Challenge! Open Governance 2017 Application Form for Citizens & Students

Title of Regional Issue*	No.	Title	Name of Municipality
	-（事務局用）	Use of moving vehicle data	Aizuwakamatsu City
Name of the Idea (disclosure)	Connect with the Region, Snow Clearance Project		

（*Enter the title of regional issue of the applying municipality as described in COG2017 website.

1. Applicant Information

Name of the team (disclosure)	STEM Leaders with Hanyu	
Team attribution (disclosure)	◯ 2. 学生によるチーム	
Number of members	5	
Team leader (only the name will be disclosed)	Name (disclosure)	Yuki Sato

※Conditions for information disclosure

Information provided in "2. Description of Idea" beginning on the next page will be disclosed under the Creative Commons Attribution 4.0 International license (CC BY 4.0) after confirmation of its contents. At the request of the applicant, however, such information will be disclosed under the CC BY-NC (Attribution – Noncommercial) 4.0 International license. Please let us know your preference at the time of application. In both cases, the name of the applying team will be used.

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(Notes)

<Name of the file for application and addressee>

1. Send the file with the filename COG2016_applicationform_teamname_municipalityname to the address below. You can also access this address via the application registration column on the COG2016 website of the Graduate School of Public Policy, The University of Tokyo: admin_padit_cog2016@pp.u-tokyo.ac.jp

<Public or private information>

2. The name of the idea, name of the team, team attribution, name of the team leader, and "description of idea" will be open to the public.

3. The contents above will be reviewed before disclosure (anything which is harmful to public order, unethical, or making use of a plagiarized idea will not be disclosed).

4. The "self-evaluation" column of the application form will not be disclosed. However, if the content is excellent and deemed useful for other applicants, it may be disclosed after consultation during the advice stage after the open review.

5. If any element associated with an intellectual property right whose holder is not a member of the applying team, such as texts, photographs, and graphics, is included in the "description of idea," it should be demarcated stating that it is quoted according to the relevant laws and regulations or that its use has been approved by the right holder. Please do the same for the "self-evaluation" column.

<List of the team members>

Submit the list of the team members in the attached Excel file (Any information about members other than the team leader as specified in 2. above will not be disclosed except to the COG Secretariat. Please see the attachment for details)

2. Description of the Idea

Fill in three items: (1) content of idea, (2) rationale for idea, and (3) how to realize it.

(1) content of the idea

Please show the contents of the idea by putting these elements in the idea as to who, what, where, when, and how it is a public service (activity) to do.

Connect with the Region – Snow Clearance Project

In Aizuwakamatsu City 60% of the total annual complaints received by the road maintenance division relate to snow clearance. For example, in December 2014 alone the road maintenance division received **a total of 934 complaints and requests relating to snow clearance**. In this context, we focused on those concerning **"dealing with ruts and bumps, etc."** and **"better snow clearance (unacceptable standard)."** We considered that the reason for these issues could be the low level of skill of existing, new, and emergency snow clearance providers. We note that the reason for this low level of skill could be that there is no snow clearance evaluation system, no method for grasping local characteristics, and the state of the roads. We propose a web app which can solve the above problems.

[Overview of the Snow Clearance Project]

Who? Collaboration of the road maintenance division, snow clearance providers, and citizens,

What? Snow clearance that is satisfactory to citizens,

Where? All of Aizuwakamatsu City,

When? During winter,

How? A public service which uses a web app to detect bumps in the roads.

[Overview of Web App for Detecting Bumps]

1. What can be done with the web app

1.1 Evaluation of existing snow clearance providers

⇨Result: Visualization of the existing snow clearance ability leading to improvement of the provider.

1.2 New suppliers and those in emergency situations can quickly learn the characteristics of the region and its roads (*see note below).

⇨Result: Providers can swiftly and thoroughly clear snow.

*Characteristics of the region and the roads: Due to the fact that the location of manholes and curbs cannot be detected by the web app alone (road diagnosis map) there is a need to create a manual **for each area** which aggregates location information.

Nevertheless, there is a limit to what snow clearance service providers can achieve.

For example: Narrow roads where clearance vehicles cannot enter, roads where tight turns are not possible, places where there is high traffic volume and snow clearance vehicles cannot work during daytime, and the fact that temperatures drop at night which means that snow which melted during the day becomes frozen and unable to be cleared.

⇨Therefore, we have decided that we will need the cooperation of the city residents.

[Application]

The cooperation of residents will make it possible to clear snow from road which are too narrow for snow clearance vehicles to enter.

Furthermore, citizen cooperation with snow clearance will make it possible to **spread snow melting agents efficiently.**

*Reason for the use of melting agents: Melting the snow makes it easier to clear the uneven snow mounds.

Current Situation: A snow melting agent can only be used at night, when snow clearance providers are at work.

⇨The cooperation of residents will make it possible to ask them to spread the melting agent during the day.

*Road in the morning (left image) and at night (right image) after heavy snowfall in Aizuwakamatsu City on Dec 12, 2017. When there is heavy snowfall (right image), the bumps caused by the snow result in traffic jams.

(2) Rationale for the idea

Describe the Rationale for the idea (why have you chosen this idea?) with numerical data (achievements, statistics, or questionnaire results) and evidence (materials, plans, or existing measures) that support the idea (collectively, the "data").

Our project started from a small and quite vague problem that we observed— "Snow clearance in Aizuwakamatsu City is worse than other municipalities is it not?"

First, we compared snowfall volumes in Aizuwakamatsu City with that in other municipalities.
The table below shows snowfall volumes for the hometowns of our members—Yuzawa (Akita Pref.) and Sapporo (Hokkaido).

Year	Location	Snowfall
2015	Aizuwakamatsu City, Fukushima Prefecture (residence of Tsuchibashi)	519 cm
2015	Yuzawa City, Akita Prefecture (residence of Yuki Sato)	693 cm
2015	Sapporo, Hokkaido (residence of Kai Sato)	367 cm

<Source: Japan Meteorological Agency>

From the above table, we predicted that skill at snow clearance is not related to snowfall volume.

In order to further investigate our vague feeling that snow clearance was not good in Aizuwakamatsu City, we conducted a hearing with an employee of Aizuwakamatsu City's road maintenance division and conducted an analysis of raw data of complaints and requests relating to snow clearance.
(*The hearing with the road maintenance division was carried out as part of the University of Aizu venture experience studio course which is being carried out with the support of data scientists from Accenture and employees from the city's information policy division.

[Current state of snow removal in Aizuwakamatsu City]
・The hearing with the employee of the road maintenance division and an analysis of complaints and requests relating to snow clearance revealed that the seasonal ratio of the amount of complaints/requests per year is

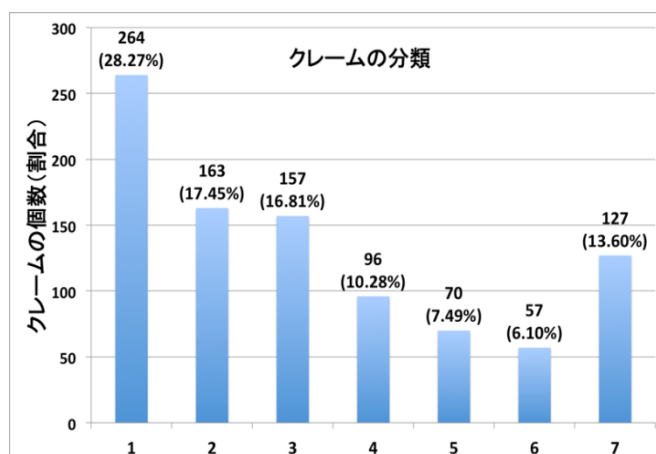### Spring/Summer/Autumn (Apr–Dec) : Winter (Dec–Mar)= 4:6

The **four winter months** when snow falls accounts for **60% of the total**.
(*Further details: Complaints and requests during spring, summer and autumn were not requests that required immediate response, such as requests for road repair or mowing.)
In other words, we found that **there is a lot of dissatisfaction with and requests for snow clearance** in the everyday lives of people living in Aizuwakamatsu City. The challenge for the city's road maintenance division is to eliminate resident dissatisfaction **and reduce the number of complaints.**

The figure below presents a categorization of the **December 2014 complaint data**.
(*According to the Japan Meteorological Agency, the snowfall in Aizuwakamatsu City totaled 180 cm in Dec 2014)

クレームの分類

縦軸: クレームの個数（割合）

- 1: 264 (28.27%)
- 2: 163 (17.45%)
- 3: 157 (16.81%)
- 4: 96 (10.28%)
- 5: 70 (7.49%)
- 6: 57 (6.10%)
- 7: 127 (13.60%)

1. 早期除雪（遅い・来ない・圧雪）
2. 排雪要望や雪山処理
3. わだち・凸凹・ザケ処理
4. 家の間口の雪処理
5. より丁寧な除雪の仕方（下手）
6. 道路拡幅
7. その他

[Considerations]

In December 2014 alone there were 934 complaints and requests relating to snow clearance.
The types of complaints were (in order of frequency) "quick clearance," "snow clearance or removal of snow mounds," and "removal of ruts and bumps, etc."

At present Aizuwakamatsu City is implementing a web app which uses snow clearance vehicle data to enable real-time knowledge of the status of the operation of snow clearance vehicles in order to address "quick clearance" complaints and requests.
In this context, we propose a system which uses data on official vehicles in order to address complaints and requests relating to "removal of ruts and bumps, etc." and "better snow clearance (unacceptable standard)."

We predict that the reasons for the large amount of complaints relating to "removal of ruts and bumps, etc." and "better snow clearance (unacceptable standard)" are as follows:

①Existing snow clearance service providers are not good at their job
[Reason]
There is no current system for assessing the skill level of existing snow clearance service providers. There is no robust development system for teaching workers new skills and improving their performance.

②New snow clearance service providers are not good at their job

[Reason]
Snow clearance in Aizuwakamatsu City is very difficult to do well without prior knowledge of the characteristics of the area and the state of the roads (ruts, bumps, potholes that exist even before snow has fallen).
(*At the moment, the yearly average of contracted snow clearance providers in Aizuwakamatsu City is 120 (30% contracts with individuals; 70% contracts with companies), with 20% of them subject to substitution in the following year).

To solve ① and ②

We have developed a web app that uses data gathered on official vehicles to detect and visualize unevenness on roads.
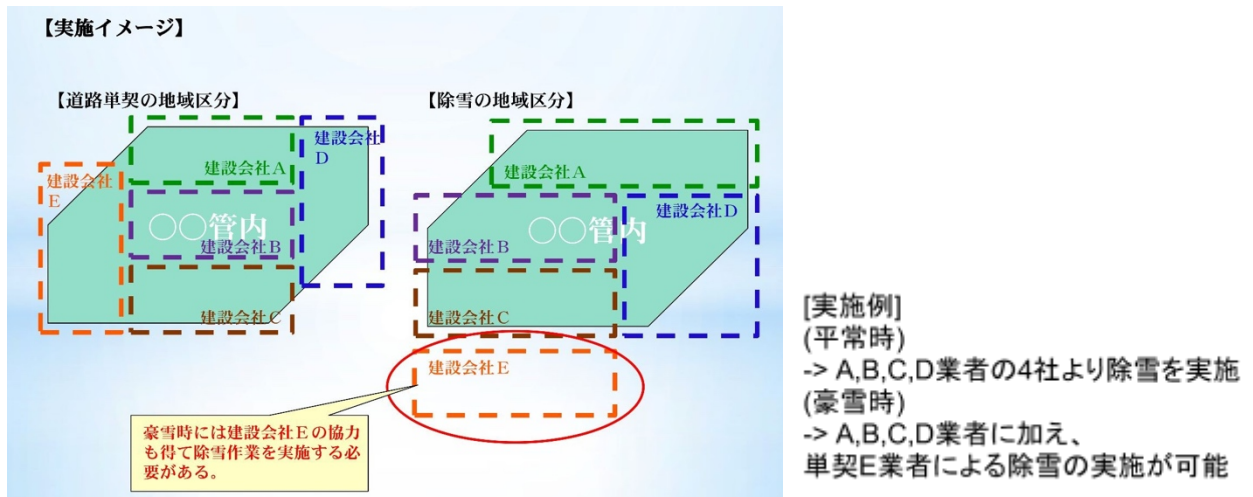
[Web app-based solution process]
1. The web app detects areas of road that are relatively uneven during winter and plots them on a map.
2. Snow clearance providers can conduct focused training on such areas. Further, by detecting unevenness outside of winter it is possible to understand the characteristics and shape of the road, meaning that new operators will be able to carry out snow clearance with fewer worries.

This web app can also solve the problem of aging and declining numbers of snow clearance providers.
[Reason]

At present, there is a concern that the population of snow clearance providers is aging and declining. Aizuwakamatsu City has implemented the system illustrated in the diagram below in order to procure support in times of heavy snowfall when there is a shortage of capable manpower. Nonetheless, due to the fact that Provider E is not familiar with the characteristics and shape of the road, they may not be able to do a good job. Using this web app will enable better snow clearance.

【実施イメージ】

【道路単契の地域区分】　　　　　　【除雪の地域区分】

建設会社E
建設会社A
建設会社D
○○管内
建設会社B
建設会社C

建設会社A
建設会社D
○○管内
建設会社B
建設会社C
建設会社E

豪雪時には建設会社Eの協力も得て除雪作業を実施する必要がある。

[実施例]
(平常時)
-> A,B,C,D業者の4社より除雪を実施
(豪雪時)
-> A,B,C,D業者に加え、
単契E業者による除雪の実施が可能

(3) How to realize it

Describe the process and milestones, etc.

●Procurement Method for Required Resources (People, Things, Money)

	Required Resources	Scale	Procurement Method
People	System operation / Maintenance staff	5	Provided by University of Aizu students involved in the course (us).
	Documentation update staff	5	As above
	Snow shoveling volunteers	500	Recruit from Josesasaizu/Sasukene! members, University of Aizu students, and Junior College of Aizu students
	Snow melting agent dispersal team	30	Negotiate with snow clearance service providers to secure cooperation
	Professional snow clearance providers	50	As above
	Snow clearance providers for testing	10	As above
	Road maintenance division / Information policy division **(see *Note 1)**	2	Already procured (close contact through university classes)
	People to promote expansion to other areas	40	From STEM Leaders (see *Note 2**)
	Advisors (from Accenture, etc.)	3	Already procured (close contact through university classes)
Things	WEB application	To a degree that can handle access by residents of Wakamatsu City	Made by University of Aizu students (us)
	Official vehicle data	From roads within Aizuwakamatsu City	To be provided by the road maintenance division **(see *Note 4)**
	Josesasaizu / Sasukene!	Depends on number of members	Meet and negotiate with Josesasaizu and Sasukene!
	Manual	For each snow clearance service provider	Created by snow clearance providers and the road maintenance division
Money	System design, development, operation, and maintenance costs	¥5 million	Money saved by the use of our app on the ¥700 million spent on snow clearance by Aizuwakamatsu City every year. Donations from those who request snow clearance may also be collected.
	Cost of snow clearance tools	¥2.5 million	
	Payment to volunteers (see **Note 3**)	¥10 million	

Note 1: We would like to make a request to link the existing snow clearance status system with our web app.

Note 2: STEM Leaders refers to the student organization made up of over ten universities that develop human resources in the STEM fields.

Note 3: 50 (number of days with heavy snow in Wakamatsu) x 50 (number of volunteers per day) x ¥2000 (rate) x 2 years = ¥10 million

Note 4: To improve data precision we would like to request steps be taken to increase target official cars, based on operation results.

●How can we measure the bumps in the road?

[Target Data]

Data from vehicles equipped with an acceleration sensor.

[Measurement Steps]

1. A Fourier transformation is applied to the target data to divide them into angular frequencies.
2. A histogram is created from the totaled amplitudes (left diagram).
3. The size of the vibration is measured using the histogram, and bumps are detected.
   *The graphs below show roads where vibrations were not detected (center diagram) and detected (right diagram). This method will enable the detection of bumps on the road.
4. If the quantity of detected bumps exceeds the top n percent, the unevenness of that location will be determined to be unacceptable and will be plotted on the map (see below).
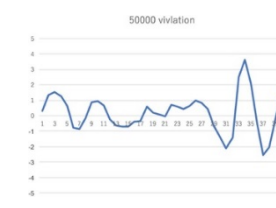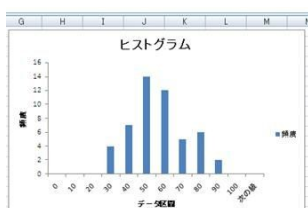
● Map specification when detecting bumps with the web app

The output (road diagnosis map) of the proposed web app is as follows.
Analyzing official vehicle data and plotting the results as points on the left map does not take into account the accuracy of the detected data.
As outliers (values caused by external shocks) exist in the detected data, creating a map such as that on the right, where a mesh overlay is applied to the roads and frequencies are calculated for each portion, takes into account accuracy.

*In the right map, the darker areas indicate greater frequency.
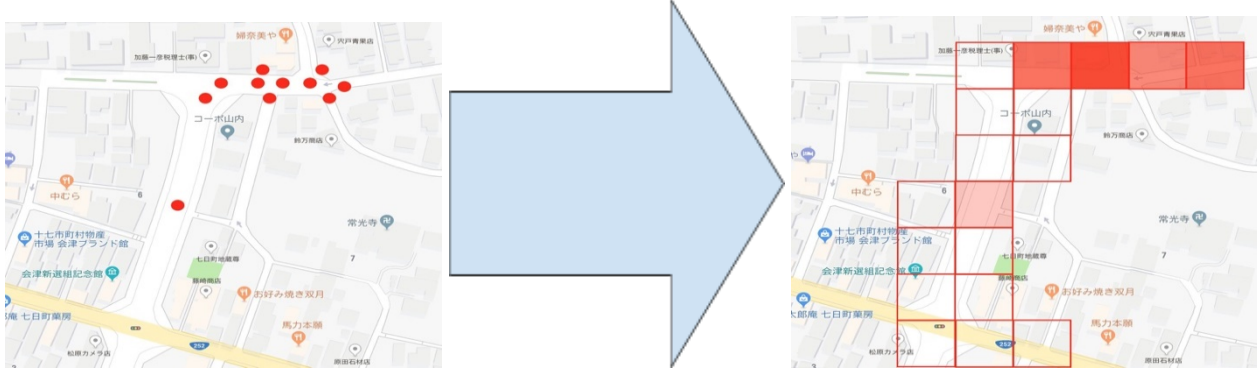
●How can we evaluate whether snow clearance is easier when new or emergency providers use the manual?

[Plan]

Several months after the introduction of the manual, providers will be asked to answer a questionnaire.

(* Because we desire a variety of data. Newcomers and those with long experience will not be asked.)

[Items]

- ●Number of years of snow removal experience
- ●Was it actually difficult to remove snow from the places that were plotted on the map? (Including reasons)
- ●Was the manual useful? etc.

[Results]

Benefits of collecting data with a questionnaire

- Possible to determine whether snow removal has become easier.
- Possible to determine the accuracy of the web app bump detection system.
- The relationship between work history and skill (whether or not the plotted points were cleared) can be investigated.

●Will citizens actually cooperate in snow removal?

[Proposal]

- Collaborate with "Josesasaizu," a group which performs snow removal as a form of exercise.
  - Request volunteer participation from "Josesasaizu" members.
- Utilize "Sasukene!," an app developed by University of Aizu students and Ichikawa Densan.
  - This is an app that people can use to signal when they are in trouble due to snowfall and thus receive help from nearby snow clearance volunteers.
    By linking this app with the proposed web app it will be possible to estimate locations that are difficult to clear with snow clearance vehicles and then request clearance for those areas. Making the flow for sending these requests automatic will further increase efficiency.

・Milestones to making the idea a reality

[Year 1] Develop and improve accuracy of bump detection system; create a manual; recruit volunteers from "Josesasaizu"; and operate "Sasukene!".

[Year 2] Test the operation of the system in a limited area; manage volunteers; and manage the app.

[Year 3 Onward] Roll out system to all of Aizuwakamatsu City; expand the volunteering operation; and manage the app.
Academic, commercial, and governmental connections from the University of Aizu, Aizuwakamatsu City, and Accenture support this project. Moreover, this project has the potential to not just be a one-off but to be an ongoing project carried out through the collaboration of present and former students of the University of Aizu and the Junior College of Aizu, as well as STEM leaders.