentation layer and evaluation layer is necessary because of the potential spillover effect. Urban design influences the performance of not only the zone in which the modification occurs but also other zones. The separation of the presentation layer and evaluation layer is necessary because of the potential spillover effect. Urban design influences the performance of not only the zone in which the modification occurs but also other zones.

The evaluation layers therefore vary in scale (from the parcel scale to the city scale) and nature (from pixel-based raster to flow-based network), and the outputs from the evaluation layers inherit the characteristics of the layers on which they are calculated.

The presentation layer and evaluation layer are bridged by the zonal statistics. In a simple term, the zonal statistics translates the outputs from the evaluation layers, which have various scales and natures, into ‘zones’ by calculating descriptive statistics such as an average, median, and/or standard deviation.

Process

Based on the final output of this studio, Urawa Misono stakeholders can start modifying the urban design plan based on their preferences, needs, and limitations. The modified urban design plan is displayed in a form of presentation layer and functions as an ‘a priori plan’ which will be constantly updated throughout the course of planning. When a developer proposes a new development project, the PSS identifies relevant performance metrics that is expected to be affected by the project. These metrics are sent to the evaluation layers and the results is translated into the presentation layer through zonal statistics. If the proposed project meets the performance target set forth in the performance zoning, the project would be approved and update the ‘a priori plan’ for the next evaluation. If the project falls below the performance target, it would be revised based on the results of evaluation layers and be tested again until it meets the performance target. Through this process, Urawa Misono will be able to meet the performance target as best as possible, regardless of what development project is proposed.

In addition, deployment of smart sensors will enable a constant collection of real-time data of how Urawa Misono residents and visitors interact with the city. This data will provide an input to the PSS which will tailor the system to be Urawa Misono specific. Currently, many of the parameters of the performance metrics are developed based on data collected from non-Japanese context and thus may have a room for adjustments. Through continuous analyses and updates to the parameters, the ‘a priori plan’ can be improved.

Figure 3. Structure of Planning Support System

<table>
<thead>
<tr>
<th>Layer</th>
<th>Type</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Layer</td>
<td>Polygon</td>
<td>Zone</td>
</tr>
<tr>
<td>Network Layer</td>
<td>Polygon</td>
<td>Parcel-Zone</td>
</tr>
<tr>
<td>Elevation Layer</td>
<td>Raster</td>
<td>Parcel-Zone</td>
</tr>
</tbody>
</table>

Figure 4. Process Flow of Planning Support System

<table>
<thead>
<tr>
<th>Process</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Developers present a development project.</td>
</tr>
<tr>
<td>2</td>
<td>The PSS identifies relevant performance metrics.</td>
</tr>
<tr>
<td>3</td>
<td>The outputs from the evaluation layers are translated into the presentation layer.</td>
</tr>
<tr>
<td>4</td>
<td>The presentation layer is updated.</td>
</tr>
<tr>
<td>5</td>
<td>The process is repeated until the performance target is met.</td>
</tr>
</tbody>
</table>
Performance zoning, as a concept, is not new to this project. Proposed originally in 1980 by Lane Kendig as a replacement for the traditional practice of Euclidean zoning, in this approach development and land use are controlled by the performance of a structure or development and the way in which it benefits the urban system and moves the city towards both normative and local goals. Performance zoning encourages mixed-use over single-use spaces and encourages high performance development. At the time though Kendig’s proposition was criticized as being overly focused on local goals. Performance zoning, as a concept, is not new to this discussion (Sedwey, 1981). Additionally the sophistication of the tools available today must reach while also controlling the quality of the urban form rather than being overly prescriptive about the design possibilities.

Along with the original six typologies, variations were developed by the performance modeling team working in Tongji University. These variations served two purposes. The first was to identify the patterns in urban form that resulted in the best performance in the abstract analytical vacuum, and the second was to provide variations on the themes presented in the original six typologies. Holding the FAR (floor area ratio) value constant to account for a consistent population density, other factors, such as BCR (building cover ratio) were allowed to vary for the three schema applied. These took the form of a centralized model in which a majority of the development is moved towards the centroid, a linear model in which the height of buildings falls off in a linear fashion and a decentralized model in which the FAR is spread across the site and away from the centroid. Analysis was carried out by both the Atlanta and Tongji teams and optimal conditions were recommended. The block typologies allow for an additional problem to be addressed. There is a significant trade off effect between various performance elements, such as solar power generation, food production and population density. As density increases, for example, the amount of land area available for food production and solar power generation decreases. This ‘iron triangle’ requires that there be trade-offs and mean that it is not always possible for each zone to independently achieve the overall system criteria of being net zero. A1, for instance, requires high density development and may be able to achieve many of the density requirements but its productivity in terms of food and water will decline. Taken in contrast to lower densities, such as C3 or D1, there becomes an opportunity to offset the impacts of the higher density developments with more productivity. In a way this is, conceptually at least, a similarity to the Transfer Development Rights strategy developed for the preservation of rural lands. While this system though as opposed to trading density, in the form of FAR, from site to site rather performance matrices are traded, density for other land intensive uses. Taken at large this causes the site as a whole to approach a net zero state as C zones begin to offset A zones allowing for more land to be used for agricultural purposes as density is moved in towards the core area.

The trade off requirements between zones and the density gradient necessitated the development of some limitations within the zones. While earlier schemes that toyed with the idea of organic growth allows urban nodes to move naturally through each phase from town-like development to dense urban core, the process supposed by the PSS for achieving net zero required artificial growth limitations. Each performance zone had the available typologies constrained in both type and variation. In principle, the idea being that the sum of the performance characteristics of, for example A1, will be offset by the sum of the performance characteristics of C3 and other zones. This can only be achieved through a limitation of the initial set.

Figure 5. Block Variation Rules

Figure 6. ‘Iron Triangle’ of Performance Trade-offs
Smart City Computing

The Smart City Computing (SC) team has been investigating not only what ‘smart city’ means, but also the potential for fully realizing a smart city.

One approach made by the SC team is to view the integration of technologies, especially Internet of Things (IoT) as an opportunity to connect people to the city itself. The Internet of Things (IoT) has been defined in Overview of the Internet of things (ITU, 2012) as a global infrastructure for the information society, enabling advanced services by interconnecting physical and virtual things based on existing and evolving inter-operable information and communication technologies. IoT applications that leverage ubiquitous connectivity, big data and analytics are enabling Smart City initiatives all over the world. These new applications introduce capabilities such as the ability to remotely monitor, manage and control devices, and to create new insights and actionable information from massive streams of real-time data. As a result, IoT is transforming cities by improving infrastructure, creating more efficient and cost effective municipal services, enhancing public transportation, reducing traffic congestion, and keeping citizens safe and more engaged in the community.

Through the studio, the SC team has been exploring how cities can be transformed. Given guidelines provided by our Japanese partners, the team explored the possibility of implementing IoT technology in alignment with their guidelines. Investigations moved toward integrating the varying scales of health (the person), home (the building), and the city. At the level of the individual, the team focused on the mobile app because of its worldwide popularity. The team proposed an app to support mobility and alternative transit modes within and around Urawa Misono. Inspired by the popular augmented reality games like PokemonGo, which attracts players to the specific locations for Pokemons, our app would also provide incentives. These would include coupons or descriptions of significant sightseeing locations to attract people along different routes through the city. Working with real-time mobility and population data in Urawa Misono, the app aims to help balance the pedestrian load around the city, especially during soccer events at Saitama Stadium.

At the city level, we focused on infrastructure and space. The team proposed a smart lighting system that would signal joggers and cars, reduce energy costs for public street lights, reduce light pollution, and which could be adjusted based on the traffic condition. An interactive bus stop was also designed for public transportation users to encourage use of alternative transportation modes and to provide a new way for residents and visitors to interact with the city. As IoT technologies offer the possibility to rearrange and transform the city, the team explored the possibility of re-arranging idle space to create more multi-use and multi-functional space in the city. Situational public space was proposed, which would have the ability to monitor real-time utilization of parking lots and public space in the city and transform these spaces when they’re not in use. The plan for Urawa Misono is to implement sensor and projector modules in some spaces around the stadium, enabling the space to morph between being a parking lot and a public exercise space. This proposal is also extended and combined with the mobile app idea. During stadium events when traffic is heavy and parking is limited, the system could adjust the price of the parking spots and encourage drivers to park farther from the stadium and walk to reduce congestion.

Overall with IoT technologies implemented in the city, a whole smart city system is planned to enhance the interaction between people and the city in Urawa Misono. The conceptual scenarios presented by the diagrams as well as the video showing how people could live with the technologies.
New technologies are changing how we interact with space and are creating new ways for people to experience the urban environment. This change shifts how we can, and should, think about the configuration and uses of public space. Changing public space from the static arrangements of the conventional park, plaza or street towards more dynamic and interactive urban experiences. The programming of the urban environment is no longer subject to “single authorship”. Rather, the smart city renders the urban designer, much like the author, dead (Barthes 1967). Space is now free to be driven by demand and desire, by both performance and potential. The city moves from the stagnant, culturally homogenizing spectacle of neon to places where the urban fabric was built with the technologies in mind. It became clear to those working on the project that these would not become “spaces that serve” (McGillivray, 2011). The fear was that the technologies would become a prescriptive part of the environment and that the smart city would never adapt to new technologies or uses.

When the design moved away from the static design of the traditional master planned development towards a more dynamic environment that grew like a garden, the new plan called for infill development using specific typological patterns whose geometry could be easily repeated across space. For the development of the smart city concept this meant that the infrastructure and technologies would not all be put in place all at once. Moreso, it meant that the technologies could no longer be directly tied to specific places, like bridges or neighborhoods near the medical facilities. This time they were tied to experiential concepts, the node, the connection, fluctuation and shaping of space. The new set of spaces that defined by the intensity and type of experiences provided by the space and the technologies needed to create those situations.

Further Research

When designing for an urban system there are a series of relationships that must be accounted for. As mentioned earlier, some of these represent relationships that exist in a mutually exclusive state where an increase in one necessitates a decrease in others. While not all relationships behave in this manner, many do. Below are some of the relationships observed both quantitatively and qualitatively throughout the design investigation.

The understanding of these trade offs and their connections to design is critical as computational and machine learning approaches require clear examples in order to be trained effectively. This requires working backwards from an existing design to its representation within a given relationship set, such as those mentioned above. This represents a building or development and being able to trace back through the design to the original parameter goals through both the current performance metrics of the final form and from analysis of design documents (drawings, etc.).
Producing a design that is truly conceptual is a non-linear process. It involves research, iteration, critique, revision, and collaboration. As is often the case in design, the metric of success is not productivity alone; it is sensitivity and decision-making based on an infinitely large set of criteria.

The task of the Conceptual Design (CD) team was to find a process that distilled the most important of these criteria into an attainable set of goals for the smart development of Urawa Misono.

To help kick off this process, the CD team initiated a charrette - a visioning exercise in which members of the entire studio share their knowledge and opinions about the project. The resulting information was extremely valuable, but was tangled up in sketches, diagrams, and scribbled text. To make sense of it all, the project leaders and the CD group organized the information into three major categories, informed by a reading by Carl Steinitz: Organization, Expression, and Allocation. With this organizational tool, the team was able to categorize the major drivers of the development and begin to form design investigations.

The next step in the conceptual design process was to complete a series of design investigations based on the inputs from the first phase. Three investigations by small groups explored three different sets of ideas. The first design investigation (CD-1) focused on transit-oriented development, a central green promenade, centrally concentrated density, and walkability. The second design investigation (CD-2) explored the implications of density spread through concentrated nodes, linear development patterns, urban metabolism, and agriculture. The third design investigation (CD-3) explored the concepts of widely dispersed density nodes, the city as a Japanese garden, constructed moments of discovery, and winding meditative pathways.

The goal for the midterm (CD-M) was to create a single proposal based on the three design investigations. It was important to not simply design by consensus, but to work collaboratively to try to bring out the best of all three investigations. For this process to be successful, team members had to be self-critical and open to the ideas of others. For the midterm proposal, the CD group arrived at a design that addressed a wide range of issues relevant to the Urawa Misono smart city development. Along with a rendered master plan, the group produced a set of diagrams which illustrated the key concepts, a 3D model for visualizing the development, as well as an outline of building typologies.

The phase of work that was to be completed in Japan was kicked off with a design workshop with local students from the University of Tokyo. Along with a site visit, this workshop led to fruitful discussions about the local culture and existing site typologies.

Once again, the design was iterated (CD-J) and the idea of planning support systems through the implication of performance zoning and the definition of block typologies began to emerge. Each performance zone or block typology had a specific criteria of density and performance, as well as suggested urban context in the form of a matrix of cellular typologies. The cellular typologies are fundamental typological designs that describe the basic performance and geometries of each performance zone or block typology. Each performance zone is assigned a number of the typological blocks that allow for performance metrics and system-wide impact to be easily and quickly measured by the addition of any design that follows the general scheme of the typology. This iterative process (CD-J) was presented to stakeholders and government officials and feedback was taken into account as the design was reworked into the final concept (CD-F).

After returning to Georgia Tech, the block typologies and the boundaries of the performance zones were refined. These zones were handed off to the Performance Modeling team to analyze and improve. CD then modeled the entire Urawa Misono site following these established block typologies. A comprehensive drawing presentation was to be completed, including a large representational drawing and a full set of diagrams to illustrate the major design moves.
The final design (CD-F) takes into account the ideas of transit-oriented development, a central green promenade, urban metabolism, agriculture, constructed moments of discovery, and walkability that were initially established after the first design charrette. There is a lineage that can be traced to the original sketches and concepts.

For the final drawing, it was decided to shift the graphical representation from a 2D master plan view to a 3D axonometric master plan to better express the strong three-dimensional ideas of the raised green promenade and density dispersion. The majority of this axonometric drawing would have simple boxes representing the buildings implemented throughout the site, while key areas around the newly established wetlands and the original train station would have detailed buildings to more clearly show the ideas of the block typologies. The group also produced a set of diagrams to illustrate the key concepts found within the final master plan.

It was extremely desirable to be able to fully illustrate the Smart City ideas established by the SC team within the final conceptual drawing. Therefore, more detailed and human-scaled drawings representing these ideas were added within the axonometric master plan drawing. Moving from left to right on this drawing, the following ideas are more closely illustrated: situational kinetic facades, situational public spaces, pedestrian navigation app, responsive lighting systems, and metabolist inspired public spaces. The situational kinetic facades have the ability to open or close based on the amount of sunlight a building is receiving. These facades also have the ability to fold down onto tracks on the ground to form hard paving, tables, or chairs within the public courtyard. The lot of land illustrated in the situational public space drawing can be used for parking on game days. On normal days in which parking is not in demand, smart sensors in the light posts can turn this space into a public amenity.

The Smart City group also developed an app that allows navigation based on preference while also offering incentives to encourage pedestrians to use different routes. This helps to lessen heavy traffic on any one specific path by encouraging users to take longer, more scenic routes in order to claim rewards such as local coupons. Responsive lighting systems are implemented at night where sensors recognize vehicular or pedestrian traffic and enable streetlights to guide their paths. These sensors prevent energy waste when roads are empty while allowing users to feel safe and secure.

The main train station was inspired by metabolist ideas of layering public spaces. The highest layer, the green promenade, is located atop the train station and offers a public amenity to city-goers even in the densest section of the city. Some shops and buildings are located at this level and many more are located on the lower street level. Parking is hidden beneath the promenade and shops. Interactive infrastructure, such as the depicted bus stop, serves multiple purposes including information sharing, game playing, and connectivity. Users at these bus stops can play games and experience being at other bus stops to pass time. This interactive option also offers safety and company during their wait.

Recommendations

The final recommendations regarding conceptual design for the government officials and stakeholders of Urawa Misono Smart City include the implementation of two major ideas on the site. The first is infrastructure changes – changing grey infrastructure to green infrastructure. These changes allow for the same amount of capacity while creating a better experience within the city. The green promenade in particular improves public experience and creates a sense of place at the functional core of Urawa Misono. The implemented ideas of metabolism create a sense of co-location with layers of train station, green promenade, shopping, and parking all located within the most central part of the city. The other major move is the planning support system that creates a framework for smarter development in terms of design, experience, and public amenity to city-goers even in the densest section of the city. Some shops and buildings are located at this level and many more are located on the lower street level. Parking is hidden beneath the promenade and shops. Interactive infrastructure, such as the depicted bus stop, serves multiple purposes including information sharing, game playing, and connectivity. Users at these bus stops can play games and experience being at other bus stops to pass time. This interactive option also offers safety and company during their wait.

Reconcile the ideas presented on this page.
Proposed Smart City Systems for Urawa-Misono

**SITUATIONAL KINETIC FACADES**

Kinetic facades have the ability to open or close based on the amount of sunlight a building receives. They also have the ability to fold down onto tracks on the ground to form hard paving, tables, or chairs within the public courtyard.

**SITUATIONAL PUBLIC SPACES**

On game days, this land can be used for parking, but on normal days in which parking is not in demand, smart sensors in the light posts can turn this space into a public amenity.

**PEDESTRIAN NAVIGATION APP**

The app developed for Urawa Misono allows navigation based on preference while also offering incentives to encourage pedestrians to use different routes. This helps to lessen heavy traffic on any one specific path by encouraging users to take longer, more scenic routes in order to claim rewards such as local coupons.

**RESPONSIVE LIGHTING SYSTEMS**

Smart street lights are implemented at night where sensors recognize vehicle or pedestrian traffic and enables street lights to guide their path. These sensors prevent energy waste when roads are empty while allowing user to feel safe and secure.

**METABOLIST INSPIRED PUBLIC SPACES**

The main train station was inspiration by metabolism ideas of layering public spaces. The highest layer, the green promenade, is located atop the train station and offers a public amenity to city-goers even in the densest section of the city. Some shops and buildings are located at this level and many more are located on the lower street level. Parking is hidden beneath the promenade and shops.

**INTERACTIVE INFRASTRUCTURE**

Interactive bus stops serve multiple purposes including information sharing, game playing, and connectivity. Users at this bus stop can play games with users waiting at others bus stops to pass time. This interactive option also offers safety and company during their wait.
The CASBEE assessment tools are grounded in three principles:

1. Comprehensive assessment throughout the life cycle of the building
2. Assessment of the Built Environment Quality
3. Assessment based on the Built Environment Load

LEED is a voluntary, market driven, consensus-based tool that serves as a guideline and assessment mechanism. While CASBEE and LEED share similar goals, LEED has a stronger foundation in the development of real estate and building rating systems. LEED is a voluntary, market driven, consensus-based tool that serves as a guideline and assessment mechanism. While CASBEE and LEED share similar goals, LEED has a stronger foundation in the development of real estate and building rating systems.
Our performance metrics were initially determined by the criteria outlined by LEED-ND. Our intention was to use these metrics as minimum standards and exceed them with the ambitious goal of designing a net-zero community. From LEED-ND, we determined that we would measure food, energy and water consumption and production, as well as thermal comfort, to create a self-sufficiency ratio in understanding site performance. Through modeling, we determined that while the community could not be designed as net-zero from the onset, we developed a set of recommendations for the Urawa-Misono stakeholders to consider to pursue a net-zero or net-positive carbon future. On a human scale, with assistance from our colleagues at the Eco Urban Lab at Tongji University, we explored the thermal comfort on our designs. Through these metrics, we are able to understand various factors that affect the comfort of people in a space.

Net-Zero as an Iterative, Collaborative Process

From researching case studies of attempts to create net-zero communities, we determined a process that could move communities toward a carbon-neutral future. Figure 2 shows net-zero as an iterative, and collaborative process. While the scope of our studio was establishing the performance zone standards, as well as the geographic boundaries for our research. The geographic boundaries of site are explored in a tiered approach (Figure 1), with our studio’s primary focus being on the Tier II and Tier levels. For Urawa Misono, performance zones that consume more than they produce can be supplemented by over producing zones. Through this process, we determined a framework for Urawa Misono to pursue a net-zero future. Stakeholders interested in pursuing this initiative should envision and establish a long-term vision. This should include milestones set in the form of carbon reduction targets, renewable feasibility studies and plain-reevaluation. Within these milestones, achievable short-term goals should be established to feed into the larger vision and milestones of carbon reductions. These short-term goals could include implementation of energy efficiency policies, promotion of alternative modes of transportation and clear scoping of these actions (i.e. the sector that will be impacted - commercial, residential, etc.).

Energy, Food, Water & Thermal Comfort

Beyond our initial analysis in Figure 2, we developed a framework for Urawa Misono to pursue a net-zero future. Stakeholders interested in pursuing this initiative should consider the potential human comfort. This should include considerations to ensure that the spaces are focused on increasing building proximity and density in the aim of generating better energy performance across blocks.

Theme 1: Centralization

Agglomeration of land use and functions focusing on a central theme varies. What changes between each iteration is the distance between buildings, closeness; the amount of entrapped open space, enclosure; and the heights of buildings.

Theme 2: Decentralization

Minimization of entrapped (courtyard) open spaces to promote inter block air flow testing whether it improves the quality of life experientially and qualitatively from the human comfort perspective. Does increasing the ratio of open (green) space.

Theme 3: Linear

Two types of linear relationships will be studied through the exploration of the theme. (1) Typologies 1 and 2 are concerned with the heights of the buildings adjusted from one side of the block to the other. Going from max permitted height to minimum in a linear approach while maintaining basements. (2) Typologies 3, 4, and 5 examine the linear concentration of open space in a similar manner but through a different FAR. (2) Typologies 3, 4, and 5 examine the linear concentration of open space in a similar manner but through this FAR. (2) Typologies 3, 4, and 5 examine the linear concentration of open space in a similar manner but through this FAR. (2) Typologies 3, 4, and 5 examine the linear concentration of open space in a similar manner but through this FAR. (2) Typologies 3, 4, and 5 examine the linear concentration of open space in a similar manner but through this FAR. 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LEED-ND

LEED-ND performance is based on our ability to optimize building energy performance on site. Our evaluation, in relation to energy performance, is rated based on Solar Orientation, Renewable Energy Production, District Heating and Cooling, Infrastructure Energy Efficiency and Light Pollution Reduction. Our team’s energy reduction techniques are established to be performed differently at each of the three tiers of the design. In Tier 1 we would rely on household contribution to the district energy plan, encouraging energy reduction through incentives. Tier 2 looks at network system energy reduction, and the larger accumulated effects of energy. Tier 3 involves the whole system approach, directing large scale infrastructure changes to adapt current site conditions for reduction of energy needs with more permanent changes in mind.

Energy Consumption

Energy consumption, for our purposes, is determined through a summation of the four major consuming components of energy that would have the most effect on the achievement of a Net-Zero community: heating, cooling, lighting, and equipment loads. A direct comparison of the level of consumption for each typology variation helped to determine the least consuming block, which then allowed us to develop form based solutions designed to reduce energy demands on site. Our aggregated design approach does require this block analysis eventually to be supplemented by a site energy analysis periodically as the site grows and more energy efficient blocks are added or adapted. These two sets of results would provide us with a fuller picture of the effect of these blocks when grouped together in a network.

Energy Production

In order to receive LEED-ND credit, a certain percentage of energy loads must be provided by renewable energy. We initially planned on expanding out scope to various types of renewable in place in Japan (wind, geothermal), but determined they were not currently feasible on our site. Subsequently, we focused on rooftop solar capture due to the policy precedent that exists in Saitama City, and the presence of rooftop solar in Urawa-Misono. Through analyzing the typologies and their variations, we are able to understand which technologies perform best in regards to rooftop solar capture (Figure 13). However, our design recommendations are based on consideration of the trade offs between rooftop solar and energy consumption.

Energy Self-Sufficiency

Energy self-sufficiency is a measure of the net energy gain on site measured here based on the form of each typology variation. Within each typology, self-sufficiency is rated to determine the most and least reliant block formation. Inter-typology comparisons may be made to determine the best means of aggregating the typologies throughout the site. Our comparative analysis of solar gain to energy consumption indicated an indirect effect of form based typology variations. Designers may use this information to determine the best means of aggregating the typologies throughout the site, balancing energy performance on site to achieve a more resilient community.

Recommendations

Our studies looked at the effect of form on energy resilience, and specifically observed the effects of BCR changes while maintaining a constant FAR. While holding FAR constant, BCR showed an inverse effect on energy gains and consumption, with increases in BCR improving solar capture and decreases reducing energy consumption. Other modifications designed to improve the resiliency of our development consider the trade-off relationship between Energy conditions. Compact shapes with limited height variations reduce thermal gains while limiting obstruction to photo voltaic potential. Maintaining density while varying building heights increases shading, relieving required conditioned spaces. Increasing solar gain to energy consumption indicated an indirect effect of form based typology variations. Designers may use this information to determine the best means of aggregating the typologies throughout the site, balancing energy performance on site to achieve a more resilient community.

Figure 12. Solar radiation results (typologies with the best photo voltaic capture are outlined in black)

Figure 13. Solar radiation results (typologies with the best photo voltaic capture are outlined in black)

Figure 14. Calculation of PV capture and consumption for self-sufficiency ratio

Table 1: Comparative analysis of solar gain to energy consumption for self-sufficiency ratio
Water

The primary aim of this exercise is to model the amount of water necessary for the sustenance of the community and how much of this can be captured and recycled on-site. Based on the proposed land use water consumption was estimated to be 47,157,155.07 liters. The highest water consumption is for agriculture and landscape irrigation uses. The harvest potential was calculated based on the area of impervious and pervious. The net collection potential is 6,535.95 liters. This is further limited by seasonality of rainfall with the highest collection potential in the month of December and lowest in February. For this base line condition, the self sufficiency is negligible since only a fraction of the water necessary can be collected on site. LEED-ND outlines four criteria for water conservation and consumption reduction.

LEED Strategies to Reduce Consumption

Outdoor Consumption

Aim: Reduce outdoor landscape irrigation by 50% with water efficient landscaping (1 point)

Strategies suggested by LEED-ND include, selection of plant species, density and micro-climate factor, irrigation efficiency, use of captured rainwater, use of recycled wastewater, use of water treated and conveyed by a public agency specifically for non-potable uses. The use of other non-potable water sources such as stormwater, air conditioning condensation, and foundation drain water. Further, adopting elements from traditional Japanese gardens such as moss and rock gardens will substantially reduce water for irrigation.

Increase harvest potential

Aim:

Stormwater Management - Implement a comprehensive stormwater management plan for the project that retains on-site the rainfall volume through infiltration, evapotranspiration, and reuse (4 points)

1) Collect surface and roof runoff within a cistern outside the stadium.

2) Develop the river channel to be floodable eco park-break down the concrete channel and create a naturalized waterway that can alleviate flooding and function as a ecological and recreational space. A case study of this is presented in Appendix 5.

Unfortunately, even with this reduction, the self sufficiency ratio did not improve.

Figure 17. Proposed stormwater management measures (location of cisterns in marked in grey)
The preliminary purpose of this exercise is to model the amount of food required by the community and evaluate how much of that can be cultivated on site. Our secondary concern is that our proposal displaces current agricultural land use. Hence the farmers and landowners must be compensated in some way.

Japanese Diet

The National Nutrition Survey in Japan was an annual survey conducted between 1946 and 1993. The aim of this longitudinal survey is to monitor the average intake for prevention of diet-related chronic diseases and health promotion (Yoshikawa et al., 1996). The graph below summarizes the food consumption of a typical person per day in Japan from the aforementioned study.

Food in the Context of Misono

The land use on site is predominantly agricultural. Any development will inevitably displace the current agricultural yield on site. Additionally the influx of large population will result in a higher food demand. In response to this, the project’s goal is to cultivate the fresh produce consumed by the community on site.

Given the urban constraints, the project’s goal is to cultivate only 33.6% of the food consumed in a typical Japanese diet.

The projected population of the community is 32,000 members. Annual consumption of fresh produce per person (based on the national nutrition survey) is 198 kg. Hence the entire community requires 6,322,384 kg fresh produce per year.

Food Convention Production

Raising awareness of sustainability and food systems is increasing integration of agriculture in urban areas. When highly dense urban areas, agriculture often manifests as community farms, commercial or institutional farms and community gardens. These newer typologies have the additional benefits of being therapeutic, engaging, promote physical activity, community cohesion, entrepreneurship in addition to providing fresh food and reducing energy spent on transportation.

“A well-maintained food garden can yield an estimated ½ pound of produce per square foot of garden area over the course of the growing season” (National Gardening Association 2014). This translates to 2.44 kg per meter square of area. Such an yield compares poorly to industrial output. For instance only if 90% of the entire site of 3 square km will there be sufficient fresh food available for a year.

Improving Production with Vertical Farming

Arable land is also finite, the need to minimize the negative environmental effects of agriculture, particularly with regard to greenhouse gas emissions, soil degradation and the protection of already dwindling water supplies and biodiversity arises. Vertical Farming holds the promise of addressing these issues by enabling more food to be produced with less resources use.

The advantages of this method are the multiplication of agriculturally productive land (by growing in vertically mounted stacks), the increase in crop yields (by using optimized production methods, such as light exposure varieties, or additional CO2 supply), the protection of the crops from weather-related problems as well as pest and diseases (as opposed to outdoor farming), and the minimization of water requirements (through water recycling) (Bamferje and Adenauer 2014).

Vertical Farming

The design is adopted from the “The economics of vertical farms” research paper published by Macrothink Institute and Institute for Food and Resource Economics at the University of Bonn. The study was stimulated in Berlin, Germany. A vertical farm of 900,000 sqm with a total of 37 floors, 25 of them solely for the purpose of crop production and 3 for aquaculture. Further, 3 uniformly distributed floors are for environmental regulation and 2 in the basement for waste management. In addition there is one floor for cleaning of the growth trays, sowing and germination, one for packaging and processing the plants and fish and one for sales and delivery at the basement.
The second phase of design was the most iterative stage of the process. During each conceptual investigation, mobility group continued to provide qualitative suggestions and quantitative analysis to the final design. Additionally, the mobility team worked closely with the studio to successfully integrate performance modeling based on proposed land use changes within Misono, allowing for continued evaluation that follows new development within Misono.

Existing Challenges and Analysis

A recently expanded roadway network, Misono’s connection to Central Tokyo via the Saitama Railway, as well as local pedestrian and bicycle facilities provide a robust network of mobility options to residents and visitors in Urawa Misono.

The expanded roadway network is built as a grid for future development and includes multiple north-south arterial roads connecting the study area to the adjacent Tohoku Expressway, and surrounding cities of Saitama City to the west, Iwatsuki to the north, Koshigaya to the east, and Higashiawa to the south. The arterials are built for a city experiencing Misono’s current population, based on projections for future development. These arterials are built with an auto-oriented trajectory in mind. Additionally, a substantial availability of off-street parking aids in creating the auto-oriented environment. Despite the large amount of available roadway capacity in the study area, the Saitama regional rail network, distributor roads and the freeway both experience heavy congestion during the peak hours of travel.

Currently, only approximately 12% of trips generated within the study area use transit. Urawa Misono Station features the lowest daily ridership along the Saitama Railway, 4,700 average daily riders in 2015. Rail service to and from Tokyo averages seven trips per hour for 5AM and 11AM. These numbers reflect low-density land use of Misono relative to other station areas on this line.

While there are existing facilities that provide multimodal options for commuting to and from the Urawa Misono Station, the following mobility study, the area’s mobility should be addressed through the proposed, performance-informed design.

The observations of the existing mobility facilities were enhanced for the availability of Person Flow Data from NTT Docomo wireless network data, which captured movement diaries of residents in the study area across an entire day.

Person flow data is generated from person trip survey, capturing movement diaries of a day. It includes various information of each traveler and each trip, such as person ID, trip ID, longitude, latitude, gender, age, purpose, occupation, and trip mode, etc. Person flow data is a way to show urban planners how existing trips move around Metro Tokyo. In the Tokyo Urban Design Studio, the Conceptual Design group also can consider the variations in proposed future land use development. The person flow data files are collected from each station from 5 am to midnight. In our Mobility analysis, we display the Misono people flow data by Mobmap software. Mobmap is a movement data analysis software with strong data visualization functions. It provides a great variation for different geographic scales and different classifications of data.

Figure 21. Existing Road Network of Misono (Road Hierarchy)
In the initial design phase, mobility input focuses on the qualitative criteria. In the following three design investigations (CD-1, CD-2, CD-3), the mobility group collaborated with designers to determine the overall spatial structure and the walkability of the plan through application of contrasting network models. CD-1 focuses on Transit Oriented Development and follows the existing road network laid by the proposed land use plan. Walkability is characterized through application of contrasting network models. Compactness in design is likely an attribute that could positively impact energy usage as well. Density relates to compactness and promotes intensive site, neighborhood, and district designs.Compact development refers to the development utilizing land efficiently through creative and intensive site, neighborhood, and district designs. Density relates to compactness and promotes more effective use of all mobility modes and urban systems. Compactness in design is likely an attribute that could positively impact energy usage as well.

The CD-1 focuses on Transit Oriented Development and follows the existing road network laid by the proposed land use plan. Walkability is characterized through application of contrasting network models. The Urawa-Misono area has a substantial number of middle-aged residents that will benefit from the promotion of healthier lifestyles amongst residents and will be important with growing elderly populations. The walkability of the proposed designs is a significant green space piece of the proposed CD-F. The proposed CD-F design has 12 or more dwelling units per acre also and 0.80 or higher floor-area ratios (FAR), for all structures within 800 meters of Urawa Misono Station, promoting shorter and fewer trips, reducing vehicle miles traveled, and creating greater connectivity throughout the site.

The proposed redistribution of water retention into green space for walking. Like in CD-1, some existing green spaces can range from playing field to highly maintained environments to relatively natural landscapes. The proposed green central promenade is a significant green space in the CD-F design that impacts the compact environment around it. The proposed redistribution of water retention into green space for walking. Like in CD-1, some existing green space can range from playing field to highly maintained environments to relatively natural landscapes. The proposed green central promenade is a significant green space piece of the proposed CD-F. The proposed CD-F design has 12 or more dwelling units per acre also and 0.80 or higher floor-area ratios (FAR), for all structures within 800 meters of Urawa Misono Station, promoting shorter and fewer trips, reducing vehicle miles traveled, and creating greater connectivity throughout the site.

The following describes the land use, walkability, and travel demand analyses that were completed to effectively analyze the walkability performance of the proposed designs. First, the compactness and green space analyses for land use decisions on CD-F are described.

Compactness Analysis
Compact development refers to the development utilizing land efficiently through creative and intensive site, neighborhood, and district designs. Density relates to compactness and promotes more effective use of all mobility modes and urban systems. Compactness in design is likely an attribute that could positively impact energy usage as well.

Green Space Analysis
Green space, in this context, refers to urban open space in the study area that is utilized for parks and other open areas. The landscape of urban open spaces can range from playing field to highly maintained environments to relatively natural landscapes. The proposed green central promenade is a significant green space in the CD-F design that impacts the compact environment around it. The proposed redistribution of water retention into a more natural environment is also considered a significant green space piece of the proposed design. Green Space is considered in the mobility analyses because it can have implications toward making an urban environment more walkable, making an aesthetically-pleasing to influence residents and visitors to do more walking. Additionally, the green promenade is directly related to better mobility in the study area because it creates new connections across the Saitama Railway yard and maintenance facility and to Saitama Stadium. The proposed land use plan. Walkability is characterized through application of contrasting network models. The Proposed land use plan. Walkability is characterized through application of contrasting network models. The Proposed land use plan. Walkability is characterized through application of contrasting network models.

Alternatives Analyses
As described, quantitative analyses were completed for the initial CD-M design and the final proposed CD-F design. Once the CD-F design was completed, the design was aggregated into three alternatives. The three alternatives are made up of a baseline design and two major design and policy decisions that could substantially impact walkability and travel demand of the study area. The three alternatives are further described below.

Alternative 1
Alternative 1 is the baseline CD-F design described previously. The plan is focused on using the existing transportation facilities and optimizing mobility and energy. Major improvements included in the plan include increasing the density of the road network, improving the walkability by developing with higher building density and more pedestrian connections, and by creating better access to the proposed central promenade of the train station and Saitama Stadium.

Alternative 2
Alternative 2 proposes changes to the baseline CD-F design by relocating the retail usage currently located within the Aeon Mall into the proposed CBD. The existing Aeon Mall parcel could be redeveloped into additional green space or residential. Removing the mall has been mentioned as a possible alternative by the local government and may aid in mitigating congestion. The retail in the CBD would likely influence mobility patterns to favor transportation modes other than the single-occupancy vehicle.

Alternative 3
Alternative 3 proposes a new train station north of Saitama Stadium. The train station north of the stadium would create another opportunity for a Transit Oriented Development and could aid the local government in attracting additional high-end office tenants. While the congestion that is currently created by the Aeon Mall will still likely be present, the additional train station would further activate the area north of the stadium and create a new employment center within the study area.
Walkability Analysis

Walkability Analysis Results

The Composite Walkability Index is used to measure the walkability level in the site. The index consists of

Alternative 1

Alternative 2

Alternative 3

Network Distance to Transit Station

Alternative 1 provides a high accessibility to the train station. The total travel time to buildings within 1,000m of the station is 1,389,320m².

By adding a secondary station, the walkability value for Zone D increased from -1.5 ~ -0.5 to -0.5 ~ 2.5. Despite the large increase, the density increases rapidly as it moves from the new station towards the stadium.

Flexibility Analysis

The Composite walkability map shows Misuno's most walkable area surrounding the station because there is a highly diverse land use mix and connectivity. Future long-range designs should address poor pedestrian connectivity in the north and part of the eastern areas.

Reach Analysis

Reach analysis calculates the number of buildings that are reachable within 400m of network distance. The histogram below shows a normal distribution. This indicates most of the buildings are within easy access.

The central node around the transit station may need greater mix of land uses.

The residential areas on the east side may need more land use diversity.

Areas outside the transit station area should focus on nodes that are more accessible than the proposed lines.

For non-transit areas, consider reducing large building volumes and distributing diverse, smaller buildings instead.

Travel Demand Model Overview

Travel demand modeling was conducted as a tool to understand how the vehicular road network will function in the future after the proposed new development is completed. Traffic assignment is used as a mobility analysis to estimate the overall transportation network performance in relation to the density distribution and total floor area across the whole site. The Trip distribution and PTV Vissim software were utilized to perform the travel demand modeling.

As mentioned, there is currently congestion being experienced on the external road network; however, the newly constructed internal road network has a low demand and a substantial amount of available road capacity. The traffic volume data for this analysis was minimal; so assumptions were made for external traffic flows and verified with an initial run of the Vissim model.

The four-step model is made up of the following steps: Trip Generation, Trip Distribution, Mode Split, and Trip Assignment. The data collection and analysis for each of these model steps are described below. However, the Trip Assignment is initiated by the Vissim model and needs no further discussion.

Mode Split

Like the Trip Distribution, the Mode Split is based on the person flow data. As stated, the person flow data comprised of the mode split was projected based on land use assumptions and on the goals of higher modal trips in the study area and more specifically, the performance zones impacted by the design changes in each of the alternatives.

Figure 25. Composite Walkability for Alternative 1

Figure 26. Reach Analysis for Alternative 1

Figure 27. Walkability Analysis for Alternative 1

Figure 28. Composite Walkability for Alternative 2

Figure 29. Composite Walkability for Alternative 3

Figure 30. Trip Distribution

Figure 31. Mode Split

Trip Generation

The trip generation, or the number of trips the new development is expected to attract, was developed for each of the proposed performance zones in the study area. The total floor area in each performance zone for the expected uses was calculated for the study area. The total floor area across the whole site.

For the initial trip generation, a walkability level was assigned to each land use type and the number of trips was estimated. Based on this data, the projected trip are expected to have the following distribution of travel.

The four-step model is made up of the following steps: Trip Generation, Trip Distribution, Mode Split, and Trip Assignment. The data collection and analysis for each of these model steps are described below. However, the Trip Assignment is initiated by the Vissim model and needs no further discussion.

The trip generation, or the number of trips the new development is expected to attract, was developed for each of the proposed performance zones in the study area. The total floor area in each performance zone for the expected uses was calculated for the trip generation. Based on each land use type and the total floor area across the whole site, the regional trip attractors are located. Included in this data, the projected trip are expected to have the following distribution of travel.

Like the Trip Distribution, the Mode Split is based on the person flow data. As stated, the person flow data was projected based on land use assumptions and on the goals of higher modal trips in the study area and more specifically, the performance zones impacted by the design changes in each of the alternatives.
Recommendations

Based on the qualitative review and quantitative analyses described above, the mobility group recommends the following steps for the community to meet goals set forth by UDCMi for each of the following major transportation modes.

Roadway
- Continue to monitor the congestion within the study area as the community grows to identify roadways that are underutilized and that may be candidates for road diets to provide more right-of-way for pedestrian and bicycle uses.
- Develop a parking strategy that uses smart technology for demand-oriented parking costs during games at Saitama Stadium and that located parking near the existing highway.
- Plan for a more transit-oriented, walkable area that minimizes the need for further roadway investments, outside of general maintenance.

Transit
- Redevelop the existing Urawa-Misono Station to enhance the proposed green promenade from the station to Saitama Stadium.
- Extend the Saitama Railway an additional station north of Saitama Stadium in the short-term. Plan and implement a Bus Rapid Transit route from Nishi-Urawa Station in Saitama City to Okagoshigaya Station in Koshygaya to connect Urawa Station to the new and west end and provide additional transit options to other areas of the region.
- Plant for an extension of the Saitama Railway north to lksukara as a long-term investment.

Investigate options for a shuttle service within the study area during game day that connects parking areas, activity centers, and Saitama Stadium to create an active and vibrant experience before, during, and after games, which would activate the area into an entertainment destination.

Pedestrian/Bicycle
- Continue to invest in sidewalks and trails along major travel corridors.
- Develop the green promenade from the train station to Saitama Stadium and the rail network along the river.
- Continue to monitor the walkability of the study area as the area redevelops.

Roadway
- Plan for a more transit-oriented, walkable area that minimizes the need for further roadway investments, outside of general maintenance.

Transit
- Extend the Saitama Railway an additional station north of Saitama Stadium in the short-term. Plan and implement a Bus Rapid Transit route from Nishi-Urawa Station in Saitama City to Okagoshigaya Station in Koshygaya to connect Urawa Station to the new

Pedestrian/Bicycle
- Continue to invest in sidewalks and trails along major travel corridors.
- Develop the green promenade from the train station to Saitama Stadium and the rail network along the river.
- Continue to monitor the walkability of the study area as the area redevelops.

Overall
- Invest in business and residential investment that creates a more walkable, dense activity center that balances neighborhood and walkable areas to increase demand for transportation and likely reduce automotive dependency in the future area.
- Continue to improve the walkable development and intercity rail capacity improvements into the more walkable development around the Urawa-Misono Station.

Mobility

Alternative 1

- Shows acceptable traffic conditions during the AM peak period, with traffic volume distributed evenly throughout the site. The noticeable areas of congestion are the south and east sections of the freeway before the first intersection connecting to the study area. Potential congestion areas are the major arterial road from east to west and along the eastern site boundary. During the afternoon, however, the road network around the mall becomes more congested, due to a different travel demand pattern. The suggestion for further improvement to avoid congestion is illustrated in the other two alternatives.

Alternative 2

- Extends the railway to the north of the stadium and proposes a new station in the area. As stated, this new station would attract a new job center and would increase the amount of trips traveling to and from the study area. The results show that there is more congestion in the road network, because the new station is adding more traffic to the whole network. Nevertheless, by adding the second station, there is an increase in the proportion of transit in the mode split of the area. Therefore, the traffic condition around the new station stays consistent with Alternative 1.

Alternative 3

- Shows the analysis with removal of the mall, relocating the retail into the CBD area. As is shown in the results, the traffic congestion in Alternative 1 is significantly improved in Alternative 3 because by relocating the mall, the original site generates less vehicle trips, and more people will go shopping in the CBD area using transit. Just the change in typology of the retail distribution is expected to impact the overall mode split of the area, as existing person flow data shows that the Aeon Mall attracts more than 80% of its trips via vehicular modes.

Vissim Model Analysis

To simulate and analyze the traffic flow of game day conditions, several traffic simulation models were developed using PTIVis 9 to investigate the existing challenges. PTIVis is a traffic modeling software which provides flexibility in the concept of time and connections allowing users to model geometries with any level of complexity. Vissim provides internal functions for the flow of automobiles, truck and pedestrian, as well as various settings for different road environments.

The first model is based on the current road conditions. The input traffic volume is estimated game day volume. The input vehicle type and proportion are adjusted by 2015 weekday Tokyo traffic report provided by Japanese partners. The vehicles are input into the model by Poisson distribution and their speed fit Gaussian distribution with fixed speed upper and lower limits. The two worst congestion areas of the model are shown above. The entrance and exit of Iwatsuki Highway have severe congestion with long queues. The results from the simulation indicate that the longest queue time could be 10 minutes or more.
Conclusions
The 2017 Urban Design Studio explores how the design, planning, and management of cities can create a resilient urban fabric, flexible enough to accommodate ongoing growth and capable of absorbing inevitable environmental shocks. The Studio used one of 2020 Summer Olympic Sites, Urawa Misono, as a pilot for this approach.

Working with partners at the University of Tokyo, the National Institute for Environmental Studies (NIES) and the Global Carbon Project (GCP), we explored the role of smart city technologies, ecological performance modeling, and third-party sustainability certifications in designing an alternative future for Urawa Misono.

This inter-cultural and interdisciplinary studio process yielded a new vision for performance zoning (originally proposed in the 1980s) as a planning support system (PSS) to enable smarter, more sustainable development over time. Together our final recommendations, listed in the beginning of this report and throughout, are intended to help create an ecologically responsive, disaster-resilient and human-sensing urban environment.

References