ROAD Reach and Frequency Model [February 2025]

1. Introduction

- The need for a R&F model arises from the collection of respondent x frame contact data from each travel survey respondent.
- Media owners and advertisers require exposure estimates over different time periods (e.g., one week, four weeks, or longer).

2. Exposure Metrics

Exposure may be expressed as:

- **Total Contacts**: Projected to the population.
- **Unique Viewers (Reach)**: Number of different individuals exposed.
- **Contacts per Viewer (Frequency)**: Average number of exposures per person.

Respondent visits are projected into an average week of the year. **IMPACTS (VACs)** are based on a simple sum of contacts, while **REACH** is calculated using negative probability, combining VA for each contact.

3. Probability Model

The reach calculation follows the **Poisson Binomial Distribution**.

The **Poisson Binomial distribution** is used in **Out-of-Home (OOH) advertising** to estimate the **reach** of a campaign—i.e., how many unique people see an ad at least once.

How It Works in OOH Campaigns

1. **Each Person Has a Probability of Seeing theAd**
   - Every individual in the target audience has a different probability of encountering the ad, based on their movement patterns and exposure to various billboards.
2. **Sum of Individual Probabilities**
   - Instead of assuming a uniform probability for everyone (as in a standard **Binomial** distribution), the **Poisson Binomial** model accounts for these individual differences.
3. **Why Poisson Binomial?**
   - It extends the **Binomial distribution** by handling varying probabilities across individuals instead of a single, fixed probability for all.
   - It provides a **more accurate reach estimate**, especially in real-world scenarios where exposure varies by location, time, and audience behavior.

4. Contact File from Travel Survey

A **contact file** from a travel survey maps individual mobility patterns to exposure opportunities for outdoor media. It includes:

- **Locations visited**
- **Time spent**
- **Transport modes**
- **Demographics**

This data enables Out-of-Home (OOH) planning and targeting by estimating the probability of different audience segments encountering specific advertising panels.

5. Reach Calculation Example

Reach (or contact) with a panel is determined from **origin and destination** data from the Travel Survey. Each respondent receives a weighting based on population estimates.

Sample Data Table:

Respondent	Contacts	Frequency	Population Weight
1	1	4	100
2	1	3	200
3	1	2	150
4	1	1	200
Total	4	10	650

Most panel attributes remain constant (e.g. height, angle, coordinates, size), but some vary by time of day (e.g. illumination, speed). Each contact receives a **Visibility Adjustment (VA) Score**.

6. Visibility Adjusted Contacts (VAC) Calculation

Each contact is weighted according to population and VA.

Example for Respondent 1:

Contact	Unweighted	Weighted	VA	Weighted VAC
1	1	100	0.2	20
2	1	100	0.3	30

Contact	Unweighted	Weighted	VA	Weighted VAC
3	1	100	0.2	20
4	1	100	0.1	10
Total	**4**	**400**	--	**80**

7. Reach & Frequency on VACs

Total Population	**Total**	**Resp 1**	**Resp 2**	**Resp 3**	**Resp 4**
Population Weights	650	100	200	150	200
Contacts ROTS (Population x Contacts)	1,500	400	600	300	200
Contacts VAC (Total weighted VACs)	415	80	180	135	20
Cover (Reach % Calculation)	48.8%	59.7%	66%	70%	10%
Reach (Cover applied to pop weights)	317	60	133	105	20
Frequency VAC (VAC / Reach)	1.31	1.34	1.36	1.29	1.00

8. Summary of Steps

1. Travel Survey determines the number of people exposed to a panel.
2. Frequency of exposure (contacts) per panel is calculated.
3. ROTS (Population x Number of Contacts) is determined.
4. VA is applied to each contact.
5. VAC is computed as VA x weighted population per contact.
6. VACs for the panel are summed.
7. Cover (Reach %) is calculated.
8. Reach % is applied to the population to get Reach VAC.
9. VAC is divided by Reach to get Frequency.

9. Digital Out-of-Home (DOOH) Considerations

- DOOH follows the same principles but accounts for **variable visibility** (spots are not visible 100% of dwell time).
- Additional variables include **spot duration, frequency, times, and days.**

- Reach may remain similar, but **VACs and frequency will vary.**
- A **100% SOV (Share of Voice)** assumes exposure of **1 spot per hour.**
- No Spotplan treats the panel as static, resulting in different reach and frequency outcomes.

10. Conclusion

- The R&F model enables **precise audience measurement** for OOH campaigns.
- Uses travel survey data for **realistic exposure estimation**.
- Incorporates **visibility adjustments** for more accurate impact assessment.
- Applicable to both **static and digital OOH** campaigns with necessary adjustments.