

## Introduction

- SWSTel wants to increase the number of subscribers to their cellular phone network along the **40-km highway**.
- For this reason, they are now trying to decide whether or not they have to **modify or expand their network**.
- If they meet the Quality of Service (block rate <2%, drop rate <1%), how much more traffic the network can handle. If not, how to **improve the system**.

## Target

- To **simulate the initial mobile telephony system** to determine if it meets the Quality of Service requirement.
- To remedy the problems by **improving the model** if there are some problems indeed.
- To **modify the model** to avoid the boundary problem and do traffic capacity planning.

## Input Analysis

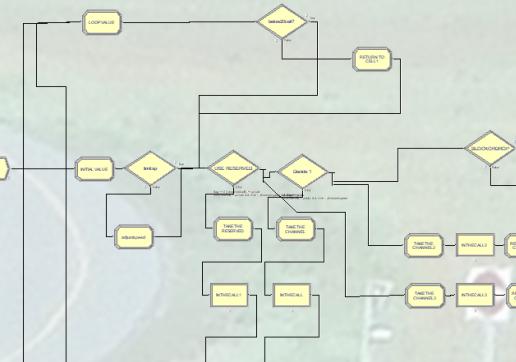
- Distribution Analysis
  - Speed ~ TRIA(70,90,1,110)
  - Interval time ~ EXPO(1.35)-0.001
  - Duration time ~ EXPO(119)
- Dimensional Analysis
  - Speed – kilometer per hour
  - Interval time - hour
  - Duration time - hour

## Model & Simulation

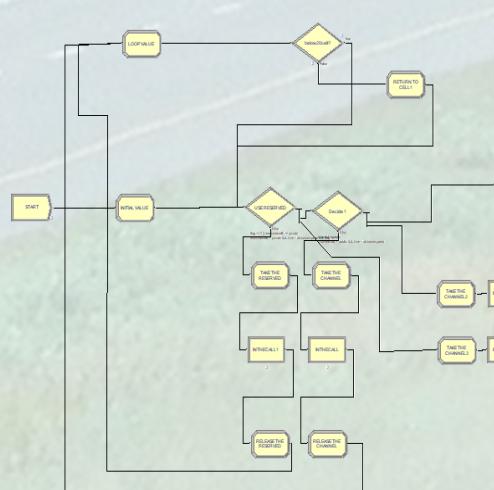
- Original Model(Model 1.0)
  - Simulate **the original system**
- Model 2.0
  - Include the **preserved channel**, Method 1
- Model 3.0
  - Include the **preserved channel**, Method 2
- Model 4.0
  - Include the **dynamic programming** of the preserved channel



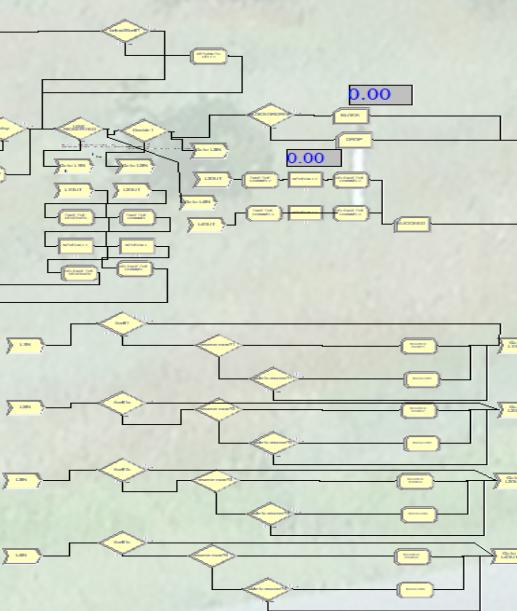
Model 1.0



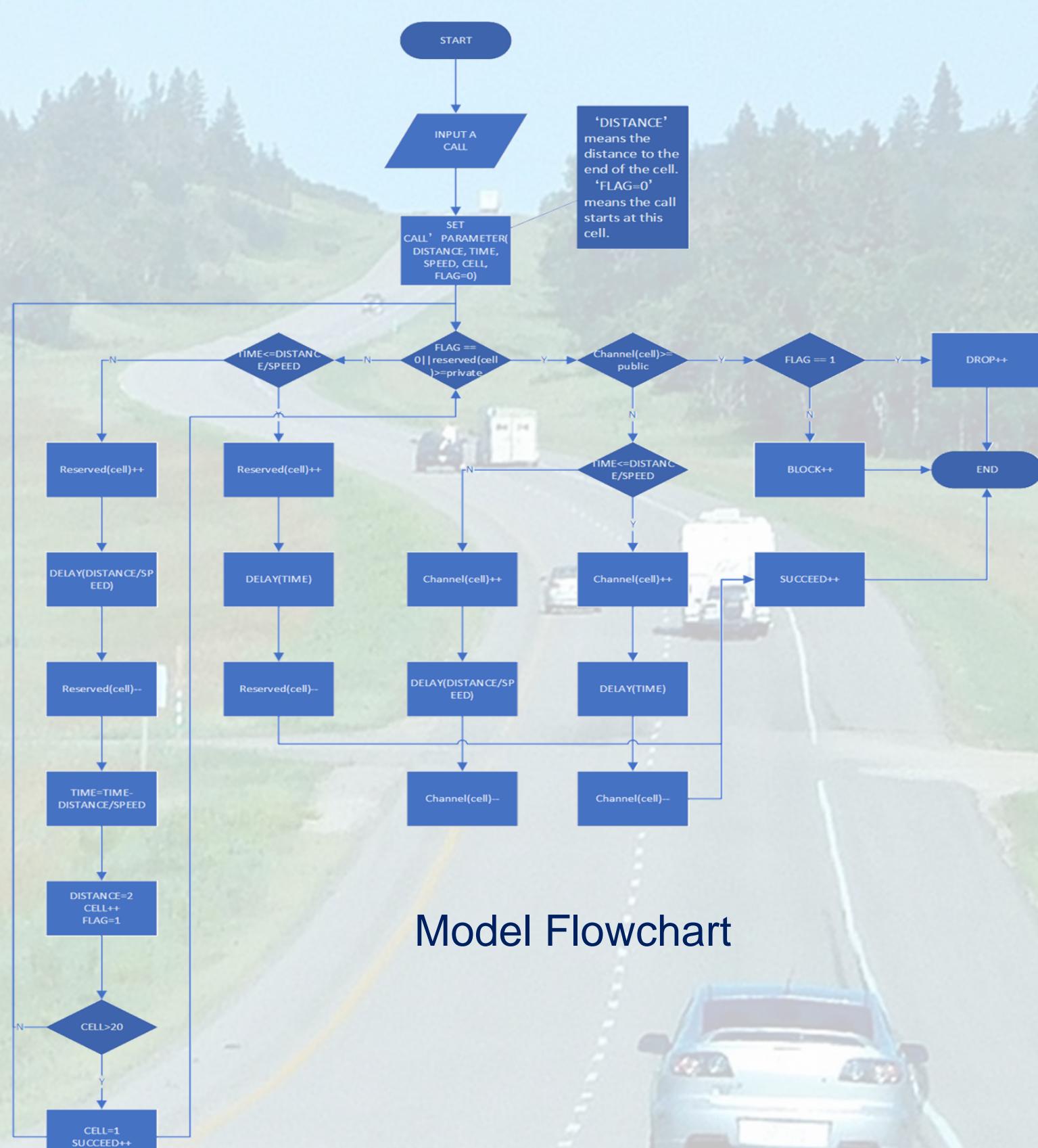
Model 2.0



Model 3.0

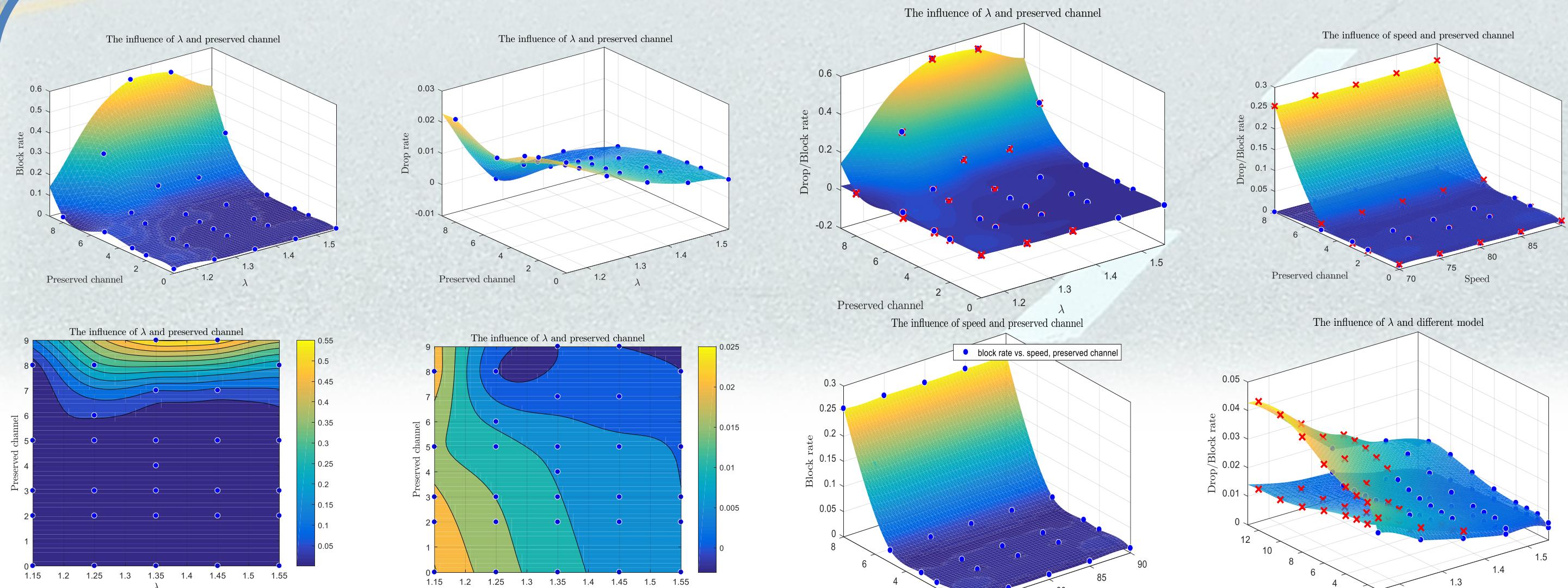


Model 4.0



Model Flowchart

## Results & Analysis & Verification



	Block Rate	Drop Rate	Succeed Rate
3	1.4308%	1.0243%	97.5449%
3+1	1.4847%	0.9986%	97.5167%
4	1.7838%	0.9520%	97.2642%

	Block Rate	Drop Rate	Succeed Rate
Block rate	0.802	-0.412	
Drop rate	-0.515	-0.764	
Spearman correlation	Preserved channel	Car speed	
Block rate	0.981	-0.047	
Drop rate	-0.981	0.016	
Spearman correlation	Model optimize	Lambda of arrival	
Block rate	0.481	-0.845	
Drop rate	-0.339	-0.929	

### Analysis

- The number of preserved channels weighs most
- Dynamic programming model has a higher succeed rate
- Lowest speed has no significant correlation to the results

### Verification

- Different model have the same result that the best preserved channel is 4

## Conclusion

- Conclusion 1**  
The system **does have a problem**
- Conclusion 2**  
In 0 preserved channel system, drop rate is 1.19%, block rate is 0.92%  
In 2 preserved channel system, drop rate is 1.08% ,block rate is 1.19%  
In 4 preserved channel system, **drop rate is 0.95%, block rate is 1.78%**  
(Most optimized model)
- Conclusion 3**  
In dynamic programming preserved channel model, **drop rate is 0.92%, block rate is 1.67%**

### Lesson Learnt

- Analyzing and understanding of the system
- Basic modeling methods
- Simulation with Arena
- Statistical data analysis
- The verification and validation of experiments
- Model experimentation and optimization
- Design poster and teamwork