Infrastructural Opportunism I-11_A Next Generation Infrastructure Case Study

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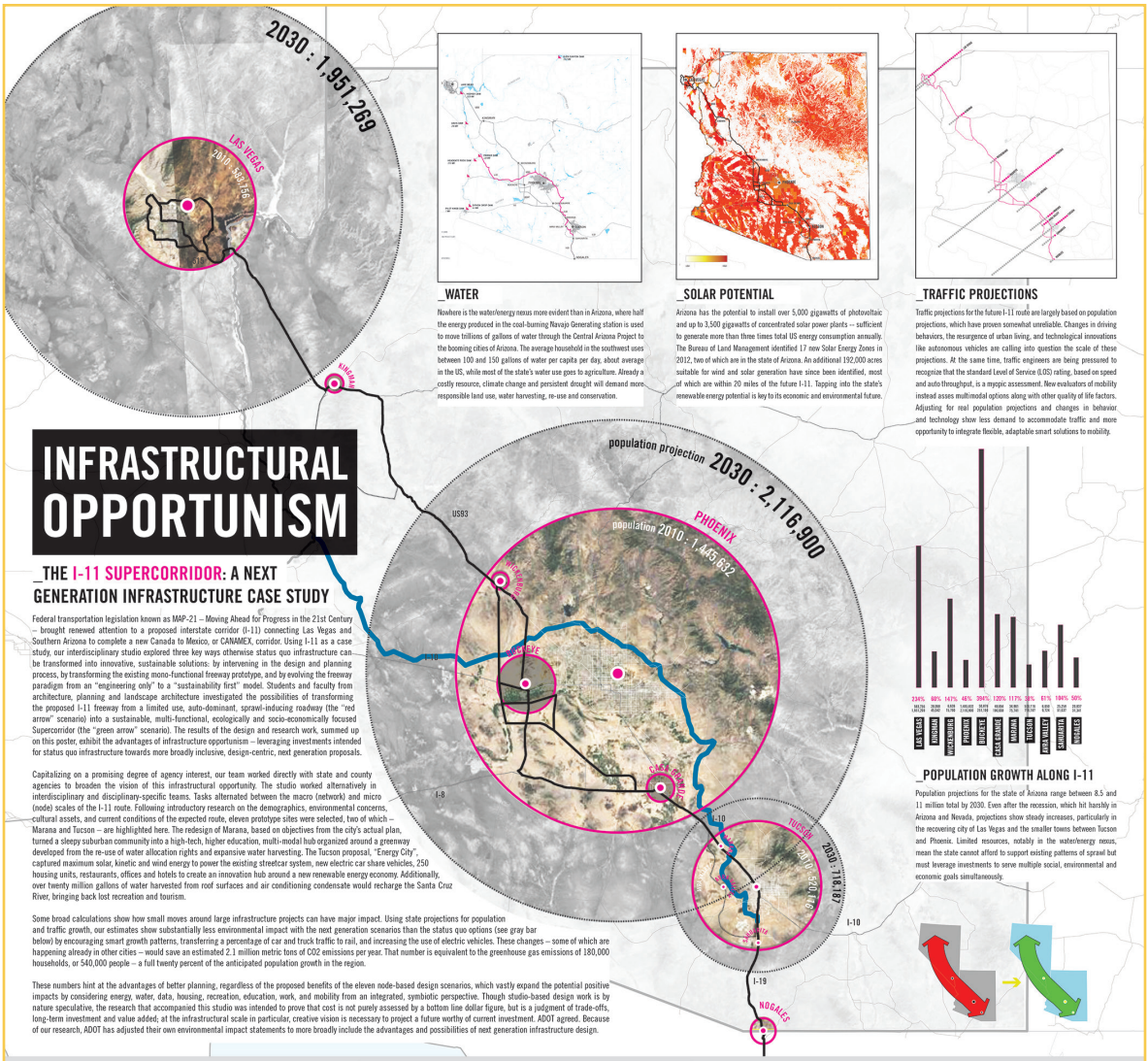
Federal transportation legislation known as MAP-21 brought renewed attention to a proposed interstate corridor (I-11) connecting Las Vegas and Southern Arizona to complete a new Canada to Mexico, or CANAMEX, corridor. Using I-11 as a case study, our studio explored three key ways otherwise status quo 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. Students and faculty from architecture, planning and landscape architecture investigated the possibilities of transforming the proposed I-11 freeway from a limited use, auto-dominant roadway (the "red arrow" scenario) into a sustainable, multi-functional, ecologically and socio-economically focused Supercorridor (the "green arrow" scenario). The results of this work, summed up on this poster, exhibit the advantages of infrastructure opportunism – leveraging investments intended for status quo infrastructure towards more broadly inclusive, design-centric, next generation proposals.

Capitalizing on a promising degree of agency interest, our team worked directly with ADOT and the Sonoran Institute to broaden the vision of this infrastructural opportunity. The studio worked alternatively in interdisciplinary and disciplinary-specific teams, alternating between the macro (network) and micro (node) scales of the I-11 route. Following introductory research, eleven prototype sites were selected, two of which – Marana and Tucson – are highlighted here. The redesign of Marana, based on the city's actual plan, turned a sleepy suburban community into a higher education, multi-modal hub organized around a greenway developed from the re-use of water allocation rights and expansive water harvesting. The Tucson proposal, "Energy City", captured maximum solar, kinetic and wind energy to power the existing streetcar system, new electric car share vehicles, housing units, restaurants, offices and hotels to create an innovation hub around a new renewable energy economy.

Some broad calculations show how small moves around large infrastructure projects can have major impact. Using state growth projections, our estimates show substantially less environmental impact with the next generation scenarios than the status quo options by encouraging smart growth patterns, transferring a percentage of car and truck traffic to rail, and increasing the use of electric vehicles. These changes – some happening already in other cities – would save an estimated 2.1 million metric tons of CO2 emissions per year, equal to roughly 180,000 households, or 540,000 people – a full twenty percent of the anticipated population growth in the region.

These numbers hint at the advantages of better planning, regardless of the proposed benefits of the design scenarios, which vastly expand the potential positive impacts by considering energy, water, data, housing, education, work, and mobility from an integrated, symbiotic perspective. Though design work is by nature speculative, the research that accompanied this studio was intended to prove that cost should not be purely assessed by a bottom line dollar figure, but is a result of long-term investment and value added. Because of our research, ADOT has adjusted their environmental impact review to more broadly include assessing the advantages and possibilities of next generation infrastructure design.



INFRASTRUCTURAL OPPORTUNISM

_THE I-11 SUPERCORRIDOR: A NEXT GENERATION INFRASTRUCTURE CASE STUDY

Federal transportation legislation known as MAP-21 – Moving Ahead for Progress in the 21st Century – brought renewed attention to a proposed interstate corridor (I-11) connecting Las Vegas and Southern Arizona to complete a new Canada to Mexico, or CANAMEX, corridor. Using I-11 as a case study, our interdisciplinary studio explored 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. Students and faculty from architecture, planning and landscape architecture investigated the possibilities of transforming the proposed I-11 freeway from a limited use, auto-dominant, sprawl-inducing roadway (the "red arrow" scenario) into a sustainable, multi-functional, ecologically and socio-economically focused Supercorridor (the "green arrow" scenario). The results of the design and research work, summed up on this poster, exhibit the advantages of infrastructure opportunism – leveraging investments intended for status quo infrastructure towards more broadly inclusive, design-centric, next generation proposals.

Capitalizing on a promising degree of agency interest, our team worked directly with state and county agencies to broaden the vision of this infrastructural opportunity. The studio worked alternatively in interdisciplinary and disciplinary-specific teams. Tasks alternated between the macro (network) and micro (node) scales of the I-11 route. Following introductory research on the demographics, environmental concerns, cultural assets, and current conditions of the expected route, eleven prototype sites were selected, two of which – Marana and Tucson – are highlighted here. The redesign of Marana, based on objectives from the city's actual plan, turned a sleepy suburban community into a high-tech, higher education, multi-modal hub organized around a greenway developed from the re-use of water allocation rights and expansive water harvesting. The Tucson proposal, "Energy City", captured maximum solar, kinetic and wind energy to power the existing streetcar system, new electric car share vehicles, 250 housing units, restaurants, offices and hotels to create an innovation hub around a new renewable energy economy. Additionally, over twenty million gallons of water harvested from roof surfaces and air conditioning condensate would recharge the Santa Cruz River, bringing back lost recreation and tourism.

Some broad calculations show how small moves around large infrastructure projects can have major impact. Using state projections for population and traffic growth, our estimates show substantially less environmental impact with the next generation scenarios than the status quo options (see gray bar below) by encouraging smart growth patterns, transferring a percentage of car and truck traffic to rail, and increasing the use of electric vehicles. These changes – some of which are happening already in other cities – would save an estimated 2.1 million metric tons of CO2 emissions per year. That number is equivalent to the greenhouse gas emissions of 180,000 households, or 540,000 people – a full twenty percent of the anticipated population growth in the region.

These numbers hint at the advantages of better planning, regardless of the proposed benefits of the eleven node-based design scenarios, which vastly expand the potential positive impacts by considering energy, water, data, housing, recreation, education, work, and mobility from an integrated, symbiotic perspective. Though studio-based design work is by nature speculative, the research that accompanied this studio was intended to prove that cost is not purely assessed by a bottom line dollar figure, but is a judgment of trade-offs, long-term investment and value added; at the infrastructural scale in particular, creative vision is necessary to project a future worthy of current investment. ADOT agreed. Because of our research, ADOT has adjusted their own environmental impact statements to more broadly include the advantages and possibilities of next generation infrastructure design.

_WATER

Nowhere is the water/energy nexus more evident than in Arizona, where half the energy produced in the coal-burning Navajo Generating station is used to move trillions of gallons of water through the Central Arizona Project to the booming cities of Arizona. The average household in the southwest uses between 100 and 150 gallons of water per capita per day, about average in the US, while most of the state's water use goes to agriculture. Already a costly resource, climate change and persistent drought will demand more responsible land use, water harvesting, re-use and conservation.

_SOLAR POTENTIAL

Arizona has the potential to install over 5,000 gigawatts of photovoltaic and up to 3,500 gigawatts of concentrated solar power plants -- sufficient to generate more than three times total US energy consumption annually. The Bureau of Land Management identified 17 new Solar Energy Zones in 2012, two of which are in the state of Arizona. An additional 192,000 acres suitable for wind and solar generation have since been identified, most of which are within 20 miles of the future I-11. Tapping into the state's renewable energy potential is key to its economic and environmental future.

_TRAFFIC PROJECTIONS

Traffic projections for the future I-11 route are largely based on population projections, which have proven somewhat unreliable. Changes in driving behaviors, the resurgence of urban living, and technological innovations like autonomous vehicles are calling into question the scale of these projections. At the same time, traffic engineers are being pressured to recognize that the standard Level of Service (LOS) rating, based on speed and auto throughput, is a myopic assessment. New evaluators of mobility instead asses multimodal options along with other quality of life factors. Adjusting for real population projections and changes in behavior and technology show less demand to accommodate traffic and more opportunity to integrate flexible, adaptable smart solutions to mobility.

_POPULATION GROWTH ALONG I-11

Population projections for the state of Arizona range between 8.5 and 11 million total by 2030. Even after the recession, which hit harshly in Arizona and Nevada, projections show steady increases, particularly in the recovering city of Las Vegas and the smaller towns between Tucson and Phoenix. Limited resources, notably in the water/energy nexus, mean the state cannot afford to support existing patterns of sprawl but must leverage investments to serve multiple social, environmental and economic goals simultaneously.

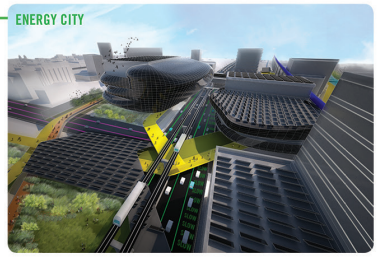
2.35 million residents in suburban growth patterns	+	85,000 new vehicle trips/day	=	4.8 million metric tons CO_2 emissions/yr (sprawl)	+	1.8 million metric tons CO_2 emissions/yr (passenger)	+	4.1 million metric tons CO_2 emissions/yr (freight)		ADDS 10.7 MIL metric tons CO_2 emissions/yr
2.35 million residents in smart growth patterns instead	+	85,000 new vehicle trips/day - shifts to rail & electric vehicles	=	1.6 million metric tons CO_2 emissions/yr (smart growth)	+	.1 million metric tons/year for commuter rail estimates	+	.05 million metric tons/year for 1% estimated electric vehicles	+	.4 million metric tons/year shifting 10% truck freight to rail	SAVES 2.1 MIL metric tons CO_2 emissions/yr

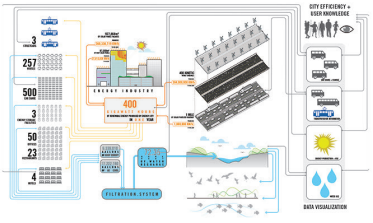
TUCSON, ARIZONA

POPULATION STATISTICS
2015 POPULATION: 526,116
20.4% OF THE POPULATION LIVES BELOW THE POVERTY LINE

ECONOMIC STATISTICS
MEDIAN HOUSEHOLD INCOME: $36,939
MEDIAN HOME VALUE: $153,700
6TH POOREST CITY IN THE US

TRANSPORTATION STATISTICS
AUTOMOBILES PER HOUSEHOLD: 1.0 - 1.7
VEHICLE MILES TRAVELED ANNUALLY: 16-18,500
WALK SCORE 73
BIKE SCORE 85
84





MARANA, ARIZONA

POPULATION STATISTICS
2015 POPULATION: 38,290
11.2% OF THE POPULATION LIVES BELOW THE POVERTY LINE

ECONOMIC STATISTICS
MEDIAN HOUSEHOLD INCOME: $71,723
MEDIAN HOME VALUE: $222,200

TRANSPORTATION STATISTICS
AUTOMOBILES PER HOUSEHOLD: 1.8 - 2.0
VEHICLE MILES TRAVELED ANNUALLY: 21-26,000
WALK SCORE 29
BIKE SCORE --
90