

*An Innovative
Liquid Transport
Device Competition
for Secondary
School Students*



Department of Architecture and Civil Engineering

City University of Hong Kong



香港城市大學
City University of Hong Kong

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This document is composed to provide relevant information for “**An Innovative Liquid Transport Device Competition for Secondary School Students**” organised in 2023 by the Department of Architecture and Civil Engineering, City University of Hong Kong.

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Copyright Declaration

Participants of this competition have given their consent to CityU to present their competition-related materials (including the device, images, submitted documents) in websites with public access and in institutional activities like exhibitions and demonstrations.

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1. Introduction

- 1.1 The Department of Architecture and Civil Engineering (ACE Department) of the City University of Hong Kong offers undergraduate programmes that cover most professional disciplines of the construction industry. These programmes include architecture, civil/structural engineering, architectural engineering (building services engineering) and surveying.
- 1.2 The ACE Department encourages its students to integrate what they have learnt and put them into practice in innovative ways. Its students have the opportunity to work with students of other disciplines on simulated projects so that they are more ready to practice in the construction industry upon graduation.
- 1.3 From time to time, the ACE Department organises competitions and other events for secondary school students to promote their interest and understanding on the various professional disciplines of the construction industry.
- 1.4 As it has always been a challenge to transport liquid materials, such as wet concrete and water, upwards in construction sites, an innovative liquid transport device competition is being organised by the ACE Department for secondary school students. It provides an excellent opportunity for secondary school students to come together to design and build a functional device that is both innovative, economic, aesthetically pleasing and environmental-friendly.
- 1.5 An organising team of academic and supporting staff (Organiser) of the ACE Department is set up to organise the competition.
- 1.6 Arrangements, details and announcements of the competition are available on the webpage https://www.cityu.edu.hk/ace/Upcoming_open_events

2. The Challenge

- 2.1 It has always been a challenge to transport liquid materials upwards effectively and efficiently in construction sites. There are several types of pumps or other liquid transport devices of various characteristics and capacities to suit different site situations.
- 2.2 To help secondary school students appreciate this, a competition is organised for them to design and build a liquid transport device (Device) through teamwork.
- 2.3 The challenge of the competition (Challenge) is for each participating team (Team) to provide an innovative Device that can transport 500 ml water from a container to another container at a specified higher level within one minute. The Device should be light, innovative, aesthetically pleasing and environmental-friendly.
- 2.4 Each Team has to prove that the Device can meet the Challenge by the actual upward transportation of water at the Competition Day.
- 2.5 The Challenge for each Team also includes the preparation of a document that helps readers to understand the design as well as the quantity and cost of the materials used for building the Device.

3. Rules and Requirements

3.1 Design of the Device

- 3.1.1 Any material, mechanical system and energy source can be used for the Device.
- 3.1.2 The Device comprises its own structural frame and decorations (if any), the water transport mechanism that also includes the facilities to draw and discharge water, and the energy source. All these components build up the total weight of the Device.

- 3.1.3 The Device should stand on top of a flat levelled platform of 500mm x 500mm (to be provided at the Competition Day) without any fixing connection. It can be extended to draw water from one container and discharge water to another container.
- 3.1.4 The Device cannot be assisted by power of any form outside the boundary (see Figure 1), i.e. the energy source of the Device must be physically within the boundary.

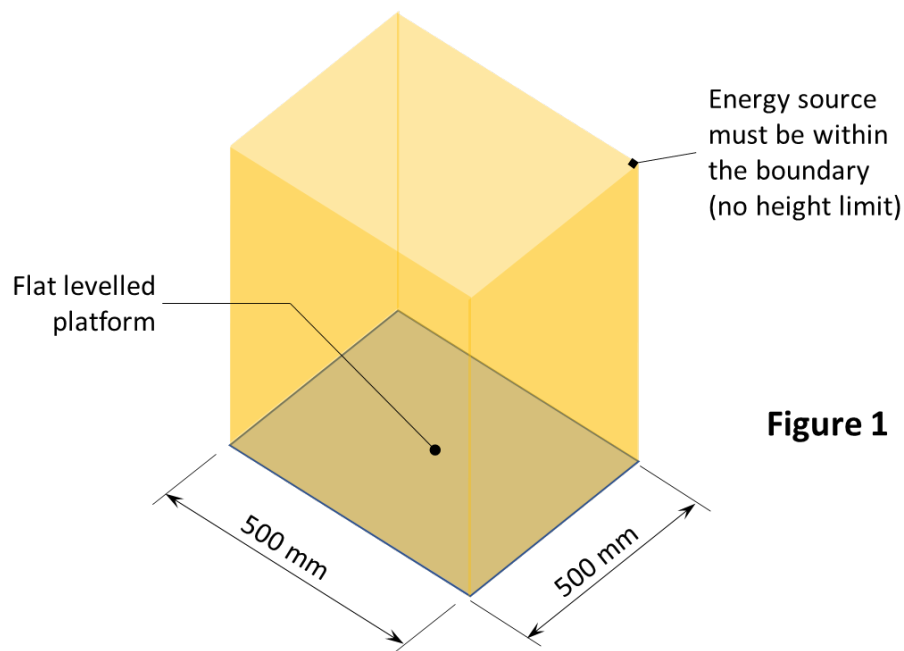


Figure 1

3.2 Documentation of the design and materials used

- 3.2.1 An explanation of the design of the Device and a detailed account of the quantity and cost of the material used in the construction and operation of the Device shall be provided in a document and submitted to the Organiser by email before the deadline as in 6.5.
- 3.2.2 The design of the Device shall cover how the Device supports its own weight and the weight of water being transported, the considerations in choosing the materials for building the Device, the mechanism for transporting water, and the energy source to power up the mechanism.

- 3.2.3 All materials used for the Device involve cost. The detailed account should include the quantity of all materials used and their associated cost. Please note that glues and adhesives, tapes, hoses, electric wires, solder welds, batteries, and any others (except those provided by the Organiser) are also included.
- 3.2.4 The document should have four one-sided A4 pages in Microsoft Word format with one-inch margin from all paper edges. The text, diagram(s) and/or table(s) can be arranged in any format, but the main text should be in “12-pt Times New Roman” font. Only English language can be used. Documents not conforming with the requirements will not be accepted.
- 3.2.5 The Team’s name and number should be indicated at the top right-hand corner of each page of the document.

3.3 At the Competition Day

- 3.3.1 Teams shall report to the competition venue by 2:00p.m. the latest.
- 3.3.2 Each Team can bring in its Device in whole or in parts. The Device should be the one as described in the submitted document.
- 3.3.3 Each Team will be provided with one square platform of 500mm x 500mm by 2:15p.m. No power supply, tools, stationeries and other materials will be provided.
- 3.3.4 By 2:45p.m. all Teams should finish assembling and setting up the Device on the provided platform. The Device should be free standing on the platform, i.e. not fixed to the platform by any connection.
- 3.3.5 The competition shall start at 3:00p.m. Each Team will be invited one by one to do the water transport.
- 3.3.6 At a Team’s turn, its members shall bring the Device supported by the platform to the competition table and connect the Device to the water containers. The relative position of the water containers and the water level at Container 1 are shown in Figure 2.

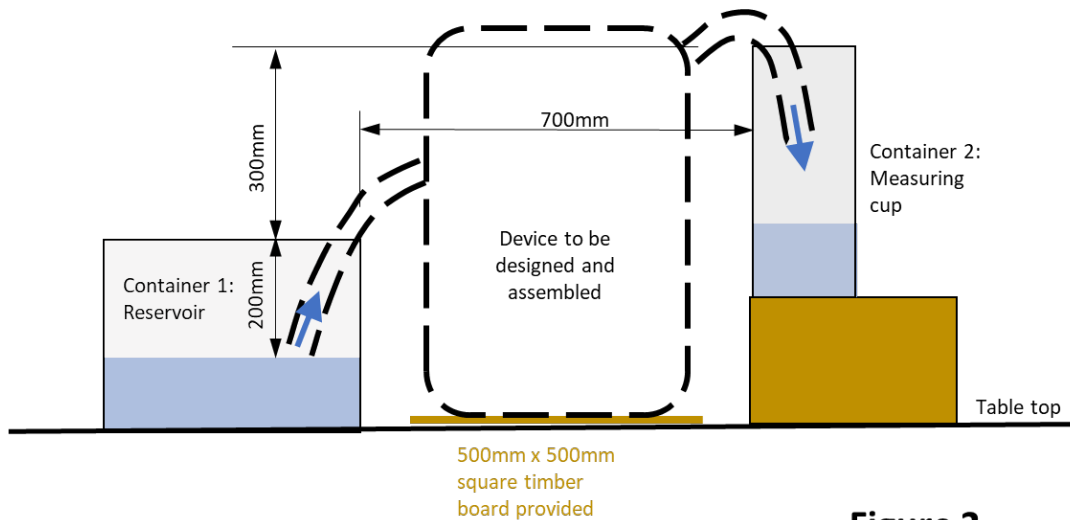


Figure 2

- 3.3.7 The water transportation mechanism can start upon getting a signal from the Organiser. Once the water transportation mechanism starts, no one can touch any part of the Device until the Challenge is completed or failed.
- 3.3.8 A challenge is completed when 500ml of water is transported from Container 1 to Container 2 within one minute from the start of the water transport mechanism. The challenge is considered as incomplete if there is any spillage of water.
- 3.3.9 Each Team can have up to a maximum of three trials to complete the Challenge.
- 3.3.10 Once the Challenge is completed, the total weight of the Device as in 3.1.2 (including the water trapped inside the Device that cannot be cleared within half minute) will be checked by the Organiser and recorded in a record sheet.
- 3.3.11 The Team Leader shall sign the record sheet of its Team to complete the competition process.
- 3.3.12 Any complaint arising should be raised to the Organiser immediately. Complaints will be considered and the outcome as decided by the Organiser will be final.

4. Competition Team

- 4.1 A competition team is a Team that has been properly registered with the Organiser through submitting a completed Registration Form (Appendix A) by email and receiving email confirmation from the Organiser. The first 20 teams that completed the registration process will enter the competition. Each Team will be assigned a Team number.
- 4.2 Any 3 to 4 full-time students by November 2023 from the same secondary school, or equivalent, in the Hong Kong Special Administrative Region can form a Team.
- 4.3 For each Team, one of the members shall be the Team Leader who shall be the sole representative of the Team to communicate with the Organiser.
- 4.4 Once a Team is registered, there shall be no change in its members and Team Leader unless there is strong valid reason(s) acceptable to the Organiser.
- 4.5 The Team shall determine itself on how the work can be shared among its members.

5. Guidance and Support

- 5.1 All the relevant details and notes of the competition are contained in this document. There is an online Briefing Session to be held on 11 September 2023 to explain the contents of this document. Interested students and their potential Advisor as in 5.3 are welcome to join the Briefing Session before submitting the Registration Form.
- 5.2 Each and every Team shall provide itself at own expense with all the materials, tools and equipment that are needed for the competition. However, Teams that can complete the Challenge will receive prize as in 7.7 or other awards.
- 5.3 Each Team has to invite ONE teacher or any other person as its Advisor who can advise the Team any time during the preparation work and at the Competition Day. No person can be Advisor of more than one team.

- 5.4 The Advisor cannot involve in the actual design and construction of the Device. He/she has to complete the Advisor Declaration Form (Appendix B) which has to be submitted together with the Team's Registration Form as in 4.1. Once registered, a Team cannot change its Advisor unless there is strong valid reason(s) acceptable to the Organiser.
- 5.5 The Advisor can also attend the Competition Day. He/she can advise the Team verbally, but cannot involve in the actual setting up and operation of the Device.

6. Key Dates

- 6.1 Please note the following key dates:

11 September 2023	Briefing Session
23 September 2023	Deadline of submitting Registration Forms
4 November 2023	Last day of making inquiries to Organiser
10 November 2023	Deadline of submitting explanation of the design and the detailed account of material quantity and cost of the Device
18 November 2023	Competition Day and presentation of awards

- 6.2 As in 5.1, a Briefing Session of the competition will be held on 11 September 2023, 6:30p.m. to 7:00p.m. via Zoom. Please complete and submit the form on <https://forms.office.com/r/HKqCzQx0kC>, and the Zoom link will be emailed to you.
- 6.3 All Registration Forms of the competition (Appendix A), together with the Advisor Declaration Form (Appendix B), should be submitted before 5:00p.m. of 23 September 2023 by email to the Organiser at acedept@cityu.edu.hk. Late submissions will not be acceptable.
- 6.4 Teams can make inquiries to the Organiser by email through the Team Leader on or before 4 November 2023. Apart from answering the Teams that made the inquiries, some of the questions and answers may be displayed on the webpage https://www.cityu.edu.hk/ace/Upcoming_open_events under the competition's FAQ section.

- 6.5 Explanation of the design and detailed account of material cost of the Device should be submitted before 5:00p.m. of 10 November 2023. Teams not submitting before the deadline will be considered as withdrawal from the competition.
- 6.6 The Competition Day and the presentation of awards on 18 November 2023 will be conducted at the campus of the City University of Hong Kong. Exact location will be announced later.
- 6.7 In special circumstances, such as typhoons, these key dates and the venue of the Competition Day and the presentation of awards may change. The Organiser will make formal announcement on the webpage https://www.cityu.edu.hk/ace/Upcoming_open_events and notify Teams if there is any change.

7. Awards and prizes

- 7.1 Only Teams that can successfully complete the Challenge in accordance with the rules and requirements will be entitled to awards and prizes.
- 7.2 The Team with the lightest device will be the Champion. It will be awarded with a trophy and HK\$5,000 worth of shopping coupons. Each member of the Team will be presented with a certificate.
- The Team with the second lightest device will be the 1st runner-up. It will be awarded with a trophy and HK\$3,000 worth of shopping coupons. Each member of the Team will be presented with a certificate.
- The Team with the third lightest device will be the 2nd runner-up. It will be awarded with a trophy and HK\$2,000 worth of shopping coupons. Each member of the Team will be presented with a certificate.
- 7.3 One special award of HK\$1,000 worth of shopping coupons will be presented to the Team with the most innovative device. Each member of the Team will be presented with a certificate. The Team receiving this award may or may not have received other award(s).

- 7.4 Another special award of HK\$1,000 worth of shopping coupons will be presented to the Team with the most elegant device. Each member of the Team will be presented with a certificate. The Team receiving this award may or may not have received other award(s).
- 7.5 Another special award of HK\$1,000 worth of shopping coupons will be presented to the Team with the most environmental-friendly device. Each member of the Team will be presented with a certificate. The Team receiving this award may or may not have received other award(s).
- 7.6 A further special award of HK\$1,000 worth of shopping coupons will be presented to the Team with the most detailed and well-presented account of material quantity and cost. Each member of the Team will be presented with a certificate. The Team receiving this award may or may not have received other award(s).
- 7.7 Teams that completed the Challenge successfully but have not received any awards in 7.2, 7.3, 7.4, 7.5 and 7.6 will receive a prize of HK\$500 worth of shopping coupons per Team. Each member of the Team will be presented with a certificate.

8. Inquiry

- 8.1 All inquiries of the competition shall be made by email to the Organiser at acedept@cityu.edu.hk.
- 8.2 Once a Team is successfully registered, all subsequent inquiries should be made by the Team Leader to the Organiser by email. Inquiries made by other team members or the Advisor will not be entertained.

Appendix A: Registration Form

Proposed name of the Team: _____

Name of Team Leader: _____ ID number: _____

School: _____ Form: _____

Mobile number: _____ Email: _____

Corresponding address: _____

Name of student: _____ ID number: _____

School: _____ Form: _____

Mobile number: _____ Email: _____

Name of student: _____ ID number: _____

School: _____ Form: _____

Mobile number: _____ Email: _____

Name of student (optional): _____ ID number: _____

School: _____ Form: _____

Mobile number: _____ Email: _____

Name of Advisor: _____

- Notes:**
1. The names in this form will be used to print certificates (if the Team has any award)
 2. ID number is the number of HKID card or passport bearing the student's name to be checked at the Competition Day.
 3. The Form of the student refers to the level of study by November 2023

Appendix B: Advisor Declaration Form

(to be submitted together with Appendix A)

Advisor name: _____

Rank and Organisation: _____

Mobile number: _____ Email: _____

Dear Organiser,

I hereby undertake to advise students of the Team _____
in the preparation for the competition, and I will not involve in the actual
design, construction and operation of the Device.

Signature

Date