

Functional specifications of the

 **taraVR** *builder*

software

taraVRbuilder „professional“ Version 7.0

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## 1. General

This document describes all functions of the taraVRbuilder – Professional - program in key words in order to provide a complete overview. This description does not replace the manual which is available as a separate document. This text is released for use in reply to inquiries, invitations to tender and requests for documentation related to the acquisition and purchase of the program.

Brief description: taraVRbuilder is a software tool for the 3D configuration and time-based simulation of conveying material flow and storage/warehouse equipment using virtual reality technology. The program is used to visualize and analyze plant facilities. Possible applications exist in the fields of sales support, planning, engineering and documentation. TaraVRbuilder can be used as a software tool within the context of the "digital factory". Its special feature is the simple and quick preparation of virtual, animated 3D scenes by users with no special programming or 3D design skills.

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Program versions and forms of presentation: German, English or Chinese user interface as well as manual delivered as a CD with USB dongle for using the program on a computer. The Chinese version is not interchangeable between other languages. Switch online between metric system (millimeter) and American system (imperial in inch, feet). The license grants the buyer the right to use the program on one workplace without any restrictions in terms of time and space.

Conditions: The program can be installed on several computers. However, its use is solely permitted on the local PC where the USB dongle supplied is installed. Server licenses are available on request. The General Terms and Conditions of tarakos GmbH are applicable. These General Terms and Conditions can be obtained from tarakos GmbH or read on and downloaded from tarakos's website at [www.tarakos.com](http://www.tarakos.com). This is also where further detailed information is available.

Training: Although the program described herein is easy to operate, we nevertheless recommend the standard training course which is included in the "taraVRbuilder professional" program package in view of the large number of functions and possibilities.

Current version and outlook: These functional specifications of "taraVRbuilder professional" are subject to ongoing updates in order to keep track of the further development of the program. The latest version (refer to the tarakos homepage) is hence always applicable. Deliveries are subject to the latest version of the functional specifications at the time of purchase.

## 2. Handling the system

### 2.1. Arrangement, positioning and setting options

A library of 3D objects is available to the user from which he can select elements of all kinds, parameterize their properties and subsequently arrange and combine these objects in an animated 3D scene. Most objects can be animated, so that an

entire animated facility is generated for warehouse, logistics and material flow applications, with the appearance and functions of this plant being very close to reality (time-based simulation). The following functions support the user in detail:

- Simple 3D positioning via logical connection points on every 3D object. The size of the connection point is adjustable or will automatically readjust depending on the distance from the virtual viewer.
- Automatic, exact positioning of follow-up objects at the point of connection of the predecessor
- Connection points are simultaneously also transfer points for material flow animation.
- Individual definition of connection points as entrance, exit or as bidirectional entrance and exit
- Connection points can be added or removed as needed.
- Representation and positioning of all objects with millimeter precision. The X, Y and Z coordinates are shown as well as the alignment and inclination in relation to the selected (active) connecting point of the object.
- Automatic copying of conveyor height, color, speed, width, transport/carrying means, etc. from the "predecessor" for the current conveyor system object when the conveyor system is expanded further
- Automatic multiple positioning of objects in the 3D scene (e.g. columns) in a freely definable, two-dimensional grid and adjustment of the "filling level" (0 to 100%)
- Option to adjust the accumulation zones (accumulation capacity) for straight and batch lines
- Measuring functions between any objects (areas) or connection points in the 3D scene; resolution and display of the measuring beam, display of relative X, Y and Z distances between two measuring points
- Additional input fields for each object used, e.g. for connection values, drives, prices, equipment group, specific information, remarks, etc.
- Selectable background presentation for the 3D scene
- Adjustment and selection of the floor space in an abstract manner or with project-specific texture or in semi-transparent mode
- Snap-function when joining two objects together; when the connection points approach each other, the approaching object automatically snaps to the connection point of the existing object when the distance between the connection points becomes smaller than a defined value. It is possible to set an audible signal at the moment of "snapping" (snapping noise).
- Manipulation of individual or grouped objects directly in the 3D window using a "mover" in order to move the object on a selectable plane or in a targeted manner in the X, Y or Z direction

- Manipulation of individual connection points with the objects "worker", "handling robot", "straight conveyor" and "shifting shuttle". Irrespective of the position from other connection points the individual connection points could move in the 3D window using a "mover" to a selectable plane or in a targeted manner in the X, Y or Z direction.
- Activation/deactivation and display of the snap function
- Free positioning of an object in the 3D scene using the "drag and drop" functionality (selecting the library object by keeping the left mouse key depressed and simultaneously pressing the Ctrl key)
- Switch between German, English or Chinese language

## 2.2 2D + 3D display options, navigation in the virtual space

- 3D navigation using the mouse, keyboard or scroll wheel
- Different virtual movement modes, such as walk, fly, shift, view or jump
- Additional sketch-type 2D representation (top view and bottom view, lateral views, isometric view, diemtric view) in an overview window
- Option to change the visual focus in the 3D scene by moving the virtual camera in the 2D area
- Automatic focus of the virtual camera on a defined object when moving the camera in the 2D overview window
- Interchanging the 3D and 2D overview windows
- Use of 2 screens for the 3D window and the overview window with accordingly configured computers and graphic cards
- Option to walk through (virtual walk-through) or fly through the virtual plant created
- Selection and storage of locations and automatic flight through the plant along the locations
- Creation, display, editing and storage of virtual round flights through the animated 3D scene, including the possibility to adjust times, angles of vision, type of routes (linear or cubic), repeat function, etc.
- The round flight can be used to subsequently create a video.
- Presentation of the 3D scene in "full-screen mode"
- Selection of different levels of detail in order to achieve a reasonable frame rate even with less powerful computers or very large plants and installations. The presentation of the following features and elements can be enabled/disabled via the ON/OFF function:
  - Supporting frames / steel structures of the conveyor system
  - Detailed view, e.g. exact display of rollers, simple surfaces or complex models as cuboids

- Option to display shadows, including the option to select the orientation of the shadow cast by static conveyor equipment and several other models on the floor
- Option to display the shadow cast by animated movements of goods conveyed and machines (e.g. hoisting hear, robot arms)
- Level of detail, dependence of the detailed object view on the distance of the virtual observer from the object

### 2.3 Operating functions to support the user

- Marking of individual or multiple objects within a project with the option to copy and to reinsert objects within the same project
- When the copied project/sub-project is inserted, the position coordinates and the orientation are copied; these parameters can be subsequently changed.
- Multiple marking of selected components of the conveyor system in order to enable simultaneous adjustment of values (e.g. position, color, orientation, carrying/transport means, etc.)
- Display of any customer-specific logo in the foreground in the png, jpg or gif format
- Blend out (make invisible) individual or multiple objects such as sub-projects, whereby the material flow function remains invisible.
- Undo function for the last input (not available for all functions)
- Slow-motion or quick-motion function with adjustable time factors
- The precision of the realtime rendering is dependent upon the size and complexity of the project and upon the performance of the hardware and software of the computer used.
- Different project saving modes:
  - The current project is automatically saved with each input and change, so that the last project status is stored in the case of an unexpected program abort.
  - The project is saved in its current condition when the "save" or "save as" function is selected.

## 3. Functions

### 3.1. Import and export of data and models

- Import of static 3D models as goods for the customer-specific extension of the goods library
- Import of static and dynamic 3D models for extending the 3D object library

- Import of 2D and 3D data for layouts, buildings, 3D objects in DXF, WRL, 3DS, STL, COB, LWO and OBJ formats
- Export of 2D and 3D data of the scene created in DXF, WRL, 3DS, STL, COB, LWO and OBJ formats (static)
- Export of images (\*.bmp) of selected locations in the 3D scene with user-definable resolution (e.g. for print templates)
- Export of animated (dynamic) scenes in encrypted VRML format (\*.wrl) for further processing in taraVRcontrol
- Export of the animated 3D scene in AVI video format with or without shadows, selectable resolution and frame rate (frames per second), various compression methods selectable, use of prepared round flights, intermediate storage of the individual images
- Export of the throughput data saved in Excel format
- Export of the component list in CSV or TXT formats
- Automatic generation of equipment lists (bills of materials) of the components installed, including export option (CSV, TXT)
- Export of the dynamic VR scene of the project in taraVRviewer format (\*.tvr) with all dynamic functions and animations
- Display of the encrypted export file (\*.tvr) can only be opened with taraVRviewer.
- Export of a tpz-file. The project file (\*.tpd), as well as the appropriate imported goods and 3D-models in the project, will be condensed and collected in the file. This file can be transcribed/sent and afterwards loaded in the taraVRbuilder. Through loading, the files will be unzipped and the project specific goods and 3D-models are made available.

### 3.2 Analysis and evaluation function

- Integration of throughput counters with differentiated approximate determination according to goods types, display of throughput rates and/or cycle rates in the 3D scene or in a separate display window that can be freely positioned on the screen. The accuracy of the throughput calculation decreases with higher time factors for the animation and with increasing complexity.
- Storage and display of throughput data according to events or time intervals in Excel format, display for each point in time for all selected, individual throughput counters with all points in time. The recording times can be indicated by an audible signal.
- Overview of the objects used in a project tree structure with automatic or manual allocation of position numbers and on several levels. The format of the position numbers can be determined by the user.

## 4. Libraries

### 4.1 Conveyor equipment, material flow and production library

Libraries with conveyor equipment objects that can be parameterized and animated. The following conveyor and material flow components are specifically available:

- Straight conveyor, unidirectional
- Straight conveyor, as reversing conveyor (bidirectional)
- Batch lines
- Curves right/left
- Transfer conveyors right/left
- Hoisting gear and vertically moving floor conveyors
- C/Z conveyors
- Winders
- Reversing stub lines as buffers, including input of capacity. After filling up, the buffer is emptied again (first in, last out – FILO)
- Ramifications and junctions 1:2 or 1:3 as well as 2:1 or 3:1 optional with turning the goods (through 90 degrees in the conveying direction) or without turning (e.g. transverse movement as a "pusher")
- Vertical distributing guides
- Bevel merge and distribution
- Working station as a straight line with two connecting points, adjustable speed, processing time and/or goods change, take-up and hand-over of up to 6 goods
- Type2 working station with one connecting point for take-up and hand-over points at the same point (bidirectional), adjustable processing time, goods change and changeover time
- Type3 working station with two connecting points for take-up and hand-over points at different points, adjustable processing time, goods change, cycle behavior and changeover time
- Line portal with up to 3 carriages that run along a supported single path. Adjustable acceleration rate and speed, overlapping working ranges of the carriages with collision avoidance, up to 50 positions can be activated, process according to a working sequence to be defined via a dedicated matrix connection point. The connection points are thereby approached one after another. Alternatively, you can choose a single or multiple gripper (H,I) or trolley as carriage
- 2D portal with up to 2 carriages, and the carriage runs along a supported parallel path, up to 50 put-down and pick-up points in X, Y and Z coordinates

- with sequential operation, alternatively single or multiple grippers (H, I), trolleys (with loading hooks), or carriages.
- Portal crane with parametrical, horizontal and vertical gate supports, maneuverable on two parallel, grounded, horizontal trains, activation up to 50 positions, operation of determined work sequence via a defined matrix, connection point will approach one after the other, a trolley with loading hooks.
  - Handling robot (5-axis robot) with up to 50 take-up and hand-over points
  - Shifting shuttle, simple depth, optionally with lifting function, entrance, exit or bidirectional charging points
  - Turntable optionally with lifting function, definition as to whether the connection point is an entrance or exit or a bidirectional entrance and exit, also suitable as a 180-degree reversing station or as a 90-degree turning station with transverse discharge function.
  - Swaying conveyor with variable, concentrated turning point, feeding/releasing position plus/minus 90 degrees.
  - Spiral conveyor / spiral chute with adjustable radius, pitch/slope.
  - Automatic high-bay warehouse, single-aisle or multiple-aisle, with different rack feeders, single-depth or double-depth storage/retrieval, customized design and layout possible by selecting compartment textures
  - Shuttle for the straight, longitudinal transport of up to 6 goods (of the same type)
  - Alignment lines as straight lines for right, left or centred alignment of the material flow. The alignment line can be optionally fitted with special transport means (slanting rollers, herringbones, etc.). As an alternative to alignment along the entire conveyor section length of the alignment line, it is also possible to use a pusher with corresponding animation. Alignment is carried out by the following conveyor equipment elements: straight lines, curves, (type 1) working station, batch lines and hoisting gears. There is always one good on the alignment line.
  - Transfer carriage as a complex shifting shuttle with single, double and quadruple charging, defined geometry for two width variants and different design
  - Double line distribution to the right, left and straight in conjunction with the transfer carriage
  - Universal "complex node" for the flexible implementation of junctions and ramifications with up to 4 connection points, free selection whether the connection point is an entrance or exit or a bidirectional entrance and exit.
  - Loading and unloading station with vertical charging and discharging of goods, horizontal charging and discharging of loading means

- Single high-bay warehouse aisle with rack feeder with pre-allocation, batch discharge with definition of sequence, table showing current utilization, presentation of different goods stored in the warehouse, or use of textures
- Vertical paternoster
- (Paternoster) as compact storage models in 4 different types, partly depicting the rotating container, take in/out option automatically or with a worker, parametric in length, high, width, opening in number, position, and size, display with sorted goods and same division.
- Horizontal circular shelf (carousel) parametrical in height, length, width, number of containers, number of sections, speed, compatible with containers of one model, several operation positions on the front side for automatic or manual operation as an entry or exit.
- Pallet stacking and destacking magazine in conjunction with individual pallet types and corresponding pallet stacks (from pallet stack library)
- Text and graphic display (as a billboard, always turning to face the virtual viewer)
- Shiftable shelf with options to parameterize the warehouse and aisle geometry, traversing of a stacker into an aisle in order to pick material from stock, operation of a second stacker in another aisle in order to add material to stock, adjustment of time behavior, connection to stacker operations only in conjunction with the additional FFZ library.

All components of the conveyor system components can be modified by the user by setting the appropriate parameters. The properties must be set for each object of the conveyor system - such as length, width, choice of carrying/transport means, speeds, junction and ramification strategies, position and number of connection points (up to 50 connecting points depending on object type), color, orientation and number of supports, angle, position in the X, Y and Z space (not all the properties for each object).

Most conveyor flanks may be adjusted according to width, color (same on both sides), as well as height and parameterize with or without an additional cornering grip (possible for both left and right sides).

Many objects permit the use of different ramification or junction strategies if there is more than one entrance and exit. In the case of ramification, alternating batch sizes as well as a percentage-based or sorted (goods-dependent) strategy can be selected. Furthermore, the user can decide whether a good approaching a blocked entrance of a conveyor will select another connection exit point as its conveying path. The priority or FIFO (first in – first out) can be selected with regard to the function.

The material flow always proceeds in the centre of the conveyor line if no alignment lines are used. Behind alignment lines, the material is subsequently taken over by downstream conveyor lines - such as working station, curve, batch line, hoisting gear – with its previous orientation (right, left, centred).

The surfaces of the components of the conveyor system can be presented in different ways. The following 28 different carrying means can, for example, be set for many (albeit not for all) conveyors: belt, rollers, small rollers, strap (two, three, eight fold), spherical braces, spherical table, accumulating chain conveyor (one, two, three fold), accumulating roller conveyor and, as a special form, "no carrying means." Presentation takes place as a 3D geometry or optionally as texture.

#### 4.2 Animations and sources of the conveyor system objects

The movements of the animated goods are displayed in realtime, i.e. with the defined speed and the correct dimensions in relation to the dimensions of the plant.

The sources of goods in the material flow / logistics scene are defined at the entrance of each conveyor line. Different goods objects can be generated with different – regular or random – frequencies. The goods then "flow" into the virtual conveyor system where they are simulated in a time-based manner. A percentage distribution or batch sizes and sequences can be optionally defined at the sources.

There is likewise a limited number of goods, so that when this limit is reached, no further goods will be produced. Commodities, material or flow of goods for a simulated animation can be produced.

The sources release the goods according to a time schedule. Goods are only released if the first section (first accumulation position) of the conveyor at the source is free. If this is not the case, no good will be released. The user can optionally activate a monitoring function which indicates as of when a source will no longer be able to release goods according to the given schedule.

The sources are started by means of a "Start" button. All sources start at the same time. The "Stop" button stops the sources. The animation continues until the plant is empty. The "Pause" button stops the source and the ongoing animation process is "frozen" until the "Pause" button is pushed again. The time factor (quick motion or slow motion) can be changed during a pause.

The sources can be stopped and all the goods in the plant can be deleted by means of the "RESET" button.

The conveying and accumulation behavior of goods on straight lines is displayed in such a manner that in the case of congestion the goods accumulate in the adjusted accumulation length and in equal distances, irrespective of the actual length of the goods and the carrying/transport means. The real accumulation behavior can be adjusted as follows for the conveyors:

- Straight line: not accumulating or accumulating; in accumulating mode, selection is possible between simultaneous (synchronous) following of follow-up goods or individual following (asynchronous or single-position control).
- Batch line: no limitation to the number of goods in the batch depending on line length and the length defined for the accumulation section (identical for

each good); in the case of the "form batch" type of batch line, the batch forming process can be defined as "accumulating" (accumulation takes place at the end of the line until the batch is complete) or "cyclic" (the first good enters at the beginning and stops until the next good pushes the first good forward until the batch is complete). The "generate batch" and "dissolve batch" functions are available in addition to "form batch". The goods may be of different types.

- Curve: determination of the accumulation zones of identical length with accumulating, synchronous flow of goods
- Other conveyor components: always one good at a time unless anything to the contrary is determined.

#### 4.3 Library with different goods

- Standard library, consisting of 33 different customary types of goods, such as empty and loaded pallet types, containers (following pages: 40, 30 and 20), workpiece holders, carton, etc.
- Pallet stack library, consisting of different pallet types, in each case as stacks of 10, 15 and 20
- Container library with 32 different standard containers, in each case empty and loaded, differing in terms of dimensions and color
- Goods library with different goods, such as barrels, empty and loaded workpiece holders, single workpieces, etc.

The user can compile a project-specific goods library consisting of 40 external (imported) goods (and additionally comprising further abstract goods) from the different above-mentioned goods libraries and other customer-specific, imported 3D goods.

- Abstract goods: The user can additionally define goods in cuboid form within a dialog (description, length, width, height, color). There is no limit to the number of these goods.
- Customer or project-specific goods by importing VRML models
- (ex. From other CAD systems) The good-object can be scaled by size when imported and offset by height. Through this offset in the animation, the good will be transported above or below the conveyor belt.

#### 4.4 Library for building parts

A standard library of building parts is available for the quick implementation of surfaces that define spaces. These elements, just like conveyor equipment, are simply arranged in the 3D space via connection points. Dimensions and color can be set. The library includes, in detail, the following elements:

- Columns, both individually and as connecting elements between wall parts, also as ramifications
- Walls with and without windows (fixed "skylight")
- Walls with fixed door openings, with or without coiling door (opens and closes at a click of the mouse)
- Wall object with freely definable opening for a window or door, adjustable by way of parameterization or using the mouse at the object

#### 4.5 Library for catwalks, paths and platforms

- Catwalks: straight, left, right, left + right
- Stairs with width, tread, angle
- Platforms with supports

These library objects can be parameterized in terms of size (LxWxH), color, angle, in each case with railings support and/or suspension elements.

#### 4.6 Library for basic bodies

New objects can be made up of basic bodies. The geometry of the basic bodies can be scaled, colored, made transparent or given textures which can be imported as digital images. The following basic bodies are available:

- Cuboid
- Cylinder
- Sphere
- Cone

#### 4.7 Library of static 3D models

Various objects from a prepared library can be inserted at any point within the 3D scene.

- Worker
- BlueBox
- Skeleton container, pallets
- Halls
- Fork-lift trucks
- Lifting trucks, trucks
- Containers
- Vessel
- Various types of machines

The user can amend this library with 3D imports. The scale of the objects can be varied by changing the X, Y or Z dimensions.

#### 4.8 Library for pipes and ducts

Straight lines, horizontal and vertical curved parts can be combined to form a pipe or duct section representing pipelines (circular cross-section) or ducts (square cross-section). The following parameters can be set in this context:

- Type of cross-section (circle or square)
- Circle diameter or width and height, respectively
- Length (of straight sections)
- Curvature radius and curvature angle
- Color

#### 4.9 User-specific libraries

The taraVRbuilder user can create their own library. Through the arrangement of single or multiple taraVRbuilder objects, that are provided with the parameters for the geometry, appearance and function/animation, are produced from a special object – specifically, object groups. These can be saved and given a name through an already named library. A picture can be created from this object, in which a control button will automatically be inserted. Numerous libraries with many objects can likewise be created. Optionally, a library can always be shown with the control buttons or user interface. A scroll down list is provided for libraries that are extensive in content. If the control button is pressed, the prepared library element with said parameters will be applied respectively to the actual project. The created user-specific libraries can be applied to cross-projects.

### 5. Additional auxiliary programs and viewers

#### 5.1 taraVROptimizer with import optimizing function

- For importing and optimizing (optimization of structure and intelligent reduction of polygons) 3D data in the VRML format (\*.wrl) from 3D CAD systems or third-party VR systems (such as CATIA, ProEngineer, AutoCAD, Solid Works, RobCAD, etc.) integrated into the taraVRbuilder program interface or as a separate program
- With simple, dialog-based operation in wizard mode
- Expert mode with many special setting options

#### 5.2 taraVRviewer for viewing the taraVRbuilder-projects created

- Display of the taraVRbuilder viewer files (\*.tvr) generated from taraVRbuilder as a complete 3D viewer with options for setting navigation, animation with start/stop/speed, use of the prepared round flights, display of the throughput counters in pieces per hour or seconds per cycle

## 6. Services

### 6.1. Training

One-day training (7hrs) for one participant within the scope of a standardized taraVRbuilder seminar (BASIC or ADVANCED) on the premises of tarakos in Magdeburg, Germany. tarakos offers training dates on a regular basis. Participants use their own notebooks on which the acquired taraVRbuilder program is installed and running with a dongle.

### 6.2 Update service

A free taraVRbuilder program update is available to the customer within 12 months following purchase of the professional version. These are program upgrades of taraVRbuilder. At the supplier's request, tarakos supplies the latest program version (as a download or on CD) free of charge as a replacement for the program versions acquired by the customer, including any additionally purchased additional libraries. The customer is responsible for installation. The latest versions are published on the tarakos website. Furthermore, in the event that any program errors and bugs are identified and subsequently remedied, tarakos GmbH also supplies so-called "patches" free of charge during the above-stated period.

### 6.3 Hotline service

Hotline service includes user support in the case of problems related to the installation, operation, and functionality of taraVRbuilder. Customers of the professional version have free access to the hotline within a period of 12 months after the date of purchase during customary business hours in Germany by telephone, in writing (letter or fax) or via e-mail. tarakos GmbH warrants availability of the hotline during a core time from 9.00 am to 4.00 pm each day. Calls must be made as standard fixed-net calls with the usual costs incurred thereby to be borne by the caller.

We assume that the user proceeds in conformity with the manuals and that he has attended training included in the price of the taraVRbuilder program.

tarakos will do its utmost in order to answer all queries and resolve all problems within the next working day. This may require cooperation by and involvement of the user.

## 7. Technical requirements

The program runs on Windows computers with the Windows XP or VISTA operating system from Microsoft with the latest service pack and graphic drivers. The graphic card and the operating system should support DirectX9 because otherwise it may not be possible to use certain functions (e.g. shadows). Further requirements include a free USB interface for the dongle and a harddisk with a free memory capacity of at least 100MB as well as a CD/DVD drive. The computer

should include a 3D graphic card with a current driver. We recommend using a computer which is not older than 2 years. The RAM should have a capacity of at least 512MB and the graphic card memory of at least 64MB.

tarakos will be pleased to give you recommendations.

Please do not use any Intel shared graphic cards (Version 8xxx) because we cannot guarantee perfect functionality in such a case!

## 8. Scope of delivery

### 8.1 Program CD with the following contents:

- taraVRbuilder Professional setup program for installation with pdf manual and project examples
- taraVROptimizer setup program for installation with pdf manual
- taraVRviewer setup program with examples
- Various software tools and utilities. These tools can be additionally installed from case to case.
  - BS-Contact as demo version (VRML viewer)
  - AdobeReader
  - DirectX 9.0c (for current graphic drivers) as installation version from Microsoft
  - hldrv32.exe as driver for the dongle
  - msjavx (MS Java Virtual Maschine)
- Performance specifications of taraVRbuilder as a PDF file, approx. 20 pages
- Overview table of all 3D objects with all parameters as a PDF file
- Images – various pictures / screenshots, in color
- Goods libraries for using further goods with taraVRbuilder
  - Containers
  - Various goods from the foods industry and mechanical engineering
- Videos in AVI format as examples of video exports from taraVRbuilder and as tutorial videos with examples of program operation

### 8.2 Dongle

Dongle for plugging into a USB port. The dongle is coded for taraVRbuilder Professional and the additional library selected. If further additional libraries or additional tools are to be used, the dongle is additionally coded for these. The dongle is necessary for the operation of the program!

### 8.3 Manual

Manual, printed version, DIN-A5 format, plastic cover, approx. 280 pages, with illustrations and diagrams, explanations for every object type, in German or English.

### 9. Additional libraries and additional tools

Further additional libraries are available for taraVRbuilder in addition to the functions and libraries described above. These additional libraries and tools are described in the appendix.

The "taraVRbuilder-professional" program package already includes one additional library. The additional libraries are described in detail in the appendix.

When ordering taraVRbuilder Professional, please indicate which library you require. The other additional libraries are available for an extra fee. The prices are stated in the price list for the latest version. Simultaneous use of multiple additional libraries is possible. The use of additional libraries is dependent upon the dongle coding which tarakos GmbH performs according to the additional libraries ordered.

## Appendix

- I. Additional floor conveyor library (FFZ) "AGV, and reach stacker, truck, as well as order picking and fork-lift truck"

### Fork-lift truck as a conventional front stacker

- Line elements: straight line, curve. crossing, turn, ramp
- Preference and ramification strategies
- Speed parameters for operations with and without loads, for straight-on and curve operations
- Display of driving sections possible as a line, 2D surface of 3D body
- Length adjustment of traversing distances, hence variable block distances
- Picking up goods to be conveyed from one or two rows and passing on to one two rows (block charging and discharging)

### Narrow-aisle stacker

- With front or right/left goods charging or discharging
- Variable adjustment of transfer point height
- In the case of laterally higher transfer points, the cabin follows the movement at an offset height
- Adjustment of construction height and stacker width
- Serves one charging and one discharging point on a line
- Operating speed settings
- Shuttle mode, no round course

### Automatic guided vehicle (AGV) systems

- Able to parametrize according to the dimensions of goods charging
- Transfer points in the same height
- Charging and discharging of goods laterally and in the front
- Line elements: straight line, curve. crossing, stub line
- Possible driving courses for AGV (no combination):
  - Linear:
    - Vehicle moves between 2 points
    - Use of branch terminal lines for charging and discharging
    - Only one vehicle or stacker possible
    - Speed parameters for operation with and without load

- Circulation:
  - All lines are unidirectional (one direction)
  - Several vehicles are possible
  - Speed parameters for operation with and without loads

Route information concerning the stackers/AGVs used, including number of vehicles, transfer points, operating routes

#### Order picking stacker

Order picking stacker for round course with charging and discharging points as well as stop positions. Take-up of several different goods. At the points of transfer, the goods move on after a set time.

Possible settings:

- Charging and discharging strategy
- Speed parameters for operation with and without load
- Waiting times
- Number of goods
- Fork length

#### Reach Stacker (mobile container crane)

Mobile container crane with receiver adjustment for 20, 30 and 40 foot container. Animation designed for the operation for ground-level container delivery, as well as other operation levels, but not for adjusted animation.

- Stretch forming elements: straight, curves, crosses, turns, ramps
- Right of way and T-junction strategies
- Speed parameters for traveling with or without load and for straight and curve
- Display of driving route as line, 2D-flat or 3D-body possible
- Length settings for driving route, through which block distances can be varied
- Pick-up and disposal of containers from materials handling equipment, portal crane, flat bed truck

#### Flat Bed Truck for Container Transport

Flat bed trucks for circuit course with loading and unloading stations, as well as stop positions. Intake of many different goods. The flat bed truck is layed out however, due to a one row system of goods/container. At the hand-over point, the goods transfer over after a measured period of time. The travel animation occurs with static speed within a section. The flat bed truck moves in a rigid manner (no buckling of the pass, no drag radius, the turning point is in the middle for lifts and order picking lifts)

Following Setting possibilities:

- Strategy for pick-up and disposal
- Speed parameters for traveling with or without load
- Idle time, quantity of goods
- Loading/un-loading option by means of lifts, reach stackers and portal cranes

## II. Additional "RFID" library

An RFID antenna system can be added at the beginning or end of a conveyor line, stacker or AGV line. Every single antenna can be clicked with the mouse; the range of the antenna beam is indicated by a semi-transparent body in the scene. If a good or vehicle is located on the conveyor line / transport route in animation /simulation mode, the antennas which have been added are successively activated and the viewer sees the individual beam cones of the individual antennas as they are activated. Activation continues only as long as the good or vehicle is located in the pertinent segment of the conveyor line / transport route. In the case of the conveyor lines, this range can be set by defining the respectively last accumulation positions.

The following parameters and/or settings are possible:

- HF or UHF antennas
- Simple to six-fold antennas
- Gate with 6 antennas
- The positions of the individual antennas - including sub-antennas - can be determined in the X, Y and Z directions.
- Setting of the beam cone for every antenna, including range in terms of height, length and width; in the case of UHF antennas, it is additionally possible to select the shape of the cone (round, square).

### III. Additional "manual order picking" library

Presentation of transport and order picking operations by animated workers.

Three options are available in this respect:

- A worker carries a good from one or more conveyor system elements to one or more other points. Transport takes place between the connection points and starts at a standard height. The walking and gripping actions are roughly indicated. The following settings can be made:
  - Pick-up points with distance and angle
  - Walking, turning and transfer speeds
  - Ramification and junction strategy; routes between the transfer points always straight and direct
  - Up to 50 take-up and hand-over points
  - Determination of points according to entrance or exit or entrance and exit
  - Sex (male or female)
  - Color of pants / shirt
  
- Person with scanner

The worker holds a scanner in his hand and can be connected to two working stations. When a good is transported to one of the working stations, the worker approaches and performs a scanning operation within a time to be determined. Thereafter, the good is transported further and the worker proceeds to another working station in order to start the scanning operation there.
  
- Person on a round course passes by addition or removal points and picks up or hands over a good there. Picking up or handing over takes place whilst passing/walking by. The actions are only roughly indicated and do not depend on the dimensions of the good. If multiple workers are used, waiting times due to congestion may occur with given courses and a defined time behavior. The following settings can be made:
  - Number of workers
  - Lines with straight line, curve, hand-over point, pick-up point
  - Sex (male or female)
  - Color of pants / shirt
  - Hand-over strategy
  - With or without order picking cart
  - Walking speeds
  - Time for taking up the good
  - Waiting time on straight line

#### IV. Additional "shelves" library

The additional "shelves" library enables the generation and parametrization of shelves. Several smaller shelves can be used to build larger ones. This is why the individual shelves also come with connection points at which other shelves can be positioned and fixed. This applies to static shelves without an automatic source point and without an animated operating unit.

The following shelf types can be selected:

- Shelf with joists (pallet shelf) with or without lower compartment bottom
- Cantilever-type shelf with or without lower compartment bottom
- Flow shelves
- Racks
- Container shelf (shelf with lower compartment bottom)

Parameterization of the above-mentioned shelf types:

- Base height
- Compartment depth, height and width
- Number of compartments (evenly distributed)
- Compartment bottom, display or hide
- With and without stoppers, roll-off protection
- Stabilizing braces
- Selection of transport/supporting means
- Order picking points
- Order picking position
- Choice of color for horizontal and vertical supports
- Allocation of fans with various storage goods with different sorting grades.

The shelves can be equipped with a dummy-conveyor element (ex. Invisible short straight section), in which a source point can be inserted, from which goods can be taken from an animated order picker or forklift. Likewise, one or even several "hollows" can be positioned in the shelves in several ways.

Different presentation modes are available for the shelves:

- as an abstract cuboid
- with a framework
- with goods

The presentation as an abstract cuboid enables textures to be applied to the surfaces of the cuboid.

## V. Additional Library “Environment-Infrastructure”

Static objects (no animation) displayed as streets, places as well as attachments and equipment to complete outside facilities and infrastructures. The single objects can, in part, be positioned and introduced on their respective connection points, as well as be partly parametrized in shape and dimension.

The following in particular:

- Turning area with delivery station, with positioning of halls and respectively the reflection of hall positions.
- Park place with slope
- Street with slope and adjustment of gradient
- Street curves adjustable right/left with slope, radius and pitch
- Street branch as T-junction with slope
- Truck scale with slope and with or without a cradle house
- Office/social container
- Unwind-trough container
- Press container (ex. for paper or plastic)
- Standard 40 foot container
- Drop-off trough (ex. for garbage)
- Passenger car (VW touran)
- Dumpster truck with two, three or four axles
- Tractors with closed semi-trailers
- Garbage truck small and large (two and three axles respectively)
- Reach stacker (mobile container cranes)
- Railway-container car with 2 containers
- Line element straight section with road bed and slope
- Lattice fence element
- Green area, without slope, rectangular

The previous slope (from previous object) and adjustment of slope degree occurs automatically. The gradient angles are set in place.

Volume calculation: A calculation function is additionally integrated, in which the entire volume of constructed walls can be calculated and displayed.

## VI. Additional Library – Monorail train

With the following objects, monorail functions can be built. Similar to Material handling and conveyor belts, various elements are combined. The settings, parameters, and animations are similarly realized as by the other material handling.

The suspension is possible at the top. A rail profile type is offered and one type of hanger. The user can himself import individual hangers as 3D-objects and thus achieve customer-specific optics. The animation occurs in the manner that, non-level conveyors as well, the alignment of hangers is always perpendicular at the bottom respective to gravity. At the present, the intake of goods for every hanger occurs.

Currently, the following hanger components are offered (more currently under construction).

- Straight section; respectively group line, setting length, slope, traffic behavior.
- Right/Left curves, radius and angle adjustable
- Upwards and downwards arches, radius and angle adjustable
- Switch 1:2 right, left
- Redistribution points 2:2 or 3:1 (1:3)
- Feeding station for acquisition of goods
- Discharge station for drop-off of goods

The allocation and yield strategies are similarly adjusted to other comparable materials handling components.

## VII. Data Exporter XML

All information to the construction, content and function of the taraVRbuilder project will be internally saved in a program database. The information can be exported in a secure XML-format with the help of XML-data exporter and usable (prepared respectively) for third systems. It is therefore possible to transmit the previously created project files in a simulation system (ex. DOSIMIS from simulation service provider center Dortmund).

Another possibility is the transmission in a Data base oriented 2D- or 3D-CAD-system.