3.7 ELECTROMAGNETIC FIELDS

Introduction

This section describes the environmental setting and effects of the proposed project with regard to electromagnetic fields (EMFs). Specifically, this section discusses existing conditions related to EMFs within the Santa Clara-Alum Rock Corridor and describes applicable regulations pertaining to EMFs. The assessment of significant impacts and mitigation measures of the proposed project related to EMFs are also described. Information in this section is based on documentation included in the Supplemental Final EIR prepared for the Capitol Expressway Corridor Project.

Existing Conditions

Environmental Setting

Electrical systems produce both electric and magnetic fields. Electric fields result from the strength of the electric charge, while magnetic fields result from the motion of the charge. Together, these fields are referred to as “electromagnetic fields.” EMFs are invisible, non-ionizing, low-frequency radiation. Electric and magnetic fields are common throughout nature and are produced by all living organisms. Concern over EMF exposure, however, generally pertains to human-made sources of electromagnetism and the increased levels of exposure that interfere with other systems and may have adverse biological effects. Under extreme conditions (i.e., the presence of intense electrical fields), EMF hazards can include shock and burn, although such conditions are rare.

Electric field strength is measured in units of volts per meter (V/m); field strength increases as voltage rises. Any object with an electric charge has a voltage (potential) at its surface and can create an electric field. When electrical charges move together (an electric current), they create a magnetic field that can exert forces on other electric currents. All currents create magnetic fields, which occur throughout nature and are one of the basic forces of nature. The strength of a magnetic field depends on the current (higher currents create higher magnetic fields), configuration/size of the source, and distance from the source (magnetic fields grow weaker as the distance from the source increases). Magnetic field strength has several units of measure. The most commonly used are milligauss (mG) and microTesla (mT); 10 mG equal 1 mT. Direct Current (DC) produces stronger EMFs than alternating current (AC). Consequently, EMF strength is measured in terms of mG. VTA’s light rail system is operated on a 525- to 875-V DC electrical system. Substations located along the alignment convert AC power to DC power. An overhead conductor, or catenary, supplies power to the trains. Each car on a train can draw a maximum of approximately 1,300 amps of current from the system. Therefore, two- and three-car trains could draw a maximum of approximately 2,600 and 3,900 amps, respectively.

During environmental review for the Vasona Corridor LRT Project in 1999, the magnetic fields associated with the existing light rail system operated by VTA were measured at four light rail stations and one substation.[1] The magnetic fields were found to vary considerably depending on factors such as train length, train mode (acceleration, deceleration, idling), number of trains, and number of passengers. The results of the measurements are summarized below.

At a distance of 20 to 30 feet from the closest track, DC magnetic fields were typically within a few hundred mG of the Earth's ambient DC field. Measured AC magnetic fields were typically 5 mG or less within 10 feet of the tracks and 2 mG or less at 20 feet from the tracks. At the substation, DC magnetic field levels ranged from about 194–921 mG at the substation perimeter. The higher level is thought to be at the location where underground feeder cables to the system are located. AC magnetic fields ranged from 0.3 mG to a maximum of about 31.3 mG at one perimeter location. The higher level is thought to be at the location where the underground Pacific Gas and Electric Company feeder cables enter the substation.

Neither the federal government nor the State of California has set standards for EMF exposure. Federal guidelines are under consideration by the U.S. Food and Drug Administration, Federal Communications Commission, U.S. Department of Defense, and Environmental Protection Agency. The International Commission on Non-Ionizing Radiation Protection and the American Conference of Governmental Industrial Hygienists (ACGIH) have guidelines for AC magnetic fields that are much higher than levels found near the VTA's light rail system. ACGIH also has guidelines for DC magnetic fields: routine occupational exposures should not exceed 600,000 mG for the whole body or 6,000,000 mG for limbs on a time-weighted average basis. For persons with cardiac pacemakers and similar medical electronic devices, wearers should not be exposed to DC magnetic field levels exceeding 5,000 mG.

Environmental Consequences and Mitigation Measures

Approach and Methodology

The effects of the EMFs associated with the proposed project were assessed based upon a review of the relevant literature and of prior environmental analyses prepared for VTA.

Standards of Significance

There are no established or regulatory governmental standards for magnetic fields directly applicable to the proposed project. Most concerns regarding the potential health effects of magnetic fields has focused on AC magnetic fields. In 1993 (Decision 93-11-013), after reviewing existing research, the California Public Utilities Commission (CPUC) states in its conclusion of law that "[i]t is not appropriate to adopt any specific numerical standard in association with electromagnetic fields until we have a firm scientific basis for adopting any particular value".[2] Based on significance criteria used by VTA and professional practice, the proposed project may result in substantial adverse effects related to EMFs if they would result in DC magnetic fields that exceed the guidelines of ACGIH.

1 Federal Transit Administration and Santa Clara Valley Transportation Authority, 2000.

2 California Public Utilities Commission, 1993.

Environmental Analysis

In order to determine electromagnetic fields impacts due to construction and operation of the proposed project, a level of significance is determined and reported. Conclusions of significance are defined as follows: significant (S), potentially significant (PS), less than significant (LTS), no impact (NI), and beneficial (B). If the mitigation measures would not diminish potentially significant or significant impacts to a less-than-significant level, the impacts are classified as "significant and unavoidable (SU)." For this section, EMF refers to Electromagnetic Fields.

For the purposes of this analysis, the proposed project includes the implementation of BRT and Single Car LRT in the Santa Clara-Alum Rock Corridor in two phases. Phase 1 includes the implementation of BRT service and Phase 2 includes the implementation of Single Car LRT service. Potential EMF impacts associated with Phase 1 and Phase 2 of the proposed project, including project options, would be largely similar. Therefore, the analyses for the two project phases are discussed together. Areas in which the effects of the two phases differ are detailed within the discussion of each significance threshold.

Potential impacts associated with the extension of transit services in the Capitol Expressway Corridor were analyzed in the Capitol Expressway Light Rail Final Supplemental Environmental Impact Report (FSEIR) dated January 2007, which is incorporated herein by reference. Potential impacts of the proposed project not analyzed in the Capitol Expressway Light Rail FSEIR are described below, as necessary.

EMF-1. Implementation of the proposed project would not result in a substantial impact from direct current magnetic fields that exceed the guidelines of ACGIH. (LTS)

The bus service improvements proposed under Phase 1 of the proposed project are not electrically powered, although some elements, such as electrically powered traffic signals and fare machines, are included. The magnetic field associated with traffic signals diminishes with increased distance from the signals, and exposure to fare machines would be intermittent. The duration of exposure to EMFs from transit system elements is relatively brief compared to the daily exposure from office equipment and household appliances, electric power lines, and other electrically powered machines. For example, the maximum magnetic field from a hair dryer can range from 60-20,000 mG, but the strength of its magnetic field drops to 1–70 mG at a distance of 12 inches. Like household appliances, the fields associated with fare machines also decline with a minimal distance.

Phase 2 of the proposed project would result in additional sources of EMF generation. The sources would include the traction power system and substations; light rail stations with various lighting, communications, utilities and fare machines; and the electrically powered light rail vehicles. EMF intensities around electrically powered vehicles vary. Under Phase 2, the greatest potential for exposure to increased magnetic fields would be within the light rail vehicles and at the proposed stations, where passengers and train operators would be exposed. Other VTA staff, such as maintenance and security personnel, would also be exposed. The magnitude of the increased magnetic field would vary considerably by location and from minute to minute. The magnetic field would fluctuate substantially, depending on factors such as train mode (acceleration, deceleration, or idle) and number of passengers at any given time. The strength of the magnetic field would also vary relative to an individual's proximity to the system. Strong magnetic fields are not associated with the normal environment and the operation of light rail trains. The dominant source of magnetic field generation is the traction power and the control equipment under the vehicle's floor.[3] The measurements of average magnetic fields for overhead powered rail vehicles have ranged from 400 mG at the head level to 1,500 mG at floor level. The actual field measurements inside existing light rail cars during peak commute periods in 1999 indicate that typical magnetic field levels are approximately 50 percent below ACGIH’s 5,000–mG threshold. Therefore, impacts related to EMFs would be less than significant.

3 Federal Railroad Administration, 1993.