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ROAD.BIN EDITOR MANUAL



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Typeset with L^AT_EX

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Introduction

Road.bin - is a file that stores navigation network for the car movement in traffic. The network is made up by points and their connections.

Navigation are linearly related points.

Road.bin contains **only navigation!** Car definition is stored in *scene2.bin* file (see Appendix).

This document summarizes only instructions how to create navigation. Algorithm, for example how AI searches the shortest path, it depends on the self study.

References:

http://en.wikipedia.org/wiki/Dijkstra%27s_algorithmn

http://en.wikipedia.org/wiki/Shortest_path_problem

http://www.youtube.com/results?search_query=shortest+path

Chapter 1

Preparation for use Road.bin Editor

The following conditions are recommended to fulfill for correct functionality:

- *Road.bin Editor* (ROE for short) - author: *me*.
- *Mafia.GetPos* tool (*Mafia* version 1.0 is required).
- Reduce resolution than is currently used in the operating system and disable fullscreen, both in the *Mafia Setup.exe*.
- Extract *missions* folder with *MafiaDataXtractor*.
- Copy all 8 models of points from *models* folder in the editor into *Mafia\models* folder - to visualize points in the game.
- Mission without sectors are recommended. Sectors can be deleted using the *Sector del* tool (please backup the original *scene.4ds* mission file). See Appendix.
- This script (below) insert into *scene2.bin* of same mission using *BScriptView 4 - 6* (menu *Insert* → *Other*) or *DCED 2*:

```
dim_ft 1
// press objectives (F1) to display navigation
label CHE
wait 1000
ctrl_read 0, OBJECTIVES
if ft[0] = 1, -1, CHE
cleardifferences
loaddifferences "CHED.chg"
goto CHE
```

Chapter 2

Points and links

2.1 Types of points



Figure 2.1: Mafia with visualized navigation points.

Following table describes two possible types of points:

Type in hex - sizeof(unsigned short int);	Description
Cross point	Defines number of points, these points are used for cross roads
Way point	Forms a real road, these points are inserted between Cross points

2.2 Attributes of points

Following table describes all attributes of Cross and Way points:

Type in hex - sizeof(unsigned short int);	Description
Cross point	
Position	Coordinates of point - point must be placed to center of cross road
Speed	If cars branching, they slow down (double of value is speed in miles per hour and triple of value is in kilometers per hour)
Semaphore	Cross road is controlled by semaphore (see Appendix)
Cross point further contains attributes for four directions - not all dirs. must be used	
Way point direction link	Over this point cars ride to next road (if the link is unused, cars don't ride to this direction and further attributes will be ignored)
Far active cross point link	Link to cross point on the end of road is active, because in this dir. will be generated cars (if the link is unused, road will be exist (used by eg AI), but cars not be generated on this direction)
Far cross point distance	To recalculate distance click on <i>Recalculate</i> or in <i>Attributes manager</i>
Angle in radians	Angle between cross points (standardly set to 3.14 rad = 180°)
Priority	Sets right of way on cross road
- priority: 0 — 100	Right of way have first car, which come to cross road
- priority: 1 — 100	The direction gives right of way
Informations	Standardly set to 0
Quaternion type of lanes and their distances	These traffic lanes are defined in each direction, distance is calculated from superior lane to right (for England roads set negative values)
- type of lane: 0	Disabled - for outer lane
- type of lane: 1	Disabled - for inner lane (eq tram lane, middle railing, etc.)
- type of lane: 2	Traffic
- type of lane: 3	Lane for longitudinal parking

Type in hex - sizeof(unsigned short int);	Description
Way point	
Position	Coordinates of point - point must be placed to center of road
Speed	Cars ride between way points by maximum speed, therefore is recommended to regulate speed in curves (see <i>Attributes manager</i>)
Near previous / next cross / way point	Car ride over these links
hline Far previous / next cross point link	This link has unknown purpose, maybe is here for faster finding shortest path by AI

Cross and way points are numbered in order. Cross points can be placed in any way, but the way points are numbered according to their positions by the X axis - the leftmost point will have ID equal to zero and the rightmost point will have ID equal to the count of way points - 1.

Chapter 3

Interface of editor

3.1 Main window

The main window contains a list of all points that are stored in the file. For inserting and managing points are used further panels.

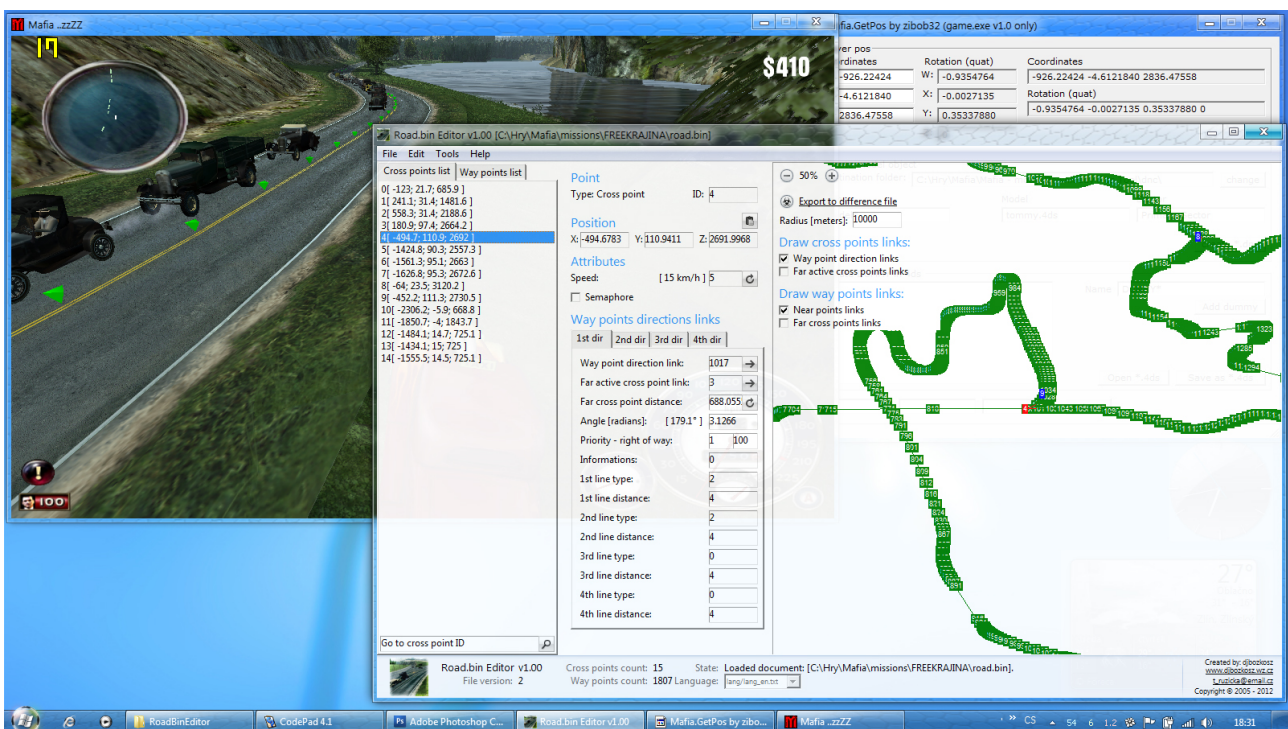


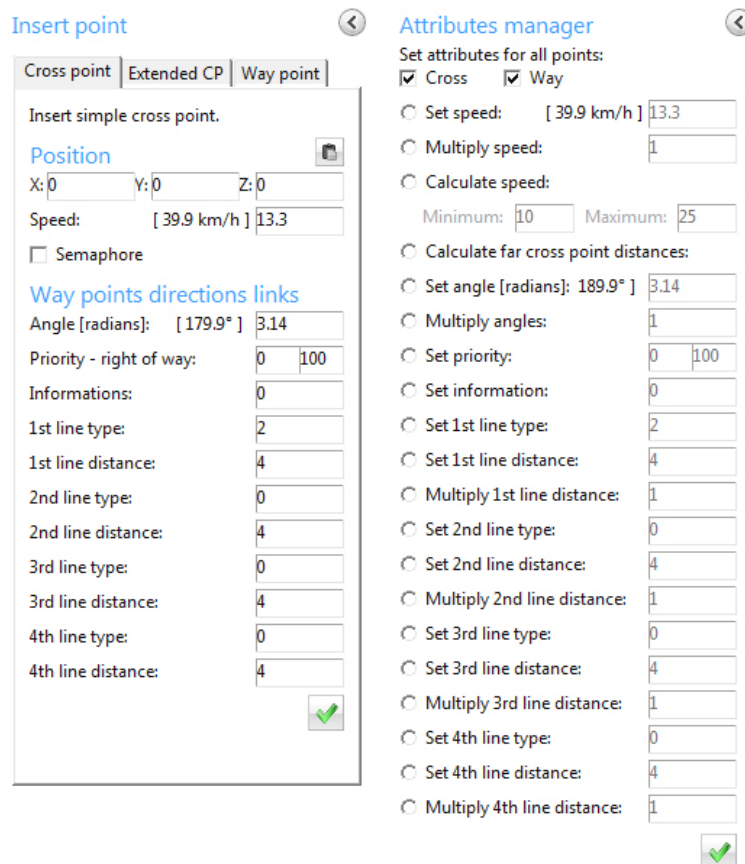
Figure 3.1: Mafia is appropriate to run in a window for easy switching between windows.

3.2 Insert point panel

This panel is used for inserting new points. In first and third tab you can insert one cross point or one way point. Second tab is for easier cross roads creation - you can insert one cross point to center and around this point is automatically inserted specified number of linked way points.

3.3 Attributes manager panel

This panel simplifies properties management of points, because allows set specified values to all cross or way points (or on absolutely all points).



Insert point

Cross point | Extended CP | Way point

Insert simple cross point.

Position

X: 0 Y: 0 Z: 0

Speed: [39.9 km/h] 13.3

☐ Semaphore

Way points directions links

Angle [radians]: [179.9°] 3.14

Priority - right of way: 0 100

Informations: 0

1st line type: 2

1st line distance: 4

2nd line type: 0

2nd line distance: 4

3rd line type: 0

3rd line distance: 4

4th line type: 0

4th line distance: 4

Attributes manager

Set attributes for all points:

☒ Cross ☒ Way

☐ Set speed: [39.9 km/h] 13.3

☐ Multiply speed: 1

☐ Calculate speed:

Minimum: 10 Maximum: 25

☐ Calculate far cross point distances:

☐ Set angle [radians]: 189.9° 3.14

☐ Multiply angles: 1

☐ Set priority: 0 100

☐ Set information: 0

☐ Set 1st line type: 2

☐ Set 1st line distance: 4

☐ Multiply 1st line distance: 1

☐ Set 2nd line type: 0

☐ Set 2nd line distance: 4

☐ Multiply 2nd line distance: 1

☐ Set 3rd line type: 0

☐ Set 3rd line distance: 4

☐ Multiply 3rd line distance: 1

☐ Set 4th line type: 0

☐ Set 4th line distance: 4

☐ Multiply 4th line distance: 1

Figure 3.2: Insert point and Attributes manager panels

3.4 Localization and editor skins

Actual editor setting is saved in *settings.txt* file. List of languages is saved in *lang\langList.txt* file. This file contains names of language files, which editor loads after startup. In lang. file is stored one definition on every line - is necessary to abide order and number of lines.

Skin definition is saved in *skin\skin.txt*. The file contains names of pictures and colors definition, which editor loads after startup.

Chapter 4

Using the editor

4.1 Preparation

- After loading required mission in Mafia please switch to operating system, run Road.bin Editor and open (*File* → *Open...*) *road.bin* file of equivalent mission.
- Then run *Mafia.GetPos* tool.
- If you move with player in the game you can see in *Mafia.GetPos* updating coordinates by actual position.
- To generate points click to *Export to difference file* (*Ctrl + E*) and save *diff\CHED.chg* file. Saved are points, which are in range defined in input follow of actually selected point. To show them in the game hit *F1* - objectives.
- You can also use *Mafia World Editor* to find coordinates.

4.2 Creating points

- If you are using *Mafia.GetPos* then place player in the desired location, where you want to create point.
- Then open *Insert point* panel *Edit* → *Insert point...* (*Ctrl + I*), select tab with required point and in *Mafia.GetPos* copy to clipboard (*Ctrl + C*) single line data, which contains three coordinates of player.
- To paste new coordinates click on button next to coordinates. Then fill other parameters (see table above). Then click on *Insert* to insert new point.
- Repeat previous three steps to create required number of points in the mission area.
- Meanwhile, you should check location of points in the game by exporting a difference file and hitting *F1* key.

4.3 Creating links

- You can create links in main window of editor.
- In table above are explained all types of links to correctly link points.
- After all modifications you have to *recalculate far cross point distances* in *Attributes manager*.

4.4 Editing and deleting points and their links

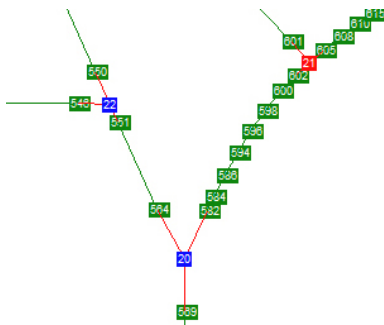
- You can use main window for manage points and links. To delete point click on *Edit* → *Delete point (Delete)*.
- To delete link set the input to value -1.

4.5 Saving

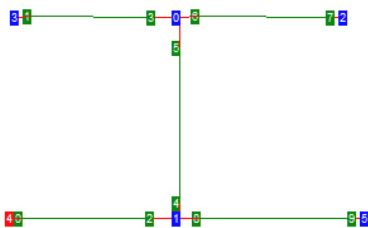
- To save file click on *File* → *Save*.

Appendix A

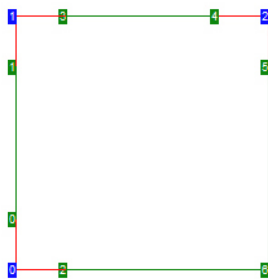
Creating navigation rules



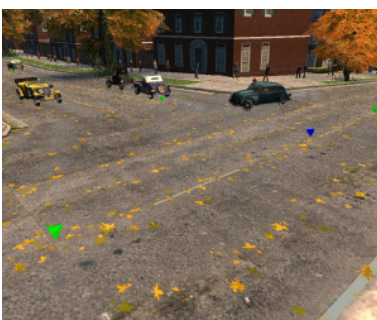
Road between cross points (blue) must contain at least two way points (green). You cannot link cross point directly or with only one way point. Way points are sorted by position in X axis. Red point (here it is cross point) is actually selected point in the editor.



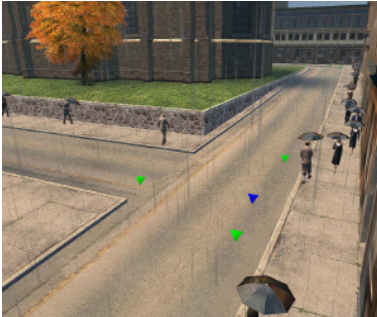
At the end of the road must be cross point too - cars be able to return.



Closed loop must contain at least three cross points.



When you are creating a road with three lanes, you have to place the points to notional centers of road where are the opposite lanes passed. Then, first cross point must have set two lanes and the second cross point from opposite direction must have set one lane.



One way is similar, but in opposite direction doesn't set far active cross point link - this avoids to generate cars in opposite direction.



In cross road mustn't have all directions a priority 1 — 100, because if in all directions were cars, arises deadlock - cars in first direction wait, until cars in second direction ride and in second direction cars waits too, until cars in first direction rides. The center of cross road is free.

If all directions have priority 0 — 100, may arise deadlock too, because branching cars can cross the way each other and they stops.

Appendix B

Erasing sectors

Exported points in the *CHG* file are visible only in the *Primary sector*. But problem is, if you need to visualize point in the interior, whose rooms are in own visual sectors. Points cannot be seen in these sectors.

Sectors and other Zmodeler unsupported objects (glow objects, etc.) can be removed by copying the *4DS* file into the same folder as the program *sector_del.exe*. In this case it will be *scene.4ds* file from the mission. After run the application is the file automatically removed. To show details, run the application via the terminal.

Is strongly recommended to **backup** the original file, because the application it irreversibly change.

Appendix C

The definition and modification of objects in the scene2.bin file dependent on the road.bin file

C.1 Traffic

To use navigation map by traffic, you need to insert them into *scene2.bin* file as object with type: point and object definition with equivalent name and with type: *Traffic definition*. You can do this with *DCED 2* or *DNC Extractor*. Object of point type is standard point. Important is the definition of traffic. The mission can include only one traffic definition.

DCED 2 allows to create definitions of pedestrians, but *DCED 2* very often damages the *scene2.bin* files and editing pedestrians through this program doesn't work correctly. Therefore, there is described more secure way.

In *DNC Extractor* at first load the mission that contains traffic definition, eg *FREERIDE*. Then check required item in *Objects* list, eg *cars* and same item in *Objects definitions* list. Click to *Extract selected* program creates *DNC* files in *DNCes* folder in the folder where is *DNCExtractor.exe*. Reopen the application and load required mission. Then click to *Import*, select *DNC* files and save the file.

Caution: if the mission was before saved in *Mafia World Editor*, you need to open mission in this editor and delete (shortcut *Del*) **point** called *Primary Sector* (if this point exist). The point has a same name as standard sector, called *Primary sector*. You can identify this point: if you select a sector called *Primary Sector* everything will be red, but if you select point called *Primary Sector* scene will be same.

Then save the mission. If the **point** isn't in the mission, just resave the mission.

Address	Hex Data	ASCII Data
0x322D60:	0D0A 7265 7475 726E 21AE 9902 0000 23AE	return
0x322D70:	0B00 0000 6361 7273 0022 AE0A 0000 000C	cars
0x322D80:	0000 0024 AE7E 0200 0005 0000 0000 00B4	
0x322D90:	4300 0096 4300 00AA 4364 0000 0013 0000	
0x322DA0:	0074 6178 6900 0000 0000 0000 0000 0000	
0x322DB0:	0000 0000 0000 0080 3F01 0000 0000 0000	
0x322DC0:	0066 6972 6500 0000 0000 0000 0000 0000	
0x322DD0:	0000 0000 0000 0080 3F01 0000 0000 0000	
0x322DE0:	0070 6F6C 696D 5475 6400 0000 0000 0000	polimTud
0x322DF0:	0000 0000 0000 0080 3F01 0000 0001 0000	€?
0x322E00:	0062 7569 6761 6E67 0000 0000 0000 0000	buigang
0x322E10:	0000 0000 0000 0080 3F01 0000 0000 0101	€?
0x322E20:	0046 6F72 4163 6F75 0000 0000 0000 0000	ForAcou
0x322E30:	0000 0000 0000 0080 3F01 0000 0000 0000	€?
0x322E40:	0063 6164 5F66 6F72 6400 0000 0000 0000	cad_ford
0x322E50:	0000 0000 0000 0080 3F01 0000 0000 0000	€?
0x322E60:	0063 6F72 6463 6100 0000 0000 0000 0000	cordca
0x322E70:	0000 0000 0000 0080 3F01 0000 0000 0000	€?
0x322E80:	0066 6F72 6474 636F 0000 0000 0000 0000	fordtco
0x322E90:	0000 0000 0000 0080 3F01 0000 0000 0000	€?
0x322EA0:	0066 6F72 5672 6F00 0000 0000 0000 0000	forVro
0x322EB0:	0000 0000 0000 0080 3F01 0000 0000 0000	€?
0x322EC0:	0068 7564 666F 7200 0000 0000 0000 0000	hudfor
0x322ED0:	0000 0000 0000 0080 3F01 0000 0000 0000	€?
0x322EE0:	0063 6865 6D61 466F 7200 0000 0000 0000	chemaFor
0x322EF0:	0000 0000 0000 0080 3F01 0000 0000 0000	€?
0x322F00:	0062 6C61 636B 0000 0000 0000 0000 0000	black
0x322F10:	0000 0000 0000 0080 3F01 0000 0000 0101	€?
0x322F20:	0061 6972 666C 466F 7200 0000 0000 0000	airflFor
0x322F30:	0000 0000 0000 0080 3F01 0000 0000 0000	€?

Cars disappear by reaching the outer radius from player: *red - float.*

On the navigation map can be generated number of cars specified by: *green* - *unsigned int*.

When you are editing this file with hex editor you **mustn't change length** of file.

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C.2 Semaphores

Semaphore is model, which contains objects with reserved names *RED*, *ORANGE* and *GREEN*, which are used as signals. Model of semaphore must be inserted in *scene2.bin* as *Model Object*, which name must begin by reserved word in scene: *semafor* (there are another reserved names too, for example: *watercity*, *taxi*, etc.).

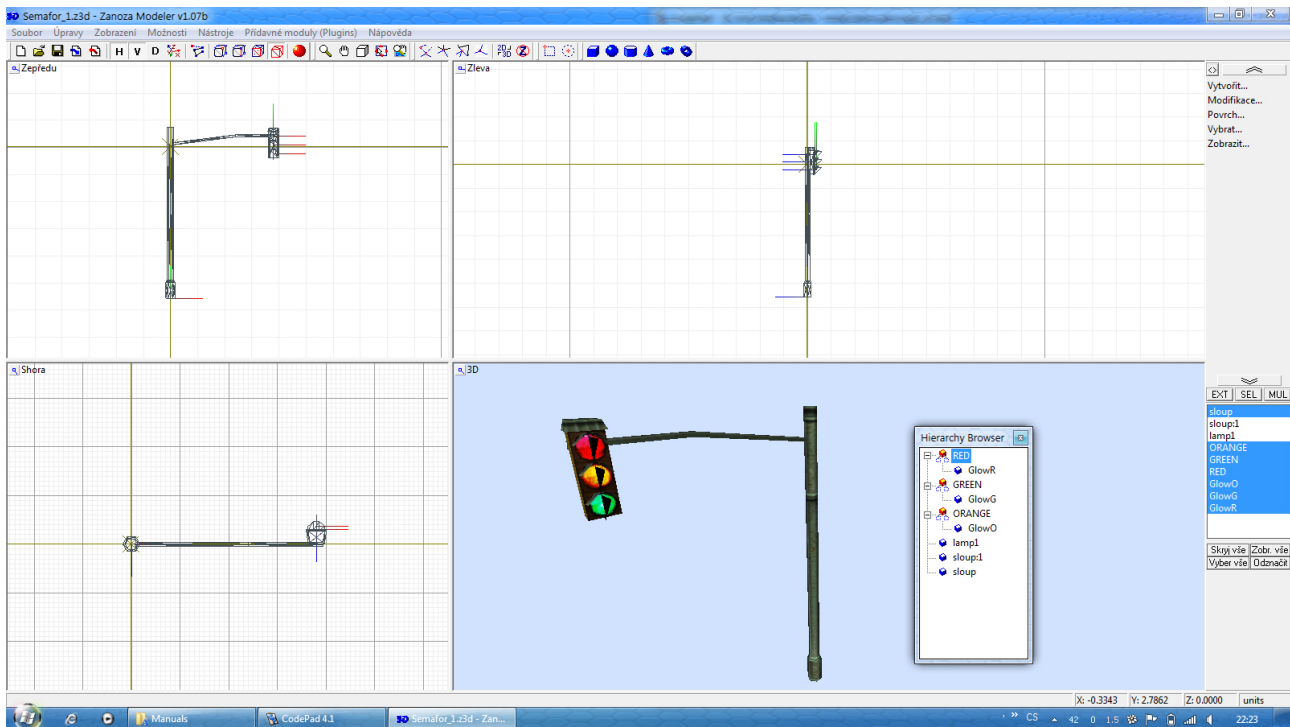


Figure C.2: Model of semaphore, here variant with linked glow objects.

Note: when you are creating glow objects, you have to create object with only one polygon (important is origin of this object, because from it will be created glow object), apply to him wanted material (usually *Mix with color*) and correctly link object to main light in model hierarchy (Tools → Hierarchy → Browser...). After export open model in hex editor and 48 bytes before the name of object change data *01 00 00 2A* to *01 06 00 2A* and change 115 bytes after the name of glow object to *00 01 00 00 00 00*. For check: after this data is double of bytes with ID of used material.

C.3 Police roadblocks

Place designated to create roadblock is defined as *DUMMY* object in model. Name of object must begin *ROADBLOCK* and must be placed near to road. Whole model must be inserted in *scene2.bin* file as *Model Object*, whose name must begin by reversed name in scene: *watercity*.

Better is create roadblocks on background, eg on imported scene (to import you have to delete sectors and then change byte before lenght of sector object name to 09 - constant for all standart objects). For model of roadblock you can use in Zmodeler model of cube from primitives. After creating, you have to change type of the object from standard to *DUMMY* object: Tools → Filters → Mafia → Object Settings...

Roadblock is generated in the whole width of road and must be active police wanted status with a gun. To create roadblock is randomly chosen police car or nail strip. Maximum count of these objects is 15, at the moment. Number of policemen isn't limited.

Model of tail strip is *barrier.4ds* and puncture is solved internally. Tail strips disappears when wanted level is ended.

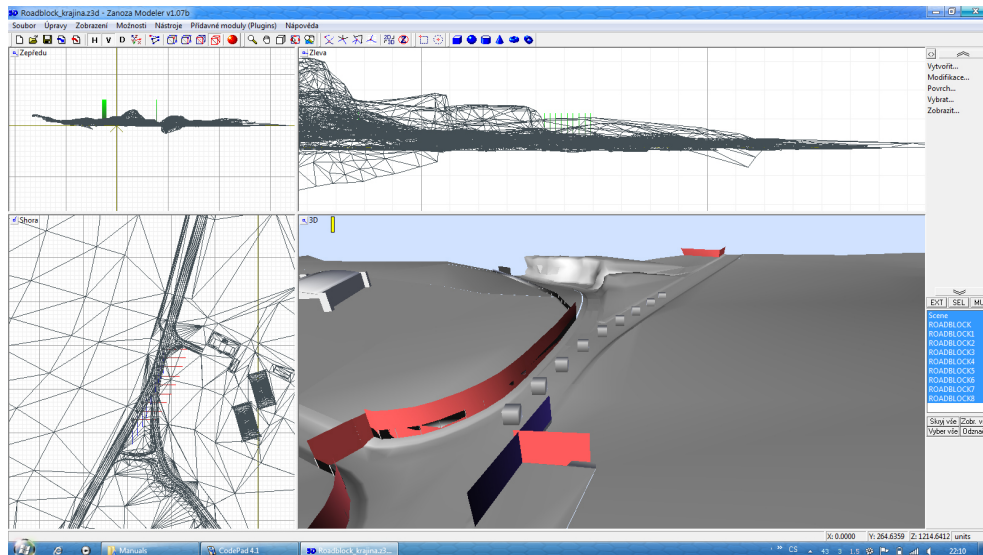


Figure C.3: Creating of DUMMY objects for roadblocks. As background is here scene.4ds model from FREEKRAJINA mission.



Figure C.4: Example of roadblocks in the game.

Appendix D

Converting numbers

Unsigned int is stored in hex form. Float is real number stored according to standard *IEEE 754* in form: sign * 2^{pow} exponent * mantissa.

Numbers are usually stored from least significant byte to most significant byte. It means, when you are converting numbers you have to reverse the order of bytes.

For example - integer: decimal form: 22 384 hex form: 00 00 56 12 stored form: 12 56 00 00.

For example - real number: decimal form: 15.256 hex form: 41 74 18 93 stored form: 93 18 74 41.

Integer numbers you can convert in calculator.

Real numbers you can convert with online convertor: <http://www.h-schmidt.net/FloatConverter/IEEE754.html> or in program *Base Converter* and or directly in hex editor *Hex Workshop*.

If you are using *Base Converter* you have to set the byte order to *Intel* and data type to *float (32)*. Then you directly copy quaternions of bytes (without reversing the order) from hex editor to converter.