I-11: Sustainable Supercorridor

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ABSTRACT

Recently enacted Federal transportation legislation known as MAP-21 — Moving Ahead for Progress in the 21st Century — has brought renewed attention to a proposed interstate corridor connecting Las Vegas, Phoenix and Tucson, Arizona. Part of the much larger Interstate 11 proposal linking Mexico and Canada (otherwise known as the CANAMEX or Intermountain West Corridor), a new type of corridor has the potential to signal a break from the 1950s model of road building and the start of a new, technologically advanced and sustainably minded network of smart infrastructure. Using I-11 as a case study, the intent of this larger research effort is to explore three key ways otherwise status quo infrastructure can be transformed into innovative sustainable solutions: by intervening in the design and planning process, by transforming the existing mono-functional freeway prototype, and by evolving the freeway paradigm from an "engineering only" to a "sustainability first" model. In collaboration with partner schools along the route (University of Arizona, Arizona State University, and University of Nevada, Las Vegas), researchers and design affiliates from architecture, planning, landscape architecture, engineering, and environmental studies are co-investigating the possibilities of transforming the proposed I-11 freeway from a limited use, auto-dominant roadway into a sustainable, multi-functional, ecologically and socio-economically focused Supercorridor. This presentation will focus on seven sites selected between Casa Grande and Nogales, Arizona and the next generation infrastructure prototype design proposals developed in the 2014 interdisciplinary urban design studio.

Keywords: Supercorridor, Interdisciplinary, Grand Challenge, Interstate 11, Next Generation Infrastructure

INTRODUCTION

Recently enacted Federal transportation legislation known as MAP-21 – Moving Ahead for Progress in the 21st Century – has brought renewed attention to a proposed interstate corridor connecting Las Vegas, Phoenix and Tucson, Arizona. Part of the much larger Interstate 11 proposal linking Mexico and Canada (otherwise known as the CANAMEX or Intermountain West Corridor), a new type of corridor has the potential to signal a break from the 1950s model of road building and the start of a new, technologically advanced and sustainably minded network of smart infrastructure. Using I-11 as a case study, the intent of this larger research effort is to explore three key ways otherwise status quo infrastructure can be transformed into innovative sustainable solutions: by intervening in the design and planning *process*, by transforming the existing mono-functional freeway *prototype*, and by evolving the freeway *paradigm* from an "engineering only" to a "sustainability first" model. In collaboration with partner schools along the route (University of Arizona, Arizona State University, and University of Nevada, Las Vegas), researchers and design affiliates from architecture, planning, landscape architecture, and engineering are co-investigating the possibilities of transforming the proposed I-11 freeway from a limited use, auto-dominant roadway into a sustainable, multi-functional, ecologically and socio-economically focused Supercorridor.

What this Supercorridor concept means specifically and how this might happen, however, remain relatively uncharted territory for freeway projects and the agencies that design and build them. In light of the scope of the work, the first two research questions are in ongoing and are briefly summarized below; the third is the primary focus of our presentation and includes research and design proposals from our recently completed interdisciplinary urban design studio.

1. How to broaden the freeway design *process*. Though outside experts are often consulted in the alignment selection or road design impact assessment studies to mitigate community demands or satisfy environmental regulations, they are rarely if ever included in the conceptualization and inchoate development of the corridor itself. Inevitably, traffic management rather than human or environmental needs tends to dictate the shape and use of much of our landscape. The broadening of the process could either reflect the consideration of a broader range of amenities as part of the programming up front (multimodal transportation, water harvesting and distribution, renewable energy, data, animal habitats, public space and open space), or it could reflect a broadening of the process through the inclusion of a broader range of experts not typically included early in the freeway planning process (architects, landscape architects, urban designers, ecologists, hydrologists, renewable energy experts, sustainably-focused transportation researchers). Both have the potential to alter the infrastructural product through greater inclusivity and broader objectives.

The hypothesis of the research to date is that any intervention must happen at the very earliest stages of the planning process, beginning with a top down position (likely armed with a powerful planning document and a committed and charismatic project champion) that sets an agenda very different from those based on the singular, historical priority of autonomous vehicle efficiency. The motivation behind Interstate 11 is particularly interesting as it is driven not from traffic capacity needs but from a vested interest in increased economic development opportunities in the southwest region. In light of that, a multi-functional, technologically savvy agenda for the corridor which is developed collaboratively with energy, environmental, planning and design professionals as a way to introduce more innovative and symbiotic networks of use could transform both the economy and the identity of the region.

2. How to *transform the freeway prototype*. Virtually unchanged since the first modern-era freeways were constructed in the 1940s and 50s, current freeway design standards are focused nearly exclusively on traffic flow and traffic safety. Though roads are one of our single largest public investments, road innovation has advanced minimally in the last half century. "Failure to Act" studies published by the ASCE show a necessary investment of $1.7 trillion towards surface infrastructure, $736 billion towards electricity, and $126 billion towards drinking water and wastewater to avoid economic penalties, reduction in standard of living, and loss of jobs.[1] With these large investment needs in mind, this research question assesses infrastructural bundling, the combining of multiple transportation and communication conduits in a shared right of way.

Bundling strategies, used informally for centuries in small, localized ways, became less prevalent with the modern era's attraction to large-scale master planning and efficiency as a guiding metric. They are returning now, however, as fewer resources are available to solve more and more complex problems, particularly those resulting from climate change, risk, and population growth. Texas's proposed $175 billion Trans-Texas Corridor is the largest case to date. The 4,000 mile long, quarter-mile wide route proposed combining cars, trucks and trains with underground space for water, electric, gas, and oil lines. The advantages include long-term economic efficiency, streamlined procurement and construction processes, an overall reduced environmental footprint, and a dedicated long-range route to reduce localized traffic congestion. The disadvantages, though, are numerous, primarily the up-front costs, wide swath of land impacts, security vulnerabilities, and, in this case, resident outcry against tolls brought on by the public-private financing model.

Our evaluation indicates that one of the Trans-Texas Corridor's critical faults was its model of infrastructural adjacency rather than infrastructural symbiosis. Lining up infrastructural needs, though potentially more efficient than not, takes vast amounts of space and does little to capitalize on their potential interactivity or provide new amenities. Alternatively, infrastructural symbiosis intentionally mimics an ecosystem by co-locating systems to shared advantage. This may be as integrated as waste products from one system providing fuel or heat for another (see NL Architects' WOS8 transfer station), or as simple as designing multi-functionality into all components (such as transit structure supporting solar panels and serving as conduits for renewable energy distribution). Following the same ecological logic, a related strategy attempts to supplement the costs (both economic and environmental) of hard infrastructure

1 American Society for Civil Engineers (ASCE), Failure to Act Economic Studies: The Impact of Current Infrastructure Investment on America's Economic Future, 2013. retrieved 2 October 2013 http://www.asce.org/economicstudy/.

by substituting it in part for green infrastructure systems, allowing nature to take back over some of the functions we have for decades superseded with technology (water purification in particular).

Interstate 11 has the potential to incorporate renewable energy, water harvesting and distribution, and multi-modal transportation as well as added public amenities and concentrated land use planning. Its potential route traverses territory that has some of the highest capacity for renewable energy in the country. The potential to co-locate renewable energy production and water capture along with transit, freight and auto traffic is an unprecedented and environmentally-critical opportunity. Designing their relationships symbiotically means the supercorridor has the potential for a net-positive contribution.

3. How to *transform the infrastructure paradigm*. Bundled or not, freeways have significant impacts on surrounding land uses, local and regional environments, human and animal habitats, and issues of economics and equity. Interstate 11 runs the risk of exacerbating the decentralized, low-density development patterns typical of Tucson, Phoenix, and Las Vegas if built in the traditional form. Instead, this third question focuses on reconceptualizing infrastructure as the largest public space component of a twenty-first century networked city. An integrated, "design first" look at the supercorridor holistically considers transportation, housing, economic development, jobs, recreation, energy, water, food, and access as key integrated ecologies of project design and planning. At the nexus of architecture, landscape architecture, and urban design, infrastructure becomes the civic core of the twenty-first century sustainable city. Designing this infrastructural civic core was the objective of the spring 2014 interdisciplinary urban design studio.

IUDS14: I-11 SUSTAINABLE SUPERCORRIDOR DESIGN STUDIO

A corridor justification report on the I-11 for the Arizona and Nevada Departments of Transportation (ADOT and NDOT respectively) was completed in August of 2013. References in that report suggest that an enhanced corridor is possible and desirable both by government agencies and community stakeholders and that further study of the concept is supported and likely. From the report:

> "There is considerable support for the study of a multi-functional Corridor that not only provides multimodal transportation opportunities but also houses assets that require similar rights-of-way. Utility (including transmission lines and telecommunications) and energy (including liquid/natural gas, fiber/dark fiber, wind, and solar) options and other emerging future opportunities were offered as potential candidates for shared or combined rights-of-way or easements… The Corridor could be the opportunity to build a smart or 'green' corridor of the future, serving as a new model for the movement of goods and people by learning from the best practices of previous corridor development."2

Capitalizing on a promising degree of agency interest, our team has been working directly with state and county agencies and engaged non-profits to broaden the vision of this infrastructural opportunity. With billions of federal, state, and local dollars at stake, we see the Supercorridor concept not only (and perhaps not even primarily) about improving the transportation model for the movement of goods and people, but about seeking innovative, high-tech and high-design, multi-disciplinary solutions that leverage this immense investment in the built environment for a range of social, economic, and environmental benefits.

The goal of this past semester's interdisciplinary urban design studio (IUDS14) was to use I-11 as a case study for the design of next generation infrastructure. The studio worked alternatively in interdisciplinary and disciplinary-specific teams. Tasks alternated between the macro (network) and micro (node) scales of the I11 route. Following introductory research on the demographics, environmental concerns, cultural assets, and current conditions of the expected route (or route alternatives, where appropriate), opportunistic yet somewhat prototypical (rural, urban, suburban) sites were selected. Fourteen interdisciplinary teams (seven from the University of Arizona, four from Arizona State University, and three from University of Nevada, Las Vegas) developed site specific proposals, while additional teams of planning students investigated questions specific to route alternatives or macro concerns. Representatives from ADOT, the Sonoran Institute, Pima County, Maricopa County, as well as professionals from the three disciplines participated as real stakeholders throughout the course of the semester.

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2 I-11 and Intermountain West Corridor Study, Corridor Justification Report. CH2Mhill and AECOM for Arizona Department of Transportation (ADOT) and Nevada Department of Transportation (NDOT). August 21, 2013. p84. Report can be found on line at: http://i11study.com/wp/wp-content/uploads/2012/09/I11_CJR_08_21_13_FINAL.pdf. retrieved 2 October 2013.

Project success was gauged by each team's ability to achieve next generation infrastructure criteria. Derived from previous research by the author, next generation infrastructure incorporates eight criteria that transform limited use conduits into part of a productive civic network.[3]

Next Generation Infrastructure is:

1. **multi-functional** – It capitalizes on overlapping spatial and economic investment to accomplish many things at once; it is a hybrid of multiple activities or uses.
2. **public** – It is the new civic realm, where public life happens, not just where tax dollars are spent.
3. **visible** – In next gen infrastructure, resource consumption and infrastructural processes are made visible to promote accountability and acknowledge responsibility for collective needs and personal consumption.
4. **productive** – Next gen infrastructure is socially productive; it increases rather than decreases equity by providing amenities, opportunities, and environmental enhancements while reducing negative impacts.
5. **locally specific, flexible and adaptable** – Unlike last gen infrastructure, next gen infrastructure recognizes the need to change over time and place, to adapt to people and technology, to be community specific, and to work at micro as well as macro scales.
6. **sensitive to the eco-economy** – Next gen infrastructure is environmentally as well as economically conscientious. It prioritizes strategies of reuse, recycle, revitalize or reinvent to expand the life of latent investment and preserve historical value.
7. **design prototypes or demonstration projects** – It recognizes infrastructure as public space for human occupation, considering qualities such as scale, materiality, use and aesthetics. Model projects show how next gen infrastructure succeeds beyond increased functionality.
8. **technologically-advanced and innovative** – Next gen infrastructure is smart. It uses new technology to increase efficiencies, human experience, environmental response, and networked capabilities.

Seven southern Arizona projects each tackled a different prototypical condition: border crossing, brownfield site, divided neighborhood, urban center, suburban sprawl, obsolete manufacturing, and wilderness. Two projects shown here, one for Marana, a bedroom community 25 miles north of Tucson, and one for Tucson's primary entrance into downtown, Congress Street and the proposed I-11, exhibit the different foci of the prototypes. The design for Marana responds to their emerging educational industry, their adjacency to water and their desire to grow independently of metro areas to the north and south. The Marana Supercorridor node is primarily a multimodal hub with expansive green infrastructure and densified residential connected to new corporate and educational development and public space. Tucson's intersection with the Supercorridor capitalizes on its position as the largest metro area in southern Arizona. Reinvented as "Energy City", the Tucson Supercorridor node captures solar and kinetic energy which charges a fleet of on-demand driverless cars and powers high-tech retail, residential and office space. The node also connects to the streetcar, commuter rail and future hyperloop. Dense development provides ample condensate and rainwater harvesting diverted to ground level living machines that ultimately recharge the Santa Cruz River and provide new recreational opportunities. The objective of these proposals is to illustrate the results of infrastructural opportunism, where leveraging major transportation investments with an innovation, design, and environmental emphasis can transform infrastructure from a string of detriments to a wealth of opportunities.

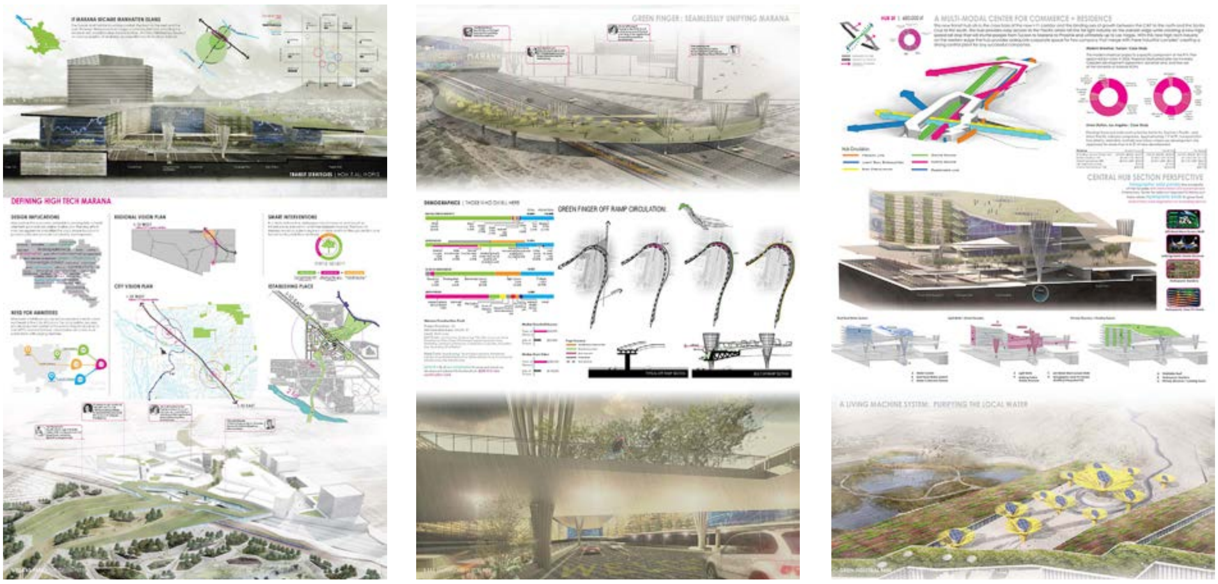
3 The Next Generation Infrastructure criteria listed here were developed by the author in conjunction with cityLAB partners as a result of previous research that emerged from work on cityLAB's WPA 2.0 competition. More on that topic can be found in Samuels (2010) "Working Public Architecture," *Places: Forum of Design for the Public Realm*, http://placesdesignobserver.com/entry.html?entry=12427. And in Dana Cuff's article "WPA 2.0: Working Public Architecture" in Harvard Design Magazine 33, Design Practices Now, vol 2, Landscape Architecture and Urban Design. Fall/Winter 2010/2011.

CONCLUSION

From Las Vegas to Nogales, the studio design proposals highlight a range of problems and opportunities inherent in a paradigmatic shift of this scale. The necessity of solving questions one and two – intervening in the process and inventing new prototypes – becomes even more evident as the design proposals clearly rely on radical reshaping of the status quo practices around infrastructure design and implementation. Our siloed thinking about use and distribution of resources is ineffective in solving the wicked problems of the coming century. For example, our collective and individual energy expenditure dedicated to car-centric living is obsolete, yet our commitment to mobility, consumption, and wealth has an inordinate impact on the mega-scale, multi-billion dollar projects that move goods and people. In this world of resource uncertainty, new infrastructure must express civic responsibility for the 21st century and be an agent of environmental, social, and economic change. The occasion to transform the legacy of sprawl into a new vision of sustainable design and planning is unprecedented.

Interstate 11 is a fortuitous opportunity intersecting the larger question of infrastructure reinvention for a new generation via interdisciplinary, collaborative thinking. The model for infrastructure design, planning, and construction lags far behind the logistically possible networked, responsive and productive possibilities. The three questions posed here with test projects developed in the design studio intend to instigate a larger conversation, beginning with the real stakeholders in the inchoate stages of large-scale infrastructure planning. This research and design will be instrumental in developing visionary solutions to some of our country's oldest and most stubborn problems – our love of mobility, our addiction to cheap energy, and our demand for easy accessibility. Simultaneously, we are building a new generation of student researchers and designers who recognize the value of cross-disciplinary collaboration, big thinking, and breaking out of the status quo.

This research was funded in part by grants from Arizona State University's Walton Sustainable Solutions Initiative and University of Arizona's Renewable Energy Network.



[Re}formation: interdisciplinary student proposal for Marana, AZ. Students: Stratton Andrews, Daniel Aros, William Greenway, Alexandra Hines, Ying Yang.

Figure 1: Energy City: interdisciplinary student proposal for Tucson, AZ.
Students: Steven Giang, Sally Harris, Kendra Hyson, Katherine Laughlin, Bernardo Teran.