# CinPark Ltd

# Parking Garage Design Decision[1]

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**Background**

Organizations typically construct and operate their own parking facilities. They hire designers, contractors to complete the construction. They buy equipment and hire staff to run the parking lot.

An innovative company in Cincinnati, CinPark, has decided to enter the market as a parking specialist company; Building, owning and operating parking garages. By undertaking multiple projects across the country they hope to achieve economies of scale in design of facilities, training of personnel, development of software, innovation of services such as valet parking and vehicle services, the procurement of equipment through volume discounts, etc.

In doing so, CinPark hopes to create significant value for its shareholders. Other examples of such companies include Standard Parking (http://www.standardparking.com) and Propark America (http://www.propark.com/).

You have been hired by CinPark to advise on the design of their next parking garage project in Cincinnati. The management believes that demand for parking space in the area will increase significantly over the next few years. They are convinced that it's a good idea to build and operate a Parking Garage in the area and have identified the location. They want you to perform a detailed analysis and report on how many floors the Parking Garage should have.

**Background Information**

A valuation based on a 12% discount rate over the next fifteen years is needed. Note that the lifetime of the car park is longer but CinPark wants the analysis to be over 15 years.

A consultant who is a parking expert proposes a likely scenario for demand growth:

1. There is an Initial Demand (Year 1) of 750 spaces. Demand is expected to rise by another 750 spaces over the next 10 years, and perhaps by another 250 spaces over the lifetime of the parking garage, giving Final Demand = 1750.
2. The average annual demand for parking spaces over fifteen years is around 1,415 spaces.

[1] This case has been edited by Yiwei Chen.

The demand profile over time is given by the formula for demand in Year k: Demand(k) = Final Demand – α exp( – β (k–1) ) where α = Final Demand – Initial Demand = 1000 and β = 0.1540 is chosen to match Demand(10) with the predicted Year 10 demand of 1500 spaces. From Year 1, average annual revenue per space used will be $5000, and average operating costs (staff, cleaning, etc.) will be about $1000 per year for each space available (note that utilization is, naturally, lower than the number of spaces available). Further yearly fixed costs, including the lease of the land, are estimated to be on the order of $1.8 million (p.a.). The set-up cost, in Year 0, includes both the lease cost and construction cost. The latter is estimated at $8,000 per space for pre-cast construction (this figure based on prior experience), with a 30% increase for floors higher than 2, that is, beyond the ground level and the first storey up. E.g., level 4 would be 30% more expensive to build than level 2, as would level 3. The site is large enough to accommodate 200 cars per level. The consultant has provided a discounted cash flow spreadsheet, **ParkingGarage.xlsx** The real question is, How many levels would you build? Answer this by going through the following steps.

## A. Traditional Perspective on the Problem

*A.i. An NPV calculation* using the "sure demand" profile given by the function Demand(k) is given. What no. of levels would you recommend on this basis?

## B. Sensitivity Analysis

The consulting parking expert is, in fact, quite unsure about the actual demand given the long time horizon. His projections are only estimates. He believes that the initial demand, the additional demand in the next decade, and the final growth beyond that decade, could all be 50% or more off his projection, either way. This leaves, on the one hand, the possibility of erecting a white elephant. On the other hand, there may well be demand above expectation – which CinPark does not want to leave untapped. The CEO requests that you do some sensitivity analysis to get a first understanding of the effect of uncertainty.

Modify the model in A.i. as follows:

Introduce a single parameter *p*%, called the Demand Factor, that will give demand in any year as *p*% of the "sure demand" value calculated in Model A.i. (This scales the sure demand curve up if $p > 100$ *and* down if $p < 100$.)

Change the Demand Factor from 50% to 150%, by hand or in a data table, to get an idea of how sensitive value is to demand; display the results in a chart.

Does your sensitivity analysis have any implications for your value estimate from Model A.i, or your recommendation based on that model?

## C. Randomizing the model and MCS

CinPark understands the dangers of valuations that treat demand forecasts as certainties.

*Model C.i*. Randomize your spreadsheet by making the Demand Factor a random variable that is uniformly distributed between 50% and 150%; either use RiskUniform(0.5, 1.5) or make use of rand() which gives a random number uniformly distributed between 0 and 1. Press F9 several times to get a feeling for the randomness. Now perform a Monte Carlo Simulation with @Risk for the number of levels recommended in Part A.i.

Produce graphical output.

*Questions:*

--- Why is the average of the distribution of NPVs lower than the NPV in your original "Static NPV" worksheet? After all, the demand variations are symmetric around the projections.

--- What is the chance of losing money on the project?

--- Investigate the shape of the NPV distribution.

--- Is that what you would have expected? Or would you have expected another shape? Can you explain the shape?

**D. Re-optimizing the number of levels**

Given the results of the Monte Carlo analysis, maybe your chosen optimal number of levels is not optimal after all. Compare the different NPV distributions that result from changing the number of levels in your model from Part C.

Produce risk profiles for various designs. How many levels would you build? And, how does risk come into your decision?

Think back on the lecture and previous stages, and then try to explain your decision in intuitive or management terms.

**E. Valuing flexibility**

Suppose you could build the parking garage with an initial configuration of two or more levels, and then add more levels in later years as demand grows. Model this, starting with your solution to C.i., using the following expansion rule: build one new level whenever demand exceeds capacity for two years in a row. (Assume that you do not expand beyond year 8 because CinPark does not want to take the risk of not clawing back its investment).

Under the expansion rule, how many levels should we build now and how much extra value does the parking garage with expansion earn on average, if any? Again, it is critical to be able to explain your recommendations using intuition and management language.

Note: The cost of the expansion should be calculated as follows. Construction costs will increase over time but this effect will be mitigated by discounting. Therefore you may assume that each additional space added costs $8000 x 1.3 (assuming you had at least two floors to begin with).