

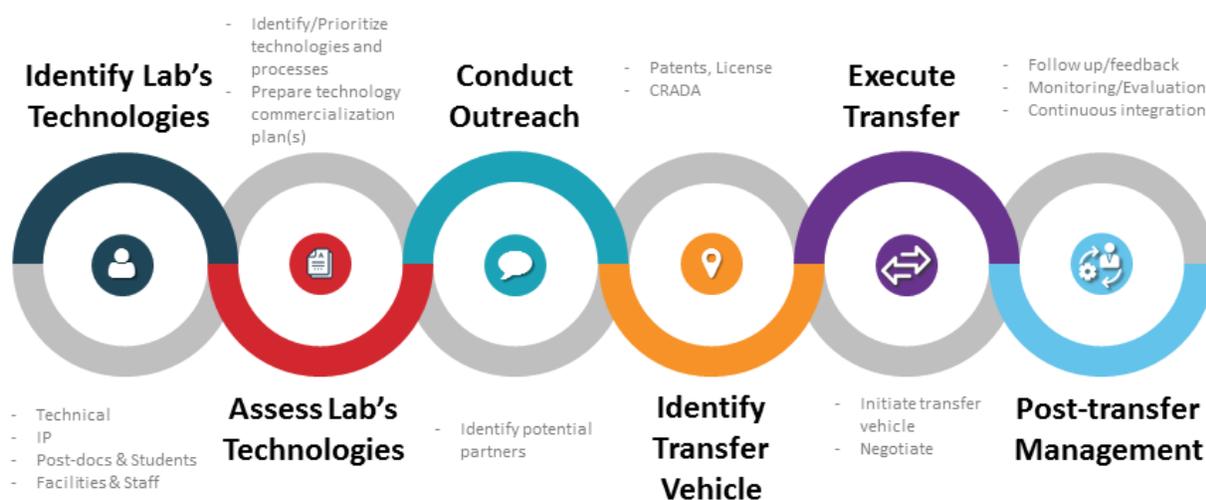
C2SMART Center Technology Transfer Plan

Revised Submission: October 15, 2018

C2SMART is committed to pursuing implementable solutions to today’s most challenging urban transportation problems. Technology transfer is a key step in achieving the center’s mission. To ensure that the outcomes of our research reach the appropriate parties, C2SMART and its affiliated faculty researchers will commit time and resources to involving key stakeholders in the research process and undertaking a comprehensive outreach and dissemination program.

As stated in the center’s proposal, all of its consortium members have extensive prior experience in transferring research outcomes and new technologies to public agencies, the private sector, and other academic institutions. This plan outlines the center’s plans and capabilities to disseminate products arising from research using both traditional and emerging methods.

Technology transfer is a unique process to bring multiple parties together to create new solutions. While each technology transfer opportunity may require a different development process, the basics of this plan are adapted from the Federal Laboratory Consortium (FLC) for Technology Transfer and “Building a Foundation for Effective Technology Transfer through Integration with the Research Process: A Primer” issued by the USDOT Office of the Assistant Secretary for Research and Technology (2016). The following figure reflects the suggested guidelines and provides an overview of the approach C2SMART will take to technology transfer:



Technology Transfer Process Overview, adapted from Federal Laboratory Consortium for Technology Transfer

The following sections detail specific areas that the center must address moving forward to facilitate and grow the overall technology transfer impact of center research. This document functions as a guide for funded investigators to meet USDOT technology transfer goals in their research. The center employs a communications associate who facilitates dissemination efforts and is tasked with tracking and collecting information of the center's technology transfer. The center also has a dedicated space at NYU, the consortium's lead university, available to all C2SMART faculty, staff, and affiliates for hosting technology transfer-focused events.

1. Involvement of Stakeholders

All C2SMART funded research seeks to identify and involve key stakeholders throughout the research process to ensure meaningful engagement, including communicating with stakeholders and partners at regular intervals to provide progress updates and solicit feedback. The center will continue to seek out further opportunities for collaboration with potential industry partners that offer a unique market position, resources, or data that can support and enhance research. To do so, the center holds and will continue to hold agency and industry roundtable discussions to solicit input on research directions, ensuring that our research outputs are relevant and useful to others in the transportation industry. Based on these meetings, recommendations are generated which are distributed to C2SMART-affiliated Principal Investigators (PIs).

Types of Stakeholders

C2SMART's research can involve several levels of stakeholders, each with varying levels of input and influence. Three different types of stakeholders are identified based on their specific power position in the project process:

- Primary stakeholders: This is the main group that will be affected positively and negatively by new transport measures and projects. For instance, citizens in general, different social groups, city districts, neighborhoods.
- Key actors: These are people who have political responsibility, financial resources or authority. Key actors can also include people exhibiting skills and expertise in transport-related domains. Examples of key actors may include government authorities, public administrations, universities, and private sector groups.
- Intermediaries: These stakeholders implement transport policies, carry out major transport activities and inform, and report on transportation. This group includes public transit and infrastructure operators, public administrators, and police.

Government Authorities	Businesses/ Operators	Communities/Local Neighborhoods	Others
Department of Transportation	Car Sharing Companies	National Environmental NGOs	Research Institutions
Regional Government	Transportation Operators/Providers	Media	Universities
Local Transport Authority	Transportation Consultants	Transportation System Users and Citizens	Training Institutions

Envisioned Stakeholders for C2SMART Center Research

C2SMART as a center is currently engaged with local transportation agencies in consortium regions both as funding and technology transfer partners. Some examples of this include engagements between center researchers and state departments of transportation on multi-year collaborative projects to redesign state processes and better integrate research from the academic environment to the engineering and policy decision-making levels. The center is also integrating itself with a limited number of industry partners that are working in overlapping areas of the center’s themes. These industry partners, whether through data sharing, knowledge/technology transfer, or funded projects, work with the Center to bring innovative technologies or concepts to the research environment while have real-world connections to their products. As the center’s portfolio of research grows, more industry partners are envisioned to participate in the center’s activities and technology transfer mission.

Stakeholder Involvement Process

C2SMART aims to build effective stakeholder engagement through a thorough assessment, planning, and communication process during research projects. Information flow between the stakeholder, decision-makers and the transportation research center is a key part of stakeholder engagement, leading to transparent, efficient, detailed, qualitative, and healthy decisions. The level and type of involvement can vary according to the stakeholder’s situation, time, skills and resources. The International Association for Public Participation identified five levels of stakeholder engagement: inform, consult, involve, collaborate and empower (IAP2, 2007). All these levels have their benefits and limitations, but selecting the right one helps ensure successful partnerships. There are six primary steps for efficient and appropriate engagement, as shown in the following figure.





Adopted from Stakeholder Involvement Handbook

The aim of a systematic analysis of actor constellations is to get a better picture of conflicts of interest or potential combinations of interested parties and to be able to better determine clusters of stakeholders. These clusters may exhibit different or similar levels of interest and capacities. The establishment of these groups can be easily carried out by developing an “Influence-Interest Matrix”, as shown in the table below. As part of its stakeholder involvement process, C2SMART will identify potential stakeholders’ level of interest and influence and the appropriate level of stakeholder engagement.

	Low Influence	High Influence
Low Stake	Least critical stakeholder group	Useful for decision and opinion formulation, brokering
High Stake	Important stakeholder group (Empowerment)	Most critical stakeholder group

Influence-Interest Matrix

At the project level, the following guidelines are suggested during proposal development and execution of funded research projects. C2SMART researchers should involve stakeholders in research in a substantive manner in the following stages:

During research scope development

1. Develop and propose research topics that have a tangible output component that can be taken advantage of by government agencies, the research community, and industry.
2. Conduct a stakeholder assessment to identify potential beneficiaries or users of the research, or that are conducting activity related to the proposed research.
3. Assess perceptions and interests and establish institutional agreements/partnerships in the form of Memoranda of Understanding, data-sharing agreements, or funding arrangements.

During the research process

4. Hold focused interviews with stakeholders to identify their technology needs and desired research outcomes.
5. Encourage stakeholder participation and information sharing at an early stage in research proceedings to reduce the risk of miscommunication or outcomes that do not meet stakeholder needs.
6. Involve all relevant stakeholders in a review process to recognize the opportunities for and challenges to the successful creation of sustainable technologies.

Upon completion of the research activity

7. Work with stakeholders to identify the short-term and long-term outcomes of each project and solicit ideas for potential future improvements.
8. Assist stakeholders in implementing and deploying research outputs (elaborated further in the following section).
9. Seek to build larger proposals in cooperation with stakeholders based on project outcomes.

During the annual Request for Proposals process, when C2SMART projects are solicited and selected, proposals that include and highlight these activities will be awarded priority points in the assessment process currently in place (detailed further in the following sections).

2. Assist Stakeholders in Implementing and Deploying Research Outputs

In order to help facilitate the timely implementation and deployment of research outputs, C2SMART researchers shall produce technical documentation to accompany research outputs and allocate funding for actual implementation. Researchers should also identify, define, and elaborate the deployment priorities. When applicable, the center will hold workshops or trainings to demonstrate outputs for the target user group, as well as plan for long-term maintenance or user support. If the research initiative results in the generation of a tool or

application, maintenance is required to ensure that the developed tools or software continue to satisfy user requirements. Developing corrective, perfective, adaptive, and preventive application maintenance procedures are encouraged for short and long term.

Research using C2SMART funds should dedicate a portion of the funding to assisting stakeholders with implementing and deploying the results of the research outputs, proportionate to the level of impact and estimated users of the research output. Each research project that results in the development of a software tool or application is also required to have an accompanying production maintenance plan that specifies the duration and level of support for the tool to be agreed on by both the researcher and sponsor/client (where applicable).

University	Technology Transfer Resource
New York University	Office of Industrial Liaison
University of Washington	CoMotion
Rutgers University	Office of Research Commercialization
University of Texas-El Paso	Office of Technology Commercialization
City College of New York	Technology Commercialization Office

During the C2SMART Request for Proposals period, proposals' technology transfer plans will be reviewed by experts and comments and suggestions on the proposed technology transfer process will be provided to the proposer.

3. Commercialization Process for Research Outputs

As most of C2SMART's research is geared toward creating open-source solutions, many of the center's outputs may not be suitable for commercialization. However, should commercialization be appropriate for a technology developed in the course of C2SMART-funded research, the center and project principal investigators will coordinate with their respective universities' offices responsible for patents and/or licensing, which are outlined in the adjacent table.

As an example, the New York University (NYU) Office of Industrial Liaison ([OIL](#)) provides support in protecting and promoting discoveries and inventions with the potential for commercial development. In the case that a PI funded by C2SMART produces such an outcome, the center will notify OIL on behalf of the PI about the new technology to determine whether a patent application is appropriate, and work with the PI and OIL on the application process. NYU researchers in the center will also work with OIL to identify potential commercial partners and the best path to market for the product. NYU Tandon has also established a successful network of startup incubators, the NYU Tandon Future Labs, for both NYU-affiliated startups as well as startups from the outside. The Future Labs support startups between Seed Stage and Series A financing with a variety of curated services and programs. Based on this experience, the center is well-positioned to provide support for other PIs. If the research output is appropriate for a

venture led by the principal investigators, entrepreneurial support will be provided by C2SMART and partnering universities.

NYU's Office of Industrial Liaison/Technology Transfer manages all activities relating to the protection and commercial promotion of inventions made at NYU. Almost 60% of NYU patents have been licensed to companies for development and commercialization, and NYU ranks first among all U.S. universities in income from technology licensing in the last 5 years. Over 100 companies have been created from NYU technologies, and NYU has created 50% more new startup companies per research dollars expended than the national average.

Rutgers University operates an Office of Research Commercialization within its Office of Research and Economic Development that actively prospects for and manages university intellectual property, evaluates and markets inventions, drafts and negotiates licenses and other agreements, develops and supports new start-up companies, and facilitates partnerships with companies worldwide. The office serves the entire university, located on 3 separate campuses throughout NJ. University of Washington's technology transfer office, CoMotion, delivers the tools and connections that the entire university community needs to accelerate the impact of their innovations. CoMotion is designed to grow UW programs, spaces, and resources to scale impactful innovation and expand the UW's societal impact by developing and connecting to local and global innovation ecosystems. UTEP's Office of Technology Commercialization manages and protects the intellectual property assets of the university, working with inventors to develop a licensing strategy and actively recruit companies that might be interested in the invention. It also handles copyrights (software), Confidentiality Agreements, and Material Transfer Agreements. CCNY has a Technology Commercialization Office (TCO) that handles innovations.

In the case that the product was the result of collaborative efforts between more than one university in the consortium, the policies set by the master sub-award agreements within the universities in the consortium shall be used to determine the proper commercialization procedure to be followed, meeting the requirements of all the universities involved.

4. Collection and Use of Licensing Revenues

Licensing revenues will be collected in accordance with the investigator's university policies on intellectual property. Should any investigator seek to obtain licensing revenues from the output of center-funded research, the Center Director must be notified in advance of all such activity. The standard procedure for licensing revenues collected from technologies developed in the course of C2SMART-funded research shall be determined by the PI's home institutions. PIs are encouraged to reinvest a portion of the revenues towards sustaining and further developing the research and technology transfer program. Should the PI want to invest in furthering the

mission of the center, the revenue may go toward supporting current research, establishing a self-sustaining business model, investing in future expansion and investing in technology transfer programs.

- A portion of the revenue for research will be marked off as a separate fund that researchers may apply for in case of a need for supplemental funding for their research.
- To establish self-subsistence, a portion of the revenue will be invested in startup incubators and accelerator programs at different universities.
- A section of the revenue will be invested in supporting technology transfer efforts, including maintenance, improvements, or updates to tools developed by the center.
- Any excess revenue will be used to invest in bonds and sound financial streams that will generate a regular profit for the center, which will then be reinvested.

Should any alternative form of disbursement for the licensing revenue be planned, the Center Director must be notified and provide approval such that the proposed strategy meets all USDOT, matching source, and university guidelines.

5. Dissemination of Research Results

As a center, C2SMART provides for a centralized effort to disseminate research results. All projects shall have a final report, a research brief, and a seminar/webinar documenting what research was conducted and the results. These materials are hosted on the respective project pages on the C2SMART website. In addition to these individual pages, C2SMART will build a technology transfer portal into its website, which will be used to host technology transfer materials from its projects, such as training videos and interactive tools.

Quarterly newsletters and an annual report provide overviews of C2SMART research activities and are disseminated via the center’s mailing list and posted on its website. The center’s communications associate will work with university marketing & public relations departments to pursue media coverage of research outcomes that may be of interest to a broader audience. Additionally, the center will host larger scale conferences to bring together multiple stakeholders on a particular topic or issue. The annual meeting of the Transportation Research Board will also continue to function as a key venue for disseminating the center’s research.

Planned Workshops/Seminars	
NYU	Annual Hackathons
	Transportation for Smart Cities Symposium at NYU Abu Dhabi
	NYC Connected & Autonomous Vehicle Symposium
CCNY	Technical Summit on Smart Cities and Transportation
UW	Regional Transportation Conferences/Workshops
CCNY	Quarterly Seminar Series
RU	Structural Health Monitoring Workshop
UTEP	Transportation Leadership Council Seminar Series

While submitting research to scientific journals is an important part of research dissemination, C2SMART encourages further efforts beyond academic publications. Center staff will provide support to projects with more extensive outreach and dissemination plans for their project outcomes. PIs should provide examples of which avenues they may use to disseminate their work in initial scopes, such as participating in research expos, conferences, meetings, etc. that provide opportunities to share research results and network with the academic community and pursuing opportunities to publicize their research in non-academic media or at conferences/forums outside of transportation engineering.

In addition, the center encourages research that feature any of the following, and will continue to do so by prioritizing and weighting proposals submitted during the center's annual Request for Proposals:

- Research projects that include outreach activities, such as hackathons, in partnership with different industry leaders, universities, and high schools. An example of successful implementation of these can be as follows:
 - Hackathons for students which will be focused on multiple issues in the industry based on projects within C2SMART. Students will be given access to the data, analysis, and conclusions of the researchers. This will encourage them to innovatively solve the problems, teach them how to access C2SMART's resources, and make them aware of the biggest issues in the transportation industry.
 - Hackathons for industry professionals where there will be exposure to the resources available at C2SMART. This will also allow C2SMART to start engagement with corporate partners, providing companies avenues to explore and provide feedback for C2SMART projects.
- Specialized apps/websites/online platforms that can be set up with regards to transportation data and findings which can help the stakeholders recognized in Part I of the plan. The apps/websites/online platforms will be free to use and broadcast publicly.

The center will also create and maintain a network of qualified individuals or organizations for possible Technology Transfer outreach beyond newsletters or email messages. This network will be advertised to center PIs and can be used to provide expert information, review planned research and technology transfer activities, and receive feedback on the proposed outreach.

6. Tracking and Reporting Research Outputs, Outcomes and Impacts

Research results are reported by PIs and research staff in quarterly reports submitted to center administration throughout the duration of the project. Once the project has concluded, overall outputs, outcomes, and impacts are consolidated into a final report which is submitted

according to USDOT guidelines and made available on the C2SMART website. Consolidated results are presented to the USDOT in the form of the PPPR and annual performance indicators.

PIs and research staff are required to monitor the performance of the parties involved, ensure that the agreements of the project are implemented, create feedback channels, and resolve any problems that arise. Each project must include a scoping document that is version controlled to track changes as the project progresses. Records of activities such as additional feature requests by stakeholders and changes to the project's goals should be maintained and shared after the project's conclusion as "lessons learned." PIs should keep a record of additional completed tasks and requests and establish guidelines for re-negotiating agreements if needed. Needed improvements in the final outcomes of the projects should be identified and addressed.

At the end of their projects, researchers shall form a common innovation platform (CIP) that provides an environment for the technology creators, the public and private partners, and the end-users for future innovation. Research outputs, outcomes, impacts and technologies can be shared with each other in this pool. The CIP will be implemented as an integrated web tool that provides center stakeholders with a customized interface to promote collaboration. In the long-run, the CIP will become an integral part of the center's web site, enabling open and easy access to research outcomes. One key aspect of this platform will be to allow interested users to virtually communicate with each other and establish further collaborations related to the projects they are interested in. Some other planned features of the CIP include:

- Access to project specific information and data
- Collaboration via chat or set-up meetings
- Ability to run virtual simulations
- Uploading new information, data descriptions, and reports
- Leaving information about ideas and themselves, links, and more
- Innovative activities as proposed by the center's researchers

As part of this effort, the center is also working on establishing a common data sharing platform that provides continuous integration (CI), version control system (VCS), and data warehousing services. CI implements continuous automated processes of applying quality control. It runs unit tests across the entire data warehouse and alerts the administrators with any failing tests. Using this platform, the center will ensure that data of all types will be managed and organized for security, consistency, and public dissemination when appropriate.

Researchers may reference or quote from the C2SMART Master Data Management Plan (DMP) as appropriate but should be sure to call out in their project DMP the unique qualities of their research, and where their DMP differs from this Master DMP. More guidance on the U.S. DOT Public Access Plan can find guidance online at the National Transportation Library.

7. Increasing Corporate Research Support

The center is focusing on developing relationships with major enterprises in the transportation industry, as well as smaller and new startup companies involved in the industry. C2SMART currently invites partnerships with companies looking to partner with the center via its webpage and electronic communications.

The center structure allows for industry partners to provide nominal research contributions or data sharing, used towards matching funding for research projects. In further rounds of funded projects, corporate partners will be encouraged and awarded positive scores during the Request for Proposals submission evaluation process.

The center is also working with the NYU Tandon School of Engineering to establish a sponsorship model for firms to invest in the center and its success. Firms can provide funding or data to tackle a research problem, while benefiting from the center's research, seminars, events, proposed testbed, and reach to agencies and partners. This structure will allow for corporate partners to match federal funds and establish a long-term relationship with the center. Similar arrangements with other institutions in the consortium will be formed. Several other centers at NYU Tandon have successfully implemented an industrial affiliates program. Industry partners may become an affiliate through a membership with the center, which may include joining the center's Advisory Board, early access to research/technology development, as well as access to engage the center and its researchers in specific research projects.

8. Technology transfer goals and performance measures

Every C2SMART project proposal shall include a technology transfer plan that includes a roadmap for how it will adhere to the guidelines laid out in this plan. The center will continue to track several performance indicators detailed in the center's proposal to evaluate individual researchers' and the center's technology transfer efforts as a whole.

The center's communications associate collects information about the center's technology transfer activities from each of its funded PIs. These performance metrics are collected as per the "center-specific" performance indicators report delivered to USDOT and tracked in the PPPR updates. The following performance measures are collected and tracked to assess the impact of the center's activities in terms of Outputs, Outcomes, and Impacts. The technology transfer goals of the center will be to reach the following benchmarks on an annual basis, and as it grows will be to achieve year-over-year growth in its technology transfer performance indicators and long-term industry partnerships.

Tracked Performance Measures	Target
Outputs	
Number of peer-reviewed papers	20 peer-reviewed papers
Number of conference presentations	10 conference presentations
Number of joint proposals/projects with industry or agency partners	10 joint proposals/projects with industry or agency partners
Website analytics statistics	5,000 pageviews
Outcomes	
Number of media interviews/mentions	10 media interviews, mentions, or coverage
Number of workshops/seminars and attendance levels	10 workshops and webinars/seminars
Hackathon participation levels	An annual hackathon attracting participants, sponsors, and partners
Number of sponsorships/partnerships resulting from hackathons	
Impacts	
Number of software tools, research results or guidelines adopted by transportation agencies	5 instances of software, tools, research results, or guidelines adopted by transportation agencies that lead to operational improvements
Number of partnerships or collaborative relationships with companies or agencies	10 partnerships/collaborative relationships with companies or transportation agencies established or renewed

9. References & Supporting Documents

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