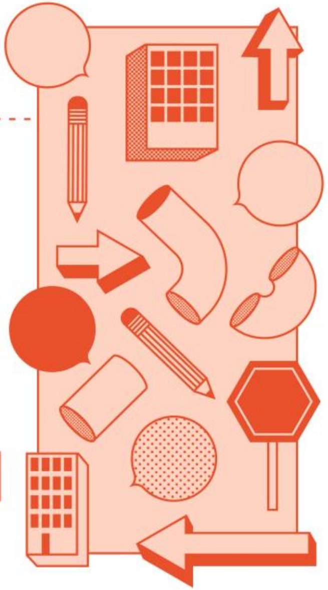
AGENCY + ACADEMIC RESEARCH EXCHANGE: DOT + DEP



At this inaugural Research Exchange event, researchers from DOT and from DEP and researchers from academic institutions will share their research ideas.

This will give DEP and DOT agency staff a sense of what academic researchers are focusing on and give academic researchers an idea of research contemplated by the agencies from their operations perspective.

For each agency, there will be a hour devoted to quick presentations, and an hour after that will be devoted to conversations and networking.

Fordham University/ Lincoln Center Campus, Leon Lowenstein Center, 12th Floor (112 West 60th Street, New York, NY)

10AM—1:15PM

- Brooklyn Law School
- City University of New York
- Columbia University
- Cornell University
- Drexel University
- Fordham University
- Manhattan College
- New York Institute of Technology
- New York University
- Pace University
- Pratt Institute
- State University of New York
- The Cooper Union
- The New School

DOT Commissioner Rodriguez: Opening Remarks

New York City Research Exchange

Fall 2024

Weigh-in-Motion (WIM) Program

With NYU

NEW YORK CITY DOT

Staten Island Plastic Asphalt Pilot

With Rutgers

Package Delivery Microhubs Pilot

With Region 2 CUNY-UTRC

DEP+Academics Pitchfest

DEP Presentations

Catch Basin Design

Environmental Protection

Bureau of Water and Sewer Operations

CONCEPT

Problem:

- DEP generally installs the Type 1 standard catch basin with curb piece.
- There is a gap in knowledge in regards to the hydraulic functionality of the Type 1 standard catch basin – specifically in terms of how much flow it can convey into the connecting sewer.

Research Question: What is the maximum flow rate that can be conveyed by the Type 1 standard catch basin?

Review of Best Available Technologies (BATs) for catch basins and any recommendations to maximize flow capture, optimal location for install and minimization of sedimentation / debris.

EXECUTION

Methodology: What new Methodology do you plan to explore in your research? For example, any new datasets? Or technologies?

- Hydraulic modeling
- Computational fluid dynamics
- Physical modeling
- Other

Curbs and Gutters

Environmental Protection

Bureau of Water and Sewer Operations

CONCEPT

Problem:

- The existing conditions for curb reveal and gutter flow varies widely throughout the City.
- Substandard conditions can contribute or even cause surface flooding by preventing water from entering catch basins.

Research Question: Which streets have substandard curbs and gutters and which are relatively worse?

Which of these streets may be contributing significantly to surface flooding?

EXECUTION

Methodology: What new Methodology do you plan to explore in your research? For example, any new datasets? Or technologies?

- Street view data
- Other data that allows for quantification of curb height, sidewalk/street slope, and gutter flow capacity

Post-Storm Flood Depths

NYC Environmental Protection

Bureau of Water and Sewer Operations

CONCEPT

Problem:
- Following a storm, there is little quantitative data regarding depths of surface flooding.
- The FloodNET sensor program has been started to help resolve this problem; however, there are and will remain massive data gaps.

Research Question: Can non-fixed technologies or methods be employed to capture surface water depths following a rain event?

EXECUTION

Methodology: What new Methodology do you plan to explore in your research? For example, any new datasets? Or technologies?

- Drone mounted LiDAR

Stormwater Conveyance & Infiltration Hybrid Practices

Environmental Protection

Bureau of Water and Sewer Operations

CONCEPT

Problem: Stormwater management is a critical aspects of urban infrastructure. DEP Bluebelt program manage storm water through temporary storage then gradually release into sewer system to reducing immediately discharge loads on sewer system. However during extreme weather conditions, the capacity of the temporary storage and the efficiency of gradual release can be insufficient.

Research Question: Can innovative hybrid stormwater management method that combine stormwater conveyance with enhanced infiltration practice be explored without causing applicable regulatory compliance issues or subsurface contaminations?

EXECUTION

Methodology: What new Methodology do you plan to explore in your research? For example, any new datasets? Or technologies?

- large diameter perforated sewer pipe and equivalent technologies equipped with proper filtration pack and monitoring sensors if needed based on exploration of the methodology

Environmental Protection

New and Emerging Green Roof Technologies

Miki Urisaka, GI R&D Section Manager, NYC DEP BEPA/GI

CONCEPT

Problem: Green roof companies are selling green roof systems that do not use traditional soil media.

Research Question: How do synthetic or alternative water retaining materials/technologies compare with traditional green roof with growing media?

EXECUTION

Business as usual: There is insufficient field data that can confirm the performance of new and emerging green roof technologies. These are difficult to quantify and credit.

Methodology: We would like to have local (NYC-based) field monitored data that can compare new green roof systems with a traditional vegetated green roof with 4" of soil media.

Noise and Air Quality

Ronald Vaughn, Deputy Director of Strategic Planning, DEP-BEC

CONCEPT

Problem:
Develop/Explore AI capabilities to improve efficiency and reduce manhours currently being used in an effort of freeing up DEP staff within our

1) Noise Camera Enforcement Program and
2) 2) Citizen Idling Enforcement Program.

Research Question: Potential automation development could include automating: the process of identifying sounds captured in video files, information from videos such as license plates and looking up vehicle owner information from outside vendor databases.

EXECUTION

Business as usual: Currently, DEP is manually reviewing video from both our Noise Camera Enforcement Program and 2) Citizen Idling Enforcement Program.

Methodology: Develop/Explore AI capabilities

Environmental Protection

Invasive Species

Jennifer Farmwald, Research Coordinator, NYCDEP Bureau of Water Supply

CONCEPT

Problem: Invasive Species are spreading rapidly throughout the NYC Watershed. We cannot monitor this threat to water quality across 2,000 sq miles in real time with traditional methods.

Research Questions:

- How/where are the shifts in abundance of invasive plants and animals impacting water quality (taste &odor, disinfection byproducts)?
- How successful are our management efforts at removing the target species and restoring the ecosystem functions?

EXECUTION

Business as usual: Traditional surveys are time consuming and cannot be implemented at an appropriate scale. We are beginning to explore eDNA/remote sensing tools.

Methodology:
Further explore eDNA, remote sensing, and other new tech to analyze relationships between observed invasive species and changes to conditions such as nutrient export, erosion, harmful algal blooms.

Determine how to best integrate new tech into both routine distribution surveys and targeted monitoring for invasive species of concern.

Environmental Protection

Emerging Contaminants

Jennifer Farmwald, Research Coordinator, NYCDEP Bureau of Water Supply

CONCEPT

Problem:

- Source and distribution of PFAS compounds in the environment, and as waste from treatment.
- Microplastics as vectors for pathogens; no widely accepted methodology to sample

Research Question: What percent removal of long chained PFAS compounds can be expected through Dissolved Air Flotation (DAF).

Review of Best Available Technologies (BATs) for treating wastewater water contaminated with PFAS.

EXECUTION

Methodology: What new Methodology do you plan to explore in your research? For example, any new datasets? Or technologies?

- Method or standard to sample and identify of microplastics at small scale.

Disinfection Byproducts + Precursors

Jennifer Farmwald, Research Coordinator, NYCDEP Bureau of Water Supply

CONCEPT

Problem:
Understand the fate of organics in City's water supply reservoirs.

Research Question:
- Quantify Cl_2 reactivity and kinetics of organic matter, determine bioavailability, and distinction between autochthonous versus allochthonous organic matter in reservoirs.
- Special studies of in-reservoir processes: photobleaching, adsorption of organic matter onto clay particles.
- Special studies of organics fractionation: lignin, amino acids, and their contribution to DBP formation.
- Investigate sources of organics: precipitation, throughfall
- Identify DBP precursor surrogates that compliment UV254 monitoring (i.e., peCOD and EEM Fluorescence spectroscopy).

EXECUTION

Business as usual:
Organic matter is a complex heterogenous mixture of many compounds. No or limited, site-specific studies on Cl_2 kinetics, bioavailability, and fate.

Methodology:
Laboratory experiments and analysis; field studies.

Environmental Protection

Climate Change

CONCEPT

Problem:

- Surface water quality
- Climate-mediated changes to ecosystem's water quality provisioning services
- Frequency of locally extreme weather events
- Downscaling regional climate models
- Impacts to infrastructure

Research Questions:

- How will increasing temperature and changing precipitation patterns alter water quality in NYC reservoirs? Key concerns: eutrophication, harmful algal blooms, and taste & odor issues; pathogens; organics; and turbidity.
- How might changes to the structure and species composition of watershed forests alter biogeochemical processes that could impact water quality?
- Identify novel natural resource management strategies to enhance ecosystem resilience to climate change?

EXECUTION

Business as usual:
Site-specific problem, poorly understood sources, sinks and kinetics of constituents responsible for algal blooms and taste & odor issues.

While there is some research to predict the impact of climate change on various ecosystems, there is limited information on how multiple climate-mediated stressors and responses may combine to change ecosystem functions as they relate to the provision of high-quality water.

Methodology: We are interested in concepts such as assisted migration, biological control, and exploring novel techniques to monitor ecosystem change.

DEP+Academics Pitchfest

Academic Presentations

Cleanlet
Keep Inlets Clean

Drexel
UNIVERSITY

Academic Research Plan

Crowd-sourced just-in-time inlet maintenance

CLEANLET

Franco Montalto, P.E., PhD, Professor

Before **After**

Before **After**

CONCEPT

Problem:

- Pluvial flooding is exacerbated when debris prevents runoff from entering catchbasins.
- The city's growing portfolio of green infrastructure practices operate at suboptimal efficiency when their inlets are blocked.
- There are thousands of catchbasins and thousands of GI practices across NYC and its logistically challenging for the city to keep them all clear of debris.

Research Question:

- What if we could crowd source debris removal at catch basin grates and GSI inlets?
- What if we could time this inlet maintenance so that it occurrs just before it rains?

EXECUTION

Methodology: Drexel university developed an app that does just that. Storm drains and inlets are added to the app. The app reads the unique precipitation forecast for each inlet. Users who have subscribed to the inlet receive push notification when forecasted rain exceeds a specified threshold. Like Uber drivers, the first user to claim the job gets it. Users receive points for visiting the inlet and taking photos of it before and after cleaning. The photos and their time stamps contain important information about the type of debris found at that location, and how time intensive it is to remove it.

Planning: The app is available now!

Value add: DEP could use it to organize its own asset managers or include the public in this activity as a form of decentralized green job.

Academic Research Plan

Quantifying differences in expected performance of proprietary green roof products

Franco Montalto, P.E., PhD, Professor

Green roof on weighing lysimeter on Fieldston School

CONCEPT

Problem:

- Green roofs (GR) are of interest due to Local Law 92/94 and the Unified Stormwater Rule
- To manage meaningful quantities of stormwater NYCDEP requires at least 4 inches of conventional growing media
- Many vendors of GR products claim their systems can retain that much stormwater, but there is currently no consistent methodology for quantification

Research Question:

- How much stormwater can alternative GR products and designs manage when subjected to contemporary NYC climatic conditions?

EXECUTION

Methodology: Drexel university has been monitoring green infrastructure systems in NYC since 2007. We have successfully used weighing lysimeters to evaluate stormwater retention from green roofs. Rainfall causes the weight to go up. Drainage and evapotranspiration cause the weight to go down. Over the course of an event the difference in weight is a direct measurement of retention. We propose setting up a weighing lysimeter testing lab in an outdoor location in NYC where vendors could compare performance of their product to benchmark GR designs.

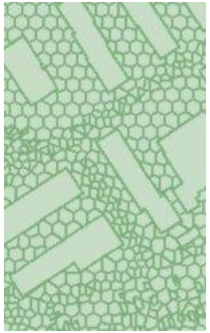
Planning: Consider repurposing scales that DEP has stored at Newtown Creek (if still available)

Value add: The research could increase the uptake of green roofs in NYC by encouraging goal driven innovation, and accelerating plan review

Academic Research Plan

Using integrated 1D-2D models to study effectiveness of different cloudburst/sponge city designs in NYC

Franco Montalto, P.E., PhD, Professor



PCSWMM 2D mesh (left)

Cloudburst field, Enghaven park (below)

CONCEPT

Problem:

- NYCDEP is increasing its investment in cloudburst projects and expanding its sister city collaboration with Copenhagen
- To reduce pluvial flooding at scale, innovation in cloudburst planning is going to be a continuous need, with customized designs developed based on land use, urban design, and drainage system opportunities and constraints

Research Question:

- What is the state-of-the-art in cloudburst/sponge city planning around the world, and how well do these and other designs work in NYC given its unique climate, land use, and drainage system characteristics?

EXECUTION

Methodology: Drexel university has been modeling green infrastructure systems in NYC since 2007. PI Montalto also has developed relationships with engineers and researchers in Copenhagen. We propose making an inventory of innovative designs and then using high resolution integrated 1D-2D PCSWMM models calibrated to local flows to simulate their effectiveness in prototypical neighborhoods of NYC, under a range of precipitation conditions.

Planning: PI Montalto surveyed cloudburst practices in Copenhagen in September, 2024. He has been studying flooding in NYC neighborhoods through recent NPCC4 and VIA research

Value add: The models would become digital twins that DEP could use to rapidly test out different cloudburst designs

Academic Research Plan

Indoor exposure to outdoor air pollution

Michael Waring, Professor and Head, Drexel Civil, Arch & Environ Eng.

Drexel UNIVERSITY

CONCEPT

Problem: Residents in urban areas are exposed to indoor pollution of outdoor origin, largely within their homes. This exposure is often negatively correlated to socio-economic demographics.

Research Question: How does residential indoor exposure to outdoor air pollution vary across cities, spatially and temporally?
– How does the variability in outdoor pollution influence exposure?
– How do the states of the housing stock and HVAC systems influence exposure?
– How can we reduce exposure through upgrades to housing or HVAC systems?

EXECUTION

Methodology: Develop datasets of weather and outdoor pollution by census tract when available, at hourly, daily, and annual res.
– Develop dataset of housing stock/HVAC system characteristics by census tract.
– Use data to run indoor air quality models and predict indoor concentrations, at high spatial and temporal resolution.
– Explore different scenarios on exposure.

Planning: Workflow for above has been developed for Baltimore. We could do a similar project for NYC.

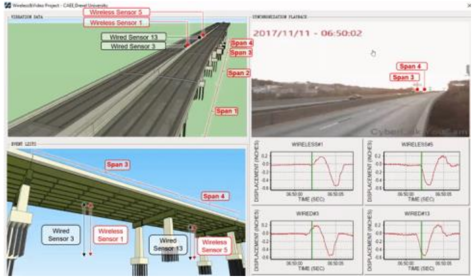
Value add: Benchmarking exposure. Future scenarios of housing/HVAC upgrades and protection plans can be explored.

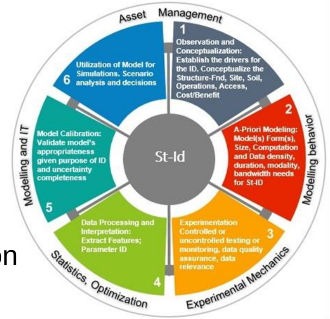
Academic Research Plan

Structural Identification (St-id) for Managing Engineered Systems: You Cannot Manage What You Cannot Measure

Ivan Bartoli, PhD, Professor

Field Experiments with wireless





Structural Identification

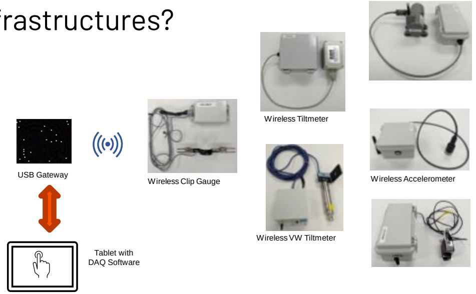
CONCEPT

Problem:

- Despite investments in infrastructure, funding will remain insufficient to ensure replacement of many critical infrastructure systems

Research Question:

- How resilient is our infrastructure transportation network? How can we prioritize investment with limited resources?
- Can rapidly deployable wireless sensing be used to assess the actual condition of infrastructures?



EXECUTION

Methodology: Drexel researchers have been at the forefront in using Structural Identification to help in identifying the root causes of performance concerns of infrastructures such as bridge by incorporating Visual Inspection, Operational Monitoring, Forced Excitation Testing, Controlled Load Testing, Non-destructive Probes, Long-term Monitoring with wired and wireless sensing systems.

Planning: PI Bartoli has leveraged this research to create digital twins of complex infrastructures, to adopt bridge sensing for bridge weigh in motion, and is currently working to demonstrate Technology Readiness Level for newly developed field ready wireless sensing.

Value add: Rapid testing, accurate modeling and calibration with creation of digital twins, enhanced asset management.

Academic Research Plan

Alexander van Geen, Research professor, Lamont-Doherty Earth Observatory

COLUMBIA UNIVERSITY

CONCEPT

Problem: Soil is recognized by NYC as a potential source of child exposure to lead but no free testing is available. Recent publications clearly show that NYC backyards, averaging 1,000 ppm total lead (5-times the newly lowered EPA standad), rather than public spaces or parks are the main problem.

Research Question: Could contaminated backyards be identified by engaging families in testing by having DEP (a) distribute an inexpensive kit for screening soil for extractable lead and (b) follow up by offering to test selected samples mailed to a central laboratory by X-ray fluorescence?

EXECUTION

Methodology: This program would build on DEP's exemplary tap water testing service to reach NYC residents. The soil screening kit is derived from an approved EPA method. A single plastic test tube contains all the necessary materials, including a cotton swab impregnated with sodium rhodizonate that turns purple in the presence of >200 ppm extractable lead in soil.

Planning: What stage are you in planning your proposed research? The kit is ready for production at a cost below $1/test.

Value add: This program will help DEP fulfill its mission of "protecting public health for all New Yorkers"

New high-res dataset: mapping location and movement of soil contamination in NYC neighborhoods

Dana R Thomson, Associate Director of Science Applications, CIESIN, Columbia Climate School (with Yushu Xia and Antoinette Wannebo)

Columbia Climate School

COLUMBIA CLIMATE SCHOOL
CENTER FOR INTERNATIONAL EARTH SCIENCE INFORMATION NETWORK

COLUMBIA CLIMATE SCHOOL
LAMONT-DOHERTY EARTH OBSERVATORY

CONCEPT

Problem: Heavy metals are known to cause irreversible damage to children and vulnerable population and we are only beginning to uncover the health risks of other pollutants such as microplastics. Despite bans, residual heavy metals are still widely found in urban soils, and subsequently in urban residences, farms, water and air. Low-income residents are more likely exposed to heavy metal contamination. Measuring actual containimation in the soil is extremely time-, human-, and resource-intensive we propose . Community members and decision-makers do not want to wait for catastrophic health impacts to occur before acting.

Research Question: Can we adequately model the propensity of the environment to store heavy metals in soil across cities to better prioritize soil testing & monitoring?

EXECUTION

Methodology: Derive a new soil contamination risk dataset from public data and evaluate its accuracy against community-referenced data in NYC and other cities. The dataset might be a citywide surface of 100x100m grid cells (approx. the size of a city block). Co-production with city agencies and engaged citizens is crucial to (a) develop a valid, scalable method and dataset, and (b) to ensure data are formatted and communicated appropriately.

Planning: Concept development phase.

Value add: Better understand storage and flow of lead and plastic within soil, water, and air systems. Co-design a mechanism (dataset) to communicate and address this with communities.

Data, Tools, & PROCESSES for Climate Resilience & Equitable Development

Linda Pistolesi, Senior Staff Associate in GIS, CIESIN, Columbia Climate School
(with Greg Yetman, Anjali Sauthoff, John Scialdone, Kytt MacManus, and others)

Columbia Climate School

COLUMBIA CLIMATE SCHOOL
CENTER FOR INTERNATIONAL EARTH SCIENCE INFORMATION NETWORK

CONCEPT

Problem: Datasets and decision-support tools for local govts (e.g., flood risk maps) are often developed in a relatively linear manner as one-off projects. What if local knowledge – including that of "experience experts" (i.e., those who were flooded) or citizen scientists (i.e., eBird, iNaturalist) – routinely fed back into data pipelines to improve outputs and decision-support tools over time?

Research Question: How might we co-design a "living" data ecosystem – perhaps around 1 topic such as watershed management – that creates new channels and relationships among decision-makers, communities, and researchers? In principle, these processes could "spill-over" to other dynamic and complex issues that require data-informed decision-making (e.g., housing crises).

EXECUTION

Methodology: Iteratively co-design and prototype a data ecosystem drawing on existing data, tools, and relationships (e.g., NYS Environmental Resource Mapper, Hudson River Flood Decision Support System, Hudson river benthic habitat mapping project).

Planning: Concept development phase.

Value add: Short run—generate new data and tools around watersheds (or other topics). Long run—build relationships and feedback loops that enable more accurate information and nimble decision-making.

Routine citywide air quality dataset co-produced with student scientists

Greg Yetman, Associate Director of Geospatial Applications, CIESIN, Columbia Climate School

Columbia Climate School

Columbia Climate School
Center for International Earth Science Information Network

CONCEPT

Problem: Students in lower-income (environmental justice) communities are often exposed to hazardous air quality and temperatures in and around their schools. Between 2022 and 2024, CIESIN with Bronx Center for Science and Mathematics, WEACT for Environmental Justice, Fordham University, and others co-developed an applied data science and environment curriculum, and co-produced a fine-scale, accurate, scalable dataset of PM2.5, NO3, and O3 by integrating data collected by students via low-cost censors with Earth Observation (EO) data.

Research Question: How might we scale this education + citizen science approach?

EXECUTION

Methodology:

- Engagement with NYC education and environmental agencies
- Co-develop a secure easy-to-use platform that facilitates data contributions by many schools, co-learning among schools, integration of sensor + EO data, and high-quality actionable information outputs
- Co-design, evaluate, and scale an applied science curriculum

Planning: Pilot is complete. Now planning and fundraising for implementation phase.

Value add: Stimulate and train the next generation of leaders. Co-produce fine-scale city air quality data routinely and accurately at scale.

Academic Research Plan

David Kay, Critical Issue Lead for Climate and Energy, Cornell Cooperative Extension

University Logo Here

CONCEPT

Problems: Rural/urban interdependencies and tensions regarding energy transitions.

Research Question: What influences shape private & public adaptation and mitigation, considering the role of attitudes, beliefs, awareness, knowledge and behaviors, and in particular how people understand interdendencies across the rural/urban spectrum in relation to climate action.

EXECUTION

Methodology: Standard social science methods including survey/questionnaire research, online or possibly mail; focus groups

Planning: Some related work not focused on NYC. These ideas are still being conceptualized.

Value add: Most climate adaptation/mitigation measures require changes in behavior. Determining the influences

Academic Research Plan

Vasil Diyamandoglu (CE) , Urs Jans (Chem), Naresh Devineni (CE), - The City College of New York

University Logo Here

The City University of New York

CONCEPT

Problem: What is the problem you are trying to analyze?

Evaluation of Biological Activated Carbon (BAC) instead of Anthracite, in the Removal of Emerging Contaminants (EC) in Drinking Water Filtration Plants where Dissolved Air Flotation is employed prior to BAC.

Research Question: What is the core research question?

The emerging contaminants frequently impose stresses in the water purification goals of existing drinking water treatment plants. Determination of the effectiveness of BAC in the removal of selected emerging contaminants observed in water.

EXECUTION

Methodology: What Methodology do you plan to explore in your research? For example, any new datasets? Or technologies?

We propose to carry out the study in full scale at the Croton Filtration Plant, a facility owned and operated by NYCDEP, Bureau of Water Supply.

Planning: What stage are you in planning your proposed research?

The background analysis and data gathering of facilities implementing the process has been ongoing for a while now. Application at the Croton Filtration Plant when it is in operation is proposed herein.

Value add: How might your research be useful to DOT/DEP? Develop operating criteria for selected EC removal to be directly implemented at the CFP.

Self-driving lab for electrochemical heavy metal detection and remediation

Joshua Schrier (Fordham) with Robert LeSuer (SUNY Brockport) & Zhongqi Cheng (Brooklyn College)

CONCEPT

Problem: Heavy metals in water and soil pose a significant health risk to city residents. Accepted methods of heavy metal analysis require costly scientific instrumentation, laboratory infrastructure, and highly trained professionals. Those affected by heavy-metal contaminants feel powerless and disenfranchised (see Flint).

Research Question: Can we develop a low-cost "*self-driving laboratory*" (SDL) instrument capable of autonomously detecting and remediating heavy metals in environmental samples, and in the process make heavy metal monitoring and remediation research more accessible, cost-effective, and efficient?

EXECUTION

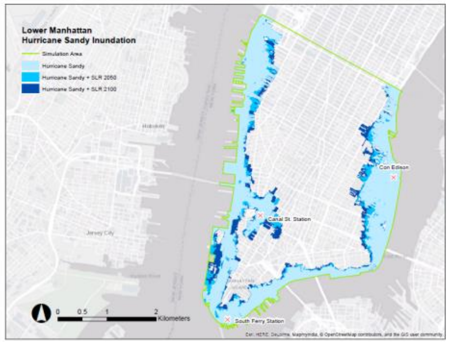
Methodology: Create a small, portable, low-cost electrochemical SDL that uses AI/machine learning to assist citizen scientists and non-experts in data collection/interpretation.

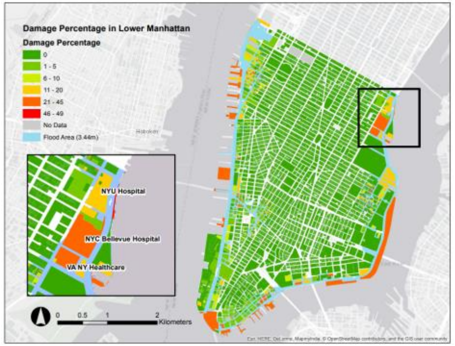
Planning: We are presently developing the first generation instrument which will provide automated heavy-metal analysis of aqueous samples with some decision-making functionality.

Value add: Low-cost, efficient, and autonomous heavy metal quantification and remediation research can enhance environmental monitoring, improve public health, engage citizen scientists, and support sustainable urban development initiatives.

Academic Research Plan

Yuki Miura, Assistant Professor, Center for Urban Science + Progress, Department of Mechanical and Aerospace Engineering, New York University





CONCEPT

Problem: **Compound flood risks amid climate change to the infrastructure in New York City.** Climate change worsens the impacts of hurricanes, and we need to implement actionable solutions based on accurate risk analyses.

Research Question: What is the socioeconomic impacts from compound flooding events amid climate change? Those include physical damage to buildings and infrastructure, economic losses due to interdependency, and social impacts.

EXECUTION

Methodology: I developed a rapid flood estimate tool, GISSR, which can be overlaid on GIS-based maps. GISSR can identify the floodplains with/without protective measures. **It is tailored for NYC with the feedback from stakeholders in the city**.

Planning: GISSR is already in use for coastal flood simulations and currently under development of combining rainfall simulations to simulate compound impacts.

Value add: Identifying the destructions to their infrastructure facilities and its impacts to help navigate decision-makings for mitigation.

Academic Research Plan

Graham Dove, Asst Professor, TMI/CUSP, NYU Tandon

NYU TANDON SCHOOL OF ENGINEERING

CONCEPT

Problem: How to better monitor and mitigate noise at ma jor construction sites, so as to reduce the impact on local communities and improve communication and awareness between communities, agencies and contractors. In particular with regard to the redevelopment of Manhattan Jail

Research Question: How do we achieve public interest noise monitoring?

EXECUTION

Methodology: Participatory community science and design, using noise monitoring sensors develop for SONYC

Planning: Effort needed to update backend systems for data logging, storage, and analysis

Value add: The research improves community relations and reduce effort spend planning response to 311 calls

Academic Research Plan

Maurizio Porfiri, Institute Professor, CUSP/MAE/BME, NYU Tandon

Cristina Dragomir, Clinical Associate Professor, NYU Liberal Studies and CUSP/TMI, NYU Tandon

NYU LIBERAL STUDIES

NYU | TANDON

CONCEPT

Problem: As coastal cities experience increasingly powerful storm surges and intense precipitation, it is expected that many inhabitants of susceptible coastal cities will become displaced. Authorities have begun investing in weather-resilient infrastructure, however, the distribution of resources across diverse communities with varied infrastructure, economic means, and social backgrounds, remains largely uninformed

Research Question: What is the interplay between climate-related disasters, city infrastructure, and communities, and how could it inform robust solutions for coastal communities?

EXECUTION

Methodology: Multidisciplinary approach, comprising: i) open-ended interviews, surveys, and oral histories to assess homeowners' climate risk awareness and viable options for climate adaptation in multiple NY communities, and ii) inference of causal associations underlying community-level house adaptation to inform effective interventions

Planning: This study is projected to begin in the Fall

Value add: Understanding the communities most vulnerable to climate change and their ability to respond to disasters will help prioritizing tasks for sewer improvements and transportation solutions

Academic Research Plan

Manny Patole, Industry Assistant Professor, Center for Urban Science and Progress, Tandon

CUSP
Center for Urban Science + Progress
NYU | TANDON

CONCEPT

Problem: Climate driven events have caused massive population displacements across the U.S., triggering spikes in housing demand into safer "receiving communities." The resulting urbanization patterns often reflect our history of segregation and car-oriented development, leading to urban disinvestment and sprawl, which in turn contribute to additional environmental hazards, such as floods, and exacerbate social inequalities. Proactive planning approaches are needed for urban development that is informed by climate resilience and housing equity.

Research Question: For this purpose, how can a decision-support tool for classifying parcels assist within a region in terms of their urban revitalization and flood hazard mitigation potential?

EXECUTION

Methodology: We will evaluate legal, planning, and policy instruments to propose ways for implementing this decision-support tool in the creation of new land disposition policies that maximize social, financial and environmental resilience with a focus on VAD property and vulnerable communities.

Planning: A similar project was conducted in Baton Rouge, LA and would like to understand how to scale it in the NYC context. I would like to collaborate with similar institutions and organizations I did in LA, leveraging open data of NYC and resources available at NYU

Value add: Our project outputs will help improve resilience of historically segregated and underinvested communities and increase the equity considerations applied to the reuse of VAD properties and vulnerable communities.

Academic Research Plan

Dr. Augustin Guibaud, Assistant Professor, Mechanical and Aerospace Dept.

CONCEPT

Problem: How is indoor air quality affected by outdoor conditions?

Research Question: How is air quality affected by vertical stratification in NYC?

EXECUTION

Methodology: Analyze existing dataset used for Air Quality Index (AQUI) and expand the network through dedicated sensors.

Planning: Early stage of outdoor data collection, a dedicated indoor-outdoor research facility has been built in the UK (CAVE).

Value add: Inform design of air management systems and filters on buildings to improve air quality and energy consumption in normal and exceptional conditions (wildfire haze).

Academic Research Plan

RAMP, Pratt, Graduate Center for Planning and the Environment

CONCEPT

Problem:

RAMP: Rebuild Adapt Mitigate Plan addresses the impact of climate change on coastal communities from an inter-disciplinary standpoint and works with local community-based organizations to reconstruct or mitigate impact with multi-facted, on the ground solutions that include hard and soft water mitigation infrastructure.

Research Question:

What is the impact of a climate change on your community from a social as well as physical standpoint and how can planning /design mitigate impacts?

EXECUTION

Methodology: We work with local community partners. We gather and interpret data collected in the field that is focused on community experience of climate change.

Planning: We have executed multiple projects: a community-wide reconstruction in Sheepshead Bay that became a Build-it-Back project involving DEP; community visioning plans for resiliency in the Lower East Side with the Good Ol Lower East side, and in Far Rockaway with RISE,

Value add: We provide strong community engagement and visioning in relationship to deep knowledge of environmental systems that could support your efforts

Academic Research Plan

Fluid Frontiers, Pratt, Graduate Center for Planning and the Environment

Pratt

Pratt SOA

CONCEPT

Problem: Fluid Frontiers studies combined sewer outflows and other aspects of sewer infrastructure in light of climate change – both sea level rise and increased rainfall. It proposes strategies to address NYC compliance with the Federal Clean Water Act that are simultaneously grounded in community engagement.

Research Question: How can sewershed analysis supply better data to support progress with stormwater management and compliance with the Federal Clean Water Act in an era of climate change? How can those strategies simultaneously benefit local communities ?

EXECUTION

Methodology: We collect data in a designated sewershed as well as gather all historical available records. We then quantify/ interpret data in relationship to projected climate change impacts on our physical and social fabric- such as land use, built typologies, infrastructure.

Planning: We have executed an indepth study this far on the Red Hook watershed. It is available for review.

Value add: We provide the ability to gather, quantify, and analyze data in relationship to sewersheds in support of your efforts. We support that science with historical research and community outreach .

Academic Research Plan

David Erdman, Director Center for Climate Adaptation

Pratt

Center for Climate Adaptation
Pratt

CONCEPT

Problem: Our research examines strategies for systematizing, scaling and expanding NYC's stormwater and blackwater reuse. The goal is to diminish combined sewer over loading and our interdependency on upstate reservoirs, two escalating stressors exacerbated by rain volumes, frequency of rain events, but also a growing risk of drought.

Research Question: To what extent could the built environment absorb water and integrate nature-based solutions to become part of the water shed? Under what permissible conditions could that capture be reused for graywater in residential, mixed use developments and/or thermoelectric plants?

EXECUTION

Methodology: We gather data, and deploy Generative AI visualizations in combination with digital twins to study and inform decision making.

Planning: We have convened workshops locally and internationally on the subject, demo-ing visualization methods. We have gathered data to better understand our models' level of resolution and access. We are assessing appropriate scales and sites for study.

Value add: We can support DEP in planning, piloting, testing , and assessing the feasibility of gray water reuse.

Academic Research Plan

Dr. Jennifer Rosati
Associate Professor of Forensic Entomology
Chair for Department of Sciences, Director of Forensic Science Program, Coordinator for First-Year Biology Courses
Department of Sciences, John Jay College of Criminal Justice (City University of New York)

JOHN JAY COLLEGE OF CRIMINAL JUSTICE

*Minority Serving Institution
**Hispanic Serving Institution

CUNY THE CITY UNIVERSITY OF NEW YORK

CONCEPT

Problem: Energy inefficiency and lack of sustainable practices leading to a high carbon footprint and increased operational costs.

Research Question:

What are the environmental, economic and educational benefits that result from the utilization of Green Space in urban academic environments?

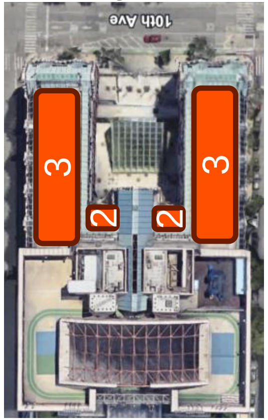
BUGZ
Biodiversity and Urban Greenspace Zone

EXECUTION

Methodology:

Smart Infrastructure Monitoring (SIM) technology for environmental monitoring from start to completion
Smart Irrigation System (SIS) to monitor soil conditions for targeted watering based on plant needs from sustainable water collections
Innovative app-based data collection using FieldVisits™
Efficient and sustainable composting using BSFL (black soldier fly larvae)
IBM video streams of live bee colonies or greenspace for JJC, CUNY, community and global engagement to promote sustainable practices

Planning:



Value added:

Template for CUNY colleges and other educational institutions
Direct Pipeline to highly qualified interns and employment opportunities
Direct access and collaboration with John Jay College to explore avenues for research as part of or undergraduate research programs, graduate programs and potential granting collaborations with faculty
Help meet the City's Initiative to have 85 percent of New Yorkers living within walking distance of a park by 2030

DOT+Academics Pitchfest

DOT Presentations

NEW YORK CITY DOT

Asphalt at Bus Stops

Chris Hrones, Director Strategic Initiatives, Transit Development
Alexander Altskan, Senior Capital Planner, Transit Development

CONCEPT

Problem: Transit Development is working to identify the conditions and/or a threshold at which asphalt rapidly deteriorates at bus stops, and therefore, when a concrete bus pad should be installed at the stop.

Research Question: What quantitative and qualitative conditions lead to rapid asphalt deterioration at bus stops? Bus frequency? Bus ridership and lingering time? Adjacent land uses? Number of hours the bus stop is in direct sunlight?

EXECUTION

Business as usual: Transit Development has identified a number of approaches to studying the problem but currently does not have the capacity to complete the research.

Methodology: Transit Development has collected a number of datasets that the researcher could analyze, including bus frequency/ridership counts, monitoring of asphalt condition over time, and observations of environmental conditions. The research would also require review of existing literature related to asphalt durability.

Bus Lane Treatment Evaluation

Chris Hrones, Director Strategic Initiatives, Transit Development
Philip Betheil, Dep. Director Bus Priority, NYCDOT

CONCEPT

Problem: DOT utilizes a variety of bus lane treatments (curbside, offset, center/median-running, busway, etc.). It is difficult to compare changes in bus speeds within each treatment type, as well as against other treatment types, due to many variables between corridors (length, density, signals and timing, turn-bays, traffic volumes, number of stops, etc.)

Research Question: How do different bus lane treatments affect bus travel speeds, controlling for other variables?

EXECUTION

Business as usual: We currently compute change in speed, but it does not consider any of the potential confounding variables.

Methodology: We have stop to stop speed data as well as a variety of other data sources, but do not have the resources/expertise to do a detailed statistical analysis that would control for other variables.

Shared Bus-Bike Lane Evaluation

Chris Hrones, Director Strategic Initiatives, Transit Development
Philip Betheil, Dep. Director Bus Priority, NYCDOT

CONCEPT

Problem: DOT has piloted shared Bus-Bike lanes, lanes which are available for exclusive use of buses and bicycles. While safety data from these lanes are promising, DOT would like a more in-depth understanding of how buses and bikes interact within these lanes that would include near-misses and overtaking instances.

Research Questions: How do buses and bikes share shared lanes? How often do buses overtake bikes or vice versa? How do these interactions differ for e-bikes and similar micromobility modes? Where do bikes ride in the lane?

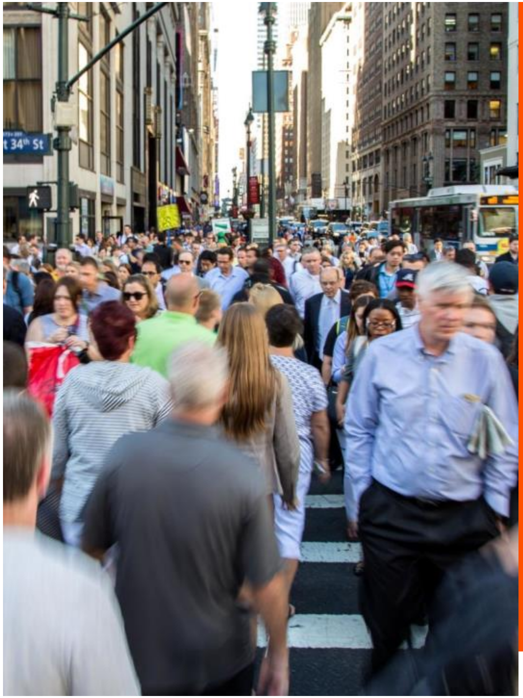
EXECUTION

Business as usual: We have analyzed safety data for some pilot locations and done a cursory manual video observation study.

Methodology: We are interested in a well-designed video observation or machine-learning video analysis study that can answer the research questions using a large dataset. DOT has some existing video data that could be used or would be able to collect additional or help arrange for installation of monitoring equipment.

Traffic Analysis

Mali'e Yoon, Project Manager TEP, NYC DOT
William Ullom, Deputy Director TEP, NYC DOT



CONCEPT

Problem:
New York City's pedestrian and traffic volumes and densities are so large that conventional factors used in analysis procedures do not accurately reflect the field conditions leading to non-optimal signal designs, unrealistic Levels of Service, and safety implications.

Research Questions:

- Investigate Highway Capacity Manual (HCM) procedure for effect of pedestrians in crosswalk on friction factor for turning vehicles.
- How can current HCM analysis methodologies and calculations be adapted to account for through vehicles bypassing downstream left turning vehicles at shared through left movements?
- How can current HCM analysis methodologies and calculations be revised to account for the effect of vehicles spilling back from turn bays?

EXECUTION

Business as usual:

- NYCDOT uses a series of worksheets and calibration procedures in order to adjust factors within the Highway Capacity Software and Synchro in order to reflect field conditions as much of the time the field measured processed volume exceeds the expected capacity of an intersection. This process takes significant amounts of time and is prone to errors.
- The analysis of right turning vehicles is overly conservative due to the aggressive driving behavior in NYC and the abundance of leading pedestrian intervals.

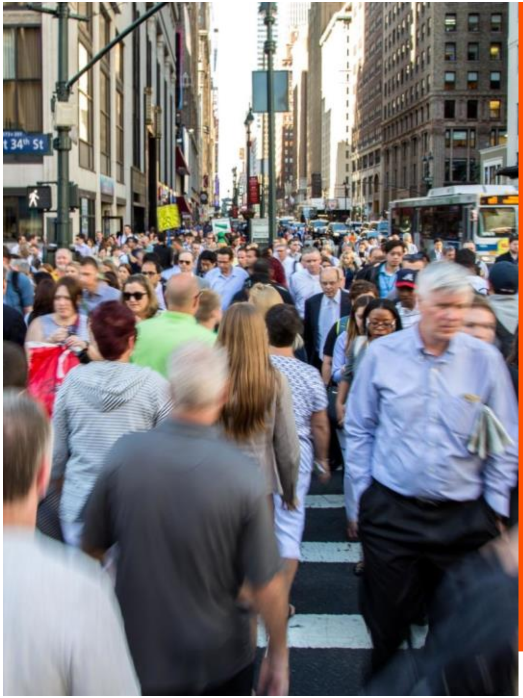
Methodology:

- NYCDOT has access to a large number of video recordings of intersections and sidewalks that could be used to develop these factors and assess new analysis techniques.
- NYCDOT has developed procedures and worksheets that can be used as a first step in identifying potential changes and adaptations to the HCM.

NEW YORK CITY DOT

Pedestrian Analysis

Mali'e Yoon, Project Manager TEP, NYC DOT
William Ullom, Deputy Director TEP, NYC DOT



CONCEPT

Problem:
New York City's pedestrian behaviors, volumes, and densities are so unique to the United States that conventional factors used in analysis procedures do not accurately reflect the field conditions leading to unrealistic Levels of Service, and safety implications.

Research Questions:
- What alterations to the existing crosswalk analysis are necessary to acount for the effect of pedestrian density on walking speed, as it is in sidewalk analysis.
- How can the crosswalk analysis be updated to account for start-up loss time and the density of pedestrians on the corner?
- What alterations to the time-space calculations in the HCM crosswalk analysis are necessary to accurately reflect that shorter crossings operate better than longer crossings.

EXECUTION

Business as usual:
- Under the current HCM procedures, the installation of a curb neckdown at an intersection leads to a poorer crosswalk operations compared to the existing conditions, which can discourage the implementation of these safety improvements.

Methodology:
- NYCDOT has access to a large number of video recordings of intersections and sidewalks that could be used to develop these factors and assess new analysis techniques.

Estimating Plaza and Park Visits

Mark Seaman, Senior Economist, Commissioner's Office

CONCEPT

Problem: When conducting benefit-cost anlayses of projects that propose building plazas or expanding parks, DOT needs to be able to estimate the future number of users for those spaces. As a starting point, it would help to know how intensively existing plazas and parks are used, in terms of visits per unit area per year.

Research Question: What is the number of visits per unit area per year for typical plazas and parks in New York City? Ideally, estimates are provided at the borough or sub-borough level, so that they reflect differences in density and land use.

EXECUTION

Business as usual: DOT estimates plaza and park visits from estimates of visits to a handful of signature parks.

Methodology: We'd like to see what can be done with existing big data sources, while addressing the challenges that some sources have in identifying pedestrians in New York City.

Measuring Open Streets Benefits

Josef Szende, Project Manager Special Projects

CONCEPT

Problem: DOT is reimagining public space through a growing number of programs and projects such as Summer Streets, Open Streets, and permanent plaza spaces. Aside from the mobility, accessibility and economic benefits, are there other benefits that can be measured?

Research Question: What are the potential air quality benefits of new public space programs? Are there corresponding health benefits that can be quantified? What about mental health? Noise reduction?

EXECUTION

Business as usual: Existing air pollution data is not granular enough to detect the impacts of open streets, such as the Community Air Survey (DOHMH).

Methodology: Use of hyper local, low-cost air sensors. Mobile and/or stationary devices.

NYC DOT Art Asphalt Art Installation

Leah Rosofsky, Project Manager, NYC DOT

CONCEPT

Problem:
How to better implement asphalt art murals to complement pedestrian spaces as part of street improvement projects

Research Question:

What are the benefits of asphalt art to better target the work more effectively?

EXECUTION

Business as usual:

- Size and scale
- Geographical reach across boroughs
- Existing site elements
- Maintenance
- No existing qualitative or quantitative data methodologies

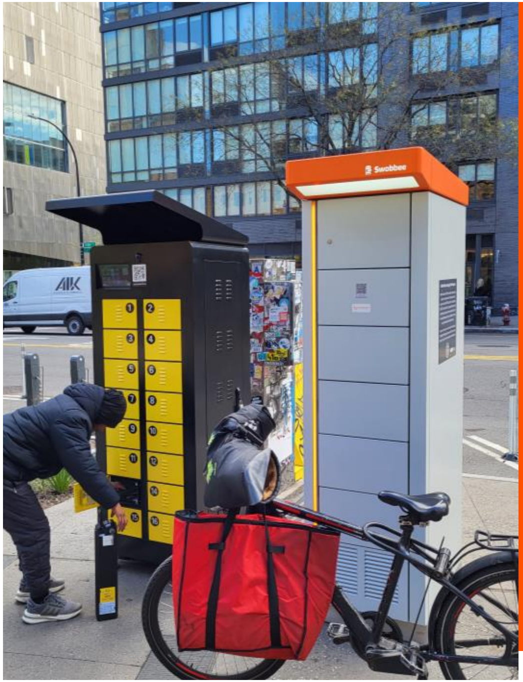
Methodology:

- Pedestrian safety surveys
- Driver behavior surveys
- Artist implementation surveys
- Open Data

NEW YORK CITY DOT

Battery Swapping Network

Seth Contreras, Innovation Advisor, NYC DOT



CONCEPT

Problem: Access to a network of safe and affordable battery swapping cabinets for delivery workers.

Research Question: How many cabinets are needed and where to place them? What kind of density do you need? How big do the cabinets have to be? What is the optimal roll-out plan?

EXECUTION

Business as usual:

- Locations of residence v. commercial
- Private property v. ROW installs
- Access to power
- Battery range

Methodology:

- DOT evaluation report expected Fall 2024 of the e-bike charging pilot
- Citywide Mobility Survey

DOT+Academics Pitchfest

Academic Presentations

C&D waste, glass powder as clinker substitution for low-carbon concrete

Shiho Kawashima, Associate Professor, Civil Engineering and Engineering Mechanics

COLUMBIA ENGINEERING

CONCEPT

Problem: The industry is seeking to increase clinker substitution in concrete to lower its embodied carbon amidst changes in policy (e.g. NYS Buy Clean Concrete). At the same time, the supply of conventional supplemental cementitious materials (SCMs) is declining (e.g. coal fly ash).

Research Question: What is the viability of utilizing waste fines from construction & demolition (C&D) waste, glass powder, and other locally-sourced alternative SCMs to replace carbon-intensive portland cement while still achieving target properties?

EXECUTION

Methodology: Explore novel methods of processing industrial waste feedstocks. Assess impact of SCMs on cement properties (e.g. reactivity, rheology) and concrete performance (i.e. ASTM strength gain, workability).

Planning: Completed a 3-year NYSERDA-funded project on utilizing concrete waste fines as fillers/SCMs, and performed lab-scale proof-of-concept.

Value add: Help identify new sources of SCMs that can simultaneously utilize waste and lower the embodied carbon of concrete to meet upcoming changes in policy.

Center for Smart Streetscapes

advancing livable, safe, and inclusive shared spaces

Andrew Smyth PI & Director, NSF Center for Smart Streetscapes

Carleton Professor, Civil Engineering, Columbia

CENTER FOR SMART STREETSCAPES

COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK

LEHMAN COLLEGE

RUTGERS THE STATE UNIVERSITY OF NEW JERSEY

FLORIDA ATLANTIC UNIVERSITY

UNIVERSITY OF CENTRAL FLORIDA

Visit cs3-erc.org

CONCEPT

Problem: U.S. urban areas face threats to **livability**, **safety**, and **inclusion** which can only be addressed by uniting community members, government agencies, researchers, and industry. This paves the way to co-design real-time, hyper-local streetscape applications built on edge-cloud technology, wireless-optical engineering, visual analytics, privacy preservation, data security, and social science.

Research Question: How to develop a sensing/communications/computing platform to support concurrently-running next-generation smart city technologies in a community-centered manner at the local/human scale.

EXECUTION

Methodology:

- **Fundamental research**
- **Community & gov. agency engagement**
- **Harlem pilot project validation**
- **Education & student outreach**
- **Industry & agency collaboration**

Planning:

- **Commencing Year 3 of 10-Year project**
- **Long-term & short-term projects**

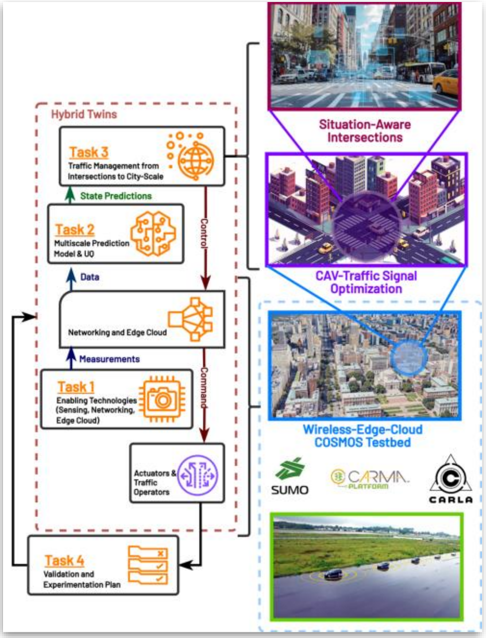
Value add:

- **Capacity & expertise in research & validation**
- **Industry, agency, & community collaboration**
- **NYC testbed**

A Hybrid "Digital Twin" of New York City

CENTER FOR SMART STREETSCAPES

Lead: Sharon Di
Assoc. Professor Civil Engineering, Columbia University



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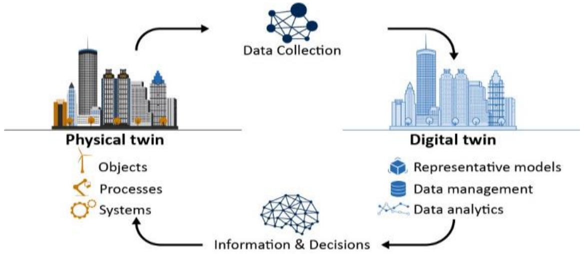
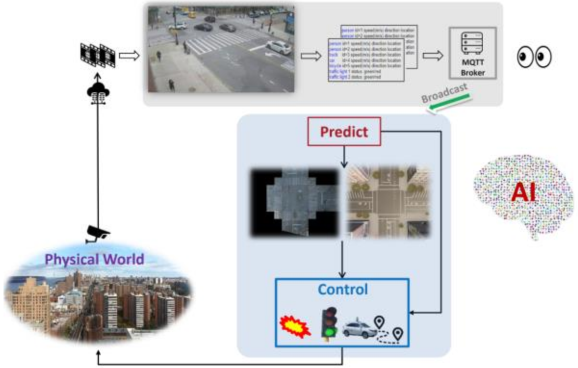
CONCEPT

Problem: Create a hybrid twin system for urban traffic management, combining AI, edge cloud computing, and advanced communication networks.

Research Question: How to create realistic models of streets, and driver and pedestrian behavior with an emphasis on replicating real world data macroscopically and microscopically.



EXECUTION



Methodology:

- **Merging virtual traffic simulations with digital twins**
- **Incorporating physics-based models & real-time data from infrastructure**

Planning:

- **Ongoing model deployment & data collection**

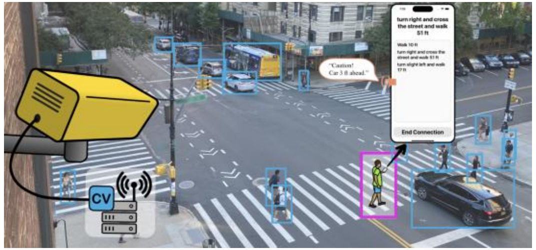
Value add:

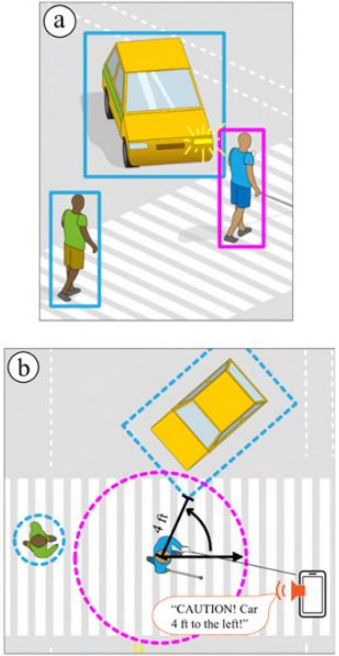
- **Blueprint to test policy, autonomous driving, & urban planning**

Wayfinding for Blind or Low-Vision

CENTER FOR SMART STREETSCAPES

Lead: Brian Smith
Asst. Professor, Computer Science, Columbia University

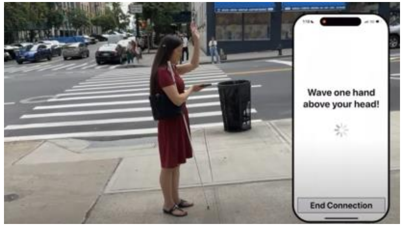




CONCEPT

Problem: Blind and low-vision (BLV) New Yorkers face safety hazards due to loud street noise and increasingly quiet vehicles. Traditional GPS applications leave gaps in locating precise position of users, creating safety gaps that extant streetscape applications can be modeled to address.

Research Question: How to leverage existing streetscape technology to provide precise, real-time, and scene-aware outdoor navigation for BLV pedestrians.



EXECUTION

Methodology:
- **Smartphone app development**
- **Computer vision pipeline**
- **Common channel signaling (CCS)**
- **User evaluation**

Planning:
- **Undergone technical & user experience evaluations**
- **"StreetNav" prototype phase**

Value add:
- **Community involvement & collaboration**
- **Community Board participation**
- **NYC testbed**

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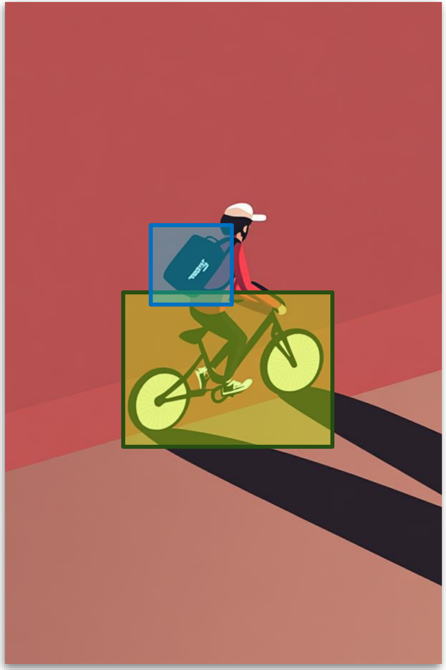
Advancing Micromobility Detection for Smart Cities

CENTER FOR SMART STREETSCAPES

Lead: Mehmet Turkcan
Assoc. Research Scientist, CS3
Columbia University



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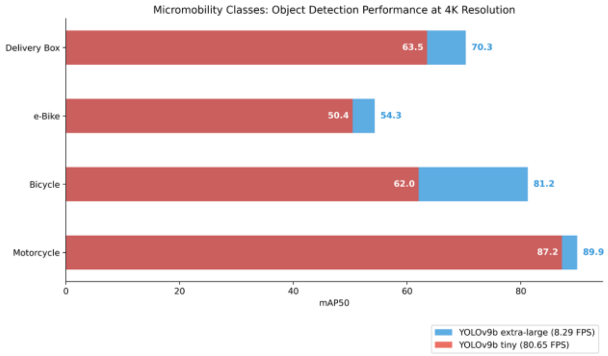
CONCEPT

Problem: Micromobility object classes such as e-bikes and e-scooters are unknown to modern computer vision models.

Research Question: How to detect and classify micromobility sources in complex urban streetscapes to enhance traffic management, improve safety, and support urban infrastructure planning.



EXECUTION

Methodology:

- **Annotations for e-bikes, bicycles, motorcycles, & delivery boxes**
- **Real-time object detection in hi-res**

Planning:

- **Ongoing deployment & data collection**

Value added:

- **Expansive datasets & modeling**
- **Real-time detection of unsafe behaviors like red-light running or helmet non-use**

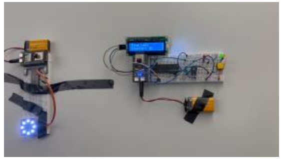
Student & Community-Driven Ideation

CENTER FOR SMART STREETSCAPES

CONCEPT

Problem: The NYC DOT is installing connected accessible pedestrian signals (APS). New APS will provide a wide range of functionalities for the DOT and the pedestrians in making streets safer.

Research Question: What obstacles older NYC residents face when crossing the street, and what capabilities can be added to APS to eliminate or reduce those obstacles.



EXECUTION

Methodology:

- **Sociology work with Harlem residents & community partners**
- **Lessons for local high schoolers & undergrads**
- **Conception, testing, & evaluation of ideal technological solutions**

Planning:

- **8 weeks of sociology work, engineering classes, prototyping, & evaluation**

Value add:

- **Future smart city leaders & innovators**
- **Community feedback & trust**

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Coordinated infrastructure expansion for heavy duty electric vehicle adoption

Manxi Wu, Assistant professor, Cornell University

CornellEngineering
Operations Research and Information Engineering

CONCEPT

Problem: Data-driven optimization methods for efficient operations of mid and heavy duty electric vehicles. Long-term infrastructure expansion via public and private coordination

Research Question:

1. How can we efficiently operate EV fleets in logistics and service operations?
2. How can we assess economic viability and guide infrastructure investments amid uncertainty in technology and adoption rates?
3. How can we ensure equity in the adoption and deployment of EV infrastructure?

EXECUTION

Methodology:

1. Develop algorithms for EV fleet routing.
2. Assess economic viability of EV adoption in heavy-duty freight.
3. Facilitate public-private sector coordination for infrastructure expansion and equitable EV adoption.

Planning: Developed efficient algorithms for EV fleet operations. Working on computation and joint design of charging and grid networks.

Value add: This research will assist the NYC DOT in aligning public and private sector incentives on infrastructure expansion for EV adoption, ensuring that plans account for economic and technological feasibility.

Data-driving road pricing: Efficiency, equity and sustainability

Manxi Wu, Assistant professor, Cornell University

CornellEngineering
Operations Research and Information Engineering

CONCEPT

Problem: Data-driven design of efficient and equitable road pricing mechanisms for NYC:

1. Mitigate congestion caused by personal trips, ride-hailing services, and logistics operations.
2. Maintain fair road accessibility for all residents.
3. Design high-occupancy toll lanes to promote carpooling.

Research Question:

1. How to design a dynamic tolling system that balances equity and efficiency?
2. How to incentivize carpooling, and how does toll affect ride-hailing and logistics?

EXECUTION

Methodology:

1. Game-theoretic model of carpool behavior
2. Inverse optimization for preference distribution estimation
3. Adaptive control for dynamic road pricing that adjusts to real-time sensor data.
4. Market design analysis of equity and welfare impacts on ride-hail and logistics.

Planning: Completed game-theoretic and carpool sensitivity analysis. Refining equity impacts and toll effects on ride-hailing, with ongoing computation and data validation.

Value add: Our work will provide NYC data-driven toll design to reduce congestion, improve equity and promote carpooling

Academic Research Plan

The City College of New York

Yiqiao Li, Assistant Professor, Department of Civil Engineering

CONCEPT

Problem: Leveraging advanced traffic sensing technologies and AI/machine learning to analyze urban traffic (with emphasis on trucks and pedestrians) for enhanced curbside and parking management, pollutant and noise estimation, safety assessment on vulnerable roadway users (VRU), etc.

Research Question: How can emerging technologies and AI/machine learning be utilized to obtain high-resolution and reliable urban traffic data to better inform operation, planning and policymaking?

EXECUTION

Methodology:
Sensing: Mobile sensing, infrastructure-based sensing and cooperative sensing
Models: AI, Computer Vision, Deep Learning, large language model (LLM), edge computing and digital twins.

Planning:

1. Sensor installation and prelimary analysis
2. Data commuication and database management
3. Model development and validation
4. Operational System

Value add:

An advanced AI/ML based traffic monitoring system

1. Provide Urban Mobility Living Laboratory (UML2) to improve traffic operations and management.
2. Fill urban freight and VRU data gap

Academic Research Plan

City College of New York

Ardavan Yazdanbakhsh, Associate Professor, Civil Engineering Dept.

CONCEPT

Problem: Understanding the relationship between economic indicators (including those published by the U.S. Census Bureau and the Bureau of Labor Statistics) and the quantities of various types of waste produced both nationally and in New York.

Research Question: Investigate the feasibility of forecasting major changes in waste production trends.

EXECUTION

Methodology: Multivariate time series forecasting models ranging from classic autoregressive models to large language deep learning, RNN, CNN, etc. Collecting publicly available waste production data and working with local agencies to obtain city and state data.

Planning: Have already completed a project on forecasting the demand for cement in the U.S. Currently we are identifying and collecting time series data on waste production.

Value: A waste forecasting software application can serve as an additional resource for economists and policy makers at the DOT and the DEP.

Academic Research Plan

Takahiro Yabe, Assistant Professor, CUSP/TMI, NYU Tandon

Maurizio Porfiri, Institute Professor, CUSP/MAE/BME, NYU Tandon

Cristina Dragomir, Clinical Associate Professor, NYU Liberal Studies and CUSP/TMI, NYU Tandon

NYU TANDON

NYU LIBERAL STUDIES

CONCEPT

Problem: E-bike delivery workers in NYC are disproportionately exposed to environmental hazards, including extreme heat and pollution. Can we identify vulnerability hotspots and policy recommendations to improve their working conditions?

Research Question: How can we develop analytical methods to estimate the experienced hazard exposure using large-scale mobility data?

EXECUTION

Methodology: Large scale mobile phone location data, GPS and heat sensors, and interviews/focus groups with community members

Planning: Started analyzing mobility data; initiating discussions with community groups to plan interviews

Value add: Improve working conditions and overall livelihoods of gig workers in NYC

Academic Research Plan

Takahiro Yabe, Assistant Professor, CUSP/TMI, NYU Tandon

Joseph Chow, Institute Associate Professor, CUE, NYU Tandon

NYU TANDON

CONCEPT

Problem: To achieve green mobility, the US government has committed to installing 500K EV charging stations (EVCSs). Drivers' behavior patterns during the 30-45 minutes charging period and the resulting economic spillover effects on local businesses are not well understood

Research Question: What are the economic impacts of placing EVCSs on the revenue of nearby businesses and use of public urban amenities?

EXECUTION

Methodology: Large scale mobile phone location data, collaboration with EVCS company

Planning: Started analyzing mobility data; obtained letter of collaboration from EVCS company

Value add: Enable community-centric planning of public EV charging infrastructure in NYC

Academic Research Plan

Manny Patole, Industry Assistant Professor, Center for Urban Science and Progress, Tandon

CUSP
Center for Urban Science + Progress
NYU | TANDON

CONCEPT

Problem: Dozens of major roadway corridors across NYC are woefully unsafe, unhealthy, inefficient, and unsustainable. Vehicles speed, pollute, and jostle in a street space free-for-all; desolate asphalt and concrete expanses are hot and impermeable; and auto-centric buildings and land uses make for an unpleasant and uninviting pedestrian experience.

Research Question: Rather than neighborhood dividers and spaces to avoid, how can NYC's arterial thoroughfares be models of sustainability, public health, social cohesion, and equality among communities along their paths?

EXECUTION

Methodology: The project will utilize open data to analyze the intersection of multiple climate and quality of life issues pertaining to these streets (such as tree canopy availability and pedestrian safety). This quantitative, spatial analysis will be grounded in qualitative observations and conversations with experts.

Planning: Preliminary research, data analysis, site visits, and discussions with experts are underway. Evaluation of potential policies and tools will be undertaken later this year. Seeking additional collaborative partnerships regarding spatial analysis and modeling.

Value add: It will identify actionable design and policy ideas to transform these corridors into more hospitable and dynamic assets.

Academic Research Plan

C2SMARTER Center Faculty: Kaan Ozbay, Joseph Chow, Daniel Vignon, Eugene Vinitsky

CONCEPT

Problem: C2SMARTER's goal is to solve problems related to urban congestion. untangling the broad system-of-systems interdependencies facing congested urban systems that not only include multiple modes, but many interrelated sectors, and understanding the system-wide impacts of congestion

Research Question: We are developing new technologies, operational policies, and strategies towards ensuring system-level congestion reduction for all users. Our focus areas are: 1) Deployment of multi-modal technologies, 2) Enhancing operations through system control and design, and 3) data-driven management and evidence-based policymaking for our state/local partner agencies and practitioners

EXECUTION

Methodology: We rely on experimentation, with the goal of using evidence-based decision making to turn research into transformative and equitable solutions that take advantage of emerging technologies such as AI/ML and connected and automated vehicles. We employ previously developed physical and cyber testbeds to validate and synthesize insights across cities.

Planning: The Center creates new research projects, in addition to the ongoing research that is in deployment/ready to use status.

Value add: Our planned upcoming efforts on Congestion Pricing monitoring/modeling and BQE alternatives analysis modeling/impact measurement are of high need to DOT, in addition to ongoing work with DOT. The Floodnet project was sponsored by C2SMART

Academic Research Plan

Ci-Jyun (Polar) Liang, Assistant Professor, Stony Brook University

Stony Brook University

CONCEPT

Problem: On-site robot fabrication of modular components is beneficial for building retrofitting in urban environments to achieve energy efficiency and sustainable development and reduce traffic burden of transporting large modular components. However, limited and narrow on-site workspace is challenging for robot manipulation, materials storage, and waste disposal.

Research Question: How to coordinate traffic data, task sequence planning, robot path planning, and material cutting planning for robot modular fabrication in narrow on-site workplaces?

EXECUTION

Methodology:
(1) Robot task and path planning algorithms in a narrow cell with large materials
(2) Material-cutting strategy that minimizes transportation needs and wastes
(3) Material transportation schedule with traffic data and site layout

Planning: Developed and tested a real-scale off-site robot cell for fabricating building retrofitting modular panels.

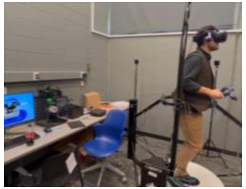
Value add: Minimize material transportation burden and construction wastes for urban building retrofitting and achieve sustainable development.

Equitable City Streets: Needs of Neurodivergent Young Adults while Walking, Biking, Driving, and Navigating Public Transit

Gongda Yu, Ye Wang, Austin Angulo, Irina Benedyk, University at Buffalo – SUNY, TRAVL Lab

University at Buffalo
Stephen Still Institute for Sustainable Transportation and Logistics

TRAVL
Transportation Research and Visualization Laboratory



CONCEPT

Motivation: Approximately 11.4 and 1.6 million adults are diagnosed with ADHD and high-functioning ASD (HF ASD), respectively, causing them to experience difficulties in navigating social situations and travel through city.

- We aims to explore difficulties faced by neurodivergent young adults while navigating city streets using different travel modes.

Research Question:

- Explore responses of neurodivergent young adults while navigate city streets using 4 modes (walking, biking, driving, riding a bus)
- Use these physiological and behavioral responses to better understand how such individuals:

(i) Multitask during travel
(ii) React to unforeseen circumstances
(iii) Adhere to traffic regulations
(iv) Communicate with other road users

EXECUTION

Methodology:

- VR + Simulated environment+ Diverse scenarios
- Physiological data, and Surveys

Planning:

Phase 1: Stated preferences survey (Septembe'24)
Phase 2: Semi-structured interview (October'24)
Phase 3: Experiments using simulations (October – December 2024)
Phase 4: Data analysis (January – March 2025)

Value add:

Safety Challenges Identified: Difficulties with reaction time, multitasking, and unforeseen circumstances while navigating city streets (e.g., insufficient road markings)
Accessible Mobility: Supporting walking, biking, and public transit to create cleaner, more equitable transportation such as designing bike lanes that consider cognitive needs of neurodivergent adults
Smart Traffic Systems: provide design suggestions for signals and signs responsive to such group needs
Equitable Design: Creating streets that serve neurodiverse populations

Academic Research Plan

John D. Atkinson
Stevens Chair in Engineering Sustainability, Associate Professor
Environmental and Water Resources Engineering, SUNY-Buffalo

University at Buffalo
The State University of New York

CONCEPT

Problem:
NYS generates ~20M end-of-life tires a year; reuse options are needed. Rubber Modified Asphalt (RMA) can consume this capacity but has not been thoroughly tested in NYS.

Research Questions:

1. Does RMA offer performance improvements in unique NYS (including NYC) conditions?
2. Is chemical leaching from tire-derived products a concern for RMA?
3. Are life cycle environmental (LCA) and/or economic (LCCA) costs a concern?

EXECUTION

Methodology:

1. Demonstration paving projects needed
2. Lab-scale chemical leaching experiments
3. Life Cycle Assessment research using SimaPro and FHWA tools

Planning:

- Laboratory and LCA research underway, with 1st phase of funding and associated publications in progress. Looking to advance.
- Identifying paving partners for demo projects.

Value add:
Identifying an environmentally friendly paving option and furthering knowledge about chemical leaching from scrap tires

Understanding Bicyclist Behavior and Perception of B2X Advanced Warning Messages within Virtual Reality

Ye Wang, Gongda Yu, Irina Benedyk, Austin Angulo University at Buffalo – SUNY, TRAVL Lab

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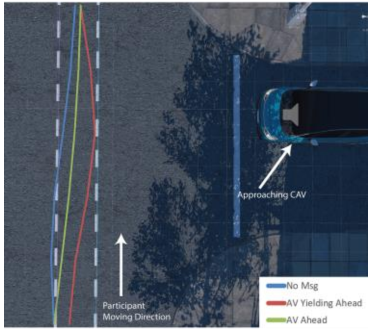
TRAVL
Transportation Research and Visualization Laboratory

CONCEPT

Problem: The widespread deployment of Connected and Autonomous Vehicle (CAV) technologies poses significant safety risks to Vulnerable Road Users (VRUs). Recent crashes involving CAVs and bicyclists have highlighted the limitations of current safety systems and the need for improved methods to protect bicyclists.

Research Question: How do advanced warning messages, communicated through various formats, affect bicyclists' behavior, trust, and perception of safety around CAVs in urban environments? Formats include:

- Heads up Display (HUD)
- Phone App notification
- Audio cue
- CAV behavioral information



EXECUTION

Methodology: Virtual reality (VR) simulation developed in Unity to assess the impact of various advanced warning messages on bicyclist behavior with CAVs at a T-intersection. Physiological data (e.g., heart rate, eye tracking) and subjective feedback will be collected to assess participants' stress, attention, and behavioral responses.

Planning:

- Phase 1: IRB approval and stated preferences survey dissemenation (Sept. 2024)
- Phase 2: Experimentation (Oct. – Dec.2024)
- Phase 3: Data analysis and report drafting (Jan. – Mar. 2025)

Value add: 1) Utilizes VR simulation to ensure research fidelity and eliminate the risks associated with real-world testing. 2) Integrates novel datasets including physiological and behavioral data to gain a deeper understanding of VRU safety and perception. 3) Demonstrates a proactive approach to inform the deployment of B2X communication technologies.

AI-based Generation of Image Descriptions for Bridge Inspection

"Arvin" Ebrahimkhanlou, Assistant Professor, Drexel University

CONCEPT

Problem: To complie a bridge report, the inspectors often have to manually describe the content of images. This will limit their productivity and the level of details they can convey in their reports.

Research Question: This study will investigate the ability of Visual-Language Artificial Intelligence Models to assist describing the content of images related to bridge condition assessment reports.

EXECUTION

Methodology: Visual-Language Artificial Intelligence Models (**new technology**) will be trained on a dataset of more than 1000 image-description pairs that my team has collected from publicly available bridge inspection guidelines (e.g., FHWA BIRM, AASHTO MBEI) and reports (**new dataset**).

Planning: My team has collected an initial dataset and trained a few AI models. We will expand the dataset by augmenting image-description pairs from NYC DOT reports and select the best AI model.

Value add: Enhancing the <u>**productivity**</u> of preparing annual bridge reports and the <u>**level of presented details**</u>.