



U.S. Department
of Transportation
**Federal Highway
Administration**

FTA Transit Climate Change Adaptation Assessment Pilot Project:

Los Angeles County Metropolitan Transportation Authority

In 2011, the Federal Transit Administration (FTA) selected seven pilot teams from across the country to conduct climate change adaptation assessments. The pilot projects were intended to advance the state of practice for adapting transit systems to the impacts of climate change. The selected projects assessed the vulnerability of transit agency assets and services to climate change hazards such as heat waves and flooding and developed initial adaptation strategies that fit with their transit agency's structure and operations. The pilot project effort is part of FTA's **climate adaptation initiative**, which also includes an **adaptation report**, workshops, and webinars.

Los Angeles County Metropolitan Transportation Authority (Metro) is the state-chartered Regional Transportation Planning Agency (RTPA) and public transportation agency for Los Angeles County (California). Metro serves as the transportation planner and coordinator, designer, builder, and operator for Los Angeles County. Metro used its existing Climate Action and Adaptation Plan (CAAP), Environmental Management System (EMS), and asset management system tools to integrate climate adaptation principles into ongoing conversations and to implement best management practices in the areas of its operations and maintenance. The project developed a comprehensive set of metrics to gauge past progress and identify new targets to guide the direction of future climate adaptation work. The project team identified messages and key points appropriate for target audiences; conducted a roundtable and a webinar; and produced a 100-second video to initiate a dialogue among stakeholders who are interested in and anticipated to work together with Metro in its climate adaptation efforts. The project sought to inform Metro staff, board members, other transit operators, and the public how they can help adapt to climate change.



Objectives

Metro has already conducted several studies related to climate change mitigation and adaptation. At the time of the pilot, Metro sought to:

- Identify pathways for integrating adaptation options into the agency's planning and programming, construction, operations, and procurement activities.
- Create replicable processes and share their outcomes with other transit agencies, the board, and the public.



Erosion from extreme heat followed by extreme precipitation. Photo credit: Metro.



Flooding at Gold Line Maintenance Yard after a short, very intense rain event. Photo credit: Metro.



Low-impact development strategy at a park-and-ride lot. Photo credit: Metro.

Approach

Integrate adaptation into the Metro EMS. An EMS (as defined by the U.S. Environmental Protection Agency) is a framework tool that helps an agency address its regulatory environmental requirements in a systematic and cost-effective manner by allowing users to set environmental targets and reminding them of the steps that must be taken during each phase of a project to ensure environmental compliance.

The methodology used in the EMS to identify and prioritize environmental impacts provides a process that can be modified to address risk to assets from severe weather and climate change. Metro used its EMS to integrate climate change adaptation into the 17 EMS elements. These elements fall under the areas of policy; planning, implementation, and operation; checking and corrective action; and management review. Examples of ways to integrate climate change into the EMS include:

- The process for setting improvement objectives can include improvements to harden assets to climate risks.
- Operational changes to protect assets can be integrated into procedures, inspections, training, and emergency planning.
- The effectiveness of adaptation efforts can be tracked and evaluated using the existing processes.
- Management review can provide a process to keep management apprised of progress.

Develop asset management tool. Metro evaluated approaches for incorporating climate risk into its asset management systems, including the Environmental Information Management System (EIMS) and the Maintenance and Materials Management (M3) System. During the evaluation, it became clear that Metro's M3 system was better suited for three reasons: (1) it is fully populated with all existing Metro assets; (2) its functionality already allows for flexible data and information input fields; and (3) it is in the process of being upgraded with additional capacity, functionality, and streamlining. M3 supports asset management, inventory, and warehouse management, as well as bus, rail, and facilities maintenance; it is integrated with Metro's purchasing and financial systems to create a seamless environment and eliminate duplication of data.

To populate the new M3 fields, Metro developed guidelines for assessing climate risks. In particular, the guidelines lead a transit agency through:

- Identifying assets;
- Screening assets for criticality;
- Screening assets for vulnerability to climate stressors;
- Screening for indicators of changing climate risk over time; and
- Assessing the overall risk of the asset.

The project team undertook a case study on the Red Line Yard to demonstrate the use of the guidelines. Metro personnel undertook the sample analysis at a workshop, evaluating the assets for criticality and vulnerability to precipitation, heat, and wind. Personnel determined criticality by asking, "If this service or asset were removed from the transit system, would the transit system be fundamentally different?" They assessed vulnerability of a service or asset by considering its exposure, sensitivity, and adaptive capacity with respect to a particular climate stressor.

In addition to criticality and vulnerability, Metro developed indicators of risk to portray the projected rate of change in extreme weather events over specific time frames (e.g., 0–5 years, 20–50 years). These time frames support both shorter-term operations needs and longer-term capital planning requirements. Metro does not have access to rigorously modeled rates of change for these time frames, so, for illustrative purposes, the team provided example rates of change (1 = not significant; 2 = somewhat significant; 3 = significant) for each climate stressor and time period (see Table 1). The overall risk associated with each asset and weather impact is determined using the following equation:

$$\text{Criticality} \times \text{Vulnerability} \times \text{Rate of Change} \\ = \text{Asset Risk Level}$$

Identify metrics. Metro worked alongside the Urban & Environmental Policy Institute (UEPI) at Occidental College to determine key metrics that the agency could use to track its progress in implementing adaptation strategies. The team derived metrics from the literature and through surveys and discussions with Metro frontline maintenance and operations staff and employees. Some of the metrics are binary (yes/no), while others require gathering and comparing numerical data.

Sample Assets	Criticality	Vulnerability	Rate of Change (Illustrative)				Wind Risk (Illustrative)			
			Yr 0-5	Yr 5-10	Yr 10-20	Yr 20-50	Yr 0-5	Yr 5-10	Yr 10-20	Yr 20-50
1. Stormwater collection system	3	1	2	2	3	3	6	6	9	9
2. Outdoor waste accumulation area	2	3	2	2	3	3	12	12	18	18
3. Underground car hoist	2	1	2	2	3	3	4	4	6	6
4. Truck assembly- on train	3	1	2	2	3	3	6	6	9	9
5. Truck assembly- off of train (spare)	3	1	2	2	3	3	6	6	9	9
6. Wheel truer	2	1	2	2	3	3	4	4	6	6
7. Bridge crane	1	1	2	2	3	3	2	2	3	3
8. Portable steamer	1	1	2	2	3	3	2	2	3	3
9. Power Substation	3	2	2	2	3	3	12	12	18	18
10. Third Rail	3	1	2	2	3	3	6	6	9	9
11. Trainway Feeder	2	2	2	2	3	3	8	8	12	12
12. Signals	2	1	2	2	3	3	4	4	6	6

Table 1: Example of asset analysis results for precipitation.

Metro then developed criteria to help narrow down the 109 initial metrics to a more manageable number. Using a qualitative scale, the project team rated each metric against the following criteria: criticality, severity, equity, feasibility, cost, best practice, climate, visibility, participation and governance, design, and mitigation. The team then summed the points and recommended the top 20 metrics as priorities.

Develop and disseminate outreach materials.

Metro developed a Climate Adaptation Messaging Strategy to inform outreach materials and ensure that it is using relevant messaging techniques. The messaging strategy identifies relevant climate adaptation messages for different audiences, including Metro Board of Directors, elected officials, and service area residents, as well as transit-dependent riders and discretionary riders.

Metro hosted two events (a roundtable and a webinar) for transit agencies and industry professionals to begin exchanging information and strategies for climate adaptation. Additionally, Metro developed a video to highlight some of the agency’s key environmental initiatives that are helping to prepare Los Angeles for the impacts of climate change.

Key Results & Findings

Metro demonstrated how transit operators can integrate climate change adaptation considerations into their EMS and asset management system. Most elements of the EMS require only minor modifications to integrate climate change adaptation considerations. Additionally, the results of the prioritization of vulnerable assets can be included in Metro’s M3 system with minor modifications. Including this information in the M3 system allows Metro to systematically review its assets in their entirety; prioritize the criticality of its at-risk assets over time; and

ultimately, identify viable strategies for minimizing climate change impacts when developing capital and operating budget actions.

Metro selected seven adaptation metrics for adoption to help determine the completeness and integration of the agency’s adaptation work as well as the effects on customer service:

1. Has a vulnerability assessment been conducted?
2. Have adaptation actions been prioritized?
3. Have vulnerable assets been mapped with transit-dependent and low-income populations?
4. Number of injuries/medical emergencies to workers and riders by temperature and rainfall.
5. Does the agency have overheating standards for public transport facilities and rolling stock?
6. Capacity to monitor weather and temperature conditions in real time at key locations in the service area.
7. Extreme weather impacts on service delays and cancellations.

Metro will also continue outreach to the community through short video segments on environmental topics, which will be played at all Metro monitors in rail and bus station platforms. Longer video segments will be played in locations such as TransitTV (TV monitors watched by bus riders) and Metro-purchased time slots.



Figure 1: Out clip from Metro video storyboard. Source: Metro.

Lessons Learned

Modulate messaging to effectively engage staff.

The team found it was more effective to discuss discrete severe-weather events (such as high winds, high heat, and heavy rain) and the possible increase in frequency of these events with bus and rail maintenance division staff (rather than focusing on discussing the impacts of climate change).

Draw on best practices learned from responding to past extreme weather events. Addressing asset breakdowns has led to an understanding of extreme weather impacts and a collection of best practices for responding. This information (including historic cost data) can facilitate a more systematic approach to planning and executing strategies to reduce the risk to Metro's existing and expanding system.

Coordinate and leverage resources across the region and different sectors. There is a need for a systematic and collective approach to climate change adaptation that expands across the public, private, and nonprofit sectors and industries.

Foster more active public engagement. Metro has yet to see the public actively engage in climate change adaptation planning. Through Metro's video outreach, the public will have an opportunity to better understand how their ridership helps to reduce their impact on the environment, and how Metro is working to provide a resilient and reliable system for its riders for decades to come.

Next Steps

Reevaluate metrics. Metro environmental staff and EMS administrative staff will annually reevaluate current metrics, benchmark progress on tracking and integration, report out on findings, and consider adoption of additional metrics as the agency's climate work progresses.

Track adaptation performance. Metro will continue to track its climate adaptation performance through the agency-wide rollout of the EMS and closely track how the EMS changes to include more and more climate-related elements. Since the EMS is a self-perpetuating management procedure, Metro anticipates learning from what new climate management ideas emerge moving forward.

Conduct detailed asset vulnerability assessment. Metro has completed a second and more detailed asset vulnerability assessment to inform (1) the specific vulnerabilities in the fixed assets of its existing system, and (2) the planning, design, construction, and operation of new rail lines.

Assess impacts on vulnerable populations. Metro has ongoing work to further examine the issues associated with transit user's mobility by investigating climate impacts on low-income, disadvantaged, and particularly vulnerable transit-dependent populations.

For More Information

Resources:

Los Angeles County Metropolitan Transportation Authority Climate Change Adaptation Pilot Project Report

Metro Sustainability: Environmental Compliance and Services Department (ECSD) Website

Building a Greener, Cleaner LA Video

Complete Set of Resources Developed During the FTA Pilot

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