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U.S. Department of Transportation
Federal Highway Administration

CHANGE LOG

TRAFFIC NOISE MODEL 3 SERIES

FHWA-HEP-24-017
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF NATURAL ENVIRONMENT
Washington, D.C.

INTRODUCTION

This document is a log of the changes that were implemented in the Traffic Noise Model (TNM) software for the version 3 series. The 3 series includes TNM 3.0, TNM 3.1, and the latest release: TNM 3.2.

This Change Log is divided into two sections, the first contains the new Change Log for modifications made to the software from version 3.1 to 3.2; the second section contains the updated Change Log for changes made from version 3.0 to 3.1.

More information about TNM 3.2 can be found online at: https://www.fhwa.dot.gov/environment/noise/traffic_noise_model/tnm_v32/ or by contacting Technical Support at: TNMHelp@dot.gov.

Section I:

TNM 3.1 to TNM 3.2 Change Log

GENERAL INFORMATION

This first section focuses on the changes made to TNM from version 3.1 to version 3.2. TNM 3.2 is the current release version.

TNM version **3.2.8741.34338** was finalized in December 2023.

The SHA256 MD5 Hash for the Installer (to verify if the download is the actual installer) is:

e5afa4233b4de4b58998647f4249a6f1d92dcabd7d9d41b3546122e2ce2fa053

It can be verified locally by executing the following command in a command prompt:

certUtil -hashfile "TNM Installer.msi" SHA256

Summary

TNM:

- Integration of the Roadway Construction Noise Model
  - Stationary equipment and mobile equipment
- Expanded sorting and filtering
- Increased maximum zoom
- Segmentation Bug/Stability Fixes

ITEMIZED CHANGES

Added:

Newly added features

User Experience

- Sorting and filtering capability for *all* data grids, including input data and Results tabs
- Validation Results tab for referencing input check error messages that clears when errors are resolved
- Separate tabs for roadway and equipment noise results, including report metric for respective results, and calculation error messages
- New '(beta)' label for parallel processing receiver calculation mode
- Equipment objects shown in Plan Builder, Section View, and 3D view

- Equipment point and object label toggles in View ribbon
- Equipment Plan Builder view and transparency toggles in legend
- Equipment inputs in Project Settings menu, Edit Pane, and Object Details Pane
- Equipment Input Report
- Provided reference CSV file containing NCHRP measured equipment spectra (uncalibrated data)
- Provided reference CSV file containing NCHRP equipment spectra with excess attenuation removed (calibrated data)
- Provided CSV file containing examples of properly formatted and calibrated user-defined equipment inputs

MODELING

- Default construction equipment acoustic sources calibrated to remove excess attenuation from NCHRP measurement ground conditions
- Point source acoustics (added stationary equipment objects)
- Acoustic source directivity (added equipment objects with separate front, left, back, and right spectra)
- Sources active for various durations throughout the averaging period, including completely inactive (added Time Active parameter for each equipment object and Analysis Period parameter for construction noise LA_{eq} computations)
- LA_{max} computations (for loudest elemental triangle across all equipment)
- Expanded spectral range of computations, including attenuation (equipment noise calculations from 12.5 Hz to 20,000 Hz)
- User-defined construction equipment with custom spectra, source height, directivity, and point or line source designation
- Equipment calculations for both all and active receivers
- Parallel barrier calculations for equipment, including error checking and user feedback
- Restored Projection Settings options from TNM 3.0 that were not included in TNM 3.1

FILE FORMAT, IMPORT AND EXPORT

- New XML tags in file format, pertaining to construction equipment inputs and results
  - See "**FILE FORMAT REFERENCE MANUAL - TNM 3.2**" for a complete overview
- Calculation results for both sources can be computed in a single application session and stored in a single project file using the same input objects
- Ability to export Barrier Analysis tables and calculation Results tabs to CSV
- Automatic export of spectral results to CSV for both noise sources (separate files for roadway and equipment noise calculations) including report metric and analysis period in filename
- New .pid file while project is open (prevents conflicting project file edits by disallowing the same project file open in multiple instances of TNM 3.2)

Fixed:

Existing features that did not work as intended and have been fixed

User Experience

- Fixed limit of 13 objects per selection/deletion
    - 'select all' and 'shift + click' now select entire object lists and correct number of objects is reported in modal window as such

Modeling

- Ensured that receiver results are always cleared after input changes that invalidate noise level results (e.g., changing object geometry or project ground type) and that "results still valid" modal window does not appear when recalculating results after noise level reset

File format, Import and Export

- Fixed numerous issues that would crash the application, including when importing TNM 2.5 projects containing tree zones

Error Log and Bug Fixes

- Fixed bug that would inappropriately reset results after some inconsequential commands in TNM (e.g., toggling labels)
- Corrected Barriers input report to properly reflect barrier type (i.e., wall or berm)
- Corrected Barrier Descriptions result report to properly determine Cost by not accruing lineal cost for barrier segments that are perturbed to zero height
- Corrected Barrier Descriptions result report to properly display minimum, maximum, and average Heights Along Barrier relative to the segment heights for each barrier design, rather than the input check heights
- Fixed bug in which phantom segment was showing up between start and end points of polyline objects
- Fixed bug in which receiver calculation would fail due to terrain interpolation issue
- Fixed bug in which the "Calculated With" field in the Reports header was displaying the current version of TNM regardless of which version the computations were conducted
- Fixed bug in which dimensionless value was being "converted to metric units"
- Ensured Legend Pane checkboxes toggle correct map element
- Ensured spectral CSV file reports data for user-selected report metric, not just LA_{eq}

Improved:

Existing features that have been improved

User Experience

- Maximum Plan Builder zoom is much higher resolution
- More robust input checking (See object intersection rules in Appendix H of TNM 3.2 Technical Manual) with more specific error messages to pinpoint non-permitted inputs
- Changed "# Receptors" to "Dwelling Units" for clarity and consistency with TNM 2.5
- Increased size of legend icons for improved visibility
- Updated TNM About window
- Relocated calculation progress bar to separate window
- Ensure all message boxes are modal, when necessary
- Changed directional arrow shape in Plan Builder icons for improved visibility when zoomed out
- Improved reliability of reloading of saved barrier designs
- Added summed Cost for each barrier design in Barrier Descriptions result report
- Removed total cost sum of all barrier designs from Barrier Descriptions result report
- Reformatted Delete Objects Warning modal window to better view all listed object names

Modeling

- Improved reliability of parallel processing results (still beta for projects with abatement barriers)
- Conversion of feet to meters made consistent throughout more of TNM code at 0.3048 (was previously 0.305 in certain cases)
- More accurate evaluation of input data coordinates when checking for invalid object intersections to catch nearly identical points in 2D and 3D space for all coordinate systems and projections

File format, Import and Export

- Reduced memory usage/output file size via additional compression

Error Log and Bug Fixes

- Reduced likelihood of application crashes, including when dividing object segments and after panning the map around the globe
- Reduced likelihood of existing results not appearing upon reload of project
- Reduced likelihood of existing barrier designs not being available upon reload of project

Other

- Updated third party libraries

Removed:

Features that are no longer part of the model

User Experience

- Deprecated redundant input check messages for non-permitted object intersections
- ESRI control of maps and data grids

Security:

- Updated digital signing certificate for authenticity verification of installer and executable.

Section II:

TNM 3.0 to TNM 3.1 Change Log

GENERAL INFORMATION

This second section focuses on the changes made to TNM from version 3.0 to version 3.1. TNM 3.1 was released in 2021.

TNM version **3.1.7970.37608** was finalized in October 2021.

The SHA256 MD5 Hash for the Installer (to verify if the download is the actual installer) is:

bae8bbf167385f8e2d895ef8ba43531d1a4012d8964a9c60c5d28c0ee8e53ee1

It can be verified locally by executing the following command in a command prompt:

certUtil -hashfile <filename> SHA256

in this case <filename> is "TNM Installer v3.1.7970.37608.msi"

Summary

TNM:

- Bug/Stability Fixes
- Barrier Analysis Improvements
- Added Unit Tests to Development Branch

TNM Batch Program:

- XML Support
- Support for Sequential calculations

ITEMIZED CHANGES

Added:

Newly added features

User Experience

- Added TNM Installer
  - TNM Installer is signed with a certificate
- Added a progress indicator when an input file is being loaded

- Added state plane adjustment feature to scale or offset map (not supported using ESRI Version)
- Added filters to the Barrier Analysis data grids
- Added ability to move complete TNM objects in the Free Version
- Added Scrollbar to Calculation Results pane

Modeling

- TNM can now run multiple instances at the same time
- TNM now resets calculated results when opening older TNM XML files
- Barrier Analysis data grids auto update when perturbations are adjusted
- Added interpolation of Z-value when subdividing segments

File format, Import and Export

- Added additional XML tags to file format, including which program calculated the results and when
    - See "**File Format Reference Manual - TNM 3.1**" for a complete overview
- Newly created studies are now saved by default with the extension ".txf" (TNM XML Format)
- Added capability to save and load calculated results to/from .txf file
    - Noise Abatement on Barrier Segment is now saved to XML
- TNM Application Title will also show TXF filename
- Added major improvements to loading in XML v2.5 files

Error Log and Bug Fixes

- Provide users with additional information to report issues back to TNM Technical Support (TNMHelp@dot.gov)

Other

- Added parallel processing of receivers (currently as a Beta version)
- Added consistent versioning of TNM related DLLs and executables

Fixed:

Existing features that did not work as intended and have been fixed

User Experience

- Added prompt to save file when closing
    - Previously, pressing close ("x") of the TNM window would immediately close the application without a prompt to save unsaved changes
- Fixed the Barrier Analysis to allow for perturbations after reloading study
- Toggle all object labels now works for all TNM objects

Modeling

- Addressed issue in saved Contours Zone file (.asc) where nodata_value of -1 would cause issues in certain cases
    - Saved Contours Zone file (.asc) now uses a nodata_value of -9999, instead of -1
- Geo spatial validation of TNM objects now matches original TNM 2.x validation
- Incorrect "Acoustic Invalid" error message with certain Ground Zones setups resolved
- Exit speed could not be determined for certain user-defined vehicles
- Fixed issue where motorcycle and user-defined vehicle would not be able to be saved in certain cases
- Fixed updating Building Row labelling for reporting Gap
    - Updated default value for Gap Percentage for Building Row to 80
- Fixed issue where TNM Batch "Active Receivers Only" would run all receivers
- Fixed various issues related to intersecting roadways, including barriers, roadways crossing over themselves, or two roadways intersecting

File Format, Import and Export

- Addressed several issues with loading partial XMLs into existing study
- Made PointNumber XML tags unique for roadways and barriers
- RunTitle XML Tag is now consistently updated
- Fixed OrderingNumber XML tag

Error Log and Bug Fixes

- Fixed numerous issues that would crash the application
- Addressed issue where webserver for 3D-view would not be able to initialize when port was already taken
- Fixed saving topology exceptions to a file without crashing the application
- Certain menu buttons where not activated when they should

Improved:

Existing features that have been improved

User Experience

- Made accessing settings more robust
- TNM Help is now a PDF
- TNM About window has been updated
- Improved progress reporting when running calculations
- Added dialog to inform users when calculated results have been saved after successful calculation
- Pressing escape will now stop "Object adding" function

- Barrier Analysis now prevents duplicate names for auto-save when a Barrier Analysis is added or removed
- Renamed certain Barrier Analysis controls
- TNM now clears the indicator when a list is empty in Barrier Analysis
- Improved highlighting of selected item between data grids and maps
- Improved Dock controller, adding more flexibility to handle the different panes
- Increased size of combo boxes as part of the data grid views so users can read full name

MODELING

- Improved model mapping (from XML file to View)
- Pane "Plan View" is now called "Plan Builder" to denote user interaction rather passive viewing
- ESRI basemaps now use SSL based basemaps
- Updated Map legend to map TNM objects color scheme, which matches original TNM 2.x colors
- Renamed "Blank" to "Basemap" in the map legend
- Improved consistency of labelling of TNM objects in data grids
- Adjusted precision in Section View to show only two decimal places
- Improved button labelling when opening and deleting contour zone grid files

FILE FORMAT, IMPORT AND EXPORT

- Improved handling of malformed XML files

ERROR LOG AND BUG FIXES

- Improved handling of application-critical exceptions and now provide users with additional information to report issues back to TNM Technical Support (TNMHelp@dot.gov)
- Improved logging, including logging of version number and 3rd party library version numbers in the log file
- The logfile is now called tnm.log, instead of CoreLogger.log. TNM Batch has a separate log as well, called tnm.batch.log
- Switched from nlog to log4net for logging

OTHER

- Upgraded to .NET Framework 4.8
- Upgraded 3rd party Telerik library
- Switched most data grids to 3rd party library Telerik control for improved functionality
- Updated ESRI Geocode endpoint to SSL

Removed:

Features that are no longer part of the model

User Experience

- TNM Help as .chm file has been removed
- The "Roadways (With Traffic)" data grid in Barrier Analysis is removed and replaced with "Barrier Design – Results per Barrier Segment" data grid

File format, Import and Export

- SQLite database for storing studies has been removed, only XML/TXF files can be used to save studies
- Serialization of results to project.bin file in temp folder has been removed

Security:

- No changes