

Fit for purpose

A dynamic CAD program facilitates the creation of car parks to national or user-defined standards, and enables the designer to take in elements such as columns and no-parking zones and then select the optimum layout

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What could be more basic than designing a car park? It is a simple rectangle, or possibly a parallelogram, with dimensions predefined by standards. From this point of view, it seems that designing car parks is a relatively easy and repetitive task.

Such an approach is obviously simplistic. Designing car parks entails more than just the repetitive geometry of parking bays. The dominant issue on car park layout design is the overall capacity, especially when it concerns paid parking. Other aspects are traffic circulation, type of places, row orientation and convenience. All these aspects and their variations make car park design far more complex than at first sight.

When developing a project, many more questions come to mind, including issues such as how to modify a parking bay in a readily drawn row and how to implement a column or add disabled parking spaces, without having to redraw the entire parking row. How to best design the traffic circulation when several choices are possible and how not to increase the number of design

iterations are further issues. How to automatically number the bays on the basis of various numbering scenarios and make exceptions for features, such as reserved spaces, is another.

Taking these questions into consideration, Canadian software developer Transoft Solutions has developed ParkCAD, a specialised tool for designing and planning car park layouts. ParkCAD enables designers to automatically run different combinations of row layouts, rotation and positions to create optimal parking-space yield, based on design parameters. It also enables users to review and refine the project without modifying the basic frame.

Design parameters

The parametrisation of the project involves several steps. The first is to choose the applicable national parking standard. The program is preloaded with a comprehensive library of standards for many countries, such as the UK, Germany, the Netherlands and France. If the user finds a parking standard missing, it is also possible to create a customised or user-defined standard, using a design wizard.

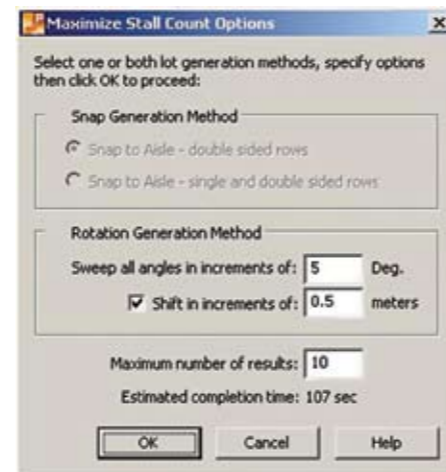
The design parameters for mid-islands can be predefined as well, without the need to redefine the island's geometry, spacing or type of surface treatment for each individual row. Similarly, dimensioning user-defined bays, wheel stops and bay numbers can be embedded within the design parameters.

For quick cost estimates, ParkCAD can assign costs for parking objects, including lengths, surfaces, aisles and islands. The software can then automatically generate costing and quantity reports based on these figures. These reports can be saved and imported to spreadsheets for further processing.

When these preparatory settings are completed, the generation of the parking



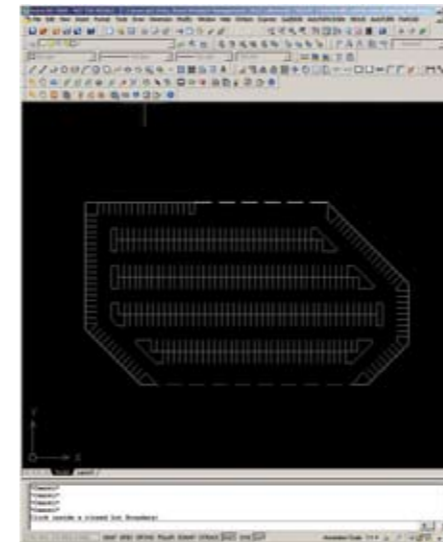
Task bar shows optimisation in progress



Users are provided with various optimisation options to generate the best results

Stall Count	Rotation	Interior Layout	Exterior Layout
300	0.00	PRVCR, Long-Str...	PRVCR, Long-Str...
303	270.00	PRVCR, Long-Str...	PRVCR, Long-Str...
302	45.00	PRVCR, Long-Str...	PRVCR, Long-Str...
309	0.00	PRVCR, Long-Str...	PRVCR, Long-Str...
305	0.00	PRVCR, Long-Str...	PRVCR, Long-Str...
300	90.00	PRVCR, Long-Str...	PRVCR, Long-Str...
379	100.00	PRVCR, Long-Str...	PRVCR, Long-Str...
378	170.00	PRVCR, Long-Str...	PRVCR, Long-Str...
377	170.00	PRVCR, Long-Str...	PRVCR, Long-Str...

The calculated result is displayed as a table in which one of the layouts can be selected



Car park without exclusion area

rows can begin, using ParkCAD's main features.

Point and click for parking

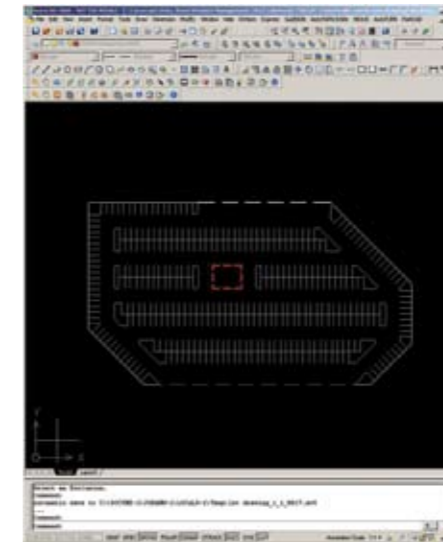
The simplest method to create parking rows in ParkCAD is with two mouse clicks (one at each end) using the following parameters: dimension of the parking bay, angle of the parking bay, spacing of mid-islands (one for each 'x' number of bays), end island and row type – flat, arrow, bumper-to-bumper interlock or herringbone interlock.

In urban areas, it is usually necessary to either align parking geometry to existing elements or to fill a predefined area with parking rows. To accommodate this, two methods were developed. The first one is to create parking rows alongside existing CAD geometry and the other is to create car parks within a polygon or bounded area, enclosed by lines that represent boundaries.

Rows from elements

A parking row is generated by selecting a single element, arc or line segment. There is one restriction to this method, which is that only 90° bays can be automatically drawn beside an arc, although along rectilinear elements any type of bay is possible. The designer just clicks on the desired element, and then confirms the type and location of parking bays.

Other combinations are possible, such as the inclusion of end or intermediate islands. Although this function does not take complex geometry such as splines or polylines into account, this can be resolved by drawing successive arcs to approximate the complex elements.



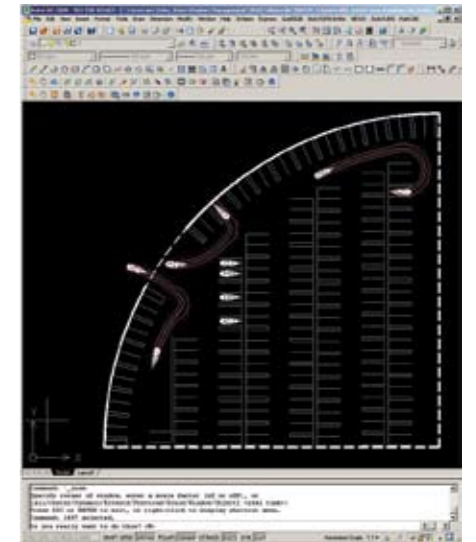
Defining an exclusion area

Closed-area car parks

One of the main strengths of ParkCAD lies in its ability to create car parks in closed areas. The designer first has to define the enclosed boundary elements, representing the car park area. The physical boundary line, shown as a black continuous line, designates the car park lines vehicles cannot drive across, such as the walls of buildings, kerbs or fences. Rows of parking bays are created beside this boundary line. The access boundary line, a black dashed line, designates the car-park lines that vehicles can drive across, such as aisles and driveways. Rows of parking bays are created inside the car-park boundary up to lines on the access boundary layer/level. The entrance boundary line (a grey dashed line) designates driveways or other breaks in the physical boundary lines that vehicles can use to enter or exit and which must be kept clear of parking bays.

By clicking inside this area, a complete parking layout is generated. As the designer rotates the mouse to confirm the row orientation, a dynamic counter gives a running count of parking bays. During this operation, it is possible to select snap-to-side, which will automatically align the interior parking rows parallel to the selected row side. The maximum number of bays can also be found automatically by indicating the increments of parking-row rotation and placement.

For example, with the options shown in the figure on the previous page (5° angular increment, and position rows each 0.5m), the optimisation of the car park results in ParkCAD calculating 1,224 different



A marina designed with ParkCAD

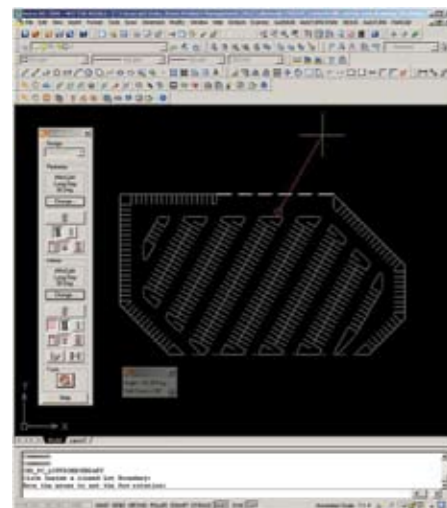
positions in just 153 seconds. The calculated results are displayed in table form, enabling the designer to select the preferred layout.

A desirable improvement of ParkCAD would be the automatic inclusion of structural elements such as beam or column frames, as is the case in underground or above-ground parking. For now this issue can be solved by post-editing the rows, using editing tools that enable, for example, adjustment of the row length or width, without changing the general pattern. Having created a car park in a designated area, the designer is able to designate areas where parking should not be placed. Typical uses for such exclusion zones would be for objects such as access ramps and returned shopping carts.

Customisation and marinas

The car park can be completed by adding and editing various elements, such as reserved places for disabled drivers, deliveries and taxis; and including bay numbers and wheel stops.

When ParkCAD was first developed it was initially intended for car-park projects but sometimes unforeseen uses – that the programmers never dreamt of – are discovered. Its use in the design of marinas is one such unexpected application. The basic rules differ just a little, although dimensioning the berths and the navigable fairways are similar to dimensioning bays and aisles in car parks. Marina designers are also able to adjust the parameters for mid-islands or the widths of the centre paths to account for the pontoons, so obtaining the desired result. ■



Definition of a car park in an enclosed area