

Research project Fieldlab Evenementen phase II: mass sports events

Data collection and monitoring of group dynamics between visitors of the Fieldlab Evenementen pilot events

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1. Introduction

The focus in this report is on event type V: mass sports events. Specifically, this means the research conducted during the mud run organised by the Mudmaster organisation and the 10-kilometre run organised by the foundation “Enschede Marathon”. The research concerns the participants in the event and therefore has a different focus than the events carried out in phase I: the soccer matches. During the soccer matches, it concerned the spectators instead of the participants.

2. The event

The definition of event type V is a mass sports event, which is characterised as an event that takes place outdoors and has an active nature. Participants are enthusiastic, active, and exuberant and have an 'assigned' starting time. Within the athletics events covered in this report, there are no allocated seating/standing places, it concerns the monitoring of the participants. Spectators were not welcome.

On Saturday 8 May, the first type V event, initiated by Fieldlab events, took place. The organisation of this event on the former Floriade grounds was in the hands of “Mudmasters”. The start of this sports event was at 09.00h and the last starting group left at 16.00h. The event ended around 18.00h.

On Sunday 16 May, the second type V event, initiated by Fieldlab events, took place. At Twente Airport, the 'Enschede Marathon Foundation' organised the 10-kilometre running event. The start of this sports event was at 10.00h and the last starting group left at 16.00h. The event ended around 18.00h.

3. Risk profile

The building block, visitor dynamics, focuses on minimising the risk of infection at events. To map the profile of the event, a distinction is made between factors that normally play a role when analysing the risks at events in a non-covid situation. A distinction is made between the activity profile, the spatial profile, and the public profile (Van den Brand & Abbing, 2003).

3.1. Activity profile

The activity profile presented in Figure 1 came about through a brainstorming session with various stakeholders (Kamphorst, Donders, Coolen, Rijn, & Pas, 2020). It concerns the processes at the event where visitors come together and where there is a possible risk of contamination. This involves visitors coming into contact with each other at a certain location, for a certain length of time and at a certain risk. By localising, describing, and analysing the risks, processes can be optimised, and the spread of risks minimised.

A distinction is made between the activity profile, the space profile, and the public profile (Van den Brand & Abbing, 2003).

Touchpoints (Ingress)		Mudrun	10-kilometre run
Parking		Nearby car park	Nearby car park
Entrance		Ticket, negative test result and after receiving tag	Ticket, negative test result and after receiving tag
Placing		Based on start time and starting area	Based on start time and starting area
Visitation		Not applicable	Not applicable
Touchpoints (Circulation)			
Beverage		Bar	Bar
Food		Snackbar	Snackbar
Toilets		At location	In the hangar
Entrance process		Through entrance gate manned by steward(s)	Through entrance gate manned by steward(s)
Exit process		Via exit gate manned by steward(s)	Via exit gate manned by steward(s)
Routes		Via signage	Via signage
Touchpoints (Egress)			
Parking		Nearby parking area	Nearby parking area
Exit		Accompanied by stewards and after return of tags	Accompanied by stewards and after return of tags

Figure 1. Activity profile

3.2. Spatial profile

Not one event is like another. It is therefore useful to use general characteristics when classifying events. Van Rijn and Van Damme (2011) describe several general characteristics related to events in addition to the characteristics mentioned by Fieldlab. These general characteristics (Figure 2) give direction to the expectations regarding the dynamics of visitors to events.

Event name	Mudmasters	10-Kilometre run
Spatial Profile		
Event location	Floriade Haarlemmermeer	Twente Airport
Event type	Recreational Sports Event	Recreational Sports Event
Sort event	Public event	Public event
Event specification	Sport event	Sport event
Attractiveness	Regional/National	Regional/National
Duration	Daytime	Daytime
Location (indoor/outdoor)	Outdoor active	Outdoor active
Accessibility	Fixed location - Existing	Fixed location - Existing
Size	Medium sized (5000 - 50.000 persons)	Medium sized (5000 - 50.000 persons)
Access	Tickets sales	Tickets sales

Figure 2. Spatial profile

The event site in Twente airport can accommodate 5000 participants. Only 1841 tickets have been sold for this occasion.

The event site Floriade can accommodate 5500 participants. For this occasion, 5000 tickets have been sold, 4500 participants showed up.

Before the events, clear and strict guidelines have been drawn up for all those directly involved. The main condition for participating in the event is the submission of a negative rapid test result at the entrance to the event site. This test must be taken at one of the affiliated test locations within 24 hours before the end of the event. Apart from this condition, additional conditions have been communicated through a developed app. For example, outside the event site, the RIVM guidelines apply to everyone involved and no specific measures or restrictions apply on the event site.

3.3. Public profile

It is essential to know the characteristics of the audience of a specific event in order to anticipate their behaviour. Audience is inextricably linked to behaviour. Before zooming in on behaviour and mood, the type of audience is mentioned. In addition to the distinction in audiences, social characteristics of audiences are indicated. Audiences display specific behaviour, but they are difficult to define and cannot easily be classified (Still, 2013).

The following characteristics of behaviour apply, to a greater or lesser extent, to visitors to both events in the different phases of the event:

Cohesive	Crowd gathered for a specific purpose or reason; No leadership.
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Figure 3. Public profile

To the participant in the event setting, passive behaviour applies during ingress and egress. During the movement phase and the performance, energetic applies. In this case, it refers to a considerable degree of physical movement and participation. The elements from the characterisation energetic, which may lead to increased risk do not apply here at all.

4. Safety measures

The events took place in a protected and controlled environment. In order to realise this environment, different safety measures were taken, such as the requirement for a negative COVID-19 test for entrance, direct communication with the visitors and ventilation requirements. This report will focus on the measures regarding visitor dynamics, such as time slots. The use of time slots aims to achieve a gradual and controlled ingress and is directly related to the starting times and physical size of the starting areas. The design and organisation of the ingress/egress process and the allocation of time slots were achieved through intensive cooperation between parties involved. Figure 3 shows the time slots and the number of participants in starting areas.

Table 1. Timeslots and number of participants 10K

Timeslots 10-Kilometre run	Start time	Available places	Participants
09.00h - 10.00h	10.00h	500	500
10.30h - 12.00h	12.00h	1500	1500
12.30h - 14.00h	14.00h	1500	250
14.30h - 16.00h	16.00h	1500	250

Arrival Timeslots mud run	Start time	Available places	Participants
08.00u	09.00u	250	250
08.20u	09.20u	250	250
08.40u	09.40u	250	250
09.00u	10.00u	250	250
09.20u	10.20u	250	250
09.40u	10.40u	250	250
10.00u	11.00u	250	250
10.20u	11.20u	250	250
10.40u	11.40u	250	250
11.00u	12.00u	250	250
11.20u	12.20u	250	250

11.40u	12.40u	250	250
12.00u	13.00u	250	250
12.20u	13.20u	250	250
12.40u	13.40u	250	250
13.00u	14.00u	250	250
13.20u	14.20u	250	250
13.40u	14.40u	250	250
14.00u	15.00u	250	250
14.20u	15.20u	250	250
14.40u	15.40u	250	250
15.00u	16.00u	250	250

In order to ensure a safe and regulated ingress (minimum contact moments), the ingress process is visualised in the figure below. Based on this process, process calculations were made to determine the capacity of the ingress process per entrance row.

With an average of 7 seconds, 8 (safety margin) participants per minute can be processed, which means an ingress capacity per row of 480 participants in 1 hour.

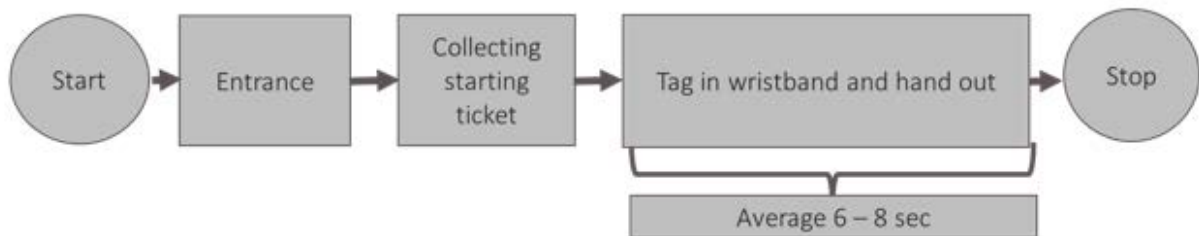


Figure 4. Ingress process 10K run

With a maximum ingress per time slot of 1500 participants, 5 rows (entrance gates) were provided. This capacity is bigger than the requirements set in advance, so there were no unnecessary waiting times at the entrance (see Figure 5).

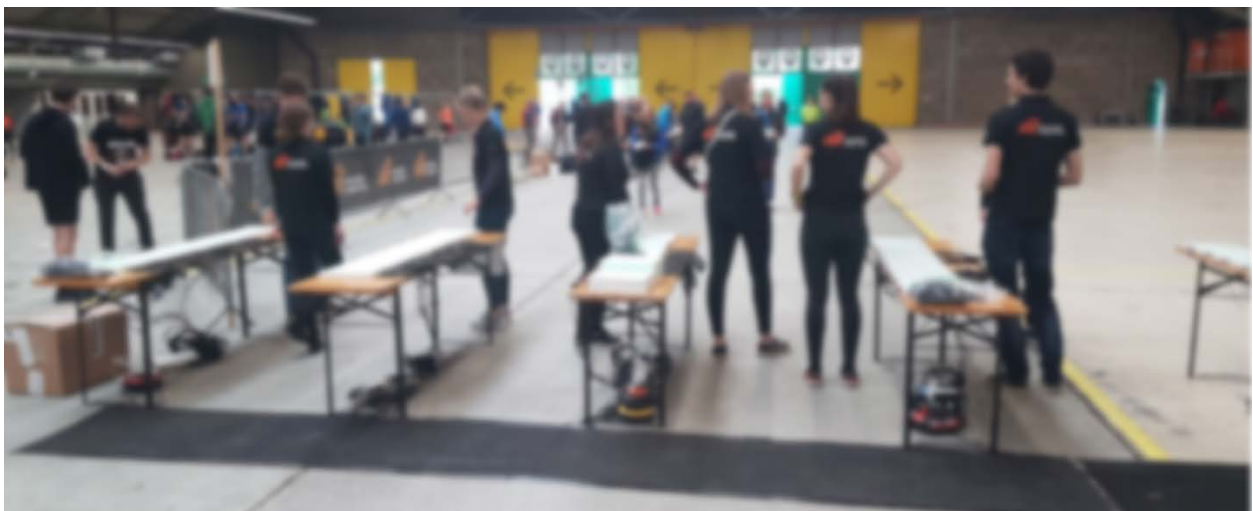


Figure 5. Ingress process 10K run

Finally, the egress process needs to be carefully organised, as the return of the tag is crucial to the research. In addition, the egress process may not lead to risky delays and undesirable situations.

The egress process is visualised in Figure 6. With an average of 4 seconds, 15 participants per minute can be processed, which means an egress capacity per row of 900 participants in 1 hour.

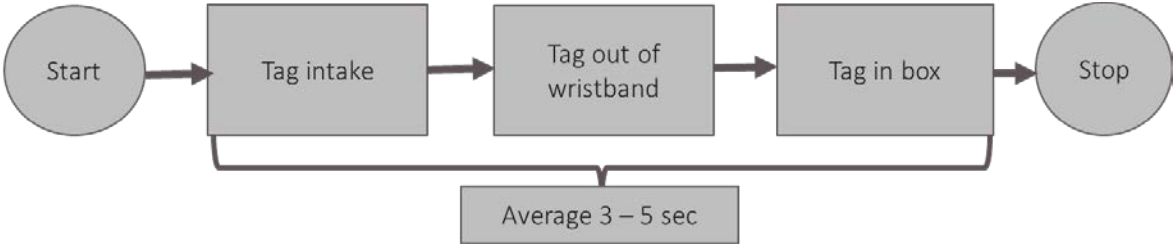


Figure 6. Egress process 10K run

With a maximum egress per time slot of 1500 participants, we worked with 2 lanes (exit gates). This capacity met the requirements set in advance, and unnecessary waiting times for egress were therefore avoided.

5. Research questions

In all organised pilot events anonymously collected data of participants is analysed. It is an experimental study in which participants are observed in two different “settings”. In each setting different measures (interventions) are in effect in which the potential impact of the interventions on visitor dynamic is observed on three variables:

- Number of contacts
- Contact distance (average per contact)
- Contact duration (for Mudmasters the process time in an obstacle will be measured, sample wise, by hand in three different obstacles)

5.1. Settings Mudmasters

The first 10 time slots have a different design than the last 10.

Table 2. Setting recreational sports event: Mudmasters

Start group	number persons	Start area setting	order-& pay method bar	Order & pay method food
1 t/m 10	250	With meander	With U	Same
11 t/m 20	250	free	free	Same

The expectation of the setting in the meander form is that participants will take positions in a stretched line, hence have fewer contacts between them. In the free setting, the expectation is that the participants will be more randomly distributed in the start area. (Figure 7)

For food and beverage, the U form had the same intention for the distribution of the participants. (see Figure 8)

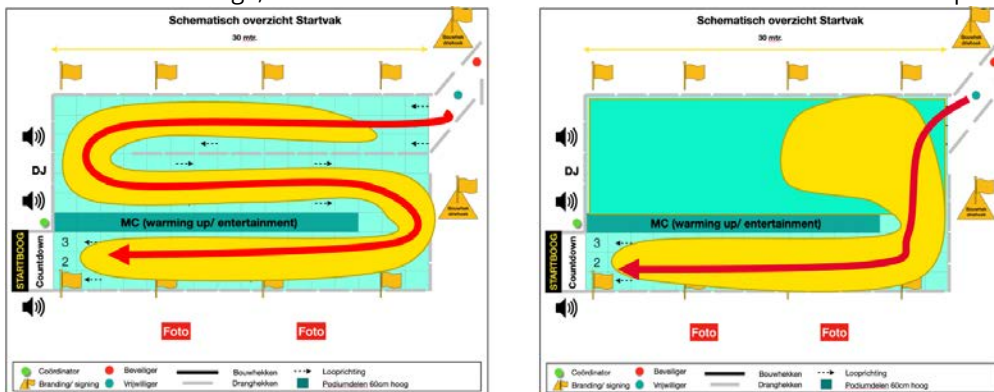


Figure 7. Design settings start area with expected participants distribution Mudmasters

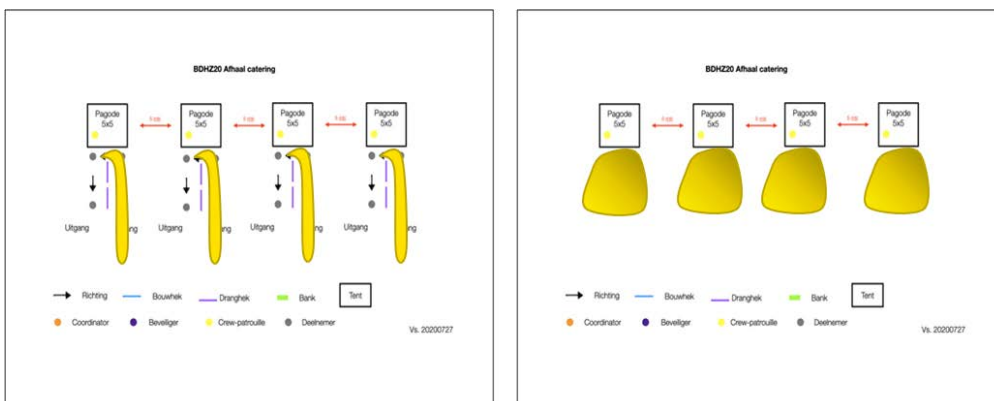


Figure 8. Design settings hospitality area with expected participants distribution Mudmasters

5.2. Settings 10-K Run

Like the Mudrun settings, settings for the 10-K were designed. (see; Table 3, Figure 8 and Figure 9)

Table 3. Setting recreational sports event: 10K Run.

Start group	Number persons	Start area setting	Order and pay method bar	Order & pay method food
Flow 3	500	with 2 persons/m2	with U	Same
Flow 4	1500	with 1 person / m2	Free	Same

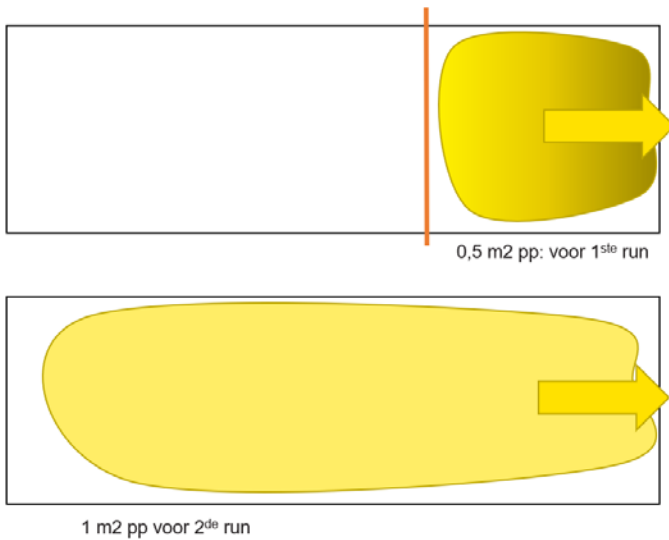


Figure 9. Design settings start area with expected participants distribution 10K

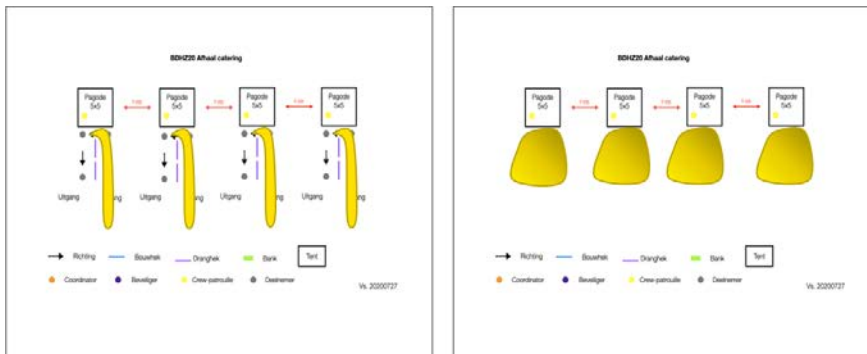


Figure 10. Design settings hospitality area with expected participants distribution 10K

6. Results

In the following sections the results of both pilot events – Mudmaster and Enschede 10km – will be discussed. Data for this study -where possible - were collected using the same research instrument as those of phase 1 of the research program. The main research goal of these pilots was to assess the extent to which a new subtype of event would reveal new findings in relation to the original research question.

6.1. Mudmasters

On May 8th, 2021, 4500 individuals participated in an outdoor obstacle run. Participants were divided into multiple continuous starting waves. Due to the safety of runner's, wearables like the contact tracking devices were not allowed. Therefore, data for this study were collected using video analyses. Due to the fact no contact tracking devices were used during this pilot, no detailed data about the duration of a contact is available. Still, the duration of a contact is an important metric, hence manual observations of the 3 obstacles on the recorded video footage is performed. By sampling the average time a participant spends on an obstacle (process time), an indication of potential contact time can be calculated.

The results of these manual observations are shown in Table 4. Its apparent from this table that the total time spend per obstacle is low. Of the three obstacles observed the average time is roughly between 1 and 1,5 minutes. These measures include the 'waiting' time of a participant at the obstacle itself. Based on a total of 16 obstacles on the course, the maximum cumulative contact duration during the run is estimated somewhere between 16 and 24 minutes.

Table 4. Measurement results obstacle process time Mudmasters

Obstacle	Sample size	Standard dev	90% Confidence interval	average
Tarzan Swing	44	6,8	42 – 50 sec	47 sec
Cap size	40	30,8	86 – 102 sec	94 sec
Pipe runner	64	34,3	72 – 87 sec	80 sec

Figure 11 presents the outcome of the automated video analyses. The number of contacts (as average per person) at the obstacles are relatively low in comparison to the other regions like entrances and drinks. Striking are also the difference in contacts between start and finish. While the start of the event is spread over several different smaller starting waves contacts remains high.

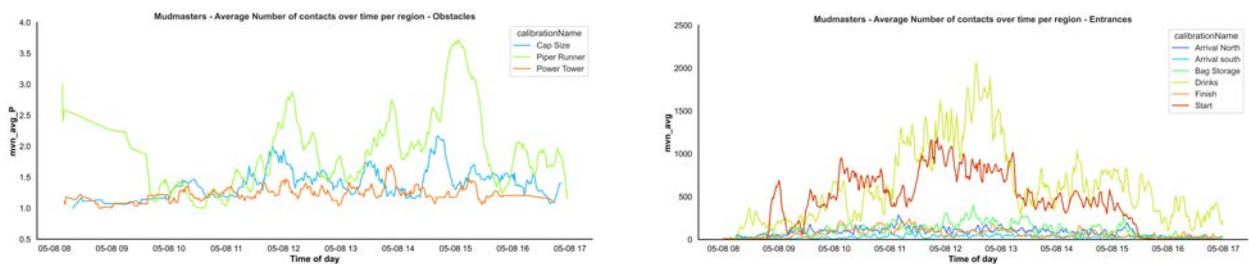


Figure 11. Average number of contacts at the obstacles (left) and at the entrances (right) Mudmasters

Beside start waves, during the pilot two different starting area designs have been created (Figure 7). The first design – in place during the first half of the event until 11:20 - of the starting area was meant to have a more controlled flow, with the aim to minimise contacts, towards the start line. The second design – in place during the second half of the event from 11:20 and afterwards - the participants had a free choice and were able to keep their distance if they like. Overall, both designs – as shown in Figure 7 - did not affect the number of contacts a participant had during the start. Manual observations showed that in both designs participants walked as close to the line as possible, as illustrated by the yellow area in Figure 12, underutilizing the potential total area to keep distance.

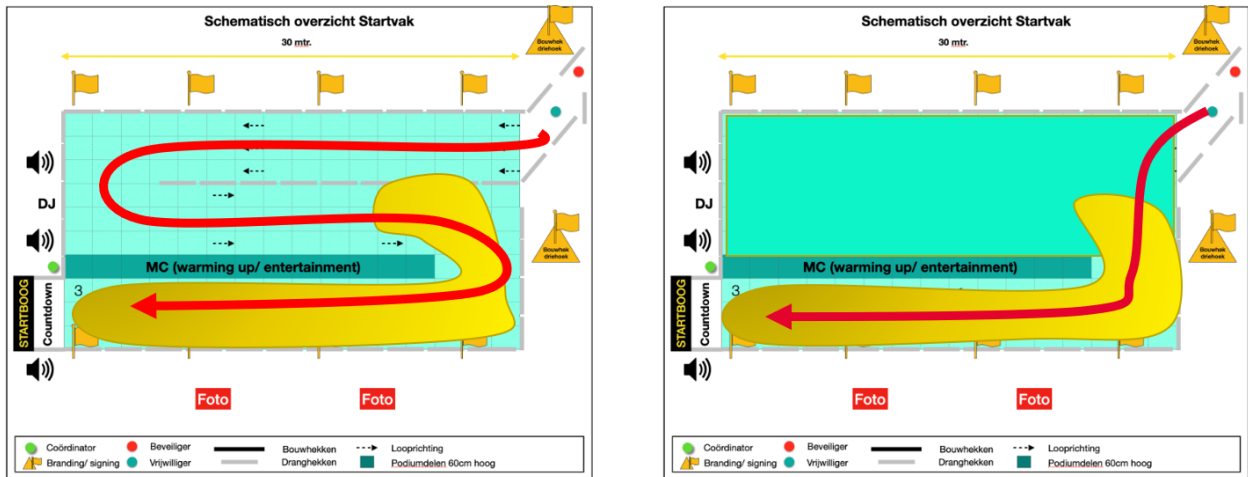


Figure 12. Setting 1 and 2 reality (compare Figure 7 design).

6.2. Enschede 10Km

On May 16th 2021, 1306 individuals participated in a 10km marathon. Participants were divided into two starting waves of 500 and 1500 (in reality, 200 and 1000). Next to the participants, another 100 VIPs were invited. Figure 13 presents the general statistics of the event. On average a participant from wave 1 had 5 unique contacts (IQR= 2-8) lasting more than 15 minutes cumulative within 1.5 meters. Participants from wave 2 had -on average- a relatively lower number of unique contacts; 2.8 (IQR= 1-4). VIPs had an average number of 4.9 (IQR= 2-8) unique contacts.

Table 5. Average amount of contacts and duration 10K

Event	Bubbel	N	Average participation time	Average amount of contacts (IQR)	Distribution
Enschede 10Km	Wave 1	200	02:49:15	5 (2-8)	
	Wave 2	1004	02:32:31	2.8 (1-4)	
	VIP	102	02:30:18	4.9 (2-8)	

As shown in Figure 14, the total number of contacts is highest at the start and finish times of a wave. Further analysis of the total number of contacts over time shows that, as illustrated in Figure 13, start wave 2 have a significantly higher number of contact moments on average per person. However, to put this number in perspective, even while start wave 2 has a five times higher number of participants than wave 1- which could lead to a higher number of total contacts - the average number of contacts per participant is only twice as high.

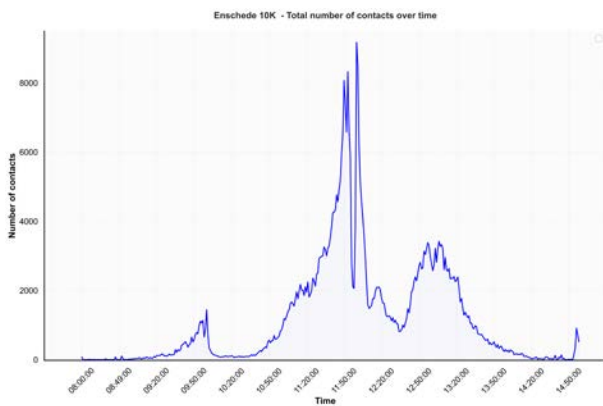


Figure 14. 10-K, total amount of contacts

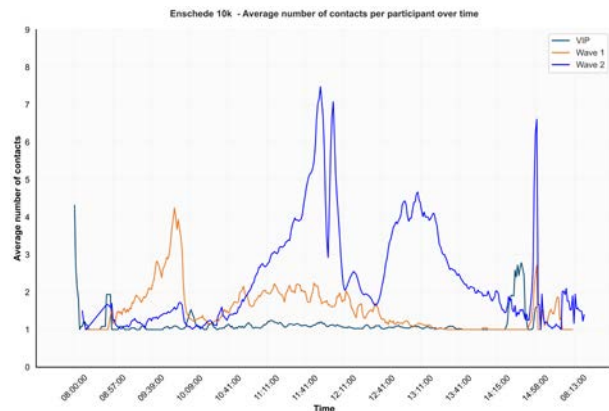


Figure 13. 10-K, total amount of contacts per person

As shown in Figure 15, a higher number of contacts in the Hangar 11 and starting areas can be noticed during start times of the different waves (10, 12, 14 and 16:00 hours). What might strike as remarkable is a large number of contacts in the hospitality zone before the different starting times. Manual analysis of the footage revealed that these contacts occur in the VIP hospitality area and not in the general hospitality area and thus are created by only a small number of visitors.

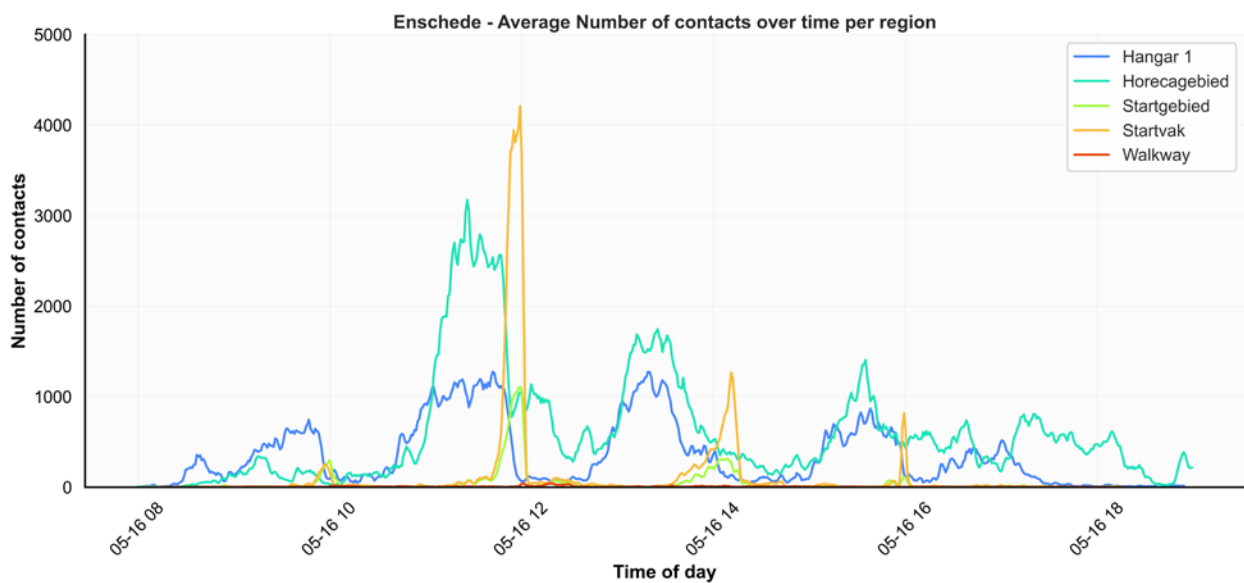


Figure 15. Video analysis, the average number of contacts per region

Regarding the design of both the start and hospitality areas, minor changes in the research design were made due to unexpected circumstances.

Start areas:

The starting area for the first wave (Flow 3) with 250 m² was designed to have an occupancy rate of 2 persons per m². Due to the low number of participants (200) the occupancy rate was only 0,8 persons per m². The second design was calculated to have an occupancy rate of 1 person per m². This flow (4) had only 1000 participants which lead to 0,66 persons per m². Adaptation of the start area to the real number of participants is not executed at that time.

Hospitality Area:

The general hospitality area was planned outside near the finish line. Participants could have a drink and a snack in the large outside area. The VIP hospitality area was located in Hangar 10.

Due to expected weather circumstances, both hospitality areas were moved from outside to inside Hangar 11. The areas were divided by a barrier line. This new setup of the hospitality areas decreased the area from about 3000m² to an area of 1280m². The 3000m² should have accommodated approximately 3000 participants. (1 person/m²). With the expected number of 200 in wave 3 and 1000 in wave 4, the maximum number of people in the hospitality area was expected to be 1200. (About 1 person/m²). Nonetheless, this theoretical density level was never achieved as shown in Figure 16.

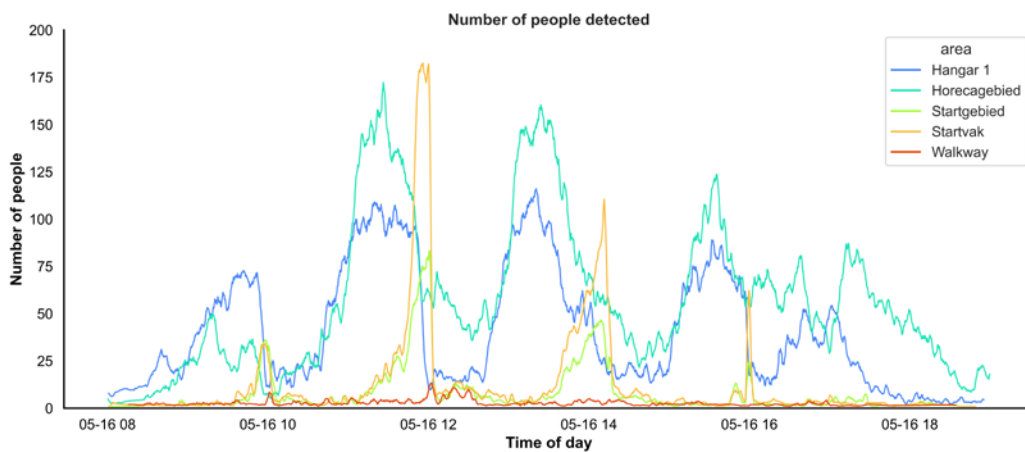


Figure 16. Number of people in area 10K

7. Discussion

This study was set out with the aim of assessing to which extent a new type of event would reveal new findings in relation to the original research question. The overall number of contacts during both pilot events was low. Most of the acquired contacts were during secondary activities, such as musical entertainment. Based on the contact data acquired during the Enschede 10k marathon around 3 to 5 contacts on average.

Despite the success demonstrated, the data collection methods used could be a limitation, as it may have affected the measurements of the number of contacts. As discussed before, data collection with contact tracking devices was impossible during the Mudmasters obstacle run due to safety concerns. Consequently, only video data collection was possible during the event. Due to practical limitations, camera footage is not able to cover the whole area of the event itself. Therefore, specific positions are chosen before the start of the event focussing on a part of the obstacle, where an expected number of participants would stay or move through the obstacle itself. Regrettably, the field-of-view of the chosen camera positions were not always optimal, due to the behaviour of the participants or unexpected changes in the layout.

The footage of the cameras has been used afterwards to gather information about the dwell time of a participant at a certain obstacle. The number of samples taken by hand, over the three observed obstacles, are limited. Therefore, the small sample size did not allow for a low standard error and should be used indicative.

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