



# Do you want our opinion on immission control?

**IMMI** – the software solution for noise







# Noise prediction and dispersion of air pollutants with IMMI

For more than 30 years, service providers, authorities and industrial companies have been relying on IMMI as one of the leading software tools in the field of immission control. IMMI is our software solution for the calculation of sound propagation outdoors, noise exposure in workrooms and propagation of air pollutants. An intuitive user interface controls the quality-assured calculation algorithms, which represent almost all common national and international regulations of immission control. Thanks to the modular software design, the configuration can be optimally adapted to the user's requirements. The basic concept: The program IMMI consists of the base module, the element libraries (guidelines) and additional features. Depending on the field of application, choose the corresponding base module and the required guidelines to put together your custom-made package. IMMI is available in four different base module versions – **Choose your individual equipment.**

## **All expansion versions provide the following performance features**

- Calculation of noise in workrooms
- Datainterface to ArcGIS
- ArcGIS-Export of noise maps into contour maps (closed polylines)
- Access to more than 30 providers of online map services (Bing, MapInfo, WMS-Server, OSM, ...)
- 3D Viewer
- Data import/export (ArcGIS, QSI, XML, CityGML, OSM)
- Macros (transformations, constructing noise-emitting buildings, designing openings)
- Calculation of  $L_{den}/L_{night}$  according to the Environmental Noise Directive 2002/49/EC
- Support of coordinate systems and coordinate transformation
- Optimization of noise barriers
- Sound transmission of noise barriers
- Noise allocation
- QSI data interface according to DIN 45687
- Calculation of multiple higher order reflection



### **IMMI Basic**

...is the cost-efficient solution for all those who require calculations with optimal accuracy and complete documentation of input and output data. Being limited to 200 obstacles, IMMI Basic can be used to calculate up to 100,000 diffracting edges in a single project.

### **IMMI Standard**

... is the convenient solution for starters in the forecast of reception points. IMMI Standard allows easy processing of a variety of projects at an extremely favourable cost-performance ratio. Being limited to 1000 obstacles, IMMI Standard can be used to calculate up to 500,000 diffracting edges in a single project. Productivity can be increased even further by adding other performance features.

### **IMMI Plus**

... is the universal program package which enables the user to calculate, evaluate and present almost all projects. To achieve this, IMMI Plus features a plurality of options which optimally support users in their work. The number of elements is only limited by the available main memory. With its up to 64 million grid points and up to 3000 obstacles, this version allows processing even large-size projects.

### **IMMI Premium**

... is the professional tool for creating large-scale noise maps with an excellent price-performance ratio. The scope of this version leaves nothing to be desired and is especially configured for the management of large data volumes. In this package, there is no limit to the number of elements or obstacles. In addition, it features options for distributed and segmented calculation in the network.





### **The following performance features can be added depending on the base modules**

- Calculation of multiple higher order reflections
- Databases (emission, attenuation, absorption)
- Expanded grid functions for linking and evaluating grid results
- Calculation of vertical grids
- Calculation of façade levels and exposure analysis according to Directive 2002/49/EC
- Hotspot analysis for action plans
- ACC (automatic cluster calculation) for calculation in the network
- ArcGIS data interface

A detailed description of individual performance features can be found in the data sheets.

### **Special configuration IMMI air pollution**

... is the cost-effective solution for all those who are engaged in calculating the dispersion of air pollutants according to TA Luft 2002 (AUSTAL2000). For more information, please refer to our data sheets.

### **Element libraries ... modular expandability**

The emission and noise impact calculations in IMMI are based on pertinent rules and standards. All rules, algorithms, tables and nomograms of a specific standard are comprised in an "element library". Along with the base module, one or more selected element libraries form the customized tool for calculating noise and the dispersion of air pollutants. All relevant calculation methods for national and international use have been implemented. Not forgetting the European Environmental Noise Directive 2002/49/EC and its implementation for application in the countries of the EU. We also implemented the current guideline (EU) 2015/996 for using CNOSSOS-EU.





## Road traffic noise

- CNOSSOS-EU – Road (EU)
- XP S 31-133 (NMPB) – Bruit des infrastructures de transportes terrestres – Calcul de l'atténuation du son lors de sa propagation en milieu extérieur, incluant les effets météorologiques (avec modèle d'émission du Guide du bruit 1980) (FR)
- NTF S 31-133 (NMPB 2008) – Noise of earthbound transport – Calculation of the attenuation of sound during propagation outdoors including meteorological effects (with French emission model Guide du Bruit 2008) (FR)
- CRTN – Calculation of Road Traffic Noise (UK)
- RMW – Reken- en Meetvoorschriften Wegverkeerslawaai (NL)
- RVS 04.02.11 – Calculation of road traffic noise (AT)
- StL 86 – Swiss standard for the calculation of road traffic noise (CH)
- SonRoad – Road traffic noise calculation model (BUWAL) (CH)
- RLS 90 – Richtlinie für den Lärmschutz an Straßen (DE)
- RLS 19 – Richtlinie für den Lärmschutz an Straßen (DE) coming soon
- PLS (Parkplatzlärmstudie) 07 – Examination of noise impact from parking places, rest stops and bus terminals as well as from indoor parking lots and underground car parks (conducted by the Bayerisches Landesamt für Umweltschutz (LfU, Administrative Office of Bavaria for Environmental Protection) (DE)

## Industrial noise

- DIN 18005 – Noise protection in city planning (DE)
  - Part 1 – Calculation methods
  - Part 2 – Noise maps; graphical representation of noise pollution
- VDI 2571 – Sound radiation from industrial buildings (DE)
- VDI 2714 – Sound propagation outdoors (DE)
- VDI 2720, Part 1 – Sound control by barriers outdoors (DE)
- ISO 9613 – Attenuation of sound during propagation outdoors (EU)
  - Part 1: Calculation of the absorption of sound by the atmosphere
  - Part 2: General method of calculation
- ÖAL Directive No. 28 – Sound radiation and sound propagation (AT)
- BS5228 – Part 1 – British Standard – Noise and vibration control on construction and open sites Part 1: Code of practice for basic information and procedures for noise and vibration control (UK)
- CNOSSOS-EU – Industry (EU)



## EU interim directives/2002/49/EC

Road traffic: XP S 31-133/NMPB + Guide du Bruit

Railway traffic: RMR-SRM II 1996

Industrial noise: ISO 9613-2

Airport traffic: ECAC.CEAC Doc. 29 2<sup>nd</sup> edition

COMMISSION DIRECTIVE (EU) 2015/996 of 19 May 2015 establishing common noise assessment methods according to Directive 2002/49/EC of the European Parliament and of the Council (CNOSSOS-EU)

## Railway noise

- Schall03 – Directive on the calculation of railway traffic noise (DE)
- Schall Transrapid – Magnetic levitation system decree (DE)
- RVE 04.02.11 (AT)
- ON Rule S 305011 – Calculation of sound immission caused by railway traffic (train traffic, shunting and cargo handling operations) (AT)
- Semibel – Swiss emission and noise impact model for the calculation of railway traffic noise (CH)
- CRN – Calculation of Railway Noise with supplement 1: Procedure for the Calculation of Noise from Eurostar Trains Class 373 (UK)
- CNOSSOS-EU – Railway (EU)

## Shipping noise

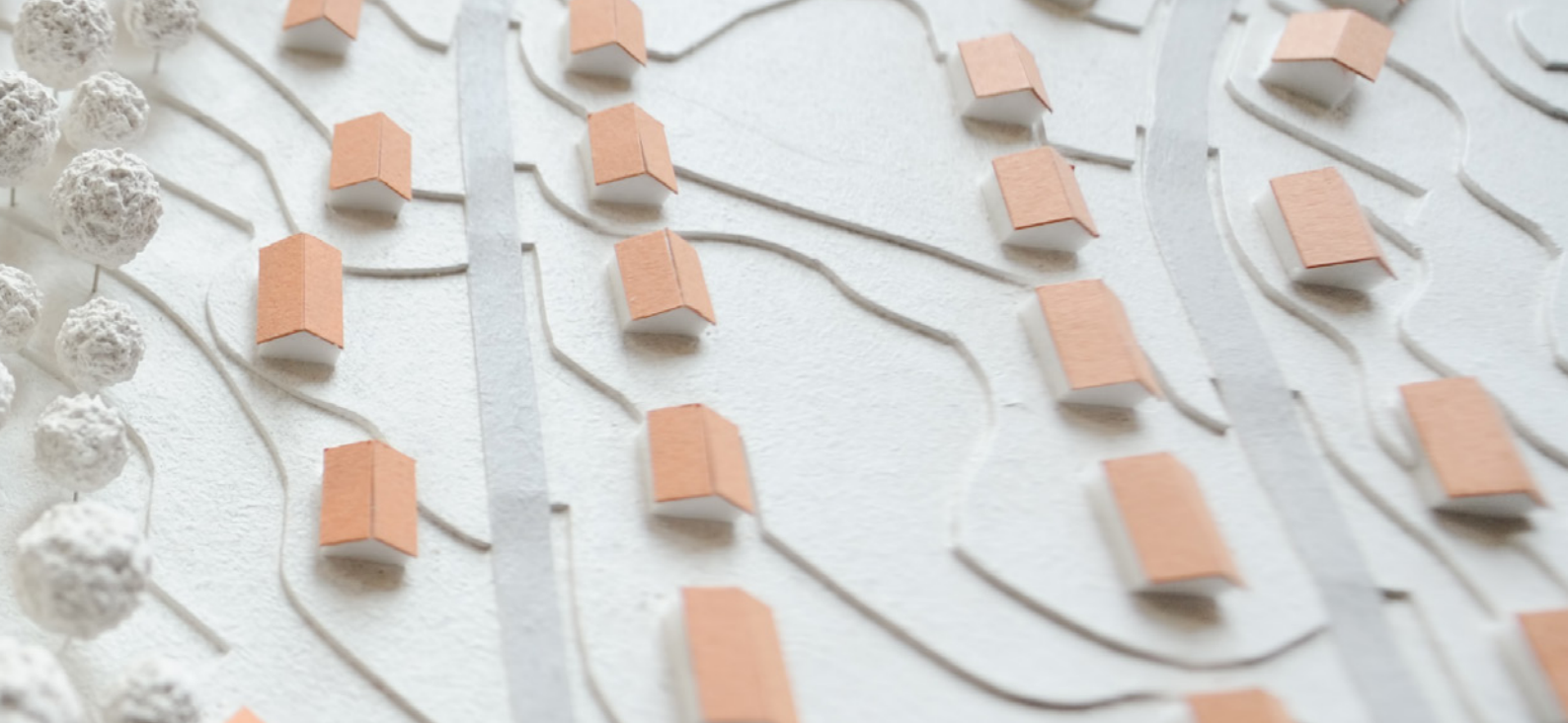
- ABSAW – Guideline for the calculation of propagation of airborne sound of the German Federal Waterways (BfG) (DE)

## Aircraft noise

- AzB 2008 – Guideline for the calculation of noise protection areas at civil and military airports according to the German act on aircraft noise („Gesetz zum Schutz gegen Fluglärm“), in combination with the data acquisition system
- DES („Datenerfassungssystem“) for the determination of noise protection areas at civil airports (DE)
- DIN 45684-1 – Acoustics – Determination of aircraft noise exposure at airfields (DE) Part 1: Calculation method
- ECAC.CEAC Doc. 29 2<sup>nd</sup> edition – Report on Standard Method of Computing Noise Contours around Civil Airports (EU)
- Directive (EU) 2015/996
- CNOSSOS-EU – Aircraft (EU)

Rating methods  
 $L_{den}$  (Italy) | LSV (from Switzerland)  
 $L_{den}$  (according CNOSSOS-EU) | recreational noise directives





## Noise at workplaces

- Rooms with individual ground plans
- Consideration of doors, windows, different absorption loss materials on walls, the roof and ground
- Database with absorption loss materials
- Verification of acoustic conditions according DIN 18041
- Standard speaker as sound source
- Calculation of reverberation time, STI and Clarity
- Calculation of noise maps or at several receiver points

## Air pollutants

- ÖNORM M 9440 (Gaussian plume model) (AT)  
VDI 3945 Part 3 (TA Luft 2002 – AUSTAL2000  
Particle model) (DE)

## Project work and data management Data input

- Import of geometry and technical data through different data interface formats: DXF, ASCII, TXT, ArcGIS (shape), QSI, OSM, CityGML, WMS, XML ...
- Input of geometry data through keyboard and mouse or on the screen using (georeferenced) background bit maps (more than 30 different graphic formats incl. PDF)
- Connection to Open Street Map and many more map browsers

- Support of all European coordinate systems (UTM, Gauss-Krüger, etc.) for georeferencing and coordinate transformation project-based work on a graphical user interface with GIS functionality
- User-friendly management of project data, results and grids
- Standard elements: buildings, walls, reflecting elements, land use zones, ground effects, attenuation by vegetation and housing, traffic lights, receiver points, compass, bridges, cantilevered barriers
- Emission sources subdivided into point, line and area sound sources, as well as traffic routes (roads, railways, air, and water), tunnels and parking lots
- Measurement of distances and angles
- Auxiliary functions for geometry editing, such as copying, moving, parallel curves, adjustment to terrain profile
- Cartographic elements (scale, legend, text boxes)
- Determination of the terrain with triangular decomposition based on altitude and/or altitude lines, or digital terrain model based on grid data
- Support of operating with multiple monitors

## Variants

- Definition of variants for calculating case studies, scenarios, planning versions



## Editing and visualizing objects

- Element database with display of technical data: tabular output, sorting by input data (e.g. number of inhabitants or vehicles), block functions for editing multiple elements at the same time
- Edit, delete, change, copy, join, split and move single or multiple elements using the mouse
- Adjust elements to the terrain and vice versa, with display of the terrain level profile
- Control the visibility of elements in the map
- Design tools and macros: build dams or cuts, generate reception points automatically, transform elements, draw free body diagrams of altitude lines, count kilometers, generate circular buildings and parallel elements, construction of vertical surfaces
- Insert nodes into polygons, delete nodes from polygons, attach nodes to polygons, check nodes, generate equidistant sections
- Constant or linear z-values in ascending or descending order, relative or absolute height
- Differentiate inhabitants in buildings from land use zones
- Thematic maps for graphical representation and monitoring of input data, e.g. display of building heights, inhabitants per building, display of the terrain model, rating of the land use zones, etc.
- Many toolboxes for quick processing
- Horizontal aligning of buildings in terrain

## Special functions for industrial noise

- Databases for sound emission values, transmission and absorption losses, meteorological annual statistics and time series, tabular output
- Macro for generating 3D structures, e.g. buildings with noise-emitting walls for calculating industrial noise
- Multiple reflections up to the 50th order
- Sound transmission of walls
- Input and calculation of linear or A-weighted cumulative, octave band and third octave band levels
- Room conditions according to EN 12354-4
- Display of noise producers
- Evaluation according to TA Lärm or individual methods
- Import of spectra from the clipboard
- Calculation of indoor levels using DIN 18041
- Calculation of RW acc. to DIN EN ISO 717-1
- Calculation of WEA acc. to LAI
- Calculation acc. to ISO
- Diurnal variation





## Special noise mapping functions

- Support of large-size terrain models and simplification functions (VIP)
- Input of the building use (resid. building, school, kindergarten, hospital, uninhabited), number of storeys, dwellings, inhabitants
- Calculation of noise maps and façade levels according to EU Directive 2002/49/EC and Directive (EU) 2015/996 (CNOSSOS-EU)
- Pre-defined rating method  $L_{den}$
- Fast automatic calculation for segmented and distributed calculation in networks
- Hotspot analysis at traffic routes
- Noise map for buildings

Calibration of sound sources or determination of the sound power level from sound pressure levels using element measurement point

## Checking and testing functions

Plausibility and geometry checks, clearly arranged lists of the data entered and graphical functions are available for checking the input data.

- Check and edit geometrical conflicts; intersection of altitude lines, intersection of buildings and roads, self-intersection of elements
- Find identical and similar elements
- Detect reception points inside buildings
- Adjust sound sources on bridges
- Calculate the terrain model (triangulation)
- Conformity with DIN 45687 – fulfilling test tasks
- Estimate the inaccuracy of results in case of optimized calculation models
- Check test tasks using the QS-Manager
- Display sound beams and reflections



## Calculation

Single points, reception grids and façade levels can be easily calculated, while sophisticated algorithms provide for short calculating times.

- Calculation according to reference (strictly as per directive) and optimized calculation model
- Automatic segmentation of line and area sound sources
- Compliance with standard-specific distance criteria
- Projection techniques help prevent discontinuities caused by obstacles and reflecting surfaces
- Multiple reflections up to the 50th order
- Free field in front of reflecting surfaces

## Calculation Control Center (CCC) for performing the calculation

- Central management of all calculations at single points, in the grid or at façade points
- Automatic calculation by means of batch job control; calculation of single points, grid and façade levels as well as of all project variants in one go
- Integrated management and registration of the results calculated
- Powerful variant management to allow studying planning scenarios
- Results lists with extended functionality
- Calculation of horizontal and vertical grids in sections of the map or in user-definable land use zones
- Color scale according to DIN 18005, ISO 1996-2, ÖAL 36, and many more
- Support of multicore computers
- Segmented and distributed calculation in the network – automated
- Linking of results
- Estimation of calculating times
- Linking and editing of calculation results with numerous mathematical functions





## Multi-Core – ACR – Segmented Calculation

These three functions considerably reduce calculating times

- Use of calculators to reduce the computation time

## Single point calculation

Results are saved in lists with varying degrees of itemization. User-definable layouts are used for representation.

- Short lists: Overview of reception points and/or rating levels for all rating periods. Comparison of results with guidance values.
- Mid-size lists: Contribution of each single sound source to the total noise impact level, identification of main sound sources and frequency contents.
- Long lists: Detailed and testable summary of all influencing variables, intermediate and final results
- Display of sound beams and reflections
- Comparison of the calculation results of variants

IMMI helps you view the lists on the screen, print complete or selected areas, copy and paste such areas to MS WORD or MS EXCEL or to TXT, RTF and HTML format via the clipboard. Additional functions facilitate comparing different variants.

## Grid calculation

The PREMIUM version features functions enabling the calculation of more than a billion points in a reception point grid and their output in many forms. Powerful functions for post-editing, combining and evaluating reception point grids facilitate working with the project.

- Simultaneously calculate all rating periods (day, evening, night, resting, etc.)
- Display defined color scales according to DIN18005, ISO 1996-2
- Display isolines
- Use mathematical operations
- Link grid results
- Join partial grids
- Generate differential grids (logarithmic and energetic)
- Create conflict maps and population equivalent values
- Export noise maps as contour areas to ArcGIS, ASCII or binary ArcGIS files, DXF

## Façade calculation/exposure analysis

Test points along façades are calculated at a defined height and at a defined distance from the wall.

- Exposure analysis according to Directive 2002/49/EC and CNOSSOS-EU: Statistical evaluation of all inhabitants or proportionate evaluation, output of the apartments, schools, kindergartens and hospitals affected
- Evaluation of the area examined, either as a whole or in parts as well as element by element
- Allocation to noise bands ( $L_{den}$  and  $L_{night}$ )
- Import and export of the results via ArcGIS data interface
- Additional statistical evaluations: min. and max. levels on buildings, all levels on buildings

## Documentation and presentation

### Lists of input data and results

- Input data, intermediate results and final results are documented in the form of clearly arranged tables which can be printed and applied to MS WORD, MS EXCEL, RTF, TXT, HTML.

## Report manager

The report manager function provides a powerful tool enabling users to design printouts and reports according to their individual needs and in many versatile forms.

- Redefined paper formats and page layouts from size A4 to size A0 in portrait and landscape formats
- Various layout components for structuring the printout as desired: plan/grid, text, graphic, color legend, element legend, header and footer
- Use of text boxes and plan clippings that can be designed as desired, support of a whole variety of fonts allowing different font colors, font sizes and font presentations
- Numerous options of labeling the axes and contour lines and displaying the scale
- Parallel output of all point, façade and grid results
- Output of layouts and thematic maps
- Printout of graphic files in more than 30 image formats, e.g. BMP, JPG

The complete testable documentation and the impressive presentation of the calculation results rank among the strong points of the IMMI programming system.





### **3D Viewer**

The powerful 3D Viewer allows moving through the 3D model in three different settings.

- Profile sections, screenshots and video recordings
- Automatic flight along line elements
- Graphic symbols for roads, vegetation, traffic light, vehicles
- Mark and modify elements
- Transparency of elements
- Display of noise grids (horizontal and vertical) on calculation height
- Profile

### **Current applications**

#### **Air pollutants**

The pollutants module in IMMI features the calculation of the dispersion of gas, dust and odor both according to the particle model (TA Luft 2002/ AUSTAL2000) and to the Gaussian model (TA Luft 1986). For this purpose, IMMI has been provided with a convenient user interface. It is similarly easy to combine the calculation of air pollutants with the forecast of noise, two environmental impacts which often originate from the same producers.

### **Noise impact of wind turbines**

IMMI can also be used for calculating the noise impact of wind turbines. The program is subject to quality assurance and performs calculations based on the following standards:

- Calculation of sound propagation according to ISO 9613 (taking into account the LAI-procedure)
- Evaluation according to TA Lärm
- Quality-assured software according to DIN 45687

Calculation of live performances at OpenAir events using optimized loudspeaker modeling (with database for loudspeaker types, 3D visualization of the directivity, connection to simulation software EASE)



### **Technical data/Hardware requirements**

- Operating system: Windows 98, 2000, XP, VISTA, Windows 7, Windows 8, Windows 10
- 32-bit processor – calculation accelerated by multiprocessor systems (at least 2 GB RAM)
- 64-bit processor – calculation accelerated by multiprocessor systems (at least 2 GB RAM per core)
- 400 MB unassigned hard disk storage capacity for program installation
- Monitor resolution: 1042 x 768
- Graphics card with 3D acceleration and MS DirectX
- Mouse and keyboard

IMMI can be run on tabletop computers and notebooks and in networks.

- Network key: Use of VPN

### **Support/Documentation**

- Detailed online help for each function, accompanied by pictures and explanatory texts
- Examples and tutorials for getting started in IMMI easily and quickly
- Web tutorials and videos for using IMMI

### **Technical support/maintenance contract**

- Technical support by phone and e-mail to answer your questions about handling the software through our hotline
- Automatic acquisition of all software updates
- Program configuration supplemented at lower prices
- Special conditions for participating in our comprehensive range of workshops and seminars
- 12-month maintenance included in the initial purchase; thereafter, a software maintenance contract must be concluded

### **Support pages on our website/ customer log-in**

As a customer, you have access to the internal pages of our website where you can find out about novelties, download updates and obtain exclusive product information.

- News on IMMI
- Download of updates, manuals, documentation and tutorials
- News ticker about workarounds, suggestions and tips
- Offers on the program
- E-mail function directly from the program
- IMMI user group on LinkedIn





### **Performance scope**

- Access to the customer area of our website
- Hardkey (USB) for program backup as single user or network license
- 12-month warranty, incl. update and hotline service

### **Summary/Training courses and seminars**

Our range of training courses and seminars always is as up-to-date as our software and measurement systems. For us, optimal service means the following: whether beginners or advanced users, we offer the training you need in our modern training classrooms at Höchberg.

- Training courses
- Workshops/special seminars/webinars
- Company seminars
- Webinars

Our website keeps you informed about current events and dates: [www.immi.eu/en/training-and-events](http://www.immi.eu/en/training-and-events)

### **Fields of application and target groups**

IMMI is a tool for calculating noise and air pollutants and is suitable for all those who

- are in charge of issues concerning immission control and air pollution prevention at authorities
- prepare expert opinions for engineering consultants
- perform noise calculations for approval procedures in the industry
- wish to efficiently forecast noise and air pollutants using one tool
- are employed in the following fields of application: EIA, approval procedures, immission control, air pollution prevention
- make use of environmental simulations for research purposes and teaching



# What moves Wölfel?

Vibrations, structural mechanics and acoustics – this is the Wölfel world. Here we are experts, this world is our home. More than 120 employees daily do their best for complete satisfaction of our customers. For more than four decades we support our customers with engineering services and products for the analysis, prognosis and solution of tasks in the fields of vibrations and noise.

Are vibrations really everywhere? Yes! That's why we need a wide variety of solutions! Whether it is engineering services, products or software – there is a specific Wölfel solution to every vibration or noise problem, for example

- simulation-based seismic design of plants and power stations
- measurement of acoustic emissions of wind turbines
- universal measuring systems for sound and vibrations
- expert reports on noise immission control and air pollution forecasts
- dynamic occupant simulations for the automotive and aviation industry
- and many other industry-specific Wölfel solutions ...



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