

View results

Respondent

10 Varun Vaid

35:51

Time to complete

ACKNOWLEDGMENT

1

Please read and acknowledge the following:

- SSC funding can take ****1 MONTH OR LONGER**** to receive after the SSC has voted to approve a project because it includes several steps:
 - the authorization of an award letter by SSC, iSEE, Division of Student Affairs, the project's advisor (*student-led projects only*), and the project lead;
 - the creation of the CFOP by the project team's departmental financial contact in conjunction with the project team;
 - the transfer of funds from SSC to the project's CFOP.
- If you are a project lead for a new project that is approved by the SSC, be sure to check your email regularly for the prompt to sign the award letter to help facilitate the efficiency of the process.
- Project teams for funded SSC projects do NOT receive funds directly. After a project's SSC funds have been transferred to the project's CFOP, the project team must work with the sponsoring department to purchase the approved budgeted items on behalf of the project team.
- If this project is funded, this application will be shared publicly on our SSC Illinois Climate Action Plan (iCAP) portal so that others can learn from your project.
- Funded projects have grant reporting requirements. See our website for more information.

*

☒ I acknowledge that I have read this information.

APPLICATION INSTRUCTIONS

Prior to starting your application, make sure you have the following information available:

- Project personnel including project lead, confirmed faculty/staff advisor, departmental financial contact, other team members
- Working Group attendance information
- Project title and abstract
- Project description including timelines, deliverables, detailed description about the project, project feasibility information
- Intended student impact(s)
- Intended sustainability impacts
- Optional supporting documentation (e.g., Working Group presentation, letters of support)
- Detailed project budget information

See our website for a sample application.

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Today's Date

4/16/2025



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Is the Project Lead a currently enrolled Illinois student? *

NOTE: Only currently enrolled Illinois students are eligible to be a Project Lead.

☒ YES (by selecting YES, you affirm that the Project Lead is a currently enrolled Illinois student)

☐ NO

4

Project Lead's Name *

Project Lead must be a currently enrolled Illinois student.

Varun Vaid

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Project Lead's University Email Address *

vvaid2@illinois.edu

6

Project Lead's Department *

Industrial & Enterprise Systems Engineering

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Has someone from the project team presented their proposed project at a SSC Working Group meeting this semester? *

If not, please attend one and present your project. After presenting your proposed project (and attendance has been documented by the SSC), please return here to complete your application. The Working Group meeting schedule can be found on the SSC website.☒ YES☐ NO

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Select the Working Group meeting at which you presented. *

☒ Energy + Transportation & Infrastructure Working Group Meeting☐ Food & Waste + Land, Air, & Water Working Group Meeting☐ Education & Justice Working Group Meeting

9

Enter the date of the Working Group meeting you attended. *

4/9/2025



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What is the name of your project? *

Sustainable Road Repair

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Total funding requested from the SSC for this project *

This application is restricted to students requesting \$10,000 or less. The amount entered here must match the amount reflected in your detailed primary budget spreadsheet that you will submit with this application.

10000

Please enter a number less than or equal to 10000

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Project Category *

- ☐ Education & Justice
- ☐ Energy
- ☐ Food & Waste
- ☐ Land, Air & Water
- ☒ Transportation & Infrastructure

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Project Abstract *

In 100 words or less, briefly describe the project.

39% of US roads are graded under poor or mediocre quality. Continued deterioration escalates costs and increases GHG emissions associated with roadway maintenance. US infrastructure collectively represents one of the most carbon-intensive industries—small improvements, like proactively identifying and fixing cracks before they become potholes, can mitigate several million tons of CO2 emissions. We want to conduct a feasibility study on using cameras in UIUC vehicles around campus to collect real-time data on road conditions. We would feed this data into computer vision models where road damage can be systematically mapped out, and ML algorithms can optimize for less carbon-intensive repairs.

PROJECT DESCRIPTION

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Describe your project in detail. Make sure you include sufficient details about your project so that the SSC can comprehensively evaluate the merits and feasibility of your project. *

Be sure to address the following:

-What are your project's goals and how do you intend to accomplish them?

-What are your project's deliverables?

Our project aims to modernize and decarbonize UIUC's infrastructure surveying and repair systems by enabling real-time, data-driven road monitoring. By equipping university-affiliated vehicles with dashcams, we can passively collect high-quality footage of campus roads without additional survey trips. This footage will feed into computer vision models trained to detect early-stage damage like cracking and rutting before it becomes severe. By identifying problem areas before they escalate into costly, disruptive, carbon-intensive repairs, we help UIUC and the Cities of Champaign and Urbana prioritize preventative maintenance, reduce material and energy use, and extend overall pavement lifespan. The result is a smarter, more sustainable infrastructure system that empowers key stakeholders with clear, actionable insights.

We foresee our project taking three phases, which may sometimes overlap.

Campus-centered data collection:

Leverage existing vehicles with a daily presence on the University's campus by equipping them with the hardware (i.e., dashcams) to survey roads. This could include Champaign-Urbana Mass Transit District (MTD) buses, University of Illinois Intercampus Shuttle (UI Ride) vehicles, any of the Facilities & Services (F&S) vehicles, etc.

Diverse and scalable data pipeline with statewide coverage:

Equip ~100 personal and commercial vehicles, including trucks operated by regional logistics firms and independent drivers, with additional dashcams to transmit roadway surface data. Statewide coverage (beyond UIUC campus) increases model training data and expands coverage beyond campus, improving system robustness. Crucially, this helps build our models for later deployment at UIUC.

API for models and analytics, easily navigable web-based dashboard:

Using collected footage, we will train and refine highly precise CV models to detect various types of road damage. Final deliverables will include:

Trained and validated suite of CV models (>90% accuracy)

API providing access to both raw dashcam footage and processed road condition data, allowing interested parties (e.g., F&S, Champaign and Urbana city contractors, researchers, CEE department) to programmatically retrieve model outputs and historical footage clips for specific geolocated road segments

Browser-based, map-integrated user interface built with UI/UX best practices to ensure accessibility, responsiveness, ease of use, and rapid adoptability

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List your proposed project's timeline and major milestones. *

NOTE: SSC funding agreements remain active for two years. Thus, your timeline should reflect your activities over a two year period or less.

We have engaged with the UIUC F&S department to see what opportunities there are for engagement. This includes potentially mounting cameras on university vehicles to collect both roadway and pedestrian sidewalk data. Lastly, we have talked with the Civil Engineering Dept. about faculty that might be interested in the project and the ISE department about contacts they have in construction and road paving.

May 15 - June 15: Urbana-Champaign data collection (local)

Form working relationships with UIUC and university-affiliated vehicle fleets, including but not limited to installing high-quality real-time dashcams on MTD buses and contacting F&S about avenues for implementation.

If funded, we would use the money to purchase dashcams as needed to install them in university-affiliated vehicles to transmit real-time roadway surface data for analysis.

If the costs of real-time dashcams (which are often costlier than dashcams available for purchase in tech retailers like Best Buy) are excessively prohibitive, we are also prepared to modulate these costs through a hybrid system

Some vehicles will be equipped with industrial-grade, real-time hardware, while others will use traditional dashcams (Garmin). For the latter, we will make biweekly trips to campus to swap and replenish SD cards.

Milestone: 20+ active university-affiliated vehicles equipped with dashcams and the requisite software to provide us with real-time access to footage

June 15 - July 15: Statewide Implementation (off-campus)

In the minimum viable test case, we will endeavor to outfit as many of our vehicles at home (i.e., cars driven by friends and family) with Garmin dashcams. We will regularly upload footage off these cars via SD card for interpretation and analysis.

Make contact with trucking and logistics companies within a 50-mile radius of Naperville, IL (includes DuPage, Will, Kane, Cook, Lake counties of Illinois)

Assess dashcam prevalence – our cursory research suggests that roughly 60% of all truck drivers have a dashcam mounted. For smaller operations or freelance/ independently-contracted truckers, purchase and install Garmin dashcams.

Identify seamless integrations with existing systems for dashcam data capture, retrieval, and any processing. For example, larger fleets may be using hardware from established providers like Samsara. Smaller fleets might provide each driver with a dashcam, but data uploads are irregularly handled via manual SD cards.

System for SD card pickup and replenishment at >5+ major warehouses, truck yards, and order fulfillment/distribution centers. Our goal is to select locations that as many truckers/fleets as possible regularly pass through.

Ex) If 10 trucks from ABC Transportation Inc. stop at Warehouse A to pick up freight each week, we need an ordered system where drivers can eject and drop off their SD cards. Purchase 10+ SD cards that drivers can easily swap out.

Milestone: 50+ active trucks collecting data via dashcam in our network, in addition to multiple private vehicles (e.g., our family cars, delivery drivers for local restaurants, etc.)

July 15 - August 15 (return to campus): Primarily focused on data processing + CV

Using all of the data that we capture and clean over the first two months of the project, build the computer vision (CV) models to identify and categorize roadway damage.

Beginning by piggybacking off of open-source, publicly available CV models developed by others, we are intent on developing reliable and refined versions of the best existing models. We are already developing rudimentary versions of these with the ~20 GB of data we have already captured from our own dashcams, but adding more data will be critical.

Note: Although we expect to amass the lion's share of roadway data (footage) from off-campus sources like trucking companies throughout Illinois and individual passenger vehicles predominantly from DuPage County, this data is indispensable to training and iterating all of the CV mo

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Has the project team spoken with UIUC's Division of Facilities and Services (F&S) personnel about the feasibility of the proposed project? *

NOTE: While this step is optional for many projects, all projects involving infrastructure (e.g., internal or external physical infrastructure of university buildings) or grounds (e.g., plantings, installing structures on campus grounds) must have F&S approval prior to receiving SSC funding. If you need assistance evaluating the feasibility of your proposed project, please reach out to SSC-Advisor@illinois.edu PRIOR to submitting your application.

- ☒ YES
- ☐ NOT YET
- ☐ N/A

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With whom in the Facilities & Services department did you speak and when did you speak with them? *

Though we do not believe this project involves any direct changes to physical infrastructure, because the main objective for the end product is to address roadway damage, we have contacted the UIUC Division of Facilities and Services. Moving forward, we hope F&S can provide valuable insights on how to make the solution easily adoptable and no-touch. At the same time, the project's primary focus is using software for infrastructure-related enablement, not directly or actively fixing things like potholes. We spoke to Ms. DeLorenzo around April 10th.

STUDENT IMPACTS

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How many students will be directly impacted by this project? *

Not including the people already on the project, we plan to include half a dozen additional students to fill various roles on this. We see this as not only an opportunity to create change but learn a lot along the way. We currently have a group of 2 students working from the civil engineering angle who would have the opportunity to understand the impact of software and how it can be integrated into the road repair process as efficiently as possible. They would get to explore the current techniques for road repair and at what level road repair best balances costs vs improvement. In addition, understanding the holistic data surrounding the state of roads and the impact of things like weather on different kinds of roads. For example how rain and trucks cause disproportionate harm to certain unpaved roads and how those kinds of issues can be planned for. Typically the upfront investment required for this kind of project would make it prohibitively difficult to explore. We also have a team of computer engineers who would have the opportunity to work with large volumes of camera data, make tweaks to camera hardware, and build out CV models. Usable, standardized data collection for this kind of scoped impact is typically hard to achieve. In addition, we would have the opportunity to learn about creating optimization algorithms with an environmental impact. Our team is also really excited to look into exploring the integration of dashcams into the Internet of Things to have better access to data. We would also get to work with software like MongoDB that would build our knowledge with data compression, databasing, storage, and efficient cloud storage architecture.

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How many students will be indirectly impacted by this project? *

Conservatively, at least 40,000 UIUC students at the undergraduate and graduate level will be directly impacted by safer roads. Our project aims to help UIUC and relevant local authorities (e.g., city of Champaign, city of Urbana) assess and flag road conditions in real time. Effectively, anyone that uses roads (local or highway) on or near UIUC's campus stands to benefit from improved road safety and proactive road maintenance. Students who drive their own passenger vehicles on campus, parents visiting campus, university-affiliated vendors and suppliers, and MTD buses transporting tens of thousands of students daily all stand to gain from the insights. The indirect gains from the project are primarily emissions-related and particularly well-aligned with SSC's stated priorities. Take the typical UIUC freshman who eats at a dining hall. When a semi-truck delivers produce/meat/dairy/any CPG to campus, it may be traveling hundreds of miles before reaching its destination. Along the way, it is inexorably contributing to infrastructural deterioration and roadway damage by way of its tonnage. This damage, if left unaddressed, directly translates to more GHG emissions. First, the environmental costs of infrastructure maintenance increase significantly with the severity of roadway damage due to the escalated resource, labor, and equipment requirements. Second, roads in disrepair typically correlate with longer travel times and greater congestion; more time spent on the road means more vehicle-related emissions (not just from trucks, from every vehicle). More on this in the next few responses. By doing a better job surveying and repairing roadways proactively, the vehicle emissions reductions eventually trickle down to every student.

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What are the intended student impacts? *

At the minimum, be sure to address the following:

-How will this project benefit students?

-How will students be involved with this project?

-What educational components are there in this project?

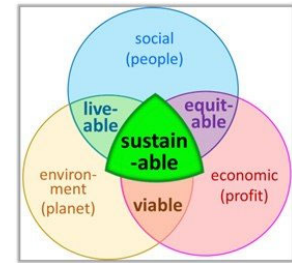
The first-order impact that the project will deliver to students is improved road safety. Assuming our models are accurate and that relevant parties (contractors and municipal transportation authorities) find the mapping useful, this project will help keep roads consistently safer. Then, because the costs of proactive maintenance are both economically and environmentally lower than reactive maintenance, students will see impacts trickle down. Student developers will be involved across the technology stack. We will enlist the help of interested students with structuring data from variegated dashcam and ELD hardware products, training the AI/ML models on the data, consulting on the UI/UX, building the front-end, public-facing website, and publicity. As the project matures and especially after students return to campus in the fall, we are excited to engage more student contributors to the project. There are two main educational components of the project. First, students directly contributing to the project will have the opportunity to apply their skills (be they in hardware engineering, AI/ML, web design, or UI/UX) to a real-world use case for the public good. This project can serve as a hands-on application of classroom learning. Second, as the project reaches more corners of campus, we also raise awareness about infrastructure's contribution to climate change. Everyone relies on commercial vehicles to deliver goods to campus, but the environmental costs of UIUC's supply chain are not captured in the economic value of the goods being transported. This project will illuminate those costs.

SUSTAINABILITY IMPACTS

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Authentic sustainability consists of the overlapping area of 3 spheres: Environment, Society, and Economy.

Describe how your project addresses sustainability. *



Environment: The more severe the damage, the exponentially higher the emissions. Proactive road repairs will slash emissions by minimizing the need for heavy machinery, excess asphalt, and repeat interventions. A small crack fixed early may last 5+ years; a big pothole ignored may need full-depth reconstruction within 1–2 years. Additionally, by using existing vehicles to passively collect data, we minimize new energy inputs and offset their carbon footprint.

Society: Addressing hazardous road conditions before they become acute improves safety and quality of life for all communities that use roads on or near UIUC's campus. For employees whose daily commute traverses these roads, safer and well-maintained roads are essential. By making road condition data transparent and accessible through our dashboard, we empower students, residents, and city officials alike to advocate for timely repairs. This democratizes infrastructure planning and enhances equity in public services in Urbana-Champaign.

Economy: Extending road lifespans and reducing expensive repairs saves taxpayer dollars. Preventative maintenance is significantly more cost-effective than emergency reconstruction. Our AI-powered dashboard enables contractors and municipalities to reduce repair costs by acting earlier. With scalable, low-cost data collection and minimal hardware requirements, the project is financially viable for long-term adoption across regions and fleets.

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How does your project promote and increase environmental stewardship at UIUC? *

If applicable, also address what the carbon, water, waste, and/or energy savings is associated with your project.

Our project promotes environmental stewardship at UIUC by reducing the carbon and energy intensity of local road maintenance. Early detection of surface damage can largely obviate the need for large-scale, carbon-intensive interventions. When road damage is caught early (e.g., using a CV model to flag hairline cracks instead of fully cratered potholes), subsequent repairs require significantly less asphalt, machinery, and crew sizes. Asphalt production alone emits nearly 30 kg of CO₂ per ton. Resurfacing just one mile of road can require over 300 tons. By contrast, sealing up cracks early may require just a fraction of that material. Not to mention the jackhammers, milling machines, gas or diesel vans/trucks to transport crews, and equipment emitting CO₂, NO_x, and particulate matter that are involved.

We want to use dashcams mounted on existing university vehicles, such as MTD buses and F&S trucks, because they already consistently travel on roads of interest. This approach eliminates the need for dedicated survey fleets and minimizes marginal energy inputs—it's real-time data capture without any new emissions. By promoting early intervention, UIUC can extend pavement life by years, reducing the frequency and intensity of disruptive repairs across campus. The result is a highly scalable model of environmental stewardship: reduced carbon footprint, lower material waste, and smarter energy use.

We'll help transform UIUC's infrastructure system into one that is sustainable by design.

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Does your project aim to advance one or more of the Illinois Climate Action Plan's (iCAP) objectives? If so, indicate which and describe how. If not, enter N/A. *

A full list can be found here: <https://icap.sustainability.illinois.edu/objectives>

Key Objective: 3.2 Increase Pavement Condition Index

The university has a stated goal of implementing the best practices for all transportation assets falling under campus jurisdiction. They explain that optimizing road surfaces should be taken just as seriously as optimizing the efficiency of the vehicles that drive on them. Where we see ourselves creating a huge impact is in the efficient allocation of funds. They explain how between 2016 and 2020, the university spent an annual \$1.5 million on pavement repairs with no improvement to their PCI score. Implementing analytics to optimize pavement repairs would reduce the spending on repairs while also giving a horizon towards actually increasing the PCI score. The university would have a better idea of what to repair when and how it would play into the long-term health of the roadway system.

Key Objective: 7.4 Local Collaborations

Even though this project is centered around the UIUC campus, the data we are collecting directly engages with local governments. There is a huge opportunity for Champaign-Urbana to access our dashboards to inform their road repair. We think that this is one of the reasons why this project is so valuable. The data collection and analytics are completely no-touch solutions for decision makers and directly play a role in better managing funds. This kind of outreach can be especially helpful to raise awareness about university projects, for example, including the SSC logo on the user interface.

FACULTY/STAFF ADVISOR

All student-led projects require a Faculty/Staff Advisor. NOTE: Blue teams must obtain confirmation from faculty/staff PRIOR to listing them as an advisor.

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Faculty/Staff Advisor's Full Name *

Stacy DeLorenzo

25

Faculty/Staff Advisor's Department *

UIUC Facilities & Services

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Faculty/Staff Advisor's University Email Address *

sdeloren@illinois.edu

PROJECT'S FINANCIAL CONTACT

The project's Financial Contact must be a full-time Illinois employee who has the authority to request a CFOP, manage the project's expenditures, and generate financial reports on behalf of the project.

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Financial Contact's Full Name *

Stacy DeLorenzo

28

Financial Contact's Department *

UIUC Facilities & Services

29

Financial Contact's University Email Address *

sdeloren@illinois.edu

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Are there additional members of your project team? *

☒ YES☐ NO

ADDITIONAL TEAM MEMBER

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Team Member's Full Name *

Isaac Hegg

32

Team Member's Campus Department *

Electrical & Computer Engineering

33

Team Member's University Email Address *

ijhegg2@illinois.edu

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Are there additional members of your project team? *

☒ YES☐ NO

ADDITIONAL TEAM MEMBER

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Team Member's Full Name: *

Michael Vincent

36

Team Member's Campus Department: *

Electrical & Computer Engineering

37

Team Member's University Email Address: *

mhv6@illinois.edu

SUPPORTING DOCUMENTATION

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OPTIONAL: Please attach any letters of commitment or support here, along with any supplemental media that will support your application (Working Group presentations, photos, etc.).

 [F&S LOS for Pavement Video analyzing VV 2025 Varun Vaid.pdf](#)

PROJECT FINANCES

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Describe how SSC funds will be used in your project.

NOTE: Only address the use of SSC funds, specifically, even if the project will be funded by multiple sources.

SSC funds will be used to purchase dashcams of varying capabilities for scalable data collection. Real-time, high-resolution dashcams will be installed on UIUC-affiliated vehicles (e.g., MTD buses, F&S vehicles), while Garmin dashcams will be provided to independent truckers, smaller regional fleets, and individual passenger vehicle owners. Funds will also cover ancillary hardware, including SD cards, card readers, and other tools necessary for efficient data offloading and processing. To manage the large volume of video data, we also intend to use SSC funding for robust data storage solutions (physical hard drives and a cloud-based subscription). Additionally, a portion of the budget will go finding and supporting UIUC student contributors with expertise in UI/UX and front-end web development. These individual will assist in building and designing a user-friendly interface for viewing road condition data, ensuring that the final platform is accessible, informative, and aligned with campus needs. To help these students, we will plan to allocate funding for food, software licenses, and outreach. The outreach will take the form of events we will cohost with other RSOs (like BuildIllinois) to promote the issue we are solving and find other interested students.

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If additional funding is required to achieve your project's goals, do you have a plan in place to obtain additional funding from other sources? *

NOTE: SSC cannot guarantee financial support beyond that provided in an approved funding agreement.

- ☒ YES
- ☐ NOT YET
- ☐ N/A

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Has your project team or department previously been awarded funding from the SSC for the same or a similar project? *

- ☐ YES
- ☒ NO

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Download, complete, and submit the **SSC-Budget-Timeline_NEW APPLICATION_template** file linked below.

<https://studentengagement.illinois.edu/sites/default/files/2024-09/SSC-Budget-Timeline-NEW-APPLICATION-template.xlsx>

*

Please be very detailed so that the SSC can fully evaluate the merit of your funding request. Your proposed budget should total the amount you are requesting and should correlate well with the the description of how you will spend SSC funds on your project on this application. The budget template allows you to also submit alternative budgets in addition to your main budget.



SSC-Budget-Timeline-4 11 Varun Vaid.xlsx