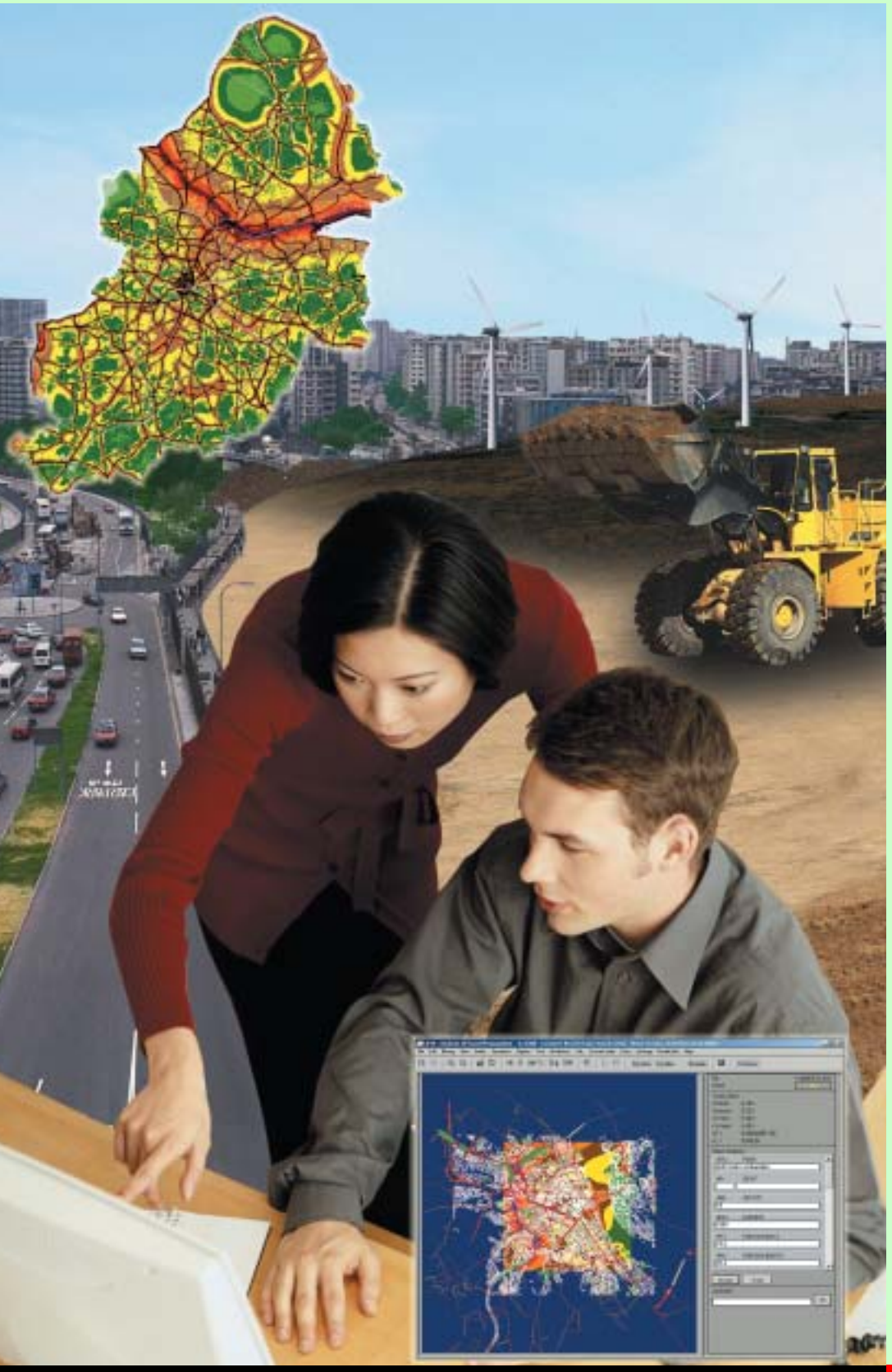
PRODUCT DATA

Lima™ Environmental Noise Calculation and Mapping Software
Version 4.0 — Types 7812 A/B/C



The first software package especially designed for large-scale noise mapping and widely used by leading noise mapping authorities, Lima™ offers a range of powerful data handling and analysis tools that makes it ideal for large scale noise mapping with fine resolution for a range of source types according to a wide range of national and international standards. Versions for smaller-scale calculations are also available.

7812

Brüel & Kjær

USES

- ❍ Environmental noise mapping
- ❍ Environmental noise management
- ❍ Environmental noise-impact assessment
- ❍ Fulfilment of European Commission directives such as Environmental Noise Directive (COM(2000) 468 final 2000/0194) and IPPC Directive (96/61/EEC)
- ❍ Integration in environmental management, traffic management and Geographical Information Systems (GIS) as noise-calculation core

FEATURES

- ❍ A range of software options from small-scale impact assessments to mapping of agglomerations
- ❍ Calculation of environmental noise in accordance with a wide range of leading national and international standards and methods (e.g., ISO 9613-2, NMPB, RLM2 as recommended by the European Commission)
- ❍ Data import in many formats, e.g., GIS (Shape), AutoCAD® (DXF), and traffic-flow data (e.g., Access)
- ❍ Several tools for advanced combination and optimisation of data from several sources to create 3-dimensional topographical models, e.g., closing and smoothing of polygons for accurate and optimal modelling of buildings and topography
- ❍ A range of modelling tools to accurately and efficiently deal with complex acoustic problems such as cantilever bridges, screens on bridges, and roads over undulating terrain
- ❍ Pre- and user-defined macros for automation of modelling tasks
- ❍ State-of-the-art calculation speeds through efficient implementation of algorithms, advanced source-selection and optimisation of calculation tolerances
- ❍ Multi-million point calculation grids
- ❍ Vertical and horizontal contours including noise levels across a facade
- ❍ Built-in annoyance-analysis tools
- ❍ A range of graphical outputs and reports in formats including OpenGL®, HPGL and Adobe® Postscript®

The Lima Concept

Since 1990, Lima has been used to evaluate the noise distribution in large areas such as entire towns, thus offering a helpful instrument to environmental planning including the preservation of silent areas and objective decision-making on prioritising noise-reduction measures. The main aim of Lima is to solve large-scale, 3-dimensional problems in the optimal calculation time without sacrificing accuracy, thereby enabling the user to produce noise-exposure maps for urban centres with a high degree of precision.

The Lima server concept enables it to support multiple-processor systems and networks, allowing it to maximise its computational capacity. Several workstations in a network environment can be set up with different functionalities, thus providing a powerful, cost-effective solution (see Fig. 1). Thus, for example, a remote server can be dedicated to the time-consuming task of calculating results, several workstations can model entry and data analysis, while a PC is dedicated to preparing reports. Additionally, several servers could simultaneously work in the background to sequentially queue and perform tasks whenever there is free capacity available on the network. The user would then be informed when a task was complete. This server concept eases the integration of third-party software modules into a UNIX environment.

With Lima, a 3-dimensional model can be built up from a range of data sources, thus greatly speeding up modelling time. Lima offers a number of import and export facilities including the import and optimisation of geometrical data. This import of geometry and data offers the advantage of reusing existing data and ensuring a standardised quality of input data for intermodal studies (e.g., for evaluating different pollutants and socio-demographic factors). However, most geometrical data has not been created with acoustic modelling in mind. Lima combats this and ensures quality data via a number of powerful techniques including:

- Closing polygons to ensure correct modelling of, in particular, buildings
- Recognising and preventing multiple existence of objects
- Linking objects to prevent gaps in the model
- Smoothing polygons to reduce the number of vectors and speed up calculations.

Conversion routines are available for a wide range of formats such as from GIS and AutoCAD®.

Complex acoustic problems, such as fly-over intersections, are dealt with accurately and efficiently through the advanced modelling tools Lima possesses. Once a model is built, its market-leading calculation speed is augmented by optimal accuracy through automatically neglecting irrelevant sources that contribute insignificantly to noise levels at a particular position.

The unique Lima command line, macro and configuration features, combined with the familiar menu user-interface, make it one of the most powerful calculation software packages on the market.

Modelling

Using Lima

Lima can be operated through its comprehensive menus or by powerful command lines (see Fig. 1). These command lines give access to more than 100 dedicated and time-saving commands for coping with the majority of tasks involved in noise calculation and mapping. In addition, the toolbar is user-definable for including the tasks most frequently used by/or most useful to the user. All input is supported by on-line Help while input dialog used to set up job files for a particular task (e.g., plot layout and format) is recorded for reuse.

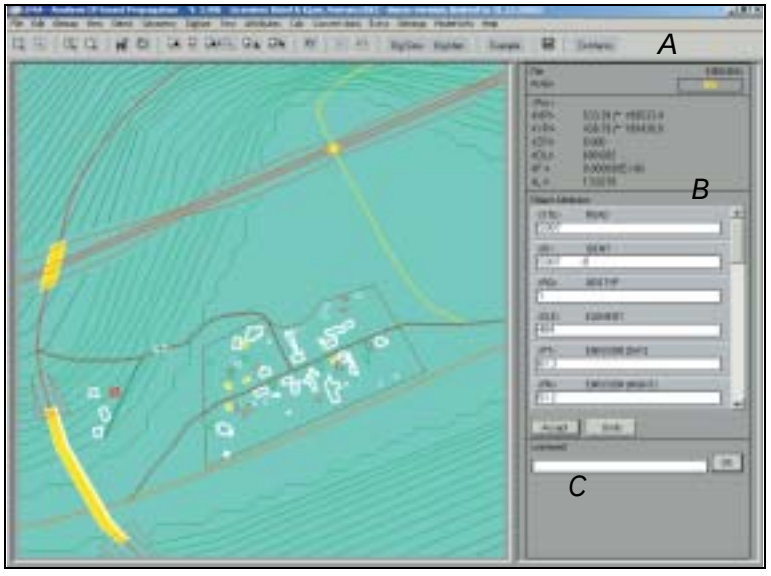


Fig. 1
A typical Lima screen showing the menu and toolbar (A), status and attributes fields (B) and command line interface (C). Here, a road is selected and some of its attributes shown

Most functions can be summoned via a dialog box. However, the command line offers access to these functions, allows the use of variables and can also be organised into macros. Model-handling speed can be greatly improved by nesting search loops. Powerful search commands that combine attribute and geometry relations are also available.

Lima is multi-lingual and comes in English and German-language versions. The on-line Help for object attributes can be translated.

Lima provides a wide range of geometry handling from simple functions such as moving, copying and rotating objects to more advanced functions such as editing, selecting or clipping objects within a defined polygonal area, and creating parallel objects. Lima performs automatic geometry checks including the indication or correction of corrupt objects or multiple identical objects at the same position – something that can occur during geometry import.

Information can be displayed on the model as user-defined symbols and text. This enables, for example, buildings to be colour-coded according to height or facade noise level, and noise sources to be indicated by ID or noise-emission level. Each object type can be described by up to 200 attributes allowing, for example, 24-hourly traffic descriptors. Attributes can be automatically changed according to a user-defined filter or rule.

In addition, the **Lima Plus** and **Lima Advanced** packages (see page 5) offer 3D views either as hidden-line vectors or in OpenGL® (see Fig. 2).

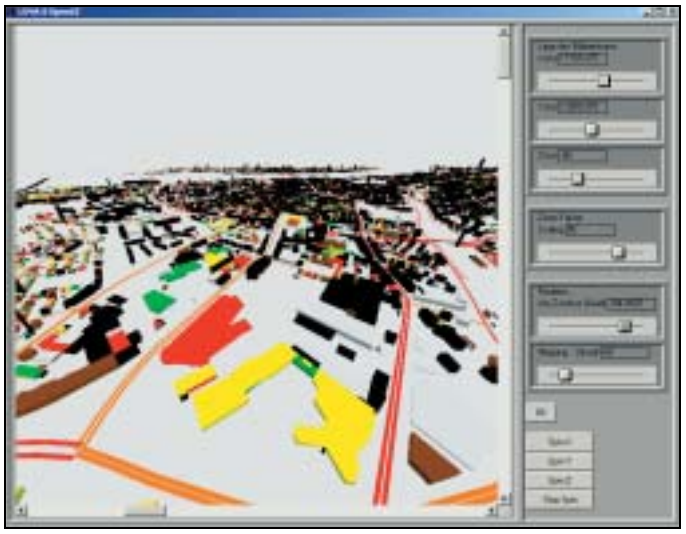


Fig. 2
Open GL® views are available in Lima Plus Type 7812 B and Lima Advanced Type 7812 C

Building a Model

Models in Lima are built up from different elements. Sources can be defined as roads and railways, industry, aircraft, leisure and sports in accordance with several calculation methods. They can be point, line, area or vertical-area (facade) sources. Each source's emission can be time-variant with up to 24 periods defined per calculation run, and include impulse and tone corrections for estimation of rating-level parameters at receiver points. Several studies that estimate source sound-power levels for various activities such as sports, car parks and lorry loading are included. Photographs of objects, e.g., sources, in bitmap files can be linked to them for easier recognition and better documentation.

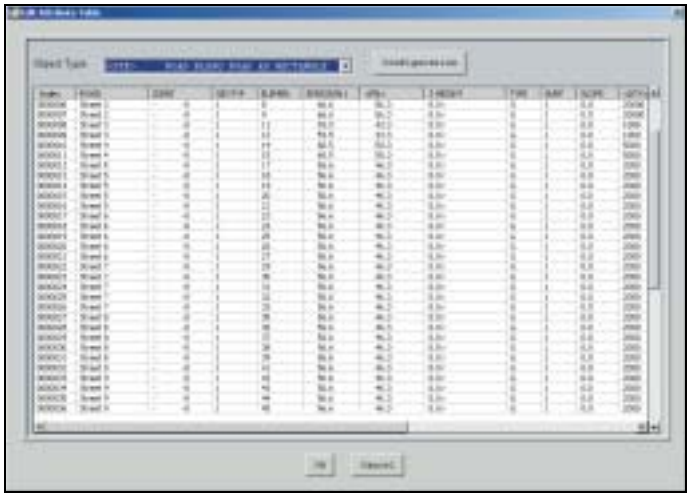


Fig. 3
Example of object attributes

The model can consist of screens, buildings, embankments (with or without screens), bridges, cantilever roofs and areas with user-defined attenuation. These obstacles can be given different reflection factors on each side as, e.g., the underside of a roof can also be reflective, thus allowing more accurate modelling of, e.g., bridges and petrol stations (see Fig. 4).

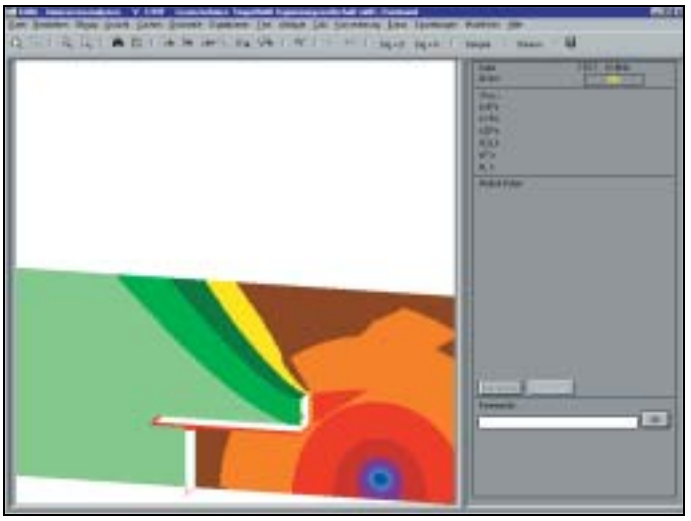


Fig. 4
Cross-sectional contour showing reflections from the underside of a bridge

The user can define new object types and edit attribute types, on-line Help and input value pick-lists for existing objects. This allows extremely flexible modelling and customisation.

A digital-terrain model represents the ground and is built up from single-point information, contour lines, ridges and cliffs. Contour lines can be generated from point and ridge information and are treated as barriers to sound propagation.

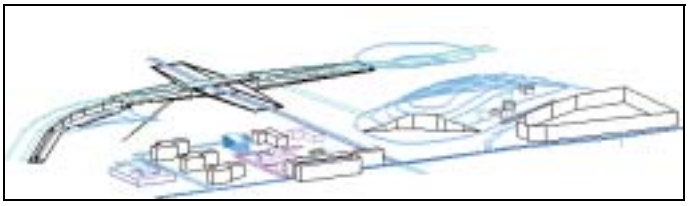


Fig. 5
Complex geometry showing an embankment on uneven terrain with a screen on top, a barrier on a bridge, a quarry face and polygon buildings

Embankments with screens on top can be generated automatically from one base line onto uneven terrain (see Fig. 5), thus speeding up and improving the result of the modelling process. The heights of objects can be absolute or relative to this digital-terrain model or to buildings in it.

Intelligent Interfaces with Other Software Ease Modelling

Data is input into the model via a digitiser, a mouse and keyboard, or by importing it from several sources (see below). One or more bitmaps can be imported, scaled and correctly orientated as a background for building models. Alternatively, models can be built up from AutoCAD® files through the DXF interface that also allows export of models back to AutoCAD® or into GIS.

Objects can be linked to tabular data and to various types of databases such as DBF and Access to enable automatic creation of models, for example, the assignment of traffic-flow parameters to roads to determine their emissions. Databases of octave band data, reflection properties and directivity can be built up and interfaced to the model. Lima can import from a wide range of GIS and traffic packages such as ArcView®, Atlas GIS™, GeoMedia, MOSS, SICAD® and SICAD® SQD. A module for importing SoundPLAN data is also available. The Lima Plus package includes one user-selected import module while the Lima Advanced package includes all available interface modules. A separate Lima Data Exchange Module including data interface in all available interface formats is also available.

Most geometrical data does not usually consider any acoustic aspects and the standard of imported geometry can accordingly be of a widely varying quality, thus necessitating

pre-processing. Lima offers a number of powerful pre-processing tools that greatly reduce pre-processing time and effort:

- All Lima packages include an automatic concatenation function that converts single-line segments to closed polygon objects. This is a very useful feature in urban noise mapping where AutoCAD® files of buildings and roads are available but are often built up in a way that is optimised for drawing and bears little or no resemblance to the physical objects represented
- There are several methods of assigning heights to objects and the automatic fitting of line and area objects to the ground surface, reducing modelling time for roads in undulating terrain.
- A routine to simplify polygonal objects with regard to their neighbourhood is particularly useful for smoothing height contours to a suitable resolution for noise calculations
- The Model Checking function is also useful for automatically checking and correcting area polygons and closing gaps in polylines.

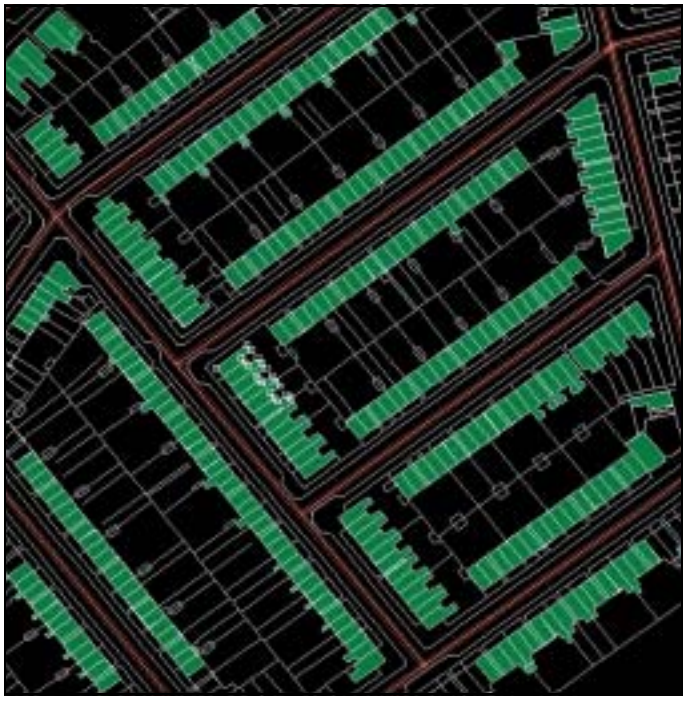


Fig. 6
An example showing the Lima concatenation function. The original AutoCAD® building information shown by white squares represents the back walls of the real buildings. Similar lines represent the front walls and the building separators. Lima converts them to separate buildings (coloured polygons with white border)

Calculation

All Lima packages calculate in accordance with a wide range of international and national standards and regulations including the European Commission's de-facto methods for mapping road (the French NMPB), railway (the Dutch RLM2) and industrial noise (ISO 9613). A Lima Aircraft Module is also available for calculating in accordance with the German AzB method and for the simulation of a moving point source.

The determination of the sound-propagation path is based on the demands of the applied method and on rigorous analysis to ensure good and proper results. Line segmentation is performed by the 'projection method' (see Fig. 7) while analysis of path deviation for screening due to obstacles uses 'rubber-band logic'. Side deviation is determined by a worst-case analysis based on rotating the plane of propagation. Calculation of reflection is based on virtual sources and barriers and reflectors can be positioned behind other barriers or reflectors. Results can be calculated for several periods, for example, a week, a weekend, the daytime, or a specific hour of the night.

Compound parameters such as L_{DEN} can also be calculated. Results are available as overall levels or, where the method requires, in octave bands.

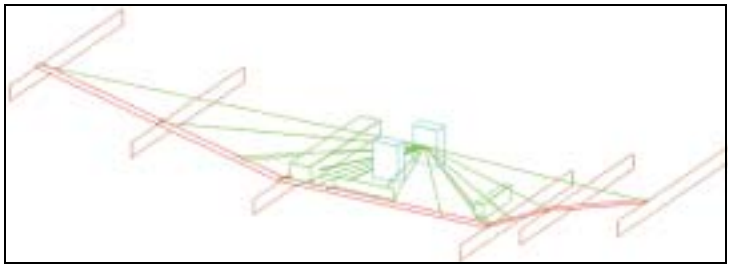


Fig. 7
Line segmentation using the projection method optimises calculation accuracy

Indoor sources can also affect outdoor noise levels. Lima handles them as facade sources whose emission is determined by source attributes and building-wall attenuation.

For each calculation, sources can be assigned one or more relevant calculation models. In addition, sources can be grouped to provide information on group contributions at receiver points as an aid to noise reduction and management.

Accuracy and calculation speed are inversely linked, that is, the higher the accuracy required, the longer the calculation will take for a given number of receiver points. However, Lima offers the user options for optimising calculation speed and accuracy as he/she sees fit. A fetching radius can be separately defined for both sources and reflectors to avoid calculating the contributions from these objects at distances further away. Careful selection of fetching radii has little effect on result accuracy. This has the added advantage of reducing the amount of result data enabling speedier analysis. In addition, a user-defined maximum tolerance in results enables Lima to neglect insignificant sources. Lima can also simplify terrain models and buildings to speed up calculation times. In addition, the achieved result quality can be statistically analysed by comparing results with a few, high-quality recalculations at random grid positions.

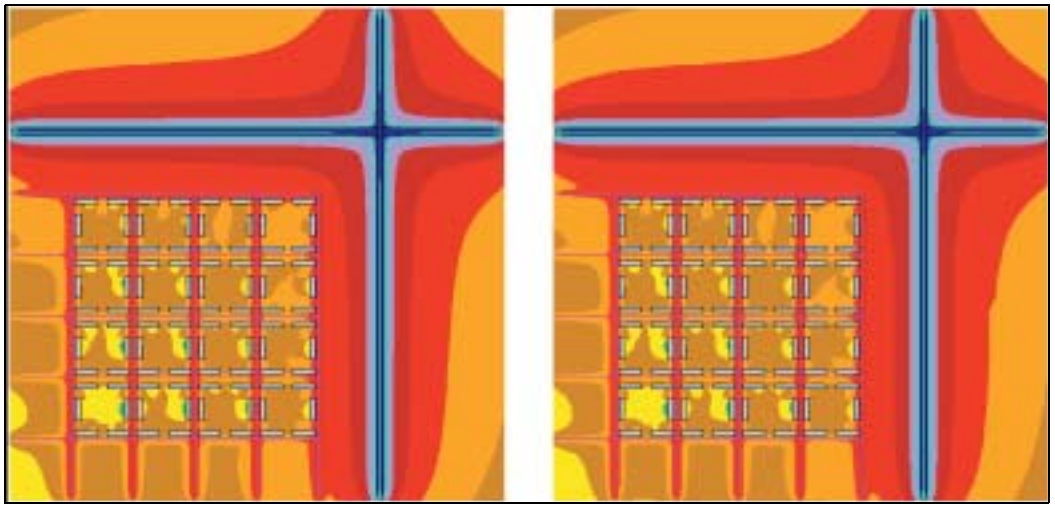


Fig. 8
Calculation speed can be greatly optimised with negligible loss of accuracy. The calculation on the left was set to a deviation of 0 dB and took 609 seconds for a 40 000-point grid. The calculation on the right on the same grid was set to a deviation of 1 dB and took 110 seconds. Times are given for a 400 MHz PC

Results are available at single receiver points or over grids. Receiver points can be at several heights in one position, and at fixed distances and in parallel to facades or roads. Results are available in various degrees of detail including descriptions of the propagation path for each reflection. The grid result files in ASCII format allow verification. Horizontal grids can have a constant height, either absolute or relative to the ground. Vertical grids can be in any plane or on a facade.

Fig. 9 *Vertical noise contour showing facade levels. A: screened by barrier on near side of road. B: reflection from screen on embankment is screened by other barrier C: increase due to reflection from screen on embankment. D: no reflection from screen on embankment. E: No screening or reflection effects*

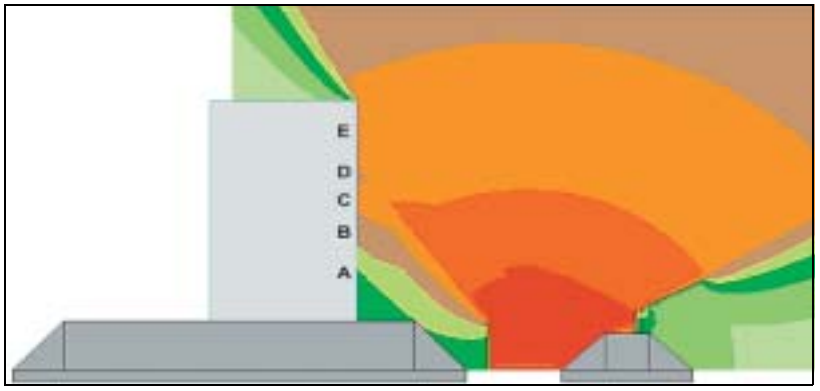


Fig. 10
Various result presentation formats for facade levels

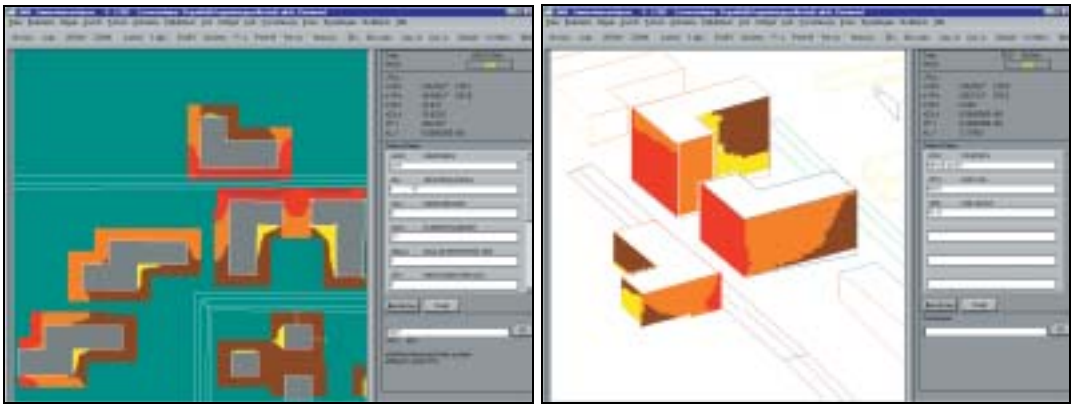


Fig. 11
Tiling allows automatic and improved calculations of large areas

A single calculation (tile) can contain several hundred thousand objects (digital terrain model, buildings and emitters) and up to almost 1 billion grid points, depending on the Lima package. For these and even larger models, the limitation becomes the size and power of the computer or server used. This means that large areas must be tiled into smaller areas. However, sources outside this area must be included to prevent inaccurate results at the edges of the tiles. In order to cope with this problem, Lima automatically and correctly tiles large models, thus reducing the risk of user error and ensuring the quality of results throughout the area.

Analysis

Several post-processing features are available in Lima:

- The Estimate Emission function uses measurement results at various positions to estimate the emission of several unknown sources. To further ease this task, Lima can import data from the 2260 Investigator™ sound level meter
- The Noise Abatement function provides a prioritised list of sources that contribute to the level at a particular receiver position. Maps showing the influence of line sources at receiver points at fixed distances to the source can also be produced

The **Lima Plus** package includes several extra analysis modules:

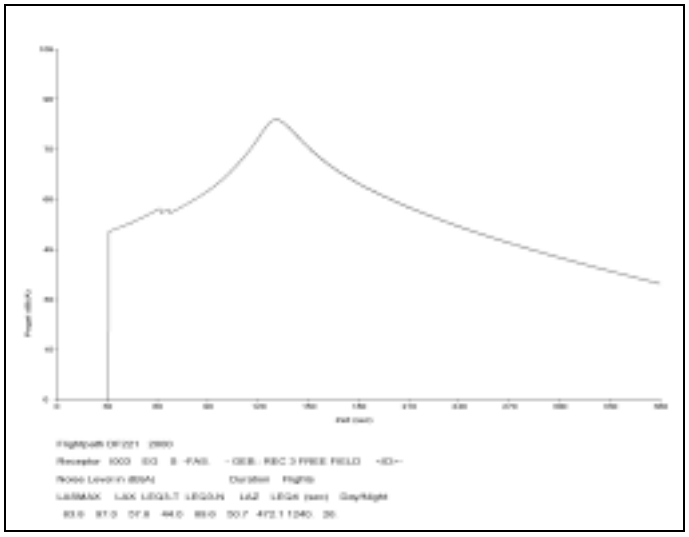
- Superposition can import several grid results into larger grid-result files and generate the best- and worst-case grid. Result files and constants can be added and subtracted arithmetically or logarithmically. This enables, e.g., combined noise maps of adjusted L_{DEN} (where aircraft noise is penalised and railway noise is given a railway bonus) that can be used to represent overall community reaction to the ambient noise. Additionally, existing grid data can be used to generate new grids by interpolation and transformation
- Statistics enables an analysis of the average and standard deviation of results or of the differences between results. This helps in assessing the quality of the model.
- Conflict maps can be produced to show areas where acceptable noise levels are exceeded. This is useful for assessing different planning zones, each with their own limits
- The Optimising Barriers function optimises the heights of barriers to achieve noise limits at defined receiver points by minimising the total screen area. Barriers are categorised into groups with limitations on the permissible changes in height
- New functionality is also added to the Noise Abatement module so that Lima can do best-/worst-case analyses for sources at varying positions on a given line. This can be used to help determine where to position noise barriers

The **Lima Advanced** package includes all the above analysis modules and the following additional functions:

- The Exposure Map function relates the number of inhabitants to calculated noise levels at one or more heights on facades. Several algorithms can be supported
- The Fixing Quotas function optimises the noise emissions of groups of sources so that limits at defined receiver points are not exceeded and the total emission is maximised within user-defined limits for particular areas of sources. This helps in planning the use of new industrial sites close to noise-sensitive locations
- More functionality is added to the Noise Abatement module so that a moving point source can be simulated. This produces a graph of the noise level at a receiver over time as well as determining the L_{Max}, SEL, etc. of the pass-by event

Furthermore, as model and result data are organised in configurable tables, these can be exported to other software such as Microsoft® Excel or GIS software for additional analysis.

Fig. 12
Analysis of the noise from a moving point source at a receiver point in the Lima Advanced package



Reporting

For all Lima packages, powerful graphical output and reports can be produced in HPGL or Adobe® Postscript®. There are user-defined layouts and legends for plots, scaleable to various sizes of printer or plotter paper. Result plots can contain noise maps, model data, background bitmaps and user-defined logos. Model and result data appear in configurable tables that can be printed and exported to Microsoft® Word and Microsoft® Excel to produce different report formats. Lima Plus and Lima Advanced can also plot 3D, hidden-line vector views.

Fig. 13
Sample printout from Lima

Applications

Lima can be used in a wide range of applications where noise calculation is required. For example, with its tiling and data exchange functions, Lima is well-suited to national and urban noise mapping for fulfilment of the European Commission's Assessment and Management of Environmental Noise Directive (drafted as COM(2000) 468 final 2000/0194). Its ability to determine source levels from measurements and identify sources with bitmaps aids environmental noise management as required, for example, by the European Commission IPPC Directive (96/61/EEC). All Lima packages are suited to environmental noise-impact assessments whether it be the basic package, capable in itself of dealing with complex situations, or the advanced package with its Fixing Quotas function.

The modular design of Lima and its ASCII data exchange supports easy integration into other software packages. Thus, Lima calculation modules can be integrated into environmental management, traffic management and GIS as the noise-calculation core. Lima is already used in connection with GIS tools such as ArcView®/ArcInfo™ and with other calculation software such as SAIL and SAOS. Lima also supports the use of further environmental analysis tools, based on the Lima input model in, e.g., the calculation of air pollution and solar radiation.

Products and Support

Lima is available in three packages to match various budgets:

- **Lima 7812 A**: Designed for small consultants and as an entry-level product to the world of Lima and environmental noise calculation, this can calculate models of up to 20000 obstacle edges and 4000 emitters without tiling. It includes all standard functions and covers all the specified road, rail and industry methods. Data can be imported and exported in DXF format
- **Lima Plus 7812 B**: Designed for medium-scale local authorities and industries, this can calculate models of up to 60000 obstacle edges and 12000 emitters without tiling. It includes 3D graphics, several supplementary tools including superposition, statistics, conflict maps, barrier optimisation and best-/worst-case analysis, and data exchange in one format of the customer's choice, in addition to all the functionality of the standard Lima package
- **Lima Advanced 7812 C**: Designed for the noise mapping and management of large cities and regions, this can calculate models of over 200000 obstacle edges and 40000 emitters without tiling on a 45 MB RAM PC. With a 160 MB RAM PC, 1000000 obstacle edges and 200000 emitters can be calculated. It includes 3D graphics, all supplementary tools, modules for annoyance analysis, fixing emission quotas and moving-point analysis, and all available data-exchange formats. It can be configured depending on the customer's hardware

In addition, two further modules are available for all the above packages:

- **Lima Aircraft Module BZ 5441**: Enables calculation of aircraft noise in accordance with the German AzB method and allows simulation of a moving point source
- **Lima Data Exchange BZ 5442**: Enables import and export of data in all defined data-exchange formats (see specifications)

Lima is also available in other configurations to fit a particular user's needs. Contact your local Brüel & Kjær representative for more information.

The first year's subscription to Brüel&Kjær's Lima Software Support and Maintenance Agreement is included in all packages. This is a service offered by Brüel&Kjær. With a valid Lima Software Support and Maintenance Agreement, you get all Lima patches and upgrades within the subscription period, ensuring that you have the latest and best-supported tools. It is also your security for getting quick and professional help when you need it, saving time and money. If you ever have a software problem with Lima, the agreement entitles you to help by e-mail, fax and telephone. Brüel&Kjær will send you a response with the answer to your Lima problem no more than 2 working days[1] after we have received your request.

In addition, Brüel&Kjær offers both product (Lima) and application (calculation and mapping) training courses. Courses are held at the Brüel&Kjær University at the corporate headquarters, at national training facilities or on-site at a customer location. Lima training courses enable you to get the most out of your Lima software. Application training courses are not product-specific and give you an insight into calculation software and applications in general, thus improving your use and understanding of them.

1. All working days from 09.00 – 17.00 Central European Time (Closed at weekends and Danish Public Holidays)
America: + time difference to CET
Far East and Asia: + time difference to CET

Specifications – Type 7812

SERVER CONCEPT

Supports multiple-processor systems and networks

GRAPHIC USER INTERFACE

Menus and Dialog: All input supported by on-line Help, default input user-defined, last input saved per project, input dialog to set up job files for external software recorded, user-defined toolbar functions
Command Line: May use variables, can be organised in macros, allows nested search loops, search commands may combine attribute and geometry relations
On-line Help: Available for all dialogues

GEOMETRY HANDLING

Geometry queries and manipulation, automatic geometry checks, correction/indication of corrupt objects, marking double objects, automatic partial/arithmetic change of attributes
Geometry Manipulation: Includes move point/object, rotate, stretch, insert/delete vertex, determine starting vertex, copy/split object, select/clip objects by polygon area, change object type, copy/substitute as parallel object, combining buildings to larger objects

DISPLAY INFORMATION

Text, user-defined symbols of object attributes, attribute-defined display style (screen and plots)
3D Views[2]**:** Hidden-line vector display/plot, OpenGL® display

MODEL CHECKING

Automatic checking/correction of area polygons, automatic gap-closing in polylines

MODEL ELEMENTS

Attributes: <200 per object
Z Definition: Absolute or relative to terrain, buildings, bridges, embankments

EMITTERS
Types: Road, rail, industry, aircraft, leisure, sports
Geometry: Point, line, area, vertical areas (facade – facades can be nested)
Multiple time-definition: Per object
Impulse and Tone Correction: Per source
Emission Studies: Sports, parking, lorry loading, forklift truck usage, petrol-filling stations included

OBSTACLES
Types: Screen, building, embankment, embankment with screen, bridge, cantilever roof, attenuation areas
Reflection Factor: Separate for side of obstacle, underside of roof

GROUND
Definition: Single point, contour lines, ridges and fracture edges
Contour lines: Can be generated from points and ridges, act as barriers for propagation

2.Lima Plus 7812B and Lima Advanced 7812C only

DATA AND MODEL ENTRY

Data Input: Digitiser, mouse, keyboard, import
Bitmaps: Multiple, calibrated, clipped and rotated used as background
Display: Opaque, transparent, resolution-reduction option
Import[3]**:** Tabular data, DXF, ArcView, ArcInfo, Atlas-GIS, ESZI, GeoMedia, GRANIS, MapInfo, MOSS, SICAD SD, SICAD SQD, SoundPlan, VISUM, defined 2260 measurement data
Object Linking: Tables, DBF, Access
Databases: Octave bands, reflection properties, directivity

PRE-PROCESSING
Concatenation: Single-line segments to closed polygon objects
Object height assignment: Several methods
Automatic fitting of line and area objects to ground surface, simplification of polygon objects with regard to neighbourhood
Objects/Attributes: User-defined configuration including on-line Help and default input values

CALCULATION

Regulations:
- **Road:** RLS 90, DIN 18005, RVS 3.02, NMPB, CRTN
- Industry: VDI 2714 / 2720 / 2571, DIN 18005, ISO 9613-2, DIN 18005, ÖAL 28
- **Rail:** SCHALL 03, DIN 18005, AKUSTIK 04, TRANSRAPID, ÖAL 30, CRN, RLM2, RLM2/ISO
- **Aircraft:** AzB

Frequency: Average frequency and octave band (depending on method)
Geometry:
- Sound Propagation Path: According to method
- Line Segmentation: Projection method and depending on regulation
- Path Deviation: Rubber-band logic and depending on regulation
- Side Deviation: Worst case analysis based on rotating the plane of propagation (rubber-band logic only)
- Reflection: Virtual sources and barriers, reflectors may be behind other barriers/reflectors unless demanded differently by regulation

Periods: Week, day, reference period, hour, compound period
Sources:
- Indoor sources: Facade sources, emission corrected by building-wall attenuation
- Groups: Determine calculation method, result grouping
- Multiple Emissions: ≤24 emissions per object calculated in parallel in one run

Accuracy: User-defined by:
- Fetching Radius: For emitters and reflectors.
- Tolerance: Maximum acceptable deviation against "accurate" calculation
- Simplification: Ground and buildings

Statistical Analysis of Result Quality: Comparison of results with high-quality recalculation at random positions
Capacity: Handling of objects (terrain, buildings and emitters) calculated in tiles
- Max. Grid Points in Tile: 32000 × 32000
- Max. Obstacle edges/Emitters in Tile:

– Lima Type 7812A: <20000, 4000 emitters
– Lima Plus Type 7812B: <60000, 12000 emitters

3. The following formats are available with Lima Advanced 7812C: ArcView, ArcInfo, Atlas-GIS, ESZI, GeoMedia, GRANIS, MapInfo, MOSS, SICAD SD, SICAD SQD, SoundPlan, VISUM. One of these formats is available with Lima Plus 7812B (user-defined at ordering)

– Lima Advanced Type 7812 C: 1000000, 200000 emitters (160 MB RAM)
– Tiling Process: automatic

RESULTS

Single Receptor: Several heights per position, parallel to facades, parallel to roads in various degrees of detail, propagation path per reflection description option
Grid Receiver:
• Heights: Constant above ground, constant above topography, absolute
• Vertical Grids: Vertical grid, on facades
• Grid result format: ASCII

POST-PROCESSING

Model and Result Data: Configurable tables for post-processing in external software
Superposition[1]: Grid results imported into other grid results, best-/worst-case result, add/subtract results or constants arithmetically or energetically, skip results at max./min. levels, result rounding, generation of new grids by interpolation and transformation
Statistics[1]: Average and standard deviation of results or result differences
Conflict Map[1]: Shows exceedance of noise limits in planning zones
Exposure Map[4]: Relates number of inhabitants to results at one or more heights by facades. 7 noise-exposure algorithms
Fixing Quotas[3]: Optimises noise emissions of source groups within limits at receiver points
Estimate Emission: Estimates source emission from SPL measurements, import from Microsoft® Excel and 2260 Investigator™ sound-level meter
Noise Abatement: Priority list, best-/worst-case analysis for variable source position on a line, map of influence of line sources
Moving Point Source Simulation[5]: nNise level vs. time, L_{Max}, SEL, etc., at receiver
Optimising Barriers[2]: Optimises barrier heights to achieve noise limits at receiver points by minimising barrier area, barrier groups with max. height-change limits

PRINTING AND EXPORT

Printing:
• Graphics: user-defined layout and legends, scaleable to DIN-size paper
• Results: noise map, model data, background bitmaps, logo
Export: Model and result data organised in configurable tables to Microsoft® Word, Microsoft® Excel, GIS, etc., model and result data in DXF and GIS formats (depending on package)

HARDWARE AND SOFTWARE REQUIREMENTS

Hardware: SVGA graphics display (1024 × 768, small character)
Processor: Intel® or compatible
Mouse: Microsoft® or compatible
Operating Systems: Microsoft® Windows® 9x, Windows NT® 4.0, Windows® 2000, Windows® XP

RECOMMENDED SPECIFICATIONS FOR RUNNING LIMA

Minimum PC Specification: 486 133MHz, 32 MB RAM, 4.9 GB HDD Microsoft® Windows® 95, 2 MB Video Ram
Recommended PC Specification: Pentium III 1 GHz, 256 MB RAM, 20 GB HDD, Microsoft® Windows® 2000 or Windows NT® 4.0, 16 MB Video Ram

RECOMMENDED SPECIFICATIONS FOR RUNNING LIMA PLUS

Minimum PC Specification: Pentium® II 200 MHz, 64 MB RAM, 6 GB HDD, Microsoft® Windows® 95, 4 MB Video Ram
Recommended PC Specification: Pentium® III 1 GHz, 256 MB RAM, 20 GB HDD, Windows® 2000 or Windows NT® 4.0, 16 MB Video Ram

RECOMMENDED SPECIFICATIONS FOR RUNNING LIMA ADVANCED

Minimum PC Specification: Pentium® III 550 MHz, 128 MB RAM,10 GB HDD, Microsoft® Windows® 95, 4 MB Video Ram
Recommended PC Specification: Pentium® III 1 GHz or faster (Lima is dual processor compatible with suitable OS), 512 MB RAM per processor, 20 GB HDD, Microsoft® 2000 or Windows NT® 4.0, 16 MB Video Ram

4.Lima Advanced 7812 C only
5.Lima Advanced 7812 C and Lima Aircraft Module order number only

Ordering Information

Lima is available in three packages and two options:
Lima Type 7812 A:
Calculates models of ≤20000 obstacle edges and 4000 emitters without tiling. Covers all specified road, rail and industry methods. Data can be imported and exported in DXF format
Lima Plus Type 7812 B:
Calculates models of ≤60000 obstacle edges and 12000 emitters without tiling. Includes 3D graphics, superposition, statistics, conflict maps, barrier optimisation and best-/worst-case analysis, data exchange (one format), all functions of the Lima Type 7812 A package
Lima Advanced Type 7812 C:
Calculates models of ≤1000000 obstacle edges and 200,000 emitters without tiling (160 MB RAM PC). Includes 3D graphics, all supplementary tools, modules for annoyance analysis, fixing emission quotas, moving-point analysis, all available data-exchange formats, all functions of Lima Type 7812 A. Configurable to customer hardware
Lima Aircraft Module BZ 5441:
Calculation according to AzB, simulation of moving-point source for all Lima packages
Lima Data Exchange Module BZ 5442:
Enables import and export of data in all defined data-exchange formats for all Lima packages (see specifications)
Lima is also available in other configurations – contact your local Brüel & Kjær representative for more information.

All Type 7812 Lima Version 4.0 Packages include the following accessories:

- Program on CD-ROM
- Program protection key
- User Manual

Accessories Available

2260 Investigator™ Sound Level Meter

Services Available

7812 A-MS1	Annual Lima Software Support and Maintenance Agreement
7812 B-MS1	Annual Lima Plus Software Support and Maintenance Agreement
7812 C-MS1	Annual Lima Advanced Software Support and Maintenance Agreement

Lima training courses
Calculation and mapping training courses

BP 1962 – 11 02/03 Rosendahls Bogtrykkeri

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