Crowd control adaptive to individual and group attributes

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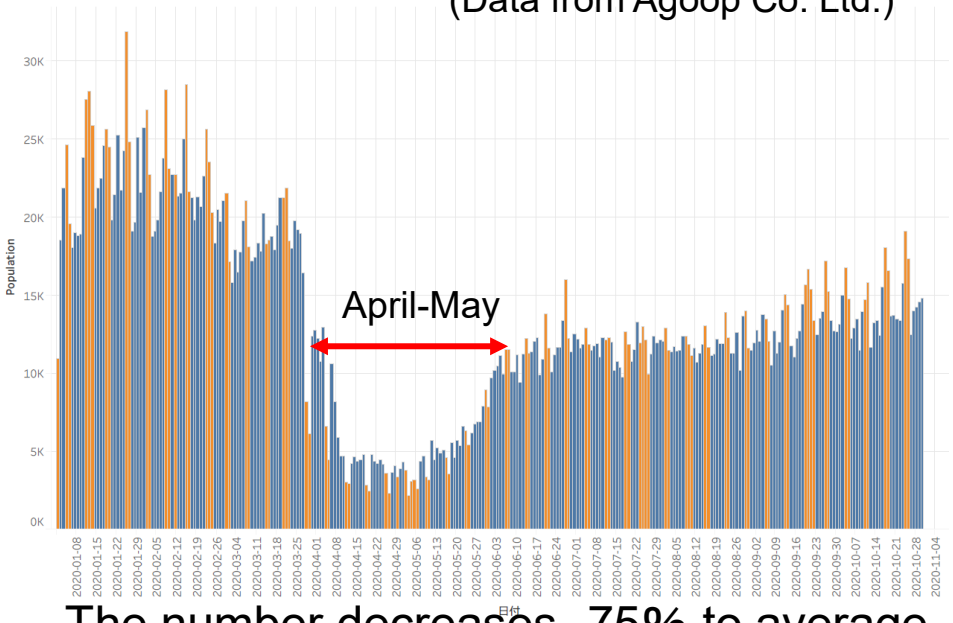
JST MIRAI

What has been changed during pandemic?

People stay at home, and economy has deteriorated!

Pedestrians at the Shibuya center street
(Data from Agoop Co. Ltd.)



The number decreases -75% to average.

We have to solve the trade-offs between safety against virus and economic prosperity.

Crowd management becomes more and more important!

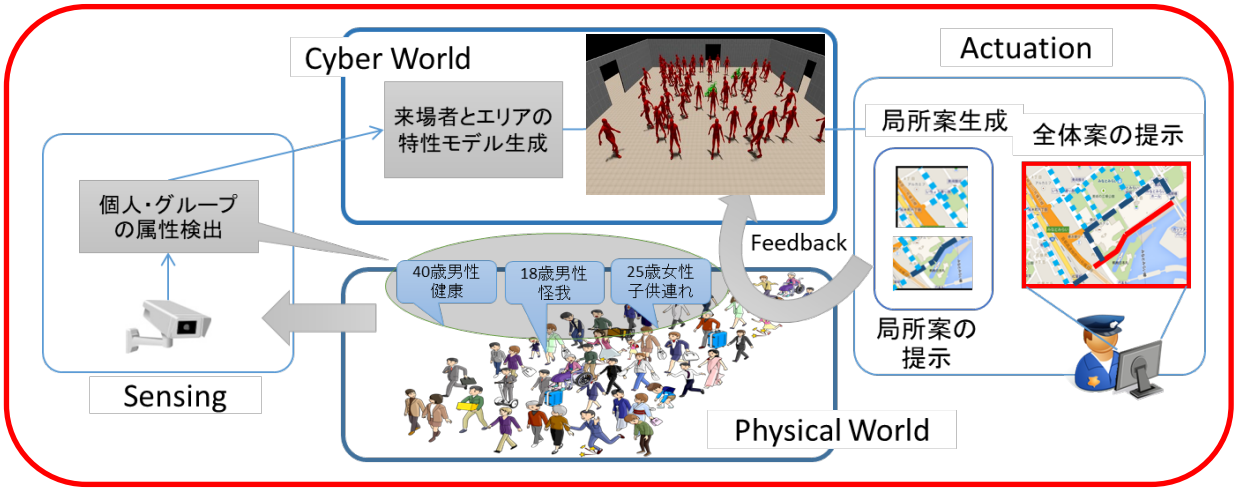
Avoid Three Cs!

✓Closed spaces
(with poor ventilation)
✓ Crowded places
(with many people nearby)
✓ Close-contact setting
(such as close-range conversations)

National project of "Crowd Management (CM)" funded by JST has been started from April 2020!

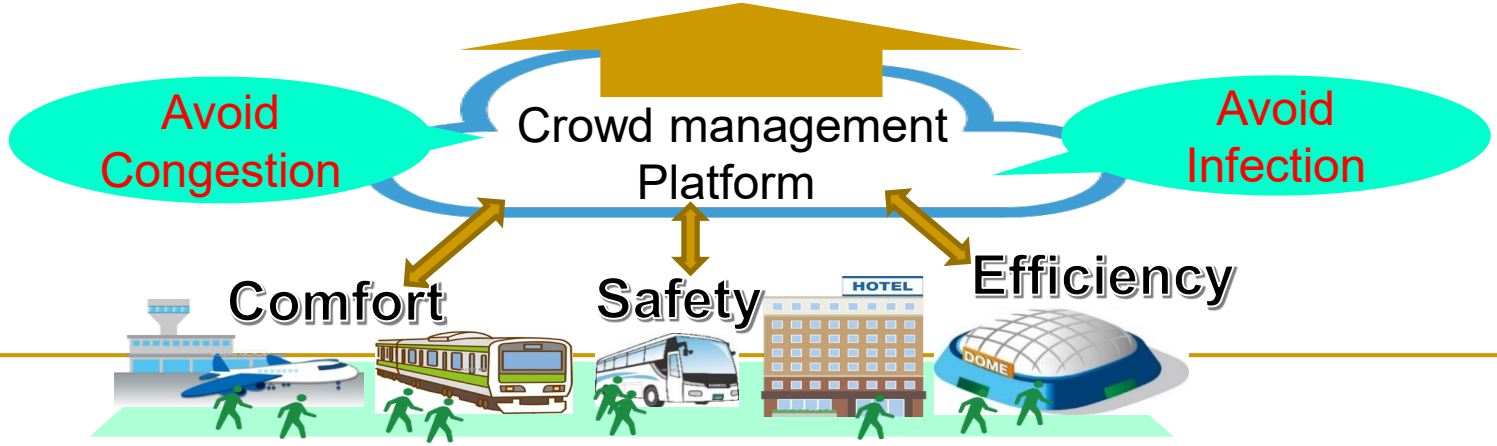
R&D Team : The University of Tokyo, Hokkaido University, Osaka University, Mitsubishi Electric, SECOM, Goodfellows, Nihon Unisys

Goal: Support individuals' comfort, safe and efficient walk by "CM platform"



Recent Development of

- ✓Sensing technology by AI
- ✓ Crowd simulation
- ✓ Information devices

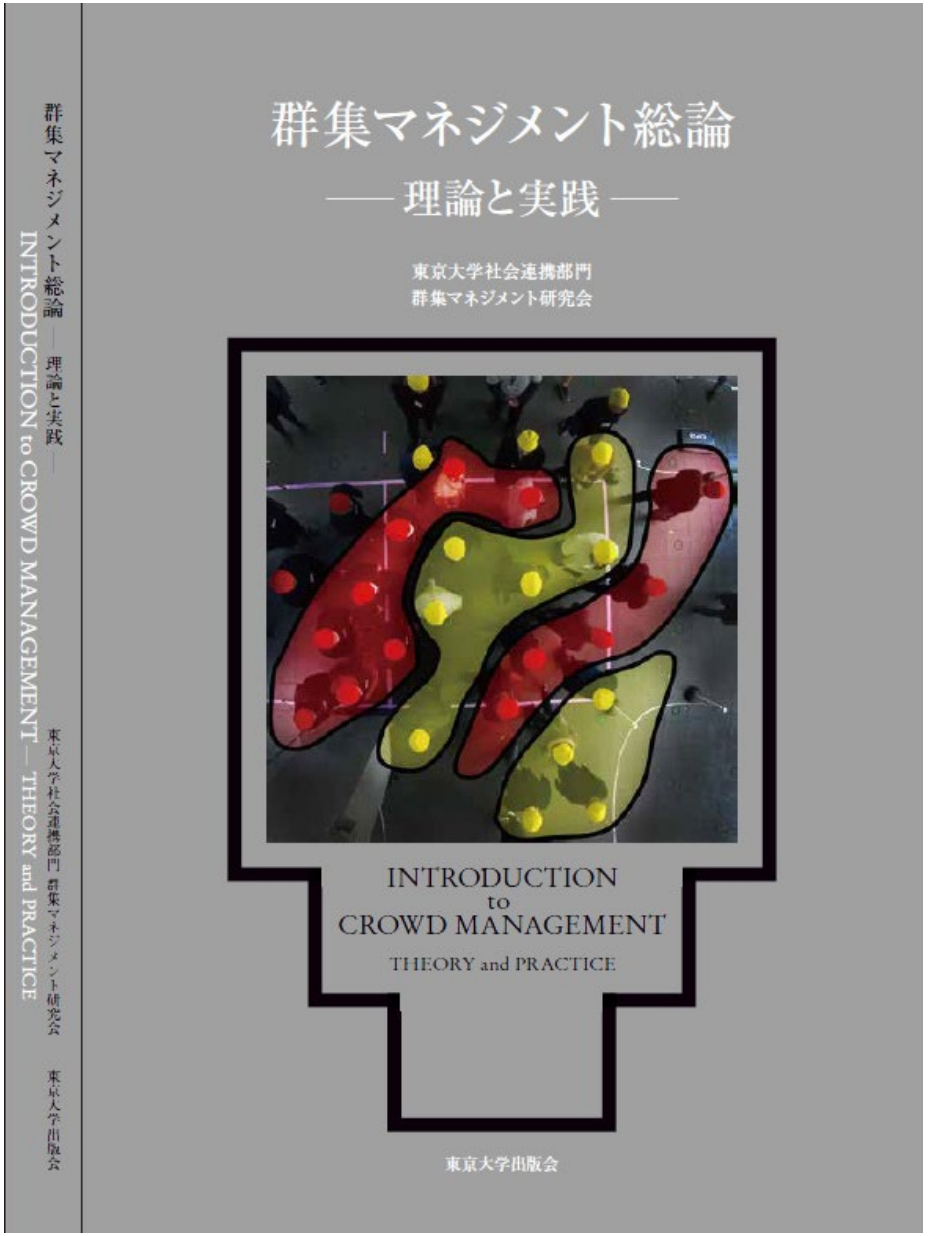


New publication "Introduction to Crowd management" has been released!

Date 17th, June, 2020
(in Japanese)

Thanks to the "free time" brought by quarantine!

English version will be published in next April from Springer!



Crowd management under COVID-19

It is not enough to control crowd only by “density”.
“Keeping Distance” becomes more important.

Risk Level ＝ usually LOS （level of service）is used. (Fruin, 1971)

LOS	walkway	steps	Queuing
A	< 0.18	< 0.53	< 0.83
B	0.18 - 0.27	0.53 - 0.63	0.18 - 0.83
C	0.27 – 0.45	0.63 – 0.91	1.08 – 1.54
D	0.45 – 0.71	0.91 – 1.43	1.54 – 3.70
E	0.71 – 1.33	1.43 – 2	3.70 – 5.26
F	1.33 ≤	2 ≤	5.26 ≤

Tokyo 2020
＝better than LOS E (in 2019)

Under Covid-19
＝”at least” LOS A is needed

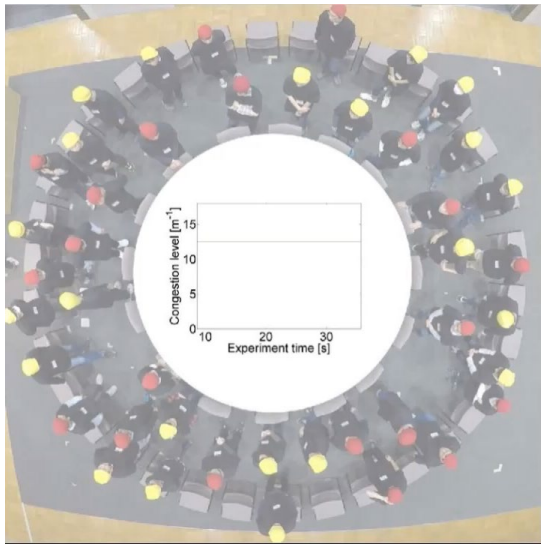
How to control crowd under COVID-19?
- ✓Ticket control and reservation becomes more important.
- ✓New index instead of LOS is needed for crowd management.

Sensing distance between individuals may be possible, but it is heavy and real-time use is difficult.

A new index of congestion

- We focus on "crossing" between individuals.
- Even if high density case, one-way pedestrians have less risk.
- Even if low density case, crossing pedestrians have high risk.

Congestion index＝"rotation of flow" / mean velocity



Density is constant throughout the experiment.

Congestion index suddenly decreases after separation of lanes!

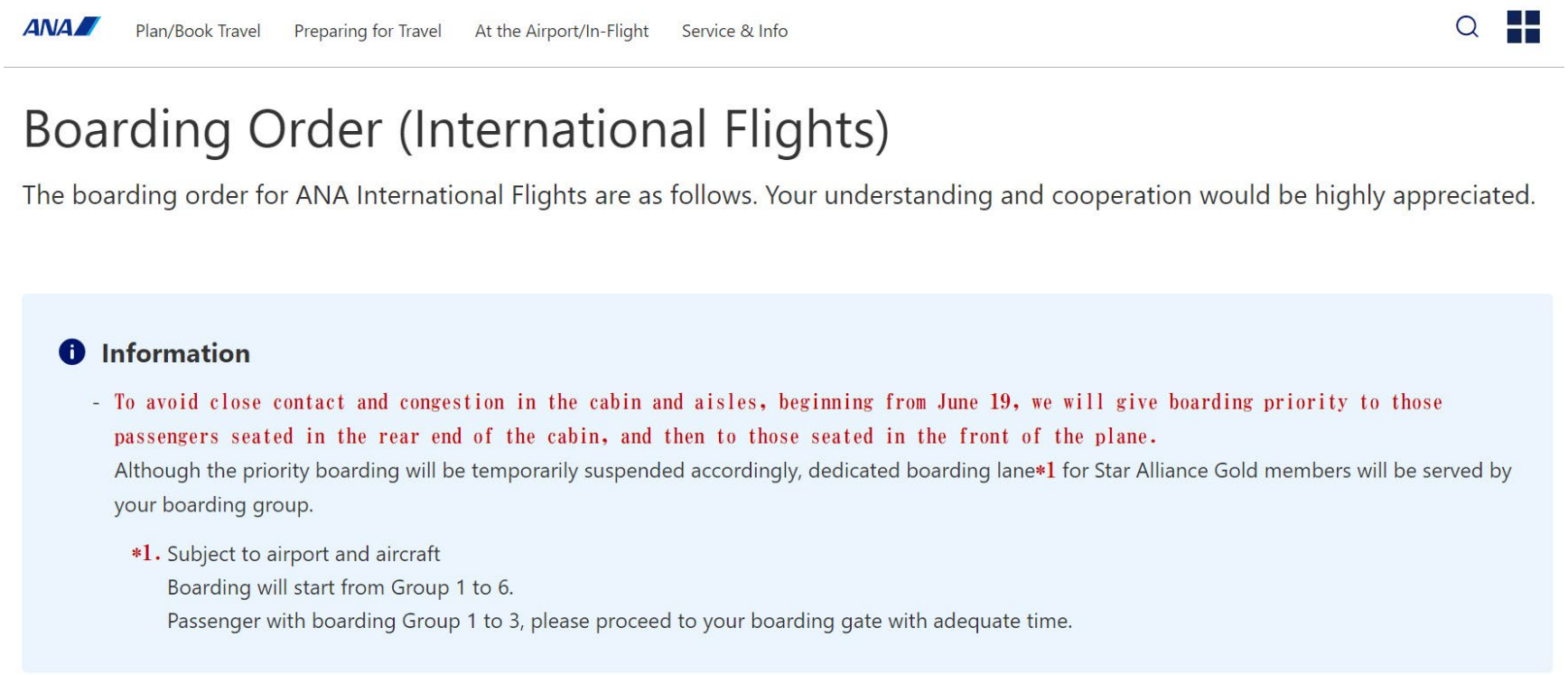
Feliciani, C. and Nishinari, K., Transportation Research Part C, vol. 91, pp. 124-155, 2018.

On boarding safety (collabo with ANA)

Advice ✓Stop priority boarding

✓Division of 6 groups, boarding from rear to front

From June 2020, ANA adopted this strategy under our consultant!



Seven "knows" for Crowd Management

1. Know your guests: learn crowd attributes
2. Know accidents: learn from the past
3. Know current situation: sensing crowd
4. Know future: simulation of crowd
5. Know risks: planning by risk assessment
6. Know control methods: crowd control
7. Know stakeholders: information sharing and decision making

Problems always arise at "boundaries"!