Austin Light Rail Phase 1

Final Environmental Impact Statement

Appendix F-2: Energy and Electromagnetic Fields Technical Report

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Acronyms and Abbreviations

Term/Acronym	Definition
ATP	Austin Transit Partnership
BTU	British Thermal Units
DEIS	Draft Environmental Impact Statement
EMF	electromagnetic fields
EMI	electromagnetic interference
FEIS	Final Environmental Impact Statement
FTA	Federal Transit Administration
Project	Austin Light Rail Phase 1 Project
ROD	Record of Decision
USDOE	U.S. Department of Energy
VMT	vehicle miles traveled

1 Introduction

This technical report provides the basis of analysis included in the Draft Environmental Impact Statement (DEIS) and supports decisions made in the combined Final Environmental Impact Statement (FEIS)/Record of Decision (ROD). The analysis and references in this technical report remain unchanged from the DEIS except for technical updates. There are no changes to effects on energy and electromatic fields from technical updates made since publication of the DEIS.

The Federal Transit Administration (FTA) and Austin Transit Partnership (ATP) are completing an environmental review of the Austin Light Rail Phase 1 Project (the Project) in Austin, Texas. This energy and electromagnetic fields technical report was prepared to support the Project's DEIS and FEIS/ROD in accordance with the National Environmental Policy Act and related laws and regulations. FTA and ATP are the Lead Agencies in the National Environmental Policy Act process.

Electric and magnetic fields, known as electromagnetic fields (EMFs), are produced wherever electricity is used. Electric fields are produced by charges; magnetic fields are produced by the flow of electric current. The greater the electric charge or current, the greater the electric or magnetic field. EMFs are produced by electrical equipment and facilities. EMFs surround all electrical equipment and facilities, including the electrical conveyance lines and electrical devices as proposed in the Project. EMFs are applicable to the Project because they result in electromagnetic interference (EMI), which can cause disruptions and possibly malfunctions in sensitive equipment. In certain situations, EMF can result in effects on human health. The EMF/EMI Study Area, defined below, was determined by the proximity of sensitive equipment related to the light rail line and the amount of electrical power the Project requires to accelerate or decelerate near sensitive facilities. However, to ensure comprehensive safety and minimize potential impacts, a buffer zone of 500 feet was established around sensitive areas.

In locations where electric currents are present, stray currents can develop if a portion of the electrical current finds an alternative conducting path. Possible conductors for these stray currents may include metal, water, or buried pipes or cables. Over time, such stray currents can lead to corrosion, which may cause pipes to leak or wires to break.

Because the light rail system under the Build Alternative and the Design Options would be of similar length and ridership, reasonably foreseeable effects on energy and EMF/EMI would be similar in all scenarios.

This report assesses the potential local and regional effects on energy and EMFs that would result from the construction and operation of the Project. Motor vehicles (for personal, business, and transit use) and public transportation systems consume energy, and energy is needed for Project construction. Operating the light rail system would

place a demand on the local utilities but would reduce vehicle miles traveled (VMT) and energy consumed in the region as a result of attracting new riders to transit.

This report:

- describes the current trend in energy consumption surrounding the Project area;
- estimates the Project's effect on energy consumption, including energy needs and savings;
- reviews the potential effects of light rail systems on EMFs with respect to human exposure and EMI at sensitive receptors;
- evaluates the potential adverse effects of the light rail's energy consumption; and
- identifies mitigation efforts to reduce potential effects, including minimization strategies that ATP would use to reduce energy usage and minimize EMF disruptions within the Project corridor.

The Study Area for analysis of energy demand is the Austin Energy Service Area, approximately 437 square miles of Travis and Williamson Counties and a small portion of Hays County. Because light rail vehicles rarely have an adverse effect on sensitive equipment from a distance greater than 100 feet, the Study Area for assessing EMI effects, referred to as the EMF/EMI Study Area, is defined as 500 feet from the centerline of the Build Alternative.

2 Regulatory Setting

This assessment was conducted in accordance with the following:

- **National Electrical Code (latest approved version), National Fire Protection Association.** Sets the global standards for electrical safety for residential, commercial, and industrial occupancies (National Fire Protection Association 70 2020, or latest approved version).
- **National Highway Traffic Safety Administration's Corporate Average Fuel Economy.** National Highway Traffic Safety Administration's Corporate Average Fuel Economy standards regulate how far vehicles must travel on a gallon of fuel. National Highway Traffic Safety Administration sets Corporate Average Fuel Economy standards for passenger cars and for light trucks (collectively, light-duty vehicles), and separately sets fuel consumption standards for medium- and heavy-duty trucks and engines (National Highway Traffic Safety Administration 2024).

- **Clean Cities and Communities.** Fosters the nation's economic, environmental, and energy security by working locally to advance affordable, domestic transportation fuels, energy efficient mobility systems, and other fuel-saving technologies and practices (U.S. Department of Energy [USDOE] 2024).

- **Federal Communications Commission, 47 Code of Federal Regulations 15.** Provides rules and regulations regarding licensed and unlicensed radiofrequency transmissions.

- **Federal Communications Commission, Office of Engineering and Technology Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields.** Provides assistance in evaluating whether proposed or existing transmitting facilities, operations, or devices comply with limits for human exposure to radiofrequency fields adopted by the Federal Communications Commission (Federal Communications Commission 1997).

- **U.S. Department of Commerce, Federal Communications Commission, 47 Code of Federal Regulations 1.1310, Radiofrequency Radiation Exposure Limits.** Based on the 1992 version of the American National Standards Institute / Electrical and Electronics Engineers C95.1 safety standard. These limits are used to evaluate the environmental effect of human exposure to radiofrequency radiation.

- **U.S. Department of Transportation, Federal Railroad Administration, 49 Code of Federal Regulations 236.8, 238.225, and 236 Appendix C.** Provides rules, standards, and instructions regarding operating characteristics of electromagnetic, electronic, or electrical apparatus, and regarding safety standards for passenger equipment.

- **Occupational Safety and Health Administration, 29 Code of Federal Regulations 1910.97.** Contains safety standards for occupational exposure to non-ionizing electromagnetic radiation.

3 Methodology

3.1 Energy

The EMF/EMI Study Area for analysis of energy demand is the Austin Energy Service Area, approximately 437 square miles of Travis and Williamson Counties and a small portion of Hays County. Energy consumption is commonly measured in terms of British Thermal Units (BTU). A BTU is a unit of heat defined as the amount of heat required to raise the temperature of 1 pound of water by an additional 1 degree Fahrenheit. To assess energy consumption for the Build Alternative, direct energy use was calculated for automobiles and transit. The corresponding electrical demand was calculated in

terms of megawatts, then converted to BTUs where necessary, and compared to current estimates of peak demand and supply capacity within the Project electrical grid(s). The factors used to convert VMT to BTUs for personal and commercial vehicles were based on FTA's New Starts Template (FTA 2023). The factor used to convert VMT to BTUs for light rail was from the *Transportation Energy Data Book: Edition 40* (USDOE 2022).

3.2 Electromagnetic Field / Electromagnetic Interference

The EMF/EMI Study Area for electromagnetic disruption is defined as a 500-foot buffer from the centerline of the Build Alternative. Maps, surveys, photographs, and databases were reviewed to identify sensitive receptors within the EMF/EMI Study Area that could be susceptible to EMFs and EMI produced by the Project. Sensitive receptors include universities, medical institutions, high-tech businesses, airports, and governmental facilities (i.e., police and fire) that may use equipment that could be affected by new sources of EMFs.

4 Affected Environment

4.1 Energy Resources

In 2023, Austin Energy provided more than 14,000 gigawatt hours of electricity to more than 550,000 customers in Austin and parts of Travis and Williamson Counties (Austin Energy 2023). Overall, Austin comprises approximately half of the Austin Energy Service Area, and in 2023, 70 percent of Austin Energy's portfolio was carbon-free energy. Austin Energy plans to phase out its single remaining coal-powered plant and move to 100 percent carbon-free generation by 2035 (Austin Energy 2023).

4.2 Electromagnetic Field / Electromagnetic Interference

Within the EMF/EMI Study Area, ATP identified four potential EMF/EMI sensitive receptors. Receptors that are assumed to contain equipment that would be sensitive to EMI within 500 feet of the Build Alternative Project alignment, and their potential concerns, are listed in **Table 1**.

Table 1: Potential EMF/EMI Sensitive Receptors

County	Sensitive Receptor Name	Type	Distance (feet)[1]	Potential Concerns
Travis	The University of Texas at Austin	School	100	Sensitive research equipment
Travis	Austin Fire Station No. 6	Fire	70	EMI with emergency equipment
Travis	The University of Texas Department of Radio-Television-Film and Department of Communications	School	60	Interference with communications equipment
Travis	Austin Fire Station 22	Fire	45	Interference with existing equipment

[1] Distance from the Project centerline

5 Environmental Consequences

5.1 No Build Alternative

The No Build Alternative serves as the baseline from which to compare the effects of the Project. The No Build Alternative is defined as the existing transportation system and any committed highway and transit improvements defined in the *2045 Regional Transportation Plan* (Capital Area Metropolitan Planning Organization 2024) except for the Project. The No Build Alternative would create additional energy demands in the region because of population and employment growth, greater levels of congestion, and slower transit speeds. However, the increased energy demand that the light rail system and construction would place on the electrical grid under the Build Alternative would not occur under the No Build Alternative.

Under the No Build Alternative, ambient EMF conditions would be similar to the existing conditions in the EMF/EMI Study Area, although ambient EMF conditions would be expected to rise with increasing use of technology, population, and employment density.

5.2 Build Alternative and Design Options

The Build Alternative would introduce a new mode of transportation in the corridor, potentially stimulating surrounding growth that could lead to increased energy consumption. The potential increase in urban development and economic activity could lead to greater energy demand from various sectors, such as residential, commercial, and industrial. Overall, because the light rail system under all proposed Design Options would be of similar length and ridership, reasonably foreseeable effects on energy and EMF/EMI would be similar for the operational effects of all Design Options.

5.2.1 Operational (Long-Term) Effects

5.2.1.1 Energy

Energy Requirements

The proposed traction power system design for the Build Alternative would include traction power substations ranging from 1.10 to 5 total megawatt capacity and would be adjacent to the alignment, spaced approximately 1 mile apart. Traction power substations are electrical substations that convert electric power to the appropriate voltage, current type, and frequency for use by light rail vehicles. The traction power substations would be spaced approximately 1 mile apart along the Project corridor.

According to the *Transportation Energy Data Book: Edition 40*, the average light rail vehicle energy demands per passenger mile is 1,307 BTU (USDOE 2022). A passenger mile is not dependent on the number of passengers traveling on the system but represents the operation miles of the light rail network. To calculate the estimated energy demands of the Project, the average BTU per mile traveled was applied to the Project's length. As shown in **Table 2**, the estimated energy consumption for the Project is approximately 12,809 BTU per passenger mile. The estimates for BTUs per passenger mile would be updated as design and anticipated energy demands are refined.

Table 2: Estimated Energy Consumption for the Project

Transportation Mode	Energy Consumption Factor (BTU/passenger mile)
Light Rail	12,809

Source: USDOE 2022.

Austin Energy would provide the electricity to power the Project. The Project would not have a direct need for new energy production facilities or capacity-enhancing alterations at existing energy production facilities. The Project's estimated annual energy consumption when fully operational is expected to be in the range of 60 to 70 gigawatt hours, a small fraction of Austin Energy's portfolio (see **FEIS Appendix E-9**). Austin Energy's plans for 100 percent carbon-free electricity generation by the year 2035 would still be attainable with the Build Alternative's annual energy consumption; therefore, the operation of the Build Alternative would not conflict with those adopted plans.

Energy Savings

As population increases, VMT are projected to increase as well; the Federal Highway Administration forecasts that VMT will increase at an average annual rate of 0.6 percent between 2019 and 2049 (Federal Highway Administration 2023).

The Project is expected to eliminate approximately 61,965 daily VMT. The annual VMT and energy consumptions, and expected decreases in automobile VMT, are shown in **Table 3**. Annual passenger vehicle travel within the corridor would be reduced by approximately 20.14 million miles with the new transit service, thereby reducing passenger vehicle energy consumption by 68,985 million BTUs per year by 2045.

Table 3: Projected 2045 Annual VMT and Energy Use Effects Under the Build Alternative

Transportation Mode	Annual VMT Decrease	Energy Use Decrease (million BTU)
Automobile	20,138,625	68,985

Sources: USDOE 2022; FTA 2023.

5.2.1.2 Electromagnetic Field / Electromagnetic Interference

The overhead catenary wires, also known as messenger wires (wires that provide direct power to the train), and the power transmission lines that provide power to the traction power substations along the proposed Project route would produce EMFs. EMFs would also be produced by the train cars themselves, both within and outside the cars, especially when they are moving. The electricity needed to operate the train cars flows from the overhead catenary wires to the traction motors and other electronic equipment. The power flows through the cables located either in the ceiling or under the floor of the cars. The amount of electricity flowing in these cables would vary depending on whether the train is accelerating, running at steady speed, decelerating, or is stopped. The electrical current would be highest when the train is accelerating. EMFs would be created whenever the train operates.

EMFs can cause a variety of effects on humans. Certain EMF combinations can cause shock and burn injuries through direct contact with energized components; others can interfere with the operation of electrical and magnetic devices, including heart pacemakers. Based on data available from similar rail systems, however, operation of the light rail is unlikely to generate health effects for riders or people along the tracks.

Because EMFs can cause EMI, which can cause disruptions and possible malfunctions in sensitive equipment, ATP would contact each of the sensitive facilities identified in the EMF/EMI Study Area if the Build Alternative is selected to determine the type and location of sensitive equipment in relation to the light rail line. If needed, ATP would perform modeling to identify existing levels of EMIs at these facilities and the potential EMI levels that would result from the Project to determine whether mitigation is warranted. The EMI implications of the Project are further described in **Attachment A**.

Additionally, where there are electric currents, it is possible that stray currents would occur when a portion of the electrical current finds an alternative conducting path, such as metal, water, or a buried pipe or cable. Over time, a stray current can cause corrosion, which in turn can cause pipes to leak or wires to break. ATP would minimize

or avoid the potential for stray current effects by selecting best management practices in control measures for stray currents. The best management practices may include one or a combination of the following:

- Installing cathodic protection systems in nearby utility lines, such as galvanic anodes, electrical isolation with insulating unions at connections to existing piping, pipe coatings, bonded mechanical pipe joints, and permanent test facilities to monitor stray currents and rates of corrosion;
- Installing insulating unions to break the electrical conductivity of the pipe and force the stray current to take another path;
- Isolating the electrical rails from the ground; and
- Installing stray-current-control track-fastening systems where appropriate, such as tie-and-ballasted track using high-resistance track-fastening systems on concrete ties; direct-fixation track using high-resistance, rubberized track fastening systems; and embedded track using various methods of rail encapsulation such as rail coatings, polyurethane encasement, and rail boots.

5.2.2 Construction-Related (Short-Term) Effects

5.2.2.1 Energy

Construction of the Build Alternative would temporarily increase energy consumption. However, this effect would occur only during the Project's construction phase. Total estimated energy consumption during construction is 517,178 million BTUs, as shown in **Table 4** (FTA 2022). Calculations take into consideration mode of transport; length of track; construction of parking lots, facilities, and stations; and the energy required to manufacture construction materials. Additionally, the completed Project would ultimately decrease energy use and highway VMT in the region, as shown in **Table 3**.

Table 4: Estimated Energy Usage for Project Construction

	Energy Use (million BTU)		
	Upstream	Downstream	Total
Construction	489,717	27,462	517,178
Transitway Maintenance	0	24,921	24,921
Facility Operations	0	937,150	937,150
Vehicle Operations	54,230	52,948	107,177
Vehicle Maintenance	0	0	0

Sources: FTA Transit Greenhouse Gas Emissions Estimator.

5.2.2.2 Electromagnetic Field / Electromagnetic Interference

Construction would result in negligible EMF/EMI effects because construction equipment generates low levels of EMFs and EMI. The only EMI that could be generated during construction activity would be occasional licensed radio transmissions between construction vehicles.

6 References

Austin Energy. 2023. Austin Energy Annual Report FY 23. https://austinenergy.com/-/media/project/websites/austinenergy/about/2023_annual_report.pdf?rev=b0f42e1f4dfe42608168bba715cc732a&sc_lang=en&hash=D00164C7BA7947EBE73F252334DA37CE.

Capital Area Metropolitan Planning Organization. 2024. *2045 Regional Transportation Plan*. Adopted May 4, 2020. Updated May 2024. Accessed July 2024. https://www.campotexas.org/regional-transportation-plans/2045-plan/.

Federal Communications Commission. 1997. *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields*. OET Bulletin 65. Edition 97-01. August. https://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65.pdf.

Federal Highway Administration. 2023. Special Tabulations. 2023 FHWA Forecasts of Vehicle Miles Traveled (VMT). July 27. Accessed April 17, 2024. https://www.fhwa.dot.gov/policyinformation/tables/vmt/vmt_forecast_sum.cfm.

FTA. 2022. Transit Greenhouse Gas Emissions Estimator v3.0. Accessed March 21, 2024. https://www.transit.dot.gov/regulations-and-guidance/environmental-programs/transit-greenhouse-gas-emissions-estimator-user.

FTA. 2023. New Starts Templates Part 1. Accessed February 16, 2024. https://www.transit.dot.gov/funding/grant-programs/capital-investments/new-starts-templates-part-1.

International Commission on Non-Ionizing Radiation Protection. 2020. “Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz).” *RF EMF Guidelines 2020*. Accessed February 16, 2024. https://www.icnirp.org/en/publications/article/rf-guidelines-2020.html.

International Committee on Electromagnetic Safety of the Institution of Electrical and Electronic Engineers. 2002. *ICES 2002: IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0–3 kHz*. Accessed February 16, 2024. https://www.emfs.info/limits/limits-organisations/ices-2002/.

National Highway Traffic Safety Administration. 2024. Corporate Average Fuel Economy. United States Department of Transportation. Available online: https://www.nhtsa.gov/laws-regulations/corporate-average-fuel-economy.

USDOE. 2022. *Transportation Energy Data Book: Edition 40*. Prepared and published by Oak Ridge National Laboratory under contract with the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Vehicle Technologies Office. February. Updated June 2022. https://tedb.ornl.gov/.

USDOE. 2024. Clean Cities and Communities. A U.S. Department of Energy Partnership to Advance Clean Transportation Nationwide. Available online: https://cleancities.energy.gov/.

Attachment A. Electromagnetic Interference White Paper