

WATERLOO **ENGINEERING**

Consulting Engineering Design Problem

Fall 2011
Waterloo Engineering Competition
November 4-5

General Rules & Guidelines

1. All communication devices must be turned off.
2. Competitors will be allowed to use:
 - a. Computers, USB keys, CDs, pre-existing files etc.
 - b. Internet
 - c. Reference books

All other tools must be cleared with the competition coordinator before use. Cell phones, BlackBerrys, online communication (e.g. MSN, GoogleChat, Skype) or other communication devices are prohibited.

Violation of these rules may result in disqualification.

3. Visitors are not allowed throughout the development and build stage.
4. Keep work stations clean. Clean up at the end.

Schedule

The schedule for Consulting Engineering is as follows:

| | | | |
|-------------------------|-------------------------|------------------------------------|-----------------------------------|
| Friday, November 4 | 5:15 p.m. – 5:30 p.m. | Check-In | DWE 2527 |
| | 5:30 p.m. – 6:00 p.m. | Welcome/Briefing | DWE 2527 |
| | 6:00 p.m. – 12:00 a.m. | Design | Various Assigned Classrooms |
| | 12:00 a.m. – 12:15 a.m. | Submissions/Debriefing | DWE 2527 |
| Saturday, November 5 | 8:00 a.m. – 8:30 a.m. | Check-In | RCH 2nd Floor Lobby |
| | 8:30 a.m. – 12:30 p.m. | Presentation/Demonstration | RCH 103 |
| | 12:30 p.m. – 1:00 p.m. | Prizes and Winner Announcements | RCH 103 |

Food will be available between 8:30 to 9:30 p.m. Drinks will be available when the food arrives but Competitors are encouraged to bring water bottles as bottled water will not be provided. There will be water fountains nearby for refills.

Please remind the competition coordinators and volunteers of your dietary restrictions and/or allergies.

There will be a question period after the problem is presented during the briefing session. No questions will be answered during the development and build stage to ensure fairness in the competition.

Background

UW Parking is expected to make some difficult decisions in the years ahead. Though 6000 total spaces (visitor, student, and faculty and staff) currently exist [1], demand is expected to outstrip supply before 2020 [2]. There is currently 7,000,000 square feet of campus space, and it is anticipated to grow to 9,000,000 by 2030 [1]. It should be noted that much of this expansion is expected to take place outside of the traditional ring road area. See Appendix for the number of spaces by lot. See the Campus Master Plan, South Campus A for more detailed projections.

According to the campus plan, a strategy is needed to reduce parking needs [2]. Transportation Demand Management is expected to mitigate this demand, in addition to generating at least some of the revenue for future parking structures and the visual impact of large parking lots is to be discouraged.

Full-time Transportation Options

| Faculty/Staff Parking | Adult Bus Pass | Student Unreserved parking pass | Student Residence parking pass | Student Bus Pass |
|-----------------------|----------------|---------------------------------|--------------------------------|--|
| \$36/month | \$64/month | \$158/term | \$140/term | \$49.75/term (included, non-refundable) |

- 10 AM and 2 PM tend to be the busiest times in campus parking lots.
- Tuesday, Wednesday and Thursday are the busiest days of the week.
- Over 1600 student spots available (in C, N, W and X)
- 2100 currently issued student parking passes, first-come, first-served
- X, J, S, V and UWP mainly for residents with staff overflow and extra student pass spots

UW Parking staff determine ad hoc, each term, based on the general emptiness of the lots how many student passes can be issued, to a maximum of 2500. There is usually still a waiting list. Despite surplus space at some of the more distant lots, some lots are frequently full during peak periods and students who attempt to park there must find an alternative lot. Though WatPark (see Resources) currently displays the status of Lot C, the status of all other lots is available only by checking the sign located at the lot, which is electronically monitored to indicate full when the net number of cars entered equals the number of spaces.

Visitor Parking

Visitor parking rates were raised for the first time in over a decade this September; comparable markets in KW and at other universities range from \$8-\$12 per day. Certain premium lots charge \$2/hour

| Month | Cost/Day | Total Revenue |
|----------------|----------|---------------|
| September 2010 | \$3 | \$13,069 |
| September 2011 | \$5 | \$13,720 |

UW Parking Services Financials

In its current state, UW Parking Services takes in enough income to cover its labour expenses and basic upkeep. UW Parking services does not benefit from parking violation revenues. This income (exceeding \$100,000/year) is used for scholarships and bursaries. A new surface spot is estimated to cost \$2500-\$4000/space, whereas a structure can run \$32,000-\$40,000/space. If monies were available, top priorities, according to Sharon Rumpel, Manager of Parking Services, include: capital purchases of equipment, repairing infrastructure, enhanced signage and more advanced gating systems (eg. RFID tags with transponders, as opposed to the current card readers).

Miscellaneous

UW Parking currently has the authority to replace 'lost' spaces (ie. Parking spaces built over by buildings), but not to create 'new' spaces. However, it is not clear where lost spaces could be developed. There is currently a carpooling program at the University of Waterloo [1]. 15 permits have currently been issued.

Problem Statement

Your group has been hired by the University Of Waterloo Board Of Governors to prepare a report on the parking situation at the University of Waterloo. It should define both the quantitative (**eg.** number of spaces, cost) and qualitative (**eg.** convenience, equity) needs and concerns. It should dictate how best to achieve these objectives, in the short (<2 years), medium (5-10 years) and long-term (several decades).

Think carefully about your stakeholders. While the campus master plan (including Transportation Demand Management) is not inviolate, think of who would need to be convinced to make changes. What stakeholders are important to key decision-makers in the University? If you do decide to continue existing policies, rather than generate your own solutions, there will be a greater onus to justify and elaborate on the details and implementation of the plan.

Assume the Regional Rapid Transit Proposal will not be reversed, though the exact route locations and corresponding express bus routes are not yet finalized. While the University of Waterloo has contracted you, the University need not necessarily be responsible for implementation of all aspects of your solution. However, you will have to justify how the University could influence, lobby or spend to achieve the proposed course(s) of action.

Some Guidance

Go here: http://wec.uwaterloo.ca/consulting_engineering.html to see how you will be judged (“Marking Scheme”) and what you’re supposed to be doing (“Deliverables”).

It is highly recommended (as the marking scheme shows) to use a structured engineering design method to form the outline of the report and presentation.

Some questions that can get you started (but that do not necessarily have to be answered word-for-word; they are just meant to help you address the problem statement):

- What is the current plan?
- What are some drawbacks to the current plan?
- Who is affected?
- What are the various transportation options?
- What incentives are at play?
- What behaviours need to change?
- What technologies or capital investments must be made?
- How do we measure success?
- What does an ideal solution look like?

Resources

WatPark <http://opendata.uwaterloo.ca/parking/home/>

Campus Map <http://uwaterloo.ca/map/>

References

[1] UW Parking Services <http://parking.uwaterloo.ca/>

[2] Campus Master Plan <http://plantoperations.uwaterloo.ca/cmp/cmp.php>

Area in Acres

Parking Lot Inventory March 2010

Campus Lots

| Number | Parking Lot Name | Regular Spaces | Disabled Spaces | Other Spaces | Total Spaces | Paved Area | Island Area | Total Area | Chargeable Area |
|--------|------------------------|----------------|-----------------|--------------|--------------|------------|-------------|------------|-----------------|
| P01 | A | 633 | 3 | 0 | 636 | 5.100 | 0.250 | 5.350 | 5.100 |
| P02 | B | 188 | 4 | 0 | 192 | 2.950 | 0.080 | 3.030 | 2.950 |
| P08 | Bauer Warehouse | 21 | 0 | 0 | 21 | 0.270 | 0.000 | 0.270 | 0.270 |
| P04 | Brubacher House | 18 | 0 | 0 | 18 | 0.200 | 0.000 | 0.200 | 0.200 |
| P05 | C | 807 | 2 | 0 | 809 | 6.390 | 0.340 | 6.730 | 6.390 |
| P06 | CL Playing Fields | 61 | 0 | 0 | 61 | 0.380 | 0.000 | 0.380 | 0.380 |
| P07 | Columbia Greenhouse | 15 | 0 | 0 | 15 | 0.250 | 0.000 | 0.250 | 0.250 |
| P08 | CLV - North | 309 | 0 | 0 | 309 | 2.840 | 0.060 | 2.900 | 2.840 |
| P09 | CLV - S / Visitor | 161 | 1 | 0 | 162 | 1.500 | 0.170 | 1.670 | 1.500 |
| P10 | D | 15 | 6 | 11 | 32 | 0.340 | 0.000 | 0.340 | 0.340 |
| P11 | E | 67 | 0 | 0 | 67 | 0.580 | 0.000 | 0.580 | 0.580 |
| P12 | ECEC (PAS) | 20 | 0 | 0 | 20 | 0.140 | 0.000 | 0.140 | 0.140 |
| P13 | ECH Gravel | 95 | 0 | 0 | 95 | 0.738 | 0.005 | 0.743 | 0.738 |
| P14 | H1 | 200 | 2 | 0 | 202 | 1.240 | 0.010 | 1.250 | 1.240 |
| P15 | H - Visitors | 70 | 0 | 0 | 70 | 0.530 | 0.000 | 0.530 | 0.530 |
| P16 | Health Services Staff | 23 | 0 | 0 | 23 | 0.076 | 0.000 | 0.076 | 0.076 |
| P17 | Hildegard Marsden | 50 | 0 | 0 | 50 | 0.430 | 0.000 | 0.430 | 0.430 |
| P18 | J | 67 | 0 | 0 | 67 | 0.460 | 0.000 | 0.460 | 0.460 |
| P19 | K | 91 | 0 | 0 | 91 | 0.650 | 0.000 | 0.650 | 0.650 |
| P20 | L | 203 | 3 | 0 | 206 | 1.370 | 0.030 | 1.400 | 1.370 |
| P21 | M | 166 | 2 | 0 | 168 | 1.420 | 0.030 | 1.450 | 1.420 |
| P22 | N | 252 | 0 | 0 | 252 | 1.844 | 0.002 | 1.846 | 1.844 |
| P23 | O Visitor | 69 | 0 | 0 | 69 | 1.100 | 0.000 | 1.100 | 1.100 |
| P24 | O | 146 | 0 | 0 | 146 | 0.530 | 0.000 | 0.530 | 0.530 |
| P25 | R | 139 | 0 | 0 | 139 | 0.886 | 0.002 | 0.888 | 0.886 |
| P26 | RAC | 152 | 4 | 0 | 156 | 1.430 | 0.030 | 1.460 | 1.430 |
| P27 | S | 75 | 0 | 0 | 75 | 0.550 | 0.000 | 0.550 | 0.550 |
| P28 | T | 89 | 0 | 0 | 89 | 0.602 | 0.002 | 0.604 | 0.602 |
| P29 | Tutors Houses | 13 | 0 | 0 | 13 | 0.046 | 0.000 | 0.046 | 0.046 |
| P30 | University Club | 46 | 2 | 0 | 48 | 0.440 | 0.000 | 0.440 | 0.440 |
| P31 | UWP | 611 | 8 | 2 | 621 | 5.640 | 0.050 | 5.690 | 4.321 |
| P32 | V | 74 | 0 | 0 | 74 | 0.560 | 0.000 | 0.560 | 0.560 |
| P33 | W | 189 | 0 | 0 | 189 | 1.274 | 0.004 | 1.278 | 1.274 |
| P34 | X | 627 | 0 | 0 | 627 | 4.883 | 0.004 | 4.887 | 4.883 |
| P35 | Health Sciences Campus | 226 | | | 226 | 1.670 | 0.030 | 1.700 | 1.670 |
| | Total | 5988 | 37 | 13 | 6038 | 49.309 | 1.099 | 50.408 | 47.990 |

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