# Rapid Estimation of Building Damage by Conventional Weapons

Tan Choon Ming Martin
Thesis advisor: Morris Driels
Second Reader: Christopher Adams

**Background** - Due to the shifting paradigms of modern-day warfare, new threats are constantly being identified. Military forces in the world are evolving more efficient ways to operate their assets in the most effective and strategic manner. Many times, commanders on the ground require a quick assessment on the potency of a certain munition on specific targets. During such situations, time is not a luxury that can be spared for complex and detailed simulations to be performed.

**Objectives** - To develop a code using open-source information and commercially-available software to evaluate the degree of damage to a building. A model is developed using Microsoft Excel and Visual Basic to examine how a warhead will interact with different types of structures and to provide the user with a reasonable model of the degree of damage to the building of interest.
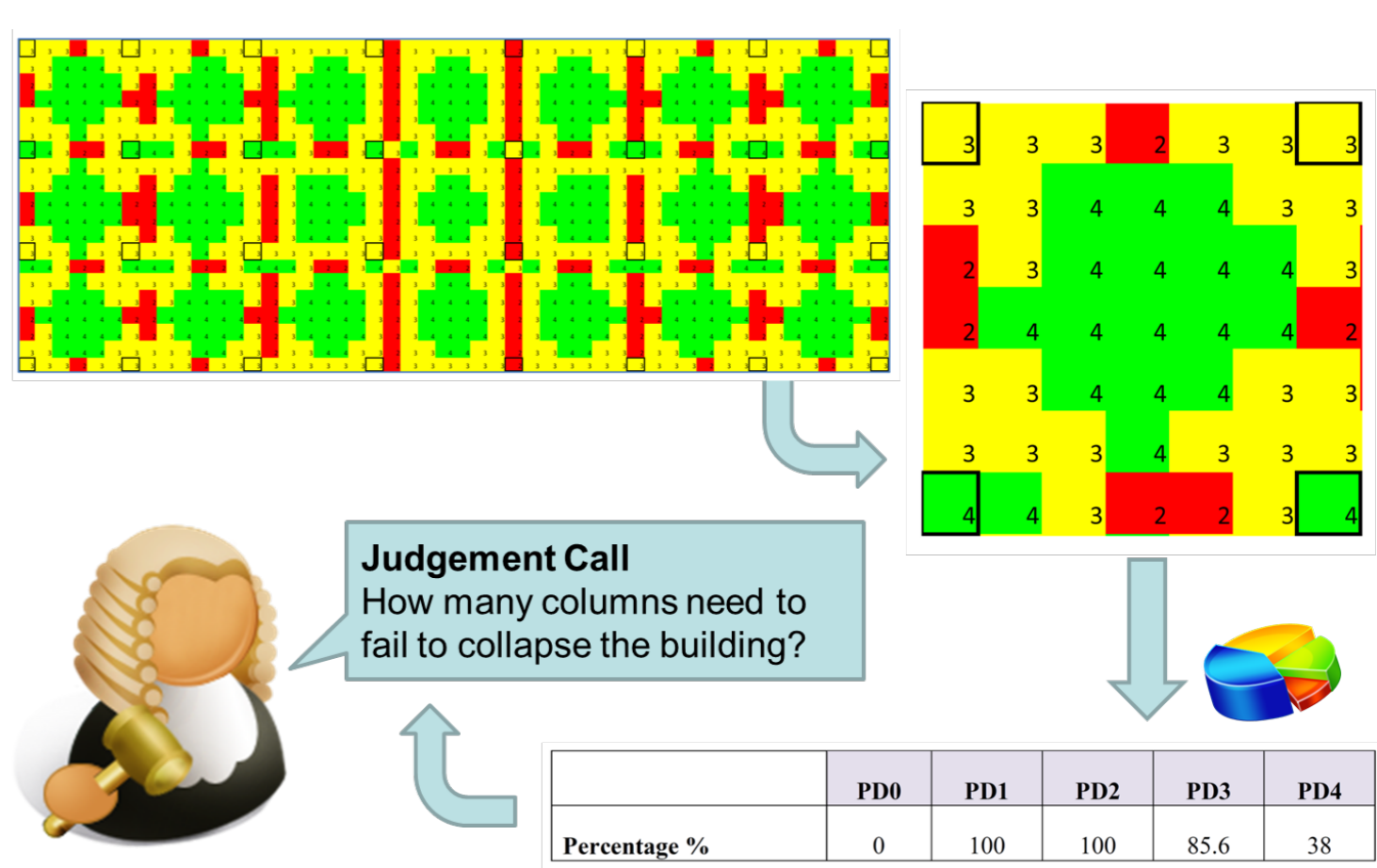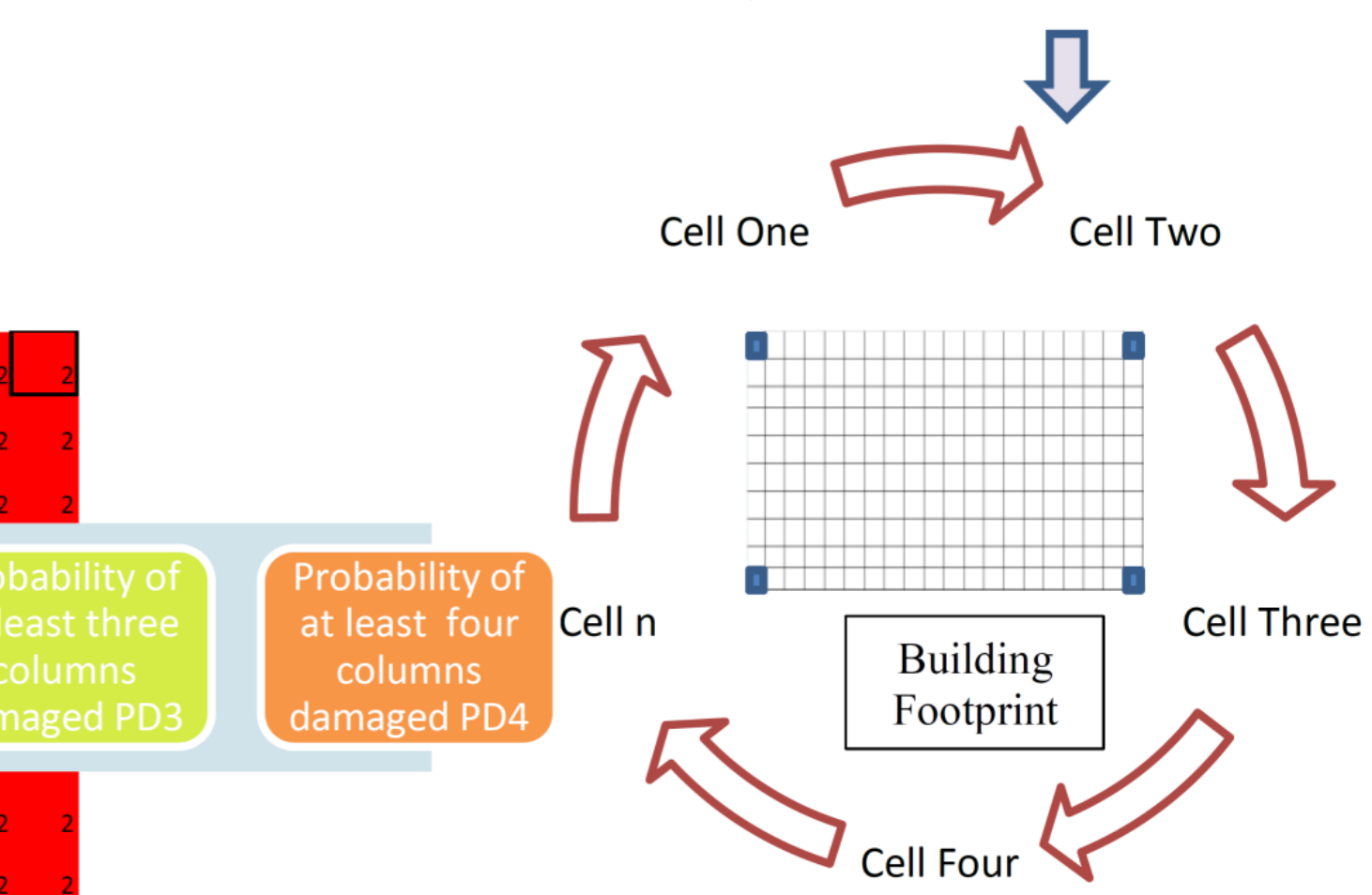
**Main Research Ideas** - The program gathers inputs such as weapon, building size, and the method of construction. With this information, the Building Damage Program (BDP) predicts the number of columns that will fail and provide results to the user for interpretation on whether the building will collapse.

**Results** – A Lethality Matrix showing how many columns will fail if a warhead detonates in that cell, and the probabilities of at least 1, 2 ,3 and 4 columns failing when a warhead detonates anywhere in the building.
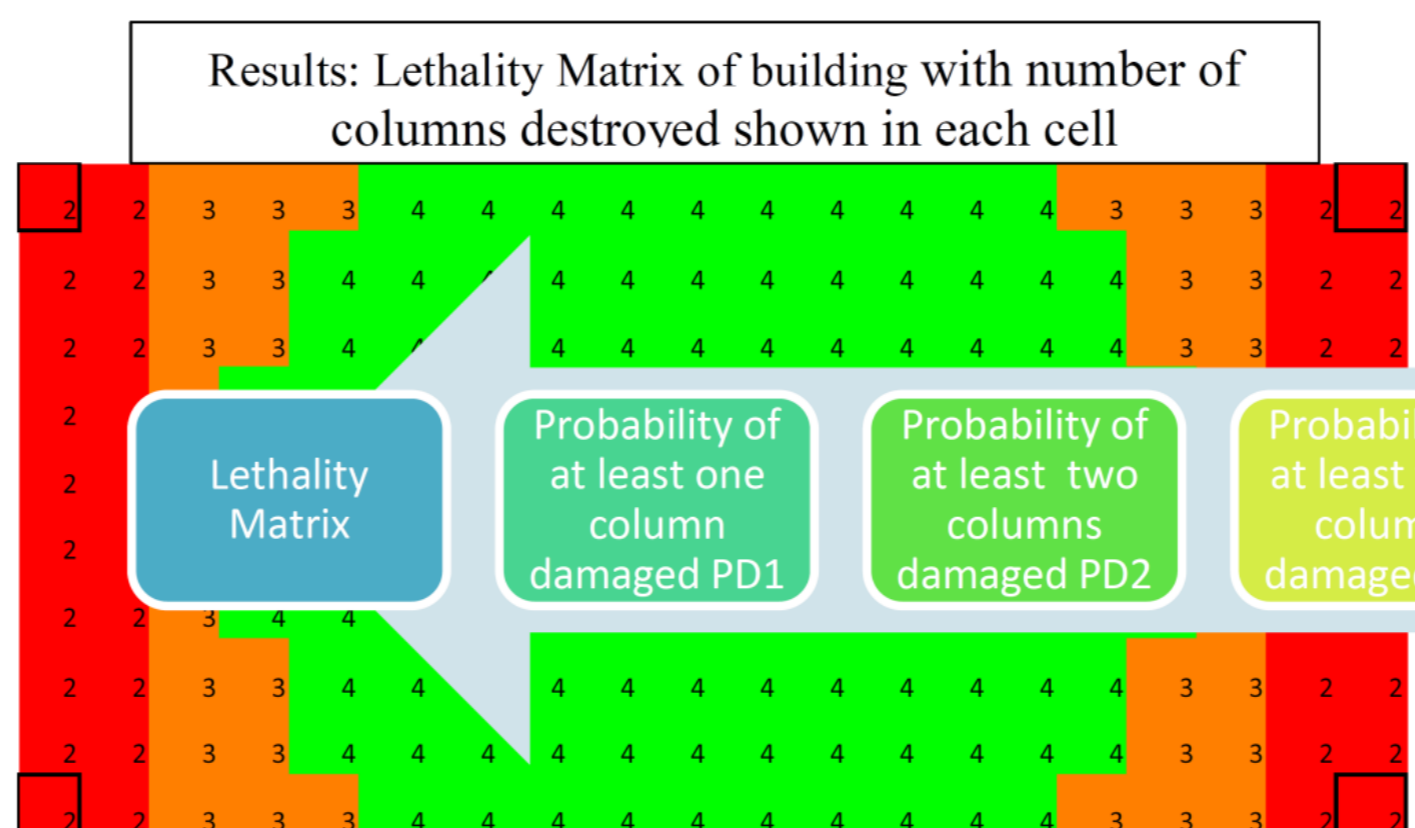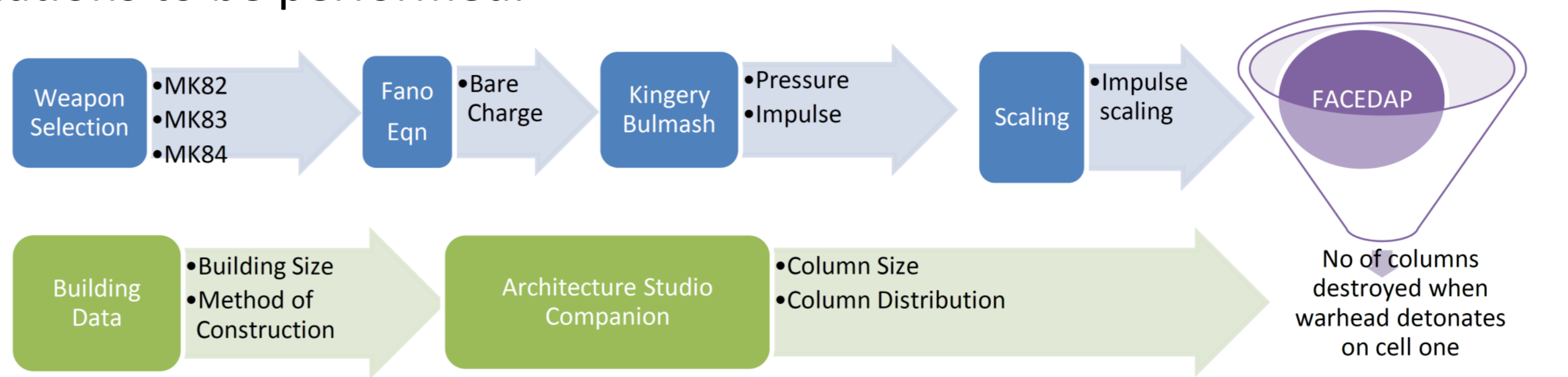
**Benefits** - Firstly, it uses open-source information. Secondly, it is fast and does not require a long simulation time. Thirdly, users will not require special training, as the BDP runs on commonly used software that is widely available.

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Process flow diagram:
Weapon Selection (•MK82 •MK83 •MK84) → Fano Eqn (•Bare Charge) → Kingery Bulmash (•Pressure •Impulse) → Scaling (•Impulse scaling) → FACEDAP → No of columns destroyed when warhead detonates on cell one

Building Data (•Building Size •Method of Construction) → Architecture Studio Companion (•Column Size •Column Distribution)

Cell One, Cell Two, Cell Three, Cell Four, Cell n — Building Footprint

Results: Lethality Matrix of building with number of columns destroyed shown in each cell

Lethality Matrix | Probability of at least one column damaged PD1 | Probability of at least two columns damaged PD2 | Probability of at least three columns damaged PD3 | Probability of at least four columns damaged PD4

**Judgement Call**
How many columns need to fail to collapse the building?

|  | PD0 | PD1 | PD2 | PD3 | PD4 |
|---|---|---|---|---|---|
| Percentage % | 0 | 100 | 100 | 85.6 | 38 |

References
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