**Title**

框架：

1. 为了优化现有的新泽西州收费站模型，我们首先选择了Garden State Parkway的Asbury Park Toll Plaza作为原始收费站模型。我们确定了新的收费广场的形状、大小以及新的合并模式、收费模式比例。
2. 通过我们这一模型，新泽西州公路收费管理局可以采取更有效的方式进行收费，并且在运用更小成本的同时获取更高收益。
3. 我们使用排队论模型优化出最好的收费站排队模式，使用可接受间隙理论模型计算出最优的收费广场合并模式，并且使用元胞自动机拟合了低谷期和高峰期的交通流。
4. 对于事故分析，我们使用了层次分析法，挑出评定安全系数的六个因素，构造判断矩阵并得出这些因素的权重，最终计算出改进前后的安全系数并进行对比，确认改进后的安全系数大于改进前。
5. 我们运用成本-效率二维模型和查找车辆用户信息，找出零钱收费站、电子收费站、人工收费站的最优比值为2：1：1。
6. 我们查找了真实数据来检验模型，通过计算确定我们的现有模型相比原有模型成本更低、效率更高、安全系数也更高，我们的模型不一定是最优的，但一定是有效的。

Summary

In order to optimize existing toll plazas in New Jersey, we firstly selected Asbury Park Toll Plaza on Garden State Parkway for our research. We formulated the shape, size, merging pattern and proportion of different tollbooths of the new toll plaza model.

With our model, New Jersey Highway Charge Authority can take a more effective way to collect tolls and achieve higher yields while reducing costs. We used queuing theory model to determine the best queuing pattern in our toll plaza model. We used gap acceptance theory model to find the optimal merging mode, and developed cellular-automaton to fit the traffic flow in heavy and light situations. For purpose of accident prevention, we used Analytic Hierarchy Process(AHP) to study the security co-efficiency. We identified six factors for assessing the security coefficient, constructed the judgment matrix and then obtained these factors’ weight. Finally we calculate the security coefficient of Asbury Park Toll Plaza and our new toll plaza model, arrived at the conclusion that our new toll plaza model is safer than before.

Using cost-efficiency curve and user info, we found out the optimal proportion of exact-change tollbooths, electronic toll collection booths and manual tollbooths is 2:1:1. After all, we searched the real data and put it into our model to examine it. Through calculation, we ensure that our new toll plaza model has lower cost, higher efficiency and stronger accident prevention system than Asbury Park Toll Plaza. We show that this strategy maybe is not optimal but can be improved by assigning different numbers.