

Advanced Air Mobility Effects on South Carolina Highway Infrastructure

Jacob Perkins

The Citadel

OVERVIEW OF eVTOL MOBILITY

Over the past 2 years, The Citadel's capstone program has investigated the addition of eVTOL vertiports to South Carolina airports such as Rock Hill–York Country Airport (RKH) and Charleston Executive Airport (JZI). Electric Vertical Takeoff and Landing (eVTOL) aircraft are entering the advanced air mobility field promptly with lacking infrastructure to support this advancement in transportation technology. Stratview analyst project that the eVTOL market will be valued at \$55.7 billion by the year 2040 [1]. Leading developers have secured partnerships with companies such as UPS, FedEx, Uber, and numerous airlines to portray many uses for eVTOL advancement. Although the eVTOL market is full of excitement and developmental investments, highway infrastructure must be expanded to encompass vertiport additions to existing airports. This abstract will explain the eVTOL potential to significantly impact highway infrastructure in South Carolina, further needing specialized airport roadway design to support operations of these aircraft.

eVTOL PASSENGER SERVICE DEMAND

As eVTOL technology reaches consumer market, experts assume this aircraft will be used for private and public transportation first, likely in the next 5-years. Co-Leader of McKinsey Center for future mobility, Robin Riedel, proclaims that eVTOL technology is a mode of transportation that will eventually become frequently used [2]. One of the main ways in which eVTOLs will impact highway infrastructure is by reducing traffic congestion of surrounding areas. Although the thought of alleviating traffic congestion is appealing,

transportation engineering must be able to support an influx of personal transportation around vertiport additions. To provide the seamless experience eVTOLs offer, highway infrastructure near vertiport additions must be updated to ease congestion during peak impact hours.

eVTOL CARGO DISTRIBUTION DEMAND

In addition to personal transportation, eVTOLs present the potential to revolutionize the transportation of cargo. With an average speed of 175-mph and range of 150-miles, eVTOL aircrafts are able to maneuver difficult terrain along with avoiding traffic congestion, creating ideal cargo operations. As developers begin to coordinate partnerships with logistics companies, daily cargo flights in a single region could reach 2,357-flights per day [3]. eVTOLs will have the ability to fly cargo from manufacturing plants to local airports for further dispersion. Although eVTOLs benefit logistical constraints, a ground aspect of delivery is still needed to take packages from local airport holding centers to customers. To complete this revolution in cargo transportation, logistical eVTOLs will need to be integrated into existing transportation networks such as major highways. The current highway infrastructure will need to be updated in order to accommodate this influx in ground transportation units to fully encompass the advantages of eVTOLs.

FUTURE eVTOL IMPACT ON SOUTH CAROLINA

Leading developer, Beta Technologies, is establishing an eVTOL charging network throughout the nation. This network was further established in 2022 by the addition of an eVTOL charging station to the Rock Hill–York County Airport. South Carolina airports such as Charleston-Executive, Rock-Hill, and Greenville-Downtown have begun to consider the addition of this advanced mode of transportation into daily operations. As this industry approaches the

consumer market, highway infrastructure near South Carolina airports should be updated to encompass all aspects of eVTOL technology. Table 1, below, shows highway infrastructure updates in areas of possible vertiport additions to cater to the seamless logistics mobility of eVTOLs. Updated infrastructure to support the eVTOL industry is a crucial element to grow and meet emerging mobility demands in South Carolina.

Table 1: South Carolina airports with possible vertiport additions as identified by South Carolina Aeronautics Commission Executive Director, Gary Siegfried [4].

South Carolina Airport	2022 Annual Operations	Highway Infrastructure Update Needs
Rock Hill-York County (RKH)	28,372	Capacity improvements along state and local roads connecting to I-77 (4.9 miles) and traffic signal improvements on SC-161
Charleston Executive (JZI)	31,552	Update traffic signal at SC-700, River Rd. intersection to allow connection to I-526 extension
Greenville Downtown (GMU)	85,071	Local street network capacity and intersection improvements (Tower Dr., Eisenhower Dr., Lowndes Hill Rd., SC-291)
Greenville-Spartanburg International (GSP)	52,154	Enhance ground transportation for cargo, EMS, and passenger demand connecting to existing roads (Aviation Pkwy., GSP Dr., Stevens Rd., and SC-14)
Beauford Executive (ARW)	18,128	Ground transportation improvements to support eVTOL manufacture, SkyDrive, and related suppliers. Development of economic growth, including SC-21 access and regional network improvements
Anderson Regional (AND)	31,600	Improve local connectors to I-85 network capacity and improvements along SC-28 and US-29 to connect to US-178

SUSTAINABLE FUTURE FOR SOUTH CAROLINA

As the new technology of eVTOLs reaches the consumer market, future highway infrastructure investment will be crucial to aspects of passenger and cargo operations. With the South Carolina Aeronautics Commission investing in the future of advanced air mobility, South

Carolina Department of Transportation will be able to embrace future mobility needs. From this, the Palmetto State will provide future highway infrastructure essential for the mobility needs of citizens, businesses, and future economic developments.

REFERENCES

1. “EVTOLs: The new 'vertical' for the composites industry.” (n.d.). *Thought Leadership Report*, <<https://www.stratviewresearch.com/composights-portal/evtols-the-new-vertical-for-composites>> (May 2, 2023).
2. Heineke, K., Kloss, B., and Riedel, R. (2021). “Advanced air mobility in 2030.” *McKinsey & Company*, McKinsey & Company, <<https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/advanced-air-mobility-in-2030>> (May 2, 2023).
3. Rimjha, M., Tarafdar, S., Hinze, N., Trani, A. A., Swingle, H., Smith, J. C., Marien, T. V., and Dollyhigh, S. (2020). “On-demand mobility cargo demand estimation in northern California region.” *2020 Integrated Communications Navigation and Surveillance Conference (ICNS)*.
4. “APO TERMINAL AREA FORECAST DETAIL REPORT.” (n.d.). *Federal Aviation Administration*, FAA, <<https://taf.faa.gov/Home/RunReport>> (May 3, 2023).