

Infrastructure System-of-Systems: A Holistic Approach for Infrastructure Resilience and Sea-Level Rise Adaptation

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Grand Challenges Provide Grand Opportunities



*Restore and Improve
Urban Infrastructure*

*We are at a tipping point toward a new
paradigm in engineering, construction,
and management of civil systems!*



Paradigm Shift in Urban Infrastructure

Climate Change Impacts



Increased Frequency and Magnitude of Extreme Events

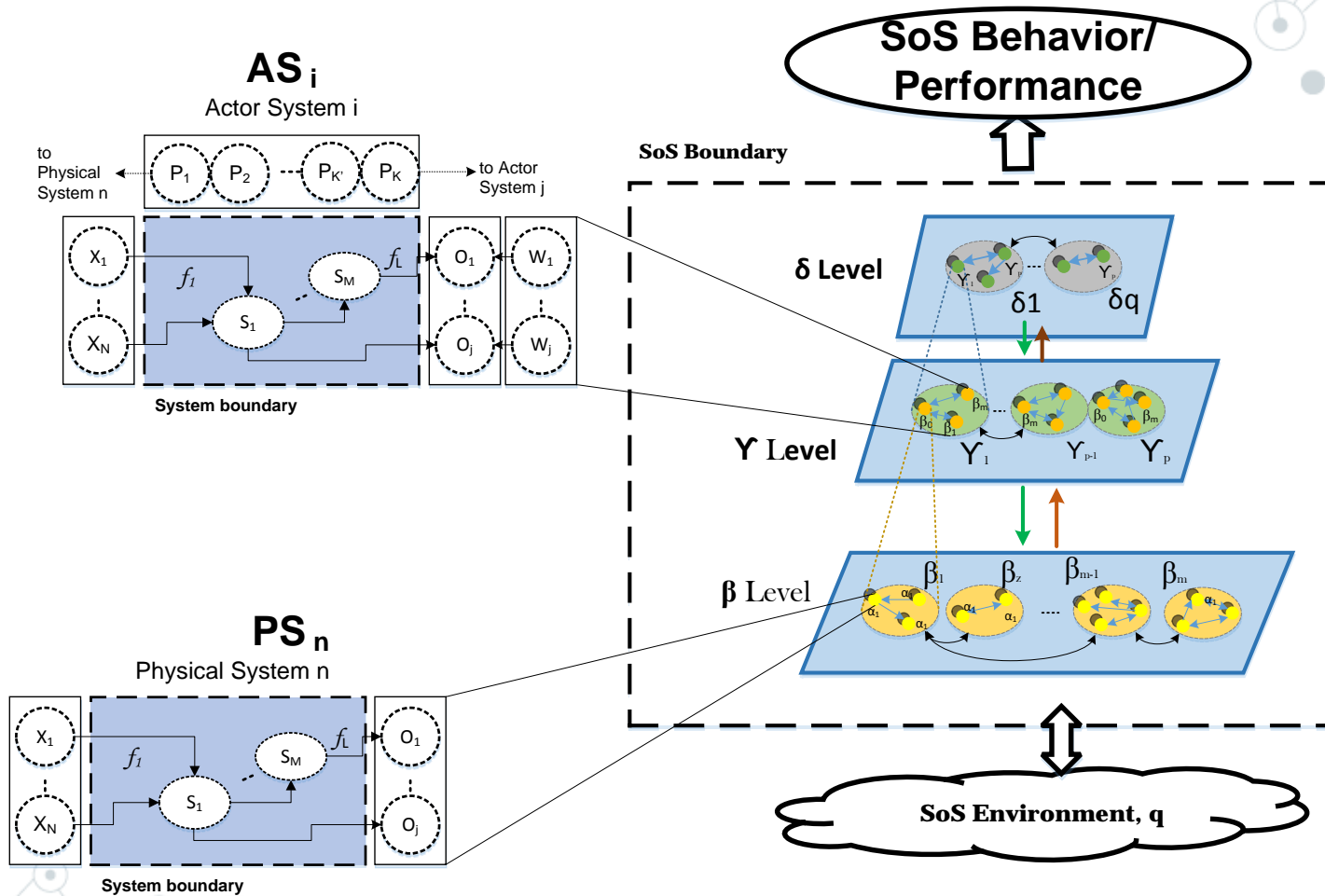


Urbanization and Environmental Impacts of Civil Systems



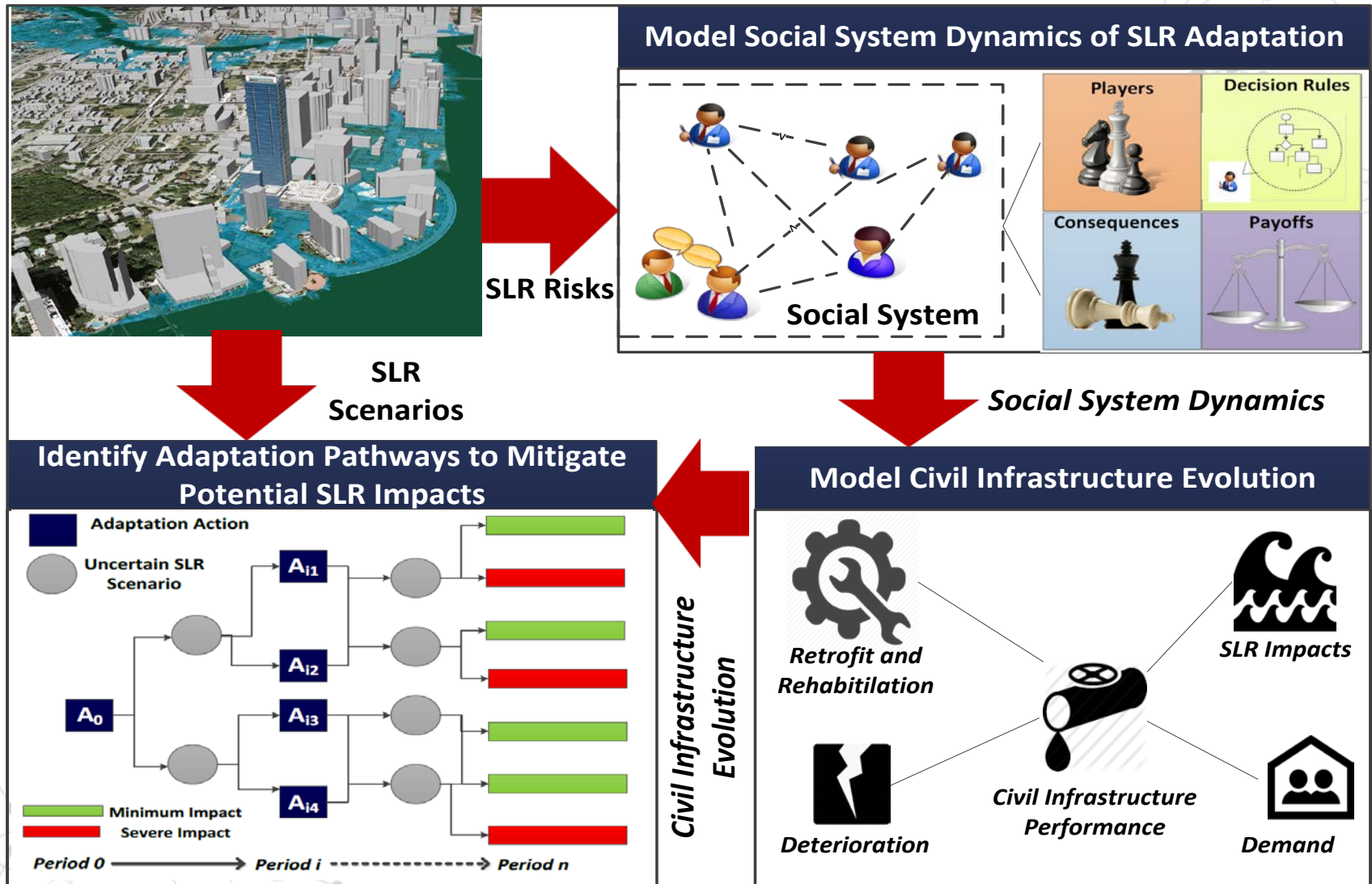
Supply-Demand Disparity

System-of-Systems: A Holistic Approach

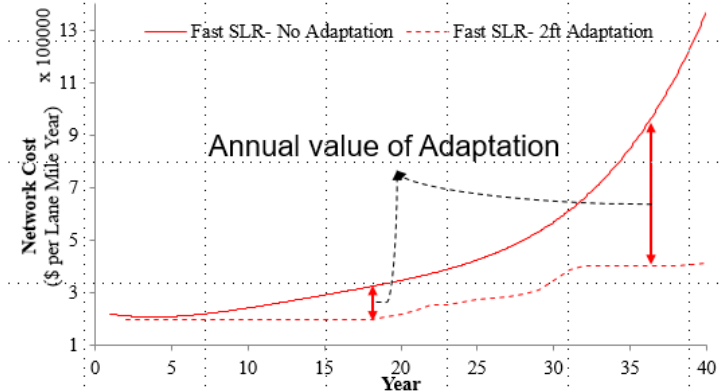
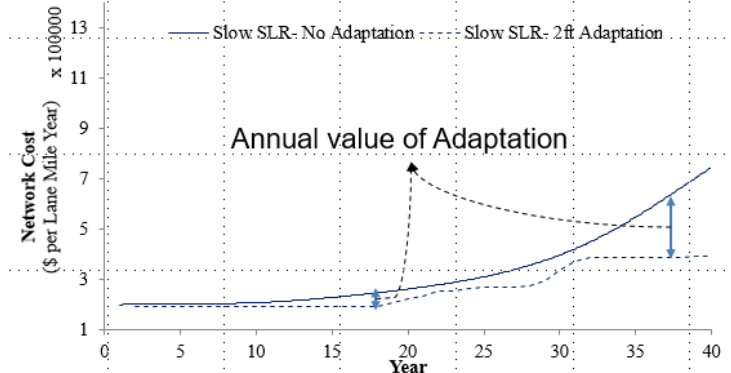
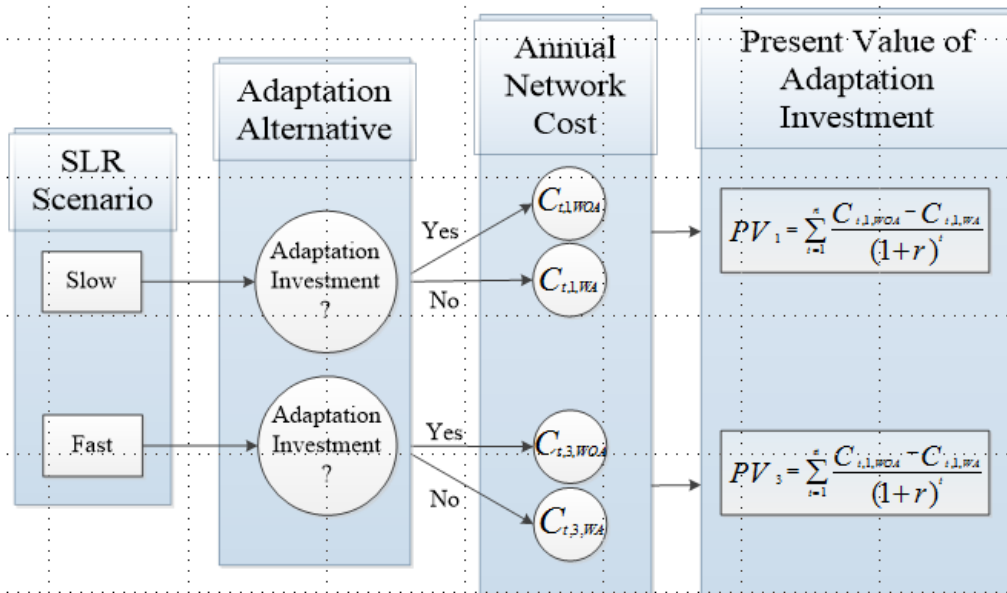
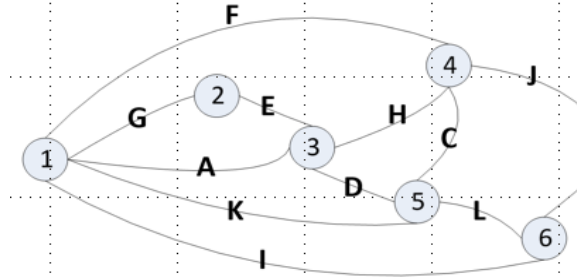
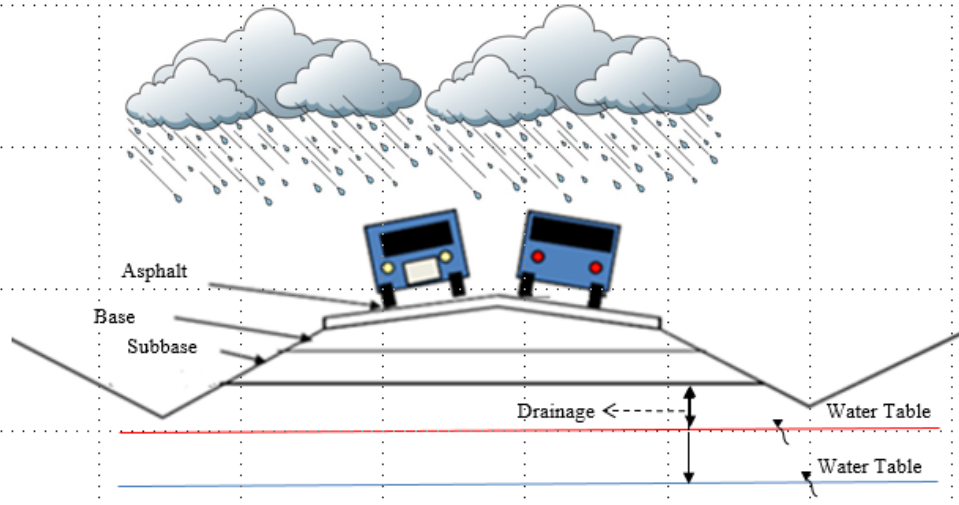


Civil Systems: Coupled Complex Infrastructure-Institution Systems

Actionable Science of Infrastructure Adaptation is Missing



Robust Decision-Making under Uncertainty using Exploratory Analysis – Road Network



Robust Decision-Making under Uncertainty using Exploratory Analysis - Demo

Sea Level Rise Adaptation Simulation Model Water System Analysis



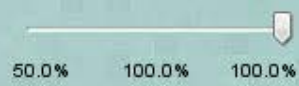
Choose actual sea level rise scenario: Choose starting perceived sea level rise: Choose agency risk attitude:

- Slow
- Medium
- Fast

- Slow
- Medium
- Fast

- Risk Averse
- Risk Neutral
- Risk Seeking

Choose treatment plant capacity:



Choose starting budget:



Choose demand:

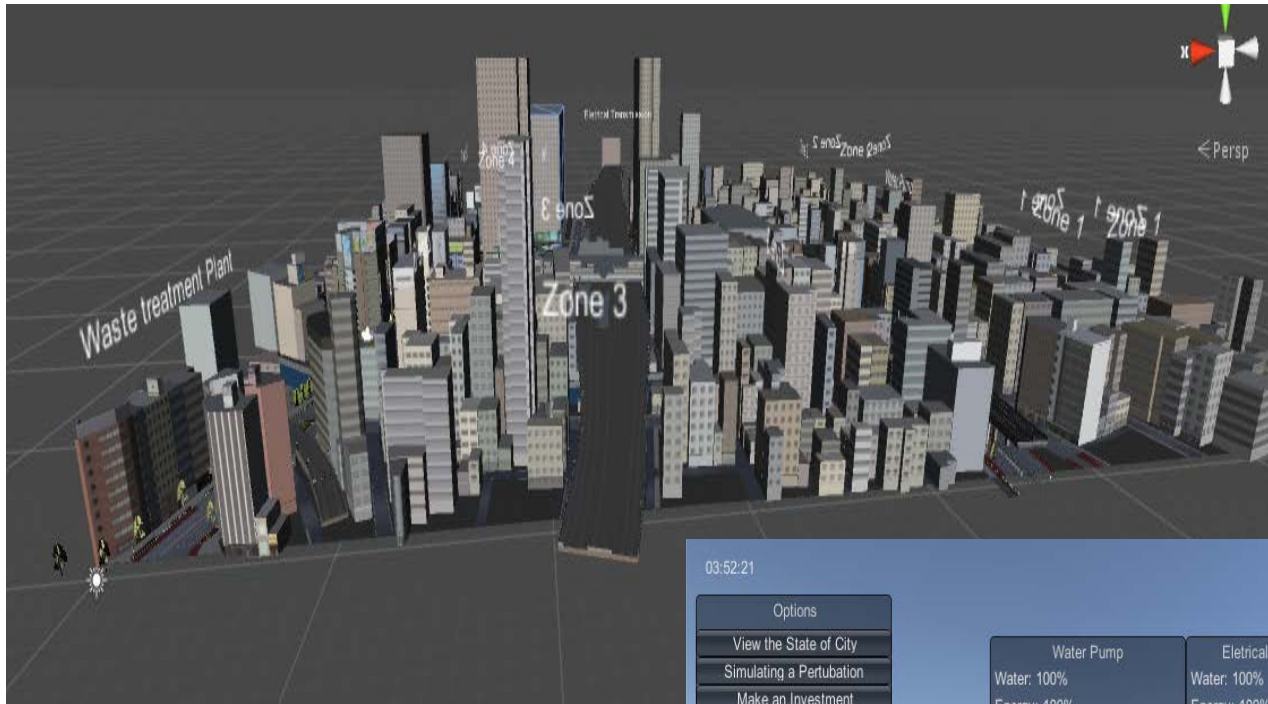


Choose capital funding for every 20 years:



Run

Collaborative Resilience Analysis in a Decision Theatre



03:52:21

Options			
View the State of City			
Simulating a Perturbation			
Make an Investment			
Save the City State			
Exit the simulating			

Water Pump	Electrical Transmission	Waste Water	
Water: 100%	Water: 100%	Water: 100%	Water: 100%
Energy: 100%	Energy: 100%	Energy: 100%	Energy: 100%
Sewer: 100%	Sewer: 100%	Sewer: 100%	Sewer: 100%
Buildings: 100%	Buildings: 100%	Buildings: 100%	Buildings: 100%

User 1	User 2	User 3	User 4
Water: 100%	Water: 100%	Water: 100%	Water: 100%
Energy: 100%	Energy: 100%	Energy: 100%	Energy: 100%
Sewer: 100%	Sewer: 100%	Sewer: 100%	Sewer: 100%
Buildings: 100%	Buildings: 100%	Buildings: 100%	Buildings: 100%

A 3D perspective view of the city model, overlaid with a semi-transparent interface. The interface includes a menu of options and several data panels. The data panels show 100% status for Water, Energy, Sewer, and Buildings for various city components and four users (User 1 to User 4). The city model is visible in the background, with labels for 'User 1', 'User 2', 'User 3', and 'User 4' overlaid on the buildings.

Thank You!



<http://www.isos-lab.com>