# Course Scheduling Proposal

## FOR USC MARSHALL

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# AGENDA

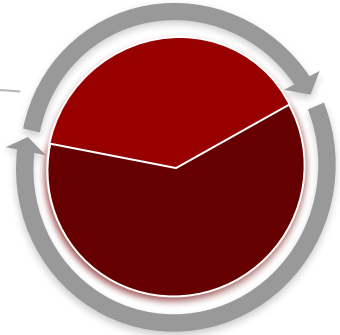
**01** CURRENT PROCESS
**02** OUR APPROACH
**03** RESULTS
**04** FUTURE IMPROVEMENTS

# CURRENT PROCESS

## Phase 1

**~40%**

Slots filled based on historical data & special requests



## Phase 2

Remaining slots filled

### Classroom Resources

Average Utilization Rate of 85.5%

### Prime Time Slots

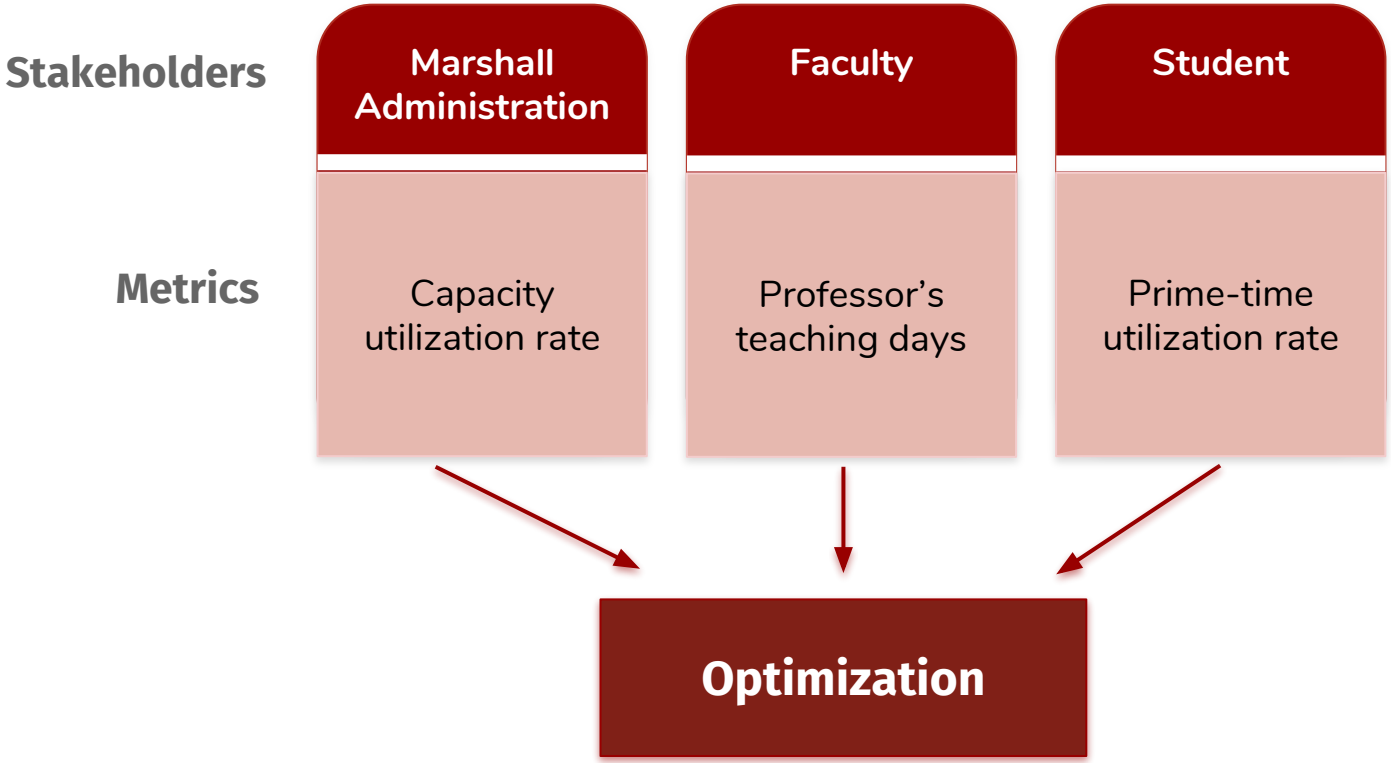
Average Utilization Rate of 46%

### Time-Consuming Process

### Faculty Preferences

# PROPOSED PROCESS

## PRIMARY GOALS



# MAIN ASSUMPTIONS

01

Predicted # of Students Registered for Course
= Average # of Students Enrolled in Course for past 2 years

02

Classroom capacity remains constant

03

# of Sessions Required for each section remains same as previous term

04

Assign courses on top 7 course patterns:
*MW*, *TH*, *M*, *T*, *W*, *H*, *F*

# OBJECTIVE

Professor's teaching days

$$\text{maximize}\Big(\quad 3 * \frac{1}{|PS|}\sum_{i\in I}\sum_{j\in J}\sum_{d\in D}\sum_{t\in T} X_{ijpt}\frac{student_i}{seat_j} \;-\; \frac{1}{|P|}\sum_{p\in P}\sum_{d\in D} PD_{p,d} \;+\; 2 * \frac{1}{5*8*60*|J|}\sum_{i\in I} PT_i * TS_i * 30\Big)$$

Capacity utilization rate

Prime-time utilization rate

# CONSTRAINTS

01 No conflicts for classes and professors

02 Number of registered students do not exceed capacity

03 Professors teach in the same building on a given day of week

# SUBSETTING THE INPUT DATA

**2899 Courses**
Time length: 1 to 4 hours
Capacity: Mostly 0 to 70 students

**6 Terms**
Spring, Summer, and Fall semesters from 2015 to 2016

**44 Classrooms**
Sizes: 20+ to 250+

**85 Courses**
Time length: ≤ 4 hours
Capacity: < 150 students

**1 Term**
2015 Fall

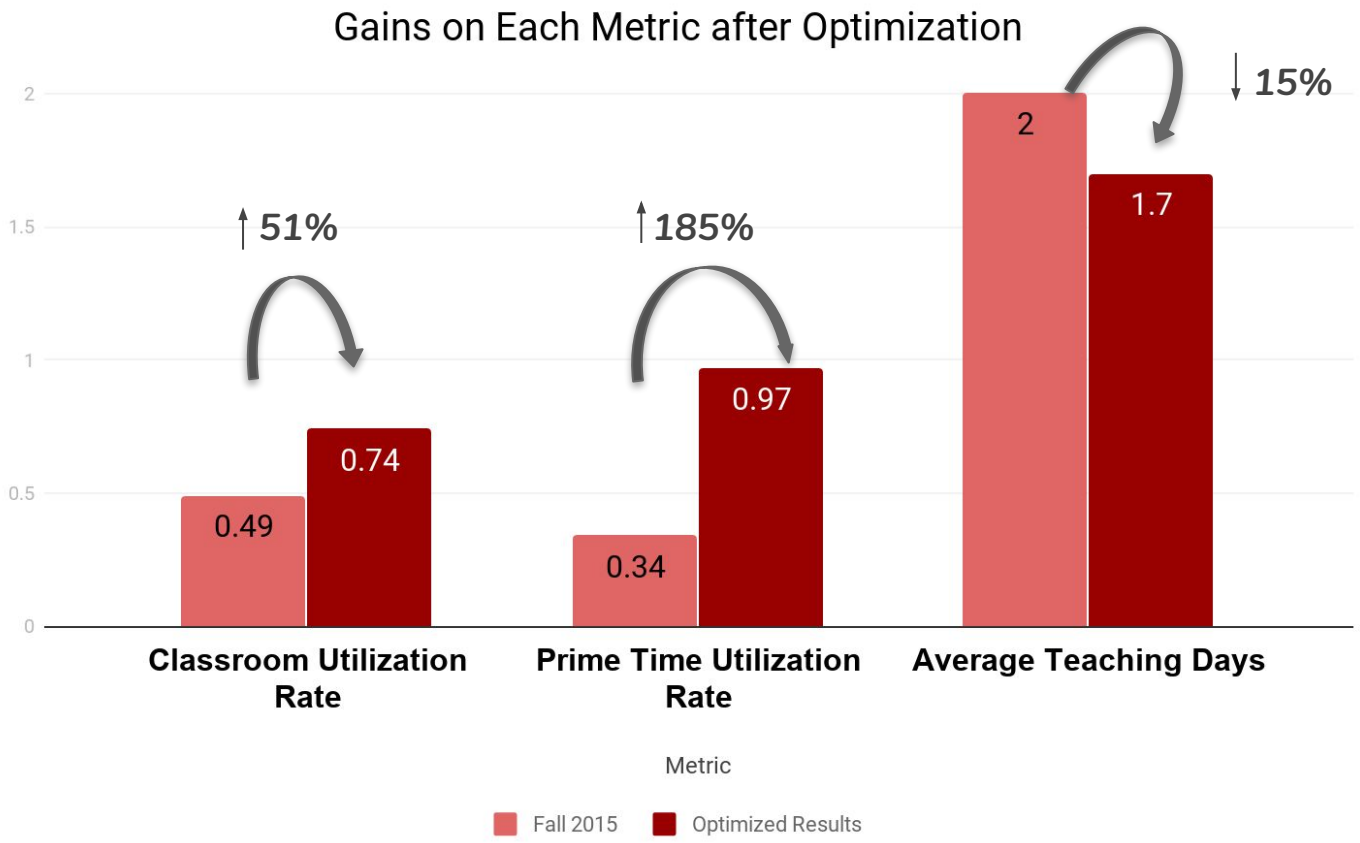
**6 Classrooms**
Sizes: 20, 48, 56, 60, 77, 149

*Optimization*

$$\frac{\text{Total number of registered students}}{\text{Total number of available seats}} = (9.7)$$

$$\frac{\text{Total number of registered students}}{\text{Total number of available seats}} = (8.4)$$

# RESULTS


Gains on Each Metric after Optimization
2
1.5
1
0.5
0
51%
185%
15%
0.49
0.74
0.34
0.97
2
1.7
Classroom Utilization Rate
Prime Time Utilization Rate
Average Teaching Days
Metric
Fall 2015
Optimized Results

# KEY TAKEAWAYS

| | | | |
|---|---|---|---|
| **Focus** | Preference of Professors | Convenience of Students | Utilization of Resources |
| |  |  |  |
| **Metrics** | Professor's teaching days | Prime-time utilization | Classroom utilization |

# FUTURE IMPROVEMENTS

Conduct surveys to check preferences of different people

Balance differences between departments

Apply MIP formula to the whole dataset

Consider more stakeholders

# Thank You!

# BACKUP SLIDES

# Data Understanding

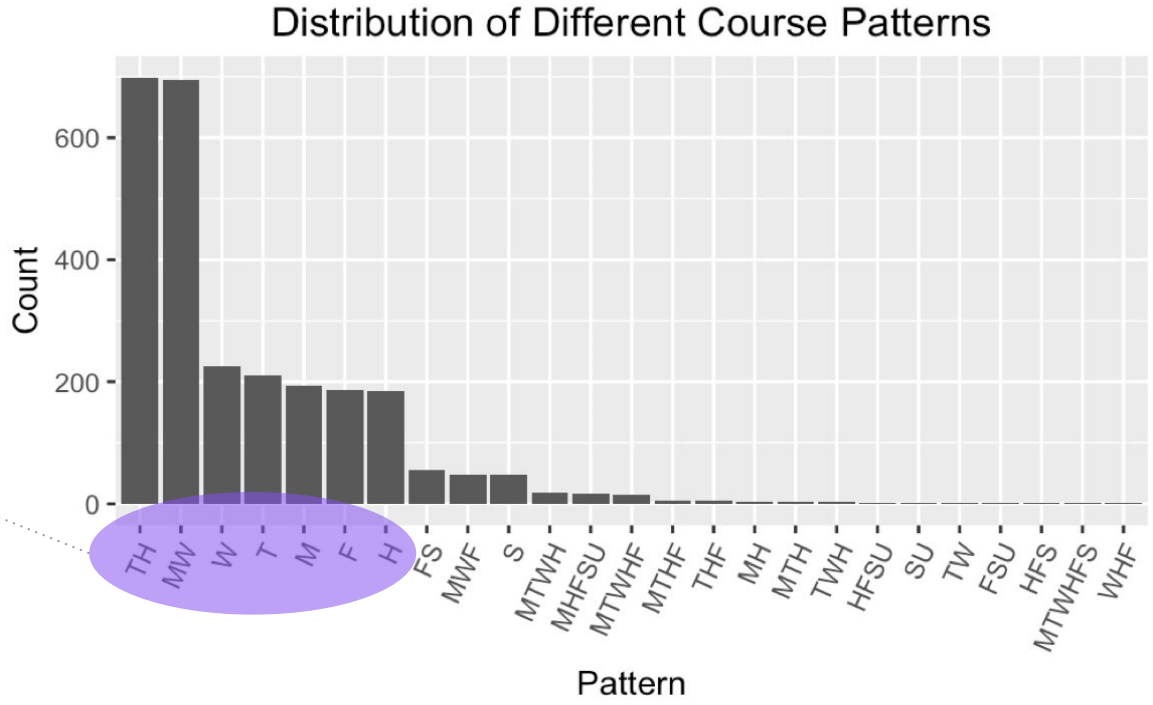
***Top 7***

**Course Patterns:**

Tues and Thurs

Mon and Wed

M , T , W , H , F

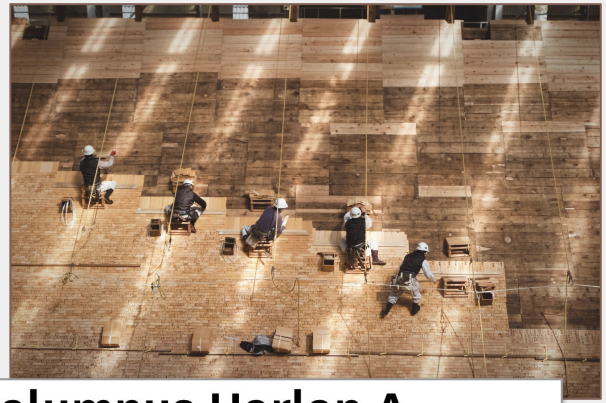


# Current Situation

- **Classroom supply shortage**

  **Upcoming large scale renovations**
  Bridge and Accounting buildings

  **Land restrictions** prevent building additional classrooms

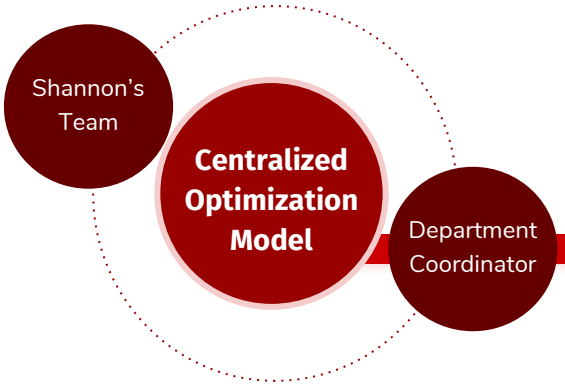


**Gift from alumnus Harlan A. Helvey to benefit USC accounting program**

$15 million gift will support renovation of 90-year-old structure to be renamed Harlan A. Helvey Hall

- **Rising demand** for Marshall courses

# Our Proposed Process




1

**Deliver master schedule**
to department coordinator

2

Perform **final revisions**

3

**100% scheduled**
course sections

## Deal with Different Time Length Session

*Divide 13.5 hour schedule into 26 30-minute blocks*

## Course Section Data

*Course Section ID*
*Number of Students Registered*
*Number of Sessions per week*
*Session Time Length*
*Professor*

## Classroom Capacity Data

*Set of Available Classrooms and corresponding capacities*

*Centralized Optimization Model*

# FORMULATION - Constraints

1. Every professor can only teach one session at one time slot
2. If a section is assigned to a classroom, other sections must not be assigned to the same classroom, during the same day/time slot
3. For each course section, we must fully assign its required sessions.
4. Classes cannot last beyond school time (9:30PM).
5. If a section is divided into 2 sessions, it must be allocated to the same time on Monday/Wednesday or Tuesday/Thursday.
6. If the section is required to divide into two sessions, it will not be assigned to Friday.
7. Number of students enrolled in the course must not exceed the number of seats offered in the course's assigned classroom.
8. Professors who have more than one section will stay in the same building.

# Metrics Calculation Formula

- **Classroom Utilization Rate**

$$\frac{1}{J}\sum_{j\in J}\frac{\text{Predicted \# of Registered Students}}{\text{Classroom Capacity}}$$

- **Prime Time Utilization Rate**

$$\frac{\text{Total time length of all sections in prime time (by mins)}}{\text{\# of classrooms * 8 hours * 5 days * 60 mins}}$$

- **Average Teaching Days per Week**

$$\frac{\text{Professors' total teaching days per week}}{\text{Total number of professors}}$$