3 Creating an evaluation

This chapter of the *User Guide* identifies and describes the inputs required to create a standard evaluation. It is essential that system users be familiar with the processes described in this chapter as it is the platform for further project evaluation work while using CBA6. Processes common to all types of project evaluation are covered in this chapter.

This section outlines the process required, including when and how inputs are to be specified within CBA6, to create project evaluation files.

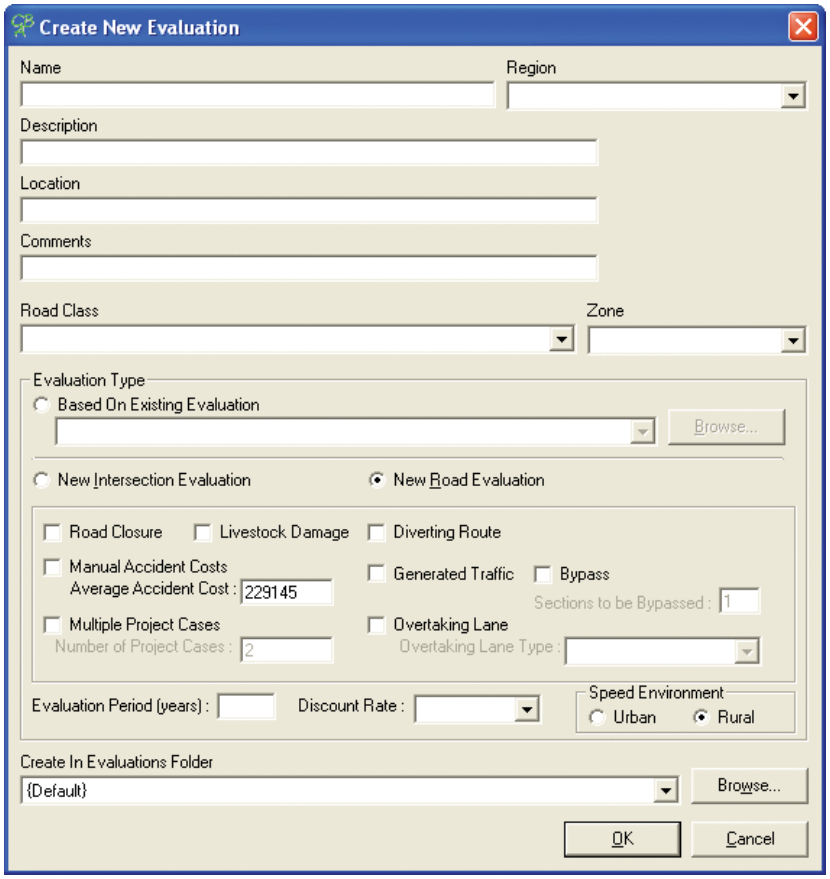
3.1 Create new evaluation

To begin a road project evaluation it is important that the system user has all the required information. This includes all basic entered data and a detailed understanding on the type of project the system user is attempting to evaluate (including relevant issues and method development). Once this information and understanding is attained, the system user will then be ready to undertake a new evaluation.

To create a new evaluation, go to the evaluations menu and select 'create new evaluation', see Figure 24.

Sections 3.1.1 to 3.1.12 explain the features of the 'create new evaluation' screen.

Figure 24: Create new evaluation screen



3.1.1 Name

Enter the name of the new project into this field. There is a 20-character limit. For example, '85-10c-42' or 'overtaking lane upgrade'.

3.1.2 Region

System users should select the region where the project is geographically located from the drop-down menu. These regions are:

- Central West
- Darling Downs
- Far North
- Fitzroy
- Mackay/Whitsunday
- Metropolitan
- North Coast
- Northern
- North West
- South Coast
- South West
- Wide Bay/Burnett.

Note: The selection of region has no bearing on the results of the CBA.

3.1.3 Description

The description of a new project, including the type, is entered into the 'description' field. For example, '2 km head-to-head overtaking lane' or 'timber bridge replacement'.

3.1.4 Location

This field enables the system user to provide more specific information on the location of a project. For example, '2 km west of Bundaberg' or alternatively, the chainage of the road could be used.

3.1.5 Comments

The system user can use the 'comments' field to provide generic information about a project or any other relevant information that needs to be mentioned. For example, 'this project involves several overtaking lanes'.

3.1.6 Road class

There are four categories of functional road class. The corresponding class of a project should be selected from:

- national
- state strategic
- regional
- district.

3.1.7 Zone

The four types of zones that can be selected in the drop-down menu are:

- dry reactive
- dry non-reactive
- wet reactive
- wet non-reactive.

These zones reflect soil types and weather conditions within a project section. The selected zone alters the deterioration rates of pavement types. Pavement deterioration is covered in further detail in Section 5.1.

3.1.8 Evaluation type

A new evaluation can be created from the following options:

- based on existing evaluation
- new intersection evaluation
- new road evaluation.

3.1.8.1 Based on existing evaluation

When system users select the 'based on existing evaluation' option, CBA6 will re-create an existing evaluation of their choice. It may be useful to re-create an existing evaluation to test the CBA results when changing an input variable, such as traffic volumes, see Section 4.6.3.

3.1.8.2 New intersection evaluation

CBA6 can be used to create intersection evaluation files. Intersection evaluations are shown in detail in Section 5.5.

3.1.8.3 New road evaluation

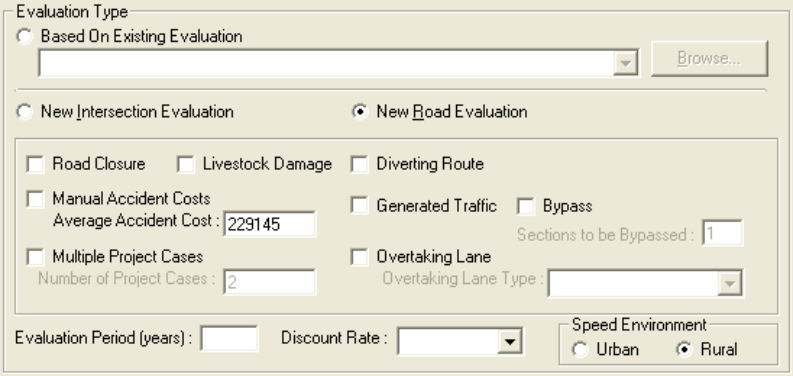
The new road evaluation option allows the system user to assess a range of road evaluation types, other than intersection evaluation. These CBA6 project modules include:

- road closures
- livestock damage
- diverting routes
- manual accident costs – detailed safety analysis
- generated traffic
- bypasses

- multiple project cases
- overtaking lanes.

Each of these modules is discussed in Section 4.6.3.

Figure 25: Evaluation type options



3.1.9 Evaluation period

The evaluation period includes the initial period of capital investment and the subsequent period over which the benefits of the project accrue. The evaluation period entered into this field should allow sufficient time to include design and implementation. For further detail or clarification on the evaluation period, see Section 4.1.1 of the *Theoretical Guide*.

3.1.10 Discount rate

The discount rate can be set at the appropriate rate required by the decision maker.

Note: When the system user selects 'road class' from the drop-down option, a default rate will be selected in the 'discount rate' field. The default for a national highway is 7% while state strategic, regional and district road classes are defaulted to 6%. Please seek specialist advice on the choice of discount rate. See Section 1.5 of the *Theoretical Guide* for further information.

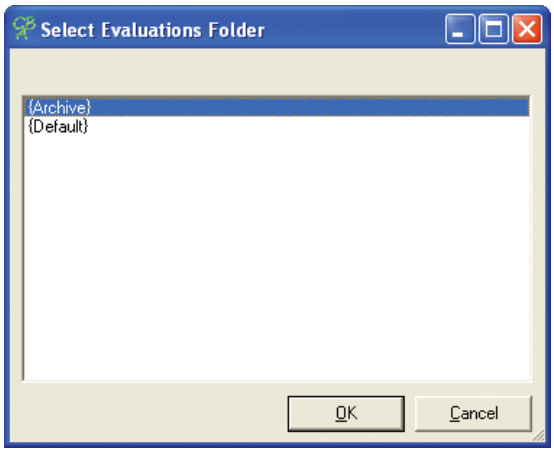
3.1.11 Speed environment

CBA6 allows the system user to choose between a rural or urban speed environment. This selection of speed environment only alters the TTC and the average accident cost to reflect the classification; it does not provide any additional measures to quantify urban evaluations.

3.1.12 Create in evaluations folder

The ‘create in evaluations folder’ option enables the system user to save the newly created evaluation in a folder of their choice. System users can browse through the default folder options and also user created folders, see Figure 26.

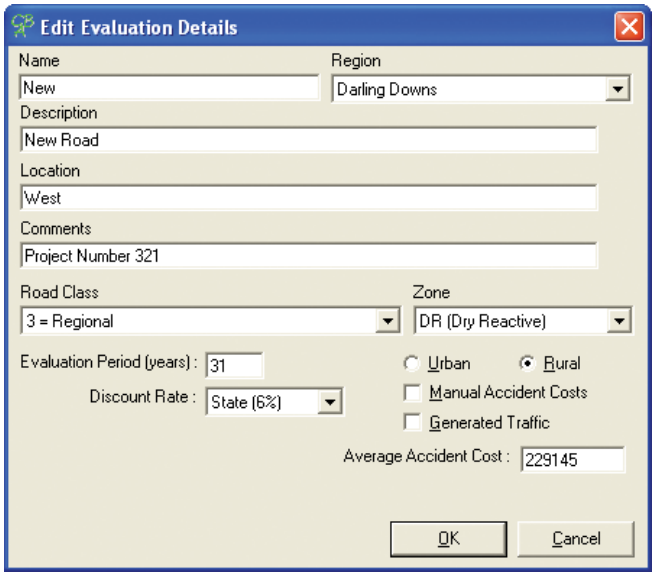
Figure 26: Create in evaluations folder



3.2 Edit evaluation

The ‘edit evaluation’ feature is found in the evaluations menu. To change minor details originally selected in the ‘create new evaluation’ screen during the evaluation, the system user is able to use the ‘edit evaluation’ function within the CBA6 tool, see Figure 27.

Figure 27: Edit evaluation



Note: Many of these changes will have no bearing on data already entered into the evaluation. However, editing the evaluation period, environmental zone, discount rate, speed environment, average accident cost and inclusion of manual accident costs will delete much of the previously entered data.

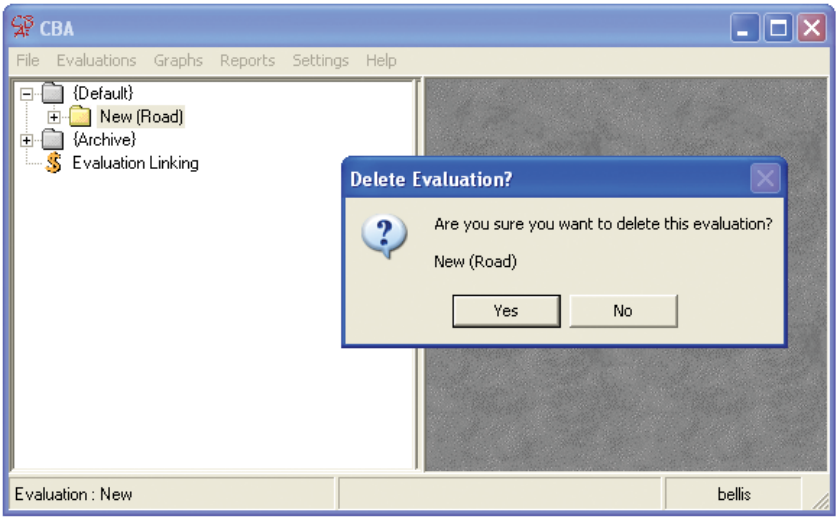
The ‘edit evaluation’ screen for overtaking lanes shows the type of overtaking lane used in the evaluation, see Figures 87, 97 and 106.

3.2.1 Delete evaluation

To delete an evaluation, highlight the appropriate evaluation and select ‘delete evaluation’ from the evaluation menu. Select ‘yes’ and the evaluation will be removed from the workspace, see Figure 28.

Note: Both edit and delete evaluation functions can be accessed through right clicking the mouse on the selected evaluation as displayed in the node tree and then selecting the function.

Figure 28: Delete evaluation



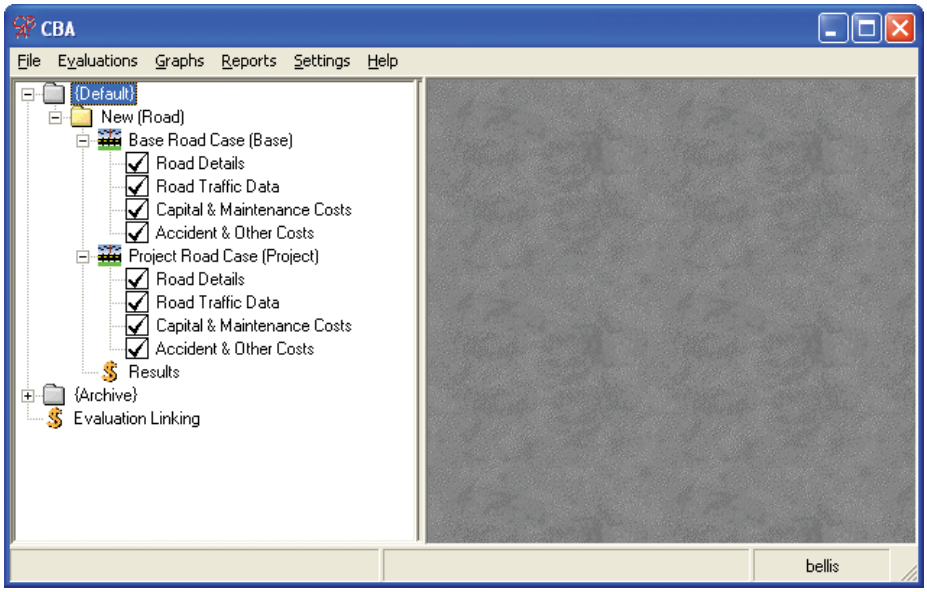
3.2.2 Evaluation linking

CBA6 can be used to link a number of individual project evaluation files. For information on how to link evaluation files, see Section 4.5.1.

3.3 CBA6 workspace

The CBA6 workspace is designed for user-friendly operation, identifying all current evaluation files and encompassing a visual navigation pane on the left hand side of the interface. This navigation pane allows quick access to system user projects and provides access to individual evaluation tasks, see Figure 29.

Figure 29: CBA6 workspace with new evaluation



The base and project case details can be found in the navigation pane under the title of the evaluation. The node tree structures show all components of the evaluation, see Figure 29. The components are:

- road details
- road traffic data
- capital and maintenance costs
- accident and other costs.

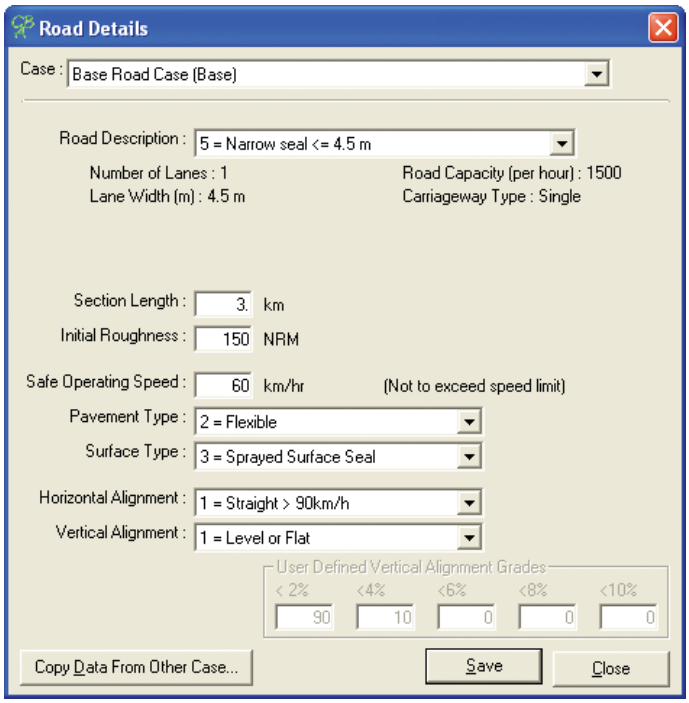
The details of each component screen are discussed further in Sections 3.4 to 3.7. For more advanced modules there will be additional input components to those mentioned above. Advanced modules are discussed in Section 5.

Note: Once these components are completed for both the base and project cases, a tick will appear to mark the completion of each component. Upon start-up of a new evaluation only the 'road details' and 'road traffic data' components will be available. After the system user has provided the necessary input in these fields, the other components will become available.

3.4 Road details screen

The 'road details' screen requires the system user to enter road project data characteristics for the base and project cases.

Figure 30: Road details screen



3.4.1 Case

The case drop-down menu is used to toggle between the base case and project case. Prior to switching between the base and project cases, ensure all input data has been saved.

3.4.2 Road description (model road state)

When undertaking an evaluation, the system user should select the appropriate road description for both base and project cases. The selection is based on model road state categories, which are identified in Appendix G of the *Technical Guide*. Model road state or MRS is used to categorize a specific road type. For example, in CBA6 a single carriageway two-lane road with a seal width of 7.4 metres is defined as MRS10. The MRS used in ARMIS and other sources may not always be consistent with CBA6. In the first instance, system users should set the road description and MRS in CBA6 to the seal width of the current road or project.

The model road state is used to determine the capacity of the road and is therefore an input variable used to calculate the congestion level and operating speed of the fleet.

3.4.3 Section length

The section length represents the full length of both base and project cases in kilometres. In some instances the base case and project case section length may differ. For example, a realignment project may reduce the section length of the road, see Section 4.5.4.

3.4.4 Initial roughness

Roughness is the measure of the unevenness of a road surface. It is a useful term for the condition of a pavement, because it is a condition directly experienced by motorists. It is commonly reported in Australia by either the NAASRA Roughness Measurement (NRM) method (Austroads 2000), which is measured using the NAASRA Roughness Car, or by the International Roughness Index (IRI), which is calculated by applying an analytical 'quarter car model' to road profile data collected via laser profilometer. NRM can be reliably converted to IRI by a linear equation, and vice versa, where required. See Appendix H of the *Technical Guide*.

Historically, TMR has collected NRM using the Roughness Car, a dynamic response type device, and reported both NRM and IRI. NRM is the most readily used. For further information on this topic, see the QUT paper *Roughness Deterioration of Bitumen Sealed Pavements* (P Hunt and JM Bunker).

Table 1: Description of roughness values NRM(IRI)

Descriptive Condition	Ride Quality	Roughness Value NRM counts/km (IRI)
Excellent	Very smooth ride.	<40 (1.46)
Good	Some minor bumps encountered.	40 to 80 (2.97)
Fair	Constant small up and down movement, but reasonably comfortable driving.	80 to 110 (4.10)
Poor	Constant up and down and/or sideways movement. Can feel very rough in Trucks. Modern cars suspension makes car driving bearable, but with low comfort.	110 to 140 (5.23)
Very Poor	Uncomfortable rideability experiencing severe up/down and/or sideways movement. Drivers must maintain good control of steering and reduce speed in some circumstances.	>140 (5.23)

See Appendix H of the *Technical Guide* for conversion factors.

3.4.5 Safe operating speed

Operating speed reflects the safe operating speed for the fleet. Also known as posted speed, it is not to be confused with 'actual' vehicle operating speed, calculated separately, see Section 4 of the *Technical Guide*. Operating speed is deemed the maximum safe operating speed a vehicle should travel along a project route. CBA6 does not allow the fleet to travel any faster than this operating speed, therefore the posted or signed speed limit should be used.

3.4.6 Pavement type

There are three types of pavements used in CBA6. These are unpaved, flexible and rigid. Usually the pavement type will be defaulted to a corresponding classification as defined by the MRS. For example the default pavement type for MRS10 is a flexible pavement. The selection of pavement type affects the associated roughness deterioration profiles of the road.

3.4.7 Surface type

CBA6 has four choices of surface type: unsurfaced, primer seal, sprayed surface seal or asphaltic concrete. Usually the surface type will be defaulted based on the corresponding MRS. For example the default surface type for MRS10 is a 'sprayed surface seal'.

The sprayed surface seal will be the appropriate option for the majority of rural road projects. Concrete surface types, although used less often, are mainly used for national highways and motorways. Primer seals are used infrequently, generally for low-use roads, and provide a basic seal for the road surface. Road deterioration is also influenced by the selection of surface type.

3.4.8 Curvature

This option broadly defines the horizontal geometry of the road. CBA6 has three categories to select the curvature of the project site:

- straight
- curvy
- very curvy.

As an estimated guide for selecting the appropriate alignment category for a project site, apply the following:

- If AHSPD ≥ 90 km/h or less than 15% of the section is in a curve, the curvature = straight.
- If 90 km/h ≥ AHSPD ≥ 75 km/h or if 15% to 75% of the section is in a curve, the curvature = curvy.
- If AHSPD ‹ 75 km/h or if more than 75% of the section is in a curve, the curvature = very curvy.

Where:

- AHSPD = speed numeric reflecting the weighted average of curve design speed in a road section

Selection of the horizontal alignment of the road aspect will impact the road user costs, notably the operating speed of the fleet and tyre costs. For more information on tyre wear costs, refer to Section 4.3 of the *Technical Guide*.

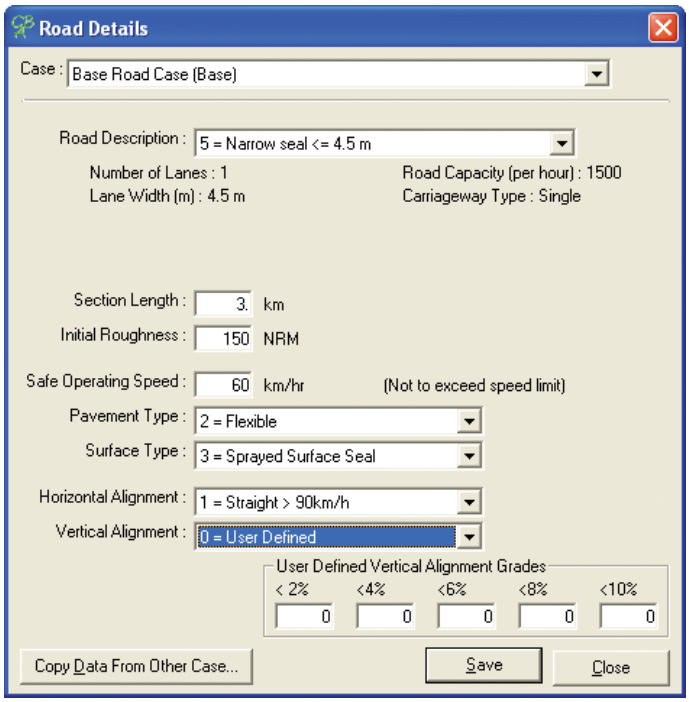
3.4.9 Vertical alignment

The vertical alignment refers to the proportions of current and proposed grade of the road section. The vertical alignment selection in CBA6 can be modified for project specific gradients (user defined) or from predetermined default selections. Selection of horizontal and vertical alignments will result in associated changes in operating speeds (see Section 3.1 of the *Technical Guide* for information on the effect the vertical gradient has on traffic volume measurements). The selection options for vertical alignment are:

- level or flat
- rolling or undulating
- mountainous
- user defined, see Figure 31.

When the predefined gradient proportions are unsuitable for a particular road segment and defined vertical alignment data is available, the system user can select ‘user defined’, located below the default alignments, to select the suitable alternative gradient specifications. The input fields represent the percentage of road which falls into the respective gradient categories, see Figure 31. These entered grades must equal 100%.

Figure 31: User defined alignment



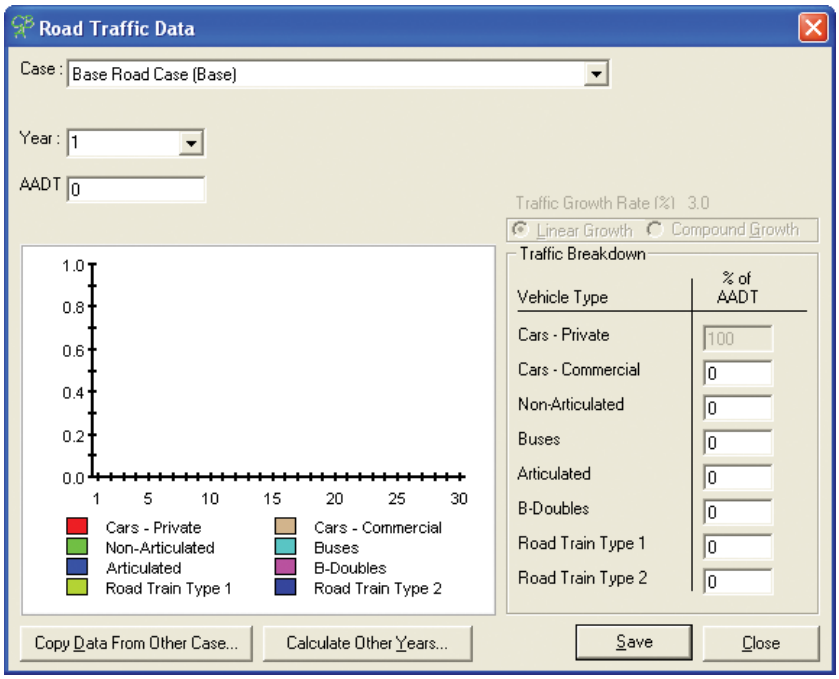
3.4.10 Copy data from other case

This option is used to quickly copy data from one case to another. For example a system user can copy base case data into the project case input screen. This option is useful when there are only a few changes in the CBA6 inputs between the base and project cases, see Section 3.8.

3.5 Road traffic data screen

The 'road traffic data' screen identifies the traffic flow, composition and growth over the life of a project, see Figure 32. Sections 3.5.1 to 3.5.4 explain the features of this screen.

Figure 32: Road traffic data screen



3.5.1 Case

The case drop-down menu is found in a number of CBA6 input screens and used to toggle between the various base and project cases traffic data.

3.5.2 Year

The year drop-down menu gives the system user access to individual years of the evaluation. System users can manually input or change traffic data for a given year.

Note: The number of years in the evaluation is specified in the 'create new evaluation' screen, see Section 3.1.9.

3.5.3 AADT and traffic breakdown

AADT refers to annual average daily traffic. This is a measure of road use by all vehicles at a daily equivalent rate. Typically, traffic data is gathered over a period of time using surveys and traffic counting devices. Where AADT volumes are not available for a given road segment, it is recommended that project-specific surveys are undertaken to provide basic data.

In the 'road traffic data' screen, CBA6 provides the system user with the following options for input:

- manually entering AADT for each year, see Section 3.5.3.1

- calculating other years function (using a linear or compound growth rate), see Section 3.5.3.2
- combining both, see Section 3.5.3.3.

Once AADT volumes have been sourced for a project, they must be disaggregated for use in CBA6. There are eight vehicle types used in CBA6, which correspond with Austroads vehicle clarifications, see Appendix E.

The vehicle types used in CBA6 are:

- cars – private
- cars – commercial
- non-articulated
- buses
- articulated
- B-doubles
- road train type 1
- road train type 2.

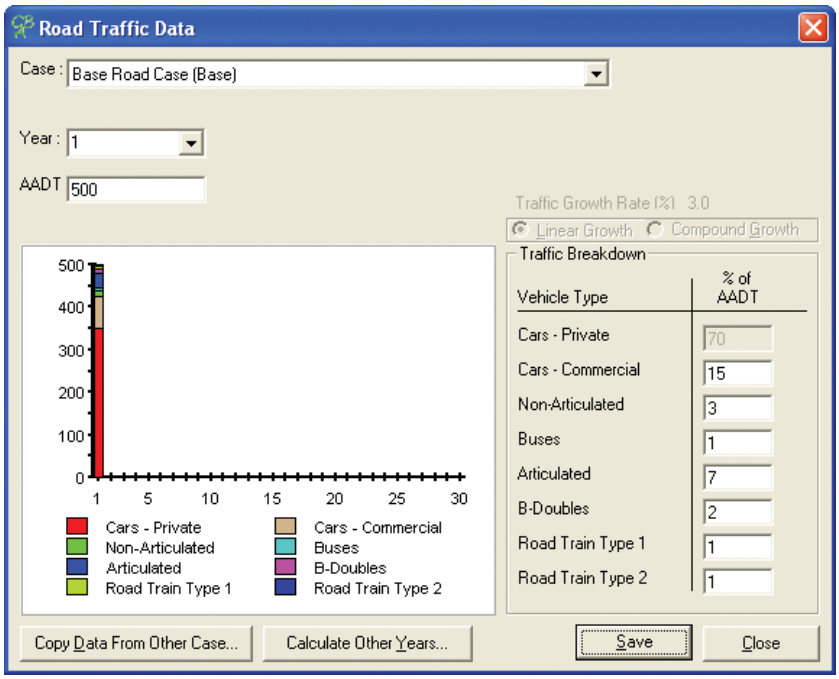
If AADT is given in vehicle numbers, then the percentage breakdown per vehicle type must be calculated prior to entry into CBA6.

Note: CBA6 automatically generates the private vehicle composition as the residual of the total AADT once other vehicle types are entered. The traffic breakdown screen is also the input source for livestock damage. For further information on livestock, see Figure 53.

3.5.3.1 Manual input

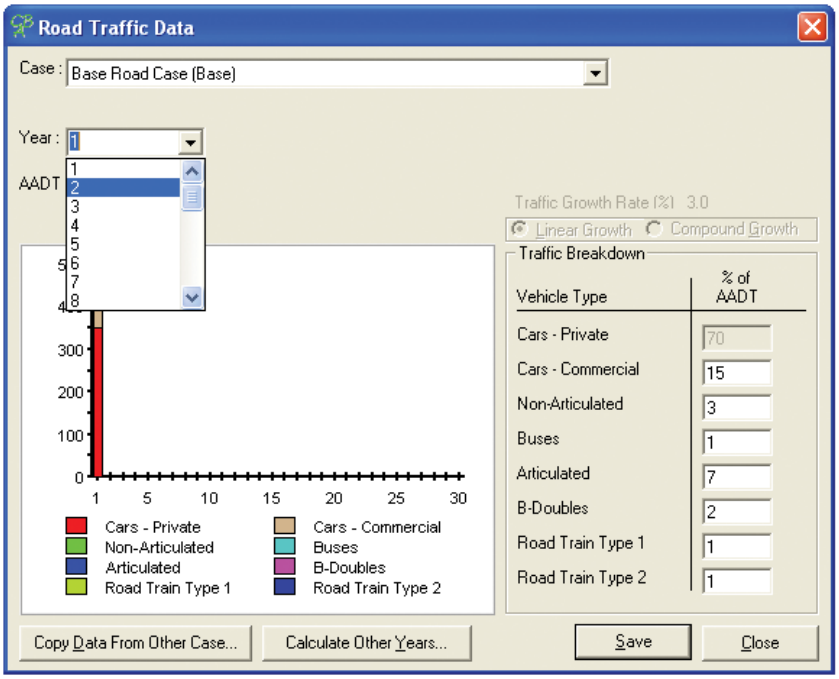
CBA6 will automatically generate traffic given an initial AADT and growth rate. To manually enter traffic data for each year, the sytem user enters AADT and a traffic breakdown, see Figure 33.

Figure 33: Manual traffic data entry – year 1



As shown in Figure 34, system users then select year 2 from the drop-down menu and input the relevant data for this year. This process is continued until all years of the evaluation period have been populated.

Figure 34: Manual traffic data entry – year 2

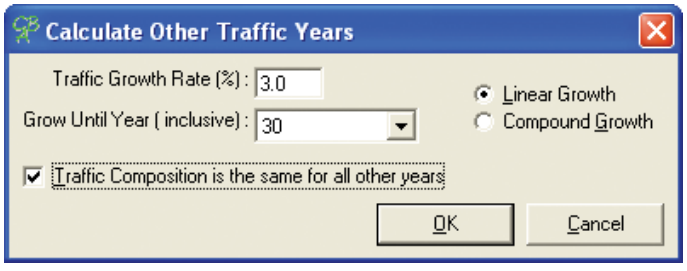


3.5.3.2 Calculate other years

To automate the population of traffic data over the entire evaluation period, CBA6 allows the system user to choose a simple linear growth rate or a compound rate to forecast future traffic growth, see Figure 35.

Note: Future predictions of traffic flows and subsequent growth are usually site specific and can be derived from future land use and road network projections. Growth rates can vary in complexity, but are often simply modelled from regional population growth forecasts.

Figure 35: Calculate other traffic years



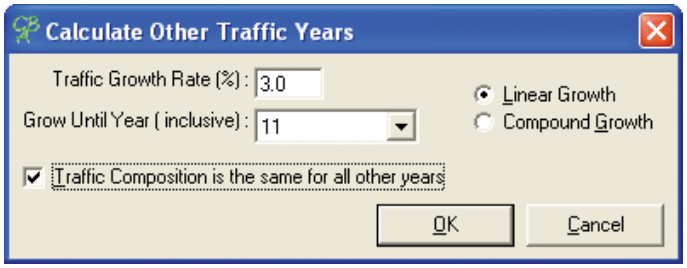
The base and project cases usually have the same traffic data inputs, however the provision of new infrastructure can lead to new or generated traffic, increasing the expected demand in the project case.

Note: If a road project is likely to change the traffic demand or breakdown between the base case and the project case, system users must use the 'generated traffic' or 'change in MCV' methodology where appropriate, see Figures 54 and 55.

3.5.3.3 Change in growth or breakdown

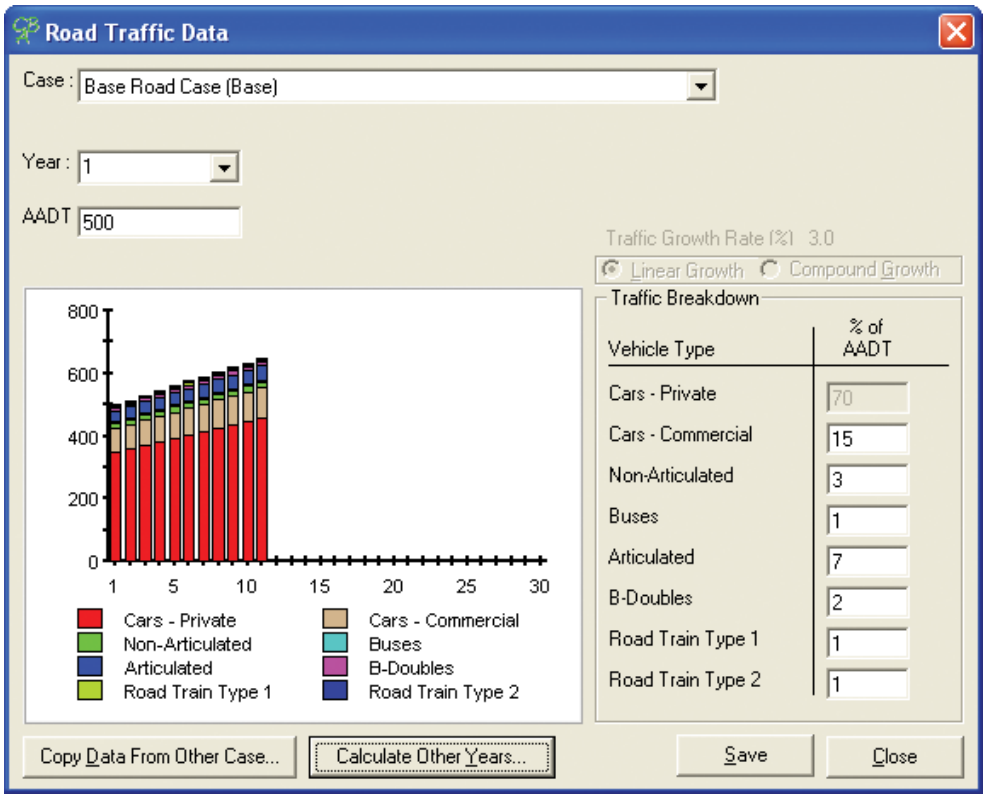
In some circumstances, traffic growth may change in future years given the influence of external factors. For example, a new mine may open causing an increase in the number of heavy vehicles using the road. CBA6 can be used to account for this change in traffic growth, see Figure 36.

Figure 36: Traffic growth from year 1 to year 11



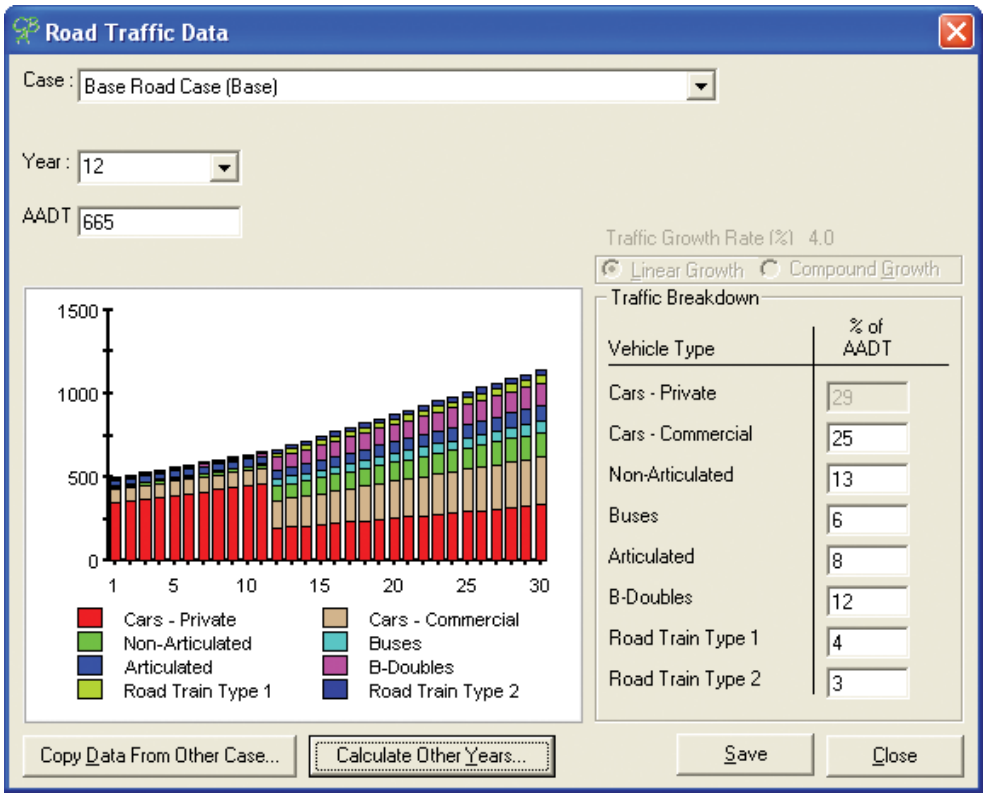
Traffic grows at 3% linear from year 1 to year 11, see Figure 37.

Figure 37: Traffic AADT from year 1 to year 11



From year 12, the traffic composition and growth rate changes. The remaining years of the evaluation are forecast as shown in Figure 38 using the 'calculate other years' function starting from year 12.

Figure 38: Traffic from year 12 to year 33



3.5.4 Copy data from other case

Traffic data can be copied from the base case to the project case using the 'copy data from other case' feature, see Section 3.8.

3.6 Road capital and maintenance costs screen

The 'road capital and maintenance costs' screen in CBA6 shown in Figure 39 is used to capture whole-of-life costs. In the base case, the anticipated costs in the absence of a project should be included over the life of the evaluation, while in the project case, costs should include any additional costs or savings in maintenance borne by a project. Typically, projects such as road widening works may require additional maintenance costs (i.e. due to increased surface area), however new technology or pavement designs may reduce extensive rehabilitation costs, effectively creating a whole-of-life maintenance saving.

The *Department Asset Management Guidelines* (2002) categories of pavement maintenance are:

- routine maintenance
- programmed maintenance – road resurfacing and/or bulk routine maintenance
- rehabilitation.

Inflation should be excluded from all maintenance costs entered into CBA6, i.e. include only real costs of maintenance. For an example of increasing real costs of maintenance, see Section 3.6.7.

Figure 39: Project case capital and maintenance cost screen

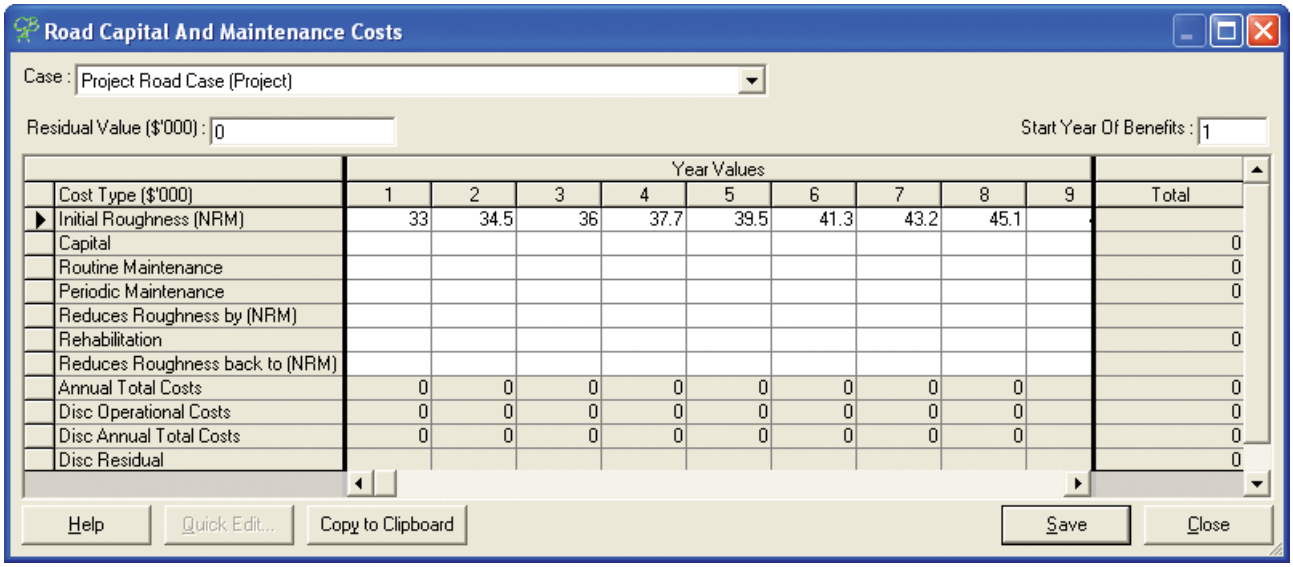
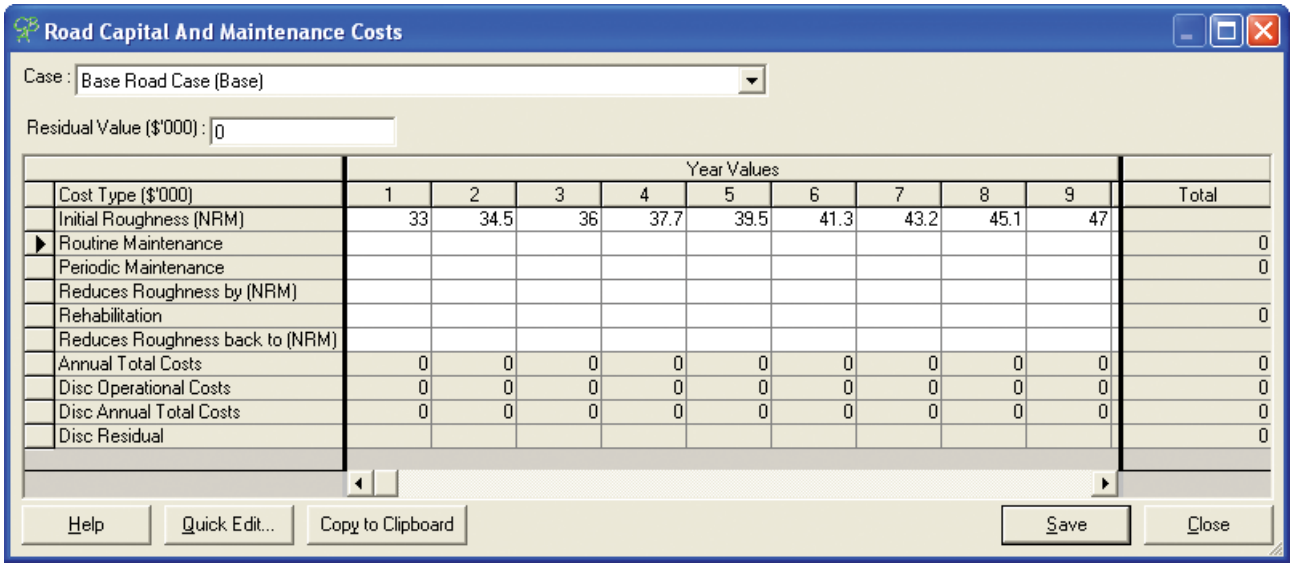


Figure 40: Base case capital and maintenance cost screen



3.6.1 Capital

Capital costs are the initial outlay or one-off investment costs needed to set up a project. These are the start-up costs required to build the road infrastructure, including any labour costs used in construction of a project.

Note: Depreciation is excluded from the analysis as the full cost to the community of the asset is determined at the time of consumption. To include depreciation would therefore distort the assumption behind the discount rate.

3.6.2 Routine maintenance

Routine maintenance preserves the shape or profile of the pavement and amenities of the road corridor. Routine maintenance has no impact on road roughness.

3.6.3 Periodic maintenance

Programmed maintenance is referred to as 'periodic maintenance' in CBA6. Periodic maintenance can have an impact on road roughness and usually reduces roughness by a factor of NRM. For example, periodic maintenance reduces roughness by 5 NRM. Periodic maintenance usually occurs at 5 to 10-year intervals.

3.6.4 Rehabilitation

Rehabilitation refers to the full reconstruction of the road surface and usually occurs at longer intervals than other types of maintenance. Rehabilitation works usually return the road to its original design roughness. For example rehabilitation reduces roughness back to 55 NRM.

3.6.5 Residual value

A residual value can be entered for both the base case and project case. The residual value is used to incorporate the additional value of the asset after the end of the evaluation period. For example, a road asset may have a useful life of 50 years, however the evaluation is undertaken over a 30-year period. To account for the remaining 20 years of useful life, a residual value is incorporated in the CBA. See Section 9.7 of the *Technical Guide* for residual value calculation.

3.6.6 Start year of benefits

The 'start year of benefit' field specifies the completion and commission date of a project. For example, if a project takes 3 years to build, the start year of benefits will be year 4.

3.6.7 Quick edit

The predominant use of the 'quick edit' function is as an alternative to manually entering maintenance costs. The 'quick edit' function allows the system user to extrapolate yearly maintenance costs over the life of the evaluation or in the years in which it occurs. To use the 'quick edit' function:

1 select relevant maintenance category (routine, periodic or rehabilitation)

2 click 'quick edit'

3 select 'start year' and 'end year'

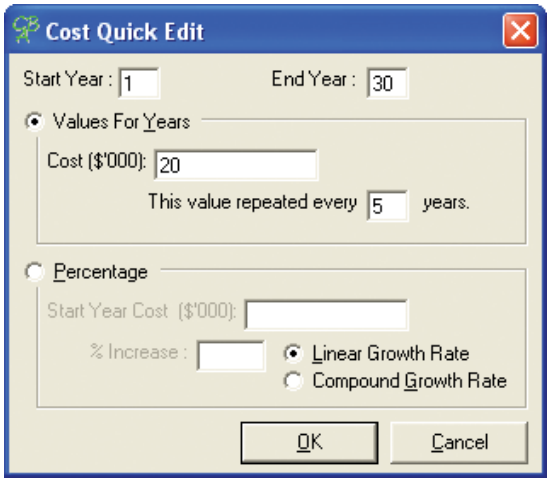
4 select either 'constant yearly value' or 'percentage' (growth function)

5 enter values

6 select 'ok'.

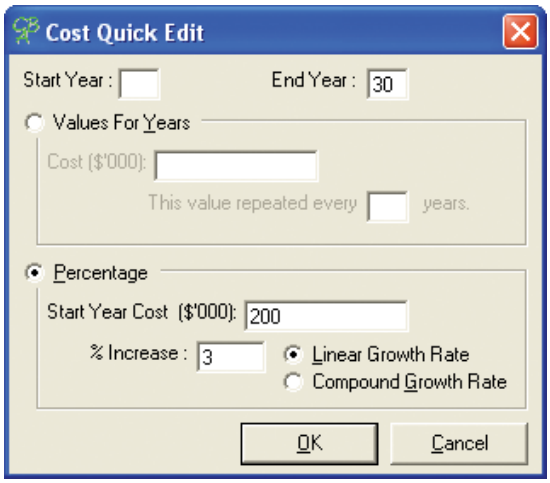
Figure 41 provides an example of $20 000 in maintenance costs spent every 5 years. To incorporate annual costs the system user would enter '1' in the appropriate field.

Figure 41: Cost quick edit constant value



To account for a change in costs each year the system user can incorporate a growth factor to the maintenance cost estimates. In Figure 59, $200 000 in costs is expected to increase by 3%. This may be warranted to maintain the road at its current roughness standard given future increases in traffic volumes.

Figure 42: Cost quick edit percentage increase



The 'quick edit' function also allows the system user to assign a consistent roughness modifier resulting from the associated maintenance costs. To quick edit the roughness modifier for periodic and rehabilitation maintenance categories:

1 select 'roughness modifier' (periodic and rehabilitation categories only), 'reduces roughness by' (NRM), or 'reduces roughness back to' (NRM)

2 select 'quick edit'

3 select 'start year' and 'end year'

4 input roughness modifier ('reduce roughness by' or 'reduces roughness back to')

5 enter repetition frequency

6 select 'ok'.

Figure 43 shows the 'quick edit' function for periodic maintenance.

Figure 43: Periodic roughness quick edit

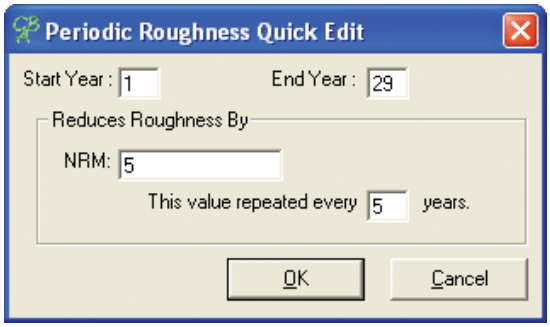
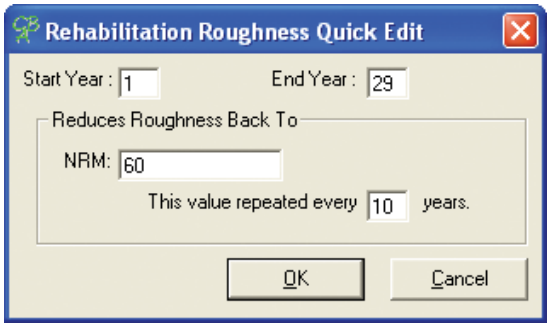


Figure 44 shows the function for rehabilitation.

Figure 44: Rehabilitation roughness quick edit



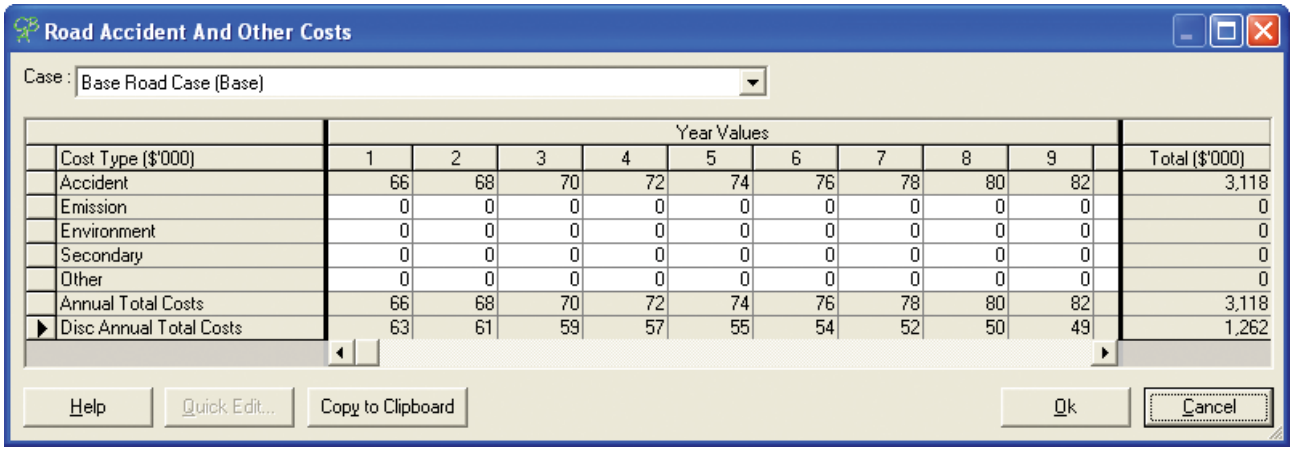
Note: Timing of the roughness reduction quick edit must match the timing of costs. For example, if costs occur in year 5, the 'reduces roughness' field must coincide with costs in year 5.

3.7 Road accident and other costs

The final input screen for a road evaluation is the 'road accident and other costs' screen, see Figure 45. CBA6 will automatically calculate the accident costs unless the system user specifies manual accident costs in the 'create new evaluation' screen. For more information on the manual calculation of accident costs, see Section 6 of the *Technical Guide*.

In this screen, system users are able to add additional costs that need to be included in the evaluation. These are usually externalities costs such as noise and emissions. For more detail on deriving user-defined externality costs, see Section 7 of the *Technical Guide*.

Figure 45: Road accident and other costs



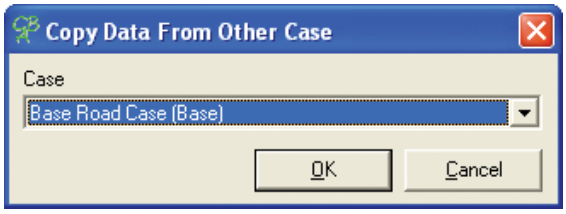
3.8 Copy data from other case

The 'copy data from other case' function, located at the bottom of both the road details and road traffic data screens of CBA6, allows the system user to directly copy all details from one case to another, i.e. base to project or project to base. This function is useful in scenarios where composition, volume and growth remain the same in both base and project cases. To copy data from one case to another:

- select case and screen to copy data to
- click 'copy data from other case'
- select 'case' to copy data from
- click 'ok'.

Note: To enable this function, one case (base or project) must be completed. The 'copy data from other case' screen can be seen in Figure 46.

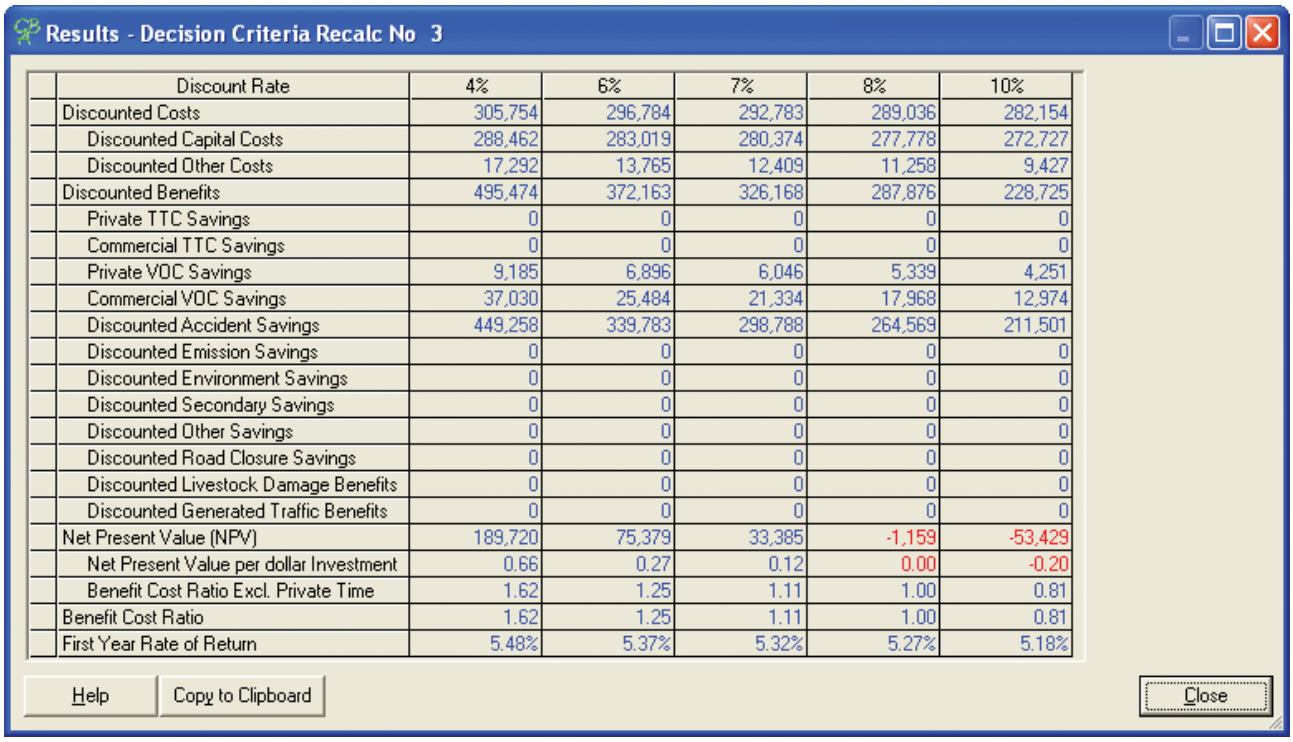
Figure 46: Copy data from other case



3.9 Copy to clipboard

The 'copy to clipboard' function allows the system user to copy data shown by CBA6 into other applications. The 'copy to clipboard' button is located in the capital and maintenance, accident and other costs, travel time, VOC and the results screens (see Figure 47). Once the data is exported, the system user is able to manipulate the format and presentation as necessary to suite any further analysis (e.g. manual amalgamation of multiple evaluation files) or reporting requirements.

Figure 47: Copy to clipboard – decision criteria



Discount Rate	4%	6%	7%	8%	10%
Discounted Costs	305,754	296,784	292,783	289,036	282,154
Discounted Capital Costs	288,462	283,019	280,374	277,778	272,727
Discounted Other Costs	17,292	13,765	12,409	11,258	9,427
Discounted Benefits	495,474	372,163	326,168	287,876	228,725
Private TTC Savings	0	0	0	0	0
Commercial TTC Savings	0	0	0	0	0
Private VOC Savings	9,185	6,896	6,046	5,339	4,251
Commercial VOC Savings	37,030	25,484	21,334	17,968	12,974
Discounted Accident Savings	449,258	339,783	298,788	264,569	211,501
Discounted Emission Savings	0	0	0	0	0
Discounted Environment Savings	0	0	0	0	0
Discounted Secondary Savings	0	0	0	0	0
Discounted Other Savings	0	0	0	0	0
Discounted Road Closure Savings	0	0	0	0	0
Discounted Livestock Damage Benefits	0	0	0	0	0
Discounted Generated Traffic Benefits	0	0	0	0	0
Net Present Value (NPV)	189,720	75,379	33,385	-1,159	-53,429
Net Present Value per dollar Investment	0.66	0.27	0.12	0.00	-0.20
Benefit Cost Ratio Excl. Private Time	1.62	1.25	1.11	1.00	0.81
Benefit Cost Ratio	1.62	1.25	1.11	1.00	0.81
First Year Rate of Return	5.48%	5.37%	5.32%	5.27%	5.18%

This function is also available within the detailed road case report to allow the system user to copy the disaggregated VOC (fuel, tyres, oil, repairs and depreciation) see Figure 25.