Request for Research Funding for FY 2024-2025			
Project Number (Research Center Use Only): SMO-25-09			
Requesting Office	SMO	**Priority**	9 of 15
Proposed Title	**3D Concrete Printing Research for Transportation Infrastructure**		
Justification	The integration of 3D concrete printing into transportation infrastructure aligns seamlessly with FDOT's mission of promoting innovation and sustainability. This cutting-edge technology utilizes computer-aided designs to craft intricate shapes and forms, surpassing the limitations of traditional construction methods. Its potential to revolutionize road and bridge construction, combined with its alignment with material science advancements and data-driven design, positions it as a pivotal player in shaping the future of transportation infrastructure.		
Impact	This research will position FDOT as a pioneer in 3D printing concrete technology in the nation. It aligns with FDOT's mission of promoting innovation and sustainability.		
Affected Offices/ Districts	Materials, Design, and Construction Offices		
Existing Work	Several studies and projects have explored the application of 3D printing technology in various aspects of transportation infrastructure. For instance, the University of California, Berkeley, conducted research on using 3D printing to create pavement structures. This work explored the potential for faster construction and improved durability in road infrastructure. Technology continues to evolve, with ongoing research and projects exploring new possibilities and addressing challenges associated with the widespread adoption of 3D printing in the transportation sector.		
Keywords Used In Existing Work Search **(Cannot leave blank)**	3D Printing; Concrete Mixtures; Construction Method; Data Infrastructure; AI; Machine Learning		
Related Contracts (Give contract numbers)	NA		
Funding Request	$100,000	**Anticipated Duration**	18 months
Project Manager	Guangming Wang	**Contracting Method**	RFP
Equipment	Estimated equipment cost (or N/A)	NA	
Urgency	Score 1-5 1= highest, most immediate need	3 3D printing technology has gradually become a hot topic in both academia and industry, but this research is not yet to the level of a 1 or 2 urgency.	
Implementability	Score 1-5 1=greatest likelihood of and proximity to implementing results	1 One of the main outcome of this research will be the development of 3D printing lab, which will be used for innovative material study and construction method.	

Project Benefits (Succinct, complete explanation)

The integration of 3D printing technology in transportation infrastructure brings forth numerous benefits:

1. **Complex Geometries:** 3D printing allows the creation of intricate and complex shapes that are challenging or impossible to achieve with traditional construction methods. This flexibility in design enhances the aesthetic and functional aspects of infrastructure.
2. **Resource Efficiency:** 3D printing minimizes material wastage by precisely depositing material where needed. This efficiency contributes to sustainable construction practices, aligning with environmental considerations.
3. **Speed of Construction:** The layer-by-layer additive manufacturing process significantly accelerates construction timelines. Rapid prototyping and construction can lead to faster project completion, reducing overall project duration.
4. **Cost Savings:** While initial setup costs for 3D printing may exist, the technology can result in long-term cost savings through reduced labor, material wastage, and faster construction cycles.
5. **Innovation in Materials:** 3D printing allows for the exploration and use of innovative materials, including high-performance and sustainable options. This opens avenues for advancements in material science within transportation infrastructure.
6. **Data-Driven Design:** Integration with computer-aided design (CAD) systems facilitates data-driven design. This means that structures can be optimized based on real-time data, leading to more resilient and adaptive infrastructure.
7. **Reduced Environmental Impact**: The efficiency in material usage and the potential for sustainable materials contribute to a reduced environmental footprint compared to traditional construction methods.
8. **Maintenance and Repairs**: 3D printing technology can be used for on-site repairs and maintenance. This ability to quickly fabricate replacement components can minimize downtime and extend the lifespan of infrastructure.

In summary, the adoption of 3D printing in transportation infrastructure brings a host of benefits ranging from enhanced design capabilities to improved efficiency, cost savings, and environmental sustainability.

Project Benefits **(Select all that apply and explain)**	**Quantifiable Benefits (units, dollars, etc…if applicable)**	**Methodology or Data Sources Used to Determine Quantifiable Benefits. If not applicable, please give justification of project benefits**
o Materials Enhancement	Improve material performance and durability	3D printing allows for the exploration and use of innovative materials, including high-performance and sustainable options. This opens avenues for advancements in material science within transportation infrastructure.
o Financial Impact	Life cycle cost savings	3D printing can result in long-term cost savings through reduced labor, material wastage, and faster construction cycles.
o Time Savings	Speed of Construction:	The layer-by-layer additive manufacturing process significantly accelerates construction timelines. Rapid prototyping and construction can lead to faster project completion, reducing overall project duration
o Lives Saved/Injuries Prevented	Minimize maintenance of traffic support	3D printing technology can be used for on-site repairs and maintenance, which can minimize MOT support and thus safe crashes or accidents due to traffic
o Other (Explain)	Reduced Environmental Impact	The efficiency in material usage and the potential for sustainable materials contribute to a reduced environmental footprint compared to traditional construction methods.

*Comments should explain and support urgency, financial benefit, and implementability scores