NM COAST:
Non-Motorized Count Assurance Tool

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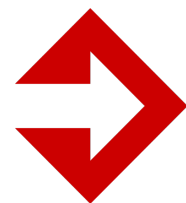
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16. Abstract

　　The Non-Motorized Count Assurance Tool (NM COAST) is a web application developed to serve as a pedestrian and cyclist data storehouse, providing support for ingesting, cleaning, storing, and downloading data from continuous or short-term counters. The attached report documents the NM COAST's library of functions and features.

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NM COAST
Non-Motorized Count Assurance Tool

About Pages

The Non-Motorized Count Assurance Tool (NM COAST) is a web application developed to serve as a pedestrian and cyclist data storehouse, providing support for ingesting, cleaning, storing, and downloading data from continuous or short-term counters. This page documents the NM COAST's library of functions and features.

▼ NM COAST and NMVDP Overview

Pedestrian and cyclist data collection is a rapidly evolving field. While the North Carolina Department of Transportation (NCDOT) and similar agencies nationwide have substantial experience in collecting motor vehicle traffic counts and leveraging current volume or predicted demand data to evaluate infrastructure investments, potential pedestrian and cyclist infrastructure is often justified by qualitative analysis or local interest. Some academic literature on bicycle and pedestrian data collection is available, but a need remains to develop robust, scalable data collection and verification procedures and develop a pedestrian and cyclist data clearinghouse to aggregate high-quality data.

The NC Nonmotorized Volume Data Program (NC NMVDP) started in November 2013 as an effort to create a rigorous and reproducible system for counting pedestrian and bicycle traffic across North Carolina. The program has progressed through three major phases. In Phase 1, continuous counting sensors were installed in NCDOT Divisions 7 and 9 between September and December 2014. In Phase 2, additional sensors were installed in NCDOT Divisions 5, 8, and 10 between October 2016 and June 2018. Under Phase 1 and 2 of the program, ITRE assisted with the installation and maintenance of counting equipment, as well as providing data management services. Under the memorandums of agreement (MOAs) between NCDOT and the local agencies receiving continuous counting equipment, NCDOT owned the counting equipment until 24 months after the installation date, after which ownership of the counting equipment transferred to the local agency. After the ownership transfer, NCDOT retains data management responsibilities (currently delegated to ITRE) for the useful life of the counting equipment, but local agencies are responsible for equipment maintenance. Additional agencies or municipalities not included in Phase 1 or Phase 2 can also opt in to NCDOT's data management services. The NC NMVDP has operated under this Collaborative Agency Model since October 2022. Additional details about the development of the NMVDP program can be found on the ITRE website.

NM COAST represents an expansion of the existing counting program to develop a vendor-independent data system that can integrate pedestrian and cyclist data from multiple sources, either automated or

manual; clean that data to a sufficient level using purely automated methods, and an excellent level if manual review is provided; and provide the cleaned data in an easily-accessible format to researchers, government workers, and the general public.

▼ Data Structure

NM COAST uses the following data aggregation structure:

Datastreams

The most disaggregated form of data available given the hardware at a location. As of September 2024, all sites report counts in 15-minute bins. At Eco-Counter continuous counters, datastreams report 15-minute volumes recorded by a single type of sensor (either PYRO or ZELT), and almost always in a single direction.

- At Eco-Counter locations with multiple sets of ZELT loops (i.e. a roadway ZELT loop and sidewalk ZELT loop), each set of loops has at least one datastream.
- Eco-Counter HD ZELT loops are a variant of loop with four diamonds instead of the usual two. These loops assign two datastreams to the HD loop set, which must be aggregated together before analysis is performed.

Sensors

Sensors represent a single mode of travel (pedestrians, roadway cyclists, or sidewalk/greenway cyclists) at a single counting location. For Eco-Counter continuous counters, this roughly corresponds to physical pieces of hardware; for example, a single PYRO sensor is responsible for all pedestrian counts at a counting location, which can be usually be subdivided into two datastreams, one for each direction.

Counters

The set of all sensors at one geographic point, along with their supporting hardware.

Stations

The collection of counters (almost always one or two) serving at a point along a greenway or road. This level of aggregation allows for better roadway volume estimates when a counter is available on both sides of the street.

▼ Modules

Create Data Report

The Create Data Report page allows users to download count data and counting location metadata for all locations in the NC NMVDP network.

Data Audit Tool

The Data Audit Tool provides a way to visually review count data and a suite of tools for rejecting erroneous counts (i.e. counts affected by counter malfunction.) Once users specify a counting location, start date, and end date, graphs are generated. A tabbed navigation bar allows the user to select between an overview page, showing daily and 15-minute counts over the entire date range for

pedestrians, road cyclists, and sidewalk/greenway cyclists, or navigate to specific pages for each travel mode. The dedicated-mode pages provide the option to approve or reject days of data individually or as a group, and provide higher-resolution graphs at the daily and weekly level if a detailed investigation is desired.

Record Elements Management

The Record Elements Management tab allows authorized users to edit station, counting location, sensor, and datastream metadata. This feature is still experimental; the Admin interface also provides this ability. The most important feature on the Record Elements Management page is the ability to batch-upload or batch-update both metadata and counts.

Counter Status

The Counter Status page provides a snapshot of the entire sensor network. It is designed to give an initial indication of whether each sensor is reasonably functional or requires further review (starting with a review of the available data, and proceeding to field investigations if needed.) The flagging algorithm assesses the last 14 days of data at each counting location. If any individual datastream provides less than 80% data coverage after scrubbing days of data that fail the quality assurance process, the entire counting location fails. This is often a result of delayed data transmission, not necessarily sensor damage, so flagged counting sites should be investigated using the Create Data Report or Data Audit tools before sending out field staff to investigate.

About

The About page contains documentation on the components and pages that make up NM COAST.

Admin Portal

The Admin Portal allows administrators to create new user and administrator accounts, provides an alternative method to editing the database compared to the Record Elements Management tab, and provides the only way to delete (rather than just modify) unwanted data or metadata records.

▼ Data Flagging Checks

All count data is subjected to an identical set of non-statistical "rule-of-thumb" checks to flag severely implausible values, such as many days with no counts or daily volumes in the tens of thousands. Tests are applied on a day-by-day basis, and run on each datastream seperately (with some exceptions for complex ZELT loop setups, where datastreams might be combined.) These checks require no manual verification, can be run on any amount of data, and are generally intended to err on the side of leaving questionable data in the dataset, rather than risking the elimination of good data to provide a more conservative dataset. A table of the current non-statistical checks is provided below.

Test	Threshold	Description
Max Daily Volume	Pedestrians = 15000; Cyclists = 5000	Scrubs any days of data where the total daily volume reported by the datastream exceeds the limit to the left.

Max Hourly Volume	Pedestrians = 3000; Cyclists = 750	Scrubs any days of data where the highest hourly volume reported by the datastream exceeds the limit to the left.
Gap	No missing data for the day	Scrubs any days of data with one or more missing 15-minute data bins.
Zero	At least one observation per nine-day window	Scrubs any days of data where the preceding four days, that day, and the subsequent four days of data all report zero volumes.

For datastreams with at least 30 days of manually-verified "passing" data and at least 30 days of manually-verified "failing" data, an additional test is performed:

1. A t-test is performed to check for statistically significant differences in mean daily volume between manually-verified passing and failing days.
2. A threshold volume is calculated that maximizes the classification accuracy of manually-verified passing and failing days based only on volume.
3. If the average volume on manually-verified passing days was found to be significantly higher than the average volume on failing days in (1), dates reporting volumes below the threshold from (2) are flagged as inaccurate. If the average volume on manually-verified passing days was found to be significantly lower than the average volume on failing days in (1), dates reporting volumes above the threshold from (2) are flagged as inaccurate.