AFA Decaux


# Methodology for a Viewed Impression currency


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RAMMEN
OM NOGET
SÆRLIGT

# Indhold



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# 1. Introduction

In the current document AFA Decaux wish to create transparency as well as understanding for the novel approaches and methods AFA Decaux use to arrive at a precise, reliable and correct number of viewed impressions forecasted and delivered at any given time by any given screen, customized cluster of screens or network as a whole.

The novel approach is based on using wifi-routers and MAC ID-recordings as main data source for the traffic flow. This means that the approach is based on a contemporary dataset and thus differs from the approach used historically to measure OOH. Therefore careful attention to industry standards developed by ESOMAR, AM4DOOH and WOO have been applied to be able to adhere to those standards and the principles behind them while applying new technology and data sources to innovate the field of OOH measurement.

While innovation in itself provide little value to the market, transparency and precision do. Therefore we apply the novel approach with the purpose of bringing a more transparent and precise currency to the market.

## 1.1 Validations and approvals

The methodology has been developed since 2019 and has undergone a number of approvals, adjustments and validations along the way. The first approval of the overall methodology and application of industry standards have been approved by Neil Eddleston, former Managing Director of JCDecaux OneWorld (Global Head of Research and Overseeing Data Governance for JCDecaux Group) and Francois-Xavier Pierrel, former Group Chief Data Officer. This was done in 2021.

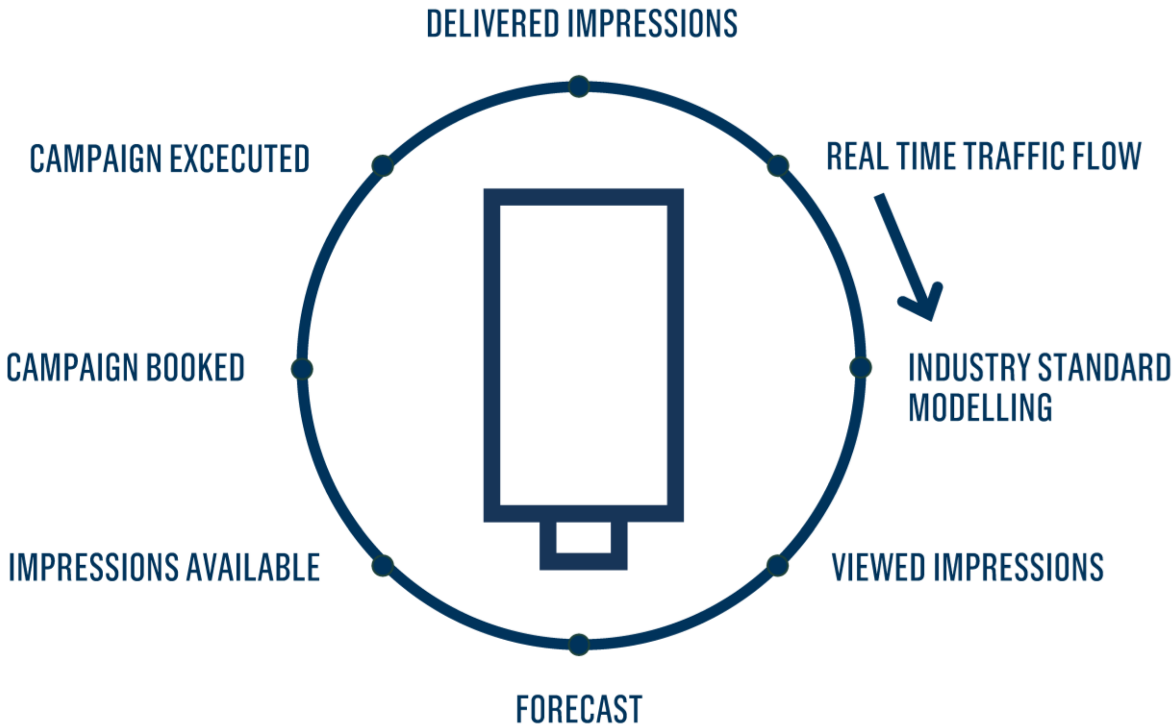
Since then the methodology has been fine-tuned continuously and at the time of writing, March 2024, different aspects of the methodology has been either performed or validated by Kantar-Gallup, Nielsen and Ipsos. Lastly, AFA Decaux have established an Advisory Board, consisting of members of GroupM, OMG and Publicis to guide the currency development and adoption in the market.

It is not within the scope of this document to describe how WiFi-routers and MAC ID-recordings can be used as source for a reach currency nor is it a practice that AFA Decaux does in the Danish market at this time.

## 2. Methodology overview

The methodology for viewed impressions spans from the process of measuring traffic flow via WiFi-routers in digital screens all the way to delivering a post-campaign report on the actual viewed impression-performance of the specific campaign. This entire methodology involves 8 steps. These 8 steps will be the headline for each chapter in this document.

The 8 steps of AFA Decaux' viewed impression methodology are:

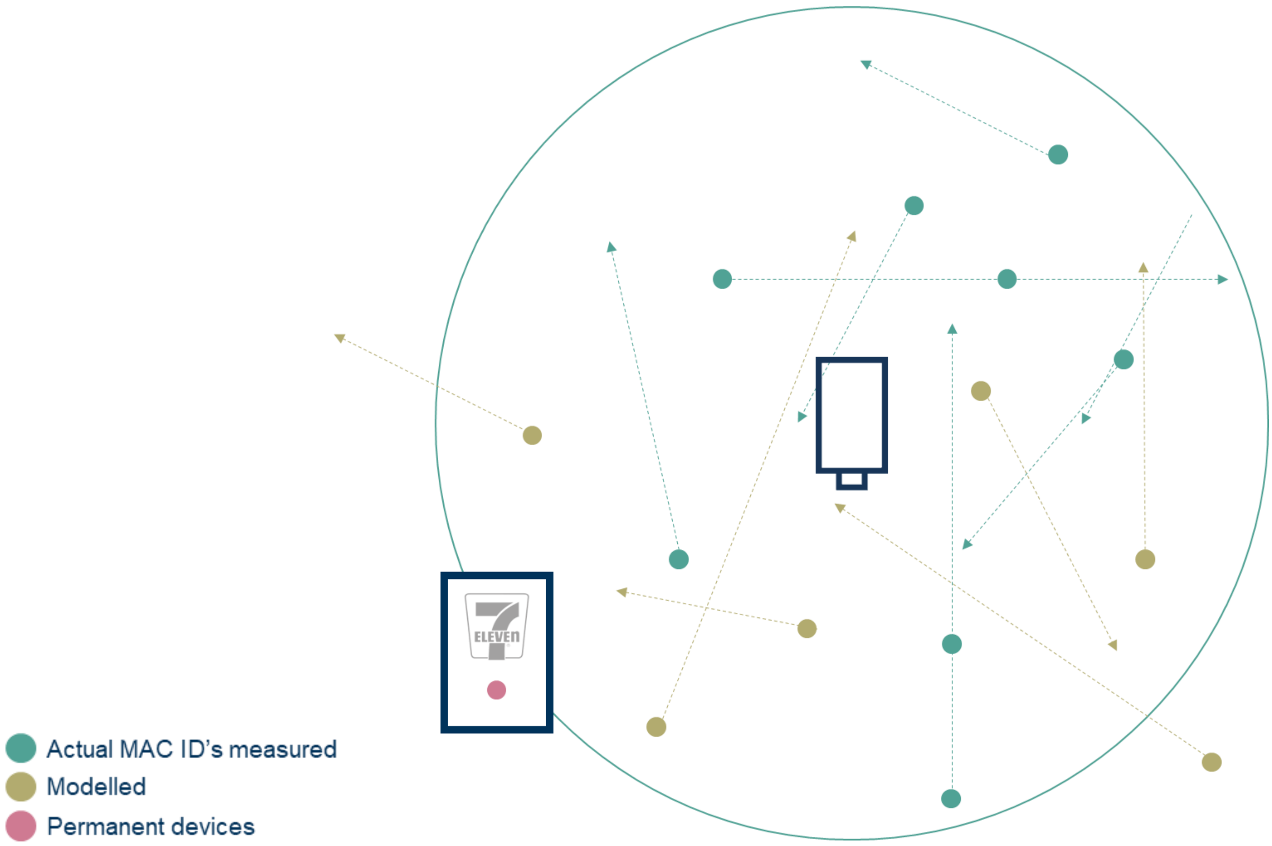


## 3. Real time traffic flow

The purpose of a traffic flow data set is to represent the number of people moving past and around the panel to be measured. This first step in the overall methodology is divided into 3 sub steps:

| RECORDING, HASHING AND DISCARDING OF MAC ID'S | MODELLING FOR REALITY | CLOSING MAC-SESSIONS |
|---|---|---|
| A WiFi-router records a MAC ID from a smart device. The MAC ID is hashed, encrypted and then deleted from the memory of the router | Manual countings and monitoring of permanent devices feed into a model that predicts the precise number of devices present by adjusting for devices not measured. | Still maintaining anonymization MAC-ID's are stitched together into MAC-sessions allowing for dwell time attribution. |

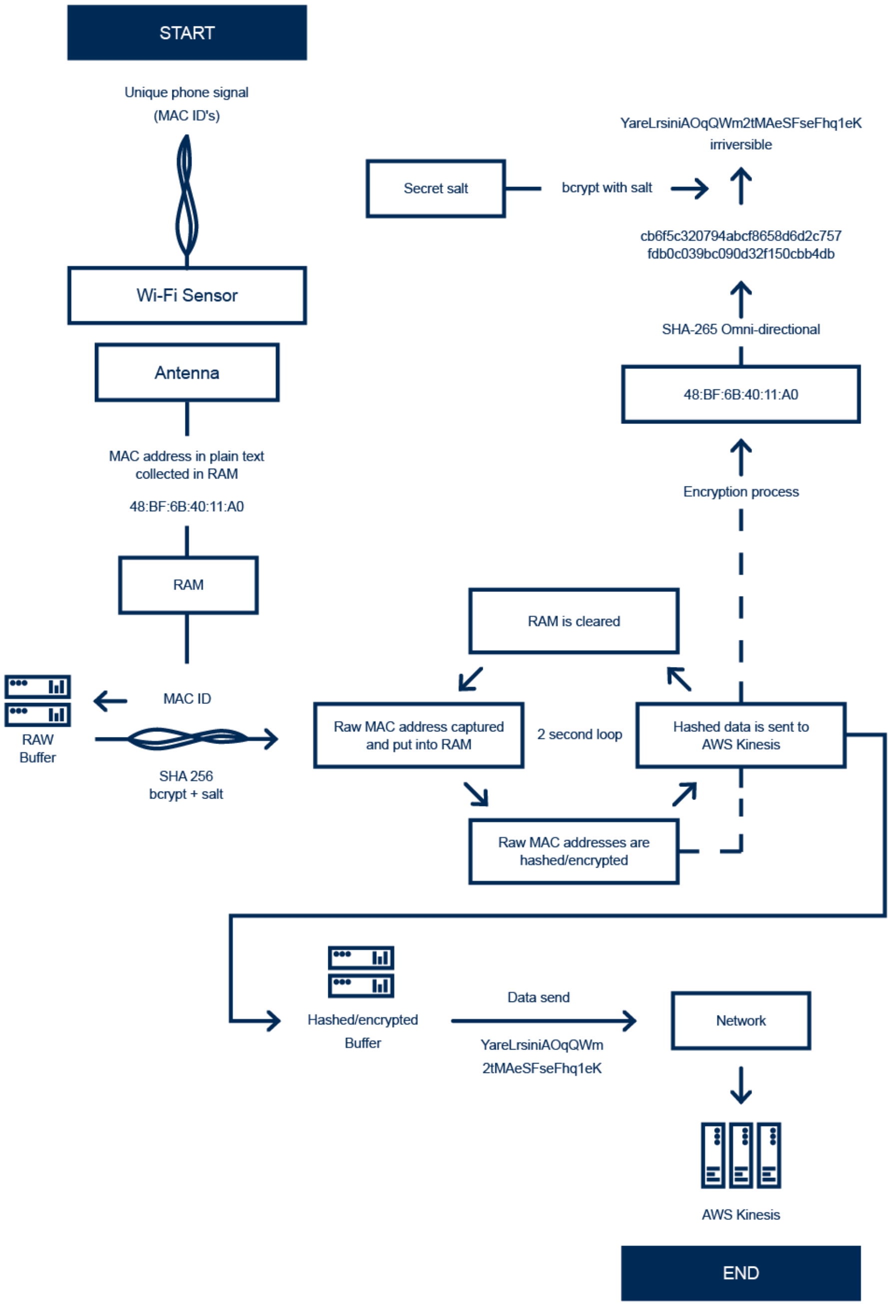
In this approach MAC-ID's and subsequently MAC-sessions are used as a proxy for actual people.



## 3.1 Recording, hashing and discarding of MAC ID's

In each digital panel AFA Decaux have installed a Wi-Fi-router with customized software developed by AllUnite. The router and software record, within the reach of the antennas of the Wi-Fi-routers, signals (MAC IDs) from smart phones which have Wi-Fi connectivity enabled.

The software on the router immediately hashes, encrypts and deletes the signals from the memory of the router. The hashing algorithm SHA 256 and the encryption processes secure privacy and compliance with GDPR. The process has been vetted and assessed by the Danish law firm Bech-Bruun and JCDecaux Group in relation to GDPR.



The new traffic ID (hashed and encrypted MAC ID's) are sent and stored in a secure database hosted by AllUnite for further modelling. First part of the modelling is to, per environment, adjust for the visibility range of the screen by discarding of Traffic ID's beyond this point. The distance to the screen is identified by recording the strength of the signal in dB. The default distances used in the model are:

| ENVIRONMENT | CITY FURNITURE (OUTDOOR) | RAIL (INDOOR) | MALL (INDOOR) |
|---|---|---|---|
| Visibility distance | 70 m | 20 m | 20 m |

Obstacles to actually see the screens are accounted for in the VA-computation done by Ipsos.

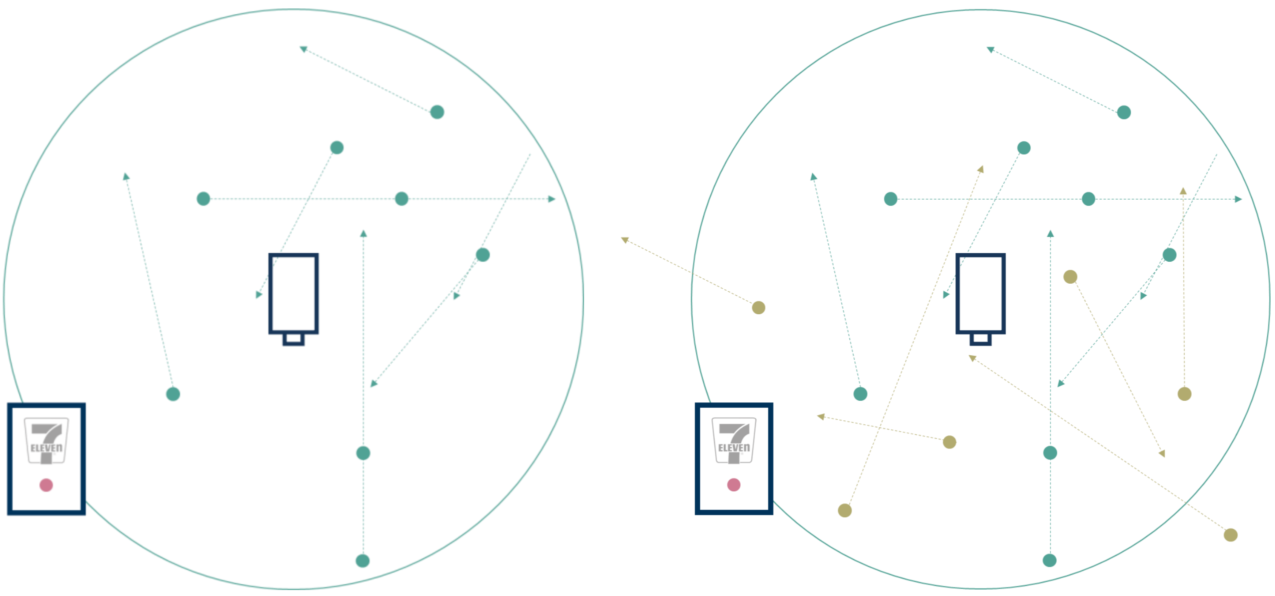



Image text: An illustration of what is measured vs what is actually happening around the screen

## 3.2 Modelling for reality

The setup described above allows AFA Decaux to document MAC-ID's with a three-second granularity within the reach of the individual Wi-Fi- router, modelled to the maximum visibility distance.

However, the MAC-ID's documented in this first part of the process will include a number of MAC-ID's that do not qualify as credible proxies for people who are to be included in the subsequent computation of viewed impressions.

This could be a store clerk with a smart phone standing next to the screen all day or a laptop in an office nearby. These MAC-ID's are identified as "permanent devices" and discarded in the final dataset.

Furthermore, to be able to arrive at a credible representation of reality, it is needed to consider people who move through the screen zone but who are not recorded as proxies by the router. This includes people not carrying a smartphone, people who have disabled Wi-Fi-connectivity on their smartphone, or people moving through the zone but who's smartphones do not ping within the time spent in the zone.

### 3.2.1 Application of machine learning model

To adjust for the above-described discrepancies between what is measured by the router and what in reality is happening a regression model is trained to predict the actual number of devices at any given time based on the input of actual measured MAC ID's.

The regression model is an Ordinary Least Squares Regression Model and the precision of the model is assessed by applying R-squared and mean average percentage error (MAPE) methods. The model is trained on data from manual countings at individual location and screen level and the precision is tested against a portion of the manual countings data set. Furthermore to validate the model's outputs third party datasets are applied where possible.

The average R-squared value is 0.89 and the average MAPE metric is 4.62% for the model as of today.
With the knowledge that terms such as "ordinary least squares regression", "R-squared" and "mean average percentage error" are not lay man's terms and requires a degree in statistics or data science to fully comprehend a quote from an assessment by Nielsen has been included below. In the subsequent pages the concept of ordinary least square regression is explained and put into context of the measurement of MAC ID's as a proxy for people.

“*This is good practice for training and testing a model. This process will ensure the modelled results will accurately reflect what is happening in the real world.* (…) *The process of manually counting traffic at the various locations is of a high standard. The care taken to ensure the representatives have the appropriate material and tools ensures the results will be very accurate. There are also rigorous steps in place to identify and remove any outliers from the datasets.*

*The model training and testing is also carried out to a very high standard.*

*Overall, the process set up by AllUnite ensures that the manual counting of traffic produces results with a high degree of accuracy.*

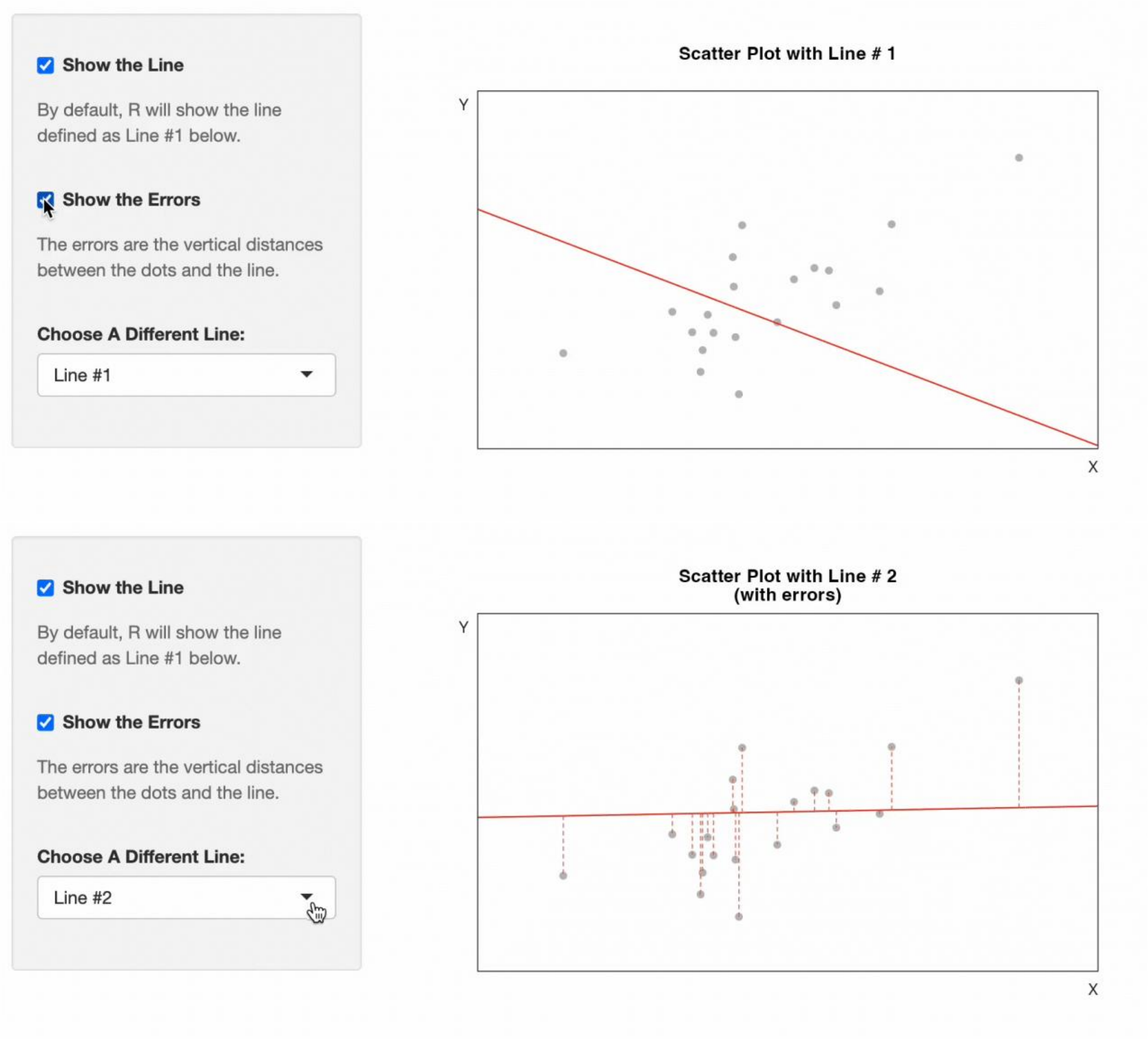
*It can be concluded, therefore, that the calibration and validation of the data collected by the AllUnite sensors is based on a robust methodology and follows good statistical principles.”*
(Ipsos Validation document, p. 3-4)

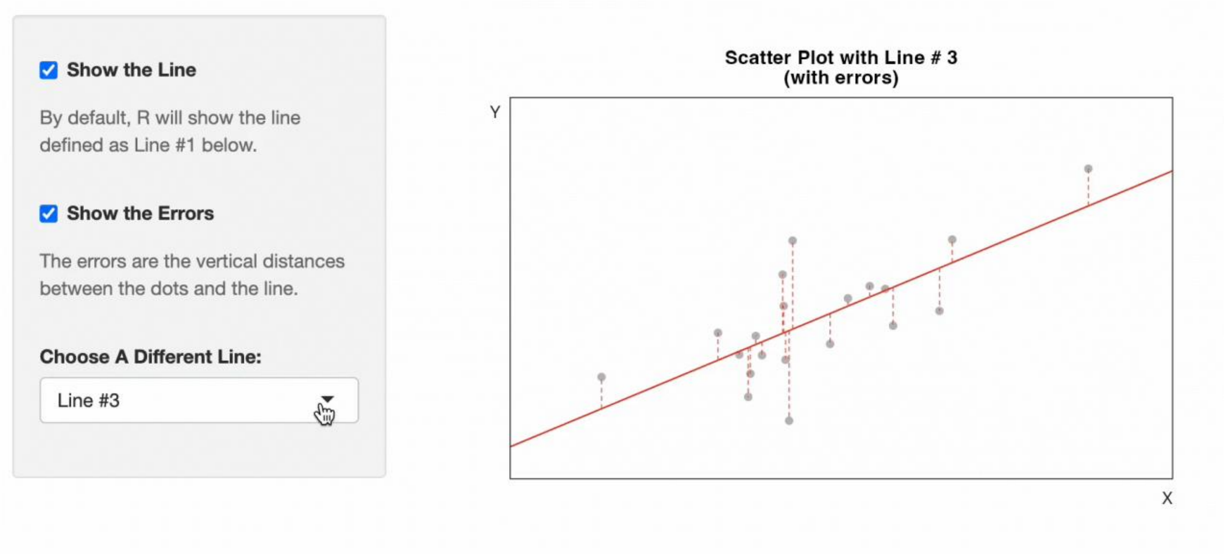
**Andrew Whitney,**
**Director Data Science, Nielsen**

#### 3.2.1.1 Ordinary Least Squares Regression Model

The purpose of the regression model is to find the line of best fit between actual measured MAC ID's and manual countings for the same location and same time. This enables the model to predict the number of people present at any given time and location on the basis of only the actual measured MAC ID's.

Consider the below example from scholar.harvard.edu where 3 lines are placed in a scatter plot illustrating their associated errors and thus the one with the best fit in the below example:






*"As we can see in the above, the errors associated with this line [Line #3] are the smallest among the three lines we have considered because Line #3 is the one closest to the data. In fact, Line #3 is the line with the smallest errors among all possible lines. It is, therefore, the line of best fit; the line that best summarizes the relationship between X and Y.*
*Mathematically, the least squares method finds the line that minimizes the sum of the squared errors (also known as residuals). Why do we want to minimize the sum of the *squared* errors rather than minimize the sum of the errors? Because we want to avoid having positive errors cancel out negative errors. This method is called *least squares* because it *minimizes* the sum of the *squared* errors, hence, it finds *the least squares.*" (*https://scholar.harvard.edu/ellaudet/least-squares-method*)*

#### 3.2.1.2 Data from AFA Decaux modelling

Below is a number of graphs that illustrate how the model's predictions correlate with the manual countings performed at various locations and times. When carrying out the manual countings traffic modality have been defined as well with the following uplift factors for cars, busses and trains:

| MODALITY | PEDESTRIAN | BIKE | CAR | BUS | TRAIN |
|---|---|---|---|---|---|
| Factor | 1 | 1 | 1.4 | 15 | 50 |

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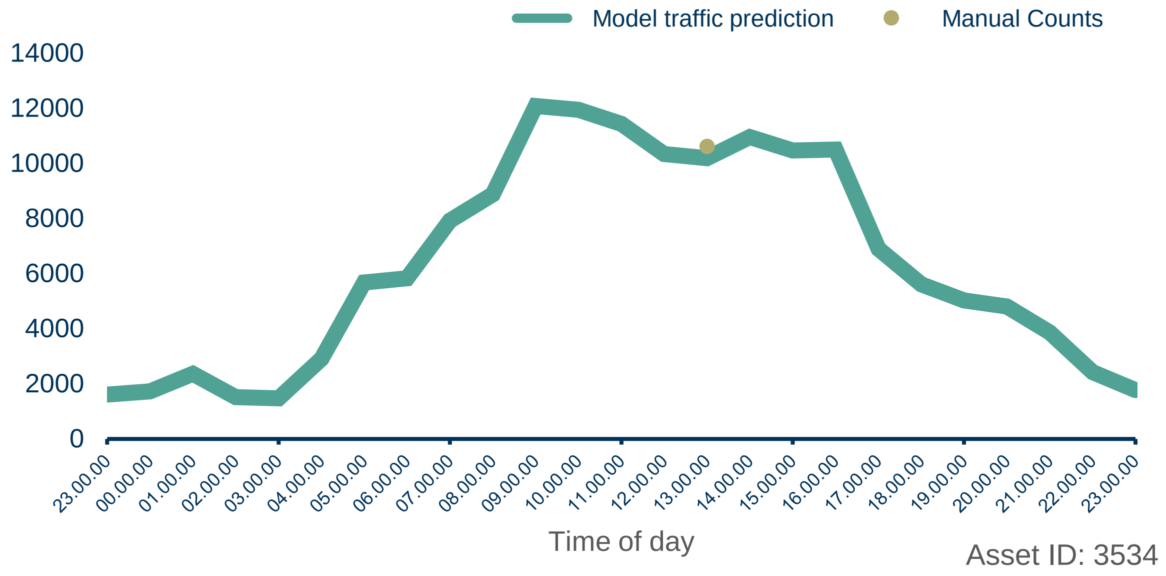
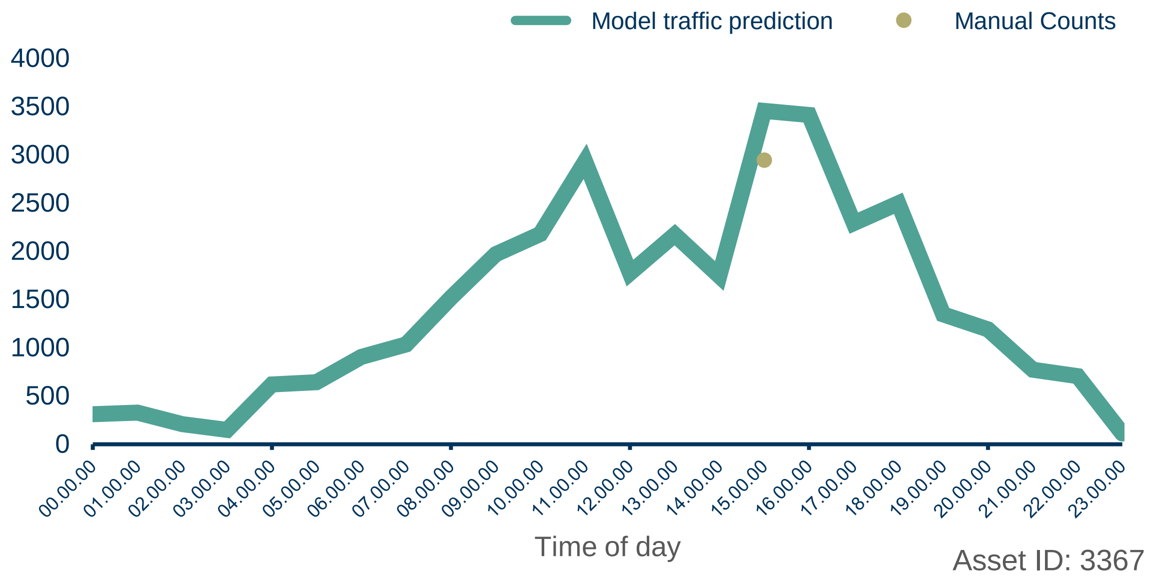
**Model prediction on digital screens in Copenhagen**



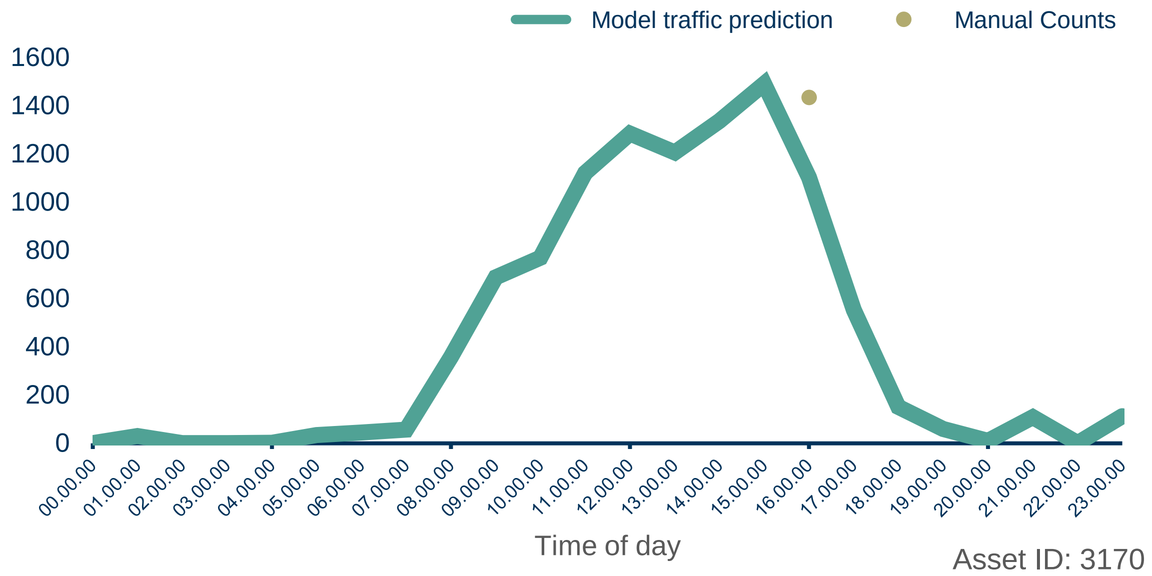

| MANUAL COUNT HOUR | FACILITY | MAPE |
|---|---|---|
| 2024-02-21 13:00:00 | AFA 124: Købmagergade 36-38 | 6.31% |
| 2024-02-22 15:00:00 | AFA 108: Vesterbrogade 1 | 4.63% |
| 2024-02-26 13:00:00 | AFA 90: H.C. Andersens Blv. | 4.13% |
| 2024-02-06 15:00:00 | AFA 34: Rådhuspladsen 45-47 | -13.28% |
| 2024-02-27 13:00:00 | AFA 90: H.C. Andersens Blv. | -3.91% |
| 2024-02-27 15:00:00 | AFA 13: Vimmelskaftet 48 | 1.88% |
| 2024-02-28 13:00:00 | AFA 42: Nørrevoldgade | 15.61% |
| 2024-02-28 15:00:00 | AFA 13: Vimmelskaftet 48 | 2.67% |
| 2024-02-29 15:00:00 | AFA 42: Nørrevoldgade | 3.86% |

Model prediction on digital screens in rail environments




| MANUAL COUNT HOUR | FACILITY | MAPE |
|---|---|---|
| 2024-02-29 13:00:00 | AFA 166: Ved Vesterport | 25.27% |
| 2024-03-01 15:00:00 | AFA 166: Ved Vesterport | 5.29% |
| 2024-03-03 13:00:00 | AFA 80: Bernstorffsgade 16-22 | 33.14% |
| 2024-03-03 15:00:00 | AFA 80: Bernstorffsgade 16-22 | -17.39% |
| 2024-03-04 13:00:00 | AFA 80: Bernstorffsgade 16-22 | 9.61% |
| 2024-03-04 15:00:00 | AFA 80: Bernstorffsgade 16-22 | 18.71% |
| 2024-03-05 15:00:00 | AFA_DK_KØB0039DJ | 5.08% |

Model prediction on digital screens in Mall environments



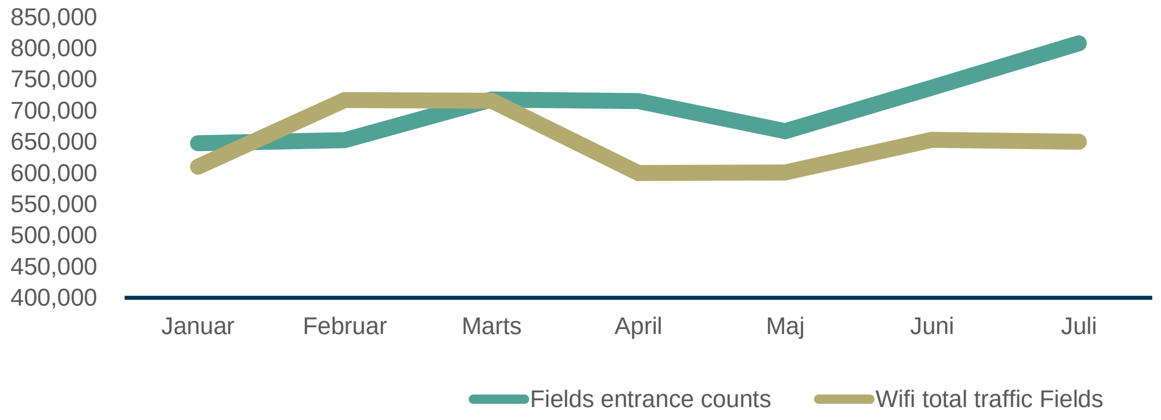

| MANUAL COUNT HOUR | FACILITY | MAPE |
|---|---|---|
| 2024-02-24 14:00:00 | AFA- Fields 11 KØB0011DM | -5.79% |
| 2024-02-25 16:00:00 | AFA- Fields 13 KØB0013DM | -3.90% |
| 2024-02-26 16:00:00 | AFA- Fields 9 KØB0009DM | 20.12% |
| 2024-02-27 16:00:00 | AFA- Fields 9 KØB0009DM | 26.83% |

#### 3.2.1.3 Third party benchmark data

In order to validate the model output, AFA Decaux apply traffic flow values and fluctuations in traffic flow from third party data sources where possible.

## MALLS

For Mall environments the monthly visitors' numbers sourced from mall owners is used to compare an average monthly traffic flow count. The comparison between the applied model and entrance counts from the mall, Field's, looks as below:

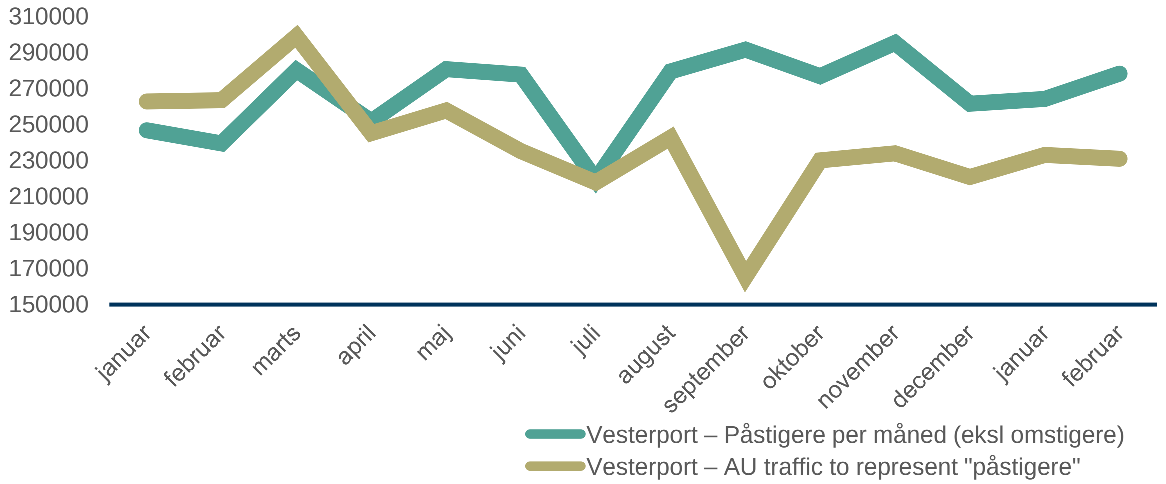



In the above comparison there is 9% difference in avg. in the favor of entrance counts from Field's.

## RAIL

For rail environments traffic flow data from passagertal.dk on a suitable station (Vesterport) is compared to the numeric values of the model output.

The comparison between the applied model and numbers from passagertal.dk looks as below:

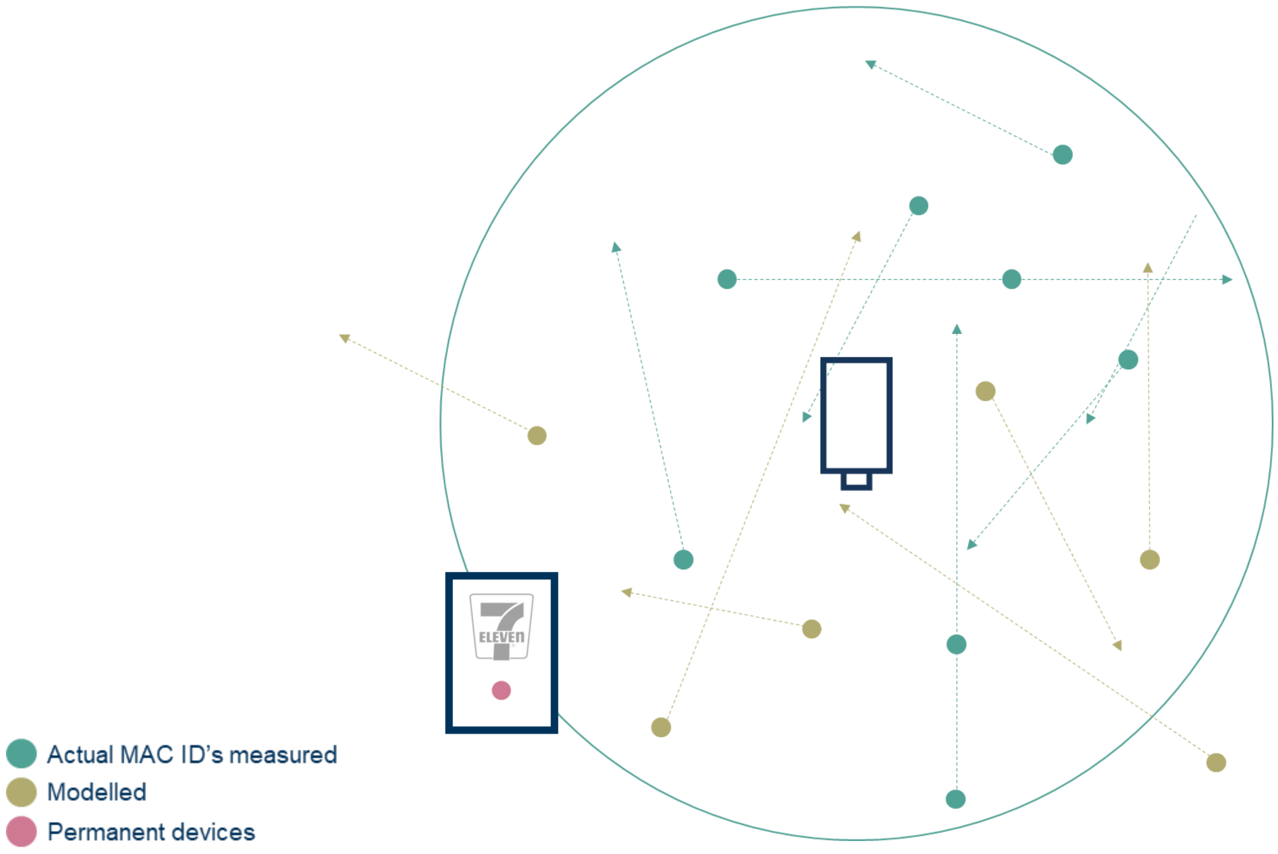



In the above comparison there is 9% difference in avg. in the favor of numbers from passagertal.dk.

**STREET FURNITURE**
For the inventory classified as street furniture, screens in Copenhagen and Aalborg City, there are no available third party data sources suitable to validate the model output for those environments. However the validation done on Rail and Mall environments is reassurance that the model delivers credible outputs for further impression modelling.

#### 3.2.1.4 Total traffic flow in real time

The process of measuring actual MAC ID's and modelling that measurement to represent reality results in a precise representation of the reality of people moving into and out of the visibility zones of the screens to be measured.



## 3.3 Closing MAC-sessions

MAC-ID’s registered so far in the process are considered “open sessions”. This means that the sessions could represent a person spending e.g. 5 seconds within the zone but also 5 minutes. In order to define a dwell time in a certain screen zone, AllUnite closes the open MAC-sessions that are in fact possible to close.

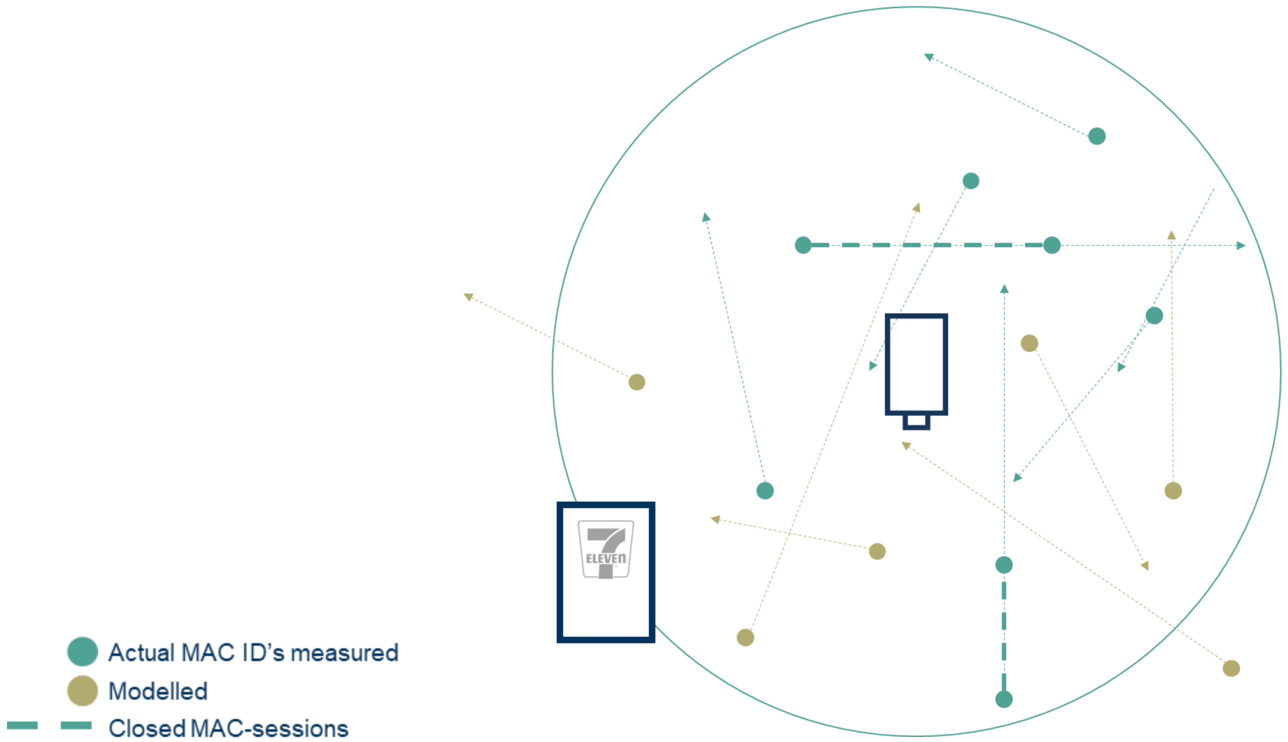
The MAC-sessions that are possible to close are the sessions stemming from a device which transmits either universally administered MAC-ID’s or a specific version of locally administered MAC-ID’s deemed “randomized trusted MAC ID’s”. For an in depth understanding of the different types of MAC ID’s and their nature see a detailed description in the Glossary chapter on page xx.

The identification of MAC-sessions stemming from the same device is possible due to the characteristics of the particular hashing algorithm used, the SHA-256.

SHA-256 algorithm allows AllUnite to identify hashed MAC-sessions stemming from the same device, but do not disclose the MAC-ID of said device.

By identifying MAC-sessions stemming from the same device, AFA Decaux can document a unique number of people and how long time they spend in a certain zone by measuring the time between pings and perform the so-called closing of MAC-sessions.

This process of closing MAC-sessions is performed every 24 hours and the dataset is extrapolated with the total amount of sessions measured including the randomized MAC-sessions.



## 3.4 Total traffic in push API

The above described process constitutes step 1 in the overall methodology of measuring viewed impressions. The data set at this point of the methodology is a data string (JSON format) with the below illustrated data points. This is made available for further modelling in a push API between sub-supplier AllUnite and JCDecaux DataCorp, which is the entity performing the further modelling. A push API secures in this case that AllUnite, upon abnormality detection based on measuring errors caused by e.g. OS-updates, can push a replacement dataset in rare, abnormality incidents not caused by traffic abnormalities.


```
{
    "date": "2023-09-02T06:00:00.0000000Z", <--
    "facilityId": "0758aa8d2daa47d294e6d6a79fe3df59", <--
    "facilityName": "AFA 107: Jernbanepladsen 47",
    "boxMac": null,
    "boxName": null,
    "trafficTotal": 20,
    "trafficNew": null,
    "trafficReturning": null,
    "trafficTotalBulk": 20,   <--
    "trafficNewBulk": null,
    "trafficReturningBulk": null,
    "devicesPermanent": null,
    "devicesByDurationRange": [
        15,<--
        5,<--
        0,<--
        0,<--
        0,<--
        0,<--
        0,<--
        0<--
    ],
    "downtimeInHours": 0
},
```

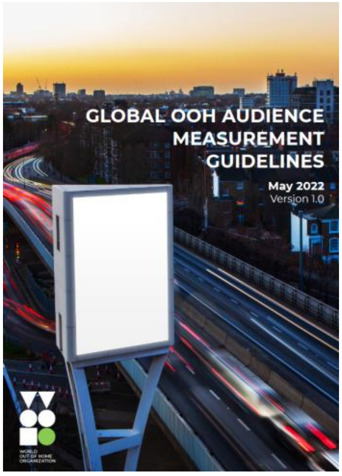

*Screenshot showing the data string sent via API from AllUnite to DataCorp.*

# 4. Industry standard modelling

In this chapter the applied modelling principles for converting the total traffic measured into viewed impressions at hourly and screen level are described. Industry standard literature on OOH measurement consists of three main bodies of work: Global Guidelines on Out-of-Home Audience Measurement by ESOMAR, AM4DOOH – The Reality of Attention to DOOH by JCDecaux, Clear Channel, Exterion, APG and FEPE and lastly Global OOH Audience Measurement Guidelines by WOO. All three reports are added as appendix's to this document.


2009


2018




2022

This chapter is divided into paragraphs where selected principles and guidelines from each report are emphasized and relativized to the actions performed in the current viewed impression-methodology.

## 4.1 Global Guidelines on Out-of-Home Audience Measurement by ESOMAR

In the ESOMAR guidelines an approach that is based on a panel, whose mobility is measured and surveyed and subsequently combined with a quantitative data source, is highlighted as the preferred way to arrive at "*a raw figure for the number of people passing a given display panel*". (s 17) This due to mainly technological restraints and financial considerations in the year 2009, where the report was published.

Much has happened since and today both new technologies have arisen and at a reduced price. Hence bringing in new technology like WiFi-sensors and a thorough methodology to go with the measurement is in line with two introductory standards from the ESOMAR guidelines:

"*The research methods need to be scientifically based. It is important to strive for system validity and reliability. By system validity we mean that it actually measures what it purports to measure. By reliability we mean that it would yield very similar findings if independently carried out a number of times*" (s. 7).
And

"*Research organizations are encouraged to be innovative, and in particular to conduct carefully controlled experiments of alternative measurement procedures*" (s. 8)

In 2009 it could be argued that the technology to precisely measure impressions at contemporary level was not mature but today in 2024 we have a technology and methodology that can meet both validity and reliability and embrace the encouragement to innovate audience measurement.

### 4.1.1 Realistic Opportunities to See and Visibility Adjustments

The two core principles of the ESOMAR guidelines are the concepts of "Realistic Opportunity to See (ROTS)" and visibility adjustment-coefficients and the fact that a raw figure of people passing a given screen at a given time needs to be weighed down according to these two principles:

"*Once a raw figure for the number of people passing a given display panel […] it is necessary to produce an audience figure for the panel in a given period of time*." (17)

Specifically for the ROTS:

"*The first is the figure for people passing in view of n advertising panel, which we have called Opportunity to Contact (OTC)*". (s. 17)

OTC translates into what we in our terminology call ROTS.

And specifically for the VA-factors:

"*The second is the figure for individuals who are likely to look at a given advertising panel, which we have called the Visibility Adjusted Contact (VAC)*" (s. 17)

Below is a description of how the current methodology adheres to these to core principles of industry approved OOH measurement:

#### 4.1.1.1 ROTS

While individuals may actively choose to watch television or news on a website, they do not actively choose to interact with outdoor advertisment. Therefore, the number of people measured need to be reduced to the number of people that have a realistic opportunity to see the screen. The number of people measured being in this methodology the Total Traffic value derived at by following the process described in Chapter 3.

According to the "Global Guidelines on Out-Of-Home Audience Measurement" created by Esomar as well as leading industry stakeholders including WFA and EACA, the ROTS (or the "Opportunity to Contact" as it is called in their report) adjust the numbers by removing those people who cannot see the screen because:

1. "*They are approaching from behind*
2. *They are travelling beneath it under the ground;*
3. *They are passing over it on a bridge;*
4. *The panel is not likely to be seen during hours of darkness unless it is illuminated and/or*
5. *The panel is too far away to be seen*"

(Global Guidelines on Out-Of-Home Audience Measurement, Esomar, p. 18).

The methodology behind the measurement of raw traffic data using Wi-Fi routers ensure that point 2 and 3 are not relevant variables to include in the ROTS for this specific measurement. This is because people above or below a screen are either not measured due to the physical barriers for the signals from their smart phones such as walls, ceilings or floors or are discarded by applying the modelling described in sub-chapter 3.2.

Since all screens are illuminated and that a maximum visibility distance is included in the equation applied in sub-chapter 5.3 Viewed Impressions and lastly that MAC ID recorded beyond viewability distance for the screen based on environment standards ensures that points 4 and 5 are considered. This leaves the point of approaching from behind to be accounted for in the ROTS.

This is done by multiplying with a factor that allows for the orientation of the screen as well as the fact that there may be more than one screen inside the asset.

The types of orientation in the AFA Decaux networks are described in the following:

| ORIENTATION TO TRAFFIC | NUMBERS OF SCREENS IN ASSET | DESCRIPTION | ROTS |
|---|---|---|---|
| Parallel | 1 | An asset with only a parallel flow of people passing it cannot have more than one screen as it will have to be mounted on a wall. This means that 100% of the people measured in the zone have a realistic opportunity to see. | 1 |
| Head on | 1 | In the event of an asset with a screen on one side, which have a head on traffic flow, that screen will be attributed with 50% of the traffic flow measured. | 0,5 |
| Head on | 2 | In the event of an asset with a screen on both sides, which have a head on traffic flow, each screen will be attributed with 50% of the traffic flow measured. | 0,5 |
| Head on/Parallel | 1 | In the event of an asset having traffic passing both head on and parallel and that asset contains one screen, it is attributed a ROTS that is the average of parallel and head on respectively (1+0,5/2). | 0,75 |
| Head on/Parallel | 2 | In the event of an asset having traffic passing both head on and parallel and that asset contains a screen on each side, each screen is attributed a ROTS that is the average of parallel and head on respectively (1+0,5/2). | 0,75 |

When comparing to traditional audience measurement methods, based on panel data, whose position have been precisely measured in relation to the orientation of the screen, the ROTS model for the current methodology could be considered cruder. This resulting in e.g. that a person traveling directly towards the side of a panel holding a screen on each side and before traveling past the panel turns 90 degrees or above and thus moving away from the panel with his/her back to the screen will be measured as a person with a realistic opportunity to see the panel, even though that might not be considered a "realistic opportunity" in the real world. However, this perceived crudity is outweighed by the contemporary precision of the real time traffic flow measurement.

#### 4.1.1.2 Visibility Adjustments

"*The basic* [Realistic Opportunity to See] *opportunity to contact for a given display panel calculated in the way described above makes no allowance for the fact that, although people passing the display panel are able to see it, they may not notice or look at it at all*" (Global Guidelines on Out-Of-Home Audience Measurement, Esomar, p. 18).

To correct for this visibility adjustment (VA) coefficients are calculated by taking several variables into account:
- A realistic viewability distance of the screen
- The setback – which is the visibility cone that indicates that the screen is in the line of sight of the person measured
- The environment the screen is placed in
- The type of the screen
- Eye-tracking studies in VR environments
- The orientation of the traffic flow

The classification variables used to compute individual VA-coefficients and the subsequent computation are validated and performed by Ipsos. The individual VA-coefficients can be accessed by request.

## 4.2 AM4DOOH – The Reality of Attention to DOOH by JCDecaux, Clear Channel, Exterion, APG and FEPE

The purpose of the AM4DOOH (Audience Measurement for Digital Out-of-Home) study was to understand and define "*the relative performance of digital ads versus static paper, in terms of an audience's likelihood to see (LTS)*". (s. 5) In this case LTS refers to what we above call VA-coefficients. The study also aimed to standardize how to take "(…)*an individual digital ad on loop with several others*(…)" (s. 3) into account.

AM4DOOH arrives at two principles that can be applied on top of the existing measurement principles from ESOMAR described above. These principles are DAM's and an impressions-formular.

### 4.2.1 Digital Attraction Multipliers (DAM)

A set of factors called Digital Attraction Multipliers (DAM's) are a value that essentially adjusts for the fact that digital images attract more attention than paper and the fact that moving content also attracts more attention than paper.

In the current methodology the DAM's used can be viewed below:

| | OUTDOOR ROADSIDE/PEDESTRIAN ENVIRONMENT | | | INTERNAL ENVIRONMENT | | |
|---|---|---|---|---|---|---|
| | Head on | Parallel | Head on/ parallel | Head on | Parallel | Head on/ parallel |
| **SD/AD** | 1,04 | 0,98 | N/A | 0,89 | 0,82 | N/A |
| **FM** | 1,16 | 1,04 | 1,10 | 1,01 | 0,90 | 0,995 |

### 4.2.2 Impressions-formular

The second principle introduced in AM4DOOH is a formular that "(…) *factors in the length of the ad, the number of ads on rotation, and the passage duration for audiences.*" (s. 23) See the formular below:

**DIGITAL OOH VIEWABILITY FORMULA**

$$\%\,Viewable = \min\left(\frac{Passage\ duration + Spot\ duration - 2}{Loop\ duration}, 100\%\right)$$

For the current methodology changes have been made to the above developed formular to allow for the formular input to be based on a contemporary data set as described in Chapter 3 and the fact that this dataset includes dwell time in 30 second brackets. The specific formular used for the current methodology will be in detail described in Chapter 5, Viewed Impressions.

## 4.3 Global OOH Audience Measurement Guidelines by WOO.

The WOO report holds a hierarchy of metrics that if adhered to will constitute an Audience Measurement that is "(…) *properly planned to deliver useful metrics during its* (red. the audience measurement) *development*." (s. 5) Those metrics are

1. "*How many people are passing OOH frames – Volume of audience available.*
2. *How many people are seeing those OOH frames – Delivered volume of audience.*
3. *Who is seeing those OOH frames – Demography and audience profiling.*
4. *How often are they seeing those OOH frames – Reach and Frequency modelling.*
5. *Of those, who has seen an individual 'spot' – Granularity require for measuring DOOH.*

6. *What was the actual performance – contemporised delivery against predicted delivery.*
7. *How does OOH contribute to the complete media campaign – Cross media measurement."* (s. 5)

As we in our measurement do not include the measurement of a reach and frequency currency points 3 and 4 are in this methodology not necessary to adhere to.

Point number 1 is essentially what is described in Chapter 3, point number 2 is in fact the application of ROTS, VA's and DAM's,. which in the methodology is described earlier in Chapter 4, sub-chapter 4.1.1.1, 4.1.1.2. and 4.2.1. Point 5 is the application of the formular from AM4DOOH described in sub-chapter 4.2.2. Step 6 is adhered to by the fact that we have contemporary (real time) data in Chapter 3 which enables the ability to compare both the forecast and the delivery of impressions. Point 7 has not been explicitly described anywhere in this methodology, however the fact that both a viewed- but also a viewable impression are possible to derive from the models makes it possible to compare to other impression based currencies such as online display, which use viewable as their impression currency standard.

## 4.4 3rd party validations

Throughout the process of developing the current methodology 3rd parties have been included to oversee, judge and perform actions where we have deemed it relevant. Kantar-Gallup have analyzed the process described in Chapter 3, thus pointing out some initials flaws that has been corrected. Initially the routers capped the count of MAC ID's per hour at 10.000 units meaning that traffic flows above 10.000 actual MAC ID's measured could not be accounted for. Secondly Kantar-Gallup pointed to the fact that a 3rd party should validate the manual countings-procedure in described in sub-chapter 3.2.1.2. For this Nielsen have validated the methodology for performing this task as well as validating the whole modelling process described in 3.2.1.

Ipsos have been employed to validate the classification of the digital screens to be measured to ensure that the quality of the data to compute VA-coeffecients is at a satisfactory level. And Ipsos have also been employed to perform the computation of the VA-coefficients.

CESP, the overseeing body for all media research methodology in France, have validated the methodology for computing viewed impressions as described in sub-chapter 5.3.

KANTAR GALLUP Ipsos Nielsen CESP

# 5. Viewed Impressions

In this chapter the precise application of the OOH measurement principles and guidelines outlined above are described in detail. The process has 3 steps that consists of a number of industry standard coefficients that down- or up-weigh the total traffic value applied in algorithms developed by JCDecaux DataCorp Division. The equations and modelling principles brought forward in this chapter have undergone a validation by CESP and a similar approach solely developed for Metro environments has been per April 2024 validated by Ipsos. An Ipsos validation of the precise approach described below is set for late 2024/early 2025.

| FROM TOTAL TRAFFIC TO EXPOSABLE TRAFFIC | DISTINGUISHING BETWEEN PASSING AND DWELLING | VIEWED IMPRESSIONS |
|---|---|---|
| The total traffic data set described in Chapter 3 is down-weighed with ROTS coefficients to arrive at a traffic datasets that is "exposable" | The exposable traffic data set is split into passing and dwelling | VA- and DAM-coefficients are applied along with an algorithm that factors in the length of the ad, the number of ads on rotation, and the passage duration for audiences |

## 5.1 Conversion from total traffic to exposable traffic

To convert the total traffic ($T_a$) into traffic that is in fact exposable to whatever content is shown on an asset screen (*a*) at any given time, ROTS-coefficients matching the environment and orientation of the screen are applied. The dataset after the application of ROTS is called "Exposable traffic" ($RT_a$).

The application of ROTS is performed in the following way:

$$RT_a = p_1(^a), T_a, \quad where: \quad p_1(^a) = \begin{cases} 1 & \text{"if the asset "}a\text{" } is\ parallel\ to\ the\ flow\text{"} \\ 0.75 & \text{"if the asset "}a\text{" is head-on and parallel to the flow"} \\ 0.5 & \text{"if the asset "}a\text{" is head-on"} \end{cases}$$

## 5.2 Distinguishing between passing and dwelling

Real-time exposable traffic" ($RT_a$) contains information that is used to compute viewed passing impressions and viewed dwell impressions simultaneously. The information used to compute viewed passing impressions represent the number of people present within the visibility distance of the asset and consists of the first MAC-session registered within a possible series of closed MAC- sessions within a screen zone. We call this information exposable passing traffic ($RT_a$).

Each exposed person within this value is present within the visibility distance for a shorter or longer period, known as the dwell time. The individual dwell time of each person will be used to compute the number of viewed dwell impressions. The information in the dataset used to compute viewed dwell impressions consists of all hashed and encrypted MAC-sessions registered (as opposed to the first MAC-session registered above) within a possible series of closed MAC-sessions within a screen zone.

The dwell time is distributed into timeslots of 30 seconds. If dwell time assumptions change within the OOH industry standard, this distribution needs to be redefined in order to meet new industry standards. This dataset is called exposable dwell traffic ($RT_a(w)$).


```
"timestamp": "2020-09-16T09:39:4[illegible].129Z",
  "machash": "string",
  "value": 100
  "signal": 0,
  "zone": "string",
  "duration": 100,

        {"sec: 01-30": 28}
        {"sec: 31-60": 8}
        {"sec: 61-80": 22}
        {"sec: 81-120": 2}
        {"sec: 121-150": 6}
        {"sec: 151-180": 12}
        {"sec: 181-210": 6}
        {"sec: 211-240": 1}
        {"sec: 241-270": 7}
        {"sec: 271-300": 3}
        {"sec: 300-: 5}

  "vendor": "string"
```


## 5.3 Computing Viewed Impressions

The computation of viewed passing and dwell impressions is performed by applying a number of equations containing presumptions and values that are derived from OOH measurement standards.

### 5.3.1 Computing viewable passing impressions

The purpose of Equation 1 below is to introduce the ability to attribute impressions to specific campaigns with specific share of time on the screens. This is necessary as impressions delivered are not equal to the number of persons measured in the exposable traffic dataset.

The exposable passing traffic ($RT_a$) is used to compute a number of viewable passing impressions $VI_a$ for an asset, using the formula below (to simplify the reading, the index of the asset is removed from the formula):

Where, *DL* is the loop duration of the asset, *DS* the slot duration, *N* the slot repetition within a loop, *DE* the exposure duration in seconds based on both the walking speed and the screen size, and *X* a criteria representing the minimum exposed duration to deliver one impression (by default set a 1 second). The walking speed is applied according to industry standards, which is 5 km/h.

The first part of this formula represents a contact probability and is multiplied with the exposable passing traffic data $RT_a$, providing a total viewable passing impression number *VI* for an asset.

**EQUATION 1 – COMPUTING VIEWABLE PASSING IMPRESSIONS**

$$VI_a = \left(\frac{\max((DS.N-2X),0)}{DL} + \left[1 - \frac{\max((DS.N-2x),0)}{DL}\right].min\left[\frac{\max(DE-2X,0)}{DL-DS.N}\right]\right).RT_a$$

### 5.3.2 Computing viewed passing impressions

The purpose of Equation 2 is to define how many of the above computed viewable impressions that are in fact viewed ($ViewedI_a$). This is important as a viewed advertisement is the prerequisite for the advertisement to have a desired marketing effect be it long or short term.

The number of viewed passing impressions are computed using Equation 2:

where $P_2(a)$ is a Digital Attraction Multiplier (DAM), *VAC* is a visibility adjusted criteria and $VI_a$ is the number of viewable impressions.

**EQUATION 2 – COMPUTING VIEWED PASSING IMPRESSIONS**

$$ViewedI_a = VI_a \cdot p_2(a).VAC,$$

### 5.3.3 Computing viewable dwell impressions

The purpose of Equation 3 is to first split the $RT_a$ into dwell time windows *w* [30s,60s] next to the asset *a* into the exposable dwell traffic data ($RT_a(w)$) and then converting that number into a number of viewable dwell impressions ($DT_a$).

Supposing *m* windows [$t_1^m$,$t_2^m$] (in seconds), we have the following formula to estimate the number of dwell impressions $DT_a$ for an asset *a*: see equation

Where $p_3$ is a fixed dwell time impression, corresponding the minimum dwell time (in seconds) to deliver one impression. In the following we suppose $p_3$ = 300s.

**EQUATION 3 – COMPUTING VIEWABLE DWELL IMPRESSIONS**

$$DT_a = \sum_{w=1}^{m} \frac{\frac{(t_1^w + t_2^w)}{2} . RT_a(w)}{p_3}$$

### 5.3.4 Computing viewed dwell impressions

The purpose of Equation 4 is to define how many of the above computed viewable dwell impressions that are in fact viewed (*ViewedI* ). This is important as a viewed ad is the prerequisite for the ad to have a desired marketing effect be it long or short term.

The number of viewed dwell impressions are computed using equation 4. $p_2(a)$ is a Digital Attraction Multiplier (DAM), *VAC* is a visibility adjusted criteria and $DT_a$ the number of viewable dwell impressions.

**EQUATION 4 – COMPUTING VIEWED DWELL IMPRESSIONS**

$$ViewedI_a = DT_a . p_2(a) . VAC$$

### 5.3.5 Total number of viewed impressions

Considering both the viewed passing and viewed dwell impressions, a total number of viewed impressions (T*ViewedI*) for an asset during a specific period) is calculated by Equation 5:

**EQUATION 5 – TOTAL NUMBER OF REAL-TIME VIEWED IMPRESSIONS**

$$TViewedI_a = ViewedI_a + DT_a$$

# 6. Forecast Principle

The methodology described so far has considered measuring viewed impressions contemporarily. This practice has been carried out since 2019. However, to be able to manage inventory in the future, hold bookings and guarantee delivery for advertisers, it is crucial to perform a forecast that estimates the viewed impression inventory available at any given time and location or locations in the future.

Technical restrictions from inventory management supplier, VIOOH, limits the update frequency of the forecast and nature of the forecast itself. Adhering to these restrictions, the forecast principle decided upon for the current viewed impression methodology will be based on a default of 16,66% share-of-time and scaled linear according to the default share-of-time. The forecast is done by creating an avg of any given hour and any given day in the future based on 4 weeks in March, from Monday March 4th to Sunday March 31st.

The forecast is uploaded to VIOOH and the creation of the forecast is done in cooperation with JCDecaux DataCorp Division.

During Q3 JCDecaux DataCorp will introduce a new tool, Audience Connect, allowing for more dynamic forecast updates of VIOOH.

## 6.1 Forecast principle for new screens

The above described forecasting principle leaves a challenge for forecasting new screens installed in new locations as these screens do not have historical traffic flow data to base the forecast on. Until a valid forecast for a new screen can be computed by an on-location sensor, AFA Decaux applies the following forecasting to new screens:

| | |
|---|---|
| **WEEK 1** | Dummy forecast uploaded in VIOOH for new screens based on existing viewed impression data sets and statistical assumptions. Sensor installed, calibrated and measuring |
| | New screens live and sellable in VIOOH, sensors measuring first week of delivered impressions |
| **WEEK 2-4** | Sensors measuring continuously |
| **WEEK 5** | New forecast uploaded to VIOOH based on prior 4 weeks of on location sensor measurements |
| **WEEK 6** | New screens attributed the forecast principle for all of AFA Decaux digital inventory |

## 7. Impressions available

With the forecast performed above AFA Decaux have an overview of estimated, available inventory in VIOOH, which allows VIOOH to compute necessary number of playouts on the screens to meet the desired number of viewed impressions for a specific campaign according to variables: time, geography, network etc.

## 8. Campaign Booked

In VIOOH the specific campaigns are booked by inputting desired number of viewed impressions along with other variables and conditions decided by advertiser and the number of impressions are then reserved for that specific campaign leaving the excess inventory left for other advertisers. VIOOH computes the number of playouts necessary to meet the desired number of impressions.

## 9. Campaign Excecuted

In this step the given, booked campaigns are executed. During the campaign period the conditions of reality occur which will result in discrepancies between the above-described forecast and the reality. Examples of this could be:

Anticipated effect on impressions per environment

| INCIDENT | RAIL | CITY | MALL |
|---|---|---|---|
| Station closed for renovation | ↓ | → | → |
| Rain | ↗ | ↓ | ↑ |
| Sun | → | ↑ | ↓ |
| National team football match | ↑ | ↑ (for Copenhagen) | → |
| Holidays and vacations | ↓ | ↑ | ↑ |

Other than the variations in traffic flow described above, VIOOH will according to the total number of impressions booked in the given period and the excess inventory not booked in the same period attribute the excess inventory to the booked campaigns.

Lastly, screen down time due to e.g. missing electricity and malfunctions on player or screen, will by VIOOH be taken into account.

## 10. Delivered Impressions

All discrepancies described above between booked forecasted viewed impressions and performed playouts and share of time will be considered in the delivered viewed impressions report. At client reporting level the below figures will be reported:

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### DIGITAL REPORTING

| | |
|---|---|
| **Client** | Aller Media |
| **Product** | Femina |
| **Medie** | Digital Copenhagen |
| **Period** | 26/02-2024 – 03/03-2024 – Week 09 |
| **Agency / Contact** | |
| **AFA Decaux Contact** | |

| | |
|---|---|
| **Campaign ID** | 778005 |
| **AFA Decaux ID** | 102054 |
| **Number of booked Screens** | 39 |
| **Campaign Duration** | 7 days |
| **Campaign Dates** | 26/02-2024 – 03/03-2024 |
| **Reporting Period** | 26/02-2024 – 03/03-2024 |
| **Booked Impressions** | 1.030.988 |
| **Delivered Impressions** | 1.043.831 |
| **Delivery in %** | 101,25% |
| | |

The calculations of the above delivered viewed impressions are based on index figures on network level.

## 10.1 Technical abnormalities

When operating with contemporary measurement incidents will occur where the traffic flow measured and the subsequent computation of impressions will vary from reality due to sensor malfunction, software glitches or changes in the OS of the measured devices. These incidents are labelled technical abnormalities. In signing the MSA, constructed by JCDecaux SA between AllUnite and AFA Decaux, such technical abnormalities are detected and corrected from AllUnite side. Until the signed MSA will enter into force AFA Decaux will manually detect and correct technical malfunctions based on the below approach:

1. Every weekday before lunch the delivered amount of impressions are monitored in HIM by AFA Decaux Analytics & Insights Department. Abnormalities – technical or due to actual traffic variation – will be registered and continuously monitored. An abnormality is defined as a discrepancy above 10% of the delivery of the previous week.
2. Thursday potential abnormalities are labelled either technical or “actual”. All abnormalities labelled technical are analyzed and a substitute data sat is prepared. A substitute data set consists of the average viewed impression delivery of the past 4 weeks in the abnormality period, taking holidays and other periods with substantial impact on impression delivery into account.
    a. Impact from holidays or other periods with substantial impact on impression delivery is assessed by manually defining a comparable period, calculating the impact vs Index 100 in the period and then replicate that impact into the substitute data set.
3. Monday and Tuesday post campaign the total technical abnormality incidents are analyzed on the infected periods are replaced with the substitute data set in the reporting to the client including a notification of the technical abnormality incident.

## 10.2 Reporting operations

The internal workflow for delivering the reporting is illustrated below

| DEPARTMENT | SALES SUPPORT | ANALYSIS & INSIGHT | SALES SUPPORT |
|---|---|---|---|
| Task 1 | Exports performance report from VIOOH per campaign | Compares VIOOH performance report data with delivered impressions data from HIM | Writes the delivered viewed impressions values into campaign report as shown above |
| Task 2 | Sends reports to Analysis & Insights | Sends delivered viewed impressions to Sales Support | Sends report to Client |

## 10.3 Dynamics and integration

To automate the above tasks it is suggested to integrate the above workflow into Dynamics.

## 11. Glossary

**MAC ID's (MAC-adresses)**
To understand how AFA Decaux in the methodology at hand use MAC ID's to document viewed impressions it is relevant first to understand the concept of MAC-ID's from a technical perspective and subsequently the two types of MAC ID's that exist:

"*A **MAC address** (short for **medium access control address**) is a unique identifier assigned to a network interface controller (NIC) for use as a network address in communications within a network segment. This use is common in most IEEE 802 networking technologies, including Ethernet, Wi-Fi, and Bluetooth. Within the Open Systems Interconnection (OSI) network model, MAC addresses are used in the medium access control protocol sublayer of the data link layer. As typically represented, MAC addresses are recognizable as six groups of two hexadecimal digits, separated by hyphens, colons, or without a separator*." (Wikipedia, April 2024)

MAC addresses can be either universally administered addresses (UAA) or locally administered addresses (LAA).

"*A universally administered address is uniquely assigned to a device by its manufacturer. The first three octets (in transmission order) identify the organization that issued the identifier and are known as the organizationally unique identifier (OUI). The remainder of the address (three octets for EUI-48 or five for EUI-64) are assigned by that organization in nearly any manner they please, subject to the constraint of uniqueness.*

*A locally administered address is assigned to a device by software or a network administrator, overriding the burned-in address for physical devices. Locally administered addresses are distinguished from universally administered addresses by setting (assigning the value of 1 to) the second-least-significant bit of the first octet of the address."* (Wikipedia, April 2024)

A universally administered MAC ID can thus be used to identify the same device over time, while locally administered MAC ID's do not in theory carry the same capability. However when analyzing the hashed and encrypted MAC ID's measured in the current methodology a variation of LAA's have occurred which sub supplier AllUnite has deemed "trusted randomized MAC ID's". These trusted randomized MAC ID's are observed in the data set due to the fact that when devices detect a known WiFi-network they transmit the LAA used to connect to this WiFi-network, when the network was first connected to. In an example this means that when a person leaves e.g. a workplace the device of that person will continue to transmit an LAA which AllUnite is then able to match to a previously transmitted LAA and thus makes it possible to attribute this LAA to the same device.

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Currently the distribution between UAA’s, trusted LAA’s and LAA’s are:

**UAA’S PER WEEK**
198.000

**TRUSTED LAA’S PER WEEK**
594.000

**LAA’S**
2.508.000

**TOTAL MAC ID’S PER WEEK**
3.300.000